NRA Anglian 130

WATER QUALITY REPORT 1993

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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 9 years in the chemical quality of rivers. We demonstrate an upgrade since last year.

This is matched by an improvement in the biological quality of rivers. The biological quality is easily the best we have ever recorded.

The causes of the improvements in river quality in recent years is better effluent quality and river flows in 1993 which were higher than those in 1992.

The number of reported Pollution Incidents increased by 4% from 1992 to 1993 though there were fewer bad incidents. The increase from 1991 to 1992 was 12%.

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

We produced proposals for Statutory Water Quality Objectives for two catchments. We produced the maps of Protection Zones for the Groundwater Protection Policy.

We advised the Government on the boundaries of Nitrate Sensitive Areas and Nitrate Vulnerable Zones.

We introduced a programme of Formal Visits for Pollution Prevention including the inspection of our Groundwater Protection Zones;

We report trends for Bathing Waters since 1987. In 1993, five Waters failed. This is a set back since 1992 but the change is not significant statistically.

We give trends for the performance of discharges since 1982. 97.2% of the sewage treatment works operated by Anglian Water complied with their Consents. This is a little worse than for 1992, which was the best ever recorded.

The number of enquiries of the Water Act Register has increased steadily since it opened in 1985. There were 925 in 1993, an increase of 44% since 1992.

We calculated the action needed to meet our River Quality Objectives for 7000 kilometres of rivers and negotiated plans and priorities for investment by dischargers;

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

Contents.....

Part 1. INTRODUCTION

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

This report covers key events and issues in 1993. There is an Index at the end of the report.

1.1 Duties

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

- to achieve Water Quality Objectives;
- to monitor the extent of pollution;
- to conserve and enhance the amenity of waters, and of land associated with such waters;
- to determine and issue Consents for the discharge of wastes;
- to maintain Public Registers of Water Quality Objectives, Consents, and water quality data;
- to advise and assist the Department of the Environment; and,
- to exchange information with Water Undertakers on pollution matters.

We operate openly in discharging our duties and aim to balance the interests of all who benefit from and make use of Controlled Waters.

1.2 National Strategy

The main aims of the National Strategy[1] are to improve the quality of waters through the control of pollution and to ensure that dischargers pay the costs of the consequences of their discharges.

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1 *NRA Water Quality Strategy. Report issued in 1993*

1.3 Regional Perspective

Anglian Region faces growth and development. This produces a workload 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.

1.4 1993

Much of our work aims to sustain water quality in the face of the risk of widespread piece-meal attrition caused by the increasing demand both for water and for the use of land.

To sustain success we must continue the cycle by which we audit compliance with water quality standards, assess priorities and take action[2]. The output for our Customers is new commerce, recreation and development that does no damage to the leisure and livelihoods currently enjoyed, and which does not prejudice opportunities in the future.

We completed successfully the following projects. We:

calculated the action needed to meet our River Quality Objectives for 7000 kilometres of rivers and negotiated plans and priorities for investment by dischargers;

produced proposals for Statutory Water Quality Objectives for two catchments;

produced the maps of Protection Zones for the Groundwater Protection Policy;

advised MAFF and the DoE on the boundaries of Nitrate Sensitive Areas and Nitrate Vulnerable Zones;

introduced a programme of Formal Visits for the purposes of Pollution Prevention including the inspection of the most important of our Groundwater Protection Zones;

liaised with HMIP and completed our responsibilities for Authorisations for Integrated Pollution Control (in such a way as promoted the achievement of our aims for Water Quality);

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2 *Anglian Region: Water Quality Reports: 1991; 1992*

continued our work on the control of Toxic and Persistent Substances; and,

closed our Laboratory and switched the work to the National Laboratory Service.

1.4 The Future

We must:

protect water quality by maintaining the recent improved quality of discharges;

continue to plan and justify any further improvements that are needed in the quality of discharges;

evaluate the need and scope to improve water quality by the control of diffuse pollution by nutrients and pesticides;

establish, with a view to future strategy, the benefits of recent schemes to remove phosphorus from large discharges of sewage effluent;

protect the Environment whilst managing the growth of work under Integrated Pollution Control;

maintain the all-round pressure of persuasion and enforcement which has helped produce a strong improvement in water quality;

through the introduction of Statutory Water Quality Objectives, consolidate and justify our efforts to maintain the quality of the Environment;

protect the Environment by responding quickly and thoroughly to Pollution Incidents;

protect the Environment by reducing the number and impact of Pollution Incidents through Pollution Prevention Visits under the Groundwater Protection Policy and visits to farms and industrial sites identified in Catchment Management plans;

protect the Environment by reducing the number and impact of Pollution Incidents through our contribution to Integrated Pollution Control;

protect the quality of groundwaters and water supplies by introducing further Groundwater Protection Zones under the Groundwater Protection Policy and completing our formal inspections of the Zones around the major sources of Public Water Supply;

plan the measures needed to clean-up or mitigate particular cases of groundwater pollution;

provide input to national policy and national projects; establish the National Centre on Toxic and Persistent Substances;

redevelop our systems for data management and the audit of water quality following the re-direction of our analytical work to the National Laboratory Service; and so contribute to improved efficiency and:

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; satisfy our commitments for Directives and International Agreements; and complete the monitoring for the 1995 Surveys of Biology, Chemistry and Nutrients;

prepare for the Environment Agency;

continue to seek improvements in efficiency;

implement National Priority Projects within the Region, for example: Market Testing; Catchment Management Plans; Information Systems; Farm Pollution; and Monitoring[3];

continue our input into policy for the implementation of new Directives;

continue to sponsor and support Research & Development so that it meets the Region's requirements for efficiency and improving the Environment; and,

continue, with the Broads Authority, the LIFE Project funded jointly with the European Union, on research which aims to restore water quality in the Norfolk Broads.

[3] *NRA Corporate Plan 1994/5*

1.5 Catchment Management Plans

This involves the NRA and others in work which will:

- identify the features and the current and potential uses of the catchment;
- set targets;
- compare targets with the current state of the catchment;
- identify the issues and the options for addressing them;
- consult on the uses, targets, issues and options;
- prepare a plan to address the issues; and,
- implement the plan, and monitor and review.

In 1993, final plans were issued for the River Cam and the coastal catchment surrounding Louth in Lincolnshire, and the combined plan for the Gipping and Stour was ready for printing. Consultation started on the plans for the Ely Ouse and the Lower Nene, and drafts were started for the Bedford Ouse and Upper Nene.

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.

Part 2: RIVERS & 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 1993 programme for chemical monitoring is shown in Table 2.1:

TABLE 2.1

Numbers of Sites and the Frequency of Sampling

Samples per year	Reservoirs	Rivers	Canals	Lakes	Total by frequency
< =4	1	126	0	19	146
5 - 12	4	945	7	11	967
13 - 24	14	41	0	20	75
25 - 48	6	18	0	0	24
> 48	0	172	0	0	172
Totals	25	1,302	7	50	**1,384**

This monitoring allows us to characterise 4,800 km of freshwaters. The total number of samples was 15,852, from 1,233 sites (see also Table 8.1).

Samples of river sediments were collected at 170 sites, mainly for the Dangerous Substances Directive. The frequencies ranged from one to four per year.

Our programme for groundwater included 697 sites and involved the collection of 2657 samples. Sampling frequencies ranged from fortnightly to one per year, depending on the type of survey and the variability of water quality at the site (see Part 2.11).

2.1.2 Continuous Monitoring

We maintain a network of 21 Automatic Monitoring Stations. These provide continuous measurements of water quality. Most stations are placed below major discharges of effluent, or directly above the abstractions made by Water Companies, or at places where water is pumped from one river to another.

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

2.2 River Quality Classification

This year sees the introduction of a new method of classifying rivers. In the interests of continuity we report for this year on river quality as assessed by both the old and the new method.

2.2.1 NWC Classification

Past reporting of river water quality has been based on the Classes introduced by the National Water Council (NWC).

The Class is determined mainly, but not exclusively, by the concentrations of Dissolved Oxygen, Biochemical Oxygen Demand (BOD) and Ammonia. The following table gives the standards. The concentrations are 95-percentiles - they must be met for 95 percent of the time.

TABLE 2.2

Class	River Quality Criteria		
	Dissolved Oxygen (% saturation) 5-percentile	Biochemical Oxygen Demand (mg/l) 95-percentile	Ammonia (mg/l)
1A Good	80	3	0.3
1B Good	60	5	0.7
2 Fair	40	9	-
3 Poor	10	17	-
4 Bad	Inferior to Class 3		

The NWC Classification of rivers for 1993 is shown in a map enclosed with this report. There have been some changes since 1992. About 7% of river lengths were upgraded, while 3% were downgraded. Overall, 95% of rivers fall into the classes defined as Good to Fair quality.

These statistics indicate that 450 km of rivers have changed Class since 1992. Changes occurred across all Classes although most were between Classes 2 and 1B, and Classes 3 and 2. There was a net upgrade of 163 km since 1992 or 425 km since 1991.

We estimate that 55% of the river length which was upgraded improved because of increased flows in the rivers following the end of the drought, and the wet weather experienced in 1992. Among these, about 15 km of the River Granta, and 11 km of the River Gipping was upgraded from Class 2 to 1B, and 10 km of Cottenham Lode was upgraded from Class 3 to 2.

Much of the remaining improvement was due to improved effluent qualities from many sewage treatment works. This included 13 km of the Watton Brook and the River Wissey, and 9 km of the River Yare. These were reclassified as Class 1B. 6.5 km of Spicketts Brook improved from Class 3 to 2.

About one-third of that river length which deteriorated did so because of poor-quality effluent discharges. The most notable change was 15 km of Soham Lode which slipped from Class 1B to 2. The reason for the deterioration in quality of over 23 km of Babingly River is not yet understood.

There were no changes in the classification of canals.

This is the last time that we will report the NWC Classification of our rivers. From now on we will use a new system called the General Quality Assessment (GQA).

2.2.2 General Quality Assessment

The chemical and biological quality of rivers is reported nationally every five years. The work of the 1990 Survey[4] showed that differences existed around the country in how the NWC system was applied, and that the system led to incorrect reports of change.

In 1991, the NRA published proposals for a new scheme. The General Quality Assessment provides a means of assessing and reporting which is nationally consistent and totally objective. The chemical component of the scheme was introduced in 1994.

The Grade for a particular stretch is determined exclusively on BOD, Ammonia and Dissolved Oxygen. The following table gives the river quality standards.

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4 *Published in December 1991*

TABLE 2.3

Water Quality	Grade	Dissolved Oxygen (% Saturation) 10-percentile	Biochemical 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 which does not meet the requirements of Grade E in respect of one or more determinands

The concentrations 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 levels 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 GQA Classification of rivers based on data collected from the three year period 1991-1993 is shown in a map enclosed with this report. There has been a net improvement of 17% (770 kilometres) since 1990. The reasons for the change were set out in Section 2.2.1.

Overall, 81% of rivers fall into GQA Grades defined as Good to Fair quality. This figure of 81% compares with 95% under the NWC Scheme with the same data. This difference reflects that the old and new schemes are not directly comparable. The lower figure for the GQA is the natural consequence of the slow-moving low flow of our rivers. This means that background levels of water quality appear worse than in fast flowing streams. The difference is highlighted by the move to a national system which requires a Class A which caters for the very different types of river across England & Wales.

In our Region, the growth of algae is encouraged by the nutrient-rich, slow-moving nature of many of the rivers. This leads to algal activity in the laboratory test for BOD, and to spurious, elevated results. Consequently, the GQA Grades are pessimistic because they are distorted by the effect of algae on the measurement of this test.

2.3 River Quality Objectives

River Classes provide an absolute measure of river water quality. A river in a good Class will generally be a good fishery and suitable for other uses like the supply of drinking water, but this cannot be guaranteed because a use can be affected by pollutants which are not in the classification system.

Therefore, in addition to the NWC and GQA systems, we have established River Quality Objectives (RQOs), for our rivers. The RQOs are defined for 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.

RQOs have been established in the Region since 1979. They ensure that river quality is checked more directly against all the quality standards needed to support those uses. Improvements to river quality, for example by expenditure on effluent treatment, are targeted to ensure that RQOs were met and maintained.

Following full public consultation in 1979, the Anglian Water Authority assigned RQOs to 1,350 stretches of river, totalling 7,843 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

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. These substances are also prominent in several of the Directives issued by the European Community.

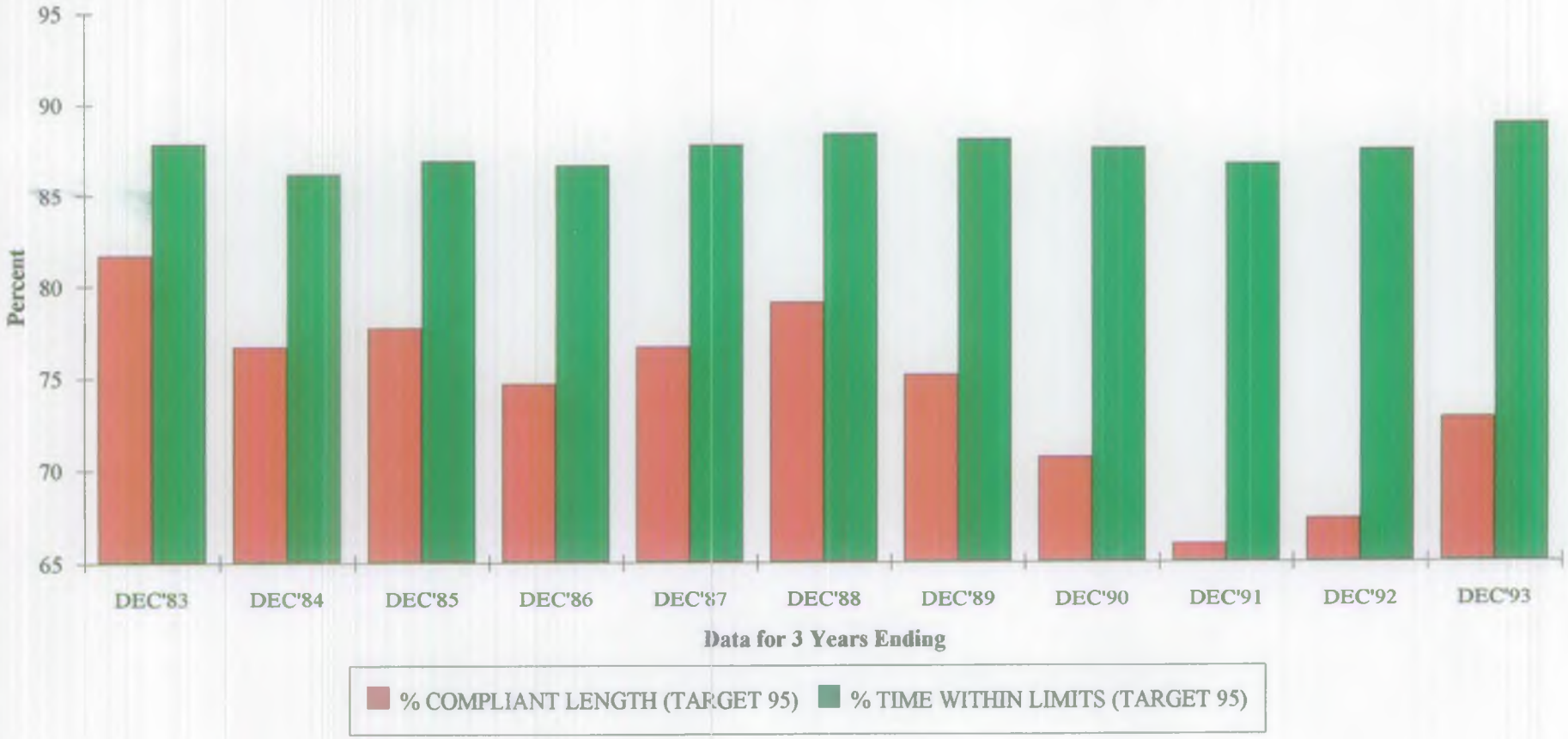
River quality is highly variable and our spot-sampling means that there is always a risk that we report wrongly that water quality has changed, or failed or passed a standard. We control this risk, which is largest at low sampling rates, using statistically-sound methods of assessing compliance and change.

In order to smooth out these effects, and to increase our ability to detect small changes in quality, we use data from three-year periods to report performance.

Every three months, we audit and report the chemical quality of 4,500 km of our rivers against the River Quality Objectives, using results from 890 sampling points. Much of the remaining 3,300 km is monitored biologically (see Part 2.6).

FIGURE 2.1

PERFORMANCE OF RIVERS AGAINST RIVER QUALITY STANDARDS



The trends in compliance for Dissolved Oxygen, Biochemical Oxygen Demand and Ammonia are given in Figure 2.1. This shows results for the average percent of time for which rivers complied, and the percent of total river length which met standards. These statistics, particularly the former, are stable and efficient measures.

For the three-year period ending in December 1993, the percent of time spent within the required limits was 88.9%, a significant improvement compared with 87.5% for the three years ending in December, 1992. Over the same period, 72.8% (3,306 km) of river lengths were of the required quality. This compares with 67.3% (3,056 km) for the three-years ending in December, 1992.

This improvement mirrors that seen for assessments based on NWC Class and GQA Grade.

As before, the performance figures for river quality are pessimistic because they are distorted by the effect of algae on the measurement of this test. If we ignore the effects of algae on the measurement of the BOD, the total length complying would increase to 81.4%, in 1990/92, and to 84.9% in 1991/93.

2.3.2 The Impact of Effluents and the Drought

We can investigate the causes of improved river quality by looking at median values of water quality. Median values are those which fall exactly in the middle of the range of values. They are very reliable indicators of underlying because they cannot be affected by extreme outlying results or changes in sampling rates.

Results from median values for all the Regions 12000 or so samples taken each year are shown in Table 2.4. This table brings together the results of 160,000 samples taken over 13 years.

TABLE 2.4

Median Values

Determinand	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
BOD mg/l	2.2	2.4	2.3	2.5	2.5	2.5	2.4	2.4	2.1	2.1	2.1	2.1	1.7
Total Ammonia mg/l	0.09	0.14	0.15	0.14	0.16	0.16	0.16	0.15	0.13	0.1	0.08	0.07	0.07
D.O mg/l	10.0	10.2	10.2	10.1	10.1	10.1	9.8	9.8	9.5	9.4	9.4	9.7	9.3
D.O % Saturation	94.8	94.8	93.4	95.8	94.3	92.2	90.5	89.4	87.8	88.7	86.4	91.4	88.4

Since the mid-1980's, the statistics for BOD and Ammonia have improved. These are the principal parameters to be affected if effluents deteriorate.

Conversely values for Dissolved Oxygen have deteriorated, and although they improved in 1992, the value for 1993 is again low. Concentrations of Dissolved Oxygen in the rivers, have been depressed by the drought and low flows, particularly in the upper reaches. The low value for 1993 is a surprise and is being investigated.

The values in Table 2.4 suggest that the apparent decline in compliance with River Quality Objectives up to 1991 was not caused directly by sewage treatment works (see also Part 4.2.5). The improved concentrations of Dissolved Oxygen, in 1992, are at least partly attributable to increased rainfall, higher freshwater flows and lower temperatures. This appears to be one reason for the improvement in compliance. The continued reduction for 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 targets known as River Quality Objectives. The Water Resources Act extended and strengthened this approach. National targets can be derived and underwritten by the Secretaries of State for the Environment and for Wales. When issued in this way the targets will be called Statutory Water Quality Objectives (WQOs).

The Act sets out the two steps by which WQOs will be introduced:

- first, the Secretaries of State set up ways of grading or classifying Controlled Waters according to water quality; and then,

- they use these Classes to define WQOs for individual segments of Controlled Waters.

Our role in the NRA is to make recommendations on both these points and to use our powers and resources to achieve the targets. After consultation through most of 1991, the NRA submitted advice on Classification. The Government used this as the basis for its own scheme, which was issued, for consultation, in 1993.

The scheme applies initially to rivers and is based on the use of rivers as water supplies, fisheries, sites of recreation, and as environmental assets.

The Government foresees separate schemes of Classification for each of these Uses, concentrating, initially, on safeguarding rivers through the Rivers Ecosystem Class. Each river will be given quality targets within a system of six Classes. The best quality, Class 1 defines a water quality which should support high-class game and coarse fisheries.

These objectives will operate a non-statutory targets in place of previous targets based on the NWC Class and RQOs. The transformation will be neutral. Subsequently, the NRA will use the process of Catchment Planning to prepare proposals for the Secretary if State for particular rivers for these targets to be made statutory.

The Government laid the Regulations for the Rivers Ecosystem Class in April, 1994.

Because formal targets for water quality have not been set in this way before in England and Wales, the NRA decided in consultation with the Government to commence the introduction of WQOs in a series of "pilot" catchments. From Anglian, the Cam and the Gipping/Stour have been included on a list of candidates from which the Secretary of State will select the first batch. We have drafted proposed WQOs for Rivers Ecosystem for these catchments.

WQOs for the other Uses described in the Government's consultation paper will follow the Government's timetable. Plans for water quality will be based on current non-statutory objectives in the meantime.

2.5 River Quality Indices

Much of the above discussion has concentrated on a few very important determinands like Dissolved Oxygen and Ammonia. At many sites we need to assess compliance with the standards for over 70 different determinands (see Part 8). The management of this large and complex workload is aided by a system of River Quality Indices (RQIs).

The Index summarises water quality and measures performance in managing resources for environmental monitoring. Data are compressed into a simple number which discriminates between good and bad quality, thus reducing the effort needed to:

- maintain an awareness of water quality;
- set targets;
- identify areas of poor quality;
- direct resources to areas of poor quality; and,
- audit sampling and analytical resources

The Indices allow us to summarise information at a site, within a District or an Area, or over the whole Region. They are used by managers to direct resources to areas of concern and to ensure that the Sampling Programme covers all our obligations.

Figure 2.2 shows changes in the Regional RQI over the five years since December 1988. No allowance has been made for algal-BOD in these values (see Part 2.3).

A perfect result is a score of 100 for each river, District, Area and the Region. The target for the Region is to see the Index rise progressively towards 100. Figure 2.3 also shows improvements since 1988, in our ability to achieve our sampling programme (in the reduction of scores for Analytical Deficiency).

2.6 Biology

In order to obtain a more complete view of the health of rivers and to help in the measurement of the impact of any pollution not covered by the assessment of chemical quality, biological quality is assessed. This assessment is based mainly on the monitoring of Aquatic Macroinvertebrates (small animals which live in the river).

Such organisms live in continuous contact with the river water and so provide information on the long-term quality of the river water. If the water is polluted, even for only a few minutes, then some or all of the macroinvertebrates may die. Recovery may take several months. This means that the biological data provide 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 biological data can give an indication of the type of pollution which has occurred.

Biological samples are collected as part of an annual survey (see section 2.6.2) and also in response to pollution incidents. A wide variety of other biological work is carried out. A list of the types and number of samples is given in Appendix I.

2.6.1 Presentation of data

Various systems are used to assess each sample. The basis for these is the scoring scheme devised by the Biological Monitoring Working Party. Families (or taxa) of macroinvertebrate which are sensitive to organic pollution score more highly (10) than those which tolerate pollution (1). The total BMWP Score for a sample can range from 0 to over 150.

In addition, the Average Score per Taxon (family) is calculated by dividing the BMWP score by the number of scoring families present. The ASPT is considered to reflect water quality better than the BMWP Score as it removes the effect of the sample size.

We have 240 sites which have been sampled each year since 1980. The ASPT scores for these sites have been given a ratings according to Table 2.5.

FIGURE 2.2

REGIONAL RIVER QUALITY INDEX

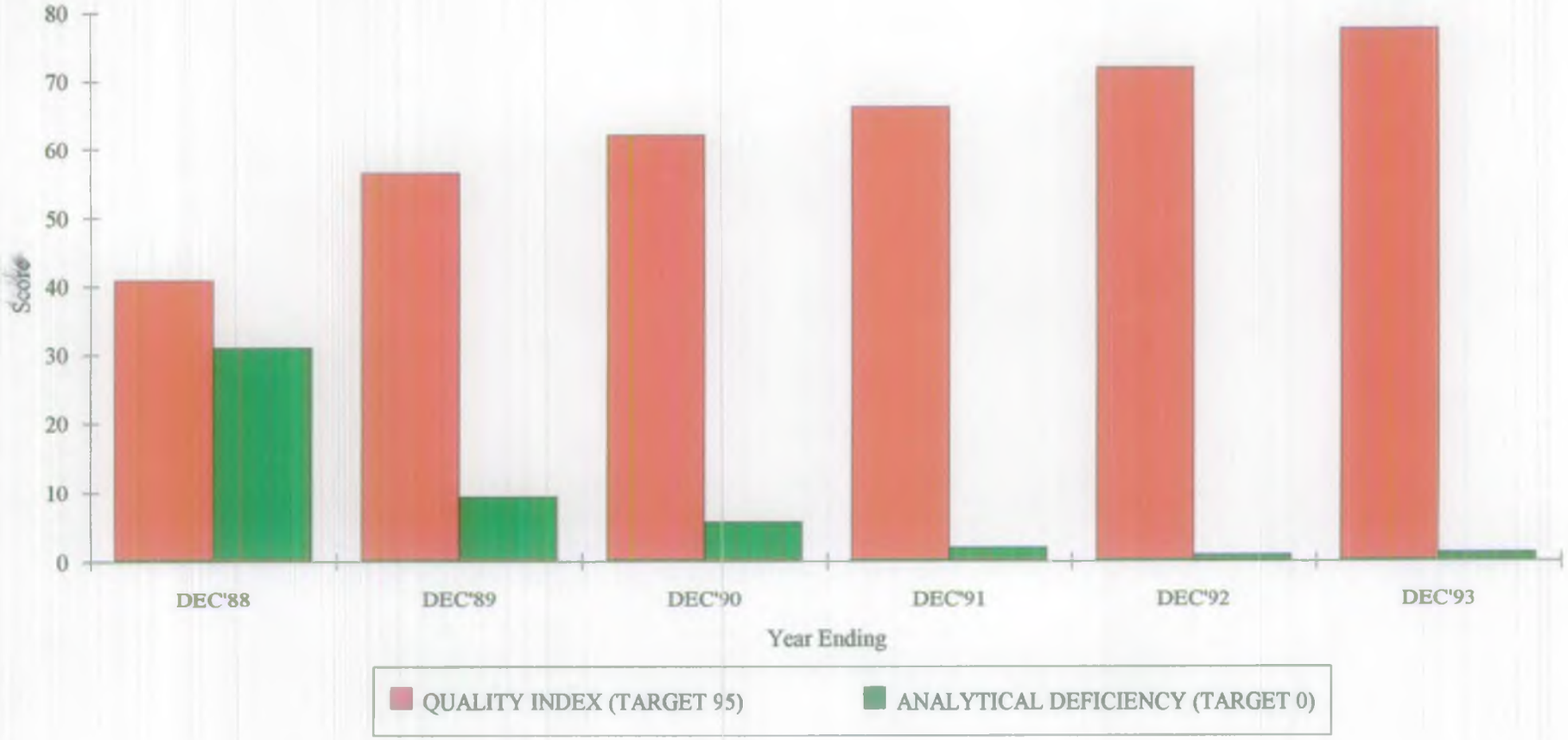


FIGURE 2.3

ASPT RANKS FOR NATIONAL REPORTING SITES 1988 TO 1993

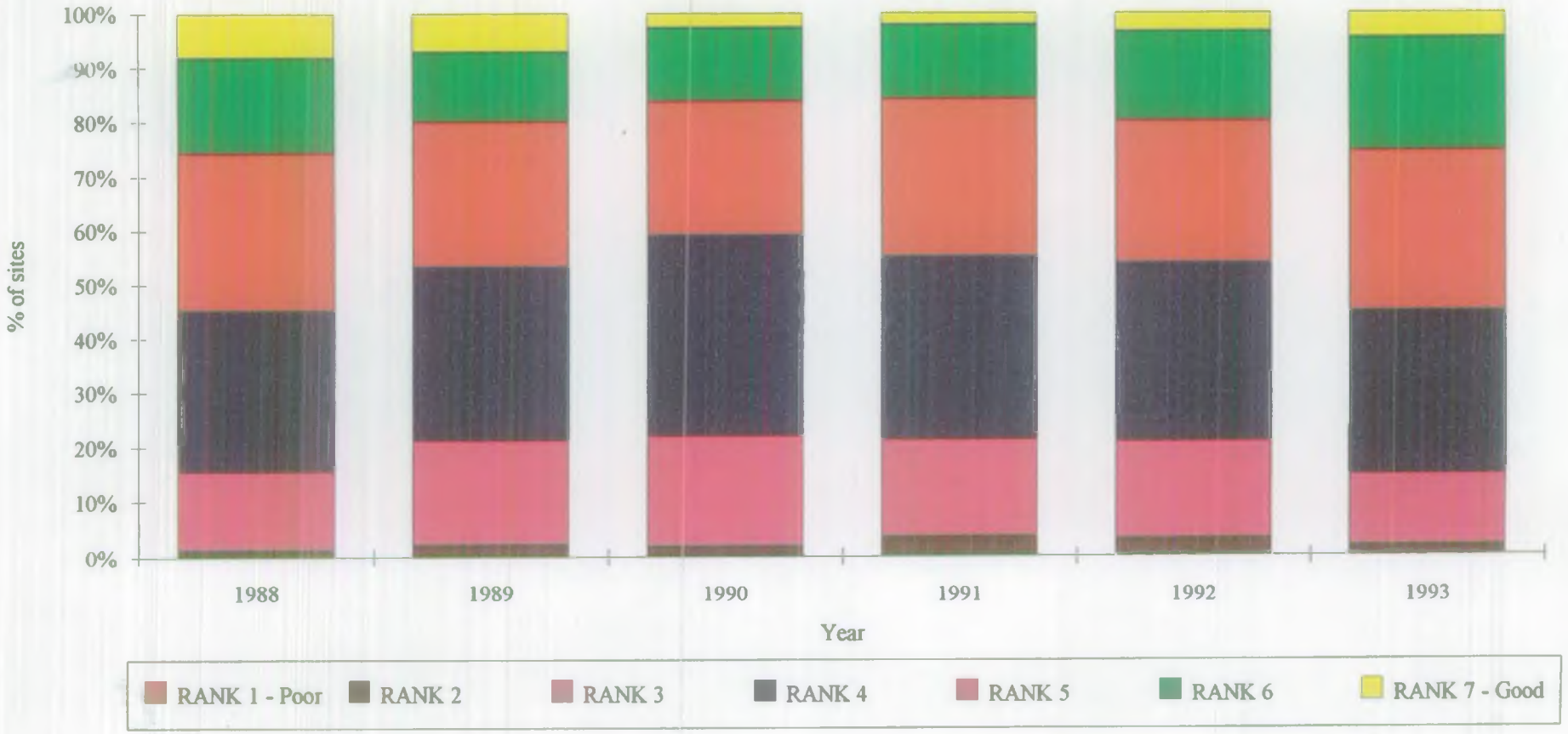


TABLE 2.5

ASPT ratings

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

The percentage of sites in each ASPT rating from 1988 to 1993 are shown in Figure 2.3. 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 and consequent improvement in quality can be seen in the 1993 data, as a higher proportion of sites in the higher ratings.

2.6.2 Biological Classification

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

The Department of the Environment funded the development of this idea to produce a mathematical model that predicts the macroinvertebrates which should be found in a clean river. The model is called **RIVPACS**, an acronym for **R**iver **I**n**V**ertebrate **P**rediction and **C**lassification **S**ystem. RIVPACS was developed by the Institute of Freshwater Ecology.

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

RIVPACS has been used to develop a National Biological Classification. For each site, the biological quality is placed in one of four bands, A to D. The bands are assigned on the basis of the ratio of observed and predicted BMWP, ASPT and number of taxa.

TABLE 2.6

National Biological Classification

Biological Band	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

The assigned Class is the median of the Class indicated by each description of water quality. But if the ASPT band is the lowest then that one is assigned to the site.

2.6.3 Biological River Quality Survey

During 1993 two samples were taken from 1,180 sites. Each sites represents a length of river and the results have been used to classify the river lengths using the National Biological Classification system described above.

The quality bands of these stretches are shown on the map enclosed with this report. The results are also summarised in Figure 2.4.

An improvement in quality has occurred in recent years. In 1993 over 60% of the river length was in band A, the best quality, compared with about 50% in 1990 to 1992.

Following the break of the drought in September 1992 biological quality began to improve as a result of higher flows. This improvement has continued in 1993.

Of the stretches which were classified in both 1992 and 1993, 24 changed by 2 or more bands. This is considered to indicate a significant change in quality.

What caused these changes to occur?

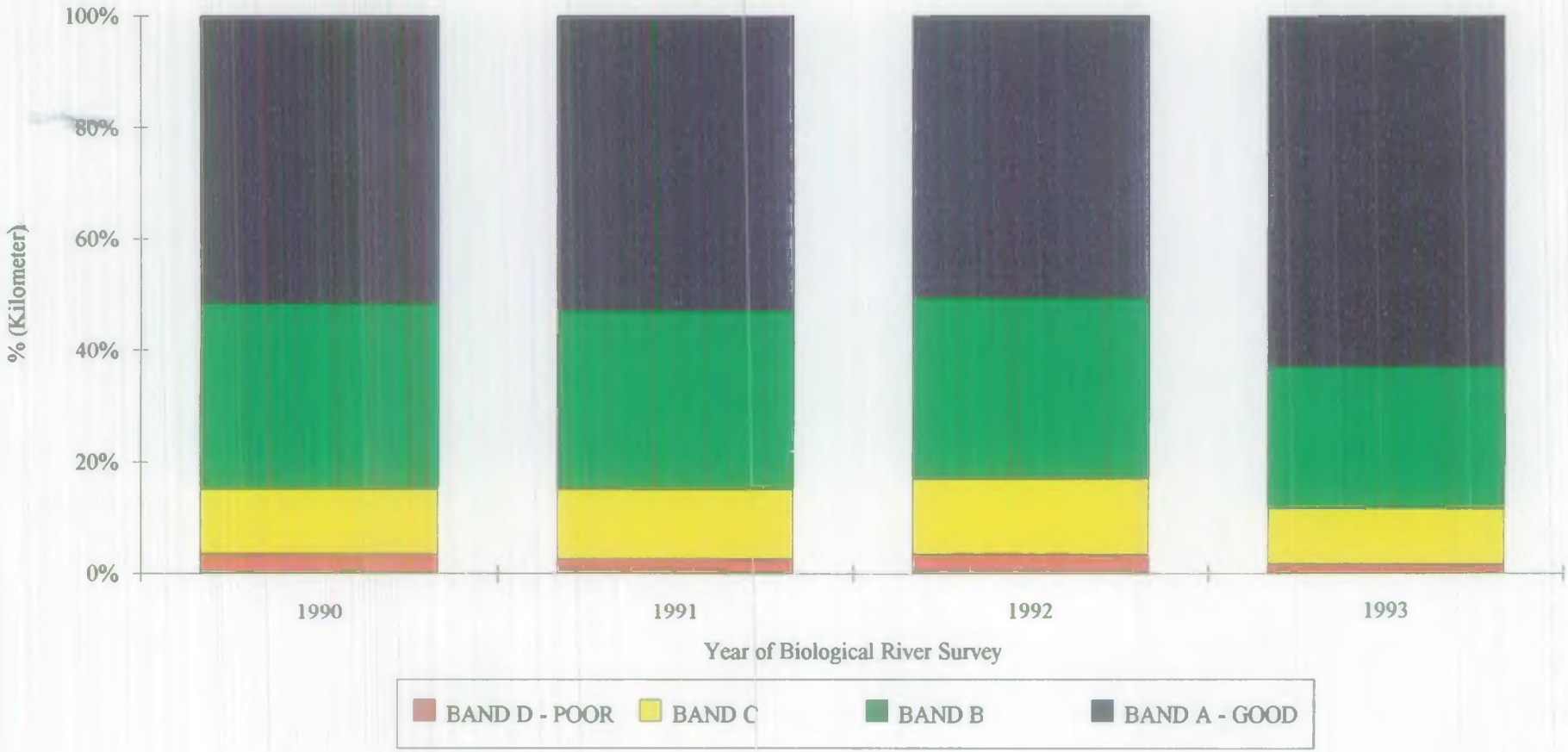
Only 3 sites decreased in quality and of the 21 sites which increased in quality, some can be attributed to specific events.

Part of the River Lark, which had decreased in quality in 1992 due to pollution by liquid fertiliser, was re-classified from C to A, demonstrating recovery following the pollution. Clipstone Brook near Leighton Buzzard improved from D to A as a result of recovery from toxic metal pollution in 1992.

Quality improved in Pierpont Drain from D to B following a campaign by NRA staff to reduce the risk of pollution at the Hansa Road Industrial Estate.

FIGURE 2.4

BIOLOGICAL RIVER QUALITY 1990 - 1993



Generally, improved quality is due to increased flows following the heavy rains in September 1992. At many sites, the improvement was attributed simply to the restoration of river flows. This has occurred on the Black Dyke, Denton Beck and Elstow Brook. Increased flow also dilutes inputs of effluent. This allowed an improvement from D to B in the quality of the Willow Brook.

Saline intrusion of some watercourses during the drought resulted in poor biological quality. Increased freshwater flows have diluted the saltwater or pushed it downstream. This had the effect of improving quality almost immediately following the rains, and this improvement has continued during 1993. The Skerth Drain has been re-classified from C to A.

2.6.4 Macrophyte Surveys

River macrophytes (plants) are becoming important in helping to determine and monitor areas affected by nutrient enrichment. Certain species tolerate high levels of nutrients. The abundance of these may then increase and they may become dominant. Diversity will decrease as a consequence. (See Part 2.7.5)

2.7 Directives

The management of river water quality is affected by several Directives issued by the European Community. They impose requirements to monitor and report. They also affect the Consenting of discharges and other measures for the control of water quality (see Part 4).

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 and their requirements will come into force progressively:

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

Several Directives apply both to fresh **and** to saline waters. For convenience, the detail on 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. With the exception of the Directive on Urban Waste Water Treatment, no Directive includes methods of assessing compliance which take account of the Laws of Chance in using samples to assess compliance. This is a serious error and poor science. It means that the assessment of compliance 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.

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 potentially less serious effects. The Directive's aim is to eliminate pollution from List I substances and to reduce pollution from List II substances.

2.7.1.1 List I Substances

Water quality standards have been set for mercury, cadmium, lindane, carbon tetrachloride, pentachlorophenol, DDT, the drins (dieldrin, aldrin, endrin and isodrin), hexachlorobenzene, hexachlorobutadiene, chloroform, trichloroethylene, trichlorobenzene, tetrachloroethylene, and 1,2 dichloroethane.

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, and report annually to the DoE (which then reports to the Commission).

We have also to control all major discharges of Listed Substances, either through the issue and review of Consents, or by our input to the Authorisations issued by Her Majesty's Inspectorate of Pollution (HMIP).

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

At the Discharge-related Sites in 1993:

[a] There were no failures to meet the criteria in any of the 17 freshwater sites designated under the Mercury Directive, nor at the 38 sites designated for the Cadmium Directive.

[b] One of the three freshwater sites monitored under the Lindane Directive failed the standard. This 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 are maintaining close contact with the company. A treatment plant is being commissioned. We anticipate that all surface water leaving the site will be treated from May 1994. A Consent has been issued for the plant and, from August 1994, the discharge must comply with Consent conditions that have been designed to prevent further failures of the river quality standard. However, the company is appealing to the DoE about some of the conditions.

[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 these substances.

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

We undertook further monitoring of the effluent and receiving waters for discharges which had low concentrations of Solvents in 1992. We shall use the results to assess whether the discharges need to be controlled for these substances.

2.7.1.2 List II Substances

For 1993 there were 106 continuous discharges to freshwaters which contained appreciable quantities of List II substances. The following sites exceeded (or nearly exceeded) the quality standards:

[a] The Willow Brook at Corby failed for Zinc. The treatment plant being built by the company responsible for the discharge is now complete. A Consent has been issued which includes a limit on Zinc and the Willow Brook has improved. However, the river quality standard was still failed in 1993. Investigations, carried out during a shutdown of the factory, have shown that zinc is still reaching the Brook from a leachate from contaminated land next to the factory. Further investigations are underway.

[b] The Hog Dyke failed its standard for Copper. The river receives effluent from the sewage treatment works for Raunds. The source of the Copper is being investigated with the help of Anglian Water's trade effluent inspectors. Negotiations are underway with Anglian Water. Our aim is to review the consent for the sewage works and add a limit on Copper.

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

2.7.2 Groundwater

This Directive protects groundwater against pollution caused by certain Dangerous Substances. It prohibits the discharge of List I Substances to groundwaters and limits the discharge of List II Substances. The lists of Substances differ to some extent from those for discharges to 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 depending on their toxicity, persistence and bioaccumulation. During 1993 the NRA set up a national committee to review the data on Substances and place them on List I or List II. The results will be made available for public examination.

At Community level, the issue of groundwater protection is moving up the agenda. The Council of Ministers issued a Resolution in 1992 that asked the Commission to draw up an Action Programme by mid-1993. The Council also 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.

Although no Action Programme was proposed during 1993, a working group (which includes NRA representation) is currently drawing up proposals. These are likely to be published in 1994.

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. The Directive contains no reporting requirement and we have not previously been asked to send our compliance reports to the DoE.

However, the Standardised Reporting Directive (see Part 2.7.7) requires that we report on the results of monitoring for all Water Quality Directives, including the Surface Water Directive. 1993 was the first year we had to report to DoE on the Surface Water Directive.

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 2.7.6).

A few other standards were failed. None of these is believed caused by discharges. There sites which exceeded for Sulphate, one of which may be due to tidal incursion beyond the abstraction point. One site failed for Ammonia. Wild foul and algal blooms are thought to be the cause.

Several sites failed for phenols. These were rural sites, with no obvious source of contamination by discharges or other pollution. The failure at one site may have been caused by the release of phenol from an abundant species of macrophyte found nearby.

2.7.4 Freshwater Fisheries

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

Generally, rivers were designated only if they complied with the Directive. This means that the Directive can help protect existing fisheries, but that it is of limited use for rivers where we want to create fisheries.

On the other hand, the Fisheries Directive is one of those which is particularly susceptible to the production of misleading results because of the Laws of Chance in sampling.

Under the Standardised Reporting Directive (see Part 2.2.7) the results of the 1993 monitoring for this Directive will be reported to the DoE. A total of 347 km (87%) of salmonid fishery complied. This is virtually the same length as in 1992 (348 km). For cyprinid fisheries, a total of 923.5 km (97%) complied. This is an improvement on 1992, when 803 km (85%) complied.

We are not aware that these failures caused actual damage to fisheries. But sites with failure are at a greater risk of failure than those which comply.

Most of the failures were for Dissolved Oxygen. These are attributed to low river flows and, in one instance, to saline intrusion. One stretch failed the standard for Un-ionised Ammonia. This failure was traced to an unsatisfactory surface water discharge from industrial premises. A prosecution is pending.

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 receiving waters. The Directive covers discharges to fresh (both surface and groundwater) and saline 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).

2.7.5.1 Eutrophic Sensitive Areas

Waters that are eutrophic, or which are at risk from becoming eutrophic, can be designated as Eutrophic Sensitive Areas under the Directive. Sewage treatment works may require nutrient removal if they serve more than the equivalent of a population of 10,000 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. The criteria are a mix of chemical parameters, such as for Phosphate and Dissolved Oxygen, and biological parameters, such as the abundance and diversity of aquatic plants and invertebrates.

Using these criteria we proposed candidates for designation by the Government. During 1993 we discussed our proposals with the DoE and Anglian Water.

As part of the process of deciding whether the candidates satisfied the Directive's definition of "eutrophic", we carried out surveys of aquatic plants. Certain species of plant tolerate high concentrations of nutrients. Surveys were carried out upstream and downstream of large discharges in order to establish whether the plant community was characteristic of a eutrophic water, and whether the discharge itself was having an impact on the plant community (Section 2.6.4).

The DoE is likely to designate the Eutrophic Sensitive Areas shortly.

2.7.5.2 Sensitive Areas for Nitrate

This applies to surface waters used for water supply which have abstraction points subject to high nitrate. Sewage Treatment Works that serve more than the equivalent of 10,000 people and which discharge directly into the Sensitive Area may be required to have treatment which is *more stringent* secondary. Secondary treatment is the norm under this Directive.

This part of the Urban Waste Water Treatment Directive is being implemented in tandem with the provisions of the Nitrate Directive (see Part 2.7.6). During 1993 we carried out studies to investigate the contribution of nitrate from large sewage discharges to the nitrate concentration at the abstraction point downstream. This information will be used by the DoE to decide the form of *more stringent treatment*.

2.7.5.3 Trade Discharges to Controlled Waters

Annex III allows some Trade Discharges to be subject to some of the Directive's provisions. Generally these are discharges associated with strong, organic effluents from the food and drinks industries. Our studies suggest that 20 discharges may be affected.

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 which are abstracted for drinking water, groundwaters with high nitrate, or waters which are eutrophic because of nitrate.

During 1992, we did 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.

Once the Polluted Waters have been identified, Nitrate Vulnerable Zones (NVZ's) will be designated. These are areas of land draining to the affected waters. During 1993 we identified the extent of Polluted Waters upstream of abstraction points, and the hydrological boundaries of the catchments draining to these Polluted Waters.

This information is being used by MAFF and the DoE to decide the so-called Hard Boundaries of the Zones. These will follow the hydrological or Soft Boundaries as closely as possible, but are based on field boundaries, roads and other easily identified physical features.

In addition, we have carried out work to identify groundwaters which have high nitrate concentrations. We have also identified the catchments (NVZ's) draining to them. We have used data from Water Companies for some of this work. As with surface catchments, Hard Boundaries are being fitted.

In the UK, groundwater Zones are likely to be based around boreholes which are used for Public Water Supply. This aspect of the Directive is being linked to the implementation of our Groundwater Protection Policy (see Part 2.11.2).

Once the proposed surface and groundwater Zones are identified there will be public consultation to ensure that the boundaries are correct. Action programmes, including mandatory restrictions on agriculture, must be established and implemented within six years of designating the Zones.

A Code of Good Agricultural Practice is being introduced which aims to achieve a general level of protection from nitrate pollution. This Code will be compulsory within Zones but voluntary throughout the rest of the country.

More details on nitrates are given in Section 2.12.

2.7.7 Standardised Reporting

From 1993, the Directive on the Standardised Reporting of Environmental Directives became relevant to Water Quality Directives. This Directive lays down requirements for reporting by Member States to the European Commission.

For Water Quality Directives, the first date for reporting under this Directive is 1996. This will cover results for 1993, 1994, and 1995.

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

Some Directives which require reporting under this new Directive, had no previous reporting requirement (for example, the Surface Water Abstraction Directive). Others, which now require annual reports, were previously reported less frequently (the Freshwater Fisheries Directive).

We now report annually to the DoE the results of monitoring for all relevant Directives. The DoE collates these reports and passes them to the European 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 all environmental matters. The Directive sets out the terms and conditions on which such information should be made available.

The Government introduced the Environmental Information Regulations (1992), which put the requirements of the Directive into UK law. These Regulations, and the accompanying Guidance Note, 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 will be much used by the Public, Pressure Groups and businesses. The Directive and Regulations effectively codify current practice of the NRA which has always sought to make information available. (In fact the information given out through our Public Register is more extensive than required by the Directive).

2.7.9 Proposed Directives

The following are proposed, or likely to be proposed soon:

- Landfill of Waste;
- Hazardous Waste;
- Integrated Pollution Prevention & Control; and,
- Ecological Quality of Surface Water.

There is also a proposal to amend the Pesticides Authorization Directive. This would establish principles for considering whether to authorise a pesticide. It is likely that this Directive (the "Uniform Principles" Directive) will include provisions designed to ensure that significant quantities of an authorised pesticide do not appear in the aquatic environment.

Progress on these Directives will depend on the political will of the Member State holding the presidency of the Commission, and how the principle of Subsidiarity is interpreted by the Commission and Member States.

2.8 Pollution Prevention

We have always carried out Pollution Prevention, but the work has not always been subject to targets, planning, programming or recording. Apart from Statutory Consultation for new developments, work on pollution prevention has tended to come about as a reactive process. For example, after a pollution incident we would address the question: "how can we prevent a similar incident occurring in the future?"

Priorities have now been set for site inspections. Our targets for 1994 have been established for several categories of site. These include Farms, Industrial Sites, Groundwater Protection Zones, known problems, concern prompted by pollution incidents, and the investigation of recorded failures to meet River Quality Objectives.

Other initiatives included:

- litter clearance in association with the Tidy Britain Group and local community associations;

- liaison with the Fertiliser Manufacturers Association (FMA) to establish guidelines on best practice to avoid pollution from the storage and use of liquid fertilisers; and,

- implementation of a Memorandum of Understanding (MOU) between the NRA and the Chief and Assistant Chief Fire Officers Association (CACFOA).

The MOU requires local liaison between the NRA and County Brigades on a range of issues. These include: the occasions when we should be informed of an incident; the provision by the NRA of a range of absorbents for some of the fire brigade's appliances; and the provision of more elaborate environmental protection equipment for support vehicles which deal with major incidents.

The MOU also requires an exchange of information on issues. These include joint inspections of high risk sites (like agrochemical stores), and the licensing of petrol filling stations.

Local liaison with some of the Region's County Fire Brigades was initiated in 1993.

2.9 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 turn out to be due to factors other than pollution (temperature induced changes in river conditions, for example). 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 1993, we dealt with 3,504 pollution incidents. This is an increase of 4% over 1992. The number of substantiated incidents was 2,625 (75%). (All further references to incidents, in this Section, refer to **substantiated incidents**).

Figure 2.5 shows the number of incidents reported annually since 1974. In 1993, only 10 (0.4%) were classified as Category 1 (see Table 2.8), compared with 18 (0.7%) in 1992.

FIGURE 2.5

NUMBER OF POLLUTION INCIDENTS

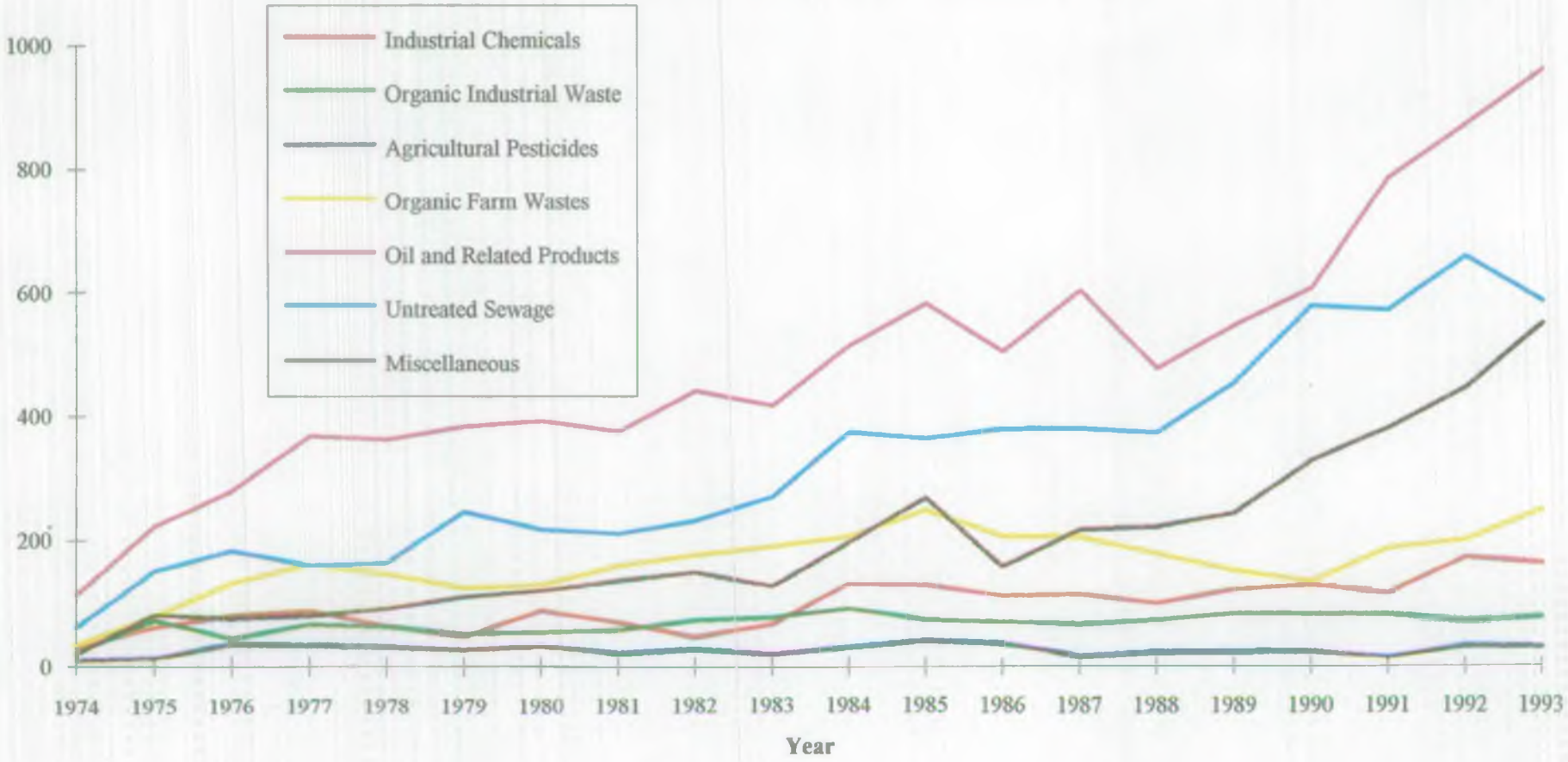


Table 2.8 Category One Pollution Incidents in 1993	
Industrial Chemicals	3
Oil and related products	3
Untreated sewage	1
Miscellaneous	3
Total	10

In 1992, Category 2 made up 40% of the total, whereas in 1993 only 24% of incidents were Category 2, with 76% in Category 3. Since 1992, there has been a 32% drop in Category 2 and a 40% increase in Category 3.

So, although the number of incidents is up on 1992, there has been a welcome reduction in number of incidents in Categories 1 and 2.

Most incidents were due to releases or spillages of Oil and Related Products (37%). The numbers of incidents of this type has increased by 10% since 1992.

Incidents caused by Organic Farm Waste constitute 10% of the total, an increased of 24%. Of the incidents caused by Organic Farm Waste, 38% are from pig farming.

Incidents from Farm Oil Spillages increased from 8 (1991) to 73 in 1993. This increase may reflect the higher rainfall in 1993.

Incidents caused by Untreated Sewage account for 22% of the total. There has been a decrease of 11%, with a big drop for Category 2 (269 in 1992, 111 in 1993).

Examples of pollution incidents during the year include:

- In February $2m^3$ of gas oil escaped from an oil tank and into Wootton Brook, Blisworth. APB Limited were prosecuted in September 1993 and fined £12,000 with costs of £749.

- 6,000 trout, eels and bullheads were killed in the River Witham at Great Ponton/Easton in September. This was due to high ammonia from a storm water dyke. Formal samples were collected and a prosecution is being considered.

- Several m^3 of blood entered the River Stour in October from a meat processing plant at Kedington.

- Waste water from a metal recycling site near Newmarket contaminated a tributary of the River Snail. A number of heavy metals such as aluminium were present in the waste water and Mayer Quarry (East Anglia) Limited were prosecuted and fined £10,000.

- In April a diesel tank was vandalised causing $3m^3$ to be lost into Willow Brook. Booms were installed and several wildfowl removed for cleaning by RSPCA. Four miles of the watercourse was affected. No prosecution was considered after the Police confirmed the vandalism.

- Raw sewage entered Ippolitts Brook, Hitchin, from an overflowing foul sewer, in February. Formal samples were collected from an Anglian Water Services Limited pumping station and on the 28 July 1993 they were prosecuted and fined £4,000, with costs of £1,216.

Figure 2.6 gives a breakdown of incidents resulting in fish mortalities. The total number has decreased slightly since 1992, and the deaths in 1993 were due to industrial wastes, and oil and their related pollutants.

Better legislative powers and our growing effectiveness at pollution prevention will reduce the number and impact of incidents. However, any decrease in the number of incidents will continue to be offset as public awareness continues to grow. This may explain why a greater numbers of less serious incidents are being reported.

2.10 Prosecutions for Pollution Incidents

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

This means that the number of prosecutions is a small fraction of the total number of pollution incidents, and some prosecutions are not brought to court until the following year. The cases brought to court in 1993 are listed at Appendix II and trends in the prosecutions over the last 15 years are shown in Figure 2.7. In 1993, 56 prosecutions for pollution were undertaken, a record number for this Region.

In addition to prosecutions, 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. The NRA has adopted guidelines followed by the Crown Prosecution Service and we are now more actively pursuing the use of Formal Cautions. This is reflected in the increase in Formal Cautions from 18 in 1992 to 36 in 1993 (see Appendix III).

Biological data were used to support a number of cases.

FIGURE 2.6

NUMBER OF POLLUTION INCIDENTS RESULTING IN FISH MORTALITIES

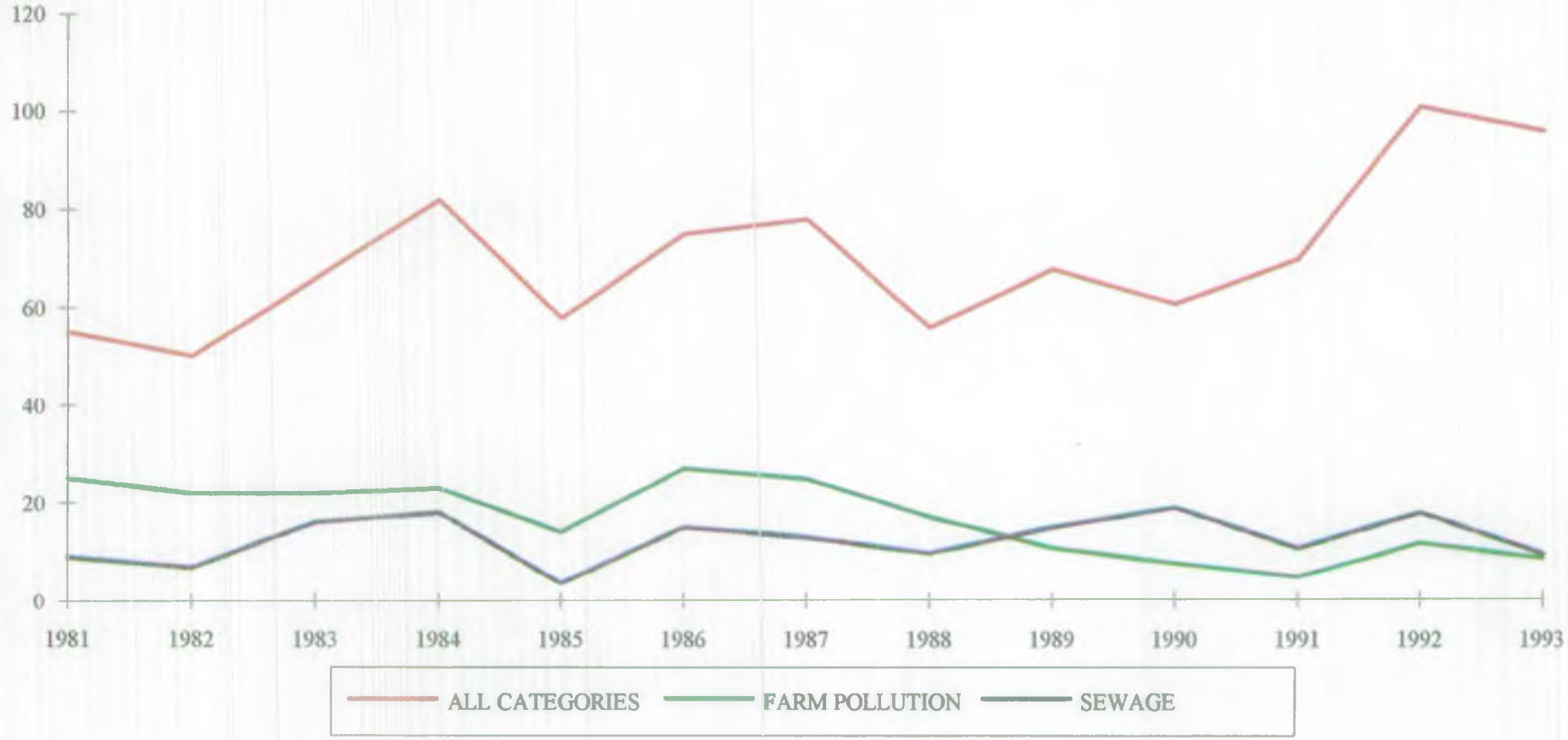
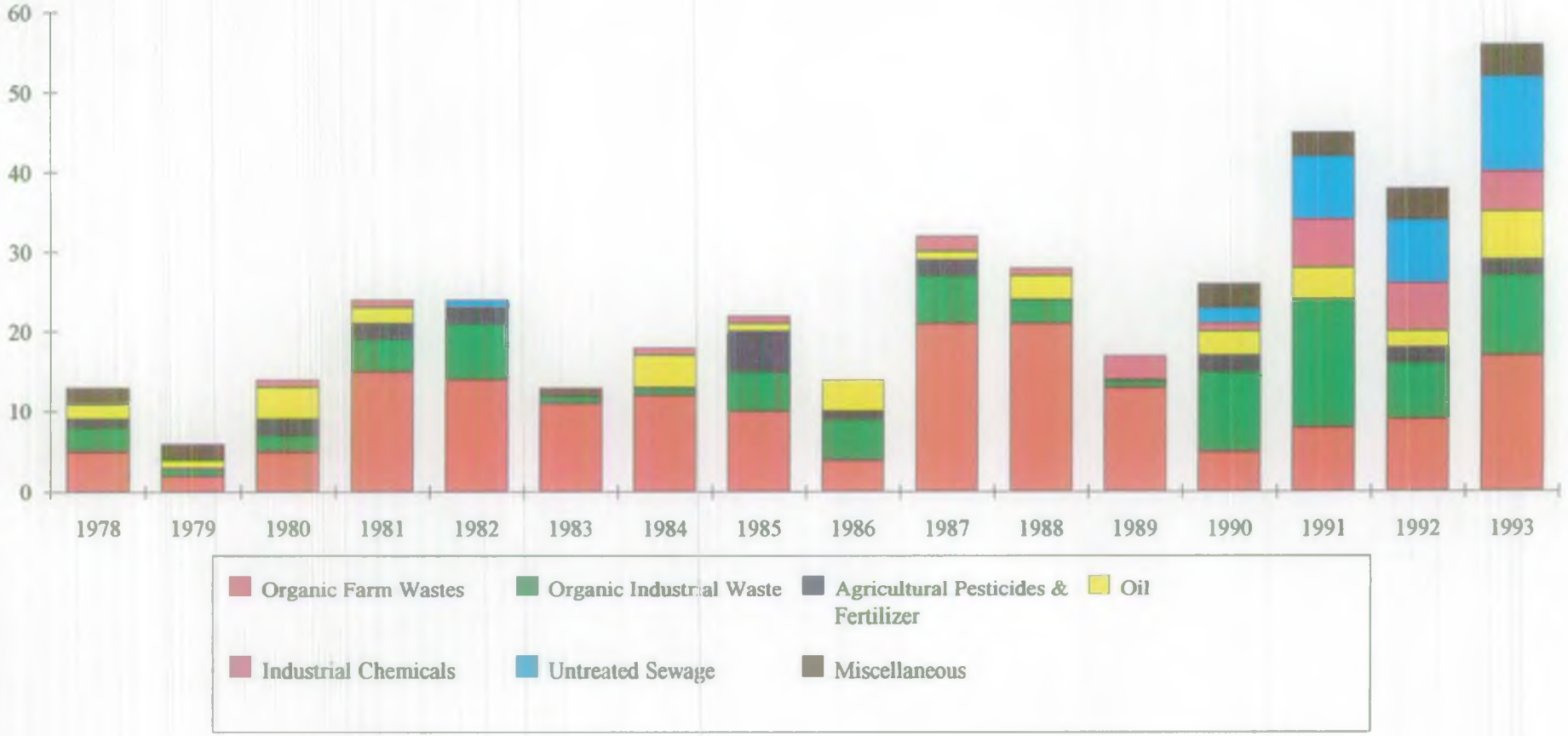


FIGURE 2.7

NUMBER OF PROSECUTIONS FOR POLLUTIONS INCIDENTS



2.11 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. 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.

2.11.1 Monitoring

Currently, we routinely monitor 700 points. Analytical suites range from simple tests, to lists including metals, pesticides and microbes (see Part 8). Most of the biggest boreholes are owned by Water Companies, and we regularly obtain their data, to supplement our own.

New national guidelines have been drawn up for monitoring. We are developing a strategy based on these guidelines. During 1993 we continued to develop a computer system to improve how we assess compliance with standards.

2.11.2 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 (Section 1.2) and to influence others, for example, in response to consultations in the planning processes of Local Authorities.

The Regional Appendix to this Policy describes the importance of our groundwaters and the geological classification of strata. It also gives NRA contacts, and explains the transition from old to the new Policy.

Our strategy is based on two approaches:

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;

ii) **Source Protection.** This applies around boreholes, wells and springs that are currently used for water supply. Three concentric Source Protection Zones may be defined around these sources. These are I (Inner), II (Outer), and III (Source Catchment).

By the middle of 1993, we had defined draft zones around 140 sources. Fifty of these were given priority for completion so that we could define Nitrate Sensitive Areas and Nitrate Vulnerable Zones. The major part of this exercise is finished. We are now working on the remaining 90 sources.

Activities which pose a threat to groundwaters are grouped together. Each group has a policy statements. The groups are:

A. Control of abstractions;
B. Physical disturbance of aquifers and groundwater flow;
C. Waste disposal to land;
D. Contaminated land;
E. Disposal of liquid effluents, sludges and slurries to land;
F. Discharges to underground strata;
G. Diffuse pollution of groundwater; and,
H. Additional activities which pose a threat to groundwater quality.

Our view on the acceptability of these activities is governed by whether it is located in any Source Protection Zones.

Site licenses for Waste Disposal site are issued by the County Councils. 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.

2.11.3 Remediation

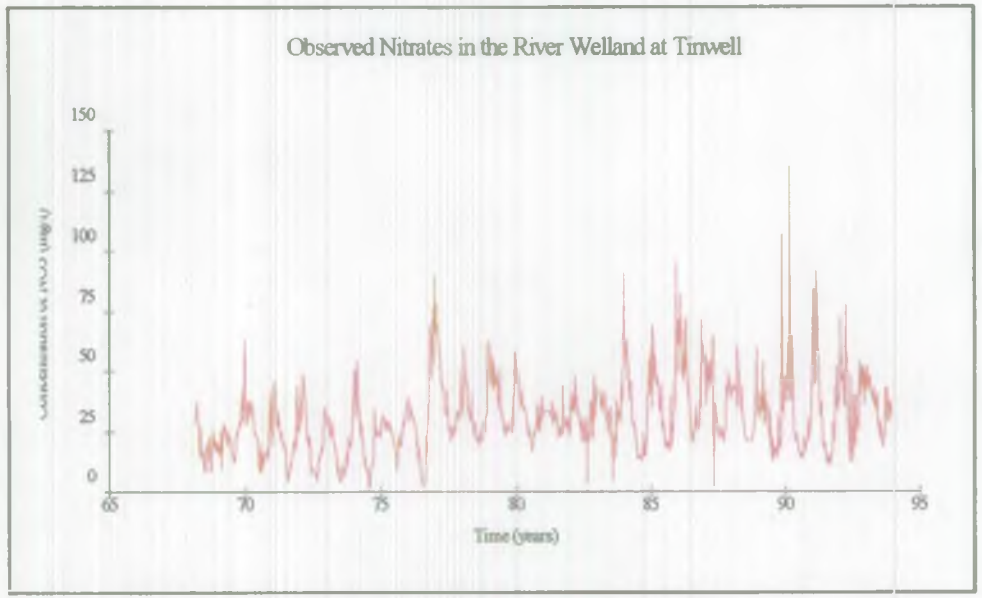
We work closely with County Councils to investigate and improve the situations around a number of contaminated sources. These include boreholes, at Mildenhall, Honington, Baldock, Bury St.Edmunds, Letchworth, Thetford, and Cambridge.

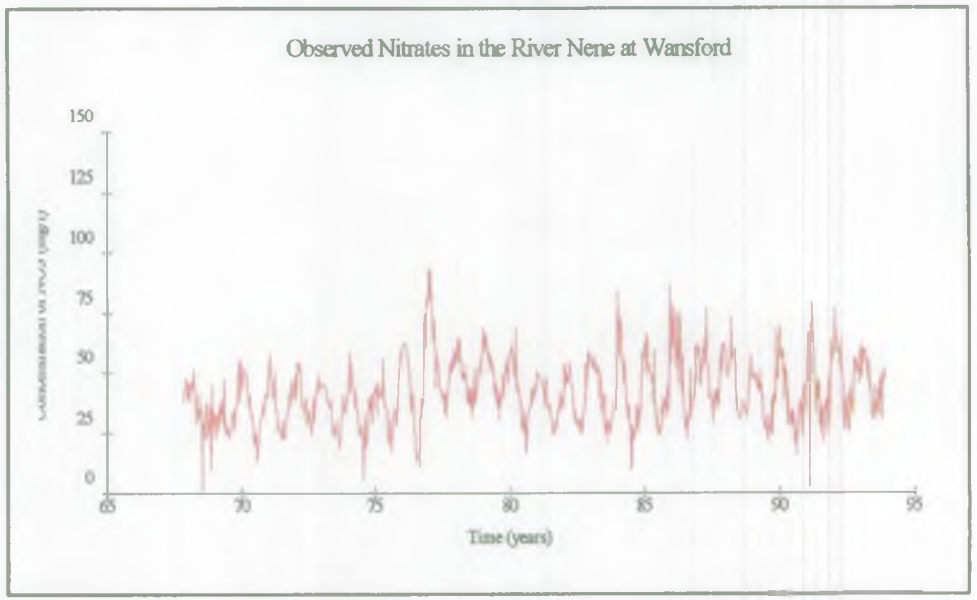
We continued to liaise with Glanford Borough Council on a scheme to reclaim contaminated land on the former Britag site in Barton on Humber. When the scheme is complete we anticipated that the potential will be reduced for pollution of the chalk aquifer and the River Humber.

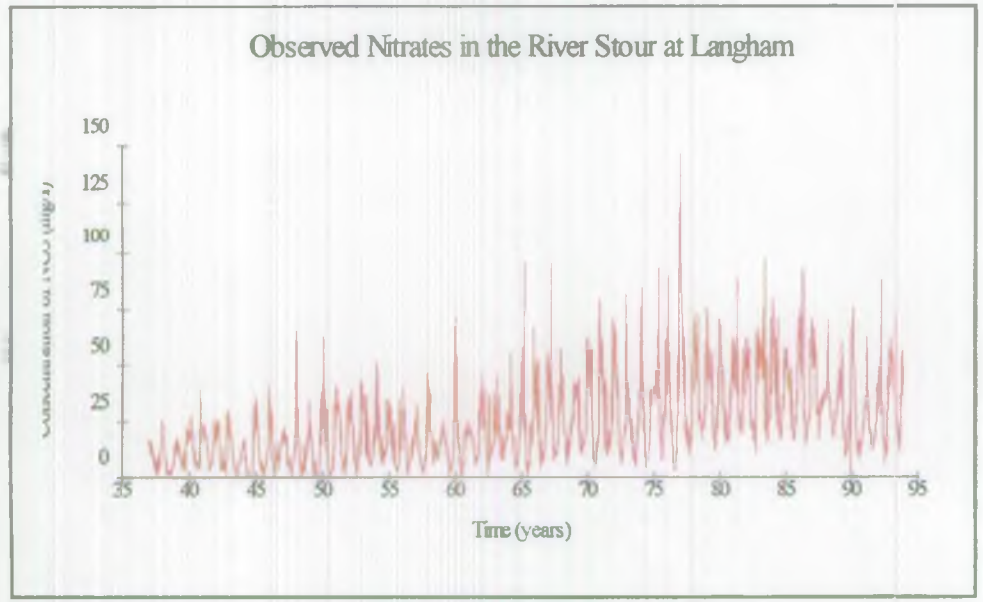
We have reported on investigations of polluted groundwater around a public water supply borehole at Etton, near Peterborough. A herbicide has been traced back to a set of landfill sites which lie to the south-west of the borehole. Although the pollutant is being removed from abstracted water by Granular Activated Carbon, we are evaluating options to prevent further pollution, and to clean up the present contamination.

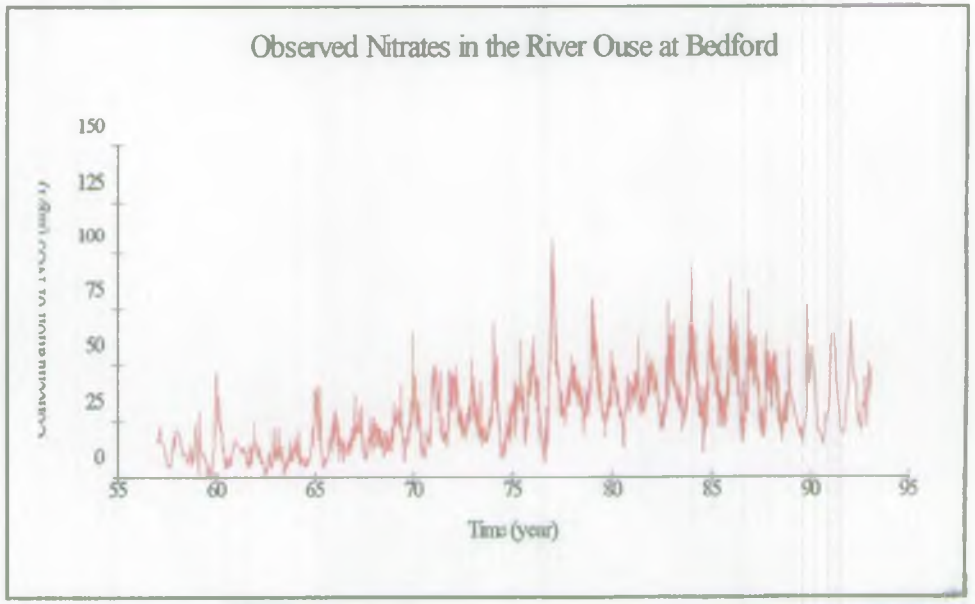
The court action by Cambridge Water Company against Eastern Counties Leather Company (ECL) of Sawston, for costs arising from historic groundwater pollution by chlorinated solvents, was finally resolved in the House of Lords. The Law Lords found in favour of ECL on the grounds that they could not reasonably have foreseen that their actions at that time would result in the contamination.

FIGURE 2.8


Observed Nitrates in the River Welland at Tinwell
150
125
100
75
50
25
0
65
70
75
80
85
90
95
Time (years)


Observed Nitrates in the River Nene at Wansford
150
125
100
75
50
25
0
65
70
75
80
85
90
95
Time (years)


Observed Nitrates in the River Stour at Langham
150
125
100
75
50
25
0
35
40
45
50
55
60
65
70
75
80
85
90
95
Time (years)


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

Following this judgement, the NRA negotiated a programme of action to be carried out by ECL. This should contain the worst of the pollution, and prevent it spreading further and affecting springs and other abstractors. We have conducted a preliminary study of the options for cleaning the groundwater, and work is continuing to provide further information.

2.12 Nitrate

2.12.1 Nitrate in Rivers

Figure 2.8 illustrates the variability of nitrates with site and season. It shows trend at four abstractions. It suggests that since 1976, the upward trend has levelled off.

2.12.2 Nitrate Sensitive Areas

The Water Resources Act 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 by the NRA of Candidate Areas, and following consultations with farmers, the Ministry of Agriculture, Fisheries and Food (MAFF) established 10 NSAs. Two are in Anglian Region, one at Sleaford and the other at Branston Booths, near Lincoln. Nine other areas were identified as Nitrate Advisory Areas (NAAs), of which 5 are in the Anglian Region.

The scheme aims to reduce nitrate concentrations by encouraging changes to farming. The scheme is voluntary and runs for five years from 1990. In the Basic Scheme, farmers are paid compensation if they change the use of their land. Larger payments are given for the bigger changes defined by the Premium Scheme. Virtually all the land in the Branston and Sleaford NSAs is included in the Basic Scheme. In addition, 13% and 33% respectively are also in the Premium Scheme.

In conjunction with the Water Companies (whose boreholes are being protected by the NSAs and NAAs), we are monitoring nitrate within the NSAs and at the boreholes. The results are sent to DoE and, through MAFF, to the farmers involved. An example is given in Figure 2.9.

The apparent reduction in nitrate since 1988 is believed due to the effects of the drought. The dry winters of 1990 and 1991 meant that less nitrate was leached from the soil. Heavy rain in the summers and autumn of 1992 and 1993 resulted in high rates of leaching. Figure 2.9 indicates that nitrate concentrations are still peaking at levels which were observed before the NSAs were set up. The situation is extremely complex, however, and it is too early to say if the changes in land use will have an effect which is detectable.

A new batch of NSAs was proposed in 1993, and consultation with farmers took place in November. The new NSAs will form part of an initiative, with EC funding, for Agricultural Measures that Benefit the Environment. Five NSAs are proposed for our Region: Brocklesby, near Grimsby; Aswarby, near Sleaford; Birchmoor, near Woburn; Slip End, near Royston; and Sedgeford near Hunstanton.

The new NSAs will again be voluntary and compensation will be paid. Most of the agricultural measures involve the conversion of arable land to grazed or ungrazed grassland. Farmers can join the new scheme in any of the five years starting in autumn 1994, and will have to commit to a five year period.

2.13 Blue-Green Algae and Eutrophication

Since the problems at Rutland Water in 1989, blue-green algae have continued to be an issue. The Toxic Algae Task Group was set up in 1989 to make recommendations for monitoring and control. The Group recommended a change from routine monitoring to Reactive Monitoring. Reactive Monitoring is monitoring which is done in response to enquiries from the public or owners.

The change to Reactive Monitoring reflects the fact that ecology of waters does not change from year to year and fluctuations in algal populations depend on the weather. Algal 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 1993, 27 waters were sampled for the first time. Of these, 13 (48%) contained populations of potentially toxic species at densities sufficiently high for us to warn owners that blooms could occur. Another 13 (48%) contained blooms or scums. In addition, 15 waters which were sampled in previous years were also sampled in 1993. All exceeded contained blooms or scums.

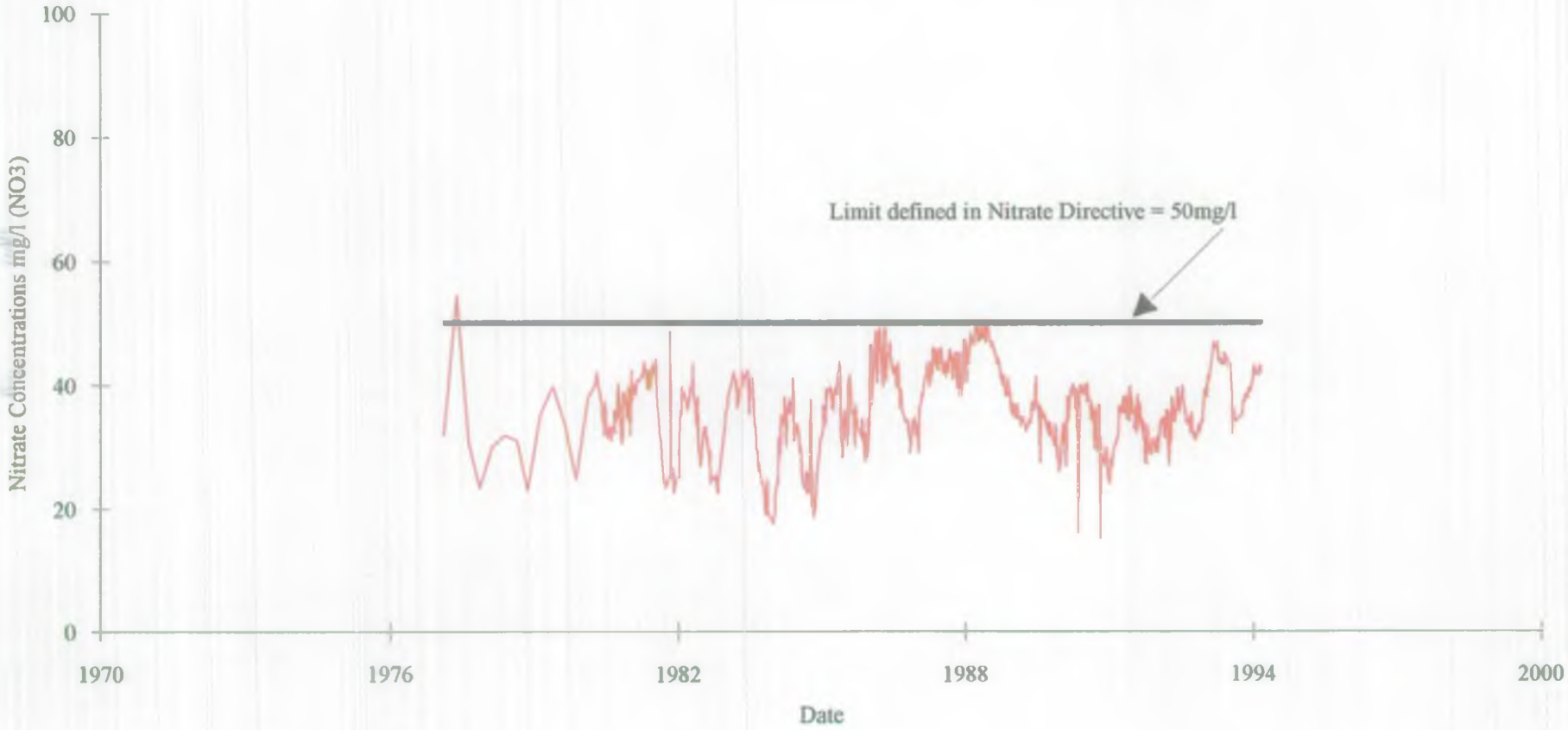
Fewer waters were sampled than in previous years. There are at least two reasons for this. First, the cooler weather gave rise to fewer problems. Second, the public is more aware of blue-green algae and has accepted that it is a natural phenomenon which has the potential to re-occur each year. This may mean that people are less likely to notify us.

The lower incidence of problems was also reflected in the lack of media attention.

The Task Group is currently co-ordinating work on Action Plans. There is no universal solution to the control of blue-green algae. Action Plans aim to provide the best option for an individual water.

FIGURE 2.9

BRANSTON BOOTHS - NITRATE CONCENTRATION



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 for control. These options are assessed and the best can then be selected and, following consultation, implemented.

2.13.1 Ferric Dosing

Anglian Water has continued to dose a number of reservoirs with ferric sulphate. This controls algae by reducing phosphorus concentrations in the water. We have monitored the effects of dosing at Covenham Reservoir, Grafham Water, Pitsford Reservoir and Rutland Water.

The results have indicated that dosing has damaged the invertebrate communities near the discharge point of some reservoirs. It is unknown whether this is caused by toxicity or blanketing.

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 he bottom of the reservoir. This kind of dosing has been proposed as a national requirement for all planned ferric dosing schemes at reservoirs.

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

We are continuing with several research projects on the control of eutrophication. 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.

As a result of the damage caused by dosing to the invertebrates of Rutland Water, the Water Company is looking for alternative strategies. Anglian Water has begun phosphate stripping at the big sewage treatment works discharging to the Rivers Nene and Great Ouse. We have begun a new project to assess the impact that this will have on the receiving waters.

As part of this we have identified rivers which contain low concentrations of nutrients. Such rivers are uncommon in our Region but are thought to support characteristic plants and invertebrates. The next stage is to identify the communities characteristic of these rivers. This will assist in determining target groups to aim for following phosphate control. (See part 2.7.5)

2.14 The Norfolk Broads

Work on the restoration of the Norfolk Broads has continued during 1993. The reduction of phosphorus inputs from sewage treatment works remains a target and, following discussion with Anglian Water, works have been identified as requiring capital investment to improve phosphorus removal (Part 4.2.11).

In addition to controlling the inputs of phosphorus, the NRA initiated a joint programme with the Broads Authority to develop novel techniques of lake restoration. This work is funded by the NRA and Broads Authority, with contributions from the Soap and Detergent Industry Association and English Nature. It also receives a grant covering 50% of the cost from the European Union LIFE Fund. A major part of the project is to develop techniques of biomanipulation to create clear water conditions by encouraging grazing zooplankton.

A critical component of the success of the biomanipulation is its stabilisation by aquatic vegetation. Partners in the project include the Dutch organisation RIZA, and a research assistant from the Netherlands is now working with the NRA and the Broads Authority on the growth of vegetation in biomanipulated lakes.

During 1993 Cockshoot Broad continued to respond to biomanipulation and a new trial was established at Alderfen Broad. These trials will be brought together with investigations of the release of phosphorus from sediments and the results of monitoring of water quality and changes in plankton. The information will used to improve the management of the Broads, and to help restore shallow lakes elsewhere in the United Kingdom.

2.15 Pesticides

Pesticides are used to control a great range of micro-organisms, weeds, animals and insects. Because of this, and increasingly accurate analytical techniques, many pesticides are now being detected, widely, in low concentrations in surface and groundwaters. Although such quantities are not known to be harmful to humans or aquatic life, it is prudent to make every effort to prevent contamination.

During 1993 we analysed for 104 pesticides and over 44,000 results were obtained.

We are producing an NRA strategy for pesticides which will include recommendations to help minimise the risk from pesticides. Our main approach is to maintain to promote the correct way of storing, using and disposing of pesticides (Best Practice), through discussions with industry, government and at agricultural shows. We are continuing to ensure that farmers and other users are aware that it only takes a very small quantity of pesticide to contaminate watercourses, and that by implementing Best Practice many small pollutions can be prevented.

For the second consecutive year, no major incidents resulted from pesticides. We hope that this is a sign that the message of "Best Practice" is getting across.

We have provided data for reviews of pesticides to MAFF and the Health & Safety Executive. These reviews are carried out when further information is needed on an Approved Pesticide, either to upgrade data or to investigate potential adverse effects. The result of one review was that non-agricultural use of the herbicides Atrazine and Simazine was banned from August 1993. This following increasing detection in surface and groundwaters. Alternative pesticides will be used by Local Authorities and others, and we will monitor for these.

Water Companies have reported a small number of instances when pesticides in potable water have been detected above the standards set down in the Drinking Water Directive. These have mainly been for the herbicides Atrazine, Simazine, Isoproturon, Diuron, 2,4 D, Dicamba and Mecoprop. The occurrence of Atrazine and Simazine should decline following their withdrawal from use and we are currently investigating the origin of the others so that action can be taken. (See Part 2.11)

As there are some 450 Approved Pesticides it is not possible to monitor for all of them. Historically, monitoring has concentrated on the older organochlorine and organophosphorus pesticides, together with the most commonly used modern products, mainly herbicides. Use of a commercial database, FARMSTAT, predicted that, in addition to the commonly found pesticides, certain others were likely to be present in river waters. To test this, special surveys were undertaken for nine pesticides. Of these, Bentazone, a herbicide use mainly on peas and beans, was detected at concentrations above the Drinking Water standard in 12% of samples. Others were detected occasionally. Work is continuing to determine the environmental significance of these pesticides.

We did more work on Tecnazene and Chlorpropham. These are anti-sprouting agents for stored potatoes. Initial indications are that these pesticides and their breakdown products are found at some locations in significant quantities in river sediments, but only at very low concentrations in river waters. Particular attention is being given to the Nene Estuary, where biological surveys indicate a stretch with severe depletion of invertebrates in the sediments. The situation is complicated by the rapid tidal movements in the estuary, and also by the identification in some sediments of a peak of Gamma HCH, an organochlorine insecticide. Work is continuing.

2.16 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 the statistical uncertainties associated with water quality data.

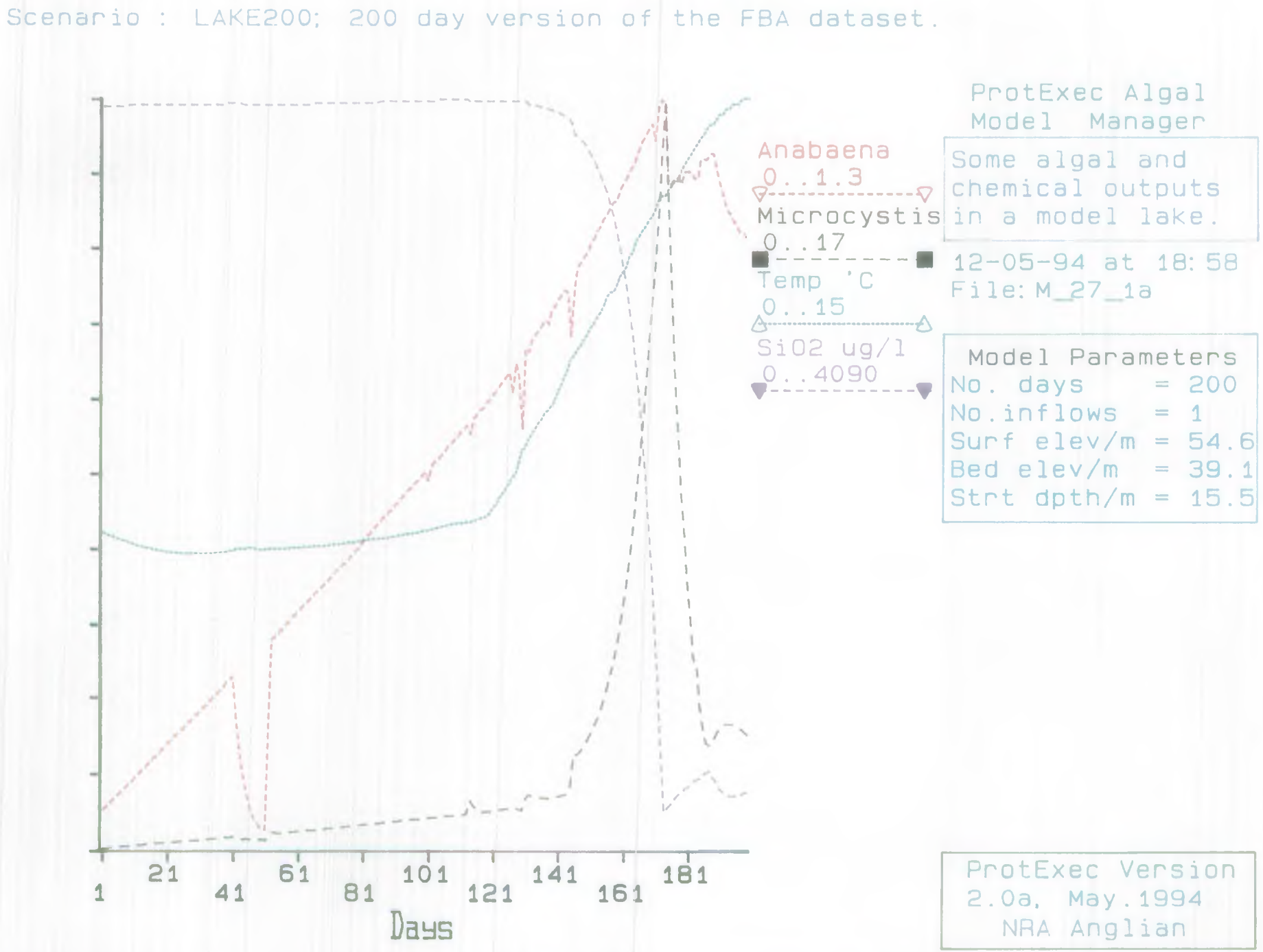
Data files have been produced or updated for the following rivers:

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

The model is routinely 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.

PROTEC-2, a model which can predict the growth of algae in water bodies, was developed under an R&D contract by the Freshwater Biological Association. The model uses environmental data such as lake dimensions, nutrient inputs, and cloud and wind information, and predicts the concentrations of algal species, including toxic blue-green algae (See Part 2.13). Figure 2.10 shows an example of the output.

FIGURE 2.10


Scenario : LAKE200; 200 day version of the FBA dataset.
ProtExec Algal Model Manager
Some algal and chemical outputs in a model lake.
Anabaena
0..1.3
Microcystis
0..17
Temp 'C
0..15
SiO2 ug/l
0..4090
12-05-94 at 18:58
File: M_27_1a
Model Parameters
No. days = 200
No.inflows = 1
Surf elev/m = 54.6
Bed elev/m = 39.1
Strt dpth/m = 15.5
1
21
41
61
81
101
121
141
161
181
Days
ProtExec Version 2.0a, May.1994
NRA Anglian

Part 3: ESTUARIES & COASTAL WATERS

3.1 Monitoring

During 1993, we worked on 22 estuaries and most of our coastal waters. Routine sampling was performed at 587 sites, including the 33 Bathing Waters. Additionally, 258 sites were sampled for special surveys. Frequencies ranged from annual to weekly. The total number of samples exceeded 6,400.

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 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 major estuaries and at several sites on the coastline. The numbers of samples are given in Appendix I.

3.2 Classification

We use the CEWP System to assess the qualities of 580 km of our estuaries, including the whole 65 km of the Humber.

There has been little change in estuary water quality since 1992. Most lengths of estuary are of good quality although there are localised areas of pollution around some outfalls.

A summary of the results for 1993 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 same as 1992.

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.

3.3 Marine Biology

A total of 4,416 samples was collected in 1993 (Appendix I). They were collected for a variety of reasons including our own routine monitoring and as part of the National Monitoring Programme (NMP).

Surveys of benthic macroinvertebrates have also been carried out to assess the impact of sewage and industrial discharges, and of outfalls in the Humber Estuary. Surveys have been carried out for statutory monitoring under the Titanium Dioxide Directives, and to establish the background quality of estuaries such as the Upper Stour.

A benthic survey assessing the impact of a recently relocated outfall from Ciba Geigy was carried out. This survey followed a previous survey in 1992 of the same area prior to the commissioning of the new outfall. No evidence was found that the discharge has damaged the biota..

A bioaccumulation study of the Great Ouse and eastern Wash has been initiated with samples of seaweed and shellfish collected and analysed for persistent substances such as metals and pesticides. So far, the results have not lead to concern.

3.3.1 Marine Algae

Nutrients can cause eutrophication which may result in blooms of algae. Decaying algae can form unsightly scums and foams which are washed inshore. This material is often confused with sewage and leads to complaints from the public.

In 1991 the NRA established a monitoring programme for algae at sites sampled for the Bathing Water Directive (see 3.4.4). Algal material was collected for analysis whenever algal blooms were visible. This programme was repeated in 1993. In addition we also monitored in response to inquiries about particular waters.

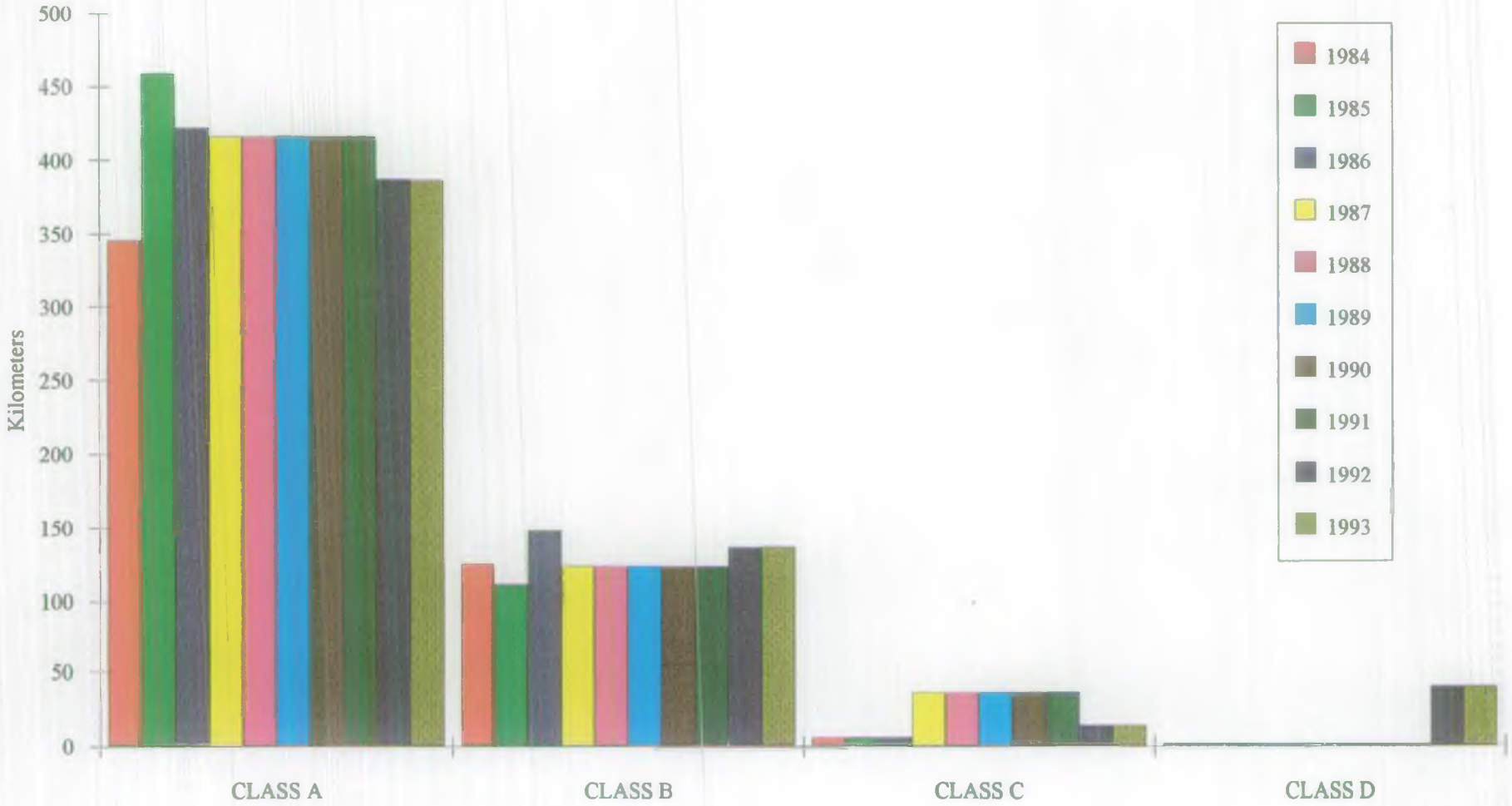
54 sites were monitored. Fourteen of these were found to have had blooms, all of these were reported as *Significant* to inquirers and Local Authorities. There were a number of press reports.

3.4 Directives

The Directives affecting Freshwaters are described in Part 2. The main, long-standing Directives affecting saline waters are those for:

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

FIGURE 3.1
ESTURINE WATER QUALITY



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 (2.7.8).

3.4.1 Dangerous Substances

The scope and objectives of this Directive are outlined in 2.7.1.

We are required to monitor marine sites affected by discharges. All our sites passed the List I Standards for mercury, cadmium, lindane, pentachlorophenol, carbon tetrachloride, the Drins (Aldrin, Dieldrin, Endrin, and Isodrin), chloroform, hexachlorobenzene, hexachlorobutadiene, tetrachloroethylene, trichloroethylene and trichlorobenzene. We also undertook background monitoring for List I Substances, as required by the DoE.

We monitored waters downstream of 33 discharges that contain List II Substances. Seven exceeded the quality standards, these being:

- The Humber Estuary at South Killingholme for Copper and Nickel;
- Fenn Creek (Crouch estuary) south of Eyotts Farm for Copper;
- The River Crouch at Battlesbridge for Copper;
- Hamford Water at The Twizzle, off Titchmarsh for Copper;
- The River Colne at Rowhedge Ferry for Copper;
- The River Stour at Baltic Wharf, Mistley for Copper; and,
- The River Orwell at Landguard Point, Felixstowe for Copper.

The failures for Copper and Nickel in the Humber resulted, at least in part, from inputs outside our Region. We liaised with other Regions on these.

The Water Research Centre has shown that the copper in the Humber is bound up with organic matter and that this form of copper has low toxicity. Concentrations of copper in excess of the standard are permitted in such cases. Any contribution to the failures from discharges from the Humber Bank will be addressed by a combination of the Waste Minimalisation Projects that are being developed by the dischargers, and Authorisations issued by HMIP under Integrated Pollution Control.

No single cause of the copper failures in Fenn Creek, the River Crouch, Hamford Water, River Colne, River Stour and River Orwell have been identified. 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 have started to monitor the discharges for copper. We shall use his information to decide whether we need to amend Consents.

3.4.2 Shellfish Waters

In contrast with the Shellfish Health Directive (see 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 2.2.7) we must report to the DoE, the results of monitoring carried out in 1993. There were few exceedences of the Mandatory Standards.

Exceedences of the DoE's suggested standard for zinc were recorded at 5 sites:

- Butley River Oysterage;
- Pyefleet Channel at North Farm Hard;
- River Blackwater off Marconi Sailing Club, Stansgate;
- Hamford Water, The Twizzle off Titchmarsh; and,
- River Roach, Monkton Quay.

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.

There were copper failures at three sites:

- Butley River Oysterage;
- Pyefleet Channel at North Farm Hard; and,
- Hamford Water, The Twizzle off Titchmarsh.

One of the failures may have been due to an industrial discharge. This discharge now has a Consent which includes a limit on copper. Another possible cause is the increasing use on boats of anti-fouling paints.

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 UK 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 1993 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 at SCM. Water around Tioxide's outfall generally exhibited lower iron concentrations than in 1992.

The results of biological monitoring indicate that, although there is evidence of impact, there has been an improvement in fauna around Tioxide's outfall. This may be linked with the commissioning of the new treatment plant during 1993. Data from around the SCM outfall continue to suggest a recovery in the fauna.

The latest Directive, 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 reduce pollution and meet the timetable imposed by the Directive. New Consents were issued for both dischargers during 1993. These reflect the standards and timescale imposed by the Directive.

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 1991, Regulations under the Water Act were issued by the DoE. These put the requirements of the Directive into UK Law and established a classification for Bathing Waters based on the Mandatory Values in the Directive.

During 1993, 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 1994 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 Waters in our Region, 28 passed the standards as assessed by the DoE criteria. This compares with 31 out of 33 in 1992 (See Table 3.1).

The five sites which failed were Cleethorpes, Great Yarmouth South, Great Yarmouth Pier, Gorleston Beach, and West Mersea. The Waters at Cleethorpes, and Great Yarmouth South also failed in 1991 and 1992. Gorleston Beach and West Mersea also failed in 1991. 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 classed wrongly to have passed or failed. 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 trend. Figure 3.2 plots the median quality for each Water over six 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 70%, approximately 5% more than in 1992, and the highest in the seven years since 1987. For 1993 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 2 to 5.

This improvement since 1987 had been attributed to a combination of capital expenditure by the Water Companies, 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 and 1993 were wetter, cooler summers than the previous three, the improvement in quality was sustained and advanced. This suggests that capital expenditure is the main cause of the improvement.

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

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

* These sites have had at least one failing sample.

3.4.5 Urban Waste Water Treatment

Discharges of sewage effluent to saline waters will be particularly affected by this Directive (see 2.7.5). It requires secondary treatment at many locations, unless the discharge goes to a Less Sensitive Area (see 3.4.5.1). 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 Less Sensitive Areas

Member States can apply treatment less stringent than secondary to discharges to marine waters where the waters have been granted the status of Less Sensitive Area (re-named High Natural Dispersion Area in 1993).

To obtain this status, the discharger must demonstrate that the discharge of primary treated effluent does not adversely affect the environment in the proposed area, or in adjacent areas. The discharger does this by undertaking what is called a Comprehensive Study.

During 1993 we commented on preliminary proposals that certain effluents be deemed to discharge to High Natural Dispersion Areas. We were also involved in the development of the methodology for the Comprehensive Studies.

3.4.6 Shellfish Health Directive

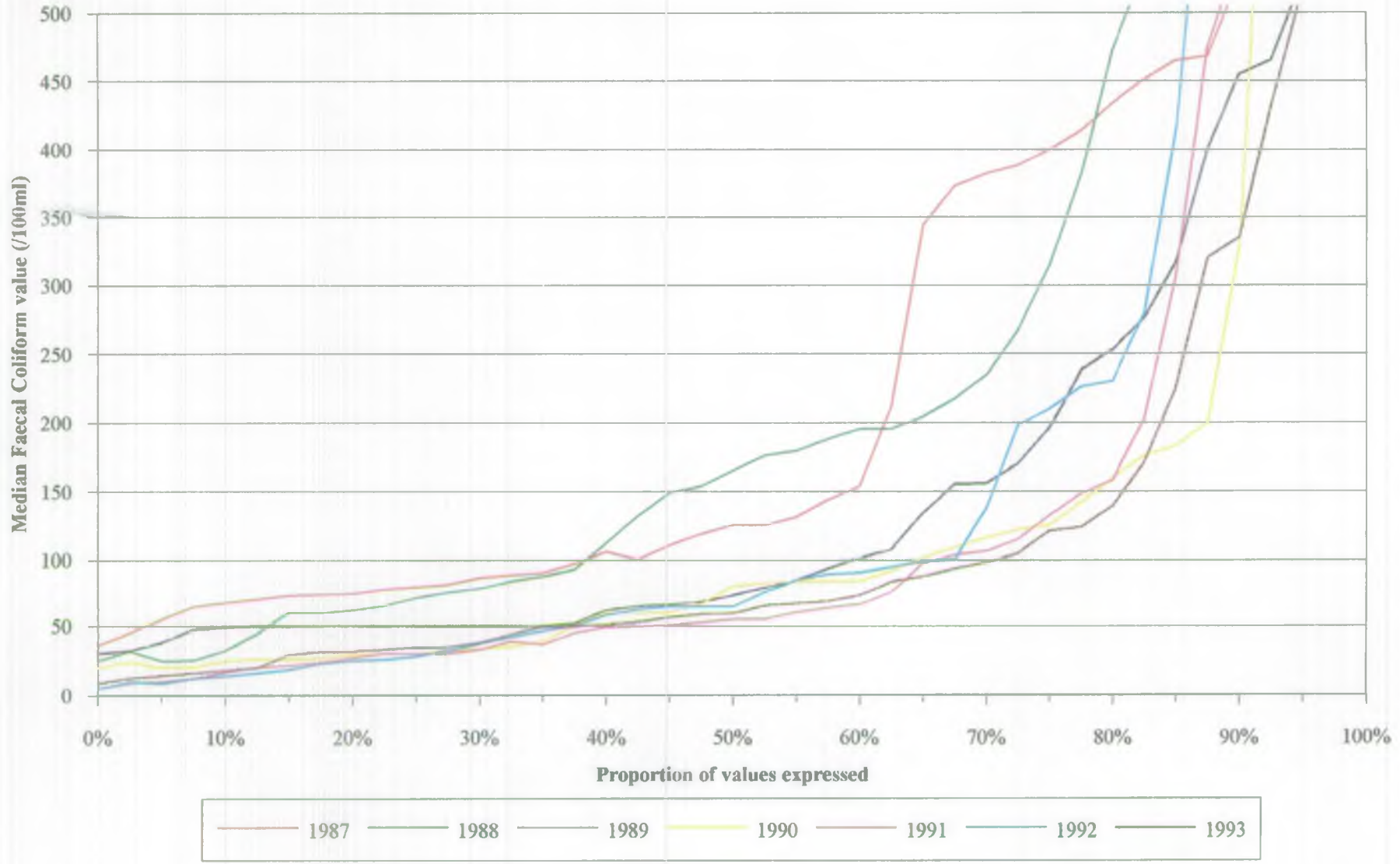
Previously known as the Shellfish Hygiene Directive, this was formally adopted in 1991. Three sets of Regulations under the Food Safety Act 1990 have been issued. These incorporate the Directive (and the related Fish Health Directive) into UK Law. The Regulations lay down conditions for the production 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 classified into 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 of these lie within our Region.

FIGURE 3.2

BATHING WATER QUALITY
EXPRESSED IN TERMS OF MEDIAN FAECAL COLIFORMS



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

Many of the 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 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 Regulations from 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 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 also to eutrophic tidal waters. Under the Directive, Vulnerable Zones had to be designated by Member States by the end of 1993. No Vulnerable Zones have yet been designated by the UK, although there are likely to be designations during 1994.

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 vulnerable 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

Our marine monitoring has greatly increased since we acquired our coastal survey vessel, the "Sea Vigil". 1993 was its second full operational year, during which it again met its targets for working hours. Details are shown in Figure 3.3.

Much of the boat's time is spent collecting nutrient data. So far we have issued a repot covering the Lincolnshire Coast and one covering the Wash. Other reports will follow shortly. Figures 3.4 and 3.5 show the location of the sampling points used for the Lincolnshire coast and the Wash.

Nutrient data for the Lincolnshire Coast are unexpectedly varied. The water between Huttoft and Ingoldmells frequently shows enhanced concentrations. Algal blooms were evident in both June 1992 and June 1993 with other blooms apparent in September along the middle to northern part of the coastline. In June 1993, there was evidence of an algal bloom in the outer Wash.

The Wash itself is not usually well mixed and the influence of the tributary estuaries can be identified well 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.

3.5.2 National Coastal Monitoring Study

Anglian Region contributes to the NRA's National Coastal Monitoring Study. Water quality data (nutrients, chlorophyll-A, organic contaminants, suspended solids, dissolved and total metals) 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 carrying a Remote Sensing Scanner 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 1993. The results of these and those from 1992 have been published in national report.

3.5.3 The Joint Nutrient Study

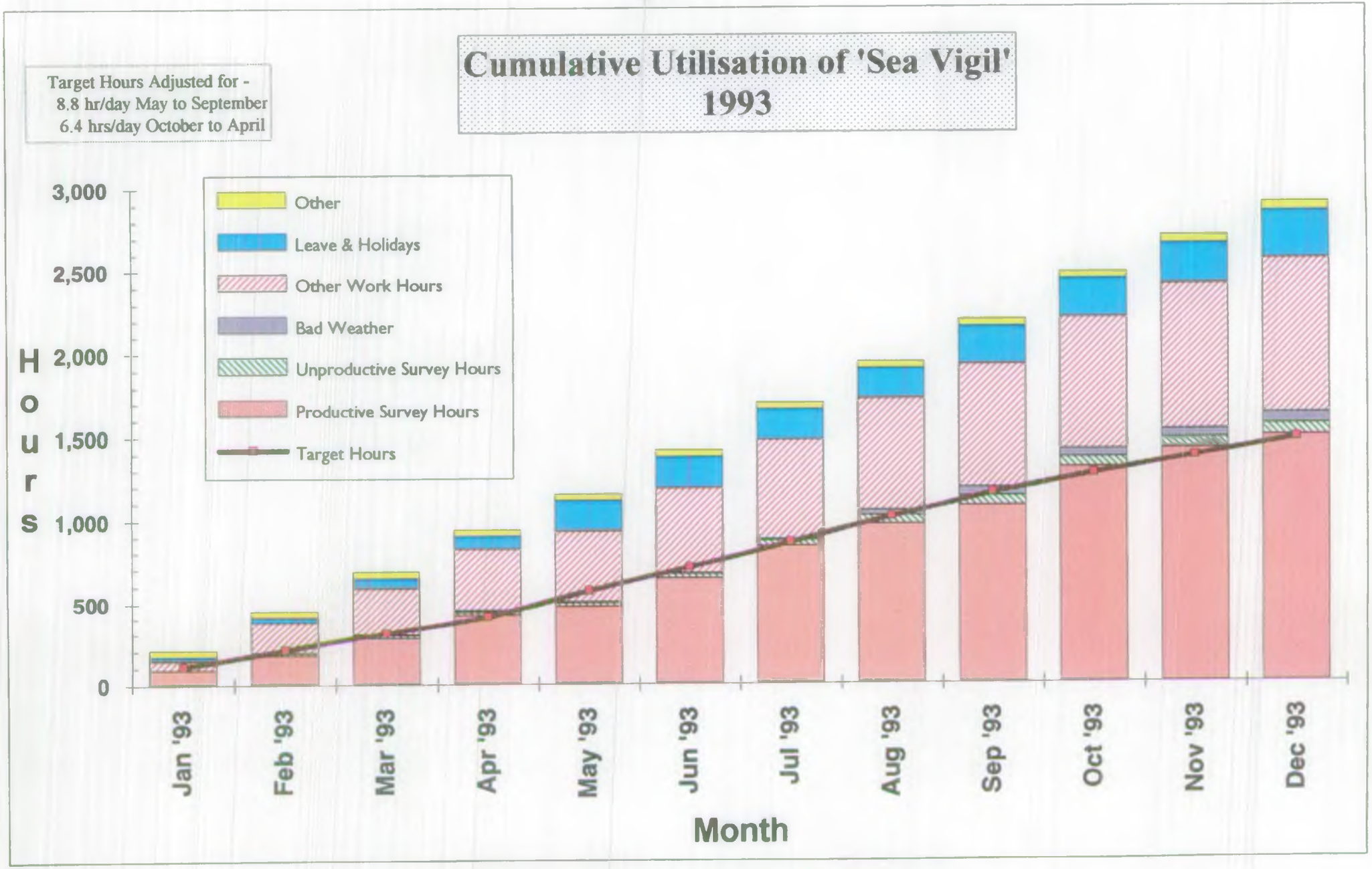
The national JoNuS study has been gathering information on the transport of nutrients through estuaries to coastal waters. MAFF, funded by DoE, has concentrated on the coastal and offshore zones between the Humber and the Thames. The NRA has contributed to the project by providing nutrient data from the Wash and its associated estuaries. We have also supported a research project at the University of East Anglia on phosphate recycling in estuaries.

The monitoring was completed in 1993 and the results of the project are being written up by MAFF. Outline proposals are currently being formulated for a second JoNuS project covering the Wash and Thames estuaries, possibly including the smaller estuaries on the east coast.

3.5.4 Red List & Annex 1A

In 1987, Government representatives to the second North Sea Conference agreed to a 50% reduction by 1995 in the loads of certain Dangerous Substances discharged to the North Sea. A list of 23 such Substances was identified: the Red List. The third North Sea Conference (held in 1990) identified a list of 36 Substances, including all of the Red List except PCBs. This is known as Annex 1A.

Figure 3.3

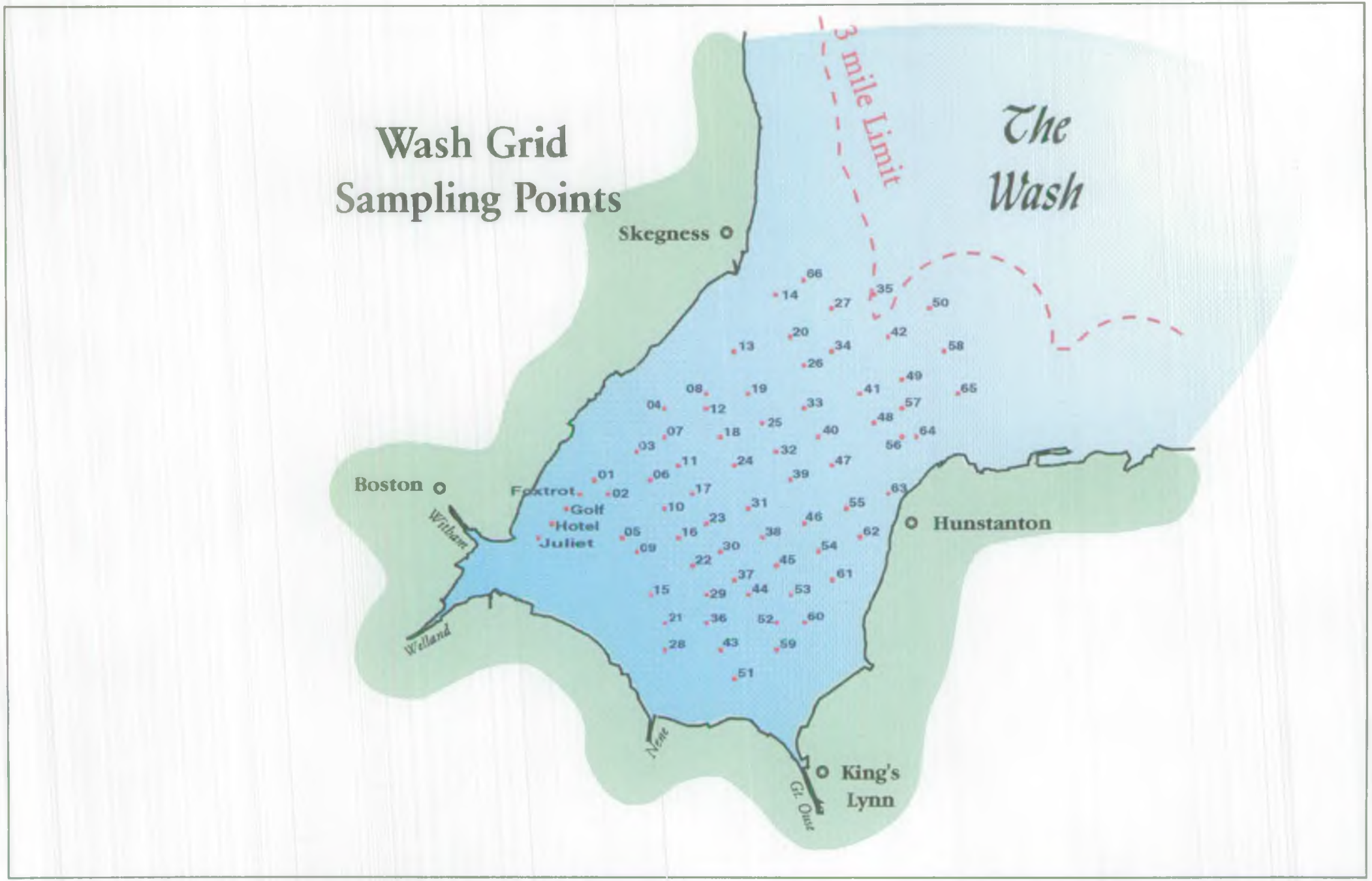


Operations - January '93 to December '93

Figure 3.4

'Sea Vigil' Sampling Points along the Lincolnshire Coast

Figure 3.5


Wash Grid
Sampling Points
3 mile Limit
The
Wash
Skegness
Boston
Foxtrot
Golf
Hotel
Juliet
Witham
Welland
Nene
Gt. Ouse
Hunstanton
King's
Lynn
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In England and Wales, the NRA has the responsibility for ensuring that this reduction is met.

Since 1990, we have collected data on all significant inputs of Red List and 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 3.6 shows the proportion of the national loads discharged to the North Sea from our Region during 1992. Anglian contributes a small proportion of the total for most substances. This reflects the lack of heavy industry and our small rivers. Four substances stand out: chromium, endrin, trifluralin and fenitrothion.

Chromium is industrial in origin and is 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. Once these plants are fully operational, the input loads will decrease.

Endrin, trifluralin and fenitrothion are pesticides. Endrin is no longer Approved for use and only small amounts are found. For 1993 the total amount in the Region was 20 grammes. Fenitrothion, although Approved, is rarely used and was only found in our Region (the total amount is 7 grammes). In both cases the identification is more a recognition of the sophistication of analytical capability than an environmental problem. The fourth, trifluralin, is an agricultural herbicide and its presence reflects the extent to which farming is a major occupation in the Region.

Agricultural herbicides find their way into rivers and the North Sea mainly from the land and hence are diffuse in origin. Such diffuse inputs cannot be controlled as easily as point source inputs. Restrictions on marketing and use are the most likely ways by which inputs could be reduced.

3.6 Paris Commission

In 1978 the Convention for Marine Pollution from Land-based Sources set up the Paris Commission. Since then, monitoring 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.

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 3.7 shows the proportions contributed by these sources, in 1992. 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 again it is the agricultural nature of the Anglian Region which accounts for its presence.

3.7 National Centre for Toxic and Persistent Substances

Since 1989, Anglian Region has provided a co-ordinating service to the NRA on the North Sea, Pesticides and Toxic Algae.

In 1993 the Chief Scientist recommended to the Chief Executive that a National Centre should be set up in Anglian Region to meet current and future commitments for Toxic and Persistent Substances (TAPS). The formal opening of the Centre is expected in 1994.

3.8 Mathematical Modelling

The aim to provide a suite of consistent techniques for calculating the measures needed to achieve our objectives for water quality.

3.8.1 Estuaries

We have used the Stour/Orwell/Harwich Harbour Model to examine the impact of a proposed new sewage treatment works which will discharge at Felixstowe. The model is unusual because it integrates 1-dimensional estuary components with a 2-dimensional coastal model. This allows us to predict the behaviour of pollutants both along the length and across the width of this system.

A model of the Humber has been completed by the Water Research Centre (WRc). WRc is also working on models of the Humber and Wash systems which will combine 1-dimensional and 2-dimensional elements in a similar fashion to the Stour/Orwell/Harwich Harbour model.

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 representatives from Anglian Water, the Water Research Centre, and our Region.

Figure 3.6

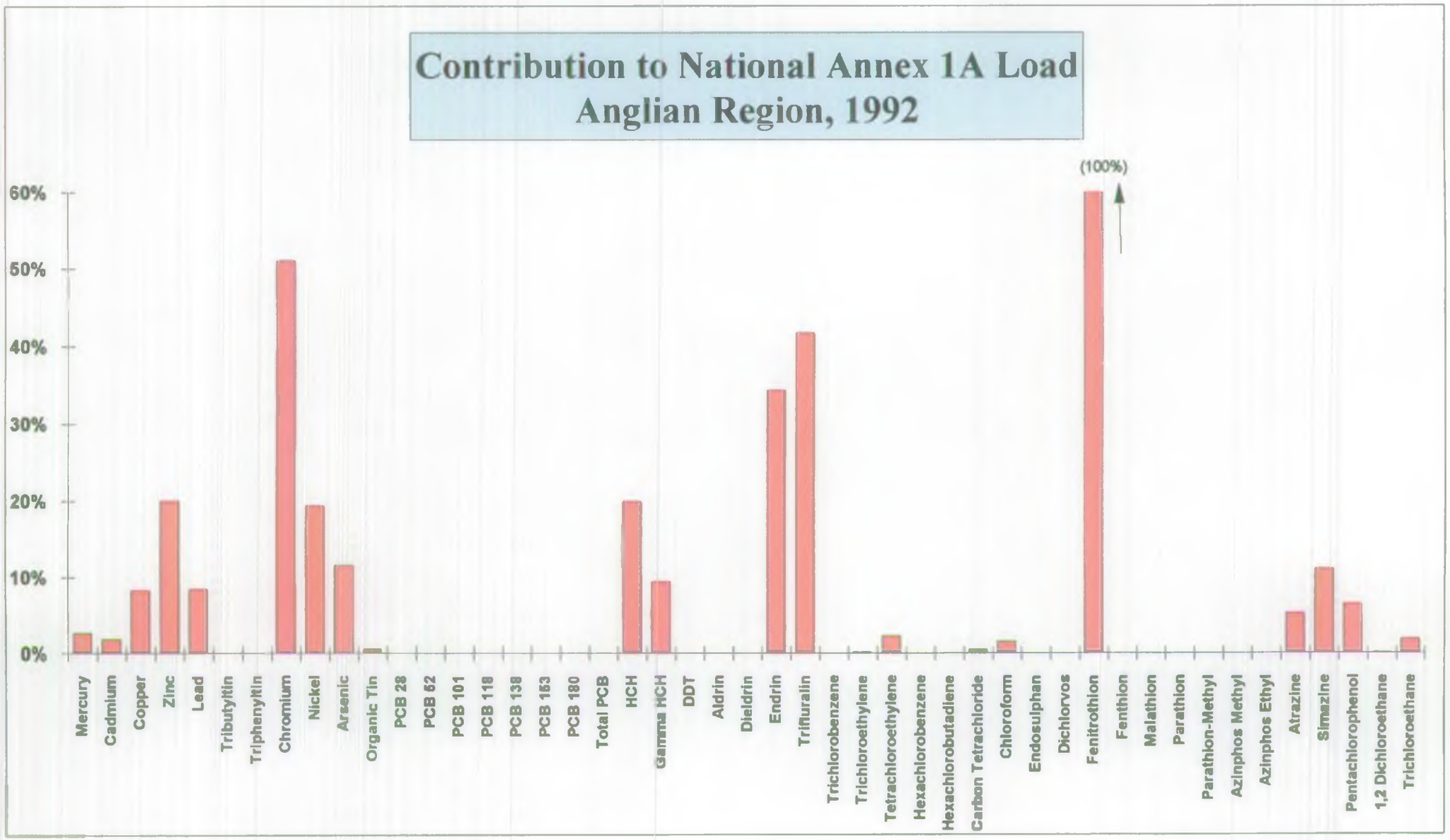

Contribution to National Annex 1A Load
Anglian Region, 1992
(100%)
60%
50%
40%
30%
20%
10%
0%
Mercury
Cadmium
Copper
Zinc
Lead
Tributyltin
Triphenyltin
Chromium
Nickel
Arsenic
Organic Tin
PCB 28
PCB 52
PCB 101
PCB 118
PCB 138
PCB 153
PCB 180
Total PCB
HCH
Gamma HCH
DDT
Aldrin
Dieldrin
Endrin
Trifluralin
Trichlorobenzene
Trichloroethylene
Tetrachloroethylene
Hexachlorobenzene
Hexachlorobutadiene
Carbon Tetrachloride
Chloroform
Endosulphan
Dichlorvos
Fenitrothion
Fenthion
Malathion
Parathion
Parathion-Methyl
Azinphos Methyl
Azinphos Ethyl
Atrazine
Simazine
Pentachlorophenol
1,2 Dichloroethane
Trichloroethane

Figure 3.7

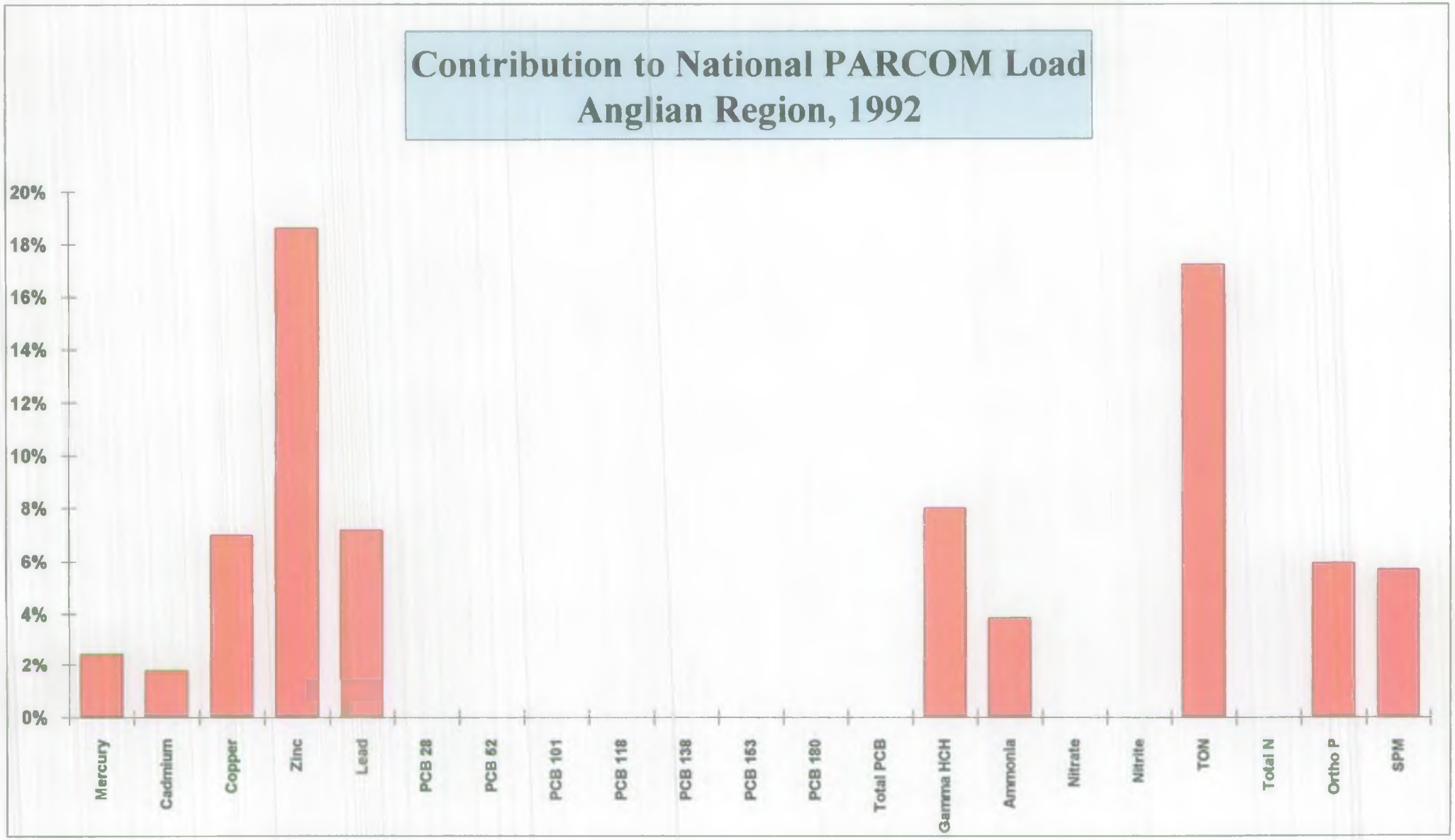
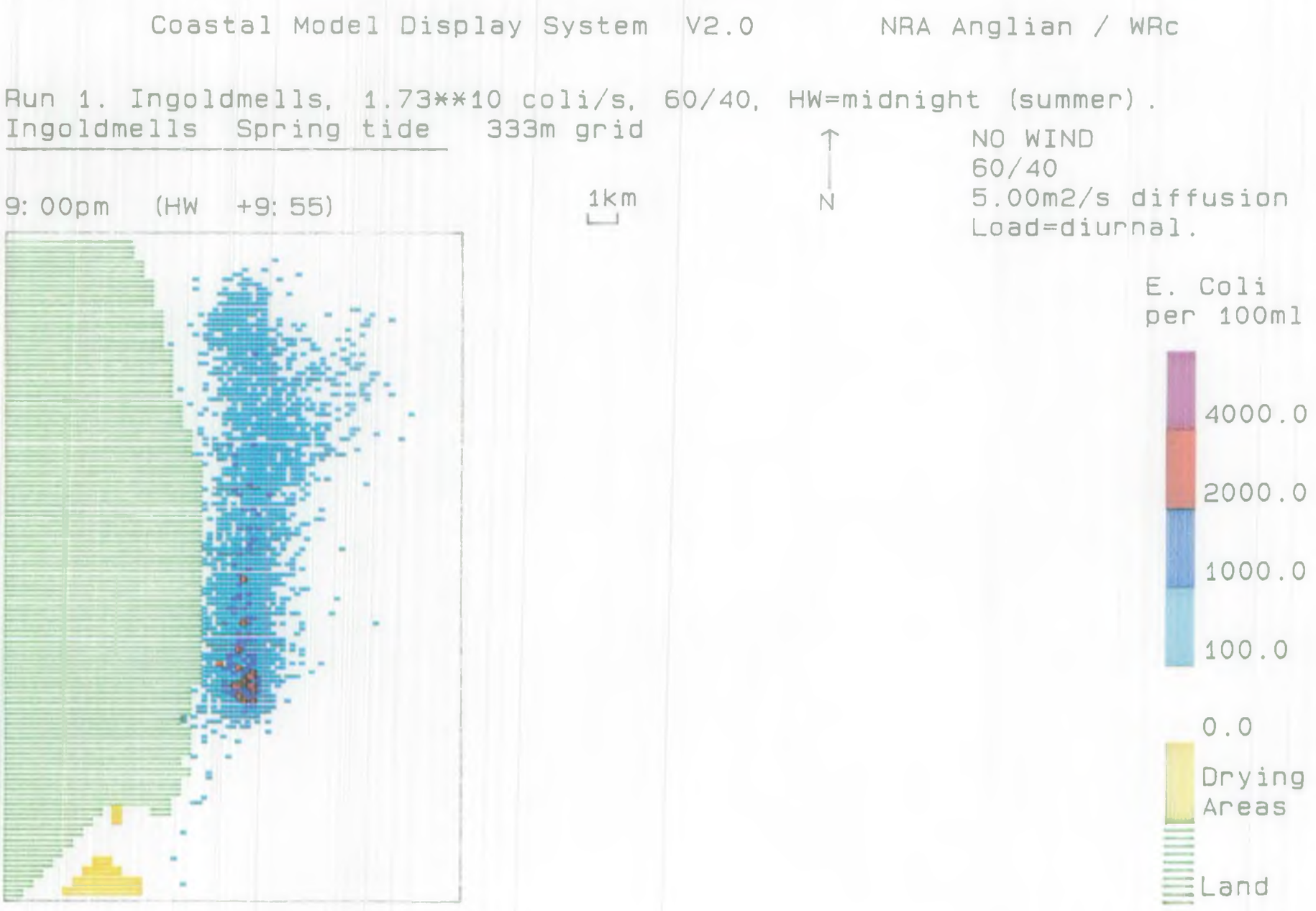

Contribution to National PARCOM Load
Anglian Region, 1992
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
Mercury
Cadmium
Copper
Zinc
Lead
PCB 28
PCB 52
PCB 101
PCB 118
PCB 138
PCB 153
PCB 180
Total PCB
Gamma HCH
Ammonia
Nitrate
Nitrite
TON
Total N
Ortho P
SPM

FIGURE 3.8


Coastal Model Display System V2.0
NRA Anglian / WRc
Run 1. Ingoldmells, 1.73**10 coli/s, 60/40, HW=midnight (summer).
Ingoldmells Spring tide 333m grid
9:00pm (HW +9:55)
1km
N
NO WIND
60/40
5.00m2/s diffusion
Load=diurnal.
E. Coli
per 100ml
4000.0
2000.0
1000.0
100.0
0.0
Drying
Areas
Land

We have copies of the models on our computers. We have made enhancements to the output, so that animated displays can be shown.

Figure 3.8 shows an example of the output which predicts the concentration and dispersion of bacterial pollution from an outfall at Ingoldmells. This 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.

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 the growth, changes in environmental standards and altered locations.

The policy of the NRA is that all new or revised Consents will aim to maintain the present quality of Controlled Waters (No Deterioration) and, wherever possible, they will ensure that Water Quality Objectives are met.

Detailed guidance on National Policy was initiated with the introduction of the Consents Manual, in draft form, in 1993. 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 main 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 term used for 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 known as 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 1.2). In itself, it has no legal force, but a number of Legal Consents (about 34%), are equivalent in all respects to the River Needs Consent and 87% of discharges comply with their River Needs Consents (See 4.2.5).

In the run-up to privatisation, the Water Authorities were given a chance to reduce their risk of prosecution. In our Region, Time-limited Consents were granted for 220 discharges from sewage works which were failing their Legal Consents. These relaxations were conditional. The Company has had to bring these works into compliance, by an agreed date, with the stricter of either the old Legal Consent or a Consent based on maintaining the 1984 effluent load. We pressed the Utility to achieve the River Needs Consent for discharges where the additional cost is less than 10% of the total.

As a result of past and recent activity, sewage treatment works in this Region have, on average, the tightest standards in the United Kingdom.

Of the Utility's sewage treatment works, 685 had Legal Consents which included numeric limits on the quality of the effluent. Descriptive consents applied to 354 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 400 Appeals built up at the DoE by 1993.

During 1993, the Secretary of State resolved the appeals on one of the key issues but this still leaves several other issues outstanding.

The number of Applications decreased from 140 in 1992, to 71 in 1993. The proportions of Applications in different categories are shown in Figure 4.1. We issued 73 Consents in 1993, including 31 for sewage treatment works.

4.2.3 Numbers of Discharges

At the end of 1993, Anglian Water was responsible for the 4008 discharges:

Sewage Treatment Works	1,023
Settled Storm Overflows	293
Storm Sewage Overflows	1,220
Emergency Overflows	951
Surface Water Sewers	366
Water Treatment Works	134
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 100,000 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.

During 1993, the number of samples collected was 11,081. This is 3% less than in 1992.

During 1993 we reviewed and revised where necessary, the frequency of sampling of discharges.

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, is a simple statement of the number of discharges which meet their Consent. This can be volatile and does not necessarily reflect the impact of effluents.

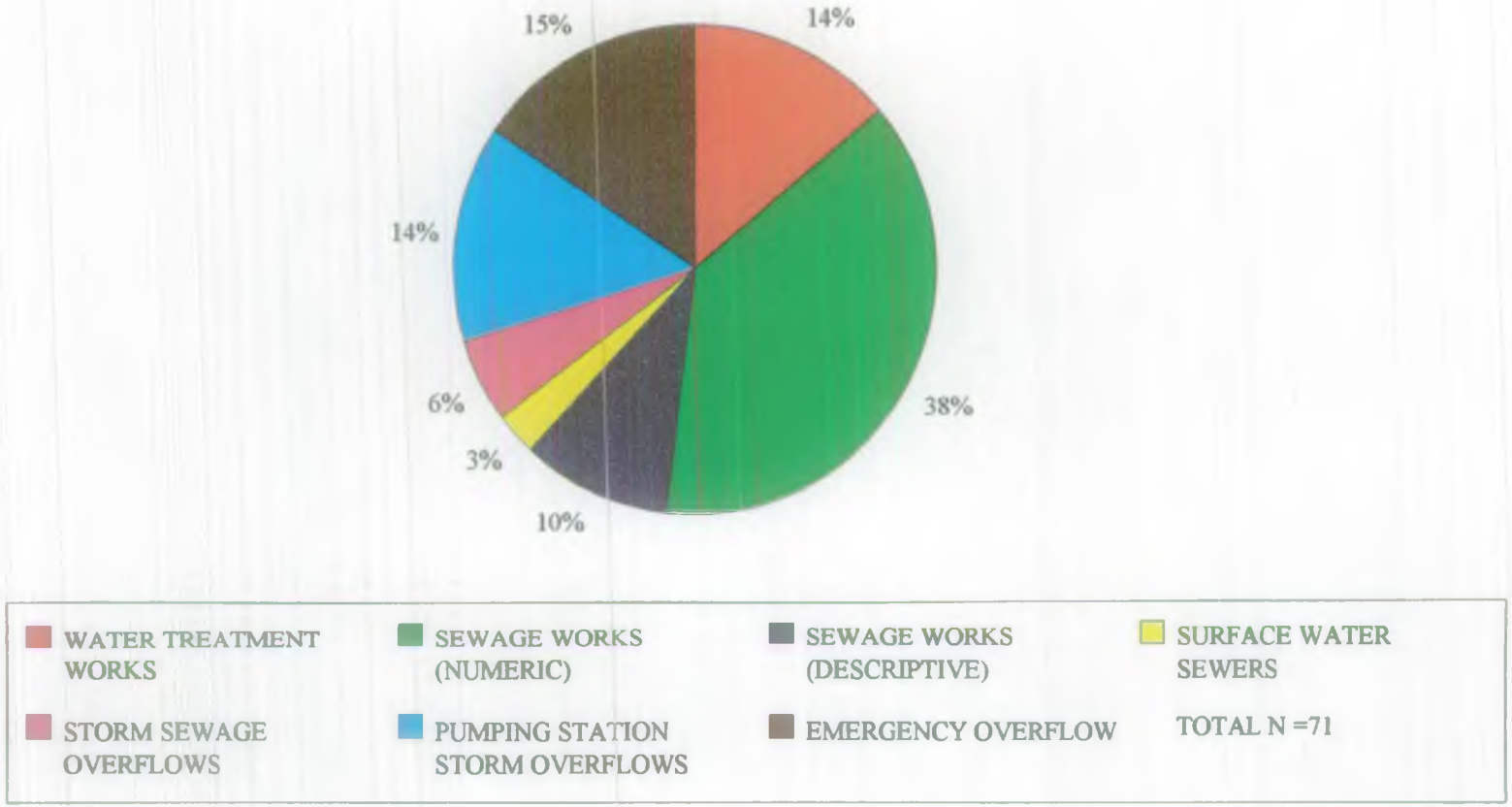
In managing the quality of receiving waters, large works are more important than small ones so we also report the percent of the total flow from all works which complies with the Consent Limits. This statistic, the Percent of Compliant Flow, is less volatile than the Percent of Compliant Works and gives 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.

FIGURE 4.1

UTILITY: APPLICATIONS RECEIVED



4.2.6 Performance against Consents

Figure 4.2 shows the performance of works against the percentile limits in their Legal Consents. The results cover all discharges which have numeric limits on the discharge quality.

Compliance with Legal Consents is a measure of how well performance matches that imposed by enforceable standards. Against this measure, the performance of discharges again exceeds the target of 95%, reflecting capital investment in sewage treatment works made by the Utility over the last few years.

Performance against a River Needs Consent gives an indication of the action needed to cater for growth and achieve Water Quality Objectives. Figure 4.4 shows that since December 1992, although the Percent of Compliant Flow judged against River Needs Consents has decreased from 80.8% to 79.2%, and the Percentage of Compliant Works has improved from 85.7% to 86.7 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 4.2 gives estimates of the ammonia loads (as nitrogen), discharged in effluents and shows a reduction of 41% over the period 1988 - 1993:

TABLE 4.2

Effluent Ammonia Loads - Comparison between 1988 and 1993

	YEAR (Number of discharges)	
	1988	1993
Tonnes Ammonia/day	6.70 (372)	3.96 (383)

Improvements in effluents are also indicated in the median values of ammonia in rivers over recent years (see Table 2.4).

4.2.7 Tidal and Non-Tidal Waters

Table 4.1 summarises the proportions of discharges to Non-Tidal and Tidal Waters. Although only 6% of works discharge to Tidal Waters, they account for around 20% of all flows because they generally serve larger populations.

TABLE 4.1

Sanitary Criteria

Receiving Water	Number of Discharges	Percent Compliant			
		Works		Flow	
		1992	1993	1992	1993
Non-tidal	648	98.6	97.2	93.7	92.5
Tidal	37	94.6	97.3	92.7	91.0
Total	685	98.4	97.2	93.4	92.1

4.2.8 Upper-tier Standards

Some works also have additional standards for sanitary determinands which are absolute limits on quality. These must not be exceeded at any time and are called Upper Tier Limits. Upper tier limits apply to works with Time-Limited Consents and all numeric consents issued since the NRA was formed.

The percent of discharges which fail the Upper Tier Limits in their Consents is now 4,8 (4 discharges), the same as at the end of 1992.

4.2.9 Non-sanitary Determinands

Non-sanitary determinands, include nutrients and List 1 and II metals. In 1993, Legal Consents for 43 discharges included criteria for non-sanitary substances, almost all expressed as Absolute Limits.

Cambridge Sewage Treatment Works had a single failed sample for Lindane. No cause could be found.

4.2.10 Descriptive Consents

At the end of 1993, 354 small discharges had Legal Descriptive Consents. 300 were inspected at least once during the year, compared with 328 in 1992.

Figure 4.3 shows how the compliance of these discharges has altered over the last two years. The proportion which complied at the latest inspection is 95% (286 discharges).

FIGURE 4.2

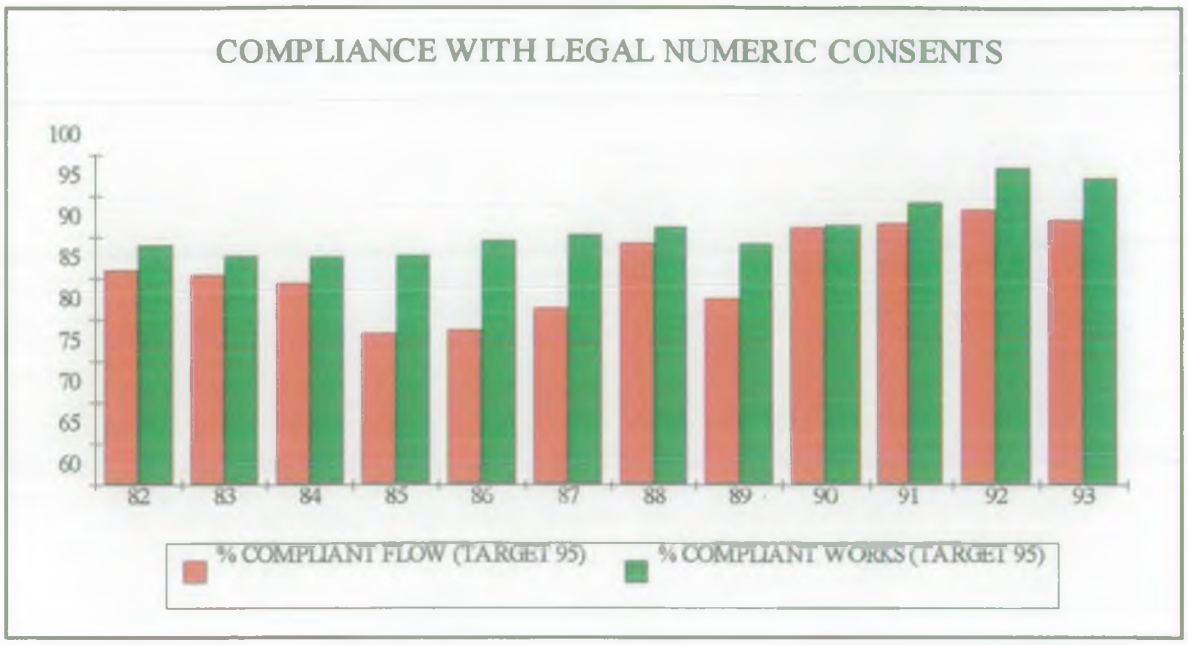


FIGURE 4.3

FIGURE 4.4

COMPLIANCE WITH RIVER NEEDS CONSENTS

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 Plans (AMP1).

Elsewhere in this report, we have reported improvements associated with investment over this period. The loads of BOD and Ammonia, carried by our rivers, have decreased (Table 2.4). The qualities of Freshwater Fisheries and Bathing Waters have improved (see Part 2.7.4 and Figure 3.2). Compliance of discharges with Legal and River Needs Consents has improved (Figures 4.3 and 4.4), and the loads of pollution have decreased (Table 4.2).

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

During 1994, the Director General will be carrying out a Periodic Review to set charges for the ten years from 1995-2004. The Utility has reviewed its Asset Management Plan, for these years (AMP2), and assessed the costs resulting from existing obligations and possible future additions.

Following input by the DoE, and negotiations with the Water Companies, the NRA produced National Guidelines for a common approach to the issues involved.

In our discussions with Anglian Water, we identified our requirements for every sewage treatment works and unsatisfactory intermittent discharge, so that costs could be estimated. The most critical aspect of this exercise was the large cost of the Urban Waste Water Treatment Directive (See Parts 2.7 and 3.4)

During this process, the DoE issued instructions that no investment should take place for environmental improvements, other than that required by Directives. Subsequently, the NRA was invited to provide the DoE with lists of its highest priority schemes outside of those for Directives. Any investment allowed on these schemes will be at the discretion of the DoE.

Regional negotiations continued into 1994, and the Utility's Strategic Business Plan was sent to OFWAT in March 1994. The Plan included a programme of work for effluent treatment and environmental improvements, as agreed between us Anglian Water. Details of the programme must await the decision on the final pricing structure.

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 they therefore have Descriptive Consents.

4.3.2 Applications for Consent

The number of Applications increased from 457 in 1992, to 584 in 1993. Of these, 474 were for sewage effluents. The proportions of applications in different categories are shown in Figure 4.5. During 1993, 537 Consents were issued.

4.3.3 Discharges

The total of 5675 Non-Utility discharges may be categorised:

Sewage Treatment Works	3,979 *
Industrial Effluents	572
Surface Waters	816
Agriculture	59
Miscellaneous	249

* This figure excludes septic tanks of which there are 10,538.

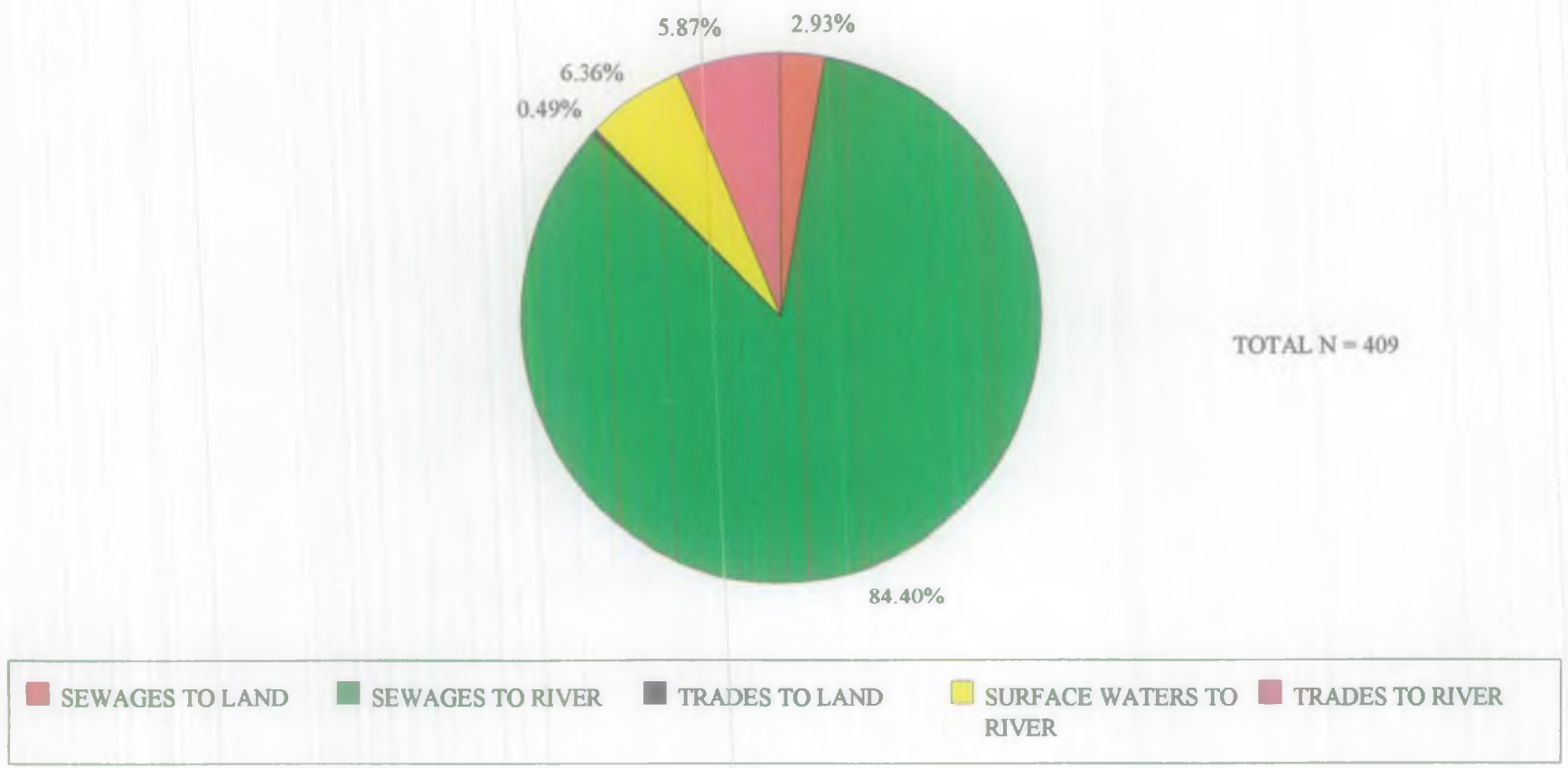
4.3.4 Monitoring

Most Non-Utility discharges are small and their potential effect on the environment is negligible. We monitor only those effluents judged to have a potential for impact (as a safeguard we rely on the biological monitoring of watercourses to tell us if we have misjudged the potential impact of discharges).

At the beginning of 1993 a review of sampling was carried out. The effect of the review is that we are now monitoring far more Non-Utility discharges than in 1992. 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.

FIGURE 4.5

NON-UTILITY : APPLICATIONS RECEIVED



Of the 430 Private sewage treatment works with numeric consent limits, 86% (369 discharges), were sampled in 1993, compared to 43% (185 discharges) the previous year. In addition, 36 discharges to Controlled Waters are made from Crown Property. These are the responsibility of the Property Services Agency.

The NRA has legal powers to control only those industrial discharges which discharge direct to Controlled Waters. Over 350 industrial effluents in this category were sampled in 1993, compared with 185 in 1992. Most discharges of effluent from traders' premises are made direct to foul sewers. These are managed by Anglian Water Services and our control of these rests with setting consents for the Company's discharges from the treatment works which receive the waste.

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 47% (173 discharges), compared with 51% (95 discharges) in 1992. The proportion of monitored industrial discharges which were compliant increased from 46% (71 discharges), to 49% (92 discharges).

The figure for compliant discharges owned by the Property Services Agency was 69% (11 discharges), slightly worse than 1992.

No general trends can be picked out of these figures because of the increase in the numbers of discharges which are monitored (see Part 4.3.4).

The figures indicate that the performance of Non-Utility discharges is far worse than those of the Utility. But 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 as 95-percentiles. Second we should compare performance using the Company's compliance with River Needs Consents. This was 87% in 1993. Table 4.3 gives figures for the Non-Utility discharges which may be compared with this:

TABLE 4.3

Non-Utility Discharge (% Compliance with Percentiles)

	1993	1992
STW	45	86
Industrial	83	55
Crown Properties	87	93

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

Toxicity tests are used to assess the effect of complex effluents on aquatic life. The chemical composition of some effluents may not be known and even if it were , toxicity data for the constituents may not be available. In these cases an assessment of the overall toxicity is a good method of monitoring quality.

We have 15 discharges with toxicity based Consents. The Consents stipulate test species found naturally in the receiving water of each discharge, for example, trout and shrimp.

Special surveys are also carried out on other to check that the toxicity of the effluents is being controlled by the standards imposed in the Consent on specific chemicals.

Screening tests for assessing the receiving waters themselves are presently under development on a national scale. These should provide a quick and cheap method of monitoring water quality.

4.5 Priority Lists and the Index of Discharge Impact

The Index of Discharge Impact (IDI) is a number which allows us to identify discharges which have the greatest potential impact on receiving waters. It is 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. These data are then weighted according to our views on the relative importance of different waters.

We use the IDI to produce ranked lists of discharges for which we would like to see improvements in the quality. These lists form the basis of discussions with the dischargers, on a number of matters including investment. (See Part 4.2.11)

4.6 Targeting and Tripartite Sampling

We use the results of 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 in a list 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. The main sample is split into three parts: one part is analysed by the NRA, one is given to the discharger and one is held in reserve. 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

4.7.1 A scheme of charges for consented discharges has been introduced in stages since 1990. It was introduced to recover part of the costs of the NRA's pollution control function, in accordance with the Water Resources Act. There are two kinds of charge, an Application Charge, and an Annual Charge.

4.7.2 Application Charge

The charging scheme covers the processing of Applications for Consent. The government introduced VAT on Application Charges from 1 April 1993. For 1993/94, the charge rates (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

4.7.3 Annual Charge

In 1991, an annual recurring charge was introduced on most categories of discharge. It is due to run for three years and will then be reviewed. Small domestic sewage discharges of less than 5 cubic metres per are exempt.

The Annual Charge is calculated using a weighting based on the size, nature and location of the discharge, three features which influence the NRA's costs for carrying out pollution control. The weighting is multiplied by the unit charge for the financial year, which is set in agreement with the Government. For 1993/4, 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 -	£ 43,762.50

In 1993, charges were levied on 6,577 discharges. Of these, about 4,370 are owned by Anglian Water Services.

4.8 Integrated Pollution Control

Integrated Pollution Control (IPC) was introduced in 1991 under the Environmental Protection Act 1990. IPC is administered by Her Majesty's Inspectorate of Pollution (HMIP).

The main objective of IPC is to prevent, minimise or render harmless discharges of the most persistent pollutants entering the whole environment, i.e. air, land and water. IPC lists the specific pollutants as Prescribed Substances and the industrial processes that produce most of the prescribed substances as Prescribed Processes.

Operation of a prescribed process requires an Authorisation (a detailed regulatory document issued by HMIP). All new operations need to be Authorised immediately. It was decided to split the large numbers of existing Prescribed Processes into groups, and deal with them on a rolling programme for completion in 1996. In 1993 categories from the Mineral Industry applied, together with industries covered by HMIP's categories for the Chemical Industry.

Before the introduction of IPC, all discharges to Controlled Waters required Consents from the NRA (see Part 4.1). Discharges not resulting from Prescribed Processes will continue to be dealt with in this way. However, where the significant bulk of the discharge originates from the Prescribed Process, an Authorisation will replace the NRA Consent.

The NRA is a statutory consultee in the Authorisation process for sites where a discharge is made to Controlled Waters. We provide recommendations to HMIP 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 NRA recommendations, but HMIP can require more stringent limits in its Authorisations based on two principles of IPC. The first is that the operator should use the "Best Available Technique Not Entailing Excessive Cost" (BATNEEC) to minimise all discharges from the process. The second that the operator should choose the "Best Practicable Environmental Option" (BPEO) for any discharge made.

During 1993, we were consulted on 44 Applications, most of which were for the area of the South Humber Bank. As a result, improvement programmes have been secured for these effluents.

Part 5: THE WATER RESOURCES ACT: WATER QUALITY REGISTER

5.1 Information

The Register contains copies of 37,000 Consent records, including Variations and Revocations. Of this total, 15,000 are for current, active discharges (excluding septic tank discharges to land). About 650 Applications were added in 1993. Details are retained on the Register for five years after Consents are revoked.

Since June 1992, the Register has held copies of all Applications and Authorisations issued by HMIP, for 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 377,000 environmental and effluent samples taken since August 1985. Results from new samples are being added at a rate of 50,000 per year. The Register gives public access to several million analytical results.

5.2 Enquiries

During 1993, 925 enquiries were received. A large proportion of enquiries originate from students, who made up 313 of the total number for 1993. Trends and categories of enquiries are shown in Figure 5.1.

Immediate access is provided to sample results from August 1985.

The NRA also willingly provides information not required to be held on the Register. The Freedom of Access to Environmental Information Regulations, introduced in 1992 gave statutory force to this existing practice. Data includes the results from biological, fisheries and sediment samples, amongst other readily accessible environmental information.

The register uses a computer-based mapping system in order to make it easier for enquirers to find out what information is available. An example is given in Figure 5.2. As well as enhancing the display of data, the system assists with data retrieval.

The Register is at Peterborough and is open on weekdays (except Bank Holidays) from 9.30 to 16.00. Inspection of the Register is free. A small charge may be made for data retrieval of Register information. Full details of charges for Register and the supply of Environmental Information are available on request.

FIGURE 5.1

WATER RESOURCES ACT REGISTER ENQUIRIES

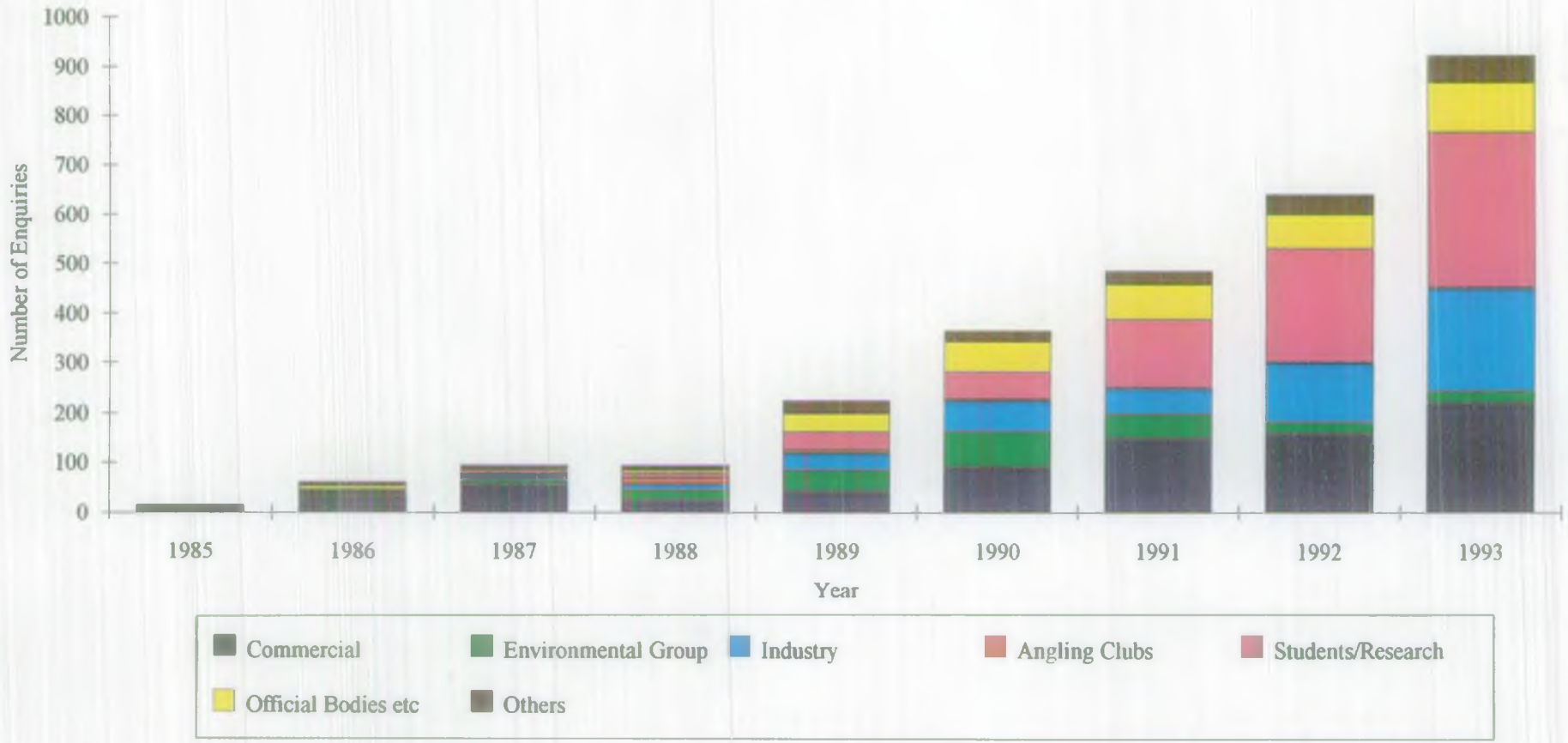
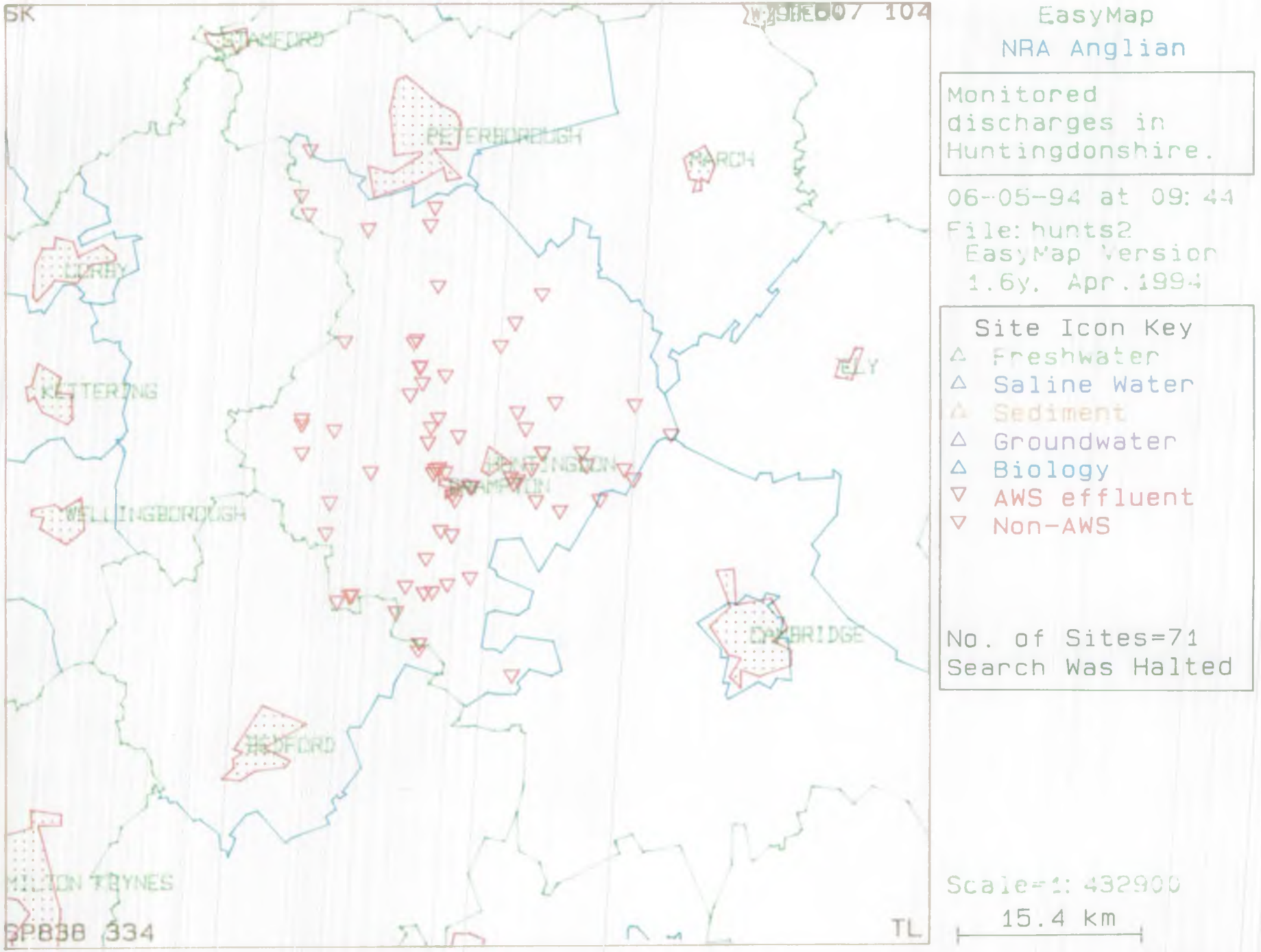


FIGURE 5.2


SK
TL
SP838 334
STAMFORD
PETERBOROUGH
MARCH
CORBY
KETTERING
WELLINGBOROUGH
ELY
CAMBRIDGE
MILTON KEYNES
EasyMap
NRA Anglian
Monitored discharges in Huntingdonshire.
06-05-94 at 09:44
File: hunts2
EasyMap Version 1.6y. Apr.1994
Site Icon Key
Freshwater
Saline Water
Sediment
Groundwater
Biology
AWS effluent
Non-AWS
No. of Sites=71
Search Was Halted
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Part 6: CAPITAL PROGRAMME

The budget awarded for Capital Development in the financial year 1993/94 was £540,000.

The number of schemes funded by the Department of the Environment was 39. Assets developed under these schemes are as follows:

TABLE 6.1

DOE ENVIRONMENTAL CAPITAL PROGRAMME

Type of Asset	Number	Cost (£ 000's)
Water Quality Monitoring Stations	3 (6)	96 (98)
Pollution Control	29 (18)	402 (201)
Marine Survey Facilities	4 (6)	38 (98)
Scientific Equipment	0 (11)	0 (84)
Laboratories	3 (13)	16 (306)
Totals	39 (54)	546 (787)

Figures for 1992/93 are given in parentheses.

These figures reflect an increased commitment to investigating and remedying pollution, especially of groundwaters.

Part 7: RESEARCH AND DEVELOPMENT

The Authority has a statutory duty to undertake research and development. Projects are established to improve the Authority's effectiveness and efficiency, to assess new areas of concern and develop new approaches to undertaking our duties.

Benefits from research projects include:

- development of approaches and policies to fulfil our duties;
- investigating new issues;
- improvements to our effectiveness and efficiency;
- enhancing our knowledge; and,
- development of links with other agencies.

Projects are appraised to ensure that they are developed cost-effectively. Options are proposed for each project that are assessed by a Project Manager and Support Group. Contracts to external contractors are let via competitive tendering.

We undertake research through two distinct research programmes. The National Programme develops projects which address National issues, and Regional Operational Investigations cover projects which are specific to a site or our Region.

In 1993 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. One notable project completed was a review of Dioxins in surface waters, the first to be undertaken in the United Kingdom.

Our part of the National expenditure was £690,000, which was the second largest of any of the Regions.

We developed and managed 24 Regional Operational Investigations. Expenditure was £300,000 compared with £452,000 in 1992. This saving has been achieved by competitive tendering, better planning, and improved targeting of projects and their resources. Co-funding of projects has also helped. In conjunction with the Broads Authority, we secured an EC LIFE Fund grant of £350,000 for a 3-year project investigating techniques for the restoration of Broadland.

Part 8: CHEMICAL LABORATORY SERVICES

In July, the NRA Board announced plans to close the Anglian Regional Laboratory at Peterborough. A National Laboratory Service was formed with a reduction in the number of laboratories nationally from eleven to six. This will achieve cost savings while allowing the same level of service to be provided to Regions.

The laboratory closed on the 31 December 1993.

The Region organises the analysis of determinands as sets or Suites. In total, these number about 200 and cover determinands to be analysed for Uses (eg. the Surface Water Directive), as Groups (eg. List II metals) and for Site-Specific purposes (eg. of an effluent with a complex set of Consent conditions). The most comprehensive suite requires the analysis for 90 determinands.

The performance of all analytical methods used in 1993 were checked on a day-to-day basis using independent standards. This gave an immediate check of the quality of the data and contributed to statistical data which can be used to assess the performance of methods and aid the interpretation of results.

The laboratory participated in the National Marine and AQUACHECK inter-laboratory quality control schemes. These are organised by the Water Research Centre. The performance in both was good. The laboratory also took part in the exercise for nutrients in sea water set up by the International Council for Exploration of the Sea (ICES). The laboratory's performance was excellent.

The numbers of samples handled for routine monitoring are given in Table 8.1. A number of unplanned samples was also analysed. These may be taken, for example, in response to a Pollution Incident. The total number of samples processed in 1993 was 51,111 (an increase of 1.5% on 1992) and the total number of analyses was 557,224 (an increase of 18.9% on 1992). A breakdown of the total number of samples taken during 1992 and 1993 is shown in Figure 8.1.

Figure 8.2 shows the continuing increase in workload which the laboratory dealt with during 1993.

Four hundred and thirty-three Tripartite Samples (see Section 4.6) were analysed.

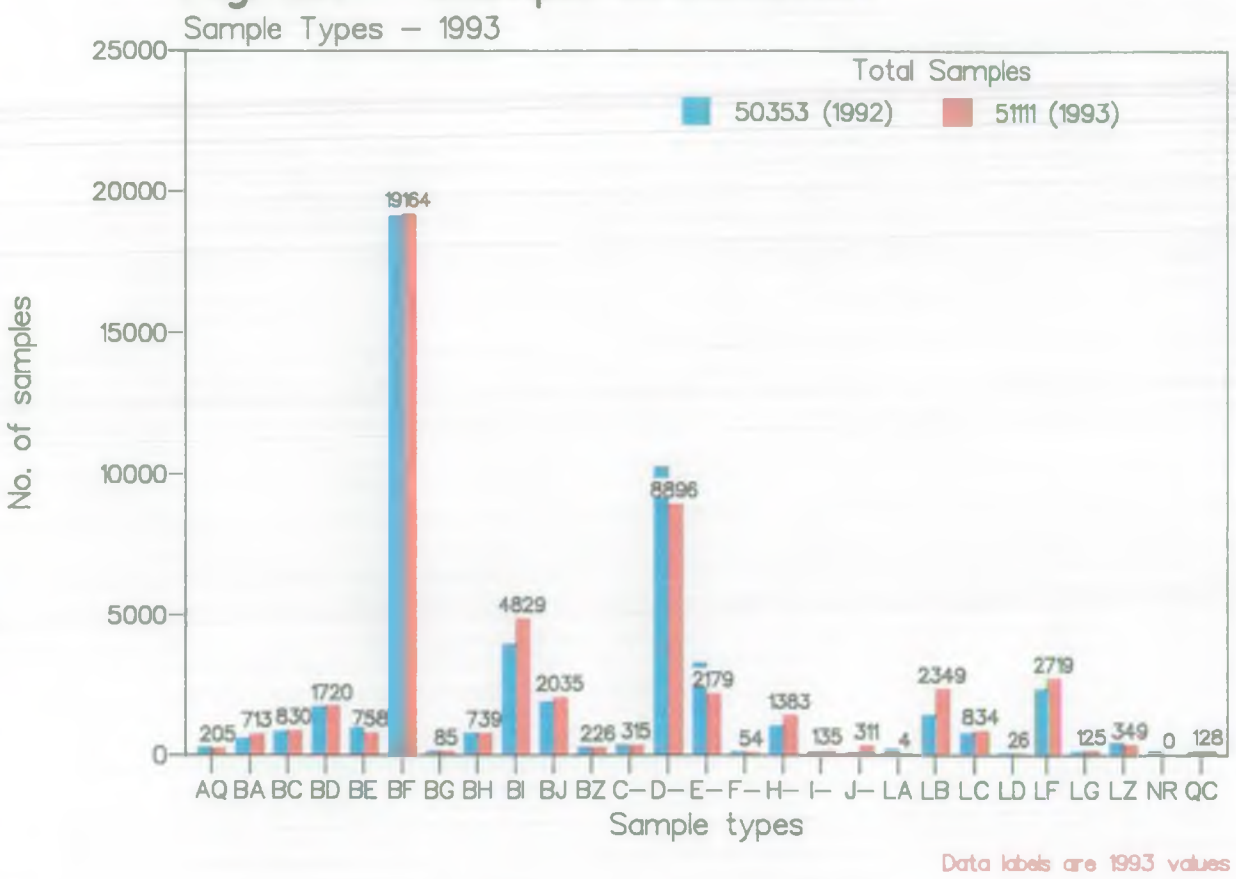
The Chemistry Laboratory was audited by the National Measurement Accreditation Service (NAMAS). The laboratory complied fully with the comprehensive operating and audit procedures that are required to maintain accreditation with this internationally recognised quality assurance system. The schedule of accredited analytical methods was increased to over 400 tests to cover the expanding analytical needs of the Region, mainly in the field of pesticide analysis.

TABLE 8.1

Routine Sampling Programme: Planned and Actual

Type of sample	SITES		SAMPLES	
	Planned	Actual	Planned	Actual
Controlled Waters:				
Lakes & Reservoirs	61	71	1045	1,288
Biota	33	32	66	59
Rivers	1,098	1,162	13,774	14,564
Groundwaters	720	697	2,824	2,657
Freshwater sediments	82	170	152	502
Estuaries	331	399	2,509	4,346
Coastal waters	190	188	2,271	1,800
Saline sediments	153	258	217	300
All Discharges	2,946	2,258	16,854	15,792
Total	4,614	5,235	37,938	41,308

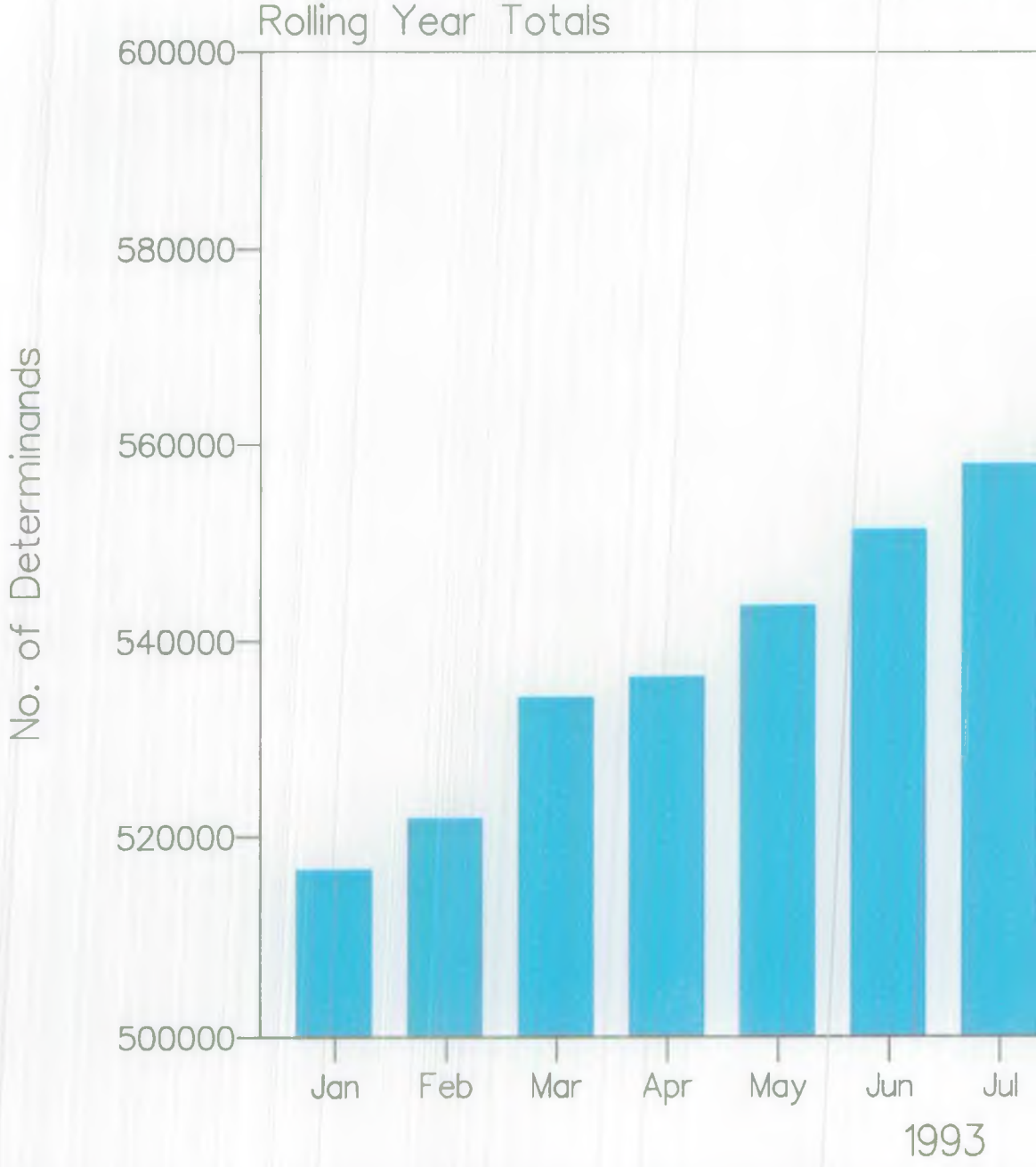
Fig. 8.1 – Sample Breakdown



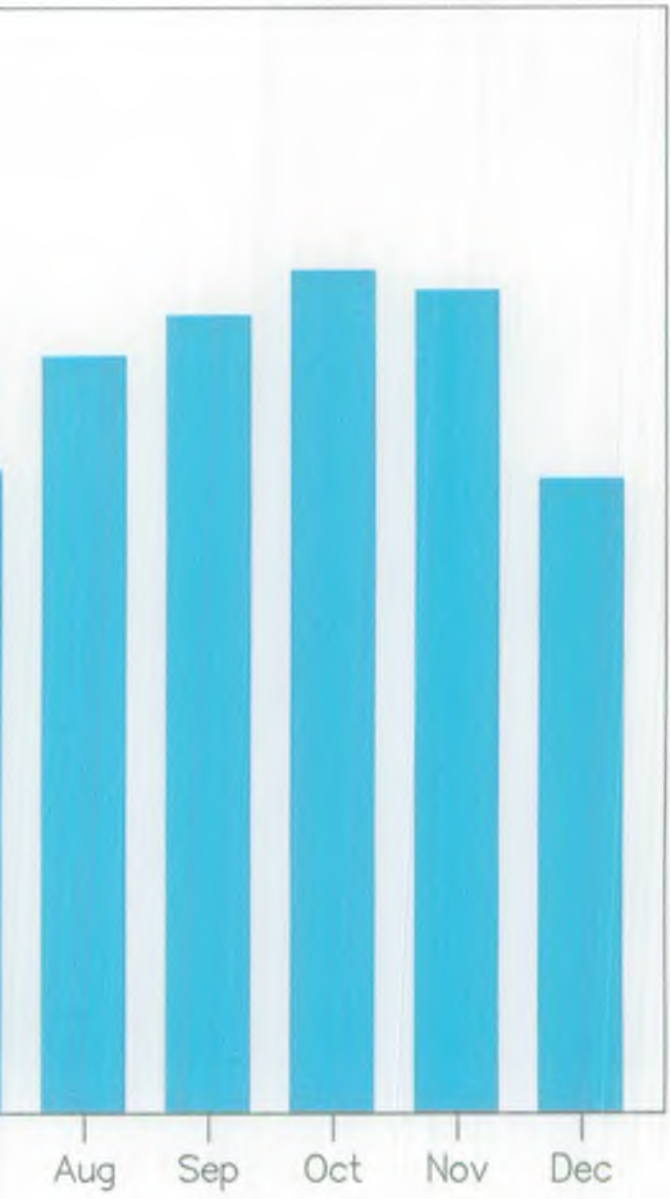
SAMPLE TYPES

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

Fig. 8.2 – Determinands



per Year



Part 9: INFORMATION STRATEGY

Water Quality monitoring is a complex process. Thousands of sites are sampled and hundreds of thousands of analytical results are generated and reported each year. Efficient management would be impossible without computer systems.

The Laboratory Information Management System (LIMS) operates on a network of PCs, and permits the direct capture of analytical results from laboratory equipment. It helps us to manage our resources by co-ordinating sampling, analysis and the storage of results. Once checked, the results are transferred to our Mainframe Computer for secure long-term storage and for access by the Water Resources Act Register (See Part 5), and a large number of Users.

The LIMS software continues to be upgraded. We developed new software to assess laboratory performance. Examples of reports are shown in Figures 9.1 to 9.3.

The Sampling Information Management System (SIMS) brings together the monitoring requirements for each site and confirms that LIMS is set up to analyse for all these requirements. In 1993 we enhanced SIMS to make it even easier to retrieve and interpret our data.

We use another in-house package, the mapping system called EasyMap, to display and plot the location of discharges and sampling points. This can also display chemical data over a background map. In 1993 we added the capacity to display water pipelines, and elevation (see Figure 9.4) and a more accurate coastline.

We run a number of models that are used to predict the quality of waters under different conditions. (See Parts 2.16 and 3.8). To help with this, we purchased a UNIX Workstation to run our complex estuary and coastal models. The new computer was networked to our existing workstation, and reduced the time taken to run some models by a factor of four.

We also took delivery of a model that can predict the growth of algae in water bodies. (See Part 2.16). We helped produce data management software to run the model and display its output.

In addition, we improved our efficiency by converting a number of compliance reporting routines from the Mainframe to PC. We continued to contribute to the National Water Archive and Monitoring System (WAMS) project, helping to define the Rules by which the new system will handle data. We also provided enhanced access to services like LIMS, Charging for Discharges and Electronic Mail.

Appendix I: Biological Sampling

1. Freshwater - Rivers

	1993	1992
a. Macroinvertebrates		
Routine	2 363	(2 387)
Pollution	310	(353)
Special investigation	505	(297)
Others	35	(140)
b. Macrophytes	259	(3)
c. Microbes	558	(392)
d. Phytoplankton/Blue-green algae	345	(2)
Total	4 375	(3 574)

2. Freshwater - Lakes

a. Macroinvertebrates	1 313	(1 820)
b. Macrophytes	1 036	(237)
c. Microbes	91	(53)
d. Phytoplankton/Blue-green algae	854	(1 135)
e. Zooplankton	1 089	(1 092)
Total	4 383	(4 337)

3. Estuary and Coastal waters

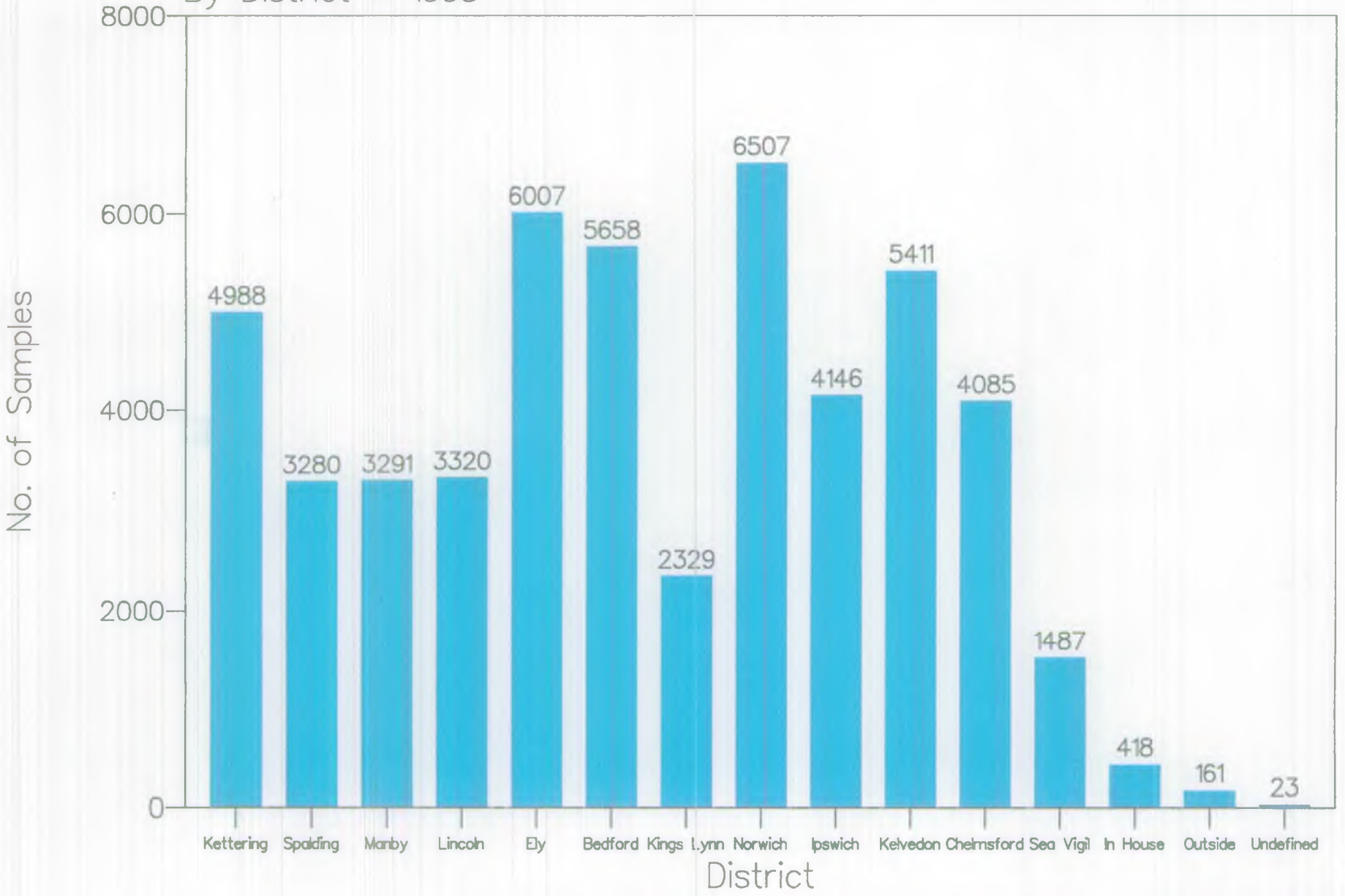
a. Macroinvertebrates		
Intertidal	502	(354)
Subtidal	991	(528)
b. Microbes	2 436	(1 929)
d. Phytoplankton	169	(243)
e. Zooplankton	44	(66)
f. Beam trawl	58	(37)
g. Bioaccumulation	202	(22)
Total	4 416	(3 179)

4. Borehole

a. Microbes	14	(4)

Fig. 9.1 – Sample Breakdown

By District – 1993



Note: Norwich District also includes samples taken for Broads Research

Fig. 9.2 – Total Samples per Month 1993

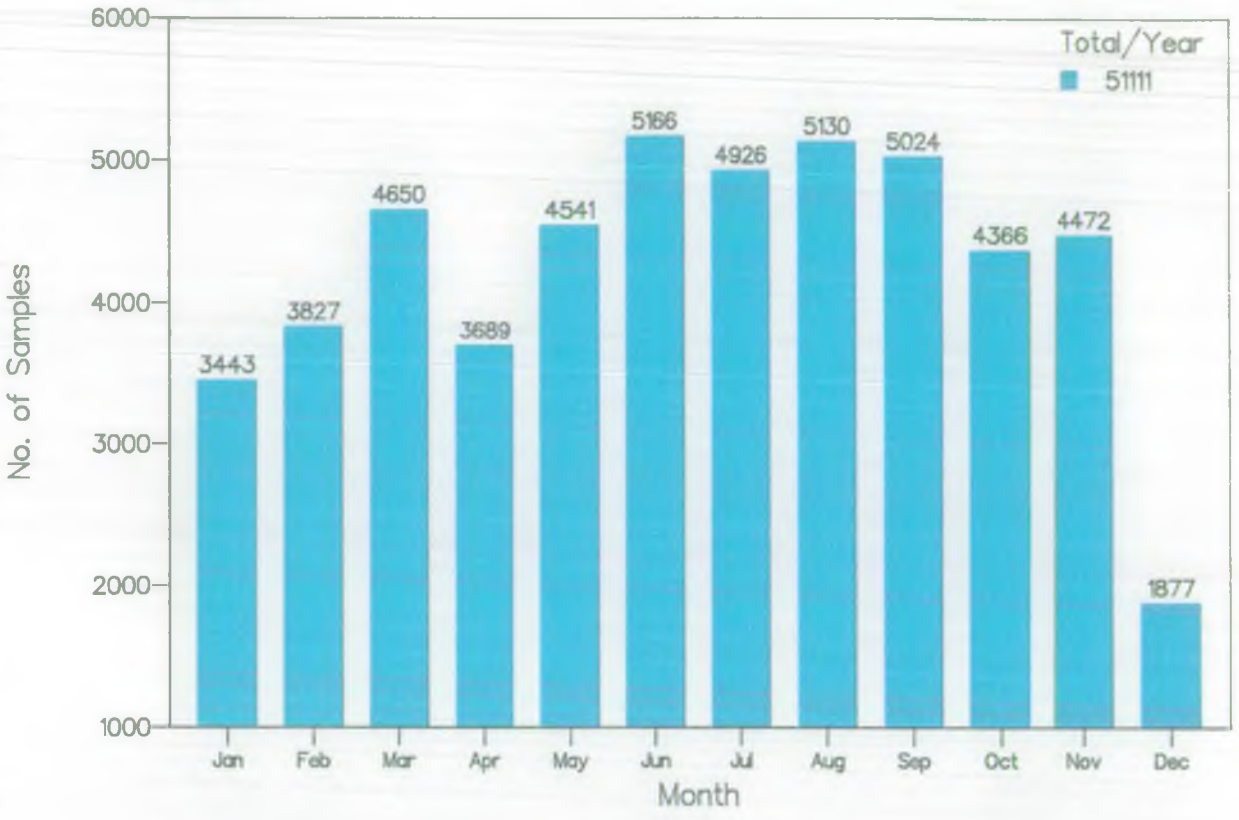


Fig. 9.3 – Total Determinands per Month 1993

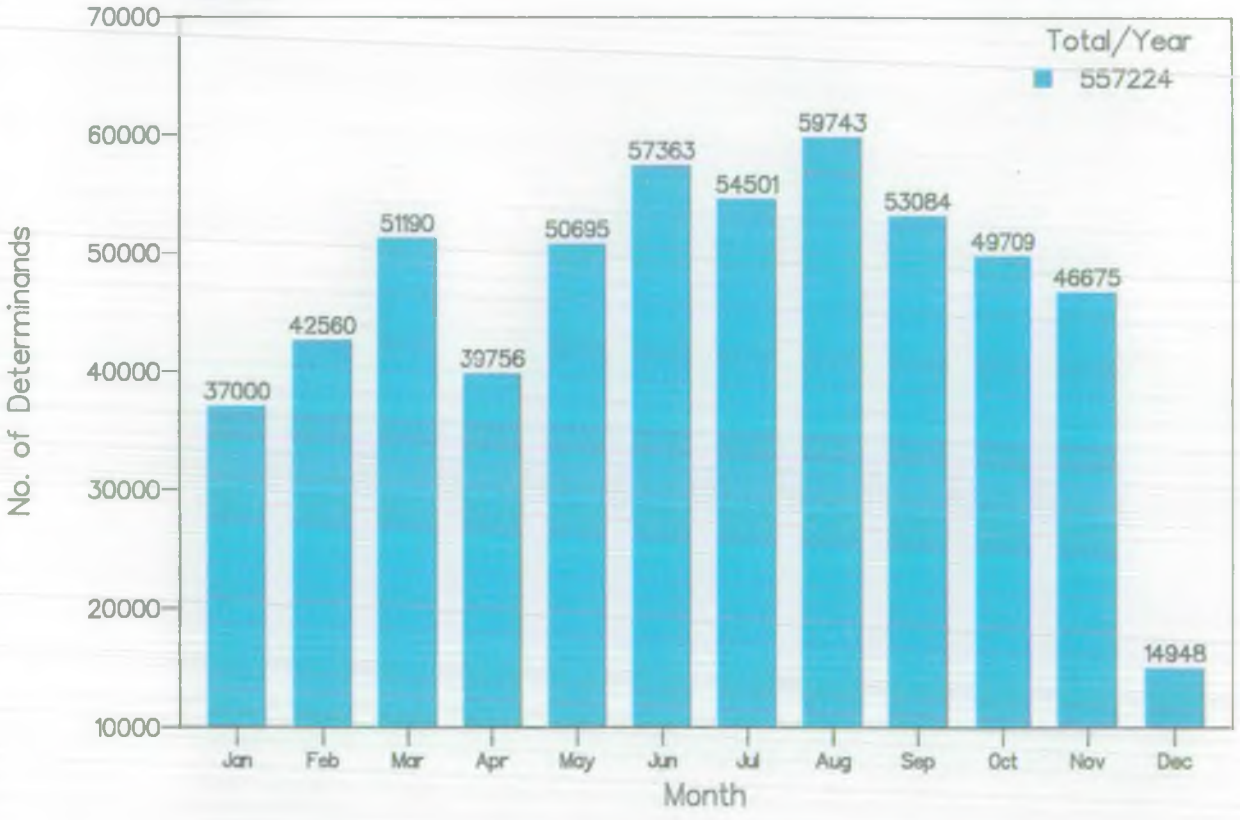
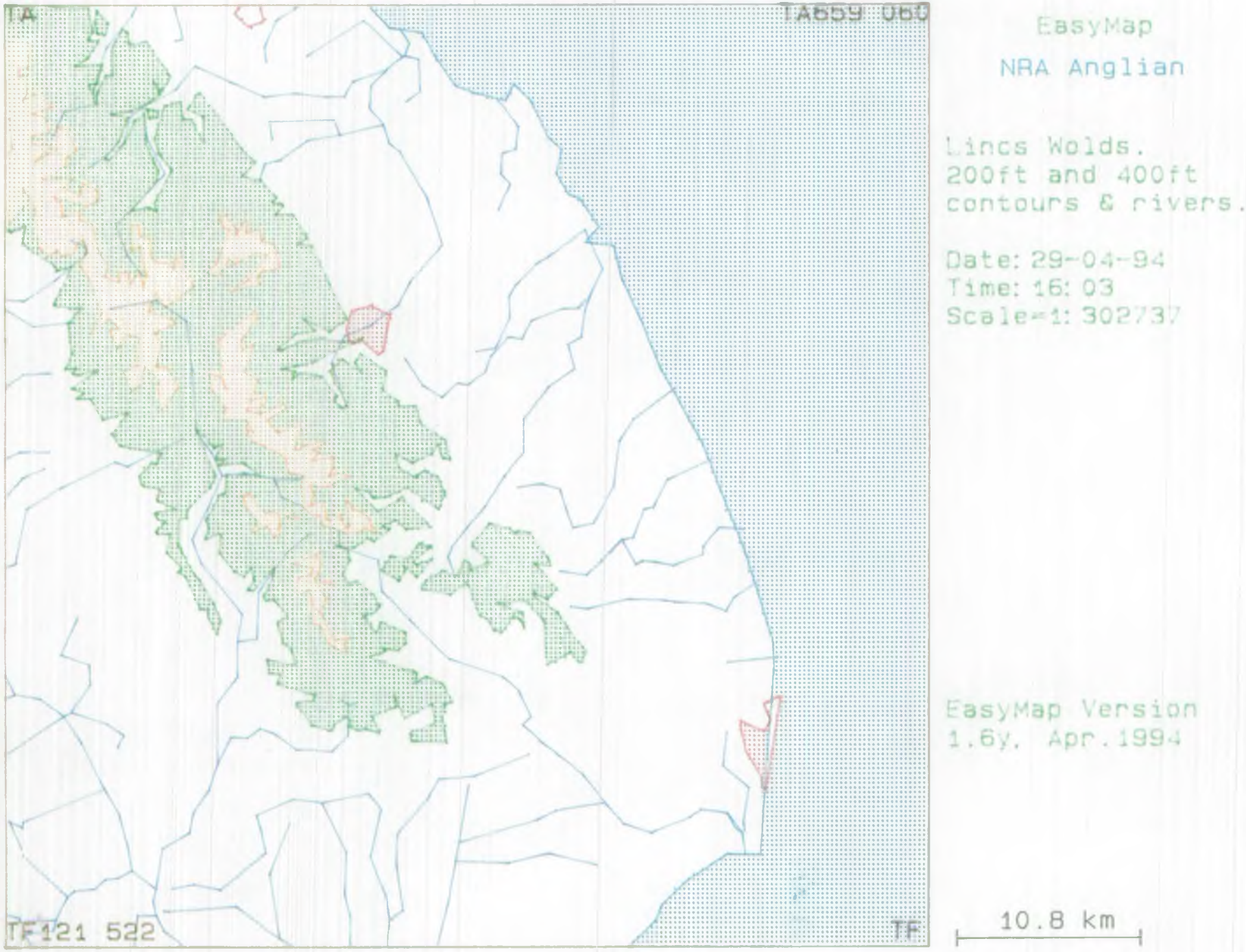


FIGURE 9.4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TA659 060
TF121 522
TF
EasyMap
NRA Anglian
Lincs Wolds.
200ft and 400ft
contours & rivers.
Date: 29-04-94
Time: 16:03
Scale=1:302737
EasyMap Version
1.6y, Apr.1994
10.8 km

Appendix II: Prosecutions brought to Court

INCIDENT	HEARING	DEFENDANT	FINE (£)	COSTS (£)
Trade effluent into tributary of the Elstow Brook at Cardington, Beds	06.01.93	Canvin International Limited	1,500.00 3,000.00	552.10
Farm effluent into a tributary of Ardleigh Reservoir	14.01.93	Walter John Wragg	3,000.00	1,650.00
Farm effluent into tributary of Sampsons Creek	15.01.93	Kenneth Walton	1,000.00	713.00
Farm effluent into tributary of Salmondby Beck	19.01.93	Frans Buitelaar (Farms) Limited	7,500.00	894.32
Trade effluent into tributary of the River Nar	03.02.93	Norfolk Farm Produce Limited	1,500.00	488.00
Trade effluent from carrot washing site	02.02.93	Albert Bartlett and Sons (Airdrie Limited)	3,000.00 5,000.00	679.80
Sewage effluent into tributary of the Blackwater Estuary	26.03.93	Greenlee Group Plc	2,000.00	658.00
Trade effluent into River Ouse	04.03.93	Ely Chemical Company Limited	4,000.00	1,024.57
Trade effluent into tributary of Cemetery Drain, Spalding	23.04.93	Christian Salvesen Food Services Limited	4,000.00	500.00

INCIDENT	HEARING	DEFENDANT	FINE (£)	COSTS (£)
Trade effluent into tributary of the River Stour	16.04.93	Wrights Farm (Middleton) Limited	300.00 700.00	500.00
Piggery effluent into tributary of Broad Fleet near West Mersea	16.04.93	A M Gray and Company Limited	3,000.00	751.55
Trade effluent into River Great Ouse at Kings Lynn	19.04.93	British Sugar Plc	5,000.00	546.80
Sewage effluent into tributary of Roman River at Abberton	14.05.93	Mr R Wigley	1,500.00	744.35
Trade effluent into tributary of River Dove at Thorndon	19.05.93	Mr G G Edgecombe	800.00	529.90
Trade effluent into tributary of Wootton Brook	21.05.93	Anglo Beef Processors Limited	3,000.00 2,000.00 2,000.00	1,162.40
Trade effluent into tributary of Hobba Dyke at Whisby	04.06.93	East Midland Oil and Gas Limited	800.00	679.34
Trade effluent into tributary of River Snail	29.06.93	Mayer Parry (East Anglia) Limited	10,000.00	680.60
Trade effluent into tributary of Renhold Brook	30.06.93	Mr K J Fuller T/A K J Fuller & Sons	1,000.00	500.00
Trade Effluent into Mow Beck Grantham	07.07.93	Grantham Road Services Limited	2,250.00	707.11

INCIDENT	HEARING	DEFENDANT	FINE (£)	COSTS (£)
Trade effluent into tributary of Long Drove Drain, Bourne	15.07.93	Mr M Robinson	300.00	200.00
Chemicals into Deanshanger Brook, Deanshanger	16.07.93	Harcros Chemicals UK Limited	5,000.00	2,207.47
Oil into tributary of Ramsey River	20.07.93	Stena Sealink Limited	4,000.00	893.93
Sewage effluent into River Wid at Shenfield	21.07.93	Anglian Water Services Limited	4,000.00	808.63
Trade effluent vegetable matter into a tributary of Gaywood River	22.07.93	Trafford Trading Company (Garden Produce) Limited	1,250.00	726.08
Sewage effluent into Ippollitts Brook at Hitchin	28.07.93	Anglian Water Services Limited	4,000.00	1,216.62
Trade effluent into ditch at Seething Airfield	29.07.93	Agritek Sales and Service Limited	2,000.00 2,000.00	953.86
Sewage effluent into tributary of River Alde	29.07.93	Suffolk Heritage Housing Association	250.00	500.00
Trade effluent into tributary of St Osyth Creek	30.07.93	J A Low and Sons	350.00	650.00
Sewage effluent into unnamed drain at Walton Highway	03.08.93	Forte (UK) Limited	4,000.00	1,243.00
Trade effluent into unnamed watercourse at Bulls Green, Toft Monks	04.08.93	G W Padley (Poultry) Limited	2,000.00	701.22

INCIDENT	HEARING	DEFENDANT	FINE (£)	COSTS (£)
Oil into tributary of River Rhee	04.08.93	Welding Alloys Limited	5,000.00 12,000.00	719.20
Trade effluent into tributary of Leiston Stream	16.07.93 07.09.93	Mr G Barker F Barker and Company	500.00	2,000.00
Pig slurry into tributary of Sharn Brook near Sharnbrook	07.09.93 08.09.93	Paul Cammack T/A Cammack and Wilcox	1,000.00	1,923.25
Trade sewage effluent into a tributary of Blackwater Estuary	08.09.93	Carcarc Waste Disposal Limited	1,500.00	595.79
Trade effluent into River Ter	08.09.93	Lord Rayleighs Dairies	800.00	510.99
Trade effluent into tributary of Hog Dyke Raunds	15.09.93	Strong and Fisher Limited	3,000.00	669.87
Oil into tributary of Wootton Brook Blisworth	17.09.93	A P B Limited	12,000.00	749.40
Trade effluent into groundwater at Finchley Avenue, Mildenhall	14.09.93	Deniet and Sons Limited	5,000.00	2,500.00
Ammonium nitrate fertiliser into a tributary of River Wissey	06.10.93	Mr C Allhusen	5,000.00	908.53
Piggery waste into the Black Brook	08.10.93	Mr J Thorpe	3,500.00	675.50
Trade effluent into a tributary of the Belstead Brook	12.10.93	Hitchcock Farms Limited	500.00	718.51

INCIDENT	HEARING	DEFENDANT	FINE (£)	COSTS (£)
Trade effluent into tributary of Willow Brook	12.10.93	William Tomkins Limited	2,000.00	607.80
Trade effluent into tributary of Gold Brook, Eye	20.10.93	Sovereign Chickens Limited	5,000.00	733.78
Trade effluent into tributary of River Dove	20.10.93	Roy Humphrey	1,200.00	645.12
Trade effluent into tributary of Lissington Beck	22.10.93	John Hebden	850.00	707.45
Trade effluent into tributary of Ray Creek	29.10.93	Kenneth Walton	2,000.00	771.89
Trade effluent into Colmworth Brook	01.11.93	Marler Haley Exposystems Limited	3,000.00	1,142.42
Trade effluent into tributary of Stainfield Beck	05.11.93	A C Bray	1,500.00	1,046.54
Dairy waste into moat at Fenstanton	12.11.93	Dairy Crest Limited	6,000.00 9,000.00	1,850.00
Piggery effluent into tributary of Salcott Creek	12.11.93	Robert George Roots T/A C C Roots & Sons	1,500.00	665.50
Effluent into tributary of Polver Drain	16.11.93	Associated Nursing Services	1,500.00	520.26
Effluent into tributary of River Bain	16.11.93	Ernest Charles Wright	1,000.00	663.19

INCIDENT	HEARING	DEFENDANT	FINE (£)	COSTS (£)
Effluent into tributary of River Waveney	24.11.93	David Mitchell D & J Mitchell Partnership	Conditional Discharge (2 yrs)	498.08
Effluent into tributary of Sandon Brook	30.11.93	Whitbread Plc	1,000.00	656.10
Trade effluent into The Humber Estuary	30.11.93	Courtaulds Fibres Limited	Conditional Discharge (3 yrs)	1,083.87
Trade effluent into tributary of Mar Dyke	15.12.93	Mr Shiraz Lakhani	2,500.00	687.50

Appendix III: Formal Cautions

INCIDENT	DEFENDANT	DATE ISSUED
Organic Farm Waste	M G Arnold and Sons	07.01.93
Tar Emulsion	Tarmac Roadstone Ltd	13.01.93
Industrial (Oil)	Lotus Cars Ltd	01.02.93
Organic Farm Waste	Mr J Gowling	13.02.93
Agricultural (piggery manure)	H J Saunders and Partners	19.02.93
White Line Paint	Humberside County Council	12.02.93
Farm Waste Manure Leachate	George Gittus	10.03.93
Organic Farm Waste	A C Bray	05.03.93
Organic Farm Waste	H Bray	05.03.93
Organic Farm Waste	Mr J H Barter	27.03.93
Sewage (final effluent)	James L Hardy	20.04.93
Sewage (crude)	Anglian Water Services Limited	26.04.93
Effluent	Foreign & Commonwealth Off.	30.04.93
Latex discharge	Dow Chemical Company Ltd	11.05.93
Vegetable Wash	H S and D Burgess	24.05.93
Agricultural (parlour drainage)	FMS Mohon	27.05.93
Agricultural (dairy unit effluent)	H E Alston (Bradfield) Ltd	07.07.93
Agricultural (farm effluent irrigation run-off)	Essex County Council	12.07.93
Farm Waste Manure Leachate	Mr S Sharp	16.08.93
Trade Overflow from sewer	Haywards Foods	23.08.93
Trade Overflow from sewer	Haywards Foods	23.08.93
Sewage	Anglian Water Services Ltd	17.09.93
Industrial (yard drainage)	Maurice Buchanan Poultry Ltd	17.09.93

INCIDENT	DEFENDANT	DATE ISSUED
Farm Waste	C J Bonner and Son	20.09.93
Agricultural (farm drainage and muck heap run-off)	R J Baker and Son	18.10.93
Agricultural (farm drainage and muck heap run-off)	R J Baker and Son	18.10.93
Industrial (poultry processors)	Paul Flatman Ltd	05.11.93
Industrial (potato sludge run-off)	Ostlers Farm Products	02.11.93
Industrial (potato sludge run-off)	Ostlers Farms Products	01.11.93
Industrial (Oil)	Spoltiswoode Ballantyne	05.11.93
Farm Waste	J K Millard and Sons	09.11.93
Abattoir Waste	G D Bowes and Sons Ltd	17.11.93
Industrial Waste	J P Simpson and Company	25.11.93
Industrial Waste	J P Simpson and Company	25.11.93
Sewage	Anglian Water Services Ltd	24.11.93
Organic Industrial Waste	Hornigold Haulage Ltd	29.11.93
Organic Industrial Waste	Lincoln Co-operative	26.11.93
Organic Farm Waste	Brian Johnson	09.12.93
Sewage	Anglian Water Services Ltd	13.12.93
Dairy Produce	Dairy Crest Limited	22.12.93

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

INDEX

NRA

National Rivers Authority
Anglian Region

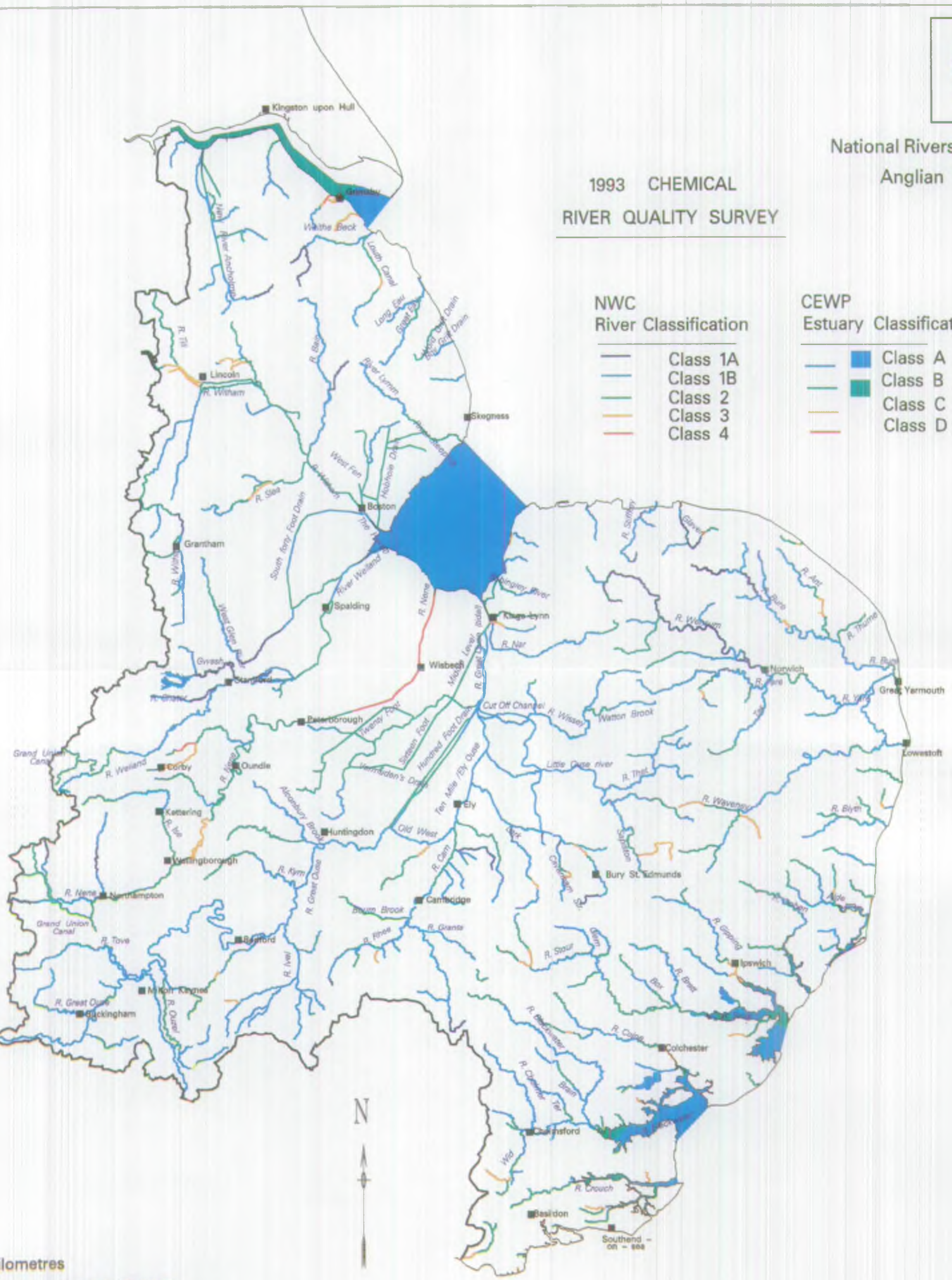
1993 CHEMICAL RIVER QUALITY SURVEY

NWC
River Classification

- Class 1A
- Class 1B
- Class 2
- Class 3
- Class 4

CEWP
Estuary Classification

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



NRA

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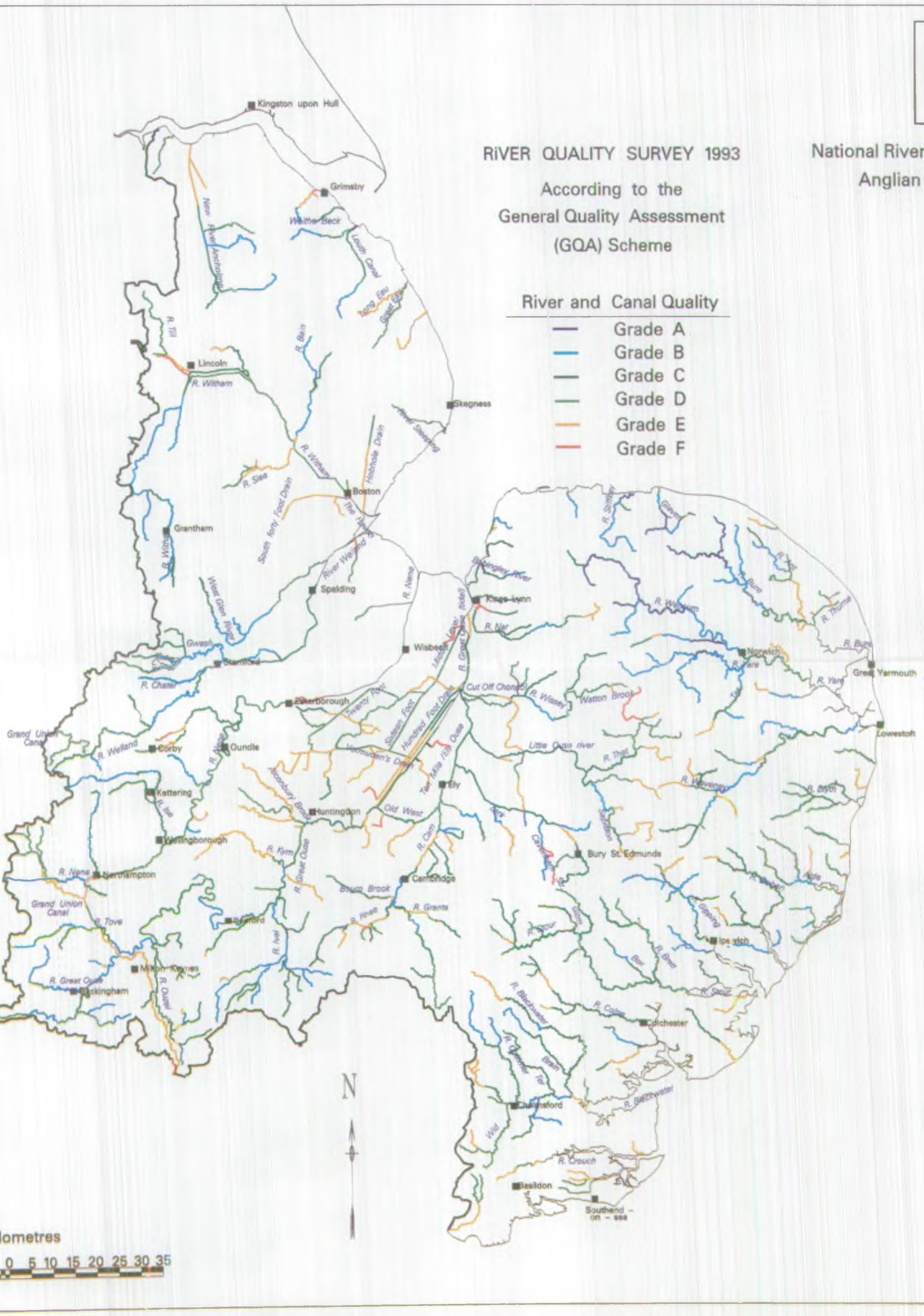
Anglian Region

RIVER QUALITY SURVEY 1993

According to the
General Quality Assessment
(GQA) Scheme

River and Canal Quality

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



National Rivers Authority
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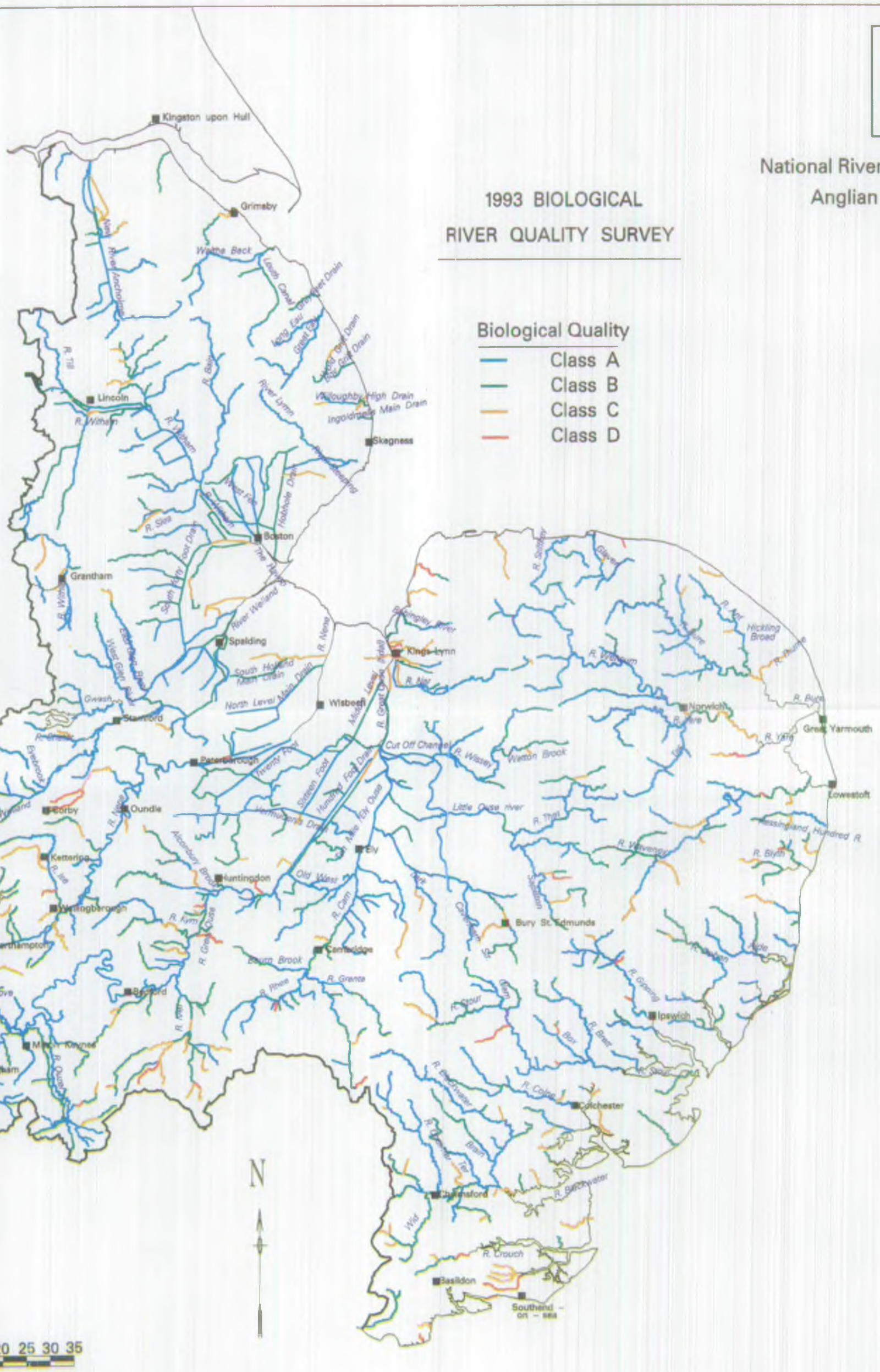
1993 BIOLOGICAL RIVER QUALITY SURVEY



Kilometres

5 0 5 10 15 20 25 30 35

Biological Quality

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