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Photo
Master

local environment agency plan

FAL AND ST AUSTELL STREAMS

CONSULTATION REPORT

MARCH 1997



ENVIRONMENT
AGENCY

YOUR VIEWS

The Fal and St Austell Streams is the second Local Environment Agency Plan (LEAP) produced by the Cornwall Area of the Environment Agency. We will be producing a further four LEAPs by the end of 1999 to complete the coverage of the Area. These will include two catchments previously covered by Catchment Management Plans produced by the National Rivers Authority (NRA).

This Consultation Report is our initial view of the issues facing the catchment. Public consultation allows people who live in or use the catchment to have a say in the development of our plans and work programmes. We welcome your ideas on the future management of this catchment:

- Have we identified all the issues?
- Have we identified all the options for solutions?
- Have you any comments on the issues and options listed?

Do you have any other information or views that you wish to bring to our attention?

This is your opportunity to influence our future plans.

We look forward to hearing from you.



Geoff Boyd

Area Manager, Cornwall

Please send your comments by 19th May 1997, preferably by writing to:

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ENVIRONMENT AGENCY



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CONTENTS

VISION	1
INTRODUCTION.....	2
The Environment Agency	2
This Local Environment Agency Plan	4
CATCHMENT STATISTICS.....	7
CATCHMENT CHARACTERISTICS	8
Landscape	8
Wildlife	8
Historic Environment	9
Economy	9
ISSUES.....	10
ISSUE 1: AIR POLLUTION	11
ISSUE 2: MANAGING WATER RELATED RECREATION	12
ISSUE 3: IMPACTS ON FRESHWATER AND ESTUARINE FISHERIES	13
ISSUE 4: POTENTIAL TO IMPROVE FRESHWATER FISHERIES	15
ISSUE 5: IMPACTS ON COMMERCIAL AND NATURAL SHELLFISHERIES	18
ISSUE 6: SEA LEVEL RISE.....	21
ISSUE 7: PROTECTION OF HABITATS, WILDLIFE AND HISTORIC FEATURES	23
ISSUE 8: IMPACT OF AGRICULTURE AND HORTICULTURE.....	24
ISSUE 9: IMPACT OF THE CHINA CLAY INDUSTRY	26
ISSUE 10: IMPACT OF METALLIFEROUS MINING ACTIVITIES	29
ISSUE 11: IMPACT OF DEVELOPMENT	33
ISSUE 12: MEETING CURRENT AND FUTURE DEMAND FOR WATER.....	36
ISSUE 13: GENERATION AND MANAGEMENT OF WASTES	38
ISSUE 14: IMPACT OF SEWAGE DISCHARGES.....	41
ISSUE 15: IMPACT OF FALMOUTH DOCKS	44
ISSUE 16: UNKNOWN CAUSES OF POOR WATER QUALITY	45
SUPPORTING INFORMATION.....	46
PROTECTION THROUGH PARTNERSHIP	48
Physical Characteristics	51
Conservation - Landscape, Wildlife and Historic Features	55
Fisheries.....	63
Shellfisheries	70
Agriculture.....	73
Forestry	75
Recreation and Amenity	77
Bathing Waters	79
Proposed River Quality Objectives.....	83
Aquaculture.....	86
The Built and Developing Environment.....	87
Flood Defence	93
Mining and Quarrying	99
Contaminated Land	105
Abstraction and Water Supply.....	107
Effluent Disposal	119
Waste Management.....	126
Oil Pollution Prevention	129
Controlled Processes.....	130
Air Quality	133

Table 1 : Catchment statistics	7
Table 2 : Drainage areas	7
Table 3: Initiatives in plan area	49
Table 4 : Biological classification	59
Table 5 : Presence of fish species with self-sustaining populations	64
Table 6 : Rod fishing open seasons	65
Table 7 : Obstacles impassable or partially passable to fish	67
Table 8 : Oyster fishery	70
Table 9 : Shellfish beds classified under the EC Shellfish Hygiene Directive	71
Table 10 : Pollution incidents arising from agricultural activities 1993 to 1995	74
Table 11 : Compliance against EC Bathing Water Directive as assessed by the Department of Environment	80
Table 12 : Fish farm abstractions and discharges	86
Table 13: Examples of recent/ongoing development proposals within the catchment in which the Agency has an interest	89
Table 14 : Development restraints due to problems in sewerage infrastructure and/or potential flooding	91
Table 15 : Flood defence structures	94
Table 16 : Flood warning	97
Table 17 : Metal concentrations in samples of brown algae from Restronguet Creek	103
Table 18 : Public water supply abstractions	112
Table 19 : Future demand forecasts for SWW's Colliford Strategic Supply Zone	112
Table 20 : Percentage of population on mains sewerage	121
Table 21 : Pollution incidents arising from industrial and sewage effluents 1993 to 1995	121
Table 22 : List I monitoring	122
Table 23: Annual estimated waste production in Cornwall	127
Table 24: Recycling of domestic waste 1994/5	128
Table 25 : Part A Controlled Processes in the catchment	131
Map 1: Fal and St Austell Streams	6
Map 2: EC Directive Monitoring	40
Map 3: Special Area of Conservation	47
Map 4: Geology	50
Map 5: Hydrometry	52
Map 6: Landscape designations	54
Map 7: Conservation designations	56
Map 8: Biological Survey	58
Map 9: Fisheries	62
Map 10: Potential sites for fisheries improvements	66
Map 11: Recreation	76
Map 12: Proposed River Quality Objectives	82
Map 13: Built Environment and Development Plans	88
Map 14: Flood Defence	92
Map 15: Active Mineral Workings	98
Map 16: Historic Metalliferous Mining	102
Map 17: Public water supply distribution system	108
Map 18: Surface Water Abstractions	111
Map 19: Groundwater Abstractions	113
Map 20: Effluent Disposal, SWW Consents	118
Map 21: Effluent Disposal, Private and Trade Consents	120
Map 22: Waste Management	125
Figure 1: Agricultural Land Use	73
Figure 2: Annual Licensed Abstraction	109
Figure 3: Nett Resource Commitment	110
Figure 4: Ground Level Ozone	132
Figure 5: Estimated Annual NO _x concentrations for 1994	132
Figure 6: Critical loads for acidity of soils and Non-marine sulphur deposition	134
Figure 7: Exceedences of critical load of acidity of soils, for 1989-92 and modelled for 2005	136

vision

The Fal and St Austell Streams Catchment is an area of great diversity that is influenced by a variety of land uses, most notably the St Austell china clay area in the east of the catchment, and farming and historic metalliferous mining throughout.

The catchment makes an important contribution to the rural economy through agriculture, china clay extraction and tourism, and contains internationally important habitats and species.

Our Vision of the Fal and St Austell Streams is of a healthy and diverse catchment, managed in an environmentally sustainable way, that balances the needs of all users with the needs of the environment. We look forward to a future where there is:

- development of sustainable farming and forestry systems which reduce diffuse pollution and improve the physical habitat of the river system and wetlands for wildlife
- maintenance and, where appropriate, enhancement of biodiversity
- significant reductions in waste and improved standards of disposal and treatment
- achievement of environmentally sustainable use of water resources
- continuing improvements to existing discharges to meet the most appropriate standards
- minimal risk to people and property from flooding
- full development of potential for sustainable salmonid and freshwater fisheries
- increasing enjoyment and appreciation of the water environment
- improvements in the quality of air

The Environment Agency cannot realise this vision on its own and will seek to work in partnership with local authorities, industry, farmers, environmental groups and other interested organisations to turn this vision into reality.

Part 1

INTRODUCTION

The Environment Agency

Who are we?

The Environment Agency is a non-departmental public body established by the Environment Act 1995 and formed on 1 April 1996. We are sponsored by the Department of the Environment with policy links to the Welsh Office and the Ministry of Agriculture, Fisheries and Food.

We have taken over the functions of our predecessors: the National Rivers Authority, Her Majesty's Inspectorate of Pollution (HMIP), the Waste Regulation Authorities (WRAs) and some parts of the Department of the Environment (DoE).

We provide a comprehensive approach to the protection of the environment by combining the regulation of air, land and water into a single organisation. We cannot work in isolation, but seek to educate and influence individuals, groups and industries to promote best environmental practice, and develop a wider public awareness of environmental issues.

Our Vision is:

- a better environment in England and Wales for present and future generations

We will:

- protect and improve the environment as a whole by effective regulation, by our own actions and by working with and influencing others
- operate and consult widely
- value our employees
- be efficient and businesslike in everything we do

Our Aims are:

- to achieve significant and continuous improvement in the quality of air, land and water, actively encouraging the conservation of natural resources, flora and fauna
- to maximise the benefits of integrated pollution control and integrated river basin management
- to provide effective defence and timely warning systems for people and property against flooding from rivers and the sea

- to achieve significant reductions in waste through minimisation, re-use and recycling and to improve standards of disposal
- to manage water resources to achieve the proper balance between the needs of the environment and those of abstractors and other water users
- to secure, with others, the remediation of contaminated land
- to improve and develop salmon and freshwater fisheries
- to conserve and enhance inland and coastal waters and their use for recreation
- to maintain and improve non-marine navigation
- to develop a better informed public through open debate, the provision of soundly based information and rigorous research
- to set priorities and propose solutions that do not impose excessive costs on society

Sustainable development

In 1987, the World Commission on Environment and Development (the Brundtland Commission) defined sustainable development as that *which meets the needs of the present without compromising the ability of future generations to meet their own needs*.

Sustainable development brings together four sets of values: environmental protection, providing for the future, quality of life, and fairness, to create a new policy which integrates environmental, developmental, social and economic concerns.

One of the primary reasons for setting up the Environment Agency was to provide a means of helping the government deliver its sustainable development strategy. Section 4 of the Environment Act (1995) defines the Agency's aims and states that *the minister shall give statutory guidance on objectives and the contribution to sustainable development*. Guidance has been published by the Department of the Environment¹, and the key elements are that the Agency should:

- take a holistic approach to the protection and enhancement of the environment
- take a long-term perspective
- maintain biodiversity by exercising its statutory obligations with respect to conservation
- discharge its regulatory functions in partnerships with business in ways which maximise the scope for cost effective investment in improved technologies and management techniques
- provide high quality information and advice on the environment

Our management of the catchment will take forward these key elements as our contribution towards sustainable development.

Our umbrella duties

There are a number of umbrella duties which we carry out for all our functions:

- Rural Areas - when considering any proposal, we must have regard to any effect which the proposals would have on economic and social well-being of local communities in rural areas. Some of our activities, such as meeting statutory objectives, emergency actions and the taking of legal actions are not subject to this appraisal

- **Costs and Benefits** - we are required to pay regard to the likely costs and benefits when deciding whether to exercise our powers. Costs include both financial costs and costs to the environment; benefits include those which communities will enjoy, both now and in the future
- **Conservation** - we must have regard to conservation in our pollution control functions, and we have a duty to further conservation in all our other functions. We also have a duty generally to promote the conservation of flora and fauna dependent on the aquatic environment

What we do not do

We do not cover all aspects of environmental legislation and service to the general public. Your local authority deals with all noise problems; litter; air pollution arising from vehicles, household areas, small businesses and small industries; planning permission (they will contact us when necessary); contaminated land issues (in liaison with ourselves); and environmental health issues.

This Local Environment Agency Plan

This Local Environment Agency Plan (LEAP) slots into a sequence of Catchment Management Plans (CMPs) which were being prepared by the NRA to cover all river catchments in England and Wales. We will use LEAPs to cover the same topics as Catchment Management Plans but they will also deal with other topics to cover the full range of our responsibilities.

A holistic approach to environmental management is required to plan for sustainability and improvement. LEAPs allow the full range of management issues to be identified and considered within a geographical area which is both relevant and meaningful. They are strategic in nature, since individual catchments cover large areas of land, often straddling local authority boundaries.

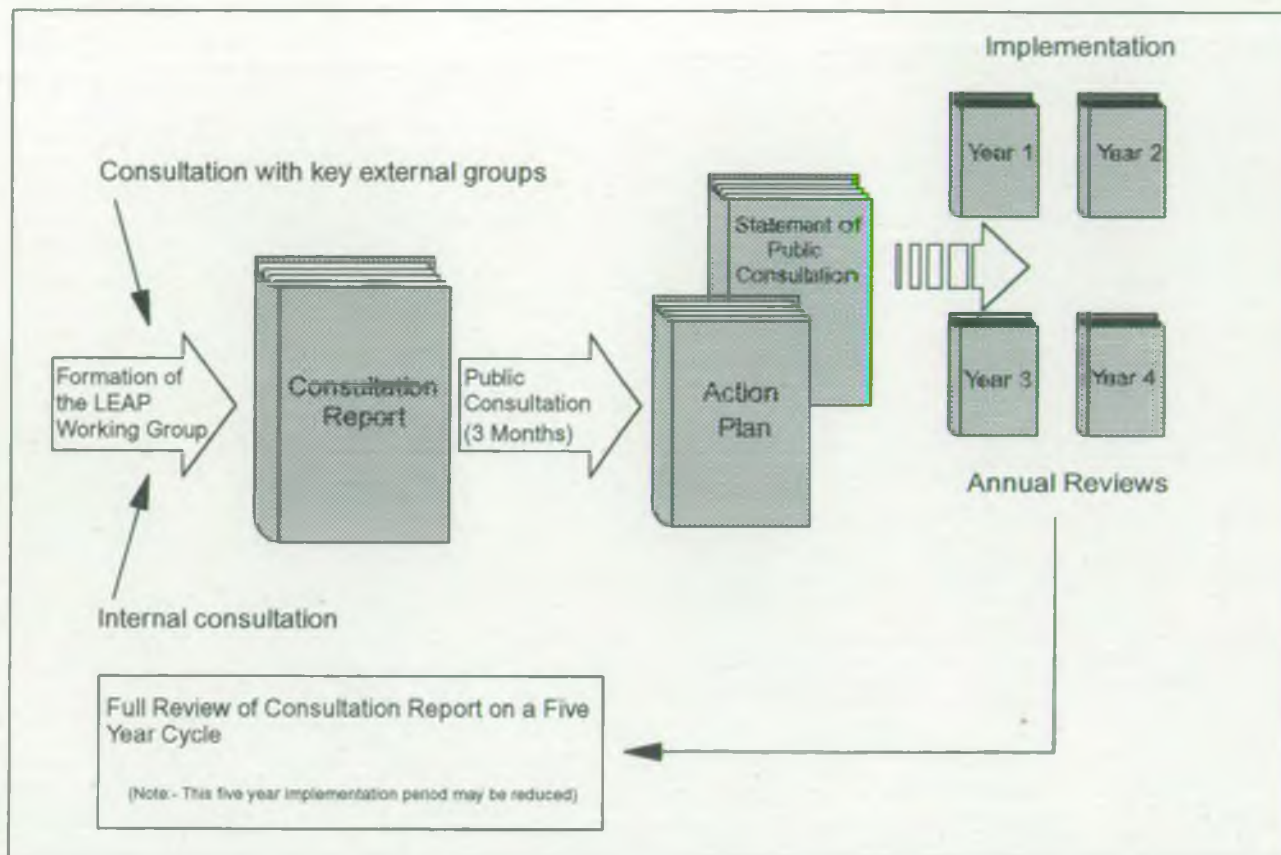
Economic and political constraints will influence what we are able to do. For example the funds that the water service companies and other industries invest in pollution control will make a difference to the extent of water quality improvements that we are able to achieve.

Local Environment Agency Plans and Development Plans

While we can control some of the things that influence the quality of the environment, we have only limited control over the way that land is developed. This is the responsibility of local planning authorities.

Local authorities prepare statutory development plans; the policies in these plans will guide the way that land is developed in the future. We advise and guide local planning authorities to encourage them to adopt policies that protect the environment from harmful development. Where we can, we will reinforce these policies when we comment on planning matters or if we are making our own decisions.

The LEAP Process



This Consultation Report

This Local Environment Agency Plan Consultation Report gives you the opportunity to comment on environmental problems or our work. It describes the environmental resources of the area, explains how these resources are affected by human uses or pressures, and outlines issues where we or others need to take action to address problems in the environment.

How to use this plan

This report is split into two parts:

Part 1 includes:

- An introduction;
- An outline of the issues that we face in our management of the catchment. (Issues are supported by more detailed information in Part 2). Options and Actions for the resolution of these issues are also identified;
- Protection through partnership. This section outlines work that we do in collaboration with other organisations and where the work of other organisations plays an important part in helping us to achieve some of our aims and objectives.

Part 2

- Includes a detailed account of the uses and pressures on the area. This section forms a useful reference document and will provide background information relevant to the issues identified in Part 1.

References are given in superscript throughout the document (i.e. ¹)

Map 1 - The Fal and St Austell Streams Catchment



Information correct as of December 1996

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Fal and St Austell Streams Local Environment Agency Plan
Environment Agency

Catchment Statistics

Table 1 : Catchment statistics

Area Drained	860 km ²
Principal Towns	Truro, St Austell, Falmouth
Approx. Population	152,145
Length of Main River	48 km
Length of Controlled Water	382.50 km
Local Authorities	Restormel Borough Council, Carrick District Council, Kerrier District Council, Cornwall County Council
Total Volume Licensed Abstractions: (Ml/year)	
Groundwater	44,835
Surface water	30,442
Average Annual Rainfall (averaged across the catchment)	1175 mm

Table 2 : Drainage areas

River	Area drained upstream of;	Area drained (km ²)	Length of river (km)
Par	Tidal Limit	71.75	15.30
Crinnis	Tidal Limit	15.50	6.50
St Austell	Mean High Water	109.50	11.00
Fal	Tidal Limit	110.50	29.0
Fal Estuary		109.25	
Helford	Tidal limit	216.75	5.9
Truro Rivers	Tidal limit	142.50	7.50
Carnon	Tidal limit	84.25	9.00

Catchment Characteristics

The Rivers Fal, Par, Crinnis and St Austell drain a large part of southern Cornwall from Gribben Head in the east to Gunwalloe in the west. The major urban areas are St Austell, Truro and Falmouth. Carrick Roads forms a large deep-water harbour which gives Falmouth its importance as a major port. Truro is the administrative centre of Cornwall. In the east china clay extraction, the dominant activity, has a significant effect on the area. Historic mineral mining has left a legacy of old mines and adits, particularly in the Carnon Downs area. The remainder is rural in character, ranging from moorland headwaters, to arable farmland, meadowland and extensive woodland in the lower reaches of the rivers.

Landscape

Distinctive landscapes occur within this catchment. The landscape types have been described fully in the Countryside Commission's 'New Map of England'² and Cornwall Landscape Assessment³. The central two thirds or so comprise intricate estuaries with considerable areas of mudflat exposed at low tide. Oak woodland fringes much of the estuary, frequently reaching right down to the water's edge. Inland, undulating farmland, mostly put to dairying, is criss-crossed by a network of cornish hedges, many of which support mature trees and are significant in the landscape. Farmsteads and villages lie scattered across this landscape.

The western and eastern parts of the catchment display the effects of past and present mineral working. In the west the granite district of Carnmenellis rises up above the surrounding land and presents a windswept, treeless face. Heather moorland and smallholdings are punctuated by derelict engine houses and mine spoil heaps. This higher, rough ground is reflected in the east by the Hensbarrow granite district though here the skyline is dominated by vast white conical or flat-topped china clay waste tips. Scrub covered slopes lead down to deep turquoise pools at the tips' bases. Industrial remains are frequent with evidence of tin streaming in valley bottoms. Today this rough, disturbed land supports wetland and willow scrub which provides a contrast to the modern large-scale clay workings nearby.

At the far south of the catchment, the Lizard displays a landscape unique in England. A windswept plateau, clothed with generally unenclosed heathland, culminates in high, colourful cliffs and rocky headlands. The underlying serpentinite rock influences both landscape and ecology greatly here.

A spectacular coastline exists along virtually the whole of the edge of this catchment. Frequent rocky headlands are interspersed with narrow coves where small fishing villages have developed. This coastal landscape is distinct from most of the hinterland and is a highly valued resource.

Wildlife

This catchment contains a range of habitats of great national and international importance. On the Lizard peninsula, the geology and climate support heathland vegetation that is unique in Europe, and supports many extremely rare plants and invertebrates. The coast around the Lizard is rich in rare species, and prized by geologists.

Heathland also occurs in the east of the catchment and close to Truro. Goss Moor, the source of the River Fal, supports the largest inland wetland in Cornwall, and is a mosaic of dry and wet heath, mires and willow scrub.

The marine and intertidal areas of the Fal and Helford are of great nature conservation value. Various species of wader and waterfowl use the estuaries as feeding sites, and nationally a number of organisms are only found here. Within the Helford Estuary there is a Voluntary Marine Conservation Area. The historic and contemporary input of mining waste to this system has resulted in the development of heavy metal-tolerant species, and the Fal system constitutes a unique scientific resource in this field.

More detailed reviews of the conservation interest in the Fal Estuary can be found in two reports produced for the Falmouth Bay & Estuaries Initiative⁴.

Across the wider countryside, other fragments of semi-natural habitat remain. These are linked by vegetated stream and river valleys and cornish hedges.

The catchment contains a variety of fisheries, with most watercourses supporting populations of coarse fish and brown trout, and some supporting migratory sea trout and salmon. The estuaries and coastal waters contain a wide variety of fish and shellfish.

Throughout there are Red Data Book species (a list of threatened species) and other rare plants and animals, many occurring in designated sites.

Historic Environment

The activities of past generations have shaped the urban and rural landscapes of the area. Bronze Age remains survive quite extensively on the Lizard and on the uplands of Carnmenellis and Hensbarrow, although the china clay industry has had considerable impact on the latter area.

During the Medieval period the rivers and streams and estuaries, in particular the Fal, were of great importance to the local inhabitants in the winning, working and export of metals. Metalliferous mining in the Carnon area reached its peak in the 18th and 19th centuries. Many historic features remain, from stamps and smelt sites to aqueducts and loading quays. Within the china clay area the Luxulyan Valley contains significant historic remains, many of which are being managed and restored.

A more detailed review of the historical interest in the Fal Estuary can be found in a report produced for the Falmouth Bay & Estuaries Initiative⁵.

Economy

The china clay industry dominates the economy and the landscape of the St Austell area. It is the largest private employer in Cornwall, generating jobs directly in the winning, processing and distribution of china clay and indirectly through ancillary industries and general commerce.

The whole of the catchment is very heavily visited and tourism is an important part of the local economy. Visitors come for traditional seaside holidays and for water-based activities, such as sailing. Falmouth is an important port for both recreational and commercial vessels as it is a deep water port and can refit ships of considerable size. The Fal Estuary is known for its oyster beds and fishing takes place all around the coast.

Dairying is the predominant farming activity, with mixed farming and rough grazing taking place on poorer land, and horticulture is important in some localities.

Part 1

ISSUES

ISSUE 1: AIR POLLUTION

Background

Air pollution may be in the form of gas or particulate matter. Its dispersion and dilution depends on the nature of pollution and climatic conditions. Its impact may be local, especially with regard to particulate matter which will often settle on nearby land or water. Or it may be global, for example affecting the ozone layer or the concentrations of greenhouse gases such as carbon dioxide.

Effects on the catchment

Ozone and Nitrogen Oxides

Ozone levels in parts of the catchment are generally above those at which damage to vegetation may occur. There have been exceedences of World Health Organisation (WHO) air quality guidelines for effects of nitrogen oxides (NO₂ and NO) on vegetation in some localities, see Figure 5. Management of these issues will be picked up in the work of the Cornwall Air Quality Forum.

Current action

The Cornwall Air Quality Forum has been formed as one of 14 pilot areas nationwide. It is led by Carrick District Council, and has representation from all local authorities in the county and the Agency. The Forum has been funded by the government to:

- review and assess government guidance on air quality strategy, its appropriateness, requirements and applicability. They intend to do this through producing a strategy.
- carry out an assessment of monitoring techniques for PM10s (dust) at a china clay quarry site.

A contract has been let to complete this work by September 1997.

Air quality information exists for Cornwall but there is *not* full knowledge of what is available. Information is held in different places and is not easily accessible as a whole. Members of the Air Quality Forum are working together to identify all available information.

Issue 1: Air pollution

Option	Responsibility	Benefits	Constraints
Issue 1: Air pollution			
* Draw up strategy	Cornwall Air Quality Forum	Information for management decisions leading to environmental improvement	Availability of information

Area Detail

Further detail on the area can be found in Part II, Supporting Information:

Air Quality

ISSUE 2: MANAGING WATER RELATED RECREATION

Background

The demand for water-based and water-related recreation is steadily increasing. This is something that we are generally in favour of, and have some duties to support and encourage. However, our other responsibilities require us to protect sensitive habitats and species and the interests of other users.

Examples in the catchment

Conflicts with other uses

Sometimes there can be a conflict between recreational use, conservation and commercial interests. These conflicts are often best managed by informal agreement and/or zoning. In order to properly plan and manage there is a need for a good level of baseline information to define zones, and a co-ordinated approach from a number of bodies. A more detailed review of multiple use in the Fal Estuary has been carried out in a report produced for the Falmouth Bay & Estuaries Initiative⁶ (FBEI).

Issue 2A: Conflict between users

Water Contact Sports

A number of people have expressed concern about the suitability of water around Falmouth Docks and Restronguet Creek for water contact sports. It is unclear who is responsible for monitoring and disseminating this information to the public. Our monitoring in this respect is given more fully in Supporting Information, page 79. We make our results available to local authorities and also make them available at our Bodmin and Exeter offices for anyone who wishes to view them.

We are investigating water quality standards to protect water contact sports. Establishing appropriate standards is the subject of research, and until they are developed further we cannot introduce them.

Canoeing

Canoeing currently takes place on a tidal reach of the River Fal where there is a right of passage. However, there have been complaints about access to the water in this area and we feel it would be beneficial to pursue an Access Agreement with the British Canoe Union (BCU) and landowners. Any agreement would need to consider the interests of riparian owners and the quiet nature of the area which contributes to its wildlife and landscape value.

Issue 2B: The need to set up canoe access agreement for the Fal

Option	Responsibility	Benefits	Constraints
Issue 2A: Conflict between users			
* Support the development and implementation of issues in the FBEI plan	Agency/ FBEI/ recreational bodies	To ensure that Agency duties to recreation are achieved	Resources
Issue 2B: The need to set up canoe access agreement for the Fal			
* Set up agreement, then:	Riparian owners/ BCU	Control access through responsible organisations and minimise conflict	None known
* Promote access agreements	BCU		None known
* Provide notice boards on riverside to publicise agreements	BCU/ Agency		Cost
* Improve access/exit points	BCU/ Agency		Cost

Area Detail

Further detail on the area can be found in Part II, Supporting Information:

Recreation

Bathing Beaches

ISSUE 3: IMPACTS ON FRESHWATER AND ESTUARINE FISHERIES

Background

Major impacts on the fishery in the plan area are principally poor water quality and poaching. Poor water quality can be due to inputs from agriculture, effluent disposal, china clay extraction or historic mining areas, see Issues 8, 9, 10, 16.

Examples in the catchment

Poaching

No large-scale poaching occurs on the freshwater system. However some illegal rod fishing takes place on the Rivers Tresillian, Allen and Kenwyn. Poaching of salmonids and juvenile bass is a major problem within the Fal and Helford Estuaries. Rigorous and high profile enforcement within the rivers, estuaries and coast needs to be maintained by the Environment Agency, Ministry of Agriculture Fisheries and Food (MAFF) and Cornwall Sea Fisheries Committee (CSFC). Whilst the Agency endeavours to respond quickly to all reports of poaching reductions in staff and funding mean that we rely heavily on information from other bodies and the general public to alert us quickly to poaching incidents. We can then target resources effectively to combat the problem.

Many reports have been made by members of the public about illegal fixed netting for bass and/or salmonids within the Fal and Helford Estuaries and illegal gill netting is suspected to take place off the Manacles. Drift netting for undersized bass and salmonids has taken place in the Fal and Helford Estuaries. St Austell Bay is known for extensive inshore fixed netting for bass and salmonids. There was a marked increase in this form of netting in 1995.

MAFF are currently seeking an extension of the bass nursery area in the Fal Estuary. The current area of designation is thought to have significantly assisted in the conservation of bass stocks, though no known official monitoring of populations is undertaken. Voluntary monitoring of juvenile bass stocks is carried out by members of the Helford Voluntary Marine Conservation body. The legislation does not cover shore anglers. We would support self regulation by anglers and fishing clubs in advertising the current size limit and any catch and return initiatives.

Issue 3A: Poaching of salmonids and juvenile bass

Currently there is a difference in the size limit for bass caught within and outside the estuary. Within the estuary we are the sea fishery authority and the minimum landing size is 36cm. Outside the estuary Cornwall Sea Fisheries Committee (CSFC) are the authority and the size is 37cm. CSFC have asked us to raise the minimum landing size limit to 37cm to make enforcement easier. We have agreed to do this, and will be seeking permission from MAFF to create a new byelaw. External consultation will be required as part of this process.

Issue 3B : Increase minimum bass size limit

Traditional ebb netting for sea fish takes place within the Bass Nursery areas. This is technically illegal and exemption permits would be needed to regularise the existing situation. We will look at this issue in consultation with the relevant parties.

Issue 3C: Ebb netting for sea fish

Natural predation

Natural predation of fish by mammals and birds occurs throughout the fishery, and is perceived by others as being an issue. At present it is not known if this is having a significant impact on fish stocks. Licences to kill predators are issued by MAFF once a fishery owner proves economic impact. We work with fisheries owners and MAFF to advise on preventative measures. We will not support the licensed killing of predators until and unless proof of serious commercial damage has been established and killing proven to be the most effective means for preventing significant loss to fish stocks.

Issue 3D: Natural predation of fish stocks

Disease

Diseased bullheads have been found in the River Allen Catchment during NRA surveys in 1992 to 1995. Although at some sites large numbers of bullheads were infected no dead fish were found. The cause of the disease is not known, nor its normal occurrence levels. A sample is currently with the

MAFF fish diseases laboratory. No bullhead population within other Truro rivers appears to have been infected by this fish disease nor do any other fish species.

Issue 3E: Investigate causes of bullhead disease

Introductions and escapees

Within the plan area there are stillwater lakes containing a variety of fish species not found within the river system. We are concerned about the occurrence and impact of fish escapees on native species. For example, a parasite occurring in eels is thought to be linked with introduced species.

Issue 3F: Introduction of non-native fish species into freshwater and the marine environment

Option	Responsibility	Benefits	Constraints
Issue 3A: Poaching of salmonids and juvenile bass			
* Rigorous and high profile enforcement * Public reporting of suspected poaching	Agency/ MAFF/ CSFC General Public	Protect stocks	Resources
Issue 3B : Increase minimum bass size limit			
* Create byelaw	Agency	Assist enforcement	Cost/resources
Issue 3C: Ebb netting for sea fish			
* Investigate legalising situation	Agency	Legalise appropriate practices	Identification of ebb netters Cost/resources
Issue 3D: Natural predation of fish stocks			
* Prove economic impact	Fishery Owners	Basis to promote action	
Issue 3E: Investigate causes of bullhead disease			
* Identify parasite and its normal occurrence levels * Monitoring on River Allen and other rivers * Minimise risk of spreading to nearby catchments if not present * Limit risk of spreading parasite by our own work or fishermen - best practice	Agency	Knowledge - basis for control if necessary Ensure cannot affect other stocks	All options: Cost/resources
Issue 3F: Introduction of non-native fish species into freshwater and the marine environment			
* Update database on distribution of non-native species within stillwater fisheries * Regular inspections of stillwater fisheries * Monitoring of non-native escapees recorded during fisheries work * Publicise regulations and hazards of fish disease	Agency	Provide data for decision making Reduce illegal non-native introductions Provide data for decision making Better public understanding	All options Cost/resources

Area Detail

Further detail on the area can be found in Part II, Supporting Information:
Fisheries

ISSUE 4: POTENTIAL TO IMPROVE FRESHWATER FISHERIES

Background

Wild fisheries are important natural assets and are also of commercial value for rod fisheries. Several rivers support self-sustaining populations of fish species given special protection by the European Union Species and Habitats Directive 1992 such as salmon, bullheads and brook lamprey. There needs to be protection and promotion of these fish species and their habitat.

Rivers in the area naturally contain brown trout and sea trout. A few have shown sporadic evidence of salmon successfully spawning. Where these are found throughout the area they have adapted to local conditions (water quality and habitat). Some areas have scope for improvement.

We are currently involved in implementing a classification scheme following a research and development project which will enable us to set targets for the catchment and also put the fisheries into a national context.

Poor juvenile salmonid populations were found on several of the area's streams. Some of the causes, for example, historic metalliferous mining in the Carnon valley (where there are no fish at all) have such an impact that the fishery is unlikely to improve in the near future. However, improving water quality and the results of fisheries surveys indicate that with further improvements there is the potential to develop a larger salmonid fishery on some rivers.

Examples in the catchment

Knowledge of fish populations

There are several watercourses in the plan area where little or no data on fish populations is available. This limits our ability to set objectives to improve fisheries. The St Austell River, Par River and Percuil River all need more detailed fish population surveys. Results from surveys have indicated poor trout densities on the upper reaches of Portholland Stream, an absence of brown trout on Porthoustock. The causes of these low densities are not known. Although high trout parr densities were recorded at Constantine Quay, no evidence of trout fry were found.

Issue 4A: Poor fish population information

Eels are a natural resource as they are fished for by man, birds and animals. In order to properly manage the resource we need to have a better understanding of eel populations. Some data on the freshwater stage of their lifecycle can be collected as part of our routine surveys. However, there is concern over their survival at sea and research work is being undertaken to investigate the decline in the European eel. The Agency supports this work. The study of eel tissue can also reveal the level of bioaccumulation of toxins (such as metals and pesticides) and their suitability as a food source.

Issue 4B: Insufficient knowledge of eel populations to enable sustainable management.

The age of salmonids can be determined by scale readings. Data on sea trout age classes is only available for the River Tresillian. No evidence of trends in abundance can be determined from the small data set of scaled sea trout currently available. We would encourage anglers to send in scales and catch details of all rod caught fish to assist us in gathering information on stocks.

Issue 4C: Insufficient age class data for adult sea trout

Water Quality

In order to protect water quality we are seeking River Quality Objectives and long term River Quality Objectives on a number of river stretches (see page 83). We are also investigating the possibility of recommending several new stretches to the Department of the Environment for them to designate under the EC Freshwater Fish Directive to provide better protection of salmonids. These are on the Fal, St Austell and Par Rivers, Kestle, Portholland, Percuil, Manaccan, Tywardreath and Trevella Streams.

Issue 4D: Designation of new stretches under the EC Freshwater Fish Directive

Areas of Potential Improvement

The Caerhays Stream could support a larger fishery than at present but has been the site of agricultural pollution in the past (see page 24). Gwindra and St Keverne Streams have both seen improvements in water quality in recent years and may be capable of supporting salmonid populations.

The Tywardreath Stream contains low densities of trout fry and parr within a highly managed stream habitat (regular canalisation for flood defence purposes). There might be opportunity for habitat improvements. Other areas which may benefit from habitat improvement should be highlighted as part of 6A.

Issue 4E: Areas of potential improvements**Obstructions**

Within the plan area there are several obstructions that are considered to prevent access of migratory fish and where action might be undertaken. Two 19th century weirs on the River Fal, Virginia Weir and Grampound Town Weir and Rosevallon fish pass need assessment. A crump weir on the River Kenwyn may prevent sea/brown trout migrating upstream. The series of culverts and weirs on the lower reaches of the River Allen may inhibit regular sea trout migration although these are Agency maintained flood defence structures, designed to be passable to fish. The Tresillian River could support a larger fishery than at present if trash dams are removed.

The Portholland Stream has the potential to support a larger brown trout fishery. An impassable concrete outfall weir onto the beach at Portholland prevents migratory salmonids entering the river.

Issue 4F: Obstructions to fish migration requiring improvement or maintenance**Rod Catch Records**

Rod catch records for the plan rivers are sparse and only cover the Fal, Tresillian and Kennal for a limited number of years. Rod catch data has also been collated in different ways. Currently the Fal rod catch data is amalgamated with data from many other small Cornish/Devon rivers. This information would be more valuable if the catches were separated. Monitoring of salmon and sea trout catches from individual rivers will aid future management.

Issue 4G: Need for improved recording of rod catches

Option	Responsibility	Benefits	Constraints
Issue 4A: Poor fish population information			
* Review juvenile survey programme to include St Austell, Par and Percuil Rivers	Agency	Improved management decisions	Cost/resources
Issue 4B: Insufficient knowledge of eel populations to enable sustainable management			
* Monitoring of eels	Agency	Provide data for decision making and management strategies	Cost/resources
Issue 4C: Insufficient age class data for adult sea trout			
* Further scale reading to investigate adult population trends in stock abundance	Agency	Provide data for decision making and management strategies	Cost/resources
* Send scales from and details of rod caught fish to Agency for analysis	Anglers		
Issue 4D: Designation of new stretches under the EC Freshwater Fish Directive			
* Investigate designation of new stretches	Agency	Better protection of salmonid areas	Cost/resources

Issue 4E: Areas of potential improvements			
* Investigate sites to assess opportunity and works required * Draw up list of costed works	Agency	To enable prioritisation of available resources	Cost/resources
Issue 4F: Obstructions to fish migration requiring improvement or maintenance			
* Survey obstructions and determine action needed	Agency	To enable prioritisation	Cost/resources
* Carry out cost benefit analysis	Agency	Open up new areas	
* Carry out appropriate actions	Agency		
Issue 4G: Need for improved recording of rod catches			
* Individual records needed for Rivers Fal, Tresillian and Kennal on National list * Consider adding records for Helford River and Caerhays Stream to national list	Agency Agency	Both options: Improved fishery management	Cost/resources

Area Detail

Further detail on the area can be found in Part II: Supporting Information

Fisheries

Appendix B

ISSUE 5: IMPACTS ON COMMERCIAL AND NATURAL SHELLFISHERIES

Background

There are a number of shellfish beds within the Fal and Helford Estuaries, representing a valuable natural and economic resource. There are a number of issues relating to subjects such as moorings which have been discussed in the Falmouth Bay and Estuaries Initiative⁷.

The Environment Agency monitors water quality under the EC Shellfish Waters Directive, see pages 70 and 71. Sampling under the EC Shellfish Hygiene Directive is undertaken by the Port Health Authority (PHA) on behalf of MAFF to determine the bacteriological quality of shellfish flesh, see page 71.

Effects on the catchment

Water pollution

EC Shellfish Waters Directive

In 1994 the standard for saline zinc concentrations under the Directive was exceeded three times in the Fal Estuary, Turnaware Bar site. These exceedances are thought to have occurred due to the proximity of this site to the Carnon River which takes the discharge from County Adit and the abandoned Wheal Jane mine. The next phase of the Wheal Jane project will include an assessment of whether improvements to treatment at Wheal Jane will bring about compliance with the Directive.

Issue 5A: Exceedences of EC Shellfish Waters Directive Standards

Non-designated Shellfish Waters

We monitored water quality and the quality of shellfish (oyster) tissue at 9 other sites in 1994 which are not covered by the EC Shellfish Waters Directive. Water quality and the quality of shellfish were assessed using the EC Shellfish Waters Directive standards. In 1995 a MAFF monitoring programme for chemical contaminants in shellfish flesh commenced, with sampling undertaken by the Port Health Authority.

In 1994 the standard for zinc concentrations in the water samples was exceeded once at 2 sites, off Halwyn and Mylor Bank, and a number of sites had results for metals which exceeded the typical range expected for oyster tissue. It is known that mining activities have had a significant impact on the tidal waters within this area which would affect levels of metals both in water and in shellfish tissue, see pages 103 and 122.

EC Shellfish Hygiene Directive

There are currently 22 monitoring points in the estuary. Two of them, Flushing and Grimes Bar, have recently been downgraded from Class B to Class C. This means that the shellfish have to be relaid in clean water for at least two months in order to cleanse the flesh. Flushing had been a traditional and convenient place to relay oysters, but is now unsuitable. This downgrading is of obvious concern to all those involved in the industry. Over the summer period in 1996 we carried out a bacteriological tracking survey in the upper Fal Estuary. The aim was to quantify the effects of Laddock and Newham Sewage Treatment Works discharges, with particular reference to shellfish beds. At the time of printing this Consultation Report the survey report was expected to be available by summer 1997. Widespread public concern has focused on discharges from sewage treatment works. However the observed deteriorations in shellfish quality in the Fal have not been proven to be linked to the sewage discharges in the area. This view on the linkages is not shared by the Falmouth and Truro Port Health Authority.

Issue 5B: Downgrading of sites under the EC Shellfish Hygiene Directive

Marine Bioaccumulation

A number of sites, where we undertake monitoring, had results for metals which fell outside the typical range expected for mussel tissue and seaweed. It is known that mining activities have had a significant impact on the tidal waters⁸.

Red Tide

There are a range of particular types of marine algae which cause discoloration of water, known as Red Tides. During June 1995 a Red Tide was reported in the Fal Estuary and analysis identified high numbers of the marine dinoflagellate *Alexandrium tamarense*. This particular species has been associated with the formation of toxins which accumulate in shellfish, and gave rise to concerns over public health.

Tests by the Ministry of Agriculture, Fisheries and Food on shellfish flesh positively identified the presence of Paralytic Shellfish Poisoning (PSP) toxins. This justifies the precautionary approach adopted by the Port Health Authority prohibiting the collection of shellfish for consumption. Sediment samples were shown to contain high numbers of *A. tamarense* cysts, which often form after blooms. Analysis of the cysts confirmed that they were of a toxic form of *A. tamarense*, and therefore likely to produce toxic blooms in the future. There has been a further bloom in 1996, and PSP has again been identified.

In addition to warm calm waters the formation of the bloom has been linked with elevated nutrient levels in the upper estuary. We are carrying out an investigation to explore the possible designation of the Fal Estuary as a 'sensitive area' under the Urban Waste Water Treatment Directive (UWWTD), see page 124.

Issue 5C: Red Tides in Fal estuary**Marine Conservation**

As the Fal and Helford Estuaries are designated a candidate Special Area of Conservation there may be a requirement to review current fishery status/regulations to assess any impact on the (as yet to be established) conservation objectives. Under the Environment Act there is a mechanism to create Fisheries Byelaws for reasons of marine conservation.

The current division of legislative responsibility for shellfishing is unclear. There is a requirement to clarify the legal situation and to establish the viability of current Agency byelaws.

Issue 5D: Clarification of shellfishing legislation**Bait-digging**

Bait-digging is perceived by some as being on the increase in some parts of Cornwall. Almost all of the increase is associated with commercial bait collectors. This may be having an adverse effect on ecology and landscape locally, and research would be invaluable to ascertain whether such use is sustainable. If it is not, measures to control the practice should be brought in. There is a need to identify the responsible authorities and interest groups to carry this forward.

Issue 5E: Ecological and landscape impacts of baitdigging

Option	Responsibility	Benefits	Constraints
Issue 5A: Exceedences of EC Shellfish Waters Directive Standards			
* Review of 1996 data to identify causes	Agency		
Issue 5B: Downgrading of sites under the EC Shellfish Hygiene Directive			
* Investigate to identify possible causes	MAFF/ PHA/ Agency		
Issue 5C: Red Tides in Fal Estuary			
* Complete 'sensitive area' studies under UWWTD	Agency	Improve understanding of the system	Cost

Issue 5D: Clarification of shellfishing legislation			
* List and rationalise current legislation	Agency/ Harbour commissioners/ Port Health Authority/ MAFF Environmental Health Dept.	Better management of the shellfishery	Cost
Issue 5E : Ecological and landscape impacts of balt-digging			
* Identify relevant groups * Map current areas of digging and quantify crop * Research impact	Foreshore Owners/ EN/ Others?	Quantify impacts and identify possible solutions	Cost

Area Detail

Further detail on the area can be found in Part II, Supporting Information:

Fisheries

Effluent Disposal

Mining and Quarrying

ISSUE 6: SEA LEVEL RISE

Background

The Intergovernmental Panel for Climate Change predictions for sea level rise are used with allowances for any land movement (tectonic changes). The net sea level rise estimates are then used to establish the anticipated effects over the life of the scheme. The approach is to design the works so that as sea level rise occurs the defences can be raised without having to rebuild the whole structure.

Raising the level of defences above that necessary today can only be justified where evidence of actual sea level rise supports the need. The current allowances for the South West Region of the Agency are a rise of 5mm/year until the year 2030 and 7.5mm/year thereafter. A further effect of global warming is that of increased storminess, potential consequences of this include increased wave action and annual precipitation.

Effects on the catchment

Flood defence

We have designed our flood defence schemes with an allowance for a rise in sea levels. A review of existing defences has been undertaken in two separate phases of a Sea Defence Survey project carried out for the NRA. Phases 2 and 3 reviewed defences at Falmouth, Swanpool Beach, Maenporth, Flushing, Mylor Churchtown, St Mawes, East and West Portholland, Par, Portmellon Cove, Pentewan, Polkerris and Mevagissey. Phase 4 reviewed defences in Restrouquet Creek Penryn, and Helford.

The forthcoming Shoreline Management Plan will consider management options for discrete sections of coastline.

Issue 6A: Sites which could become vulnerable to tidal flooding

Ecological impacts

A report for English Nature on coastal processes and conservation⁹ identified two distinct areas within the Fal Estuary which would respond differently to changes in sea level: the outer estuary of Carrick Roads and the inner tidal creeks. It concluded that the impact on Carrick Roads would be to encourage deposition (of sediment) in response to increased tidal energy. However, the current rate of deposition of sediments is identified as being insufficient to combat increases in tidal energy. It is anticipated this energy will be transferred inland. An increased depth of water within Carrick Roads will accentuate this.

In the inner creeks increased wave erosion is expected, which could result in erosion of the saltmarsh edge. However the impact is difficult to predict, partially due to high levels of deposition by historic mining. Where the natural transition from saltmarsh to woodland exists a landward movement of the saltmarsh zone is expected. Where this movement is prevented, for example by geology or development, habitat may be lost.

Intertidal habitats may be lost, unless they re-create naturally or through human intervention. Any intervention could have knock-on effects for other fringing habitats. An assessment of the potential for preservation or re-creation at different locations, and the consequences of each needs to be carried out.

Issue 6B: Possible loss of intertidal and fringing habitats

Some level of erosion of banks within the estuary is expected. At Boscawen Park this has already taken place although here the causes might include the cessation of depositing dredge material which absorbed wave power. Options to deal with such erosion within the estuary are varied and would need careful evaluation depending on the site.

There are a significant number of historic remains to be found in intertidal areas and fringing land such as small quays and tide mills. Full consideration of these historic features should be given in any proposals.

Water quality

There is a constant movement and redistribution of sediments due to normal tidal movements. Sea level rises may change established patterns resulting in the re-suspension of contaminated sediments, particularly those arising from historic mining activities. This could have a potential impact on water quality in the estuaries (toxicity and suspended solids).

Issue 6C: Possible re-suspension of contaminated sediments.**Sand extraction**

Sand has been extracted, ostensibly for agricultural purposes, from the dune system at the back of the beach at Poldhu Cove for many years under the Devon and Cornwall Sea Sand Act of 1609. The dunes provide protection for the road and reedbeds inland. Although Poldhu does not appear to have suffered erosion in the past as a result of sand removal, the removal of material may cause erosion elsewhere in the coastal system. The National Trust, who own and manage the land, have begun measures to stabilise and develop the dunes. The Environment Agency supports this action.

The removal of sand at Poldhu Cove and the threats from coastal erosion and recreational pressure to historic and natural conservation features have been highlighted as concerns in the Lizard to Lands End Shoreline Management Plan.

Issue 6D: Removal of sand at Poldhu Cove

Option	Responsibility	Benefits	Constraints
Issue 6A: Sites which could become vulnerable to tidal flooding			
* Identification of vulnerable sites	Shoreline Management Plan	Clearer understanding of coastal processes	Cost
* Modification of existing flood defence schemes	Agency/Local authorities/ MAFF	Alleviation of flooding	Cost
* Design of new flood defence schemes taking account of sea level rise	Agency/Local authorities/ MAFF	Alleviation of flooding	Impacts on other parts of coastal system
Issue 6B: Possible loss of intertidal and fringing habitats			
* Identification of vulnerable sites	Shoreline Management Plan	Provide basis for decisions	Cost
* Assessment of suitability of sites for re-creation	Biodiversity Action Plans/ FBEI	Maintain existing size of habitats	Cost
Issue 6C: Possible re-suspension of contaminated sediments			
* Modelling of changes in sediment movement patterns	National R&D project		
* Identification of 'hot spots'			
Issue 6D: Removal of sand at Poldhu Cove			
* Encourage growth of sand dunes	National Trust	Both options: Protection of dune and reedbed habitats	Cost
* Prevent sand removal or limit it as far as possible	Kerrier District Council	Help minimise sea erosion in coastal system	Commercial objections of sand extractors

Area Detail

Further detail on the area can be found in Part II, Supporting Information:

Flood Defence

Landscape, Wildlife and Historic features

Contaminated Land

ISSUE 7: PROTECTION OF HABITATS, WILDLIFE AND HISTORIC FEATURES**Background**

Within the plan area there are a range of international, national, county and locally important habitats, wildlife and historic features, many of which have some form of designation aimed at their protection. In addition there are many sites which have no particular designation, and species which do not depend solely on specific protected sites.

It should be our aim to achieve more sustainable use and development within the catchment, allowing us to meet our current needs, without compromising the environment and the ability to meet future needs.

Effects on the catchment

It is well recognised that conservation 'features' are under threat from human activities, indeed records show that there have been significant losses within the catchment:

Semi-natural habitat

Nationally there have been dramatic falls in certain species and habitat. This is reflected within Cornwall and this catchment. A review of habitat loss has been undertaken by Cornwall Wildlife Trust. Many of these losses have occurred within areas designated for protection, identifying that such measures are not adequate in the way they have been employed. We feel that a target of no additional losses should be set.

Conservation in this broad sense should be an integral part of all activities, and many of the issues and proposed actions within this document promote sustainability, or seek to make up for serious losses or impacts. However, additional, specific conservation actions might be required. These could be developed through the 'Cornwall Local Biodiversity Initiative' currently being progressed by a wide range of interested bodies in Cornwall, and through English Nature's 'Natural Areas' Initiative.

Issue 7A: Need to protect and enhance conservation 'features'

A key area for wildlife within this catchment is Goss Moor, much of which is a National Nature Reserve. This is predominantly a wetland site and so the Agency will continue to play a major role in its management.

For such wetland sites in England and Wales, formal strategies are being produced in order to clearly guide management with particular reference to the management of water tables. These are known as Water Level Management Plans and they seek to balance the needs of conservation, flood defence and agriculture. Some work has already been done on the site to monitor the water table and to restore the degraded channel of the River Fal. A Water Level Management Plan will assist in more holistic management of factors affecting the site, including land and water management adjacent to the site.

Issue 7B: Water Level Management Plan for Goss Moor

Option	Responsibility	Benefits	Constraints
Issue 7A: Need to protect and enhance conservation features			
* Implementation of protection through existing designations * Draw up and implement Biodiversity Action Plans	LPAs/ Landowners Conservation groups/LPAs	Both options: Protection and enhancement of environment	Cost
Issue 7B: Water Level Management Plan for Goss Moor			
* Review rehabilitation work * Prepare Water Level Management Plan	Agency/ EN/ Landowners	Increased understanding of system and better site management	Cost

Area Detail

Further detail on the area can be found in Part II: Supporting Information
Landscape, Wildlife and Historic features

ISSUE 8: IMPACT OF AGRICULTURE AND HORTICULTURE

Background

Agricultural land covers approximately 93% of the plan area and the way this land is used has a large impact on the environment. There is a declining trend in the numbers and severity of pollution incidents relating to farming. This has probably resulted from the extensive, proactive pollution prevention work carried out by the NRA and the subsequent positive response from the farming community. However, farming continues to have an impact on water quality within the catchment.

Examples in the catchment

Water Pollution

Farming activities/agricultural runoff contributed/caused EC Bathing Water Non-compliance at Porthluney through the contamination of Caerhays Stream.

Farming activities/agricultural runoff could have caused the non-designated bathing water at Portholland to exceed the standards set out in the EC Bathing Waters Directive.

Water may be liable to become eutrophic due to nutrient inputs. Agriculture could be a source of some nutrients, from organic wastes and inorganic fertilizers. There have been instances where the land has been used sacrificially to overcome shortfalls in farm waste storage facilities during bad weather. We are currently investigating trophic status of part of the Fal Estuary under the Urban Waste Water Treatment Directive (see page 41), though this only looks at the impact of direct discharges. If the investigations show the waters to be eutrophic, but not due to direct discharges we would seek to investigate the impact of diffuse sources (including agricultural) under the EC Nitrates Directive. If a designation under the EC Nitrates Directive was made we might request MAFF to seek controls over some agricultural practices. However, in 1992 we carried out farm visits throughout the catchment, resulting in improvements where pollution was occurring. We regularly revisit high risk locations.

Issue 8A: Impact of farming activities/agricultural runoff on water quality

Bulb growing

The increase in bulb production in the plan area, particularly new areas near Penkivel Stream, Caerhays Stream, Percuil River and Helford is of concern. Soil loss can be considerable and pesticides may bind to soil particles and find their way into the water environment through runoff.

There could be implications for certain aquatic species if they accumulate these substances in their tissue, and this could possibly be the cause of increased levels of pesticides found in eel tissue and a reduction in eel numbers. We have identified the Caerhays Stream as having potential for improvements as a fishery, (see page 16).

Bulb growing also brings economic benefits and in this area we have been liaising closely over the developments to ensure minimum impact.

Issue 8B: Impact of bulb growing and changes in farming practise

Sheep-dips

The number of sheep farmed within the catchment is low and it is not expected that there is a widespread risk of water pollution from the use of organophosphate (OPs) chemicals in sheep-dip. Our biological monitoring does not indicate any water quality problems associated with the use of OPs.

More sheep farmers are now using alternative pyrethrum based chemicals which are considered less hazardous to human health. However, we are concerned about a number of pollution incidents in the North West Region affecting river invertebrates. These have involved, or seem likely to have involved pyrethroid sheep-dip, which is more toxic to river invertebrates than the old OP dips. We advise farmers that sheep-dip solutions need to be handled and disposed of with care, that we no longer consider soakaways a suitable means of disposing spent dip, either OP or pyrethroid. Farmers should spread diluted spent dip onto land well away from rivers, streams, drains, boreholes or aquifers.

Waste

Waste-spreading to land in the catchment may be an issue in the future. Land is already used for the disposal of agricultural wastes and sewage sludge. In 1998 the disposal of sewage sludge at sea will be prohibited under the EC Urban Waste Water Treatment Directive. This could increase the loading to land, and result in an increased risk of pollution associated with land runoff. Waste applied to existing semi-natural habitats can damage their wildlife value. Application of all agricultural wastes to land for agricultural benefit are currently an exempted activity and so do not require a formal waste management license from us. When dealing with notifications for such activity we will seek to dissuade landowners from spreading wastes on semi-natural habitats, and continue to promote the Code of Good Agricultural Practise.

Issue 8C: Spreading waste on semi-natural habitat

Option	Responsibility	Benefits	Constraints
Issue 8A: Impact of farming activities/agricultural runoff on water quality			
* Monitor and investigate inputs	Agency/Farming Industry	Achieve compliance with water quality standards	Costs
Issue 8B: Impact of bulb growing and changes in farming practise			
* Continue to monitor eel tissue and numbers for pesticides * Intensive study of eels in one sub-catchment * Advice on pesticide use and land management to prevent soil loss.	Agency Agency MAFF/Farming Industry	Information for action	Cost
Issue 8C: Spreading waste on semi-natural habitat			
* Encourage protection from waste disposal activities	Agency/landowners/farming industry	Maintain biodiversity	

Area Detail

Further detail on the area can be found in Part II, Supporting Information:

Agriculture

Fisheries

Landscape, Wildlife and Historic features

ISSUE 9: IMPACT OF THE CHINA CLAY INDUSTRY

Background

The extraction and processing of china clay dominates the landscape and economy of the St Austell area, as it has for the past 100 years. China clay production generates large quantities of waste and affects water quality, water resources and air quality.

There is general recognition of the huge potential for this industry to alter the landscape. We work with the industry to ensure impact is minimised. Particularly sensitive areas such as watercourses, wetlands and heathlands are given priority for protection through the Minerals Planning process. The industry recognises that matters of landscaping and restoration of waste tips are of increasing importance and consults widely with interested bodies including the DoE, Cornwall County Council and the Environment Agency. The County Council and the industry are jointly developing a tipping and restoration strategy for the St Austell china clay area.

A great deal of scope exists for habitat re-creation and restoration in the clay area as the actively quarried areas are restored. English Nature have proposed a special project that seeks to link fragments of existing semi-natural vegetation along the River Fal by targeted habitat creation in former extraction areas. The net benefit to the environment can be maximised by targeting particular sites or areas for restoration. The industry appears to be in favour of this and would play a fundamental role in its success. English China Clay International (ECCI) are undertaking advanced planning work for their redundant lands, leading to restoration of degraded river channels and associated wetlands, from a conservation perspective.

It is anticipated that expansion and deepening of productive pits will continue. Further development of existing tips and some new tipping sites will be required.

A Code of Practice relating to water quality is being developed by the Environment Agency and china clay industry to promote good practice and eliminate some of the impacts and risks through management of sites. Liaison meetings are held between the industry and the Environment Agency to ensure that currently held licences are understood by the licence holders and that we understand the complex pit operations.

Under the Environment Act 1995, the Minerals Planning Authority has a duty to review old mineral planning permissions (sites where the predominant permission was granted between 1948 and 1982) and to give them conditions to bring them into line with modern standards. Many of these workings are in areas with landscape designations and have conservation value, particularly where working ceased some years ago. The review will be phased in over the next three years and will put modern conditions on these historic permissions where they do not significantly reduce the economic operation of the workings. We are a statutory consultee in this process and will be recommending conditions to minimise the impact of these workings on the environment.

Effects on the catchment

Expansion and restoration

Cornwall Minerals Local Plan Deposit Draft identifies that approximately 600 hectares of new land will be required in the St Austell area up to the year 2011 for extraction and tipping. Our concerns include contaminated drainage water arising from new tips if not carefully sited and managed. English China Clay are submitting a new scheme to extend tipping near Wheal Remfry following the refusal of planning permission for an extension of tipping at Caverigan in 1995.

Issue 9A: Expansion of china clay workings and tipping sites

Restoration initiatives have included a DoE commissioned study to review and assess the landscaping and revegetation of china clay wastes.

Issue 9B: Restoration of china clay tipping sites

Water Pollution

China clay occurs in areas where the geology can have high natural levels of metals, particularly zinc and copper, and watercourses may be acidic, (low pH values) which results in the mobilization of

these metals. Extraction and processing can exacerbate this impact. The extent and nature of the clay winning activities results in discoloration of streams and rivers in the area and the potential to discharge large quantities of suspended solids. Historical activities have resulted in siltation of watercourses, caused blanketing of river beds by solids making rivers unsuitable for supporting streambed animals and fish species which need good water quality, invertebrates and spawning habitat. They have also been significant in contributing sediment to the head of estuaries.

EC Dangerous Substances Directive

We are currently investigating 14 china clay discharges which may cause or contribute to Environmental Quality Standard exceedences under the EC Dangerous Substances Directive (List II) for either copper, zinc, pH, or all three. The findings will be reported in 1997. Where our investigations show concentrations of pH and metals are uncontrollable (i.e. caused by natural geology or abandoned mines) it may be appropriate to apply for derogations of relevant parameters.

Failures of proposed River Quality Objectives

The following china clay discharges have failed their discharge consent assessment for pH in the year ending 23/12/96. These discharges may result in non-compliance with the 'long term' RQO downstream:

- i) The Goverseth Plant discharging to Gwindra Stream (2 marginal failures)
- ii) Burngullow Tube Press discharging to Coombe Stream (3 failures)

It is possible that discharges from and processes relating to the china clay industry may contribute to non-compliance with 'long term' RQOs on stretches on the following watercourses: Par River, Rosevean Stream, St Austell River, Gwindra Stream, Coombe Stream, Dubbers Stream and Bodella Stream. Reasons for the failure could include any of the following:

- The stretch is affected by low flows.
- The stretch may be affected by natural sources of low pH. We will carry out studies to determine the relative impact of the discharge and natural sources of low pH on water quality.
- The stretch receives the discharge which is currently failing its consent to discharge. We are taking action to ensure that the consent standards are met.
- Samples taken at the sampling point have been shown to represent discharge quality, rather than receiving water quality, and appropriate sampling points need to be identified.
- A chemical has been used in the china clay process which impacted on receiving water quality. This problem has now been resolved.

Biological monitoring by the Environment Agency has shown that the Rivers Fal, Par, St Austell and Crinnis Stream are adversely affected by discharges and processes of the china clay industry. In addition to water quality, the natural beds of the watercourses have been infilled and silted over with sand, mica and clay, resulting in a depleted macro invertebrate and macrophyte community.

Issue 9C: Impact of china clay discharges and processes on water quality

Waste

The industry creates large amounts of mineral waste (estimated at 20 million tonnes per year) such as china clay sand which needs disposal. Control over the disposal and tipping of mineral waste lies with the Mineral Planning Authority and is addressed through appropriate planning conditions being put upon mineral workings. We do not licence mineral waste tips under waste regulations.

Water Use

During china clay operations large quantities of water are used, accounting for 93% of total volume of groundwater and 12.5% of surface water abstractions licensed within the catchment. China clay

PART 1: THE MANAGEMENT PLAN

operations can lead to abstracted water being discharged in a different part of the river catchment or even in another catchment. The channel of the St Austell and Par Rivers have been changed considerably through the winning, processing and transporting of china clay.

The industry has complex water uses and needs, often re-using water, making effective measuring and monitoring of abstraction quantities difficult despite the industry's active co-operation. Many of the abstraction licences have been in force for many years and do not always have conditions to minimise environmental impact. Improvements to monitoring continue, and the operation of abstractions is a topic at regular meetings between the Agency and the industry. For enforcement purposes these operations are inspected once a year to ensure compliance with license conditions.

Option	Responsibility	Benefits	Constraints
Issue 9A: Expansion of china clay workings and tipping sites			
* Ensure that permissions minimise environmental damage	Cornwall County Council/ China clay industry	Protection of the environment	Operational and commercial considerations
Issue 9B: Restoration of china clay tipping sites			
* Pilot Study for the development of tipping and restoration strategy in the western part of the China clay district	China clay industry/ Cornwall County Council	Environmental gains including compliance with EC Directives	Cost Operational and commercial considerations
* Research to appraise the occurrence and utilization of secondary aggregates such as china clay sand	DoE	Environmental gains including re-use of waste	Cost Distance from markets. Overcoming prejudice in consumers (mainly construction industry)
Issue 9C: Impact of china clay discharges and processes on water quality			
* Investigate causes of EC Dangerous Substances Directive Exceedance * Review of discharge consents in stages, towards river needs consents * Review monitoring	Agency/China clay industry	Tackle root cause of exceedance New consents based on river needs will protect requirements of uses of the receiving waters Provide sound basis for decision making	Commercial concerns of China clay industry

Area Detail

Further detail on the area can be found in Part II, Supporting Information:

Mining and Quarrying
Contaminated Land
Abstraction and Water Supply
Effluent Disposal
Built and Developing Environment
Controlled Processes
Waste Management

ISSUE 10: IMPACT OF METALLIFEROUS MINING ACTIVITIES

Background

Historically, the catchment was one of the most important and extensively mined areas in the South West, principally for tin and copper. Underground workings have altered groundwater flows and intercepted surface water drainage, discharging via mine workings rather than flowing back into rivers and streams.

Water quality, particularly in the Carnon River Catchment, has been affected by mine drainage over hundreds of years. Pumping mines dry to allow mining exposes metal sulphides (principally iron pyrite) in the rock to air, conditions which (combined with bacterial action) promote oxidation and generates acidity. When mining stops and groundwater levels recover, the accumulated products of pyrite oxidation, acids and metals, are flushed from the system. These products are toxic.

Whilst there are a range of effects from mining throughout the area, water quality related effects are particularly focused on two sources in the Carnon Valley, County Adit and Wheal Jane, the mine which released millions of gallons of contaminated minewater in November 1992.

Effects on the catchment

Water pollution

EC Dangerous Substances Directive

In 1992/93/94/95 water quality in the Carnon River failed to meet Environmental Quality Standards (EQS) in the receiving water under the directive at Devoran Bridge and Clemows Stream (Baldhu Stream) for a number of metals; arsenic, cadmium, copper, iron and zinc. The uncontrolled release of minewater from Nangiles Adit (Wheal Jane), in particular, had a major deleterious impact on water quality in the river and Fal Estuary during 1992. The ways in which the requirements of this (and other) Directives can be met are being investigated as part of the Wheal Jane project. However, even without the Wheal Jane input, compliance would not be achieved as there are other significant inputs of metals to the Carnon River. The discharge from County Adit, which provides nearly 50% of the river's flow has a low pH (e.g. pH of 4) and contains exceptionally large amounts of dissolved metals due to weathering of mine waste and disturbed mineral lodes intercepted by water draining to the adit. The discharge has a major impact on the metal loadings observed in the Carnon River which are subsequently discharged to tidal waters within Restronguet Creek.

Annex 1A Reduction Programme

Significant loads of cadmium, copper, zinc, lead, nickel and arsenic were found at Devoran Bridge (Carnon River) in the period 1990-1994. The high recorded loads of metals are a result of the extensive mining that has taken place in the catchment and in particular, inputs from Wheal Jane and County Adit. We have identified the Carnon river as a significant source of zinc to the Fal Estuary.

EC Shellfish Waters Directive 79/923/EEC

In 1994 the standard for saline zinc concentration was exceeded three times at the Fal Estuary, Turnaware Bar site. These exceedances are thought to have occurred due to the proximity of this site to the Carnon River which takes the discharge from the abandoned Wheal Jane mine.

Issue 10A: Continuing Impact of minewaters on water quality

Ecological and archaeological impact

Many former mining sites are particularly rich in unusual bryophyte (e.g. ferns) communities, others are important for dragonflies and damselflies (Odonata). Cornwall Wildlife Trust are producing 'Key Bryophyte and Odonata Site' reports to highlight the most important areas. These two documents will provide a framework for deciding on the future management of old mining sites. Many sites are of great interest for scientific study and much research work is being carried out on the colonising species of plants and animals by institutions around the UK. Gaps exist in knowledge of some sites and there is a need to produce a definitive report on the conservation value of all mine sites in the county before any significant management is proposed. Biodiversity Action Plans may be a route for achieving this.

Issue 10B: Nature conservation management of former mine sites

The variety and abundance of freshwater and marine plants and animals are affected by metals and the smothering effect of sediments. Levels of impact vary, decreasing with distance from the mine discharges, from a greatly impoverished river ecosystem, such as in the Carnon River, to metal tolerant communities of reduced diversity in Restrouquet Creek and Carrick Roads.

Acid minewater drainage and metals can impact on wild fisheries. For example on the Calenick Stream, 1995 trout parr results were poor, especially at the highest two sites. Considerable ochre deposits were observed at Hugus (SW 7844 4380) in 1995 which could explain the poor trout fry density found at this site. Our 'Mines Database' records an old mine site upstream of the site.

Elevated levels of metals have been found in oyster tissue, mussel tissue and seaweed. Data suggests that concentrations of zinc in the oysters have not changed as a consequence of the release of untreated minewater and the reproductive capacity of the oyster community does not appear to have been adversely affected. MAFF have now stopped their intensive monitoring following the Wheal Jane incident.

After the incident in 1992 copper and zinc concentrations in the brown alga *Fucus vesiculosus* increased above the already elevated concentrations. Concentrations have since declined, but more recent data are incomplete.

In the Autumn of 1992 swans in the Fal Estuary began to fall ill in unusual numbers, and between January 1993 and October 1995 at least 54 died. Research into swan populations, movement and mortality were initiated and the results gained so far indicate that the deaths are generally linked to heavy metal contamination and toxicity. The majority of the swans died from zinc toxicity, which is believed to be a result of the inputs from the Wheal Jane system to Restrouquet Creek. There also appears to be a historic lead problem, which was exacerbated by a feeding station being unfortunately established at the site of an old lead smelter in Penpol Creek. Studies are continuing to better define the cause of death.

Issue 10C: Fal swan mortality

There is concern over the inappropriate management of archaeological remains on mine sites. There is a need for a thorough awareness of what archaeological value a site has before any changes are made. Normally this assessment is made when planning proposals are being drawn up. A more proactive approach to the cataloguing of features and their management requirements would highlight any threats to the resource.

Issue 10D: The need to protect archaeological remains

Contaminated ground

Widespread contamination of ground has occurred from the former operation of metalliferous mine workings in the area. Elevated concentrations of heavy metals, compared with background levels, are often encountered in ground that has been previously backfilled with mining waste or spoil, or along river banks or in river estuary sediments where long term accumulation of metals can occur. Leaching of heavy metals from such ground, or the interception of minewater drainage, may subsequently impact upon both local groundwater and surface water quality.

During any work on spoil heaps or contaminated sites any soil containing metalliferous mining waste exported off site must be disposed of in an appropriate licenced landfill. Development of such a facility within a historic mining area with an effective completion arrangement could be a suitable way of meeting local needs and minimising environmental risks. This would help to ensure that mining wastes are not transported long distances outside mining areas with the associated risk of dispersing metalliferous contaminants over wide areas.

Issue 10E: Handling of metalliferous waste arisings

Contaminated sediments

Sediments are contaminated with metals in Restronguet Creek and localised areas of Carrick Roads. Disturbance of these sediments could result in increases in concentrations of trace metals in the overlying waters as they are released from resuspended sediments. Disturbance could be due to human activity or natural processes such as normal tidal redistribution or sea level rise (see page 21). Full consideration should be given when considering proposals for new development.

Issue 10F: Impact of estuary sediment contamination on water quality**Wheal Jane**

Since the incident of 1992 we have been actively pumping and treating the majority of water to prevent the discharge of untreated minewater from Wheal Jane. We are now carrying out a project to review the implications of a number of options for future minewater treatment.

Issue 10G: Future management of Wheal Jane minewater**County Adit**

The County Adit system has over 30 miles of adits and branches and originally received drainage from over 40 mines. It drains a large area, including United Downs Landfill site (see page 38). It is the source of a significant volume of the flow in the Carnon River, 234 litres/second in summer and up to 300 litres/second in winter (approximately 50% of the flow of the River Carnon, sometimes more). Maintenance of such a structure is prohibitively expensive (in the region of millions of pounds per year) and is not the responsibility of any one body, so progress so far has been limited to a one mile section draining Mount Wellington and Wheal Jane.

There could be improvements in water quality in the Carnon River if surface water which currently drains through the mine system was intercepted and returned directly to nearby watercourses. However, at present there are considerable uncertainties over the pathways by which water drains into the mine systems and over the options available to minimise mine drainage. Part of the Wheal Jane project is to investigate the potential for preventative measures to reduce the quantity of acid minewater generated in Wheal Jane and other relevant mineworkings including the County Adit, e.g. to prevent clean water from entering the mine systems. The effects of surface and groundwater interaction on both flow and water quality are being studied.

Unpredictable collapses of the system and the ingress of surface water could lead to changes in water quality or quantity anywhere in the system or even sudden catastrophic release. Carrick District Council is spending several million pounds on the Mineral Tramways project in the Poldice Valley and has renovated paths and industrial buildings along the valley. The County Adit itself is of enormous historical importance and investment being made in this recreational/tourism/educational resource could give rise to opportunities to maintain parts of the County Adit.

Issue 10H: The future management of County Adit

Option	Responsibility	Benefits	Constraints
Issue 10A: Continuing impact of minewaters on water quality			
* Apply Agency Policy, the results of R&D and the Wheal Jane project to generate actions	Agency	Appropriate levels of action	Resources
Issue 10B: Nature conservation management of former mine sites			
Prepare site management plans	CWT	Ensuring the distinctive biodiversity of mine sites is conserved	Compilation of single document to hold all relevant information, i.e. time, cost

Issue 10C: Fal Swan Mortality			
* Issue report combining studies carried out so far (post-mortems and movement) * Continue studies into swan deaths (postmortems and movement studies)	Agency	Understanding of work so far	Cost
* Find alternative funding to continue research into mute swans as indicators of heavy metal pollution	Agency national R&D	Increased understanding	Cost Complicated situation
Issue 10D: The need to protect archaeological remains			
Undertake audit	CAU	Protect remains	Cost
Issue 10E: Handling of metalliferous waste arisings			
* Develop site to take waste * Seek policy statements in forthcoming Cornwall Waste Local Plan	LPAs/ Developer/ Agency	Conserve existing landfill space	Cost, possible environmental impact
Issue 10F: Impact of estuary sediment contamination on water quality			
* Review impact of new development proposals	Planning authorities/ Developers	Prevent water quality deterioration	Cost
Issue 10G: Future management of Wheal Jane minewater			
* Develop long term solution for Wheal Jane (3 year consultancy studies) * Long term treatment of minewater	Agency/DoE Agency/DoE	Decision based on assessment of risk and cost-benefit Decision based on assessment of risk and cost-benefit	Water quality targets Cost Available land
Issue 10H: Future management of County Adit			
* Maintenance of adits	Local authorities/ national government/ Mineral owners/ Landowners	Possibility of unpredictable collapse of system / ingress of surface water / sudden catastrophic release	Cost (Millions of £s) Health & Safety
* Maintenance of County Adit in Wheal Jane / Poldice / Wheal Maid area	LPAs/ Mineral owners/ Landowners	Parts of system maintained recently and could be accessed	Cost
* Management of surface water ingress - promotion of surface water sewerage in Redruth	Agency/ Local Authority	Reduce volumes of minewater discharges	Need to balance with amount of development likely over next 40 years ie build 5% more then is it going to make a difference
* Mine Drainage Prevention Study - Report due by December 1997 (part of Issue 10G)	Agency		

Area Detail

Further detail on the area can be found in Part II: Supporting Information

Mining and Quarrying

Contaminated Land

Landscape, Wildlife and Historic features

ISSUE 11: IMPACT OF DEVELOPMENT

Background

New developments have significant implications for the land, air and water environment. They require the extraction and processing of building materials and may generate significant amounts of waste through construction. They alter the natural landscape, causing increased surface water runoff which could lead to flooding and introduce activities which bring a higher risk of pollution. Built development can have many direct and indirect impacts on nature conservation, archaeology, landscape and recreation. New housing and industry increases the demand on services, including water supply, and result in increased amounts of waste. Air emissions, particularly from industrial premises can affect the local and wider environment.

Effects on the catchment

Flooding

Each of the three main urban centres; St Austell /Par/St Blazey, Truro and Falmouth /Penryn has experienced flooding in the past which has been relieved by flood alleviation schemes. These were built by our predecessors and have allowed further development to go ahead in the respective catchments. However, there are still areas where further development will increase flood risk.

Major capital flood protection proposals can have potential impact on river processes and wetland habitats, as they involve engineering works in the floodplain or river valley. For any capital scheme we carry out an environmental assessment and incorporate mitigation and compensation elements in the design. This applies equally to fluvial or coastal defence schemes. The Shoreline Management Plan process will help to provide prescriptive information on the latter.

We are currently looking at potential new schemes to alleviate existing flooding at Pentewan, Mevagissey and Ladock.

Issue 11A: Flooding downstream from existing and new development

A programme of flood risk data survey, interpretation and provision to planning authorities is in hand, though currently predominantly for "main rivers". Floodplain information for main rivers is now available for the St Austell Catchment, and the remaining area should be available to local authorities by Spring 1997.

Issue 11B: The need to identify flood risk for planning authorities

Building in a certain place can lead to higher rates of runoff entering watercourses which then passes downstream, possibly leading to flooding. This has an effect on the watercourse, which may undergo increased erosion or an altered flow regime. It can also reduce the amount of rain entering groundwaters, leading to reduced summer flows. More research into the exact effects of this on animals and plants would be helpful and could lead to mitigation measures being identified. One measure that could be more widely adopted is source control; the selective use of structures such as soakaways as part of a development to promote infiltration. These would help to replenish groundwater as well as reduce the erosion potential in watercourses, however their use must be site dependant.

Issue 11C: Promote source control

Water pollution

There are a number of sewage treatment works in the plan area that, although they are not currently causing an environmental problem, are working at capacity or have operational problems. The settlements served by these works are not designated as formal development restraint areas by the Agency. We have concerns that new development could cause these works to fail their consents and have an environmental impact on the receiving watercourse. We hold regular meetings with South West Water to review the performance of such works and development constraints.

There are a number of locations where consented discharges are having an environmental impact where we recommend development restraint (see Table 14) and will progressively seek improvements.

Water quality problems associated with urban runoff also occur. These can be controlled, for example, by passing water through oil interceptors.

A number of villages in the plan area are not on mains sewerage and have seen a proliferation of septic tanks over the years. The cumulative effect of a large number of septic tanks concentrated in a small area can cause environmental impact, particularly to groundwater. The Agency will monitor development closely in these areas, controlling the installation of private treatment systems through our powers under the Water Resources Act 1991.

The Environment Act introduced new duties on water service companies to provide public sewers for domestic properties that were built by June 20th 1995 in either rural or urban areas where there are environmental or amenity problems which exist or are likely to arise. This duty is subject to environmental, engineering and economic criteria. Any Parish or District Council may apply to SWW for a scheme. If there is a disagreement over the need for a scheme or the implementation of the new duty then the Agency can be called in to arbitrate.

Issue 11D: New development in vulnerable areas

Surface water runoff from new development can carry pollutants such as oils. There are a number of methods of source control which can be designed into new developments to limit such pollution. These are highlighted on a video 'Natures Way'¹⁰.

Issue 11C: Promote source control

There is a particular concern about the risk of pollution of the College No 4 Reservoir from surface water drainage off the Penryn bypass. We have engaged consultants to produce a report on the options and preliminary costs for diverting flows around the reservoir. This will include a site survey and runoff analysis (including drainage from the ASDA store site).

Issue 11E: Risk to College No4 Reservoir

Review of old mineral permissions

Under the Environment Act 1995, all old Minerals Planning Permissions (post 1947 Act) are to be reviewed and given 'modern day' conditions. The Agency is a statutory consultee in this process. Many of these old sites are inactive, but may still have valid permission. As many sites have developed valuable nature conservation interest following cessation of working, if it were to recommence it is imperative that strong conditions should be put in place. Other sites may be inappropriate for reopening altogether. Some sites may have geological or archaeological value. A thorough assessment of each site is needed prior to conditions being drawn up. Compensation from the Mineral Planning Authority may be required if new conditions restrict the economic viability or availability of the resource.

Issue 11F: Ensure appropriate operation of mineral workings with old Planning Permissions

Wildlife

New development is one of the major threats to semi-natural habitats and the species they support. Cornwall Wildlife Trust, through the 'LIFE' project, are mapping the levels of change in such habitats, and what they have been converted to. In the first instance loss of semi-natural habitats is resisted if suitable mitigation cannot be found.

The foreshore is a specific area subject to frequent development pressure in this catchment. We seek to prevent such areas being lost through development, as this results in a loss of wildlife habitat and can have adverse effects on currents and sedimentation patterns within the estuary as a whole. The Special Area of Conservation proposed for much of the Fal and Helford Estuaries will generate conservation objectives followed by a scheme of management governing development within the intertidal area. Shoreline Management Plans are also likely to generate site specific option recommendations for coastal defence in this area.

Issue 11G: Need to protect semi-natural habitat, in particular with regard to the foreshore

Option	Responsibility	Benefits	Constraints
Issue 11A: Flooding downstream from existing and new development			
<ul style="list-style-type: none"> * Plan development to prevent increase of flooding risk * Formally adopt currently informal development restraint areas (Table 14) * Construct flood alleviation schemes at Pentewan, Mevagissey and Ladock 	LPAs Agency/ developers LPAs Agency/LPAs MAFF	No additional flooding problems No additional flooding problems Alleviate flooding	None known Constrains development Cost
Issue 11B: The need to identify flood risk for planning authorities			
* Section 105 survey of catchment	Agency	Updated information on flooding problems	Cost for minor watercourses
Issue 11C: Promote source control			
<ul style="list-style-type: none"> * Natures Way video * Develop policy 	Agency/LPAs	Improved environment	
Issue 11D: New development in vulnerable areas			
<ul style="list-style-type: none"> * Monitor development and its effects * Formally adopt currently informal development restraint areas (Table 14) and improve discharges * First time sewerage 	Agency / LPAs LPAs/SWW Householders/ LPAs/SWW	All options: No further environmental effects	Cost Engineering and economic
Issue 11E: Risk to College No4 Reservoir			
<ul style="list-style-type: none"> * Investigate options to protect reservoir * Carry out works, dependant on findings 	Agency Agency/ SWW/ LPA	Both options: Protect water supplies	Engineering and economic
Issue 11F: Ensure appropriate operation of mineral workings with old planning permissions			
* Review all existing Planning Permissions for mineral extraction	Mineral Planning Authorities/land owners/operators	To ensure that environmental needs are fully considered	Many sites to cover Many interests to balance Cost
Issue 11G: Need to protect semi-natural habitat, in particular with regard to the foreshore			
<ul style="list-style-type: none"> * Resist any development which results in loss of semi natural habitat * Re-create habitat where loss is unavoidable 	Planning authorities Planning authorities	Protect biological diversity	More expensive and less effective than protecting original habitat

Area Detail

Further detail on the area can be found in Part II : Supporting Information

Built Environment

Flood Defence

Effluent Disposal

Landscape, Wildlife and Historic features

Protection Through Partnership

ISSUE 12: MEETING CURRENT AND FUTURE DEMAND FOR WATER

Background

The plan area falls within South West Water's (SWW) Colliford Strategic Supply Zone and much of the public water supply comes from outside the plan area (see Map 17).

We have produced demand forecasts for the area served by the Colliford Strategic Supply Zone looking at two scenarios, 'high' and 'low' demand growth (see page 112).

Comparing these forecasts to the current drought reliable yield of 166 MI/d for the zone shows that in 2021 under the 'high' scenario there will be a deficit of 57MI/d whilst under the 'low' scenario there will be a deficit of 17MI/d.

Effects on the catchment

Meeting current public water supply demands

Comparing the current level of developed resources with the current demand for water there should be no difficulty in meeting current demands in an average year.

Future Options

We have a duty to secure the best use of developed water resources whilst also having regard for the statutory obligations of SWW to provide a reliable supply of potable water to their customers. We will adopt a staged approach whereby we would ensure that all appropriate demand management, leakage control and environmentally sound resource management options are exhausted before considering the development of new resources (see Tomorrow's Water¹¹ for more details).

If, despite measures to use existing resources more efficiently, new resources are required, we would favour pump storage schemes for the strategic Colliford reservoir. These schemes would involve the pumping of water to storage from rivers at times of high flow. This would be attractive to the Environment Agency because best use would be made of existing reservoirs and it would probably delay the need for any new resource developments beyond the year 2021. However, environmental impacts must be determined.

Specific conservation concerns centre around the effects of abstraction on watercourse ecology and on sensitive wetland habitats. A number of sites in the catchment are subject to specific monitoring of water levels for conservation reasons, but many other areas are not. Recent emergency Drought Orders have highlighted the need for good baseline information targetted to vulnerable sites.

Issue 12A: Meeting future public water supply demand

Coping with droughts

The 1995 drought has not altered our view that there is a resource surplus in the Colliford Zone. Following the experience of 1995, SWW have undertaken a wide range of measures to enable them to take a much greater proportion of the licensed resource than they were previously able to. SWW have also instigated an enhanced leakage control programme which has made significant savings in the Colliford Strategic Supply Zone as well as introducing compulsory metering for customers with sprinklers and/or swimming pools. In addition, we have sought undertakings from SWW regarding operational improvements aimed at minimising the wastage of licensed resources.

We are currently in the process of agreeing a detailed Drought Management Plan (DMP) for the Colliford Strategic Supply Zone, with SWW. This will establish a staged programme of water conservation measures to be taken as a drought intensifies. These will include operational management of public water supply sources. For example; maximising the use of river abstractions within licensed limits to conserve reservoir storage, demand (customer) management such as enhanced leakage control and/or hosepipe bans as well as Drought Orders/Permits, where these are deemed necessary.

Issue 12B: Coping with droughts

Non-public water supply abstractions

Industry

The most significant industrial user in the catchment is the china clay industry - for specific discussion see page 26.

Option	Responsibility	Benefits	Constraints
Issue 12 A: Meeting future public water supply demand			
<ul style="list-style-type: none"> * Modelling of Colliford Strategic Supply Zone to determine the yield, best use of available resources and future developments * Encourage demand management and leakage control * Review of reservoir operating rules 	SWW/Agency	All options: Efficient use of water resources Improved water environment	All options: Resources Co-operation of the water company
Issue 12B: Coping with droughts			
* Produce and implement a Drought Management Plan	SWW/Agency	Environmental protection	All options: Resources Co-operation of the water company

Area Detail

Further detail on the area can be found in Part II, Supporting Information:
Abstraction & Water Supply

ISSUE 13: GENERATION AND MANAGEMENT OF WASTES

Background

With the exception of household waste no detailed information exists on the amounts of waste generated within the plan area. However estimates have been pulled together as part of the ongoing work by Cornwall County Council to produce a waste Local Plan (due for consultation in Spring 1997). This document will be the first review of all waste arisings in Cornwall and a proposed strategy for dealing with waste.

Estimates are that mining and quarrying generate approximately 75% of total waste produced, of which 91% is from the china clay industry. The catchment contains a large proportion of the china clay workings in Cornwall. The particular difficulties of disposing of waste has been recognised by the industry and County Council and is discussed in more detail on page 27.

Agricultural wastes are the next most important by volume, at approximately 20%. The majority of this is organic matter, such as manure, which is normally applied back onto fields. Whilst the method of application can cause water pollution, it is perhaps better to think of such material as a useful by-product rather than a waste. We promote the continued use of the Code of Good Agricultural Practice as a method of pollution prevention. Farms also do generate real wastes, such as plastics, metals and tyres, but all wastes arising from agricultural premises currently fall outside the scope of the waste regulations. The government has indicated that it will look at changing the legislation so that these will become classified as "controlled waste", and therefore be subject to regulation and control.

Whilst only small by volume, household, commercial and industrial (non construction and demolition waste) can be some of the most potentially polluting. These are mostly taken to landfill sites, with the exception of special or hazardous wastes, 90% of which are "exported" from the county.

There is a significant amount of contaminated land in the catchment, which may produce waste when redevelopment takes place. Much of this is due to metals levels, which would be exceptional in a national context, but not at a local level.

Effects on the catchment

Pollution

The United Downs landfill site has no lining and operates on the dilute and disperse principle. With the history of mining activity in the area it is considered that much of the leachate produced will drain into the underlying mines and eventually discharge to the River Carnon either through the County Adit or via mine water pumped from the Wheal Jane mine. Some leachate may also drain to the south towards the Hicks Mill catchment. Evidence indicates that significant dilution of leachate occurs within the minesystem minimising impacts on surface waters. A regular programme of ground and surface water monitoring is undertaken around the landfill site.

Waste facilities

United Downs, the main landfill site for the plan area (and west Cornwall) is going to be full sometime in the next 5 years. Due to the length of time required to plan, approve and start up new facilities key waste management decisions are required in the next 2 years.

Planning for the management of waste is best undertaken looking at a large geographical area, as well as the needs of particular locations. For this reason there is a need to look at demand and supply beyond the boundary of this catchment. This will be done by the County Council who are required to make provision for sufficient and adequate facilities and potential operators.

Issue 13A: The provision of new waste management facilities

There is an established hierarchy of planning for waste, from national strategy to regional and local planning. There is a requirement on the Environment Agency to produce a regional strategy to outline the current and future needs for waste management. This work will be undertaken in two distinct phases, firstly data on current requirements will be collected in a waste arisings survey. This information will also feed into the national strategy. The second stage is the production of the

regional strategy. Due to a government requirement the County Council has to produce a Waste Local Plan.

There are a number of initiatives within the catchment to promote the reduction and wise management of wastes. For example the Ports of Truro, Falmouth and Penryn have produced a Waste Management Plan, as part of an Environmental Management System. The Environment Agency is to start a programme of visiting firms who produce waste and advise and work with them on methods that can reduce wastes and increase profit. This will coincide with the introduction of Producer Responsibility Obligations (Packaging Waste) Regulations, 1997, which have been developed to accord with the EU Directive on packaging waste. We will be responsible for the monitoring and enforcement of these new regulations.

Issue 13B: The need for sustainable waste management

Option	Responsibility	Benefits	Constraints
Issue 13A: The provision of new waste management facilities			
<ul style="list-style-type: none"> * Reduce waste production * Reduce waste requiring disposal by encouraging and developing recycling initiatives * Identify suitable sites 	Cornwall County Council / Agency		Public acceptance Availability of suitable sites
Issue 13B: The need for sustainable waste management			
* Draw up strategies	Cornwall County Council/ Agency/LPAs /Producers	Adequate planning for future management of waste	Resources

Area Detail

Further detail on the area can be found in Part II: Supporting Information
Waste Management

Map 2 - EC Directives Monitoring



Information correct as of December 1996

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Fal and St Austell Streams Local Environment Agency Plan

Environment Agency

ISSUE 14: IMPACT OF SEWAGE DISCHARGES

Background

Rivers have a natural ability to render the main constituents of many effluents harmless, providing that effluent disposal is properly controlled. Throughout the catchment there are numerous sites which operate with a discharge consent from the Environment Agency to discharge effluent into freshwaters, estuaries and off the coast.

Discharge consents only apply to point source discharges; specific, identifiable discharges of effluent from a known location. Diffuse sources of pollution, such as minewater drainage, and pollution incidents, such as accidental spillages, cannot be controlled by discharge consents.

Examples in the catchment

River Quality Objectives (RQOs)

SWW sewage discharges contributed to:

- i) non-compliance with the long term RQO on the Fal River
- ii) non-compliance with the RQO on the Gwindra Stream

Both of the above stretches have been affected by the discharge from North Fal Sewage Treatment Works (STW). Permanent improvements have been made to the works which have resulted in improvements to water quality. These are expected to result in future compliance with RQOs. The discharge consent will be reviewed to protect the RQO as part of SWWs Asset Management Plan 3 (AMP3).

- iii) occasional non-compliance with the long term RQO Kennal Stream due to Stithians and Ponsanooth STW. Improvements are planned as part of SWWs Asset Management Plan 2 (AMP2).
- iv) St Austell North (Luxulyan) STW has no ammonia on its consent. The quality of the discharge varies, and has the potential to cause non-compliance with long term RQOs in the Par River. The discharge consent will be reviewed to protect the RQO as part of SWWs Asset Management Plan 3 (AMP3).

Issue 14A: Non-compliance with River Quality Objectives

EC Bathing Waters

SWW sewage discharges have contributed to historic EC Bathing Water non-compliance at: Pentewan, Polstreath, Gorran Haven (Little Perhaven), Gyllyngvase, Maen Porth, Swanpool, Coverack and Polurrian Cove.

Private sewage discharges may have contributed to historic EC Bathing Water non-compliance at Par, Porthallow and Polurrian Cove. Porthallow currently has no public sewers. A new duty on water service undertakers to provide first time sewerage has been introduced under the Environment Act 1995, see page 33.

Issue 14B: Non-compliance with EC Bathing Waters Directive

Non-designated Bathing Waters

Mevagissey Beach and Portloe Beach have exceeded the standards set out in the EC Bathing Waters Directive. Improvements are planned under the Urban Waste Water Treatment Directive, see next section.

Issue 14C: Impact of sewage discharges on non-designated bathing waters.

Urban Wastewater Treatment Directive (UWWTD)

There are two SWW UWWTD schemes at Falmouth and Mevagissey and seven UWWTD appropriate treatment schemes at Porthscatho 1, Porthscatho 2, Church Cove, Malpas, Mullion, Portloe and Frogpool. Improvements are planned for SWW's crude sewage discharge at Mevagissey. We are in discussion with SWW on the timing and nature of the improvements. At Mevagissey the SWW crude

discharge will be transferred to Menagwins STW to receive secondary treatment, for the 1997 bathing. The SWW discharge at Portloe is identified for improvements under the Directive. However, these improvements may improve aesthetic quality but will probably not improve bacterial quality.

Improvements need to be made to numerous private discharges with Deemed consents within the catchment under the Directive by the end of 2005. Some of these have already been undertaken.

Eutrophication

We have identified part of the Fal Estuary as a candidate sensitive area. The qualifying discharge is Truro (Newham) STW. The sensitive area boundary is shown on Map 2. It includes the Truro and Tresillian Estuaries from the A39 Road Bridge on the Truro River and from Tresillian on the Tresillian River to Woodbury on the River Fal.

The formation of the 'Red Tide' algal has been linked with elevated nutrient levels in the upper estuary. If the proposed sensitive area under the UWWTD is accepted, it will require the installation of nutrient stripping at Newham STW.

Issue 14D: Eutrophication In the Fal Estuary

Organotin

Tributyltin (TBT) has been detected from the SWW outfalls at Middle Point and Penance Point. These are not consented to discharge TBT, but SWW are not discharging intentionally, and do not know how the TBT is entering the sewerage system. We are working with SWW to identify and stop the source(s).

Issue 14E: Tributyltin In SWW discharges

Septic tank discharges

There are a number of locations where effluent from septic tanks has been reported as causing a pollution but we have not recorded significant impacts on watercourses. We will monitor development closely to ensure new private drainage facilities do not add to any perceived problems, see Table 14.

Environmental impact

There are a number of locations where monitoring has shown an environmental impact by consented discharges. In these locations we will progressively seeking improvements to the discharge. However, we recognise the need for improvements to be prioritised through SWW's expenditure programme. We also seek support from local planning authorities in preventing any new development which would make the problem worse, see Table 14.

Stretches may also be impacted by consented discharges, which we can control through legislation. If there is pollution occurring on such watercourses we rely heavily on being informed by members of the public.

Special Area of Conservation

A number of major sewage works, and smaller works, discharge into the Candidate Special Area of Conservation (SAC). There may be a need to review these under the SAC legislation, to ensure that nature conservation needs are fully considered.

Public concern

There is general public concern that there has been a decline in water quality within the Fal and Helford Estuaries, particularly around Malpas, Falmouth Harbour, Pendennis Headland and Carrick Roads. Improvements are planned for the Falmouth area and we will continue with our extensive monitoring programme to detect any significant changes in water quality.

Fal & St Austell Streams LEAP Consultation Report

Further detail on the area can be found in Part II: Supporting Information
Effluent Disposal

ISSUE 15: IMPACT OF FALMOUTH DOCKS

Background

The Environment Agency is the statutory authority in England and Wales for regulating the largest and most complex industrial processes which discharge harmful non-radioactive and radioactive waste to air, water and land. To do this we use a system known as Integrated Pollution Control (IPC). Operators of these controlled processes are required to have an authorisation to discharge waste.

Effects on the catchment

Falmouth Docks are engaged in the maintenance of ships, which includes the application and removal of anti-fouling compounds from ships. This has been contributing to exceedences of Environmental Quality Standards (EQS) under the EC Dangerous Substances Directive for Tributyltin (TBT) and copper.

During the process of gritblasting, small airborne particulate matter can be produced. This can be minimized using wet blasting techniques.

Substantial tonnages of TBT contaminated gritblasting residues are produced annually by ship re-fitting operations at Falmouth Docks. In the past the residues have been sent to United Downs landfill site. At present they are sent out of the county for disposal.

Issue 15: Impact of Falmouth Docks.

Option	Responsibility	Benefits	Constraints
Issue 15: Impact of Falmouth Docks			
* Review options to minimize releases to air land and water * Implement improvements	A&P Falmouth Limited	Environmental improvements	Technology/ Cost

Area Detail

Further detail on the area can be found in Part II: Supporting Information

Controlled Processes

Contaminated Land

ISSUE 16: UNKNOWN CAUSES OF POOR WATER QUALITY

Background

Our monitoring under various EC Directives and water quality objectives may identify problems where we do not know the cause. In such cases we normally undertake investigations to identify the cause.

Effects on the catchment

Unlicensed discharges and accidents which result in pollution can have a great impact on river and fish life. For example on the River Fal at Retew (SW 927 570) no trout parr were recorded in the 1995 survey. There was a known pollution incident prior to the survey in which over 200 salmonids were reported killed. The cause of the incident was untraced. On the Tresillian River an unusually low trout parr density was recorded at Rosewyn (SW 8905 5421) in 1992, suggesting evidence of a pollution affecting this area during the previous year, however nothing was reported.

Option	Responsibility	Benefits	Constraints
Issue 16: Unknown causes of poor water quality			
* Reporting of pollutions	General Public	Environmental improvements Minimize impacts of pollutions	Resources

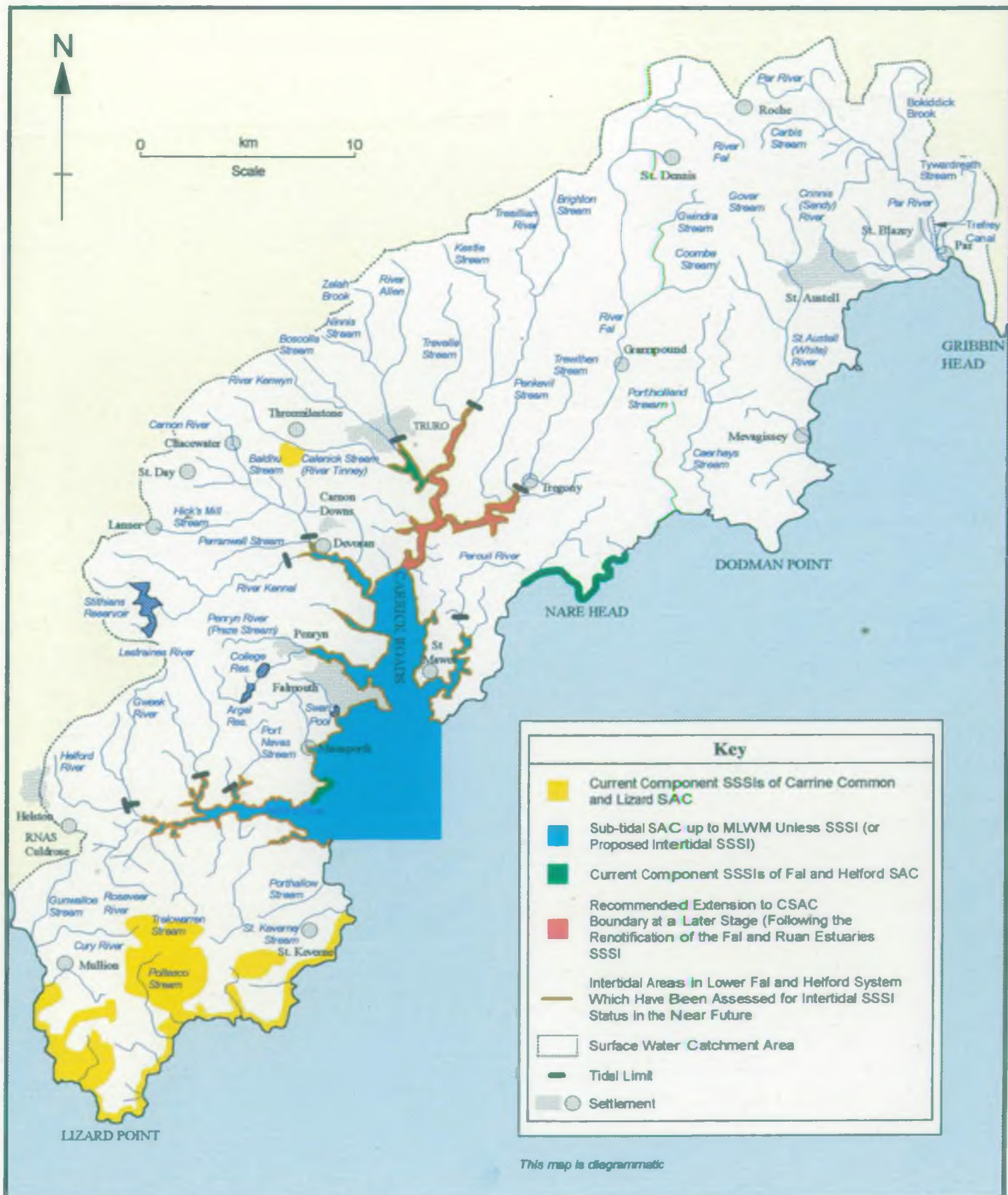
Area Detail

Further detail on the area can be found in Part II: Supporting Information:
Proposed River Quality Objectives

Part 2

SUPPORTING INFORMATION

Map 3 - Special Areas of Conservation



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PROTECTION THROUGH PARTNERSHIP

There are a range of initiatives by various bodies which at some level cover the area of this plan. These are statutory and non-statutory in nature and cover a variety of topics from environmental to social and economic. A number have produced, or are producing some form of documentation. It is important for all parties where different interests overlap that discussion occurs on those areas of common interest. In this way we can integrate action, being more efficient in our actions, avoiding duplication (or conflict) and make the most of limited budgets. A summary of those initiatives most relevant to this plan is given on Table 3.

Planning Authorities

Possibly the most important agencies are the County and District Planning Authorities, who are responsible for controlling development within the catchment, particularly through the County Structure Plan, Local Plan and Minerals Local Plan process. The Agency is a Statutory Consultee for Structure and Local Plans and certain types of development proposals. The Agency works closely with LPAs to ensure that Development Plans contain appropriate policies to protect the environment.

Development will normally have an impact on the environment but it can also provide opportunities for conservation and recreational enhancements or fund improvements to problems caused by contamination, flooding, infrastructure deficiencies or environmental nuisances.

The Agency, in liaison with LPAs, seeks to manage development so that it is sympathetic with the environment. However, in certain situations, such as deficient sewerage and/or sewage treatment services or severe flood risk river catchments, the Agency will recommend formal development restraints.

Falmouth Bay and Estuaries Initiative (FBEI)

This initiative has been supported by an umbrella group of organisations to look at management issues. Some of these have direct relevance to this plan process and we have liaised closely in the production of both Consultation Reports so that all issues are covered with minimum duplication of effort. Supported by the umbrella group and a variety of subgroups representing a variety of interests, there are certain subjects which are more appropriately dealt with solely by the FBEI, such as tourism, landscape and economic development.

The Environment Agency fully supports all the management aims and objectives contained in the Strategic Guidelines which are launched with this document. We will be involved in the delivery of appropriate 'specific outcomes'.

Candidate Special Area of Conservation (SAC)

The SAC designation will result in a review of actions which could impact on specified conservation interest. These may be actions such as commercial activity or recreation and could include some which take place outside of the estuary, such as discharges to freshwater. The review will result in a management plan which needs to be agreed by groups with statutory powers in the estuary. We would expect this Local Environment Agency Plan and the FBEI to be key references and starting points for liaison in the planning process for the SAC.

Shoreline Management Plans (SMPs)

SMPs are being produced for the coastline within this plan. They are prepared jointly by a range of groups with statutory powers and provide a forum for an integrated review of coastal processes and sustainable coastal defence policies. They also set objectives for the future management of the shoreline.

Table 3: Initiatives in plan area

Plan	Responsibility	Geographic Area	Subject Matter	Outputs	Dates	Steering Group	Contact
Local Environment Agency Plan	Environment Agency	Freshwater systems from Par to Helford . Gribbin Head to Lizard	Environmental management, water, land and air	Consultation Report Action Plan Annual Review	Jan 1997 mid 1997	Y	Environment Agency Cornwall Area
County Structure Plan	Cornwall County Council	Entire county	Strategic planning - social, economic, environmental	Draft plan Deposit plan	Sep 1994 Nov 1995	Y	Planning Dept Cornwall County Council
Local plans - Carrick DC Restormel DC Kerrier DC	District Councils	Individual districts	Detailed planning - social, economic, environmental	Draft plans Deposit plans	1994/ 1995	Y	Planning Depts at relevant District Council offices
Minerals local plan	Cornwall County Council	Entire county	Strategic & detailed planning - minerals issues	Draft plan Deposit plan	Dec 1994 Feb 1996	Y	Planning Dept Cornwall County Council
Falmouth Bay & Estuaries Initiative: Strategic Guidelines	Falmouth Bay & Estuaries Initiative project officer	Coastline from Lizard Point to Dodman Point and inshore waters	Environmental management, development, recreation, landscape, archaeology	Consultation draft Final report	Oct 1996 1997	Y	Cornwall County Council
Estuary Manag't Plan: Historic Landscapes	Cornwall Archaeological Unit	Fal & Helford estuary & some coastline	Environmental, development, recreation	Consultation Draft Final Plan		Y	Cornwall Archaeological Unit
Shoreline Management Plan	Relevant District Councils	Lizard to Lands End Rame Head to Lizard	Coastal Processes management policies	Scoping study Management plan	Feb 1997 Early 1998	Y	Planning Dept. Kerrier District Council
Candidate Special Area of Conservation	All 'Relevant' bodies	Fal/Helford Estuaries and coast and inshore waters from Nare Point to Zone Point	Management of marine related environment for conservation purposes	Site designation Conservation objectives Management Plan		Y	English Nature
Natural Areas	English Nature	Same as LEAP	Biodiversity and landscape	Framework documents to be trialled nationally	unknown		English Nature
Tipping & restoration strategy	Cornwall County Council/ China clay industry	Fal River (initial trial)	Future management of China clay industry waste tipping. Inc. Conservation, landscape and recreation	Framework for future tipping and restoration			Cornwall County Council
Landscape Assessment of Cornwall/ New Map	Cornwall County Council/ Countryside Commission	Same as LEAP	Landscape quality, description, enhancements, archaeology	2 reports	1995 and 1994		Countryside Commission
Environmental Management System (EMS)	Ports of Falmouth, Penryn & Truro	Fal Estuary within harbour authority boundaries	Environmental management of port activities	Final report/ Annual review Associated public information	1996		Carrick Maritime Dept. Harbourmasters Office, Truro Falmouth Harbour Commissioners
Waste Local Plan	Cornwall County Council	Cornwall County	Strategic management of wastes	Consultation Draft Final report	Spring 1997	Y	Cornwall County Council
Helford Voluntary Marine Conservation Area Strategic Guidelines	HVMCA Advisory Group	Helford River	Environmental management, recreation, monitoring	Consultation draft Final report			HVMCA Secretary

Map 4 - Geology



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Physical Characteristics

Geology

The geology of this catchment can be divided roughly into three main sections: the Lizard Series, the Carnmenellis and St. Austell granites and the Devonian sediments.

Lizard Series

Within the Lizard peninsula are found a variety of igneous and metamorphic rock types including the serpentinite, so popular as carved ornaments. Away from the sheer coastal cliffs, the inland peninsula consists of a flat platform about 80m above sea-level. The principal igneous rocks are the Lizard peridotite, gabbro and basic dykes (known locally as 'elvans'). The principal metamorphic rocks are gneiss and a variety of schists.

North of the Lizard complex, the igneous and metamorphic rocks are separated from the normal Devonian sediments by a belt of rock known as the Meneage Breccia, consisting of slates, breccias, volcanic rock and various other materials.

Devonian Sediments

The Devonian sediments within the catchment consist of the fossiliferous slates of the Meadfoot Beds in the north, the interbedded grey slate and light brown sandstone of the Grampound Crit, and over the majority of the southern section, the slates and sandstones of the Veryan, Portscatho, Falmouth and Mylor Series. All of these sediments have been subjected to low-grade metamorphism and varying degrees of folding. The resultant rocks are known locally as 'shillite'.

Granites

Within the catchment there are parts of two granite intrusions: the St. Austell granite in the northeast and the Carnmenellis granite in the west. Metamorphic aureoles are found associated with both these bodies and their shape reflects the subsurface shape of the plutons. The aureoles are characterised by spotting of some of the slates. The southern portion of the St. Austell granite has undergone extreme weathering and the resultant china clays are extensively mined. Small amounts of low-grade china clay were formerly worked from quarries on the margin of the Carnmenellis pluton but no trace of these workings now remain.

Hydrogeology

None of the rocks within the catchment have been classified by the Agency as being a 'major aquifer'. All the rocks have, however, been classified as 'minor aquifers' and, as such, have sufficient groundwater resources in the weathered zone and in fissures in the bedrock to support locally important abstractions. The weathered zone on the granites is variable in thickness. It is generally absent on the hilltops and up to a few metres thick in the valleys. The weathered zone is generally less than 15m thick. Beneath the weathered zone, groundwater flow is predominantly along the major joints. The depth of water abstraction boreholes in the catchment does not bear any direct relationship to the depth of the water table but simply reflects the depth necessary to intersect sufficient water-bearing fissures.

Map 5 - Hydrometry



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There are also many groundwater abstractions from abandoned mine shafts and adits. In addition to supporting groundwater abstractions, water stored in the large number of old mine workings provides a significant contribution to the base flow in the area's rivers.

Hydrology

The area includes two major estuaries, the Helford and Fal whose catchments are influenced by the mining industry. The estuary of the Par River has silted up over the past three centuries.

The St Austell River watercourse and channel has been affected by both its past loads of china clay and abstraction of water by the China clay industry. The steep gradient of the St Austell and Par Rivers should have resulted in flashy rivers but the combined effects of the China clay industry, cross catchment transfers and the porous nature of the catchment has resulted in less flashy rivers than would be expected with peak flows reduced and rivers falling away less fast than would be anticipated.

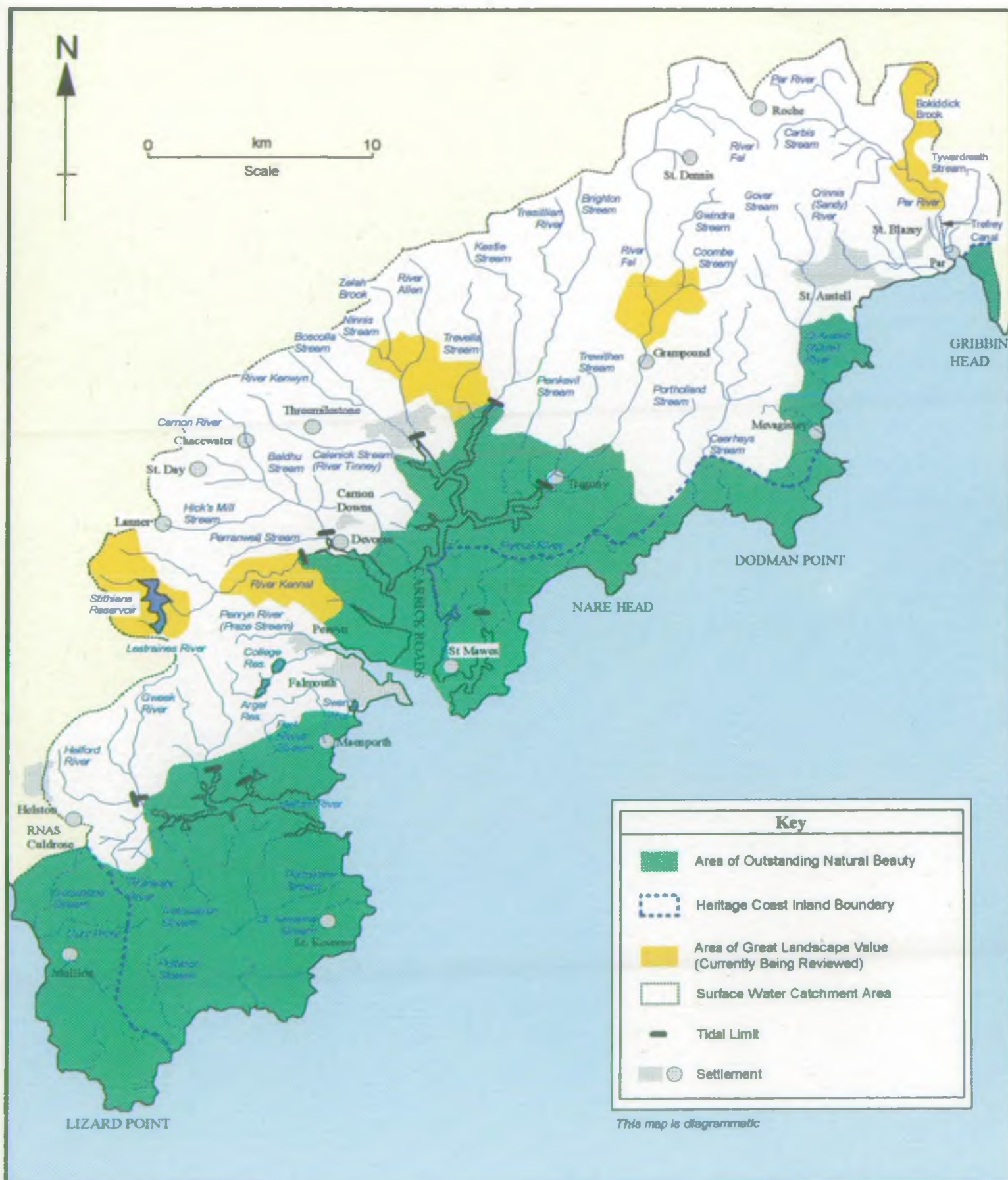
The River Kenwyn which joins the River Allen in Truro to enter the tidal reaches of the Truro River is relatively flashy and has caused flooding of Truro on two separate occasions. The River Kennal below Stithians reservoir exhibits relatively flashy characteristics which have been reduced by the presence of the reservoir dam.

The Carnon River, which receives about half its flow from the County Adit, shows characteristics of a river with a strong groundwater component.

Hydrometric Gauging

The Agency hydrometric network is shown on Map 5: Hydrometry. The six river gauging stations take river level/flow measurements every 15 minutes. Average flows, catchment areas and length of records at the gauging stations are available on request from our Cornwall Area office at Bodmin. There are also six temporary flow monitors on the Carnon catchment to collect flow data in connection with the Wheal Jane project. In addition, data exists from spot measurements taken at locations throughout the catchment. A network of 14 rain-gauges provide good coverage of the Fal and St Austell Streams Catchment (see Map 5). Annual rainfall totals at rain-gauge sites vary from 1000 mm to 1542 mm (1961-90 LTA) within the catchment. There are no groundwater monitoring sites within the catchment.

Map 6 - Landscape Designations



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Conservation - Landscape, Wildlife and Historic Features

Here we consider the natural environment and the historic built environment. We concentrate in particular on rivers and wetlands.

Our Objectives

To ensure that these features are not degraded through neglect, mismanagement, or insensitive development and wherever we can take measures to enhance them.

The Role of the Environment Agency

In fulfilling all our functions we must contribute to the conservation of nature, landscape and archaeological heritage. We have a *regard* to conserving and enhancing flora, fauna, geological or physiographical features when carrying out our pollution control functions, and a *duty* to further conservation when carrying out our other functions. We also have a *duty* generally to promote the conservation of flora and fauna dependent on the aquatic environment. An important part of our work is to influence land use planners and land managers to look after rivers and wetlands sensitively. Legislation tells us what we can and can't do to regulate work in rivers and floodplains.

Landscape - Designated Areas

Area of Outstanding Natural Beauty (AONB) - Much of the southern part of the catchment, including the whole of the Lizard and Fal estuary, lies within the Cornwall AONB. These landscapes are of national significance and are afforded special protection from development by Planning Authorities.

Heritage Coast - The central section of coastline in the catchment, and the west coast of the Lizard are designated Heritage Coasts. This is a national designation applied to coastlines with a rich landscape, conservation and recreational resource. Heritage Coast Plans in these areas seek to develop co-ordinated protection and use.

Areas of Great Landscape Value (AGLV) - A few inland parts of the catchment are designated AGLVs. This is a County designation given to landscapes not quite as significant as AONBs. Protection of these areas is afforded through the County Structure Plan.

Wildlife - Designated Areas

Proposed Special Areas of Conservation (SACs) - SACs are currently being proposed across the European Union member states to protect the habitats and species of prime conservation importance within the EU. A number of sites are proposed within this catchment, namely: The Lizard and Carrine Common, which are important heathland sites, and Fal and Helford, an important marine and intertidal site. English Nature can provide further information if necessary.

Map 7 - Conservation Designations



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Sites of Special Scientific Interest (SSSIs) - SSSIs are recognised as nationally important sites, and are afforded specific protection through legislation. Within the catchment there are 37 SSSIs covering a variety of habitats - see Appendix A for details. Seventeen of these sites have been designated for geological reasons - an indication of the complex geology found within the catchment.

National Nature Reserves (NNRs) - Whenever possible, the finest examples of Britain's SSSIs are purchased or leased by English Nature and run as NNRs. Nature conservation is the primary aim of these sites. Much of the Lizard is an NNR. Lowland England's largest heath, Goss Moor, is also an NNR.

Areas of Great Scientific Value (AGSV) - There are several AGSVs in the catchment. The AGSV designation recognises that important sites such as SSSIs cannot be sustained effectively as isolated islands and seeks to provide (through the County Structure Plan¹²) buffer zones around sites, wildlife corridors to link sites, and emphasize the most important areas of nature conservation to concentrate resources.

Cornwall Nature Conservation Sites (CNC Sites) - CNC Sites are identified by the Cornwall Wildlife Trust as sites of county importance for wildlife, but are not afforded statutory protection. See Appendix A for a list of names and the main habitats. As with SSSIs we would not normally issue an authorization which would damage a CNC site.

Local Nature Reserve - Swanpool at Falmouth has been designated a Local Nature Reserve by Carrick District Council. A Management group runs the reserve. The site is also an SSSI.

Helford Voluntary Marine Conservation Area (HVMCA) - This non-statutory area includes foreshore and subtidal areas of the Helford Estuary. It is managed by an advisory group, whose aims are to promote conservation and study of the area and to promote education of the public, students, etc. in sustainable marine conservation. A number of valuable research projects are continuing in the area.

A very high proportion of semi-natural habitat within the area is owned and sympathetically managed by the National Trust, most noticeably on the Lizard.

Biodiversity

Biodiversity quite simply refers to the variety of life on Earth. We are losing biodiversity. We have also lost over 100 species in the UK this century; globally half of all species of birds and mammals could be extinct within the next thirty years.

The conservation and enhancement of biodiversity must be integrated into all our decision-making. Targets need to be set to prevent further loss and guide recovery.

The recently published document 'Biodiversity: the UK Steering Group Report'¹³ contains costed targets and actions for the protection and restoration of priority habitats and species up to the years 2000 and 2010. Regional and County Biodiversity Action Plans will give the local focus. 'The Biodiversity of the South West: An Audit of the South West Biological Resource'¹⁴ has been produced by a partnership of organisations - the County Wildlife Trusts, RSPB, ourselves and the Regional Planning Conference.

Map 8 - Biological Survey



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The Agency serves on the working party which is developing a Biodiversity Action Plan for Cornwall for a wider Steering Group, covering all environmental interests in the county. For some species and habitats the Environment Agency is identified as being the co-ordinating body (sometimes jointly) for a number of Action Plans. These are all linked to the water environment, reflecting previous involvement and expertise. Additionally, we are identified as having a role to play in the delivery of Action Plans for other habitats and species. Within this plan area Biodiversity Action Plans will be produced for the following habitats and species, which are considered to be under particular threat, or of particular importance: estuaries, reedbeds, lowland heathland and seagrass beds.

National and regional plans will be relevant to this catchment, for example for the salmon and otter.

Freshwater biology

We monitor the ecological quality of rivers by sampling the benthic aquatic macroinvertebrates. These are the small animals that live in river sediments or on stones in the river. They are unable to move far and so are affected by the long term conditions in the river. We use this biological information to classify rivers using the new General Quality Assessment Biology classification scheme, as follows:

We collect samples during spring, summer and/or autumn and use a variety of scoring systems to assess the quality of watercourses. More detail on methodologies is available from Agency offices. We use an Environmental Quality Index (EQI) to classify rivers as follows:

Table 4 : Biological classification

Biological Class	Description	River Lengths (km)
a	V. Good	36.3
b	Good	55.8
c	Fairly Good	34.5
d	Fair	44.4
e	Poor	8.0
f	Bad	13.2

Data generally indicate a high quality water environment, supporting varied invertebrates, game and coarse fish. Localized problems however, particularly metal contamination, have reduced the diversity and abundance of both groups from levels which could be expected.

The River Fal and its tributaries are affected by the China clay industry and metals contamination. The natural watercourse substrates have been infilled and silted over with sand, mica and clay, resulting in a depleted macroinvertebrate and macrophyte community. The presence of *Cladophora* spp. (filamentous algae) below Trerice Bridge in the autumn suggested an organic enrichment problem. A deterioration in water quality at Carsella in the autumn may be attributed to a warm water temperature at the time of sampling and an organic enrichment influence.

The headwater streams and tributaries of the River Par, the St Austell River and the Crinnis Stream are similarly affected by china clay mining activity. The poor water quality generally found in the Gover stream also appeared to be due to the effects of china clay. This was suggested by the results on the Hembal Brook, but low flows also seem to have contributed to the impoverished fauna found here. The poor biological scores found at Caerhays appeared to be due to saline intrusion.

The 1995 biological data continued to reflect the impact of metalliferous contamination on the River Carnon, Hicks Mill Stream and Baldhu Stream. Reasonably good water quality was indicated on the

River Kennal, although a decline in scores in autumn at Ponsanooth Gauging Station appeared to be due to organic enrichment.

Calenick Stream appeared to be affected by metalliferous contamination. The decline in autumn scores for Moresk Laundry Bridge on the River Allen appeared to be due to tidal back-up, or possibly organic enrichment. Water quality at Bosvigo Bridge on the River Kenwyn seemed to be reasonably good, although there were some indications of possible organic enrichment. There were also indications of seasonal organic enrichment at Polwheveral Bridge on the Lestraines River.

Marine biology

The NRA carried out benthic surveys of marine macroinvertebrate infauna (animals living within the substrate) of the Helford Estuary in 1993 and the Fal Estuary in 1994.

Fal Estuary

The upper Truro, Tresillian and Fal Estuary areas were characterised by the same few dominant upper estuarine faunal groups, with polychaete worms and molluscs dominating. The uppermost sites of the Tresillian and Fal Estuaries showed less diversity and species richness than the sites further downstream.

The community structure in Restronguet Creek and the western section of Carrick Roads indicated heavy metal pollution. The subtidal sites showed depressed diversity and species richness, consistent with the intertidal results. Carrick Roads and the north of the Percuil Estuary were noted for the occurrence of rare species and high conservation value.

Helford Estuary

The upper estuary was characterised by dominant upper estuarine faunal groups; with polychaete worms, oligochaete worms and the gastropod mollusc dominating. There was some statistical indication of pollution disturbance at the site off Scotts Quay, at the mouth of Polpenwith Creek. Since the previous survey in 1990 the mid estuary subtidal site, Pedn Billy, had changed significantly with a large drop in the range of species. An increase in silt levels and possible loss of Sea Grass (*Zostera sp.*) were possible factors related to the reduction in diversity.

The intertidal site remained the most diverse of all the intertidal sites surveyed. The subtidal contained rich and diverse infaunal communities, though there were major changes in ecology since the 1990 survey. There was a shift from organic rich, fine sediment species to those more typical of coarser sediment habitats indicating a change in the physical habitat.

The 'Fal 2000' conference highlighted the range of estuary studies undertaken and the need for a centralized database to be produced. This might be produced through the EC Life project being headed by the Cornwall Wildlife Trust, or through any conservation review as part of the proposed SAC designation.

Historic Environment - Designated Sites

Scheduled Ancient Monuments (SAMs) - There are numerous SAMs within the catchment: 88 SAMs are of national importance, protected in law. English Heritage advises the Secretary of State for the Department of National Heritage on matters relating to SAMs. They are given full consideration by the Agency in any relevant applications. There are also many more unscheduled monuments that could be of national, regional or local importance.

Area of Great Historic Value (AGHV) - Parts of the Lizard are designated as an AGHV by Cornwall County Council, in recognition of the concentration of archaeological interest.

Historic Settlements - These are of county importance for archaeological conservation, both above and below ground. As with AGHVs, these are afforded special protection in the County Structure Plans. There are 6 Historic Settlements. They are: Falmouth, St. Mawes, Tregony, Grampound, Penryn and Truro

PART 2: SUPPORTING INFORMATION

Listed Buildings - There are numerous listed buildings within the catchment which are considered of county importance. Records are kept by District and County Councils and protection is offered through the planning system.

The Environment Agency checks that any "in-house" developments or operations, or anything we authorize, do not impact on listed buildings.

Map 9 - Fisheries



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Fisheries

This use relates to the conservation of fish species, the maintenance and development of their environment and the exploitation of stocks.

Our Objective

To maintain, improve and develop fisheries.

The Role of the Environment Agency

We have duties and powers to:

- regulate fishing through a licensing system
- police the illegal taking of fish and the sale and export of wild salmon and trout
- ensure the unobstructed migration of salmon, sea trout and eels
- monitor fish stocks
- control the movement and introduction of fish or spawn into any waters other than fish farms
- control fish disease outside fish farms
- raise income through duties on fishing licences
- ensure adequate levels of water to support fisheries
- ensure suitable water quality through the EC Freshwater Fish Directive and Water Quality Objectives.

Local Perspective

Fisheries surveys

Fisheries surveys have been carried out at various sites in the catchment since 1968. Most of the monitored rivers contain self-sustaining populations of fish in addition to trout, most commonly eel, bullhead and brook lamprey. Densities vary within the different river systems. Species recorded in fisheries surveys are listed by subcatchment in Table 5 : Presence of fish species with self-sustaining populations. Sporadic records of juvenile salmon have been found on the Caerhayes, Tresillian and Kennal. The latest known distribution of juvenile salmon and trout, based on our monitoring sites is shown on Map 9 (Note : The fishery may extend further than indicated, and we have not surveyed unnamed watercourses).

Analysis of survey data

This report contains only a summary review of Agency fisheries records, and only those stretches where there are problems have been highlighted, in Impacts on the Freshwater fisheries, page 13. A copy of the detailed analysis is available from the Bodmin office on application.

Table 5 : Presence of fish species with self-sustaining populations

	salmon ¹	brown trout/sea trout	bullhead ²	eel	minnow	3 spined stickle-back	brook lamprey ³	stone loach
Par River		*		*	*	*		
St Austell Stream		*		*				
Caerhays Stream	P	*/*	*	*				
Portholland Stream		*	*	*				
Percuil River		*		*				
River Fal	P	*/*	*	*	*	*	*	*(1978)
River Tresillian	P	*/*	*	*			*	
River Allen		*	*	*	*(1986)		*	
River Kenwyn		*	*	*	*(1986)		*	
Calenick (Tinney)		*		*	*(1986)			
Carnon River								
Perranwell Stream		*		*				
River Kennal	P	*/*		*				
Port Navas Stream		*		*				
Constantine River (Lestraines River)		*		*				
Constantine Quay		*		*			*(1987)	
Gweek River		*		*			*	
Helford River		*		*				
Rosevear River		*	*	*			*(1992)	
Trelowarren Stream		*		*				*
Mannacan Stream		*	*	*				
Porthallow Stream		*	*	*				
St Keverne Stream				*				
Kynance Farm Stream				*	*			

¹ Denotes presence ² Denotes European Species and Habitats Directive fish species. (1992) Year species last recorded. P Species present but unknown if self sustaining populations.

Rod Catches

Rod catch records for the rivers are sparse and only cover the Fal, Tresillian and Kennal for a limited number of years. Records were only kept for rivers considered to have runs of sea trout. Rod catch data has also been collated in different ways with some recorded data being totals of rod caught sea trout from a number of different catchments.

Fal : Historically there are very few records of sea trout caught from the Fal. It will therefore be important to monitor future sea trout and salmon rod catches from the Fal especially with the improvements in this fishery evident from the recent juvenile salmonid survey data.

Tresillian : A fair run of sea trout is present on the Tresillian with the highest annual recorded catch 38 in 1987.

Kennal : Sporadic evidence of catches of sea trout are evident from the Kennal with a maximum catch of 11 recorded in 1968. However there are large gaps in the available data.

There are no estuarine net fisheries for salmon and sea trout within the plan area.

Trends in abundance

Data on sea trout age classes is only available for the Tresillian. Fish surveys in 1986, 1992 and 1995 have recorded adult sea trout of between one and six years of age (freshwater and sea age combined). Within the 43 sea trout caught in fish surveys river age has varied between one and three years. No evidence of trends in abundance can be determined from the small data set of scaled sea trout currently available.

Introductions and escapees

Freshwater fish surveys have revealed perch in the River Fal and rainbow trout in the Rivers Allen, Calenick and Kennal. Kennack Stream was stocked with 200 Brown Trout in 1986.

Legislative controls

It is a requirement of section 25 of the Salmon and Freshwater Fisheries Act (1975) that in order to fish for salmon, trout (including migratory trout), freshwater fish and eels in any waters in the South West Region, anglers need an Environment Agency national rod licence* and permission from the owner of the fishery.

* = Except in waters where a General Licence is in force - please check with the owner of the fishery in advance.

* = There is also an excusal on licensing for rod and line eel fishing in some tidal waters.

There are many other legal requirements relating to fisheries matters. Information is available from the Fisheries Department, Environment Agency Cornwall Area Office, Victoria Square, Bodmin.

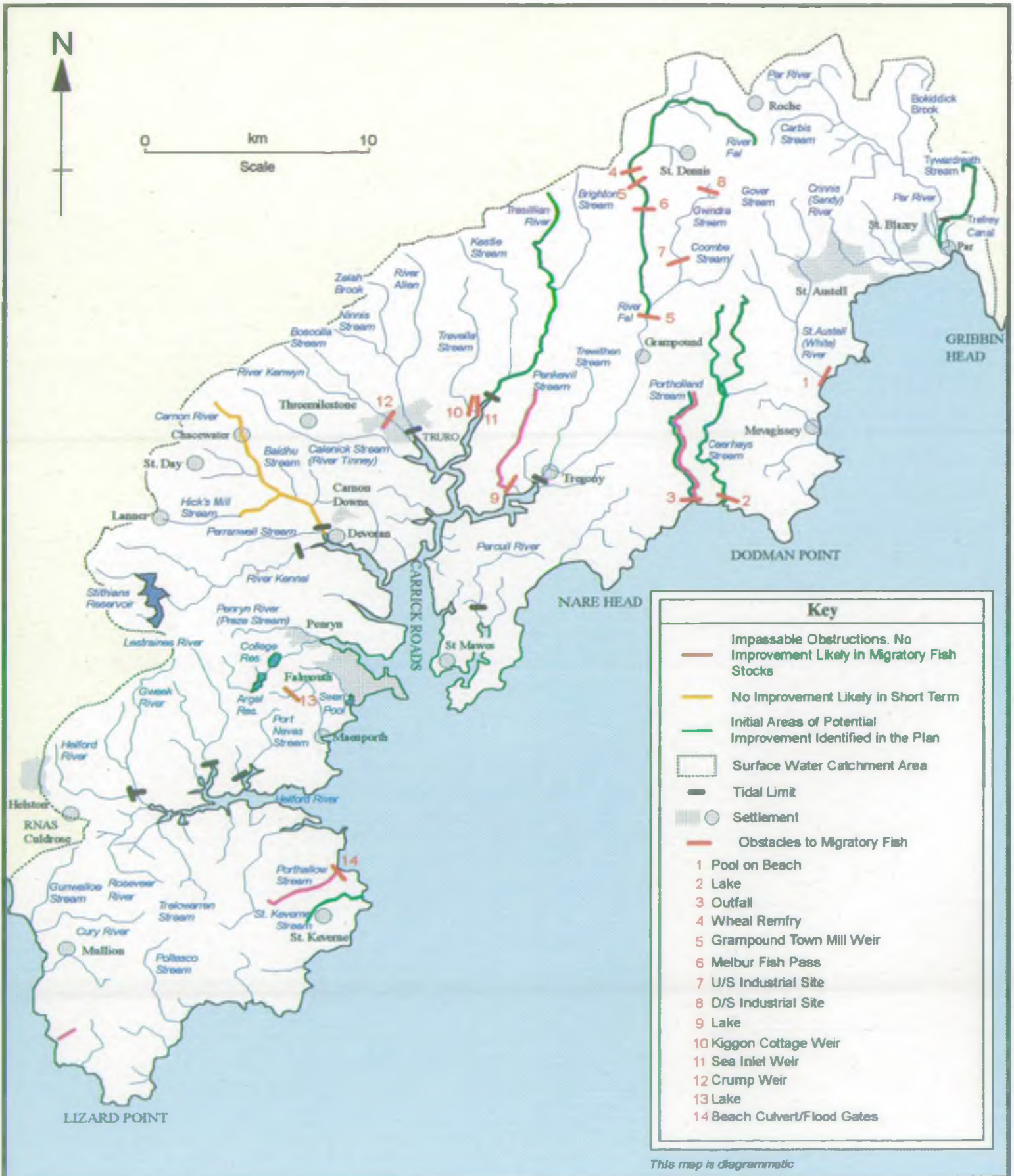
Byelaws

The area's fisheries are protected by many byelaws. The Environment Act 1995 allows fisheries regulators to make byelaws to control fisheries for environmental reasons as well as for fisheries management. A full list is available from the Fisheries Department. The rod fishing open seasons i.e. the period when it is permitted to fish in the river are shown in Table 6. Within enclosed still waters there is no close season for coarse fish, eel or rainbow trout unless one is imposed by clubs or fishery owners.

Table 6 : Rod fishing open seasons

Salmon	1 April to 15 December
Sea Trout	1 April to 30 September
Brown Trout	15 March to 30 September

Map 10 - Potential Sites for Fisheries Improvements



Information correct as of December 1995

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River Fal Catchment Management Plan
NRA South Western Region

Obstructions to migratory fish

Obstacles that are impassable or partially impassable, both natural and man-made are shown in Table 7.

Table 7 : Obstacles impassable or partially passable to fish

	River	Obstacle Name	Passable/ impassable
1	St Austell River	Pool on beach	Unknown
2	Caerhays Stream	Lake	Unknown
3	Portholland Stream	Outfall onto beach	Impassable
4	Fal	Wheal Remfry	Difficult in low flow conditions
5	Fal	Virginia Weir	Passable but needs assessment
6	Fal	Grampound Town Mill Weir	Passable but needs assessment
7	Fal	Melbur Fish Pass	Passable
8	Gwindra Stream	U/S Industrial Site	Impassable
9	Gwindra Stream	D/S Goonvean Macadam	Impassable
10	Penkevil Stream	Lake	Passable but needs assessment
11	Trevella Stream	Weir/Footbridge	Impassable
12	Trevella Stream	Sea Inlet Weir	Passable only at high water
13	River Kenwyn	Crump Weir	Impassable
14	Maenporth Stream	Lake	Impassable
15	Porthallow Stream	Beach culvert / flood gates	Impassable - not possible to alter

Of the obstructions highlighted above, we have indicated some where action could be undertaken to improve passage which would result in improvements to the fishery, see page 16

Habitat improvements

Work has been done on gravel improvements and trash dam clearance at a number of locations throughout the catchment. Ongoing assessment is carried out by routine electric fishing surveys and observation. The fish passes have proved to be successful on the River Fal as juvenile salmonids have been found upstream.

Fal recovery programme

The Fal has been stocked with juvenile salmon from the River Fowey. Two naturally spawning salmon parr were found in 1992. As a result the Fal fishery recovery plan (in conjunction with ECCI) was instigated in 1992. The recovery plan included:

1. A salmon and sea trout restocking programme
2. Bypass channel conversion into artificial spawning beds
3. Installing a fish pass
4. A recovery monitoring program for invertebrates and fish

Actions 1, 2 and 3 have been carried out. Action 4 is ongoing. We will monitor improvements as part of our routine fish surveys. Any recovery must be sustained and built on. With Agency fisheries resources dwindling, prioritisation of areas of work is crucial to get the best return on resources invested.

Water quality

EC Freshwater Fish Directive 78/659/EEC

The Freshwater Fish Directive 'on the quality of waters needing protection or improvement in order to support fish life' (78/659/EEC) ensures that water quality in designated stretches of water is suitable for supporting certain types of fish.

This Directive contains two sets of quality standards. One set of standards protects cyprinid or coarse fish populations. The other set of standards that are stricter, protects salmonid fish populations for example, salmon and trout.

We are responsible for monitoring the water quality of identified fisheries and reporting the results to DoE who decide whether the standards in the Directive have been met. Where the requirements of this Directive are not met, we are responsible for identifying sources of pollution and making sure that improvements are made. Map 9 shows the designated salmonid and cyprinid stretches.

Derogations

Where EC Directives standards, particularly those for metals and/or pH, are not met due to natural causes, we can recommend a derogation, that is these standards will not apply.

Compliance

One stretch, on the Calenick Stream from Treyew to the natural tidal limit, exceeded the standards for zinc in 1992, 1993, 1994 and 1995. This exceedance was found to be due to the natural geology and discharges from abandoned mines, and therefore this stretch is derogated for zinc.

Estuarine fisheries

Sea fisheries in the estuarine and coastal waters of England and Wales, out to 6 miles, are regulated by Sea Fisheries Committees (SFC) established under the Sea Fisheries Regulation Act 1966 and, in the case of migratory salmonid stocks by the Environment Agency. Outside the estuaries Cornwall Sea Fisheries Committee (CSFC) has regulatory powers relating to sea fish.

The Environment Agency is the Sea Fisheries Authority in the Fal and Helford Estuaries and has many byelaws regulating sea fisheries, in addition to migratory salmonid regulations (see Appendix B). We restrict the use of nets with the Salmon and Freshwater Fisheries Act 1975 (SFFA 1975) Section 6(1) as amended by the Salmon Act 1986 (SA 1986) Section 33. These sections prohibit the use of fixed engines. Section 27 of SFFA 1975 also prohibits the use of any net to fish for salmon, sea trout or freshwater fish unless licensed. The Agency will not normally license nets in these areas.

SFFA 1975 also places many restrictions on the use of rod and line as do the numerous rod fishery byelaws.

Within Environment Agency Sea Fisheries Authority Areas (see Map 9) other estuary legislation exists. This includes Cornwall River Authority Sea Fishery Byelaw No 3 Attended Draft and Seine Nets: No person shall use in fishing for sea fish between the expiration of the first hour after sunset and the commencement of the last hour before any draft or seine net having a mesh size of less dimensions than 1 1/2 inch from knot to knot, or six inches round measured when wet.

Bass legislation

In 1990 MAFF implemented a strategy for the conservation and management of the bass fishery. The strategy involves:

- A minimum landing size for bass of 36cm. This applies to both commercial fishermen and anglers.
- Restrictions on the use of gill and similar nets.
- A prohibition on bass fishing from any vessel inside the nursery areas for all or part of the year. The bass nursery areas are shown on Map 9. In the CSFC area (outside the estuary) a byelaw prohibits the landing of bass below 37cm.

Although the above regulations legally protect juvenile bass within the nursery areas it is difficult to prove that juvenile bass survival has greatly improved. Illegal netting of undersized bass still occurs within these sanctuary areas. Policing of the estuaries is actively carried out by the Environment Agency.

The Falmouth Bay and Estuaries Initiative⁷ contains the objectives of increasing awareness of rules and regulations governing fishing within the estuary, and reviewing the implications of crab trapping. We will be involved in carrying this out.

Coastal legislation

Restricted Areas for surface fixed nets exist to protect salmonids migrating around the coast prior to entering estuaries and rivers. These prohibit the use of any net that is less than 3 metres below the surface at any state of the tide. Restricted areas are shown on Map 9: Fisheries. These regulations are actively policed by the Environment Agency.

Passage of migratory fish

Where significant numbers of migratory fish pass through an estuary we may set non-statutory water quality standards for ammonia and dissolved oxygen, as defined in the AMP2 guidance note. We apply these standards during critical periods of the year when salmonid migration is taking place.

The non-statutory water quality standard for ammonia for 1990 to 1994 was met at all the routine monitoring locations.

The non-statutory water quality standard for dissolved oxygen for 1990 to 1994 was met at all the routine monitoring locations except Truro - Woodbury in 1990. The most likely reason for this is a natural dissolved oxygen sag which occurs in estuaries and is probably exacerbated by sewage inputs. This area is discussed under the Urban Waste Water Treatment Directive, see page 41.

Shellfisheries

As the Sea Fisheries Authority we have byelaws relating to shellfisheries but the licensing of the oyster fishery in the Fal estuary is regulated by Truro Harbour Authorities.

The operation of shellfish beds requires the lease of the sea bed from the owner of the fundus (the channel bed below high water mark). Additionally to protect the shellfish beds from other activities which may be damaging to cultivation, 'Several' or 'Regulating' Orders may be sought. Both are granted by government, after application to MAFF, and give protection for specified species and areas for a number of years.

Table 8 : Oyster fishery

Area	Owner	Operator	Origin of Oysters
Percuil	Duchy of Cornwall	Helford Oysters	Artificially Laid
Fal	Truro Harbour Authority	Licensed Boats	Native
Helford	Duchy of Cornwall	Helford Oysters	Native

One of the limiting factors to the development of shellfisheries is water quality. Water quality in the estuaries has historically been affected by numerous untreated discharges, many of which have been improved, or will be improved over forthcoming years. This may result in the reclassification of the shellfisheries to make them more viable. However, the observed deteriorations in shellfish quality in the Fal have not been proven to be linked to sewage discharges in the area. If there were an improvement it could be expected that there would be greater interest in establishing shellfish beds. However, there may be other constraints on expansion, such as space, access, alternative uses and infrastructure, which would need consideration. The proposed designation of the Special Area of Conservation (see page 48) does not prevent development of the shell fishery. Full designation might however alter the control and management of existing operations and any future development, both currently undertaken by MAFF and CSFC in consultation with other groups.

EC Shellfish Waters Directive 79/923/EEC

The Directive "on the quality required of shellfish waters" specifies quality standards for waters supporting designated shellfish populations.

We are responsible for monitoring the chemical quality of designated shellfish waters and reporting the results to DoE who decide whether the standards in the Directive have been met. Where standards are not met, we are responsible for identifying sources of pollution and making sure that improvements are made.

Three sites in the Fal Catchment are monitored under this Directive. These are shown on Map 2.

In 1994 the standard for saline zinc concentration was exceeded three times at the Fal Estuary, Turnaware Bar site. These exceedances are thought to have occurred due to the proximity of this site to the Carnon River which takes the discharge from County Adit and the abandoned Wheal Jane mine.

Non-designated shellfish waters

There are nine sites in the catchment which are not covered by the EC Shellfish Waters Directive where shellfish (oysters) are harvested. All of these sites are located in the Fal Estuary: Off Halwyn, East Bank (South End), Mylor Churchtown, Mylor Bank, Opposite Mylor Bank, Off Penparrow Point, Flushing, Off Halwyn (Relay Point) and Restrouguet Creek.

We monitored chemical water quality and the quality of shellfish (oyster) tissue at these sites in 1994. Water quality and the quality of shellfish were assessed using the EC Shellfish Waters Directive standards

In 1994 the limit for zinc in the water samples was exceeded once at Off Halwyn and Mylor Bank.

The concentrations of organochlorine compounds in tissue samples were all within the typical range expected for shellfish. A number of sites had results for metals which exceeded the typical range expected for oyster tissue. It is known that mining activities have had a significant impact on the tidal waters within this area which would affect levels of metals both in water and in shellfish tissue, see page 18.

EC Shellfish Hygiene Directive 91/492/EC

The Shellfish Hygiene Directive 'laying down the health conditions for the production and the placing on the market of live bivalve molluscs' protects the health of consumers of live bivalve molluscs such as mussels and oysters. This Directive defines standards for shellfish quality required in the end product. It also classifies bivalve mollusc shellfish harvesting areas into four categories according to the concentrations of bacteria found in the shellfish flesh. The Directive also lays down an audit trail from producer to consumer.

The Ministry of Agriculture, Fisheries and Food (MAFF) and the Department of Health (DoH) share responsibility for this Directive in England and Wales. We have only a minor role in implementing this Directive. Although we provide information on the location of discharges that may affect harvesting areas, we cannot require that improvements are made to polluting discharges under this Directive. However, we can use our powers to ensure that water quality does not deteriorate in harvesting areas.

There are five areas classified as bivalve mollusc production areas. Each of these is subdivided into a number of shellfish beds which are monitored under the Directive. These are shown on Table 9. Due to the confidential nature of the location of the beds we have not mapped them. The production area is available through MAFF.

Table 9 : Shellfish beds classified under the EC Shellfish Hygiene Directive

Production Area	Bed Name	Species	Class
Truro River	Grimes Bar	<i>O. edulis</i>	C
	Tregothnan	Mussels	B*
	Maggoty Bank	<i>O. edulis</i>	B
Tresillian River	All beds	Mussels	C
Fal	Ruan Creek	Mussels and cockles	C
	South Wood	Mussels	
	Flushing and Falmouth Wharves	<i>O. edulis</i>	B*
	All other beds	<i>O. edulis</i>	C
Percuil River	Unable to name	<i>O. edulis</i>	B
Helford	Port Navas	Mussels and	A
	All other beds above Helford Point	<i>O. edulis</i> <i>O. edulis</i>	B

* - Provisional classification. Note: Information correct as of September 1996.

Shellfish harvested from category A areas may go for direct human consumption. Shellfish harvested from category B areas must be depurated, heat treated or relaid to meet category A. Shellfish harvested from category C areas must be relaid for long periods (2 months) to meet category A or B before consumption. They may also be heat treated by an approved method.

Marine bioaccumulation

Mussels and seaweed take up certain metals and organic compounds from seawater and concentrate these substances within their tissues. This process is known as bioaccumulation. Analysis of mussel tissue and/or seaweed gives an indication of contaminants present in seawater. We have monitored the quality of mussel tissue/seawater at nine sites within this plan area.

The concentrations of organochlorine compounds in mussels tissue and seaweed samples were all within the typical range expected for shellfish. A number of sites had results for metals which exceeded the typical range expected for mussel tissue and seaweed. It is known that mining activities have had a significant impact on the tidal waters within this area. This would affect levels of metals both in water, shellfish and seaweed, see page 18.

Agriculture

Over 80% of the land in England and Wales is farm land. The way this land is used affects the quality of the environment. We are concerned about the pollution of surface and groundwaters from animal wastes, fertilizers and pesticides. Soil erosion, land drainage and stock damage to riverbanks can also be a problem. A sustainable farming system that conserves the soil and minimizes and recycles wastes will reduce the risk of damage to the environment.

Our Objectives

- to encourage agricultural practices that improve the water environment
- to protect the environment from farming activities.

The Role of the Environment Agency

There is only a limited range of things we can do to influence the way farmers use land. Other agencies such as MAFF can encourage sensitive farming practices using financial incentives. However, we can control and prevent pollution in the same way as we do with any other industry.

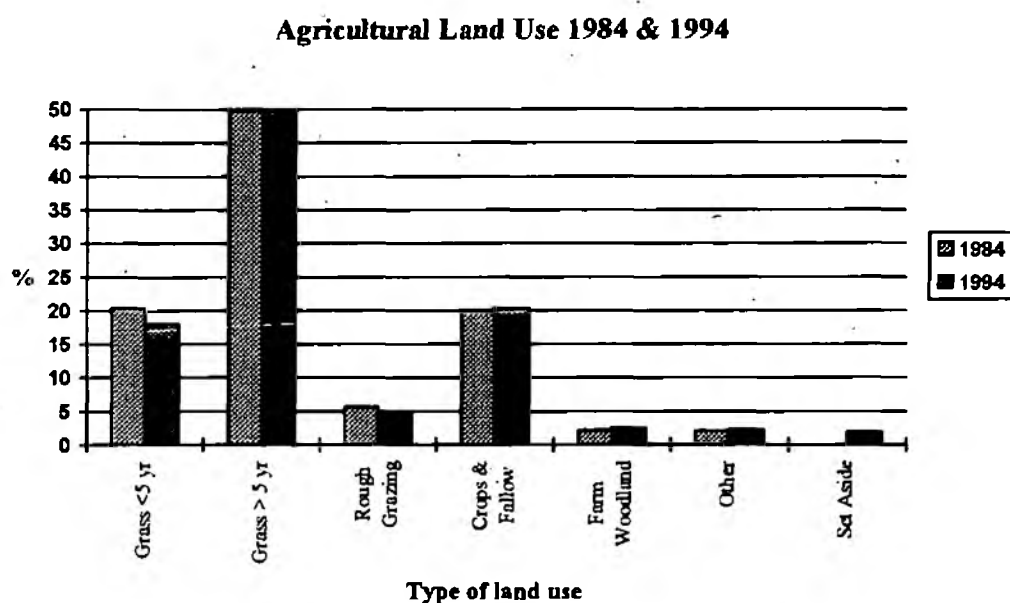
We have duties and powers to:

- prevent and control pollution through the enforcement of the Control of Pollution (Silage, Slurry & Agricultural Fuel Oil) Regulations 1991
- deal with pollution incidents
- issue consents to discharge from farms. However, we encourage farmers to dispose of farm wastes to land rather than discharging treated waste directly to rivers
- regulate the abstraction of most water for use on farms
- control certain structures in, over or under watercourses through land drainage consents.

Local Perspective

Agricultural land covers approximately 67,000 hectares of the catchment, just over 93% of the total area. The majority of the agricultural land, approximately 73%, is grass.

Figure 1: Agricultural Land Use



Farm types

Dairying is the dominant farm type in the plan. The number of dairy farms has fallen by almost 20% whilst cattle and sheep holdings have increased by nearly the same amount. The dairy herd in the catchment has fallen over ten years to about 30,800 cows but there has been a dramatic increase of 80% in beef cattle. There has been an increase of over 19% in numbers of sheep. The decline in dairy farming is a function of many factors: in addition to milk quotas, there has been an increased level of concern about pollution and a difficult economic climate. Such changes may reduce the use of fertilisers and general pollution load from dairy farming, however a reduction in the total number of dairy units is offset by remaining units getting larger.

Horticultural holdings have increased by over 60% but a significant number of these are small scale. There has been a large drop in top fruit and considerable increases in hardy nursery stock, bulbs and flowers grown in the open. Horticulture is particularly concentrated around the Helford Estuary where there is increased demand for water abstraction and risk of diffuse inputs of chemicals, fertilizers, pesticides and herbicides.

Long term trends

Long term trends indicate that the movement to two types of holding, part time farms and large specialist units, is likely to continue. The smaller holdings are becoming part-time and interest in diversification schemes will increase to maintain employment and incomes. Reforms in the Common Agricultural Policy and milk marketing are likely to exacerbate these trends, in the short term benefiting livestock farmers.

Grants for installing or improving farm waste facilities have been removed which leaves the full cost of further improvements with farmers. Limited non-chargeable independent pollution advice continues to be available from ADAS and we urge farmers to take advantage of this service.

Table 10 shows a continuing decline in the numbers and severity of pollution incidents relating to farming.

Table 10 : Pollution incidents arising from agricultural activities 1993 to 1995

Pollution Incidents	Major	Significant	Minor
1992	0	16	86
1993	1	6	58
1994	0	1	56
1995	0	1	45

Changes in farming practices can alter the risks of pollution and damage to the environment. The trend towards large dairy holdings and subsequent concentrations of livestock increase the risk of any pollution incident, though larger farms are likely to be better financed to handle farm waste. Farm diversification can have various impacts on the environment and concerns for us, for example, pond creation. Increased acreage under maize may have implications for pollution loading as this is often regarded as a crop on which large quantities of organic manure can be disposed. Once harvested the soil is often left exposed through the autumn and winter which can result in significant erosion and soil loss from the land.

Forestry

Well managed woodlands in the right places does not harm the water environment and will often bring benefits. However, in certain circumstances forestry development and management can cause problems. Areas of concern to the Environment Agency nationally include acidification, soil erosion, pollution, water yield, increased flooding risks and damage to wildlife habitats.

Regulation of forestry is the responsibility of the Forestry Authority. To minimize these adverse effects the Forestry Authority has published a series of Guidelines in respect of Water, Nature Conservation, Landscape Design, Archaeology and Recreation, against which all forest operations are assessed. These Guidelines encourage environmentally sympathetic forest planting, management and harvesting through grant aid using the Woodland Grant Scheme and the issuing of felling licences.

Our Objectives

- to encourage forestry practices that improve the water environment
- to protect the water environment from the negative effects of forestry activities.

The Role of the Environment Agency

We have duties and powers to:

- regulate some forestry works using land drainage legislation
- deal with pollution incidents.

Local Perspective

A Forestry Authority census of British woodland is in progress and the South West counties will be covered over the next few years. Some of the deciduous woodlands in the catchment are of ancient origin and have national and regional wildlife interest. Some are designated as SSSIs and county wildlife sites.

90% of new plantings are deciduous, with most blocks between 2 and 5 ha. Except on larger private units the production of timber is not the prime aim, the trend being towards amenity, conservation, landscaping and shelter belt plantings. This management can be expected to be more sympathetic in terms of impact on the water environment and landscape generally.

Some forestry within the catchment is owned or managed by Forest Enterprise (the operational arm of the Forestry Commission). This is managed with commitment to improve landscape and wildlife value and public access to comply with statutory duty unless any such activity is prohibited by conditions of a lease agreement. The Commission's medium and long term plans alongside watercourses aim to introduce more diversity in species and age classes of trees (both coniferous and deciduous) to produce habitats appropriate to a site. This will be achieved through introducing open space, manipulation and management of existing vegetation, and, as a third option new planting.

In this catchment, as in the rest of Cornwall, the greatest potential for problems to the watercourse arises from pollution caused by careless harvesting. The Forestry Authority, which licenses felling, is aware of the general problem and advises applicants with reference to 'Forest and Water Guidelines'¹⁵.

Map 11 - Recreation



Information correct as of December 1996

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Fal and St Austell Streams Local Environment Agency Plan
Environment Agency

Recreation and Amenity

Millions of people spend their spare time enjoying our rivers and coasts. Where we can we try to improve facilities for these people but we must always safeguard the environment from the damage they might cause.

Our Objective

We maintain rivers so that they can sustain angling at an appropriate level and seek to develop the amenity and recreational potential of inland and coastal waters and associated land.

The Role of the Environment Agency

We have duties and powers to:

- maintain, improve and develop fisheries allowing for a sustainable harvest of fish by anglers where appropriate
- raise money for fisheries management by issuing rod licences for freshwater angling
- enforce regulations and byelaws to prevent damage to fish stocks
- protect and maintain access to beautiful areas or special sites of interest
- make sure that land and water under our control is made available for recreation and at all times provide for the needs of the chronically sick or disabled
- charge for facilities that we provide for recreation
- make byelaws to regulate recreation.

Local Perspective

Much of this catchment has a high level of water-related recreational use, focused strongly on the coast. We are not aware of any recent comprehensive report on the recreational use of the area, but the following uses are certainly apparent:

Bathing

See Bathing Waters, page 79

Coastal watersports

Activities such as surfing, snorkelling, water skiing, diving and windsurfing take place along much of the coast. No figures of the number of people taking part in such activities exist, and many people carry out their sport in an informal way. Some activities are more formally organised - for example, Coverack Youth Hostel teach windsurfing at Coverack beach throughout the summer.

Surfing takes place at suitable locations all along the coast.

Boating and sailing

This section of coast plays host to the whole range of maritime sailing, from small dinghy sailing right up to major international yacht races. During the summer the bays and creeks are alive with different types of sail, and through the winter significant areas are taken up for boat storage and maintenance.

In recent years gig racing has developed as a popular competitive sport in the summer. Most sizeable towns and villages on the coast have a boat or two, and the fleet is still increasing.

Pleasure trips are run up and down the Fal and at times in the Helford, enabling those without their own boat to appreciate the creeks and coast.

The Fal is widely known as the third deepest natural harbour in the world. The sheltered nature of the waters make it ideal for leisure boating, which use cannot be underestimated.

Angling

The rivers in the area support game fishing for sea trout and brown trout. Following work on the River Fal fishery (See page 67) there is an increasing chance of salmon in this river. Eel fishing also takes place on many rivers.

Fishing for a wide variety of marine species is a popular activity along the coast, with some sites, such as around Porthallow on the Lizard being especially heavily used. Offshore reef and wreck fishing is also popular.

Inland there are a number of coarse fisheries. South West Water manage a popular coarse fishery at College reservoir near Falmouth and rainbow trout fisheries at Argal and Stithians Reservoirs. In addition there are 11 coarse, 4 trout fishing and 3 mixed commercial lakes or ponds in the catchment.

Canoeing

Canoeing takes place in the estuarine areas and around the coast when conditions permit. Groups also canoe on the Fal from Tregony downstream. There is currently no formal access agreement for this activity, which is something that needs addressing in order that conflict with landowners, sensitive species or other river users is avoided. Where a canoe access agreement is negotiated, we can assist with improving safety and information at entrance/exit points.

Public paths

The very popular South West Coastal Path follows the coast across this whole area. In places heavy use is putting pressure on the fabric of the path and protective measures are needed, as highlighted in the South West Coast Path Strategy. The philosophy of trying to encourage people into the wider countryside is being developed, but undoubtedly the coast will remain a strong magnet.

In the north west of the catchment, along the Carnon Valley, the Mineral Tramways recreational route terminates at Devoran. This route was being developed by Kerrier Groundwork Trust to allow people to journey through former mining sites from Portreath on the north coast to Devoran on the south. Other bodies may take up the project.

Birdwatching

This activity takes place across the whole catchment, but is difficult to quantify. A number of sites are particularly popular, such as the mudflats on the Fal and Helford estuaries, Stithians and Argal Reservoirs, Swanpool, and the whole of the Lizard during spring and autumn, when migration is in full swing.

Bathing Waters

The beaches within the plan area are a valuable recreational and economic asset. We monitor and report on the water quality at the most heavily used beaches under different programmes. The results of our monitoring show where improvements need to be made and are used in deciding investment by water companies and private dischargers.

EC Bathing Waters Directive (76/160/EEC)

The Bathing Waters Directive 'concerning the quality of bathing water' (76/160/EEC) protects the environment and the health of bathers using identified bathing waters by reducing pollution entering identified bathing areas. The Directive contains standards for nineteen microbiological, physical and chemical parameters to assess bathing water quality. Compliance is assessed mainly by standards for bacteria (total and faecal coliforms) found in sewage.

We are responsible for monitoring the quality of identified, popular bathing waters and providing the results to DoE who decide whether the standards in the Directive have been met. Where identified bathing waters fail to meet the Directive, we are responsible for identifying sources of pollution that are causing failures, and making sure that improvements are made.

There are 24 EC Bathing Waters in this catchment (see Map 11). At 17 of the 24 sites we monitor freshwater inputs to the bathing waters. This monitoring is not a requirement of the Directive but carried out in order to help identify potential causes of non-compliance.

8 of the 24 Bathing Waters complied with the standards in the period 1986 to 1995. These were at: Crinnis (leisure centre) Beach, Porthpean Beach, Port Mellon Beach, Gorran Haven (Vault) Beach, Porthoustock Beach, Kennack Sands, Poldhu Cove Beach and Gunwalloe Cove Beach.

In the period 1994 to 1996, 3 of the 24 Bathing Waters failed to comply with the Directive, compared to 16 in the period 1986 to 1994. The probable reason for non-compliance and any improvements that have occurred or are planned are shown in Table 11. Improvements are planned for a number of Bathing Waters where there have been no recent failures. These improvements are required to discharges still posing a serious threat to Bathing Water compliance. For a more detailed review of the causes of non-compliance see page 24 and page 41.

PART 2: SUPPORTING INFORMATION

Table 11 : Compliance against EC Bathing Water Directive as assessed by the Department of Environment

Name	Compliance											Probable Cause(s) of Failure	Improvements
	1986	87	88	89	90	91	92	93	94	95	96		
Polkerris Beach		F										Par spit outfall	Par scheme in 1993
Par Beach	F						F					Par Spit outfall. Private discharges	Par scheme in 1993
Crinnis (Golflinks) Beach				F								Par Spit outfall and Charlestown/Duporth outfall	Par Scheme in 1993
Charlestown Beach	F		F	F								As Crinnis (Golflinks) Beach	As Crinnis (Golflinks) Beach
Duporth Beach	F	F	F		F							As Crinnis (Golflinks) Beach	As Crinnis (Golflinks) Beach
Pentewan Beach	F	F	F	F								St Austell River which is contaminated by St Austell (Menagwins) STW	Phased improvements have been carried out at St Austell (Menagwins) STW and additional work is funded under SWW AMP2 investment programme
Polstreath Beach	F											Mevagissey outfall	SWW have planned to transfer the discharge to St Austell (Menagwins) before the 1997 bathing water season
Gorran Haven (Little Perhaver) Beach	F	F			F						F	Gorran outfall	Secondary treatment installed in Autumn 1994. Starting in 1997 ultra violet disinfection will be required for the bathing season
Porthluney Beach						F						Caerhays Stream probably contaminated by agricultural runoff	We have carried out an intensive campaign, visiting all farms in the catchment. Numerous problems were identified and addressed
Pendower Beach	F											River contaminated by a private discharge	Now resolved
Gyllyngvase Beach		F										Falmouth outfalls and unsatisfactory sewerage systems	SWWSL have planned interim scheme to be completed by 1997 bathing water season to address bathing water compliance and further improvements to be completed by December 2000 under UWWTD
Swanpool Beach		F					F	F				As Gyllyngvase Beach	As Gyllyngvase Beach
Maen Porth Beach		F						F				As Gyllyngvase Beach and inputs from Maen Porth Stream	As Gyllyngvase Beach
Porthallow Beach	F	F	F	F		F		F	F	F		Untreated private discharges	We have recently completed a study on the effect of these discharges and have notified the Parish and District Council of the new first time sewerage duties on water service companies
Coverack Beach	F				C				F			i) Agricultural runoff contaminating Coverack Stream ii) Unsatisfactory combined sewer overflow and Coverack Mill pumping station	i) We have carried out an intensive campaign, visiting all farms in the catchment. Numerous problems were identified and addressed ii) We have identified a storm sewage discharge for improvements in SWW AMP2 improvement programme
Polurrian Cove Beach	F											Polurrian Stream, and discharges in and around Mullion Cove, including Mullion outfall, Mullion Public Toilets and Mullion Cove Hotel	Under SWWSL'S investment programme, secondary treatment will be installed at the Mullion outfall

C - Compliance Not Determined F - Fail

Non-identified Bathing Waters

As well as the identified EC Bathing Waters we monitor the quality of nineteen popular, "non-identified" bathing waters in the Fal Catchment at: Spit Beach, Carne Beach (Pendower), Portscatho Beach, St Anthony Head Beach, Mevagissey Beach, Hemmick Beach, Portholland Beach, Portloe Beach, Porthcurnick Beach, Towan Beach, Porthbeor Beach, Great Molunan Beach, St Mawes Beach, Loe Beach (Feock), Church Cove (Lizard), Polpeor Cove, Kynance Cove, Church Cove and Jangye-Ryn. See Map 11: Recreation.

Water quality at these sites was assessed against the EC Bathing Waters Directive imperative standards for bacteria.

The Bathing Water at Spit Beach exceeded the standards in 1990, 1991 and 1992. Exceedance was probably caused by SWW Par Spit outfall. Improvements were made in 1993 as part of the Par scheme with flows being transferred from this outfall.

The Bathing Water at Portscatho Beach exceeded the standards in 1992 and 1994. This exceedance is caused by SWW discharges. These discharges are identified for improvements under the Urban Waste Water Treatment Directive.

The Bathing Water at Mevagissey Beach exceeded the standards in 1993, 1994 and 1995. This exceedance is caused by a SWW discharge, See page 41.

The Bathing Water at Portholland Beach exceeded the standards in 1994. The reason for this exceedance is thought to be due to agricultural sources, see page 24.

The Bathing Water at Portloe Beach exceeded the standards in 1993 and 1994. This exceedance is caused by a SWW discharge, see page 41.

This monitoring programme has now finished.

Map 12 - 1995 Compliance with Proposed River Quality Objectives (River Ecosystem Classification)



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Proposed River Quality Objectives

The water quality targets that we use in all rivers are known as River Quality Objectives (RQOs). RQOs are used for managing water quality and are based on the River Ecosystem (RE) classification scheme. The River Ecosystem scheme is made up of five water quality classes (RE1 to RE5). These classes reflect the chemical quality needed by different types of river ecosystem including the types of fishery they can support (See Appendix C, Table 1). We have proposed our River Quality Objectives (RQOs) using a classification scheme known as River Ecosystem which was introduced by the National Rivers Authority, following public consultation, in 1994. This scheme replaces a former scheme introduced by the Water Authorities in the late 1970s known as the National Water Council (NWC) scheme. Further details of the RE scheme and how we have translated RQOs for the catchment to this scheme are available on request.

How RQOs will be set

All RQOs must be achievable and sustainable. This means we that we must be able to identify what needs to be done to meet the RQO. We must also be able to ensure, as far as is practicable to do so, that water quality can be maintained at this level in the future.

We set RQOs based on the need to protect current water quality and future use. The available investment to improve water quality, including, for example South West Water's AMP2 investment programme agreed with Government (see page 119) needs to be taken into account.

We will aim to achieve the River Quality Objectives by a certain date within the next 5 to 10 years.

Setting Long Term RQOs

In addition, we will set long term RQOs where there are no resources available to ensure that the RQO is achievable or sustainable within the next 5 to 10 years.

We will use these long term RQOs as a basis for setting consents for new discharges and planning for future water quality improvements.

"Set Aside" of Data

In certain circumstances we can "set aside data", that is we will not take into account some or all the results for a particular determinand when we assess compliance with an RQO (See Appendix C, Table 2.)

For example we will "set aside" data where high concentrations of metals or low pH are caused by the natural geology of the catchment. This allows us to protect good water quality reflected by other water quality parameters in the RE classification.

There are a number of stretches where we are unsure if elevated levels of copper and zinc are due to historic mining activities or current China clay industry discharges. We are undertaking investigations into the relative impacts from each source, see page 27. Until the cause is proven we will set a RQO of RE5 and a long term RQO that will protect higher water quality currently achieved by other water quality parameters.

RQO proposals for the Fal Catchment

The RQOs based on the RE classification we are proposing for the catchment are shown on Map 12 and in Appendix C, Table 3. We aim to achieve these proposed RQOs from 1997 unless a later date is shown next to the class, for example: RE2 (1998), where we aim to achieve RE Class 2 from 1 January 1998.

Long term RQO proposals

In addition there are 16 stretches where we are proposing additional long term RQOs (as well as RQOs) that we would like to achieve but for which there are currently no resources to make improvements. These are also shown in Appendix C, Table 3 and on Map 12; for example [RE2] indicates that a long term RQO of RE2 applies in that stretch.

Compliance with proposed RQOs and Long Term RQOs

Map 12 also shows where current water quality fails to meet its RQO. This assessment is based on three years of routine monitoring data from the Public Register collected between 1993 and 1995. We have shown failures to meet RQO as "significant" and "marginal" failures. Significant failures are those where we are 95% certain that the river stretch has failed to meet its RQO. Marginal Failures are those where we are between 50% and 95% certain that the stretch has failed to meet its RQO.

Of the 58 monitored river stretches (198 km) in the catchment there is 1 stretch (2.1 km) which significantly fails to meet its RQO, and 3 stretches (5.6 km) which marginally fail to meet their RQO. The reasons for these failures are explained below.

River	Stretch name	Reason for RQO non-compliance	Reason for long term RQO non-compliance	Possible cause
Par River	Lavrean Bridge to Luxulyan Bridge	Copper	Potential ammonia	China Clay, St Austell North STW, low flows
Par River	Luxulyan Bridge to Treffry Bridge	Copper	Potential ammonia	China Clay, St Austell North STW, low flows
Par River	St Blazey Bridge to Normal tidal limit	Copper		Low flows
Rescorla Stream	Source to Par Confluence	Copper		Low flows
Rosevean Stream	Source to Par Confluence		pH	China Clay
Carbis Stream	D/S Great Wheal Prosper to Par Confluence		Copper	China clay
Molinnis Stream	Source to Carbis Stream Confluence		Copper	China clay
St Austell River	Lansalson Bridge to Iron Bridge		Copper, pH	China Clay
Gwindra Stream	Source to Below Drinnick		pH	China Clay
Gwindra Stream	Bellow Drinnick to Goonbarn		pH	China Clay
Gwindra Stream	Gwindra Bridge to Fal confluence		Ammonia	North Fal STW
Coombe Stream	Source to Hendra Bridge *		Biochemical oxygen demand, Ammonia, Copper, pH	China Clay, Septic tanks from Lanjeth Village
Coombe Stream	Hendra Bridge to Coombe		Copper, zinc, pH	China Clay
Dubbers Stream	Source to Gwindra Stream confluence		pH	China Clay
Bodella Stream	Source to Fal confluence		pH	China Clay

* Monitoring point has been moved downstream

Possible reasons for failures

12 stretches could be impacted by discharges from the China clay industry which are currently unconsented to discharge the parameter which is causing failure. We are investigating the nature and impact of these discharges under the EC Dangerous Substances Directive, see page 27.

Inadequate sewerage

4 stretches could be impacted by discharges from sewage treatment works or sewerage systems which are currently unconsented to discharge the parameter which is, or could, cause failure. The nature and impact of these are discussed on page 41.

Low Flows

On 4 stretches failure was caused by elevated levels of copper which occurred during a period of drought. Under such conditions a higher percentage of the flow is made up of groundwater. We know that mining of mineral loads containing copper occurred in this area and this could be the cause of the failures. We need to investigate the levels of contribution from such sources against those from licensed discharges. If the failure is considered to be caused by uncontrollable sources (natural or historic mining) we will seek a 'set aside' of the copper data.

Aquaculture

Here we consider the use of riverside beds or ponds to rear fish. Water used by fish farms is all returned to the river at some point downstream of the abstraction. Impacts arise due to the reduction in river flow in the by-passed reach and from the effluents in the returned water.

Our Objective

To protect rivers from the effects of fish farms.

The Role of the Environment Agency

We have duties and powers to:

- issue abstraction licences to protect the water environment and legal uses. We can put conditions on new licences to achieve this
- issue discharge consents to protect the river from pollution caused by fish food or chemicals used to control pests or diseases
- control the movement of some fish to prevent the spread of diseases. MAFF are responsible for registered fish farms
- ensure safe use of herbicides in accordance with MAFF and Agency Codes of Practice
- ensure that farmed fish cannot escape and compete with native species.

Local Perspective

There are four fish farms in the catchment.

Authorisations of commercial fish farms in the area have been reviewed by a fish farm control group to ensure that fish-farms had all relevant permissions for abstractions, discharges and weirs. Changes in licensing following the Water Act 1989¹⁶ had given rise to anomalies that the Group has endeavoured to put right.

Ventontrissick abstracts through a Licences of Entitlement, granted under the Water Resources Act of 1989. This could potentially result in abstractions which cause environmental damage. No such impacts are known at this site.

Innis Moor fish farm, on a tributary of the Par River farms rainbow trout for the table and has a stillwater fishery. The farm holds an impoundment licence and an abstraction licence with a condition for a residual flow of 194,000 gallons/day.

Geen Mill on a tributary of the River Tresillian breeds ornamental fish. Whilst draining ponds the water is pumped to the River Tresillian. There is no continuous discharge therefore a discharge consent is not required.

Gwarnick Mill previously abstracted water under a Licence of Entitlement which was handed in prior to a change of ownership. The ponds can be fed by groundwater which does not require a licence. However, if trout are to be reared there is likely to be a requirement for abstraction that needs a licence. We are currently in discussion with the owners over the requirements of such a licence.

Table 12 : Fish farm abstractions and discharges

Fish farm	NGR	Abstraction Licence	Discharge Consent
Innis Moor	SX 033 567	786.5 m ³ /day	786.5 m ³ /day
Geen Mill	SW 883 470	288.0 m ³ /day	not required
Ventontrissick	SW 814 501	1824.0 m ³ /day	231.0 m ³ /day
Gwarnick Mill	SW 815 493	Under discussion	1036.8m ³ /day

The Built and Developing Environment

Development is essential to the economic and social wellbeing of the community. However, its effects on the environment can be detrimental.

We liaise with Local Planning Authorities and developers to ensure sympathetic development with the environment.

The Role of the Environment Agency

We have duties and powers to:

- Advise Local Planning Authorities on appropriate policies for the environment in local strategic plans.
- Advise Local Planning Authorities on the effects of specified types of development proposals.
- Regulate new development by authorising land drainage structures, waste storage, transfer and disposal, discharging of effluent and abstraction of water.

The Planning Liaison section of the Agency provides a single point of contact to ensure that all relevant issues relating to the environment are properly addressed by the planning system. Planning Liaison represents the views and policies of the Environment Agency to a variety of customers, including Local Planning Authorities, Highway Authorities, developers and their Agents and others who have the potential to affect the environment. Through planning legislation the Agency aims to protect and enhance the environment so as to make a positive contribution towards sustainable development. We are concerned with quality and quantity of development and its general appropriateness in a particular location with respect to our interests.

Sustainable development does not mean environmental protection at all costs. It involves finding ways to encourage environmentally compatible economic activity and discouraging or controlling environmentally damaging activities.

Local land use and planning initiatives

The Lizard peninsula and Falmouth and Penryn lie in an Assisted Area. The rural parts of the catchment, except for Truro and central Carrick are in a Rural Development Area and have been designated under European Structural Fund Objective 5b, which provides support for rural areas. St Austell has Intermediate Area status. Restormel is a Derelict Land Clearance Area where 100% grant aid may be available to reclaim derelict land.

The Agency is currently discussing issues with Cornwall County Council for the new Structure Plan¹², Waste Disposal Plan and Minerals Local Plan¹⁷. We are also involved in the emerging Districts' Local Plans¹⁸. The Environment Agency will seek to influence the allocation of land to ensure that adequate infrastructure exists prior to development and, furthermore, that development does not damage conservation interests or be at risk from, or result in, flooding. All local plans covering the catchment area have incorporated a number of policies for positively protecting the water environment as a result of early discussions with the former National Rivers Authority.

Tourism

Tourism is an important part of the local economy. Seasonal population increases put pressure on infrastructure and services. The coastal area from west of St Austell to Helston, including The Lizard, Roseland and Carrick Roads is a Tourism Pressure Area, where growth in tourist accommodation is limited either by severe congestion, environmental sensitivity of the area, or both.

A more detailed review of the economic profile of tourism and other port activities in the Fal Estuary has been carried out in an Msc thesis. An updated summary has been produced for the Falmouth Bay & Estuaries Initiative¹⁹.

Map 13 - Built Environment and Development Plans



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Table 13: Examples of recent/ongoing development proposals within the Fal and St Austell Streams LEAP area in which the Agency has an interest

Location	Description	Environment Agency Involvement/Concerns
Wheal Busy, Chacewater	Golf course and associated buildings	Former mining site. Contaminated land. The Environment Agency seeks conditions
Swanvale, Falmouth	Local Needs Housing	The proposed site may be contaminated. Re-development could pose a threat to the water quality of Swanpool which is a proposed SSSI. The Environment Agency has worked closely with English Nature to ensure minimal impact. Surface water from the site should drain downstream of the undersized culverts draining Swanpool
Kernick Farm, Penryn	Superstore	Surface water discharge would have added to flooding problems downstream. Solution found by discharge through attenuation structure
Newham, Truro	Redevelopment	Former tip site. Contaminated land. Extensive investigations required to ensure redevelopment does not cause pollution. Need to maintain integrity of existing adjacent flood defences
Caerhays	Water environment. Project phased over 10 years	Advice given from specialist sections in support of scheme
United Downs	Industrial Sites	Contaminated land. Redevelopment will require investigations and assessment for mitigation measures required to prevent pollution
Treliske, Truro	Hospital buildings etc.	Surface water drains naturally to R. Tinney catchment which has existing flooding problems. Scheme in place to pump surface water to next catchment
Indian Queens	Power Facility	IPC site. Contingency plan in place which addresses our concerns
Gaverigan	China clay waste tip	Contaminated drainage. Loss of SSSI. Application refused. Consultation ongoing on revised application.
Holmbush, St Austell	Superstore	Diversion of Sandy River
St Stephen	Any development	Unresolved surface water disposal problems
Bodelva	Eden Project., Botanical gardens under glass utilizing former china clay pit	Initial consultations underway. Environmental Assessment required
Gloweth, Truro	Any development	A Flood Alleviation scheme is required at Calenick before development proceeds
College River catchment, Penryn	Industrial, retail and residential	There is a flooding problem in Penryn. Development in the catchment is at capacity. There are some proposals to drain surface water discharges to College Reservoir No 4 which is the potable supply for Penryn and Falmouth. Pollution could enter the reservoir, threatening the water supply
Goss Moor	Land Restoration	Former unauthorised tipping on wetland site of National Importance

Transport and road schemes

The main-line London to Penzance railway runs through the catchment, as well as the Par to Newquay branch line which is important for the transportation of china clay. As part of the A30 improvement scheme consideration is being given to realign the Par - Newquay branch line by utilising an existing mineral line thereby releasing land for the road improvement.

Cornwall County Council are currently undertaking a transportation study of the china clay area.

The Agency is a statutory consultee to the Department of Transport for new trunk roads and advises County and District Councils on their own road schemes. We are involved throughout the process, from route choice and design to construction.

Particular areas of concern from road developments are:

- pollution risks from spillage of oil and chemicals
- flood risk from surface water runoff
- damage to the amenity and wildlife value of rivers and wetland
- possible pollution and flood risk during construction
- effect on water resources by altering or blocking groundwater flow
- disposal of excavated soil and rock

Proposed road schemes in the catchment:

The Environment Agency has a number of concerns regarding the discharge of highway drainage from roads. The capacity of all bridges crossing receiving watercourses involved with the A30 improvements scheme must be checked. There is particular concern regarding the situation at Luxulyan, where a flooding problem is known to exist.

County road programme - proposed schemes 1991 to 2011

A39 Trispen bypass and A30 - Truro link.

A39 Carnon Gate - Playing Place. The discharge has been accounted for in Penpol Flood Defence scheme. Highway drainage at Carnon Downs bypass has been upgraded to accept additional flows. The volume of highway drainage to Calenick catchment will be no more than that discharged at present and may possibly be a reduction in volume on completion of this scheme.

A390 Grampound bypass.

A391 St Austell North East Distributor Road. The highway drainage will drain to the Sandy River. The discharge point will be located downstream of the river culvert beneath the A390, to prevent flooding of the road.

Tregolls Road diversion, Truro - the culvert under Tregolls Road must be assessed for adequate capacity and any required improvement carried out before development.

The Agency has worked with the Highways Agencies on the the design of new roads and during bridge repairs to provide for protected species such as bats, otters and dippers.

Industry

The largest industry in the east of the catchment is the China clay industry. The total increase in land occupation by the industry in the St Austell area over the period 1991 to 2011 is expected to be approximately 600 ha. The China clay industry is described in more detail in on page 26. Falmouth is an important deep water port (the third deepest natural harbour in the world), ship repair centre, and there are small fishing ports at Mevagissey and Penryn.

In addition to industrial estates in major towns a number of small industrial sites are scattered throughout the catchment. Assessment of risk to the water environment by these sites is undertaken by the Environment Agency during its winter Task Force operations.

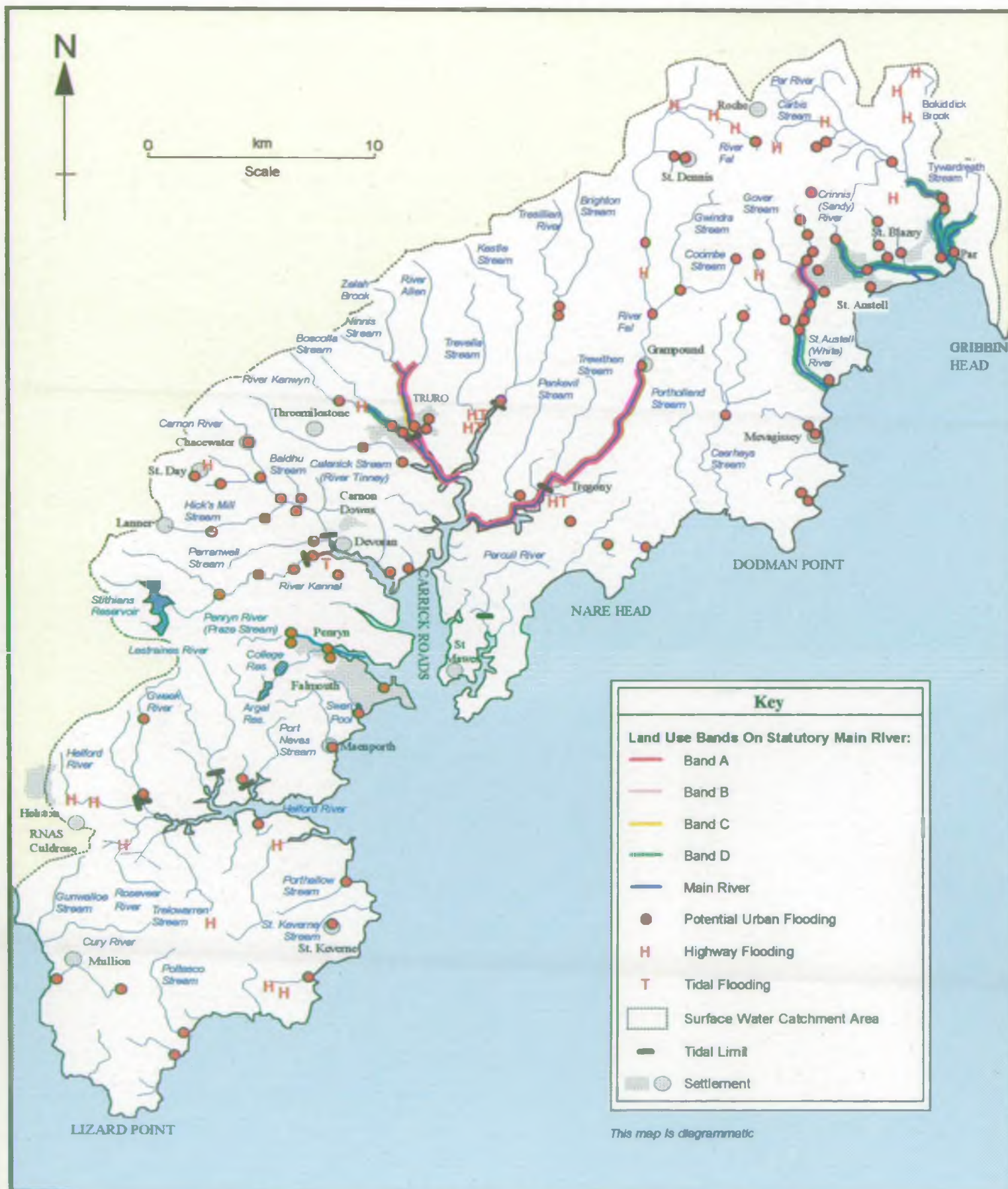
Future industrial development

Indian Queens Power Station is designed to supply electricity during periods of peak demand to the National Grid, typically during the winter months. We regulate this process through an IPC authorisation. Construction is now complete and operation is planned to commence during winter 1996. Monitoring of air quality has been taking place for the past year around the site to provide background data prior to operations beginning. Once the power station is operational we carry out regular routine inspections to ensure compliance with the site's IPC authorisation.

Table 14 : Development restraints due to problems in sewerage infrastructure and/or potential flooding

Settlement	Reason
Calenick	Existing flooding will be exacerbated by any significant development which increases surface water runoff.
Carharrack	Existing flooding will be exacerbated by any significant development which increases surface water runoff.
Chacewater	Existing flooding will be exacerbated by any significant development which increases surface runoff . Wheal Busy is of particular concern.
College Stream Catchment	Existing flooding will be exacerbated by any development which increases surface water runoff unless it forms part of the 5 hectares of land agreed with Carrick and Kerrier District Councils.
Falmouth Maenporth Penryn Budock Water Mabe Burnthouse	Localised flooding occurs in the Dell catchment (Falmouth) and the catchments which flow to Swanpool and Maenporth. We would like to monitor development within this area closely.
Flushing	Crude discharge to estuary.
Gorran Churchtown	Adverse effect caused by SWW effluent discharge, any further increase in flow will cause a deterioration in water quality.
Gorran Haven	Existing flooding will be exacerbated by any significant development which increases surface water runoff.
Helston	Existing flooding (in Gweek) will be exacerbated by any significant development which increases surface water runoff.
River Kenwyn Catchment	Localised flooding occurs at Little Canaan at Treworder and we will continue to object to significant development upstream of this area until the risk is removed.
Threemilestone	
Ladock	Localised flooding around Ladock Village Hall.
Lanjeth	Proliferation of private septic tanks and soakaways have caused pollution and environmental health problems in certain locations. We wish to monitor development closely.
Lanner	Existing flooding will be exacerbated by any significant development which increases surface water runoff.
Malpas	Limited infilling only. We wish to be consulted over any development.
Mawnan Smith	Existing flooding at Maenporth will be exacerbated by any significant development which increases surface water runoff.
Mevagissey	Effluent causes gross aesthetic pollution. Limited development permitted after screening installed on outfall. Existing flooding will be exacerbated by any significant development which increases surface water runoff.
Mullion Cury (Cove)	Existing flooding will be exacerbated by any significant development which increases surface water runoff. Limited increase in development as agreed with Kerrier District Council, to protect bathing waters.
Polkerris	We will not object to single plot infills, however, all other proposals should be referred to us for consideration to protect bathing waters.
Ponsanooth Stithians	Adverse effect caused by SWW effluent discharge, any further increase in flow will cause deterioration of water quality.
Porthallow	At present does not have mains drainage system. We would like to be consulted on all development in this area as the existing arrangements are causing both a pollution problem and a public health nuisance.
St Day	Existing flooding will be exacerbated by any significant development which increases surface water runoff.
St Keveve	Adverse effect caused by SWW effluent discharge, any further increase in flow will cause deterioration of water quality.
River Tinney Catchment Threemilestone Kea	Existing flooding will be exacerbated by development which increases surface water runoff.
Trethurgy	We have received complaints about septic tank problems and wish to monitor development closely.
Zelah	We are aware of local problems associated with the discharge of effluent from septic tanks and wish to monitor development closely.

Map 14 - Flood Defence



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Flood Defence

River flows vary widely and are affected by the weather, geology and land use. We manage flood risk from rivers and the sea using Flood Defence and Land Drainage powers.

Today we manage flood defences and land drainage to balance the needs of all river users with the needs of the environment.

Our Objectives

To provide effective defence for people and property against flooding from rivers and the sea; and to provide adequate arrangements for flood forecasting and warning.

The Role of the Environment Agency

Our statutory flood defence committees make decisions on flood defence. All rivers are classified as either "main rivers" or "ordinary watercourses" (sometimes referred to as "non-main rivers"). We control work (through land drainage consents) and supervise flood defence matters on all watercourses, but have special powers to carry out work on main rivers and sea defences. Local authorities have the same special powers for flood defence on ordinary watercourses.

We have duties and powers to:

- control certain works and advise planning authorities on flood defence
- maintain and improve the flood defence system which is under our control
- provide flood forecasts and warnings so that risk to life and damage to property is reduced during river and sea floods.

Local Perspective

The Fal Catchment Group includes the rivers Fal, Kenwyn, Allen, Truro, Praze, St Austell (White), Sandy and Par System. Few of the rivers are still in their natural physical state, having been altered during past human activity (largely mining) and more recently through flood alleviation schemes. There are 48 km of designated "main river" which are shown on Map 14

Flooding

Historic records show that there has been minor flooding in a number of other locations around the catchment the bulk of which affect highways or a very few properties. Most occur on ordinary watercourses where the local authorities have powers to carry out work.

Flood problems will be reviewed as part of the Section 105 survey - Development and Flood Risk. Indicative floodplain information will be available for the whole catchment by April 1997. Where significant numbers of properties are shown to be at risk further detailed work will be undertaken to see if an improvement scheme can be justified on cost benefit grounds. If justification is available then the scheme is placed on the Long Term Needs Programme for future work.

In recent years much has been done to protect the city of Truro, Penryn, St Austell and the Par/St Blazey Area. Extensive improvements and flood defence schemes have been undertaken on all main rivers in this catchment. The table below outlines these schemes

Table 15 : Flood defence structures

River	Location	Protection for
Praze Stream	Penryn	Numerous properties in Truro Lane/Kimberley Park Areas. Historical flooding since beginning of the century. Flood Defence Scheme undertaken in 1993/94. Final phase is programmed to start in 1998 subject to funding being available.
Kenwyn	Truro	History of flooding since nineteenth century. Extensive flooding to properties in January and October 1988. Areas at risk include St Georges Road, River Street and Victoria Square. Scheme undertaken in 1989 to strengthen flood walls, increase capacity in City culvert under River Street and construct a flood retention dam at Newmills. Works were completed in 1991.
Allen	Truro	History flooding in the St Austell Road and Old Bridge Street area of the city. A scheme to offer some protection to Old Bridge Street was undertaken in 1985. This scheme was upgraded in 1994 to offer a 1 in 100 year standard. A flood retention dam was also constructed at Idless in 1993/94.
Truro	Boscawen Park/ Lighterage Quay	A pair of mitre lock gates form a tidal barrier across the Truro River to reduce the risk of flooding to low lying parts of the city centre. While the lock gates are resisting the tides, flood water flows from the rivers Kenwyn and Allen plus local surface water runoff can be stored upstream of the barrier.
St Austell (White)	St Austell-Pentewan	Flood banks protect public amenity, rights of way, two large caravan sites and other property.
Sandy	St Austell	Capital funded improvements to sections of the Sandy River through Holmbush including channel and culvert improvements give protection to property.
Par River system		Extensive channel improvements to Par River and Treffry Canal. Construction of a major pumping station on the St Blazey Stream. Small pumping stations at Kilhaddon and Middleway and flood control barriers at Highway, Treemill and Tywardreath Streams all provide protection to property and highway.

Regulation

The main urban centres have all been troubled with flooding in the past which has been relieved by flood alleviation schemes built by the NRA (see Table 15). These have also allowed further development to go ahead in the respective catchments.

The remainder of the area is predominantly rural but the expansion of existing towns and villages and individual developments could increase the flood risk to an unacceptable level if the watercourse that receives the runoff has insufficient capacity to cope with the extra flow. There are a large number of localised urban flooding problems throughout the area. Our aim is to identify these problems before they occur and either object to the development or request that compensation works are carried out in advance of the development. An example of this is where a developer replaces an inadequate culvert that was causing flooding, allowing his development to go ahead as well as modest developments elsewhere in the catchment. Table 14 : Development restraints due to problems in sewerage infrastructure and/or potential flooding, lists locations where we are concerned about the flood risk implications of development.

Maintenance

We are currently developing a Flood Defence Management Manual. This will pull together information relating to the management of flood defences, addressing differences between targets and actual standards of service. The manual is expected to be in place in 1997.

At present the maintenance work to mained watercourses falls into the following five categories:

- Routine maintenance on flood schemes consisting of grass cutting, vegetation trimming, tree management, servicing flap valves and clearing weed screens.
- Infrequent dredging on shoal removal, carried out every 2-10 years depending on need. Generally where flood schemes are located.

- Infrequent repairs and minor enhancements to flood schemes.
- Clearance of fallen trees and debris dams in main rivers anywhere within catchment.
- Infrequent clearance work where necessary, approximately every 10 years along watercourses to avoid loss of design flood capacity and reduce risk of trees being washed into rivers and causing debris dams, particularly at river crossings during flood events.

The annual cost of maintenance varies depending on need each year, generally it is of the order of £150,000. Annual conservation liaison meetings are held to outline our maintenance programme to external conservation bodies. Each year within this programme some conservation enhancements and recreational improvements are carried out.

The main elements of work detailed in 1 and 2 are included within informal contracts known as Service Level Agreements. Anyone who has a specific interest regarding such work can make a formal request to the Agency to review the maps within these documents.

Standards of service for maintenance

We have developed a system in our Flood Defence Management Manual to assess the standard of service needed for Flood Defence maintenance. The system uses the term 'House Equivalents' (HEs) to equate the value of all types of land for different land use features.

The methodology splits the river into reaches and defines typical land use on either side of the river. It then uses a combination of historic flood data and analysed flood data to determine the number of HEs affected per km per year. The higher the score the greater the need for maintenance or a capital scheme.

The system originally only looked at flood damage. However, it is recognized that damage due to waterlogging is important for some agricultural land. Initial recommendations have been provided to include this important factor and further research work is needed. Map 14: Flood Defence shows the land use banding for the catchment.

A review has shown that current levels of maintenance along river stretches is appropriate.

Improvements

On sections of 'main river' we can build new flood defences if flooding is a serious problem. Nowadays we usually only build new defences to protect built up areas from flooding. All schemes must be technically, economically and environmentally sound. We undertake a programme of capital works shown on our Medium Term Plan which is derived from long term flood defence needs.

Different types of land and property need different levels of protection. We use indicative standards, based on the nature of the land use to design schemes. Once a problem is identified consideration will be given to carrying out improvements. The benefit of such improvements should generally exceed the cost of the work. In deciding whether a scheme is justifiable both environmental and economic benefits are considered.

Within the plan area much of the required flood defence work has been undertaken and only the improvements listed below are planned. However, sea level rise might require a review of this position.

In Penryn, stage 1 of the Praze Flood Alleviation Scheme has been completed. The final phase of the scheme, replacement of the culverts beneath Tresooth Lane and Trelawney Park has been delayed due to reduced funding and is now planned for 1998/99.

Continuing discussion with the Truro Harbour Master and local river users has resulted in a modified form of operation of the Truro Tidal Gate to meet our flood defence requirements whilst minimising the amount of local disruption to harbour users.

On the St Austell (White) River ongoing minor repair and reinstatement work can be expected over the next year or so while the new flood banks stabilise.

Improvements to the screens and access arrangements at Boscundle on the Sandy River are planned in conjunction with the St Austell North East Distributor Road.

Operational repairs and improvements are also planned in 1996/97 for the flood storage reservoirs at Treemill Stream (Par) and St Blazey. These minor repairs have been highlighted in a recent report on a statutory inspection by an All Reservoirs Panel Engineer.

Shoreline Management Plans

The aims in producing Shoreline Management Plans are to improve understanding of coastal processes, predict the likely future evolution of the coast, identify assets at risk (including conservation and recreation) and improve consultation between organisations with an interest in the shoreline. The plans will consider options and detail preferred approaches, recommend monitoring programmes and identify environmental enhancements. There are two SMPs in this plan area. Each study will be carried out in the following stages:

- Stage 1 Scoping Study
- Stage 2 Detailed study of Coastal Interest and Coastal Processes
- Stage 3 Consider options and detail Preferred Approach

The Lizard to Lands End project has now completed stage 2, with reports²⁰ having been presented to the steering group. Within this plan area issues have been highlighted such as the impact of removal of sand at Poldhu Cove and threats to historic and natural conservation features. Issues will be promoted through the established mechanisms of Local Plans and the local Planning system. The Rame Head to Lizard is being lead by Kerrier District Council and Stage 1 commenced in August 1996.

Emergency response and flood warning

Absolute flood protection is not possible. Because of this we need to warn people when there is a danger of flooding. We took over the role of warning the public and other organisations of likely flooding from the Devon and Cornwall Police on 1 September 1996. We have developed communication systems aimed at providing flood warnings to those members of the public most at risk. We have a strategy which details how the procedures operate and which we use to improve our emergency response. We also maintain a flood plan which details the procedures for spreading flood warnings. Where possible we aim to issue a warning at least 2 hours in advance of flooding.

In general all the river systems in this catchment give a particularly rapid response to heavy rainfall. Most main rivers have benefited from flood alleviation schemes in recent years and are able to cope with severe conditions fairly well.

High flows coupled with very high tides in the Par River System require the careful monitoring and management of flows between the Treffry Canal and Par River. The tidal barrier in Truro should be operated when tide level is expected to cause a risk of flooding to low lying parts of the city.

Rainfall information is available from the Meteorological Office and Agency rain gauges and the passage of flood flows can be monitored by the telemetry in gauging stations shown on Map 5.

Flood Warnings are issued for the following rivers:

Table 16 : Flood warning

River	Location	Warnings issued
Allen	At Truro	Yellow, Amber, Red
Fal	Trenowth to Tregony	Yellow, Amber, Red
Kenwyn	Newmill to Truro	Yellow, Amber, Red
Tinney	Calenick	Amber, Red
Par	Luxulyan to St Blazey	Yellow, Amber, Red
Par	At Par	Red
Tidal	South Cornwall Coast	Yellow, Amber, Red

Warnings are issued by direct contact and via local radio. Recorded information on current flood warnings is also provided. Leaflets are available from Agency offices which fully explain the flood warning service²¹. South Coast Tidal warnings are issued when conditions are expected to cause problems; local action is taken on receipt of these warnings. Information on tide levels is available from gauges at Devonport Dockyard, Sutton Harbour, Truro Tidal Barrier and Newlyn.

A study into the level of Service for Flood Warning is currently being carried out to determine whether the required standard is being met: it is expected to be completed in this study area by the end of 1997. The results will identify additions and other changes to the Flood Warning network.

We aim to prepare and keep up-to-date a plan for responding to flooding and damaged flood defence structures within specified time limits, depending on location and potential impacts. During a flood event our prime role is to ensure that the flood capacity of each river is maximised. This is achieved by actioning response levels A and B, defined as follows:

A Checking operational flood defence systems are working properly. This includes operating barriers, closure of flood gates, positioning stop logs, ensuring pumping stations are operating, adjusting sluice gates/ penstocks etc. ensuring flood storage areas are utilised properly.

B Check river reaches to avoid obstruction of watercourses and monitor river levels. This includes clearance of trash screens, inspecting sensitive locations where blockages may occur, checking flood defences to ensure they are functioning properly, reporting on river levels to assist with flood warning.

Operational response to Levels A and B in this catchment would include the following:

A Operation of tidal gates at Lighterage Quay and checks on the gate/control structures at Newmills and Idless flood retention dams, Truro. Operation of the controlling penstocks on the Par River System and flood retention dams at Tywardreath Highway and Treesmill, Par.

B Clearance of screens in Par, Truro and Penryn. Checks on major river crossings throughout the catchment and inspection of flood defence schemes where warnings are in force, particularly on the Par system, St Austell (White) River, the Rivers Kenwyn and Allen in Truro and the Praze Stream in Penryn.

The appropriate action to take during a flood event is decided by the Area Base Controller who uses up-to-date telemetry information, radar data, experience and judgement of need considering the situation across the area and the available resources. The Base Controller's handbook contains specific information about flood defence schemes and sensitive locations in each catchment; this handbook needs regular updating

Map 15 - Active Mineral Workings



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NRA South Western Region

Mining and Quarrying

The Environment Agency recognises the economic importance of quarrying, mining, gravel and mineral extraction to the region, however, exploration and extraction can significantly affect surface and groundwaters locally and across catchments.

Abandonment of mines and after use of quarries may also pose threats to the water environment.

Our Objectives

To minimize the damage that mineral extraction can do to water purity and to reserves of water held in the ground. Where possible we will steer mining and quarrying operations away from important aquifers.

The Role of the Environment Agency

We have duties and powers to:

- control the quality of water discharged from mineral workings
- prosecute offenders if they cause pollution
- issue Conservation Notices where mining/quarrying activities could have a negative impact on water resources.

Both the EC Dangerous Substances Directive and Annex 1A programme are relevant to mining and quarrying in the plan area. For further detail see pages 122 and 123.

Local Perspective

There are 376 mines identified in the catchment, all of which are now closed. Historically, the most important mining area was the River Carnon subcatchment, which was one of the most extensively mined areas in the South West. Over 111 mines have been identified here. Copper and tin mining has taken place throughout the northern part of the catchment area, particularly on and around the St Austell and Carnmenellis Granite.

Active Mineral Workings

China Clay

The extraction and processing of china clay dominates the landscape and economy of the St Austell area. The Cornish china clay deposits are of national importance. The broad area occupied by the industry is approximately 60 km², consisting largely of the granite uplands associated with Hensbarrow Downs. Current annual production in the St Austell area is about 2.85m tonnes, over 80% of which is exported through the ports of Par and Fowey. The China clay industry consults with the Environment Agency and other interested bodies on matters of restoration of the tips and other environmental issues.

Stone Quarries

There are six active quarries in the catchment (aggregates and hedging stone), intermittent working for ornamental serpentine on The Lizard and four dormant stone quarries. One of these dormant quarries, Grampound, is close to the River Fal, but has informal conditions agreed regarding surface water and groundwater disposal. The extraction of serpentine is authorised on large areas on The Lizard but is limited to annually agreed, small scale excavations which must be restored on a regular basis.

Several quarries are in SSSIs and the County Council, in their Mineral Plan, " propose investigation into the need and potential for establishing buffer zones between some quarries and sensitive other uses.

Calcified seaweed

Dredging for Maerl, a calcified seaweed, takes place commercially in the Fal Estuary under a license from the Ministry of Agriculture, Fisheries and Food. The Maerl within the estuary is a species of national, and international wildlife conservation importance. It is found in 3 separate forms: living

beds, dead beds and dead beds covered in silt. The first two have significant ecological value, whilst the third is thought not to and therefore suitable for abstraction. Concern has been expressed that extraction methods could result in the resuspension of potentially contaminated silts, or increased erosion of the estuary shoreline.

Mineral consultation areas

There are ten small Minerals Consultation Areas in the catchment and a larger one at St Austell for china clay. The County Council is also considering the designation of a Mineral Consultation Area on The Lizard to safeguard resources of serpentine. These procedures exist to ensure that surface development does not unduly sterilise mineral resources.

Special procedures exist for the establishment and operation of Mineral Consultation Areas for china clay. Where there is disagreement over whether particular non-mineral development should be permitted, the application should be referred to the Secretary of State for his own determination.

Historic mining activity

The NRA South Western Region completed the 'Mines Database' project in 1995, set up to compile a systematic database on mines, adits and associated infrastructure. Information has been gathered largely as a desktop exercise and stored in a map based format. Given the extent and historic nature of mining in the catchment, work to date cannot be considered totally comprehensive or accurate, but rather a first step. Further development of the project could result in ground truthing and adding to existing data. Responsibility for the physical dangers posed by shafts and adits lies with the landowner, however, where there is public access and a perceived threat to public health the District council may intervene.

Wheal Jane

Wheal Jane was the last mine working in this area. Regular pumping during the working of Wheal Jane had depressed the water table by about 400 m. When the mine was closed in 1991 pumping ceased and the minewaters began to rise. Minewater reached the surface in November 1991 and flowed through the temporary treatment system, instigated by the former NRA in conjunction with the then mining company (Carnon Consolidated Ltd), now South Crofty PLC. Mine water backed up in the mine system above Wheal Jane Adit to the level of Nangiles Adit. A further increase in minewater caused the plug in Nangiles Adit to fail in January 1992 releasing 5 to 10 million gallons of untreated minewater into the Carnon River carrying with it an estimated 100 tonnes of metal in 24 hours.

The impact of the release of untreated minewater from Nangiles Adit on the impoverished community in the Carnon River is difficult to quantify. The most significant consequence of the release was the greatly increased metal loading to the Fal Estuary from the Carnon River. Metal inputs to the estuary rose to 30 kg/day cadmium, 20 tonnes/day zinc and 30 tonnes/day iron and the pH dropped from about 6.5 to 4.5. Following the rapid decline in minewater release and subsequent treatment water quality improved steadily and by October 1992 metal concentrations had returned to the pre-incident levels throughout the estuary.

The most visible consequence was the vivid orange brown discolouration in Restronguet Creek and Carrick Roads and at its extreme in the sea off Pendennis Point almost reaching the Helford Estuary.

The metal concentration in sediments in the estuary had been high previously due to the surrounding geology and mining activity. Sediment metal concentrations are highly variable reflecting local deposition and remobilisation currents. Surveys did not show any consistent trend in metal concentrations in response to the minewater release, although there were temporary localised increases in Restronguet Creek.

Prior to the release, the flora and fauna of Restronguet Creek were impoverished from the high sediment and metal loading from historic mining activity. The head of Restronguet Creek supports only two species of benthic macroinvertebrates (ragworm and peppery furrow shell), both of which have been shown to develop metal tolerance and so little impact of the incident was detected. In

contrast, the mouth of the creek supports 24 species. Some of these species were adversely affected, with a high proportion of the Northern Barnacle population (*Balanus balanoides*) around Restronguet Creek being killed (probably as a result of being smothered by iron precipitate). Recruitment of the Australian Barnacle (*Elminius modestus*) was rapid. In general, the flora and fauna of the Carrick Roads were little affected by the temporary increase in metal concentrations.

Following the Wheal Jane incident in January 1992, the pumping and treatment of the minewater was restarted around Janes Adit and transferred to the No 2 shaft. Since then the system has been constantly upgraded as part of a £8.3 million project, funded by DoE, to treat the minewater in the short term and to research into the most appropriate and cost-effective long term treatment strategy.

The temporary treatment system now treats on average 3 million gallons of minewater a day in the summer and 6 million in the winter. Removal of 97% of metals is achieved by lime dosing and storage of metalliferous sludge in the Clemows Valley Tailings Dam. Ore from South Crofty mine is processed at the Wheal Jane mill and tailings are also disposed of in the Tailings Dam. Water quality in the Carnon River has now been restored to the level observed prior to the closure of Wheal Jane.

The dam, which is owned by South Crofty PLC and is also used for the disposal of tailings from their milling operations, has approximately 5 years storage capacity remaining. We have, therefore, been investigating possible alternative methods for the treatment of minewater. Construction of a small scale pilot passive system in the Carnon Valley was completed in December 1994. This experimental system, which is at the forefront of biological treatment technology, treats about 1% of the volume of minewater from Wheal Jane. The system removes metals in a series of stages using reedbeds and other biological systems.

Map 16 - Historic Metalliferous Mining



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We recently reported to DoE on long term treatment options and sought approval from DoE for further funding to complete the studies needed to determine the best long term solution for Wheal Jane. This project will run from April 1996 to March 1999 and will involve operation of the current treatment system and operation of the pilot passive trials for another two years.

In addition, detailed modelling of water quality and hydrology, from minewater to estuary, will be carried out to develop an integrated model for the Carnon River catchment, Restronguet Creek and Carrick Roads. The integrated model will be used to predict the improvement in minewater quality with time, the effect of the various treatment options, including no treatment, on the extent of iron discolouration and biota in the estuary. Other studies include a biological assessment of the area, acid mine drainage prevention, a detailed cost-benefit analysis and an assessment of suitable active and passive treatment systems for long term treatment.

We have produced a booklet on our involvement in Wheal Jane²², which is available through Agency offices.

Long-term effects

Although the acute effects of the Wheal Jane incident on the flora and fauna of the estuary appear to have been minimal, concern has been raised over the potential effects of chronic (long-term) exposure to certain metals. A number of issues have received particular attention, including:

Zinc accumulation in oysters

Routine monitoring of metal levels in the oysters (*Ostrea edulis*) from near the entrance to Restronguet Creek has been undertaken by the Ministry of Agriculture, Fisheries and Food. MAFF have concluded that concentrations of zinc in the oysters have not changed as a consequence of the release of untreated minewater and the reproductive capacity of the oyster community does not appear to have been adversely affected. At no time has MAFF/ Environmental Health Department advised that the recorded zinc concentrations in oysters would render them unfit for consumption. MAFF have now stopped their intensive monitoring following the Wheal Jane incident.

Metal accumulation in brown algae

Copper and zinc concentrations in the brown alga *Fucus vesiculosus* have been widely used as an indicator of long-term exposure to elevated metal concentrations in the Fal Estuary⁸.

Samples of algae taken from Restronguet Creek during July, 1991 (i.e. pre-incident) were found to contain metal concentrations elevated above normal background, as might be expected given the historically elevated metal loadings entering the creek. However, repeat sampling in the spring and summer of 1992 (i.e. post-incident) revealed a further increase above the already elevated concentrations (see Table 17). Concentrations have since declined, but more recent data are incomplete.

Table 17 : Metal concentrations in samples of brown algae from Restronguet Creek

	Cadmium	Copper	Iron	Zinc
Control Site: Falmouth Beach	0.6	9	no data	244
Pre-incident: July 1991	3.2	150	222	774
Post-incident: March 1992	1.0	270	2958	869
May 1992	1.5	259	5117	2226
July 1992	1.4	204	1706	2020

All data expressed as mg/kg dry weight

Mortality in swans

Mute swans began to fall ill in the Fal Estuary during autumn 1992 and over the next three years many died (Issue 10C).

Post mortem examinations showed evidence of zinc toxicity and, in some cases, lead toxicity. Tissue analysis confirmed high metal concentrations. As a complicating factor 11 out of 24 swan brains showed evidence of a disease - non-purulent encephalitis. Analysis of archived tissues from swans which had died before 1992 also showed rising zinc concentrations. Population monitoring has shown that despite the swan mortalities the number of swans on the lower Fal Estuary is higher than ever, and in particular, that the artificial feeding has attracted more swans to the estuary.

In addition, movement studies showed that swans that spent most of their time in Restronguet Creek and were not any more likely to fall ill than those that spent most of their time elsewhere.

Changes in species composition

The observation that increased mortality in populations of the Northern Barnacle was followed by rapid recruitment of the Australian Barnacle has raised the possibility that the species composition of the barnacle population may have been fundamentally altered.

Comparison of the 1982 and 1992 maerl surveys showed a significant increase in dead maerl, a decrease in numbers of the peacock fan worm (*Sabella pavonina*) and an increase in snakelocks anemone (*Anemonia vividis*). It is difficult to attribute causes to these changes as the surveys were done 10 years apart. Maerl is slow growing and long-lived, therefore dieback is of concern.

The County Adit

The County Adit is a complex system of mine adits that drains an area in excess of 25 km², discharging into the River Carnon above Wheal Jane between Bissop and Twelveheads. The extent of the adit system is indicated on Map 18 and includes over 60 mines. As can be seen from the map the adit system extends beyond the Carnon River and Poldice Stream catchments and includes drainage which prior to the development of the adit system would have previously drained to the north, out of this plan area.

The adit discharge has a low pH and contains exceptionally large amounts of dissolved metals. This results from weathering of mine waste and disturbed mineral lodes intercepted by water draining to the adit. The discharge has a major impact on the metal loadings observed in the Carnon River which are subsequently discharged to tidal waters within Restronguet Creek (Issue 10H).

Contaminated Land

Contaminated land is defined as any land which appears to a local authority to be in such a condition, because of the substances it contains, that water pollution or significant harm is being, or is likely to be caused. This interpretation is subject to guidance yet to be issued by the Secretary of State under the new provisions of the Environment Act (1995). Some sites will be designated by the same guidance as 'special sites' and these will become the responsibility of the Environment Agency. The process of identifying contaminated land across England and Wales is in its very early stages. The Department of the Environment is carrying out formal consultation on its draft contaminated land guidance between October and December 1996. The target date for implementation, subject to Parliamentary approval, is April 1997.

Derelict land is land which is considered to be so damaged by industrial or other developments that it is incapable of beneficial use without treatment. Such land includes for example, closed and disused waste tips or disused factory sites.

Our Objective

To prevent the pollution of ground and surface water or environmental harm arising from contaminated land.

The Role of the Environment Agency

Dealing with contaminated land is complicated. Often a lot of work has to be done to understand the problem fully. Before any action is taken we have to be sure that what is recommended (which can be very costly) will have worthwhile and lasting benefits. Some of the Environment Agency's priorities are given in the NRA's 'Contaminated Land and the Water Environment Report'²³ where we also describe some things we can do to tackle the problem. Planning authorities also have powers that they can use. We can:

- comment on planning applications and give advice on the need for contaminated land assessment and design objectives for site remediation
- take enforcement action if contaminated land is causing pollution
- advise local authorities when they undertake surveys to identify contaminated land
- After the implementation of the new provisions we will be able to:
- ensure that 'special sites' are dealt with in the most appropriate manner; left undisturbed, targeted for redevelopment or clean up plans prepared
- once the process of identifying sites is well underway we have a duty to prepare and publish a report on the state of contaminated land from time to time, or if specifically requested to do so by the Secretary of State.

The Environment Act 1995 provides a new legal framework for dealing with problems of contaminated land. Part II of the 1995 Act imports a new Part IIA into the Environmental Protection Act 1990. The new provisions do not replace the current system for achieving the clean up of contaminated land through the planning process as part of normal development schemes.

Whilst the regulation of waste under Part II of the 1990 Act is the responsibility of the Environment Agency, primary responsibility for identifying and assessing contaminated land is placed on local authorities.

Local Perspective

The precise nature and full extent of contaminated land within any catchment is difficult to accurately define since the contamination of many sites is only realised when they are developed or when pollution occurs.

Within the catchment, widespread contamination of ground may have occurred from the former operation of metalliferous mineworkings in the area. Elevated concentrations of heavy metals, compared to background levels, are often encountered in ground that has been previously backfilled with mining waste or spoil, or along river banks where long term accumulation of metals can occur.

Leaching of heavy metals from such ground, or the interception of minewater drainage, may subsequently impact upon both local ground and surface water quality.

Assessment of impact and risks to local water interests may show any of the following mitigation measures to be necessary:

- minimise ground disturbance,
- avoid soakaways in mine waste materials,
- seal the surface and other measures to limit rainwater infiltration,
- remove mine wastes to an appropriately licensed landfill site,
- avoid direct discharge down mine shafts,
- encourage plant cover to stabilise mine spoil dumps, and
- treat mine discharge waters.

All open and closed non-inert landfill sites are by definition contaminated sites, but other waste management activities may have the potential to cause contamination (see page 126). The closed landfill at Tresize has previously accepted domestic wastes, and is now managed by Cornwall County Council as the waste mass decomposes. There are however, numerous smaller sites throughout the catchment that are reported to have been filled prior to the commencement of county waste management in 1974, for example, Newham landfill near Truro.

The other main potential cause of contamination within the catchment is current or former industrial use, which due to the rural nature of much of the catchment is concentrated in Falmouth, Truro and St Austell. However it should not be forgotten that a larger number of activities have the potential to cause contamination; for example agriculture, petrol filling stations or domestic heating oil tanks. The size of the contamination source is not necessarily a guide to the risk that is posed.

China clay

The China clay industry recognises that matters of landscaping and restoration are of increasing importance and consults widely with interested bodies including the DoE, Cornwall County Council and ourselves. Initiatives include:

- a Pilot Study for the development of tipping and restoration strategy in the western part of the china clay district.
- a DoE commissioned study to review and assess the landscaping and revegetation of china clay wastes by Wardell Armstrong.
- research to appraise the occurrence and utilization of secondary aggregates such as china clay sand (commissioned by DoE).

Contaminated sediments

Contamination of the sediments of the Fal Estuary is widespread but variable in degree. Before the undertaking of any activity likely to disturb and mobilize the sediments in this area the Environment Agency would require the nature and severity of contamination to be established such that appropriate mitigating measures could be taken. Ministry of Agriculture Fisheries and Food have an interest in activities requiring Food and Environmental Protection Act licences, particularly those where disposal of sediment to sea was proposed.

Abstraction and Water Supply

Here we consider the abstraction of water from the surface or below the ground for public water supply, industry and other uses such as spray irrigation. Our document "Regional Water Resources Development Strategy - Tomorrow's Water" has provided much of the technical water resources information provided in this plan.

Our Objective

To manage water resources to achieve the right balance between the needs of the environment and those of the abstractors.

The Role of the Environment Agency

Our management of water resources is guided by the European Union and UK legislation. We have duties and powers to:

- ensure that water is used properly, regulating abstractions using licences
- conserve water supplies and protect them from over use

The Role of South West Water

Public water supplies are provided by South West Water (SWW). They have duties to:

- provide mains water
- ensure water is of suitable quality
- meet demand

Environment Agency Policies and Activities

We have adopted a range of key policies in order to fulfill our statutory duties. Foremost amongst these are:

- Sustainable Development: Ensuring that there will be no long-term deterioration in the water environment due to water resources development and use
- Precautionary Principle: Making sure that decisions made and measures implemented err on the safe side of caution if significant environmental damage may occur, or if knowledge on the matter is incomplete
- Demand Management and Better Use: Ensuring due attention has been given to the management and conservation of water resources by measures to control waste and manage demand and to make best use of existing resources, before licensing the development of additional sources.

Local Perspective

In the catchment there are currently 67 licensed surface water and 636 licensed groundwater abstractions for public water supply and for private water use. The latter includes the supply of water for some private dwellings, industrial use, agriculture, fish farming and amenity purposes. The authorised annual total of water which can be abstracted from the catchment is 44,835 Megalitres/year (Ml/y), 30,442 Ml from surface waters and 14,393 Ml from groundwater sources (1 Ml = 1 million litres).

The theoretical available resource in the catchment is the proportion of rainfall not evaporated or taken up by plants. The authorised total of water which can be abstracted from the catchment amounts to 8% of the theoretical available resource. We are not aware of any widespread environmental damage caused as a result of this level of abstraction although there may be localised impacts.

Map 17 - Public Water Supply Distribution System



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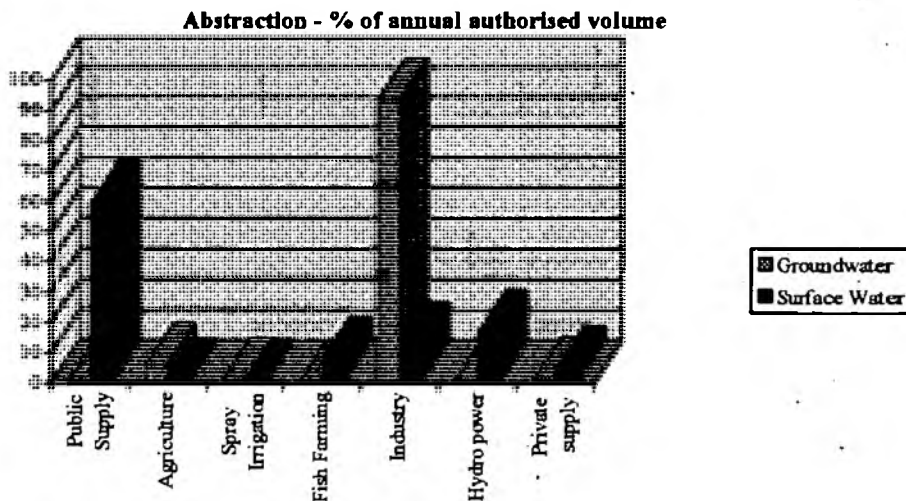
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Public water supply accounts for the greatest proportion of surface water abstracted. The largest proportion of licensed groundwater use is for industry (china clay) although general agriculture use is more widespread and accounts for the largest number of licences.

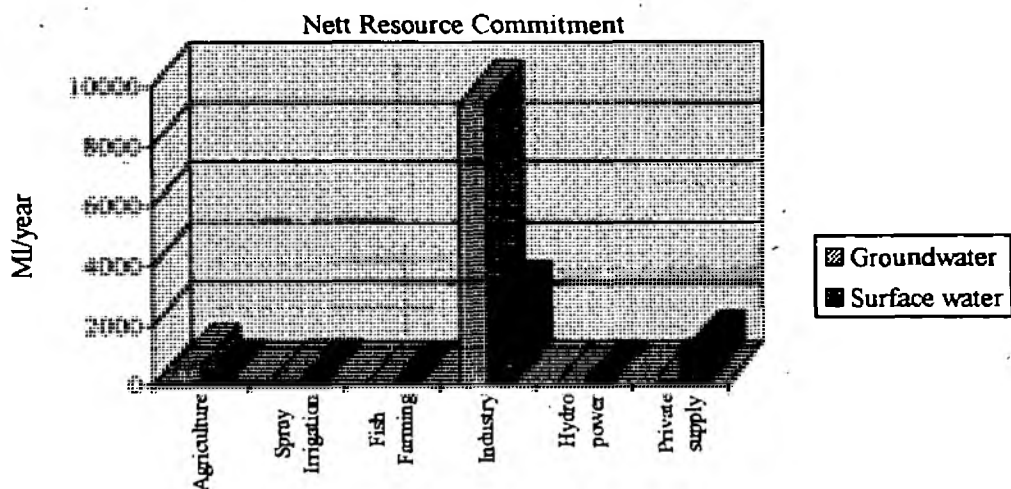
Figure 2: Annual Licensed Abstraction



Licensed abstractions can either be consumptive or non-consumptive. Consumptive abstractions use most of the abstracted water with little returned to the original point of abstraction. Examples are public water supply, industrial processing and spray irrigation. Non-consumptive abstractions use only a small proportion of the abstracted water and return the remainder to the vicinity of the abstraction point. Examples include fish farming, hydropower generation and amenity features such as ornamental lakes. Consumptive uses have potentially more impact on rivers than non-consumptive, though the latter can have local impacts depending on the rate of abstraction and local conditions.

Consumptive uses account for 30% of the groundwater and 64% of the surface water annual authorised abstraction volume. The majority of licensed consumptive use, other than public water supply, is accounted for by the abstractions for industrial purposes. The nett resource committment is shown in Figure 3.

Figure 3: Nett Resource Commitment



Nett resource commitment = Authorised quantity x Proportion of abstraction **not** returned.

Public Water Supply

Abstractions for public water supply represent 40% of the total annual licensed volume in this catchment. South West Water (SWW) are responsible for maintaining this supply and abstract water from a combination of surface water sources. The area covered by this plan lies within the Colliford Strategic Supply Zone (see Map 17: Public water supply distribution system) and so is fed by sources both within and outside the plan area. Within the area the company operate three reservoir schemes, Stithians, College and Argal. Stithians is also supported by a licensed surface water abstraction used to augment (top up) reservoir storage. The operation of Stithians to partly meet demands in the west of Cornwall means that the area supplies need to be supported by imports of water from Colliford Lake and the River Fowey via the Cornwall Spine Main.

The three licences to abstract water from sources within the catchment operated by SWW are described in Table 18. These authorise a total maximum abstraction of 106.4 Mld. All licences are for surface water abstractions.

Map 18 - Surface Water Abstractions



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For the Colliford Strategic Supply Zone SWW currently has available resources totalling 166 Mld. With average demand in the early 1990s of 151 Mld this supply zone enjoys a surplus of some 15 Mld.

Table 18 : Public water supply abstractions

Source	Daily Licensed Quantity (MI)	Annual Licensed Quantity (MI)	Comments
College & Argal Reservoirs	12	3,485	Reservoirs combined and operated as one source.
Stithians Reservoir	39.8	10,320	Compensation release of 2.76Mld.
River Kennal	54.6	4,091	No abstraction of river water when flows are less than 5.62Mld. Abstraction is for the purpose of increasing the rate at which Stithians Reservoir refills during the winter.

Future Demand

The extent to which demand for potable water supply will increase over the next 30 years will depend upon a number of factors including population growth, numbers of new dwellings, personal use of water, level of economic activity, measures to reduce demand and climate change.

We have produced demand forecasts for the area served by SWW's Colliford Strategic Supply Zone (Tomorrow's Water¹¹) looking at two scenarios. The 'high' and 'low' demand forecasts for the Colliford Zone are shown in the table below for 2001, 2011 and 2021.

Table 19 : Future demand forecasts for SWW's Colliford Strategic Supply Zone

Strategic Supply Zone	Demand Forecast Scenario	Forecast Average Demand (MI/day)		
		2001	2011	2021
Colliford	High	169	195	222
	Low	148	164	183

Comparing these forecasts to the current drought reliable yield of 166 MI/d shows that the supply zone could be in deficit by 2011 under the 'high' scenario.

Map 19 - Groundwater Abstractions



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Future Options

We have a duty to secure the best use of developed resources whilst also having regard for the statutory obligations of SWW to provide a reliable supply of potable water to their customers. Whatever the precise pattern of future demand growth the Environment Agency will adopt a staged approach whereby we would ensure that all appropriate demand management, leakage control and resource management options are exhausted before considering the development of new resources (see Tomorrow's Water11, for more details).

Demand Management and Leakage Control

We will encourage the promotion of a range of demand management measures including metering of all new properties, selective metering in areas where resources are under stress and the promotion of efficient water use through water saving appliances.

Before considering applications for additional public water supply licences, we expect the water company to set economic leakage targets. We will audit these targets and expect SWW to demonstrate to us that they are being achieved.

Resource Management

We will also require the water company to show us that all existing sources are being managed properly and that where feasible, water will be transferred from areas of surplus to areas of deficit. The aim is to ensure optimal conjunctive use of the various sources within the Zones, whilst taking into account environmental considerations. We will ensure that Operating Agreements are reviewed at regular intervals to ensure that the operation of the Colliford Zone keeps pace with growth in demand, in particular the peak demands associated with drought. Improvements to SWW's infrastructure would help to alleviate the problems of meeting peak demands in parts of west Cornwall and thus maximise the potential of using Colliford Lake conjunctively with local sources.

Resource Development

If, despite these measures, new resources are required, the Environment Agency would favour pump storage schemes for the strategic Colliford reservoirs. These schemes would involve the pumping of water from downstream in a catchment at times of high flow. This would be attractive to the Environment Agency because best use would be made of existing reservoirs and it would probably delay the need for any new reservoir developments beyond the planning horizon of 2021.

Private water use

The total volume of licensed abstractions for purposes other than public water supply represents an average of 73.8 Ml/d. Of this averaged total 39.4 Ml/d is from groundwater sources and 34.4 Ml/d from surface water sources. There are 634 groundwater and 64 surface water licences for private purposes. The exploitation of water resources for private use in the Fal Catchment is based mainly on a few large surface water abstractions. The large number of small groundwater licences, especially for general agricultural purposes, reflects the presence of minor aquifers in the catchment.

By multiplying the authorised quantity by the proportion of the abstraction not returned for each category of licenced purpose it is possible to define the current net resource commitment. The current annual net resource commitment for the Fal Catchment for purposes other than public water supply is 5831Ml or an average of 16 Ml/d.

Although there are several Licences of Entitlements (LoE) within the catchment area none of these have been identified as causing significant impact on the watercourse.

Predictions of future growth in non-public water supplies are more difficult to assess than those for public water supply. Water use is greatly influenced by numerous and differing political, economic and environmental factors and any predictions are always likely to be subject to the unpredictable influences of commercial markets.

It is possible that there may be local environmental problems associated with full uptake of the few consumptive private abstractions in the catchment. The Agency will continue to monitor the net commitment to private water abstractions and have a regard to the amount of licensed volume take up and its effects. Future abstraction needs will be addressed in the standard way through the abstraction licensing procedure.

Industry

The forecast growth rate for industry to 2021 is 0.75% per year. However, the growth rate is dependent on other factors:

- changes in the economy; during recession there has been a marked decline in the uptake of private licensed resources for industrial use
- abstraction of water is not a necessary adjunct to industrial growth

Therefore, in reality future growth in industrial water use in the catchment will probably be limited to currently established industries and could largely be met by the increased uptake within already licensed quantities. The largest industrial user in the catchment is the China clay industry - for specific discussion see page 26.

Domestic Water Supply

Private water supply abstractions for domestic purposes tend to be very small and to be dispersed across the catchment, in contrast to the more concentrated point sources for public water supply. A large increase in applications is not anticipated.

It is possible that there may be local environmental problems associated with full uptake of the few consumptive private abstractions in the catchment. The Agency will continue to monitor the net commitment to private water abstractions and have a regard to the amount of licensed volume take up and its effects. Future abstraction needs will be addressed in the standard way through the abstraction licensing procedure.

Drought Orders

Following the 1995 drought, there was a drought order granted for Stithians. This resulted in a reduction in the compensation flow to the River Kennal from 0.0316 cumecs to 0.0158 cumecs from September 1995 to January 1996. Effects on the fisheries were monitored during the time the order was in effect. Extensive observations were carried out. Although river levels were very low there were no signs of fish in distress. Juvenile fish monitoring during the summer of 1996 showed no obvious detrimental impact on the river.

Protecting the Quality of Drinking Water Supplies

EC Surface Water Abstraction Directive 75/440/EEC

The Directive 'concerning the quality required of surface water intended for the abstraction of drinking water in the Member States' (75/440/EEC), protects the quality of surface water used for public supply. This Directive ensures that water abstracted for public supply meets certain quality standards and is given adequate treatment before entering public water supplies.

The Directive sets out imperative standards that must be achieved, and guideline standards that Member States should aim to achieve, for water for public supply which is to be given different levels of treatment.

We are responsible for monitoring the quality of designated surface water abstractions and reporting the results to DoE who decide whether the standards in the Directive have been met. Where standards are not met, we are responsible for identifying sources of pollution and making sure that improvements are made.

Derogations

Where EC Directives standards, particularly those for metals and/or pH, are not met due to natural causes, we can recommend a derogation, that is these standards will not apply.

There are three identified surface water abstraction points in the Fal Catchment. These are shown on Map 2.

Compliance

The standard for dissolved iron was exceeded in College Reservoir in 1993 and 1995. A derogation for dissolved iron has been applied at College Reservoir since 1994.

The standards for colouration were exceeded at Stithians Reservoir in 1993, Argal 1993 and 1995 and at College Reservoir in 1993, 1994 and 1995. All three sites are upland moorland sources, with naturally occurring high colouration derived from humic acids in the peaty soils. A derogation for colouration has been applied at College Reservoir since 1993 and at Argal Reservoir since 1995.

All 3 sites exceeded the standards for phenols and/or dissolved and emulsified hydrocarbons in the period 1993 to 1995. We are concerned about the suitability of the methods for analysis for dissolved and emulsified hydrocarbons as specified in the EC Surface Water Abstraction Directive. Exceedances of the Directives standards cannot always be attributed to polluting discharges, and we suspect that some exceedances may be due to natural compounds resulting from the breakdown of natural vegetation. We are involved in discussions with the Department of Environment, with a view to reviewing the analytical methods used. The Agency will continue to report exceedances of the EC Surface Water Abstraction Directive standards. However, as there are no obvious sources of these compounds in the catchment we are not planning to undertake any further studies until we receive direction from the DoE.

Environmental impacts of abstractions

A water resources report²⁴ for the NRA highlighted three sites on the River Fal and one site on The Lizard where abstractions which might be having some impact on the environment, though the significance of these impacts was 'small' or 'minor'. No actions are therefore planned at these sites. However, routine monitoring and enforcement by the Agency should pick up any local problems, and this will be reviewed if circumstances change.

Groundwater Protection

The EC Groundwater Directive (80/68/EEC) controls the release of certain substances to groundwater. There are two lists of substances; those in List 1 should not be released, while those in List 2 can only be released in limited amounts. We ensure that the principles of the Groundwater Directive are implemented through our waste licensing activities and through our work to control the discharge of effluents to soakaways.

There are no statutory standards for the quality of groundwater and because of the difficulties in obtaining and interpreting information we have only a limited understanding of groundwater quality. In this catchment, mine drainage is known to have contaminated groundwater within areas of metalliferous mining, see page 100.

Groundwater Protection Policy

In 1992 the NRA published its Policy and Practice for the Protection of Groundwater. This document, which we fully endorse, explains why we must safeguard the quality and flow of water in aquifers and outlines how we and other organisations can respond to the threats posed to groundwater by the way we use and develop land.

Our document contains policy statements in the following areas:

- physical disturbance of aquifers affecting quality and quantity
- waste disposal to land

PART 2: SUPPORTING INFORMATION

- contaminated land
- disposal of sludges and slurry to land
- discharges to underground strata
- diffuse pollution
- other activities affecting groundwater quality

We are presently mapping the vulnerability of groundwaters in England and Wales and are working on a classification of all areas at 1:10,000 scale. The results of this work for Cornwall will be published in 1997.

We work with Planning authorities to minimise the risks posed to groundwater from development and land use changes. The greatest protection is given to the most vulnerable areas around water supply boreholes.

Map 20 - Effluent Disposal, SWW Consents



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Fal and St Austell Streams Local Environment Agency Plan
Environment Agency

Effluent Disposal

Here we consider the disposal of effluent directly to rivers, estuaries, the sea or into the ground.

Effluent includes sewage, industrial and farm wastes. We regulate the disposal of effluent by issuing consents to control discharges and by taking action if a river is accidentally polluted.

Our Objective

To protect the water environment from harm caused by the disposal of effluent and allow the widest possible use to be made of rivers.

The Role of the Environment Agency

We have duties and powers to:

- authorise discharges through a system of consents. It is illegal to discharge sewage effluent or trade waste without the consent of the Environment Agency. Before making a discharge it is necessary to apply for a consent. We look at the circumstances in each case. We can refuse a consent if a discharge will cause an unacceptable deterioration in water quality
- monitor discharges to see if they comply with consent standards. We may prosecute dischargers if they exceed consent conditions
- prevent illegal discharges
- direct investment in sewerage and sewage treatment by the water companies in line with AMP2 guidelines (see section below on Improvements to South West Water (SWW) Discharges).

Improvements to South West Water (SWW) Discharges

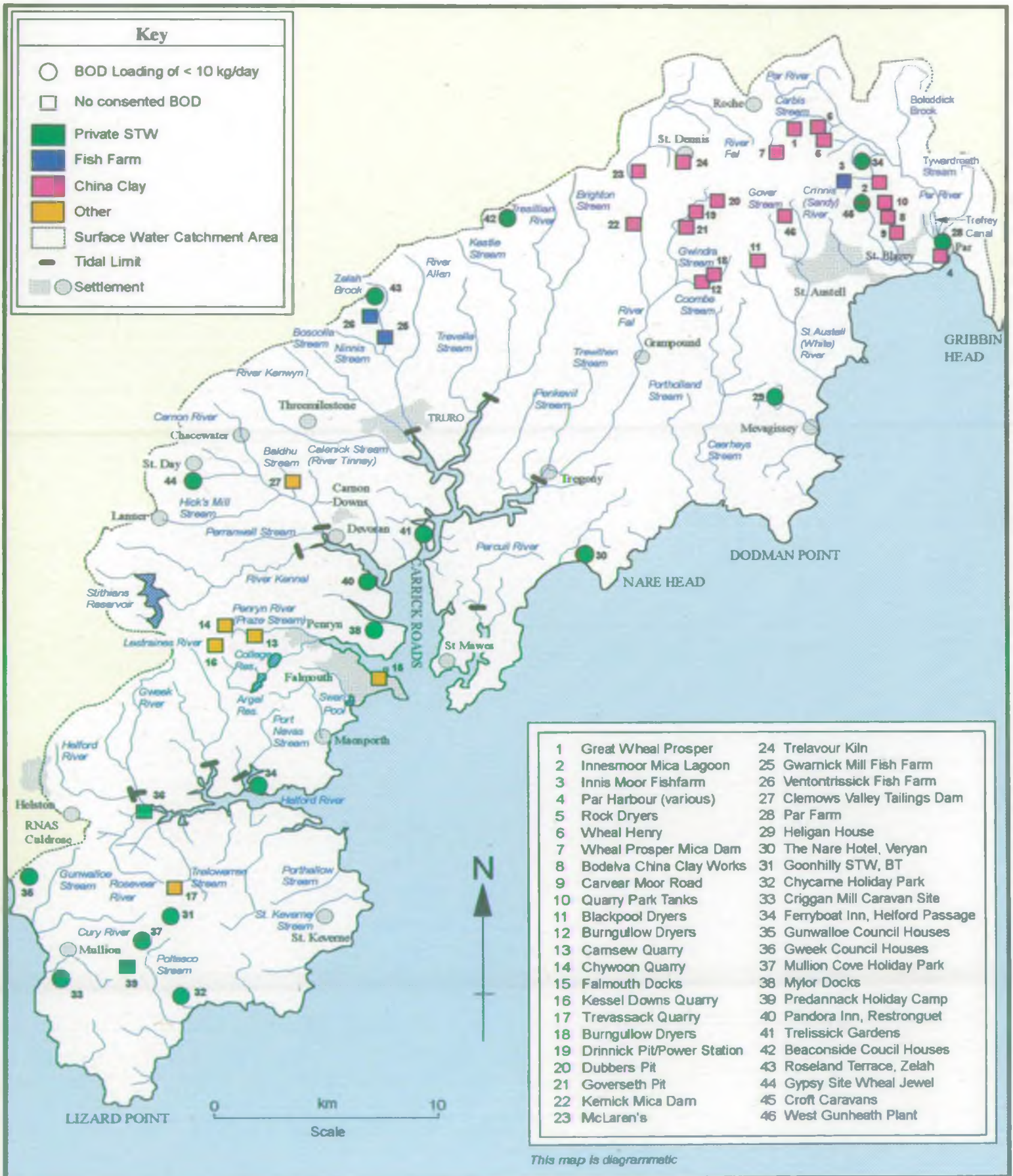
Improvements to SWW's discharges over the next 10 to 15 years are subject to available funding approved by OFWAT, the water industry's economic regulator. A Strategic Business Plan, (Asset Management Plan 2 (AMP2)), for these schemes was developed based on guidelines agreed between the NRA, Department of the Environment (DoE), Water Services Companies and OFWAT. The plan was submitted to OFWAT early in 1994.

In order of priority, schemes included are:

1. schemes required to meet and maintain **current** EC and domestic statutory obligations
2. schemes required to meet and maintain **new** EC and domestic statutory obligations
3. schemes which already have been separately justified, required to maintain river quality relative to the 1990 NRA survey of water quality or to achieve river or marine improvements.

OFWAT declared the associated customer charging base in July 1994. This was subsequently reviewed by the Monopolies and Mergers Commission at SWW's request. We have agreed a programme and timetable for improvement schemes in the catchment and these are described in Issue 14: Impact of sewage discharges. We are currently negotiating a programme for improvements to intermittent discharges with SWW.

Map 21 - Effluent Disposal, Private and Trade Consents



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Fal and St Austell Streams Local Environment Agency Plan
Environment Agency

Local Perspective

There are two types of consented discharges in the catchment:

- **Continuous** from sewage and trade wastes.
- **Intermittent** from storm sewer overflows and emergency overflows.

These are either discharges to ground or surface waters.

Continuous Discharges

Within the catchment there are 31 SWW sewage treatment works (see Map 20) of which 6 are small works which receive no trade effluent and have descriptive consents, where no numerical quality standards are imposed.

There are 22 consented private sewage treatment works of greater than 5m³/day volume (see Map 21).

The past, current and projected proportion of population on mains sewerage systems are given in Table 20 (Source: SWW, Forward Planning Dept.).

Table 20 : Percentage of population on mains sewerage

	% of population on mains sewerage - 1992	Forecasts of % population connected to mains sewerage - 2011	
		Low	High
St Austell Streams	88.25	89.80	90.00
River Fal	79.40	82.20	83.10
TOTAL	82.00	84.40	85.20

Pollution Events

Table 21 shows there are, and will continue to be, a significant proportion of private discharges.

Table 21 : Pollution incidents arising from industrial and sewage effluents 1993 to 1995

Pollution Incidents	Major	Significant	Minor
Industrial			
1992	1	15	86
1993	0	6	75
1994	0	5	95
1995	0	7	60
Waste Water Treatment			
1992	0	8	95
1993	0	7	83
1994	0	6	76
1995	0	3	88

Our national policy is to discourage the proliferation of small private treatment plants in favour of mains connections. We will refuse consent applications where people on mains sewerage wish to change to private discharges.

There are currently 33 recommended areas of development restraint in the catchment (see Table 14). Restraints may be for water quality reasons; where sewage treatment works (STWs) are not complying with their consents, where they are having an environmental impact on receiving waters, or are causing EC Directive failure. Development restraints are requests by the Environment Agency to planning authorities to prevent development which would require connections to mains sewerage systems where this would make an existing problem worse.

The proliferation of septic tanks causes environmental effects in several areas. Development restraints are in force for this reason in Trethurgy, Lanjeth, Porthallow and Zelah.

Industry

There are 25 consented trade discharges in the catchment, mainly for china clay (see Map 21: Effluent Disposal, Private and Trade Consents).

Deemed Consents

There are numerous deemed consents within the catchment, discharging to the estuary or tidal waters. These are historic consents (covering usually basic effluent systems or crude discharges) where there has not been legislation to ensure improvements. Many will have to make improvements to comply with EC Directive compliance dates. In advance of this we are involved in negotiating improvements for the discharges, and much progress has already been made.

Intermittent Discharges

There are numerous intermittent discharges in the catchment, for example storm sewer overflows. Most are not known to cause significant problems.

EC Dangerous Substances Directive 76/464/EEC

The Dangerous Substances Directive 'on pollution caused by certain substances discharged in the aquatic environment of the community' (76/464/EEC) protects the water environment by controlling discharges that contain harmful substances to rivers, estuaries and coastal waters.

This Directive describes two lists of compounds. List 1 contains substances regarded as particularly dangerous because they are toxic, they persist in the environment and they bioaccumulate. Discharges containing List 1 substances must be controlled by Environmental Quality Standards (EQSs) issued through Daughter Directives. List 2 contains substances which are considered to be less dangerous but which can still have a harmful effect on the water environment. Discharges of List 2 substances are controlled by EQSs set by the individual Member States.

We are responsible for authorising, limiting and monitoring dangerous substances in discharges. We are also responsible for monitoring the quality of waters which receive discharges containing Dangerous Substances and reporting the results to DoE who decide whether the standards in the Directive have been met. Where the requirements of this Directive are not met, we are responsible for identifying sources of pollution and making sure that improvements are made.

List 1 Substances

Table 22 : List 1 monitoring

Site	Substance(s) monitored
St Austell Menagwins STW	Mercury, Cadmium
South Crofty plc, Clemows Valley	Cadmium (2 sites)

There were Environmental Quality Standards exceedances for cadmium in the receiving waters at Clemows Valley in 1992, 1993, 1994 and 1995. Non-compliance at these sites are the result of the discharges from the Wheal Jane Mine, County Adit and other mine discharges, see page 29.

There are 3 National Network sites which also monitor for the Directive. There was an EQS exceedance for chloroform at Pentewan Bridge in 1992. Data for this site shows that only one failure occurred, in October. The source of this failure was not identified. There was an EQS exceedance for cadmium at Devoran Bridge in 1992, 1993, 1994 and 1995. This is a result of the discharges from the Wheal Jane Mine complex, County Adit and other mine discharges, see page 29.

List II Substances

Twenty-eight sites are monitored for List II substances in the plan area.

Fifteen of the sites monitor china clay discharges. The following china clay discharges may have caused/contributed to EQS exceedances in the receiving waters: Wheal Henry, Wheal Prosper Mica Dam, Innesmoor Mica Lagoon, Rock Driers, Blackpool Plant and Driers, Kernick Mica Dam, Goverseth Plant, Parkandillick, Currian Catch Pit, Burngullow Driers and Tube Press, Trevalour Kilns, Melbur Driers, McLarens and Dubbers Catch Pit. The Environmental Quality Standards exceedances occurred in the period from 1992 to 1995. Any one or all of the following substances exceeded the EQS in the receiving water: pH, copper and zinc. Where EQS exceedances has occurred we will carry out studies to determine if the EQS failure is due to natural sources or as a result of the discharge. See page 27.

There was an EQS exceedance at the two sites at Clemows Valley for copper, zinc, nickel, arsenic and iron in 1992; copper and zinc in 1993; and copper, zinc, iron and pH in 1994; and copper, zinc and arsenic in 1995. Non-compliance at these sites are the result of the discharges from the Wheal Jane Mine complex.

There was an EQS exceedance in the receiving waters at North Fal STW for copper in 1992 and zinc in 1993. We have established that this failure was not due to the discharge from the STW. We will continue to monitor this site under the EC Dangerous Substances Directive for the next two years.

Falmouth Dockyard is a designated site for tributyltin (TBT), copper, zinc, lead and nickel. There was an EQS exceedance for tributyltin at this site in 1994 and 1995 and copper in 1994. Falmouth Docks are engaged in the application and removal of anti-fouling compounds from ships.

There are five main inputs of TBT : 1) The discharge of contaminated waste from the stripping and painting of ships. 2) The leaching of TBT from ships. 3) Contaminated estuary sediments in the vicinity of Falmouth Dockyards. 4) SWW discharges. 5) Illegal use of TBT.

We have issued an IPC Authorisation to Falmouth Docks which should result in a significant reduction in the quantity of TBT discharged to the Fal Estuary in the future, see page 44. However there will still be EQS exceedances in this area.

The sediments in this area have the highest level of recorded contamination of TBT in the UK (Waite & Waldock, 1993). Contamination has arisen as the result of the activities at Falmouth Docks, as well as the use of TBT anti-fouling compounds on boats using the Fal Estuary. Disturbance of these sediments principally by ship movements also contributes to the exceedance of the EQS for TBT. Falmouth Docks at present are unable to undertake dredging due to the problems associated with the disposal of TBT contaminated sediments.

Annex 1A Reduction Programme

At the second and third North Sea Conferences in 1987 and 1990, the UK Government made a commitment to reduce the loads (load = concentration x flow) of certain substances (except dioxins), known as Annex 1A substances, entering UK tidal waters from rivers and direct discharges. Annex 1A substances are those which are toxic, persistent and/or bioaccumulative.

By 1995, loads of most Annex 1A substances were to have been reduced by 50 %, but loads of mercury, cadmium and lead were to have been reduced by 70 %. However, for some substances reductions have not yet been achieved, and at the fourth North Sea Conference in 1995 it was agreed to aim to achieve these reductions by 2000.

We are responsible for monitoring and identifying significant sources of Annex 1A substances. Loads are calculated by multiplying average concentration by average flow to give a product in kg/year or g/year. We identify "significant sources" by ranking loads of Annex 1A substances, in rivers and direct discharges, in decreasing size order. A load is considered to be significant if it belongs to the group of loads that contribute to the first 95 % of the total load entering tidal waters.

Five sites in the Fal Catchment are monitored for Annex 1A purposes: Par STW, the River Par at St Blazey Bridge, the River Fal at Tregoney Gauging Station, Falmouth Docks and the River Carnon at Devoran Bridge.

Metals (Cadmium, Copper, Zinc, Lead, Nickel, Arsenic)

The River Par at St Blazey Bridge was a significant site for copper in 1990, 1992, 1993 and 1994. Fifty-seven mines have been identified in the Par Catchment, of which it is thought twenty-one were mined for copper. Dangerous substances data for tributaries of the Par River show elevated levels of metals, including copper, which exceed EQSs.

During the period 1990-1994 significant loads of copper, zinc, lead, nickel and arsenic were found at Tregoney Gauging Station (River Fal). These high loads are due to the local geology, and historic mining activity.

Significant loads of cadmium, copper, zinc, lead, nickel and arsenic were found at Devoran Bridge (Carnon River) in the period 1990-1994. The high recorded loads of metals are a result of the extensive historic mining that has taken place in the catchment, including the particular inputs from County Adit and the Wheal Jane complex.

Organic Compounds

Par (Spit) STW was a significant site for trichloroethane in 1991. Trichloroethane is used as an industrial solvent and as an industrial cleaning agent. Since 1991 the levels of trichloroethane have declined with the majority of results being below the limit of detection and we are planning no further action. A new works has been constructed.

Falmouth Docks Outfall was a significant site for organotin compounds in 1991, 1992, 1993 and 1994. See EC Dangerous Substances Directive page 122 and page 44.

EC Urban Wastewater Treatment Directive 91/271/EEC

The EC Directive "concerning urban wastewater treatment" (91/271/EEC) specifies minimum standards for sewage treatment and sewage collection systems.

This Directive specifies secondary treatment for all discharges serving population equivalents greater than 2,000 to inland waters and estuaries, and greater than 10,000 to coastal waters. Discharges below these population equivalents receive "appropriate" treatment as defined in the AMP2 guidance note. We are responsible for making sure that discharges receive the level of treatment specified in this Directive.

This Directive also allows higher standards of treatment for discharges to 'sensitive' areas. Sensitive areas are those waters which receive discharges serving population equivalents of greater than 10,000, and are or may become eutrophic in the near future. We carry out monitoring of potentially sensitive areas, and present this information to DoE who decide whether the watercourse is sensitive. We then ensure that discharges to such sensitive areas receive a higher level of treatment. A number of discharges have been identified as requiring improvement under the Directive. These are given on 41.

Map 22 - Waste Management



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Fal and St Austell Streams Local Environment Agency Plan
Environment Agency

Waste Management

Our Objective

To prevent environmental pollution through the management of wastes.

The Role of the Environment Agency

We have duties and powers to:

- Licence waste management sites.
- Ensure that new facilities have minimal adverse environmental impact by including conditions of operation within Waste Management Licences.
- Ensure that site operators make plans to monitor for changes in the quality of ground and surface waters and for the presence of landfill gas in and outside of landfills.
- Ensure that sites are maintained and operated properly by means of regular inspections.
- Take enforcement action to prevent or control pollution occurring from a licensed site or where waste has been handled or disposed of illegally.
- Undertake surveys of wastes arising to assist in the planning of waste management.

We regulate the storage, treatment, processing and disposal facilities of controlled wastes. Each type of operation may impact on the environment but landfill disposal in particular can result in the formation of a highly polluting liquid known as leachate, or landfill gas containing methane, which is potentially dangerous and also a 'greenhouse gas'. Operation of waste sites can also generate noise, dust, odour and unsightliness, and vehicle movement may cause a highway nuisance. It is therefore important that the potential impact on the proposed locations for new facilities is given careful consideration.

The NRA previously published its views on landfill in its 'Position Statement on Landfill and the Water Environment'²⁵. In this statement the concepts of waste minimisation and recycling are stressed. These concepts have been further stressed in the Government White Paper 'Making Waste Work'²⁶ which sets out the draft Government strategy for the sustainable management of waste. The Environment Agency will itself be forming a Regional Waste Strategy based on the recommendations of the White Paper.

Government strategies

In December 1995 the DoE produced the strategy for sustainable waste management based on a hierarchy of waste reduction, reuse, recovery and, lastly, disposal. In it they have set two primary targets; to reduce the proportion of controlled waste going to landfill to 60% by 2005 and to recover 40% of municipal waste by 2005. They have also made a commitment to a third target; by the end of 1998, to set a target for overall waste reduction. These primary targets are supported by a number of more detailed targets. In addition the Government encourages waste to be managed locally and not transported over unreasonably long distances.

On 1st April 1996, we became responsible, under the Environment Act 1995, for an enlarged system of waste regulation and control. We have a duty to undertake a detailed national survey of waste arisings as part of the formative work leading towards the publication of a statutory National Waste Strategy due in 1998. This work will, it is hoped, substantially improve the quality of waste arisings statistics and assist greatly in the preparation of waste local plans.

Landfill tax

The introduction of the Government Landfill Tax in October 1996 is expected to have a significant impact on waste management. The charges made to landfill operators are likely to be passed on to their customers by raising the "gate fee". The principle behind the tax is to provide a financial incentive to waste producers to minimise the waste they produce or to use methods of disposal which have less of an environmental impact. It is possible that some waste producers will simply dispose of the waste at unauthorised sites to avoid the rise in costs. Illegal waste disposal activities can cause pollution and we treat them very seriously. Regulation officers examine all such activities and enforcement action is taken where necessary. Within Cornwall the number of licensed landfill sites has remained fairly static since a number were surrendered at the time Fees and Charges were introduced

about two years ago. More recently, during the period leading up to the introduction of the Landfill Tax, a number of operators have expressed their intention to set up waste recycling or recovery plants. Some schemes are currently in the planning stages and this indicates there will be an increase in the number of such licensed activities rather than landfill operations.

Local Perspective

Waste production

The following information on estimated waste produced in Cornwall comes from the Cornwall County Council waste planning strategy, which is in production.

The accurate calculation and estimation of current arisings for individual waste streams in Cornwall is at best, fraught with difficulty. Owing to difficulties in the collection of the information and known shortcomings, the statistics for waste arisings indicated below are acknowledged to be of variable degrees of reliability and must therefore be treated in most instances with caution. The figures given for household and special waste arisings are, however, dependable, but for all other types of waste a "best estimate" has been made in consultation with the appropriate agencies and private sector operators.

Current estimates of Cornwall's annual waste production, as set out below, is around 30 million tonnes. This is dominated by wastes arising from mining and quarrying and agriculture.

Table 23: Annual estimated waste production in Cornwall

Waste Type	Quantities (million tonnes)	%
Construction and Demolition	0.2	0.6
Other Industrial	0.6	1.8
Household & commercial	0.28	0.9
Sewage sludge	0.13	0.45
Mining & quarrying	22	75
Agriculture	6	20
Dredged spoils	-	
Others	0.073	0.02
Total	29.28	100

Waste disposal facilities

There are two landfill sites in the catchment which have been licensed to accept domestic, commercial and industrial wastes: United Mines, near St Day and Tresize, near Goonhilly.

United Mines Landfill is the largest operating landfill site in Cornwall, a 100 acre site within an area formerly extensively mined for metalliferous ores. The site accepts approximately 200,000 tonnes per annum and receives all household waste from the west of Cornwall.

There is no engineered base for containment and the site operates on dilute and disperse principles with a partial leachate collection system involving recirculation of the liquid back over the waste to achieve some degree of reduction. Available evidence indicates that most of the leachate generated within the waste drains into the underlying mine workings and is subsequently discharged into the River Carnon either through the County Adit or via mine water pumped from Wheal Jane mine. We continue to monitor the site closely under the requirements of the waste management licence to allow us to assess the impact of the site on the local environment. Information that we have currently

available indicates that substantial dilution of the leachate is taking place, and that impact on the water environment is minimal.

Tresize Landfill is now closed. Some 500,000 tonnes of putrescible and other wastes were deposited. The site was operated on dilute and disperse principles, although leachate management by spray irrigation was commenced before site closure. The leachate is now being sprayed onto the grassed surface of the tip. This practice is continuing as part of post-closure aftercare and is expected to be required into the next century until all biodegradation processes have ceased at this site. The irrigation activity is subject to waste management licensing with appropriate monitoring.

In addition to United Mines and Tresize landfills, there are eleven licensed landfill facilities in the catchment, nine of which are currently operating. Seven of these accept 'semi-inert' (Category B) wastes and two sites accepting 'strictly inert' (Category A) wastes. Thirty-five other landfills are now recorded as 'closed sites', which have previously accepted a wide variety of waste types, but were generally operated on a small-scale basis. These older landfills are not considered to have any significant impact on the catchment.

Recycling

Within the plan area there are a number of initiatives by local authorities to promote the reduction and re-use of waste, including recycling points. Current levels of achievement by Local Planning Authorities (Audit Commission figures) for the recycling of domestic waste for 1994/95 are:

Table 24: Recycling of domestic waste 1994/5

Local Authority	%
Kerrier District Council	8.0
Carrick District Council	9.6
Restormel Borough Council	7.5

Current proposals for new waste disposal sites in the catchment

The United Downs landfill is serving the western part of the county comprising the District Council areas of Penwith, Kerrier, Carrick and parts of Restormel.

Remaining capacity at United Mines is estimated to be approximately 5 years²⁷. The operators, County Environmental Services (CES) are seeking means of prolonging the life of the site and identifying new capacity for the future. CES submitted a planning application for the disposal of inert wastes (soil and rock) adjacent to the site but the Planning Authority refused to grant permission and an appeal has been dismissed.

Further proposals for future capacity are expected. These might be for extensions to existing sites, or more likely, new sites, which may or may not be within the plan area. Planning applications will be accompanied by environmental impact assessments which identify catchment issues. New putrescible landfill sites will require the use of engineered liners to contain potential pollutants.

Oil Pollution Prevention

The Lord Donaldson Inquiry Report highlighted the high level of vulnerability of our southern coastline and its estuaries. During 1993 and 1994 there were 34 maritime incidents in the UK coastal waters: 17 of which could have had serious implications for our regions coastline. The report also highlighted the need for improved strategies by all agencies involved with major oil spills.

The Agency is responsible in preventing, where practicable, the spread of oil inland from estuaries on incoming tides. We need to prepare action plans in consultation with Local Authorities, MAFF, English Nature etc., to protect wherever feasible sensitive areas of coastline and estuaries. All of these bodies are consulted during the survey.

In order to carry this forward we have started a process of sensitivity mapping and oil spill protection surveys.

Sensitivity mapping

Sensitivity maps contain a high level of data relating to the location/area of all the environmental features found in the Estuary, such as: Areas of commercial shellfish harvesting (including periods of greatest environmental sensitivity); ornithological sensitivity, amenity value, EC Bathing Waters, sailing marinas and moorings, Special Areas of Conservation, SSSIs, nature reserves, heritage coastline, geological features, marine conservation importance and habitat vulnerability along with basic tidal range information.

Sensitivity maps for the Fal and Helford have been completed in detail. However, they may require updating regarding the habitat sensitivity, location and type of sensitivity i.e. SSSI or SAC and Voluntary Marine Conservation Areas. Logistic plans of booming points and priorities have also been completed for the two estuaries.

This work is submitted by ourselves to the County Emergency Plan. This plan is headed by the County Council and should provide a joint response to major pollution emergencies.

Oil spill protection surveys

This next phase includes the assessment of practical booming points from the mouth of the Estuaries up into the higher tidal reaches, with these boom emplacements being prioritised, access points and other logistical points such as: access, boom types to be used, current and other tidal information, rendezvous points, the report and its accompanying plans are extremely useful should a marine oil pollution occur.

Falmouth area OIL pollution contingency plan (FOIL)

The FOIL Plan has been developed to mitigate the effects of oil pollution in the Fal and Helford Estuaries, the Carrick Roads, and within Falmouth Port area. The plan is the result of close co-operation between local authorities, Government Departments, statutory bodies, commercial enterprises and voluntary and charitable organisations.

Controlled Processes

The Role of the Environment Agency

The Environment Agency is the statutory authority in England and Wales for regulating the largest and most complex industrial processes which discharge harmful non-radioactive and radioactive waste to air, water and land. For non-radioactive processes we use a system known as Integrated Pollution Control (IPC). Operators of these controlled processes are required to have an authorisation to discharge waste. The Agency also regulates the release of radioactive substances.

We have duties and powers to:

- regulate processes and stipulate minimum technical specifications for processes following principles of Best Available Techniques Not Entailing Excessive Cost (BATNEEC) to minimise releases whilst having regard to the Best Practicable Environmental Option (BPEO)
- review authorisations every four years.

Two lists of processes have been prescribed by regulations for control:

Part A processes are potentially the most polluting processes and releases to air, water and land are controlled under Integrated Pollution Control (IPC) by the Agency.

Part B processes are potentially less polluting, and releases to air from Part B processes are controlled at a local level under a system of Local Authority Air Pollution Control. The Environment Agency may be involved with releases to water and land.

Part A and Part B processes are defined in The Environmental Protection (Prescribed Processes and Substances) Regulations²⁸.

We also have a responsibility to supervise and regulate the spreading of sewage sludges on agricultural land.

Integrated Pollution Control (IPC)

Authorisations are issued under Section 6 of the Environmental Protection Act 1990 to operate a particular manufacturing process. The authorisation comprises of many parts including the operation of the process and keeping records, improvement programmes and releases to air, water and land.

Aspects of the process not regulated by those conditions are subject to a general condition that the person carrying it on must use Best Available Techniques Not Entailing Excessive Cost (BATNEEC):

- a for preventing the release of substances prescribed for any environmental medium into that medium or, where that is not practicable by such means, for reducing the release of such substances; and
- b for rendering harmless any other substances which might cause harm if released into any environmental medium.

Conditions set out in authorisations included provisions requiring operators to manage, supervise and control their own sites and the process they operate, monitor their release, measure their performance against these parameters and report to the Agency. We review this data and monitor and enforce IPC consents.

Table 25 : Part A Controlled Processes in the catchment

Operator	Type of Business	Legislation covering regulation
Indian Queens Power Limited	Power generation	IPC authorisation under Environmental Protection Act 1990
A & P Falmouth Ltd.	Ship repair	IPC authorisation under Environmental Protection Act 1990
Chemviron Ltd., Blackpool Works	Dispersent manufacture	IPC authorisation under Environmental Protection Act 1990

Note: Information on Part B processes available from local authorities.

Information is made available to the public via the public register, annual reports and an annual Chemical Release Inventory (CRI). Statutory monitoring information is also held on the public register. The confidentiality of some processes and discharge information can significantly affect the commercial interests of a company if they were made public. We have discretion to withhold such information. Some Government sites, such as Ministry of Defence sites, can also be exempt from the register.

Falmouth Docks

The discharge is classified as an Annex 1A significant site for TBT. This site has exceeded Environmental Quality Standards under the EC Dangerous Substances Directive, for TBT and Copper (see page 122). We have issued an IPC Authorisation to Falmouth Docks. The IPC authorisation should, within 2 years, prevent or substantially reduce the releases of TBT from hull blasting and washing operations.. However, the IPC cannot deliver any improvements to historic contamination (the most significant contributor to EQS failure) or leaching from painted ships in the docks. There will still be EQS exceedances in this area.

Radioactive substances

The Environment Agency is the principal regulator in England and Wales under the Radioactive Substances Act 1993. This statute is concerned with the storage, use and disposal of radioactive substances, and in particular, the regulation of radioactive waste. Each site is assessed by the Agency and permission granted on the basis that the use of radioactive substances is justified and that operators are prepared to abide by conditions to safeguard human health and protect the environment. The permissions take the form of:

- certificates of registration for keeping and using radioactive materials; and,
- certificates of authorisation for the accumulation and disposal of radioactive waste.

There is 1 authorisation and over 20 registrations in the plan area.

Estimated number of days with 8-hour periods with ozone ≥ 50 ppb, 1990-94.

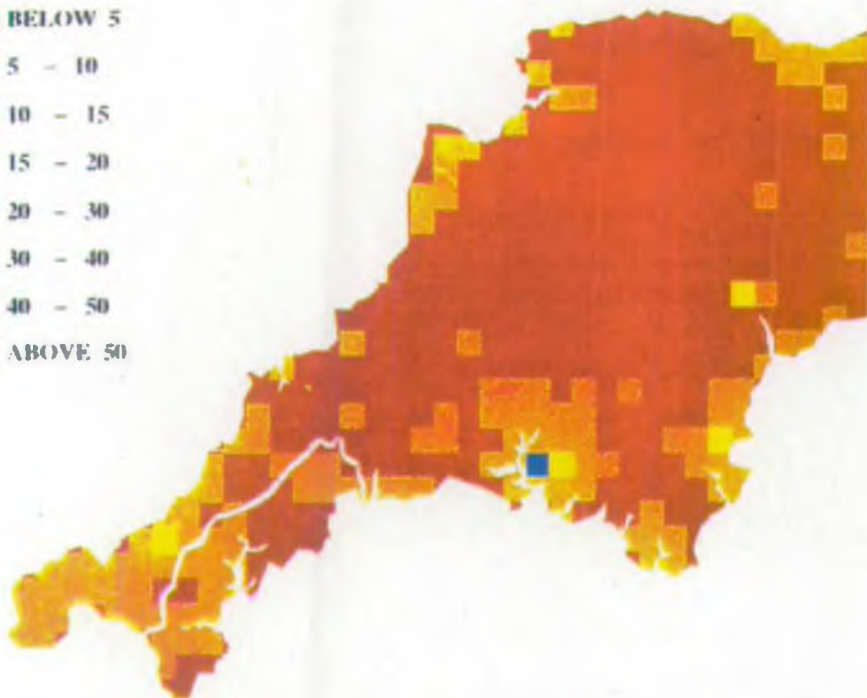
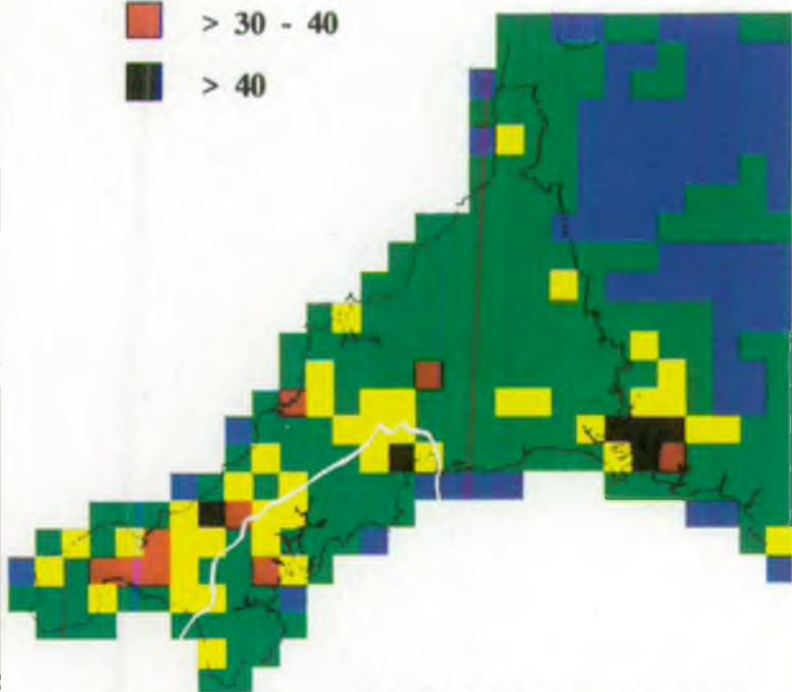


Figure 4: Ground Level Ozone

Figure 5: Estimated annual NO_x concentrations for 1994

Urban corrected annual NO_x concentrations for 1994

Concentration
($\mu\text{g m}^{-3}$)



Critical Loads Mapping and Data Centre, ITE, Monks Wood July 1996

Data acknowledgement: AEA Technology

Air Quality

Air quality is an indicator of environmental quality. Air pollution can damage plants and animals, buildings and have significant effects on soils and water. It can also cause serious problems for those with asthma, bronchitis and other respiratory diseases.

The Role of the Environment Agency

The Environment Agency has wide powers, but will need to work closely with others if environmental improvements are to be achieved. We will need to work in partnership with national and local government, business, industry, and environmental and conservation groups to maximise securing environmental improvements. This is particularly important with regard to local air quality, where the Agency is only one of a number of regulatory bodies.

Local Authorities have primary responsibility for local air quality. The Agency has powers to regulate air quality principally by operating a system called Intergrated Pollution Control (IPC) for certain industrial processes. The processes that are regulated are potentially most polluting industrial processes including large combustion plant, iron, and steel making, the chemical industry, solvent recovery and incineration plants. (See Controlled Processes).

The Agency also regulates landfill sites and in particular, landfill gas produced from the chemical and biological breakdown of waste at sites. This gas is principally a mixture of methane, a greenhouse gas which is flammable/explosive when mixed with air, and carbon dioxide, which is an asphyxiant.

The Roles of other organisations

The County Council Structure Plan contains policies on the need to control pollution and the County Analyst provides an analytical service for district Council Environmental Health Officers (EHO's). District Councils' Environmental Health departments regulate air pollution from thousands of industrial premises generally with a lesser potential to pollute than those the Agency regulates. The processes concerned are known as Part B process and only the releases to the air are controlled. District Councils also deal with a wide range of non-industrial and other forms of pollution, such as smells from domestic and agricultural premises, smoke from outdoor cable burning and noise pollution. Many local authorities monitor air quality in their area.

The Health and Safety Executive monitors the nuclear industry and issues site licences etc. The Department of Transport (DTp) enforces controls on vehicle manufacturers. The Police are responsible for controlling emissions from vehicles.

National Air Quality Strategy

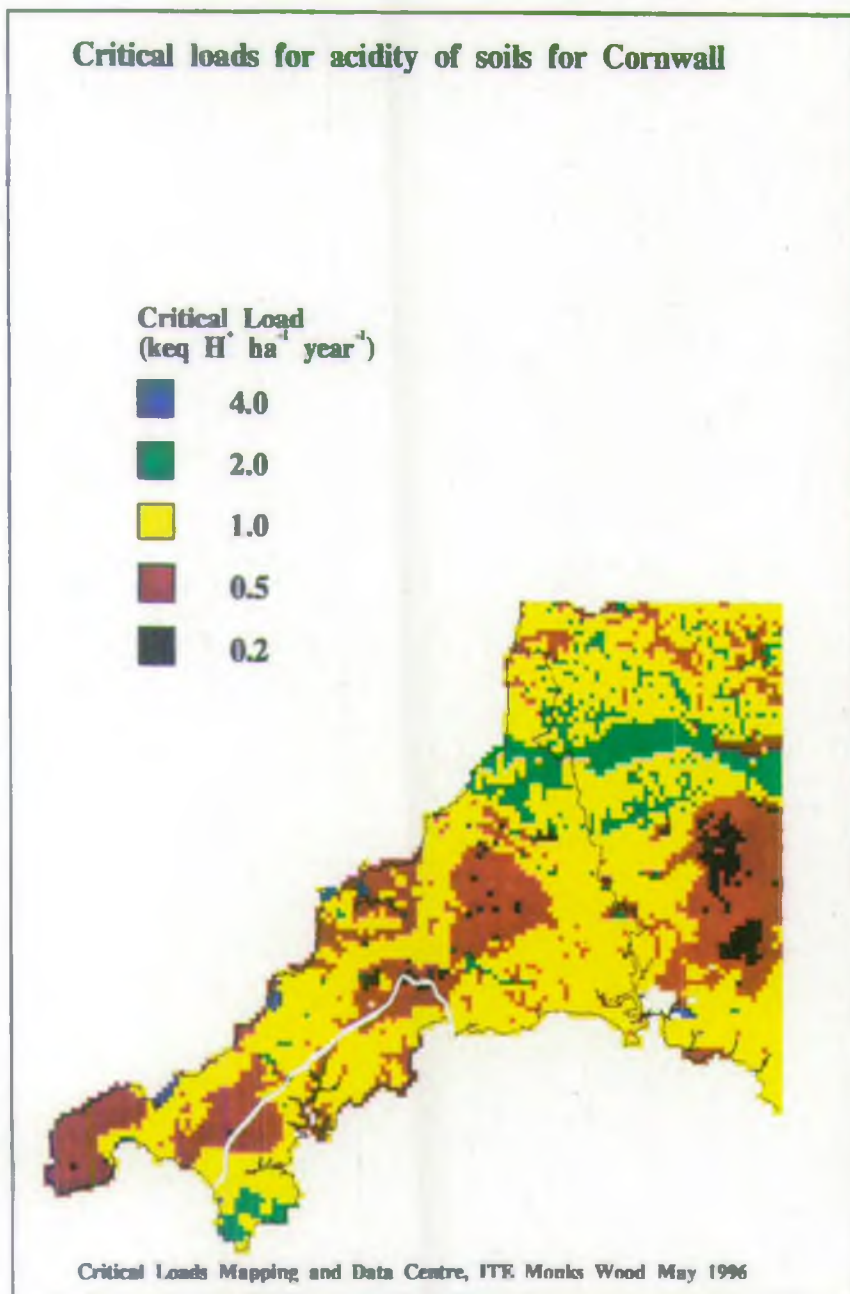
Under Part 4 of the Environment Act 1995 the Government is required to publish a national strategy for air quality including:

- a framework of standards and objectives for the pollutants of most concern
- a timetable for achieving objectives
- the steps the Government is taking and the measures it expects others to take to see that objectives are met.

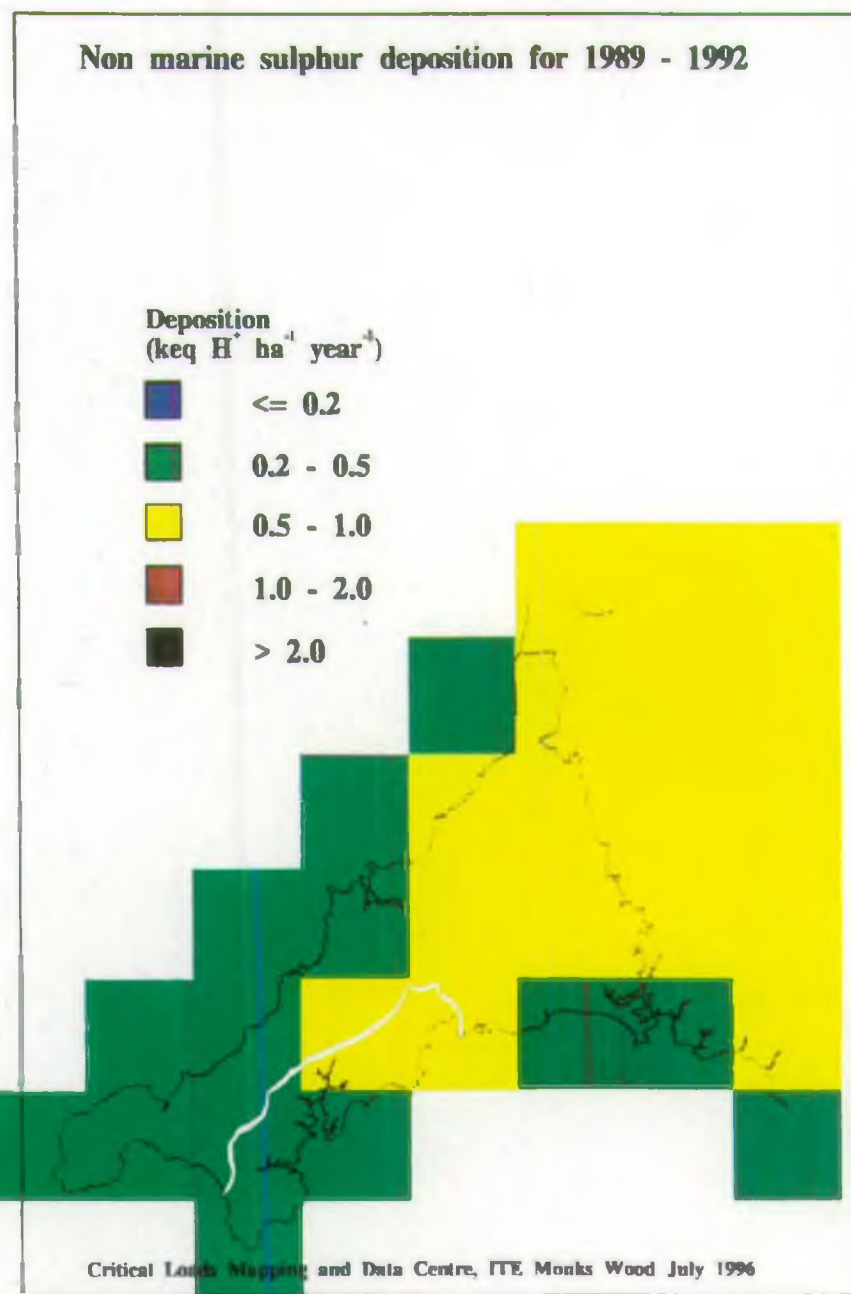
The strategy was published for consultation in August 1996. We will be working closely with local authorities to help achieve the objectives of the National Air Quality Strategy.

Pilot studies, to review and assess these national guidelines have been set up in 14 areas of the UK. A pilot study is taking place in Cornwall from 1996. Actions that come out of the pilot study, the Cornwall Air Quality Forum, may show the way forward to dealing with air quality issues in the catchment and the county.

Figure 6: Critical loads for acidity of soils and non-marine sulphur deposition



Data acknowledgement: CIAG soils sub-group



Data acknowledgement: AEA Technology

Local Air Quality Management Areas

Local authorities will be required to review present and future air quality against air quality standards and objectives shortly to be prescribed by the Government. The standards are likely to reflect advice from the Expert Panel of Air Quality Standards (EPAQS), the European Community and the World Health Organisation and will take into account potential risks, costs, and technical feasibility. The Government will set Air Quality targets which should be achieved throughout the UK by 2005. Local authorities will have to carry out periodic reviews of air quality in their areas. This may build upon existing records and reports.

Where standards are not being met or are not likely to be met an air quality management area should be declared (known as a "Designated Area"), and an action plan produced to improve air quality. This will require objective assessments together with appropriate monitoring and modelling studies. The Agency will liaise fully with local authorities and agree any maps or quotients representing air quality.

Ground Level Ozone

Ozone in the upper atmosphere shields the earth from harmful UV radiation. At ground level however, ozone can be a harmful pollutant damaging crops and building materials and causing respiratory difficulties amongst sensitive people. Ozone is not emitted directly from any man-made source in any significant quantities, but arises from complicated chemical reactions in the atmosphere driven by sunlight. In these reactions, oxides of nitrogen and hydrocarbons (derived mainly from vehicle exhausts) react in the atmosphere to produce ozone. These chemical reactions do not take place instantaneously, but over several hours or even days, and once ozone is produced it may persist for several days. In consequence, ozone produced at one site may be carried for considerable distances in the air, and maximum concentrations usually occur away from the source of the primary pollutants. The highest concentrations of ozone generally occur during hot, sunny and relatively windless days in summer.

In common with other parts of Southern England, ozone levels in the catchment are generally above those at which damage to vegetation may occur⁹. The Expert Panel of Air Quality Standards (EPAQS) recommend an Air Quality Standard for ozone in the UK of 50 parts per billion (ppb) as a running 8-hour average. Figure 4 shows the estimated number of days in the South West over which this recommendation would be exceeded.

The Department of Environment has published a UK strategy on the reduction of emissions that can produce ozone¹⁰. Nationally the Environment Agency will have an input into the reduction of volatile organic compounds (VOCs) and oxides of nitrogen (NO_x), both of which are precursors in the formation of ground level ozone. VOC and NO_x releases from IPC processes are controlled by limits in authorisations. These limits will be reduced over time as operators move towards new plant standards.

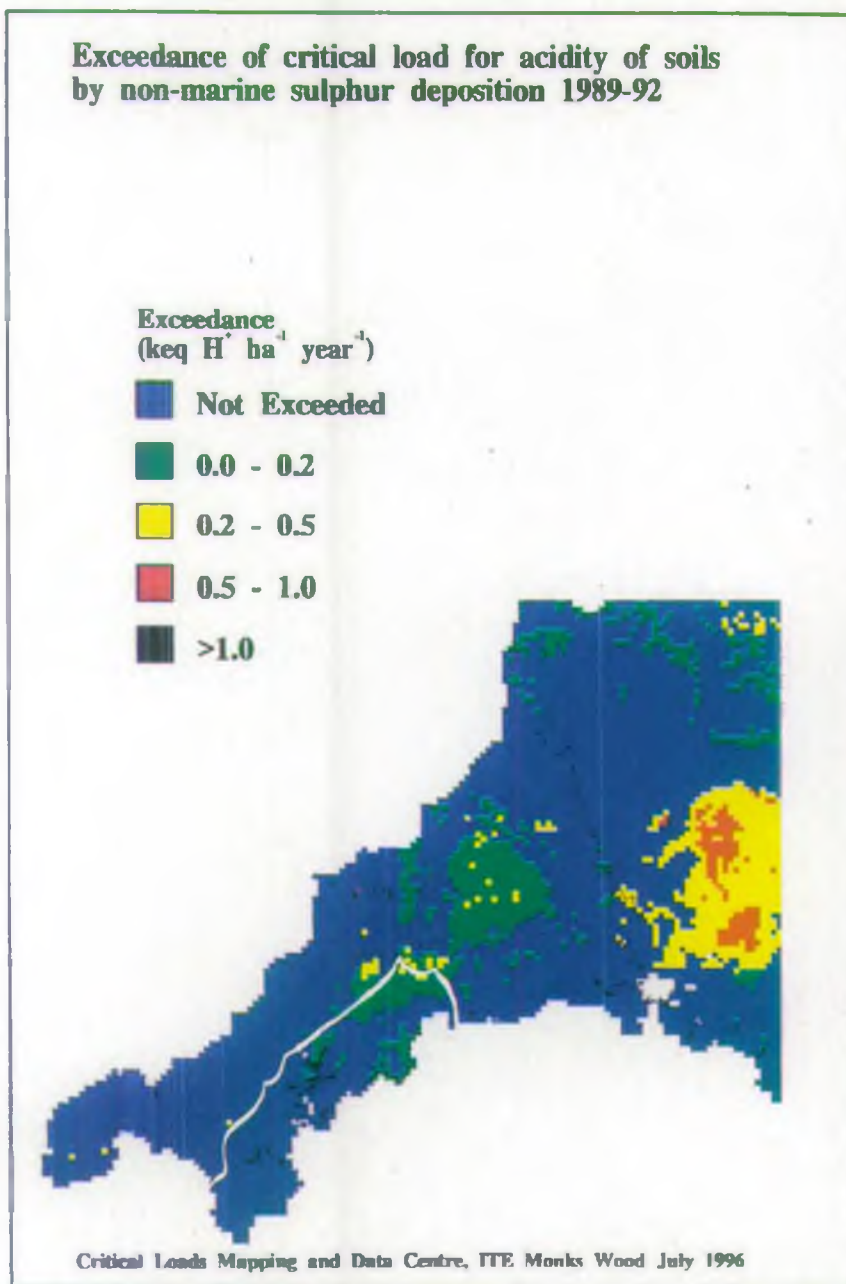
Nitrogen Oxides

The World Health Organisation (WHO) and United Nations Economic Commission for Europe have recommended an air quality guideline of 30 micrograms/m³ (15.7 ppb) for effects of nitrogen oxides (NO₂ and NO) on vegetation. Figure 5 indicates that this value is exceeded in one or two localities.

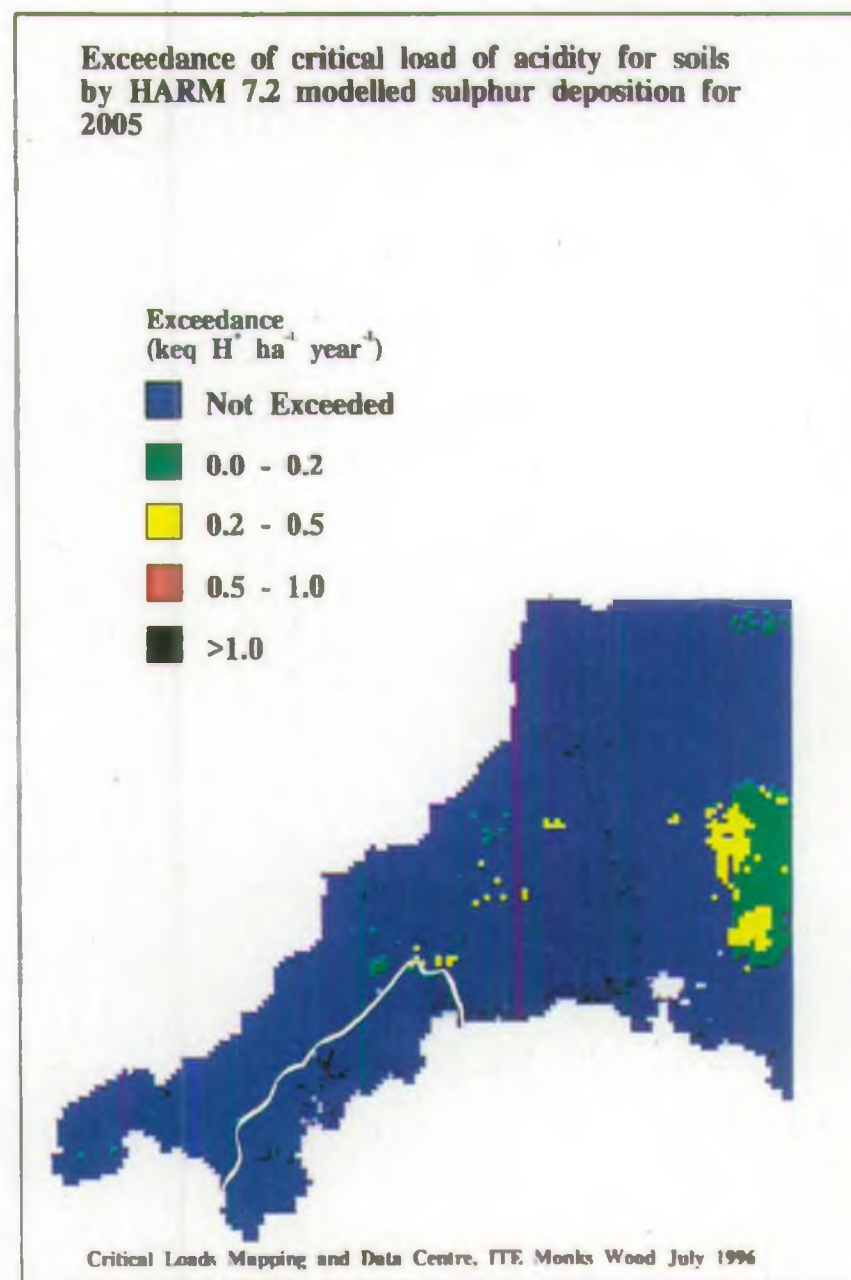
A map based on national monitoring data is not able to indicate specific sources which might lead to local exceedances, for example, alongside busy roads or industrial sources. These could only be identified through local monitoring.

It is anticipated that exceedences of air pollutants recorded within the catchment will be reviewed as part of national and local initiatives previously described.

Figure 7: Exceedences of critical load of acidity of soils, for 1989-92 and modelled for 2005



Data acknowledgement: CLAG soils sub-group



Data acknowledgement: CLAG soils sub-group, Hull University

Acid Rain

The term 'Acid Rain' is loosely used to describe wet or dry deposition of acidic compounds from the atmosphere. It is popularly used to mean rain, mist or snow which contains acid compounds predominantly of sulphur and nitrogen. The main sources of these acid gases are power stations and other large industrial combustion plants which burn fossil fuels (coal, oil and gas) and (particularly in the case of oxides of nitrogen) motor vehicles. Ammonia which arises from agriculture may under some soil conditions also lead to acidification. Natural sources of sulphur dioxide such as volcanoes and marine algae account for only a few percent (less than 5%) of the acid deposition received in the UK.

In some parts of the UK, natural ecosystems have a significant capacity to neutralise acidity and acid deposition has little impact on them, but in acid sensitive areas, acid rain causes damage to plants and soils in which they grow. In these areas substances can be released from soils which runoff into water bodies and are toxic to water life. Acid deposition can also alter the acid balance in water bodies and this too has an effect on the life they support; it can also corrode buildings. Acid rain components which contain nitrogen have the effect of acting as a fertilizer; this can change the make up of communities of land and water plants and affect animals that live on them.

The control of acid rain has been underpinned by the concept of critical loads. The concept of a critical load is a simple one - it is the threshold at which the pollutant load causes harm to the environment and has been defined by the United Nations Economic Commission for Europe as:

- a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on sensitive elements of the environment do not occur according to present knowledge.

In the case of soils the critical load has been calculated on the basis of the rate of production of acid neutralising compounds a part of natural weathering. Different soils will weather at different rates and hence will be more or less sensitive to acid deposition. Rocks such as granite are relatively slow to weather and therefore are sensitive to acid deposition.

Figure 6 shows the distribution of critical loads of acidity for soils and an estimate of the current deposition of sulphur calculated on a 20km grid. Figure 7 shows the exceedence of the critical loads for soil. The critical loads are particularly exceeded over moorland in the north of the catchment.

In England and Wales, typically 49% of acid deposition arises from large combustion sources such as power stations or refineries, 32% from European sources, 11% domestic, other industry and natural sources 4-5% each. It is expected that action at a national level by the Agency will significantly reduce the input from the major UK combustion sources. Figure 7 also shows the anticipated level of exceedence in 2005 once the controls announced in March 1996 on power station emissions have been fully implemented. By 2005 it is likely that European sources will be the largest contributor (40%) with large combustion sources and domestic emissions contributing approximately 25% each.

APPENDIX A

SSSI Designations

The 37 SSSIs within the catchment could be grouped as follows:

Goonhilly Downs, Mullion Cliff to Predannack Cliff, West Lizard, Kennack to Coverack, Coverack to Porthoustock and East Lizard Heathlands all occur on the Lizard Peninsula, which has a very distinct geology and climate. Extensive tracts of lowland heath occur here, with two communities including the rare Cornish Heath, which is found nowhere else in Great Britain. Many parts of these sites have frequently waterlogged soils, which has allowed wetland vegetation to develop. These SSSIs contain a wealth of rare lower and higher plants and invertebrates, many of which themselves are only known from the Lizard in this country.

Goss and Tregoss Moors, Carrine Common and Penwethers, Retire Common, Breney Common and Red Moor also support areas of lowland heath, much of which is wet heath. Goss Moor is regarded as the largest inland wetland in Devon and Cornwall.

Baulk Head to Mullion contains two reedbeds, one of which is the second largest in Cornwall.

Malpas Estuary and Fal and Ruan Estuary are intertidal mudflats in the upper reaches of the Fal Estuary, and are important for migrating and overwintering waders and waterfowl.

Caerthillian to Kennack, Gerrans Bay to Camels Cove and Rosemullion Head support important coastal and intertidal flora and fauna and geological features.

Merthen Wood comprises ancient woodland dominated by Sessile Oak, and supports a number of rare invertebrate species.

Crowhill Valley comprises ancient Sessile Oak woodland, but also has an important Willow and Alder carr area.

Trehane Barton contains Cornwall's largest population of Greater Horseshoe Bats **check

The remaining 17 SSSIs in the catchment have been designated for geological reasons. Many occur on the Lizard, namely: **Gunwalloe Coastal Section, Lizard Point, Polbarrow to The Balk, Kynance Cove, Kennack Sands, Coverack Cove and Dolor Point, Dean Quarry, Porthoustock Point, Lankidden and Meneage Coastal Section.**

The other geological sites are: **Tregurgus Quarries, Carn Grey Rock and Quarry, Luxulyan Quarry, Roche Rock, Trelavour Downs, Wheal Gorland and Wheal Martyn.**

APPENDIX B

Environment Agency Fisheries Legislation (Estuaries)

Fal Estuary

Boundaries	<p>A line from the southernmost extremity of Pendennis Point to the Lighthouse at St Anthony.</p> <p>Bass Nursery Areas. (1) A line 045° true from Weir Point to Tumaware Point. (2) A line 151° true from St Mawes Castle to Caricknath Point.</p>												
Jurisdiction	<p>Environment Agency is the Sea Fisheries Authority in addition to having powers over Salmon, Trout and Freshwater Fish, and Bass Nursery Areas.</p>												
Legislation	<p>(1) SAFFA 1975. Sec 6 (1) as amended by Salmon Act 1988. Sec 33.</p> <p>No fixed engines including unattended drift nets.</p> <p>(2) SAFFA 1975. Sec 27.</p> <p>No fishing for Salmon, Sea Trout, Trout or Freshwater Fish, unless with a licensed instrument. Rod and Line would be licensed but not Net.</p> <p>(3) Cornwall River Authority. Sea Fishery Byelaws.</p> <p>Attended Draft and Seine Nets: No person shall use in fishing for sea fish between the expiration of the first hour after sunset and the commencement of the last hour before any draft or seine net having a mesh size of less dimensions than 1½ inch from knot to knot, or six inches round measured when wet. Fishing for Sand Eels with a Seine Net of smaller mesh may be permitted by obtaining a letter from the Environment Agency.</p> <p>Bass Legislation. The use of any Gill Net and similar enmeshing nets with a mesh size between 65mm and 89mm stretched is prohibited within British Sea Fisheries limits.</p> <p>Permission to net in an area must be obtained from the relevant Authority or Riparian Owner.</p> <p>(4) MAFF Bass Nursery Areas and other conservation measures.</p> <p>No netting for Bass within the Nursery Areas from 1st May to 31st December inclusive. Drift netting outside these times is permitted.</p> <p>Fishing with Rod and Line from shore for Bass inside Nursery Areas is permitted all year round. Rod and Line fishing for Bass from boat is prohibited during the closed season. The minimum landing size for Bass caught inside the Estuary is 36cm measured from the tip of the tail to the end of the snout.</p> <table><thead><tr><th><u>Size Limits Species</u></th><th><u>Minimum Landing Size</u></th></tr></thead><tbody><tr><td>Bass</td><td>36cm Tip of Tail to Snout</td></tr><tr><td>Mullet</td><td>20cm Tip of Tail to Snout</td></tr><tr><td>Sea Trout (Rod and Line)</td><td>7 inches Fork of Tail to Snout</td></tr><tr><td>Trout (Rod and Line)</td><td>7 inches Fork of Tail to Snout</td></tr></tbody></table> <p><u>Seasonal Variations</u></p> <table><tbody><tr><td>January to December</td><td>All restrictions apply with exception to Bass Legislation.</td></tr></tbody></table>	<u>Size Limits Species</u>	<u>Minimum Landing Size</u>	Bass	36cm Tip of Tail to Snout	Mullet	20cm Tip of Tail to Snout	Sea Trout (Rod and Line)	7 inches Fork of Tail to Snout	Trout (Rod and Line)	7 inches Fork of Tail to Snout	January to December	All restrictions apply with exception to Bass Legislation.
<u>Size Limits Species</u>	<u>Minimum Landing Size</u>												
Bass	36cm Tip of Tail to Snout												
Mullet	20cm Tip of Tail to Snout												
Sea Trout (Rod and Line)	7 inches Fork of Tail to Snout												
Trout (Rod and Line)	7 inches Fork of Tail to Snout												
January to December	All restrictions apply with exception to Bass Legislation.												
Other Agencies	<p>Fal Harbour Office, Truro Harbour Office</p>												

APPENDIX B

Helford Estuary

Boundaries (1) A line drawn across the Estuary on a bearing of 190° true from Mawnan Shear to a point on the opposite shore.

(2) A line drawn across the Estuary on a bearing of 199° true from Rosemullion Head to Dennis Head.

Jurisdiction The Environment Agency is the Sea Fisheries Authority inside Boundary (1) in addition to having powers over Salmon, Trout, Freshwater Fish and Bass Nursery Areas. The Area between (1) and (2) is under the jurisdiction of the Cornwall Sea Fisheries.

Legislation (1) SAFFA 1975. Sec 6 (1) as amended by Salmon Act 1988. Sec 33.

No fixed engines including unattended drift nets.

(2) SAFFA 1975. Sec 27.

No fishing for Salmon, Sea Trout, Trout or Freshwater Fish, unless with a licensed instrument. Rod and Line would be licensed but not Net.

(3) Cornwall River Authority. Sea Fishery Byelaws.

Attended Draft and Seine Nets: No person shall use in fishing for sea fish between the expiration of the first hour after sunset and the commencement of the last hour before any draft or seine net having a mesh size of less dimensions than 1½ inch from knot to knot, or six inches round measured when wet. Fishing for Sand Eels with a Seine Net of smaller mesh may be permitted by obtaining a letter from the Environment Agency.

Bass Legislation. The use of any Gill Net and similar enmeshing nets with a mesh size between 65mm and 89mm stretched is prohibited within British Sea Fisheries limits.

Permission to net in an area must be obtained from the relevant Authority or Riparian Owner.

(4) MAFF Bass Nursery Areas and other conservation measures.

No netting for Bass within the Nursery Areas from 1st May to 31st December inclusive. Drift netting outside these times is permitted.

Fishing with Rod and Line from shore for Bass inside Nursery Areas is permitted all year round. Rod and Line fishing for Bass from boat is prohibited during the closed season. The minimum landing size for Bass caught inside the Estuary is 36cm measured from the tip of the tail to the end of the snout.

<u>Size Limits Species</u>	<u>Minimum Landing Size</u>
Bass	36cm Tip of Tail to Snout
Mullet	20cm Tip of Tail to Snout
Sea Trout (Rod and Line)	7 inches Fork of Tail to Snout
Trout (Rod and Line)	7 inches Fork of Tail to Snout

Seasonal Variations

January to December All restrictions apply with exception to Bass Legislation.

Other Agencies Cornwall Sea Fisheries, Helford Harbour Master

APPENDIX B

CORNWALL SEA FISHERIES DISTRICT

FIXED ENGINES BYELAW 1987

The Local Fisheries Committee of the Cornwall Sea Fisheries District by virtue of the powers vested in them by Section 5 of the Sea Fisheries Regulation Act 1966 and Section 37(2) of the Salmon Act 1986 and with the consent of the South West Water Authority made the following byelaw on the 10th July 1987.

1. For the purposes of Section 6 of the Salmon and Freshwater Fisheries Act 1975 the use and placing of fixed engines is authorised in the Cornwall Sea Fisheries District subject to the following conditions:
 - (i) The head line of every fixed engine shall be at least 3m below the surface of the water at any state of the tide when set in the following areas less than 1 nautical mile from the low water line along the coast and between the following eastward and westward boundaries.

Provided that on the landward side of a line from Merope Rocks to Cataclews Point and thence to Roundhole Point within Area (1) above a fixed engine may be used between the 1st October and 31st December and the 1st January and the 31st March in any year within 3 metres of the surface.
 - (ii) The head line of every fixed engine shall be at least 3m below the surface of the water at any state of the tide when set in the following areas:

Area (3)	Falmouth Bay, bounded on the east by a line drawn 090 degrees true from Rosemullion Head and bounded on the west by a line drawn 150 degrees true from Black Head (South of Coverack).
Area (4)	Gerrans Bay, bounded on the east by a line drawn 180 degrees true from Nare Head and bounded on the west by a line drawn 180 degrees true from Zone Point.
Area (5)	Dodman bounded on the east by a line drawn 090 degrees true from Dodman Point and bounded on the west by a line drawn 215 degrees true from Greb Point.
Area (6)	St Austell Bay, bounded on the east by a line drawn 180 degrees true from Pencarrow Head and bounded on the west by a line drawn 90 degrees true from Black Head.
2. For the purpose of this byelaw "fixed engine" has the same meaning as in the Salmon and Freshwater Fisheries Act 1975.
3. This byelaw shall come into operation on the confirmation hereof by the Minister of Agriculture, Fisheries and Food and may be cited as the Cornwall Sea Fisheries District Fixed Engines Byelaw 1987.

NOTE:

Sections and areas not relevant to this plan area have been omitted.

This byelaw does not permit fixed engines to be set in estuaries in Cornwall where the National Rivers Authority has the powers of a Sea Fisheries Committee.

Appendix C

Table 1 : Standards For The Five River Ecosystem Use Classes

Use Class	DO % sat 10%ile	BOD (ATU) mg/l 90%ile	Total Ammonia mgN/l 90%ile	Un-ionised Ammonia mgN/l 95%ile	pH 5%ile & 95%ile	Hardness mg/l CaCO ₃	Dissolved Copper µg/l 95%ile	Total Zinc µg/l 95%ile	Class Description
1	80	2.5	0.25	0.021	6.0 - 9.0	10 >10 and 50 >50 and 100 >100	5 22 40 112	30 200 300 500	Water of very good quality suitable for all fish species
2	70	4.0	0.6	0.021	6.0 - 9.0	10 >10 and 50 >50 and 100 >100	5 22 40 112	30 200 300 500	Water of good quality suitable for all fish species
3	60	6.0	1.3	0.021	6.0 - 9.0	10 >10 and 50 >50 and 100 >100	5 22 40 112	300 700 1000 2000	Water of fair quality suitable for high class coarse fish populations
4	50	8.0	2.5	-	6.0 - 9.0	10 >10 and 50 >50 and 100 >100	5 22 40 112	300 700 1000 2000	Water of fair quality suitable for coarse fish populations
5	20	15.0	9.0	-	-	-	-	-	Water of poor quality which is likely to limit coarse fish populations

Table 2. Stretches where data has been 'set aside'

River	Stretch	Data Set Aside
Par	A391 Bridge - Higher Menadew	Copper
Crinnis	Cuddra Road Bridge - NTL	Copper, Zinc
Tinney	Hugus - NTL	Zinc
Carnon	Chacewater Viaduct - Below Chacewater STW	Copper, Zinc
Carnon	Below Chacewater STW - Twelveheads	pH, Copper, Zinc
Carnon	Twelveheads - d/s County Adit	pH, Copper, Zinc
Carnon	D/s County Adit - Bissoe Bridge	pH, Copper, Zinc
Carnon	Bissoe Bridge - Normal Tidal Limit	pH, Copper, Zinc
Hicks Mill Stream	Source - Carnon confluence	Copper, Zinc

Appendix C: Table 3

River	Stretch	Length (km)	RQO RE	RQO RE
		(KM)	Short Term	Long Term
Par River	Criggan Moor - Higher Menadew	1.6	2	
	Higher Menadew-Lavrean Bridge	0.5	1	
	Lavrean Bridge-Luxulyan Bridge	2.1	4	3
	Luxulyan Bridge-Trefry Bridge	1.9	3	2
	Trefry Bridge -St. Blazey Bridge	3	2	
	St Blazey Bridge-Normal Tidal Limit	2	2	
Tywardreath Stream	Source - Normal Tidal Limit	5.6	2	
Bokiddick Stream	Source-Lowertown Farm	3.6	2	
	Lowertown Farm-Par Confluence	4.4	1	
Treverbyn Stream	Source-Par Confluence	3.5	2	
Rescorla Stream	Source-Par Confluence	1.7	1	
Rosevean Stream	Source-Par Confluence	1.9	5	2
Carbis Stream	Source-D/S Wheal Prosper	1.8	1	
	D/S Grt Wheal Prosper-Par Confluence	5.2	5	1
Molinnis Stream	Source-Carbis Stream Confluence	1.1	5	1
Rosevath Stream	Source-Par Confluence	3	3	
Crinnis River	Cuddra Road Bridge-Normal Tidal Limit	1.9	1	
St. Austell River	Below Pentewan Road Lab-Iron Bridge	4.2	5	2
	Iron Bridge-Molingey Gauging Station	1.8	3	
	Molingey Gauging Station-Mean High Water	3	2	
Polgooth Stream	Source-Prior to St Austell Confluence	4	2	
Gover Stream	Source-Above St. Austell Confluence	3.5	2	
Mevagissey Stream	Source-Normal Tidal Limit	3.8	2	
Caerhays Stream	Polmassick Bridge-Normal Tidal Limit	6.2	2	
Fal	Tregoss Bridge-Gaverigan Bridge	4.2	1	
	Gaverigan Bridge-Below McLaren's	2	2	
	Below McLaren's-Terras Bridge	4.8	2	
	Terras Bridge-Crampound Bridge	5.8	4	2
	Crampound Bridge-Normal Tidal Limit	8.9	2	
Gwindra Stream	Source-Below Drinnick	2.3	5	2
	Below Drinnick-Goonabarn	0.3	5	2
	Goonabarn-Gwindra Bridge	2.8	2	
	Gwindra Bridge-Fal Confluence	3.2	5	4
Coombe Stream	Source-Hendra Bridge	0.2	5	2
	Hendra Bridge-Coombe	3	5	2
Dubbers Stream	Source-Gwindra Stream Conf	1.4	5	2
Bodella Stream	Source - Fal Confluence	2.9	5	2
Tresillian River	Source-Ladock Water Pumping Station	6.3	1	
	Ladock Water Pumping Station-Normal Tidal Limit	6.2	2	
Kestle Stream	Source-Tresillian River Confluence	9.2	1	
Brighton Stream	Source-Tresillian River Confluence	6.8	2	
Allen (Fal)	Source-Normal Tidal Limit	9.6	2	
Kerwyn	Source-Normal Tidal Limit	7.5	2	
River Tinney	Hugus-Normal Tidal Limit	4.6	1	
Carnon River	Chacewater Viaduct-Below Chacewater Stw	2.4	2	
	Below Chacewater Stw-Twelveheads	1.6	1	
	Twelveheads-D/S County&Wellington Adits	0.9	3	
	D/S County&Wellington Adits-Bissoe Br	0.6	3	
	Bissoe Bridge-Normal Tidal Limit	2.7	3	
Baldhu Stream	Above Clemows Tailings Dam-Carnon Confluence	0.8	5	
Hick's Mill Stream	Source-Carnon Confluence	4.9	2	
Kennal	Stithians Reservoir-Ponsanooth Gauging Station	6.2	1	
	Ponsanooth Gauging Stn-Normal Tidal Limit	1.8	2	1
Mylor Stream	Enys-Normal Tidal Limit	1.6	1	
Porth Navas Stream	Source-Normal Tidal Limit	3.8	1	
Lestraines River	Source-Normal Tidal Limit	7.4	2	

Abbreviations

AMP3	Asset Management Plan 3
AONB	Area of Outstanding Natural Beauty
AGHV	Area of Great Historic Value
AGLV	Area of Great Landscape Value
AGSV	Area of Great Scientific Value
BATNEEC	Best Available Techniques Not Entailing Excessive Cost
BCU	British Canoe Union
BPEO	Best Practicable Environmental Option
CAU	Cornwall Archaeological Unit
CCC	Cornwall County Council
CES	County Environmental Services
CNC	Cornwall Nature Conservation site
CRI	Chemical Release Inventory
CSFC	Cornwall Sea Fisheries Committee.
CWT	Cornwall Wildlife Trust
DMP	Drought Management Plan
DoE	Department of the Environment
DoH	Department of Health
Dtp	Department of Transport
ECCI	English China Clay International
EMS	Environmental Management System
EN	English Nature
EPAQS	Expert Panel of Air Quality Standards
EQS	Environmental Quality Standard
FBEI	Falmouth Bay and Estuaries Initiative
FOIL	Falmouth area Oil pollution contingency plan
HE	House Equivalent
HMIP	Her Majesty's Inspectorate of Pollution
HVMCA	Helford Voluntary Marine Conservation Area
IPC	Integrated Pollution Control
LEAP	Local Environment Agency Plan
LOE	Licence of Entitlement

LPA	Local Planning Authority
LTA	Long Term Average
MAFF	Ministry of Agriculture, Fisheries and Food
NGR	National Grid Reference
NNR	National Nature Reserve
NRA	National Rivers Authority
NWC	National Water Council
OFWAT	Office of Water Services
OP	Organophosphates
PHA	Port Health Authority
R&D	Research & Development
RE	River Ecosystem: RE1, RE2 etc.
RQO	River Quality Objectives
SAC	Special Area of Conservation
SAM	Scheduled Ancient Monument
SFC	Sea Fisheries Committee
SFFA	Salmon and Freshwater Fisheries Act
SMP	Shoreline Management Plan
SSSI	Site of Special Scientific Interest
STW	Sewage Treatment Works
SWW	South West Water
TBT	Tributyltin
UWWTD	Urban Waste Water Treatment Directive
VOC	Volatile Organic Compounds
WHO	World Health Organisation
WRA	Waste Regulation Authority

Units

mm	Millimetres
ml	Millilitres
km	Kilometres
km ²	Kilometres squared
ha	Hectares
m ³ /s	Cumecs; cubic metres per second
MI/d	Megalitres per day (MI = 1,000,000 litres)
MI/y	Megalitres per year
ppb	Parts per billion
NO ₂	Nitrogen dioxide
NO	Nitrogen oxide
NO _x	Oxides of Nitrogen

Glossary

ABSTRACTION

Removal of water from a surface or groundwater source of supply.

ADIT

Gently sloping passage from mine workings into valley areas to allow water to drain out of the working (the downstream entrance is called the adit portal).

ALLUVIAL DEPOSITS

Sedimentary deposits resulting from the erosive action of rivers. Typically fine grained material carried by the river and deposited in areas such as floodplains, but often including sandy or gravelly beds too.

ANNEX 1A SUBSTANCE

Substance which has been selected for monitoring on the basis of its persistency, toxicity and ability to bioaccumulate.

AQUIFER

Layer of porous rock able to hold and transmit water. Often classified as major, or minor, depending on the extent to which they support higher yielding borehole systems.

AUGMENTATION

The support of a downstream river abstraction by releasing (usually) equivalent quantities of water from an upstream source (whether it be a reservoir, another river or groundwater source such as a borehole).

BASEFLOW

The flow in a river comprising emergent groundwater sources. In dry conditions river flows comprise entirely of baseflow.

BIOACCUMULATION

Concentration of pollutant substances, such as metals, within the tissues of organisms.

BIOCHEMICAL OXYGEN DEMAND (BOD)

A measure of the amount of oxygen consumed in water, usually as a result of organic pollution.

BRYOPHYTES

Mosses and liverworts.

BUFFER ZONE

Strip of land 10-100m wide, alongside rivers which is removed from intensive agricultural use and managed to provide appropriate habitat types. Benefits include potential reduction of inputs into the river such as silt, nutrients, livestock waste, as well as improving habitat diversity and landscape.

CAMBIC STAGNOGLEY SOILS

Soils with a distinct topsoil and no clay-enriched sub-soil.

CHERT

A hard sedimentary rock very similar to flint.

COMPENSATION FLOW

A defined release from a reservoir to compensate for the impact of the impoundment by maintaining a minimum flow in the river downstream.

CONJUNCTIVE USE

The operation of two or more sources in a systematic manner to provide a yield greater than the sum of those sources if operated independently.

CONSENT

A statutory document issued by Environment Agency under Schedule 10 of Water Resources Act 1991 to indicate any limits and conditions on the discharge of an effluent to controlled water.

CRITICAL LOAD

The maximum load of a pollutant which a given ecosystem can tolerate without suffering adverse change. The Department of Environment has calculated critical loads for freshwaters in the UK, compared them with the non-marine inputs of sulphur, and derived maps which indicate where critical loads for acidity for freshwaters are currently exceeded. Forest planting proposals within these areas are likely to require a catchment-base assessment to determine the susceptibility of surface waters.

CULVERT

Channel or conduit carrying water across or under a road, canal etc.

CYPRINID

Fish of the carp family (i.e. coarse fish).

DEPURATE

To make or become free of impurities.

DESORPTION

The removal of absorbed material.

DETERMINAND

That which is to be determined or measured.

DE-WATERING

Removal of groundwater to reduce flow rate or diminish pressure.

DROUGHT ORDER

Drought Orders are made by the Secretary of State upon application by the Environment Agency or a water undertaker, under powers conferred by Act of Parliament, to meet deficiencies in the supply of water due to exceptional shortages of rain. The terms and conditions under which Drought Orders may be obtained are given in Sections 73-81 of the Water Resources Act 1991 and Sch 22 S139 of the Environment Act 1995. Drought Orders are sub-divided into 'Ordinary' and 'Emergency' Drought Orders. A Drought Order could contain provisions such as; to authorise abstraction from an unlicensed source, override the conditions on an existing abstraction licence, limit the amount of water which may be taken from a source, vary discharge conditions or might allow the prohibition of use of water for particular purposes, to allow a ban on non-essential use of water (for example in car washes) or to introduce the use of stand-pipes.

DROUGHT RELIABLE YIELD

The output capacity of a reservoir, reservoir system, conjunctive use scheme etc. It is the average output (volume/day) that can be sustained through a design drought period. 1976 has been regarded as the critical historical drought sequence, with a risk of occurrence regionally of approximately 1:50 years but current research into extended flow sequences back to the last century and modelling particular water supply schemes suggests that 1975-76 may be much more severe than a 1:50 years sequence.

ECOSYSTEM

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

ENVIRONMENTAL QUALITY STANDARD (EQS)

The quantity of a substance found in a body of water which should not be exceeded in order to protect a given use of the water body. An EQS is set by the European Community through EC Directives and the government.

ENVIRONMENTALLY SENSITIVE AREA

Area where the landscape, wildlife and historic interest are of national importance. Payments are made by Agriculture and Fisheries Departments for appropriate sensitive land management.

ESCAPEMENT

Numbers of fish that survive to spawn.

EVAPOTRANSPIRATION

Loss of water by land plants due to evaporation and transpiration.

EUTROPHICATION

The enrichment of water by nutrients, especially nitrogen and/or phosphorous, which causes: 1) accelerated growth of algae and higher plant, 2) changes in the ecological balance, and 3) deterioration in water quality.

FAULT

Plane surface of fracture in rock body, along which observable relative displacement has occurred between adjacent blocks.

FISSURE

A crack or open break in rocks.

FISH SURVEY

Electric-fishing survey of between 1 and 3 runs within a stop-netted section of river.

FLUVIAL

Pertaining to river flow and its erosive activity.

FRY

Juvenile salmonids that have left the gravel and are less than one year old.

GLEYSOILS

One of the seven major groups in the soil classification of England and Wales. They are characteristically affected by the periodic or permanent saturation by water in the absence of effective artificial drainage.

GRILSE

Atlantic salmon that have remained in the sea for only one winter.

GROUND TRUTHING

Investigations to check that the situation on the ground matches desk-top studies.

HYDROGEOLOGY

Branch of geology concerned with water within rock bodies or bedrock.

LEACHATE

Solution formed when water percolates through a permeable medium. Can be mineral-rich, toxic or even carry bacteria.

LICENCE OF ENTITLEMENT

Licence granted under Schedule 26 of the Water Act 1989 in respect of a previously exempt abstraction greater than 20m³/day which required a licence by virtue of an amendment to Section 24(2) and (3) of the Water Resources Act 1963. (This only covered particular domestic and agricultural uses, including fish farming and flows to domestic amenity ponds).

LICENCE OF RIGHT

Licence granted under Section 23 of the Water Resources Act 1963 in respect of an abstraction which was already in operation when that Act was passed.

MACROINVERTEBRATE

A large invertebrate e.g. mayfly, snail, fly.

MAIN RIVER

Some, but not all, watercourses are designed as 'Main River'. 'Main River' status of a watercourse must first be approved by MAFF. Statutory (legally binding) maps showing the exact length of 'Main River' are held by MAFF in London and the Environment Agency in Regional Offices. The Environment Agency has the power to carry out works to improve drainage or protect land and property against flooding on watercourses designated as 'Main River'. The Environment Agency do not have the legal power to spend public funds on drainage or flood protection works on watercourses not designated as 'Main River'.

METAMORPHIC AUREOLE

The area around an intruded magmatic body, e.g. granite, where the country rock has been altered and affected by the heat.

MINIMUM ACCEPTABLE FLOW (MAF)

A prescribed flow in river set by the Secretary of State under Section 21 of the Water Resources Act 1991 as amended by Sch 22 S133 of the Environment Act 1995, in order to protect the riverine and fisheries environment and/or to ensure the acceptable dilution of effluent discharges and the protection of legitimate riparian interests.

MITIGATION

Rearing of stock salmonids to compensate for loss of juvenile production as a result of major impoundments (dam construction).

MULTI SEA WINTER

Atlantic salmon that have remained in the sea for two winters or more.

NATURAL AREA

The whole of England has been described as a series of ecologically distinct areas following survey work by English Nature.

ORDINARY WATERCOURSE

A flood defence term, not relevant to other functions. A watercourse that does not form part of a main river.

PARR

Juvenile salmonids aged one year and older.

PERMEABILITY

A measure of the ease at which liquids (or gases) can pass through rocks or a layer of soil.

PHABSIM

A suite of computer programs used to generate habitat *versus* discharge relationships for assessing that effects of abstraction upon fish, invertebrates and macrophytes.

PREVIOUS SPAWNER

Salmonids that are returning to spawn for a second or subsequent occasion.

PODZOLIC SOILS

Well drained black or dark brown soils, with a compact subsurface horizon enriched in humus and normally overlain by a bleached layer.

POROSITY

The volume of water which can be held within a rock or soil, expressed as the ratio of the volume of the void space to the total volume of the material.

POTABLE

Water of a quality suitable for drinking.

PRESCRIBED FLOW (pf)

Flow below which a river must not be reduced as a result of licensed abstraction.

PRESCRIBED FLOW CONDITION

A prescribed flow condition is a trigger for abstraction to be reduced or cease unless supported by artificial releases. Often a specific condition on abstraction licenses to protect the river environment and other legal users.

Q95

The flow that on average is equalled or exceeded for 95% of the time.

REDD

Hollow created in river bed gravels by spawning salmonid fish into which the female deposits ova.

RESERVOIR PUMPED STORAGE.

The supplementation of the natural inflow to a reservoir with river water abstracted downstream or transferred between catchments, and pumped to the reservoir at times of high flow. Pumped storage ensures that the reservoir is refilled sufficiently for the start of the next Summer drawdown period.

RIFFLE

Stony or gravelly part of river bed shallow in dry weather flow. Fast stream on most non-chalk areas have alternating riffles and pools.

RIFFLE SURVEY

Electric-fishing survey on riffle areas for 20 minutes with no stop nets.

RIPARIAN OWNER

Owner of riverbank and/or land adjacent to a river. Normally owns riverbed and rights to at least midline of channel.

RIPARIAN ZONE

Zone alongside watercourse stretching from top of channel to next change in land form (most often banks) or vegetation type.

RIVER CORRIDOR

Land which has visual, physical or ecological links to a watercourse and which is dependent on the quality or level of the water within the channel.

RIVER QUALITY OBJECTIVE (RQO)

The level of water quality that a river should achieve in order to be suitable for its agreed uses.

RIVER REGULATION

The maintenance of a stated flow in rivers in order to allow abstraction to continue during times of low flow and for environmental protection. This is achieved as for river augmentation by supporting river flows using upstream sources.

SALMONID

Game fish of the salmon family e.g. salmon, brown trout and sea trout.

SEA LICE

Parasite found on salmon who have recently returned to freshwater. Cannot survive long in freshwater.

SMOLTS

Young salmonids migrating to sea for the first time and adapted to life in salt water.

STAGNOGLEY SOILS

Seasonally waterlogged, slowly permeable soils, prominently mottled with a distinct topsoil.

TASK FORCE

An intensive investigation of possible sources of pollution following non-compliance in the catchment.

TRANSMISSION LOSSES

Transmission losses comprise 'river losses' and 'operational augmentation losses'. River losses relate to identified losses through the bed or banks and estimates of surface water evaporation. Operational augmentation losses can be from errors in forecasting (when augmentation releases need to start and end), resulting in augmentation releases on days they are not required or when demand is lower than forecasted and water is released in excess of abstraction needs.

TWO SEA WINTER (2SW)

Atlantic salmon that have remained in the sea for two complete and consecutive winters.

References

- 1 The Environment Agency and Sustainable Development. Department of the Environment, MAFF, Welsh Office, November 1996.
- 2 The New Map of England: a celebration of the South West Landscape. Countryside Commission, 994. CCP444.
- 3 Cornwall Landscape Assessment, Cornwall County Council/Countryside Commission, 1994.
- 4 A Nature Conservation Overview, Environmental Consultants (CTNC) Ltd, 1996. The Fal Estuary: Coastal Processes and Conservation, Institute of Estuarine and Coastal Studies, 1996.
- 5 An Historical Audit of the Fal Estuary, Cornwall Archaeological Unit, 1996. Final report mid 1997.
- 6 A multiple use zoning scheme: a summary of regulations for Falmouth Bay and Estuaries, English Nature, 1996.
- 7 Fal Bay and Estuaries Initiative: Strategic Guidelines Consultation Draft. Fal Bay and Estuaries Initiative, October 1996.
- 8 Wheal Jane Environmental Assessment Report. Knight Piesold and NRA, 1995
- 9 The Fal Estuary: Coastal Processes and Conservation. English Nature, Report No. Z058-95-D.
- 10 Natures Way - Designing for Pollution Prevention, International Association of Water Quality, 1996.
- 11 Tomorrows Water: South West Regional Water Resources Development Strategy. NRA South Western Region, April 1995. SW-4/95-1k-B-ANOQ.
- 12 Cornwall Structure plan, Deposit Draft. Cornwall County Council, November 1995.
- 13 Biodiversity: the UK Steering Group Report. HMSO. ISBN 0-11-753218-5.
- 14 Biodiversity of the South West: An Audit of the South West Biological Resource, RSPB, February 1996.
- 15 Forest & Water, Guidelines. 3rd Edition. Forestry Authority, 1993.
- 16 Water Act 1989. HMSO.
- 17 Cornwall Minerals Local Plan, Deposit Draft. Cornwall County Council, February 1996. ISBN 1-898166-11-0.
- 18 Restormel Local Plan, Deposit Draft. Restormel Borough Council, March 1995. Carrick Local Plan, Deposit Stage. Carrick District Council, November 1994.
- 19 An Economic Profile of the Falmouth Bay & Estuaries Initiative Area, A C Pennington, Bournemouth University, 1996.
- 20 Lizard to Lands End Shoreline Management Plan. In preparation.
- 21 Flood Warning Information for the East Cornwall Catchments. Flood Warning Information for the West Cornwall Catchments. Environment Agency South West Region. SW-9/96-32K-D-AVCP.
- 22 Wheal Jane, A Clear Improvement, Environment Agency South West Region. SW-12/96-3K-E-AWPM.
- 23 Contaminated Land and the Water Environment. NRA, March 1994. ISBN 0-11-886521-8.
- 24 NRA South Western Region Low Flow Study Final Report Volumes 1 and 2. Sir William Halcrow and Partners, April 1991.

- 25 Landfill and the Water Environment, NRA Position Statement, January 1995. HO-1/95-5k-B-AMRS.
 - 26 Making Waste Work, A Strategy for Sustainable Waste management in England and Wales. DoE & Welsh Office, December 1995. ISBN 0-10-130402-1. Making Waste Work Summary. DoE & Welsh Office. 95 EP 130.
 - 27 Towards a Waste Planning Strategy for Cornwall. Cornwall County Council. in preparation.
 - 28 The Environmental Protection (Prescribed Processes and Substances) Regulations 1996-97. Environment Agency. HO-5/96-7K-C-AULP.
 - 29 Ozone, Expert Panel on Air Quality Standards. DoE, May 1994. ISBN 011-752-8730.
 - 30 Reducing emissions of volatile organic compounds (VoCs) and levels of ground level ozone: A UK Strategy. DoE, November 1993.
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MANAGEMENT AND CONTACTS:

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

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

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