

# RIVER EXE CATCHMENT MANAGEMENT PLAN CONSULTATION REPORT



**NRA**

*National Rivers Authority  
South Western Region  
December 1995*

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Published December 1995

### **THE NRA AND THE ENVIRONMENT AGENCY**

The NRA will form the major part of a new organization which will have responsibilities for the environmental protection of water, land and air. The new Environment Agency starts its work of managing the environment in England and Wales on 1 April 1996.



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## RIVER EXE CATCHMENT MANAGEMENT PLAN CONSULTATION REPORT

### FOREWORD

The National Rivers Authority has, since its formation in 1989, been developing the process of catchment management.

A major initiative is the commitment to produce Catchment Management Plans setting out the Authority's vision for realising the potential of each local water environment.

An important stage in the production of the plans is a period of public consultation. The River Exe Consultation Report covers a large and important catchment and the NRA is keen to draw on the expertise and interest of the communities involved.

Please comment, your views are important, even if it is to say that you think particular issues are necessary or that you support the plan and its objectives.

Following on from the Consultation Report an Action Plan will then be produced with an agreed programme for the future protection and enhancement of this much loved area.



**MALCOLM CHUDLEY**  
Area Manager (Devon)

Environment Agency  
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**River Exe  
Catchment Management Plan  
Consultation Report  
South Western Region**

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## 1. MISSION AND AIMS

We will protect and improve the water environment by the effective management of water resources and by substantial reductions in pollution. We will aim to provide effective defence for people and property against flooding from rivers and the sea. In discharging our duties we will operate openly and balance the interests of all who benefit from and use rivers, groundwaters, estuaries and coastal waters. We will be businesslike, efficient and caring towards our employees.

Our aims are to:

- \* Achieve a continuing overall improvement in the quality of rivers, estuaries and coastal waters, through the control of pollution.
- \* Manage water resources to achieve the right balance between the needs of the environment and those of the abstractors.
- \* Provide effective defence for people and property against flooding from rivers and the sea.
- \* Provide adequate arrangements for flood forecasting and warning.
- \* Maintain, improve and develop fisheries.
- \* Develop the amenity and recreational potential of inland and coastal waters and associated lands.
- \* Conserve and enhance wildlife, landscape and archaeological features associated with inland and coastal waters of England and Wales.
- \* Improve and maintain inland waters and their facilities for use by the public where the NRA is the navigation authority.
- \* Ensure that dischargers pay the costs of the consequences of their discharges and, as far as possible, to recover the costs of water environment improvements from those who benefit.
- \* Improve public understanding of the water environment and the NRA's work.
- \* Improve efficiency in the exercise of the NRA's functions and to provide challenge and opportunity for employees and show concern for their welfare.

# Map 1 - River Exe Catchment





## 2. CATCHMENT VISION

The River Exe Catchment covers a large area (1,530 km<sup>2</sup>) and drains diverse habitats ranging from the moorland of Exmoor National Park at the River Exe's headwaters, to the City of Exeter where it flows into the Exe Estuary.

The catchment is home to approximately 235,100 people and many more visit to enjoy the natural beauty, particularly of Exmoor and the coastal resorts of Dawlish and Exmouth.

Apart from tourism, the catchment supports a mixed agricultural and industrial economy. Several large industries have historically used one of the major tributaries, the River Culm.

Our vision of the River Exe Catchment is of a healthy and diverse water environment, managed in an environmentally sustainable way, balancing the needs of all users.

Our vision for the future is of a catchment where there is:

- \* achievement of environmentally sustainable use of the water resource
- \* maintenance and, where appropriate, enhancement of biodiversity, particularly of aquatic and wetland environments
- \* conservation and, where appropriate, enhancement of the semi-natural ecosystem, including improvement of degraded aquatic and water fringe habitats
- \* conservation of features of archaeological and historic interest within the aquatic and wetland environment
- \* continuing improvement to existing discharges to meet the most appropriate standards
- \* development of a sustainable agricultural, aquacultural and forestry system which reduces the risk of diffuse pollution and improves the physical habitat of the river system and wetlands for wildlife
- \* increasing enjoyment and appreciation of the water environment
- \* minimal risk to people and property from flooding
- \* maintenance of the natural hydrological cycle, including natural river and wetland functions and processes
- \* achievement of sustainable salmonid, sea and shell fisheries within the catchment.

### 3. INTRODUCTION

This report:

- \* describes how the catchment is used
- \* explains what we are doing to protect or enhance the water environment.

Sustainable development can be defined as *development that meets the needs of the present without compromising the ability of future generations to meet their own needs*, and it is at the heart of UK policy on the environment. A recent Government publication, Sustainable Development - The UK Strategy (Ref. 1), recognizes the inland freshwaters of the UK as *a vital and highly valued component of the UK environment and ecology*, along with the conflicts that may arise between different purposes and uses of the water and water environment.

A holistic approach to river management is required to plan for environmental sustainability and improvement. To this end, the NRA has developed the concept of Catchment Management Plans (CMPs). These allow the full range of water management issues to be identified and considered within a geographical area which is both relevant and meaningful. CMPs are strategic in nature, since individual catchments cover large areas of land often straddling local authority boundaries.

#### 3.1 CATCHMENT MANAGEMENT PLANS AND DEVELOPMENT PLANS

Whilst we can control some of the things which effect the quality of the water environment we have little direct control over the way that land is developed. This is the responsibility of local planning authorities. We do, however, seek to influence their decisions.

Local authorities prepare statutory Development Plans. The policies in these plans will guide the way that land is developed in the future. We have published guidance for local planning authorities to encourage them to adopt policies which protect the water environment from harmful development. Where we can we will reinforce these policies when we comment on planning matters, contribute to Local Plans, or if we are making our own decisions.

#### 3.2 THE CONSULTATION REPORT

This Consultation Report includes the sections detailed below.

**Catchment Characteristics**, which provides a brief, general introduction to the catchment describing its key characteristics.

**Catchment Uses**, which describes the resources and activities which use or influence the water environment. They may either have an impact on, or have certain requirements of the water environment. We include notes on our role and objectives in managing or promoting this use.

**Targets and State of the Catchment**, where we assess the state of the catchment by looking at four aspects of the water environment:

- \* Water Quality
- \* Water Quantity
- \* Physical Features
- \* Flood Defence.

We identify environmental quality targets where we can. Our present rate of success at reaching these targets is one way that we can report on the current state of the catchment.

**Issues and Actions**, where we identify the reasons for not reaching targets or fulfilling our objectives. This section summarizes these issues and proposes actions to resolve and minimize them.

### 3.3 YOUR VIEWS

We hope that this report will be read and commented on by everyone who has an interest in the water environment of the River Exe Catchment.

**Have we identified all the problems in the catchment? If not we would like to know.**

**Do you agree with the River Quality Objectives proposed?**

**Are there any issues which you want to highlight?**

**Are there different ways you think we ought to tackle the issues?**

Please send your comments by 29 February 1996 to:

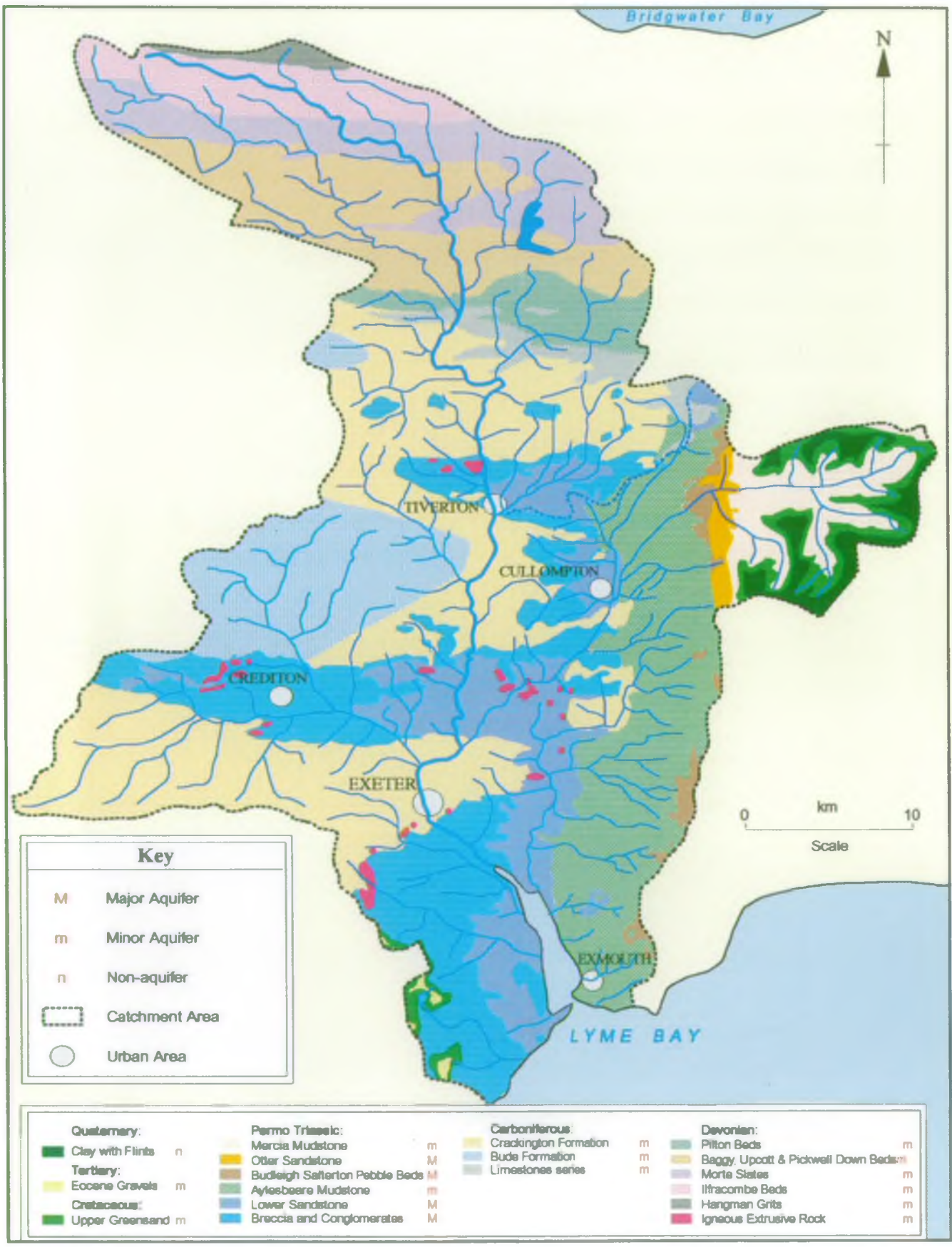
Judy Proctor  
Catchment Planner - Devon Area  
NRA South Western Region  
Manley House  
Kestrel Way  
EXETER  
Devon EX2 7LQ

Your views will help us finalize the Action Plan and prepare future Reports. We will not republish this Consultation Report.

### 3.4 THE ACTION PLAN

We will collate responses to this report and publish an Action Plan. Progress with the actions identified will be carefully checked and annual progress reports published. Within five years of publishing the Action Plan we will do a major review of the progress that has been made.

# Map 2 - Geology



## 4. CATCHMENT CHARACTERISTICS

### 4.1 INTRODUCTION

The purpose of this section is to provide a general introduction to the River Exe Catchment and to describe some of its key features which are important to its management.

### 4.2 GEOLOGY, HYDROGEOLOGY AND SOILS

The headwaters of the River Exe lie on Middle and Upper Devonian rocks (see Map 2). These rocks include the Ilfracombe Beds, Morte Slates, Pickwell Down Beds, Upcott Beds and the Baggy Beds. These strata are a complex sequence of slates, siltstones, thin limestones and sandstones.

These rocks act as a minor aquifer and usually yield only sufficient water to meet the private domestic requirements. However, they provide essential support to the baseflow of the upper reaches of the Rivers Exe, Barle and Batherm during extended dry periods. Overlying soils are mainly podzolic and surface water gley soils, although brown earths and pockets of raw peat and groundwater gley soils also exist (see Table 1).

Immediately to the south of Dulverton an east-west band of Pilton Shales crosses the catchment. These are generally soft slates with lenses of sandstones and beds of shell debris limestone. Rocks of the Culm Group outcrop south of the Pilton Shale. The Crackington and Bude Formations (interbedded sequence of sandstones, shales and mudstones) outcrops over much of Mid Devon and extends down the west and central part of the catchment as far as Exeter. These shales and sandstones act as minor aquifers providing only small yields for private domestic supplies and support to river baseflow. The soils overlying the shales are typically slowly permeable clayey soils, with some areas seasonally waterlogged. Soils overlying the predominately sandstone area are typically well drained fine loamy soils.

Breccia and Conglomerate deposits, which are classified as a major aquifer, overlie the Culm Shales, and outcrop around Tiverton and in a 3 to 7 kilometre wide band which extends from the western edge of the catchment through Crediton to south of Cullompton. The Breccia and Conglomerates also outcrop along the western side of the Exe Estuary. In general the deposits are less cemented to the east of the catchment and provide a greater yield from boreholes and wells, for domestic and agricultural use, including spray irrigation. Soils overlying these rocks are usually well drained gritty reddish loamy soil.

In places Lower Sandstone overlies the Breccia and Conglomerate deposits as in the Clyst Valley, Crediton Trough and to the west of the river Exe Estuary. These deposits act as major aquifer and are loosely or uncemented sandstone with high permeability and significant storage. This aquifer is exploited for public supply, they also provide large private agricultural supplies and support stream and river flows. The soil derived from the Lower Sandstone are well drained sandy loamy soils, which are prone to water and wind erosion.

Associated with the Lower Sandstone are outcrops of basic lavas. These outcrops are found in the areas around Exeter, Crediton and Tiverton.

In the east of the catchment Aylesbears Mudstone (Lower Marl) overlies the Lower Sandstone. These mudstones are generally of low permeability and are classed as a minor aquifer. However, large supplies can be obtained by drilling into the underlying lower Sandstone deposits. The Budleigh Salterton Pebble Beds and Otter sandstone are major aquifers, however, only small areas of outcrop occur along the eastern boundary of the catchment. The soils overlying the mudstone are slowly permeable reddish fine silty or fine loamy soil, with some areas seasonally waterlogged.

## CATCHMENT CHARACTERISTICS

**Table 1: Characteristics of Soils found in the River Exe Catchment**

CHARACTERISTIC	SOIL TYPE		
	Brown Earths	Brown Podzolic Soils	Surface Water Gley Soils
DIRECTION OF WATER MOVEMENT	Vertical percolation but some localized and seasonal, lateral flow	Vertical percolation	Lateral runoff except in very dry weather, then bypass flow to shallow depth
SOIL WATER STORAGE CAPACITY (Average days/year spare capacity)	Well drained, moderate storage capacity (160-210 days)	Well drained, moderate storage capacity (160-200 days)	Waterlogged from autumn until early summer, slight storage capacity (35 days)
STREAM RESPONSE TO RAINFALL	Slight	Muted	Immediate
GROUNDWATER VULNERABILITY CLASS	Intermediate leaching potential	Intermediate leaching potential	Low leaching potential
LAND DRAINAGE	Little or none	None	Widely drained
AGRICULTURAL USE	Readily cultivated and trafficked. Arable and grass ley.	Too steep for cultivation. Pasture, rough grazing.	Permanent pasture, moor, wet rough grazing, scrub. Trafficability difficult October to April
OLD PERMANENT GRASS	Mixed species grass with bracken and gorse	Mixed species grass with bracken and gorse	Culm grassland with <i>Molinia</i> and locally heath
ORGANIC WASTE AND EFFLUENT DISPOSAL			
Season	Long	Long (but slope dependent)	Very short
Runoff Risk	Small	Small (but slope dependent)	Large. Also risk in dry weather from crack bypass
BOD Amelioration	Large	Large	Slight
Excavated Stores, Soakaways etc.	Little water to pollute but Basal Head gives route for added liquid	Little water to pollute but Basal Head gives route for added liquid	Much water in Basal Head ready to be polluted

The above summary table highlights some of the soil characteristics which dictate land use and the potential impact on the water environment.

## CATCHMENT CHARACTERISTICS

Mercia Mudstone (Upper Marl) outcrops in the base of the Culm Valley and is generally a minor aquifer consisting of mudstone and clays with low permeability. The soils overlying the Mercia Mudstone are similar to those derived from the Aylesbeare Mudstone. The Upper Greensand that outcrops along the valley sides is a minor aquifer. This provides significant supplies, generally from springs, and is the source for several watercourses including the River Culm. The clays with flints that overlie the Upper Greensand is a non-aquifer, however, water supplies can be obtained by drilling into the Mercia Mudstone and Greensand minor aquifers beneath. Greensand derived soil is typically deep well-drained loamy soil. The soils over the clay outcrop are slowly permeable seasonally water logged clayey soils.

Extensive deposits of alluvium and river gravel are also associated with the river channels throughout the catchment. At the base of the River Exe and Culm Valleys well developed gravel deposits overlie the Mudstone. They generally have high groundwater flow and storage. Often in direct continuity with the river, they provide a significant recharge during dry periods.

### Map 3 - Hydrometric Network



Information correct as of October 1995  
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## CATCHMENT CHARACTERISTICS

### 4.3 CLIMATE

#### Rainfall

The average annual rainfall for the catchment is 1,097 mm which is higher than the national mean (908 mm). It ranges from 772 mm on the eastern side of the Exe Estuary to 2,018 mm on Exmoor.

#### Temperature

The accumulated temperatures above 0°C give an indication of how warm the period is from mid-winter to early summer and how favourable the area is for early crop germination and growth. The mean for the River Exe Catchment at 1,406°C is higher than the national mean of 1,344°C. This reflects the favourable climate of the South West peninsula.

#### Moisture

Soil moisture deficit is a measure of how much the land suffers from drought in the summer months. It measures how far the soils fall below saturation level, taking into account both rainfall and water uptake by plants.

Conversely, field capacity days indicate the number of days on which the soils are saturated and can not be cultivated. In the River Exe Catchment the mean is higher than the national mean. This is important in terms of soil workability and its suitability for sensitive crops.

### 4.4 HYDROLOGY

River flow is currently monitored at fifteen river gauging stations in the River Exe Catchment (see Map 3). Most of the sites are linked to the NRA's regional telemetry network and are also used for flood warning purposes.

There are currently twenty-six instantaneous water level (flood warning) stations in the catchment which are used for flood warning purposes. Two of these stations, Ashcombe and Dunkeswell have rain-gauges. Four hydrometric sites are also used for flood warning purposes as mentioned above. Water level data are collected once a day from these sites via the Public Switched Telephone Network. During a flood event the stations are contacted more frequently.

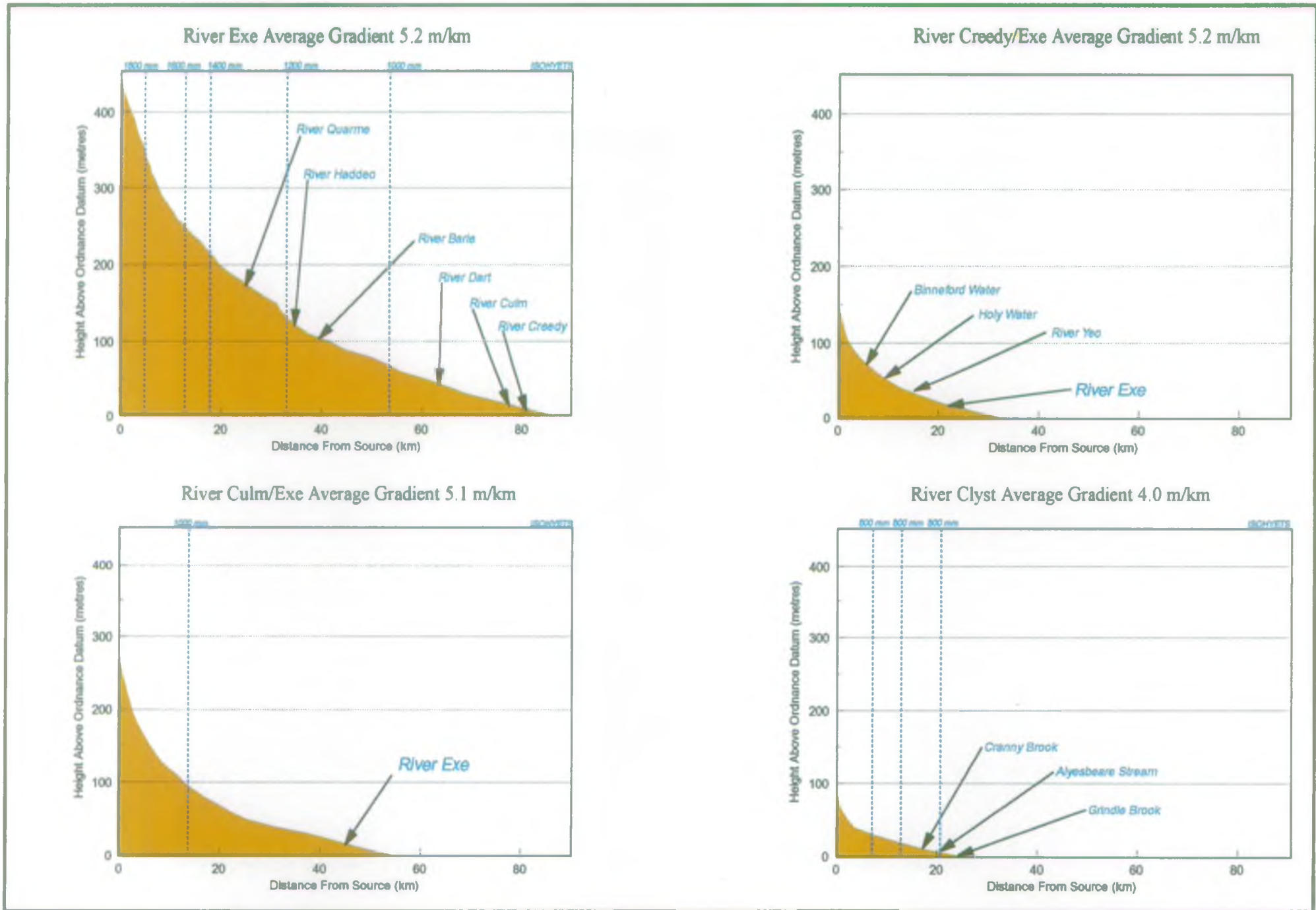
There are thirty-five groundwater monitoring sites in the River Exe Catchment. The majority of them are sited north of Dawlish and west of Crediton within the major aquifers.

The River Exe rises at a level of 450 m AOD on Exmoor and descends 87.2 km to its tidal limit, an average gradient of 5.2 m/km. The River Culm rises at 280 m AOD on the Blackdown Hills. It descends 45.3 km along an average gradient of 5.1 m/km to its confluence with the River Exe. Figure 1 shows the river profiles for the Rivers Exe, Culm, Clyst and Creedy.

An analysis of the thirty-seven year flow record (1957-1994) for Thorverton gauging station on the River Exe indicates a mean daily flow of 15.887 m<sup>3</sup>/s and a measured Q95 flow of 1.941 m<sup>3</sup>/s. The Q95 represents 12% of the mean daily flow. Although this percentage is low when compared with other rivers in the country, within Devon this percentage reflects the fact that the River Exe responds relatively slowly to floods and after flooding recedes slowly, especially in the lower catchment.

The maximum daily mean flow of 286.95 cumecs and the maximum instantaneous flow of 492.56 m<sup>3</sup>/s were both recorded on 4 December 1960 at Thorverton. Serious flooding in October and December 1960 emphasized the need for a flood alleviation scheme for the River Exe through Exeter.

# Figure 1 - River Profiles



Information correct as of October 1995

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## CATCHMENT CHARACTERISTICS

On average, flows fall below the Q95 value for eighteen days a year. In the drought years of 1976, 1984, 1989 and 1990 flows were below this level on 99, 65, 60 and 29 days respectively. On 27 August 1976 a minimum flow of 0.422 m<sup>3</sup>/s, 2.7% of the mean daily flow was recorded. Flows are now controlled by releases from Wimbleball Reservoir.

A continuous compensation flow of 0.106 m<sup>3</sup>/s is currently released from Wimbleball Reservoir into the River Haddeo. Releases are also made from the reservoir to support public water supply abstraction further downstream (see Section 5.9).

Figure 2 shows hydrographs for Cofton Farm and Beare Hill gauging stations.

### 4.5 POPULATION

The population of the River Exe Catchment is approximately 235,100 (based on the 1991 census data, as supplied by the local authorities), a density of 154 persons/km<sup>2</sup>. The population density for Devon in 1991 was 155 persons/km<sup>2</sup>.

Most of the catchment is populated by isolated farmsteads, hamlets, villages and small towns. However, it has one of the highest percentages of urban development in Devon with a growth of 2.7% a year. The six main urban areas are Exeter, Tiverton, Cullompton, Crediton, Exmouth and Dawlish.

Between 1981 and 1991 the overall catchment population increased by 6%. The largest increases occurred in parishes adjoining the catchment's urban areas, especially around Exeter, Crediton and Cullompton.

Parishes in the upper part of the River Exe Catchment, on or near Exmoor, tended to show small changes in population.

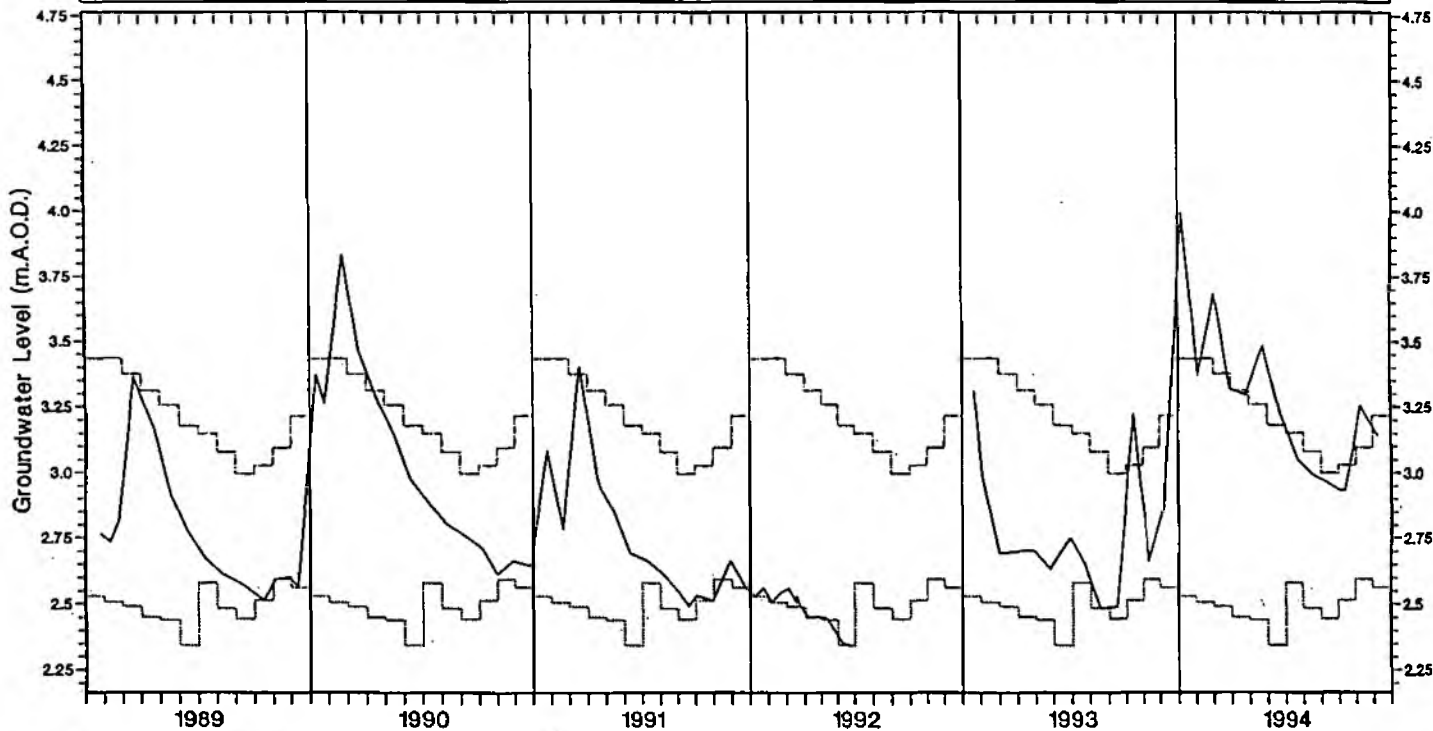
**Table 2: Key Statistics for the River Exe Catchment**

Catchment Area	1,530 km <sup>2</sup>
Rivers:	Length of River (km) (upstream of Tidal Limit*)
Exe	82.7 km
Culm	45.3 km
Clyst	25.1 km
Creedy	24.3 km
Population (1991)	235,100 persons (approx.)
Main Towns/Cities	Exeter, Crediton, Tiverton, Cullompton, Exmouth, Dawlish
Average Annual Rainfall (source MAFF)	1,097 mm
Controlled Water Length (Monitored for Water Quality Purposes)	656 km

\* Tidal Limit as defined in Section 192 of the Water Resources Act, 1991 (Ref. 2).

Figure 2 - Hydrographs for Gauging Stations at Cofton Farm and Barehill

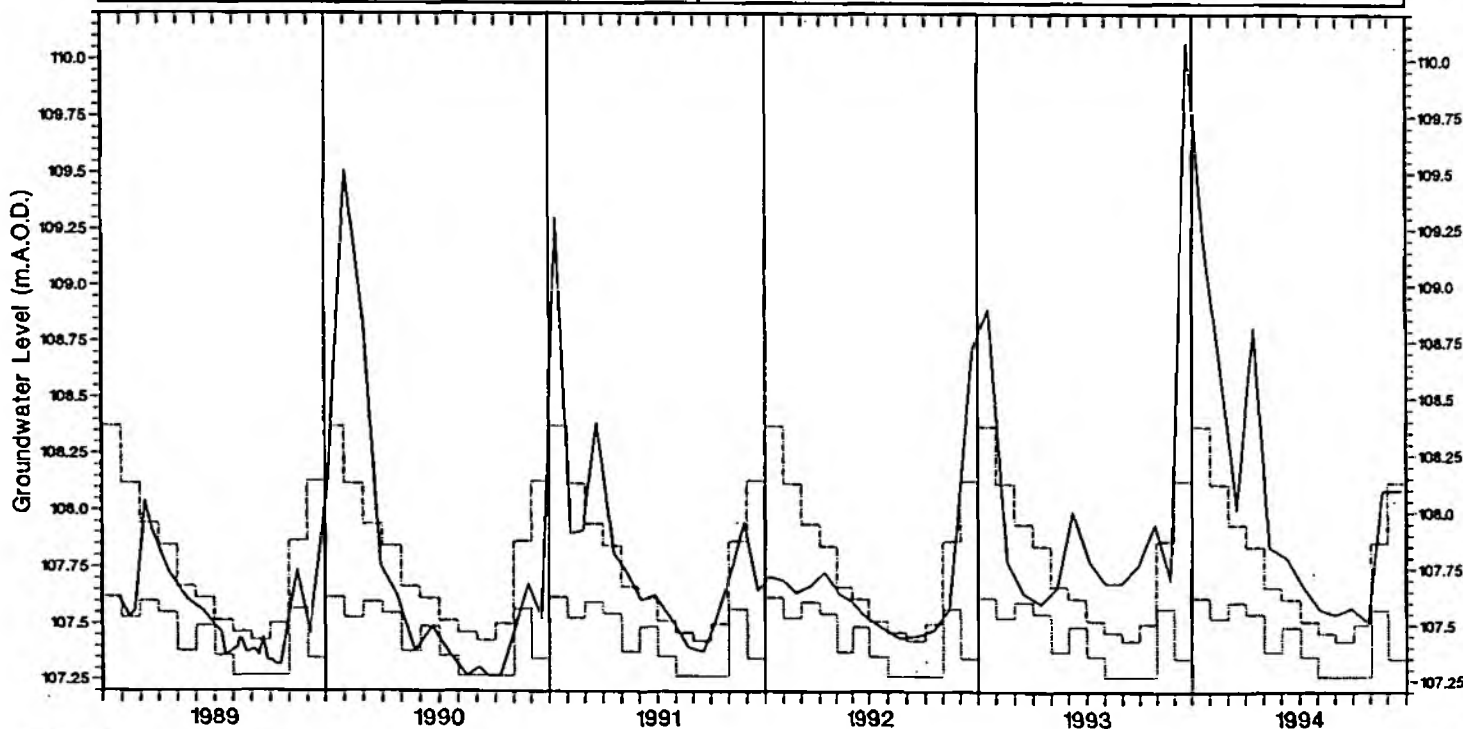
N.R.A. SOUTH WEST REGION HYDROMETRIC SERVICES GROUNDWATER HYDROGRAPHS	STATION NAME STATION No. N.G.R. AQUIFER	COFTON FARM SX98G041 SX-9680-8033 L.SANDSTONE
	1989 ANNUAL AVERAGE 1990 ANNUAL AVERAGE 1991 ANNUAL AVERAGE	2747 m.A.O.D. 2820 m.A.O.D. 2734 m.A.O.D.
	1992 ANNUAL AVERAGE 1993 ANNUAL AVERAGE 1994 ANNUAL AVERAGE	2481 m.A.O.D. 2789 m.A.O.D. 3283 m.A.O.D.



1989-1994 MONTHLY AVERAGE ———  
 1989-1994 MONTHLY MINIMA ———

8-MAR-95

N.R.A. SOUTH WEST REGION HYDROMETRIC SERVICES GROUNDWATER HYDROGRAPHS	STATION NAME STATION No. N.G.R. AQUIFER	BAREHILL SS70G004 SS-7830-0210 -
	1989 ANNUAL AVERAGE 1990 ANNUAL AVERAGE 1991 ANNUAL AVERAGE	107.547 m.A.O.D. 107.725 m.A.O.D. 107.830 m.A.O.D.
	1992 ANNUAL AVERAGE 1993 ANNUAL AVERAGE 1994 ANNUAL AVERAGE	107.467 m.A.O.D. 108.013 m.A.O.D. 108.026 m.A.O.D.



1989-1994 MONTHLY AVERAGE ———  
 1989-1994 MONTHLY MINIMA ———

1-SEP-95

## 5. CATCHMENT USES

### 5.1 LANDSCAPE, WILDLIFE AND ARCHAEOLOGY

We consider here how we protect and manage the natural environment and the historic built environment associated with rivers and wetlands.

#### **Our Objective**

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

#### **The Role of NRA**

Legislation determines what we can and cannot do to regulate work in rivers and floodplains. An important part of our work is to influence land use planners and land managers to look after rivers and wetlands sensitively.

We have duties and powers to:

- \* conserve and enhance landscape, wildlife and natural features especially in rivers and wetlands
- \* protect and conserve buildings, sites and objects of archaeological, architectural or historic interest.

Our work involves a range of activities:

- \* we study river and wetland wildlife and we are developing better methods for doing this
- \* we are developing standard ways of reviewing the effects of our work on wildlife
- \* we are establishing a national database to store wildlife information
- \* we are improving the way we consider and carry out Environmental Assessments
- \* we encourage local planning authorities and developers to promote wildlife conservation on rivers and wetlands and we encourage the development of new river management techniques.

#### **Catchment Perspective**

##### *General*

Much attention has been focused recently on these aspects of Devon's environment. Detailed documents have been produced by various bodies which have been of great use in the production of this summary. For more detail it is recommended that reference is made to these documents:

The Devon Landscape: A Draft Strategy for Consultation, Devon County Council, September 1994 (Ref. 3)

The New Map of England: a celebration of the South Western Landscape, Countryside Commission, 1994 (Ref. 4)

Nature's Place - A Nature Conservation Strategy for Devon, Devon County Council, November 1994 (Ref. 5).

# Map 4 - Landscape and Heritage



## CATCHMENT USES

The River Exe Catchment is a large and diverse one and any condensed assessment has shortcomings. In the following sections we have tried to draw out the most important aspects of the catchment, specifically in relation to rivers and wetlands.

### *Landscape*

A number of landscape designations apply to the catchment (see Map 4). The National Park and Area of Outstanding Natural Beauty (AONB) are landscapes of national importance, designated under the National Parks and Access to the Countryside Act 1949 (Ref. 6). At a county level, large areas of the rest of the catchment are designated Areas of Great Landscape Value (Devon) or Special Landscape Area (Somerset), to which certain County Structure Plan (Refs. 7 and 8) policies apply. Other, smaller areas fall in to the Coastal Preservation Zone.

The River Exe Catchment extends across several different landscape types. The Rivers Exe and Barle rise in the wet open moorland of Exmoor, before running south-eastward through steep sided valleys with extensive broadleaved woodlands. Further east, smaller tributaries run off the Brendon Hills, with the River Haddeo dammed to create Wimbleball Reservoir. Much of the Exmoor landscape has been modified by man, with extensive enclosure and agricultural improvement taking place in the 19th century, giving it a softer, less rugged appearance than Dartmoor.

Below Dulverton there is a transition where the River Exe and its tributaries cut through the Culm Measures creating valleys with rounded ridges between. The floodplain starts to open out and there are meadows alongside the river on the valley floor. The River Exe valley becomes the dominant landscape feature around Bampton. The sides are heavily wooded, with rock outcrops and occasional quarries standing out in contrast. The floodplain becomes increasingly broad further south and rolling farmland replaces woodland on the higher ground to the sides.

Tiverton marks another change, this time to the Devon Redland which extends to the coast and includes the valleys of most of the larger tributaries of the River Exe. Even the River Culm, which rises on the Upper Greensand of the Blackdown Hills where small fields and high hedges create an enclosed, intimate feel, soon enters the more open landscape of Red Devon. The rivers here are more typical lowland rivers, meandering across a flatter landscape with valleys separated by low hills in a patchwork of pasture and arable. Major transport routes follow several of the rivers.

South of Exeter and backed to the west by the Haldon Ridge, the Exe Estuary exerts its own particular influence on the landscape. Wide open spaces with extensive grazing marshes are set against the constantly changing aspect of the estuary itself.

Where we undertake significant works, the effects on the landscape are considered as part of an established environmental appraisal procedure. If inadequate information is available, the necessary landscape assessment will be carried out. When dealing with proposals by others, we will require consideration of the impact on landscape to be appropriate to the scale of the proposal.

### *Archaeology*

There are a broad range of sites and features of historic and archaeological importance many are protected by statute and others are not.

Archaeological sites of national importance may be scheduled as Ancient Monuments. About 111 have been designated within the catchment, mostly clustered in Exmoor National Park, within Exeter City and to the west of Brampford Speke. Ten Historic Parks and Gardens (see Appendix 1) are recognized in the catchment (see Map 4).

## CATCHMENT USES

The Devon County Sites and Monuments Register includes data on a large number of items (over 50,000 in Devon), for example, the Exeter Ship Canal which is the oldest ship canal in the country. The register is the principal source for assessing archaeological significance. Areas of importance for archaeology have not been designated in Devon as they have in some other counties (e.g. Cornwall's Areas of Great Historic Value and Somerset's Areas of High Archaeological Potential).

Some organic remains associated with rivers have been found in the past, notably a timber trackway on river gravels at Marsh Barton, part of an ancient quay in a creek at Kenton, a possible wood-lined leat at Tiverton and evidence of erosion control at Upexe. Artifacts connected to Brunel's atmospheric railway are present in the sands of the estuary. Despite apparently promising conditions, Exmoor has not been a significant source of finds, perhaps because of the relative lack of disturbance. However, the area does contain Taw Steps, an excellent example of prehistoric clapper bridge, which crosses the River Barle.

Buildings of particular significance are protected by the Planning (Listed Buildings and Conservation Areas) Act 1990 (Ref. 9). Depending on the level of importance, different grades are applied. Around 10% of buildings in rural districts are listed. A wide variety of Conservation Areas have been designated throughout the catchment to protect areas of special architectural character and interest; these range from sections of Exeter dating from the medieval period, to typical villages such as Bickleigh, or the industrial revolution architecture of the Tiverton Canal.

### *Wildlife*

#### Designations

As in the majority of the catchments in Devon, the River Exe Catchment is of great importance for nature conservation; indeed it contains some of the finest sites in the South West. The Exe Estuary and surrounding land are designated as a Special Protection Area (SPA) under the EC Birds Directive (Ref. 10), and as a Wetland of International Importance, especially as a waterfowl habitat, under the terms of the RAMSAR Convention. The East Devon Pebble Heaths is a proposed SPA.

The EC Habitats Directive (Ref. 11) seeks to protect habitats and species by the designation of Special Areas for Conservation (SACs). The process of defining SACs is currently underway and will be completed by 1998. The East Devon Pebble Heaths are under consideration as a possible SAC. Consents and licences may need to be reviewed in a SAC.

Twenty-seven sites are designated Sites of Special Scientific Interest (SSSI) (see Appendix 2 for details), including a number of river and wetland sites (see Map 5). In particular, the River Barle is considered to be the best English example of a river which has an acidic upland character grading into a rich sandstone type, while the River Exe at Brampford Speke is selected for its interesting geomorphology, demonstrating river and floodplain forming processes.

The Exe Estuary has been selected as the highest priority site in the NRA's Devon Area for production of a Water Level Management Plan. This initiative, promoted by the Ministry of Agriculture, Fisheries and Food (MAFF) and involving detailed discussions between NRA, English Nature and landowners, will seek to manage water levels for the benefit of conservation where possible.

The Exmoor and Blackdown Hills Environmentally Sensitive Areas (ESAs) both include part of the River Exe Catchment. ESAs are designated by MAFF and aim to encourage traditional farming methods and conserve and enhance the ecology, landscape and historic features of the area.



## CATCHMENT USES

Several areas of the catchment in Devon are designated Nature Conservation Zones and are therefore subject to certain County Structure Plan (Refs. 7 and 8) policies.

There are twenty-two Nature Reserves in the catchment (see Appendix 3) including a number of high quality wetland reserves, some of which are open to the public. In addition, there are many sites of semi-natural habitat outside designated areas which are of conservation value. Programmes to identify those sites of county or local wildlife importance are well advanced in both Somerset and Devon; those in Mid Devon and East Devon are now completed. This will help us to protect important habitats and species from inappropriate development. There is also a scheme to identify sites of at least county earth science importance. It is hoped that all these non-statutory sites will be identified in published Local Plans and, thereby, gain a measure of protection.

### Habitats

English Nature (EN) has recently, through its Natural Areas initiative, divided the country on the basis of land use and ecology. Most of the River Exe Catchment falls within the Exmoor and Quantocks, and Devon Redland areas, with smaller sections in the Culm Measures and Blackdowns areas.

Key habitats have also been identified by English Nature. The most significant types closely linked to the water environment are: valley oak woods on Exmoor; alder and willow carr and spring-line mires in the Blackdowns; the freshwater habitats of the Exeter and Grand Western Canals; fast flowing acidic rivers like the River Exe and upper Barle; bogs on Exmoor; and the Exe Estuary, particularly its sea grass beds and sand dune system.

River corridor surveys have been carried out for the NRA on much of the 'main river' sections of the Rivers Culm and Clyst. Areas subject to routine maintenance on the lower River Exe, River Kenn and some minor tributaries have also been surveyed.

### Species

Much species survey work has been done on the catchment by a variety of organizations, particularly in relation to the Exe Estuary. The NRA has also carried out, in addition to the routine invertebrate sampling programme detailed surveys at thirteen sites in the catchment. These surveys include invertebrates, plants, corridor habitat and channel morphology. Similar surveys took place as part of the investigation of a low flow site on the River Barle.

Otters are recorded from most parts of the catchment, although at lower levels of abundance than on the North Devon rivers. The population would appear to be recovering from the decline of the sixties and seventies, and this may result in migration to adjacent catchments. Several road casualties have been recorded recently, which can provide useful information on pollutants through post-mortem analysis. Otters are fully protected under the Wildlife and Countryside Act 1981 (Ref. 12) and are also listed in Annex II of the EC Habitats Directive (Ref. 11).

Water voles are present in small numbers at a few sites in the catchment, mainly on the River Culm. This restricted distribution may be due to a scarcity of suitable rivers, although a recent survey links declining numbers to the spread of feral mink, which are widespread.

The catchment supports a number of important breeding sites for grey heron, including one of the largest in Devon, at Powderham. Mute swans also breed in good numbers on the lower River Exe and River Culm. The Exe Estuary, like other Devon estuaries, has seen a significant increase in the numbers of little egrets present and breeding seems likely in due course.

# Map 5 - Nature Conservation Resources and Formally Designated Sites



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## CATCHMENT USES

Canada geese are becoming more common, with a large resident population using the Exe Estuary. The expansion of this introduced species is causing concern to both conservationists and farmers. Shelduck breed in small numbers around the Exe Estuary, while goosander are increasingly common on the middle reaches of the catchment and it seems probable they are breeding there.

Exminster Marshes provide breeding habitat for Redshank, one of just a few sites in Devon, and also Lapwing. Recent works here by the Royal Society for the Protection of Birds (RSPB) and NRA have improved habitat and numbers are increasing in response.

There are scattered records of kingfishers breeding in the catchment, mostly on the lower River Exe, River Culm and River Creedy (Yeo), but populations of this species fluctuate with hard winters which cause extensive mortalities. Sand martins are also mostly restricted to these areas, with two of Devon's largest colonies on the River Exe and River Culm. Sand Martins appear to be recovering from their catastrophic decline in the mid-1980s which occurred due to drought in their sub-Saharan wintering habitat.

Grey wagtails are common breeding birds throughout the catchment, showing some preference for more upland areas, while the related yellow wagtail prefers wet lowland grassland and has only bred at two Devon sites, one of which is in the River Exe catchment. Dippers are another typical upland species and are uncommon on the lowland rivers.

Cetti's warbler is a relatively recent addition to the breeding birds of Devon and again the Exe Estuary, especially the upper section, is one of the main breeding areas. It is also a focus for breeding sedge and reed warblers. While not strictly a wetland species, curlew buntings are now virtually restricted in England to the coastal strip of south Devon, including the area to the west of the Exe Estuary. Their survival appears to depend largely on the retention of traditional farming practices. In contrast, reed buntings breed over a much wider area but are still largely associated with wetland habitat, notably reed beds and rushy pastures.

Reflecting its international designation, the River Exe Estuary is important for breeding birds and wintering species, especially wildfowl and waders. In particular, over 5% of the British population of Slavonian grebes are found here, as are some 2% of the world population of dark-bellied brent geese and large numbers of widgeon. Flocks of avocets in excess of 400 birds attract birdwatchers from far away, while a large proportion of wintering black-tailed godwits are also present. Altogether, peak winter populations on the Exe Estuary regularly reach 50,000 birds.

Although breeding remains more or less restricted to the coast, the numbers of cormorants feeding and roosting inland is giving rise to concern, particularly in terms of their perceived impact on fish stocks.

Ponds in the Clyst valley are known to contain great crested newts, a species fully protected under the Wildlife and Countryside Act 1981 (Ref.12), as amended.

A number of fish species are recorded from the catchment of conservation value; atlantic salmon and sea bass are both economically important and subject to extensive protection measures, whilst allis shad, bullhead and lamprey species are less well studied, although all are covered by the Habitats Directive (Ref. 11).

Two butterfly species particularly associated with wetland sites have been recorded, but their current status in the River Exe Catchment is uncertain; Marsh Fritillary is protected under Annex II of the Bern Convention and the High Brown Fritillary is listed as rare in the British Red Data Book: 2 Insects (Ref. 13), indicating that it is found in fewer than fifteen 10 x 10 km squares in Britain. Both species are declining rapidly.

## CATCHMENT USES

A good range of dragonfly species are present, with white-legged damselfly, migrant hawker, hairy dragonfly and four-spotted chaser among the more notable species. The Southern Damselfly, for which the East Devon Heaths are internationally important, breeds in wetlands forming part of the adjacent River Otter Catchment.

The native or white-clawed crayfish is found in small numbers, mainly in the Rivers Creedy and Culm; this species is rare in Devon and has declined drastically throughout England, mainly as a result of crayfish plague spread by other crayfish species introduced for commercial production. The Creedy population has recently been recognized as of regional importance.

Specific types of sandbank in the Exe Estuary provide the right conditions for *Ophelia bicornis*, a marine worm (see Section 6.1). The Exeter Canal has been a location for the freshwater jellyfish *Craspedacusta sowerbyi*, but populations rarely persist for more than a few years.

Several significant aquatic plant species are found in the catchment. Canadian arrowhead, an introduced species, is nationally rare in Britain. Other species are nationally scarce; fringed water-lily and the pondweed (*Potamogeton trichoides*) are freshwater species while eelgrasses (*Zostera spp.*) provide a vital food resource for estuary-feeding geese. Also nationally scarce, Corky-fruited water-dropwort is locally frequent, particularly in riverside meadows in the lower River Exe Catchment.

A continuing programme of assessing the distribution of several invasive plant species is undertaken by the NRA. Giant hogweed does not appear to be an extensive problem in the River Exe Catchment, but Japanese knotweed and Himalayan balsam are widespread and increasing along river margins, often at the expense of native flora.

## 5.2 FISHERIES

We consider here the conservation of wild fish and their habitats.

### Our Objective

To protect and improve the river environment to ensure the continued survival of fish stocks.

### The Role of the NRA

We have duties and powers to:

- \* maintain, improve and develop the wild fish resource of the catchment
- \* ensure chemical water quality in those stretches designated under the EC Freshwater Fish Directive (Ref. 13) complies with standards
- \* control the movement and introduction of fish
- \* enforce regulations and byelaws to prevent illegal fishing.

Our work involves a range of activities:

- \* we survey rivers to check the number, age, and types of fish they support. If numbers are very low we try to identify the problem and improve the situation
- \* we make sure the abstraction of water or damming of rivers does not seriously disrupt the life cycles of fish
- \* we consult widely with people who have an interest in Fisheries.

### Catchment Perspective

Fish are good indicators of the overall health of our rivers. We use special survey equipment to assess the quality of fish populations.

#### *Salmonid Fisheries*

The catchment supports a large run of salmon that sustains both a commercial net fishery in the estuary and an active sport fishery on much of the main river and its tributaries. Salmon rod catch returns from this fishery are generally the highest in the South of England. The migratory fish run is comprised almost exclusively of salmon, sea trout being virtually absent. In comparison with other rivers in the south-west, the River Exe is unique in this respect. Salmon spawn in the middle and upper reaches of the catchment in late autumn and winter. Most salmon running the River Exe in recent years have been grilse (fish that have spent one winter at sea) which enter the river between June and September. The numbers of larger 'Spring Fish' (fish that have spent more than one winter at sea) which enter the river at other times of the year are small in comparison to the grilse run. The middle and upper reaches of the River Exe, and most of the main tributaries support stocks of brown trout for which there is a significant rod fishery (see Map 6).

# Map 6 - Salmonid Distribution



### *Freshwater & Eel Fisheries*

In the River Exe Catchment, there are significant coarse fishing interests in the rivers, still waters and canals (see Map 7). There is a prolific and varied coarse fishery in the lower reaches of the River Exe at Exeter. This fishery contains quality carp, roach, dace, bream and perch, and to a lesser extent, chub and pike. The middle reaches of the river support a limited coarse fishery in the Tiverton area where roach and dace are caught. Grayling are also found in this area, and their distribution extends further upstream to Oakford. Fishing pressure for this species is very light.

There are two major canals in the River Exe Catchment; the Exeter Canal and the Grand Western Canal at Tiverton. The Exeter Canal supports a varied mixed fishery containing bream, roach, dace, perch, and rudd, with some good specimen carp and pike. The Grand Western Canal is a good mixed fishery noted for tench. In addition, the following species are present: perch; pike; roach; rudd; carp; bream and eels (eel distribution on Map 8 and angling on Map 9).

### *NRA Owned Fisheries*

The NRA owns fishing rights on the River Exe at Tiverton and the River Exe and River Creedy at several locations between Cowley Bridge and Countess Wear. The stretch at Tiverton is leased to the Westcountry Rivers Trust and offers both game and coarse fishing. The NRA actively manages the game fishing of the Exeter stretches but leases the coarse fishing to the Exeter and District Angling club. All NRA owned fisheries in the catchment may be fished by the general public upon purchase of the appropriate permit.

### *Estuarine Fisheries*

The estuary sustains a wide range of fishing activities from major commercial operations to small scale part-time activities. Much of the estuary is used by bass and mullet as a nursery and feeding area where they proliferate in the summer months. A designated bass nursery exists in the estuary which affords protection to the juveniles of this species.

Eighteen licences are issued by the NRA in the estuary for the capture of migratory salmonids which operate during the season from 14 February to 16 August.

The largest commercial fishery on the estuary is molluscan shellfish farming which concentrates on the cultivation of mussels and oysters. Shellfish are also taken from wild beds in the area which provide cockles, mussels and winkles. Small crabs are collected for bait from the shoreline using crab tiles.

We issue a limited number of licences for the use of fyke nets to trap eels, an activity that is conducted in most parts of the estuary. Elver dip nets are also used in the tidal reaches of the Rivers Exe and Clyst.

# Map 7 - Coarse Fish Distribution



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River Exe Catchment Management Plan

NRA South Western Region



# Map 8 - Eel Distribution



# Map 9 - Angling



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River Exe Catchment Management Plan

NRA South Western Region

### 5.3 RECREATION AND AMENITY

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

#### Our Objective

To develop the amenity and recreation potential of inland and coastal waters and associated land.

#### The Role of the NRA

We have duties and powers to:

- \* protect and maintain access to beautiful areas or special sites of interest
- \* make sure that the land and water we own is made available for recreation and at all times take into account the needs of the chronically sick or disabled
- \* charge for facilities that we provide for recreation
- \* make byelaws to regulate recreation.

We are involved in a range of activities:

- \* we work with other agencies such as planning authorities and sports associations to develop recreation facilities
- \* we work with other organizations to develop plans and strategies for promoting recreation in the water environment
- \* we carry out and support practical projects to enhance recreation opportunities.

#### Catchment Perspective

Recreation use of the estuary is considered in detail in the recently produced document 'The Future Management of the Exe Estuary - Draft Management Plan' (Ref. 15). Although factual inaccuracies have been recognized within the document, it does not seem sensible to attempt a revision within this Catchment Management Plan. This section of the plan deals with those aspects of recreation which are closely tied to water and not those, such as picnicking, which although linked are not dependent on the aquatic environment.

#### *Bathing Beaches*

The coastal section of the catchment, straddling the mouth of the Exe Estuary, is a very important holiday area, with the resorts of Dawlish and Exmouth attracting large numbers of visitors, particularly in summer (see Section 6.1 for detail on the bathing water quality of these beaches).

# Map 10 - Recreation and Amenity



## CATCHMENT USES

### *Watersports*

The estuary is a major recreation site throughout the year, with a wide variety of watersports taking place (see Map 10). Users are both locals and visitors. Access is gained via a number of public and private slipways, distributed around the estuary. The River Exe is unusual in having a right of navigation extending above the tidal limit, to Exeter Quay. Exeter City Council is the navigation authority.

A number of sailing clubs and schools are based on the estuary. Dinghy racing is popular, with events up to national level taking place regularly. There are also in excess of 1500 moorings for larger boats, principally in the lower estuary. Windsurfing is increasingly important both in the estuary and along the seafront. Windsurfing schools operate at Exmouth. The river in the quay area of Exeter is used for training by Devon County Council for both windsurfing and dinghy sailing. Wimbleball Reservoir, owned by South West Water also provides opportunities for these sports.

There are few sites for waterskiing in Devon, but there is a designated area in the estuary off Exmouth and we have licensed limited training facilities on the Exwick Flood Relief Channel in Exeter. The recreation use of this site is currently under review. Jetskiing takes place at several locations in the estuary and, occasionally, elsewhere.

Canoeing occurs at a number of locations throughout the catchment (see Map 10); limited access agreements have been negotiated by the British Canoe Union (BCU) for parts of the River Barle and River Exe. The annual Exe Descent between Tiverton and Exeter attracts large numbers of competitors. The River Culm has no formal agreement but is canoed fairly frequently, apparently without significant conflict. Both the Grand Western Canal and the Exeter Canal provide safe, undemanding canoeing and they are used by various groups. A circular route from Exeter, taking in the upper estuary and returning via the canal, is possible and has been used for a national competition. Canoeing is also possible at Wimbleball. Surf canoeing occurs at Dawlish and Exmouth with some hire facilities available.

Rowing takes place mainly on the Exeter Canal and at Wimbleball, under the control of local clubs and Exeter University.

### *NRA Owned Sites*

Although the NRA is not a major landowner in Devon, it does own two sites of considerable recreation importance in the River Exe Catchment, at Exeter and at Tiverton.

In Exeter, much of the riverside land between Cowley Bridge and Countess Wear is under NRA ownership, although almost all is leased out. The major areas with public access are the Exwick Flood Relief Channel and the part of the Riverside Valley Park from Trews Weir to Countess Wear Bridge, which is leased to and managed by Exeter City Council. Both areas function as part of a major flood defence scheme, so that recreation facilities are limited by the provision of open space. However, the flood relief channel has been used in the past for model boating, windsurfing, raft races and waterskiing. Some of these activities are less popular with the general public and have led to complaints about disturbance of both wildlife and other users of the area. We are therefore, considering how best to manage matters to benefit the maximum number of people and to balance the varying demands on the site.

In addition, the land along the Alphin Brook also provides open space for walkers and others; this scheme is being assessed for ways of improving its recreation value.

## CATCHMENT USES

At Tiverton, the NRA owned land is again part of a major flood defence scheme; it includes walkways alongside the river through the centre of town. Although mostly hard surfaces, it is a well-used site, especially by dog walkers. Consideration is being given to schemes to enhance the appearance of the site.

### *Access*

Several long distance recreation footpaths traverse the catchment; the Two Moors Way, which runs from the north coast to Ivybridge, passes close to the source of the River Exe and overlooks part of the Barle Valley before turning south towards Dartmoor; the Exe Valley Way roughly follows the course of the river for about twenty-one miles between Stoke Canon and Exebridge; the Grand Western Canal towpath from Tiverton to the Devon-Somerset boundary links with footpaths running to Wellington; the South Devon Coast Path (part of the South West Peninsula Coast Path National Trail), which follows the whole coastal length of the catchment; and the East Devon Way which starts from Exmouth and runs roughly parallel to the coast path a few miles inland.

There are also further paths under consideration for development; a link to join the Exe Valley Way, which currently ends as a cul-de-sac, to the Two Moors Way; and links from the Exe Valley Way to Exeter and beyond to the South Coast Path.

Elsewhere, the extent of access to the river bank is variable; parts of the upper Rivers Exe, Barle and Haddeo have riverside footpaths and there are sections of both shores of the Exe Estuary with public access, but the majority of the catchment is privately owned with no public right of way along the river.

## 5.4 FLOOD DEFENCE AND LAND DRAINAGE

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.

Flood risk and land drainage have always affected the way we use land. By improving our control of water we have been able to make more extensive use of river and coastal floodplain for farming or building towns. This control can take many forms: from simple channel alterations to major floodbanks and artificial washlands. Works constructed for other purposes, such as weirs, mills and bridges, have also altered the natural river system.

Better protection from floods and better land drainage has improved our quality of life. However, unless properly managed, these benefits may result in other problems such as increased downstream flows and a legacy of expensive works for future generations to maintain. Changes in land use, made possible through drainage and flood defence, may also cause significant environmental damage, particularly to wetlands.

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 NRA**

Legislation determines what we can and cannot do. 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 supervise all flood defence matters but have special powers to carry out or control work on 'main rivers' and sea defences. Local authorities and in some areas internal drainage boards are responsible for flood defence on ordinary watercourses. Local authorities are also responsible for protecting the coast from erosion by the sea.

We have duties and powers to:

- \* control certain works and advise planning authorities on flood defence matters
- \* 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.

## CATCHMENT USES

We are involved in a range of activities:

- \* we work closely with other agencies including MAFF, local authorities, conservation and recreation bodies
- \* we survey assets and flood risk areas to improve our management of flood defence
- \* we are working on a Flood Defence Management Framework and related systems to ensure that flood defence assets are managed properly
- \* we set and monitor specific targets to improve our performance
- \* we support Research and Development and are developing best practices for our work
- \* when granting land drainage consents we ask applicants to consult river interests (e.g. River Exe Riparian Owner's Association) on the proposed work.

### Catchment Perspective

The land drainage system of the River Exe is generally a natural system in a rural catchment. Extensive field drainage enters the river system.

There is an extensive network of 'main river' associated with the River Exe Catchment which is summarized in Table 3.

**Table 3: Main River in the River Exe Catchment**

Watercourse	Length (km)		Predominant Land Use
	Tidal	Fluvial	
Exe	1.5	99.50	Agriculture
Withycombe	2.5	5.25	Urban
Bampton		1.50	Urban
Kenn	0.5	8.50	Agriculture
Alphin		20.00	Ag/Urban
Woodbury	0.7	6.05	Ag/Urban
Clyst	7.5	25.75	Agriculture
Grindle		2.75	Agriculture
Pinn		2.00	Ag/Urban
Cranny		4.75	Agriculture
Creedy		13.25	Agriculture
Yeo		13.75	Agriculture
Culm		16.00	Agriculture
Weaver		8.00	Agriculture
Spratford		9.75	Agriculture
Halberton		4.00	Agriculture
Lowman		1.75	Urban
Bathorn		6.50	Agriculture
Barle		35.75	Agriculture
Haddeo		5.75	Agriculture



## CATCHMENT USES

Extensive maintenance of existing flood defence schemes is carried out and is summarized in Table 4.

**Table 4: Summary of Routine Flood Maintenance Work in the River Exe Catchment**

Scheme	Sea Defences (SD) Tidal (T) Fluvial (F)	Nature of Work (WL = Water Level) (GC = General Clearance)
Exeter	F	GC, desilt, screens, flaps, safety
Dawlish	SD	Revetment, groynes
Withycombe	F/T	GC, desilt, screens, flaps
Wotton	F/T	GC, screens, flaps
Kenn	F/T	GC, desilt, screens, flaps
Powderham	T	GC, revetment
Woodbury	F	GC, desilt, screens
Alphin	F	GC, desilt, WL control, screens, flaps
Ide	F	GC, screens
Clyst Banks	T	GC, flaps, desilt
Clyst St Mary	F	GC, flaps, desilt
Stoke Canon	F	GC, desilt, flaps
Cullompton	F	GC, revetment
Uffculme	F	GC, flap, desilt
Culmstock	F	Flaps
Fordton	F	GC, desilt
Yeoford	F	GC, desilt,
Tiverton	F	GC, flaps, safety, desilt
Lowman	F	Flaps, desilt, revetment
Dulverton	F	GC, screens, sluices, flaps, desilt
Exe Bridge	F	GC, desilt, flaps

In addition to the above scheduled maintenance, the following work is undertaken as it arises: tree clearance; debris, silt and gravel removal; repairs to structures, training works and revetments. In the Exminster Marshes a ditch maintenance programme is carried out and a water level management agreement between the NRA and EN is in place and is currently being further developed.

In the past various channel clearance schemes have been undertaken on the following rivers: Clyst, Creedy/Yeo, Withycombe, Woodbury, Culm and Weaver.

Table 4 also lists flood defence schemes which have been undertaken within the River Exe Catchment. We are investigating improvements to the schemes at Powderham, Stoke Canon and Exebridge.

### *Emergency Response*

The NRA has a commitment to improve the Emergency Response Level of Service (ERLOS) so that where possible a warning is issued at least two hours in advance of flooding. A study is currently being carried out to determine where improvements are necessary to meet this standard.

Flood warnings are given for locations with identified flood risks within current monitored areas on the upper, middle and lower River Exe and the Rivers Barle, Bathern, Clyst, Creedy, Upper and Lower Culm and the Lowman. Operational emergency response is concentrated at Exmouth, Lympstone, Woodbury, Exminster, Ide and Dulverton, which involves the clearance of screens and penstock (water control device) operation.

## CATCHMENT USES

### *Development Control*

Major development occurs mainly to the south of a line defined by Crediton, Tiverton and Uffculme and particularly in the Exeter and Exmouth areas. North of this line there are only minor development pressures. Development in respect of the major rivers is generally limited by the extent of the floodplain. This is particularly important on the River Exe between Exeter and Bampton, the River Culm between Exeter and Uffculme and the River Yeo at Crediton.

Development control problems in the subcatchments are generally related to surface water runoff and the capacity of the receiving watercourses (see Table 5). Approximately 700 referred planning matters are dealt with each year in the River Exe Catchment.

**Table 5: Major Development Control Issues within the River Exe Catchment**

Location	Type and Size of Development	Nature of Problem
Exeter Matford Marshes	Retail, Industrial Major	Significant impact on floodplain and flood flows requires detailed investigation.
Kenton	British Gas Pipeline	Major crossing of the River Kenn.
Crediton, Wellparks, Adjacent A377 Road	Retail, Industrial Major	Land identified within Local Plan is in the River Yeo floodplain. Objection maintained.
Crediton Chapel Downs	Residential/Major	Surface water runoff will increase flood risk at Westwood. Channel improvements have been identified.
Crediton Westernlea	Existing Residential Development Subject to Flooding	Flood alleviation scheme proposed by the developers of the site has been consented by the NRA.
Cullompton Colebrook Lane	Residential/Major	Extensive downstream channel improvements have been carried out.
Cullompton Meadow Lane	Residential/Moderate	Extent of floodplain has limited development. Highway proposals need to be examined.
Tiverton Kennedy Way	Various/Moderate	Development on site will be subject to flood levels.
Tiverton Mid Devon College	Extension to College	A scheme to protect the site has now been designed by consultants acting for the Education Authority. The scheme will enable new development.
Tiverton Cotteylands	Residential/Major	Detailed hydraulic investigation of the Cottey Brook undertaken to determine channel capacity.

## 5.5 THE BUILT ENVIRONMENT AND DEVELOPMENT PLANS

Here we consider the built environment and the process of planning and regulating the construction of new development including roads, housing and industry.

County and district planning authorities plan and control development; although they must consult the NRA, they do not have to follow our advice.

### Our Objectives

To protect the water environment from the harmful effects of development and to minimize flood risk.

### The Role of the NRA

There are two main ways we can influence development:

- \* through the planning system we can assist local planning authorities to allocate land for development by commenting on local plans, identifying constraints and highlighting where the river environment can be enhanced through sympathetic development
- \* we can advise planning authorities on the control of development by offering formal and informal comments to planning authorities on planning applications and development guides. In some circumstances, we can also influence development using our powers, for example Land Drainage Consents.

We are also active at a higher level informing strategic planners of our environmental concerns, for example rivers affected by over-abstraction or water supplies threatened by major pollution hazards.

Local authorities prepare statutory development plans. In January 1994 the NRA published guidance notes for local planning authorities on ways of protecting the water environment through development plans. The notes highlight areas that concern us and offer guidance on model policies (Ref.16).

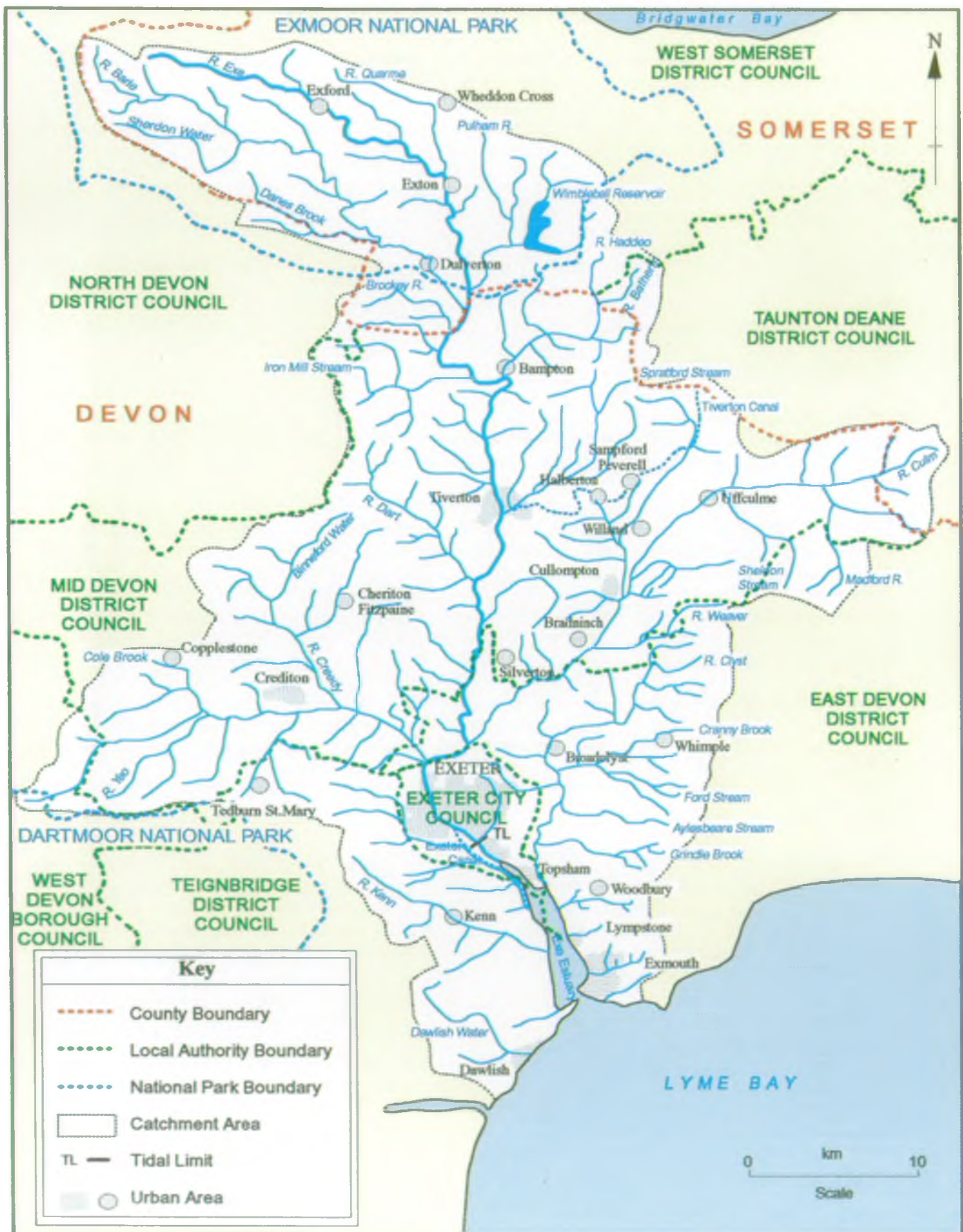
### *Planning and Flood Risk*

The Government view is that development should be guided away from areas that may be affected by flooding and should be restricted where it would increase the risk of flooding. To achieve this it expects local authorities to use their planning powers and the NRA to assist by providing advice on development and flood risk. The work that is under way now on preparing flood plans is an example of this advice (see section 6.4 Flood Defence and Land Drainage, Targets and State of the Catchment).

### **Catchment Perspective**

The Regional Planning Guidance for the South West was published in July 1994 (Ref. 17). This guidance recognizes the need to achieve sustainable development, and aims to secure the best environmental development strategy for the region as a whole. We have taken part in the preparation of the guidance which includes advice on rivers, water supply and waste water disposal. The guidance influences the contents of County Structure and Local Plans.

# Map 11 - District and County Boundaries



Information correct as of October 1995

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## CATCHMENT USES

The Devon County Structure Plan 2011 (Ref. 7) provides a framework for development and land use within Devon for the period upto 2011. The plan contains policies and advice to ensure protection and conservation of the water environment. 'Policy EN24 seeks to protect the quality of water reserves and water area within the County, including coastal waters, and the need to take account of flood risk when considering the location of developments'.

The plan contains policies and advice to ensure protection and conservation of the water environment, with development in the countryside being strictly controlled. In determining proposals for development regard must be had to 'the quality or quantity of existing and proposed water supply sources; the effect on water quality in rivers and estuaries; the effect on coastal water pollution and, any resulting increase in risk of flooding'.

The rivers of the catchment flow through eight district councils and the Exmoor National Park (see Map 11). Only four of these district councils (Mid Devon, East Devon, Teignbridge and Exeter City) and the Exmoor National Park include a significant component of the catchment. The Local Plans in these areas vary widely in their adoption of water protection policies (see Table 6) although in general plans produced more recently (and in consultation with the NRA) reflect NRA model policies well.

The Exmoor and East Devon Local Plans (Refs. 18 and 19) are of particular note for their comprehensive range of policies dealing with the water environment. A good example from the Exmoor Local Plan (Ref. 18) is that concerning the protection of river corridors 'Development which would harm the landscape, nature conservation, fisheries or recreational interest of rivers and their surroundings would not normally be permitted. Wherever possible the proposal should incorporate measures for enhancement, habitat restoration and where appropriate public access and interpretation'.

We are currently consulting with Mid Devon and Teignbridge District Councils over their Local Plans (Refs. 20 & 22) and will be involved in the consultation of the next Exeter City Plan.

To ensure consistency across the planning districts within the catchment, all districts are issued annually with consultation guides (Ref. 15). These guides include general information and specific advice on settlements where there are infrastructure deficiencies which could be or are affecting water quality. The guides also include advice on development within floodplains and areas liable to flooding.

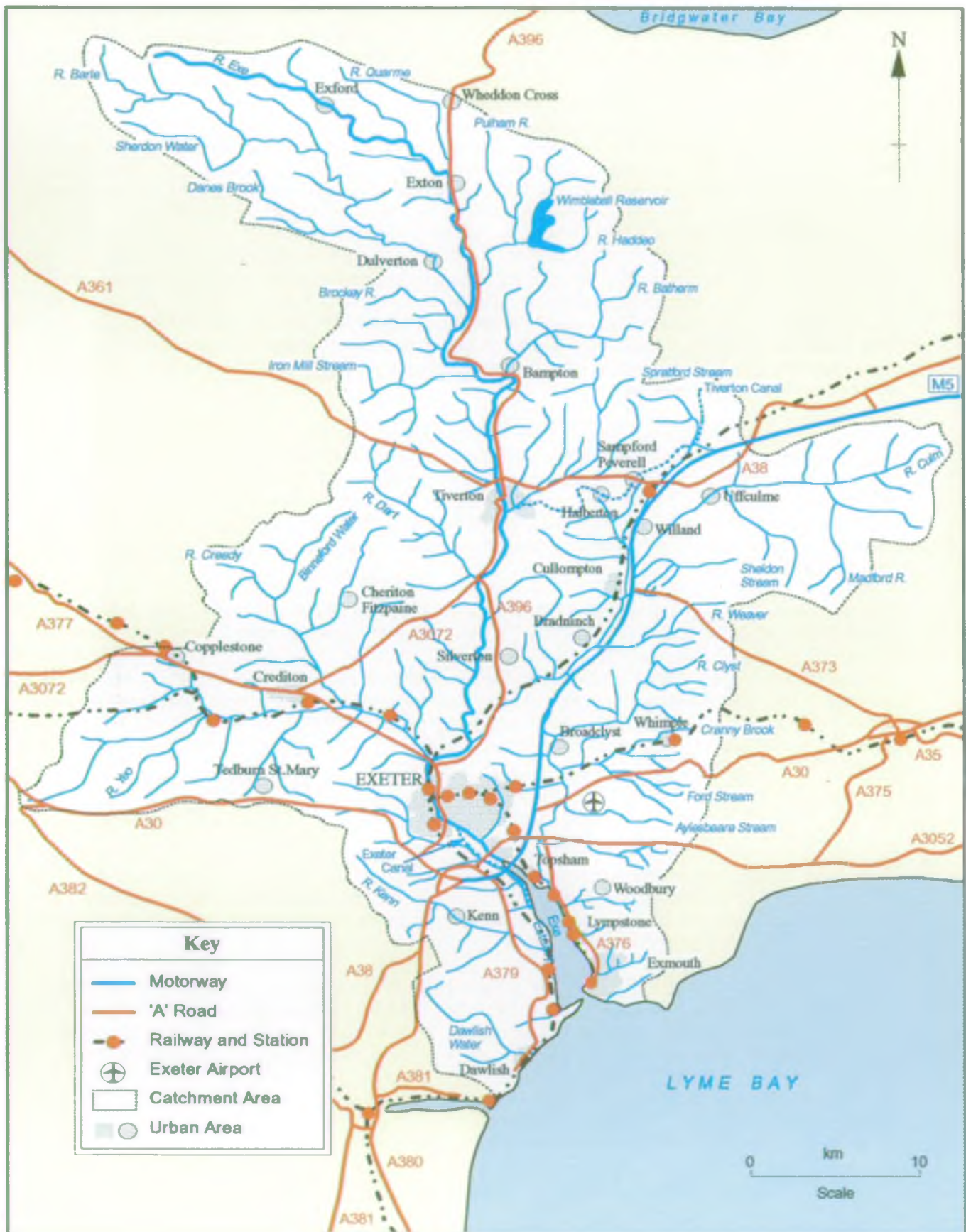
### *Roads*

We are a statutory consultee to the Department of Transport when new trunk roads are developed, we also have input into road schemes proposed by the County and District Councils. We are involved throughout the process, from route choice and design, through to construction. Through consultation we seek to protect the water environment from adverse impacts and secure enhancement where possible.

We have powers to control highway drainage through prohibition notices and discharge consents. This allows us to insist upon measures to alleviate pollution such as the use of interceptors to contain accidental spillage. During the planning of new roads we seek to prevent habitat destruction within the river corridor as this leads to a loss of conservation and amenity value.

The catchment has a well developed road network (see Map 12) which includes the M5 and several major trunk roads providing good access to other parts of the south west. This network is, however, under increasing pressure from heavy traffic loads particularly in the holiday season.

# Map 12 - Built Environment



## CATCHMENT USES

There is only one major road scheme currently planned in the catchment. This is a new route bypassing a section of the A30 between Clyst Honiton and Honiton. The NRA and its predecessor the South West Water Authority have been consulting with the Department of Transport since 1972 over this route and consultation is still ongoing. We have commented in detail upon the proposed route and all formally consentable works applied for have been granted, however, consent has not been applied for all consentable works associated with the route.

### Mineral Plans

These are addressed in Section 5.11, Mining and Quarrying.

**Table 6: Details of the Local Plans Covering the River Exe Catchment**

Local Authority (part in catchment)	Housing Provision 1989-2001 (Dwellings)	Employment Land Provision 1989-2001 (ha)	Local Plan Plan Status	Water Protection Policies
Mid Devon District (majority)	7,200	80	Mid Devon Local Plan Deposit-Copy October 1994	One policy referring to flood defence, water quality and water resources. NRA in consultation.
East Devon District (minority)	8,000	75	East Devon Local Plan Post Consultation	Water quality, flood defence, water resources, river and coastal conservation.
Exeter City Council (wholly)	5,000	120	Exeter Local Plan Plan adopted 15 Nov 1993	Conservation and recreation of River Exe and estuary in Riverside Park Local Plan (Ref. 21).
Teignbridge (minority)	8,900	70	Teignbridge Local Plan Adoption expected late summer 1996	Flood defence, Water quality, conservation and recreation in river corridors and Exe Estuary (Ref. 22).
Exmoor National Park Authority (minority)	100	-	Exmoor Local Plan	River corridor - conservation/recreation and amenity. Fisheries, flood defence, water quality, water resources, groundwater protection.

### Notes

Local Plans go through various stages before they are finally used i.e. **adopted**. The stages are usually as follows: the first stage is the consultation phase whereby consultees are invited to comment upon the **consultation draft**. After consultation a **deposit draft** is written and further consultation is sought. This leads to a **deposit copy** of the plan which is available widely to the general public. A public enquiry may then follow at which all public concerns can be raised both verbally and in writing. An **inspectors report** is produced from this by the inspector appointed by the Secretary of State for the Environment. The Secretary of State then approves the plan with any modifications from the inspectors report he considers to be valid and the plan is finally **adopted**.

# Map 13 - Waste Disposal





## 5.6 WASTE DISPOSAL

Here we consider the disposal of waste to land. Some wastes, as they break down, can form very polluting liquids, known as leachate. Leachate can pollute water both above and below ground.

Waste disposal sites are licensed by the County Waste Regulation Authority (WRA) who make sure that sites do not endanger public health, cause pollution or spoil the local area. WRAs consult us on all applications for waste disposal licences and we recommend ways of ensuring the water environment is protected. We have published our views on landfill in our Position Statement on Landfill and the Water Environment (Ref. 23). In this statement we encourage waste minimization and recycling.

Some wastes can be spread on farmland to improve the soil. We advise the WRA on ways of protecting the water environment from this activity.

The WRAs will, with the NRA, form part of the Environmental Agency from 1 April 1996.

### Our Objective

To prevent the pollution of ground and surface water or damage to wetlands caused by the disposal of waste to land.

### The Role of the NRA

We have duties and powers to:

- \* monitor the quality of water around waste disposal sites
- \* prosecute offenders if pollution is caused.

Our work involves a range of activities:

- \* we work with planning authorities to ensure that new waste disposal sites are put where pollution risks are minimized and where they pose least risk to the water environment as a whole
- \* we ensure that site operators are aware of the necessary monitoring requirements for pollution prevention purposes when new waste disposal licences are sought
- \* we help to make sure that sites are maintained and operated properly.

### Catchment Perspective

We have identified seventy-five landfill sites and fourteen waste transfer stations or civic amenity sites in the catchment (see Map 13).

Sixteen of the landfills are currently operational with thirteen licensed to accept inert wastes only. Stoke Hill waste disposal site near Stoke Canon is licensed to accept industrial waste from the paper mills. The Punchbowl site near Crediton was licensed to accept domestic waste and closed in November 1994.

There have been recent problems with leachate disposal at the Stoke Hill site. A major improvement to the leachate system has been carried out and it is hoped this will resolve the problem encountered. Monitoring of the situation will continue.

## CATCHMENT USES

Punchbowl waste disposal site was operated on the 'attenuate and dilute' principle which was a previously acceptable method for this type of domestic waste site. Problems with leachate contamination have been experienced in the upper reaches of the Hollacombe Water, a tributary of the River Creedy, where high ammonia and low oxygen concentrations have been frequently recorded (see Section 6.1 for current status).

All the remaining sites are closed. The majority accepted inert or semi-inert demolition wastes, although there are a number of old council waste disposal sites which accepted commercial and household wastes. These sites are generally close to Exeter or large towns within the catchment. The environmental impact of these old waste disposal sites is now minimal. However, the redevelopment or installation of services across these sites may cause a release of contaminants. A risk assessment study which recommends appropriate mitigation measures is required prior to any disturbance of these sites.

Leachate from the former county site at Ashley is collected and pumped to Tiverton Sewage Treatment Works (STW). The holding lagoon at Ashley (has overflowed), due to a pump failure, polluting a small watercourse. We are assuring more secure pumping arrangements are installed at Ashley.

Higher Kiln waste disposal site was the only licensed industrial liquid waste disposal site in the NRA's Devon Area accepting solid and liquid wastes since the 1940s and was run on the 'attenuate and dilute' principle. The site was closed in 1992. Higher Kiln and other waste disposal sites which are causing pollution to surface or groundwaters are discussed in more detail in Section 6.1.

Planning applications have been submitted for new waste disposal sites at Hillhead, Uffculme and Aller Barton close to Cullompton to accept putrescible wastes. The proposals at Aller Barton landfill site state the site will be lined to contain any leachate generated and will have appropriate environmental monitoring. The detailed pollution prevention measures necessary to protect the water environment will be addressed at the Waste Management Licensing stage. For Hillhead we are currently submitting our considered planning response and a request for further information.

The incinerator on the outskirts of Exeter currently burns the majority of Exeter's domestic waste. However, the requirement for it to meet new emissions standards in 1996 may result in its closure.

On 1 May 1994 the waste management licensing system established by the Environmental Protection Act (Ref. 24) was implemented. This legislation introduces a range of new duties on the WRAs and waste disposal operators. In particular, Waste Disposal Licences have become Waste Management Licences. These licences can only be surrendered when the Regulatory Authorities are satisfied that the site no longer represents a risk to the environment and a completion certificate is issued.

Sewage sludge from Countess Wear STW is currently dumped out at sea. Sewage sludge from some other SWWSL sewage treatment works, private septic tanks and cess pools is spread to land in parts of the catchment. This practice is likely to increase after 1998 when the North Sea Agreement (Ref. 25) and the Urban Waste Water Treatment Directive (Ref. 26) abolish dumping sludge at sea. Improvements to sewage treatment works will also result in additional sludge being generated. Devon WRA closely monitor the spreading of wastes to land and ensure frequent changes in the use of fields. Concerns exist at a number of sites, particularly in the Dunkeswell area, where spreading occurs over the airfield. The airfield site drainage is very efficient, which can result in only minimal treatment of the waste prior to discharge to a surface watercourse. The NRA will work with the WRA and operators to reduce the pollution potential by ensuring good site selection.

## 5.7 FARMING

With more than 80% of the land in England and Wales used for agriculture, there is significant scope for impact on the water environment. The intensification of agriculture, which intended to provide a reliable food source, has in some locations caused water pollution, low river flows, damage to fisheries and areas of high conservation value, and increased the risk of flooding. A sustainable farming system that conserves the soil, uses water wisely, minimizes and recycles wastes and protects important wildlife habitats will reduce the risk of damage to the water environment.

### Our Objectives

To protect the water environment from potentially damaging farming activities and to encourage agricultural practices that improve the water environment.

### The Role of the NRA

The NRA has duties and powers to:

- \* prevent pollution from agriculture through the enforcement of the Control Of Pollution (Silage, Slurry and Agricultural Fuel Oil) Regulations 1991 (Ref. 27)
- \* deal with pollution incidents, restoring waters to their previous condition
- \* issue consents to discharge from agricultural premises. However, the NRA encourages the disposal of farm waste to land in preference to consenting discharges from agricultural treatment systems
- \* regulate the abstraction of water for agricultural use.

Additionally through liaison and R&D initiatives the NRA is committed to:

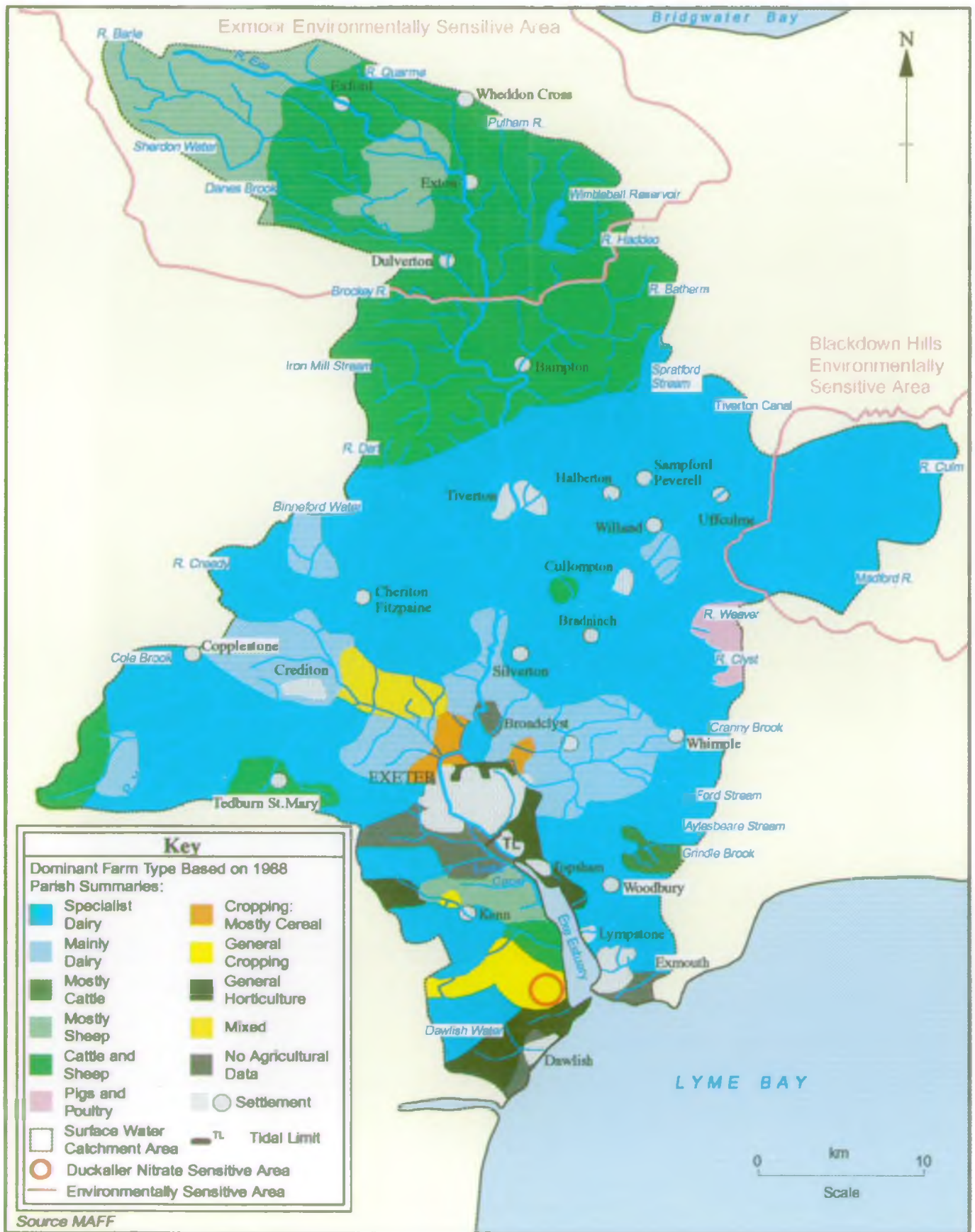
- \* promoting the Codes of Good Agricultural Practice for the Protection of Water and Soil (Refs. 28 and 29)
- \* promoting the free pollution prevention advice from ADAS on behalf of MAFF
- \* further developing best practices to prevent pollution
- \* carrying out farm visit programmes
- \* improving public awareness of the impact of agriculture on the water environment.

### Catchment Perspective

#### *Land Use*

Agricultural land accounts for approximately 80% of the catchment area (130,000 ha in 1993, MAFF statistics). Since 1983 there has been little change in the total agricultural area and it is not expected to increase or decrease in the near future.

# Map 14 - Farming



Information correct as of October 1995

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River Exe Catchment Management Plan

NRA South Western Region

## CATCHMENT USES

Grassland dominates the catchment making up some 76% of the total agricultural land. The use of both short term grass leys (<5 years) and long term grassland have declined, whilst over 1000 ha have reverted to rough grazing. There has been a slight fall in the area of crops and fallow, whilst farm woodland has increased by 12%.

The distribution of dominant farm types across the catchment is shown in Map 14. Dairying is the dominant farm type over most of the catchment, accounting for 20% of the total number of farms. There are mainly cattle and sheep farms in the north of the catchment, particularly on Exmoor which has low grade agricultural land. The area south of the Rivers Clyst and Kenn and the area on the western side of the Exe Estuary are more varied with a greater proportion of arable crops and horticulture, which reflects the higher grades of agricultural land there.

Farming types have changed as regulations and demands have altered. Between 1983 and 1993 dairy holdings have declined by 25% due to many factors including the imposition of milk quotas, tighter pollution regulations and a difficult economic climate. Cattle and sheep farms have increased by 14% over the same period, largely because of changes in the dairy sector and the less capital intensive nature of these enterprises. However, it is unlikely that this rate of growth will continue with the imposition of cattle and sheep quotas.

### *Pollution Risk from Farming*

Livestock farms in the catchment have been and continue to be a major source of pollution incidents. However, recent investment in waste storage and handling techniques, largely supported by MAFF grant aid, has caused a significant reduction in the number of point source polluting discharges. This grant aid has now ceased and this is likely to affect future improvement on farms where no such investment was made (however, grant aid may be available in the future for the small number of farms within the Nitrate Vulnerable Zone (NVZ) in the catchment, see Section 6.1).

Although point source discharges have decreased, problems with diffuse runoff have tended to increase. This is largely a result of the poor management of farm waste when applied to land, particularly in areas where there are clay type soils, mainly in the mid catchment area. Farms in the catchment have been visited during farm visit campaigns by NRA staff in 1993/1994 and 1994/1995 (see Table 7). Where actual or potential pollution problems were identified the farms have been revisited and appropriate remedial measures have been taken or are underway. Details of watercourses that have failed to meet water quality objectives, and where farming has been implicated are given in Section 6.1.

The pollution risk varies across the catchment depending upon the type of farming. The upper River Exe subcatchment with its generally low intensity agriculture tends not to significantly affect water quality, although problems with farm runoff are not unknown. In 1991 a sheep dipping site was found polluting a stream near Dulverton, with an organophosphorus pesticide (remedial action was taken). The northern part of this area is also subject to Exmoor National Park and Environmentally Sensitive Area (ESA) designations. These include measures to encourage less intensive farming and have positive benefits for the water environment, particularly when targeted to protect watercourses.

The River Culm subcatchment has the highest numbers of livestock per hectare in the River Exe catchment (1.78 grazing units/ha). This intensive dairy and beef production has historically led to significant water quality problems. Part of this area is within the Blackdown Hills ESA (see Map 14) and has low intensity farming, with consequently fewer water quality problems.

## CATCHMENT USES

Areas within the Rivers Culm, Clyst and upper Weaver, have been pilot areas for the MAFF scheme to introduce Farm Waste Management Plans on a voluntary basis. This scheme was conducted by ADAS and involved consultation with the NRA. As many farms as possible were encouraged to participate in the scheme which involved drawing up plans that show when, where and how much livestock waste can be safely spread on their farm with minimum risk to pollution. Initial assessments in the River Clyst show improved water quality (Ref. 30) although it is too early to fully determine the benefits.

The lower River Exe subcatchment is an area of relatively intensive livestock farming. Dairying, in particular, has increased in intensification, with the average dairy herd size up from 78 in 1983 to 90 in 1993, thus concentrating farm waste onto fewer premises but also onto those best able to invest in pollution control. Pollution problems have been mainly associated with waste storage and slurry spreading and to some extent pesticides from the arable and horticultural enterprises. Elevated concentrations of atrazine and simazine are occasionally detected at the Pynes Public Water Supply (PWS) intake upstream of Exeter, so far we have been unable to trace their sources.

The River Yeo subcatchment follows the same general trend as the whole catchment, with an increase in intensification of dairying but no overall increase in livestock numbers.

The River Kenn and Dawlish Water subcatchments represent a small but intensively farmed arable area on high grade agricultural land. This intensive use has led to high nitrate concentrations in the Duckaller and Vennbridge PWS boreholes (see Map 14 and Section 6.1).

The area around Dawlish also suffers from severe soil erosion, with deep gullies having been formed. Loss of soil can lead to siltation of the watercourses and the Exe Estuary. The NRA urges farms to use the MAFF Code of Good Agricultural Practice for the Protection of Soil (Ref. 29). Farmers should contact MAFF or specialist consultants if they require detailed advice on a field-by-field basis. Conservation headlands, the creation of hedges and converting high risk areas to permanent grassland may help control soil erosion and act as buffer zones to protect the water environment.

**Table 7: Farm Pollution Investigations in 1993/94 and 1994/95**

Watercourse	No. of Farms Identified as Actual or Potential Pollution Problems	Years Visited
Colebrooke and River Yeo	2	94/95
River Troney	1	94/95
River Swine, Iron Mill Stream and Parkhouse Water	4	94/95
River Dart (Bickleigh), River Burn and River Little Dart	14	94/95
Spratford Stream	15	93/94
River Creedy and Holly Water	2	93/94
River Creedy and Sholbrooke	7	93/94
Wilson Water and Binneford Water	7	93/94

## 5.8 FORESTRY

Well managed forestry in the right places does not harm the water environment and will often bring benefits. However, in some circumstances poorly managed forestry development has the potential to cause problems: acidification, soil erosion, pollution, water yield, increased flood risks and damage to wildlife habitats are examples. In the south west forestry does not usually cause problems for the water environment.

The Forestry Authority regulates forestry in the UK and encourages environmentally sympathetic planting and woodland management through grant schemes and the Forest and Water Guidelines (Ref. 31).

### 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 NRA

We have duties and powers to:

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

Our work involves a range of activities:

- \* we are improving links with the Forestry Authority and local authorities to ensure that we are consulted on all forestry schemes and on Structure/District/Local Plans, particularly where Indicative Forestry Strategies are being developed
- \* we identify areas that might be sensitive to the planting and felling of forests to the Forestry Authority, Forest Enterprise and local authorities
- \* we are promoting the 'Forest and Water Guidelines' (Ref. 31) and developing 'best practice' forestry techniques further in conjunction with the Forestry Commission
- \* we are working at ways of improving the way we consider the environmental impact of proposed forestry schemes. At the moment only new planting schemes which are large or by nature of the site are likely to cause damage require an environmental impact assessment, but large scale woodland management activities may cause as much damage to the water environment if not responsibly organized.

### Catchment Perspective

Forests and woodland are widely scattered across the catchment, but with more towards the north of the catchment (see Map 15). Here many of the steep river valleys of the River Exe and its tributaries are lined with oak and other deciduous woodland, much of which is ancient woodland.

# Map 15 - Forestry





## CATCHMENT USES

There are a few coniferous plantations in the catchment. The largest of these are the plantations at Great Haldon which are owned by the Forestry Commission and managed by Forest Enterprise. Forest Enterprise are committed to working within the 'Forest and Water Guidelines' (Ref. 31) to ensure forestry operations do not damage the water environment. We are not aware of any problems at Forestry Commission sites within the catchment.

MAFF statistics indicate that there were 4375 ha of Farm Woodland in the catchment in 1993. This total represents an increase of nearly 17% since 1983. The majority of this woodland is found in the River Yeo (1370 ha) and upper River Exe (1996 ha) subcatchments.

There are no acid sensitive areas in the catchment and acidification is not considered to be a problem. Forests are not considered to affect the total water resources of the catchment.

Forestry operations do not generally impact upon the water environment in the catchment. However, there have been a few localized incidents where forestry vehicles running over tracks through streams have caused high suspended solid loadings. This problem has occurred at the privately owned Kings Brompton Forest, near Wimbleball Reservoir, but is also likely to occur elsewhere. These problems are minor and have been dealt with on a site-by-site basis by NRA staff on the ground.

Future forestry development within the catchment is unlikely to be significant. Where replanting does occur the Forestry Authority will promote deciduous planting alongside water courses to act as 'buffer zones' and conservation corridors, in line with the 'Forest and Water Guidelines' (Ref. 31). We would like to be consulted about any large forestry development which might impact upon the water environment.

# Map 16 - Licensed Surface Water Abstractions $\geq 20 \text{ m}^3/\text{day}$



## 5.9 WATER ABSTRACTION AND SUPPLY

Here we consider the abstraction of water from the surface or below the ground for public water supply, industry and other uses.

### Our Objective

To manage water resources to secure the best use of water whilst considering the needs of the environment and those of legitimate abstractors.

### The Role of the NRA

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

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

Our work involves a range of activities:

- \* we enforce abstraction licence conditions to protect the water environment and the rights of other abstractors
- \* we plan the future use of water on the basis that water supply companies reduce leakage to an acceptable level and make best use of available resources
- \* we are working on a system for mapping the availability of groundwater
- \* we are developing and implementing a consistent approach to determining licences
- \* we support selective domestic metering where resources are stressed
- \* we define groundwater protection zones and publish groundwater vulnerability maps to protect resources from development and pollution risks.

### Catchment Perspective

#### *Current Licensed Abstractions*

There are two basic categories of licensed abstractions: consumptive and non-consumptive uses. Consumptive uses generally involve a loss of a proportion of the water abstracted. Non-consumptive uses are uses such as fish farms and hydropower which essentially return all the abstracted water back to the catchment.

There are 1677 current licences in the River Exe Catchment (as at 15/1/95) with a total annual authorized abstraction of approximately 580,400 Ml, 98% of this volume is from surface waters (see Map 16) and 2% from groundwater (see Map 17). Consumptive uses account for 23% of the total authorized resource, the remainder being for non-consumptive uses.

The annual authorized total for consumptive use (133,500 Ml) represents approximately 18% of the flow at the River Exe's tidal limit (740,000 Ml/year).

# Map 17 - Licensed Groundwater Abstractions $\geq 20 \text{ m}^3/\text{day}$



## CATCHMENT USES

Figure 3 shows the proportion of the total volume authorized for abstraction from both surface and groundwater for broad categories of uses.

### *Public Water Supply*

Both Wessex Water Services Ltd (WWSL) and South West Water Services Ltd (SWWSL) are responsible for providing mains supplies in the River Exe Catchment. SWWSL is the major water company within the catchment. The companies organise their water supply networks into supply zones. Customers in the River Exe Catchment are served by the Roadford and Wimbleball supply zones of SWWSL, and the Somerset Supply Zone of WWSL (see Map 18). The major one is the Wimbleball Zone that encompasses the River Exe Catchment below Exebridge and the catchments of the Rivers Otter, Sid and Axe.

SWWSL's principal abstractions are at Tiverton and Exeter, both of which are supported in part by controlled releases from Wimbleball Reservoir. The main settlements that receive a supply supported by Wimbleball are Tiverton, Cullompton, Honiton and Exeter. Wimbleball also supports an inter-catchment transfer from Exebridge to the River Yeo near East Anstey (River Taw Catchment). Public water supply from groundwater sources is obtained from aquifers at Dawlish and Crediton.

Dawlish is the only significant settlement in the catchment which receives water from the Roadford Zone; whilst Dulverton, Exford and Exton are the main settlements in the catchment that receive water from WWSL's Somerset Zone.

Water for public supply is moved both within and outside the catchment. Raw water leaves the catchment via the Exe/Taw transfer and by WWSL's direct abstraction from Wimbleball. Water is treated at Allers Water Treatment Works (WTW) for supply within and outside the catchment and at Pynes WTW for supply to Exeter and surrounding towns.

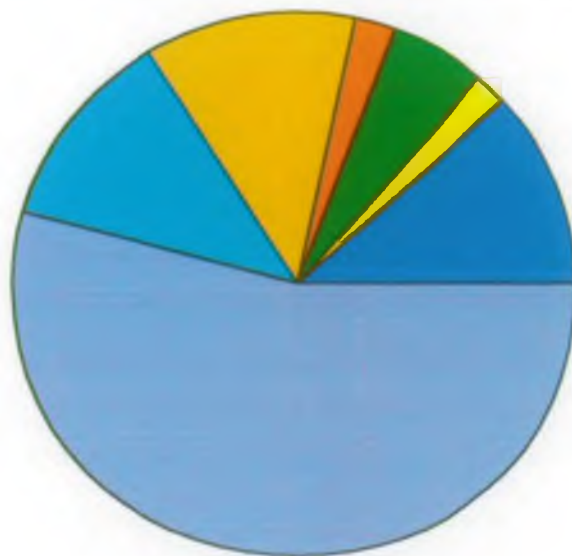
### *Reliable Yields Of The Supply Zones*

The reliable yield is the maximum quantity of water that can be reliably supplied from a source during a drought of severity similar to 1975/76. The reliable yield of the sources within the River Exe Catchment have been totalled to be 98 MI/d and this is derived from the figures in Table 8.

**Table 8: Reliable Yields for the Supply Zones in the River Exe Catchment**

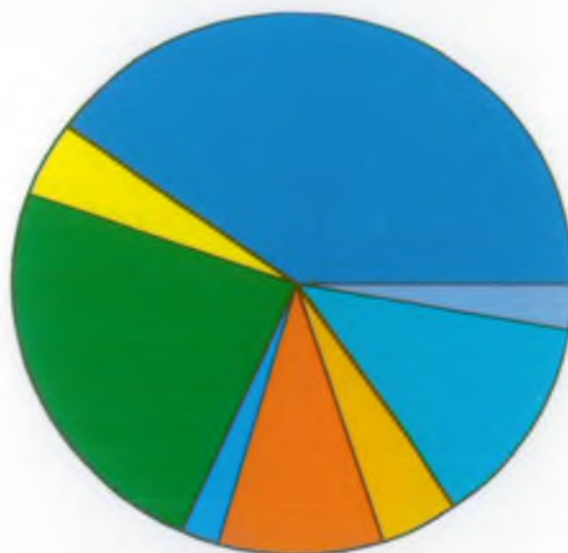
Water Company	Supply Zone	Reliable Yield of Zone (MI/d)	Reliable Yield of Sources within River Exe Catchment (MI/d)
South West Water	Wimbleball	98	64
	Roadford	326	1.9
Wessex Water	Somerset	115	32

**Figure 3 - Abstraction Statistics**



**% Abstraction of Surface Water**

South West Water 11.7%	Wessex Water 2.0%	Agriculture 5.6%	Spray Irrigation 0.1%	Consumptive Use
Industrial 2.3%	Private Water Supply 12.1%	Fish Farms 12.0%	Water Power 54.2%	



**% Abstraction of Groundwater**

South West Water 40.1%	Wessex Water 4.5%	Agriculture 23.7%	Spray Irrigation 2.2%	Consumptive Use
Industrial 9.5%	Private Water Supply 4.7%	Fish Farms 12.6%	Water Power 2.7%	

### *Public Water Supply Abstractions*

SWWSL's total authorized abstraction for public water supply from the River Exe Catchment is 47,220 Ml/year. This represents 12% of the total authorized surface water abstraction and 40% of the total authorized abstraction from groundwater.

Wimbleball Reservoir, in the headwaters of the River Haddeo, was commissioned in 1978 to meet both rising demand in the River Exe Catchment and in WWSL's Somerset Supply Zone. The licensed abstraction from Wimbleball Reservoir is by far WWSL's largest abstraction from this catchment with an authorized annual total of 11,614 Ml. All of this abstraction is used for direct supply in the Somerset Supply Zone.

Wimbleball has a useable storage capacity of 21,320 Ml. This resource is used to support existing abstractions from the River Exe. SWWSL's supply network also allows Wimbleball to support potential growth in demand in towns such as Honiton, Ottery St Mary and Sidmouth; currently dependant on local sources.

The existence of Wimbleball Reservoir secured the potential yield of the Bolham, North Bridge and Pynes leat abstractions from the River Exe up to 60.4 Ml/d. The NRA also has a fisheries bank of 909.2 Ml reserved in Wimbleball. This bank can be used during the year for environmental protection and to benefit fisheries.

Table 9 shows the existing surface water abstraction licences for public water supply in the River Exe Catchment, with their respective authorized limits and conditions. In addition to those listed SWWSL also have a licence for the proposed Wimbleball Pumped Storage Scheme. Under this scheme water would be pumped into Wimbleball Reservoir during the winter to ensure the reservoir has increased capacity for supporting abstractions during the following summer.

### *Groundwater for Public Water Supply*

Water from the Dawlish Sandstone Aquifer is abstracted via boreholes at Duckaller and at Vennbridge. At Duckaller there is a production borehole and a second borehole to provide compensation water discharges to the Cockwood Stream and Duckaller Farm pond. A similar situation exists at Vennbridge with a compensation water discharge to Staplake Brook. Boreholes, at Coleford and Knowle pump water from the Permian Knowle Sandstone for public supply in the Crediton area.

It is a condition of these borehole licences that nearby stream flows are maintained at or above agreed minimum rates. The Coleford and Knowle boreholes also have a review condition to allow assessment of any long term effects of abstraction not previously forecast.

### *Other abstractions*

#### *Non-Mains Domestic Supplies*

Though the majority of premises within the catchment have a mains supply, there is also a small number of private supplies for both domestic and commercial use in the inland rural area. Some of the domestic supplies are exempt from control (by being  $< 20 \text{ m}^3/\text{d}$ ) and therefore unlicensed; we have no record of these supplies. In rural areas with a low population density there may be difficulties in supplying mains water at reasonable cost. In these circumstances groundwater supplies provide a useful alternative, yields permitting.

# Map 18 - Water Company Supply Zone Boundaries





## CATCHMENT USES

**Table 9: Surface Water Public Water Supply Abstraction Licences in the River Exe Catchment**

Licence Site Name and NGR	MI/d	MI/y	Licence Conditions
Wimbleball (WWSL) SS 968 293	45.5	11,613	Maximum daily quantity may only be abstracted on 183 days in any year and during the remainder 32 MI/d.
Exebridge (SWWSL) SS 933 249 - Exe/Taw transfer, water is pumped to the Molland Yeo for abstraction at Newbridge WTW.	23	3450	Time limited until May 2004. Annual quantity will reduce to 667 MI from 01/01/98. Emergency use in the event of a failure elsewhere in the system supplying Newbridge WTW.
Bolham (SWWSL) SS 948 153	32	11,564	Subject to a prescribed flow of 3.158 cumecs as measured at Thorverton Gauging Station. If flow drops below this then part of abstraction above 2.7 MI must be supported by equivalent volumes from Wimbleball. Total discharge from Wimbleball must not exceed 12, 585 MI/year.
North Bridge (SWWSL) SX 931 970 - Licence of Right - Second Licence	24.5 42	8297 14300*	Unconditional Prescribed flow of 3.16 cumecs at Thorverton.
Pynes Leat SX 913 959	29	10,585 14300*	To be taken only if a breakdown occurs at North Bridge.

\*Annual limit for use in conjunction with Licence of Right.

### Agricultural

Although there are many water abstractions for agricultural use in this catchment some are exempt from licensing control (by being <20 m<sup>3</sup>/d) and, therefore the figures are an underestimate of the actual abstraction. Authorized abstraction from surface water represents 6% of the total licensed volume, and 3% from groundwater.

### Spray Irrigation

Water abstraction for spray irrigation purposes (for farming and leisure facilities, such as golf courses) represents 2% of the total groundwater resource authorized for abstraction. Very little is abstracted from surface water. Demand generally occurs at times of the year when water resources are naturally low and impacts can be high. Therefore, we will generally expect any new schemes to include the provision of off-stream winter filled storage to protect the water environment and make best use of available resources.

Spray irrigation has been identified as having a slight potential for increased future use (NRA Regional Water Resources Strategy, Ref. 32). Increases are predicted to be 1.7%, for the period 1991-2001, and 1% for the period 2002-2021.

## CATCHMENT USES

### Industrial

Most businesses in this catchment obtain their water from the mains and only 8% of the total annual authorized groundwater and 2% of the surface water is authorized for industrial use. The largest abstractions for industry are J Bibby Paper Ltd., Lloyd Maunder Ltd. and Devon Crest Poultry Ltd. Little growth is expected in industrial abstraction in the catchment. The national water resource strategy 'Water Nature's Precious Resource' (Ref. 33), gives a growth rate of 0.8% for the UK as a whole.

### Hydro-electric Power Generation (HEP)

Fifty-four percent of the total surface water authorized to be abstracted from the River Exe Catchment is for the production of HEP, e.g. in association with Pynes WTW (not being used) and at John Heathcoats Works. These abstractions are mainly associated with old water mills. 1% of the total volume of groundwater authorized for abstraction is authorized for use in HEP. No growth is predicted in this use.

### Fish Farms

Fish farming is an important industry in the catchment, providing at least 20 rural jobs and accounts for approximately 16% of the UK trout restocking market.

Approximately 12% of the total surface water and 13% of the total groundwater authorized to be abstracted is for fish farming purposes. Fish farms abstracting from surface water include Exe Valley Fishery, Bellbrook Trout Farm and Hartford Fish Farm.

The outstanding 'Licence of Entitlement' applications at Highleigh and Rainbow Valley Fish Farms will be signed imminently. We will continue to advise on the installation of flow measurement methods at Hartford Fish Farm. The Exe Valley Fishery gauge is partly calibrated.

### *Current and Future Demand for Water*

We have compared the current level of available resource for public water supply to our forecasts of future public demand for water. From this comparison it is possible to identify areas of potential surplus and deficit through to the end of the planning horizon of 2021. We have also conducted a similar exercise for private water resources.

### Public Water Supply - Water Companies

The extent to which demand for potable water supply will increase over the next thirty years will depend upon a number of factors including population growth, numbers of new dwellings, personal use of water, levels of economic activity, measures to reduce demand and climate change. We have produced demand forecasts for each of SWWSL's and WWSL's strategic supply zones and are currently refining these to smaller supply areas as more information becomes available.

### Resource-Demand Balance

Comparing the Wimbleball Strategic Supply Zone reliable yield of 98 MI/d with current demand shows that the Wimbleball Supply Zone currently has a surplus of 10 MI/d. The Roadford and Somerset Supply Zones have a 80 MI/d surplus and a 9 MI/d deficit respectively. The Wimbleball Pump Storage Scheme, when constructed, will provide an additional yield of between 25-30 MI/d and secure supplies to this catchment well into the next century.

## CATCHMENT USES

For future demand, two alternative scenarios are presented in the form of a 'high' and a 'low' forecast. The former assumes high growth in consumption, no improvements to reduce losses and no increase in domestic metering to reduce water use. The latter assumes low growth in domestic consumption, no growth in industrial/commercial consumption, broad company leakage targets for SWWSL and WWSL and little or no increase in the proportion of domestic properties subject to metering above 1991 levels (further details are given in the Regional Water Resources Strategy, Ref. 32).

The forecasts for 2021 are shown in Table 10 below.

**Table 10: NRA Demand Forecasts for the Water Companies Operating in the River Exe Catchment**

Water Company	Supply Zone	Predicted Demand for 2021 (MI/d)	
		High	Low
SWWSL	Wimbleball Roadford	121	108
		347	291
Wessex Water	Somerset	175	131

It is evident from Table 10 comparing the forecast demand with the existing available yield of the supply zone (see Table 9) that without the implementation of the Wimbleball Pumped Storage Scheme the River Exe Catchment along with others in the supply zone would fall into deficit before 2021 (see Table 11 below).

**Table 11: The Demand Resource Balance in the River Exe Catchment**

Water Company	Supply Zone	Predicted Demand for 2021 (MI/d)	
		High Scenario	Low Scenario
SWWSL	Wimbleball Roadford	-22	-10
		-21	+34
Wessex Water	Somerset	-60	-16

## CATCHMENT USES

### 5.10 EFFLUENT DISPOSAL

Here we consider the disposal of effluent directly to rivers or into the ground. Effluent includes sewage, industrial or farm wastes. We regulate the disposal of effluent by issuing consents and take action if a river is polluted.

Rivers can render the main constituents of many effluents harmless by natural processes, providing that disposal is properly controlled.

#### **Our Objectives**

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

#### **The Role of the NRA**

We have duties and powers to:

- \* authorize discharges through a system of consents. It is illegal to discharge sewage effluent or trade waste without the consent of the NRA. We consider applications for consent to discharge on a case-by-case basis and can refuse to consent a discharge if it will cause an unacceptable deterioration in water quality
- \* check discharges to see if they comply with consent standards. We may prosecute dischargers if they exceed consent conditions
- \* prevent illegal discharges
- \* influence investment in sewerage and sewage treatment by the water companies in line with AMP2 guidelines (see section below on Improvements to SWWSL Discharges)

We are involved in a range of activities:

- \* we work with planning authorities to control development where the sewerage or sewage treatment system is overloaded
- \* we liaise with trade dischargers, farmers and SWWSL, carry out regular site inspections and monitor discharge quality
- \* we constantly review and develop our approach to water sampling.

#### **Improvements to SWWSL Discharges**

Improvements to SWWSL'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

## CATCHMENT USES

- 3) schemes which already have been separately justified, required to maintain river quality relative to the 1990 NRA survey of water quality (Ref. 34) or to achieve river or marine improvements.

OFWAT declared the associated customer charging base in July 1994. At the end of July 1995 the Monopolies and Mergers Commission (MMC) published their review of SWWSL's AMP2 programme. The NRA shall be seeking confirmation with SWWSL on the timing and details of the schemes shown in Table 12.

**Table 12: Planned Improvements to STWs in the River Exe Catchment (AMP2)**

STW	Receiving Water	Treatment Level	Investment Driver	End Date
Dunkeswell	Dunkeswell Stream	Secondary	UWWTD AT	1997
Exton North	Exe Estuary	Primary	UWWTD AT	2005
Exton South	Exe Estuary	Primary	UWWTD AT	2005
Bampton	River Bathern	Secondary	UWWTD AT	2005
Bradninch	Cole Brook (Culm)	Secondary	UWWTD AT	2005
Countess Wear	Exe Estuary	BOD Load	UWWTD	2000
Dawlish	Sea	Primary*	UWWTD	2000
Crediton	Rivers Creedy, Yeo	Tertiary	UWWTD	1998
Cullompton	River Culm	BOD Load	UWWTD	2005
Pennymore**	Pennymore Stream	Aesthetic	Public Complaint	2005
Oldways End**	Brockey River	Aesthetic	Public Complaint	2005
Willand	River Culm	(20:35:15)F	Maintenance of Load	1997

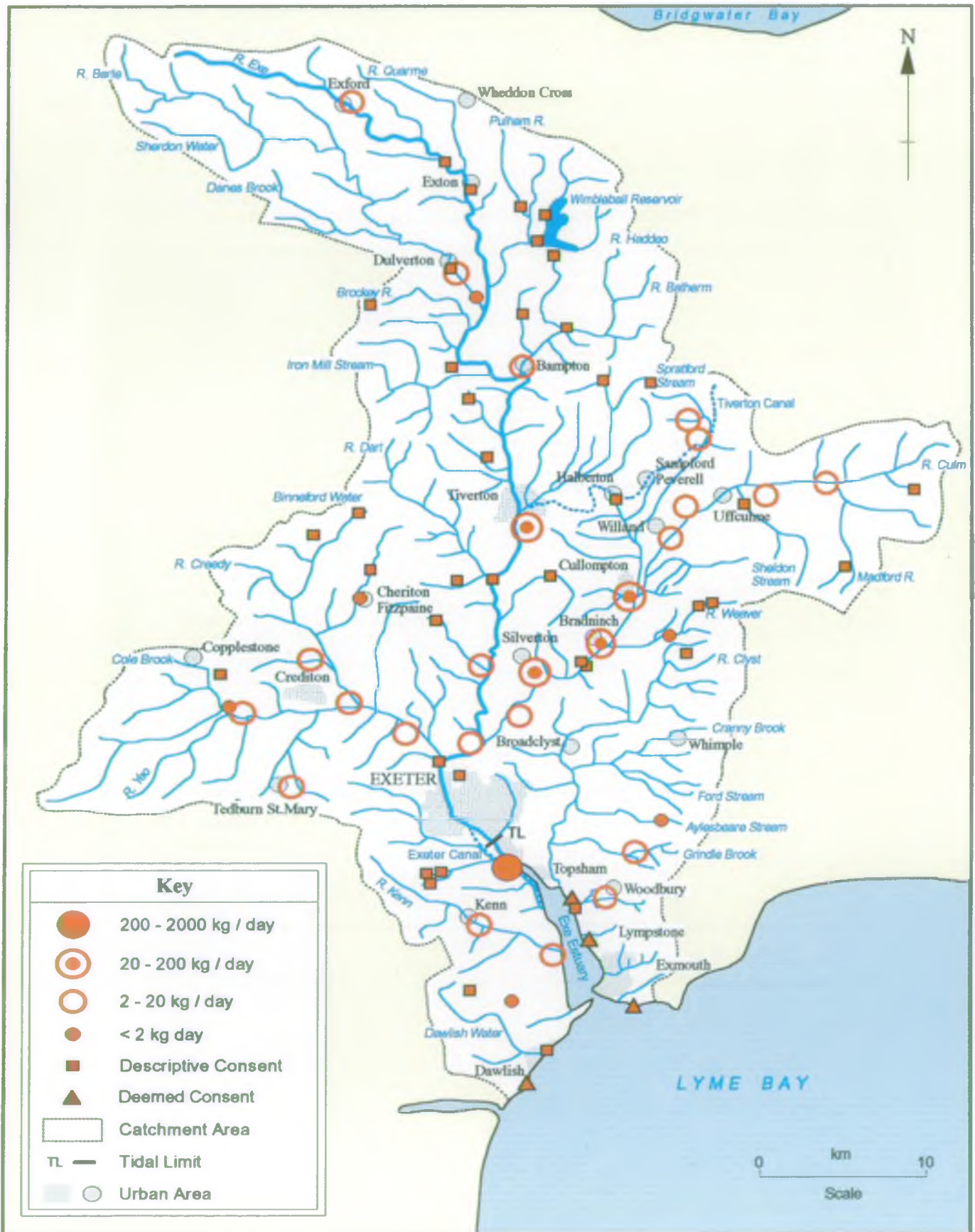
\* Depends on results of comprehensive study.

\*\* These are works with descriptive consents which are subject to public complaint.

### Catchment Perspective

Maps 19 and 20 show the major discharges of sewage and trade effluent respectively to the River Exe Catchment. We estimate that the total consented organic load (expressed as Biochemical Oxygen Demand, BOD) which can be discharged directly to watercourses from SWWSL numerically consented STW is approximately 442 kg/day and 740 kg/day to the estuary. There is less than 12 kg/day from private STWs.

# Map 19 - Consented Effluent Disposal - Sewage (SWWSL)



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The total consented trade effluent load is approximately 1,134 kg/day to watercourses with none to the estuary. The discharge from Countess Wear (Exeter) STW to the estuary has a consented BOD load of 727.5 kg/day and is the largest in the catchment. The second largest in the catchment is from Devon Valley Mill (a paper mill) with a load of 648 kg/day to the River Culm.

Some SWWSL STWs, which have descriptive consents, are of concern. These are ones which receive effluent from a population equivalent in excess of 250. We intend to review the consents at Halberton, Sampford Peverell, Dunkeswell, Bridgetown and Winsford, in order to replace the descriptive conditions with numeric ones. STWs at Pennymore, Exeter (Argyle Road) and Morebath, which although receiving effluent from a population equivalent of less than 250, are also of concern as they cause noticeable environmental impact. Enforcement is required at these locations.

Eight SWWSL discharges in the catchment are of concern as they receive little dilution in the receiving watercourse. Some of these are the subject of consent reviews.

Recent improvements by SWWSL include new improved sewage treatment works at Crediton, Newton St Cyres, Exford, Burlescombe and Westleigh, Culmstock, Plymtree and Oldways End. Improvements to the sewage treatment facilities at Crediton and Newton St Cyres have resulted in significant improvements in water quality in the River Creedy. Improvements have also been carried out at Cheriton Bishop and Yeoford STW.

The River Exe, and in particular the River Culm, has been used for industrial water supply and effluent disposal since the last century. Improvements to effluent treatment facilities have been made over the last few years to the following major trade discharges on the Rivers Exe and Culm:

J Heathcoat and Co Ltd, Tiverton (Exe)  
St Ivel Ltd, Hemyock (Culm)  
Lloyd Maunder Ltd, Willand (Culm)  
Higher Kingsmill (St Regis Paper Co Ltd), Cullompton (Culm)  
Devon Valley Mill (Bibby's) (Culm)  
Silverton Mill (St Regis Paper Co Ltd), Cullompton (Culm).

This process is resulting in significant reductions in effluent BOD loads and subsequent river quality improvements.

There are approximately twenty-seven combined sewer storm overflows (CSOs) and pumping station emergency overflows in the catchment (excluding discharges at sewage works). Six are understood to have impacts, mainly aesthetic, on their receiving watercourses. As there is limited SWWSL investment available for the resolution of these unsatisfactory discharges (under the AMP2 programme), these and other CSOs in the catchment may not be assigned sufficient priority to qualify them for improvement work within the next ten years.

Although there are no major pollution problems, provision of rural first time sewerage would rectify minor pollution at Argyle Road, Exeter, Withleigh, Tiverton, Clyst St George, Ebford, Exebridge and Uplowman.

We are in the final stages of determining the applications for consent to discharge at Hartford and Bellbrook Fish Farms. The consents for discharge at Highleigh and Exe Valley will be reviewed to ensure all outfalls are covered.

# Map 20 - Consented Effluent Disposal - Trade $\geq 5 \text{ m}^3/\text{day}$



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## CATCHMENT USES

### *1994 Non-compliant Discharges (SWWSL/private STW/trade)*

Of over fifty SWWSL sewage treatment works on the River Exe, only one works (Countess Wear, Exeter) failed its consent (look-up table consent) during 1994. This was an ammonia failure and the works remained on a formal audit sampling programme until this problem was resolved in December 1994.

A total of eight small private sewage treatment works exceeded their consent limits in 1994, five, more than once in the year. None of these works caused an environmental impact and the operational/management problems were resolved through liaison between Water Quality staff and the discharges. One major trader (Higher King's Mill) had significant failures of consent, but £150, 000 is to be spent in plant improvements. There were occasional marginal failures at fish farms with differential consents, and one fish farm in the catchment experienced a succession of failures in the summer probably due to high nitrates in the feeder stream.

### *Pollution Events*

Table 13 shows pollution incidents by source.

**Table 13: Reported Pollution Incidents in the River Exe Catchment (1992-94)**

Type of Pollution	Number of Incidents		
	1992	1993	1994
Farms	99	100	11
Oil	36	25	13
Trades	58	63	30
Storm Sewage Overflow	102	105	110
Vehicle	14	14	9
Other	68	163	178
Not Found	45	25	45
<b>Total</b>	<b>422</b>	<b>495</b>	<b>396</b>

# Map 21 - Mining and Quarrying



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### 5.11 MINING AND QUARRYING

We recognize the economic importance of mining and quarrying to the region. However, exploration and extraction can significantly affect surface and groundwaters.

Areas of concern to us include:

- \* extraction which can result in the loss of aquifer material and groundwater resources
- \* the removal of material from above the water table which reduces natural filtration and increases pollution risk to groundwaters
- \* surface water runoff from spoil heaps and worked areas and discharges from mines and quarries which can cause pollution
- \* abandoned mines and the after use of quarries can pose threats to both surface and groundwaters.

#### **Our Objective**

To minimize the damage that mineral extraction can do to water quality and to reserves of water held in the ground.

#### **The Role of the NRA**

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.

We are also involved in a range of activities:

- \* we monitor the changes that existing mines and quarries are causing to rivers, springs, wetlands and water supplies
- \* we negotiate with mineral operators to improve situations where their operations are damaging surface or groundwaters
- \* when new controls become available we work with planning authorities to obtain better standards and working practices
- \* we advise planning authorities on the effects that proposed mineral development will have on the water environment. We will object to mineral development that will cause harm to the water environment.

## CATCHMENT USES

### Catchment Perspective

#### *Minerals Plan*

The Devon Minerals Local Plan, Consultation Draft 1994 (Ref. 35) sets out to protect mineral resources in Devon and to allow their exploitation without causing undue damage to the environment. The plan proposes Mineral Consultation Areas (MCA's) within which non-mineral development is strictly controlled. This ensures that the ability to exploit important mineral resources is not lost through surface developments (but in no way presumes planning permission approval for mining or quarrying). The plan also contains policies to protect the environment from the damaging activities of mineral extraction.

The Exmoor Minerals Plan is included in the Exmoor National Park Local Plan (Ref. 18). The plan's objective is 'to ensure that damaging mineral extraction does not take place in the National Park unless there is an overriding national need which is sufficient to justify the potential harm to National Park purposes'. There are currently no operative mines or quarries in the National Park.

We have been consulted on both Minerals Plans and have provided comments and advice on particular areas of concern. We have not objected to any of the proposed MCA's in the Devon Minerals Local Plan (Ref. 35), but have provided specific advice on areas where flooding and groundwater protection are important issues. Adequate protection has been given to the water environment in the plan but we have recommended that more prominence is given to the protection of surface waters.

#### *Mining*

The geology of the River Exe Catchment is described in Section 4.2. Both the host rocks themselves and the minerals contained within them are exploited economically. Mineralization within the catchment is scattered over a wide area, with the Devonian slates and sandstones, which outcrop in the north of the catchment, being the most important host rocks. These rocks have been severely deformed and folded and contain economic deposits of principally iron and manganese, within the resulting fractures. Further south the younger Carboniferous rocks show evidence of scattered small scale mineralization. This mineralization includes oxide ores of iron and manganese and sulphide ores of copper, iron, zinc, lead and silver.

There are no active metalliferous mines within the River Exe Catchment although forty-two abandoned metalliferous mines have been identified (see Map 21). One additional mine within the neighbouring River Teign Catchment may also drain into the River Exe Catchment. Twenty-one mine drainage shafts have also been identified, which have the potential to discharge mine drainage to surface waters.

The mines of the upper River Exe and Barle subcatchments were the only mines of any significance. Recorded iron production for the whole catchment exceeds 1 million tonnes of iron ore. The majority of this production was derived from two mines situated in the Brendon Hills. Lothbrook Mine was operational from 1839 to 1883 and produced over 750,000 tonnes of iron ore. Florey Hill Mine was worked from 1865 to 1883 and produced nearly 240,000 tonnes of ore. Most of the mines had closed by the mid 1880s but the area was subject to further investigations in the early 1990s and during World War II.

## CATCHMENT USES

The majority of the mines in the catchment were small scale operations and are unlikely to pose any threat to the aquatic environment. The larger iron mines of the Brendon hills worked siderite (iron carbonate), goethite and limonite (hydrated iron oxides). The weathering of these minerals does not carry the same risk of acid mine drainage as the weathering of iron sulphide minerals commonly found in West Devon and Cornwall. The impact of mining within the River Exe Catchment is likely to be minimal and restricted to small watercourses in the immediate vicinity of mineral workings. It is also possible that some river sediments, in the vicinity of abandoned metalliferous mines may contain elevated levels of heavy metals.

### *Quarrying*

There are seven active quarries within the catchment working mainly sandstone, limestone, sand and gravel (see Map 21). All of these quarries are located in areas where there is either a major or a minor aquifer and, therefore, groundwater protection (Section 6.1) is an important issue. The Devon Minerals Local Plan (Ref. 35) identifies this issue for the MCA's within which these quarries are located.

The largest area of quarrying in the catchment is at the Westleigh group of quarries (Westleigh, Fenacre and Rocknell), owned by Camas Aggregates Ltd. This is an area of concern for the NRA as the existing planning permissions have no depth restrictions associated with them. Camas can quarry and dewater without constraint and have no obligation to make good any damage to the water environment they may cause. In 1994 Camas applied for planning permission for a small lateral extension to the quarries. If new permission is granted it will have associated with it modern planning conditions which would protect or mitigate against environmental damage and also limit the depth of the workings.

Considerable changes to the hydrology of the area around the Westleigh Quarries has occurred during the period of quarrying. The NRA, Devon County Council and Camas all agree that the springs which used to feed into the adjacent Grand Western Canal no longer flow, that the hydraulic gradient between the canal and the quarry has been reversed and that the hydraulic gradient towards the quarry will increase as the quarry is deepened.

The NRA and Devon County Council are seeking to ensure that the new planning application results in securing an adequate supply of water for the canal.

# Map 22 - Proposed River Ecosystem Target Classes (1995) and Compliance (1993)



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## 6. TARGETS AND STATE OF THE CATCHMENT

### 6.1 WATER QUALITY

We aim to maintain and improve, where appropriate, the quality of water for all those who use it. We achieve this by setting water quality targets for the catchment based on:

- River Quality Objectives to protect recognized uses
- standards laid down in EC Directives
- international commitments to reduce the amount of Annex 1A Substances entering tidal waters.

In this section, we report on the state of the catchment by comparing existing water quality with relevant water quality targets. We have identified issues where targets are not being achieved and action is needed to improve water quality. We have also identified other water quality issues in the catchment.

#### River Quality Objectives

The water quality targets that we use for 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) (see Appendix 4) which reflect the chemical quality needed by different types of river ecosystem including the types of fishery they can support. The RE classification scheme replaces the National Water Council (NWC) system that was previously used by the NRA.

#### *RQOs Targets for the River Exe Catchment*

The RQOs based on the RE classification, that we are proposing for the River Exe Catchment, are shown on Map 22. These RQOs will apply from 1 January 1996 unless there is a date shown next to the class for example: RE2 (1996) - an RQO of RE Class 2 must be achieved from 1 January 1996.

In addition, we are proposing undated 'long term' RQOs (LTRQO) for the following river stretches that we would like to achieve but for which there are currently no resources to make improvements (see Table 14). These LTRQOs are shown on Map 22 in the following way: [RE2] - LTRQO of RE2.

#### *State of the Catchment*

Map 22 also shows where current water quality fails to meet its proposed RQO. This assessment is based on three years of routine monitoring data from the Public Register collected between 1992 and 1994. We have shown failures to meet RQO as either 'significant' or '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 eighty-six monitored river stretches in the River Exe Catchment there are three stretches which significantly fail to meet their RQO and nine stretches which marginally fail to meet their RQO. The reasons for these failures are explained over.

## TARGETS AND STATE OF THE CATCHMENT

**Table 14: Long Term RQOs for the River Exe Catchment**

River	Stretch	Downstream NGR Monitoring Point	Long Term RQO
Exe	Below Tiverton STW - Bickleigh Castle	SS 9367 0688	RE1 (extensive salmonid spawning)
Exe	Bickleigh Castle - Thorverton Gauging	SS 9358 0161	RE1 (extensive salmonid spawning)
Clyst	Source - Clyst Hydon	ST 0363 0156	RE3 (brown trout spawning)
Clyst	Clyst Hydon - Clyst St Lawrence	ST 0275 0003	RE3 (brown trout spawning)
Clyst	Clyst St Lawrence - Ashclyst	SY 0112 9833	RE2 (brown trout spawning)
Clyst	Ashclyst Farm - A38 Bridge Broadclyst	SX 9842 9760	RE2 (Biological quality of NRA Class B and brown trout spawning)
Cranny Brook	Barnshayes - Crannaford Crossing	SY 0130 9596	RE2 (brown trout spawning)
Cranny Brook	Crannaford Crossing - Confluence	SX 9905 9545	RE2 (brown trout spawning)
North Brook	Source to Tidal Limit	SX 9389 9057	RE2
Creedy	Creedy Bridge - Westacott Cottages	SX 8550 9985	RE2 (salmonid spawning)
Culm	Skinnners Farm - Confluence (5 stretches)	SX 9380 9760	RE2 (need to continue recent river quality improvements - biological quality of NRA Class B)
Spratford Stream	u/s Strong, Rawle and Willand - Confluence (3 stretches)	ST 0258 0769	RE2 (need to continue recent river quality improvements)
Dunkeswell Stream	Source - Confluence	ST 1492 0829	RE1 (need to continue recent river quality improvements)
Grand Western Canal	Source - to end (Basin, Tiverton)	SS 9633 1239	RE3
Batherm	Ranscombe - Bowbierhill Wood	SS 9380 2085	RE1
Brockey River	Source - Confluence	SS 9243 2450	RE1
Haddeo	Source - Wimbleball Inflow	SS 9870 2880	RE1 (in dry summers dissolved oxygen is low)



## TARGETS AND STATE OF THE CATCHMENT

### Significant Failures

#### 1. River Exe (Collipriest to below Tiverton STW)

River water quality in this river stretch did not meet the proposed target RE1 in 1993, although recent monitoring data (1994) shows compliance with the target. Therefore, target RE1 (1995) is proposed and we will continue to monitor to ensure the recent improvement in river water quality is sustained and meets the proposed target.

#### 2. Alphin Brook (Source to Dymond's Bridge)

Poor river water quality previously detected resulted in a thorough investigation into the cause in 1993. Several polluting discharge sources were found and follow-up enforcement visits were carried out. Further improvements are needed to meet the proposed target RE2 (1999).

*Issue 1: Failure to meet proposed WQO target RE2 in upper Alphin Brook.*

#### 3. River Weaver (Source to Higher Weaver)

High BOD concentrations detected in river water samples in 1993, which failed the proposed RQO RE2 for this river stretch, resulted in a RE3 classification.

Field investigations carried out during 1993 found discharges from several farms, a STW (SWWSL) and a fishery all contributing to poor water quality in the River Weaver. Follow-up enforcement visits were undertaken at these sites.

Further improvements in river water quality are necessary to achieve the proposed target.

*Issue 2: Failure to meet proposed WQO target RE2 (1995) in upper River Weaver.*

### Marginal Failures

#### 1. Grindle Brook (Source to Confluence)

High BOD concentrations detected in the Grindle Brook resulted in a marginal failure of the proposed RQO RE2 (1999).

Field investigations into the causes of poor river water quality were carried out during 1993. Several polluting discharges from farms, a private STW, a grain store, and industrial complex were found. Follow-up enforcement visits were carried out.

Current biological quality (1994) of the Grindle Brook only achieved NRA Class B. Biological quality is likely to improve following the improvements to river water quality.

Some further improvements to river water quality are necessary to meet the proposed target.

*Issue 3: Marginal failure of proposed WQO target RE2 (1999) in Grindle Brook.*

#### 2. Aylesbeare Stream (Source to Confluence)

Previous poor water quality detected in this stream resulted in a field investigation in 1993, which found polluting discharges from several farms and a private septic tank. Follow-up enforcement visits were carried out and improvements to water quality were secured.

## TARGETS AND STATE OF THE CATCHMENT

Recent (1994) river water quality meets the proposed WQO RE2 (1995) and so vigilance is needed to ensure this improvement is sustained.

### 3. River Creedy (Westacott Cottages to Confluence)

Recent (1994) improvements to river water quality following significant improvements to the treatment facilities at two STWs mean that current water quality in the lower stretches of the River Creedy meet the proposed RQO RE2 (1995).

Vigilance is needed to ensure that these recent improvements are sustained.

### 4. Holly Water (Source to Confluence)

Recent deteriorations in river water quality due to high BOD concentrations result in a marginal failure of the proposed target RE2 (1995).

Task force investigations were carried out during the winter 1993/94 and identified a number of problems. Enforcement visits have secured improvements where necessary and so river water quality should improve.

*Issue 4: Marginal failure of proposed WQO target RE2 (1995) in Holly Water.*

### 5. River Weaver (Higher Weaver to Confluence), River Dart (B3137 Bridge, Bradley to Confluence), Uplowman Stream (Source to Confluence) and Madford River (Source to above Dunkeswell Abbey)

Recent (1994) improvements to river water quality in these stretches mean that current water quality now meet the proposed WQO targets.

Vigilance is needed to ensure that these recent improvements are sustained.

### 6. Spratford Stream (Source to Leonard Moor Bridge)

High BOD concentrations detected in the upper Spratford Stream result a marginal failure of the proposed WQO target RE2 (1995).

Current biological quality (1994) of this stretch only achieved NRA Class B.

Several polluting farm and sewage discharges have been identified. Investigations and subsequent enforcement action are needed to ensure improvements to river water quality are secured.

*Issue 5: Marginal failure of proposed WQO target RE2 (1999) in the upper Spratford Stream.*

## EC DIRECTIVES

There are six EC Directives which currently apply to the River Exe Catchment and the designated stretches and monitoring sites are shown on Map 23.

### EC Bathing Waters Directive

#### *Target*

The Bathing Waters Directive 'concerning the quality of bathing water' (Ref. 36) protects the environment and public health of bathers using identified bathing waters by reducing pollution entering identified bathing areas.

## TARGETS AND STATE OF THE CATCHMENT

The Directive contains standards for nineteen microbiological, physical and chemical parameters (Appendix 5) 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 the failures, and making sure that improvements are made.

### *State of the Catchment*

There are five identified Bathing Waters in the River Exe Catchment which are monitored under the Directive, at Sandy Bay, Exmouth, Dawlish Warren, Dawlish (Town) and Dawlish (Coryton) Cove. These waters are affected by discharges of sewage from coastal outfalls off Exmouth and Dawlish.

The following table shows when failures have been recorded.

**Table 15: Years of Failure at Designated Bathing Waters**

Bathing Water	Year
Sandy Bay	1993
Exmouth	1993
Dawlish	1986
(Town)	1992

To assess bacterial loading to the bathing waters, the Littleham Brook at Exmouth which discharges directly into the bathing area at Maer Rocks and the Dawlish Water at Dawlish (Town) have been monitored since 1993. Both freshwater streams have high total coliform and faecal coliform concentrations and are thought to contribute to bathing water failures in this area. The source of this contamination is likely to be urban and farm runoff.

A SWWSL 'Clean Sweep' Scheme is underway at Exmouth; commissioning commenced in July 1995. The scheme involves treating sewage flows from Exmouth, Lypstone and Budleigh Salterton at a new sewage treatment works at Maer Lane, Exmouth. The proposed scheme involves secondary treatment followed by ultra-violet (UV) disinfection. The discharge of sewage sludge will cease.

Improvements are to be made to the STW at Dawlish, which will improve effluent quality to the sea outfall. However, bacteriological pollution from the Dawlish Water will still present a problem.

*Issue 6: Bacteriological pollution from combined sewer overflows discharging into the Dawlish Water.*

### **EC Dangerous Substances Directive**

#### *Target*

The Dangerous Substances Directive 'on pollution caused by certain substances discharged in the aquatic environment of the community' (Ref. 37) protects the water environment by controlling discharges that contain harmful substances to rivers, estuaries and coastal waters.

# Map 23 - EC Directive Monitoring and Compliance with Standards (1994)



Information correct as of October 1995

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## TARGETS AND STATE OF THE CATCHMENT

This Directive describes two lists of compounds. List I contains substances regarded as particularly dangerous because they are toxic, they persist in the environment and they bioaccumulate. Discharges containing List I substances must be controlled by Environmental Quality Standards (EQSs) issued through Daughter Directives (see Appendix 6). List II contains substances which are considered to be less dangerous but which still can have a harmful effect on the water environment. Discharges of List II substances are controlled by EQSs set by the individual Member States (Appendix 7).

We are responsible for authorizing, 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 (Ref. 37) 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.

### *State of the Catchment*

Map 23 shows the EC Dangerous Substances Monitoring Sites and their compliance.

#### List I Substances

##### Freshwater River Exe

There are two designated List I sites in the River Exe: Dulverton Laundry and Stoke Hill Landfill site. Prior to 1994 Dulverton Laundry was consented to discharge cadmium, carbon tetrachloride, chloroform and perchloroethylene to the River Barle. Monitoring of the receiving waters was carried out in the River Barle and in the River Exe at Trews Weir. The discharge is now relocated to the foul sewer but monitoring must continue for two years. Monitoring of the discharge from Stoke Hill landfill has recently (November 1994) commenced in the Culm Leat and in the River Culm at Stoke Canon.

The receiving waters for Dulverton Laundry now meet the EQS. EQS standards have been met at all other freshwater List I EC Dangerous Substance monitoring sites.

##### Tidal Exe Estuary

SWWSL has consented trade discharges of mercury and cadmium to Exmouth STW. There are three receiving water monitoring points for the discharge from Exmouth STW. From 1990 to 1994 the EQSs for both mercury and cadmium were met at all sites.

SWWSL has also consented trade discharges of cadmium and lindane (gamma hexachlorocyclohexane (HCH)) to Countess Wear STW. There are three receiving water monitoring points for the discharge from Countess Wear STW. From 1990 to 1994 cadmium concentrations were within their EQS. Failure with the EQS for HCH was reported in the receiving waters for 1990 and 1991. Prior to 1992, laboratory analytical methods for HCH were unable to distinguish between HCH and tecnazene giving rise to apparently high HCH concentrations. The introduction of improved analytical methods in 1992 suggest that the previous high results were caused by analytical problems.

The mouth of the Exe Estuary is monitored for all List I substances. The EQSs have not been exceeded at this site from 1990 to 1994.

A standstill provision applies to concentrations of List I substances in sediments. An apparent increase in sediment levels of gamma HCH at the site monitoring Countess Wear in 1993 was probably due to changes in analytical limits of detection rather than an actual increase.

## TARGETS AND STATE OF THE CATCHMENT

### List II Substances

#### Freshwater River Exe

There are six EC designated List II sites (at Dulverton Laundry, Dulverton STW, Strong, Rawle and Strong Ltd, Cullompton STW, Stoke Hill Landfill and Crediton STW) which discharge to the freshwater River Exe and whose receiving waters are regularly monitored.

Dulverton STW, which discharges to the River Barle, is not consented but is designated for the following metals; copper, zinc, lead, chromium, nickel and iron. The EQS was exceeded for copper in 1994 in the receiving watercourse, the cause of which is unknown.

*Issue 7: High copper concentrations in River Barle downstream of Dulverton STW.*

Crediton STW is consented for copper, zinc and lead, and discharges to both the River Creedy and the River Yeo (Creedy). The EQS for iron was exceeded in the River Creedy and Yeo (Creedy) in 1992 due to elevated background concentrations from the catchment geology.

#### Tidal Exe Estuary

There are two EC designated List II sites, at Exmouth and Countess Wear STWs, which discharge to the tidal Exe and whose receiving waters are regularly monitored. There have been no exceedances of List II standards in the receiving waters.

### EC Freshwater Fish Directive

#### *Target*

The Freshwater Fish Directive 'on the quality of waters needing protection or improvement in order to support fish life' (Ref. 14) 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 fish populations. The other set of standards that is stricter, protects salmonid fish populations for example, salmon and trout.

There are two sets of standards for each fishery type: imperative standards, which must be achieved and guideline standards which Member States should aim to achieve.

We are responsible for monitoring the 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.

#### *State of the Catchment*

Map 23 shows the designated salmonid fishery stretches in the River Exe Catchment. All designated salmonid stretches met the imperative standards of the Directive. There are three designated cyprinid stretches two of which have exceeded imperative standards see Table 16 opposite.

*Issue 8: Algal blooms result in poor water quality in both the Exeter and Grand Western Canal.*

## TARGETS AND STATE OF THE CATCHMENT

**Table 16 : Non-compliant Cyprinid Stretches in the River Exe Catchment with Imperative Standards of the EC Freshwater Fish Directive**

Watercourse	Stretch	Length (km)	Failing Determinands	Year	Causes of Failure
Exeter Canal	Exeter Quay - Turf Locks	7.2	pH (High)	1993	High pH levels and associated high suspended solids, DO and BOD are a result of frequent algal blooms. These occur naturally due to the slow flow and high nutrient status of the canal.
Grand Western Canal	Burnhill Farm - Fenacre Bridge	2.0	Total Ammonia	1992	Two high total ammonia results occurred during winter months probably due to algal decay.
	Burnhill Farm - Fenacre Bridge Fenacre Bridge - The Basin, Tiverton	2.0 16.3	DO pH (High)	1994 1993	Poor water quality in the canal has been an on-going problem, particularly at the basin end. The canal has very little flow, with only a small feeder spring. The problem is probably exacerbated by enriching inputs from intensive duck feeding (at canal basin end) and fishing (bait). These activities will contribute to algal blooms which result in DO and pH problems.

## TARGETS AND STATE OF THE CATCHMENT

### EC Urban Wastewater Treatment Directive

#### *Target*

The EC Directive 'concerning urban wastewater treatment' (Ref. 26) specifies minimum standards for levels of sewage treatment and sewerage 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 (see Effluent Disposal Section 5.10).

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, and/or lower standards of treatment to 'less 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 to find out whether a watercourse is a sensitive area. We present this information to DoE who decide whether the watercourse is sensitive. We then ensure that discharges to the sensitive area receive a higher level of treatment.

Less Sensitive areas or 'High Natural Dispersion Areas' (HNDAs) are those estuarine or coastal waters which are naturally very dispersive. In these areas a lower level of sewage treatment is required. However, dischargers must demonstrate that no additional harm will be caused to the environment by the lower level of treatment by carrying out detailed studies called 'Comprehensive Studies'. We are responsible for ensuring that these studies are carried out correctly.

#### *State of the Catchment*

There are two schemes needed to meet the main requirements of the Directive (Ref. 26) in the River Exe Catchment; Countess Wear and Cullompton STW. Five schemes are identified as necessary under the appropriate treatment provision (see Table 12).

The River Creedy has been identified as a Sensitive Area (Eutrophication) from Crediton STW (SS 8484 0063) to the Exe Estuary (SX 9310 9090). The qualifying STW is Crediton with a population equivalent of 12,500. Phosphorus removal is to be installed at this STW by the end of 1998. Routine monitoring will continue to confirm the Sensitive Area status.

#### *Issue 9: Eutrophication in the River Creedy.*

The sea off Exmouth and Dawlish has been identified as a HNDA. SWWSL will be carrying out comprehensive studies in order to demonstrate that no additional harm will be caused by the lower level of treatment.

#### *Issue 10: Comprehensive Studies required to demonstrate the High Natural Dispersion Area off Exmouth and Dawlish.*



## TARGETS AND STATE OF THE CATCHMENT

### EC Surface Water Abstraction Directive

#### *Target*

The Directive 'concerning the quality required of surface water intended for the abstraction of drinking water in the Member States' (Ref. 38) 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 the standards are not met, we are responsible for identifying sources of pollution and making sure that improvements are made.

#### *State of the Catchment*

There are four designated Surface Water Abstraction points in the River Exe Catchment (see Map 23)

All these sites have exceeded the imperative standards of the Directive (Ref. 38). Details and reasons for non-compliance with the Directive are shown in Table 17.

*Issue 11: High polyaromatic hydrocarbon concentrations in the River Exe at Pyne's Intake.*

## TARGETS AND STATE OF THE CATCHMENT

**Table 17: Details of Non-compliance with the EC Surface Water Abstraction Directive in the River Exe Catchment**

Site	Reason for Failure	Possible Causes of Failure
Wimbleball Reservoir	Dissolved and Emulsified Hydrocarbons 1993 and 1994  Total Phenols: 1994	See footnote.  See footnote.
Exe at Bolham Leat	D&E HCarbons: 1994	See footnote.
Exe at Pynes Intake	Polyaromatic Hydrocarbons: 1994	Investigation is planned to find reasons for non-compliance.
Dawlish Water at Thorne's Intake	D&E HCarbons: 1993 and 1994  Colouration: 1993 and 1994 Dissolved Iron: 1994  Total Phenols: 1994	See footnote.  An upland area site with peaty soil and coniferous plantations. Consequently, the river is prone to natural colouration during rainfall.  See footnote.

### Footnote

#### Phenols and Dissolved and Emulsified Hydrocarbons (D&E HCarbons):

We are currently concerned about the suitability of the methods for analysis of phenols and dissolved and emulsified hydrocarbons as specified in the EC Surface Water Abstraction Directive (Ref. 38). Exceedence of the Directive's standards cannot always be attributed to polluting discharges and we suspect that some exceedences may be due to natural compounds resulting from the breakdown of vegetation. We are involved in discussions with the DoE, with a view to reviewing the analytical methods used. We will continue to report exceedences 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.

## TARGETS AND STATE OF THE CATCHMENT

### EC Shellfish Hygiene Directive

#### *Target*

The Shellfish Hygiene Directive 'laying down the health conditions for the production and the placing on the market of live bivalve molluscs', (Ref. 39) protects the public 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 (Appendix 8).

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 can not control the quality of polluting discharges under this Directive.

#### *State of the Catchment*

Four sites on the Exe Estuary (Western Beds) are classified as Category B waters.

### Other International Commitments

#### *Target*

#### 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 load (concentration x river flow) of certain substances known as 'Annex 1A' substances (see Appendix 9) entering tidal waters from rivers and direct discharges. Annex 1A substances are those which are toxic, persistent and which bioaccumulate. Loads of most Annex 1A substances are to be reduced by 50%, but loads of mercury, cadmium and lead are to be reduced by 70%. Reductions are to be achieved by 1995 compared with a 1985 baseline or a 1991/1992 baseline where data for 1985 are unavailable.

We are responsible for carrying out monitoring and identifying significant sources of these substances. We identify significant sources by ranking loads of Annex 1A substances in rivers and direct discharges according to their size. A discharge is significant if it belongs to the group of discharges that contribute the first 95% of the total load entering tidal waters. In accordance with DoE guidelines we identify where reductions can be made.

#### Paris Commission Annual Surveys

In June 1988, the Paris Commission decided to implement a comprehensive annual study of selected waters to Paris Convention Waters (the North East Atlantic excluding the Baltic and Mediterranean) with the aim of monitoring 90% of the loading of each selected pollutant entering Convention Waters. In England and Wales, we have responsibility for carrying out the survey in accordance with the methodology laid down by the Paris Commission. The first survey was undertaken in 1990.

#### *State of the Catchment*

Three sites on the River Exe are monitored for Annex 1A and Paris Commission purposes. These are at Exeter (Trews Weir), Exeter (Countess Wear) STW and at Exmouth STW.

# Map 24 - Biological Classification (1994)



## TARGETS AND STATE OF THE CATCHMENT

Significant loads of cadmium, copper, zinc, lead, nickel and chromium have been recorded at Trews Weir on the River Exe during the period 1990 - 1993. Significant loads of fenitrothion, gamma HCH, endrin, malathion and parathion methyl have been recorded at Countess Wear in the River Exe Estuary during the period 1990 - 1993. Significant loads of copper have been recorded at Exmouth during the period 1990 -1993.

In 1992 the River Exe entered the top ten ranking of significant sites for total nitrogen (Contaminants Entering the Sea (Ref. 40)). The PARCOM data take into account concentration and flow. The concentration of nitrate in the River Exe is typical of a river of this nature; its apparently high national ranking is not a cause for concern.

For many substances the UK has met its commitments to achieve reductions in loadings. Before actioning further investigations to reduce inputs; we have been advised by the DoE to await the outcome of the fourth ministerial conference on the North Sea, which took place in June 1995. We expect to hear from the DoE shortly.

### **Additional Monitoring**

As well as the work we carry out to meet the requirements of RQOs, EC Directives and other international commitments, we carry out additional monitoring which helps us to determine the state of water quality in the River Exe Catchment.

### **Biological Monitoring**

#### *Target for Freshwater*

We monitor the ecological quality of rivers by sampling benthic aquatic macroinvertebrates. These are small animals which live in river sediments. They are unable to move far and so are affected by long term conditions in the river.

We collect samples from the river during the spring, summer and autumn and make a list of the different families (taxa) of macroinvertebrates present. We compare the range of families found with what we would expect to find in a similar unpolluted river using a predictive database model which uses the Biological Monitoring Working Party (BMWP) scoring system. We use this information to classify rivers as follows:

<u>Biological Class</u>	<u>Description</u>
A	Good
B	Moderate
C	Poor
D	Very poor

We have examined sites in the River Exe Catchment where the Biological Class is not A (good quality).

#### *State of the Catchment*

Map 24 shows the most recent full biological classification of the River Exe Catchment.

In general the river achieves NRA Class A representing Good Ecological Quality. However, there are a number of stretches which only achieved NRA Class B (moderate) and NRA Class C (poor) ecological quality. Those sites with ecological quality less than good are shown in the table over.

## TARGETS AND STATE OF THE CATCHMENT

**Table 18: Sites of Moderate or Poor Ecological Quality in the River Exe Catchment**

River	Site	NGR	Year	Biological Class
Northbrook	Northbrook Park	SX 9403 9080	1994	B
Grindle Brook	Winslade Park	SX 9770 9019	1994	B (linked to Issue 3)
River Kenn	A38, Kennford	SX 9117 8663	1994	B
River Clyst	Broadclyst	SX 9843 9760	1994	B
River Clyst	Clyst Honiton	SX 9860 9357	1994	B
River Culm	u/s Silverton Mill	SS 9800 0102	1994	B
River Culm	d/s Silverton Mill	SS 9745 0138	1994	B
River Culm	Columbjohn	SX 9589 9980	1994	B
Spratford Stream	Leonard Moor Bridge	ST 0449 1410	1994	B (linked to Issue 5)
Spratford Stream	Tiverton Junction	ST 0320 1160	1994	C

The river water quality of the Grindle Brook, River Clyst, part of the River Culm and Spratford Stream has already been discussed. Those river stretches not already discussed have been identified below.

Polluting discharges from the closed waste disposal site at Mincinglake, several CSOs and urban runoff enter the Northbrook.

Farm waste management plans have been drawn up for a number of farms in the River Clyst subcatchment; improvements to water quality and hence ecological quality are expected.

An investigation into the causes of poor river water quality identified a number of polluting discharges in the upper River Kenn. Enforcement visits have secured improvements. Further monitoring will indicate the need for any further field investigations.

River water quality continues to improve in the Spratford Stream and River Culm following improvements to the treatment facilities at the major discharges. It is expected an improvement to ecological quality will follow.

*Issue 12: Moderate or poor aquatic macroinvertebrate quality in Northbrook, River Kenn, River Clyst and Spratford Stream.*

### *Target for Estuaries*

We have monitored the biological quality of the Exe Estuary to provide an indication of the water quality in the estuary.

## TARGETS AND STATE OF THE CATCHMENT

### *State of the Catchment*

A survey of the macroinvertebrate fauna of the Exe Estuary was carried out in 1990 providing a baseline set of data. The main findings of the 1990 survey were that the biological communities present in the estuary were typical of this type of environment (Ref. 41).

Species richness was lowest in the upper reaches due to reduced salinities and increased towards the estuary mouth. In muddier areas marine worms dominated including the ragworm *Nereis diversicolor* and the amphipod *Corophium voluator*. In sandier habitats the lugworm *Arenicola marina* and the peppery furrow shell *Scrobicularia plana* were present. The relatively rare flowering plant *Zostera marina* or eelgrass was found in the lower reaches of the estuary and previous surveys recorded one of only two known populations in the UK of the marine worm *Ophelia bicornis*.

### **Water Quality in Estuarine and Coastal Waters**

#### *Target*

The survey of bathing water quality at water contact sports sites will indicate water quality problems close to beaches.

#### *State of the Catchment*

##### Estuary Quality

Estuary monitoring data collected over the tidal cycle from four sites in the estuary between 1990 and 1994 has shown elevated nutrient levels. We have also recorded high chlorophyll a concentrations (>10mg/l) associated with nutrient runoff following high rainfall. During summer 1995 an algal bloom developed in the Estuary. However, there is no evidence to suggest that the algal blooms are sustained or have caused other water quality problems.

If algal blooms develop in future we will consider whether the Exe estuary requires further monitoring to establish whether it should be identified as a 'sensitive area' under the UWWTD (Ref. 26) or a 'polluted water' under the Nitrates Directives (Ref. 42).

##### Water Contact Sports

The coastal waters and estuary of the catchment are used for water contact sports. Our monitoring of EC and non-identified bathing waters provides information on water quality close to beaches. This monitoring for water contact sports has provided information on water quality further offshore.

There are two water contact sports sites in the River Exe Catchment monitored for total coliforms, faecal coliforms and faecal streptococci (see Table 19 below).

At both sites concentrations of bacteria were generally low. If the imperative bacteriological standards of the Bathing Waters Directive (Ref. 36) are applied to the Water Contact Sports sites then the Exe Estuary mouth site exceeded the standard in 1992 and 1993. The Exmouth site met with the standards during the period 1992-1993.

*Issue 13: Concern over water quality adequate to protect water contact sports in the mouth of the Exe Estuary.*

## TARGETS AND STATE OF THE CATCHMENT

**Table 19: Water Contact Sports Site Monitoring in the River Exe Catchment**

Site Name	NGR	Years Monitored
Exe Estuary Mouth	SY 0098 7995	1992 and 1993
Exmouth	SX 9990 8050	1992 and 1993

Monitoring sea water quality at these sites will no longer be carried out.

### Non-designated Shellfish Waters

#### *State of the Catchment*

There are three discrete areas in the Exe Estuary where mussels and Pacific oysters are farmed. These are located on the western side of the Exe Estuary. We have monitored water quality and the quality of shellfish tissue at these sites.

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 this tissue gives an indication of contaminants present in sea water.

The concentration of metals and organochlorine compounds in water samples were all within the EQS under the EC Shellfish Waters Directive (Ref. 39).

Tissue levels of cadmium, copper, arsenic, nickel, lead, mercury and zinc were all within the typical range expected in shellfish. Two of the sites had results for chromium which fell outside the typical range expected for oyster tissue.

**Table 20: High Chromium Results in Oyster Beds in the Exe Estuary**

Shellfish Type	Actual Result for Chromium mg/kg Dry Weight	Typical Range mg/kg Dry Weight
Oyster	4.42	<1 - 3.5
Oyster	11.20	<1 - 3.5

Tissue levels of chromium may fall following the period of self cleansing in clean sea water.

A single site on the Exe Estuary at Bull Hill has been used to monitor shellfish for their tendency to bioaccumulate persistent chemical and bacterial contaminants.

Results from the annual surveys since 1990 indicate that for organic contaminants no samples have exceeded guideline EQS values for mussel tissue; most analyses indicated levels below the limit of detection.

Table 21 details results of metal analyses which indicate concentrations of arsenic and copper which are marginally outside the typical range of trace metal values based on data from MAFF surveys.



## TARGETS AND STATE OF THE CATCHMENT

**Table 21: High Arsenic and Copper Concentrations in Mussel Tissue in the Exe Estuary**

Metal	Actual Result (mg/kg) Dry Weight on 24.02.94	Typical Range (mg/kg) Dry Weight
Arsenic	20.3	4.50 - 15.00
Copper	22.2	5.00 - 16.00

Copper may be taken up by the shellfish from the water column, as it is an active ingredient in some anti-fouling paints, although some research has suggested that the use of mussels as monitors for background levels of copper, arsenic, zinc and silver may be unreliable.

### EC Groundwater Directive

Whilst the EC Groundwater Directive (Ref. 43) controls the release of certain substances to groundwaters, there are no statutory standards for groundwater quality. The NRA can only compare water quality with appropriate standards for the 'use' to which groundwaters are put. However, there is no compulsion for the NRA to ensure that groundwater quality achieves desirable use standards.

Groundwater quality within the catchment is generally reflected by river water quality during dry weather periods when river flow is almost entirely derived from groundwater seepage. Within the catchment this indicates that groundwater quality is likely to be suitable for providing river baseflow and supporting identified river water uses.

A small number of boreholes in the catchment have been sampled but no conclusions about general groundwater quality can be drawn as the groundwater links a vast area, varies in three dimensions and we have limited knowledge of geological control on groundwater quality.

A key element to assist the protection of groundwater generally is identifying areas which are particularly vulnerable according to properties of the soil cover and the underlying rocks. A programme of Groundwater Vulnerability mapping is underway and will assist in future pollution prevention planning.

### Groundwater Protection Policy

The protection of aquifers from pollution is of great importance as the contamination of groundwater may put water supplies at risk. Contamination may also affect river water quality where the baseflow depends on groundwater. If groundwater becomes polluted it is not easy to detect and is difficult and expensive to clean up. So, it is better to prevent or reduce the risk of groundwater contamination in the first place rather than deal with the consequences.

In 1992 we published our Policy and Practice for the Protection of Groundwater (PPPG) (Ref. 44). This document is a national policy which ensures that there is a consistent approach to the prevention of groundwater pollution. The policy document sets out why we must safeguard the quality and flow of water in aquifers and outlines how the NRA with the co-operation of other organizations and individuals will work to reduce risk of groundwater pollution.

## TARGETS AND STATE OF THE CATCHMENT

The PPPG statements cover the risks posed by various activities based on the type of aquifer, its vulnerability and, in the case of drinking water sources, the proximity to that source. Our policy document contains policy statements on the following:

- \* Control of groundwater abstractions
- \* Physical disturbance of aquifers affecting quality and quantity
- \* Waste disposal to land
- \* Contaminated land
- \* Disposal of sludges and slurries to sand
- \* Discharges to underground strata
- \* Diffuse pollution
- \* Other threats to groundwater quality.

Catchment Management Plans need to address the importance of pollution prevention planning in achieving and maintaining future groundwater.

We have mapped the vulnerability of groundwaters in England and Wales and are working on a more detailed classification. The results of this work will be published in 1998.

We work with planning authorities to minimize the risks posed to groundwater from development and land use changes. We concentrate our efforts in the most vulnerable areas around water supply boreholes.

### *Target*

To protect groundwater from all types of threat, large and small, from point and diffuse sources, and by both persistent and degradable pollutants.

### *State of the Catchment*

Redevelopment of sites, particularly the old waste disposal and industrial sites close to Exeter and other towns, may cause a release of contaminants, which could result in groundwater pollution. A risk assessment study which recommends appropriate mitigation measures would be required.

Higher Kiln waste disposal site was closed in 1992 following the detection of trace levels of industrial organic solvents in nearby springs, one of which is used as a private water supply. Since then detailed monitoring of the groundwater, springs and surface waters around the site have been undertaken. Indications are that since tipping stopped a general gradual improvement in groundwater quality has occurred. Plans are currently being progressed for restoration of the site in a manner which will not lead to any further deterioration.

Oil was deposited at the site until 1975 when oil was found in an offsite borehole. A small scale oil scavenging operation was undertaken for a number of years. Oil has not been detected in any other offsite monitoring boreholes or springs. Recent analysis of the oil has revealed that it contains PolyChlorinated Biphenyls (PCBs). PCBs have not been detected in the other boreholes, spring and surface water monitoring points. Following discussions with the NRA the site owner is investigating the extent of the oil plume and any flow direction.

## TARGETS AND STATE OF THE CATCHMENT

In addition to our routine groundwater monitoring of this area we will be undertaking a sampling programme along the River Bathern during low flow conditions, which is designed to establish the presence of any westward migrating leachate from Higher Kiln.

*Issue 14: Pollution of groundwater around Higher Kiln Waste Disposal Site.*

### **EC Nitrates Directive**

Restrictions on certain agricultural activities are necessary in areas sensitive to surface and groundwater pollution. The EC Directive 'concerning the protection of waters against pollution caused by nitrates from agricultural sources' (Ref. 42) protects waters from pollution by nitrates used in agriculture. This Directive requires Member States to identify waters that are or could be affected by pollution from nitrates. The land draining to these polluted waters must be designated as 'nitrate vulnerable zones' (NVZ). Action plans must be established to reduce existing nitrate pollution and prevent further pollution. Outside NVZs, Member States must establish and promote a code of good agricultural practice (Ref. 28).

We are responsible for advising on the selection and boundaries of NVZs. The designation of NVZs and agricultural measures to be adopted is the responsibility of Government.

### *State of the Catchment*

High nitrate concentrations detected in the Duckaller and Vennbridge public water supply boreholes has led to the designation of a Nitrate Sensitive Area (NSA) between the River Kenn and Dawlish Water, around the Duckaller borehole (see Map 14). The NSA is a voluntary scheme whereby MAFF compensates farmers to reduce the use of nitrogenous fertilisers and to convert arable land to grassland in order to protect public water supplies from nitrate contamination.

This area is also one of the proposed NVZs currently being designated, which covers a similar area to the NSA but also includes the Vennbridge borehole. The NVZ's are being designated to achieve compliance with the EC Nitrates Directive (Ref. 42). The details of measures to be taken within the NVZs are still being drawn up but unlike the NSAs these measures will be compulsory and farmers will not be compensated.

There is currently insufficient data to designate Bow, a private water supply source, as NVZ although it may warrant designation in the future.

*Issue 15: High nitrate concentrations in groundwater.*

## TARGETS AND STATE OF THE CATCHMENT

### 6.2 WATER QUANTITY

We aim to manage water resources to achieve the right balance between the needs of the environment and those of the abstractors. In this section we will assess the state of water resources in the catchment. We consider how the water environment is affected by abstraction and look at the needs of the abstractors. In particular, we discuss the obligations we have to ensure that there is adequate water for public supply.

The Water Resources Development Strategy for South Western Region - 'Tomorrow's Water' (Ref. 32) sets out how we would like to see water resources developed in the future. Our strategy follows the principles of sustainable development with proper safeguards for the environment.

To promote our strategy for the region we:

- \* encourage the efficient use of water
- \* expect abstractors to use existing sources efficiently before new sources are developed
- \* approve developments that cause the minimum problems for the environment
- \* solve existing environmental problems caused by abstraction where benefits outweigh the costs and funds can be found.

#### The Natural Water Environment

##### *Target*

To protect the water environment from damage by abstraction.

##### *State of the Catchment*

Overall the catchment is not stressed by abstraction although there are some problem areas.

##### Low Flow Site Identification

In 1990 consultants were commissioned to carry out a study (Ref. 45) into the extent and nature of artificially influenced low flows in the previous NRA South West Region. Sites were identified where artificially depleted flows were believed to affect adversely the river corridor environment in some way. Eleven of these sites are in the River Exe Catchment and are summarized in Table 22.

Nineteen of the sites were identified for priority action. The only site in the River Exe Catchment in the top nineteen is the Exe Valley Fishery at Perry Weir (ranked serious, on the River Barle (SS 932 247)).

NRA South West undertook a further review in 1993 in order to reappraise the scale of potential low flow problems, and to include all Licences of Entitlement (LoEs). This process highlighted one further site in the River Exe Catchment at Bridgetown Mills (SS 923 337).

Following research a standard method (SWK Methodology) for assessing low flows was developed. In the South West the methodology was applied to twenty-six sites including the River Barle at Perry Weir and Bridgetown Mills. The results of the exercise proved inconclusive. The methodology has since been reviewed.

## TARGETS AND STATE OF THE CATCHMENT

**Table 22: Perceived Low Flow Sites in the River Exe Catchment (ranked in Low Flows Study Report, (Ref. 45))**

River/National Grid Reference	Site	Nature of Problem	Perceived Significance	Purpose
Barle (Exe) SS 932 247	Exe Valley Fishery, Perry Weir	400 m deprived reach, leat takes nearly all flow in low flows	Serious	Fish Farm
Exe SS 949 139	Heathcoats Textiles Factory	800 m reach with very low flows	Major	Fish Farm
Haddeo (Exe) SS 945 280	Exmoor Trout Farm (Hartford)	Deprived reach of 150 m	Major	Fish Farm
Iron Mill Stream (Exe) SS 898 201	Bellbrook Fishery	400-500 m reach virtually dry	Major	Fish Farm
Exe SS 919 229	Highleigh Mill Fish Farm	800 m reach with very low flows	Major	Fish Farm
Exe SS 929 217	Rainbow Valley Trout Farm (Black Cat/Oakford)	800 m reach with reduced flow	Medium	Fish Farm
Exe SX 917 962 and SX 906 951	Pynes Weir and Exwick Leat	Reduced flow over weirs, loss of wetted area	Medium	HEP
Barle (Exe) SS 913 281	Dulverton Laundry	Takes nearly all flow down leat, small stretch	Small	Industry
Exe SS 935 267	Dulverton Fish Farm (closed)	400 m reach with reduced flow	Minor	Fish Farm
Burn (Exe) SS 949 066	Burn Valley Trout Farm (closed)	Leat Abstraction	Minor	Fish Farm
Lympstone Brook (Exe) SX 994 840	Lympstone Mill	300 m reach almost dry	Minor	HEP

## TARGETS AND STATE OF THE CATCHMENT

We will use the revised methodology to produce a new regional list. Sites towards the top of this list and not already under investigation will be considered for priority treatment once current investigations are complete, solutions implemented or additional resources become available.

*Issue 16: Need to reassess sites based on improved low flow identification techniques.*

### Perceived Low Flow Sites - River Barle

Perry Weir diverts a proportion of the flow into Exe Valley Fishery leaving a deprived reach from the weir to the Rivers Barle and Exe confluence some 500 m further downstream.

Hydrological investigations indicate that abstraction at the authorized licensed maximum would have a significant impact on the flow in the River Barle downstream of Perry Weir. Simulations also suggest that abstraction at the authorized maximum licensed rates could significantly reduce the habitat available to salmon and trout in the deprived reach.

Fisheries studies undertaken since 1992, including radio tracking, have not demonstrated that the actual abstraction regime at Perry Weir has had any significant impact on either juvenile production or fish movement. Furthermore, ecological studies, including river corridor surveys and invertebrate sampling, do not suggest that the abstraction is having a significant impact on the ecology in the deprived stretch.

Further hydrological or conservation work at this site has been postponed until the fisheries studies are complete. As the previous fisheries studies were carried out during a wet summer further investigation has been undertaken this summer under naturally low flows.

Some water enters the deprived reach through leaks in the weir wall. Current work to improve the weir will further reduce flows.

*Issue 17: Low flows in the River Barle.*

### Reported Falling Groundwater Levels at Dawlish Warren

In recent years concern has been expressed about falling water tables of three sand dune systems in Devon. Substantial drying out of the dune habitats at Braunton Burrows, Northam Burrows and Dawlish Warren is endangering survival of their outstanding wildlife interest.

Research is necessary to determine the movement of water within the dune habitats. Specifically, the objectives of this research (Sand Dunes Project) are to:

- \* describe the known and surmized hydrological history of each sand dune system
- \* explain how the groundwater systems are operating and, if appropriate, assess the main causes of the falling water tables
- \* recommend appropriate remedial/restorative measures.

We will seek to influence with others the implementation of the management plan proposed.

*Issue 18: Reported falling groundwater levels at Dawlish Warren.*

## TARGETS AND STATE OF THE CATCHMENT

It is essential that hydrometric data are available to provide accurate information on flows in the River Exe through Exeter and entering the estuary. Since the gauging station at Trews Weir closed in 1981, a requirement has often been highlighted for the site to be replaced. Accurate data are required to enable informed decisions to be made on many important issues, particularly relating to abstraction licences and prescribed flows. These data will also allow confirmation, or otherwise, of the method used for assessment of flows at Exeter to identify the true impact of abstractions or impoundments within the main River Exe Catchment. The gauge will also be invaluable in assessing flood volumes through a vitally important flood relief scheme which protects parts of Exeter City from inundation by flood waters.

*Issue 19: Need for a gauging station to monitor flows of the River Exe in Exeter at Trews Weir.*

### Public Water Supply

#### *Target*

To ensure that there is enough water available for public water supply now and in the foreseeable future.

#### *State of the Catchment*

Under the two demand scenarios described in Section 5.9 deficits in water supply have been forecast for the SWWSL Wimbleball Supply Zone. Water deficits will be reached by 2006 under the high scenario and by 2011 under the low scenario.

The options to meet this deficit and to ensure that the low demand scenario is the one that actually occurs are outlined below in order of preference.

- 1) Demand Management: We promote the selective metering of domestic supplies, efficient water use and recycling.

The potential savings in household consumption that can be achieved through the use of metering have been demonstrated by numerous trials nationally. Whilst we do not expect every property to be metered the installation of meters in all new properties is encouraged. SWWSL and WWSL are moving in this direction but as yet do not support a policy of compulsory metering. The benefits of metering are described fully in the Regional Water Resources Development Strategy (Ref. 32).

- 2) Resource Management: Leakage control and operational improvements.

The loss of water between the point of abstraction and the point of consumption by the customer is collectively known as 'leakage'. This loss includes pipe bursts, leaking joints, overflows from service reservoirs and losses on the part of the system where the customer is responsible for pipe maintenance. Considerable savings of water put into supply could be made in some areas given sufficient effort to improve leakage control. We are currently investigating where such savings might arise.

In the absence of a leakage figure, or indeed a range of leakage levels agreed with the water companies, our broad leakage target of 200 litres/property/day is used. We are keen to assign local targets based on the local demand areas in the future.

## TARGETS AND STATE OF THE CATCHMENT

### 3) Resource Development

We are working to devise an agreed operational management strategy for the Wimbleball pumped storage scheme with SWWSL. This will clarify the current and likely future operation of the major sources in the River Exe Catchment taking into account the environmental requirements of the system. This type of scheme will provide additional environmental benefit in terms of the fisheries bank as well as providing increased resources for use in East Devon.

*Issue 20: Forecast deficit in supply in Wimbleball Supply Zone.*

#### Duckaller and Vennbridge Groundwater Boreholes

Groundwater level and stream flow data have been collected over the last 20 years. This information will be reviewed by 31 March 1996 to assess the extent to which there is a sustainable balance between available resources and licensed abstractions. It will identify whether there are any particular actions which need to be taken to maintain such a balance, e.g. by promoting changes to mitigation arrangements or to conditions on specific existing abstraction licences.

*Issue 21: Perceived over-exploitation of the Duckaller/Vennbridge aquifer.*

#### Coleford and Knowle Groundwater Boreholes

Both abstraction licences contain review conditions (95/96) to allow the assessment of any unforecasted abstraction impacts. The review will identify whether any actions are required to maintain a sustainable balance between available resources and licensed abstraction.

*Issue 22: Review of Coleford and Knowle abstraction licence conditions.*



## TARGETS AND STATE OF THE CATCHMENT

### 6.3 PHYSICAL FEATURES

#### *State of the Catchment*

#### Recreation

Use of the coastal area is intense during the summer, leading to some conflicts, both between recreation users and between recreation and conservation interests. Sites at both Dawlish and Exmouth are of high conservation value and there is potential for this to be affected by visitor pressure. River sites may also be affected; at Taw Steps on the River Barle, for example, large numbers of visitors to this important archeological site cause erosion of bankside vegetation.

*Issue 23: Need to balance recreation and conservation uses of coastal and river sites.*

Similarly, with ever increasing recreation activity in the Exe Estuary, there will be greater scope for conflicts between different user groups, for example jetskiers and birdwatchers, or dinghy sailing and power boating. Agreed zoning by time or space may help to reduce the problem.

*Issue 24: Need to accommodate recreation uses of the estuary.*

The Exwick Flood Relief Channel offers great potential for water-based recreation in the heart of Exeter which has never been fully realized. We are reviewing the use of this site and are exploring ways of managing it to maximize its value.

*Issue 25: Need for revision of recreation management of Exwick Flood Relief Channel.*

Public access from Exeter's Riverside Valley Park south to the Exe Estuary is difficult, involving a dangerous road crossing. We own land on both sides of the road, and there may be a possibility of developing a safe crossing point here. A solution to crossing the canal would still be required.

*Issue 26: Need for improved access to and from NRA owned land at Countess Wear.*

The Tiverton Flood Defence Scheme would benefit from enhancement of its amenity value. There is also a significant problem with dog fouling at the site.

*Issue 27: Need for amenity improvements to Tiverton Flood Alleviation Scheme.*

The existing access agreements for canoeing in the River Exe Catchment are presently restricted to the winter months. This is largely to prevent disturbance of the important game fishery during the summer. There may be opportunities for canoeing, particularly by 'touring' canoes, at locations where conflicts would not arise. Restricting access to particular times or pre-arranged dates might be an option.

*Issue 28: Limited access agreements for summer canoeing.*

Where canoeing already occurs, access points are generally not easy to use, involving some risk for able-bodied canoeists and ruling out access by less able people. Simple structures (steps, limited surfacing) could be put in place at a few major sites at relatively low cost.

*Issue 29: Poor physical access to river for canoeing, particularly for less able canoeists.*

## TARGETS AND STATE OF THE CATCHMENT

Some NRA regions operate telephone message services for canoeists, giving advice on access, river levels and other aspects of river canoeing. In Devon a similar service is operated on the River Lyn. These services can prevent canoeists making long journeys only to find conditions are unsuitable, either leading to disappointment or possible environmental impact. The lines could also be used to provide fishing information.

*Issue 30: Lack of readily available information on canoeing conditions.*

### Landscape

Traditional landscapes may be adversely affected by changes in land use and new development. River valleys are acknowledged as important features within the overall landscape.

Intensification of farming practices in response to new pressures or incentives may result in loss of hedgerows and alteration to historic field patterns. Expansion of forestry, especially coniferous plantations, can significantly alter the appearance of river valleys. Concerns have been expressed over the impact of large scale green field development and inappropriate recreation use.

Although the NRA does not have a programme for strategic landscape assessment, a methodology exists for use when actions likely to impact upon the landscape are under consideration.

*Issue 31: Impact on landscape of inappropriate development.*

Concerns have also been raised over the aesthetic impact of litter in rural and urban areas within the river corridor in the catchment.

*Issue 32: Litter in River Exe Corridor.*

### Archaeological and Historic Value

Features of interest will require continued protection if they are to survive. Unidentified features are at risk from new development or changes in practice, both of which may result from increased use of the area. Such losses might include palaeo-environmental information as well as artifacts.

There is an absence of easily accessible, general information on the historic environment, contrasting with that available for landscape and nature conservation. A need exists for a simple assessment of the overall value of the catchment to provide a framework for considering actions in relation to the historic environment. Such a document could be based on political or catchment boundaries and would be particularly helpful to the NRA in commenting on various proposals.

*Issue 33: Absence of general assessment of archaeological/historic value of whole catchment.*

*Issue 34: Need for improved archaeological input to NRA routine conservation screening activities.*

### Ecology

Although we can influence many of the activities affecting the quality of the water environment, it is difficult to set targets to protect a minimum amount of a particular habitat, or a minimum acceptable number of a particular species. If we are to achieve environmental sustainability of the aquatic environment, it is important to maintain biodiversity in the catchment.

## TARGETS AND STATE OF THE CATCHMENT

Two important projects currently under way in Devon should assist in that process: the Rivers and Wetlands Project, led by Devon Wildlife Trust (DWT) and involving all the major organizations who are active in conservation of the water environment; and the development of a Nature Conservation Strategy for Devon (Ref. 5), dealing with all aspects of nature conservation and including but not specializing in aquatic conservation. The Rivers and Wetlands project will publish Biodiversity Action Plans for key habitats and species in Devon. We will incorporate both the targets and actions in our own Catchment Management Plan Action Plan.

We are closely involved with both these initiatives, which aim to set agreed targets for both species and habitats, helping to prioritize and direct effort. It is likely that we will adopt these targets within CMPs where appropriate. Until targets are set we shall continue to promote good management for the benefit of conservation.

*Issue 35: Need for clear biodiversity targets for conservation of the water environment.*

The protection afforded by various designations should help to maintain the high conservation value of large parts of the catchment. However, increasing recreation and development pressures may conflict with conservation use, most notably in the Exe Estuary area. An agreed estuary management plan is needed.

*Issue 36: Need for implementation of estuary management plan.*

Undesignated sites and more widely distributed species are recognized as being more vulnerable, and their conservation value is also acknowledged as significant, particularly where locally typical habitats and species are involved. Identification of sites of more local importance is helpful in achieving protection. DWT's production of inventories of sites of wildlife interest is a helpful initiative to which the NRA has contributed.

*Issue 37: Need for better understanding of significance of the conservation importance of the whole catchment.*

Loss and degradation of valuable semi-natural habitats continues to be a concern, for example the loss of Culm grassland or scrub and bracken invasion of spring-line mires in the Blackdowns. This can be due to a number of factors, including neglect or mismanagement, but is often due to a change of agricultural practices. Further development of programmes such as Countryside Stewardship and MAFF's agri-environment package may enable the retention or revival of less intensive agricultural practices.

*Issue 38: Loss and decline in value of semi-natural habitats.*

River floodplains, and especially the wetlands contained within them, are another area at risk. We are involved in a number of initiatives to protect these sites. We also have some major land holdings for which we will develop plans to benefit conservation while fulfilling the areas' other role of flood defence.

*Issue 39: Need for retention/restoration of conservation value of floodplain wetlands.*

The patchy otter population of the river gives some cause for concern; the River Exe Catchment should provide a centre for expansion into the poorly populated catchments to the east. We are developing a national strategy for otter conservation; for the River Exe this will largely involve monitoring the population.

*Issue 40: Otter population below optimum level.*

# Map 25 - State of the Catchment, Barriers



## TARGETS AND STATE OF THE CATCHMENT

Historically the south-west has not been a major population centre for water voles. The recent national survey showed, however, that the species has declined significantly. We should seek to protect the remaining population.

### *Issue 41: Decline of water vole population.*

Sand martins are prone to move their nest sites as conditions of river banks change. They are also vulnerable to works such as erosion control. Surveys have been carried out in the past but updated information would be very useful.

### *Issue 42: Lack of current information on sand martin distribution.*

Little is known about the distribution of species of lamprey and allis shad; species listed in the EC Habitats Directive (Ref. 11). We carry out fish surveys at a number of sites which offer opportunities for recording these.

### *Issue 43: Need for improved information on species of lamprey and allis shads.*

The native or white clawed crayfish is found in the catchment. Small numbers have been recorded in the River Culm, but the River Creedy subcatchment appears to support a significant population. The native crayfish population is at risk from disease and should be protected.

### *Issue 44: Need for protection of native crayfish.*

There are records of a number of rare plant species from the Exeter Canal. The canal is subject to a variety of uses and management. Some of these may damage plants, although there is no current information on their distribution or abundance (see Issue 8).

### *Issue 45: Lack of full understanding of distribution of rare plant species in Exeter Canal.*

Our surveys of invasive plant species improve our understanding. We may need to implement control where harmful effects on the ecology or flood defence capacity of the river is detected.

### *Issue 46: Spread of invasive plant species.*

#### Barriers

There are over fifty major weirs and obstacles in the catchment the majority of which are now easily overcome by migrating fish (see Map 25).

On the Rivers Barle and Exe, Perry Weir and Oakfordbridge Weir present problems for the upstream migration of salmon during low flows, as does Exwick Weir situated between the two confluences of the Rivers Exe and Creedy. The weir at Oakfordbridge has a small fish pass installed, but this is known to be ineffective. Negotiations are continuing to have a more efficient device installed.

Flood control structures on the Alphin Brook and the River Kenn prevent salmon entering these watercourses.

The weir at Clyston Mill on the River Clyst is a complete barrier to upstream movement. Salmonids are generally deterred from entering this tributary as a result of poor water quality so the barriers in the system are of little consequence at the moment.

# Map 26 - State of the Catchment, Juvenile Salmon



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River Exe Catchment Management Plan

NRA South Western Region

## TARGETS AND STATE OF THE CATCHMENT

On the River Culm, where there have been continued improvements in water quality, conditions may become suitable for supporting migratory salmonids. In these circumstances, considerable significance would be attached to ensuring that migratory fish had free passage over barriers in the river.

Sparte conditions in early 1995 resulted in the levelling of two major weirs in the River Creedy, Higher Marsh and Gunstone. Fordton Weir which is passable only in high flows, is now the only significant obstruction in this system upstream of Exwick Weir, and some priority must be attached to improving conditions for fish passage over both of these structures. With greatly improved water quality and free access to the spawning areas, the salmonid fishery on the River Creedy will be allowed to develop rapidly.

*Issue 47: Impeded fish migration on the Rivers Exe and Creedy.*

*Issue 48: Obstruction to fish passage on the River Culm.*

Downstream migration of smolts is hindered by intakes at Highleigh Mill on the River Exe, Perry Weir on the River Barle and Oakfordbridge Weir on the River Exe, and the intake to the leat feeding the Heathcoats factory in Tiverton. The installation of weed screens at Oakford Fish Farm has improved conditions for smolt migration since at the point of screening they are diverted back into the river. Similar developments will be encouraged. We operate screens at Heathcoat's factory on an annual basis to reduce smolt entrapment.

*Issue 49: Smolt entrapment.*

### Fisheries

The River Exe Catchment supports salmon, brown trout, coarse and eel fisheries. Map 26 shows details of the status of the juvenile salmon fisheries in the catchment.

Analysis of current and historical (1956-1972) catch returns from rivers across the country has shown a marked decline in the numbers of fish entering rivers between 1 January and 31 May. The River Exe Catchment has been no exception where recent average rod catches of these 'spring fish' have declined to as little as 9% of the historic average. This reduction is one of the worst observed for rivers in the South West. Many factors affecting the extent of the spring run are beyond our control, but protective measures taken locally may have an important influence on the recovery of the spring fish. The fish disease UDN (Ulcerative Dermal Necrosis) has undoubtedly had an effect on the spring run in the past, but although cases are still fairly common in the Exe Catchment, UDN is not thought to be a major factor inhibiting the recovery of the spring fish run.

*Issue 50: Decline in runs of spring fish.*

Three major tributaries of the River Exe; the Rivers Culm, Creedy and Clyst are currently under-performing as salmonid fisheries. This state may be attributed primarily to historical problems associated with water quality, and also to obstructions to fish migration that are present in each of the rivers rather than the quality of the spawning gravels (see Map 27). Continued improvements to the water quality of the River Culm will make the installation of fish passes on major structures worthwhile which will greatly increase the potential for salmonid production in these subcatchments.

*Issue 51: Poor migratory fish runs on the Rivers Culm, Creedy and Clyst*

# Map 27 - State of the Catchment, Spawning Areas

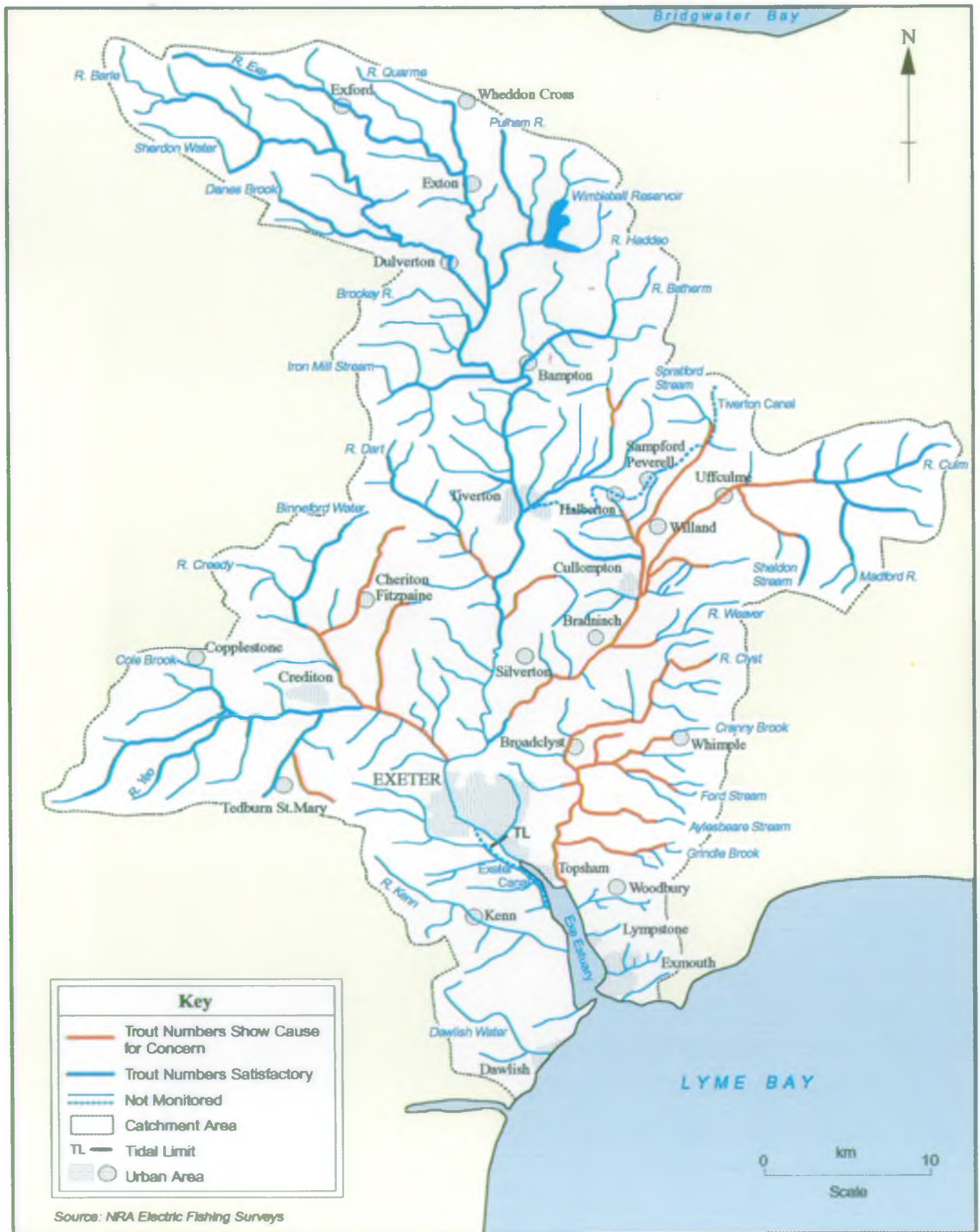




# Map 28 - State of the Catchment, Rainbow Trout



# Map 29 - State of the Catchment, Juvenile Trout



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River Exe Catchment Management Plan

NRA South Western Region

## TARGETS AND STATE OF THE CATCHMENT

Similar concerns have been expressed over plans to increase fish farming activity in the same area. The development of new fish farms is covered by legislation that allows for a greater level of environmental control than for existing operations.

### *Issue 52: Escapement of rainbow trout.*

Fisheries interests on the middle section of the River Exe have identified that there may be a reduction in stocks of brown trout in this area. Recent survey work has shown that juvenile recruitment in this species is good, and the large numbers of trout removed during fish rescues suggest that current stock levels are satisfactory (see Map 29). It is possible that a decline in the numbers of larger fish may be occurring due to over exploitation of the stock from angling pressure since most fish of this size are removed from the fishery.

### *Issue 53: Perceived decline of brown trout populations.*

In the summer of 1994, there was a large coarse fish mortality in the Grand Western Canal caused by low oxygen concentrations which was associated with the dense plant growth in the canal at that time. Measures taken at the time reduced fish losses, but further action is required to prevent the problem recurring.

### *Issue 54: Regular fish mortalities in the Grand Western Canal (Tiverton).*

Drift netting activity in the Exe Estuary presents a potential threat to migratory fish stocks. Outside the banned range of 65-89 mm, there are no restrictions on the mesh size for drift nets used for the capture of bass and mullet. The size of mesh commonly used for the capture of these species would also catch salmon which at certain times of the year congregate in the estuary prior to moving upstream. Since netting in the estuary may be conducted throughout the year, migratory fish stocks are very susceptible to this type of fishing activity. The restrictions on the type of gear which may be used, and the locations in which fixed nets at sea may be operated, afford a high level of protection for migratory fish providing that regular monitoring is carried out.

### *Issue 55: Capture of migratory fish in drift nets.*

Assertions made by regular anglers of the Exeter Canal suggest that the quality of the fishery has declined in recent years. The reason for this is unclear, but it is thought to be related to an increase in the clarity of the water following a reduction in use of the canal by boat traffic. The change to the clarity of the water may have resulted in a change of the fish population structure, and influenced the diversity and the extent of water plants present. Our fisheries surveys and analysis of catch returns show that the canal currently supports a mixed but imbalanced coarse fish population. Further investigative work is required upon which future management decisions need to be based.

### *Issue 53: Perceived decline in the quality of fishing on the Exeter Canal.*

It is widely accepted by anglers that in recent years there has been an increase in the extent of predation by fish-eating birds on freshwater fisheries. In this catchment the large numbers of cormorants observed are the principal concern.

Both salmonid and coarse fish populations are susceptible to avian predation and are known to be targeted by cormorants at various locations in the catchment. However, we will not support licensed killing of fish-eating birds until and unless proof of serious damage has been established and killing proven to be the most effective means for preventing significant loss to fish stocks. However, we are committed to working positively with owners and anglers to establish the full facts in each situation.

### *Issue 57: The effect of fish-eating birds on salmonid and coarse fish populations.*

## TARGETS AND STATE OF THE CATCHMENT

The presence of non-native coarse fish species (particularly chub) in the catchment suggests that illegal releases of fish have taken place. If these stocks become established the river's natural fish population may be adversely effected due to the risk of disease transfer and competition for food and habitat with the non-native species.

*Issue 58: Illegal releases of non-native fish species.*

## TARGETS AND STATE OF THE CATCHMENT

### 6.4 FLOOD DEFENCE AND LAND DRAINAGE

Targets for flood defence may be prescribed (e.g. the time allowed to determine a flood defence consent), indicative (e.g. relating to the level of flood protection appropriate to a particular land use), or business (e.g. a commitment which the NRA has imposed upon itself to improve efficiency or cost effectiveness).

Serious floods occur less often than minor floods. The term 'return period' describes how often on average a flood might occur. For example, a 10 year return period flood might be equalled or exceeded once every 10 years on average or a more serious flood once every 100 years on average.

The standard of flood protection at a location is the worst flood (expressed as a return period) which can be withstood without significant flooding. Flood defence schemes only alleviate flooding up to the design standard, a more serious flood may still occur.

We manage flood defence by setting target standards, measuring existing standards, and addressing the difference.

#### *Target*

To ensure that coastal defences take full account of coastal processes.

#### *State*

The NRA is a member of the Lyme Bay and South Devon Coastline Group, which includes other coastal defence authorities. This group will oversee the production of the Shoreline Management Plan for the South Devon Coastline. The scoping study for this plan started in June 1995 for completion in October 1995. The plans will be prepared during 1996 and 1997.

*Issue 59: Proposals for coastal defence works need to be considered within an overall and integrated strategy.*

#### **Regulation**

##### *Target*

To provide planning authorities with sufficient information to ensure that the effects of development on flood risk are properly considered in accordance with the Department of Environment Circular 30/92 (Ref. 46).

##### *State of the Catchment*

Information is currently provided on the basis of historic flood records and survey data. We have agreed with planning authorities how we can improve this information. We have planned to provide floodplain mapping information (S105 Surveys) for the River Exe Catchment by April 1996.

*Issue 60: Need to identify flood risk for planning authorities.*

#### **Maintenance**

We maintain rivers and flood defence structures to minimize the risk of flooding (see Map 30). We try to focus our work where it is needed most. We work out how best to concentrate our efforts using a method called Standards of Service (SoS). We have only just started to use this technique and are collecting the information we need to make it work.

# Map 30 - State of the Catchment, Flood Defence



## TARGETS AND STATE OF THE CATCHMENT

### *Target*

To apply a consistent approach to flood defence maintenance, with work targeted at areas of greatest need.

### *State of the Catchment*

The NRA Sea Defence Survey has been completed and the SoS methodology will be introduced during 1995 and 1996. An asset survey will be carried out during 1995 and 1996. Our conservation duties apply to flood defence work.

*Issue 61: Continue to improve the efficiency and effectiveness of our flood defence work.*

### *Target*

To manage water levels properly for farming, flood defence and wildlife particularly in special sites.

### *State of the Catchment*

There is one area within the catchment where EN have identified the need for a Water Level Management Plan, in accordance with MAFF guidelines (see Issue 37).

### *Target*

To maintain channel capacity at fifteen locations.

### *State of the Catchment*

Debris and silt collects at these locations, requiring regular maintenance and special attention is required during periods of high flow, to avoid blockage (see Table 4 in Section 5.4).

### **Improvements**

We can build new flood defences if flooding is a serious problem in a particular area. Nowadays we usually only build new defences to protect built up areas from flooding. All schemes must be technically, economically and environmentally sound. We keep a list of schemes called a Programme of Capital Works which helps us to plan for the future.

Different types of land and property need different levels of protection. We use the indicative standards (return period in years) detailed in Table 23 to design schemes.

## TARGETS AND STATE OF THE CATCHMENT

**Table 23: Indicative Flood Defence Standards for Different Land Use**

Current Land Use	Land Use Band	Target Standard of Protection (Return Period)	
		Sea (Years)	River (Years)
High density urban, containing significant residential and non-residential property	A	100 to 200	50 to 100
Medium density urban	B	50 to 200	25 to 100
Isolated or rural communities. Highly productive agricultural land	C	10 to 100	5 to 50
Generally arable farming with isolated properties	D	2½ to 20	1¼ to 10
Extensive grassland with few properties at risk	E	less than 5	< 2½

NB: Indicative standards are only a guide: they may not always be appropriate.

### *Target*

To identify and investigate all flood risk locations.

### *State of the Catchment*

There is currently a risk of flooding at Topsham, Bampton and Woodbury Salterton. These locations are included in the current programme of Capital Works for 1998 to 2000. We are also investigating the need for works at Exebridge and at Bickleigh.

*Issue 62: Risk of flooding at Topsham, Bampton, Woodbury Salterton, Exebridge, Bickleigh and Powderham.*

### **Emergency Response**

Absolute flood protection is not possible. Because of this we need to warn people when there is a danger of flooding. We have a strategy which details how these procedures operate and which we use to improve our emergency response.

### *Target*

Where possible, to issue a warning at least two hours in advance of flooding.



## TARGETS AND STATE OF THE CATCHMENT

### *State of the Catchment*

Flood Warnings are issued for the following rivers in the River Exe Catchment:

Barle for Withypool, Newbridge  
Bathern for Bampton  
Clyst for Broadclyst, Clyst Honiton, Clyst St Mary  
Creedy for Crediton, Yeoford, Fordton  
Upper Culm for Hemyock, Culmstock, Uffculme, Coldharbour, Cullompton  
Lower Culm, for Hele, Silverton Mill, Stoke Canon  
Upper Exe for Exford, Winsford, Bridgetown, Exeter Inn, Exebridge  
Middle Exe for Oakfordbridge  
Lower Exe for Bickleigh, Upexe, Netherexe  
Lowman for Craze Lowman, Tiverton.

In some locations the target is not being achieved. The most common reasons are an insufficient response time provided by the upstream river level sensor, a breakdown in or omission from the cascade system, or no instrumentation.

*Issue 63: Need to improve flood warning at some locations.*

### *Target*

Prepare and keep up-to-date a plan for responding to flooding and damaged flood defence structures.

### *State of the Catchment*

This plan ensures flood defence schemes perform as designed and any other problems arising on the 'main river' system are dealt with. We respond according to those criteria planned (see Appendix 10) and carry out the tasks prescribed under Response Levels A and B (see Appendix 11). There are currently no problems in operating this plan.

## 7. SUMMARY OF CATCHMENT ISSUES AND ACTIONS

Issue	Options/ Actions	Benefits	Constraints	Action By	
				Lead	Other
1. Failure to meet proposed WQO target RE2 in upper Alphin Brook	<ul style="list-style-type: none"> <li>Follow up previous catchment inspection to ensure improvements to treatment facilities and drainage arrangements sustained.</li> <li>Enforce pollution control legislation where appropriate.</li> </ul>	Achieve RQO Environmental improvement	Cost. Potential costs to polluters.	NRA	Landowners and Dischargers
2. Failure to meet proposed WQO target RE2 (1995) in upper River Weaver.	<ul style="list-style-type: none"> <li>Follow up previous catchment inspection to ensure improvements to treatment facilities and drainage arrangements sustained.</li> <li>Enforce pollution control legislation where appropriate.</li> </ul>	Achieve RQO Environmental improvement	Cost. Potential costs to polluters.	NRA	Landowners and Dischargers
3. Marginal failure of proposed WQO target RE2 (1999) in Grindle Brook.	<ul style="list-style-type: none"> <li>Follow up previous catchment inspection to ensure improvements to treatment facilities and drainage arrangements sustained.</li> <li>Enforce pollution control legislation where appropriate.</li> </ul>	Achieve RQO Environmental improvement	Cost. Potential costs to polluters.	NRA	Landowners and Dischargers
4. Marginal failure of proposed WQO target RE2 (1995) in Holly Water.	<ul style="list-style-type: none"> <li>Investigate further causes of poor water quality if river water quality fails to improve.</li> <li>Secure improvements where necessary.</li> </ul>	Achieve RQO Environmental improvement	Cost. Potential costs to polluters.	NRA	Landowners and Dischargers
5. Marginal failure of proposed WQO target RE2 (1999) in the upper Spratford Stream.	<ul style="list-style-type: none"> <li>Investigate causes of poor water quality.</li> <li>Secure improvements where necessary.</li> </ul>	Achieve RQO Environmental improvement	Cost. Potential costs to polluters.	NRA	Landowners and Dischargers
6. Bacteriological pollution from combined sewer overflows discharging into the Dawlish Water.	<ul style="list-style-type: none"> <li>Investigate to identify point source inputs to Dawlish Water.</li> <li>Seek appropriate improvements.</li> </ul>	Meet EC Bathing Waters Directive	Potential cost.	NRA	

Issue	Options/ Actions	Benefits	Constraints	Action By	
				Lead	Other
7. High copper concentrations in River Barle downstream of Dulverton STW.	<ul style="list-style-type: none"> <li>Continue to monitor as required under the Directive and investigate any further failures.</li> </ul>	Meet EC Freshwater Fish Directive		NRA	
8. Algal blooms result in poor water quality in both the Exeter and Grand Western Canal.	<ul style="list-style-type: none"> <li>Seek to influence the management of the canals to improve the environment to address works quality, water quality, recreation and fishery concerns.</li> </ul>	Environmental improvement	Resources	NRA	DCC, MDDC, ECC, Canal Ranger Grand Western Canal Advisory Committee
9. Eutrophication in the River Creedy.	<ul style="list-style-type: none"> <li>Install phosphorus removal at Crediton STW by 31/12/98.</li> <li>Continue monitoring.</li> </ul>	Environmental improvement. Meet EC UWWTD.	Cost to SWWSL	SWWSL NRA	
10. Comprehensive studies required to demonstrate the High Natural Dispersion Area off Exmouth and Dawlish.	<ul style="list-style-type: none"> <li>SWWSL to provide evidence through comprehensive studies.</li> <li>NRA to audit study and determine status.</li> </ul>	Improved information.	Cost	SWWSL NRA	
11. High polyaromatic hydrocarbon concentrations in the River Exe at Pyne's Intake.	<ul style="list-style-type: none"> <li>Investigate cause.</li> <li>Carry out risk assessments at industrial sites upstream of intake.</li> </ul>	Meet SWA Directive	Control	NRA NRA & SWWSL	
12. Moderate or poor aquatic macroinvertebrate quality in Northbrook, River Kenn, River Clyst and Spratford Stream.	<ul style="list-style-type: none"> <li>Confirm significance of failures.</li> <li>Secure improvements where appropriate.</li> </ul>	Environmental improvement.	Cost	NRA	

Issue	Options/ Actions	Benefits	Constraints	Action By	
				Lead	Other
13. Concern over water quality adequate to protect water contact sports in the mouth of the Exe Estuary.	<ul style="list-style-type: none"> <li>Issue under review.</li> </ul>	Safe use.	Lack of legislation. No enforceable standards.	NRA	
14. Pollution of groundwater around Higher Kiln Waste Disposal Site.	<ul style="list-style-type: none"> <li>Low flow study of River Bathern.</li> <li>Develop a Management Plan with the owners for Higher Kiln Waste Disposal Site.</li> <li>Continue groundwater monitoring.</li> </ul>	Environmental impact.	Cost	NRA	Higher Kiln Owners
15. High nitrate concentrations in groundwater.	<ul style="list-style-type: none"> <li>Review NVZ designations on 4 year period.</li> <li>Provide advice to DoE and MAFF on sources of using criteria specified by DoE &amp; MAFF.</li> </ul>	Improved information.	Cost	DoE/ MAFF NRA	NRA, MAFF, DoE
16. Need to reassess sites based on improved low flow identification techniques.	<ul style="list-style-type: none"> <li>Continue groundwater monitoring.</li> <li>Produce a revised list of low flow sites.</li> </ul>	Better planning.		NRA	
17. Low flows in the River Barle.	<ul style="list-style-type: none"> <li>Carry out juvenile salmonid fish surveys under low flow conditions to assess effects.</li> <li>Continue impact studies.</li> <li>Review situation after weir improvements.</li> </ul>	Improved information.	Cost	NRA	
18. Reported falling groundwater levels at Dawlish Warren.	<ul style="list-style-type: none"> <li>Continue to contribute to Dunes Project.</li> </ul>	Improved information.		EN	NRA, DCC, Plymouth University
19. Need for a gauging station to monitor flows of the River Exe in Exeter at Trews Weir.	<ul style="list-style-type: none"> <li>Design and construct a gauging station at Trews Weir.</li> </ul>	Flow assessment for water resources and flood warning.	Cost	NRA	

Issue	Options/ Actions	Benefits	Constraints	Action By	
				Lead	Other
20. Forecast deficit in supply in Wimbleball Supply Zone.	<ul style="list-style-type: none"> <li>● Encourage metering in all new developments.</li> <li>● Encourage selective metering as an alternative to new resources.</li> <li>● Promote the efficient use of water for agricultural purposes.</li> <li>● Encourage and publicise efficient water use and recycling.</li> <li>● Encourage leakage reduction to a general target of 200l/property/day and set local leakage targets.</li> <li>● Encourage water companies to make best use of water resources.</li> <li>● Develop Wimbleball Pumped Storage Scheme as licensed in consultation with planning authorities.</li> </ul>	Meet deficit in a sustainable manner.	Cost environmental constraints. Co-operation of the water company.	NRA	SWWSL Water Users
21. Perceived over-exploitation of the Duckaller/Vennbridge aquifer.	<ul style="list-style-type: none"> <li>● Review existing data.</li> <li>● Promote changes to mitigation arrangements or licence conditions.</li> </ul>	Meet water supply demand in a sustainable manner.		NRA	
22. Review of Coleford and Knowle abstraction licence conditions.	<ul style="list-style-type: none"> <li>● Review existing data.</li> <li>● Promote changes to mitigation arrangements or licence conditions.</li> </ul>	Meet water supply demand in a sustainable manner.		NRA	
23. Need to balance recreation and conservation uses of coastal and river sites.	<ul style="list-style-type: none"> <li>● Develop and implement agreed recommendations of the Exe Estuary Management Plan.</li> <li>● Seek opportunities for green tourism initiatives which will improve recreation opportunities without significant impact on conservation.</li> <li>● Need for improved visitor management at Tarr Steps.</li> </ul>	Improved management of estuary. Improved recreation and conservation.		Estuary Manager Exe Estuary Officers Working Group Exmoor National Park	NRA Users

Issue	Options/ Actions	Benefits	Constraints	Action By	
				Lead	Other
24. Need to accommodate recreation uses of the estuary.	<ul style="list-style-type: none"> <li>Develop and implement agreed recommendations of the Exe Estuary Management Plan. (see Issue 23).</li> </ul>	Improved management of estuary.		Estuary Manager Exe Estuary Officers Working Group	NRA, Users
25. Need for revision of recreation management of Exwick Flood Relief Channel.	<ul style="list-style-type: none"> <li>Draw up management plan for recreation (and conservation) by end 1996, taking into account operational and other requirements of the site.</li> </ul>	Improved recreation and conservation.	Flood alleviation requirements	NRA	Users
26. Need for improved access to and from NRA owned land at Countess Wear.	<ul style="list-style-type: none"> <li>Investigate possibility of incorporating new crossing point in existing structures.</li> </ul>	Improved access.	Flood alleviation requirements	NRA	Users
27. Need for amenity improvements to Tiverton Flood Alleviation Scheme.	<ul style="list-style-type: none"> <li>Review possibilities with other agencies, Mid Devon District Council (MDDC), for carrying out enhancements to scheme.</li> <li>Develop and implement solution to dog fouling problem with co-operation of other interested parties.</li> </ul>	Amenity improvements.	Flood alleviation requirements	NRA	BCU, REROA, Landowners
28. Limited access agreements for summer canoeing.	<ul style="list-style-type: none"> <li>Encourage discussions between interested parties (BCU, REROA and landowners) to investigate possibilities for extending access agreements.</li> </ul>	Improved recreation.	Environmental protection access	NRA	BCU, REROA, Landowners
29. Poor physical access to river for canoeing, particularly for less able canoeists.	<ul style="list-style-type: none"> <li>Encourage discussions between interested parties to investigate the possibilities for improving physical access to the river.</li> </ul>	Improved recreation.	Environmental protection access	NRA	BCU, DCC, LAs
30. Lack of readily available information on canoeing conditions.	<ul style="list-style-type: none"> <li>Investigate possibility of setting up with others telephone information lines with others.</li> </ul>	Improved recreation.	Environmental protection access	NRA	BCU, DCC, LAs

Issue	Options/ Actions	Benefits	Constraints	Action By	
				Lead	Other
31. Impact on landscape of inappropriate development.	<ul style="list-style-type: none"> <li>Seek to influence developers and decision makers to avoid proposals likely to have an adverse impact on the landscape on those planning applications submitted to the NRA.</li> </ul>	Landscape protection.	Non-statutory consultee.	NRA	Developers, Planning Authorities
32. Litter in River Exe Corridor.	<ul style="list-style-type: none"> <li>Investigate volunteer litter removal.</li> </ul>	Aesthetic improvement.	No lead body.		Volunteer Groups, LAs, NRA, REROA
33. Absence of general assessment of archaeological/historic value of whole catchment.	<ul style="list-style-type: none"> <li>Support production of document(s) covering entire area; investigate potential for collaboration.</li> </ul>	Archaeological protection.	Cost	NRA	EH, DCC, DAS
34. Need for improved archaeological input to NRA routine conservation screening activities.	<ul style="list-style-type: none"> <li>Consider possibility of input from external consultees.</li> <li>Set up pilot project to assess feasibility.</li> </ul>	Archaeological protection.	Cost. Time restraints.	NRA	DCC
35. Need for clear biodiversity targets for conservation of the water environment.	<ul style="list-style-type: none"> <li>Continue input to Rivers and Wetlands Project and Devon Nature Conservation Strategy (Ref. 5).</li> </ul>	Environmental protection and monitoring.	Cost	DWT	NRA, EN, DCC, SWWSL, WERG
36. Need for implementation of estuary management plan.	<ul style="list-style-type: none"> <li>Continue to work with other agencies and organisations to develop an agreed plan.</li> </ul>	Integrated management.	Cost	Estuary Manager	Exe Estuary Officers Working Group

Issue	Options/ Actions	Benefits	Constraints	Action By	
				Lead	Other
37. Need for better understanding of significance of the conservation importance of the whole catchment.	<ul style="list-style-type: none"> <li>Continue to support production and updating of wildlife inventories.</li> <li>Monitor CWS sites.</li> <li>Clarify status of rivers within CWS selection guidelines.</li> <li>Press for incentive schemes for landowners to enable restoration and retention of floodplains as features of conservation value.</li> </ul>	Improved information.	Cost	DWT	NRA, Planning Authorities
38. Loss and decline in value of semi-natural habitats.	<ul style="list-style-type: none"> <li>Promotion of schemes that support good management of high value habitat e.g. ESA, Countryside Stewardship, MAFF agri-environment package.</li> <li>Encourage better targeting of schemes, so that they are appropriate to local habitats.</li> <li>Push for continuation of Countryside Stewardship after 1996, with local relevance to Devon and extension of waterside fringe scheme.</li> <li>Identify with others specific priority sites in need of enhancement.</li> </ul>	Environmental improvements.	Cost	NRA	CoCo, MAFF
39. Need for retention/restoration of conservation value of floodplain wetlands.	<ul style="list-style-type: none"> <li>Development of formal Water Level Management Plan for Exe Estuary by 1996, building on success of Exminster Marshes project.</li> <li>Continue to collaborate on studies relating to water levels at Dawlish Warren.</li> <li>Investigate modification of management of NRA's land holdings to maximize value while fulfilling other requirements.</li> <li>Produce management plans for two wetland sites in upper estuary owned by NRA and forming part of the SPA by 1997.</li> </ul>	Environmental enhancement.	Cost Flood Protection	NRA, EN EN NRA NRA	RSPB NRA, DCC, NDDC, IDB RSPB, EN



Issue	Options/ Actions	Benefits	Constraints	Action By	
				Lead	Other
40. Otter population below optimum level.	<ul style="list-style-type: none"> <li>● Implement improved monitoring strategy by 1997.</li> <li>● Support habitat management or restoration principally for the benefit of otters.</li> <li>● Continue to support programme of post-mortem examination and tissue analysis.</li> </ul>	Increase in otter populations.	Cost	NRA DWT	Volunteers
41. Decline of water vole population.	<ul style="list-style-type: none"> <li>● Investigate possibility of survey of likely habitat.</li> <li>● Raise awareness of field staff and encourage reports of presence. Work with interested parties such as fishermen, to encourage reports of presence.</li> </ul>	Improved information		NRA	River users
42. Lack of current information on sand martin distribution.	<ul style="list-style-type: none"> <li>● Raise awareness of field staff and encourage reports of presence. Work with interested parties, such as fishermen, to encourage reports of sand martins.</li> <li>● Survey for potential breeding habitat for sand martins.</li> </ul>	Improved information.		NRA	River users
43. Need for improved information on species of lampreys and shads.	<ul style="list-style-type: none"> <li>● Maintain records arising from existing survey programme.</li> </ul>	Improved information.		NRA	
44. Need for protection of native crayfish.	<ul style="list-style-type: none"> <li>● Maintain records arising from biological or fisheries surveys.</li> <li>● Implement no-go area proposals for introduced species.</li> <li>● Consider need for more extensive surveys to assess distribution and abundance of the River Creedy crayfish population.</li> <li>● Look at Water Quality required for native crayfish.</li> </ul>	Improved information. Environmental protection.		NRA	

Issue	Options/ Actions	Benefits	Constraints	Action By	
				Lead	Other
45. Lack of full understanding of distribution of rare plant species in Exeter Canal. (see Issue 8).	<ul style="list-style-type: none"> <li>Encourage production of survey and mapping of canal flora.</li> </ul>	Improved information.		NRA	ECC
46. Spread of invasive plant species.	<ul style="list-style-type: none"> <li>Continue programme of surveys.</li> <li>Consider need for control programmes.</li> </ul>	Improved information.	Cost	NRA	Riparian Owners
47. Impeded fish migration on the Rivers Exe and Creedy.	<ul style="list-style-type: none"> <li>Improve conditions for upstream migration of salmonids at Perry Weir on the River Barle and Oakfordbridge Weir on the River Exe, and Fordton Weir and Exwick Weir on the River Creedy.</li> </ul>	Increased salmonid spawning areas.	Cost	NRA, SWWSL	Fishing interests
48. Obstructions to fish passage on the River Culm.	<ul style="list-style-type: none"> <li>Conduct obstruction survey.</li> <li>Identify priority sites for improvements.</li> <li>Consider native crayfish when planning works.</li> </ul>	Increased salmonid spawning areas.	Cost	NRA	Fishing interests
49. Smolt entrapment.	<ul style="list-style-type: none"> <li>Encourage the installation and correct operation of effective smolt screens at known problem sites. (Recent legislation requiring compulsory screen installation being interpreted).</li> </ul>	Reduced smolt mortalities.	Costs. Current legislation.	NRA	Landowners
50. Decline in runs of spring fish.	<ul style="list-style-type: none"> <li>Promote conservation measures, e.g. bag limits for anglers and agreed restrictions on netting.</li> <li>Carry out investigations into distribution, spawning activity and behaviour of spring fish in the river to give us better information about their protection and enhancement.</li> </ul>	Improved spring runs.	Costs. Current Legislation.	NRA	Fishermen
51. Poor migratory fish runs in Culm, Creedy and Clyst.	<ul style="list-style-type: none"> <li>See Issue 46</li> <li>Seek improvements in water quality.</li> </ul>	Improved salmonid fishery.	Cost	NRA	

Issue	Options/ Actions	Benefits	Constraints	Action By	
				Lead	Other
52. Escapement of Rainbow Trout.	<ul style="list-style-type: none"> <li>Remove fish on a routine basis using electric fishing methods and seek to recharge costs.</li> <li>Ensure proper screening at fish farms (see Issue 47).</li> </ul>	Protect natural population.	Costs. Current Legislation	NRA	Landowners
53. Perceived decline of brown trout populations.	<ul style="list-style-type: none"> <li>Monitor stocks through routine survey programme.</li> <li>Review existing data and advise on appropriateness of restocking.</li> </ul>	Improved knowledge of fishery. Problem areas identified.	Costs	NRA	
54. Fish mortality risk in the Grand Western Canal (Tiverton) (see Issue 8).	<ul style="list-style-type: none"> <li>Ensure that a regular weed cutting and dredging programme is adopted on the Grand Western Canal.</li> <li>Investigate the flow regions.</li> </ul>	Reduced fish mortalities.	Costs	Grand Western Canal Advisory Committee, Canal Ranger, DCC	NRA
55. Capture of migratory fish in drift nets.	<ul style="list-style-type: none"> <li>Monitor drift net fishery closely.</li> </ul>	Reduced illegal exploitation.	Costs	NRA, ECC	
56. Perceived decline in the quality of fishing on the Exeter Canal.	<ul style="list-style-type: none"> <li>Introduce a regular programme of surveys to identify the problem.</li> <li>Assist in the management of the fishery where appropriate.</li> </ul>	Improved fisheries.	Costs	NRA, ECC	
57. The effect of fish-eating birds on salmonid and coarse fish populations.	<ul style="list-style-type: none"> <li>Co-operate with the licensing authority to progress further research into this issue.</li> <li>Continue to work positively with owners and anglers to establish the full facts in each situation.</li> </ul>	Increased knowledge and awareness.	Lack of knowledge. Protected species.	NRA	MAFF, Landowners, Fishermen

Issue	Options/ Actions	Benefits	Constraints	Action By	
				Lead	Other
58. Illegal releases of non-native fish species.	<ul style="list-style-type: none"> <li>● Refuse stocking of non-native fish species.</li> <li>● Enforce the relevant legislation (Section 30 Salmon and Freshwater Fisheries Act).</li> </ul>	Maintain natural fish populations.		NRA	Fishermen
59. Proposals for coastal defence works need to be considered within an overall and integrated strategy.	<ul style="list-style-type: none"> <li>● Preparation of a Shoreline Management Plan for the Lyme Bay and South Devon coastline.</li> </ul>	Improved management.	Cost	NRA	WDDC, EDDC, SHDC, WPBC, TBC, PCC, DCC, DoCC
60. Need to identify flood risk for planning authorities.	<ul style="list-style-type: none"> <li>● Provide information by April 1996 to prevent inappropriate development in the floodplain.</li> </ul>	Floodplain protection.	Cost	NRA	Planning authorities
61. Continue to improve the efficiency and effectiveness of our flood defence work.	<p>Implement the flood defence management system by:</p> <ul style="list-style-type: none"> <li>● Carrying out asset survey.</li> <li>● Comparing actual against target SoS and address the differences.</li> </ul>	Flood protection and environmental improvement.	Cost	NRA	
62. Risk of Flooding at Topsham, Bampton, Woodbury Salterton, Exebridge and Bickleigh, Powderham.	<ul style="list-style-type: none"> <li>● Carry out feasibility study at Topsham, Bampton and Woodbury Salterton.</li> <li>● Examine flood protection at Exebridge, Bickleigh and Powderham.</li> </ul>	Flood protection.	Cost	NRA	MAFF
63. Need to improve flood warning at some locations.	<ul style="list-style-type: none"> <li>● Complete the review of flood warning study.</li> </ul>	Improved warning.	Cost	NRA	Emergency Services



## APPENDICES

### APPENDIX 1: Historic Parks and Gardens designated under Historic Buildings and Ancient Monuments Act 1953

A La Ronde and The Point In View  
Bridwell  
Killerton  
Knightshayes Court  
Luscombe  
Mamhead  
Oxton House  
Powderham Castle  
Rockbeare House  
Shobrooke Park

### APPENDIX 2: Sites of Special Scientific Interest

Bonhay Road Cutting  
Posbury Clump  
Southey and Gotleigh Moors  
Ashculm Turbary  
Blackdown and Sampford Common  
Stouts Cottage  
Lower Whipcott  
Kersdown Quarry  
Five Oaks, Bampton  
Bickleigh Wood  
Barle Valley  
Exe Estuary  
South Exmoor  
North Exmoor  
Killerton  
Brampford Speke  
Tidcombe Lane Fen  
Stoke Woods  
Haldon Forest  
Haldon Heaths  
East Devon Pebblebed Commons  
River Barle (proposed)  
Dawlish Warren  
Maiden Down  
Dawlish Cliffs  
Rungdown  
Great Haldon Heaths

## APPENDICES

### APPENDIX 3: Nature Reserves in the River Exe Catchment

Name	NGR	Status	Tenure/Owner
Ashculm Turbay, Hemyock	ST 147 157	SSSI	DWT
Bowling Green Marsh	SX 968 881	SSSI/SPA/RAMSAR	RSPB
Barley Valley	SX 901 924	LNR	Exeter City Council
Brimley Hill Mire	ST 175 141	ST 175 141	SWT
Dawlish Warren	SX 985 794	SSSI/LNR	DWT/Teignbridge DC
Exminster Marshes	SX 954 872	SSSI/SPA/RAMSAR	RSPB managed
Exe Reed Beds	SX 957 885	SSSI/SPA/RAMSAR	DWT
Exmouth (to Lypstone)	SX 995 830	SSSI/SPA/RAMSAR /LNR	Subject to negotiation
Fordy Park Wood	SS 818 058		Woodland Trust
Grand Western Canal	SS 980 123	Country Park	DCC
Hurscombe	SS 194 317		SWT
Lark Copse	SX 925 945		DWT
Little Breach	ST 115 154		Butterfly Conservation
Liverton Copse	SX 025 823		Woodland Trust
Lickham Common	ST 127 123		DWT
The Maer	SY 016 802	LNR	EDDC
Meadow Park Woodland	ST 034 106		Woodland Trust
Mounsey	St 194 130		SWT
Munty	ST 194 130		SWT
Northdown Wood	SS 923 062		Woodland Trust
Old Sludge Beds	SX 952 888	SSSI/SPA/RAMSAR	DWT
Percy Wakley Wood, Sheldon	SY 034 953		Woodland Trust

APPENDICES

APPENDIX 4: 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-ionized Ammonia mgN/l 95%ile	pH 5%ile & 95%ile	Hardness mg/l CaCO <sub>3</sub>	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	30 200 500 500	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	30 200 500 500	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	500 700 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	500 700 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



## APPENDICES

### APPENDIX 5: EC Directive Concerning the Quality of Bathing Waters (76/160/EEC)

#### Microbiological Standards

Parameter	Units	Value (1)		Status	
		I	G	I	G
Total coliforms	no/100ml	10,000	500	95 % of samples	80 % of samples
Faecal coliforms	no/100ml	2,000	100	95 % of samples	80 % of samples
Faecal streptococci	no/100ml	-	100	-	80 % of samples
Salmonella	no/l	0	-	95 % of samples	-
Enterovirus	PFU/10l	0	-	95 % of samples	-

PFU = Plaque Forming Units

Notes :

- (1) I = Imperative or Mandatory standard.  
G = Guideline standard.
- (2) There is currently no imperative standard for faecal streptococci, however, it has been proposed that the Directive should be revised and should include an imperative standard for faecal streptococci of 400/100ml.

#### Aesthetic Criteria

Parameter	Analysis Method	Description/Standard
Colour	Visual inspection	No discernible change
Mineral oils	Visual inspection	No visible surface film
	Olfactory inspection	No odour
	mg/l after extraction and weighing dried residue	≤ 0.5
Surface-active substances (methylene-blue active)	Visual inspection	No lasting foam
	mg/l as lauryl sulphate	≤ 0.5
Phenols	Olfactory inspection	No specific odour
	mg/l	≤ 0.05
Transparency	m	1
Tarry residues, solid floating material, effluent sticks	Visual inspection	Absent

## APPENDIX 6: EC Dangerous Substances Directive (76/464/EC) - EQSs for List I Substances

## EQSs FOR LIST I SUBSTANCES (INLAND WATERS)

Parameter	Units	Value	Status (1)
Mercury	$\mu\text{g Hg/l}$	1.0	AA,T
Cadmium (2)	$\mu\text{g Cd/l}$	5.0 1.0	AA,T AA,T,B (4)
Hexachlorocyclohexane (HCH) (2)	$\mu\text{g/l}$	0.1 0.05	AA,T AA,T,B (4)
Tetrachloromethane (CTC)	$\mu\text{g/l}$	12	AA,T
DDT (para-para DDT isomer) (2)	$\mu\text{g/l}$	0.01	AA,T
Total DDT (2)	$\mu\text{g/l}$	0.025	AA,T
Pentachlorophenol (PCP) (2)	$\mu\text{g/l}$	2	AA,T
'The Drins' (from 1 Jan 1989)	$\mu\text{g/l}$	0.03 (3)	AA,T
Aldrin (from 1 Jan 1994)	$\mu\text{g/l}$	0.01	AA,T
Dieldrin (from 1 Jan 1994)	$\mu\text{g/l}$	0.01	AA,T
Endrin (from 1 Jan 1994)	$\mu\text{g/l}$	0.005	AA,T
Isodrin (from 1 Jan 1994)	$\mu\text{g/l}$	0.005	AA,T
Hexachlorobenzene (HCB) (2)	$\mu\text{g/l}$	0.03	AA,T
Hexachlorobutadiene (HCBd) (2)	$\mu\text{g/l}$	0.1	AA,T
Chloroform	$\mu\text{g/l}$	12	AA,T
1,2-dichloroethane	$\mu\text{g/l}$	10	AA,T
Trichloroethylene	$\mu\text{g/l}$	10	AA,T
Perchloroethylene	$\mu\text{g/l}$	10	AA,T
Trichlorobenzene(TCB)	$\mu\text{g/l}$	0.4	AA,T

## APPENDICES

### EQSs FOR LIST I SUBSTANCES (TIDAL WATERS)

Parameter	Units	Value	Status (1)
Mercury (2)	µg Hg/l	0.3	AA,D
Cadmium (2)	µg Cd/l	2.5	AA,D
Hexachlorocyclohexane (HCH) (2)	µg/l	0.02	AA,T
Tetrachloromethane (CTC)	µg/l	12	AA
DDT (para-para DDT isomer) (2)	µg/l	0.01	AA
Total DDT (2)	µg/l	0.025	AA
Pentachlorophenol (PCP) (2)	µg/l	2	AA
'The Drins' (from 1 Jan 1989)	µg/l	0.03 (3)	AA,T
Aldrin (from 1 Jan 1994)	µg/l	0.01	AA
Dieldrin (from 1 Jan 1994)	µg/l	0.01	AA
Endrin (from 1 Jan 1994)	µg/l	0.005	AA
Isodrin (from 1 Jan 1994)	µg/l	0.005	AA
Hexachlorobenzene (HCB) (2)	µg/l	0.03	AA
Hexachlorobutadiene (HCBd) (2)	µg/l	0.1	AA
Chloroform	µg/l	12	AA
1,2-dichloroethane	µg/l	10	AA
Trichloroethylene	µg/l	10	AA
Perchloroethylene	µg/l	10	AA
Trichlorobenzene(TCB)	µg/l	0.4	AA

Proposals have been published for the following List I substances but these have not, so far, been adopted:

Trifluralin, endosulphan, simazine, triorganotin compounds (tributyltin oxide, triphenyltin acetate, triphenyltin oxide, triphenyltin hydroxide), atrazine, organophosphorus substances (azinphos-methyl, azinphos-ethyl, fenitrothion, fenthion, malathion, parathion and parathion-methyl, dichlorvos).

- Notes: (1) AA = Annual Average, T = Total, B = Background Monitoring  
 (2) A 'standstill' provision exists for concentrations in sediments and/or shellfish and/or fish  
 (3) Maximum of 0.005 for Endrin  
 (4) B = Background Monitoring: only applies at designated end of catchment sites

## APPENDIX 7: Dangerous Substances Directive (76/464/EC) - EQSs for List II Substances

## EQSs FOR LIST II SUBSTANCES (INLAND WATERS) (1)

Parameter	Units	Value (3)		Hardness (mg CaCO <sub>3</sub> /l)	Status (2)
		A Std	B Std		
Lead	µg Pb/l	4 10 10 20 20 20	50 12 5 12 5 25 0 25 0 25 0	0 to 50 50 to 100 100 to 150 150 to 200 200 to 250 > 250	AA,D
Chromium	µg Cr/l	5 10 20 20 50 50	15 0 17 5 20 0 20 0 25 0 25 0	0 to 50 50 to 100 100 to 150 150 to 200 200 to 250 > 250	AA,D
Zinc	µg Zn/l	8 50 75 75 75 12 5	75 17 5 25 0 25 0 25 0 50 0	0 to 50 50 to 100 100 to 150 150 to 200 200 to 250 > 250	AA,T
Copper	µg Cu/l	1 6 10 10 10 28	1 6 10 10 10 28	0 to 50 50 to 100 100 to 150 150 to 200 200 to 250 > 250	AA,D

APPENDICES

Parameter	Units	Value (3)		Hardness (mg CaCO <sub>3</sub> /l)	Status (2)
		A St d	B St d		
Nickel	µg Ni/l	50 10 0 15 0 15 0 20 0 20 0	50 10 0 15 0 15 0 20 0 20 0	0 to 50 50 to 100 100 to 150 150 to 200 200 to 250 > 250	AA,D
Arsenic	µg As/l	50		All	AA,D
Boron	µg B/l	2000		All	AA,T
Iron	µg Fe/l	1000		All	AA,D
pH	pH values	6 to 9		All	95% of samples
Vanadium	µg V/l	20 60	20 60	0 to 200 200+	AA,T
Tributyltin	µg/l	0.02		All	M,T
Triphenyltin	µg/l	0.02		All	M,T
Polychlorochlormethyl- sulphonamidodiphenyl ether (PCSDs)	µg/l	0.05		All	T, 95% of samples
Sulcofuron	µg/l	25		All	T, 95% of samples
Flucofuron	µg/l	1.0		All	T, 95% of samples
Permethrin	µg/l	0.01		All	T, 95% of samples
Cyfluthrin	µg/l	0.001		All	T, 95% of samples

## EQSs FOR LIST II SUBSTANCES (TIDAL WATERS)

Parameter	Units	Value (1)	Status
Lead	$\mu\text{g Pb/l}$	25	AA,D
Chromium	$\mu\text{g Cr/l}$	15	AA,D
Zinc	$\mu\text{g Zn/l}$	40	AA,D
Copper	$\mu\text{g Cu/l}$	5	AA,D
Nickel	$\mu\text{g Ni/l}$	30	AA,D
Arsenic	$\mu\text{g As/l}$	25	AA,D
Boron	$\mu\text{g B/l}$	7000	AA,D
Iron	$\mu\text{g Fe/l}$	1000	AA,D
pH	pH values	6 to 8.5 (3)	95% of samples
Vanadium	$\mu\text{g V/l}$	100	AA,T
Tributyltin	$\mu\text{g/l}$	0.002	M,T
Triphenyltin	$\mu\text{g/l}$	0.008	M,T
Polychlorochlormethyl-sulphonamidodiphenyl ether (PCSDs)	$\mu\text{g/l}$	0.05	T, 95% of samples
Sulcofuron	$\mu\text{g/l}$	25	T, 95% of samples
Flucofuron	$\mu\text{g/l}$	1.0	T, 95% of samples
Permethrin	$\mu\text{g/l}$	0.01	T, 95% of samples
Cyfluthrin	$\mu\text{g/l}$	0.001	T, 95% of samples

## Notes:

- (1) National environmental quality standards recommended for the UK.
- (2) AA= Annual Average; D=Dissolved; T=Total; M=Maximum Allowable Concentration
- (3) A Std denotes standards for the protection of sensitive aquatic life  
B Std denotes standards for the protection of other aquatic life

## APPENDICES

### APPENDIX 8: EC SHELLFISH HYGIENE DIRECTIVE (91/492/EC)

#### END PRODUCT STANDARD

- \* Must be fresh and alive (response to percussion)
- \* must contain <300 faecal coliforms or <230 E.coli per 100g shellfish flesh
- \* no salmonella in 25g of flesh
- \* no toxic or objectionable compounds such as those listed in Directive 79/923/EEC
- \* Paralytic Shellfish Poison must not exceed 80 µg per 100g of flesh
- \* Diarrhetic Shellfish Poison must not exceed 'dangerous levels'
- \* provision for a future virological standard
- \* provision for revision of bacteriological standard

#### CLASSIFICATION OF HARVESTING AREAS

Category A <230 E.coli/100g <300 faecal coliforms/100g	flesh may go for direct human consumption
Category B <4600 E.coli/100g category <6000 faecal coliforms/100g (in 90% of samples)	must be depurated, heat treated or relayed to meet category
Category C <60,000 faecal coliforms/100g	must be relayed for long periods (2months) to meet Category A or B (may also be heat treated by approved method)
Category D above 60,000 faecal coliforms/100g or at discretion of Member State	Prohibited

**APPENDIX 9: THIRD NORTH SEA CONFERENCE - PRIORITY HAZARDOUS SUBSTANCES (ANNEX 1A LIST OF SUBSTANCES)**

Mercury	Simazine
Cadmium	Atrazine
Copper	Triorganotin compounds
Zinc	Azinphos-ethyl
Lead	Azinphos-methyl
Arsenic	Fenitrothion
Chromium	Fenthion
Nickel	Malathion
Aldrin	Parathion
Dieldrin	Parathion-methyl
Endrin	Dichlorvos
Isodrin	Trichloroethylene
HCH	Tetrachloroethylene
DDT	1,1,1-trichloroethane
Pentachlorophenol	Trichlorobenzene
Hexachlorobenzene	1,2-dichloroethane
Hexachlorobutadiene	Polychlorinated biphenyls
Carbon tetrachloride	Dioxins (*)
Chloroform	
Endosulphan	
Trifluralin	

At the Third North Sea Conference, the UK Government undertook to reduce loadings (flow x concentration) of the 'Annex 1A' list of substances except dioxins (\*) entering UK tidal waters from rivers and direct discharges by 50% (70% for Hg, Cd, Pb) by 1995, against a 1985 baseline.

**APPENDIX 10: Action Plan in Response to Flooding in the River Exe Catchment**

Standby Manpower Schedule (Alert Given)	Work Carried Out
Teignmouth Gates 2 Hours Response Time	
Dawlish 4 Hour Response Time	
Withycombe 4 Hour Response Time	Screens at Culverts on Scheme
Kenn Outfall 2 Hour Response Time	Screen Outfall on Scheme
Powderham 2 Hour Response Time	Screen at Culvert
Lympstone 1 Hour Response Time	Screen and Sluice on Scheme
Woodbury 4 Hour Response Time	Screens on Scheme
Turf Outfall 4 Hour Response Time	Penstocks at Outfall



## APPENDICES

Standby Manpower Schedule (Alert Given)	Work Carried Out
Exe Marshes 4 Hour Response Time	Water Level Control Structures
Clyst Banks 4 Hour Response Time	Flood Banks
Clyst St Mary 4 Hour Response Time	Flood Banks
Exeter 2 Hour Response Time	Radial Gate
Ide 4 Hour Response Time	Screen at Culvert Entrance
Stoke Canon 4 Hour Response Time	Flood Banks
Cullompton 4 Hour Response Time	Screens on Scheme
Exe Catchment 4 Hour Response Time	Bridge Checks and Flood Banks
Dulverton 2 Hour Response Time	Sluice Controls and Screens on Scheme

**APPENDIX 11: Flood Defence Response Levels**

**Response Level A**

- Operating barriers.
- Closure of defences, attendance to flood gates, stop logs.
- Activating pumping stations.
- Adjustments to sluice gates and other flood discharge structures.
- Operation of flood storage and diversion works.
- Adjusting as necessary flow control arrangements such as penstocks, flaps etc.

On completion of tasks within response level A the Authority has ensured that no flooding will take place or be exacerbated due to the system not being in place or operating correctly.

**Response Level B**

System in place under Response Level A.

- Check and clear trash screens as necessary.
- Inspect sensitive locations - restricted urban channels, culverts.
- Keep under surveillance those defences under stress.
- Provide information to update the flood warning system.

On completion of tasks within Response Level B the Authority has ensured that the flood defence system is both in place and is performing as effectively as possible. Beyond this any flooding is likely to be as a result of the flood exceeding the standard of protection or a failure of the system which could not be anticipated.

## **GLOSSARY**

### **ALLUVIUM**

Material transported by a stream or river and deposited as the river floodplain.

### **ATRAZINE**

A herbicide of the triazine group which is persistent in the environment.

### **AGRI - ENVIRONMENTAL**

Agricultural practices which have environmental benefits.

### **AQUIFER**

A sub-surface zone or formation of rock which contains exploitable resources of groundwater. Aquifers are classed as either major, minor or non aquifers depending upon the extent of the groundwater resource. Major aquifers provide large yields and are usually used for public water supply, minor aquifers have smaller yields and are usually used only for local water supply, non aquifers yield little water and have very few, if any abstractions.

### **AREA OF OUTSTANDING NATURAL BEAUTY**

Landscapes with distinctive character and natural beauty of national importance designated under the Natural Parks and Access to the Countryside Act (1949). These areas are administered by the Countryside Commission with a view to conserving and enhancing their natural beauty.

### **ASSET MANAGEMENT PLAN 2 (AMP2)**

South West Water's Capital Investment Programme.

### **BERN CONVENTION**

International agreement which carries obligations to conserve wild plants, birds and other animals, with particular emphasis upon endangered and vulnerable species and their habitats. This agreement forms the basis of the Habitats Directive.

### **BIOCHEMICAL OXYGEN DEMAND (BOD)**

A measure of the amount of dissolved oxygen consumed in water, usually as a result of organic pollution.

### **BIODIVERSITY**

The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems. (Article two of the Biodiversity Convention)

### **BRECCIA**

Coarse grained sedimentary rock with angular particles.

### **BUFFER ZONES**

A strip of land, typically 10-100 m wide alongside rivers which is removed from intensive agricultural use. Can reduce inputs of pollutants and improve habitat diversity and landscape.

## CARBONIFEROUS

Period of the Palaeozoic era, following the Devonian era and preceding the Permian. Economically, the most important system containing the world's coal reserves and oil, oil shale, iron ore and fire clay deposits.

## COLIFORM (FAECAL COLIFORMS)

A group of bacteria distinguished by their ability to degrade lactose to produce acid and gas. They are used as indicators of possible contamination of water by sewage. The faecal coliforms, a subgroup of coliforms, are normally found only in faeces and are therefore a more reliable indicator of contamination by sewage.

## CONGLOMERATE

Coarse grained rock in which the particles are rounded and greater than 2mm in size.

## CONSERVATION NOTICE

Abstractions for dewatering (e.g. removal of water in a mine or quarry) do not require a licence from the NRA. However, where these involve the construction or extension of a well, borehole or other 'dewatering works' the NRA must be notified. The NRA must also be notified of any construction or extension of boreholes for searching or extracting minerals. In both cases the NRA may respond by issuing a 'Conservation Notice'. This requires the person giving the notice to take reasonable measures to conserve water. These measures may refer to particular features e.g. a wetland or someone's water supply.

## COUNTRYSIDE STEWARDSHIP SCHEME

An initiative of the Countryside Commission in collaboration with English Nature, English Heritage and MAFF to enhance and conserve important English landscapes, wildlife habitats and history.

## COUNTY WILDLIFE SITES

Sites which are of county significance for wildlife, in line with formal guidelines prepared by the Devon Wildlife Trust.

## CULM

A geological formation in SW England comprising beds of shales and thin layers of impure anthracite, all of carboniferous age.

## CULM GRASSLAND

A habitat which comprises a characteristic mixture of marshy grassland, bog, wet heath and scrubby woodland which collectively supports a wide range of flora and fauna. The habitat is underlain by a geological formation of sandstones and shales.

## CYPRINID

Fish of the family Cyprinidae (e.g. roach, bream, carp, chub).

## ENDRIN

An insecticide of the organochlorine chemical family. Once used to control a wide variety of agricultural insect pests and also voles in orchards. Highly toxic to most animals and also persistent. All products containing this were banned for use in the UK by 1989.

## **GLOSSARY**

### **ENTEROVIRUS**

These viruses are monitored for under the EC Bathing Water Directive (160/76/EEC) for designated bathing areas 'wherever there are grounds for suspecting a deterioration in water quality'. They replicate in the intestinal tract, commonly cause asymptomatic immunizing infections which protect against further infection, give rise to viraemia, occasionally infect the central nervous system, are more common in children than adults, cause infections predominantly in summer and autumn and include the viruses that cause polio and meningitis.

### **ENVIRONMENTAL QUALITY STANDARD (EQS)**

The concentration 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.

### **EUTROPHIC**

Water enriched with nutrients which results in high plant (usually algal) growth. Usually used when referring to enrichment from man-made sources such as fertilizers leaching from the soil.

### **FAECAL STREPTOCOCCI**

Disease causing bacteria, arranged in chains and found present in faeces. Faecal streptococci are monitored as part of the EC Bathing Waters Directive (76/160. EEC).

### **FARM WASTE MANAGEMENT PLANS**

Voluntary plans drawn up between farmers and ADAS advisers describing the planned disposal of waste on the farm e.g. when and where.

### **FENITHROTHION**

An insecticide of the organophosphorus chemical family. Used widely to control insects in agriculture, forestry and for public health purposes.

### **FRACTURE**

Clean break in rock due to strain and stress from faulting or folding: characteristic break pattern of a mineral.

### **FYKE NET**

A tube shaped net with a series of internal funnels, it is laid on the river bed to catch fish (usually eels).

### **GAMMA HCH**

An insecticide of the organochlorine chemical family. Used widely to control insects, public health pests and animal skin parasites. Also known as Lindane.

### **GEOMORPHOLOGY**

Scientific study of land forms and of the processes that formed them.

### **GREENSAND**

Calcareous sandstones and sandstones rich in glauconite (hydrous potassium-iron-alumina-silicate clay mineral) which gives the sandstone a green colour.

### HYDROGEOLOGY

Branch of geology concerned with water within the Earth's crust.

### INTERCEPTOR

A device for containing oil, which when used as part of a drainage system limits the amount of oil discharging to watercourses and to the ground from roads and garages etc.

### LOOK UP TABLE

A statistically based table for the determination of consent compliance for water company discharges. Drawn up by the DoE in consultation with the water companies it is based on allowing a failure in 5% of samples.

### MALATHION

An insecticide and acaricide (spiders and mites) of the organophosphorus chemical family. Used widely to control insects and other pests including animal skin parasites and human head and body lice.

### PARATHION METHYL

An insecticide and acaricide (spiders and mites) of the organophosphorus chemical family. Used widely to control agricultural insect pests.

### pH

A measure of the acidity or alkalinity of a solution. This is related to the balance between hydrogen ions ( $H^+$ ) and hydroxyl ions ( $OH^-$ ) in the solution.

### PERMIAN

Final geological period of the Palaeozoic era. It succeeds the Carboniferous and precedes the Triassic. New red sandstone is linked with this era.

### PHENOLS

A class of aromatic compounds with one or more hydroxyl (-OH) groups directly attached to the benzene nucleus.

### Q95

The flow that on average is equalled or exceeded for 95% of the time.

### RAMSAR CONVENTION SITES

Sites identified by UK Government under the Convention on Wetlands of International Importance which was ratified by the UK Government in 1976.

### SECTION 105 SURVEYS

Surveys carried out for flood defence purposes under Section 105 of the Water Resources Act.

### SIMAZINE

A herbicide of the triazine group which is persistent in the environment.

## **GLOSSARY**

### **SITE OF SPECIAL SCIENTIFIC INTEREST (SSSI)**

A site given a statutory designation by English Nature or the Countryside Council for Wales because it is particularly important, on account of its conservation value.

### **SPECIAL AREA OF CONSERVATION (SAC) AND SPECIAL PROTECTION AREA (SPA)**

Areas designated under the Habitats Directive.

## UNITS AND ABBREVIATIONS

### UNITS

mm	Millimetre
m	Metre
km	Kilometre
m/km	Metres per kilometre
persons/km <sup>2</sup>	Number of people per square km
ha	Hectare
m <sup>3</sup>	Cubic metres
m <sup>3</sup> /s	Cumec; cubic metre per second
m <sup>3</sup> /day	Cubic metres per day
Ml/day, Ml/d	Megalitres per day
Ml/year	Megalitres per year
kg/day	Kilograms per day
°C	Degrees Centigrade
%	Percentage
>	Greater than
<	Less than
≥	Greater than or equal to
≤	Less than or equal to
mg/l	Milligrams per litre
no/100ml	Number per 100 millilitres
no/l	Number per litre
PFU/10l	Plaque forming units per 10 litres

### ABBREVIATIONS

AMP2	Asset Management Plan 2
AGLV	Area of Great Landscape Value
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
AT	Appropriate Treatment
BCU	British Canoe Union
BMWP	Biological Monitoring Working Party
BOD	Biochemical Oxygen Demand
CMP	Catchment Management Plan
CoCo	Countryside Commission
CSO	Combined Sewer Overflow
DAS	Devon Archaeological Society
D&E HC	Dissolved and Emulsified Hydrocarbons
DCC	Devon County Council
DO	Dissolved Oxygen
DoCC	Dorset County Council
DoE	Department of the Environment
DWT	Devon Wildlife Trust
EC	European Commission
ECC	Exeter City Council
EDDC	East Devon District Council
EH	English Heritage
EN	English Nature
EQS	Environmental Quality Standard
ERLOS	Emergency Response Level of Service
ESA	Environmentally Sensitive Area
FA	Forestry Authority
FC	Forestry Commission
FE	Forestry Enterprise
HEP	Hydro-electric Power
HNDA	High Natural Dispersion Area



## UNITS AND ABBREVIATIONS

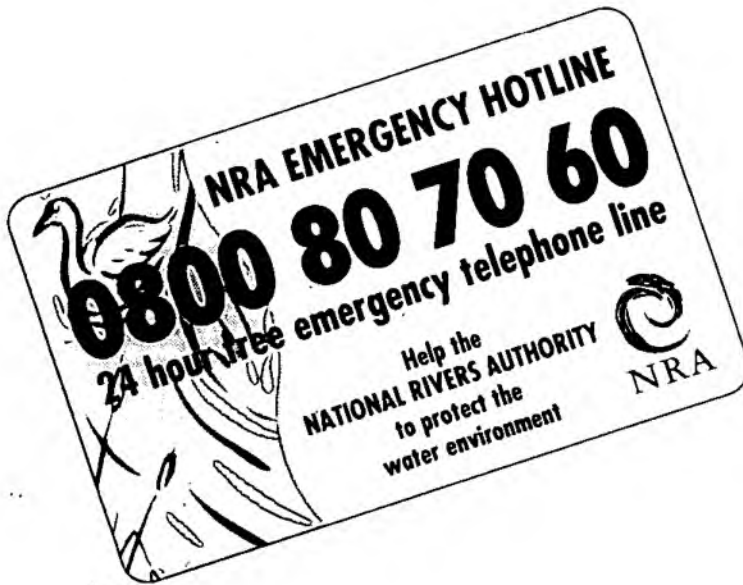
IDB	Inland Drainage Board
LA	Local Authority
LoE	Licence of Entitlement
LTRQO	Long Term River Quality Objective
MAFF	Ministry of Agriculture, Fisheries and Food
MCA	Mineral Consultation Area
MDDC	Mid Devon District Council
NDDC	North Devon District Council
NGR	National Grid Reference
NRA	National Rivers Authority
NSA	Nitrate Sensitive Area
NWC	National Water Council
NVZ	Nitrate Vulnerable Zone
OFWAT	Office of Water Services
PARCOM	Paris Commission
PCB	PolyChlorinated Biphenyl
PCC	Plymouth City Council
PPPG	Policy and Practice for the Protection of Groundwater
PWS	Public Water Supply
R&D	Research and Development
RE	River Ecosystem, RE1, RE2 etc.
REROA	River Exe Riparian Owners Association
RQO	River Quality Objective
RSPB	Royal Society for the Protection of Birds
SAC	Special Areas of Conservation
SAM	Scheduled Ancient Monument
SCC	Somerset County Council
SDC	Sedgemoor District Council
SHDC	South Hams District Council
SLA	Service Level Agreement
SMP	Shoreline Management Plan
SoS	Standards of Service
SPA	Special Protection Area
SSSI	Sites of Special Scientific Interest
STW	Sewage Treatment Works
SWK	Scott, Wilson, Kirkpatrick (methodology)
SWQO	Statutory Water Quality Objective
SWWSL	South West Water Services Limited
TBC	Torbay Borough Council
TDC	Teignbridge District Council
UK	United Kingdom
UV	Ultra Violet
UWWTD	Urban Waste Water Treatment Directive
WDC	Woodspring District Council
WDDC	West Dorset District Council
WERG	Wetland Ecosystem Research Group
WOAD	Welsh Office for Agricultural Development
WPBC	Weymouth and Portland District Council
WQ	Water Quality
WQO	Water Quality Objective
WRA	Waste Regulation Authority
WSDC	West Somerset District Council
WWSL	Wessex Water Services Limited
WT	Woodland Trust
WTW	Water Treatment Works

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