

Upper Thames Catchment Management Plan

Consultation Report

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UPPER THAMES CATCHMENT MANAGEMENT PLAN : CONSULTATION REPORT

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THE DRAFT VISION

UPPER THAMES CATCHMENT

In preparing the catchment vision, the NRA has defined what it would wish the catchment to be and the principle we will be following in working towards that vision. The catchment vision may not be something that can be achieved in the next five years, but something we can all work towards.

The Upper Thames lies mainly within the counties of Gloucestershire and Wiltshire, with a small part of Oxfordshire in the South-East corner also included. It covers the complete length of the River Thames upstream of Buscot lock and 11 major tributaries join the river in this section. The area is predominantly rural, although the urban settlement of Swindon dominates the southern half.

The Upper Thames and its tributaries, together with other water bodies within the catchment, are valuable as fisheries and for general wildlife conservation, as a source of water for potable supply and as a resource extensively used for recreation and navigation. While the Cotswold Hills display a unique landscape character and appeal projected by the limestones which were for centuries used as the universal building stone of the area, the Cotswold Water Park provides over 5000 hectares of water-related activities including conservation, angling and boating. The lakes of the park also provide flood attenuation and storage.

Development pressure will continue to be a perceived threat, particularly from mineral extraction, road and bypass proposals and water transfer schemes, not only in terms of impact on local residents but also on flood risk and environmental grounds.

To realise the potential value and optimise the use of the water environment, the NRA will work in partnership with local authorities, environmental groups, and other interested agencies. The Upper Thames CMP will provide an important focus for this partnership. Our aim is not only to maintain the existing values of the catchment, but also to:

- a) improve the landscape and conservation value of the water environment where opportunities exist;*
- b) improve access, information and visitor facilities where recreation is sustainable, ie, where there will not be a detrimental effect upon the environment;*
- c) alleviate local riverside flooding where properties may be affected;*
- d) maintain, improve and develop fish stocks in order to optimise the environmental and social benefits from their sustainable utilisation;*
- e) protect and improve the water quality;*
- f) recognise and protect the strategic importance of the Thames Path National Trail;*
- g) ensure water resources are not only well-managed, but developed in a sustainable manner so as to not adversely affect river flows;*
- h) contribute to the management of the Cotswold Water park area in providing planning advice and resources to monitor its effective implementation and to ensure that areas of value are conserved, and those which have become degraded are enhanced.*

SECTION 1
INTRODUCTION

1. INTRODUCTION

THE NATIONAL RIVERS AUTHORITY

- 1.1 The National Rivers Authority (NRA) was established in 1989 as an independent public body with statutory responsibilities for water resources, pollution control, flood defence, fisheries, recreation, conservation and navigation in England and Wales. Within the next three years the government plans to merge the NRA with Her Majesty's Inspectorate of Pollution and the Waste Regulation Authorities to form the Environment Agency. This new agency will have wide ranging powers and responsibilities in terms of environmental management.
- 1.2 The NRA is funded through a variety of charges eg water abstraction charges, effluent discharge charges, rod licence fees, navigation licence fees etc as well as through government grants from the Department of the Environment (DoE), Ministry of Agriculture, Fisheries and Food (MAFF), and Welsh Office (WO).
- 1.3 As Guardians of the Water Environment, the NRA has defined its role in the following mission statement:

'The National Rivers Authority will protect and improve the water environment. This will be achieved through effective management of water resources and by substantial reductions in pollution. The Authority aims to provide effective defence for people and property against flooding from rivers and the sea. In discharging its duties it will operate openly and balance the interests of all who benefit from and use rivers, ground waters, estuaries and coastal waters. The Authority will be business like, efficient and caring towards its employees'.
- 1.4 The NRA is committed to preparing a sound and thorough plan for the future management of the region's river catchments. This Consultation Report phase of the Catchment Management Plan (CMP) is a step towards achieving that goal for the Upper Thames catchment, which lies within the West Area of the NRA's Thames Region (NRA-TR).

CATCHMENT MANAGEMENT PLANNING

- 1.5 The water environment, eg rivers, streams, lakes, ponds, aquifers, springs etc is subject to a wide variety of uses which invariably interact and sometimes conflict with each other. The catchment management planning process has been developed to help manage all water based interests within individual catchment areas and any

interactions or conflicts between them for the overall benefit of the water environment and its users.

- 1.6 Although the NRA have a pivotal role to play in the management of the water environment, the catchment management planning process recognises that a partnership approach between the NRA and others is essential. Consequently, this report has been produced as a means of progressing detailed consultation with all interested parties.
- 1.7 As CMPs are intended to produce a framework for advising on development plan policies including issues such as water and sewerage infrastructure, flood plain, waste disposal etc; it is, therefore, hoped that Planning Authorities would give due regard to CMPs when formulating development plan policy.
- 1.8 Each section of this document contains its own introduction but in summary the report comprises:
 - a description of the relevant natural features of the catchment (Section 2);
 - a description of the actual and potential uses eg water abstraction, navigation, flood defence, of the catchment and draft environmental objectives for the conservation and enhancement of these uses (Section 3);
 - a description of the current status of the catchment in relation to the key characteristics of water quality, water resources and physical features (Section 4); and
 - a presentation of 'catchment'-specific issues (Section 5).
- 1.9 Within each section synoptic maps are used to complement and enhance the text and to illustrate relevant features.
- 1.10 To assist in the preparation of this plan a range of organisations and groups were contacted during April and May 1994. The results of this informal liaison are summarised in Appendix A.
- 1.11 The purpose of the consultation phase is to:
 - consolidate and confirm the range and extent of catchment uses;
 - obtain views on the (relative importance of) issues facing the water environment; and
 - begin the process of identifying and implementing action plans.
- 1.12 This document is therefore part of a process that will enable a shared vision of the catchment to be developed which will guide all NRA activities for the next 5 to 10 years. This vision and its supporting strategies will be presented in the 'Final Report'

of the CMP. The timetable for completing this report is currently July 1995. Regular monitoring and updating of the plan will be an integral part of the process ie an annual progress report and a repeat of the process every 5 years.

- 1.13 The NRA welcomes comments on the document. Details of the consultation process and the overall programme are given in Section 6.

SECTION 2

CATCHMENT DESCRIPTION

2. CATCHMENT DESCRIPTION

INTRODUCTION

2.1 This section provides a general overview of the catchment and describes its natural features under the following headings:

- topography;
- geology and hydrogeology;
- rainfall and river flow;
- strategic and local planning.

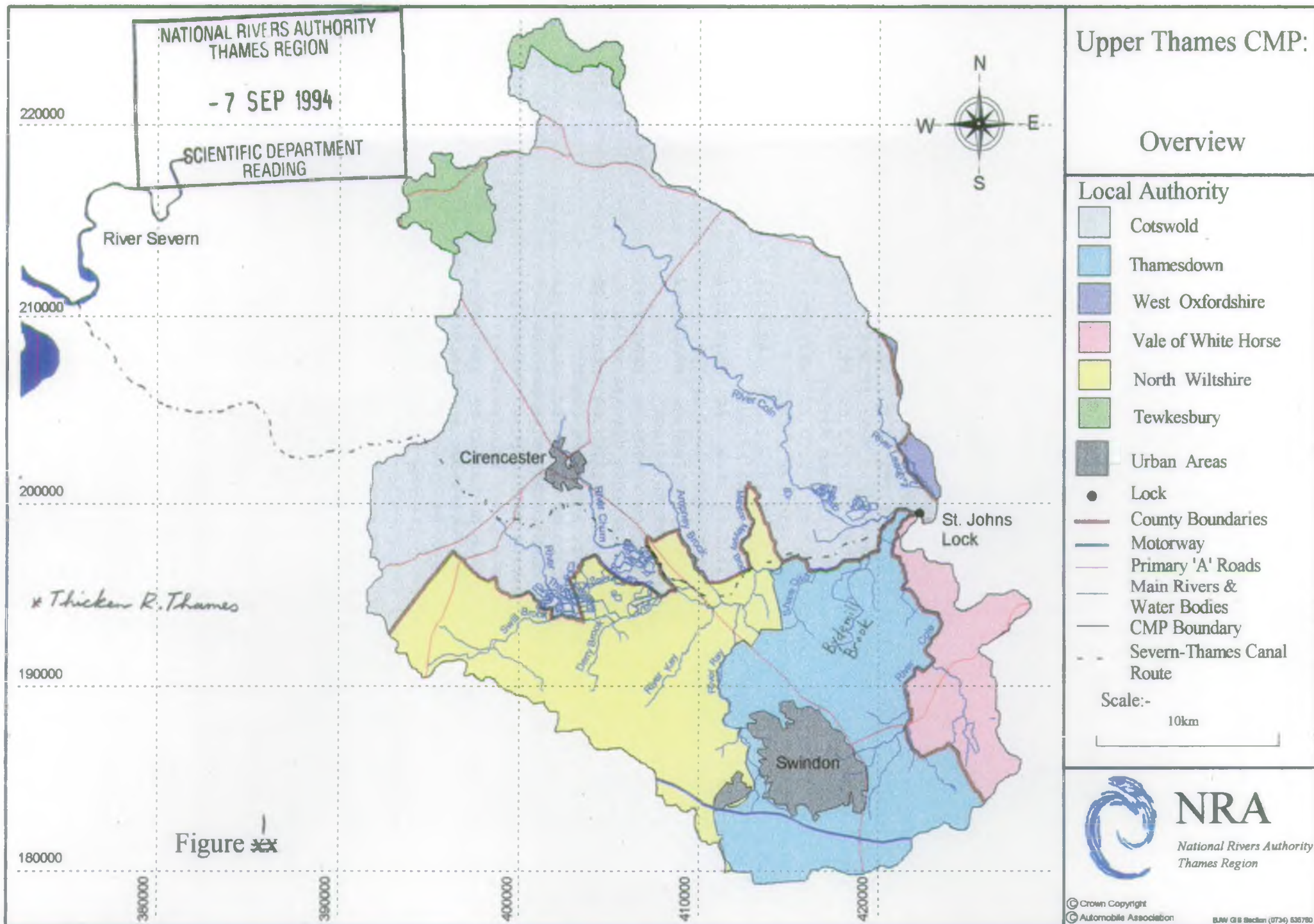
2.2 The boundary of the Upper Thames catchment includes all land which drains to the Upper Thames extending to Buscot Lock together with its tributaries including the rivers Churn, Coln, Ray, Key, Cole, Swill Brook and Ampney Brook (see Figure 1).

2.3 The key statistics of the catchment are:

- **Catchment Area : 994 km²;**
- **Population (estimate): 230,000;**
Major towns: Swindon, Cirencester
- **Average Annual Rainfall : 609.3 mm;**
- **Main River Length 337 km (maintained by NRA for flood defence purposes);**
- **Controlled Water Length xx (km) (monitored by NRA for water quality purposes).**

OVERVIEW OF THE CATCHMENT

2.4 The total length of the River Thames covered in this plan is 31.5 km with an area of approximately 1000 km², which represents about 9% of Thames Region's total catchment area.



- 2.5 The area identified in this plan as the Upper Thames lies mainly within the counties of Gloucestershire and Wiltshire, with a small part of Oxfordshire in the south east corner. It covers the complete length of the River Thames and its tributaries upstream of Buscot Lock:
- River Leach;
 - River Coln;
 - Marston Meysey Brook;
 - Ampney Brook;
 - River Churn;
 - Swill Brook;
 - River Key;
 - River Ray;
 - Share Ditch;
 - Bydemill Brook;
 - River Cole.
- 2.5 The catchment can be divided along the River Thames with all the tributaries to the north rising from the Cotswolds and fed by springs, while those to the south being largely associated with clay catchments or the urban conurbation of Swindon.
- 2.6 Water quality in the Upper Thames catchment ranges from "good" to "bad". The highest quality is to be found in Cotswold rivers such as the Churn and the Coln, whereas a lower quality is to be found in the Ray and some of the smaller brooks and ditches.
- 2.7 The area is predominantly rural with the Cotswolds, an Area of Outstanding Natural Beauty (AONB), occupying the northern half. However, the settlement of Swindon (population 150 000) dominates the southern half. Other settlements include Cirencester, Wroughton, Cricklade and Highworth.
- 2.8 The area is skirted along its southern boundary by the M4 motorway and the A40 trunk road crosses in the north. The remains of the Thames and Severn Canal cross from Lechlade to the west, and further south are the scattered remnants of the Wiltshire and Berkshire Canal and the North Wiltshire Branch Canal.
- 2.9 The Cotswold Water Park, currently split into an eastern and western section, also lies within the Plan area. It is the largest concentration of gravel pits and associated land in Great Britain, and covers some 5 700 hectares of which almost 1 000 hectares is open water in the form of approximately 100 man made lakes. It straddles the boundary between Gloucestershire and Wiltshire and includes parts of the Cotswold and North Wiltshire Districts.

TOPOGRAPHY

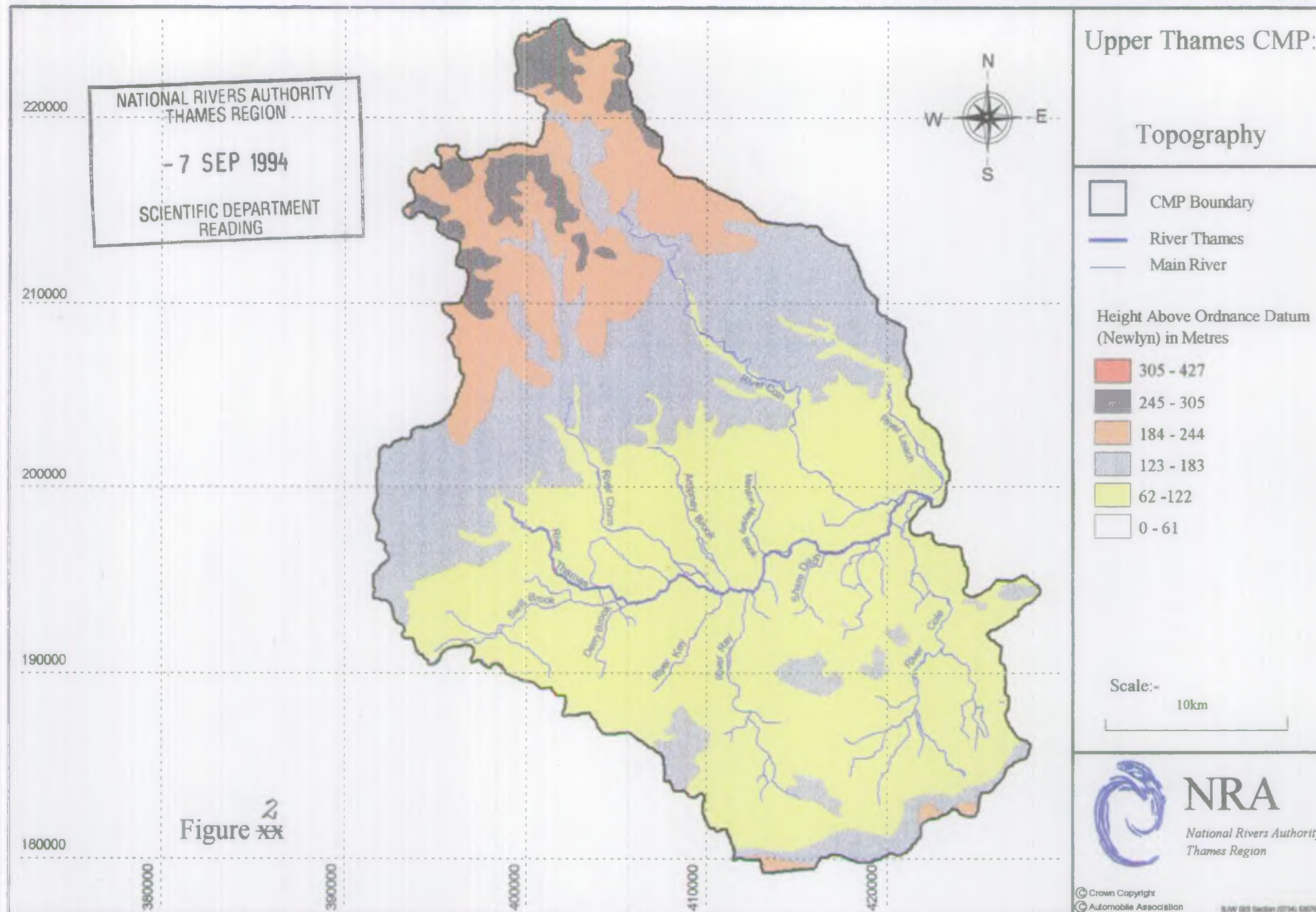
- 2.10 The Upper Thames catchment drains from the Marlborough Downs in the south and the Cotswold Hills to the north. The Marlborough Downs form an escarpment in the south east corner of the catchment and reach a height of 277m AOD at Liddington Castle (see Figure 2).
- 2.11 The Cotswold Hills form the northern section of the catchment between the towns of Cheltenham, Cirencester and Northleach. The highest point in the catchment which exceeds 320m AOD, lies within the Cotswold Hills to the north east of Cheltenham.

Table 2.1 - Key Features of the Main Tributaries

River	Area (km ²)	Topography/ Geology	Comments/Key Features
Churn	132.43	Cotswolds, steep sided valleys; Limestone	A spring fed river. Upper and middle reaches are influenced by the Cirencester urban area. A number of mills and weirs have affected the channel.
Ray	83.91	Rolling hills; Clay	Catchment is strongly influenced by the Swindon urban area.
Ampney Brook	75.78	Lower Cotswolds; Limestone	A small, spring-fed brook.
Coln	177.21	Cotswolds, steep sided valleys; Limestone	A spring fed river. Very little urban development in the catchment.
Cole	140.82	Rolling hills; Clay	Fed by largely surface run-off. Influenced by the Swindon urban area.
Leach	78.09	Lower Cotswolds; Limestone	A spring fed river. Ephemeral (ie dries up) over its middle reaches.

- 2.12 The main rivers in the catchment drain from the north and south to the Thames Valley in the centre. The River Thames rises from its source at Thames Head in the west and falls nearly 50 metres before leaving the catchment at Lechlade. The Thames has its confluence with the Leach, Cole and Coln at Lechlade.

Topography



GEOLOGY AND HYDROGEOLOGY

- 2.13 The catchment is comprised of a series of geological strata of Jurassic age dipping in a south-easterly direction as shown in the cross section (Figure 3) below. To the north west the Cotswold limestones, the Great and Inferior Oolite, outcrop at the surface and form the high escarpment of the Cotswold hills overlooking the Vale of Evesham (see Figure 4). South east of Cirencester, these limestones dip underneath the Oxford Clay, then the Corallian strata, then Kimmeridge Clay and finally the Cretaceous clays and Chalk in the extreme south of the area. Moving further south east, the clays become progressively thicker and the oolites more deeply confined. The southern end of the catchment is dominated by the steep chalk escarpment of the northern edge of the Wiltshire Downs overlooking the Vale of the White Horse.
- 2.14 In hydrogeological terms there are two major aquifers within the catchment; those of the Great and Inferior Oolitic limestones. These limestones are extensively faulted and are highly fissured. They exhibit Karstic features such as very rapid fissure flow of rainfall percolation and ground water and very rapid changes of ground water level (Figure 7). As a result, many of the rivers 'flow underground' each year in the summer and autumn, giving rise to long dry sections.

Figure 3 - Cross section

- 2.15 The ability to transmit ground water rapidly gives rise to a very "flashy" response to ground water levels and to river flows, both receding very quickly after just a few weeks of low rainfall. Thus "drought" conditions can manifest themselves in a few months and summer season droughts are quite a common natural occurrence.

220000

210000

200000

190000

180000

NATIONAL RIVERS AUTHORITY
THAMES REGION

- 7 SEP 1994

SCIENTIFIC DEPARTMENT
READING

Figure 

Scale:-

10km

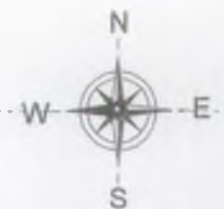
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Upper Thames CMP:

Solid Geology

-  CMP Boundary
-  River Thames
-  Main River
-  Middle Chalk
-  Lower Chalk
-  Upper Greensand
-  Gault
-  Undivided Lwr Greensand
-  Portland Beds
-  Kimmeridge Clay
-  Corallian
-  Oxford Clay
-  Cornbrash
-  Forest Marble
-  Great Oolite
-  Fullers Earth Clay
-  Inferior Oolite
-  Upper Lias



NRA

National Rivers Authority
Thames Region

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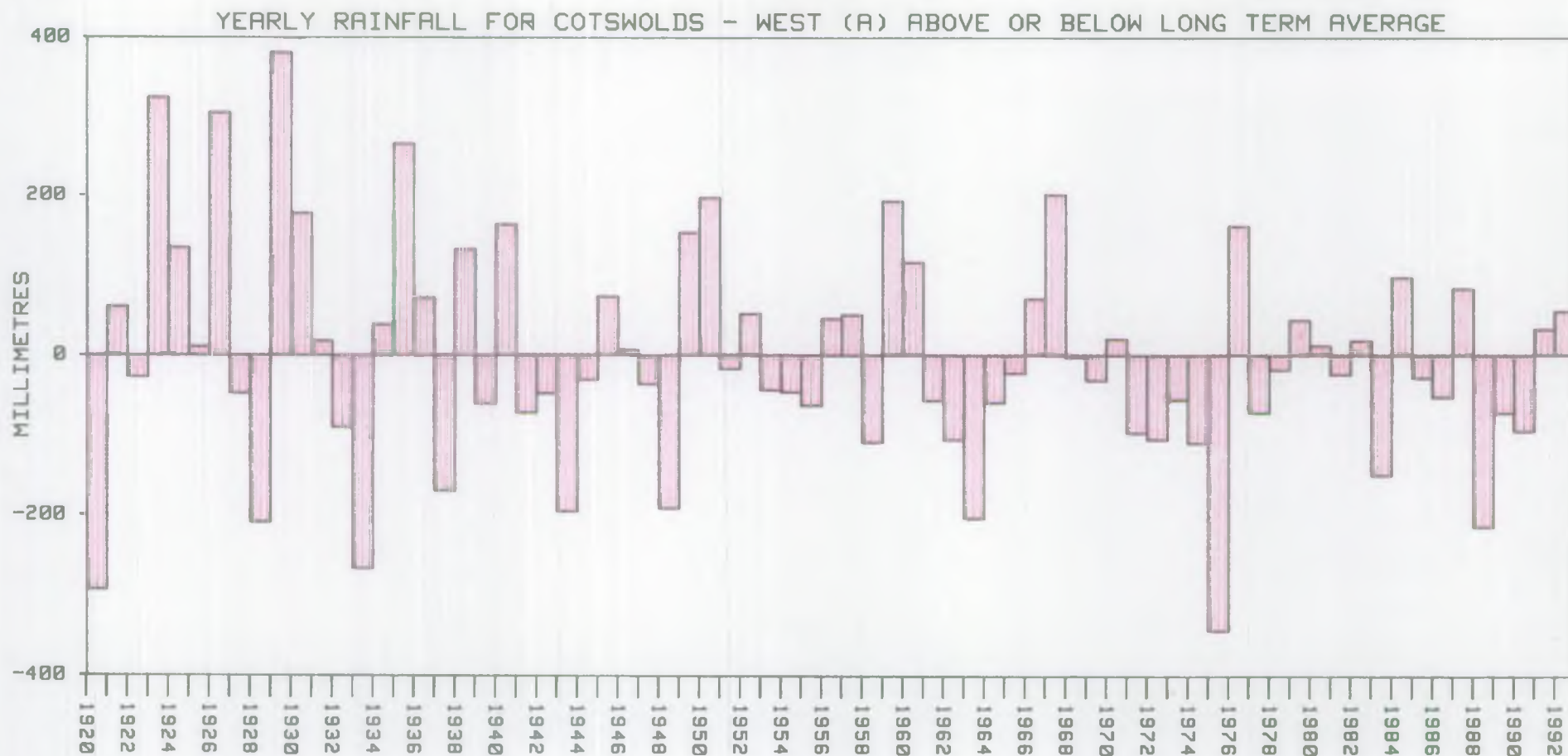
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Annual rainfall and percolation data over the last 70 years is shown in Figures 5 and 6. The data over the last 10 years is of particular interest. The 10 years prior to 1992 had below average rainfall and percolation was the lowest experienced over the last seven decades.

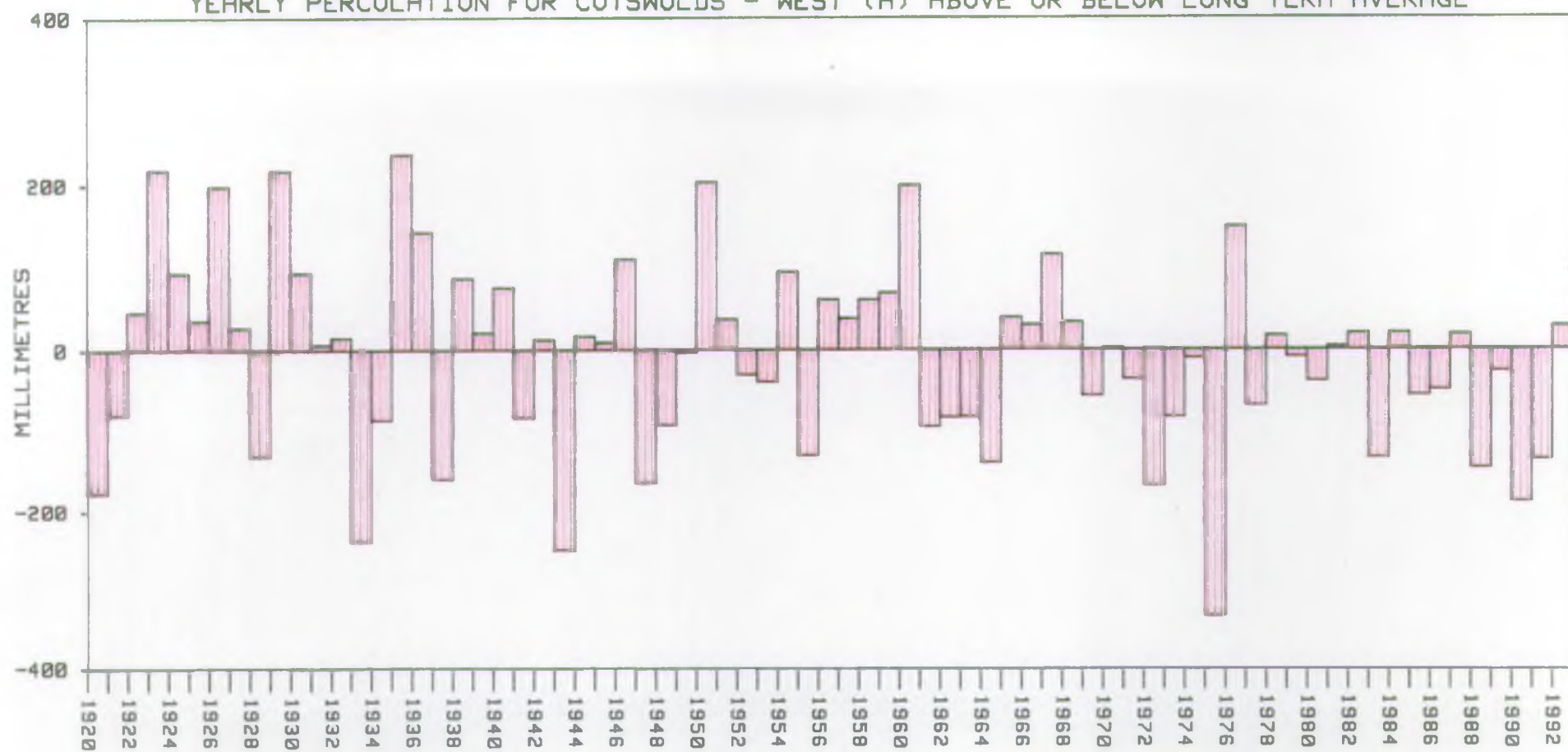
- 2.16 The two oolite limestone aquifers are separated by the Fullers Earth Clay and thus the two ground water systems are generally separate on a regional scale. The faulting, however, produces ground water exchange between the two aquifers locally.
- 2.17 Between the Oxford and Kimmeridge Clays are Corallian strata deemed a minor aquifer and important in the Swindon and Shrivenham area.

Figure 5 - annual rainfall

Figure 6 - annual percolation



YEARLY PERCOLATION FOR COTSWOLDS - WEST (A) ABOVE OR BELOW LONG TERM AVERAGE



RAINFALL AND RIVER FLOW

- 2.18 The average rainfall across the catchment is 609.3 mm. Rainfall varies depending on topography and meteorological conditions, from 900 mm/year in the Cotswolds to under 600 mm in the lower parts of the catchment (see Figure 8).
- 2.19 The rivers in the northern part of the catchment flow across limestone and are fed by springs. They tend to have high base flows and respond more slowly to rainfall than clay catchments.
- 2.20 The rivers to the south of the catchment rise in Kimmeridge clay. In clay catchments summer flows tend to be low and the rivers respond very rapidly to rainfall, ie the rivers in clay are "flashy".
- 2.21 Hydrographs for the Rivers Coln, Cole, Churn and Thames (Figure 9 a-d) show the differences between the flow characteristics of the rivers draining the limestone Cotswolds catchments and those draining the southern "clay" catchments. The River Coln displays the classic characteristics of a ground water fed stream, with a high base flow, but comparatively low peak flood flows. The Churn shows some of the characteristics of a ground water fed river, but has a lower baseflow than the Coln. The River Cole is very flashy and the hydrograph is typical of a clay catchment stream.

NATIONAL RIVERS AUTHORITY
THAMES REGION

- 7 SEP 1994

SCIENTIFIC DEPARTMENT
READING



Upper Thames CMP:

Rainfall & River Flow

CMP Boundary

River Thames

Main River

Rainfall (mm)

600 - <700

700 - <800

800 - <900

900 - <1000

Flow Gauging Stations

Recording Rain Gauges

Daily Rain Gauges

Scale:-

10km



NRA

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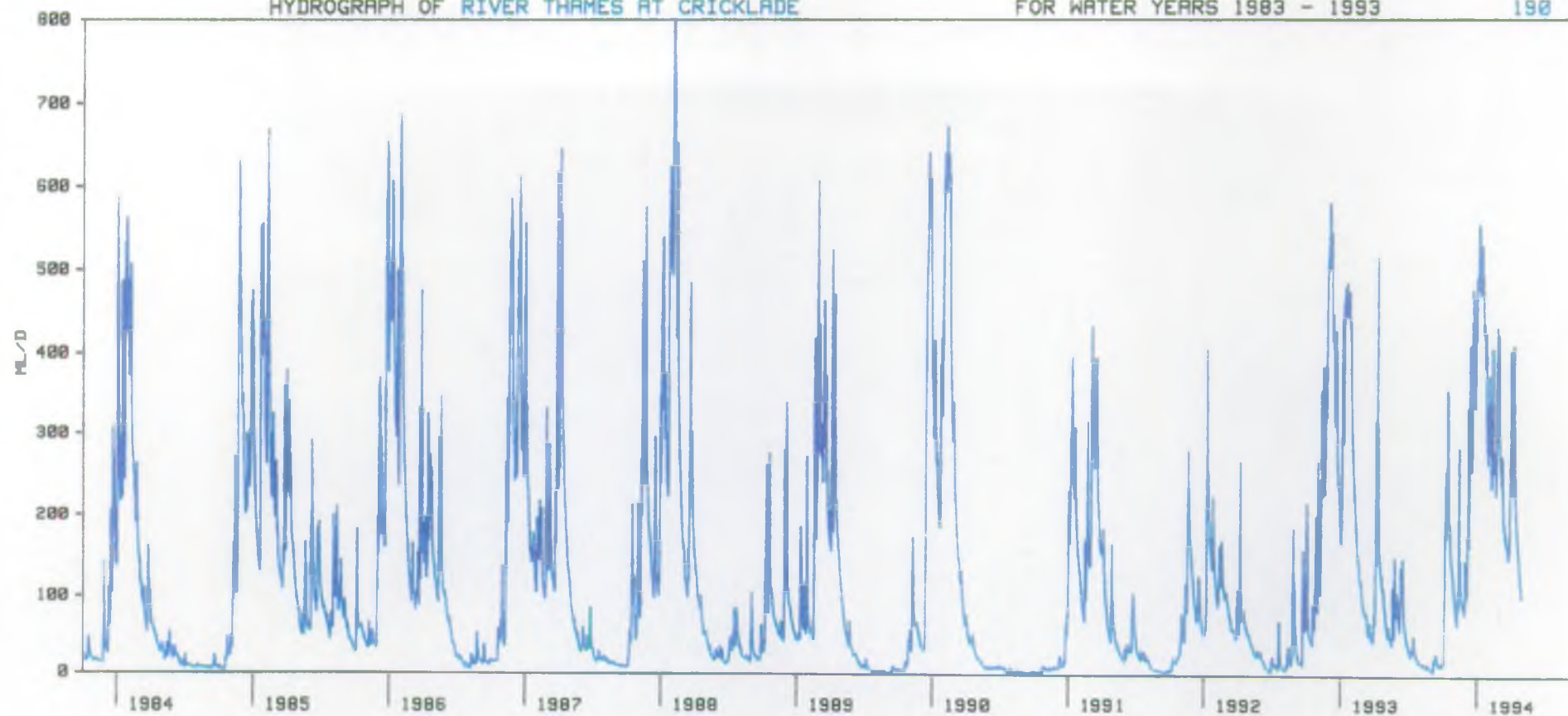
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Figure 9
xx

HYDROGRAPH OF RIVER THAMES AT CRICKLADE

FOR WATER YEARS 1983 - 1993

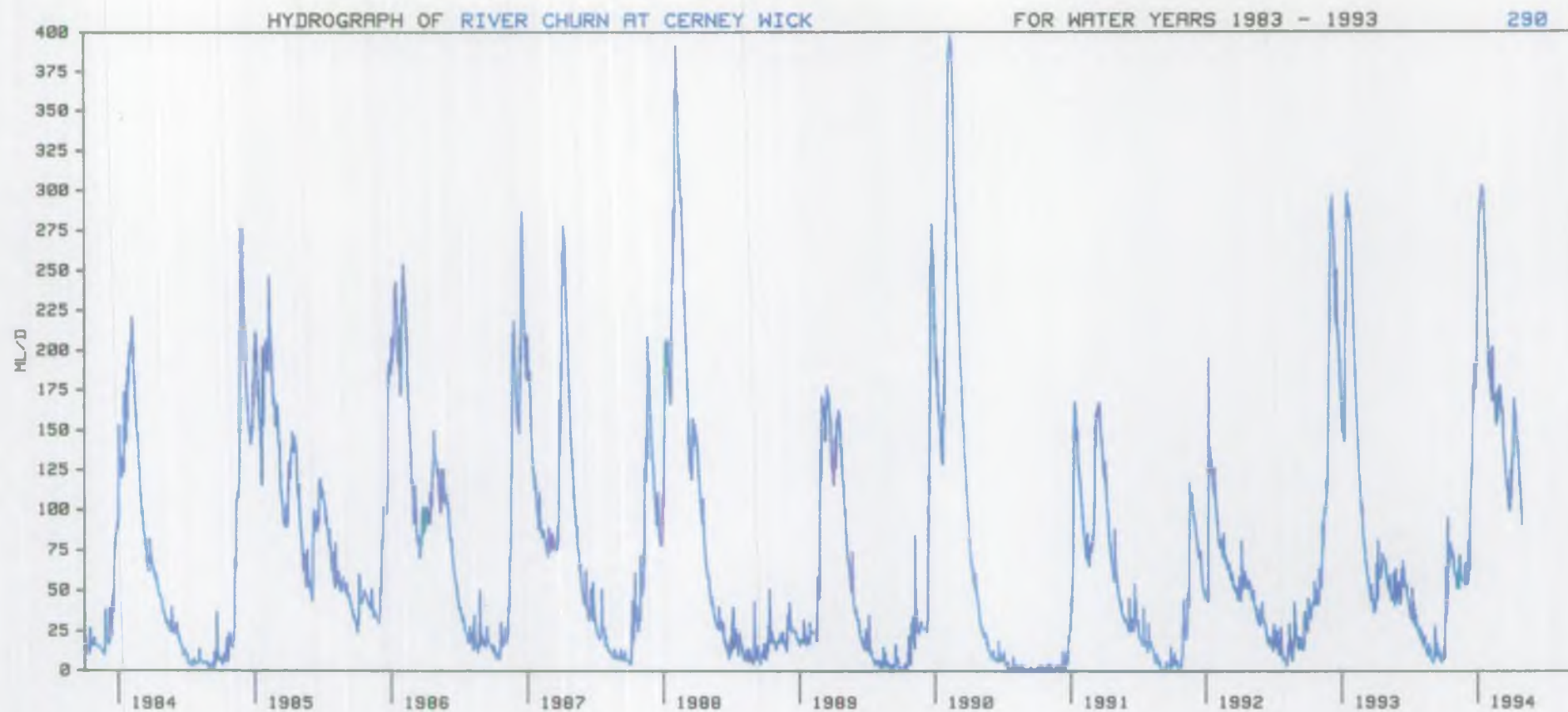
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HYDROGRAPHS TO BE REDUCED
IN SIZE.

Figure 9 Hydrographs a, b

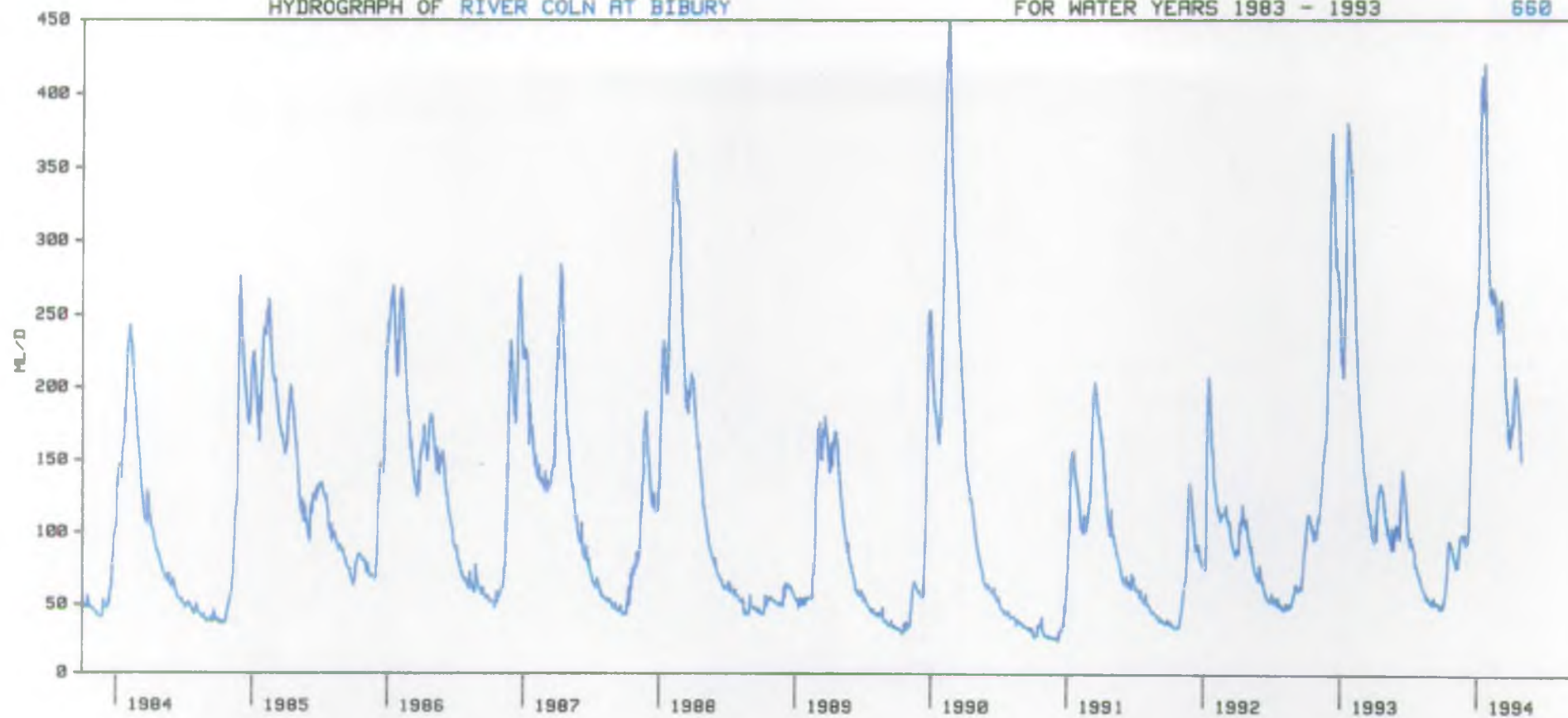
Figure 9 Hydrographs c, d

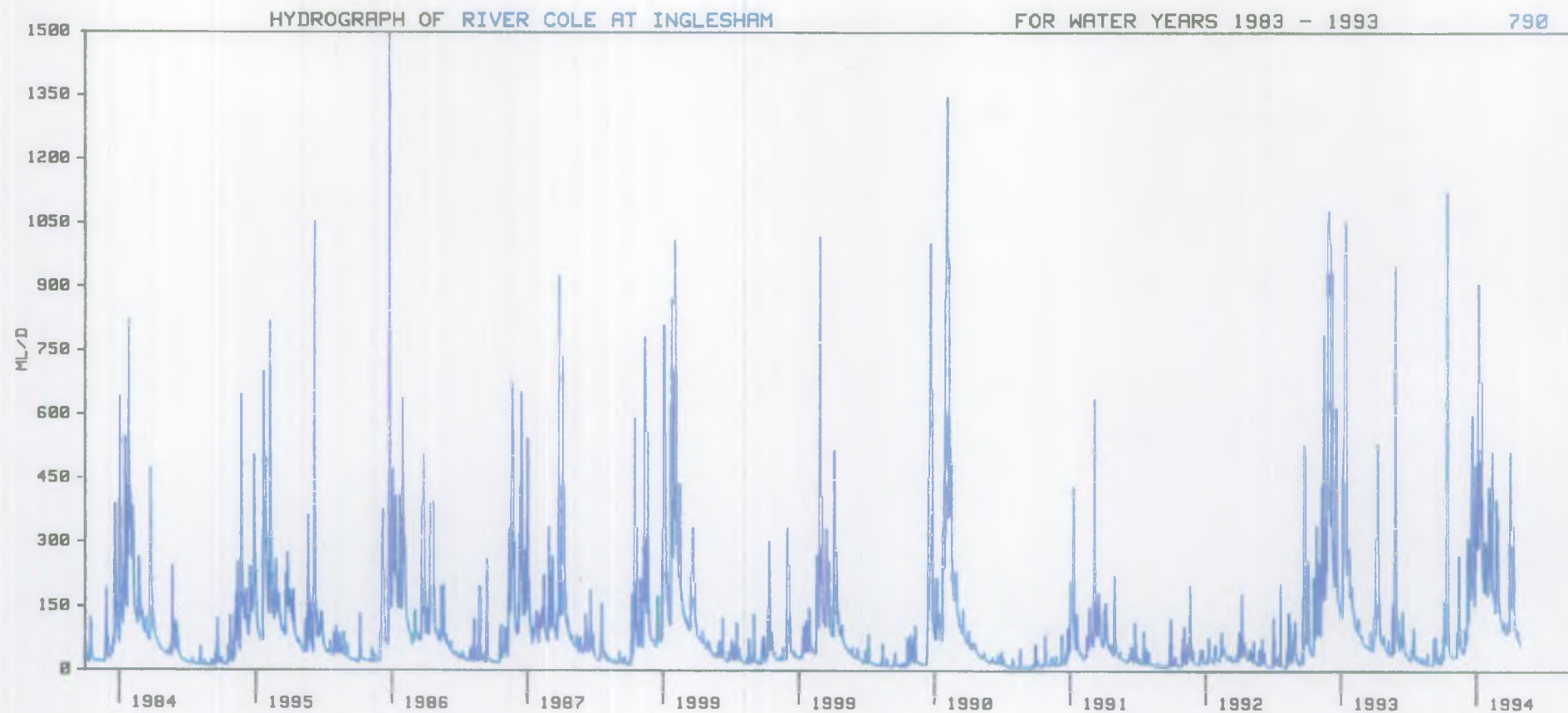


HYDROGRAPH OF RIVER COLN AT BIBURY

FOR WATER YEARS 1983 - 1993

660





STRATEGIC AND LOCAL PLANNING

- 2.22 The table below summarises the areas of the catchment covered by different Local Authorities (see Figure 1).

<u>County Councils</u>	<u>Sq Km</u>	<u>%</u>	<u>District Councils</u>	<u>Sq Km</u>	<u>%</u>
Gloucestershire	590	59	Cotswold DC	560	56
			Tewkesbury BC	30	3
Oxfordshire	50	5	Vale of White Horse DC	50	5
			West Oxfordshire DC	4	<1
Wiltshire	354	36	North Wilts DC	160	16
			Thamesdown BC	190	19
TOTAL	994	100%	TOTAL	994	100%

- 2.23 The population of the catchment area is estimated at 230,000. The main towns and their estimated 1991 populations are given below:

Swindon	150 000
Cirencester	17 600
Highworth	8 000
Wroughton	7 000
Purton	4 000
Cricklade	3 900
South Cerney	3 000
Fairford	3 000
Lechlade	2 500
Shrivenham	2 250
Northleach	1 500
Ashton Keynes	1 400

- 2.24 Most of the County, District and Borough Councils have recently revised or are currently revising their statutory land use development plans. These documents when considered in conjunction with Regional Planning Guidance provide the best means of establishing possible future land use trends which have an impact on, or interact with the water environment.
- 2.25 More specifically, the government published its Regional Planning for the South West in July 1994. This will guide the development of those parts of the Upper Thames area that lie within Wiltshire and Gloucestershire. The remainder is covered

by Regional Planning for the South East. The NRA has given due regard to this guidance in preparing this CMP. The particular provisions that may affect this CMP are:

- 3.1/2 *All development is to be sustainable and environmental appraisals of all development plans is to be advocated;*
- 3.4 *Degraded areas should be restored and enhanced;*
- 3.7 *Scattered development is encouraged;*
- 3.17 *Swindon will no longer be expected to grow at previous rates. The 'rural buffer zone' to the north will continue to be protected from inappropriate development;*
- 4.27/8 *Water supply and sewerage issues are to be taken into account in development plans. Water supply sources should be protected and rates of development should not exceed the capacities of existing or planned infrastructure;*
- 4.33 *Development plans should not provide for inappropriate development in areas which are at risk from flooding;*
- 7.5 *Facilities for leisure should be actively encouraged where this is compatible with conservation objectives;*
- 7.6 *Recreation based on rivers and lakes should be consistent with the principles of sustainable development. Plans should set out policies for conservation and development along the routes of national trails;*
- 8.6 *Minerals planning authorities should recognise that a balance must be struck between the economic and environmental requirements of the community;*
- 8.8 *They should also ensure that future permissions for mineral extraction should be in accordance with the principles of sustainable development.*
- 9.13 *The improvements to the A417/A419 (Swindon to Gloucester) are important for meeting economic objectives.*

2.26 The following development plans apply to the catchment:

Structure Plans

Gloucestershire Structure Plan - 1st Alteration (Approved 1992)
Oxfordshire 2001 (Approved 1992)
North East Wiltshire Structure Plan (Approved 1993)

Local Plans

Cotswold District Local Plan (Deposit Draft 1993)
Vale of White Horse Local Plan (Consultation Draft Nov. 1993)

West Oxfordshire Local Plan (Deposit Plan 1993)
North Wiltshire Local Plan (Adopted 1993)
Thamesdown Local Plan (Deposit Draft 1994)
Tewkesbury District Local Plan (Consultation Draft due Sept 1994)

2.27 Minerals and Waste Local Plans

Oxfordshire Minerals and Waste Local Plan (Deposit 1993)
Wiltshire Minerals Local Plan 1989
Upper Thames Policy Review 1993 - Gloucestershire CC

2.28 In general the NRA's representations on development plans have concentrated on the preservation and enhancement of the water environment. It is hoped that these representations would help to cement CMPs into the development planning process.

2.29 In particular, the NRA considers that the Upper Thames valley constitutes a natural resource of great environmental, cultural, and historic value. Any development proposals should therefore be controlled to ensure they are environmentally sustainable. In particular the exploitation of aggregates should not exceed the environmental capacity of the Cotswold Water Park Area.

2.30 Consistent with the aims of sustainable development, the NRA has asked, for example Gloucestershire CC, that plan policies should aim to achieve the following objectives:

- (i) meet the basic needs of all the inhabitants;
- (ii) secure and stimulate economic prosperity in all parts of the county;
- (iii) conserve and enhance the environment;
- (iv) maintain a high quality of life.

SECTION 3
CATCHMENT USES

3. CATCHMENT USES

INTRODUCTION

- 3.1 This section describes current and future uses of the water environment within the catchment. Current uses include activities planned to be completed in the short-term whilst future uses include potential activities. For each of the catchment uses the following information is provided:

Catchment Perspective - this describes how the use manifests itself within the catchment.

Environmental Objectives - this suggests broad based environmental objectives for the conservation and enhancement of the use and/or the water environment.

Maps are used to enhance the information in the text and highlight the physical context of the use.

- 3.2 In most cases the description of the use is a summary of detailed reviews, investigations or studies produced by the NRA and/or other organisations. Support documents may therefore be available for those interested in learning more about the catchment.

NATURE CONSERVATION AND LANDSCAPE

- 3.3 The term "river landscape" describes the entire river corridor and incorporates all the physical and ecological uses and values in the corridor. The limits of a river corridor are arbitrarily defined, but can include the area viewed from the river or a river valley and in some instances the entire flood plain.
- 3.4 The landscape reflects the complex interplay between the natural environment and man's activities. Geomorphology, topography and drainage provide the basic elements of the landscape and, together with associated vegetation and settlement patterns, determine the essential landscape character of different areas.
- 3.5 A key element of a river landscape is the natural environment. Thus, nature conservation is a central feature in the river landscape.
- 3.6 The NRA seeks to maintain and enhance the quality of the river landscape as part of its statutory functions. In most instances, the Authority does not have direct control over the development of the river corridors and must rely on influencing the planning process and the use of advocacy techniques to influence development.

- 3.7 The NRA would wish for local authorities to review the extent of their non-statutory landscape designations and has made representations for the Upper Thames Valley to be protected by such a designation. To this end the NRA has carried out Strategic Landscape Assessments within the CMP area.

Catchment Perspective

- 3.8 The Cotswold hills (covering the north part of the catchment area) are considered to be a high quality landscape. It is characterised by open wolds, dry stone walls, ancient woodlands and shelter belts, deep river valleys with meandering streams and historic towns and villages. The Oolitic limestone of the Cotswolds supports unimproved grasslands and beech woods of a high nature conservation value.
- 3.9 The River Churn valley to the north of Cirencester is an attractive open, flat valley with water meadows. The Coln and Leach occupy narrow, deep valleys which break up the smooth, undulating expanse of the Cotswold dip slope.
- 3.10 The very high quality and variety of the Cotswold's landscape has been recognised through its designation as an AONB by the Countryside Commission. The northern section of the catchment area between Cirencester and Brockhampton lies entirely within the Cotswold AONB. A management plan for the AONB is in preparation by the Cotswold AONB Joint Advisory Committee (including Gloucestershire CC and Vale of White Horse DC). An Issues Report was published in April 1994 towards a draft management strategy by mid 1995.
- 3.11 Part of the Cotswold hills have been designated an Environmentally Sensitive Area (ESA) by MAFF and there are in addition a number of countryside stewardship schemes in operation in the area. Both schemes offer management agreements to farmers and land managers to enhance and conserve landscapes and habitats.
- 3.12 The Cotswold Water Park has become one of the largest concentrations of open water in southern Britain. The calcareous nature of the water makes natural vegetation and invertebrate colonization extremely rich and varied. There are 26 SSSIs within the area, and the Cotswold Water Park SSSI has recently been designated by English Nature, including eleven of the lakes in the Water Park area (see Figure 10). This designation is based upon the plant communities present. In addition to the SSSIs, many other sites of notable conservation value have been identified and form an important part of the ecological resource of the catchment area.
- 3.13 The Cotswold Water Park is of national importance for wildfowl and qualifies for SPA and RAMSAR status, although its eligibility for such status has recently been questioned. The site is however significant for the wintering populations of seven-

bird species and breeding populations of two bird species.

- 3.14 There are extensive areas of Ancient Woodland to the north and west of Cirencester particularly along the valleys of the rivers Churn and Coln.
- 3.15 Land use in the southern half of the catchment area is dominated by Swindon, by transport corridors and other infrastructure uses such as the airfields at Fairford, South Cerney and Kemble.
- 3.16 The southern part of the catchment area to the south east of Swindon lies within the North Wessex Downs AONB. Other countryside areas to the north of Wroughton and Wanborough, south and east of Highworth, and south west of Cirencester are designated by the respective local authorities as either Important Local Landscapes, Special Landscape Areas or Areas of High Landscape Value, rural buffer zones or important areas of open land.
- 3.17 The Upper Thames Otter Habitat project was initiated by NRA-TR and is co-funded by the NRA and British Telecom. The project is run by the Bucks, Berks and Oxon Naturalist Trust (BBONT) in conjunction with the Gloucestershire Wildlife Trust and the NRA. The project, which commenced in 1992, seeks to enhance and improve aquatic and riparian habitats to benefit all wildlife and especially to encourage wild otters (which had become extinct in Oxfordshire in the 1970s) to recolonise the region naturally. This project will continue during 1994/95.
- 3.18 River corridor surveys have been carried out within the last two years on the Rivers Cole, Ray, Churn and Ampney Brook and will be undertaken on the Rivers Coln and Leach in 1994/95. The corridor surveys on the Cole and Ray were commissioned to provide information which could be incorporated into the development plans for the creation of a community forest in the Swindon Area. Their general conclusion served to confirm that the rivers in the northern part of the catchment have a higher ecological value than those in the south. These lower values in the south were attributed to intensive agriculture and urban development.
- 3.19 The NRA has undertaken a strategic landscape assessment of the Coln and Leach catchments. The assessment concluded that much of the river corridor in these catchments is worth conserving whilst certain reaches have been degraded and warrant restoration. The findings of the assessment are discussed in Section 4.

Table 3.1 - Upper Thames - Sites of Special Scientific Interest

Name	Grid Ref.	Nearest watercourse	Type
Barnsley Warren	SP 055064	Ampney Brook	BotG
Elmlea Meadows	SU 079948	Thames	BotG
Foss Cross Quarry	SP 056092	Ampney Brook-remote	GeoL
Hampen Railway Cutting	SP 062205	Remote	GeoH
Hornsleasow Roughs	SP 117323	Remote	BotG
Puckham	SP 010224	Trib of Coln-remote	Bot3
Whelford Meadow	SP 168000	Coln	BotG
Winson Meadows	SP 0903081	Coln	BotG
Wicklesham & Coxwell Pits	SU 28559425 SU 28959415 SU 29209420	Cole-remote	GeoG
Tuckmill Meadows	SU 240900	Tuckmill Brook	BotG
Burderop	SU 165810	Ray	BotW
Clattinger Farm	SU 012933	Thames/Swill Bk	BotG
Clouts Wood	SU 137796	Ray	BotW
Coate Water	SU 188820	Dorcan Brook(Cole)	FauB
Emmet Hill Meadow	SU 009901	Thames/Swill Bk	BotG
North Meadow	SU 098944	Thames	BotG
Okus Quarry	SU 147836	Ray	GeoP
Restrop Farm & Brockhurst Wood	SU 073866	Thames/Key	Bot2
The Coombes	SU 228826	Trib of Cole	BotG
Old Town Railway Cutting	SU 153832	Ray	GeoJ
Upper Waterhay Meadow	SU 069837	Thames	BotG
Pike Corner	SU 036934	Thames/Swill Bk	BotG
Stony Furlong Railway Cutting	SP 063106	Trib of Coin	GeoL
Distillery Farm Meadow	SU 027892	Thames/Swill Bk	BotG
Wildmoorway Meadows	SU 066973	Churn	BotG
Key to types:			
BotG -	Botanic/grassland	GeoL -	Geological/Limestone
BotW -	Botanic/woodland	GeoG -	Geological/gravel
Bot2 -	Botanic/grassland woodland	GeoP -	Geological/Portland Succession
Bot3 -	Botanic/grassland woodland marshland	FauB -	Fauna/bird population

- 3.20 MAFF have produced a guide 'Water Level Management Plans - A Procedural Guide for Operating Authorities'(1994) to assist operating authorities responsible for flood defence and land drainage in the preparation of such plans. **Water Level Management Plans** provide a means by which the water level requirements for a range of activities in a particular area, including agriculture, flood defence and conservation (for example water dependent SSSIs) can be balanced and integrated. Part of this guide stresses the importance of water levels to agriculture and soil structure. As composed these plans will form an essential input to CMPs. English Nature are currently programming key sites for management planning. There are no high priority sites in this catchment.

Environmental Objectives

- 3.21 To protect and conserve highly valued river landscapes and enhance degraded river landscapes.
- 3.22 To safeguard and enhance the special ecological interest for which sites have been designated (eg SSSI).
- 3.23 To promote the conservation of all aquatic life and associated non-aquatic organisms in the river corridor, and to protect the integrity of all habitats of nature conservation value.
- 3.24 To carry out channel and riparian enhancement schemes on currently degraded rivers and river corridors.

FISHERIES

- 3.25 This use relates specifically to the maintenance of breeding populations of salmonid (ie game) and cyprinid (ie coarse) fish. European Commission (EC) Freshwater Fisheries Directive (78/659/EEC) "on the quality of waters needing protection or improvement in order to support fish life" provides a statutory basis for the protection of water quality in certain rivers. Fish populations provide useful information on the general health of the aquatic ecosystem because:

- they are biological indicators of changes in river flow, habitat and quality;
- they are exploited by commercial and recreational fisheries;
- they contribute to the diversity of the water environment.

Catchment Perspective

- 3.26 The catchment provides high quality game and coarse fishing. The limestone streams to the north of the catchment, including the Leach, Coln and Churn, contain good populations of brown trout whilst the streams to the south tend to support coarse fisheries. The condition of the fisheries in each of the main rivers, based on the most recent surveys, are described below.
- 3.27 The River Thames supports a coarse fishery. When last surveyed in 1987, poor water quality, probably attributable to effluent from the Swindon Sewage Treatment Works (STW), was having a noticeable impact on the fishery. With recently improved effluent quality from the works the fishery should improve. Poor habitat also affects the fishery in this area.
- 3.28 The River Leach supports a thriving brown trout population. In the downstream reaches rainbow trout are present as a consequence of escapes from fish farms. Coarse fish from the River Thames are also found in the lower reaches.
- 3.29 The Coln below Bibury is managed as a trout fishery, both recreational and commercial. The river is regularly stocked with takeable size trout. Trout are also present in some of the upper reaches. In general the Coln fishery is good, however, the recruitment of young fish is poor, possibly as a consequence of low flow constraints and the siltation of spawning gravels.
- 3.30 The fishery in the Ampney Brook is poor, mainly as a consequence of very low flows. In 1989, 90 and 91 (as a consequence of severe drought) the Brook dried up completely and the only fish present have migrated into the Brook from the River Thames.

Figure 11 - Fisheries

- 3.31 Upstream of the Cotswold Water Park, the River Churn is an important recreational brown trout fishery. The river is regularly stocked. Downstream of the Water Park coarse fish tend to dominate as a consequence of a change in habitat and fish moving upstream from the River Thames. The trout fishery in the upper reaches does not perform as well as expected.
- 3.32 The River Ray below Swindon STW sustains a healthy coarse fish population. However, further downstream the fishery deteriorates. Upstream of Swindon STW the fishery is not viable as a consequence of insufficient, **but natural**, flows.
- 3.33 The River Cole contains a coarse fishery. This fishery does not perform as well as might be expected. A combination of urban and industrial sources in the Swindon area have led to pollution incidents and poor quality run-off which are a likely cause for the poor performance. In addition, past unsympathetic drainage works appear to have detrimentally affected in-stream habitat.
- 3.34 The Cotswold Water Park provides a mixture of high quality game and coarse fisheries.
- 3.35 Both the Water Park and many of the rivers are regularly stocked by the NRA and Angling Clubs. Stocking is carried out for a variety of reasons, including the replacement of stock caught by anglers, establishment of fisheries in the newly filled extraction pits and to re-establish the fishery following a pollution incident.
- 3.36 The NRA undertakes surveys of the fisheries every five years. These surveys collate data on habitat, biomass (the weight of fish per square metre of water surface) and collect general information on a range of factors, including flows and the impacts of pollution incidents.
- 3.37 Improvements to the fishery habitat in the River Ray are being considered by the NRA and a habitat improvement scheme is planned for a section of the River Cole at Coleshill. This scheme is part of an EU LIFE supported demonstration project on river restoration - one of only two sites chosen in the UK. The aim of this project is to illustrate the integrated approach to comprehensive restoration on environmentally degraded rivers. The project will be run by RPP Ltd and partially funded by the NRA (approximately £70K over 3 years for NRA-TR alone). Works will include re-profiling the channel to include pool/riffle sequences, restoration of river bank and corridor habitats, restoration of river meadow whilst maintaining flood protection standards and improving access to the site. The project may require a degree of pre- and post-project monitoring such as geomorphology, water quality including sediment monitoring, hydrology, ecology and public perception.
- 3.38 In both the Ray and the Cole, the improvements in habitat are required as a

consequence of unsympathetic drainage and channel maintenance activities in the past. Habitat enhancement is also taking place on the river Leach at Fyfield.

Environmental Objectives

- 3.39 To work towards the production of a diverse and sustainable fish population within the catchment.
- 3.40 To identify and address physical, chemical and biological factors preventing the achievement of the above.
- 3.41 To safeguard and maintain the water quality of all designated salmonid and cyprinid fisheries.

HERITAGE

- 3.42 Heritage deals with features of archaeological significance, areas which have been designated as conservation areas because of their urban form, and sites which are of heritage value because of their historic or archaeological importance. Many of these sites have a strong relationship with the landscape.

Catchment Perspective

- 3.43 The counties of Wiltshire, Oxfordshire and Gloucestershire contain a wealth of archaeological features which vary from isolated visible remains such as earthworks, to broad tracts of countryside where the range of features creates an archaeological landscape. Important features within the catchment area include barrow groups, ancient trackways and Roman roads, Iron Age hill forts and the archaeological features of the North Wessex Downs and the Upper Thames Valley.
- 3.44 Although much of the area is famous for its ancient landscape, it also has many features representing later periods including Saxon and medieval settlements and their field systems, and post medieval features such as water meadows. In terms of industrial heritage, there are a number of important features such as the Thames and Severn and Wilts and Berks Canals. There are a large number of Ancient Monuments in the catchment area with particular concentrations in Cirencester and Cricklade.
- 3.45 The Catchment Area also has a large number of conservation areas, buildings of historical or architectural interest, large country houses and many parks and gardens of special historic interest as listed by English Heritage.

Environmental Objectives

- 3.46 To safeguard the special archaeological and heritage interest for which sites have been designated (eg conservation areas).
- 3.47 To conserve and enhance areas of archaeological and heritage value.

AMENITY AND RECREATION

- 3.48 Activities such as walking, bird watching, angling, boating, sailing, rowing, canoeing, cruising and picnicking bring people into close proximity with the water. The principal concerns are general aesthetic acceptability of water features, access to and along watercourses and the provision of appropriate facilities. The key physical resources in the catchment include the rivers themselves, and the Cotswold Water Park, an area containing over thirty man-made lakes.

Catchment Perspective

- 3.49 The River Thames Recreation Strategy, currently in its consultation stage, is a project co-funded by the Sports Council in conjunction with the NRA. The main aim of producing this strategy for the River Thames and its banks is to optimise its recreational potential while conserving the landscape and heritage value. The Thames Recreation Strategy will also form an important part of the catchment management planning process, providing guidelines for the management of the River Thames as a recreational resource.
- 3.50 The catchment area is of value for both informal countryside recreation and leisure, and for organised sports activities. There is an extensive network of rights of way including a number of long distance paths such as the Thames Path, the Ridgeway and the d'Arcy Dalton Way (see Figure 12).
- 3.51 The key recreational resources are the River Thames and the Cotswold Water Park, both of which are used for a range of recreational activities, including cruising, canoeing, angling, walking and boating. The majority of the major river are used for some form of recreation, mostly angling.
- 3.52 The Thames Path was designated by the Secretary of State for the Environment in September 1989. It is being jointly promoted by the Countryside Commission and the NRA and the declared intention is to establish a walkway for over 200 miles from the Thames Barrier at Greenwich to the source of the River Thames near Kemble, Gloucestershire. In the Upper Thames, the Thames Path will increase awareness of this remote area and encourage an increase of visitors especially to its official source known as Thames Head which is situated close to Kemble.
- 3.53 The Cotswold Water Park is an important recreational resource. Thirty four lakes accounting for about half the total water area of the park are used for some form of water-based recreation including water skiing, dinghy sailing, jet skiing, windsurfing, game and coarse angling. A few areas have been developed as Country Parks (Keynes and Neigh Bridge) or for public access and picnicking. Recently cases of Dermatitis were reported from persons in contact with the water

Amenity & Recreation



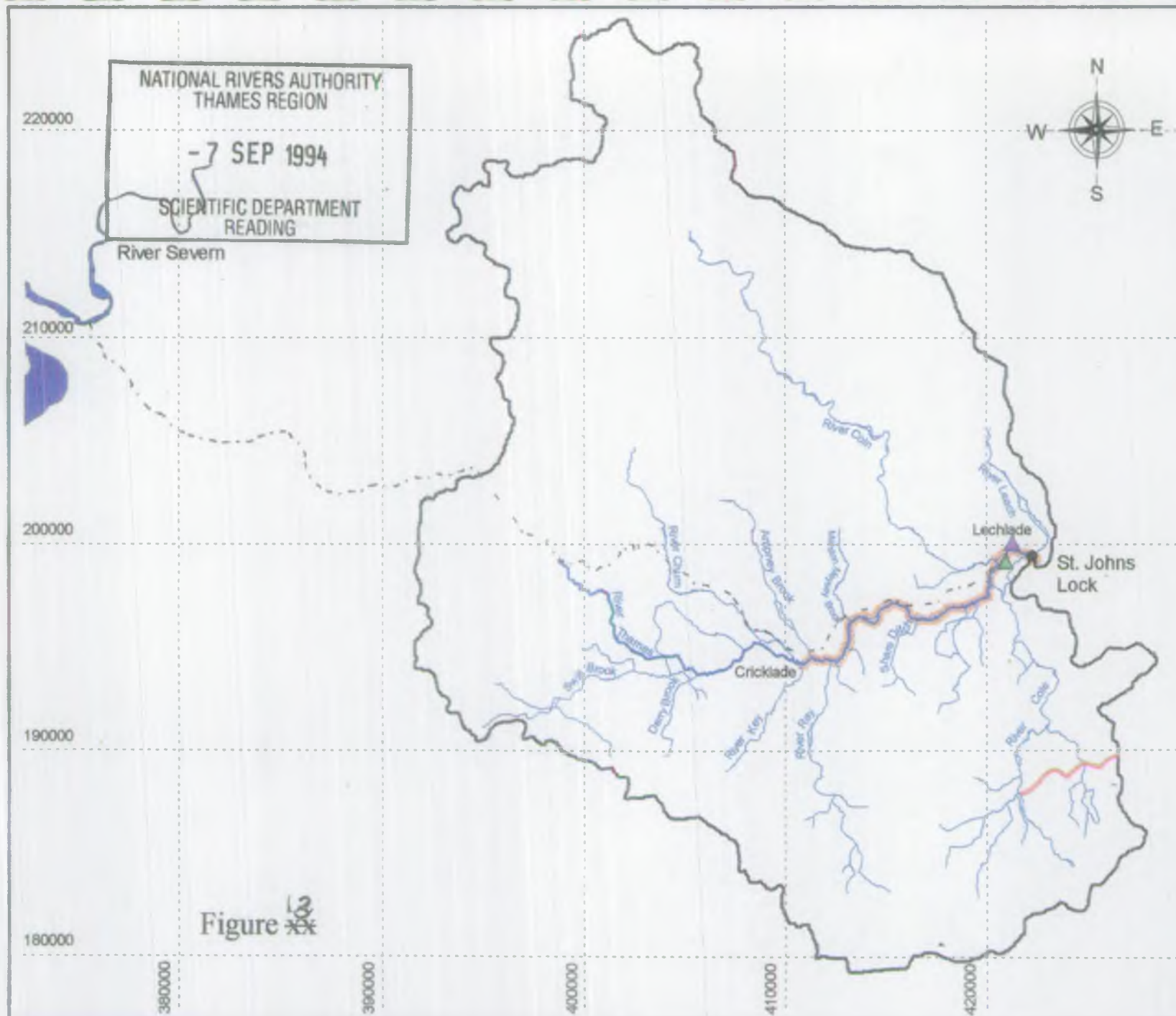
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at Keynes Country Park. The NRA were called in to identify the offending organism and signs were erected warning the public about the problem. Public footpaths and bridleways have also been improved and developed. Several lakes remain unrestored and there is further potential for recreational activities.

- 3.54 Within the Water Park area, eleven of the lakes are designated as SSSIs. It is therefore essential that the requirements and pressures of recreation are balanced with the significant conservation interest of the area.
- 3.55 A number of tourism-related developments have taken place in the western section of the Water Park, including The Watermark holiday homes development, Cotswold Hoburne caravan park and Gloucestershire CC South Cerney Water Sports Centre. Permission has also been given for two golf courses and a hotel at Fairford and South Cerney and there are proposals for an international rowing and canoeing course at Cleveland Lakes.
- 3.56 Angling is an important recreational use of much of the catchment including the Cotswold Water Park. There are in excess of 25 angling clubs in the catchment and this large number is indicative of the high level of fishing interest.
- 3.57 Canoeing is also an important recreational use. Currently canoeists use reaches of the Rivers Thames, Ray, Churn and Coln.










Environmental Objectives

- 3.58 To protect and promote all appropriate water related recreational uses, including the provision of sufficient access as required for recreational purposes.



Upper Thames CMP:

Navigation

-  CMP Boundary
-  River Thames
-  Main River
-  Rights of Navigation
-  Line of Wilts & Berks Canal
-  Severn - Thames Canal Route
-  Lock
-  Moorings (4)
-  Marina

Scale:-
10km



NRA

National Rivers Authority
Thames Region

NAVIGATION

- 3.59 This use relates to those waterways for which there is a statutory right of passage for boat traffic. The amenity and recreation, fisheries and landscape and heritage elements of navigation are considered in other use category descriptions.

Catchment Perspective

- 3.60 Within the plan area the Thames is a public navigation between St Johns Lock and High Bridge, Cricklade (19.2 km/12 miles). Above that the river is private and the right to navigate must be negotiated with the riparian landowner (see Figure 13).
- 3.61 Above Lechlade the Thames is relatively narrow and shallow and it is impossible for large craft to cruise much beyond Inglesham. Engineering works to increase the navigability of this stretch to Cricklade have been reviewed in the past. A decision was taken by NRA and the local Authorities not to change the important natural habitat of the river in this area. It is however, still a public navigation for all craft able to cruise to Cricklade.
- 3.62 The only lock within the area is St. Johns Lock at Lechlade. It is here that the statue of Old Father Thames rests. This statue originally marked the site of Thames Head near Kemble in Gloucestershire but was moved to its present site in 1974.
- 3.63 The limited moorings in this area are fully utilised. There are about 50 moorings situated at the Roundhouse, the Trout, Lechlade and Inglesham, all privately owned as well as at St. Johns Lock and Buscot Lock which are NRA owned. Approximately another 120 off-river moorings exist at the Riverside Marina, Lechlade.
- 3.64 There are plans to reopen the Thames-Severn and Wilts-Berks canal. Whilst these canals will undoubtedly provide a valuable recreation resource, their reopening raises a number of multifunctional issues including water supply, water quality management and conflict with other uses. Probably of most immediate concern is the issue of water resources as a consequence of the limited potential for water resource development in the catchment.

Environmental Objective

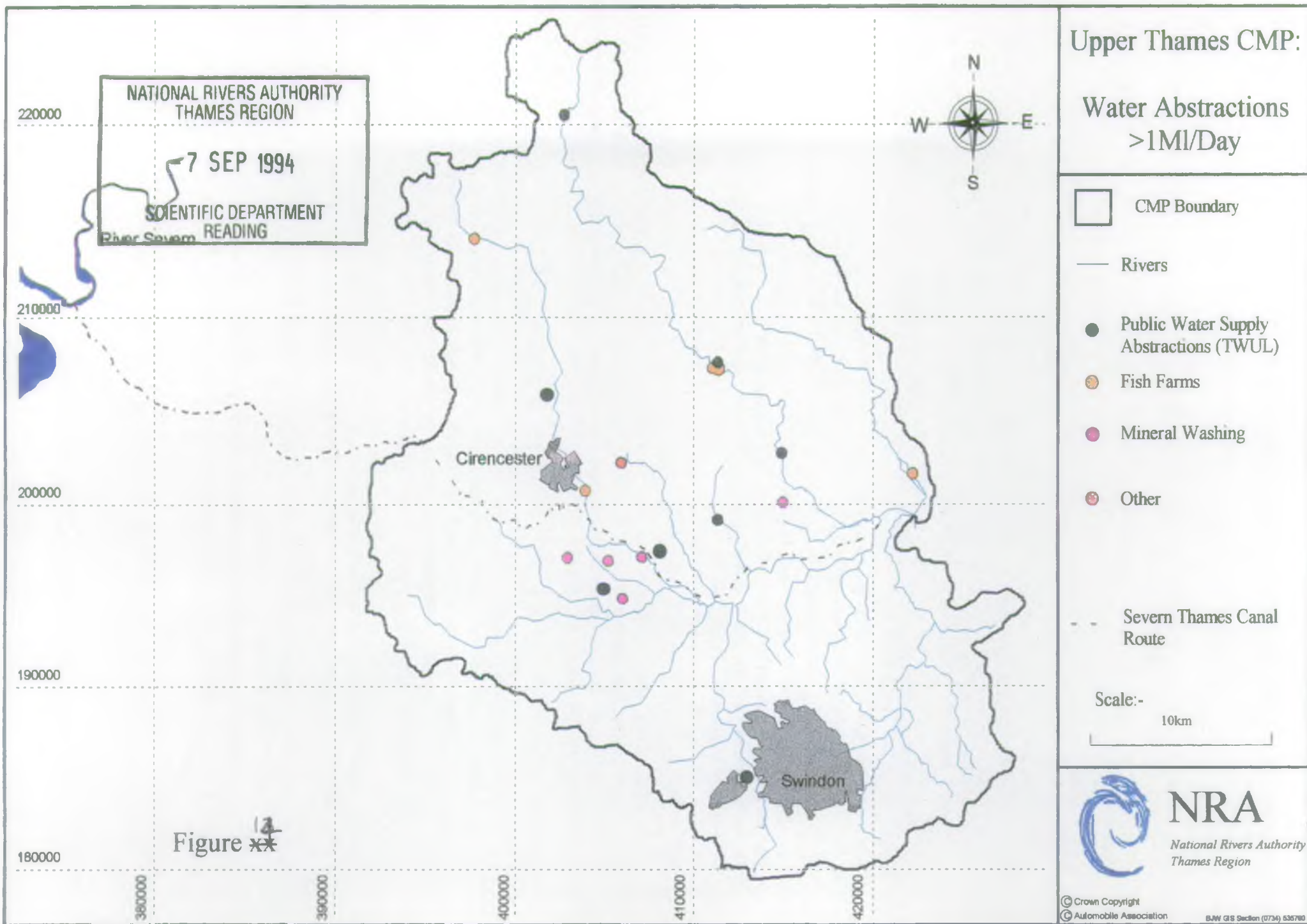
- 3.65 To maintain or improve water resources and physical characteristics in the catchment to sustain the Thames navigation.

WATER ABSTRACTION

- 3.66 This use deals with surface and ground water abstractions for potable (ie public water supplies) and non-potable (eg industrial, agricultural, recreational) supplies. Major potable abstractions are operated by Water Supply Companies in this case Thames Water Utilities Ltd (TWUL). Since 1963 abstractions have been licensed to ensure they do not have a significant impact on existing sources, surface water flows and the water environment. Abstractions of less than 20m³ per day for domestic use do not require a licence from the NRA.

Catchment Perspective

- 3.67 Abstraction is the removal of water from rivers or ground water and may vary in size from the small amounts needed from a garden well to supply a single household, to the large quantities needed from a river to flow through a fish farm. In the Upper Thames catchment, rivers and ground waters are both used to supply various needs. Abstraction from rivers is dominated by the requirements of Fish Farms (99%), whilst Public Supplies are the main abstractions from Ground waters (see Figure 14).
- 3.68 The major aquifers (water-bearing rocks) are the Great and Inferior Oolites (limestones) which form the Cotswold Hills. The Great Oolite is a more important source than the Inferior Oolite. There is some Chalk in the area, but this is restricted to the escarpment of the Marlborough Downs in the south and has only local significance.
- 3.69 The NRA's regulatory role in the management of abstraction is governed by the Water Resources Act 1991 which sets out a system of Abstraction Licensing (see Section 4 : Water Resources). Licences enable the NRA to control abstractions by setting limits on the amount which may be taken and the purposes for which the water may be used. When considering new proposals, the NRA also has powers to impose conditions to protect the environment.
- 3.70 Abstraction licence inspections are carried out to ensure that the licence holder understands what the licence says, and to ensure that the licence holder is complying with the conditions of the licence. The frequency of the visits depends upon the environmental impact of non-compliance. There are 236 licences in the Upper Thames catchment. In the past 12 months 66 of the targeted 95 visits were undertaken due a shortfall in resources - in this case all the high impact licences were concentrated on. Targets next year will change to approximately 85 inspections as a results of the introduction of a new national scheme for enforcement.



- 3.71 Table 3.2 shows details of the amounts of water actually abstracted from each type of source for a variety of purposes in 1992. Figures are in Millions of Litres per day (Ml/d [1 Ml/d is equivalent to 220,000 gallons per day]). The Total Authorised Abstraction volume is about 170 Ml/d over half of which is for Fish Farming and is totally returned to the river after use. The average amount of water input from rainfall, after evaporation and plant growth, which is effective in recharging ground water and supporting river flow is about 950 Ml/d, which compared to a net abstraction for consumptive uses of 65 Ml/d demonstrates the area carries a generally low abstraction load.

Table 3.2 - Water Abstraction by Source Type

Use	Sources and abstraction (Ml/d) in 1992						Total
	Gt. Oolite	Inf. Oolite	Corallian	Gravels	River	Chalk	
Public Water Supply	33.81	19.82			0.0	0.32	53.95
Private Water Supply	.28	0.47	0.0	0.02	0.15	0.03	0.95
Agriculture	1.11	0.06	0.15	0.24	0.23	0.14	1.93
Spray Irrigation				0.10	0.40		0.5
Washing				5.30			5.30
Industrial Processes	0.04			0.17			0.21
Fish	0.13				85.21		85.34
Water Transfer	0.02				0.08		0.1
Cooling	0.00						0.00
Flow Augmentation	0.00						0.00
Totals	35.39	20.35	0.15	5.83	86.07	0.49	148.28

Environmental Objective

- 3.72 To manage water resources to achieve the right balance between the needs of the environment and those of the abstractors.
- 3.73 To ensure that Licence Holders understand and comply with the terms and conditions of the licences.
- 3.74 To ensure that abstraction does not-cause any deterioration of water quality.

EFFLUENT DISPOSAL

- 3.75 This use relates to the disposal of domestic, industrial and agricultural effluents to the river system and to ground. Discharges can affect both the quality and quantity of a river. In terms of water quality discharges can have a severe impact on a river. From a water quantity perspective effluent discharges can maintain river flows during times of drought.
- 3.76 All discharges direct to receiving waters in the catchment are controlled by means of either NRA consents or HMIP authorizations. These are legal documents issued by the NRA which impose conditions on the quantity and quality of a discharge in order to protect the environment. The regulators have powers to monitor both the quantity and quality of these effluents and if the conditions are not being met, to take action to ensure compliance.

Catchment Perspective

- 3.77 There are 161 consented discharges into the Upper Thames catchment, 78 of which have a maximum consented volume of more than 5 cubic meters per day. The majority of these discharges are either TWUL or private STWs (see Figure 15 below). The largest discharges by volume are those from the TWUL STWs and fish farms. The larger sewage effluent discharges and the standards they are required to achieve are shown in Table 3.2 whilst information on the total number of discharges is presented in Table 3.3.
- 3.78 Changes to the consents and/or the STWs have been proposed at 14 of the 30 TWUL STWs in the catchment in order to meet the requirements of EC Directives and to provide better protection for the aquatic environment (see Figure 16). The proposed changes have been included in the TWUL Asset Management Plan (AMP 2) submitted to the Office of Water Services (OFWAT). Discussions are taking place between the NRA and TWUL to agree priorities for action on a region-wide basis.
- 3.79 The larger sewerage discharges and the standards they are required to achieve are shown in Table 3.2 whilst information on the total number of discharges is presented in Table 3.3.

Figure 15 pie charts



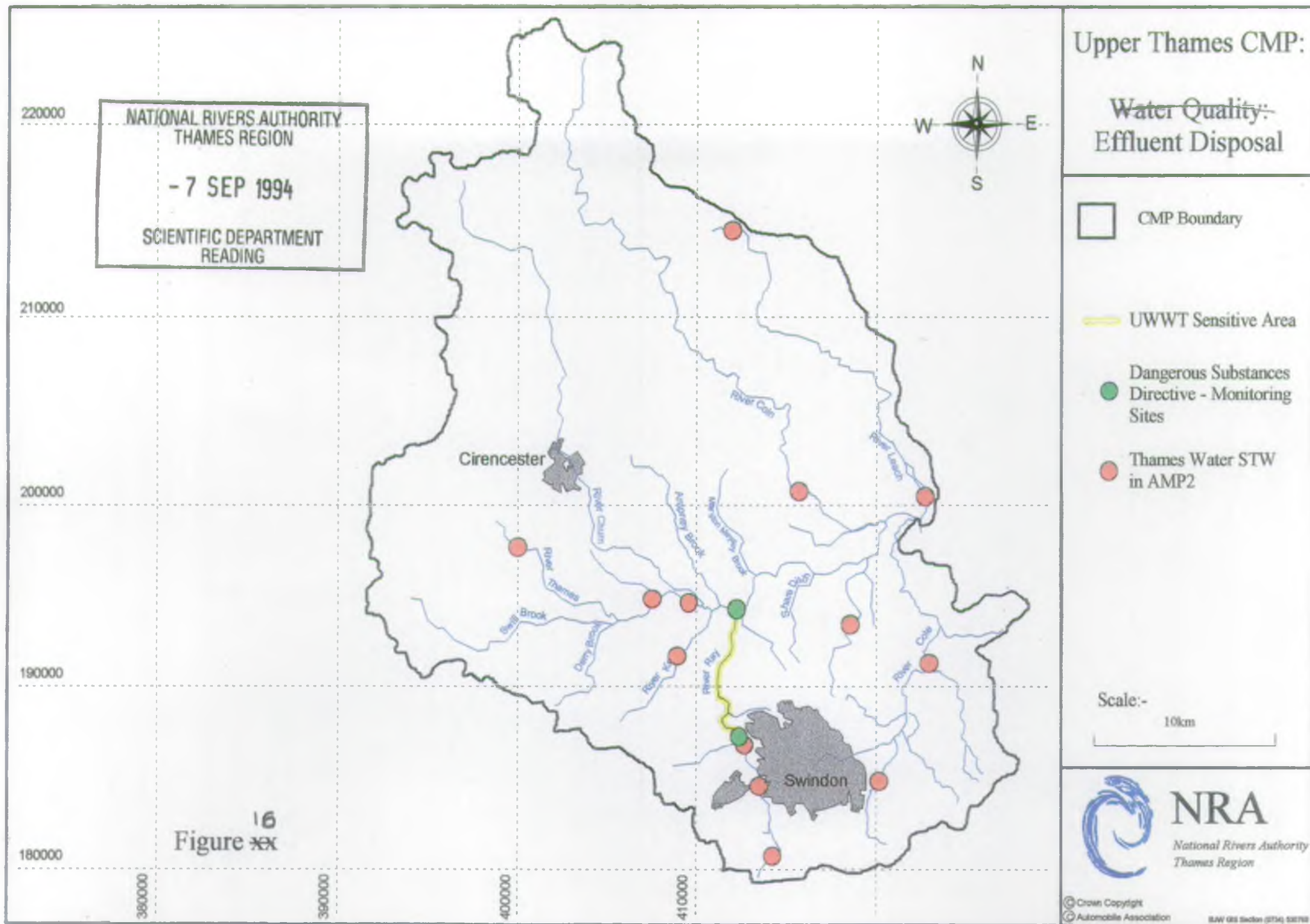


Table 3.2 - Major Sewage Effluent Discharges

River and effluent source	Consented Volume (m ³ /d)	Type of discharge	General Consent Conditions (SS/BOD/Amm. N all mg/l)
River Ray			
Swindon	132,900	Sewage effluent	17/11/5
Wroughton	6,000	Sewage effluent	30/20/4
Thames			
Cirencester	40,000	Sewage effluent	25/10/12
Purton	2,835	Sewage effluent	45/30
Coln			
Fairford	1000	Sewage effluent	45/30
Cole			
Highworth	5,700	Sewage effluent	35/20/10
Shrivenham	6,000	Sewage effluent	45/30
Leach			
Lechlade	4,975	Sewage effluent	45/30/5

Table 3.3 - Other Major Discharges

Type	Sub-Type	Sub Total	Sub Total (Vol m ³ /day)	Total	Total Volume m ³ /day
TWUL STW				30	213.157
Non TWUL STW				94	1,923.8
Private	Fish farms	9	182,364		
	Mineral Workings	8	64,287		
	Farms	9	253.5		
	Other	11	11,159	37	258,063.5
Totals				161	500,144.3

- 3.80 The River Ray is the most heavily used river in the catchment for effluent disposal. During low flow a significant proportion of the flow of the Ray is made up from effluent from the Swindon STW. Recently the Swindon STW has been upgraded, resulting in improved water quality and this improvement should result in a healthier river ecosystem in the River Ray.
- 3.81 In 1993 only two TWUL STWs were recorded by the NRA as failing to meet their discharge consent. These works were Andoversford and Purton Other smaller private STWs also failed.

Environmental Objectives

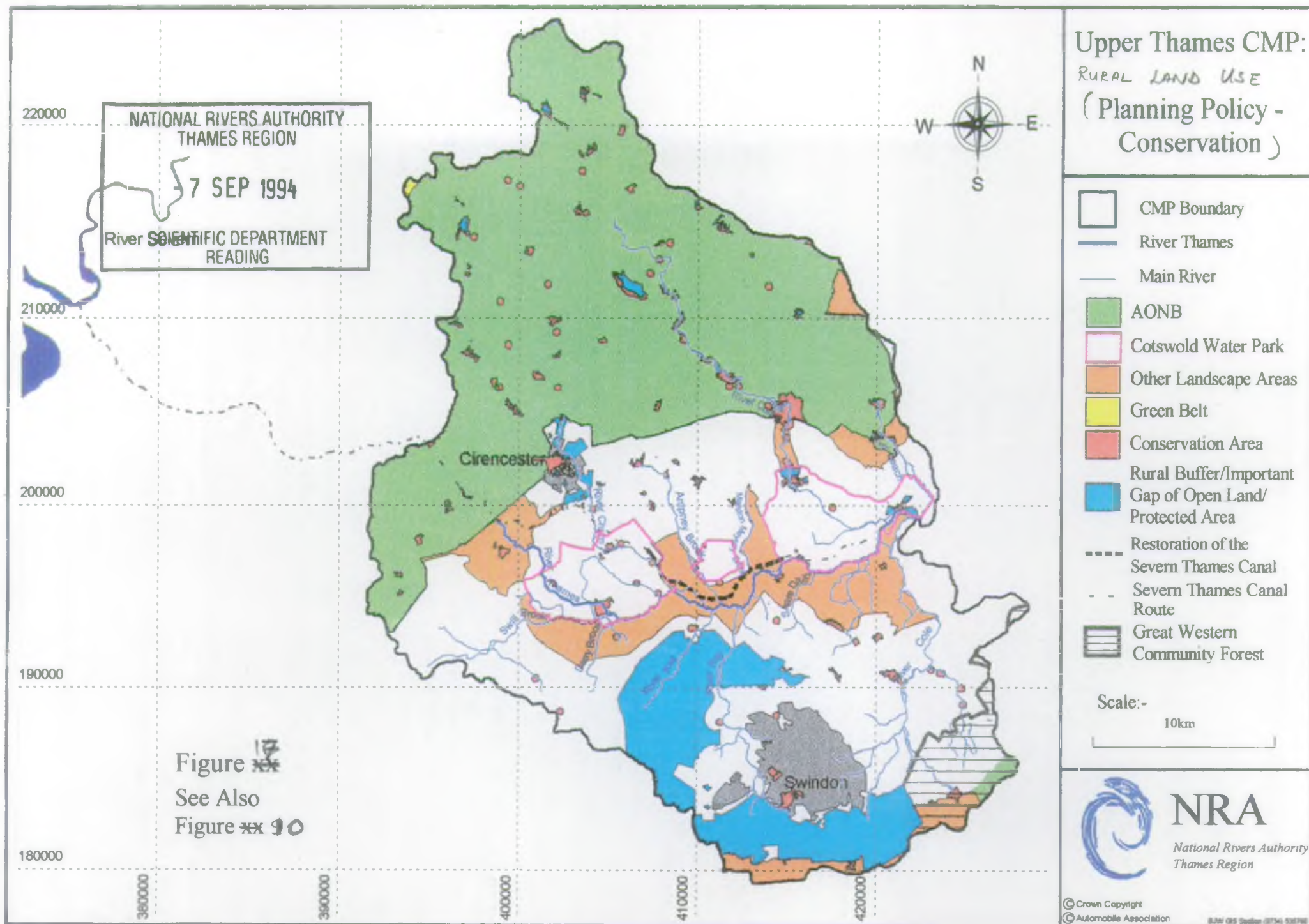
- 3.82 To control the discharge of effluent to the water environment in such a way that water quality objectives are achieved, nature conservation and fisheries interests and other uses are not compromised.

RURAL LAND USE

- 3.83 Rural land use relates mainly to agricultural policy and the environmental and water resource aspects of agriculture.

Catchment Perspective

- 3.84 MAFF estimate that the majority of farms in the catchment area are likely to be of good to moderate quality ie classified as Grade 3 land. The agricultural land use within the catchment area is principally general cropping followed by grassland. For the cropped areas around 69% are for cereals, 26% for break crops such as oilseed rape, beans and linseed with horticultural crops, sugarbeet and potatoes grown to a lesser extent.
- 3.85 The study area falls into three district areas in terms of agriculture. The first is the dip slope and valleys of the **Cotswolds**. The limestone soils of the dip slope are predominantly under (arable) crops including cereals and oilseed rape. The steeper slopes are under permanent grass with significant areas of woodland in the valley slopes of the Churn and Coln and in several large parks. The valley floors are generally under meadow land for sheep and cattle.
- 3.86 The second major area is the **Vale of the Thames**, a broad alluvial plain used to graze both sheep and cattle but with significant areas under arable farming where the fertile soils are better drained such as over terraces and hilly limestone outcrops.
- 3.87 The third area includes the low hill country around **Swindon**, the **Vale of the White Horse** and the scarp slope of the **White Horse Hills**. This is an area of mixed farming varying with soils, drainage and slope. The low hills around Swindon enjoy well drained, tillable soils supporting both arable farming and grazing. The Vale of the White Horse is largely under grass with arable farming on the better drained slopes. The scarp slope of the chalk downs is under permanent grass grazed by sheep but with versatile, well-drained soils at its foot.
- 3.88 Over the last decade, the area of cropped land has declined by approximately 15% which is particularly due to the decline in cereal production. The introduction of Common Agricultural Policy (CAP) reforms in 1992 also resulted in a decrease in the area of arable land. These reform measures require all but the smallest farms to set-aside 15 % (minimum) of land growing cereals, oilseed and protein crops in order to receive Arable Area Payments. On the land that is set-aside, agricultural crops for food production cannot be grown for the duration of the set-aside period. In addition farmers are not allowed to apply artificial fertilisers or pesticides. They are encouraged to manage the land in an environmentally beneficial manner.
- 3.89 Grassland has also declined over the last decade. Cattle numbers predominantly dairy have fallen by 26% as have pigs and poultry. In comparison sheep numbers have increased by 24%



- 3.90 Regarding farm size approximately 58% of holdings are over 20ha with the predominant full-time holdings keeping cattle and sheep.
- 3.91 As occurs in this catchment, agricultural areas have the opportunity for grant-aided conservation and enhancement of landscape and wildlife either through Countryside Stewardship or **Environmentally Sensitive Areas (ESA)**. Such voluntary designations have an impact on the management of agricultural land and therefore indirectly on the water environment. The ESA Scheme was introduced to help protect those areas where the landscape, wildlife or historic interest are of national importance, from the changes brought about by the development of more intensive farming methods. The scheme encourages farmers to adopt agricultural practices that will help protect and enhance the environment. Farmers enter into management agreements with MAFF and in return receive an annual payment for each hectare of land entered into the scheme. Two ESAs have been established within the Catchment plan area:
- (i) **Upper Thames Tributaries**
This area was designated in 1994 and covers the Thames from Oxford to Kelmscott including the flood plains of the Rivers Ray, Evenlode and Windrush. In the Upper Thames Tributaries, MAFF's aim is to conserve and enhance the diverse wildlife of the area's valuable wet grassland. Farmers who enter the scheme must agree to farm in ways which help nature conservation, for example by limiting their use of fertilisers and pesticides. They must also maintain landscape features such as hedges, traditional farm buildings and trees. Farmers are encouraged to increase area of grassland and to raise water levels to create the right conditions for nesting and over-wintering birds.
 - (ii) **The Cotswold Hills**
This area was also designated in 1994 and extends south west of Chipping Campden, South of Cheltenham to Malmesbury. MAFF aims to maintain and enhance the traditional landscape of the Cotswolds, wildlife interest and to conserve and protect areas of archaeological and historic interest. Farmers who enter the scheme must agree to maintain existing grassland and not to increase the area of arable farm land. They must restrict the use of pesticides and fertilisers and restore dry stone walls using traditional techniques and materials. In addition, farmers are encouraged to revert arable land to extensively managed permanent grassland.
- 3.92 **Nitrate Vulnerable Zones (NVZ)** require farmers, in areas where water sources are high in nitrate, to observe a programme of compulsory measures such limiting the timing and volume of organic manure and inorganic fertiliser application. A NVZ has been proposed at Fairford (see Section xx).
- 3.93 The **Great Western Community Forest Project** (see Figure 17) covers the southern part of the catchment area. This is one of twelve national forest projects to be undertaken by the local authorities in association with the Countryside

Commission and the Forestry Commission. It will cover 20,000 hectares around Swindon and will seek to create a variety of landscapes incorporating farmland, wetland, meadows, lakes and parkland as well as woodland. It is intended to increase tree cover to between 25% - 35% in the Community Forest Project area, to conserve and enhance waterside landscapes and habitats and integrate conservation and recreation opportunities along the rivers.

Environmental Objectives (still to be completed)

- 3.94 Pollution Prevention
- 3.95 Water Resources
- 3.96 realise opportunities for environmentally sensitive agricultural practice in terms of ESA and NVZ.
- 3.97 Buffer zones / set aside

URBAN LAND USE

- 3.98 Urban land use covers urban development, such as the construction of new roads and the growth of urban centres. Development of urban areas can have a significant impact on the water environment, including the river landscape, water quality (in urban streams) and water resources.

Catchment Perspective

Gloucestershire

- 3.99 Within the northern part of the catchment area Gloucester CC exercise a policy of development restraint. Cirencester is the main town in the northern part of the catchment area but development pressure here is resisted and where possible diverted to Wiltshire ie Swindon. Limited residential development is planned in Cirencester, Lechlade and Fairford (see Figure 18). Development boundaries are defined around towns and villages. With the reduction in activity on US Airforce sites and the associated transfer of facilities back to the RAF/MOD, there is potential for developments in remote airfield locations such as Fairford Air Base. The NRA needs to continue to form robust links with all the relevant parties.

- 3.100 Bypasses are planned for both Fairford and Lechlade as well as major improvements to the A417/419 from Swindon to Gloucester which include the following schemes:

- Blunsdon Bypass;
- Latton Bypass, including the grade separated junctions within the Water Park Spine Road (West and East);
- Cirencester and Stratton Bypass;
- North of Stratton to Nettleton Improvement;
- Crickley Hill (Birdlip) Improvement.

A link through the eastern section of the Cotswold Water Park is also proposed.

Wiltshire

- 3.101 Swindon is the main urban centre within the catchment area and the primary focus for new growth. It has a large manufacturing base including motor vehicles, engineering and pharmaceuticals and has undergone major recent expansion. Further development for residential, business and leisure use is anticipated within the urban area whilst protecting key open areas such as along the River Ray. The former Great Western Railway workshops have been proposed for major mixed use redevelopment.

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Upper Thames CMP: URBAN LAND USE (Planning Policy - Development)



- CMP Boundary
- River Thames
- Main River
- Cotswold Water Park Boundary
- Road Construction/Improvements
- Office/Light Industry/Research (Business Use)
- Industry/Warehousing/Business
- Employment Use
- Residential
- Retail (Warehousing & Reserve)
- Golf Course
- Urban Renewal - Mixed Use
- Recreation
- Motorists Facilities

Scale:-
10km

Figure 18
xx



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- 3.102 A major new housing and employment development area is planned to the north of Swindon up to 2001 with a capacity to accommodate 27 000 people. Twenty nine hectares of employment land are proposed together with 8 500 houses. An amenity lake will be provided as part of the Moulden Hill County Park.
- 3.103 Limited growth is planned for Highworth, Wroughton and Cricklade together with employment development at the South Marston industrial estate and airfield.

Environmental Objectives

- 3.104 To influence and control future built development in such a way that the environmental values of the river corridor are maintained and enhanced, and to protect the integrity of the river corridor through urban areas.
- 3.105 To ensure the provision of infrastructure required to protect and enhance the water environment.
- 3.106 To influence and control infrastructure provision in such a way that other uses are not compromised.

MINERAL EXTRACTION AND SOLID WASTE DISPOSAL

- 3.107 Mineral extraction has the potential to affect the catchment through subsidence or effluent discharge whilst works are active. When they are closed their possible use as solid waste disposal sites could lead to contamination of ground and surface water. County Councils are the licensing authority with respect to extraction of natural resources and must through their Minerals Plan achieve adequate mineral supplies with minimal environmental cost.

Catchment Perspective

- 3.108 The main activity in the catchment area is the extraction of sand and gravel from the Thames Valley. This was begun during the 1920s and is concentrated within the Cotswold Water Park (see Figure 19). The eastern section around Lechlade and Fairford is largely within Gloucestershire whilst the western section around South Cerney and Ashton Keynes is within Wiltshire and Gloucestershire.
- 3.109 The gravel reserves have been on average 4 to 5 metres deep under shallow overburden and, due to a high water table, extraction sites have become lakes rather than being restored to dry land.
- 3.110 In the eastern section extraction has been concentrated to the south and east of Fairford and more recently north of Kempsford. In the west, the main extraction areas have been at the Shorncote and to the north, south and east of Ashton Keynes.
- 3.111 The County Councils intend to concentrate further aggregate extraction in the Cotswold Water Park. Wiltshire CC have identified a number of areas of search for further extraction ie the Latton, Marston Meysey and Ashton Keynes areas although they anticipate that these may be insufficient to meet anticipated needs to 2001 (Wiltshire Minerals Local Plan, 1989).
- 3.112 Gloucestershire CC have recently prepared the Upper Thames Policy Review (1993) which points to the need to identify new resource areas to meet latest forecast requirements. Former resource areas at Cerney Wick, to the east of Fairford and north of the Keynes Country Park have been identified as priority areas with a large area at Down Ampney also identified as a further reserve area.
- 3.113 The local authorities seek to maintain a stock of land to provide a ten year supply of aggregates, to minimise the adverse environmental impact of mineral extraction, to protect long term reserves, and to ensure the satisfactory restoration of workings. They also set out detailed criteria for the Assessment of applications by the planning authorities including consideration of the impact on the water environment.

220000

NATIONAL RIVERS AUTHORITY
THAMES REGION

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SCIENTIFIC DEPARTMENT
READING

210000

200000

190000

180000

Figure ¹⁹⁻¹² xx

380000

390000

400000

410000

420000



Upper Thames CMP:

Mineral Extraction &
Solid Waste Disposal

-  CMP Boundary
-  Main River
-  Cotswold Water Park
-  Existing & Past Permissions
-  Areas of Search
-  Privately Owned Waste Disposal Sites
-  Committed Refuse Disposal Site
-  Past Clay Permissions
-  Mineral Processing Plant

Scale:-

10km



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- 3.114 The 'Threatened Valleys Campaign - Upper Thames Branch' was launched recently. They aim to 'fight plans for further widespread sand and gravel extraction along the Upper Thames valley'. They are concerned that gravel extraction detrimentally and permanently alters landscape and as a pressure group wish to inform planners and politicians of this loss and other impacts.
- 3.115 There are 22 solid waste disposal sites in the catchment and nearly three quarters of these lie within the Cotswold Water Park. All of the sites except one are private landfill sites which are licensed to dispose of a range of inert wastes including commercial, industrial, farm and builders wastes and naturally excavated materials (see Figure 19).
- 3.116 There is one household waste disposal site at Broad Blunsdon and this is owned by Wiltshire CC. There are no household landfill sites within the Cotswold or Oxfordshire areas of the Catchment.
- 3.117 The Waste Disposal Authorities for the catchment are Wiltshire, Gloucestershire and Oxfordshire CCs. The WDAs recognise the need to minimise the pollutant effects of waste disposal on wetlands and other natural water resources and protect aquifers, reservoirs and watercourses.

Environmental Objectives

- 3.118 To ensure the sustainable use of resources whilst protecting the existing nature conservation value of the Cotswold Water Park, (especially its nationally important bird populations) and maximise the potential for enhancing the conservation value of the area by influencing restoration of future working, where appropriate, to provide wetland or open water habitat mosaics.
- 3.119 To control and influence mineral extraction, restoration and after-use and solid waste disposal in other areas of the catchment in such a way that other uses are not compromised.

FLOOD DEFENCE

General

- 3.120 An important use of waterways is to act as a conduit for the removal of flood water in order to reduce the risk of flooding. Flood defence is concerned with managing flood risk and encompasses a range of activities, from maintaining the flood carrying capacity of river channels to providing flood forecasts and warnings.
- 3.121 Frequently flood risk reduction measures involve increasing the capacity of the channel to carry flood flows by widening and deepening the river channel. NRA undertake a rolling maintenance and repair programme of river control structures. These measures can have an impact on the river environment and there is the potential for conflict between flood risk management and with uses directly related to the river environment, such as fisheries and ecology.
- 3.122 The NRA TR are the primary group involved in flood defence matters and on designated 'main rivers' the NRA have permissive powers to minimise the risk to existing and future uses (eg development). District Councils and County councils have permissive powers to carry out works on 'ordinary' (non - Main) watercourses. For flooding from sewers the responsible group is either the Local Authority or TWUL.
- 3.123 The NRA normally measure the standard of flood protection in terms of the frequency at which (eg 1 in 50 years), on average, it will prove effective. Policies for flood risk management have been developed for the entire Thames catchment based on the flooding frequency and are currently in the process of being implemented. These policies comprise two strands;
- (i) **Standards of Service (SoS).** The SoS policy sets targets for acceptable frequencies of flooding, such as once in twenty years, for each reach of a designated main river. Targets depend on the type of land use and the economic value of the land affected, for example, urban areas will have a higher target than unimproved farmland. The SoS approach provides the NRA with a method for prioritising its watercourse management activities.
 - (ii) **The Thames Non-Tidal Flood Plain Policy.** This policy seeks to limit development in areas which flood more frequently than once in one hundred years. Implementation of this policy is the responsibility of local authorities through their development plans. The NRA has a crucial role in providing local authorities with accurate information on the 100 year flood. Under an agreement between the Local Authorities and the NRA, the Local Authorities are required to follow the NRA's advice on flood risk management and likewise the NRA will support Local Authorities if their development plans are appealed or challenged at a public enquiry.

- 3.124 As part of its statutory functions the NRA is required to prepare surveys of areas where flooding problems are likely to arise. These surveys will form the basis of the NRA's advice to local authorities.
- 3.125 The Standards of Service system is a method for the NRA to prioritise its watercourse maintenance activities ie flood alleviation whereas the non-tidal floodplain policy is a mechanism to advise local planning authorities and others on future land use and protection of the floodplain.

Catchment Perspective

- 3.126 The lower lying areas of the catchment and the areas around the Cotswold Water Park are occasionally subject to flooding. Figure 20 highlights the areas in the catchment that are known to have flooded in the past and the limits of the main river, over which the NRA have permissive powers for flood risk management. In certain parts of the catchment flooding is a particular problem and these areas include Somerford Keynes, Ashton Keynes, South Cerney and the Cotswold Water Park.
- 3.127 In order to ensure that flood risk is minimised the NRA undertake weed cutting during the summer months, dredging and clearance.
- 3.128 As a consequence of development pressure, including further mineral extraction in the Cotswold Water Park, the Upper Thames catchment has been selected by the NRA as a high priority catchment for surveys related to flood risk assessment in relation to implementing these NRA policies.
- 3.129 The NRA recognise that irrespective of attempts to minimise flood risk through the implementation of various policies and actions, flooding still represents a significant risk to human life. In this respect the NRA operates a flood forecasting service in the catchment which uses telemetered information from a number of sites and information from flood defence staff in the field. Flood warnings are issued by the NRA River Control Room at Reading to Thames Valley Police and local Councils. Annual Flood Warning seminars are also held to review the flood forecasting and warning process.
- 3.130 The NRA are recognised by the public as the agency which should be contacted when a flooding problem occurs. However, flood management activities on 'non-main' rivers is the responsibility of local authorities and the NRA do not have the powers to take action to reduce flooding. In some cases, the NRA does become involved in these issues and disseminates their experience in flood risk management to local authorities and affected communities.

Environmental Objectives

- 3.131 Reduce the localised flood risk at Somerford Keynes, Ashton Keynes and South Cerney and investigate the role of the Cotswold Water Park in flooding/flood alleviation and storage.

- 3.132 To continue weedcutting and other minor channel works as necessary to minimise flood risk and to ensure that conservation guidelines are adhered to for good working practice for environmental sensitivity during river management operations.
- 3.133 To implement the Standards of Service (SoS) policy in the Upper Thames catchment.
- 3.134 To implement the Thames Non-Tidal Flood Plain Policy.
- 3.135 To improve arrangements for flood forecasting and warning.
- 3.136 Continue to disseminate information on flooding and flood protection measures to local authorities who have permissive powers with respect to flood defence on "non-main" rivers.

SECTION 4
CATCHMENT STATUS

4. CATCHMENT STATUS

INTRODUCTION

- 4.1 This section compares the current status of the catchment with the objectives suggested in Section 2 as well as with standards and targets (where they have been developed) in terms of water quality, water resources and physical features.
- 4.2 Comparison of the 'current status' with the 'overall objective' enables issues (which may be problems due to failures to meet targets, or conflicts due to differing uses having opposing requirements) to be identified.
- 4.3 A range of data and information has been used to assess the catchment status. The assessment incorporates the results of a consultation exercise undertaken by the NRA and analysis of existing data on the catchment which is held by the NRA and is publicly available.

WATER QUALITY

Introduction

- 4.4 A principal aim of the NRA is to achieve a continuing improvement in the quality of rivers through the control of pollution. To achieve this aim, the NRA seeks to maintain waters that are already of high quality; to improve waters of poorer quality and to ensure all waters are of an appropriate quality for their agreed uses.
- 4.5 Water quality improvements cost money and in many cases it is the public who pay the bill for these improvements either directly or indirectly. It is important to relate the cost of any proposed schemes to the benefits, in deciding whether or not individual schemes go ahead and in assigning priorities. The NRA is in the process of standardising a system to carry out this type of cost benefit analysis for improvements to river quality.
- 4.6 The quality of rivers is assessed both chemically and biologically. Chemical monitoring provides an indication of the conditions of the water at the precise time of monitoring but can miss events occurring between sampling times. Biological monitoring can provide a picture of the long term quality of surface water and can detect a greater range of quality problem than will show up in routine chemical monitoring and analyses.
- 4.7 Nutrient concentrations are monitored at key sites and sites where nutrient enrichment could be a problem. High levels of nutrients can alter the ecological balance in rivers and lakes, in some cases causing excessive plant growth and nuisance algal blooms.
- 4.8 The visual appearance of a watercourse is often considered its most important aspect. At present the NRA is studying methods of systematically monitoring and classifying watercourses according to their aesthetic qualities.
- 4.9 Information of water quality is held on Public Register, which is available for inspection at the NRA Reading Office (Tel: 0734-535000). The information held on the register includes: water quality classifications, applications for consents and issued consents to discharge, chemical quality information and details of prosecutions.

Surface Waters

Chemical Status

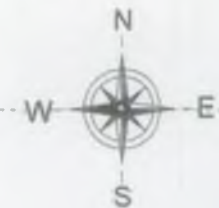
Assessment of Surface Water Quality

- 4.10 Up to April 1994, the quality of rivers was reported in terms of the National Water Council (NWC) classification scheme. In this scheme, rivers were assigned

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THAMES REGION

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READING



Upper Thames CMP: Water Quality: General Quality Assessment

 CMP Boundary

General Quality Assessment 1991-1993

-  A
-  B
-  C
-  D
-  E
-  F
-  No Data

Scale:-
10km



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Figure ~~xx~~ 21

Cirencester

Swindon

to one of 6 classes based principally on the biochemical oxygen demand (BOD) and the concentrations of dissolved oxygen and ammonia. A number of problems with the application of the NWC scheme have been identified and it has recently been replaced by a new scheme called the General Quality Assessment (GQA). This consists of a number of separate water quality assessments, each providing a separate 'window' through which water quality can be viewed. The first of the 'windows' to be developed is the chemical component. Details of this chemical component are given in Appendix E. It is intended that further 'windows' will be added, covering biology, nutrients and aesthetic quality, but this will depend on the successful development of suitable methods and classification systems. The General Quality assessment is designed to be based on a three year period, to show long term quality.

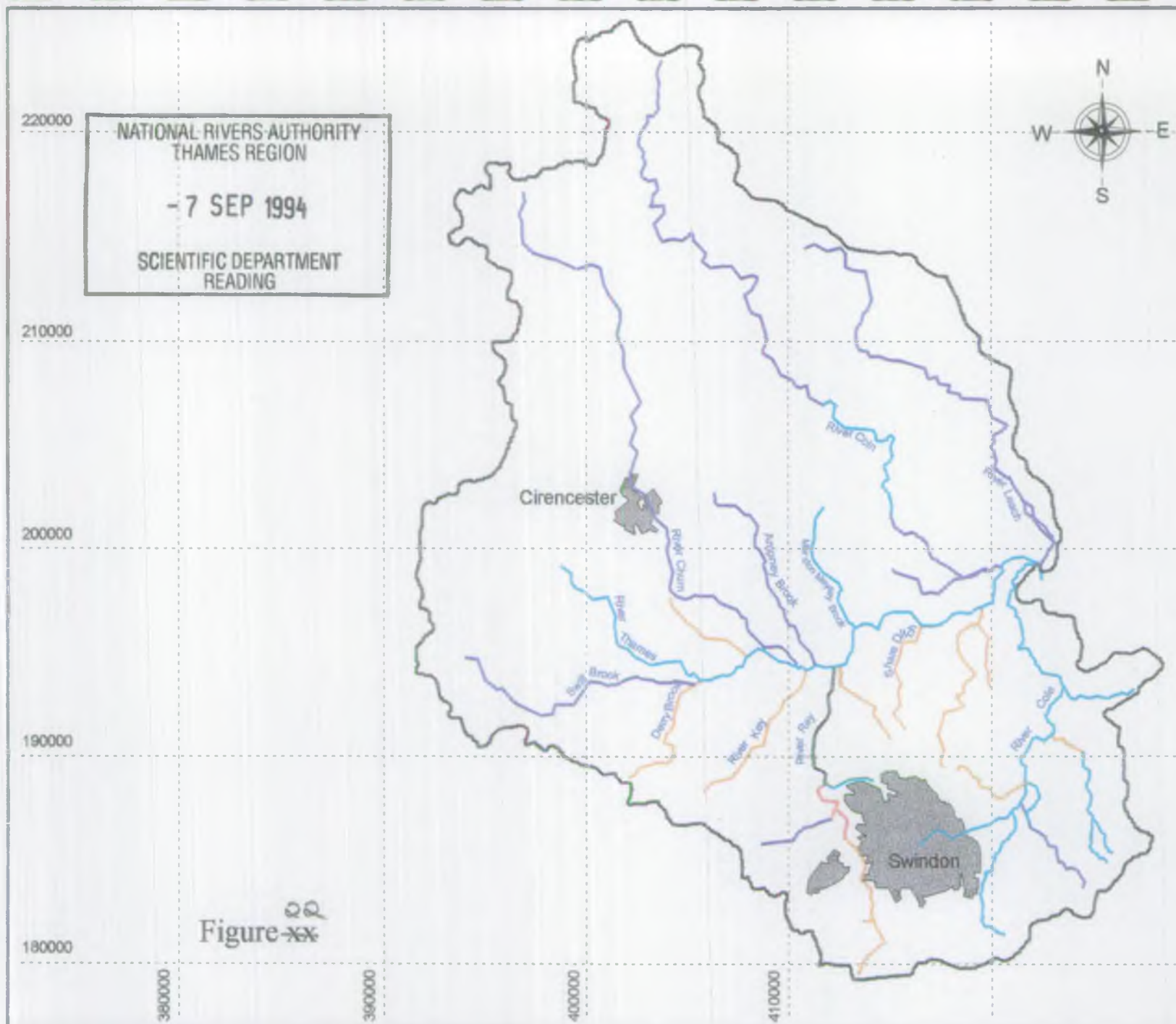
- 4.11 The GQA chemical quality of rivers in the Upper Thames catchment is given on Figure 21.

Water Quality Objectives

- 4.12 Chemical quality objectives for watercourses were formerly set using the NWC system of chemical classification. These were called River Quality Objectives (RQOs). This system could be used to state what chemical quality was required but the link to actual uses of the watercourses was not well defined. Objectives are now being set using a system which links water use to the objectives set for it. For each defined use there will be a range of standards which will be used as targets for the water quality.
- 4.13 This system is still in the process of development but will, in the future, allow the Department of the Environment to set Statutory Water Quality Objectives (SWQOs). The DoE will require by law, that the NRA ensure that a watercourse is maintained at the quality standards defined by the SWQOs set for it. The former RQOs were not statutory.
- 4.14 Five defined uses have been proposed River Ecosystem; Special Ecosystem; Abstraction for Potable Supply; Abstraction for Industry or Agricultural and Water Sport Activity. Up to date (October 1994) regulations have been produced only for the River Ecosystem (RE) use. Five classes have been established within this use, and are shown in the following table.

Descriptions of the Five River Ecosystem Classes

Class RE1	:	Water of very good quality suitable for all fish species.
Class RE2	:	Water of good quality suitable for all fish species



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READING

Upper Thames CMP:
Water Quality:
Provisional River
Ecosystem Objectives
TO BE REPLACED

□ CMP Boundary

River Ecosystem
Classes

- RE1
- RE2
- RE3
- RE4
- RE5

Scale:-
10km

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Figure xx

Class RE3	:	Water of fair quality suitable for high class coarse fish populations
Class RE4	:	Water of fair quality suitable for coarse fish populations
Class RE5	:	Water of poor water quality which is likely to limit coarse fish populations.
Unclassified	:	Water of bad quality in which fish are unlikely to be present or insufficient data available by which to classify water quality.

- 4.15 Chemical standards have been set for each of these classes and details of these standards are given in Appendix E.
- 4.16 The new River Ecosystem classes were used to set water quality objectives for the Upper Thames catchment. The results are shown on Figure 22. The water quality objectives have been set taking into account current and future uses of the watercourses in this catchment. The compliance of the reaches with their target objectives are judged against a rolling, three calendar year period. So for this report compliance was judged using the years 1991 to 1993.
- 4.17 Each water quality objective has a target date. Those which reaches which already comply with their objectives have the current date as their target date. Those reaches requiring some improvement have the target date set for the time when the improvements will take effect. These improvements include capital investment plans which the NRA have advised TWUL to carry out.
- 4.18 Several of the reaches have had future objectives set which are higher than their current achievement, even though no specific improvements are planned. This is because, in some cases, the river quality would have been in a higher class but for one, isolated, poor result. In the cases, where the cause of the poor result has been identified and dealt with, the higher class objective has been applied for the year 1995.

[TO FOLLOW TABLE CONTAINING OBJECTIVES WITH TARGET DATES IN THE FUTURE - EXPECTED NOVEMBER 4)

EC Directives

- 4.19 Three EC water quality Directives apply to the catchment. The Fisheries Directive (78/659/EC) applies to designated sections which are marked on Figure 23. This directive is concerned with ensuring that water quality in the designated reaches is capable of supporting certain types of fish. Two fish types are incorporated into the

EC Designated Fisheries Reaches

10km



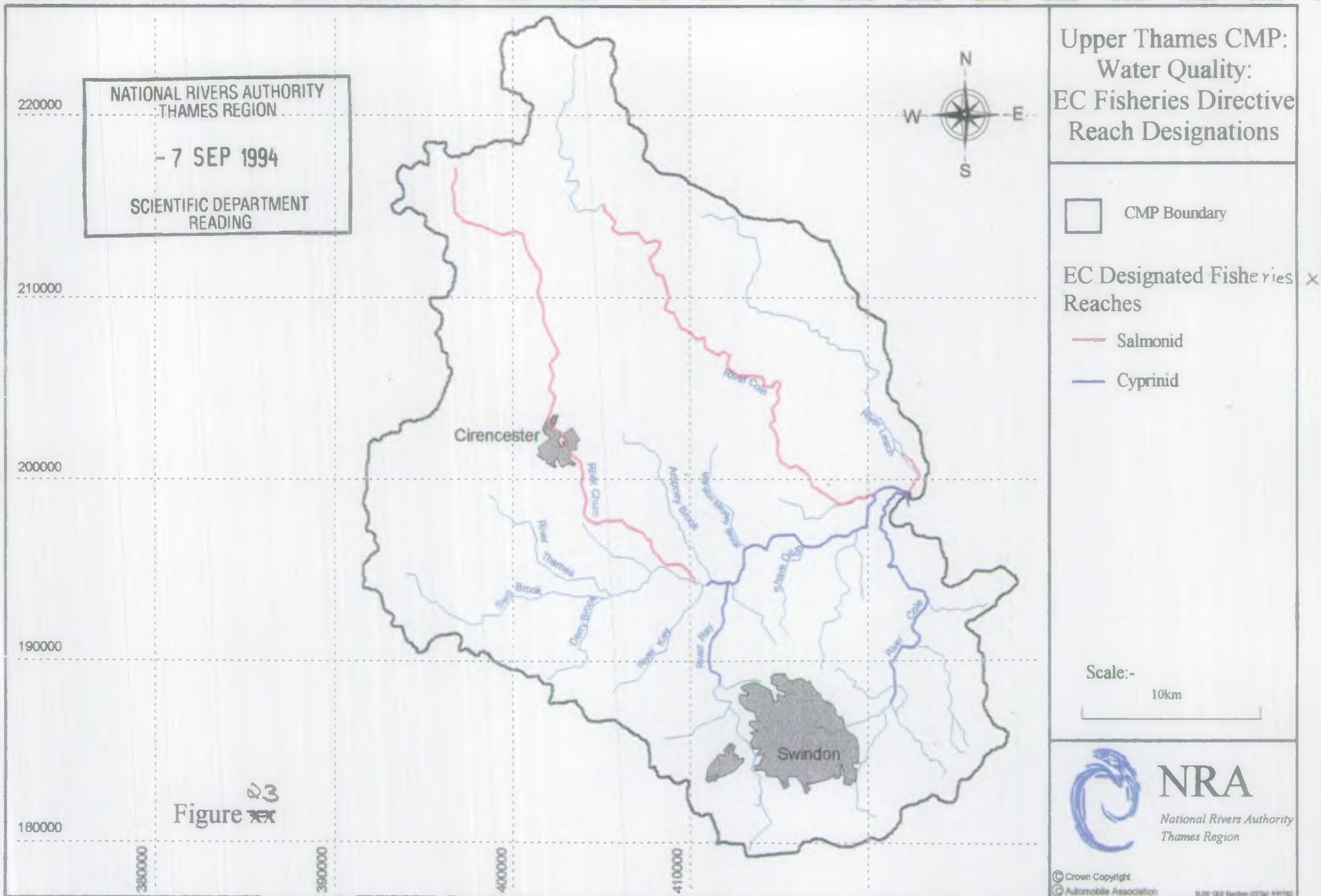
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BLUE-CHIP DESIGN: IT'S ALL ABOUT THE DESIGN



directive; (i) salmonid, which includes trout, grayling and salmon, and (ii) cyprinid, which includes coarse fish species, such as roach and perch.

The EC Directive on the Quality of Fresh Waters Needing Protection or Improvement to Support Fish Life (78/659/EEC)

- 4.20 Approximately half of the river length in this catchment is designated under the directive. Of the 22 designated reaches, 11 are designated as Salmonid fisheries and 11 as cyprinid fisheries. Designated reaches in both the River Ray and the River Thames downstream of Swindon STW failed to comply with the water quality standards in the directive during the 3 year period 1991 - 1993. As described earlier, improvement work has been carried out at Swindon STW and this will ensure that these reaches pass in future years.
- 4.21 The River Thames from Ashton Keynes to Eysey (Cyprinid), the River Leach from East Leach to Little Faringdon (Cyprinid) and the Ampney Brook from its source to the Thames (Salmonid) have been recommended by the NRA-TR for designation by the DoE under the directive. This should help to ensure that the current water quality in these reaches is maintained. The locations of the sections proposed for EC designation are also shown on Figure 23.

The EC Directive on Pollution caused by certain Dangerous Substances Discharged into the Aquatic Environment of the Community (76/464/EC).

- 4.22 This directive provides for the control of discharges of certain dangerous substances into the aquatic environment. The substances which come under the control of the directive have been selected mainly on the basis of their toxicity, persistence, and potential to accumulate in biological organisms. They include specific organic compounds such as pesticides and solvents, and specific metals.
- 4.23 The concentration of cadmium is monitored in the Thames at Eysey downstream of Cricklade STW and those of both cadmium and mercury are monitored in the Ray at Moredon Bridge downstream of Swindon STW. Both cadmium and mercury are classified as dangerous substances under the Directive. Both sites comply with the requirements of the Directive and data collected to date indicates that cadmium and mercury are rarely detected in these discharges.

EC Urban Waste Water Treatment Directive [UWWTD] (91/271/EEC) : Sensitive Areas (Eutrophic)

- 4.24 The urban waste water treatment directive sets priorities for the treatment of sewage according to the size of the discharge and the type and sensitivity of the receiving waters. Receiving waters which may be subject to eutrophication problems are to be designated as sensitive areas (eutrophic) by the DoE under the directive and phosphate removal at STWs discharging into these receiving waters is to be considered.

- 4.25 The River Ray (see Figure 16) has been designated by the DoE as a Sensitive Area (eutrophic), however there are no plans to remove phosphate from the final effluent discharged into the Ray from Swindon STW, as the DoE have decided that such a measure is unlikely to have an effect on eutrophication.

Biological status

- 4.26 The health of the river ecosystem is monitored using aquatic macro-invertebrates. These are the small animals which inhabit the river ecosystem. Macro-invertebrates respond to a variety of changes in water quality, such as; organic pollution, persistent toxic contaminants, and acute spillages. As the macro-invertebrates are present 24 hours a day, they may be used to detect the changes that may be missed by spot chemical sampling.
- 4.27 Macro-invertebrate samples are collected using standard NRA techniques - the three minute kick-sweep technique, where suitable. Families found during sorting are scored in accordance with their tolerance to pollution using a system established by the Biological Monitoring Working Party (BMWP). A high BMWP score indicates good water quality whilst a low score represents poor water quality.
- 4.28 Care must be taken interpreting macro-invertebrate data because macro-invertebrate populations vary according to micro-habitat, ie the physical condition of the river, such as whether the river has a rocky or muddy bed. In some cases low BMWP scores may be a natural phenomenon rather than a consequence of pollution. To assist in the interpretation of biological data a computer programme has been developed which predicts the BMWP scores for an unpolluted stretch of river taking into account the local physical conditions. This system allows an accurate comparison to be made between the unpolluted and current state of the waterway and takes into account the physical characteristics of the river.
- 4.29 The reaches which failed to meet their predicted BMWP scores are shown on Figure 24 and biological scores are listed in Appendix E. The streams in the northern half of the catchment mostly achieve high BMWP scores which indicates they have good water quality. Scores in the upper Churn are particularly high indicating exceptionally good water quality. Many reaches in the smaller brooks fail to meet their predicted BMWP scores. Sections of watercourses which failed to meet their targets or which showed large changes in the biological scores over the last five years are listed in Table 4.2.

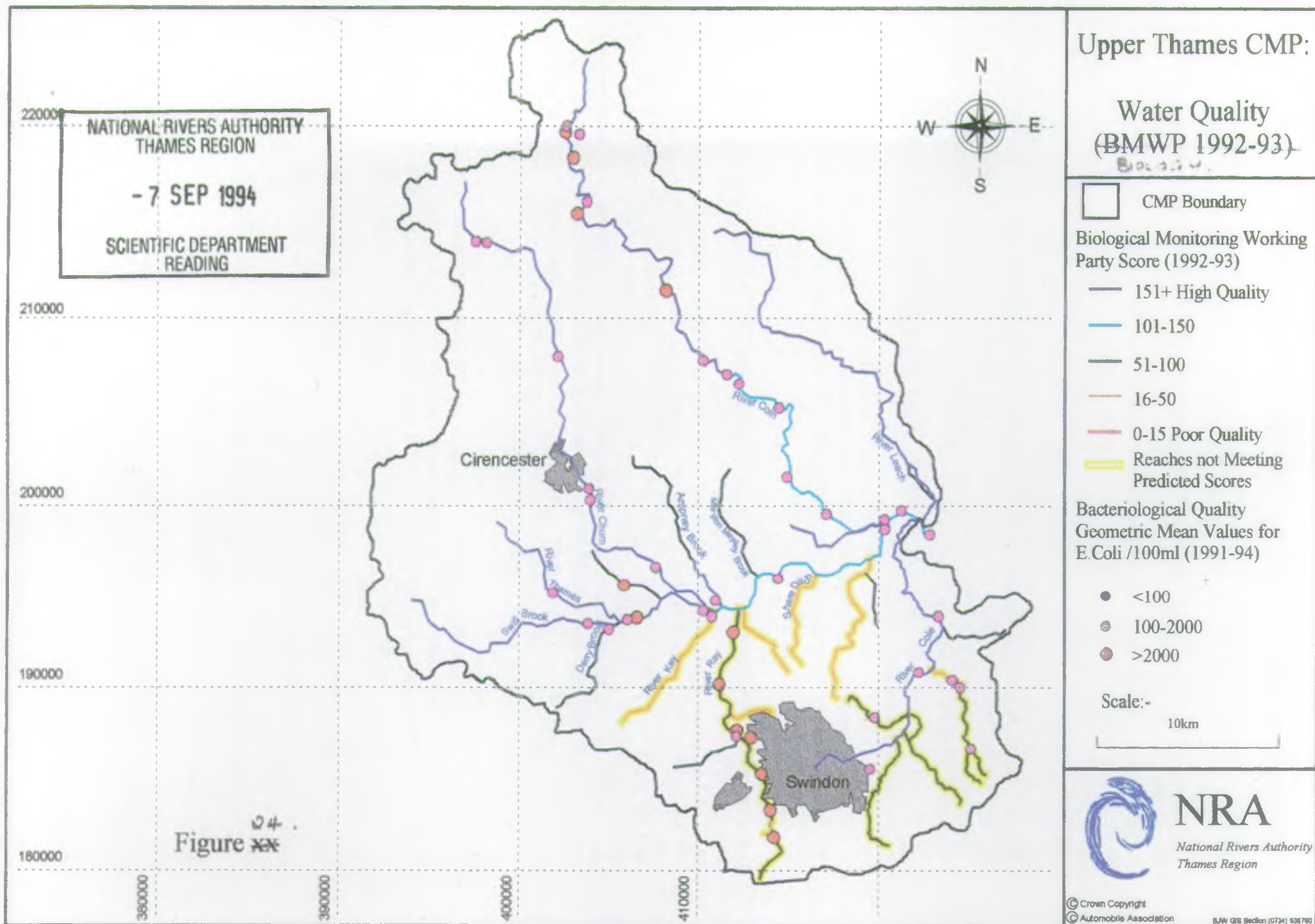


Table 4.2 - Sections of Watercourse Having Poor Biology or Showing a Large Change in Biological Status Over the Last Five Years

Watercourse	Biological Issue	Cause	Comment
Ray above Swindon STW	Poor biology	Urban run-off and pollution	In urban areas intermittent pollution in small streams is a common problem
Ray below Swindon STW	Poor, but improving biology	Impacts of urban pollution; improvements in Swindon STW	Biological health in the Ray has improved as a consequence of improvement to the Swindon STW
Key	Poor biology	A possible cause is the Purton STW	Further investigation into the cause of the poor biology is required
Swill and Liden Brooks	Fluctuating biological scores	Unknown	Further investigation is required
Bydemill Brook and Veneymore Stream	Declines in biological quality since 1990	Unknown	Further investigation is necessary
Ampney and Marston Meysey Brooks	Biological improvements since 1990	Higher flows	Both these streams dried up in the drought of the 1990's. Their biology has now recovered
Churn at Cerney Wick	Improvement since 1990	Higher flows	The higher flows since 1990 have resulted in a healthier ecosystem in the Churn

Bacteriological monitoring

- 4.30 Total and faecal coliforms are indicators of the level of contamination by faecal material from animals and humans. These bacteria may be from a number of sources including point sources, such as STWs and spillages from agricultural slurry tanks, and diffuse run-off from urban areas and farmland. The results of bacteriological monitoring of rivers are presented in Appendix E, and on Figure 24.
- 4.31 Levels of bacteria are of particular concern in terms of the health of people who come into contact with the water. The health implications of the bacteriological conditions in the catchment are the responsibility of the local authorities' Environmental Health Officer, and not the NRA, (see Section 3 Amenity & Recreation).

Nutrient Status

- 4.32 Nutrients are essential to the normal functioning of ecosystems. However, in excessive quantities nutrients may cause nuisance aquatic plant (macrophytes) and algal growths. The human activities which tend to cause excessive nutrient levels are agricultural practices and effluent discharges.
- 4.33 Excess nutrient problems are of concern in the catchment. As mentioned earlier in this section the River Ray downstream of the Swindon STW is classified as "Sensitive Area (eutrophic)". Macrophyte surveys of the Ray are being undertaken to assess the scale of the eutrophication problem, and some macrophyte data has already been collated as part of the routine river corridor surveying programme.
- 4.34 Intensive algal surveys of the River Thames are planned to continue to build on the data already collected. These surveys will provide information for the SWORP proposal, the Severn-Thames Transfer and the implementation of the Urban Waste Water Treatment Directive. Initial results of the algal surveys indicate that there is a substantial increase in algae in the River Thames downstream of the River Ray.

Pollution Incidents

- 4.35 The number of recorded pollution incidents has grown over recent years. This increase appears to be attributable to a range of factors, such as better communication facilities (eg setting up of 'pollution hotlines') and greater environmental awareness amongst the general public, rather than a genuine increase in pollution incidents.
- 4.36 The NRA divide pollution incidents into three classes, major, significant and minor, depending on their severity. The criteria used to assess the class of incident are given in Appendix E. There were 285 incidents recorded, 19 of which were classed as significant. There were no major incidents.
- 4.37 Details of all the incidents recorded over 1992-3 are presented in Table 4.3.

Table 4.3 - Pollution Incidents (1992/93)

Pollution Type	Thames Direct	Leach	Cole	Ampney Brook	Churn	Ray	Cole	Total
Oil	8	2	5	0	8	30	31	84
Sewage	30	0	7	1	4	9	11	62
Agriculture	20	0	3	0	0	7	6	36
Chemical	3	0	0	0	6	11	5	25
Natural	10	0	6	0	3	2	5	26
General	7	1	3	0	4	24	11	50
Not known	0	1	1	0	0	0	0	2
Total	78	4	25	1	25	83	69	285

4.38 The NRA operates a proactive approach to pollution control and prevention. There are four strands to this approach:

(i) **Farming and Agriculture:**

- All farms throughout the catchment are visited by NRA staff periodically. The programme is structured on sub-catchments where all farmers receive an advisory visit. Nearing completion are campaigns on Elcombe, Lydiard and Shaw Brooks (Upper Wiltshire Ray) and Lenta and Lertwell Brooks (River Cole). These will be followed by other sections of the River Cole, Churn and Swill Brook;
- NRA staff provide advice on Grant Aid schemes for farm improvements to ensure adherence to the Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) Regulations (1991);
- Herbicide use near waterways is controlled by regulations which are administered by the NRA;
- Ground water Protection Zones are being established by the NRA and this protection concept will provide a further means of controlling pollution in certain areas and will be targeted in addition to surface water catchments in the future;
- The NRA also raises awareness of water pollution prevention by giving regular presentations to farming and community groups;
- The introduction of, and control created by the Control of Pollution (silage, slurry, and agricultural fuel oil) Regulations 1991.

(ii) **Industry:**

- The two key centres are Cirencester and Swindon. Due to the high proportion of incidental pollution in Swindon, a mail shot was made to all

businesses in 1992. Some 11% responded and subsequently a number of trading estates have been targeted including Kembrey, Elgin & Hawkesworth, Cheney Manor and Dorcan.Liden in 1995/6. Love Lane, Cirencester is included in the 1994/5 programme.

- NRA staff seek to raise awareness amongst industry of water pollution prevention by freely distributing 'NRA Pollution Prevention Guidelines'.

(iii) Other Activities:

- NRA staff target a number of other activities in the catchment as part of their advisory visits and inspection programme, including STWs, marinas, Ministry of Defence installations (Wroughton, South Cerney, Fairford, Kemble and Little Rissington) and mineral extraction sites (1995/96).

(iv) Public Awareness & Education:

- Part of the pollution prevention strategy involves the dissemination of information to the general public. This includes NRA staff speaking to various groups, including schools and community groups, and includes publishing best practise guidelines and producing videos. Cotswold DC chair a particularly worthy environmental forum with delegates from, NFU, CLA, EN, NRA etc. The NRA would encourage this approach to be repeated by other Authorities.

4.39 Information on prosecutions and fines over the past five years is listed in Appendix E.

Ground water Quality

4.40 Ground water within the catchment is generally of very good quality and provides an important resource. Several public supply abstractions are sited in the catchment and significant quantities of water contribute to river flows, particularly in the north of the catchment.

4.41 The catchment is largely rural, with the main urban area of Swindon to the South. Rural areas are largely unsewered and there are a number of discharges of sewage effluent into the ground in the catchment.

4.42 Industrial activities, such as gas and engineering works, may have resulted in the contamination of ground. Such sites may pose a risk to water quality, particularly during redevelopment. The use of soakaways for the disposal of road runoff and airfield runoff can contribute to the degradation of ground water quality, for example when deicers and herbicides become washed into the ground.

4.43 The NRA has a duty under the Water Resources Act 1991 to monitor and protect the quality of ground water; to assist in this duty, the NRA has published a document entitled 'Policy and Practice for the Protection of Ground water' (PPPG). The non-

statutory policies described in the document are used as a framework for decision making on ground water issues; particularly relating to landfill activity, current and former industrial sites, for example in the Swindon area; airfields at Kemble, Enstone and Fairford; use of soakaways (road and rail drainage), effluent discharges and agricultural activity. The NRA is currently in discussion with the Ministry of Defence regarding airfields in the catchment at Fairford, Kemble, South Cerney and Wroughton.

- 4.44 Mineral extraction by sand and gravel workings has been concentrated within the Cotswold Water Park, often with subsequent restoration to lakes. Extraction of clays in the south of the catchment, particularly in the Swindon area have largely been restored by landfilling of wastes. Special precautions will be required for any proposed mineral extraction of areas within or near sites where groundwater may have been affected as a result of present or former use, eg airfields sewage works and landfill sites. Such sites may have an impact on the proposed after use, particularly in cases of proposed restoration to wetlands or lakes. Waste disposal sites which have taken putrescible wastes may generate leachate which poses a risk to groundwater.
- 4.45 A Regional Appendix is available, outlining the application of the policies as they affect aquifers in the Upper Thames area. In this area a considerable proportion of the base flow of rivers, particularly those in the north, is provided by ground water. Consequently the management of groundwater quality and surface water quality is inextricably linked.
- 4.46 As part of the PPPG, the NRA is delineating Groundwater Protection Zones, within which certain activities could present unacceptable risk to the public supply boreholes around which they are drawn. The NRA seeks to control polluting activity within these zones especially. The location of zones, and information on their use are available from the NRA-TR offices in Reading.
- 4.47 In addition maps are being published which give an indication of the groundwater 'vulnerability' in terms of the aquifer importance and the soil characteristics. Vulnerability Maps at a scale of 1:100,000 covering the Upper Thames catchment are due for release by 1995/96. A UK coverage map is provided with the PPPG document showing general categories of vulnerability. This UK map (scale 1:1 000 000) has already been published.
- 4.48 There are no Nitrate Sensitive Areas in the catchment. There is, however, a proposed NVZ associated with the public supply abstraction at Fairford. This represents compliance with the EC Nitrate Directive (91/676) and proposes to reduce water pollution by nitrates from agricultural sources under the control of MAFF. A consultation period on proposed NVZs ended on 31 August 1994.
- 4.49 There are no statutory water quality objectives envisaged for groundwater in the near future. However, a network of groundwater monitoring sites is currently being established which enables the NRA to comply with its duty to monitor groundwater quality. There are currently approximately 20 sites in the upper Thames catchment,

although the programme is undergoing review at present.

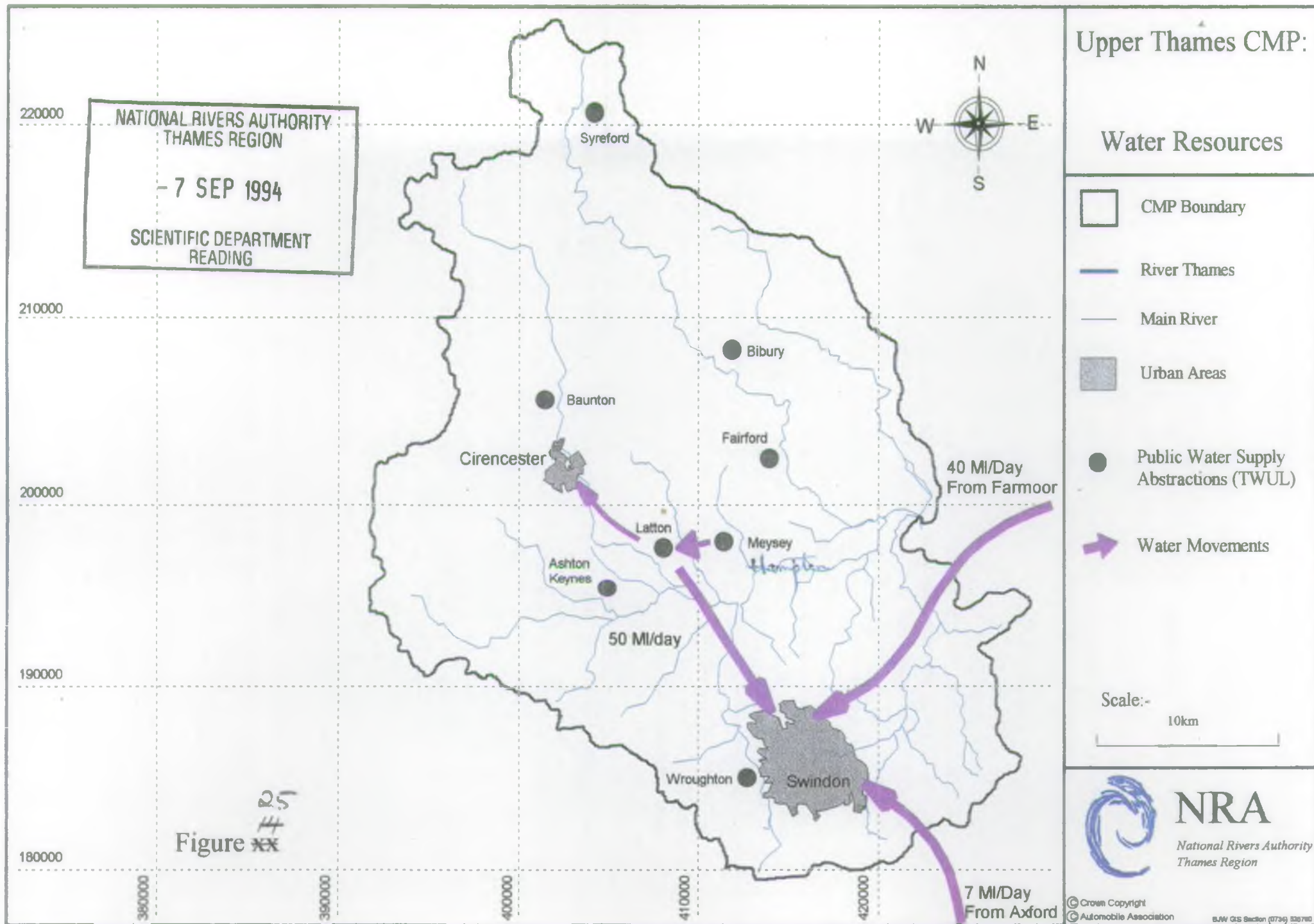
Water Quality Issues

4.50 The water quality issues are therefore as follows:

- **[Reaches with WQO targets set in the future details to be provided - expected 4/11/94];**
- **[Reaches with WQO targets set in the future details to be provided - expected 4/11/94]** Reaches with WQOs lower than would be expected: Rivers Coln and Thames, Lertwell, Liden, Tuckmill and Westrop Brooks;
- The River Ray below Swindon STW fails to meet its EC Fisheries Directive water quality standard. However, in the future the River Ray is expected to meet these targets as a consequence of improvements to the Swindon STW;
- The NRA has recommended that the length of river designated under the EC Fisheries Directive is increased. Additional lengths of river recommended for designation include sections of the Rivers Thames, Leach and Ampney Brook;
- Biological monitoring indicates that the quality of groundwater fed streams has improved since 1990 as a consequence of higher flows;
- Sections of the Rivers Ray, Key, Shill, Liden, Bydemell and Veneymore Brooks have poor biology which indicates they are polluted. The causes of the pollution are unknown except in the case of the River Ray;
- Intermittent pollution is an ongoing management issue and urban sources of pollution are a particular problem on the River Ray;
- A NVZ has been proposed around the abstraction site at Fairford.

WATER RESOURCES

- 4.51 In managing water resources, the NRA seeks to achieve a sustainable balance between the needs of the environment, the needs of the Public and Private Water Supply. The NRA must have particular regard for the statutory duty of the Water companies to supply water, whilst at the same time seeking to further the conservation and enhancement of the natural water environment.
- 4.52 The Water Resources Act 1991 sets out a system of Abstraction Licensing (see Section 3 : Water Abstraction) which allows the NRA to control the abstraction of water. The Act also sets out what matters the NRA must take into account when considering an application for a licence (eg whether the requirements of the applicant are reasonable; the impact on other water users; the impact on river flows etc) and describes the procedures which must be followed when applying for a licence.
- 4.53 In response to its duties under the Act, NRA-TR has developed a set of formal policies for handling applications for licences and changes to existing licences. These policies do not in general allow the abstraction of water from rivers (or nearby ground waters) for consumptive use in the summer months, and encourage the development of winter storage for such uses as Spray Irrigation. It is also unlikely that the NRA would grant new licences authorising abstraction for continuous major abstractions (such as public supply).
- 4.54 The Water Resources Act 1991 also establishes the power to specify Minimum Acceptable Flows in rivers. The NRA, in response to this, is carrying out research into Ecologically Acceptable Flows, which will help our understanding of what a living river needs to survive.
- 4.55 The extended dry period from 1989 to 1992 has increased public awareness and concern about the impact of abstraction on river flows in the area. It is important to distinguish between the impacts of abstraction and the impacts of drought, which are beyond our control. The NRA nationally is developing a methodology for assessing the severity of low flow conditions resulting from excessive, but authorised, abstraction. This methodology has been applied to the Churn and Ampney Brook. Preliminary results show that the effects of abstraction on these rivers are relatively less significant than previously thought.
- 4.56 Water resources to meet the demands of public water supply are particularly influenced by major centres of demand at Swindon and Cirencester. In meeting existing demands, local resources are supplemented by conjunctive management with imported water resources mainly from Farmoor reservoir in Oxfordshire and also from Axford on the River Kennet. At times of low flow in particular, the Farmoor reservoir is a major strategic water resource to the area.
- 4.57 Growth in demand for water may be influenced by a number of factors; for example, by increasing water use in the home, population growth and local development pressures, and economic trends which may affect commercial water usage. 'Future Water Resources in the Thames Region' published in June 1994, sets out a strategy



for the future planning and sustainable management of water resources to meet the reasonable needs of public water supplies, industry and agriculture in the region. It shows that existing resources can sustain planned levels of local development in the Upper Thames area as identified by existing Local and County Council structure plans (including the Swindon Northern Sector Developments).

- 4.58 Controlled growth in demand for water is a critical feature of the strategy for the longer term. For example, further control of losses through leakage from mains and encouraging more efficient use of water at work and at home can significantly affect the growth in demand for water. In this way, it may be possible to delay the need for major new strategic water resource schemes or perhaps avoid them altogether for the foreseeable future.
- 4.59 If growth in demand cannot be contained, the strategy identifies a number of schemes to meet future demands; two of which may impact and benefit the Upper Thames area. These are:
- a scheme to transfer water from the River Severn to the River Thames at times of low flow;
 - the proposed reservoir scheme in south-west Oxfordshire, (SWORP).
- 4.60 These schemes would be required to support increasing demand for water principally in the Upper Thames and London supply areas in the Region. However, their successful promotion should not be seen as a foregone conclusion. Any strategic scheme is likely to have significant environmental impact as well as benefit which will need to be thoroughly assessed. Experience of the development of other strategic schemes has shown that some schemes may take up to 15 to 20 years from conception to implementation.
- 4.61 The development of new strategic water resource schemes may provide an opportunity to vary the operation of existing licensed resources or may be brought forward in cases where abstractions are proved to adversely affect the water environment.
- 4.62 The Water Resources Issues relevant to the Upper Thames are therefore as follows:
- managing growth in demand ie through leakage control and metering etc;
 - water resources development options such as SWORP or the Severn-Thames transfer;
 - effective NRA guidance to local planning authorities.

PHYSICAL FEATURES

Flood Defence

- 4.63 The NRA has developed a system for assessing the level of protection an area should be given against flooding known as the "Standards of Service for Urban and Rural Flood Defence" (SoS) as discussed in section x.x above. Five land use types are used to decide the required level of service, ranging from A (heavily urbanised) to E (non-intensive agriculture). Associated with each land use class is a target which specifies the maximum acceptable frequency of flooding. The standards of service for designated areas in the catchment are listed in Appendix E.
- 4.64 There are a number of problems in applying these Standards of Service: (i) an area may not meet its target but the cost of works to ensure that the target is met may exceed the benefit; (ii) Land use changes over time and therefore the standards of service targets may become out of date and may require constant updating; (iii) The standards only apply to certain reaches and the approach may not be consistent with a total river or total catchment approach.
- 4.65 It is better to prevent flooding rather than solve problems later. However, the relevant authority for controlling development in the flood plain is not the NRA but the local planning authority. A flooding policy, known as the Non-Tidal Floodplain Policy has been adopted by the NRA and involves close liaison with the local planning authorities to ensure its implementation. This policy precludes most development in areas which flood more frequently than once in one hundred years to protect the catchment's flood storage areas and routes. Development which is allowed in these areas must meet the following requirements:
- flood flows must not be impeded;
 - the storage capacities associated with flood plains must not be reduced;
 - the number of people or properties at risk from flooding must not be increased;
 - land required for maintenance of, or access to water courses must not be obstructed;
 - environmental impacts must be kept to acceptable levels.

Hydraulic studies are necessary to help identify the areas covered by this policy.

- 4.66 This approach is detailed further in the DoE circular 30/92 which encourages local planning authorities and NRA to liaise closely on flooding and surface water run-off matters. The aim is to ensure that flood defence risks of development are an integral part of the decision making process undertaken by local planning authorities on relevant planning applications. In this respect the NRA has a responsibility to prepare surveys empowered under Section 105 of the Water Resources Act 1991 to

define the nature and extent of flood risks. The preparation of such surveys is the subject of a recent 'Memorandum of Understanding' between representatives of local planning authorities and the NRA.

- 4.67 The Standard of Service system is a method for the NRA to prioritise its watercourse maintenance activities whereas the non-tidal floodplain policy is a mechanism to advise local planning authorities and others on future land use and protection of the floodplain.
- 4.68 There are a number of local flooding issues. These do not directly involve the NRA because the issues do not occur on designated main rivers. Local authorities have the permissive powers for these watercourses. However, the NRA has become involved in flood management on these minor watercourses through encouraging discussion between the local authorities and the communities affected.
- 4.69 The role of the Cotswold Water Park in flooding is unknown as a consequence of a lack of understanding of the hydraulic processes in the park area. This lack of understanding is of concern given that further mineral extraction is planned and that mineral workings are thought to have resulted in properties being subject to increased flooding risk.
- 4.70 The NRA have the flood warning target that the police will be informed 4 hours in advance of an event in rural areas and 2 hours in urban areas.
- 4.71 The following is a summary of the flooding related issues:
- the standards of service concept is difficult to apply;
 - insufficient data are available to successfully implement current NRA policies;
 - there may be problems in applying strict environmental criteria to the Standards of Service approach;
 - the (SoS) system at present does not wholly allow for sites where frequent inundation/high water levels are desirable for nature conservation purposes;
 - there are localised flooding issues but these are generally the responsibility of the local authorities and not the NRA;
 - the role of the Cotswold Water Park in flood storage terms is unknown.

Riverine Environment and Fisheries

- 4.72 The quality of the river environment is important in terms of fisheries, conservation and amenity use. A rigorous methodology for assessing general environmental conditions associated with a river has not yet been developed, however, the NRA is conducting research in this area. Specific targets for the riverine environment are

difficult to set, but from a conservation viewpoint they should aim to achieve a healthy, diverse aquatic and riparian habitat supporting a wide range of flora and fauna. In more general terms the river environment should be capable of supporting the range of uses that could reasonably be expected to take place.

- 4.73 One method the NRA uses to obtain general information on riverine environments is the River Corridor Survey. They give a total overview of the distribution of plant communities along a river system, pick out the more diverse and impoverished reaches and give detailed reach information that can be used when assessing planning applications and land drainage consent applications. The Rivers Ray, Cole, Churn and the Ampney Brook have all been surveyed in the last 2 years and the Thames and Coln will be surveyed in 1994/95.
- 4.74 The NRA has developed targets for fisheries based on the amount of fish (biomass) found in a certain area. Two targets have been set; one for EC designated salmonid waters, the other for EC designated cyprinid waters. Biomass is sampled during routine fisheries surveys which are undertaken on a rolling programme basis throughout the Thames catchment. Individual water courses have all been surveyed in the last 5 years, and individual watercourses are now being programmed for fishery surveys to coincide with the production of Catchment Management Plans. The reasons for failing to meet the biomass targets are listed in Table 4.4.
- 4.75 NRA Fisheries Officers suggest that the salmonid fishery is not performing as well as expected, possibly as a consequence of a lack of suitable spawning gravels. Channel maintenance and drainage (dredging) activities are thought to have detrimentally affected habitats for all flora and fauna including spawning gravels on many rivers. Other habitat failings are also a problem and in some cases water quality is a contributory factor. Stretches of the River Coln are subject to localised angling pressure.
- 4.76 River habitat enhancements have been undertaken by the NRA on the River Cole, and on the River Ray. Further schemes are planned for both rivers to ameliorate the impacts of channel maintenance and drainage activities. NRA plans for this work have been subsumed into the River Restoration Project (see 3.32?). Further enhancement is also taking place on the river Leach.
- 4.77 Enhancement work has been muted as part of the Upper Thames Otter Habitat Project such as tree planting, gravel reintroduction, pools and riffles and creating spawning grounds for trout. The project officer has also spent time encouraging land owners to fence off land along the river to prevent entry (and erosion by) grazing stock and create a vegetated river corridor which will not only benefit Otters but other species as well. The project officer also wishes to carry out a survey pinpointing areas where other otter-related work can be undertaken such as the construction of artificial holts.
- 4.78 There are a number of conflicts between conservation and fisheries and other uses of the water environment. Such conflicts include the impact of channel maintenance on river habitats, and recreational activities, such as jet skiing, in the Cotswold

Water Park.

4.79 The issues in terms of the riverine environment and fisheries relate to:

- low flows;
- poor habitat as a result of drainage activities;
- effluent from Swindon STW affecting water quality, although this situation ought to have improved;
- conflict between conservation and fisheries on the one hand, and the various uses of the water environment on the other;
- The protection of the nature conservation resource of the Cotswold Water Park and associated rivers.

Table 4.4 - State of the Fishery

River	Performance of the Fishery	Comments
Ampney Brook	Poor	The river dried up in 1989, 90 and 91
River Churn	Biomass targets not achieved in 1990 in the upper reaches.	Low flows resulting from lack of rainfall in the upper reaches were probably having an impact on the fishery
River Cole	Biomass targets not achieved in 1992.	The failure to meet the targets appears to be attributable to fish kills associated with pollution incidents.
River Coln	Reaches biomass target.	Level of recruitment is poor, possibly as a consequence of low flows resulting from lack of rainfall and poor habitat.
River Leach	Biomass target achieved.	
River Ray	Biomass target not achieved in 1991.	Poor effluent quality from the Swindon STW probably is responsible for the fishery failing to meet its target. The STW has been upgraded since 1991 and the effluent quality ought to have improved.
River Thames	Biomass levels are not available.	Effluent from Swindon STW is thought to be having an impact on the fishery.

River Landscape

- 4.80 The objective in relation to the river landscape is as follows; and this objective also applies to urban and rural land use:
- To conserve and enhance river corridor landscapes.
- 4.81 The landscape values of the River Coln and Leach are shown on Figure ???. Whilst much of these catchments are of high quality and therefore warrants protection, some reaches would benefit from enhancement. In order to pursue the objective of protecting and enhancing the river landscape the NRA must influence planning policy in the catchment.
- 4.82 In addition to influencing planning policy, the NRA needs to become more involved in the development of agricultural policies in the catchment, such as the establishment of ESAs.
- 4.83 The landscape value of most of the river corridor in the catchment except the Coln and Leach Rivers, has not been determined. Further landscape assessments are required.
- 4.84 In the Coln and Leach catchments landscape assessments of certain sections of the river corridor are required to determine the type of remedial work necessary and to identify areas worthy of special protection.
- 4.85 The issues in terms of landscape are summarised below:
- Further more detailed landscape assessments are required in the Coln and Leach to define specific landscape issues.
 - The NRA needs to take more of a proactive role in the planning process in order to protect and enhance river landscapes.
 - The NRA needs to have greater input into agricultural policies in the catchment.
 - The landscape value of all rivers in the catchment, except the Coln and Leach, is not documented.

SECTION 5
CATCHMENT ISSUES

5. CATCHMENT ISSUES

INTRODUCTION

5.1 In the previous sections a number of issues have been identified. The order in which these issues are stated in the report directly reflects the proportion of views expressed in the responses to the informal consultation exercise. In this section these are grouped and discussed under the following inter-related headings:

- river flows and levels;
- water quality protection and enhancement;
- flooding in certain areas;
- fisheries
- the Cotswold Water Park;
- recreation and plans to re open canals;
- the increasing water demand, Severn-Thames transfer, SWORP;
- integrated management of the entire catchment;
- communication.

5.2 The issues will be discussed in terms of:

- (i) **Management Options:** A consideration of the strategies to address the issue and a discussion of the implications of adopting these. Advantages and disadvantages of the strategies are then considered. Detailed analyses of the possible strategies, their costs and timetables for implementation, have not been prepared and are beyond the scope of the Consultation Report.
- (ii) **Implementation:** The agencies, groups and individuals responsible for implementing the way forward.

RIVER FLOWS AND LEVELS ISSUES

Overview

- 5.3 The drought of 1989-1992 resulted in 'low flows' in rivers across the area, particularly those fed by groundwater. These low flows generated much concern in the general public.

Issue

- 5.4 During the drought of the 1989-92, there was considerable public concern about flows, levels, water quality and in-stream ecology in the groundwater-fed watercourses in the northern part of the catchment. The public attributed the flow reductions to groundwater abstractions. The NRA commissioned a study to look at the causes of flow reductions and changes to the aquatic ecosystem in the Coln River. The main findings of the study, published in 1992 are as follows:
- (i) Severe one year droughts and, in particular, low winter rainfalls have a significant impact on river flows. The river dried up in 1890 and it appears to dry up occasionally, albeit rarely;
 - (ii) Ground water abstraction appears to be a minor factor in reducing river flows compared with the impact of the drought in the late 1980s;
 - (iii) Smaller flows have resulted in a reduction in aquatic plant growth. These plants are normally so abundant that they hold back river flows and cause river levels to rise. The reduction in channel vegetation and the consequent decrease in levels has had a severe impact on both the appearance and the ecology of the river;
 - (iv) A change in plant species composition seems to have occurred, with water crowfoot being replaced by attached algae in some reaches. The reasons for the change are not clear, but may be related to river flows;
 - (v) Siltation of the river bed, which was a key concern amongst anglers, is probably a consequence of reduced river flows;
 - (vi) River and land management do not appear to have contributed significantly to the observed problems. However, dredging in the 1950's may still be having an impact on the aquatic ecosystem in some reaches;
 - (vii) The ground water system in the catchment is very complicated.
- 5.5 The Cotswold's hydrogeology is very complicated but further studies to advance our understanding would be very expensive, and may not be cost-effective.

Management Options

- 5.6 The report on the Coln presented a number of recommendations. These recommendations and other suggestions are presented below as possible ways forward.

(i) **Monitor the changes in aquatic plants and undertake research**

The change in aquatic plants from species such as water crowfoot to attached algae has been reported by river users in many catchments in the Thames region. Research into this problem ought to be undertaken and a monitoring programme established to provide baseline data. If research is undertaken it should be targeted to rivers or reaches where changes in vegetation characteristics do not conform to the expected.

Advantages: Increased understanding. This understanding will assist in the accurate identification and assessment of the problem.

Disadvantages: Cost of monitoring and research. No guarantee of conclusive results.

(ii) **Set minimum acceptable flows**

Minimum flows provide a useful management tool but have not been set for the catchment. Setting minimum flows requires a detailed understanding of the hydrology of the individual streams in the catchment.

Advantages: Enable targets to be set.

Allows performance to be assessed.

Disadvantages: Minimum acceptable flows are very difficult to set, particularly for the streams which "dry up" occasionally, albeit rarely. A thorough understanding of the hydrology of the streams is required. Often there is an insufficient length of data to set MAFs. The NRA is currently engaged in R&D work aimed at establishing the requirements for Ecologically Acceptable Flows to scientifically specify the amount of flow to sustain the environment. Statutory MAFs themselves may be too rigid to be genuinely useful.

(iii) **Undertake catchment specific studies in the other Cotswold catchments**

In terms of Cotswold catchments (other than the Coln) where there are public concerns about low flows further studies are required. In most cases the cause of low flows is clearly understood, ie the low rainfall during the drought of 1989-1991. Where there is evidence that other factors may have significant effect, the NRA has already commissioned some studies aimed at assessing the extent of the problem.

Advantages: The causes of the low flows can be clearly identified, uncertainty will be reduced, public debate lessened and effective action plans can be formulated.

Disadvantages: Cost.

Implementation

- 5.7 The NRA has a lead role to play in all the above options. In terms of the first option English Nature may wish to become involved in a large scale study into aquatic plants, particularly if valuable freshwater sites were experiencing adverse changes, and where these were apparently not the result of natural changes in flow regimes. TWUL may wish to participate in further studies into the aquifer system in the catchment.

MEYSEY HAMPTON GREAT OOLITE ABSTRACTION LICENCE ISSUE

Overview

- 5.8 Groundwater abstraction needs to be managed to keep the impact on river flow within acceptable bounds.

Issue

- 5.9 The current (TWUL) abstraction licence for the Meysey Hampton Great Oolite source expires in January 1998. This will present an opportunity to review the location and quantity of abstraction from this aquifer. If studies which have recently been started ultimately justify action to alleviate low flows in the lower Churn and Ampney Brook, redistributing abstraction to obtain the maximum benefits to river flow will need to be considered. In addition to Meysey Hampton (GO) itself, the effects of abstractions at Latton and Baunton should also be assessed.

5.10 Management Options

The following options are suggested:

(i) Desk Study

Consider all existing data on groundwater levels and river flows in relation to abstraction history.

Advantages: Cost effective review of existing data.

Disadvantages: Conclusions may be limited - no evaluation of new information.

(ii) Field Investigations and Pumping Trials

Assess the need for design and carry out pumping trials and other field investigations. These will need to utilise existing facilities as it is likely to be difficult to justify substantial capital expenditure.

Advantages: Collection and evaluation of new field data.

Disadvantages: Conclusions may be limited with additional costs incurred over and above option 1. Likely to be an expensive option.

(iii) **Mathematical Modelling**

Carry out modelling of the groundwater systems of the oolite limestone aquifers. An existing model is restricted to the Great Oolite aquifer, whereas a multi-layered model incorporating the Inferior Oolite aquifer and intervening clays may be required for more accurate and representative simulations. An equivalent model has recently been developed for the adjacent Malmesbury Avon catchment in NRA South Western Region.

Advantages: Likely to provide the most comprehensive analysis of all options available.

Disadvantages: Conclusions from a modelling study are limited to the fact it is a modelled scenario only, and may not necessarily reflect the true picture. Also a costly exercise.

Implementation

- 5.11 Any investigations should be completed by Spring 1997 to allow time to formulate and consult on a plan for groundwater abstraction management well in advance of expiry of the Meysey Hampton licence. Any field pumping trials will require the co-operation of TWUL and along with any other investigations should be carried out during 1995/1996.

WATER QUALITY PROTECTION AND ENHANCEMENT

Overview

- 5.12 In some reaches chemical Water quality objectives have target dates in the future. Biological monitoring indicates pollution in the Rivers Key and Ray and in many of the smaller brooks in the southern part of the catchment. A NVZ is in the process of being established at Fairford to protect the water quality of a ground water abstraction used for potable supply.

Issue

- 5.13 **[TO BE PROVIDED SHORTLY DETAILING REACHES WITH OBJECTIVES WITH TARGET DATES IN THE FUTURE AND PLANNED INVESTMENT SCENARIOS - EXPECTED 4/11/94]**
- 5.14 **[TO BE EDITED TO REFLECT LATEST WQO GUIDELINES - EXPECTED 4/11/94]** Additionally, sections of the Rivers Coln and Thames and the Lertwell, Liden and Westrop Brooks fail to meet their WQO. The causes of the failures are unknown, but could include pollution from agricultural sources or from small rural sewerage schemes.
- 5.15 Biological monitoring indicates poor water quality in sections of the Rivers Key and Ray, and in the Swill, Liden, Bydemill and Veneymore Brooks. In the River Key and the smaller brooks the sources of pollution may be from agricultural activities or discharges from rural sewerage schemes. The reasons for poor biology in the River Ray is intermittent pollution from urban sources and possibly run-off from contaminated land.
- 5.16 There are no Nitrate Sensitive Areas in the Upper Thames catchment. However, a NVZ has been proposed at Fairford under the EC Nitrate Directive. This zone will assist in the protection of groundwater quality at the TWUL abstraction at Fairford. In addition, the NRA is commencing a groundwater quality monitoring programme which will provide base line information.
- 5.17 A Sensitive Area (eutrophic) has been designated on the River Ray downstream of Swindon, until its confluence with the River Thames, under the Urban Wastewater Treatment Directive. The NRA has considered that phosphorus removal is not cost effective or appropriate at the qualifying STWs on this stretch of the Ray and Langford Brook, because it is unlikely to have a significant effect on eutrophication ie it is caused by other inputs.

Management Options

- 5.18 The following options for each of the issues identified above are suggested:

(i) **[EXPECTED 4/11/94]**

(ii) **Continue a Proactive approach to pollution prevention and Control. To further water quality protection, undertake research into the causes of failures to meet biological 'targets' and causes of chemical water quality achievement to be lower than expected. The research programme will need to focus on the following areas:**

- impacts of small rural sewerage schemes on water quality. Many villages in the Upper Thames area have no foul sewer available and therefore rely on cesspools, septic tanks or private sewage treatment plants for disposal. In many cases they give rise to localised pollution problems which are difficult to resolve. The NRA needs to be able to collect more information to quantify this problem;

For example, the NRA are supporting a student project on Rural Sewage Disposal in the Cotswold DC area as a first step to understanding this problem in the Upper Thames area. This will include a survey by questionnaire accompanied by NRA leaflets on domestic pollution prevention and may serve to raise public awareness on the issue. Subject to post project evaluation, the NRA may repeat the exercise in other areas of the Upper Thames catchment;

- means to control pollution incidents from urban and agricultural sources;
- the surface water quality problems associated with urban run-off and contaminated land, particularly in the Swindon area. In the short term monitoring of the local watercourses needs to be undertaken. However, in the long term an investigation of the extent of contamination is needed. Pollution prevention campaigns have been carried out around Swindon and will be repeated in the future with the aim of minimising contamination of surface water.

Advantages: Minimise pollution incidents. The result of the research will enable decision-makers to identify failures to meet targets.

Disadvantages: Cost of monitoring, implementation and research. Investigations of this nature will probably take years to complete due to current operational priorities.

(iii) **Protection of Groundwater Quality**

There are three parts to this way forward; (a) implementation of the NRA Groundwater Protection Policy with the designation of ground water 'vulnerability' and the establishment of ground water protection zones; (b)

establishment of a monitoring programme, (c) establishment and management of NVZs and other protection/remediation measures as necessary.

Advantages: Monitoring will provide information to 'water managers'. The establishment of NVZs will assist in protecting groundwater quality and will result in overall savings to the public in relation to the treatment of water. Proactive use of the policy give guidance to developers and protection of Ground water Quality.

Disadvantages: Costs of monitoring and costs associated with establishing NVZs.

(iv) Continued Biological Monitoring and Monitoring of Discharges

The routine monitoring of macroinvertebrates (sites surveyed at least annually), bacteriological sampling (rolling programme), algal sampling (specific sites) and aquatic plant sampling (rolling programme) is to be continued. Continued biological monitoring upstream and downstream of discharges from STWs, fish farms and other discharges is also advocated as well as specific investigations into consents under review and at specific potential pollution hotspots such as contaminated sites in the Swindon area.

Advantages: Monitoring will provide information on the biological status of watercourses in the catchment, as well as assessing the impact of various discharges to watercourses. This information is essential for effective water quality management.

Disadvantages: Costs of monitoring.

Implementation

- 5.9 The NRA has a role to play in all the above options. TWUL may wish to become involved in options 1 and 4. Farmers, MAFF, local authorities and industry all have roles to play in options 3 and 4.

FLOODING ISSUES

Overview

- 5.20 Flooding occurs in certain places in the catchment as stated above. The NRA operates two different flood management policies and the implementation of both of these is associated with a number of problems.

Issue

- 5.21 The towns affected by localised flooding problems include Ashton Keynes, Somerford Keynes and South Cerney. In the majority of cases the flooding affects minor watercourses where the NRA does not have statutory responsibility for flood risk management. (The NRA has responsibility for flood risk management on designated 'main' rivers only). However, the NRA does become involved in these localised issues as it is viewed by the public as the agency responsible for river and flood management. In these cases the normal approach of the NRA is to set up communication links with the relevant local authority, which has statutory responsibility for flood risk management, and the affected community.
- 5.22 On designated main rivers the NRA operates two parallel flood management policies; (i) the Non-Tidal Flood Plain Policy, and (ii) a system of Standards of Service for different types of land use as stated in section x.x.
- 5.23 The Non-Tidal Floodplain Policy seeks to limit development in areas which flood more frequently than once in one hundred years. However, at present it is not possible to accurately determine the 100 year flood. NRA-TR in particular depends on heavily on historical data such as the 1947 flood (which has been used as a surrogate 1 in 100 year return period event. Therefore the NRA needs to produce 'synthetic flood maps' whereby the flood envelop is defined statistically from computer models.
- 5.24 Building up this flood risk data is a huge and costly undertaking. Therefore, the NRA has decided to prioritise its catchments for work and the Upper Thames and its tributaries are considered to be in the priority 1 category.
- 5.25 Implementing the Standards of Service policy is problematic. Flooding on some land use types may exceed the required target but the costs of raising flood protection to the required standard may significantly outweigh the benefits. In effect the policy appears to assume that the current land use in an area is acceptable whereas in some circumstances it may be more appropriate to encourage land use changes rather than set impossibly high standards of service. This is a matter for MAFF and the DoE to decide upon.
- 5.26 Implementing the SoS policy requires a substantial amount of data. The acceptable standards and current frequency of flooding for each reach on a river needs to be determined and normally these data are obtained through intensive surveys of land

prone to flooding and hydraulic modelling. Hydraulic modelling, in particular, requires large amounts of data and is a costly exercise. The NRA are implementing the SoS policy on a catchment by catchment basis as resources and funding permits, and updating targets as necessary.

- 5.27 Another problem with the Standards of Service approach is that it is implemented on a reach by reach basis which makes the policy difficult to integrate into a total catchment perspective. A further problem is that land use may change over time necessitating a change in the standard of service. For example, a flood scheme may be designed to provide a low level of protection but subsequent development may require a higher level of service, or high value agricultural land may be placed under "Set Aside" which will reduce the level of service required and will result in a loss of investment in flood protection works. The Standards of Service concept, therefore, is not straight forward to apply in reality.

Management Options

- 5.28 Options for each of the three issues identified; (i) localised flooding, (ii) implementation of the Non Tidal Flood Plain Policy and (iii) implementation of the Standards of Service Policy are as follows:

(i) **Localised Flooding**

In terms of flooding which does not occur on "designated main rivers", ie flooding for which local authorities have responsibility, the NRA may wish to continue to act as a broker between the affected community and the local authority. There is also a public perception problem over the differing responsibilities of the NRA and Local Authorities which needs to be addressed ie through publishing public relations material, taking opportunities to address meetings etc. (See also Cotswold Water Park issue x.x)

Advantages:

NRA can disseminate the extensive experience it has in flood risk management to both the affected community and the local authority. Better flood risk management may result.

Disadvantages:

The NRA has no statutory involvement in localised flooding and would probably have to be invited to participate in the management process. Cost of 'educating' external parties.

(ii) **Non Tidal Flood Plain Policy and determination of the 100 year flood plain**

Before hydraulic modelling can be undertaken a considerable amount of data has to be collected ie aerial photography and photogrammetry to provide survey data. Therefore, data collection is the first part of the S105 exercise to be executed. Additional aerial photographs will be flown during the winter.

The Memorandum of Understanding also requires that local authorities will provide the NRA with any data it so requires to undertake this initiative.

The NRA also need to ascertain the level of detail required within these flood risk investigations ie in light of the expense, would a broad-brush approach be adequate in some cases. Computer model development will also need to be undertaken.

Advantages: Better information for decision making and fulfil the requirements of circular 30/92 towards more protection from flooding.

Disadvantages: Cost of the study is huge and will be a huge investment of staff resources.

(iii) Standards of Service Approach

Conduct a research programme into the application of the Standards of Service Approach, perhaps using a range of different catchments as case-studies. Flood defence staff will continue to use their (subjective) judgement based on experience.

Advantages: The results of the research programme will allow water managers to apply the Standards of Service concept in a more effective and objective manner and compliment the views of experienced staff when making decisions.

Disadvantages: The research may take many years to complete, therefore the Standards of Service approach may not be able to be effectively applied for a number of years. Research may be better applied to other catchments outside the Upper Thames CMP area.

Cost of research, although the long term benefits of having an effective flood risk management system in place may well exceed the cost of the research.

Implementation

5.29 The NRA has a lead role to play in all the above options. Local authorities and communities have a role to play in option 1.

FISHERIES ISSUES

Overview

- 5.30 Throughout much of the catchment the fishery does not appear to be performing as well as could be expected. In addition, there is conflict between fisheries and other users in the catchment.

Issue

- 5.31 The biomass targets on the Rivers Churn, Cole, Ray, Thames and the Ampney Book are not being achieved. The river ecosystems appear to be capable of supporting a good quality fishery and the reasons for the lower than expected performance of the fisheries are unknown. Possible reasons include the impact of the drought in the early 1990's and poor recruitment which may be related to a lack of spawning gravels.
- 5.32 There are conflicts between fisheries and other uses. For example, in the Cotswold Water Park some recreational uses, such as jet skiing are in direct conflict with fisheries use, as well as wider nature conservation interests.

Management Options

- 5.33 The following ways forward are suggested:

(i) **Continue to monitor the state of the fishery**

Baseline information, including fish habitat assessment, is required to determine the state of the fishery and to detect changes. Currently the NRA survey the rivers in the catchment approximately every five years and it is suggested that this programme continues.

Advantages: Better information.

(Results of fishery enhancement efforts can be assessed and monitored.

Disadvantages: Cost of monitoring.

(ii) **Investigate the cause of the small amount of suitable spawning gravels**

There does not appear to be an obvious explanation for the reported reduction in spawning gravels. Further investigations are required.

Advantages: Better information allowing an accurate assessment of the problem.

Information obtained may be incorporated into other management activities which may have an impact on spawning gravels, such as channel maintenance for

flood management purposes.

Disadvantages: Cost of investigations.

(iii) Reduce the impact and frequency of pollution incidents

In the River Cole catchment polluting spillages appear to be having an impact on the fishery. The NRA will seek to ensure that pollution incidents are kept to a minimum through pollution prevention and consent enforcement activities. The issue of pollution incidents is discussed further in 4.34.

Advantages: Improvement in the fishery.

Disadvantages: Cost.

(iv) Prepare a Fisheries Plan

A fisheries plan should be prepared for the catchment.

Advantages: The development of the fishery would be planned in a sustainable manner. The plan could be used to resolve conflicts between fisheries and other users. A fisheries plan could form part of an overall strategy for the Cotswold Water Park. Long-term costs associated with fisheries management could be reduced.

Disadvantages: Upfront costs of preparing the plan.

Implementation

- 5.34 The NRA has a key role to play in monitoring the state of the fishery and in conducting research into fish habitat in the catchment. Anglers may also have a role to play. Involving anglers in both a monitoring programme and fish habitat studies may be beneficial in optimising the fishery and from a communications perspective.
- 5.35 In terms of reducing the risk associated with pollution incidents the NRA has a key role to play. Other agencies and individuals also have an important role, including farmers, industrial operators, transport operators and TWUL.

COTSWOLD WATER PARK ISSUE

Overview

- 5.36 Aggregate extraction in the Cotswold Water Park gives rise to a number of issues including impacts on fisheries, flooding and nature conservation. There is also pressure for housing and holiday home development.

Issue

- 5.37 The Cotswold Water Park is a nationally important water feature, especially in terms of wildlife. From a catchment perspective, the Park is important in terms of the fishery, flood hazard management, recreation and conservation. The Cotswold Water Park SSSI is formed from 11 of the park's existing lakes. The Park has been created by aggregate extraction and the extraction needs to be carefully managed to ensure that current uses are sustained and that opportunities, rather than problems, are created. The sustainability of the quality and quantity of surface and ground waters, particularly require the strict control of gravel extraction. De-watering can have significant effects on flows in watercourses with resultant reduction in water quality due to lack of dilution of effluents. In complex areas such as the Park, de-watering of one pit can enhance flows in one water body at the expense of another. It is essential that both the owners and users of the park are in agreement. The following specific issues need to be addressed:

- (i) low flows in the River Thames, Churn and Swill Brook;
- (ii) the development of several major schemes in the western sector of the park without main drainage;
- (iii) the incidence of flooding through run-off from the lakes in the western sector;
- (iv) the future of extraction of gravel in the Down Ampney area;
- (v) problems connected with the diversion of the A419 around Latton;
- (vi) uncertainty in the eastern sector of how the park will develop because of the problems with the bypasses for Lechlade and Fairford and the absence of a spine road in this sector.

Management Options

- 5.38 Three possible options have been identified:

- (i) **A Land use Strategy - The Upper Thames Land use Initiative**
The Upper Thames Land use Initiative has been developed by the NRA as a vision for the Cotswold Water Park which seeks to ensure that future development is environmentally sustainable, and in particular takes account of the environmental sensitivity of the area. It was based on a site by site analysis of the areas of search for minerals. It has been agreed by the NRA's core functions and has also been accepted by MAFF and English Nature as a sound basis for the future planning of the area. It comprises the three

Figure 26 Upper Thames Land Use Initiative

following elements:

- (a) Areas where the NRA are likely to formally object to extraction through the planning process, such as SSSI's;
- (b) Areas where extraction followed by restoration to agriculture is acceptable;
- (c) Areas where extraction followed by restoration to diverse wildlife habitats, including open water and wetlands, is acceptable.

The NRA intends to promote the strategy through the planning process and will advocate certain development options at the appropriate planning fora.

Advantages: The advantages of this strategy include the potential enhancement and sustainability of the aquatic environment in the Water Park. This proactive approach allows the NRA in its role as a statutory consultee to make a material contribution to the debate on the future of this important environmental resource.

Disadvantages: The document is an overview and as such cannot be used as a practical management tool. Also flood routing during high level flood events may not be the same as 'traditional' flood flows.

(ii) **Further studies**

In order to ensure that extraction in the Cotswolds is environmentally sustainable research is required. In particular the following areas require further investigation:

- (a) *The hydrology, hydrogeology and hydraulics of the Cotswold system need investigating.* The purpose of this investigation will be to assess the impacts of mineral extraction on flooding, water quality, river flows and water dependent habitats;
- (b) *Landscape assessment.* The impact of future developments on the overall landscape needs to be assessed, particularly in relation to the Thames Path National Trail. Other bodies, such as the County and District Councils and the Countryside Commission, may wish to be involved;
- (c) *Buffer zones.* It is widely known that buffer zones are beneficial from a number of environmental perspectives, including water quality protection and ecological enhancement. However guidelines for their implementation are still at a provisional stage. Further information is required on the type and location of buffer zones which would

maximise their benefit in the Water Park Area.

Advantages: The main benefit from the above studies will be better information for decision making. Identifying and carrying out studies will mean that a full NRA view is promoted at the pre-application stage.

Disadvantages: Cost. However, this may be overcome if developers are financially responsible for further studies.

(iii) **Actions to reduce flood risk to people and property**

In the absence of detailed research, certain actions can be taken to reduce flood risk. This approach is in keeping with the concept of precautionary action. Additionally, extraction could be undertaken perpendicular rather than parallel to groundwater contours to reduce flooding. Consideration should also be given to after use - care is required in deciding how the land is to be utilised with particular regard to raising ground levels, bunding etc.

Advantages: Reduction in flood risk.

Disadvantages: None.

Implementation

- 5.39 The NRA has a role to play in all the above options. For some options a range of organisations will be involved, for example, local authorities and English Nature. All the relevant agencies will need to communicate and coordinate their activities to ensure the sustainable management of the region. The NRA needs to be proactive, it must have clear and defined options for the Cotswold Water Park, particularly in view of the fact that there are so many other interested parties.

RECREATION AND CANAL RESTORATION ISSUE

Overview

5.40 There are a number of recreational issues in the catchment:

- community interest groups support the reopening of the two canals in the catchment, the Thames-Severn and the Wilts and Berks canal. However, there is concern that there may be insufficient water to operate the canals;
- The River Thames Recreation Strategy is currently being developed;
- certain user groups, in particular canoeists, feel under represented in terms of recreational facilities in the catchment.

Issues

5.41 In terms of public opinion, the reopening of canals is welcomed. Certain community based groups, in particular the Cotswold Canal Trust, are actively promoting the reopening of the Thames-Severn canal. In addition there are proposals to reopen the Wilts-Berks Canal. The reopening of canals represent the development of a valuable recreational resource but have a number of multifunctional implications.

5.42 Canals require an appreciable quantity of water to support navigation and run successfully. As has been discussed in the flows-levels section earlier there are already significant water resource constraints in the catchment. There may therefore be insufficient water to operate the canals and the reopening of the canals may intensify water resource problems. The Cotswold Canal Trust have suggested incorporating the canal into Wiltshire CC's Minerals plan and using de-watering water from gravel extraction to supply the canal or as the media for strategic water transfer. They also believe that the canal could be used to relieve flooding and that available water could be back pumped to maintain water level and flow.

5.43 The Wilts & Berks Canal Amenity Group 'promotes the protection, preservation and improvement of the Wilts & Berks Canal and its branches for the benefit of the public, with the ultimate goal of restoring a continuous navigable waterway linking the Kennet & Avon Canal, the Thames & Severn Canal and the River Thames'. Restoration has been continuing steadily especially around Swindon. For example, the group are poised to begin work at Wootton Bassett in the autumn after the completion of a ecological study partly funded by Wiltshire Rural Action. This particular section is set to integrate with part of the Great Western Community Forest. The group have realised that a full scale engineering feasibility study, encompassing the costs and benefits of the restoration, needs to be considered seriously to secure progress in the future.

5.44 The British Canoe Union has pointed out that there are too few canoe facilities in the Upper Thames catchment. NRA staff with responsibility for recreation concur with

the Canoe Association's view. There may be the possibility that other user groups are similarly under represented in terms of recreational facilities.

Management Options

5.45 The following strategies are suggested:

- (i) **Conduct a thorough investigation into the environmental aspects of reopening the Thames-Severn canal and the Wilts and Berks canal.**
To ensure that canal restoration has negligible impact on the environment, an environmental impact assessment should be undertaken. This assessment should pay specific attention to the water resource related aspects of the canals.

Advantages: The environmental issues can be identified.
The water resource constraints can be objectively assessed.

Disadvantages: Cost; however, an EIA will probably have to be undertaken as part of a scheme to reopen the canal.

- (ii) **Develop recreation facilities for specific activities**
Where it is clear that recreational facilities are lacking for certain uses, the NRA may be prepared to provide these facilities or encourage the user group if they seek to provide the facilities themselves. However, the provision of additional recreational facilities should not be conducted on an ad-hoc basis but should be viewed from a total catchment perspective within the context of the Recreation Strategy.

Advantages: Facilities will be provided for user groups who need them.

Disadvantages: Cost of providing facilities; potential conflict between uses.

- (iii) **Development and implementation of a River Thames Recreation Strategy (non-tidal Thames)**

The Recreation Strategy consultation document proposes a series of policy statements and recommendations for action. Those pertinent to the Upper Thames include the following:

- (a) *Policy 1:* The banks of the Upper Thames are a valuable countryside resource and should be protected from development which will affect the rural and tranquil nature of the area. The enjoyment of the area for recreation should be encouraged, with visitors 'managed' so that the underlying rural landscape is not disturbed.

- (b) *Policy 2:* Priority will be given to the improvement of the amenity value of the riverside in areas where there is potential and it is appropriate to do so. The source of the Thames is an important site, both as a local feature and because it marks the beginning of the Thames path. The provision of important visitor facilities, including information, close to the site should be encouraged.
- (c) *Policy 3:* In the Upper Thames the development of additional permanent moorings on the main river channel should be resisted in order to maintain the 'empty', rural character of the river valley. It is believed that there is scope for additional off-stream moorings, but these must be low key and sensitively located in areas where there is existing development.

If these policies are accepted, then the NRA and others will be charged to implement them and promote them.

Advantages: A recreation strategy will enable balanced development to occur. One of the Strategy's key functions will be the coordination of the numerous organisations who are involved with the 'management' of the River Thames.

Disadvantages: Cost of developing these policy and managing possible conflicts of interest.

Implementation

- 5.46 The NRA has a key role in many of the above options and strategies. In terms of promoting the canal development a number of different agencies have an involvement, including local authorities and the relevant canal promotion groups. Users groups, such as canoeists, have a key role to play in working with the NRA to provide facilities.

FUTURE WATER RESOURCES : MEETING FUTURE DEMANDS FOR WATER

Overview

- 5.47 'Future Water Resources in the Thames Region - A Strategy for Sustainable Management' (1994) shows that the demand for water from current planned development in the area can be met from existing licensed resources. This includes the major expansion of Swindon, of which the Northern Sector Development is a key component. The demand arising from this development will be met by increasing the conjunctive use of existing licensed local and strategic resources.

Issue

- 5.48 Meeting future needs for water resources will require a combination of methods to manage growth in demand which will involve us all in one way or another. For example, through further leakage control, possibly domestic metering and generally raising awareness of more efficient use of water at work and in the home.
- 5.49 If growth in demand cannot be managed in the longer term, new strategic schemes may need to be promoted. A number of schemes have been identified, including a new reservoir in south-west Oxfordshire (SWORP), possible inter basin transfers in the region or increasing re-use of water.

Management Options

- 5.50 The NRA recognises that there are many uncertainties in planning for the future, in forecasting demand as well as the time needed to promote major new water resource schemes and to address all the potential environmental impacts. The Region has identified investigations to establish a position on each of the key water resource development options and is committed to completing these over the next five years. During this time a much clearer picture should become available of the scope for managing growth in demand for water and promoting water use efficiently. The following two management options should be considered in light of this:

(i) Managing Growth in Demand

The sustainable management of the Region's water resources relies on the proper and efficient use of water. Essential to this is the achievement of economic and practical levels of leakage control and domestic metering. The NRA believes that both OFWAT and the Water Companies should be given a statutory duty to promote the efficient use of water.

Advantages:

Controlling the growth in demand for water will delay or potentially avoid altogether the need for new water resource schemes, many of which will be remote from the immediate area of need and also have significant environmental impact.

Disadvantages: None.

(ii) NRA Planning Guidance To Local Authorities

In liaison with the Local Planning Authorities, the NRA would normally seek to discourage development (unless new resources can be made available in good time) in locations where:

- water resources are already scarce; or,
- additional development is likely to result in less reliable supplies for the existing population and industry.

Without adequate co-operation between the Planning Authorities and the NRA to identify and avoid such development, the NRA must be concerned that it may result in pressures for further abstraction with undesirable environmental consequences.

Advantages: Forward planning will provide guidance to local authorities ensuring that infrastructure constraints are fully recognised and that the timing of development does not compromise existing levels of service.

Disadvantages: None

Implementation

- 5.51 The NRA, Water Companies, the Water Regulator (OFWAT), water consumers, planning agencies and central government all have a role to play in the implementation of the above options.

INTEGRATED MANAGEMENT ISSUE

Overview

- 5.52 Sustainable management, which is the overall concept guiding the development of this catchment plan, requires an holistic integrated approach.

Issue

- 5.53 As a key part of the move towards sustainable human use of ecosystems, a more integrated approach to natural resource management is required. Developing integrated management approaches represents a substantial challenge to all those who live in and use a catchment. The concept of integration requires specialists to broaden their perspective and appreciate the impact of specific activities on the entire catchment and over different periods of time.

Management Options

- 5.54 Three ways forward have been identified;

- (i) **Develop a research programme into integrated management using specific catchments or sites**

Research into the practical aspects of integrated management is required. Certain catchments should be chosen as case studies to explore the problems and practicalities of implementing the concept of integrated catchment management. The Upper Thames catchment lends itself well to such a programme on account of the large number of sub catchments, one or two of which would be chosen for a research project, eg the Cole, Coln or Ampney Brook. The benefits of the river restoration project on the River Cole at Coleshill for integrated catchment management could be assessed for example river maintenance, monitoring and flood defence cost reductions, costs of changed agricultural system associated with rural restoration and recreation etc.

Opportunities for community based initiatives should also be identified whereby the NRA take a collaborative but not necessarily leading role on certain projects. In this instance it would be particularly useful to monitor the success of different parties working together.

Advantages:

The techniques of integrated catchment management can be developed in a structured environment. The results and achievements can be disseminated to natural resource managers throughout England and Wales.

Long term catchment management costs, such as flood defence and channel works, may be significantly reduced.

Disadvantages: High initial investment in research and lack of staff resources.

- (ii) **Greater Involvement by the NRA in planning and development issues**
It is better to influence development proposals at an early stage rather than have to react to decisions when they are made. There is a role for the NRA to promote the protection and enhancement of the water environment at the earliest possible stage in planning and development issues. A proactive rather than a reactive approach should be adopted ie through 'area-specific' planning studies.

Advantages: A higher proportion of planning and development issues will take account of impacts on the water environment.

Disadvantages: Additional costs to the NRA of becoming involved in planning/development issues. Also need considerable effort to get this established.

- (iii) **Long term monitoring**
Continued long term monitoring is necessary to ensure changes over time and trends are detected. This should include the success of the Catchment Management Plan itself.

Advantages: Better information for decision makers; long term savings as a consequence of more accurate decision making.

Disadvantages: Costs. Level of monitoring needs to satisfy both statutory requirements but also be appropriate for how the data is used.

Implementation

- 5.55 A range of agencies would need to be involved in the research project, including farmers, local authorities, MAFF, NRA, Universities, communities, other central government agencies. A funding agency would be required to provide the up-front costs of research. The NRA has a key role to play in influencing planning/development decisions and in long term monitoring.

COMMUNICATION ISSUE

Overview

- 5.56 Good communication between the various groups involved in catchment management is required to ensure that the catchment is managed on a sustainable basis.

Issue

- 5.57 The actions of a range of individuals and user groups impact on the catchment and affect different uses. All groups, both statutory and non-governmental, need to communicate to ensure that development at the catchment scale is sustainable and that the ability of the ecosystem to support different uses is sustained. Also need to make communication at 'grass roots' level to the public as effective as possible
- 5.58 A possible approach to encourage communication between the different "players" in the catchment is for the NRA to facilitate a working group. This group could comprise representatives from the statutory agencies and leading interest groups.

Management Options

- 5.59 The catchment lies within NRA-TR West area. It is hoped that this more 'local' focus makes the NRA ability to communicate and respond more effective. Views are sought on the merits of the NRA leading a "catchment working group" or other similar groups. The NRA are committed to producing annual reviews of the Catchment Management Plan Final Report detailing data updates and the progress of actions. The NRA is also considering providing less formal, interim newsletters every six months.

Advantages: There are a number of benefits to be obtained from a working party type of approach.

Disadvantages: The working party needs to be carefully structured to ensure that all groups have access to the resources necessary to enable them to successfully contribute to the decision making process. Also there is a current view that too many meetings are held as opposed to dedicating resources to more tangible actions. Increased public relations also needs the provision of considerable resources.

Implementation

- 5.60 All interested parties have a role in the establishment and success of a system of working groups.

SUMMARY OF KEY ISSUES

Figure 27 Key Issues

SECTION 6
NEXT STEPS

6. THE NEXT STEPS

6.1 This document has been produced through internal discussion, informal liaison with a wide range of organisations (see Appendix A) and a desk study of readily available reports produced by organisations such as local authorities.

6.2 Whilst every effort has been made to ensure the accuracy of the information quoted, the plan may contain a number of omissions and inaccuracies. The next step, therefore, is to formally consult with organisations, groups and individuals interested in the future of the catchment's water environment. Consultation will enable the NRA to:

- clarify the extent and distribution of current uses of the catchment;
- assess the importance of catchment uses;
- identify the wide range of likely, possible and potential future catchment uses;
- expose catchment specific issues to a wide audience;
- ensure decisions on the future management of the catchment are based on accurate information and the fullest possible range of views from interested parties.

6.3 In commenting on this plan it is hoped that both points of detail and strategic issues will be tackled. To aid this process a Consultation Response Questionnaire has been provided. In particular the following questions should be considered:

- have the current and future uses of the catchment been correctly identified?
- have the issues been fairly addressed and what opinions do you have on them and the options we propose?
- have any issues been missed?
- how should the evaluation of the issues and the development of strategies and action plans be progressed?

6.4 During the consultation period comments can be submitted in writing to:

Upper Thames Catchment Management Plan
National Rivers Authority Thames Region
Isis House
Howbery Park
Wallingford
Oxon OX10 8BD

6.5 Our Project Manager for the CMP, Jamal A Hamid or Michelle Doyle (Catchment Planning Officer), can be contacted on (0734) 533304/11. All comments must be with us by 17 February 1994.

6.6 The consultation phase incorporates a number of separate but linked activities. These include:

- a launch using news, radio and television releases;
- distribution of the full plan and/or a summary leaflet of key organisations, groups and individuals;
- a display for use in libraries and other public areas;
- public meetings as appropriate.

6.7 At the end of the consultation phase results of the process will be considered in detail before producing a definitive Catchment Management Plan. The Final Report will define both a strategy for the future management of the catchment and a series of action plans for the NRA and others to implement in order to deliver the strategy.

6.8 The information and views you provide are therefore a very important step in the overall process. It is hoped that you will respond positively to this initiative so that a shared vision for the Upper Thames Catchment can be developed.

APPENDICES

APPENDIX A - RESULTS OF INFORMAL LIAISON

APPENDIX A - RESULTS OF INFORMAL LIAISON

- A.1 A total of 214 organisations were consulted during an informal consultation exercise regarding this CMP. Of these organisations, 25% responded with either issues regarding the catchment area or just to acknowledge that although they did not have any observations at this stage, they would like to be consulted at a later stage of the Plan. Over half of these responses were received from County, District and Parish Councils. The following provides a summary of the issues raised during this informal consultation exercise:

PARISH COUNCILS

- Low water levels in rivers and brooks ie:
 - Ampney Brook
 - River Coln
 - River Leach.
- Great Oolite aquifer being over abstracted;
- Concerned about abstraction from rivers for domestic/commercial supply;
- Choking of rivers by weeds;
- Effects of gravel extraction in Cotswold Water Park on water levels;
- Flood risks from River Thames after gravel working;
- Water quality in rivers/brooks ie Tuckmill Brook;
- Diminishing wildlife especially birds;
- Need for water supply reserves in time of drought.

LOCAL AUTHORITIES (County/District Councils)

- Excessive water abstraction from oolites;
- Lowered river levels and low stream flows;
- Concern over provision of adequate water supplies;
- Need for positive environmental protection policies and practices;
- Protect pure water resources in gravels;
- Concern over nitrate/phosphate levels in rivers;
- Restrain building on flood plain;
- Promote access for recreation/leisure along riverside paths.
- Concern over flooding;
- Need for river management eg weeds, dredging;
- Preservation of river banks eg Coln, to prevent flooding;
- Importance of Cotswold Water Park for nature conservation, recreation and mineral extraction;
- Support restoration of canal network.

MAFF

- agricultural land use;
- NVZs
- ESAs
- Water Level Management Plans

LANDOWNERS (through County Landowners Association)

- Prevent pollution of springs flowing into Coln;
- Concern over lowered water levels in springs, Ampney Brook and rivers Thames, Churn, Coln, Leach and Swill Brook;
- Need for river management eg weed clearing;
- Concern over sudden rises in level in Thames and the resulting flooding of crops;
- Concern over impacts of abstraction by TWUL at Baunton especially during droughts;
- The impacts of the SWORP;
- Fertilizer run off and associated effects on the river ecosystems;
- Ecological deterioration/loss of wildlife as a result of lowered water levels in streams etc;
- Deteriorating river quality affecting fisheries;
- Access needs to be recognised not only near large settlements and River Thames, but also in rural areas and around streams;
- Perceived threat of major water transfer scheme on the environment.

INTEREST GROUPS/NON GOVERNMENT ORGANISATIONS

**Great Western
Community
Forest**

- Concern over nitrate and phosphate levels, pesticides, agricultural and urban area run-off and resulting pollution in rivers.
- Loss of herb rich meadows in river corridors.
- Reduction in wildlife.
- Promote waterside landscapes, countryside stewardship and river restoration projects.
- Need for more natural river landscapes for wildlife and recreation.
- Safeguard recreation routes eg along Rivers Ray and Cole.

Thames Water

- The CMP should reflect realities of funding, timescales and priorities. Costs and benefits, nature and timing of improvements should be identified.

**Angling
Interests**

- Restrict abstraction licences from the Thames tributaries to prescribed flows.

- Impacts of flood management on the fishery.
- Concern over quality of tributaries (Thames).
- Cotswold Canals Trust
 - Thames and Severn canal - could relieve flooding.
 - Proposal to back pump water up the canal to provide water for navigation and increase low flows in Thames Head waters, thereby avoiding water resource conflicts.
- NFU
 - Interested in effects on water quality of agricultural run off and sewage sludge.
 - Water availability and abstraction licensing.
- CPRE
 - Limit abstraction/impacts on river flows.
 - Protect water quality and wildlife.
 - Restrain development if water supply infrastructure is out of phase.
- National Trust
 - Mention Countryside Stewardship Schemes and Rivers Restoration Project.
- Friends of the Earth
 - Important issues include:
 - Low flows
 - Development on flood plains
 - Recreation impact
 - Monitoring
 - Protection of potable sources
 - Water quality issues
 - Contaminated Land
 - Eutrophication
 - Water logged soils
 - ESAs and Nitrate SAs
 - Landfill and minerals industry
- RSPB
 - Safeguard habitat for breeding birds, invertebrates and aquatic plants in Cotswold Water Park.
 - Create wetland habitats, grassland and reedbeds in Cotswold Water Park.
 - Safeguard SSSIs.
 - Include a commitment to prepare and implement water level management plans for important wetland wildlife sites.
 - Have regard to Environmental Procedures for Inland Flood Defence Works.
- British Canoe Union
 - Acknowledge canoeing on water sites in catchment and also potential for additional sites. Rivers Thames, Ray, Churn and Cole are used by canoes.
 - Access agreements on all canoeable rivers are desirable.

- Recognition by NRA of the need for more access for recreation purposes to land held by NRA.
- Correlate fees paid by canoeists on River Thames with development of canoe site facilities
- Prevent changes in river engineering (weirs and sluices etc) which jeopardise canoeing activity.
- Water quality.

English Nature

- Use of aquatic herbicide at the Cotswold Water Park
- Water quality at the Water Park in relation to increased development taking place here and changes in runoff.
- Minimum intervention on the Swill Brook, Ray, Coln and Churn so as to maintain as natural a profile and flow as possible.
- Target areas for water level enhancement to recreate wetland habitats, eg for breeding waders.
- Native crayfish populations need to be maintained - strategy for crayfish farms.
- Intrusion of new fish farms into floodplain and possible loss of wet grassland.
- Encourage natural otter recolonisation rather than deliberate reintroductions.
- Upper Thames navigation - impact of restoration of river navigation and linkage to restoration of Severn - Thames Canal.

Cotswold Water Park
Villages Society

- Frequent flooding in the area of Somerford Keynes and Ashton Keynes.

River Thames Society

- Potential impact of the renovated canal.
- Conflicts between those using old gravel workings for aquatic sports and the needs of the wildlife.

APPENDIX B - DEFINITION OF CATCHMENT USES

APPENDIX B - DEFINITION OF CATCHMENT USES

FISHERIES

- B.1 This use relates specifically to the maintenance of breeding populations of salmonid (ie game) and cyprinid (ie coarse) fish. European Commission (EC) Freshwater Fisheries Directive (78/659/EEC) "on the quality of waters needing protection or improvement in order to support fish life" provides a statutory basis for the protection of water quality in certain rivers. Fish populations provide useful information on the general health of the aquatic ecosystem because:

- they are biological indicators of changes in river flow, habitat and quality;
- they are exploited by commercial and recreational fisheries;
- they contribute to the diversity of the water environment.

LANDSCAPE

- B.2 The landscape reflects the complex interplay between the natural environment and man's activities. Geomorphology, topography and drainage provide the basic elements of the landscape and, together with associated vegetation and settlement patterns, determine the essential landscape character of different areas.

HERITAGE

- B.3 Heritage deals with features of archaeological significance, areas which have been designated as conservation areas because of their urban form, and sites which are of heritage value because of their historic or archaeological importance. Many of these sites have a strong relationship with the landscape.

AMENITY AND RECREATION

- B.4 Activities such as walking, bird watching, angling, boating, sailing, rowing and picnicking bring people into close proximity with the water. The principal concerns are general aesthetic acceptability of water features, access to and along watercourses and the provision of appropriate facilities.

NAVIGATION

- B.5 This use relates to those waterways for which there is a statutory right of passage for boat traffic. The amenity and recreation, fisheries and landscape and heritage elements of navigation are considered in other use category descriptions.

WATER ABSTRACTION

- B.6 Water is abstracted (removed) from rivers and groundwater to provide for the needs of Agriculture, Industry and Public Supply. Abstractions are controlled by a system of Licences introduced in the 1960's and now administered by the NRA. Licences restrict the amount of water which may be taken and can include further conditions to provide enhanced environmental protection. Some small abstractions eg to supply a single household do not require a licence.

EFFLUENT DISPOSAL

- B.7 This use relates to the disposal of domestic, industrial and agricultural effluents to the river system. The conditions to be met by a discharge are set out in a discharge consent which is issued by the NRA and applies to the specific discharge. Discharges can affect both the quality and quantity of a river. In terms of water quality discharges can have a severe impact on a river. From a water quantity perspective effluent discharges can maintain river flows during times of drought.
- B.8 When setting a discharge consent the NRA takes account of both the upstream water quality and the flow in the receiving water body. The NRA has a statutory role to monitor discharges and assess the effluent quality against the specifications in the consent.

RURAL LAND USE

- B.9 This section outlines the planning policies of the local authorities at structure plan and local plan level dealing with conservation of both the natural and built environment.

URBAN LAND USE

- B.10 This section includes the policies of the relevant local authorities at structure and local plan level dealing with future development. It sets out the general strategy and policies for individual land uses.

MINERAL EXTRACTION AND SOLID WASTE DISPOSAL

- B.11 Mineral extraction has the potential to affect the catchment through subsidence or effluent discharge whilst works are active. When they are closed their possible use as solid waste disposal sites could lead to contamination of ground and surface water. The County Councils are the licensing authority with respect to extraction of natural resources and must through their Minerals Plan achieve adequate mineral supplies with minimal environmental cost.

FLOOD DEFENCE

- B.12 This use deals with the protection of people with property from flooding from

natural watercourses. Certain watercourses are designated as 'main river'. On main rivers the NRA have permissive powers to: construct new defences; maintain defences; and, control the actions of others so that the risk to existing and future uses (eg development) can be minimised. The NRA TR are the primary group involved in flood defence matters but on ordinary rivers Local Authorities are the first point of contact. For flooding from sewers the responsible group is either the Local Authority or TWUL.

- B.13 The standard of flood protection can be measured in terms of the frequency at which (eg 1 in 50 years), on average, it will prove ineffective. The standards considered appropriate vary according to the land use to be protected and the economics of providing the service. Flood defence work is closely associated with the physical form of the river and the adjacent areas. River maintenance may involve dredging, weedcutting, clearance of debris and other operations. Ensuring the environmental sensitivity of such operations is of paramount importance. There is therefore potential for conflict with uses which depend on the structure of the river eg fisheries and ecology.

APPENDIX C - GLOSSARY

Units

Length:	10mm = 1 cm (equivalent to 0.394 inches)
	100cm = 1m (equivalent to 39.37 inches)
	1000m = 1km (equivalent to 0.621 miles)
	1 mile = 1.609 km
Area:	10 000 m ² = 1 ha (equivalent to 2.47 acres)
Density:	1 000 ng/l = 1 ug/l (equivalent to 3.53 x 10 ⁸ ounces)
	1 000 ug/l = 1 mg/l (equivalent to 3.53 x 10 ⁵ ounces)
Flow:	1 000 l/s = 1 m ³ /s (equivalent to 35.31 cusecs)
	1 000 m ³ /d = 11.6 l/s (equivalent to 0.41 cusecs)
	1 Ml/d = 11.6 l/s (equivalent to 0.224 mgd)
	(cumec = cubic metres per second)

<i>Abstraction</i>	Removal of water from surface or groundwater, usually by pumping.
<i>Abstraction Licence</i>	Licence issued by the NRA under S38 of the Water Resources Act 1991 to permit water to be abstracted. The maximum abstraction rates are specified in the licence.
<i>AOD</i>	Above Ordnance Datum
<i>AONB</i>	Area of Outstanding Natural Beauty as designated by the Countryside Commission
<i>Aquifer</i>	A layer of underground porous rock which contains water and allows water to flow through it.
<i>Baseflow</i>	That part of the flow in a watercourse made up of groundwater and discharges. It sustains the watercourse in dry weather.
<i>Biochemical Oxygen Demand (BOD)</i>	A measure of the amount of oxygen consumed in water, usually as a result of organic pollution.
<i>Catchment</i>	Area from which river systems, lakes and reservoirs collect water.
<i>Confluence</i>	The point at which two rivers meet.

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<i>Consent</i>	The statutory document issued by NRA under schedule 10 of the Water Resources Act 1991 to indicate any limits and conditions on the discharge of an effluent to a controlled water.
<i>County Structure Plans</i>	Statutory documents produced by County Councils (CC) outlining their strategy for development over a 10-15 year timescale.
<i>CMP</i>	Catchment Management Plan - integrated plans for the catchment which cover all the functions of the NRA. These provide the strategy by which the catchments will be managed.
<i>Cyprinids</i>	Coarse fish of the Carp family ie roach, dace, bream.
<i>Dangerous Substances</i>	Substances defined by the European Commission as in need of special control because of their toxicity, bioaccumulation or persistence. The substances are classified as List I or List II according to the Dangerous Substances Directive.
<i>Dissolved Oxygen (DO)</i>	The amount of oxygen dissolved in water. Oxygen is vital for life so this measurement is an important, but highly variable, indicator of the 'health' of the water. It is used to classify waters.
<i>Diffuse pollution</i>	Caused by the areal spread of pollutants or by the cumulative effect of many individual or ill-defined events ie acid rain, pesticides etc.
<i>Directive</i>	A type of legislation issued by the European Community which is binding on the member states.
<i>District Local Plans</i>	Statutory documents produced by District or Borough Councils (DC/BC) to implement the development strategy set out in County Structure Plans. Specific land use allocations are identified.
<i>DoE</i>	Department of the Environment

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<i>EA</i>	Environmental Assessment
<i>EC</i>	European Commission
<i>Eutrophic/Eutrophication</i>	The enrichment of water by nutrients especially compounds of nitrogen and/or phosphorus causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and the quality of the water concerned.
<i>Flood plain</i>	This includes all land adjacent to a watercourse over which water flows or would flow but for flood defences in times of flood.
<i>GIS</i>	Geographical Information System
<i>Groundwater</i>	Underground water contained in the pores and fissures of aquifers (water bearing strata).
<i>Invertebrate fauna</i>	Animals which lack a vertebral column - used for biological classification. Especially macro-invertebrates (animals of sufficient size to be retained in a net with a specified mesh size).
<i>Landfill</i>	Site used for waste disposal into/onto land.
<i>LNR</i>	Local Nature Reserve
<i>Macrophytes</i>	Plants that can be seen by the naked eye.
<i>MAFF</i>	Ministry of Agriculture, Fisheries and Food.
<i>Main River</i>	Some, but not all, watercourses are designated as 'Main River'. 'Main River' status of a watercourse must first be approved by MAFF. The NRA has the power to carry out works to improve drainage or protect land and property against flooding on watercourses designated as 'Main River'.
<i>MoD</i>	Ministry of Defence
<i>NRA-TR</i>	National Rivers Authority - Thames Region

<i>Potable water</i>	Water suitable for human consumption.
<i>Prescribed Flow (Flow Constraint)</i>	A river flow incorporated as a condition in an abstraction licence, such that abstraction must cease once the flow falls below this value.
<i>Riparian</i>	A person/organisation with property rights on a river bank.
<i>River Corridor</i>	Of particular importance to the NRA, such a corridor is a continuous area of land which has visual, physical or ecological links to a watercourse and is dependent on the quality or level of water within the Channel.
<i>River Quality Objective (RQO)</i>	The level of water quality that a river should achieve in order to be suitable for agreed uses.
<i>Run (fish)</i>	To migrate upstream from the sea especially in order to spawn.
<i>Salmonids</i>	Fish classified as belonging to the Salmon family ie salmon, trout, char etc.
<i>Septic Tank</i>	A small tank receiving and treating sewage by bacteria.
<i>Set-aside</i>	Temporary withdrawal of agricultural land from agricultural production.
<i>Silage</i>	A winter feed for cattle. Silage is produced in the summer by bacterial action on freshly cut grass.
<i>Site of Special Scientific Interest (SSSI)</i>	A site given a statutory designation by English Nature because it is particularly important, on account of its conservation value.
<i>Slurry</i>	Animal waste in liquid form.
<i>Source Control</i>	A collective term to describe the management of run-off at or near the point of impact of rainfall and before it reaches the traditional piped drainage and sewer systems of urban areas (see <i>Swale</i>).

<i>Springs</i>	Natural emergence of groundwater at the surface.
<i>STW</i>	Sewage Treatment Works
<i>Swale</i>	An example of Source Control attenuation, these are elongated grass channels used to convey and treat run-off. Others include balancing ponds, permeable pavements and underground water butts.
<i>SWQOs - statutory water quality objectives</i>	Water quality objectives set by the Secretary of State, in relation to controlled waters.
<i>Sustainable</i>	Capable of being maintained at a steady state without exhausting natural resources or causing ecological damage.
<i>Sustainable development</i>	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
<i>Topography</i>	Physical features of a geographical area.
<i>UWWTD</i>	Urban Wastewater Treatment Directive
<i>Watercourse</i>	A stream, river, canal or the channel, bed or route along which they flow.

APPENDIX D - DESCRIPTION OF RESPONSIBILITIES

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Introduction

The supply of water for domestic consumption and industrial use is not the responsibility of the NRA but of **water and sewerage undertakes**. The prices charged by these private companies are regulated by the **Office of Water Services**. The quality of water supplied for consumption is monitored by the **Drinking Water Inspectorate** and **District or Borough Councils**.

The disposal of sewage effluent is the responsibility of **water and sewerage undertakers**. their discharges are subject to control by the NRA. Potentially significant industrial discharges to the water environment are controlled by **Her Majesty's Inspectorate of Pollution**.

The NRA has the primary responsibility for flood defence and land drainage matters but on "ordinary watercourses" the responsible land drainage and flood defence agency is the **District or Borough Councils** may also manage on behalf of **water and sewerage undertakers** surface water drains leading to rivers and watercourses.

The responsibilities of the above organisations are described below. The activities of the NRA are then described in detail.

Water and Sewerage Undertakers

These private companies are responsible for providing water supplies and the management of STWs. Thames Water Utilities Ltd provide services to the catchment area.

Her Majesty's Inspectorate of Pollution (HMIP)

HMIP is the regulatory authority for Integrated Pollution Control. This is a system introduced to control pollution from industrial processes which could cause significant pollution to air, land and water. Discharges from STWs and other discharges to water are regulated by the NRA.

Drinking Water Inspectorate (DWI)

The DWI is responsible for checking that companies supplying drinking water carry out proper monitoring and meet the regulations for the quality of water supplies set in part by the European Community Drinking Water Directive.

Office of Water Services (OFWAT)

A government agency responsible for making sure that the water and sewerage undertakers provide customers with a good quality and efficient service at a fair price.

District or Borough Councils

These authorities monitor the quality of all water supplies, including private supplies, within their area. They can require improvements to be made to private water supplies.

Watercourses which have not been statutorily designated as "main river" on maps held by the NRA and Ministry of Agriculture, Fisheries and Food (MAFF) are known as "ordinary watercourses". The provision of flood defence and land drainage services on these watercourses is the responsibility of the relevant council.

National Rivers Authority (NRA)

AIMS

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

STRATEGIC OBJECTIVES

Water Resources

It is the NRA's responsibility to assess, manage, plan and conserve water resources. The Water Resources Act 1991 describes the duty of the NRA to be to ensure measures are taken towards conservation, redistribution, augmentation and proper use of water resources. The Act requires the NRA to make arrangements with water and sewerage undertakers and statutory water companies for securing proper management and operation of water resources and associated works. To effect these requirements the NRA controls abstractions by a licensing system and has the power, if necessary, to issue drought orders and designate water protection zones and nitrate sensitive areas.

Under the Water Resources Act 1991 all abstractions require a licence except for those of less than 20 cubic metres a day for domestic or agricultural use from surface water and those of less than 20 cubic metres per day for domestic use. There are also other exceptions for small abstractions from boreholes and springs. Charges for abstraction licences are based upon quantity, source, season and loss.

To secure proper management of water resources the NRA operates a hydrometric network of rainfall and river flow gauging stations. These not only provide data for water resource assessment but also for flood prediction, impact of effluent discharges, fisheries management, conservation and recreational uses.

Our Strategic Objectives are:

- To plan for the sustainable development of water resources, developing criteria to assess reasonable needs of abstractors and of the environment.
- To collect, validate, store and provide hydrometric data and water environmental data in order to assess water resources.
- To apply a nationally consistent approach to abstraction licensing, including licence determination, charging, policing and enforcement.
- To implement a consistent approach to the resolution of inherited problems caused by authorised over-abstraction.
- To work with other functions and external bodies to protect the quality of our water resources.

Water Quality

The aim of the NRA is to maintain and improve the quality of rivers, estuaries, coastal waters and groundwater through the control of water pollution. These aims are fulfilled via:

- water quality management;
- effluent quality regulation;
- pollution incident investigation; and,

- pollution prevention

Water quality management is based principally on monitoring of the environment to establish chemical, biological and microbiological quality. These data are used by the NRA to detect trends, plan improvements and execute its statutory duties regarding the setting of discharge parameters and compliance with EC directives.

The NRA controls inputs into the environment via the issue of consents. Discharges from industrial, agricultural, domestic and sewage related sources are regulated by specification of effluent quality limits and conditions which the discharger must achieve. Such discharges are routinely monitored and failure to satisfy consent conditions may lead to legal action being taken.

The NRA makes an immediate response to all reports of pollution. During a pollution incident investigation actions are taken to identify the source, stop the discharge, minimise adverse effects and ensure remedial work where appropriate is completed. Legal action is considered in cases of serious and/or repeated incidents.

Pollution prevention via development control and advice on best practice to industry, farmers, water supply and sewage companies is carried out in support of water quality management to prevent deterioration of the water environment.

Our Strategic Objectives are:

- . To maintain waters that are already of high quality.
- . To improve waters of poorer quality.
- . To ensure all waters are of an appropriate quality for their agreed uses.
- . To prosecute polluters and recover the costs of restoration from them.
- . To devise charging regimes that allocate the costs of maintaining and improving water quality fairly and provide incentive to reduce pollution.

Conservation

Conservation activities of the NRA aim to:

- conserve and enhance the wildlife, landscapes and archaeological features associated with inland and coastal waters; and,
- promote the conservation of aquatic flora and fauna.

The statutory duties under the 1991 Water Resources Act further state that the NRA shall further the conservation and enhancement of natural beauty in respect of proposals relating to NRA functions, protect sites of conservation interest and take into account the effects that any proposals would have. This is achieved through regulating the work of others through the land use planning consultation process and the issuing of consents under the Land Drainage Act 1991 and Water Resources Act 1991 for works adjacent to rivers. The

NRA also carries out a programme of conservation works using its own workforce, in addition to assessing the conservation implications of other functional activities.

Our Strategic Objectives are:

- . Assess and monitor the conservation status of inland and coastal waters and associated lands.
- . Ensure that the NRA's regulatory, operational and advisory activities take full account of the need to sustain and further conservation.
- . Promote conservation to enhance the quality of the aquatic and related environment for the benefit of wildlife and people.

Recreation

The NRA has statutory duties to:

- develop the amenity and recreational potential of waters and land owned by it; and,
- promote water recreation on all inland and coastal waters generally within its aims of environmental guardianship and improvement.

Recreation and amenity includes provision for opportunities and facilities for sports associated with water and the surrounding land, passive activities around water including public access and rights of way and the general aesthetic quality of the water environment.

These duties are identified in the 1991 Water Resources Act in addition to a Code of Practice which gives guidance on the kinds of provision required and the need to consider collaborative management with other bodies.

In addition to these recreation and amenity considerations the NRA, where it is the authority, has responsibilities towards the maintenance and improvement of waterways for navigation.

Our Strategic Objectives are:

- . Maintain, develop and improve recreational use of NRA sites.
- . To take account of recreation in proposals relating to any NRA function.
- . Promote the use of water and associated land for recreational purposes.

Fisheries

The general fisheries duties of the NRA are set out in the Water Resources Act 1991. Under this Act the NRA is responsible for the regulation of fisheries through the application of orders, byelaws and licensing systems.

An essential feature of the Water Resources Act 1991 is the statutory duty placed on the NRA to "maintain, improve and develop fisheries". The term "fisheries" encompasses both sport fisheries and commercial fisheries, however the Act extends further to effectively cover all inland waters, other than fish farms, which are regulated by the Ministry of Agriculture, Fisheries and Food, which have the capacity to support fish. Sport fisheries include waters such as rivers, streams, canals, lakes, ponds and reservoirs.

To discharge its statutory duties the NRA undertakes a wide range of fish surveillance and monitoring activities. Fish populations are biological indicators of changes in river flow, quality and habitat. The regulation of fish introductions and fish capture are important activities.

The costs of the fisheries service are met, in part, by funds raised from rod licences.

Strategic Objectives:

- . Protect and conserve salmon, trout, freshwater, eel and, where appropriate, coastal fisheries.
- . Regulate fisheries through the enforcement of a consistent series of licences, orders, byelaws and consents.
- . Monitor the fisheries status of rivers and inland estuaries and, where appropriate, coastal waters.
- . Formulate policies to maintain, improve and develop fisheries and restore and rehabilitate damaged fisheries.
- . Provide an efficient and effective fisheries service which is responsive to the needs of its customers and which is based on a sound charging system.

Flood Defence

The NRA has powers to:

- protect people and property against flooding from rivers and the sea;
- provide a means for the drainage of land; and,
- provide adequate arrangements for flood forecasting and warning.

Certain watercourses are designated as "main river". On main rivers the NRA have permissive powers to: construct new defences; maintain defences; and, control the actions of others so that the risk to existing and future uses (eg development) can be minimised. The NRA are the primary group involved in flood defence matters but on ordinary rivers District or Borough Councils are the first point of contact. For flooding from sewers the responsible group is either the District or Borough Council or TWUL.

The standard of flood protection can be measured in terms of the frequency at which (eg 1 in 50 years), on average, it will prove ineffective. The standards considered appropriate vary according to the land use to be protected and the economics of providing the service.

These activities are undertaken under the 1991 Water Resources Act and are directed by the Regional Flood Defence Committee. In addition to works on statutory main river, the NRA also has powers to control weirs and culverts on ordinary watercourses that would otherwise affect the flow.

Our Strategic Objectives are:

- . To develop and implement our flood defence strategy through a systematic approach for assessing capital and maintenance requirements and develop medium and long-term plans for those defences owned and maintained by the NRA.
- . To encourage development of information technology and extension of facilities which will further improve the procedures for warning of, and responding to, emergencies.
- . To support R&D which will assist in identifying future flood defence needs.
- . To review best practices for all operational methods, and the identification and justification of work, thus

increasing efficiency and enhancing value for money.

To heighten general awareness of the need to control development in flood plains and contribute to the development of catchment management plans.

To identify opportunities for the enhancement of environmental, recreational and amenity facilities when undertaking flood defence works.

Navigation

Our future strategy is to take a lead in working with other navigation authorities to bring about a more consistent approach to the administration of navigation in inland waters than currently exists in England and Wales, and to facilitate and regulate the use of those inland navigations for which the NRA is navigation authority or has powers, and to manage the inter-relationship of navigation with other core functions of the NRA.

Our Strategic Objectives are:

- Contribute to the development of an overall navigation strategy for England and Wales.
- Regulate NRA navigations through the enforcement of a consistent series of licences, orders, byelaws and statutes.
- Maintain and improve NRA navigation fairway, facilities and standards.
- Recover from users the costs of providing specific navigation facilities and a reasonable proportion of the costs of maintaining the navigation.

Land Use Planning

The NRA is a statutory consultee of the land use planning system and seeks to ensure that local authorities take into account the needs of the water environment when preparing development plans and determining planning applications.

A close working relationship is required with both County, District and Borough Councils on mineral workings, waste disposal issues, infrastructure works, works within river corridors or floodplain, and any activities likely to pollute surface or groundwaters or increase the demand for water resources.

Guidance notes for local planning authorities on the methods of protecting the water environment through development plans have been produced (September 1993), and these are being promoted in conjunction with the initiative to prepare Catchment Management Plans.

Summary

Further details on the work of the NRA can be found in a series of NRA strategy documents covering: water quality; water resources; flood defence; fisheries; conservation; navigation; recreation; and, research and development. These documents are available from the NRA Corporate Planning section at our head office in Bristol.

APPENDIX E - LISTS, DATA AND STANDARDS

(data sets still outstanding)

Upper Thames Catchment Management Plan

BMWP Scores at Each Site (1992/93 Data)			
Site	Reach	Score	Achieves Target Class
Ampney Brook	At Sheeppen Bridge	161	Y
Blunsden Brook	At Roadbridge, Water Eaton	42	N
Broadwell Brook	At Friars Court, Clanfield	106	Y
Bydemill Brook	Above Thames	43	N
Cerney Wick Brook	At Spine Road South Cerney	116	Y
Churn	At North Cerney	202	Y
Churn	At Gauging Station, Cerney Wick	192	Y
Cole	At B4019, Coleshill	153	Y
Coln	At Fossebridge	160	Y
Coln	At Gauging Station Bibury	166	Y
Coln	At Roundhouse, Lechlade	104	Y
Derry Brook	At Roadbridge, Ashton Keynes	81	Y
Dudgrove Stream	At Gate 7, RAF Fairford	89	Y
Haydon Wick Brook	Above Ray, Haydon Wick	42	N
Highmoor Brook	Below Norton Ditch	39	N
Key	At A419 Roadbridge, Cricklade	39	N
Leach	At B4449, Lechlade	164	Y
Lenta Brook	At Hinton Marsh Farm	65	N
Lenta Brook (East)	At A420 Roadbridge	23	N
Lertwell Brook	Near Zulu Buildings, B400	52	N
Liden Brook	Opp Lower Earls court Fm Building	63	N
Lydiard Brook	Above Ray (Wilts)	93	Y

Upper Thames Catchment Management Plan

Site	Reach	Score	Achieves Target Class
Marston Meysey Brook	At R/b below Marston Meysey	90	Y
Ray	At Moredon Bridge, Swindon	57	N
Ray	At Morris Street, Swindon	75	N
Ray	At Seven Bridges, Cricklade	80	N
Share Ditch	At Roadbridge, Castle Eaton	38	N
South Marston Brook	At Nightingale Lane, Sth Marston	63	N
Swill Brook	At High Bridge, Ashton Keynes	160	Y
Thames	At Eysey	184	Y
Thames	At Water Intake, Buscot	127	Y
Tuckmill Brook	Above Shrivenham STW	79	N
Tuckmill Brook	75m below Shrivenham STW	48	N
Veneymore Stream	Below Little Faringdon Trout Fm	96	Y
Waterloo Ditch	At Coleshill	82	Y
Wroughton Ditch	Below Wroughton STW	46	N

Microbiological Surveillance of the Upper Thames Catchment 1991-1994
(Including a Subjective Assessment of Levels of Bacterial Contamination)

Watercourse	Number of Sites Sampled	Number of Samples					Problem Areas
		Total	Background Levels	Treated Sewage Present	Poorly Treated Sewage Present	Gross Faecal Contamination	
Thames	8	155	96	55	4	0	d/s Ashton Keynes S.T.W.
Swill Brook	1	4	3	1	0	0	
Derry Brook	1	4	4	0	0	0	
Cerney Wick Brook	1	18	6	9	3	0	South Cerney
Churn	7	24	19	5	0	0	
Key	1	4	2	2	0	0	
Ray (Wilts)	6	32	0	28	3	1	Whole length d/s Wroughton Ditch
Hreod Burna	1	4	0	4	0	0	Hreod Burna School
Lydiard Brook	1	4	3	1	0	0	
Coln	13	66	42	22	2	0	Withington, Fossebridge
Shipton Stream	1	4	1	3	0	0	Shipton Solers
Cole	2	2	2	0	0	0	
Dorcan Brook	1	1	1	0	0	0	
South Marston Brook	1	1	1	0	0	0	
Lertwell Brook	1	1	1	0	0	0	
Tuckmill Brook	2	2	2	0	0	0	

APPENDIX E - POLLUTION PROSECUTIONS AND CAUTIONS

NAME	LOCATION	DATE OF INCIDENT	FINE	TYPE OF POLLUTION
Mr R Archard	Share Ditch, Castle Eaton	12/3/90	£250	Slurry
Thames Water Utilities Ltd	R Ray, Swindon	30/6/90 - 1/7/91	£5000	Sewage Effluent
Mr P H Crocker	Hykemerres Stream, Upper Minety	19/2/91	£500	Slurry
Mr P H Crocker	Hykemerres Stream, Upper Minety	19/4/91	£500	Slurry
Moreton C Cullimore Ltd	Swill Brook, Ashton Keynes	9/4/91	£500	Silt
Mr R Klindt	Bydemill Brook, Hannington	26/5/91	£2000	Slurry
Mr J D Jenkinson	Trib. River Thames, Lechlade	25/6/91	£500	Silage
Mr B Hinton	R Churn, Cockleford	17/10/91	£350	Sewage Effluent
Mr B Hinton	R Churn, Cockleford	6/1/92	£350	Sewage Effluent
Mr P Francis	Haydon Wick Brook, Haydon Wick	27/1/93	£750	Gas Oil

description of bands

Reaches in the Upper Thames
19/9/94

River Code	Reach Num	Downstream Name	Upstream Name	Downstream G.R.	Upstream G.R.	LUB	Catch Num	Reach Length
0253 /00	1	SWILL BROOK	MRL	SU05149304	SU03848924	D	1	5.364
0252 /05	1	HYKEMERES STREAM	MRL	ST98419166	ST94709061	D	1	4.185
0252 /04	1	SWILL BROOK	MRL	ST98589203	ST01128927	D	1	3.472
0252 /01	1	SWILL BROOK	MRL	SU05239304	SU05949209	E	1	1.569
0252 /02	1	LEIGHFIELD BROOK	MRL	SU05409248	SU05499204	D	1	0.499
0250 /00	1	R.THAMES	MRL	SU10759373	SU06908843	D	1	7.417
0252 /00	2	SWILL BROOK BRIDGE	PILL BRIDGE	SU01689325	ST98209194	E	1	4.848
0001 /59	43	CASTLE EATON BRIDGE	TOWN BRIDGE CRICKLADE	SU14449581	SU10149397	C	1	6.736
0001 /60	46	NEIGH BRIDGE	M.R.L. THAMES HEAD	SU01869475	ST98549875	D	1	8.220
0001 /60	44	TOWN BRIDGE CRICKLADE	WATERLAY BRIDGE	SU10149397	SU06009327	C	1	4.928
0001 /60	45	WATERLAY BRIDGE	NEIGH BRIDGE	SU06009327	SU01869475	C	1	5.954
0254 /00	1	SWILL BROOK	M.R.L.	SU02299344	ST99619447	E	1	3.882
0251 /02	1	R.THAMES	CERNEYWICK BROOK	SU03829415	SU04109684	E	1	3.486
0251 /01	1	R.THAMES	ASHTON FIELD BROOK	SU07829446	SU04109684	B	1	5.156
0252 /00	1	R.THAMES	SWILL BROOK BRIDGE	SU05489324	SU01689325	D	1	4.345
0252 /00	3	PILL BRIDGE	M.R.L.	ST98209194	ST95339277	E	1	3.870
0251 /00	3	RAILWAY (DISMANTLED)	M.R.L.	SU04109840	SP02300437	C	2	7.253
0251 /00	1	R.THAMES	ROADWAY	SU10249402	SU07829600	D	2	5.350
0251 /00	2	ROADWAY	RAILWAY (DISMANTLED)	SU07829600	SU04109840	D	2	6.115
0248 /05	1	R.RAY	M.R.L.	SU13118389	SU13028249	E	3	1.795
0248 /02	1	R.RAY	M.R.L.	SU12228695	SU10868603	E	3	2.075
0248 /00	2	TADPOLE BRIDGE	RAILWAY	SU11108973	SU12838620	D	3	5.909
0248 /00	3	RAILWAY	M.R.L.	SU12838620	SU12768346	D	3	3.536
0248 /03	1	LYDIARD BRIDGE	M.R.L.	SU11318623	SU11278563	E	3	0.742
0248 /04	1	R.RAY	M.R.L.	SU13418487	SU15178254	C	3	3.749
0248 /00a	1	R.RAY	M.R.L.	SU11349089	SU11078978	E	3	1.395
0248 /01	1	R.RAY	M.R.L.	SU12378721	SU14028664	E	3	2.063
0248 /00	1	R.THAMES	TADPOLE BRIDGE	SU12199394	SU11108973	D	3	4.072
0249 /00	1	R.THAMES	DRAIN CONF. (ADJ FOX COV.)	SU11209406	SU08699872	D	4	5.716
0249 /00	2	DRAIN CONF. (ADJ FOX COV.)	M.R.L.	SU08699872	SP06620177	E	4	5.335
0247 /00	1	R.THAMES	M.R.L.	SU12469390	SU13429241	E	5	2.234
0244 /01	1	SHARE DITCH	M.R.L.	SU15519311	SU14739266	E	5	0.875
0246 /00	1	R.THAMES	M.R.L.	SU12989459	SU13889322	D	5	1.808
0245 /00	1	R.THAMES	M.R.L.	SU13249585	SU12640042	E	5	5.840
0244 /00	1	R.THAMES	M.R.L.	SU16539596	SU16409223	E	5	5.231
0243 /01	1	BYDEMILL BRIDGE	M.R.L.	SU19299606	SU19859366	E	5	2.766
0243 /00	2	FOOTBRIDGE	M.R.L.	SU18359490	SU17589133	E	5	6.086
0243 /00	1	R.THAMES	FOOTBRIDGE	SU19519680	SU18359490	E	5	2.771
0001 /57	40	GRAFTON WEIR	ST. JOHN'S WEIR (MAIN)	SU27109917	SU22309904	C	5	4.344
0001 /59	42	HAMMINGTONWICK DITCH	CASTLE EATON BRIDGE	SU18969652	SU14449581	C	5	5.867
0001 /59	41	ST. JOHNS WEIR (MAIN)	HAMMINGTONWICK DITCH	SU22309904	SU18969652	C	5	5.650
0242 /00	1	R.THAMES	WHELFORD MILL	SU20479885	SU17149923	C	6	5.085
0242 /00	2	WHELFORD MILL	FOOTBRIDGE	SU17149923	SP14900232	C	6	4.991
0242 /00	3	FOOTBRIDGE	ROADWAY	SP14900232	SP14380478	E	6	5.026
0242 /00	4	ROADWAY	A433	SP14380478	SP11460688	E	6	5.195
0242 /00	5	A433	FOOTBRIDGE	SP11460688	SP08800992	D	6	5.623
0242 /00	6	FOOTBRIDGE	STOWELL MILL	SP08800992	SP08181295	E	6	4.216
0242 /00	7	STOWELL MILL	M.R.L.	SP08181295	SP05071499	E	6	5.482
0235 /00	1	R.THAMES	FOOTBRIDGE	SU22349890	SU21459623	C	7	5.759

0235 /00	2	FOOTBRIDGE	COLESHILL BRIDGE	SU21459623	SU23409348	E	7	5.116
0235 /00	3	COLESHILL BRIDGE	B4000	SU23409348	SU22189057	D	7	4.756
0235 /00	4	B4000	DORCAN BROOK	SU22189057	SU19898620	D	7	5.341
0241 /00	1	R.COLE	M.R.L.	SU19898620	SU17938374	E	7	3.891
0239 /00	1	LENTA BROOK	M.R.L.	SU21728666	SU21778487	E	7	2.043
0237 /04	1	TUCKMILL BROOK	M.R.L.	SU25088643	SU25488586	D	7	0.730
0237 /01	1	TUCKMILL BROOK	M.R.L.	SU25018742	SU25628589	E	7	2.110
0238 /00	1	R.COLE	M.R.L.	SU21508723	SU24308378	E	7	4.433
0235 /05	1	R.COLE	M.R.L.	SU21718824	SU19218807	E	7	3.264
0237 /02	1	TUCKMILL BROOK	RAGNALL BROOK	SU24798790	SU24348689	E	7	1.384
0237 /00	1	R.COLE	A420	SU23029068	SU24638963	E	7	2.717
0237 /00	2	A420	RAILWAY	SU24638963	SU24818784	E	7	2.040
0237 /00	3	RAILWAY	M.R.L.	SU24818784	SU24928515	D	7	3.083
0235 /00	5	DORCAN BROOK	M.R.L.	SU19898620	SU17608580	E	7	3.108
0240 /00	1	R.COLE	M.R.L.	SU20998684	SU19598226	E	7	5.625
0237 /03	1	STAINSWICK BRIDGE	M.R.L.	SU24348689	SU24628574	D	7	1.429
0233 /00	1	R.THAMES	VENEYMORE STREAM	SU22419898	SP21570207	C	8	4.623
0233 /00	2	VENEYMORE STREAM	WEIR M.R.L.	SP21570207	SP20280526	D	8	5.048
0234 /00	1	RADCOT CUT	R.LEACH	SU24509872	SP23140000	E	8	2.295