



NRA

*National Rivers Authority
Thames Region*



RIVER KENNET CATCHMENT MANAGEMENT PLAN

CONSULTATION REPORT

MARCH 1993

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River Kennet

CATCHMENT MANAGEMENT PLAN

Consultation Report

March 1993

*National Rivers Authority
Thames Region
King's Meadow House
King's Meadow Road
Reading
RG1 8DQ*



THE NATIONAL RIVERS AUTHORITY

The National Rivers Authority (NRA) is a major environmental protection agency responsible for safeguarding and improving the water environment. In our role as Guardians of the Water Environment our aim is to safeguard the total river environment, not just the many rivers, streams and lakes in the area but also the quality and quantity of underground water. NRA Thames Region is one of nine regional units whose activities include:

- **WATER RESOURCES** *the planning of resources to meet the needs of the Region; licensing companies and individuals to abstract water*
- **POLLUTION CONTROL** *maintaining and improving water quality; granting consents for discharges to the water environment*
- **FLOOD DEFENCE** *the general supervision of flood defences; the carrying out of works on main rivers*
- **FISHERIES** *the maintenance, improvement and development of fisheries*
- **CONSERVATION** *furthering the conservation of the water environment and protecting its amenity*
- **RECREATION** *promotion of water based recreation*

CATCHMENT MANAGEMENT PLANS

The integrated management of river catchments is at the heart of our work. Catchment management plans provide a means for setting priorities for the NRA and others, to solve environmental problems and to conserve and enhance the water environment - both now and in the future.

The plans will, by their very nature involve us in close contact with local communities and statutory organisations who share our concern and interest in the water environment.

The Consultation Report this leaflet summarises contains a detailed review of the catchment and identifies several issues (see over) we believe we should tackle. Only when we have received your views will we prepare the final Catchment Management Plan.

THE CONSULTATION PROCESS

We are keen to receive your views on the issues we have identified and to hear whether there are any other matters affecting the water environment in the catchment which you think the NRA and others should consider.

We have consulted directly with:

- *all relevant County, District and Parish Councils*
- *statutory bodies*
- *representative groups - local interest groups*
- *others known to have an interest in the catchment*

In addition we will be organising a number of static displays and meetings over the period up to mid June 1993. These will be advertised in your local press.

To comment on the plan please write to:

**CRAIG WOOLHOUSE
NATIONAL RIVERS AUTHORITY
THAMES REGION
THE GRANGE
97 CROSSBROOK STREET
WALTHAM CROSS
HERTFORDSHIRE EN8 8HE
(BEFORE FRIDAY 11th JUNE 1993)**

Should you wish to discuss matters further or obtain a copy of the full Consultation Report, please contact Craig Woolhouse on **0992-645067**.

Upon completion of the consultation phase we will review the comments received and inform those commenting on the plan how we intend progressing towards producing a final plan. The final plan will contain a strategy for the future management of the catchment and a series of action plans for the NRA and others to implement to achieve the strategy.



NRA

*National Rivers Authority
Thames Region*

RIVER KENNET CATCHMENT MANAGEMENT PLAN CONSULTATION REPORT



**SUMMARY LEAFLET
MARCH 1993**

CATCHMENT ISSUES

In the Consultation Report a number of key issues have been identified of which brief summaries are given in this leaflet. We would welcome your views on these and any other relevant matters that concern you.

COMMUNICATIONS

How can the NRA and other groups work together to improve the water environment?

Should there be a forum for the Kennet Catchment?



CHANGES IN CATCHMENT STATUS

Over the past few decades conditions in the Kennet catchment have changed in

several ways. These include changes in rainfall patterns, increased demand on water resources and changes in the way the river is managed. Land uses have also changed, we therefore need to:

- review our understanding of the water environment
- review Abstraction and Discharge Licences
- plan for future development pressures in the catchment
- seek habitat enhancement opportunities
- work with other organisations to explain the importance of the water environment and identify joint initiatives / actions



UPPER KENNET RIVER LEVELS

Following public concern over river levels in the upper Kennet the NRA set up a study to investigate all relevant issues and how these have changed.

This study has formed the basis of a published action plan which was presented at a public meeting in Marlborough in January 1993. This issue is one which has been widely debated with local interest groups and the aim is to complete the action plan by September 1993. Further information and copies of the action plan are available from:

Dr Mike Owen,
NRA Thames Region,
Kings Meadow House,
Kings Meadow Road,
Reading, RG1 8DQ.



KENNET AND AVON CANAL

After 30 years of work by voluntary and statutory organisations the Kennet and Avon canal was re-opened in 1990. The future success of the canal depends upon its development as a self financing recreational resource, whilst maintaining it as an important ecological asset.



FISHERIES AND CONSERVATION MANAGEMENT

The River Kennet catchment forms a unique landscape, fisheries, ecological and recreational asset. A co-ordinated management plan that can strike a balance between these uses will be developed. Mineral extraction, waste disposal, residential development and highway projects may impinge on the floodplain of the middle and lower Kennet valley. The planning of rural and urban land uses must be incorporated with any ecological management plan to ensure suitable management of the whole river corridor.

WATER QUALITY PROTECTION

The catchment has generally good water quality and is an important source of drinking water. To protect and improve the water environment we need to gather more information on pollution risks and act against polluters.



NEWBURY AND THATCHAM

Development on and close to the floodplain of the River Kennet over the last 30 years has potentially increased the flood risk to people and property in Newbury and Thatcham.

We will prepare a floodplain protection policy and examine flood defence options.

WEST BERKSHIRE GROUNDWATER SCHEME

The scheme is owned and operated by the NRA and uses abstracted groundwater to ameliorate low flows. In the past it has only been used occasionally.

We will review the use of the scheme in relation to its potential to support water supplies and protect natural habitats.

CATCHMENT BACKGROUND

The River Kennet joins the River Thames at Reading, 70km east of its origins in the Marlborough Downs in Wiltshire.

The tributaries of the River Kennet include the Foudry

Brook, Aldbourne, Shalbourne and Rivers Lambourn, Enborne, Dun and Og. The catchment covers an area of 1164 km², and is predominantly rural in character.

Significant urban areas include south-west Reading, Newbury, Thatcham, Tadley,

Hungerford and Marlborough. Much of the western part of the catchment falls within the North Wessex Downs Area of Outstanding Natural Beauty and is protected from further urban development. Parts of the catchment are exceptional conservation, fisheries, and recreational assets. Water quality in the catchment is generally good, but concern has been expressed about the quality in parts of the River Kennet. There is also concern over the low flows in the upper Kennet. The Kennet and Avon canal which was re-opened in 1990 has also suffered from a shortage of water. British

Waterways, who maintain and operate the canal, have recently published proposals to increase its recreational use.

The lower Kennet Valley has seen significant change

over the last 40 years

with both urban development and mineral extraction occurring at numerous sites between Newbury and Reading. Both activities are likely to continue for the foreseeable future although at a lower rate.



RIVER KENNET CATCHMENT MANAGEMENT PLAN - CONSULTATION REPORT

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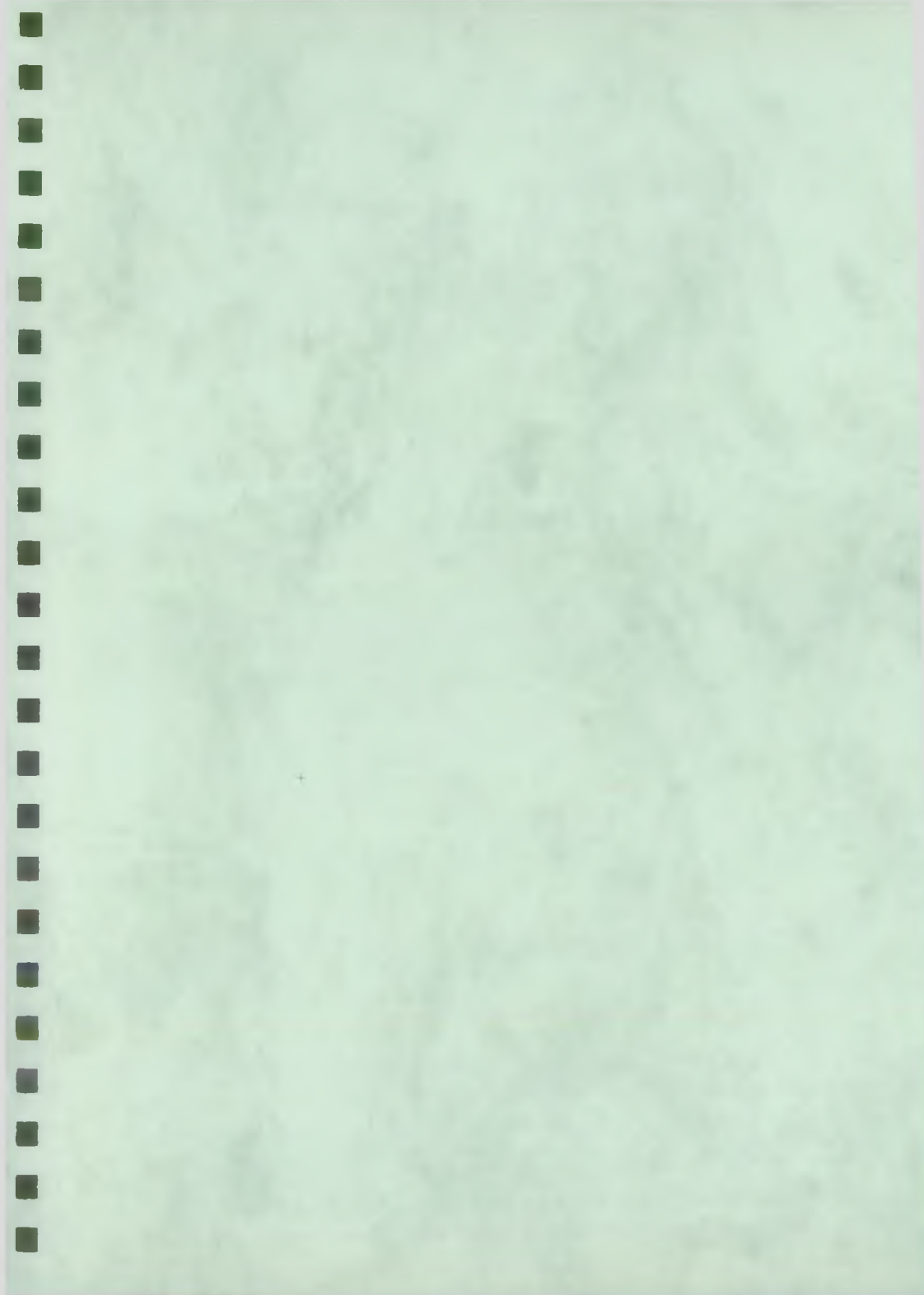
APPENDIX IV - *GLOSSARY*

ACKNOWLEDGEMENTS

- (1) All those organisations, groups and individuals who responded to the NRA during the period of informal liaison. A detailed review of this process is given in Appendix II.
 - (2) The Department of Highways and Planning at Berkshire County Council for the provision of digital data for the synoptic maps.
 - (3) Ordnance Survey on whose maps some of the information shown on the synoptic maps is based. (Crown Copyright Reserved Licence No. WU29859X).
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NOTE

- (1) Whilst every effort has been made to ensure the accuracy of information in this Report it may contain errors or omissions which we will be pleased to correct.



Section 1
INTRODUCTION

1.1 INTRODUCTION

Our Water Environment

The quality of our water environment and the way in which it is managed matter to all of us.

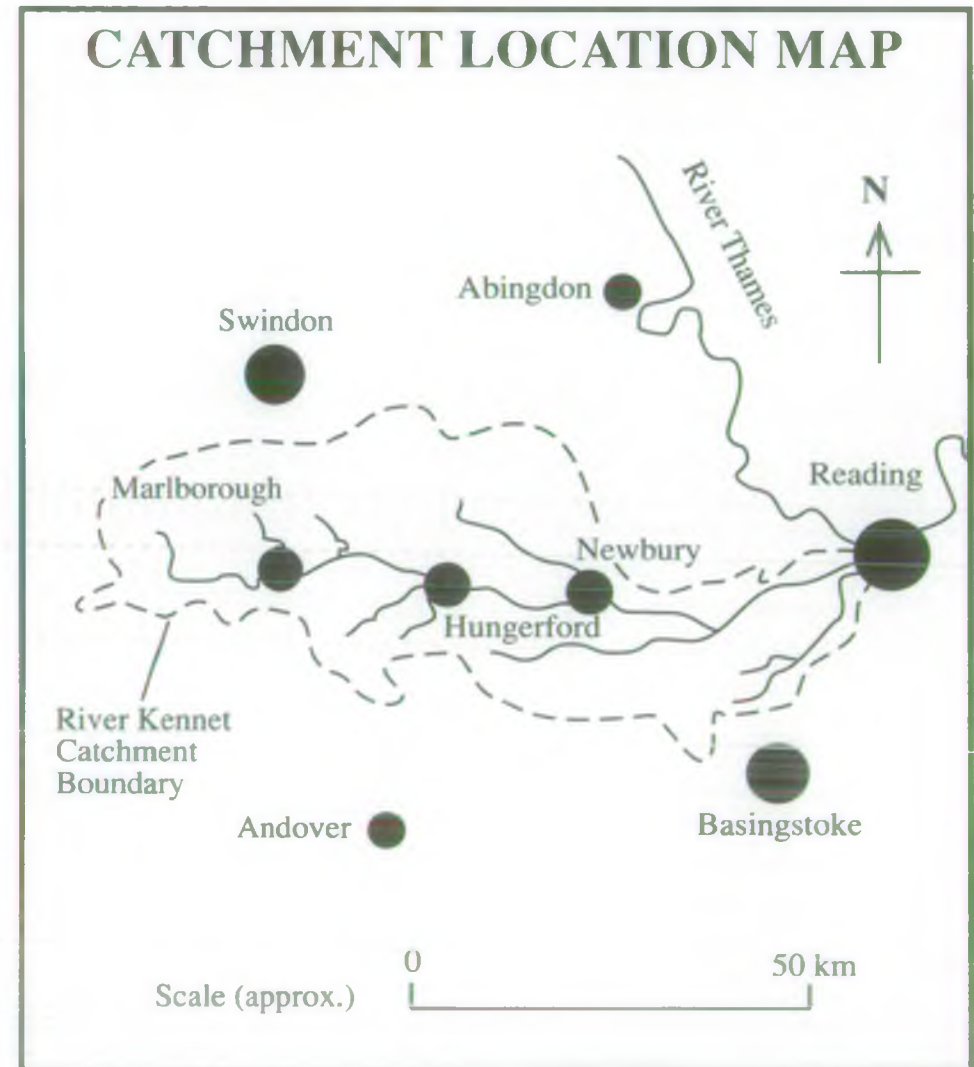
Our health depends on the availability and purity of water supplies and the way we dispose of waste water. Thames Region is highly populated and sees the greatest use and reuse of water of any part of the country. These pressures call for the strict control of water abstraction and effluent quality.

Many householders and businesses rely on flood alleviation works and warning schemes to reduce their risk of flooding. Visitors as well as local communities benefit from the amenity and recreational opportunities offered by the Region's rivers, canals and lakes.

Last, but by no means least, the water environment supports a wide variety of habitats which are home to a range of plants and animals whose conservation and enhancement is fundamental to the well being of the Region's natural resources.

This document - part of a process called catchment management planning initiated by the National Rivers Authority (NRA) - provides a focus for those concerned with the future health of the water environment of the River Kennet catchment.

Situated to the west of Reading and covering over 1160 km² the catchment is shown on the map opposite.



1.1 INTRODUCTION (ctd)

Managing the Water Environment

Established in 1989, the NRA is the principal agency responsible for safeguarding and improving the water environment in England and Wales. We have statutory responsibilities for water resources, water quality and pollution control, flood defences, fisheries, recreation, conservation and navigation.

We have defined our role as follows:

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

To meet our role we have set ourselves the following specific aims:

- *To achieve a continuing improvement in the quality of rivers, estuaries, and coastal waters, through the control of water pollution.*
- *To assess, manage, plan, and conserve water resources and to maintain and improve the quality of water for all those who use it.*

-
- *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 waters and lands under NRA control.*
 - *To conserve and enhance wildlife, landscape, and archaeological features associated with waters under NRA control.*
 - *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.*

1.1 INTRODUCTION (ctd)

In achieving our aims we recognise the need to work with local communities, landowners, interest groups, industry and other agencies whose activities and interests interact with or include the water environment. The roles and responsibilities of some of the other agencies concerned are described in Appendix I as are further details of our own objectives and responsibilities.

Managing the water environment is a complex task. Understanding how its many components - our rivers, lakes and groundwaters - behave is fundamental to our job. However, we must also assess how the way we use water and the manner in which we manage activities potentially harmful to it affect the water environment. Abstracting water, disposing of effluent, participating in water based recreation and expanding urban areas are just some of the uses and activities which we need to consider and evaluate.

To help us work with others in planning for the future of the water environment we have established a process known as catchment management planning. This document is the start of that process for the River Kennet catchment.

Catchment Management Plans

The water environment (e.g. estuaries, coastal waters, rivers, streams, lakes, ponds, aquifers, springs) is subject to a wide variety of uses which invariably interact and sometimes conflict with each other. Our catchment management planning process has been developed to help manage these interactions and conflicts for the overall benefit of the water environment and its users.

The Regions of the NRA are defined in terms of natural river catchment boundaries. These have provided a logical focus for managing the water environment over many years and this approach is reflected in the CMP process.

The purposes of a Catchment Management Plan (CMP) are to:

- focus attention on the water environment of a specific river catchment;
- involve all interested parties in planning for the future well being of that catchment; and,
- establish an integrated plan of action for managing the catchment over the next five years.

Preparation of a CMP involves a number of activities which are described in detail on the figure on p.1-7. This document, the Consultation Report, is the first step in the process and not the finished Plan. Further details of the process are given in Section 3.1.

The River Kennet Catchment Management Plan

The River Kennet is the second catchment within the Thames Region to be assessed using the catchment management planning process. Publication of this Consultation Report marks the start of a period of formal consultation which will give you the chance to work with us in planning the future of the catchment.

1.1 INTRODUCTION (ctd)

This Report (see figure opposite) does not establish a vision for the catchment or define in detail the action plans and guiding policy objectives to tackle the key issues for the water environment. Rather it describes the catchment, reviews the state of the water environment and identifies the key issues facing it.

The catchment vision and supporting action plans will be prepared once we have had an opportunity to review and consider responses to this Consultation Report.

We have produced this document through internal discussion, informal liaison with a wide range of organisations (see Appendix II for details) and a desk study of reports produced by organisations such as local authorities.

The Consultation Process

Although we have a pivotal role to play in the management of the water environment our catchment management planning process recognises that a partnership approach with other users is essential.

Consequently we have produced this Consultation Report as a means of undertaking detailed consultation with all interested parties which will enable us to:

- confirm the range and extent of catchment resources, uses and activities;
- obtain views on the issues facing the water environment identified by us;

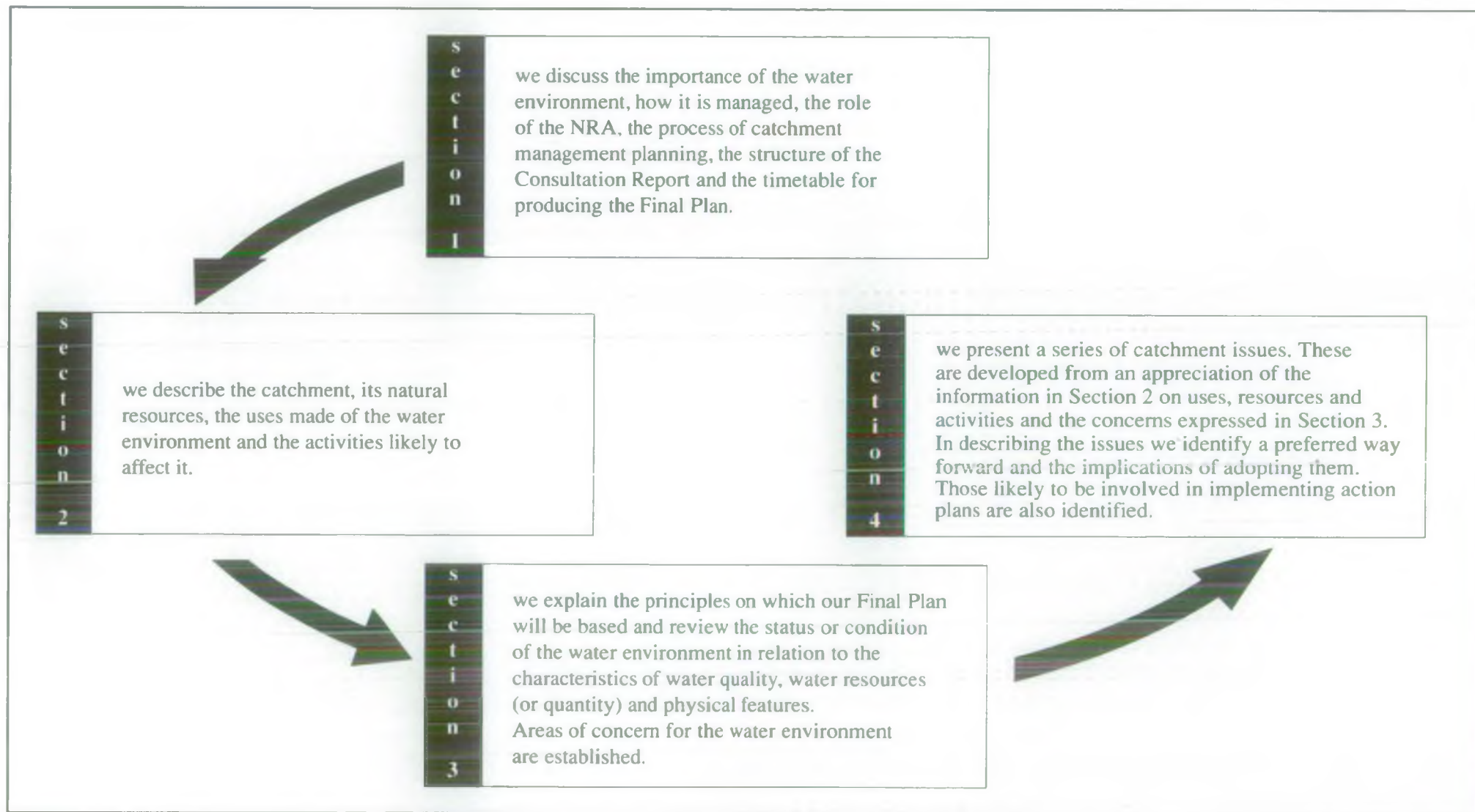
-
- begin the process of identifying and agreeing action plans; and,
 - ensure decisions on the future management of the catchment are based on a wide range of views from interested parties.

In commenting on this document we hope that you will tackle both points of detail and strategic issues. In particular we are keen for you to consider the following questions:

- have we assessed fairly the issues and what opinions do you have on them and the options we propose?
- have we missed any issues?
- how should we progress the development of strategies and action plans?

During the consultation period comments can be submitted in writing to our Project Manager for the CMP:

Mr Craig Woolhouse
River Kennet Catchment Management Plan
National Rivers Authority Thames Region
The Grange
97 Crossbrook Street
Waltham Cross
Herts, EN8 8HE.



1.1 INTRODUCTION (ctd)

He can also be contacted by telephone on 0992-645067. All comments must be with us by Friday 11th June, 1993.

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

- the distribution of the report and/or a summary leaflet to key organisations, groups and individuals;
- several public meetings;
- a display for use in libraries and other public areas; and,
- news, radio and television publicity releases.

At the end of the consultation phase we will have to consider in detail the responses we receive before producing a definitive Catchment Management Plan. The Final Plan 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.

The information and views you provide us with now are therefore a very important step in the overall process. We hope you will respond positively to our initiative so that we can jointly develop a vision for the River Kennet Catchment. Our proposed programme of activity is shown opposite.

WHO'S INVOLVED

NRA

NRA
and
everyone
interested in
the future of
the catchment

NRA
and
key groups,
organisations, and
individuals

NRA

ACTIVITY

Production of
Consultation Report
version of CMP
by NRA TR

Consultation
with
organisations, groups
and individuals

On-going discussions
as appropriate
with key groups
and individuals

Production of
Final CMP

TIMETABLE

by
late March, 1993

until
11th June, 1993

Summer 1993

by
late 1993

Steps in the process	Description of the relevant resources, uses and activities	Review of the status of the water environment	Identification of issues facing the water environment	Identification of action plans to tackle the issues	Definition of catchment vision and policy objectives	Implementation and monitoring of action plans	Review of Plan
CMP Consultation Report	✓ (in detail)	✓	✓	✓ (in outline)	(statement of principles only)	← not applicable →	
CMP Final Plan	✓ (in summary)	✗	✗	✓ (in outline)	✓	← not applicable →	
After the CMP Final Plan	← not applicable →					✓ (annual basis)	✓ (every five years at least)



RESOURCES,

Section 2

DESCRIPTION OF USES AND ACTIVITIES

2.1 INTRODUCTION

The purpose of this section is to review the physical resources of the catchment, the uses we make of the water environment and the activities likely to affect the water environment.

Following on from a general description of the catchment (Section 2.2) and a review of the geographical interests of County and District Authorities (Section 2.3) some of the physical features of the catchment are described (Sections 2.4 - 2.7) under the following headings:

- Topography
- Geology
- Hydrogeology
- Rainfall and River Flow.

Natural resources, catchment uses and activities relevant to the water environment are then described (Sections 2.8 - 2.18) under the following headings:

- Ecology
- Fisheries
- Landscape and Heritage
- Amenity and Recreation
- Navigation
- Water Abstraction
- Effluent Disposal
- Rural Development
- Urban Development
- Mineral Extraction and Solid Waste Disposal
- Flood Defence.

For each heading the following information is provided:

- (i) a page of text which describes how the resource, use or activity manifests itself within the River Kennet catchment. Two sub-headings are provided: current situation and future situation; and,
- (ii) a colour synoptic map designed to enhance the information in the text and highlight its geographical context.

In most cases the description 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. The key points raised by this review of resources, uses and activities are then summarised (Section 2.19).

KEY STATISTICS

Catchment Area (sq. km)	1164
Population within catchment	211 000
Population within 20 km of catchment	1 000 000
Average Annual Rainfall (mm)	750
Length of waterway maintained by NRA for flood defence purposes (km)	314
Length of waterway with River Quality Objective (km)	315

2.2 OVERVIEW OF CATCHMENT

The River Kennet joins the River Thames at Reading, some 70 km east of its origins in the Marlborough Downs in Wiltshire. Defined by the Berkshire and Marlborough Downs to the north and the Hampshire Downs to the south the catchment is predominantly rural in character. Significant urban areas include south-west Reading, Newbury, Thatcham, Tadley, Hungerford and Marlborough.

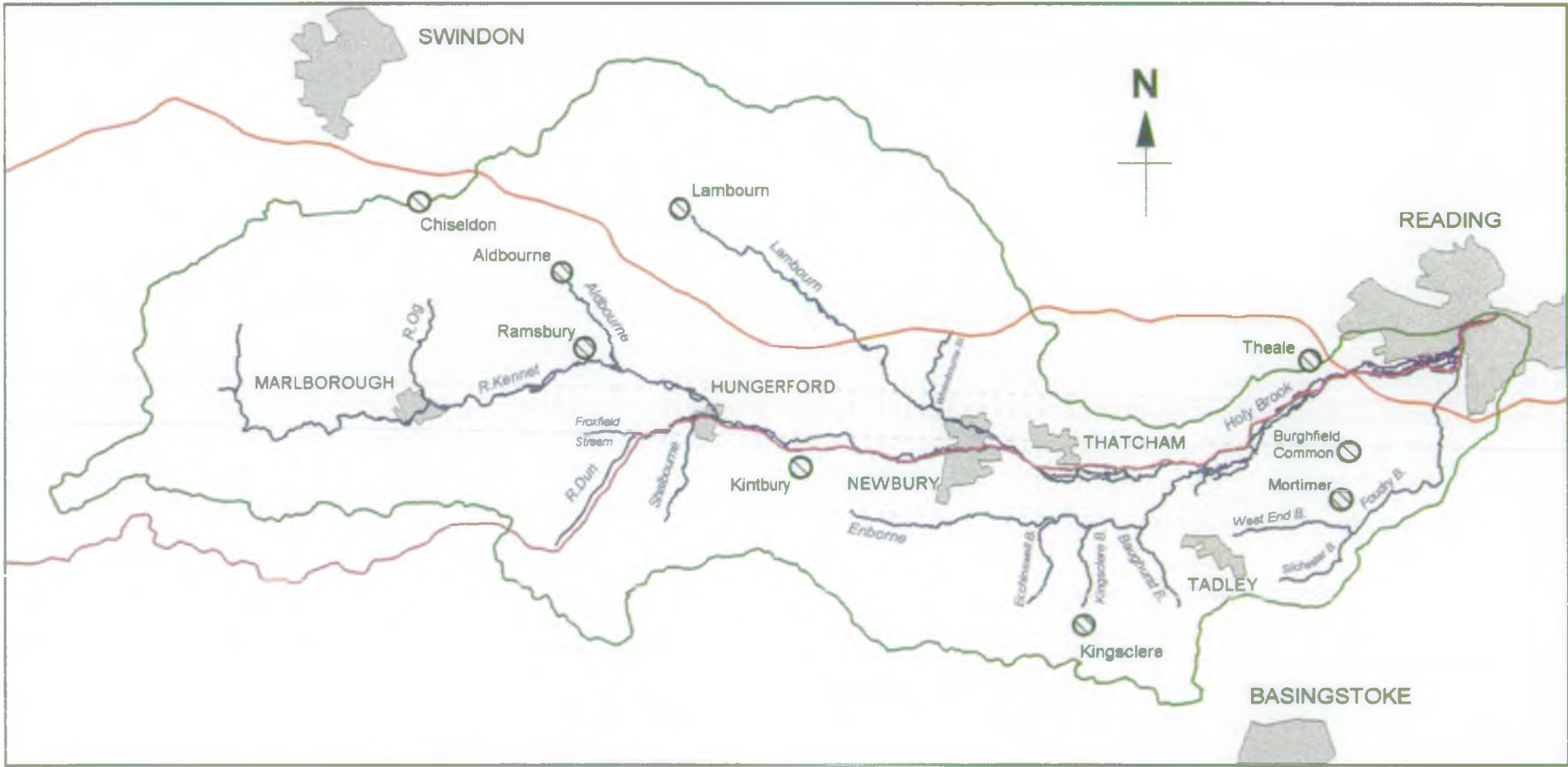
In the west and north of the catchment the watercourses are spring-fed chalk streams and the River Kennet upstream of Newbury supports a number of native brown trout and imported rainbow trout fisheries. Surveys undertaken by the NRA indicate that water quality is generally high throughout the catchment although the River Enborne and Foudry Brook, which rise on clay rather than chalk catchments, exhibit a naturally lower water quality. The condition of the River Kennet between Newbury and Reading is, however, of much local concern and a 'Cleaner Kennet Campaign' has recently been launched. The River Lambourn and Winterbourne Stream have been extensively used for research on the nature of chalk streams because of their pristine nature. Within the Lambourn catchment the horse racing industry is well established.

Much of the northern, central, western and southern parts of the catchment fall within the North Wessex Downs Area of Outstanding Natural Beauty which is a nationally recognised area designated by the Countryside Commission. The high quality of the rural landscape and the archaeological importance of sites such as Avebury (designated a World Heritage Site in 1987 under a United Nations sponsored convention) ensure that the western part of the catchment is strongly protected from large scale development by both national and local heritage and environmental protection policies.

Further east, however, the Kennet valley has seen significant change over the last 40 years with urban development at Newbury, Thatcham, Tadley, Theale and Reading and mineral extraction at numerous sites between Newbury and Reading. Over a fifth of Berkshire's current sand and gravel reserves lie in the Kennet valley and there are plans to continue to extract these. Pressure for urban expansion at Thatcham, Newbury and to the south of Reading is also likely to continue in the foreseeable future. Much of the proposed development may have both direct (e.g. development on floodplain) and indirect (e.g. increased demand for water supply) impacts on the water environment.

Past mineral extraction in the Theale/Reading area has enabled the creation of the Lower Kennet Water Park which provides a range of formal water based recreation facilities. Flowing through the water park is the Kennet and Avon Canal which when completed in 1810 provided a navigation link between London and Bristol. British Waterways, who own and operate the canal which is of recognised environmental value, have recently produced proposals to increase the recreational use of the canal which was re-opened in 1990. The canal has historically suffered from a lack of water in its western reaches.

For many years concern has been expressed over the condition of the upper River Kennet and the NRA have recently been involved in a detailed evaluation of the issue of low river levels/flows with a range of local interest groups. Many other watercourses have also suffered from a lack of flow over the last four years when rainfall has been well below normal.



<div>KEY</div> <div>SCALE</div> <div>010 km</div>		Catchment Boundary		Urban Area															
		Watercourses		Town / Village															
		Kennet and Avon Canal																	
		M4 Motorway																	

2.3 LOCAL AUTHORITIES

The following table summarises the distribution of the catchment area of 1164 sq. km² amongst County Councils and Local Authorities falling within the catchment boundary. The distribution of the catchment's population of 211 000 is shown in brackets.

<u>County Councils</u>		<u>District Councils</u>	
Berkshire	45 % (80%)	Newbury DC	42 % (46%)
		Reading BC	2 % (30%)
		Wokingham DC	1 % (4%)
Wiltshire	39 % (8%)	Kennet DC	34 % (7%)
		Thamesdown DC	3 % (1%)
		North Wilts DC	2 % (*)
Hampshire	13 % (12%)	Basingstoke and Deane DC	13 % (12%)
Oxfordshire	3 % (*)	Vale of White Horse DC	3 % (*)
TOTAL	<u>100%</u>	TOTAL	<u>100%</u>

Note: "*" indicates less than 0.5%

Most of the County Councils and District 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 (section 2.16) which have an impact on, or interact with, the natural water environment.

The following development plans have been reviewed:

Structure Plans

Berkshire (Deposit, 1992)
Mid-Hampshire and North-East Hampshire (1st/2nd Alteration, 1989)
Oxfordshire (Draft, January 1992)
North-East and Western Wiltshire (2nd Alteration, 1991)

District Plans

Basingstoke and Deane (Deposit, 1992)
Kennet: Avebury (Adopted, 1992)
Marlborough (Adopted, 1990)
Pewsey Vale (Deposit, 1992)
Newbury (Deposit, 1990)
North Wilts (Approved, 1990)
Reading (Deposit, 1992)
Thamesdown (Draft, 1991)
Vale of White Horse: Rural Areas (Draft, 1990)

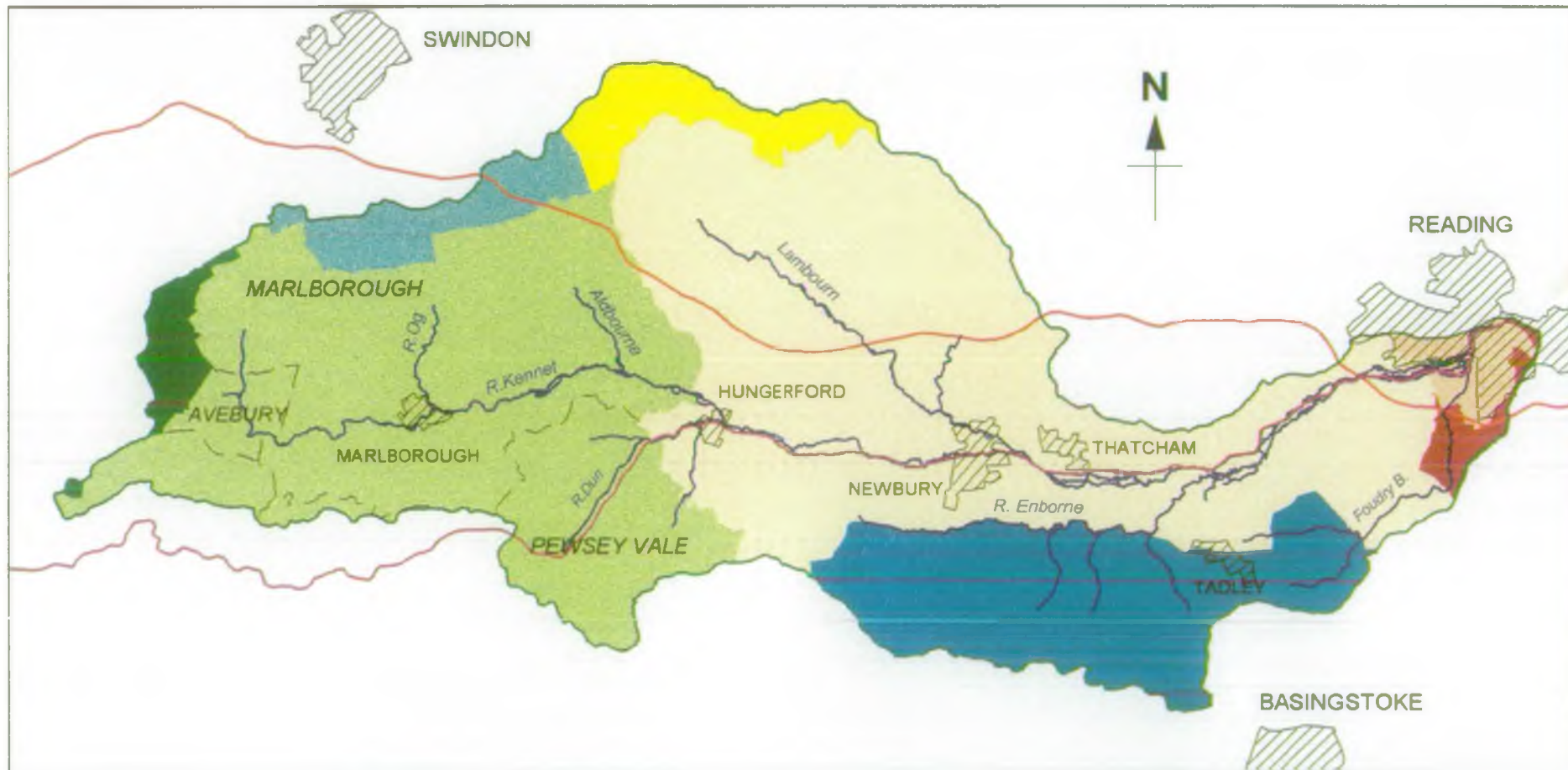
Several organisations have also developed strategies directly related to the water environment. These include:















- 1) Waterways Plan (Reading Borough Council, 1992);
- 2) Plan for the Environment, Tourism and Leisure - Kennet and Avon Canal (British Waterways, 1991); and,
- 3) Land Management in the Urban Fringe. A defence strategy for the Lower Kennet Valley (Friends of the Lower Kennet, 1991).

National Rivers Authority
Thames Region

River Kennet
Catchment

LOCAL AUTHORITIES



<div>KEY</div> <div>SCALE</div> <div>010 km</div>		Catchment Boundary		Urban Area	BERKSHIRE		HAMPSHIRE		WILTSHIRE	
		Watercourses		Area Plan Boundaries for Kennet District Council		Newbury		Basingstoke and Deane		Kennet
		Kennet and Avon Canal				Reading	OXFORDSHIRE			North Wilts
		M4 Motorway				Wokingham		Vale of White Horse		Thamesdown

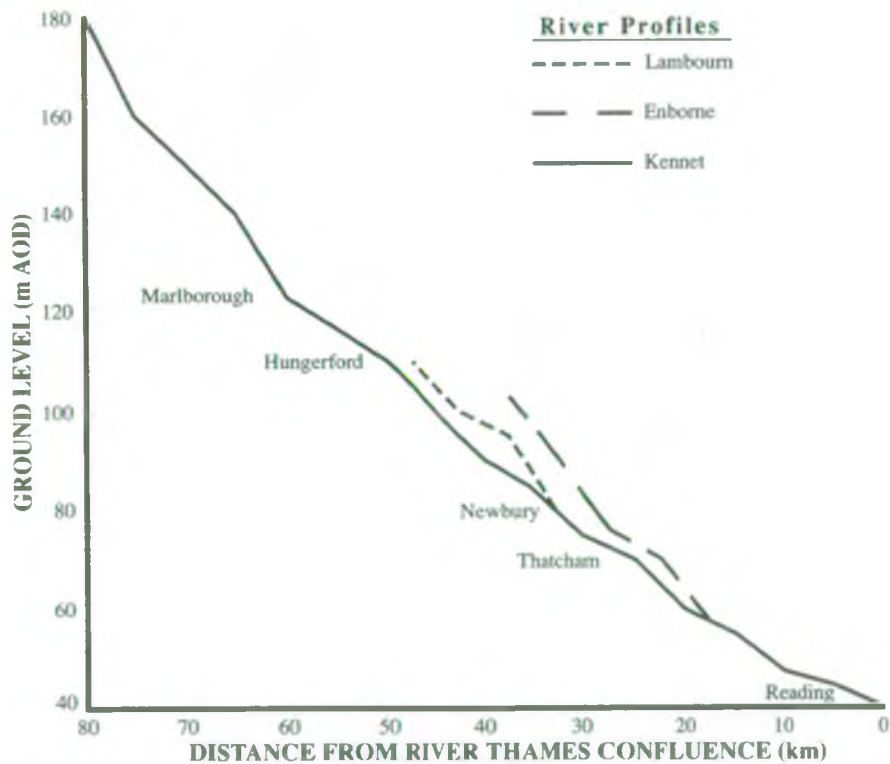
2.4 TOPOGRAPHY

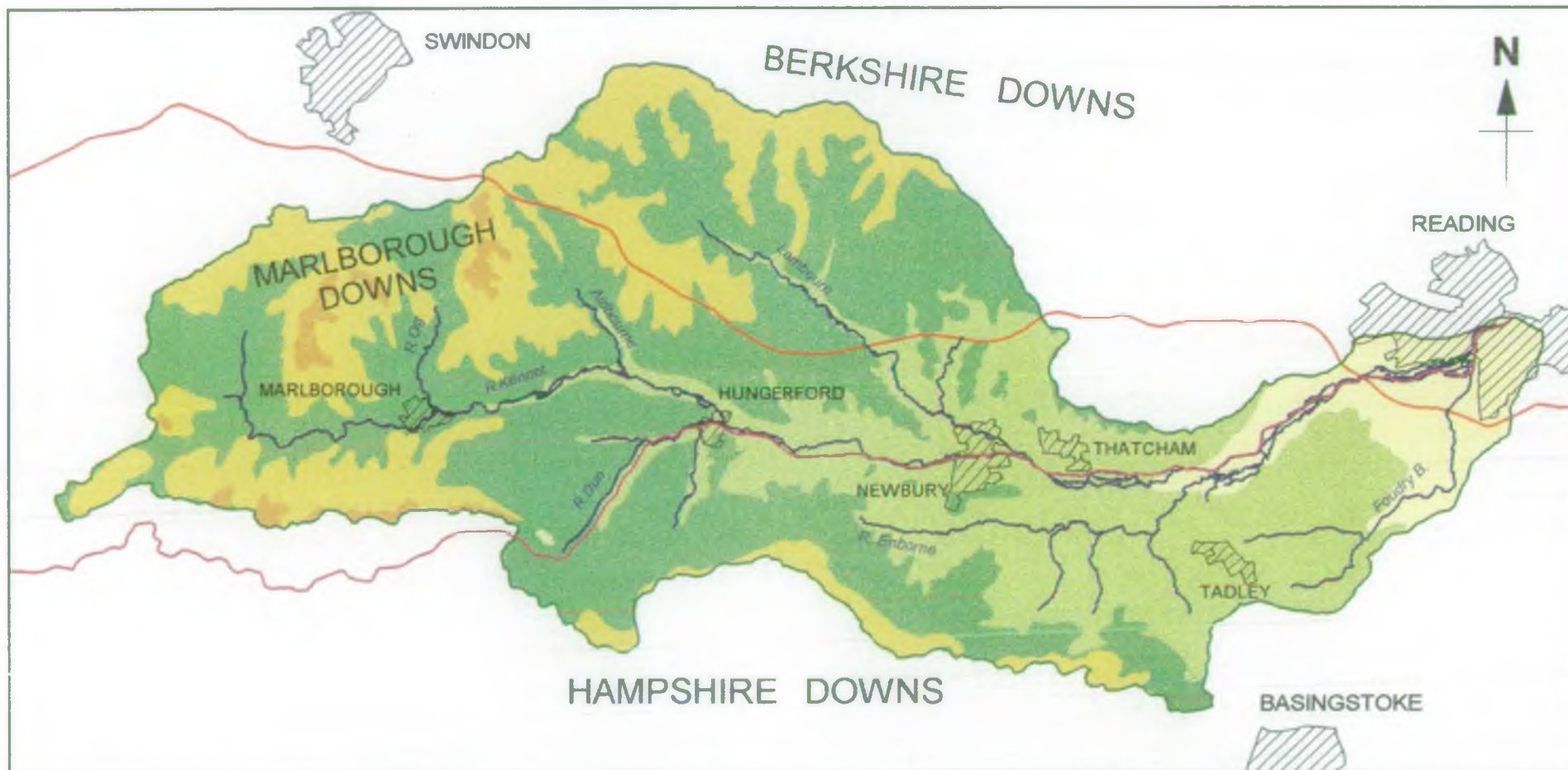
We have defined the boundary of the catchment to include all land which drains surface water runoff to the River Kennet and its tributaries which include the River Lambourn, River Enborne, Foudry Brook, River Dun, Aldbourne, Shalbourne and River Og.











The Kennet catchment is bounded by the Marlborough Downs to the west, the Berkshire Downs to the north and the Hampshire Downs to the south. Both the Marlborough Downs and Hampshire Downs reach heights of the order of 200 m AOD (Above Ordnance Datum or sea level) with the highest points exceeding 270 and 290 m in altitude respectively. The Berkshire Downs are 150 m high on average in the east but rise to 200 m AOD on average in the west.

The main rivers drain eastwards towards the confluence of the River Kennet with the River Thames at Reading. Flowing for almost 90 km, the River Kennet falls from 190 m AOD at its upper point to the north-west of Marlborough to 130 m AOD at its perennial head at Marlborough and 50 m AOD at Reading.

The gradients of several watercourses are shown on the figure opposite. In its upper reaches the River Kennet has a slope of 1 in 350. This falls to 1 in 650 in its middle reaches and 1 in 900 in its lower reaches.





KEY		Urban Area		GROUND LEVELS					
	Catchment Boundary				> 240 m		61 - 120 m		
	Watercourses				181 - 240 m		0 - 60 m		
	Kennet and Avon Canal				121 - 180 m	All Values in metres AOD (above Ord. Datum)			
	M4 Motorway								

KEY

SCALE

0 10 km

2.5 GEOLOGY

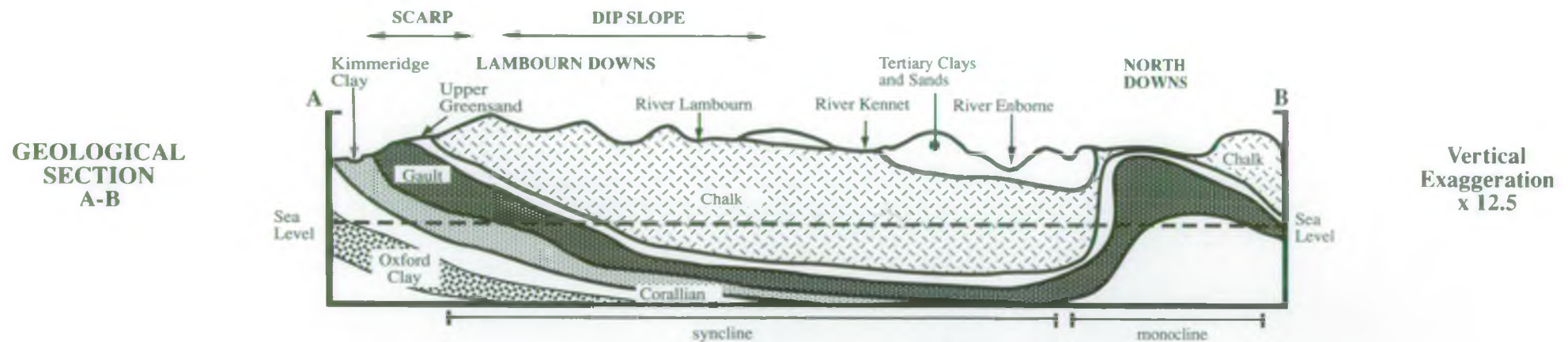
The catchment's solid geology (see map opposite) is comprised of chalk which is overlain in the east by the clays and sands of the western end of the London Basin syncline. The structure of this syncline (or natural trough) is such that the overlying strata dip gently from the north-west to the south-east over most of the catchment. However, the syncline rises sharply into a monoclinical structure (see geological section below) on the southern edge of the catchment exposing the older Upper Greensand series which underly the Chalk.

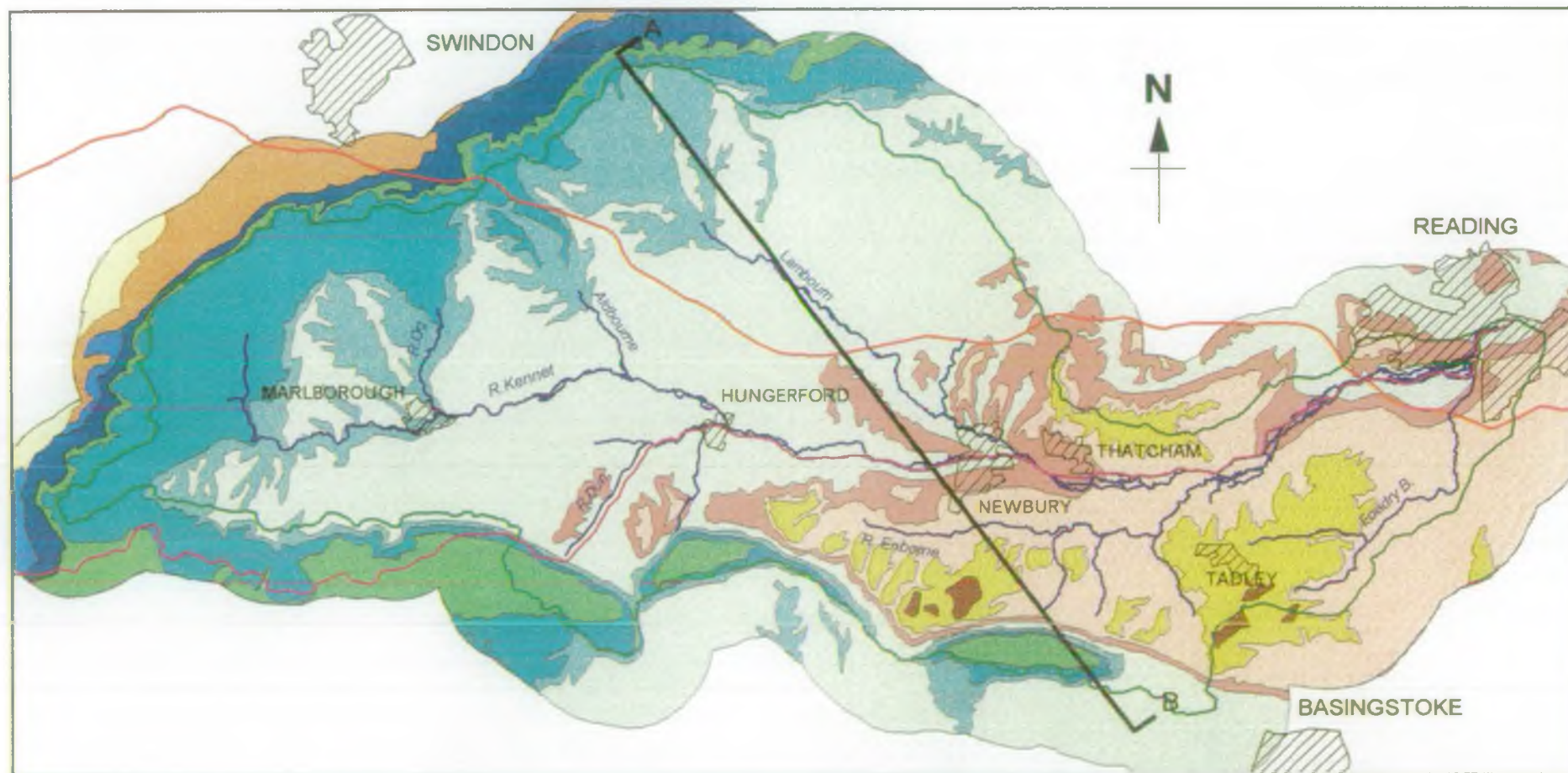
The lower chalk outcrops along the northern boundary of the catchment. Moving in a south easterly direction progressively younger rocks outcrop. These include the middle chalk, upper chalk and finally the Tertiary clays and sands of the Reading Beds, London Clays and Bagshot Beds.

Drift or surface deposits occur in the form of Plateau Gravel capping some of the higher Tertiary outcrops (e.g. Bagshot Beds), valley gravel and alluvium along the stream valleys (notably the River Kennet east of Newbury), and Head and Combe deposits in the higher dry valleys of the Marlborough and Berkshire Downs. Some of the chalk ridges are capped by Clay with Flints.

The gravel deposits in the lower River Kennet and on the Tertiary Strata outcrops are an important mineral resource (see Section 2.17) whose use is of significance to the water environment.

Watercourses on chalk and clay strata exhibit very different flow characteristics which are contrasted in Sections 2.6 and 2.7. The water bearing nature of the chalk aquifer is detailed in Section 2.6.



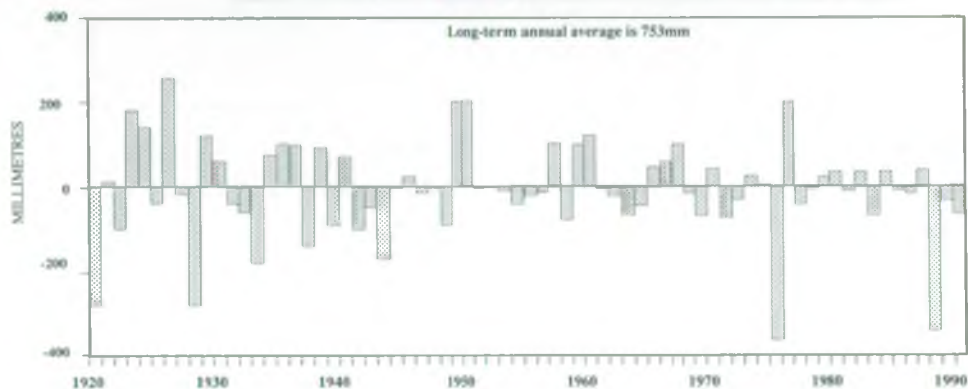


<p>KEY</p> <p>SCALE</p> <p>0 ————— 10 km</p>		Catchment Boundary		Urban Area		Middle Bagshot Beds		Upper Chalk		Gault
		Watercourses	A — B	Geological Section		Lower Bagshot Beds		Middle Chalk		Lower Greensand
		Kennet and Avon Canal				London Clay		Lower Chalk		Kimmeridge Clay
		M4 Motorway				Reading/Woolwich Beds		Upper Greensand		Coralian

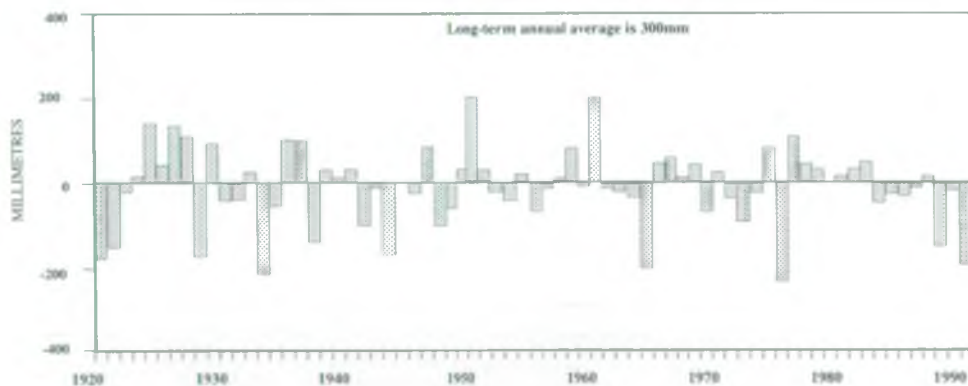
The Chalk is a major aquifer in the catchment. In the north and west of the catchment, where the chalk outcrops at the surface, the aquifer is unconfined (i.e. there is no overlying rock strata and therefore rain can percolate directly through to the aquifer). In the east, where the clay and sand Tertiaries overlay the Chalk, the aquifer is confined and percolation through these overlying impermeable strata is very limited. However, the confined chalk aquifer in this area does receive groundwater flow from the unconfined areas of chalk. Groundwater within the chalk produces a substantial springline at the base of the scarp and on the dip slope at the junction with the Tertiary strata (see geological section in Section 2.5).

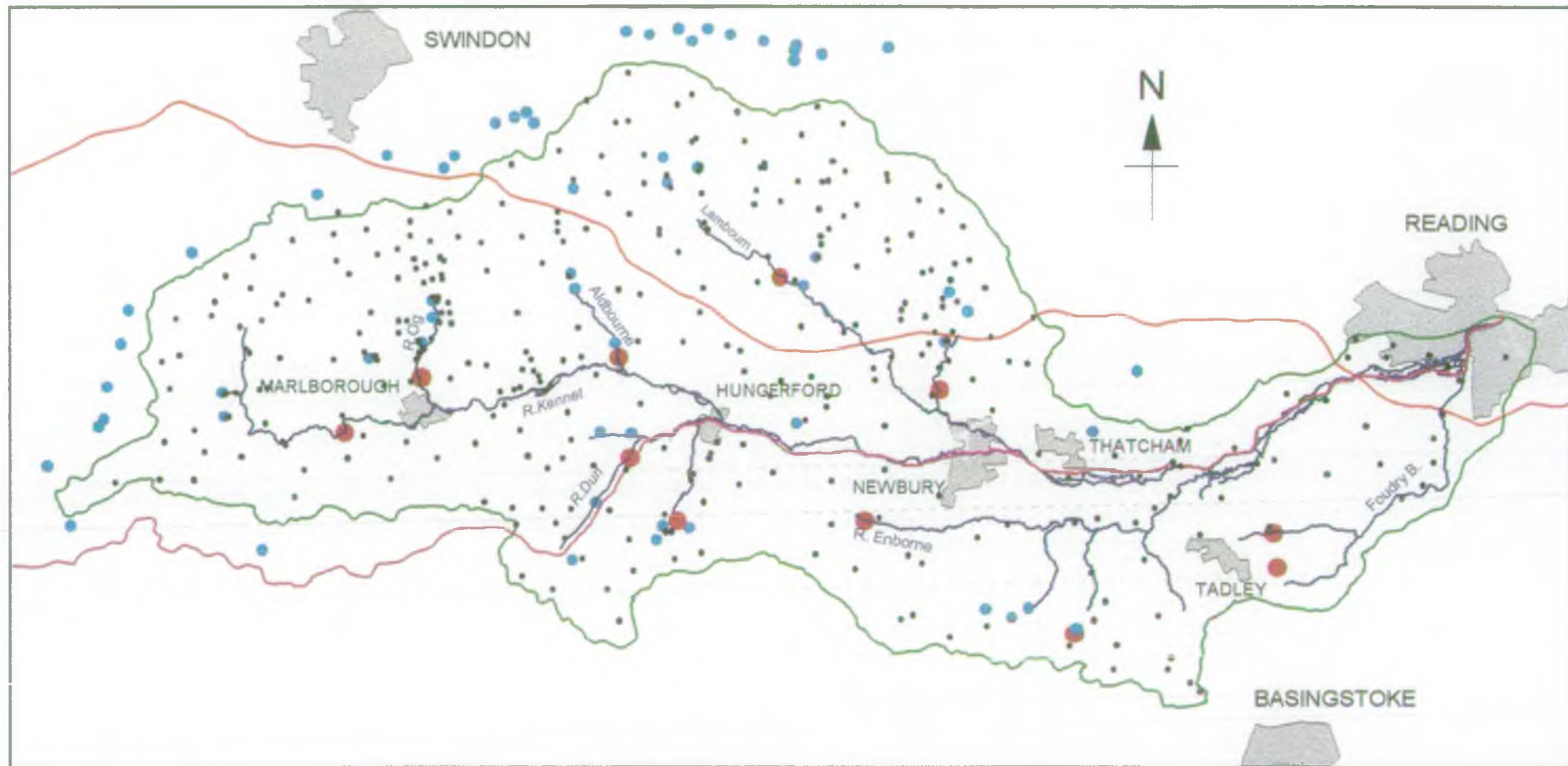
Water levels in the chalk aquifer depend not on the amount of rainfall that falls but on the amount of rainfall that percolates into the ground (see graphs opposite) and the volume of water abstracted (see Section 2.13). Changes in water levels in the chalk aquifer will affect flows in the Rivers Kennet, Og, Aldbourne, Lambourn, Winterbourne, Dun and Shalbourne. These chalk rivers have a stable base flow which is at its lowest in early Autumn. Many chalk rivers or winterbournes will only flow during the late Autumn, Winter and early Spring. In contrast, the River Enborne which rises on the Tertiary deposits, has the characteristics of a clay catchment river. These characteristics include a very variable but generally low base flow. East of Newbury the River Kennet flows largely on the Tertiary strata. The characteristics of chalk and clay rivers are further compared in Section 2.7.

YEARLY RAINFALL FOR BERKSHIRE DOWNS ABOVE OR BELOW LONG TERM AVERAGE



YEARLY PERCOLATION FOR BERKSHIRE DOWNS ABOVE OR BELOW LONG TERM AVERAGE





KEY SCALE 0 ————— 10 Km		Catchment Boundary		Urban Area						
		Watercourses		Groundwater Level Monitoring Station						
		Kennet and Avon Canal		Perennial Head of Watercourse						
		M4 Motorway		Spring Source						

2.7

RAINFALL AND RIVER FLOW

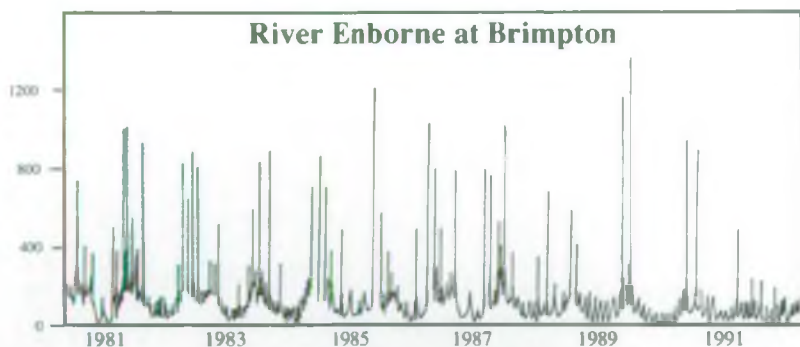
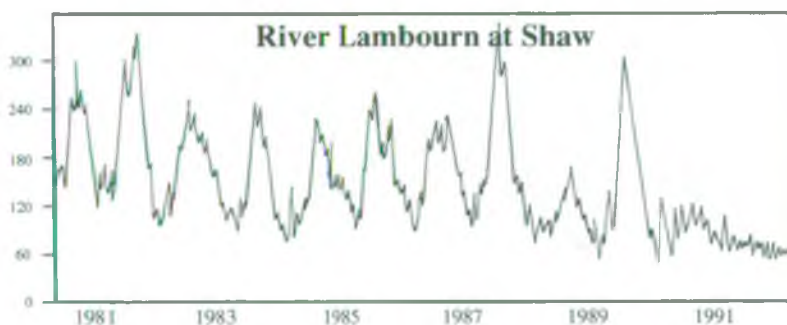
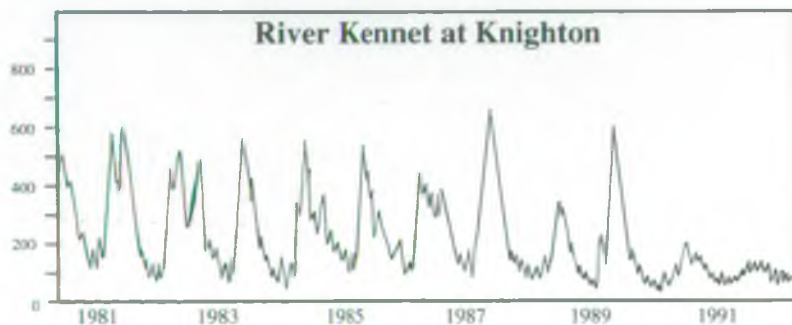
The average annual rainfall for the catchment is 764mm. This value varies across the catchment, due to topographic and meteorological effects, from 900mm on the Hampshire Downs; 800-850mm on the Marlborough Downs and Berkshire Downs; 700-750mm in the centre of the catchment; to 650mm in the extreme eastern end in the Reading area.

Plots of the 20 year moving and non-moving average annual rainfall data below show that in the latter part of this century there has been a noticeable decrease in total rainfall compared to the early part of the century.

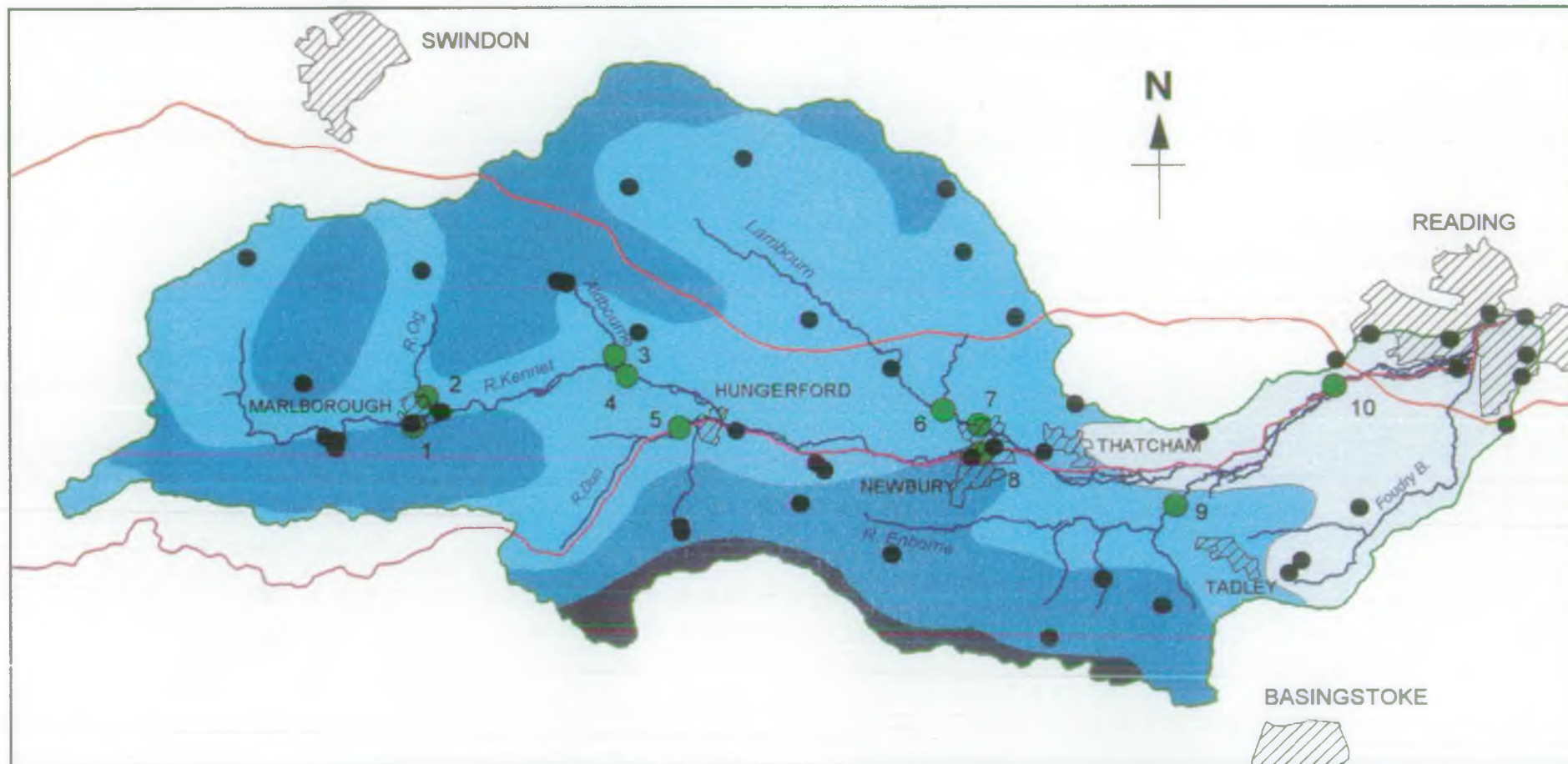


The Rivers Aldbourne, Lambourn, Winterbourne, Og and Kennet from its source to Newbury, flow across the chalk and exhibit the typical 'bourne' nature of chalk streams in that their upper courses become dry to a greater or lesser extent during the summer months. The River Enborne and its tributaries and Foudry Brook flow across the London Clay and therefore exhibit the 'flashy' (i.e. they respond quickly to rainfall) nature typically associated with clay catchments. Hydrographs of the River Kennet at Knighton, the River Lambourn at Shaw and the River Enborne at Brimpton are shown opposite. The effects of recent drought years can clearly be seen as can the hydrological differences between chalk and clay rivers.

RIVER FLOW (MI/Day)



WATER YEARS
(October to September)



KEY SCALE 0 ————— 10 km		Catchment Boundary		Urban Area		Rainfall Station	1. R. Kennet at Marlborough		Flow Gauge
		Watercourses	Average Annual Rainfall (mm)				2. R. Og at Marlborough		
		Kennet and Avon Canal		up to 700		800 to 900	3. Aldbourne at Ramsbury		
		M4 Motorway		700 to 800		over 900	4. R. Kennet at Knighton		
							5. R. Dun at Hungerford		
							6. Winterbourne Stream at Bagnor		
							7. R. Lambourn at Shaw		
							8. R. Kennet at Newbury		
							9. R. Enborne at Brimpton		
							10. R. Kennet at Theale		

Current Situation: The River Kennet catchment incorporates a number of watercourses that provide a striking illustration of chalk stream to lowland clay river type habitats. The River Lambourn for example is typical of a pure chalk stream habitat type and is the only one of its kind within the Thames catchment.

Watercourses and stillwaters within the catchment support rich floral and faunal communities in terms of both total numbers of individuals and numbers of different species present. One site on the River Kennet is, in terms of aquatic vegetation, one of the most species rich lowland river sites in the whole of Britain. Surveys of aquatic fauna frequently have high numbers of invertebrate families (e.g. mayflies, shrimps, snails, midges) for most watercourses in the catchment, including the Kennet and Avon Canal. A number of nationally rare and protected species have been found in the Kennet and Lambourn. The invertebrates are a major component of the food web and a diverse invertebrate community is vital for a healthy fish population. Natural game and coarse fish populations within the catchment form the basis of important, high quality fisheries. A number of sites in the River Kennet and redundant gravel workings provide important breeding and shelter habitat for rare species of birds.

These rich wildlife communities together with the diversity of habitat types and the wealth of extensive information available about them combine to make the River Kennet catchment a key ecological asset not only within the region but also nationally.

This importance is reflected in part by the presence of 50 Sites of Special Scientific Interest (SSSI) as designated by English Nature. There are also over 300 Wildlife Heritage Sites (WHS) as designated by Berkshire County Council, considerable Areas of High Ecological

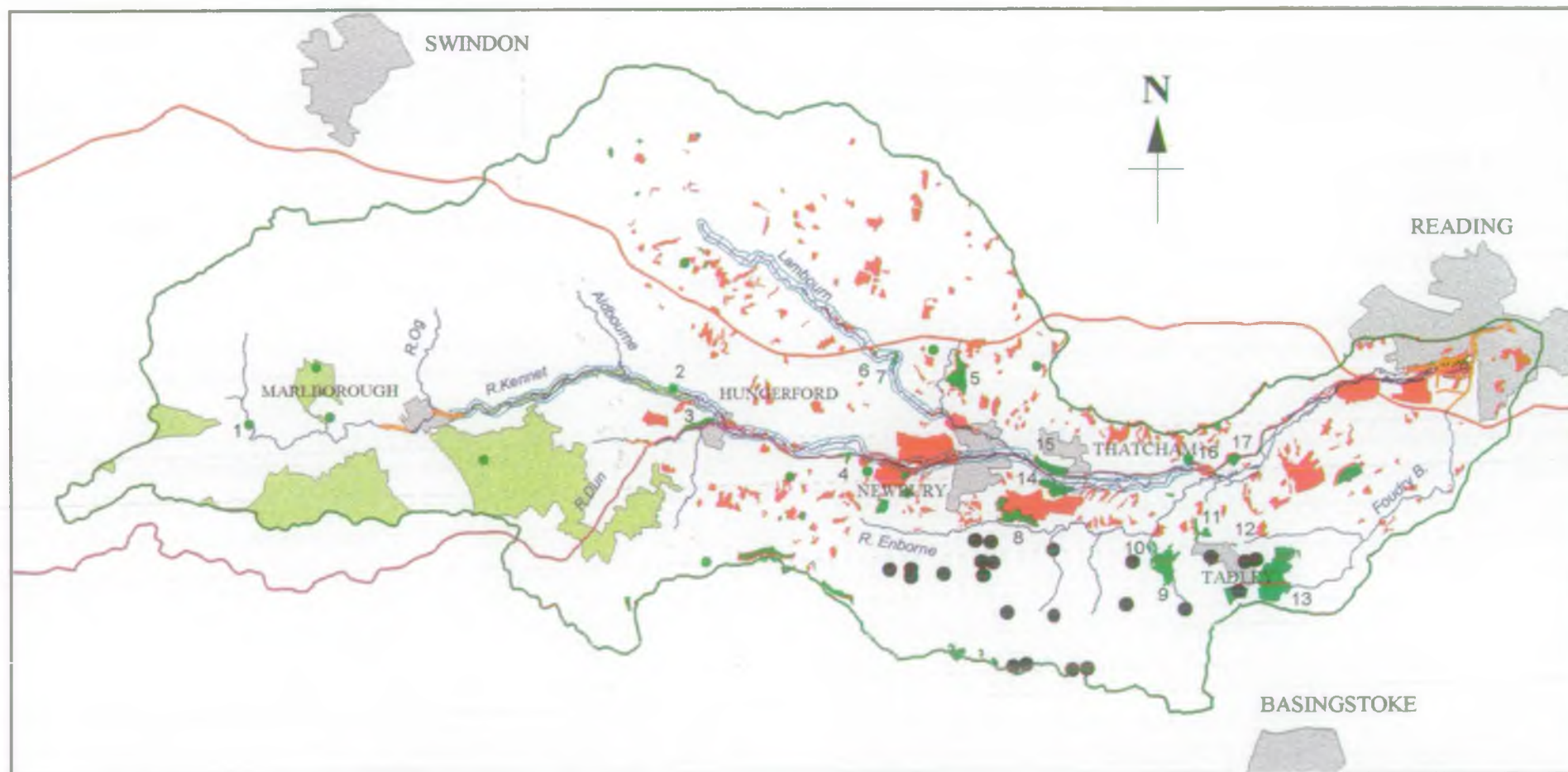
Value as designated by Wiltshire County Council and a number of Countryside Heritage Sites as designated by Hampshire County Council. These sites are shown on the accompanying map, and include sections of stream and river, reed beds, gravel pits, marshes and commons.

British Waterways completed an ecological survey of the Kennet and Avon Canal in 1988. The need to maintain and enhance the ecology of the canal is recognised in British Waterways Strategy for the canal (see Section 2.12).

Future Situation: English Nature has plans to designate part of the Rivers Kennet and Lambourn upstream of Newbury as SSSI. They are also considering the SSSI potential of floodplain habitats between Hungerford and Newbury.

Protection and management of existing sites is also of importance. The future of Thatcham Reed Beds is the subject of discussions between English Nature, Newbury District Council and the Royal Society for the Protection of Birds for instance.

There is an increasing emphasis being placed on managing the links or corridors between designated sites of ecological value. The River Kennet and its associated floodplain (which includes water meadows, marsh, carr, reed swamp and woodlands) constitutes a corridor whose value, increasingly, is being recognised by statutory and non-statutory organisations and groups. Many tributaries of the River Kennet are also being identified (e.g. Holy Brook) as important river corridors by local authorities (e.g. Reading Borough and Kennet District).



KEY SCALE 		Catchment Boundary		Urban Area		Proposed Riverine SSSI	3 - Freeman's Marsh 4 - Irish Hill Copse 5 - Snelmoor Common 6 - Easton Farm Meadow 7 - Boxford Water Meadows 8 - Greenham Common 9 - Kingsclere Stream 10 - Ashford Hill Wood and Meadows 11 - Wasing Wood Ponds 12 - West's Meadow 13 - Pamber Forest and Silchester Common 14 - Bowdown and Chamberhouse Woods 15 - Thatcham Reed Beds 16 - Woolhampton Reed Beds 17 - Aldermaston Gravel Pits (NB - only selected sites named)
		Watercourses		Wildlife Heritage Sites (Berkshire)		River Corridor Designations	
		Kennet and Avon Canal		Area of High Ecological Value (Wiltshire)		Sites of Special Scientific Interest	
		M4 Motorway		Countryside Heritage Sites (Hampshire)	1 - Silbury Hill 2 - Chilton Foliat Meadows		

Current Situation: The catchment has been recognised as providing some of the best game and coarse fishing in the UK, largely due to the pristine nature of the habitat and good water quality.

Upstream of Ramsbury the River Kennet supports stable wild brown trout and grayling populations. Estate put-and-take trout fisheries (brown and rainbow) predominate in the river's middle reaches. Between Newbury and Reading the river sustains good coarse fish populations, although effective breeding appears to be reduced in places. The lower reaches of the catchment offer a very high standard of barbel fishing and attract specimen anglers from throughout the UK.

The River Lambourn provides excellent habitat supporting a healthy, self sustaining population of native brown trout and grayling in places. As part of their restocking programme, the Thames Salmon Rehabilitation Scheme have introduced salmon fry and parr to both the Lambourn and Kennet rivers.

The Kennet and Avon Canal (see Sections 2.11 and 2.12) is one of the premier canal fisheries in the country. The canal is extensively used with an estimated 170 000 angling visits each year.

The River Enborne sustains a stable population of coarse fish and also provides excellent gravel spawning habitat that is likely to be utilised by fish moving upstream from the River Kennet.

Holy Brook sustains a stable coarse fish population, and also provides key spawning habitat for coarse fish, particularly barbel and chub. The Foudry Brook only contains a poor to moderate coarse fish population.

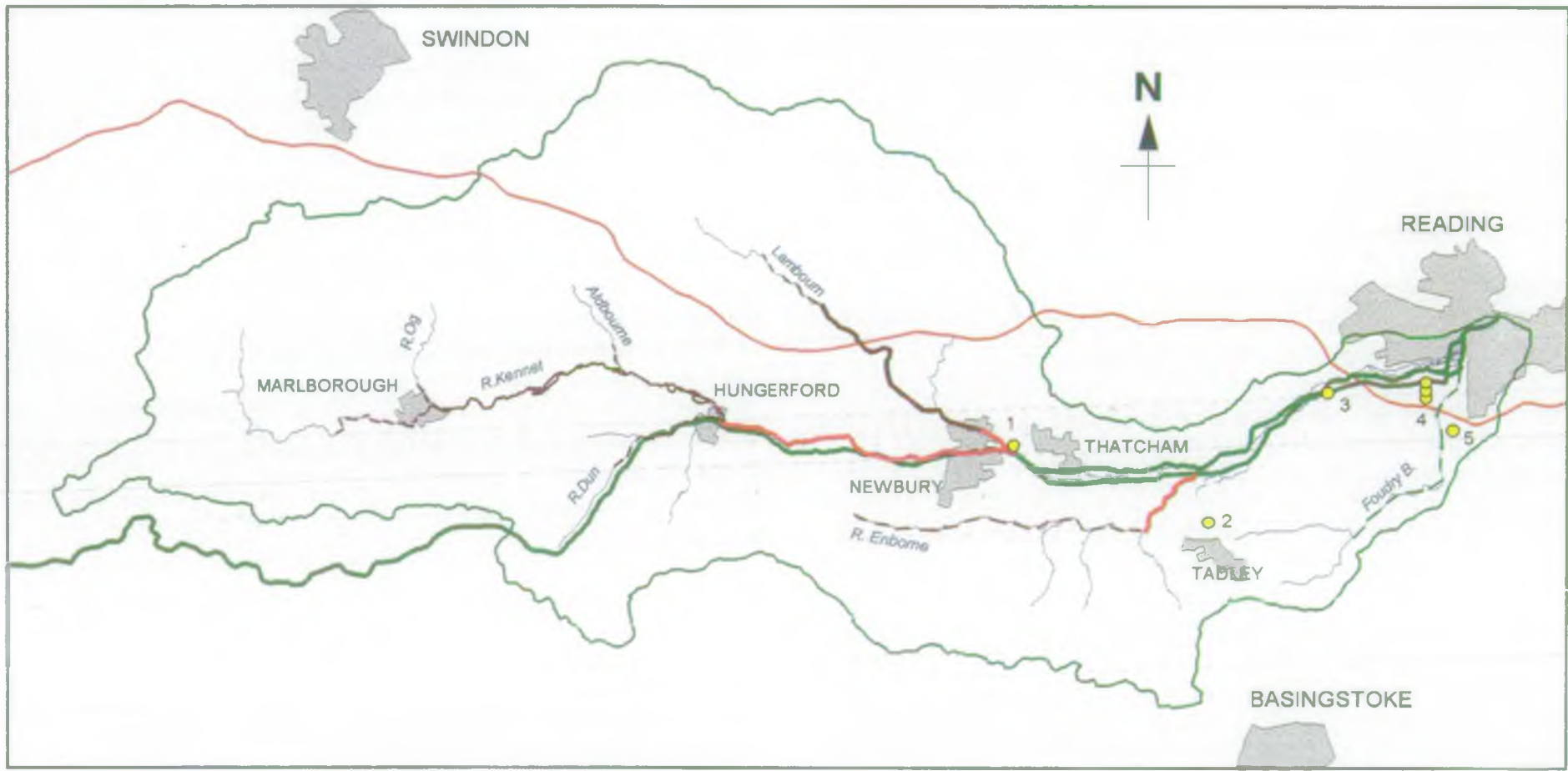
Stillwaters comprise a significant high quality fishery resource in the lower parts of the catchment and consist primarily of excellent coarse fisheries complemented by a few game fisheries. These fisheries are often the result of mineral extraction (see Section 2.17) and may be used for a number of other purposes (see Section 2.11). As the gravel pits mature, coarse fishing tends to improve and some of the older pits are the focus for specimen carp, tench and pike anglers.

Future Situation: Fish populations are dependant upon the quality of both the habitat and the water. Flow regimes are also of great importance and concern has been voiced that changes in these factors may have had a significant impact on the quality of the fisheries (see Section 3.4) which fulfil a number of vital functions. Brown trout and coarse fish are not only exploited by commercial and recreational fisheries, both of which generate financial benefits to the local communities (see Section 2.15), but also serve as excellent indicators of a river's well-being.

Stocking of juvenile salmon is planned to continue and by 1995, returning wild salmon will have access to the catchment which will provide key spawning and nursery habitat.

The NRA are actively promoting the re-establishment of native, self sustaining brown trout populations in the upper and middle Kennet catchment through a number of habitat restoration projects.

The impacts of changes in habitat, water quality and river levels are to be examined through an NRA fisheries survey of the catchment (including the canal) which will be concluded in early 1994. The NRA will use this information to help establish a fisheries management plan for the catchment.



KEY				Fishery Type		Fishery Quality		Stillwater Fisheries
	Catchment Boundary		Urban Area		Game		Good	1. Wylies 2. Aldermaston 3. Theale 4. Englefield, Farnham, Tarmac, Cottage Lane 5. Burghfield
	Watercourses				Mixed		Moderate	
	Kennet and Avon Canal				Coarse		Poor	
	M4 Motorway							

SCALE
0 10 km

Current Situation: The North Wessex Downs Area of Outstanding Natural Beauty covers a significant proportion of the catchment. This area is nationally recognised and the over-riding consideration, supported by all the relevant authorities, is to conserve and enhance the environment in order to retain its special landscape quality. The scenery is characterised by large fields, undulating landforms and an open aspect. In contrast the river valleys appear well wooded and have an intimate feel due to the smaller field boundaries.

At the County level several areas, including the Kennet valley east of the M4 towards Reading, have been designated by local planning authorities in order to protect their landscape characteristics.

East of Newbury the valley becomes broader but the intimate character of the riverscape is maintained through hedges and woodland close to the river and on the floodplain.

In addition, the local role of the water environment in the landscape of the area is recognised by several local authorities. Wiltshire County and Kennet District, for example, have developed policies to protect and enhance the special character of water meadows upstream and downstream of Marlborough.

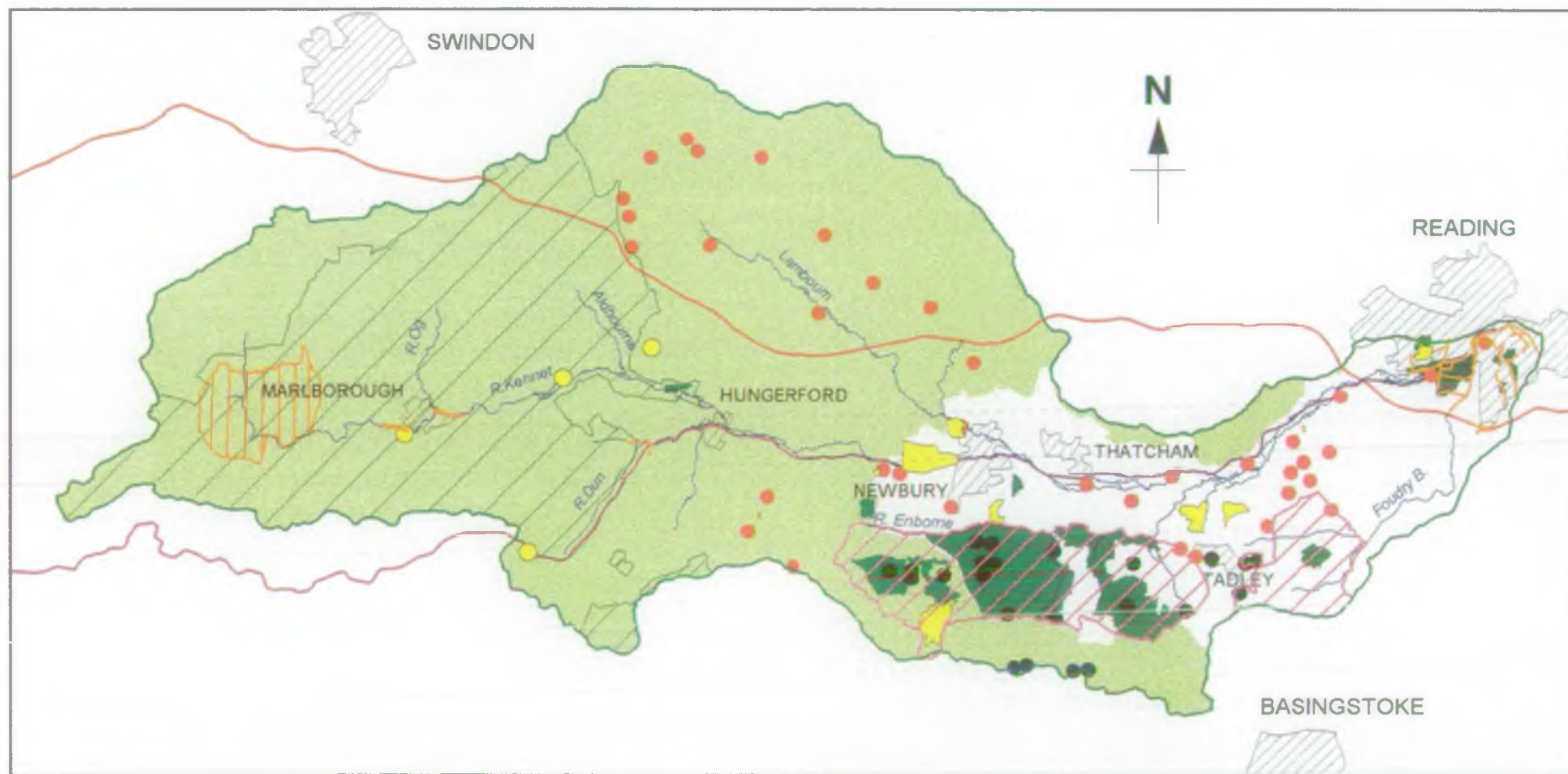
The Avebury complex, including Silbury Hill (c. 2600 BC), which straddles the River Kennet, is regarded as one of the most important Neolithic sites in Western Europe and was designated as a World Heritage Site in 1987. Running through this site is the even older prehistoric (c. 3000 BC) Ridgeway which is now maintained as a national trail (see Section 2.11). These sites exemplify the high archaeological value of the western and northern parts of the catchment where there are many nationally important Scheduled Ancient Monuments. River valleys such as those of the Kennet,

Lambourn and Dun are likely to contain many features of interest within their alluvial or drift deposits. Many of the towns and villages alongside the River Kennet and Kennet and Avon Canal have important Roman, Saxon, Medieval or Georgian origins. Countryside Heritage Areas and Sites have been designated by Hampshire County Council to recognise areas of general heritage and landscape value.

Future Situation: The particular value and sensitivity of the river/waterway landscapes within the urban and rural parts of the catchment has only been partially evaluated through general surveys of the landscape. Recent work by British Waterways to assess the landscape and heritage value of the Kennet and Avon Canal, and growing interest in the role of river corridors as environmental attributes linking into urban areas (e.g. Reading, Newbury and Kennet District Councils), highlights the need to properly evaluate the river's importance to these areas. Newbury District Council have initiated an appraisal of landscapes, including riverine landscapes, within their area.

Future activity within the river corridors, especially in the west of the catchment and throughout the length of the Kennet valley, should be sensitive to the archaeological interests of the area.

Berkshire County Council and relevant District Councils are currently considering the merits of establishing a Countryside Management Service for the lower River Kennet valley. The parallel promotion of a 'Landscape and Restoration Strategy' in the same County's Draft Local Minerals Plan (1993) (see Section 2.17) indicates the high level of interest in protecting and managing the natural resources of the lower and middle River Kennet valley.



KEY SCALE 0 ————— 10 km		Catchment Boundary		Urban Area		Area of Outstanding Natural Beauty		Scheduled Ancient Monument (Berksire Only)		Countryside Heritage Area (Hampshire)
		Watercourses				Areas of Particular, Special or Other Landscape Importance		Countryside Heritage Site (Hampshire)		
		Kennet and Avon Canal				Historic Parks and Gardens		Green / River Corridors		
		M4 Motorway				Areas of High Archaeological Potential (Wiltshire)		World Heritage Site		

2.11 AMENITY AND RECREATION

Current Situation: The key water related features are the 50 km of the Kennet and Avon canal and the 500 Ha of the Lower Kennet Water Park (and the adjacent 30 Ha Holy Brook Linear Park).

At present the Kennet and Avon Canal within the Kennet catchment supports slightly over 220 private boats, 8 hire boats and 5 day-trip boats. Visiting boats from the River Thames constitute only a small proportion of the overall traffic on the canal. The canal also offers a linear walkway, attracting over 10 million visits per annum, which links in with long distance footpaths such as the Ridgeway, the Wayfarer's Way and the Thames Path at Reading and the recently implemented Lambourn Valley Way. The canal also supports canoeing clubs at Newbury and Reading and is used annually for the Devizes to Westminster canoe race and the Hungerford to Newbury raft race.

The Lower Kennet Water Park sits astride the canal and is comprised of a series of wet gravel pits (e.g. Theale, Welman's Farm, Knight's Farm, Searles Farm, Pingewood) some of which are still being excavated. The area is also managed for conservation purposes and is of importance in regional as well as local terms for recreational pursuits such as sailing, water-skiing, angling and board-sailing.

Public open space adjacent or close to waterways is of particular amenity value in urban areas and provides informal access to the water environment for a wide range of people. Within Reading and Newbury this is well recognised in local plans (see Section 2.3) but even in smaller settlements (e.g. Kingsclere and Winterbourne) the water environment is much valued for its amenity value.

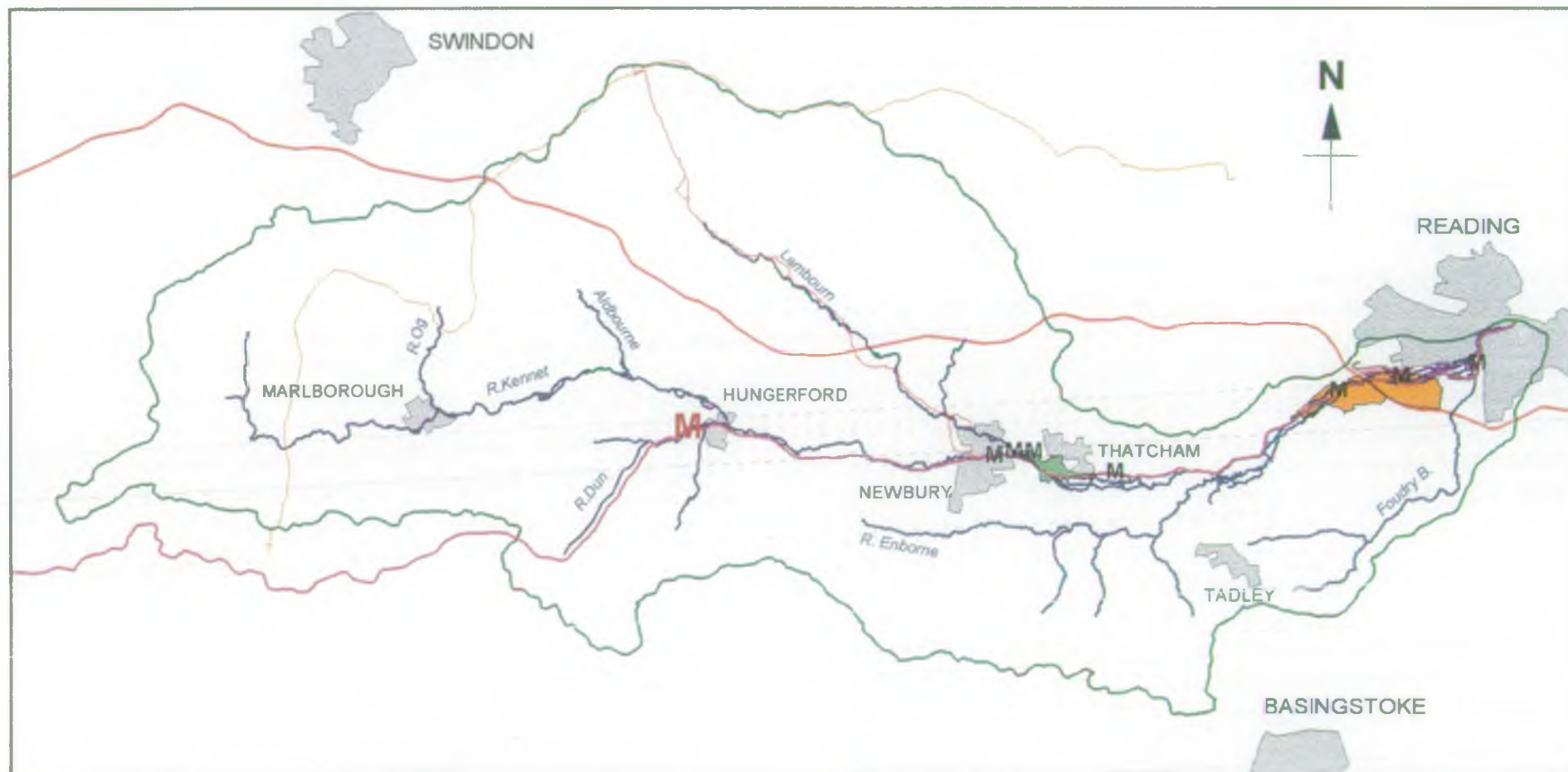
Future Situation: BW have estimated the capacity of the whole canal between Bristol and Reading at 1500 private boats (50% more than at present) and expect this number to be reached by 2003. Hire boats are expected to increase to a maximum of 100 (double the existing total). Visiting boats from the River Thames are not expected to increase substantially in the future.

There are some concerns that the increase in boat traffic on the canal may have a detrimental influence on habitats and therefore also fisheries. BW have identified the need to monitor the situation and this information will be supplemented with NRA monitoring of fisheries (see Section 2.9).

Leisure development (e.g. marinas at Highclose Farm Hungerford, Colthrop and Reading) are seen as one element in BWs plans to attract over £7 M of private sector investment to the canal.

Thatcham Moors covers 280 Ha to the south-west of Thatcham and since 1979 has been the subject of plans to increase its formal recreation potential without detriment to the ecological value of the area.

Public access to the upper River Kennet is more limited. Opportunities exist here and in the lower Kennet valley to secure improvements for informal access. This can be achieved through both Countryside Management initiatives and appropriate restoration of minerals sites.



<p>KEY</p> <p>SCALE</p> <p>0 ————— 10 km</p>		Catchment Boundary		Urban Area		Lower Kennet Water Park		Ridgeway Footpath		
		Watercourses				Holy Brook Linear Park		Lambourn Valley Way		
		Kennet and Avon Canal				Thatcham Moors		Approved Marina Site		
		M4 Motorway				Proposed Marina Sites				

2.12 NAVIGATION

Current Situation: There are two waterways in the catchment that are utilised for navigation; the Kennet and Avon canal and the River Kennet.

The Kennet and Avon canal forms a waterway link between the River Thames and port of Bristol. Construction of the canal was completed in 1810 (although the section east of Newbury was opened in 1723). Competition from rail transport quickly made it unprofitable, and it fell into decline. In 1951 the Kennet and Avon Canal Association (now Trust) was formed with the aim of restoring the whole length of the waterway as a viable navigation. This aim was achieved when in 1990 Her Majesty the Queen declared the canal open.

Over 50 km and 50 locks of the canal fall within the boundaries of the catchment. British Waterways (BW) has jurisdiction over the canal and is responsible for its maintenance and management. In order to sustain the navigation which has 'remainder waterway' status, BW are investigating means by which it can guarantee the canals financial and operational independence. A consultation document entitled 'A Plan for the Environment, Tourism and Leisure' was published in November 1991 outlining development options and the environmental constraints associated with the canal.

The River Kennet forms a link between the canal and the River Thames, and navigation on this short length of the river (approximately 1.5 km) is managed by the NRA who also operate and maintain Blake's Lock.

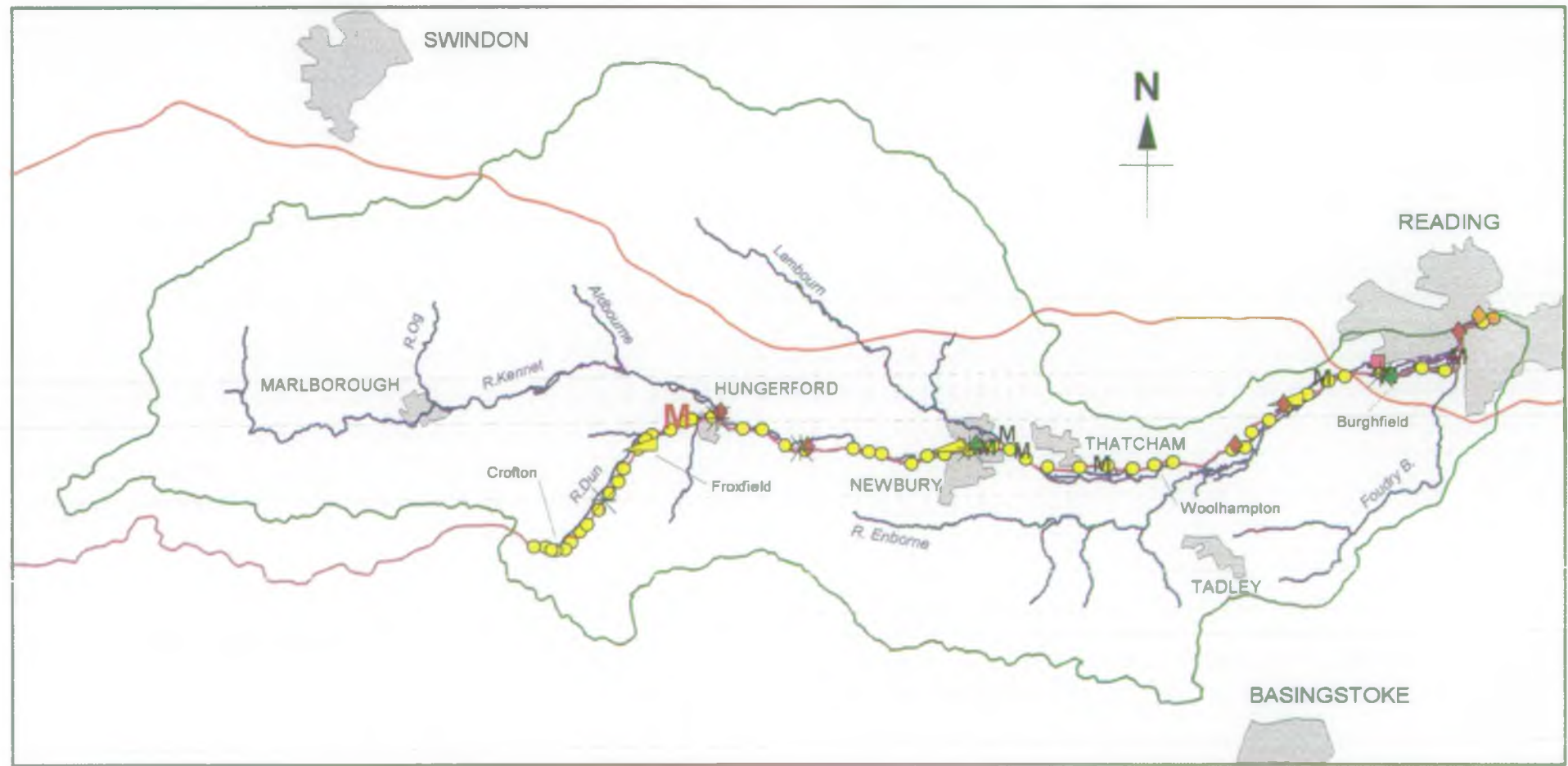
Boat traffic (see Section 2.11) on the canal as a whole is lowest in the Burghfield to Reading reach where it is only two thirds of that in the Froxfield to Woolhampton reach. BW's 1991 consultation document draws on detailed leisure, ecological, landscape and heritage surveys conducted during the late 1980s and early 1990s and contains the following statement:

'British Waterways vision for the Kennet and Avon Canal is that it will be managed as a functional, living link, providing benefits for all, with harmony between the environment, tourism and leisure.'

Elements of BW's survey work is referred to in other parts of this report.

Future Situation: Water supply for the canal is identified as both an existing and future problem for maintaining and increasing the use of the waterway. Investment is planned to be made for additional engineering works to support the basic canal infrastructure and water supply totalling £3 million over the next five years. Local authorities in the Kennet catchment currently contribute £200 000 per annum to the canal which runs at a deficit of £850 000 per annum.

The Kennet and Avon Canal Trust recently launched a multi-million pound appeal to restore the Crofton Pumping Station at the summit of the navigation.



<div>KEY</div> <div>SCALE</div> <div>0 ————— 10 km</div>		Catchment Boundary		Urban Area		Boatyard		Boatyard and Holiday Boat Hire		
		Watercourses		Proposed Marina Sites		Slipway		Public Boat Trips		
		Kennet and Avon Canal		Lock (BW Operated)		Long - term mooring		Holiday and Public Boat Hire		
		M4 Motorway		Lock (NRA Operated)		Approved Marina Site				

2.13 WATER ABSTRACTION

Current Situation: Water is abstracted from both water-bearing strata (e.g. mainly the Chalk) and from surface waters. There are also a few small abstractions from gravels, Tertiary deposits and the Bagshot Beds (see Section 2.5 for geological map). Abstractions from the Chalk are from both the confined and unconfined strata. The volume of water abstracted, the source it was obtained from and the uses it was put to in 1991 are described on the table below.

Use of Abstracted Water	Sources (Ml/d)			
	River	Chalk	Other	Total
Fish Farms	201.04	0.39	4.49	205.92
Public Water Supply	35.21	69.27	-	104.48
Industrial Processes	9.77	14.44	0.05	24.26
Gravel Washing	0.78	-	5.54	6.32
Private Water Supply	0.06	3.12	0.13	3.31
Agriculture	-	2.87	0.16	3.03
Cress	-	1.54	-	1.54
Cooling Processes	1.08	-	-	1.08
Spray Irrigation (Agricultural)	0.50	0.12	0.02	0.64
Spray Irrigation (Recreational)	-	0.21	-	0.21
Water Transfer	0.18	-	-	0.18
TOTAL	248.62	91.96	10.39	350.97

NOTE 1) 'Other' Sources are Gravel, Tertiary Deposits and the Bagshot Beds.

Excluding fish farm licences, which do not constitute a net loss to the river system, it can be seen that over 70% of water abstracted in 1991 was used for public water supplies and 17% for industrial processes (primarily Colthrop Board Mills and Courage Breweries). The largest abstraction for public water supplies was by Thames Water direct from the River Kennet at Fobney Water Treatment Works, Reading.

Approximately 30% of abstractions for public water supply from the Chalk were made use of outside the catchment (e.g. Swindon). Much of the remaining water that was abstracted was returned to the catchment as either sewage or industrial effluent.

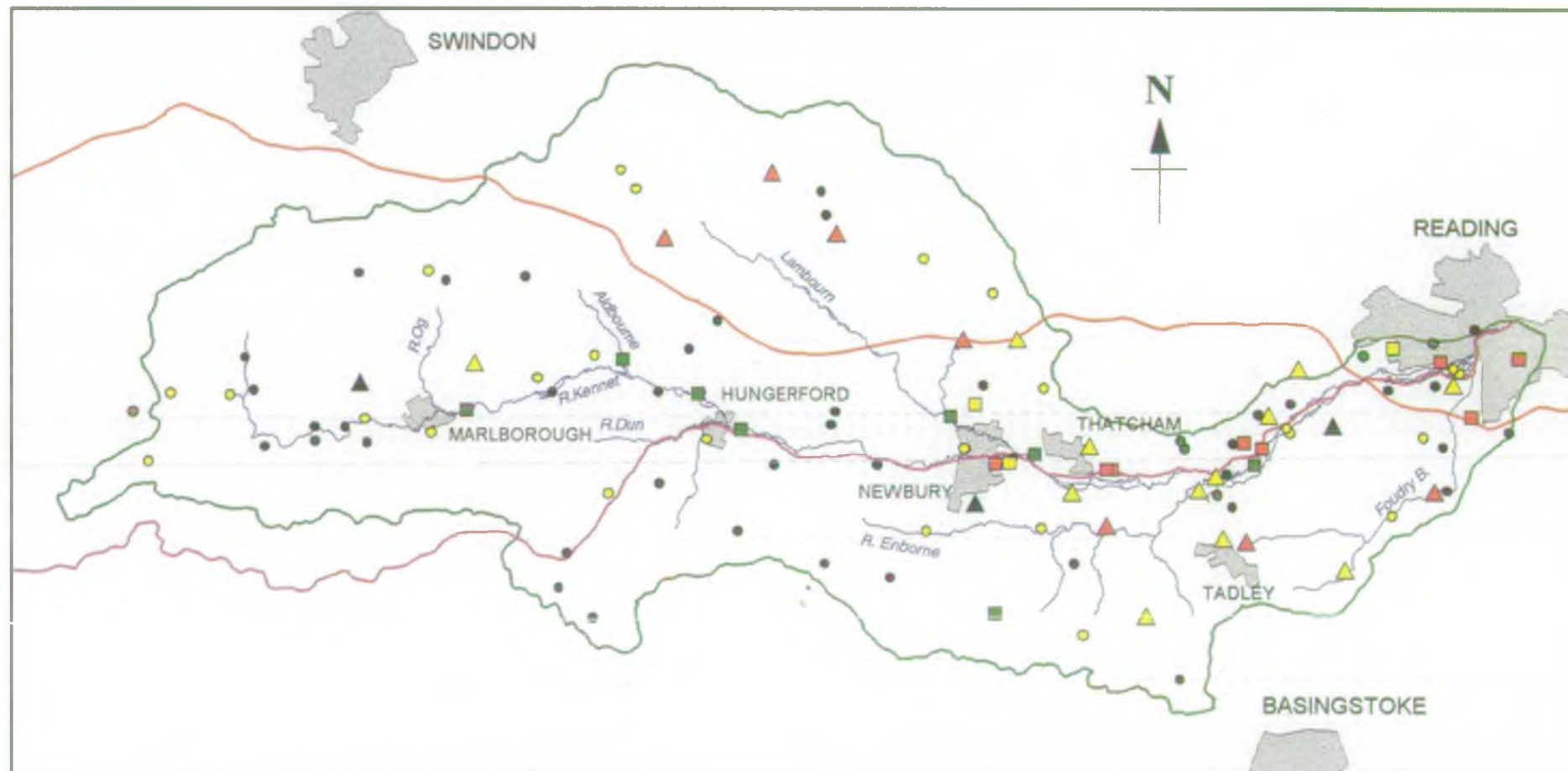
The total number of abstraction licenses has increased from 303 in 1983 to 329 in 1991 and of this number the majority (over 170) are for agricultural purposes. These are not shown on the map opposite for reasons of clarity.

Future Situation: It is unlikely that any further major abstractions will be licensed in the catchment for public supply. It is probable though that additional minor abstractions that do not have a significant impact upon the overall water resources will be allowed. Even these abstractions are likely to have flow constraints imposed upon them i.e. water may only be taken when the river is capable of meeting its own environmental needs.

Gravel extraction is planned to continue in the Kennet valley and hence there will be an on-going demand for gravel washing water. Agricultural demand may rise in the future but industrial demand is unlikely to rise significantly.

Continued water supply problems for the Kennet and Avon Canal may lead to pressure for extra demands on adjacent ground and surface water sources.

Water Resources management issues are discussed further in Section 3.3.



<div>KEY</div> <div>SCALE</div> <div>010 Km</div>		Catchment Boundary		Urban Area	LICENSED WATER ABSTRACTIONS					
		Watercourses				Public Water Supply		Industrial		River Flow Augmentation
		Kennet and Avon Canal				Private Water Supply		Fish Farms and Cress Beds		Water Transfer
		M4 Motorway				Mineral Washing		Spray Irrigation (Recreation)		Spray Irrigation (Agriculture)

2.14

EFFLUENT DISPOSAL

Current Situation: The following are the most significant of the 170 consented effluent discharges in the catchment. The figures shown are the maximum volume of effluent which is permitted to be discharged and the chemical standards which they have to achieve:

	Consented Volume (m ³ /d)	Type of Discharge	General Consent Conditions (see below)
RIVER KENNET			
Fyfield STW	3198	Sewage effluent	15/15/*
Marlborough STW	7500	Sewage effluent	30/35/30
Hungerford STW	3630	Sewage effluent	45/30/*
Kintbury STW	2454	Sewage effluent	45/30/*
Newbury STW	63000	Sewage effluent	30/15/5
Padworth Fisheries	80000	Fish Farm	4/2/0.3
Steetley Quarry	60000	Mineral working	30/*/*
Colthrop Mill	15000	Paper	45/30/10
RIVER DUN			
Berkshire Trout Farm	63371	Fish Farm	5/5/3
LAMBOURN			
East Shefford STW	4500	Sewage effluent	30/20/*
Lambourn Trout	7500	Fish Farm	10/5/2
ENBORNE			
Washwater STW	2850	Sewage effluent	45/30/*
Kingsclere STW	2160	Sewage effluent	45/30/*
Greenham Common STW	3500	Sewage effluent	30/12/4
FOUDRY BROOK			
Silchester STW	24000	Sewage effluent	25/7/5
Stratfield Mortimer STW	1635	Sewage effluent	45/30/*
Reading STW	177275	Sewage effluent	30/20/5 (and Metals)

- Notes:
- 1) Consent conditions are concentrations in mg/l of suspended solids/bio-chemical oxygen demand/ammoniacal nitrogen.
 - 2) ** indicates parameter not included in discharge consent.

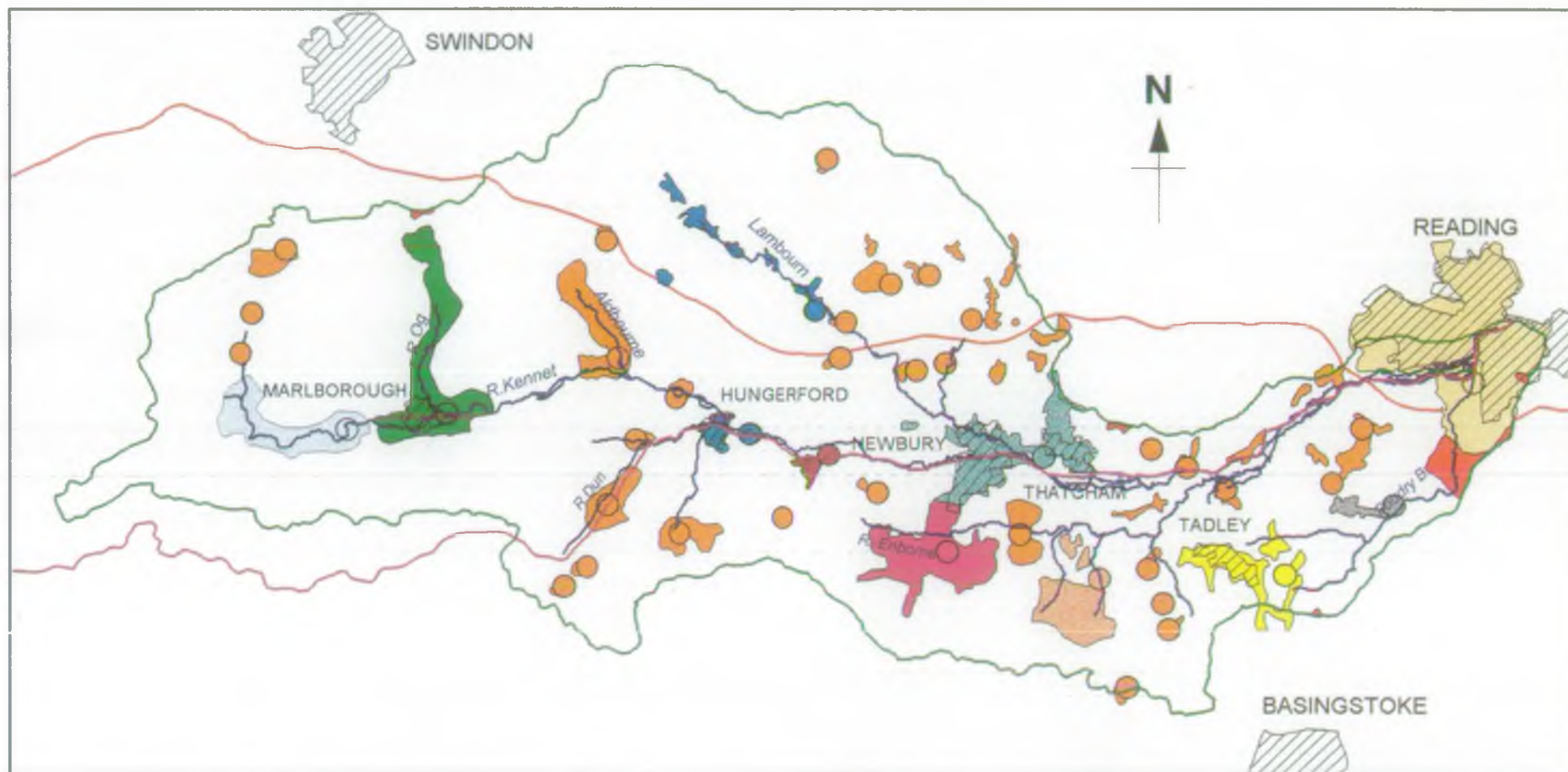
The River Kennet receives the treated sewage effluent from a large recently extended sewage treatment works at Newbury and several smaller works including Marlborough, Hungerford and Fyfield. The other large sewage treatment works is at Reading and discharges into the Foudry Brook which also receives effluent from Silchester (recently improved) and Stratfield Mortimer. The remaining tributaries of the River Kennet generally have only small sewage treatment works discharging to them. The largest of these are East Shefford, discharging to the Lambourn, and Greenham Common to the Enborne.

The high water quality in the catchment supports several fish farms (see Section 2.15) including those at Padworth, Hungerford and Bagnor which discharge effluent to the Rivers Kennet, Dun and Lambourn respectively.

The River Kennet also carries cooling and process effluent from Colthorp Board Mills and effluent from mineral abstractions at Woolhampton and Pingewood.

Future Situation: Increases in population in the catchment will mean that the volume of effluent will increase. The NRA will ensure that discharge consents are set so that water quality objectives will be achieved (see Section 3.2).

Water Quality management issues are discussed further in Section 3.2.



KEY SCALE 0 ————— 10 km		Catchment Boundary		Urban Area		Fyfield		Washwater		Reading Manor Farm
		Watercourses		Sewage Treatment Works & Sewered Areas		Elcot Lane, Marlborough		Newbury		Kintbury
		Kennet and Avon Canal		Effluent Exported from Catchment		Hungerford		Kingsclere		Stratfield Mortimer
		M4 Motorway		Minor Works		East Shefford		Silchester		

2.15 RURAL DEVELOPMENT

Current Situation: Much of the original chalk grassland traditionally grazed by sheep has been lost in the Downs. Arable farming for barley, wheat and more recently oilseed rape and linseed, now dominates in these areas although it is sometimes associated with dairy or sheep enterprises. Land adjacent to the rivers in these locations is therefore still often utilised for fattening store cattle and sheep. Field sizes tend to be large to accommodate modern machinery. The farms themselves are also large.

On the Berkshire Downs, notably in the Lambourn area, the horse racing industry has become established. Further east, on the clay soils, and also on the lowlands in general, dairy farming is more significant. Here fields are smaller, with either fences or stock-proof hedges.

The Kennet valley generally comprises relatively poor quality farmland which is used as pasture for cattle and sheep.

The quality of the river water in the west of the catchment is such that fish farming is supported at several locations. Commercially managed put-and-take rainbow trout estate fisheries are also present. These activities, along with the indigenous game and coarse fisheries, constitute a significant business based around the river. For example, fishing rights in parts of the upper River Kennet would realise well over £100,000 per kilometre were they to be made available. Annual costs of £2,000 per person for the right to fish certain game fishery reaches can be expected.

Forestry is not a major activity within the river valleys but there are several areas of Forestry Commission woodland, notably in the south of the catchment. Savernake Forest, once an ancient Royal Forest,

comprises one of the most extensive blocks of predominantly broadleaved woodland in the locality.

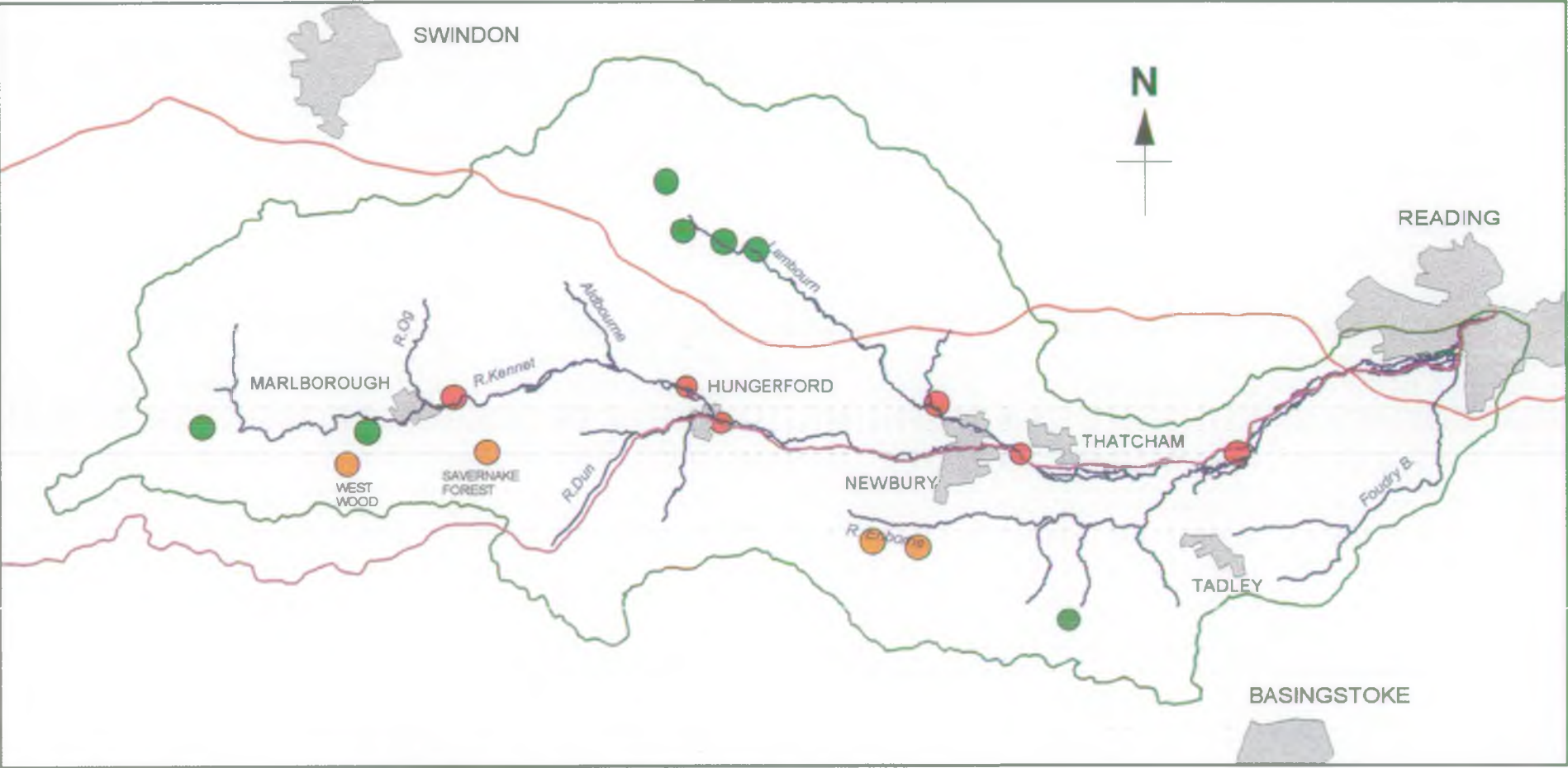
Future Situation: Over the last decade the most significant change has been the introduction of oilseed rape and linseed into the arable rotation. This is likely to continue and could further affect cropping patterns.

Recent changes in EC agricultural policy indicate that upto 15% of arable land used for cereal, oilseed and protein crops in the catchment could be put into non-rotational set-aside. Such land, if sited adjacent to watercourses, would create buffer zones capable of enhancing the conservation value of the river corridor and reducing silt and pollutant loads in surface waters.

The use of nitrogen on agricultural land is being monitored around the public water supply abstraction point at Ogbourne St. George, which has been designated a 'Nitrate Sensitive Area' (see Section 3.2). Depending on the outcome of this and similar monitoring exercises, the management of much wider arable chalkland areas, may be affected.

The Countryside Commission's Countryside Stewardship Scheme and the potential of the area for designation as an Environmentally Sensitive Area by MAFF may both be factors which influence the approach to managing rural areas in the upper River Kennet valley in particular.

The 'Wiltshire Downs Project' being promoted by the Countryside Commission will shortly look at the opportunities for environmentally sensitive tourism projects in the area west of Marlborough.



<div>KEY</div> <div>SCALE</div> <div>010 km</div>		Catchment Boundary		Urban Area						
		Watercourses		Forestry Commission Sites						
		Kennet and Avon Canal		Horse Racing Centres						
		M4 Motorway		Fish Farms						

2.16 URBAN DEVELOPMENT

Current Situation: Residential and commercial development and associated highway works have considerably altered the Newbury-Thatcham-Theale-Reading corridor over the last 30 years. During this period Berkshire as a whole has seen a 40% increase in its population.

Future Situation: The high rate of growth experienced in the Berkshire and Hampshire parts of the catchment in the last 30 years is likely to continue in the short-term as a range of committed developments and highway projects are progressively implemented.

Both Berkshire and Hampshire through their Structure Plans are looking to achieve lower growth rates in the next 10 years in order to reduce the pressures on the natural environment. The attractions of the area for developers will still be great, however, and many of the areas that have previously attracted speculative attention (e.g. south-west Reading, east of Newbury and around Thatcham) have close associations with the corridor of the River Kennet.

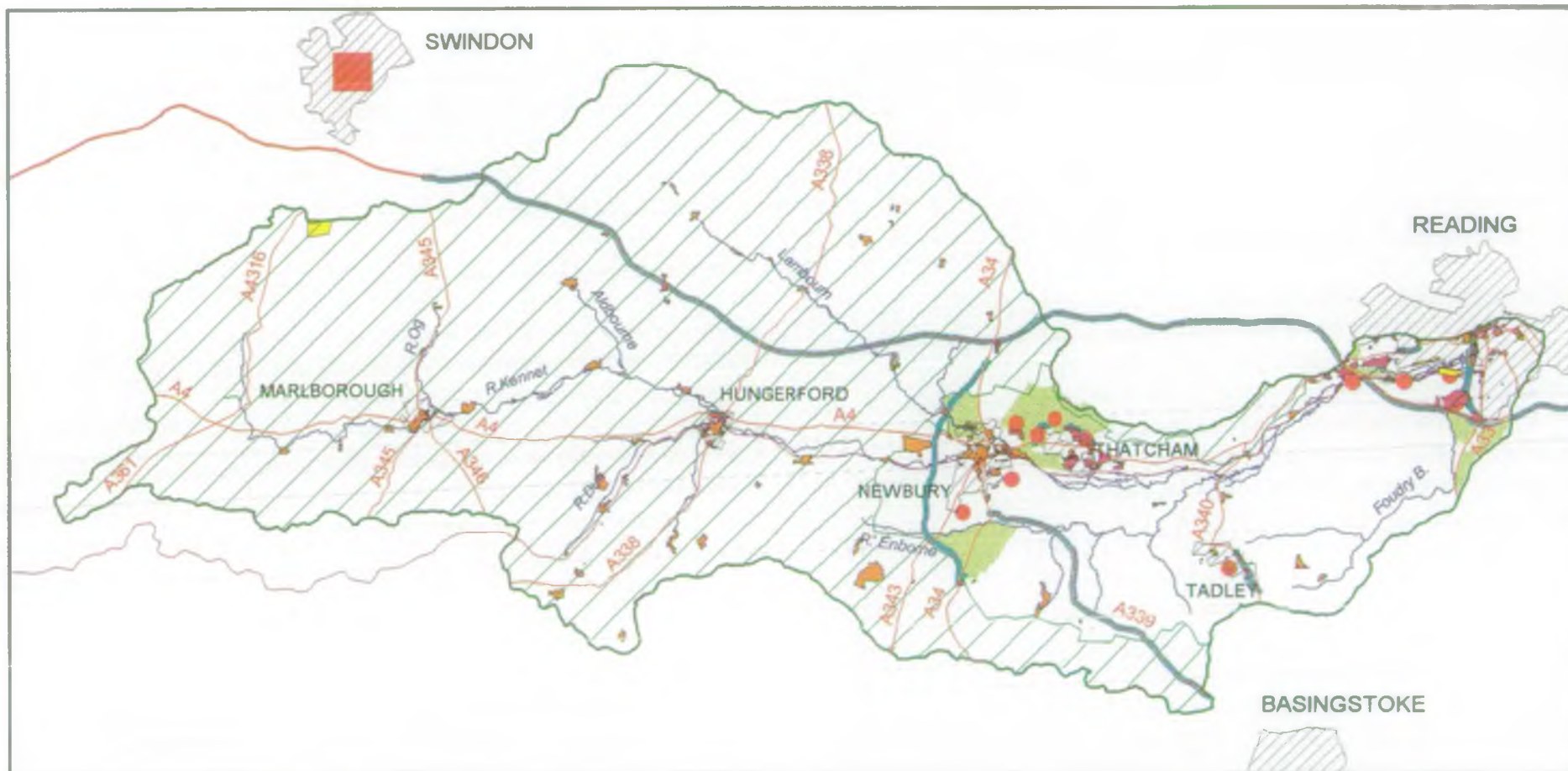
Within the parts of the catchment in Oxfordshire and Wiltshire urban developments have been far less dramatic and this situation is planned to continue.

Over the next ten years housing development in the Hampshire, Wiltshire and Oxfordshire parts of the catchment is unlikely to exceed 1000 units. In contrast Berkshire over the next 15 years will see approximately 10 000 units being built although many of these proposed units already have planning approval. Commercial development will follow a similar pattern. The Berkshire Structure Plan recognises the problems of water supply for any future developments in the area west of Theale.

Highway improvements will have a considerable impact on the water environment. The A34 Newbury by-pass and A33 Reading relief road will both cross the River Kennet floodplain and the A339, depending on its final alignment, may have implications for the River Enborne. Widening of the M4 may offer opportunities to lessen the impact of the existing motorway runoff on the River Lambourn.

Although outside the catchment area, planned growth of 10 000 housing units by 2001 at Swindon may have implications for the water resources of the River Kennet catchment although these are expected to be catered for by other sources. The South-West Regional Planning Conference wish to see lower growth rates at Swindon post-2001 with development pressures being redirected to alternative locations in the M4 corridor.

An important aspect of future land use planning policy and control activity will be the way in which it embraces the government's intention to work towards ensuring that development and growth are sustainable. Within the River Kennet catchment the NRA are keen to work with County and District Council's to ensure that land use planning decisions reflect this approach. Of particular interest are the catchment wide concerns about water resources and the more localised conservation needs of the River Kennet valley.



KEY		Development Proposals		Development Constraints	
	Catchment Boundary		Urban Area		Residential / Commercial
	Watercourses		Regional Growth Area		Recreational
	Kennet and Avon Canal		Existing Highways		Strategic Gap / Rural Buffer Setting of Settlement
	M4 Motorway		Highway Proposals / Improvements		Urban Conservation Area
			Possible Pressure Points		Area of Outstanding Natural Beauty

KEY

SCALE

0 10km

2.17 MINERAL EXTRACTION AND SOLID WASTE DISPOSAL

Current Situation: No mineral extraction takes place in Wiltshire or Oxfordshire within the River Kennet catchment. This is partially because of geological constraints but is primarily due to the area being within the North Wessex Downs Area of Outstanding Natural Beauty where mineral working is contrary to the aims of conserving the landscape quality and environment. In Berkshire about one fifth of the county's best-quality sand and gravel reserves lie in the River Kennet valley between Thatcham and the western edge of Reading. As can be seen on the map a number of gravel pits currently operate in this area and a large number have been worked in the past. Mineral reserves between Newbury and Thatcham have largely been exhausted.

Processing plants are located at Greenham, Woolhampton, Aldermaston, Beenham, Theale and Pingewood.

The majority of waste disposal sites are located around populated areas particularly to the south of Reading and the east of Newbury (e.g. Beenham). Many of these are former gravel extraction sites which are being filled back to ground level then restored.

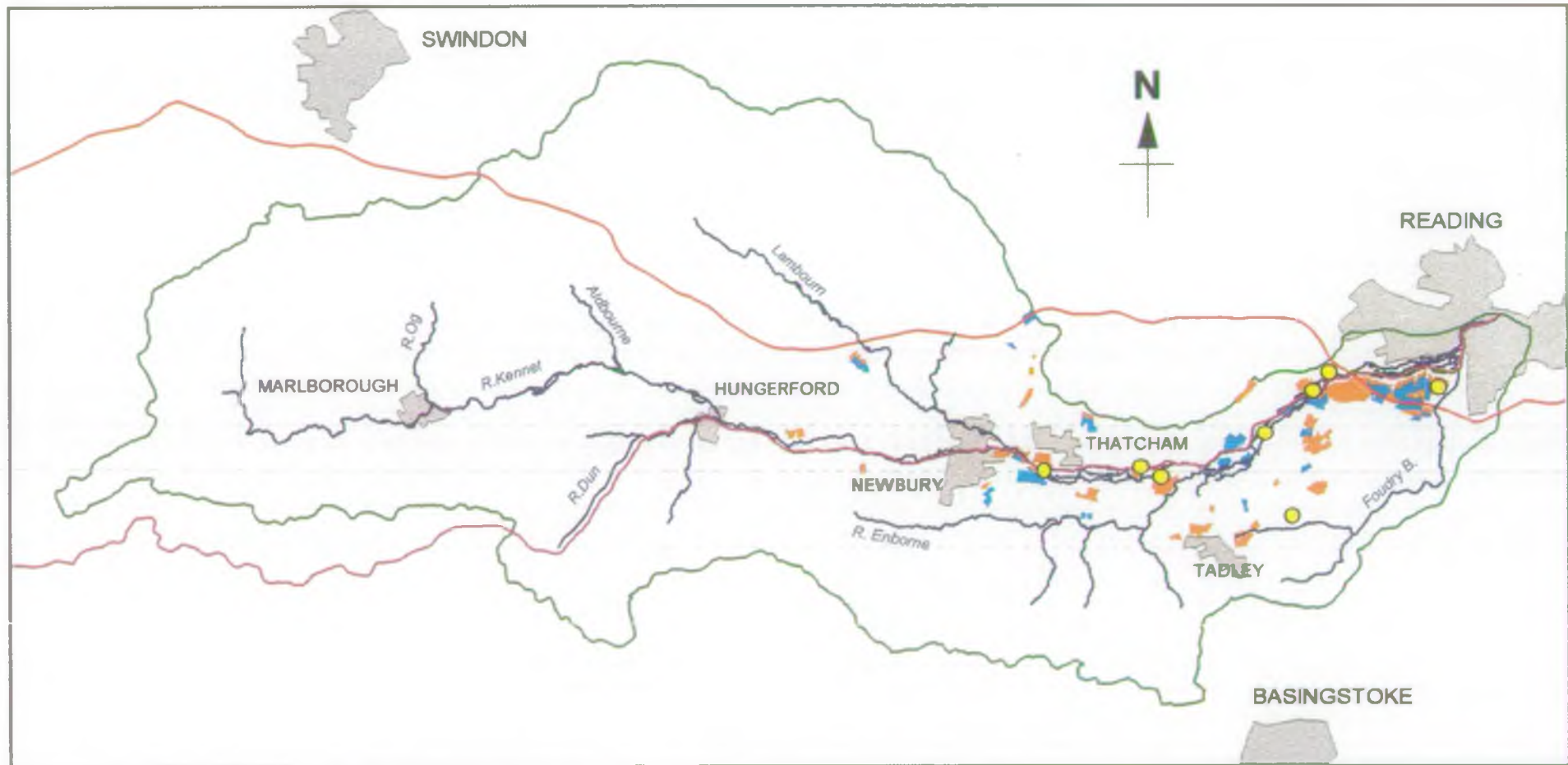
Future Situation: The Draft Replacement Minerals Local Plan (1993) for Berkshire identifies 7 possible sites for further extraction during the next 20 years in the River Kennet catchment. It is proposed that in general these new areas should not be dug until extraction has finished at nearby sites which already have planning permission. They should also make use of existing processing plant. Previous consultation documents had indicated 12 possible mineral extraction sites in the catchment. The current plan therefore marks a reduction in the proposed level of mineral working in the valley and a greater

recognition of the capacity of the valley to absorb environmental impacts. Berkshire County Council have proposed a broad landscape and restoration strategy representing a vision for the future of the Kennet valley between Newbury and Theale. This strategy applies to the whole of the valley and will therefore embrace other relevant initiatives (see Section 2.10).

Mineral extraction in the River Kennet valley is likely to continue for many years to come. Berkshire County Council recognise the role that a 'Kennet Valley Standing Conference' might play in guiding the operation of their proposed strategy. Restoration will generally be to existing ground levels using imported fill and will seek to reproduce traditional landscape and land use patterns. The cumulative impact on groundwater flows and the quality of waters will need to be carefully considered.

The document 'Waste Disposal - A New Strategy for Berkshire' (1992) indicates that over the next 15 years the disposal of putrescible (i.e. potentially polluting) waste via landfill should be phased out.

The Hampshire Minerals Plan identifies Welshman's Road, Mortimer West End in the east of the catchment as a potential gravel extraction and waste disposal infilling site over the next 20 years. No sites are identified within the catchment in the Wiltshire or Oxfordshire Minerals Plans.



KEY		Urban Area		Mineral Extraction					
	Catchment Boundary				Past				
	Watercourses				Current or with Planning Permission				
	Kennet and Avon Canal				Proposed				
	M4 Motorway								

KEY

SCALE

0 10 km

2.18 FLOOD DEFENCE

Current Situation: The map opposite highlights areas that are known to have flooded in the past (i.e. the extent of the flood plain) and the limits of main river.

Current flood forecasting relies upon a combination of telemetered information from a number of sites and information from Flood Defence staff in the field. Flood warnings are issued by NRA head office in Reading to Thames Valley Police and local Councils. Annual Flood Warning seminars are also held to review the process.

Serious flooding to urban areas occurred throughout the valley in March 1947. More recently flooding has occurred at Newbury and points downstream in 1971 and 1979. The floods of November 1992 affected many areas in the upper parts of the catchment.

The majority of maintenance works carried out to the River Kennet upstream of Hungerford involves river management work to prevent flooding. This takes the form of weed cutting (especially in the summer), tree trimming and removal and is usually carried out in close collaboration with fishery keepers and owners together with the Fisheries and Conservation staff of the NRA. The importance of this preventative maintenance cannot be overstressed.

These river management activities also form the main component of flood defence maintenance activities on the Rivers Kennet (Newbury to Thatcham), Og, Lambourn, Winterbourne, Foudry Brook and Enborne.

In the lower, more developed part of the catchment, from Thatcham to the confluence with the River Thames, maintenance activities concentrate on litter removal from the river and banks, together with

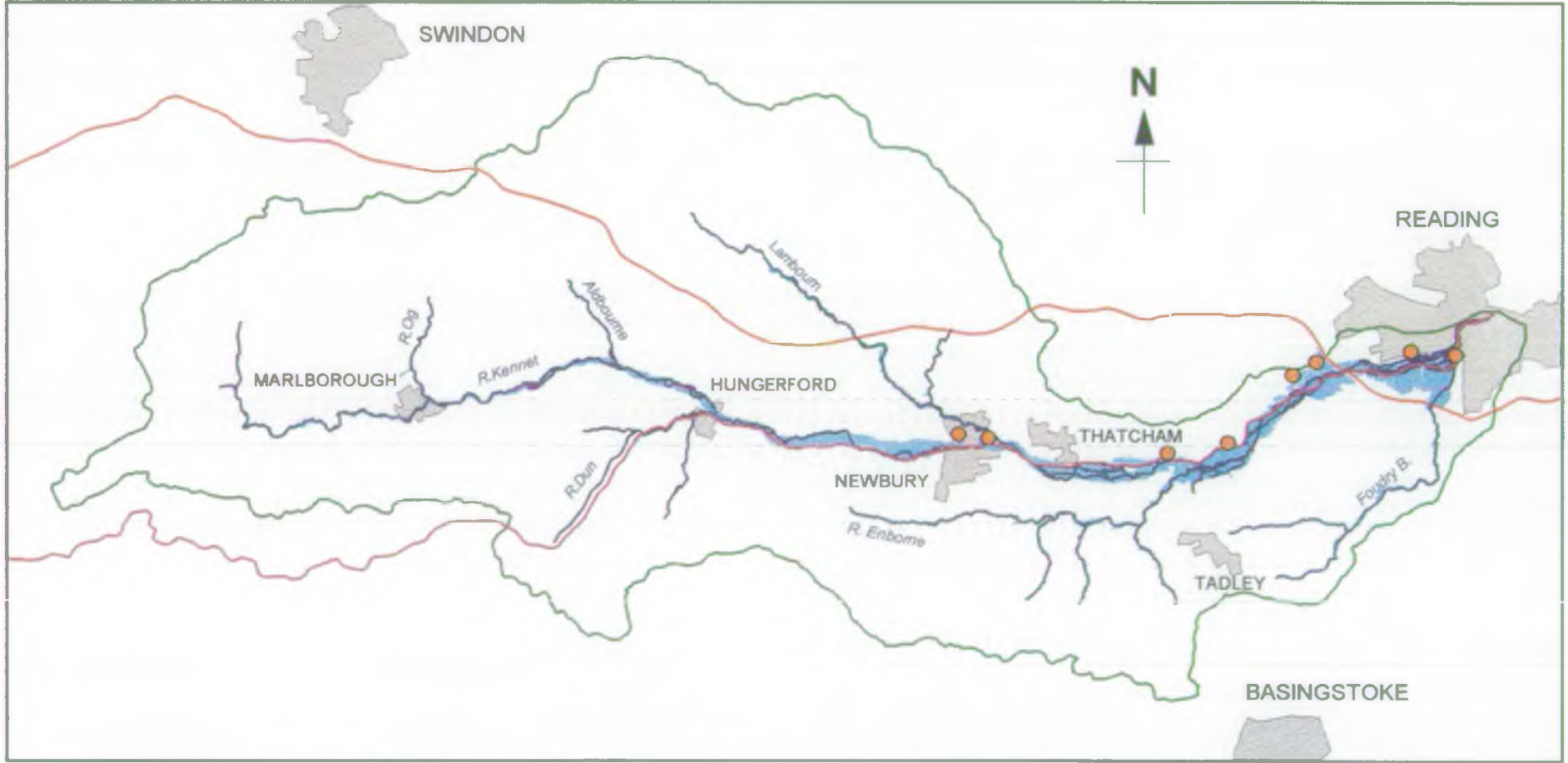
emergency works and the operation and maintenance of some river control structures.

Modifications to the River Kennet have been carried out at Hungerford to alleviate flooding problems there. Action to alleviate problems at Avebury is extremely limited due to the number and position of listed structures and monuments in the village.

Future Situation: Our reach specific Standards of Service (see Section 3.4) will be developed and updated, incorporating current information on land use, maintenance activities and flood events. All functions within the NRA will be involved in the fine tuning of a reach specific management programme and strategy to achieve specific flood defence standards.

The telemetered capacity for flood warning purposes is due to be increased, subject to appropriate benefits being identified, once higher priority catchments have been completed. The Warning Assessment Report for the River Kennet is planned for 1994.

We are currently reviewing the extent of potential flood risk in the Kennet valley from Newbury to Reading. Particular attention is being paid to the flood risk at Newbury. We are also working with District and Borough Council's to implement our floodplain policy (see Section 3.4) and will seek to ensure that future urban development (see Section 2.16) and mineral working (see Section 2.17) does not compromise existing flood defence standards of protection and where possible contributes to their improvement. Where appropriate the NRA will encourage District Council's to prepare 'Drainage Management Plans' to ensure the sound management of surface water runoff.



<p>KEY</p> <p>SCALE</p> <p>0 ————— 10 km</p>		Catchment Boundary		Urban Area								
		Watercourses		Areas known to have flooded								
		Kennet and Avon Canal		Urban areas at risk								
		M4 Motorway										

2.19 REVIEW OF SECTION

This section has reviewed the resources of the catchment, the uses we make of the water environment and the activities that might affect it. The key points raised by this review are as follows:

- the ecology and fisheries of the catchment are either nationally or regionally important;
- the landscape of much of the catchment is of national importance;
- the western half of the catchment is nationally significant in archaeological terms;
- the Kenet and Avon Canal is an important recreational, heritage, landscape and ecological asset whose future depends on securing greater financial support;
- the Lower Kennet Water Park is of county-wide importance as a recreational asset;
- water abstraction and effluent disposal are significant and important uses within the catchment;
- agricultural land use management grants offer opportunities if appropriately used for protecting and enhancing the water environment;
- urban land use change including mineral extraction will be focused on the Kennet valley downstream of Newbury;

-
-
- opportunities exist for the integrated management of the water environment in the upper Kennet (fisheries - ecology- water abstraction - landscape - rural development - flood defence);
 - opportunities exist for the integrated management of the water environment in the lower Kennet (ecology - fisheries - landscape - rural development - urban development - mineral extraction and solid waste disposal - effluent disposal - amenity and recreation - flood defence - navigation); and,
 - flood defence standards of service are maintained primarily by maintenance activities which are also of benefit to fisheries and ecology.

These key points provide a basis for identifying the issues facing the water environment which are discussed later in Section 4. Prior to presenting these issues, however, the status of the water environment is discussed in Section 3.

Section 3

STATUS OF THE WATER ENVIRONMENT

3.1 INTRODUCTION

Purpose of Section

The purpose of this section is to compare the current status or condition of the catchment (where it is known) with overall standards/targets (where they are available) in respect of water quality, water resources and physical features.

Comparison of the 'current status' with the 'overall target' enables issues - which may be problems due to failures to meet targets, or conflicts due to differing uses having opposing requirements - to be identified. The areas of concern identified in this way are summarised in Section 3.5.

Many concerns, however, are not readily identifiable by the above approach. We have therefore reviewed the responses to our informal request for information and views (see Appendix II) and evaluated ongoing activity in the NRA to identify other concerns. These have also been incorporated into Section 3.5.

In reviewing the current status of the water environment we necessarily touch on the reasons why we undertake certain monitoring activities and the legislation that is relevant to the way we manage the water environment. This review is catchment specific, however, and the following sub-sections are therefore included to:

- describe the context within which the CMP will be prepared;
- explain the principles on which the CMP will be prepared; and,
- identify national and regional initiatives of relevance to the River Kennet catchment.

Context of the CMP

The role of the NRA and the specific aims we have set ourselves were described on page 1.2. These statements, and our supporting strategic objectives which are described in Appendix I, provide the context within which the following key elements of the Final Plan will be prepared:

- vision for the catchment;
- an issues led policy framework for the management of the catchment; and,
- action plans to address issues covered by the strategic policy framework.

These elements will only be prepared once the period of consultation on this document has been completed and full consideration has been given to the responses received.

In preparing the catchment vision we will be looking to define what we wish the catchment to be and the principles we will follow in working towards the vision. The catchment vision may not be something we can achieve in the next five years, but something we can work towards over that period.

The issues led policy framework should be achievable within a five year period and the detailed action plans will:

- detail what the NRA and others will be doing and when: and,
- provide estimates of the costs and benefits of what is proposed.

3.1 INTRODUCTION (ctd)

The policy framework must be flexible enough to respond to change. The degree to which it remains relevant will be assessed through annual monitoring of the action plans and changes in the catchment. If necessary a formal review of the CMP will be initiated before the expected five year plan making cycle repeats itself (see page 1.7).

Principles for Producing the CMP

In producing the vision, policy framework and action plans the NRA will have regard to the following principles:

- we aim to ensure that implementing our role and aims, promoting the sustainable use of water and developing an integrated approach to managing catchment issues are at the forefront of our approach;
- we will maintain the existing status of the water environment and seek enhancements wherever possible;
- we will endeavour to accommodate the reasonable requirements of all parties concerned, having regard to the relative importance of the issues involved;
- we will endeavour to ensure that the CMP is based on consensus and is seen as an agreed strategy for realising the environmental potential of the catchment within prevailing economic and political constraints; and,
- we will, where appropriate and possible, assess the need for environmental improvements on the basis of what they cost, the benefits they will generate and sound technical assessments.

NRA Strategic Priorities and Activities

In reviewing the status or condition of the water environment of the River Kennet catchment and identifying issues for the catchment it is helpful to be aware of initiatives the NRA is pursuing nationally and regionally that are relevant to the catchment. These are as follows and are national unless otherwise indicated:

Water Quality

- * The Department of the Environment have recently consulted on a Statutory Water Quality Objective Scheme for surface waters which the NRA are due to progressively implement from 1993.
- * The NRA are reviewing the charging scheme for effluent discharges with a view to changing the system in April 1994 and advising government on possible incentive charging schemes to help reduce water pollution.
- * (Regional) Pollution prevention activity will be a priority in certain locations including Reading.

Water Resources

- * Undertake public consultation on, and develop a long-term strategy for, sustainable development of water resources both nationally and regionally.
- * Implement a new charging for water abstractions scheme in April 1993.

3.1 INTRODUCTION (ctd)

- * Progressively implement the NRA's Groundwater Protection Policy launched in December 1992.

Flood Defence/Multi-Functional

- * (Regional) To create a policy framework to enhance the NRA's influence in development planning and control from Regional Guidance through Structure Plans to Local Plans.

Fisheries, Recreation, Conservation and Navigation

- * Implement a strategic conservation classification scheme by 1996.
- * Develop, undertake public consultation on, and commence the implementation of, a Section 142 fisheries charging scheme by April 1994.

Information on these and other NRA activities is given in our Corporate Plan for 1992/93 which is obtainable at a cost of £10 from the following address:

National Rivers Authority
2 - 5 Alston Road
Pattinson North Industrial Estate
District 15
Washington
Newcastle-upon-Tyne
NE38 8QA.

3.2 WATER QUALITY

Introduction

The quality of surface waters is evaluated in a number of ways against a range of statutory and non-statutory standards. Monitoring of the chemical status enables the NRA to assess compliance with relevant statutory EC Directives and to classify the status of the river against non-statutory river quality objectives. Biological monitoring provides additional information which is used as an indicator of the river's overall health, unlike chemical and bacteriological sampling which is specific to the time and place of the sample. The nutrient status (i.e phosphorus and nitrogen) is monitored as a high nutrient level can upset the natural balance of a river's flora and fauna. To many people, however, visual appearance is also of great importance but at the moment we do not systematically monitor this.

Ground waters have traditionally been monitored in a less comprehensive manner. We have recently published a document entitled "Policy and Practice for the Protection of Groundwater" as part of an overall move towards better monitoring and protection of ground waters.

Details of water quality classifications, applications for consent and issued consents, sample information and details of prosecutions are held on the Public Register which is available for inspection at our Reading office (Tel: 0734 - 535000).

Surface Waters

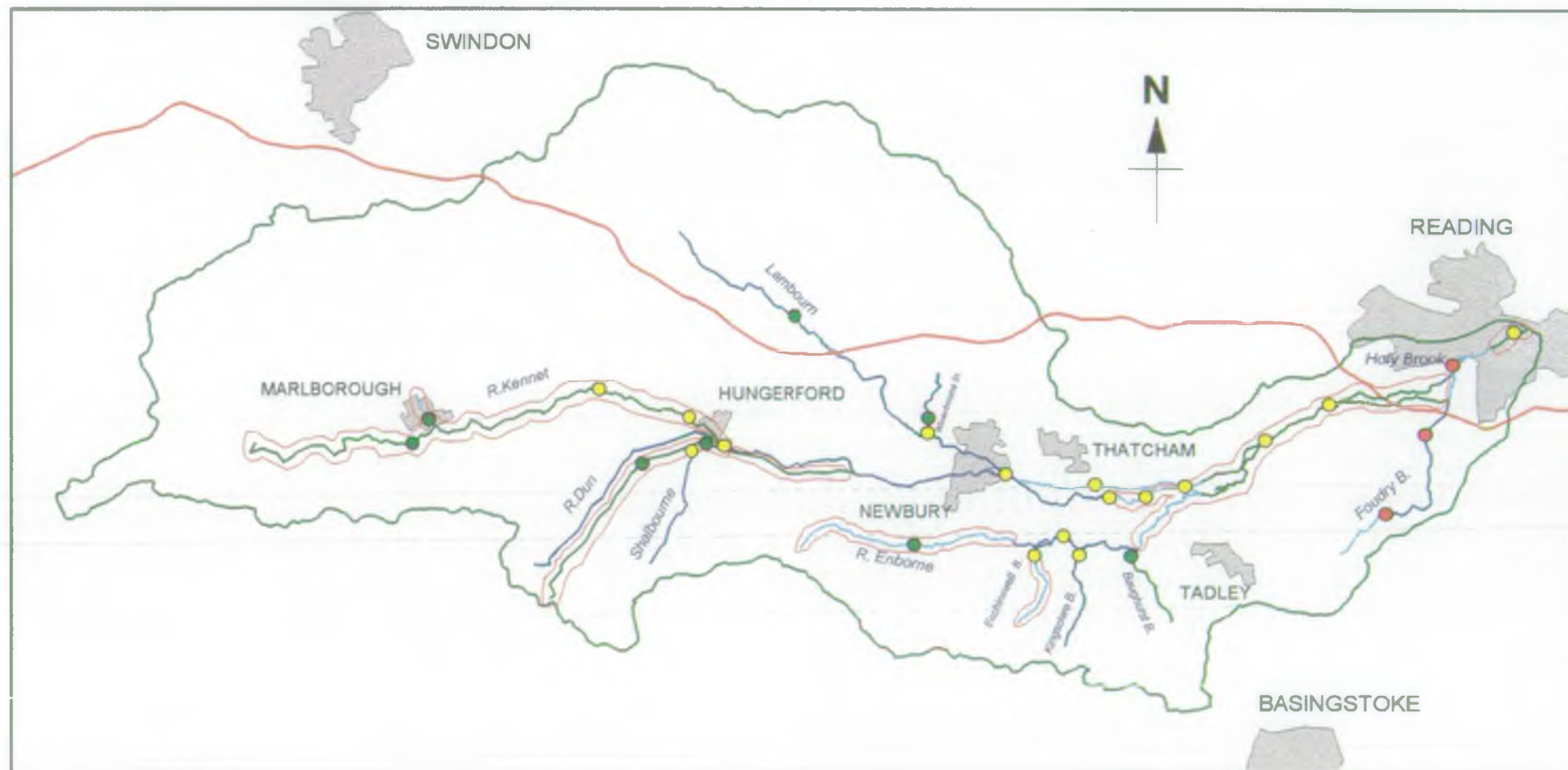
Chemical Status: We currently use a system of "River Quality Objectives" (RQOs) for the classification and assessment of watercourses (including canals). This system is derived from a 1978

National Water Council policy document and was established in 1979 using local knowledge of the uses of watercourses and contemporary water quality data. Chemical quality standards were drawn up for these objectives so that the degree of compliance could be objectively assessed. All the classified watercourses were given a current objective, and those where improvement was desirable, but not immediately practical, were also given future objectives. As the Kennet catchment is of a high water quality nearly all the current and future objectives are the same (see Appendix III). The exception is the Baughurst Brook.

A new quality classification system, known as "Statutory Water Quality Objectives" (SWQOs), will be introduced in a phased way shortly. Although similar to the existing system it will be more clearly related to the current and future uses of the watercourse and will also include groundwaters and water bodies (e.g. lakes). The system comprises a General Quality Assessment which measures the state of the waters using chemical, ecological, nutrient and aesthetic criteria. The information on catchment uses in this report (Section 2) will assist in the setting of the new SWQOs.

Using the present RQOs system the map on page 3.5 and the table of data in Appendix III compare the current chemical status of classified rivers with the current objectives. The River Quality Objective classes are as follows:

- Class 1A/B - High quality waters
- Class 2A/B - Fair quality waters
- Class 3 - Poor quality waters
- Class 4 - Bad quality waters.



KEY	SCALE	Catchment Boundary	RIVER QUALITY OBJECTIVES (1992)				Nutrient Levels (Phosphate in mg / l : Mean Value 1989 - 1992)		
			Class 1A	Class 1B	Class 2A	Reaches Failing To Meet RQO Standard	●	< 0.1	
		M4 Motorway							
		Urban Area					●	0.1 - 1.0	
							●	> 1.0	

3.2 WATER QUALITY (ctd)

The objectives and standards associated with these classes are also defined in Appendix III.

As can be seen from the information on RQOs several reaches have failed to achieve their objectives in recent years. A consideration of some of these failures is given below:

River Dun and Ecchinswell Brook - These reaches failed primarily on account of poor dissolved oxygen in 1990. No specific cause was identified.

Foudry Brook - In 1989 the downstream reach only marginally failed to reach its objective. No specific cause was identified.

Kennet and Avon Canal - Failures to achieve the dissolved oxygen and biochemical oxygen demand (BOD) parameters are common in the reaches at Froxfield and Ufton Nervet. The high BOD values are due to algae and the low dissolved oxygen levels are believed to be due to the lack of water movement in the canal.

Kingsclere Brook - The specific cause of the reach's failure to achieve dissolved oxygen standards in 1990 was not identified.

River Enborne - Certain reaches have suffered marginal failures in respect of dissolved oxygen.

River Og - Lack of flow has caused the reach to fail in respect of dissolved oxygen in 1989, 1991 and 1992.

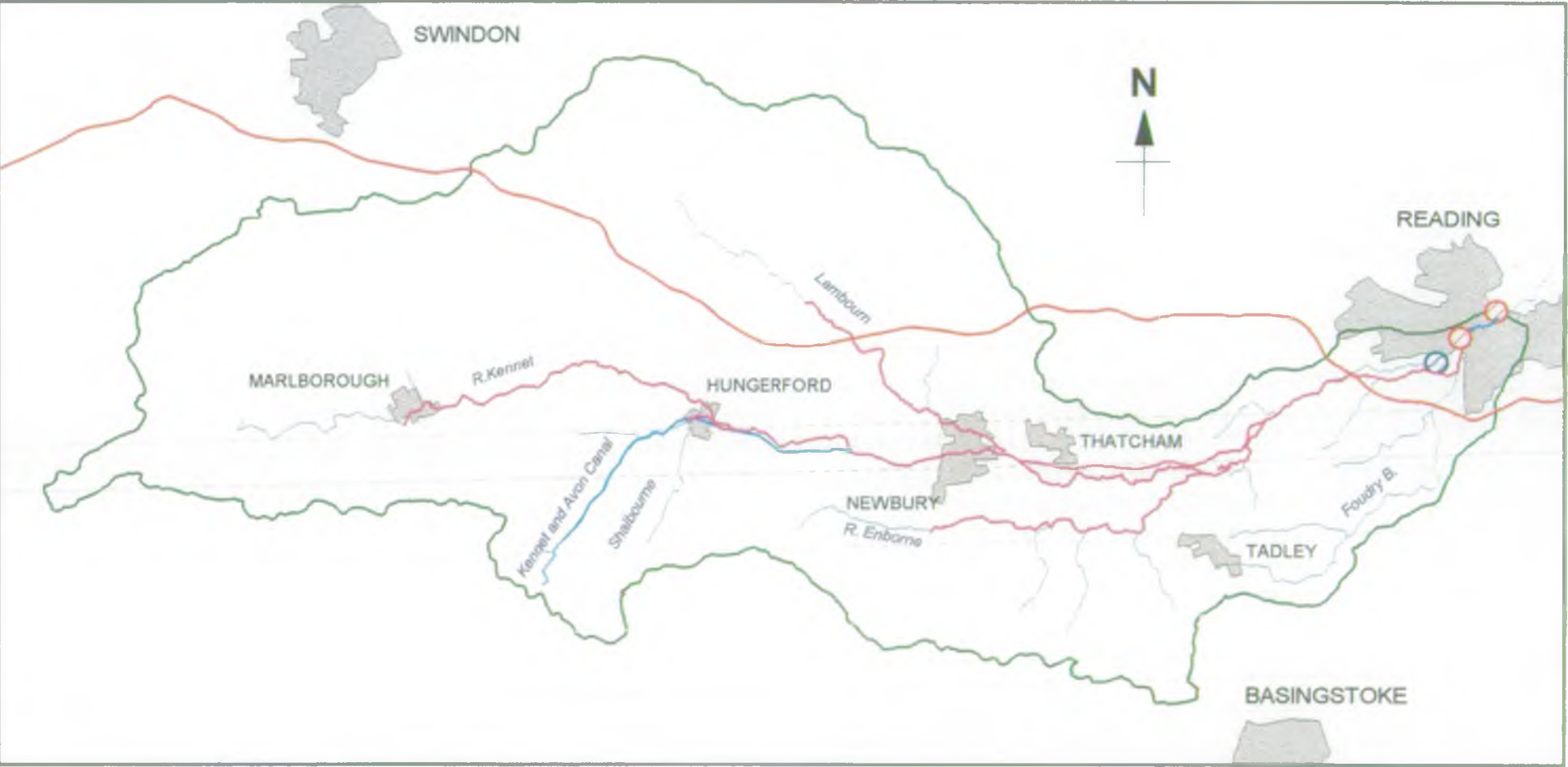
River Kennet - The upper reaches have suffered failures in respect of dissolved oxygen in recent years. Investigations are being undertaken by ourselves to evaluate the causes of this problem (see Section 4.2). Further downstream it is expected that recent improvements to the sewage treatment works at Newbury will lead to the objectives being achieved in future years. RQO failures are in part thought to be due to the affect of algae on BOD tests.

It should be noted that the Baughurst Brook is now consistently achieving its future river quality objective.

In order that RQOs are met discharges of effluent to the water environment need to be controlled. This is achieved by imposing consent conditions which limit the quality and volume of the effluent.

In the Kennet catchment there are 170 consented effluent discharges, 24 of which are to the ground. The NRA has a statutory duty to monitor these discharges and assess them against their consents. Consent compliance over the last three years has improved by nearly 10% as can be seen below:

<u>Period</u>	<u>% Compliance</u>
Oct 89 to Sept 90	76
Oct 90 to Sept 91	79
Oct 91 to Sept 92	85



<div>KEY</div> <div>SCALE</div> <div>010 km</div>		Catchment Boundary	EC Fisheries Directive Reach Designations		EC Dangerous Substances Directive		EC Surface Water for Drinking Directive			
		Watercourses		Salmonid		Monitoring Sites		Monitoring Site		
		M4 Motorway		Cyprinid						
		Urban Area								

Three European Commission (EC) water quality directives apply to the catchment. The fisheries directive, 78/659/EEC, applies only to designated reaches of watercourses and is concerned with ensuring that water quality is suitable for supporting fish populations. The fisheries directive has two levels of quality standards, one to support a cyprinid fish population (i.e. coarse fish) and a stricter level to support a salmonid fish population (e.g. trout and salmon). The designated reaches shown on the map on page 3.7 all achieved the appropriate standards in 1991/92 except for the River Enborne which failed on dissolved oxygen.

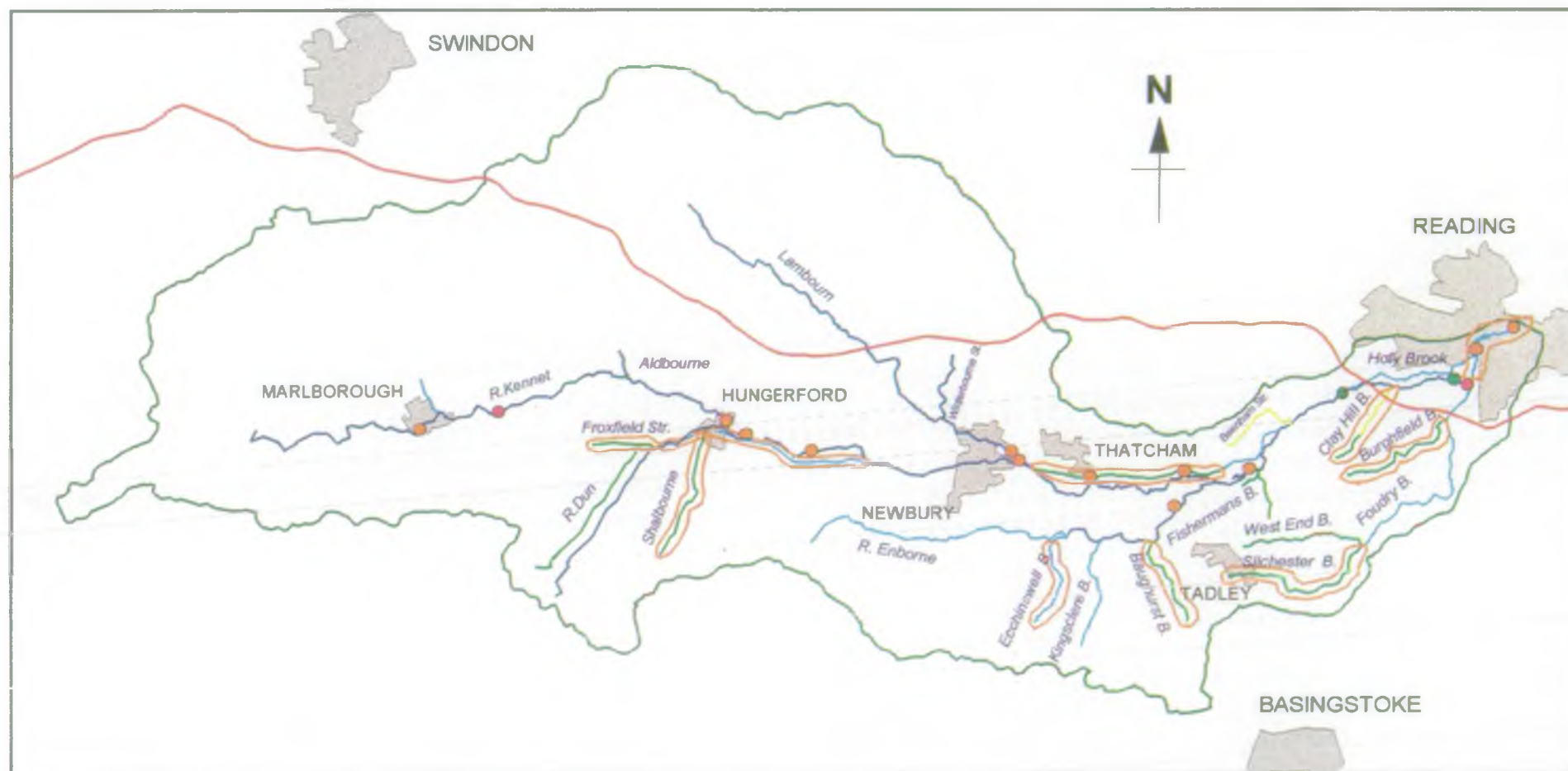
The second directive, 76/464/EEC, known as the dangerous substances directive, applies to all waters and is concerned with the discharge of substances considered to be harmful to the aquatic environment. Compliance with the dangerous substances directive is assessed by monitoring at two sites on the River Kennet. One key site, just above the river's confluence with the River Thames, is monitored for all the listed substances. At the second site, at Berkeley Avenue in Reading, only cadmium is monitored for. This is to assess the compliance of Reading STW discharge which has a consent to discharge cadmium. None of the standards were exceeded in 1991.

The third directive is 75/440/EEC which has two purposes: to ensure that surface water abstracted for use as drinking water reaches certain standards and is given adequate treatment before being put into public supply; and thereby to improve rivers or other surface waters used as sources of drinking water. There were no failures of this directive in the Kennet catchment in 1991/92. Information with respect to EC water quality directives is shown on the map on page 3.7.

Biological Status: The ecological status of the Kennet catchment is monitored annually using benthic macroinvertebrates. These are the small animals which inhabit the bottom sediments of the watercourses of the catchment. They are unable to move far and respond to water conditions throughout the year. By monitoring this response, pollutants present at very low levels, or those occurring infrequently, can be detected which may be missed in chemical sampling.

Samples are collected using standard NRA methods and analysed in the laboratory to give a complete list of the macroinvertebrates found at each site. These are related to water quality using the Biological Monitoring Working Party (BMWP) scoring system. Devised in 1980 the BMWP system is internationally recognised as a simple means of assessing water quality. A high BMWP score indicates high water quality. The number of taxa describes the diversity of the population, a high number indicating a diverse and valuable population of high conservation value.

The map on page 3.9 and the table of data in Appendix III give the results of biological monitoring in the River Kennet catchment for 1991. The River Kennet and its major tributaries the Lambourn, Dun and Enborne are of high ecological quality and have diverse faunas with many pollution sensitive animals present. The BMWP scores of over 200 are amongst the highest for the whole of the Thames Region in 1991. A more pollution tolerant fauna is present in several of the minor tributaries and consequently the BMWP scores for these watercourses are lower. In some cases sewage treatment work discharges (e.g. Silchester Brook and Clayhill Brook) appear to be the cause of the decline in quality of the fauna. A poor river habitat will also suppress the BMWP scores.



KEY		Biological Monitoring Working Party Scores for 1991				Bacteriological Quality (Geometric Mean Values for <i>E. Coli</i> / 100ml in 1991/92)			
<p>SCALE</p> <p>0 ————— 10 km</p>		Catchment Boundary		151+		16 - 50		< 100	
		M4 Motorway		101 - 150		0 - 15		100 - 2000	
		Urban Area		51 - 100		Reaches not Meeting Predicted Scores		>2000	

Total and faecal coliforms are bacteriological indicators of the extent of contamination by human and animal sewage derived materials. These may arise from point sources such as sewage treatment works or diffuse sources such as agricultural land. Results for sixteen sites are presented in Appendix III and on the map on page 3.9. The health implications of this data is the responsibility of the local authorities' Environmental Health Officer.

Nutrient Status: Nutrients are essential for successful biological growth. However, in excess, nitrogen and phosphorus may give rise to algal blooms. The majority of nutrients enter watercourses either as point sources in the form of effluents from sewage treatment works or as diffuse sources such as inputs from farming activities. In the River Kennet catchment nutrients are not in general considered to be a particular problem. The unimproved pasture land beside the river acts as a buffer for farm runoff. As can be seen from the data in Appendix III and on the map on page 3.5 the greatest nutrient concentrations are found in the Foudry and Silchester Brooks and River Kennet downstream of Foudry Brook, all of which receive sewage treatment work effluent.

Algal blooms often occur causing nuisance to fisheries owners in the middle reaches of the River Kennet. Fobney water treatment works intake was adversely affected in May 1990 as a result of an algal bloom for a period of ten days. Although often associated with high nutrient levels the algal blooms may in part also be due to reduced rates of flow in certain reaches and lower dissolved oxygen levels.

Pollution Incidents: The annual number of recorded pollution incidents is continuing to grow. This is thought to reflect greater awareness and reporting of incidents rather than a real increase in

incidents. This does not, however, reduce the importance attached to the effect on the natural water environment.

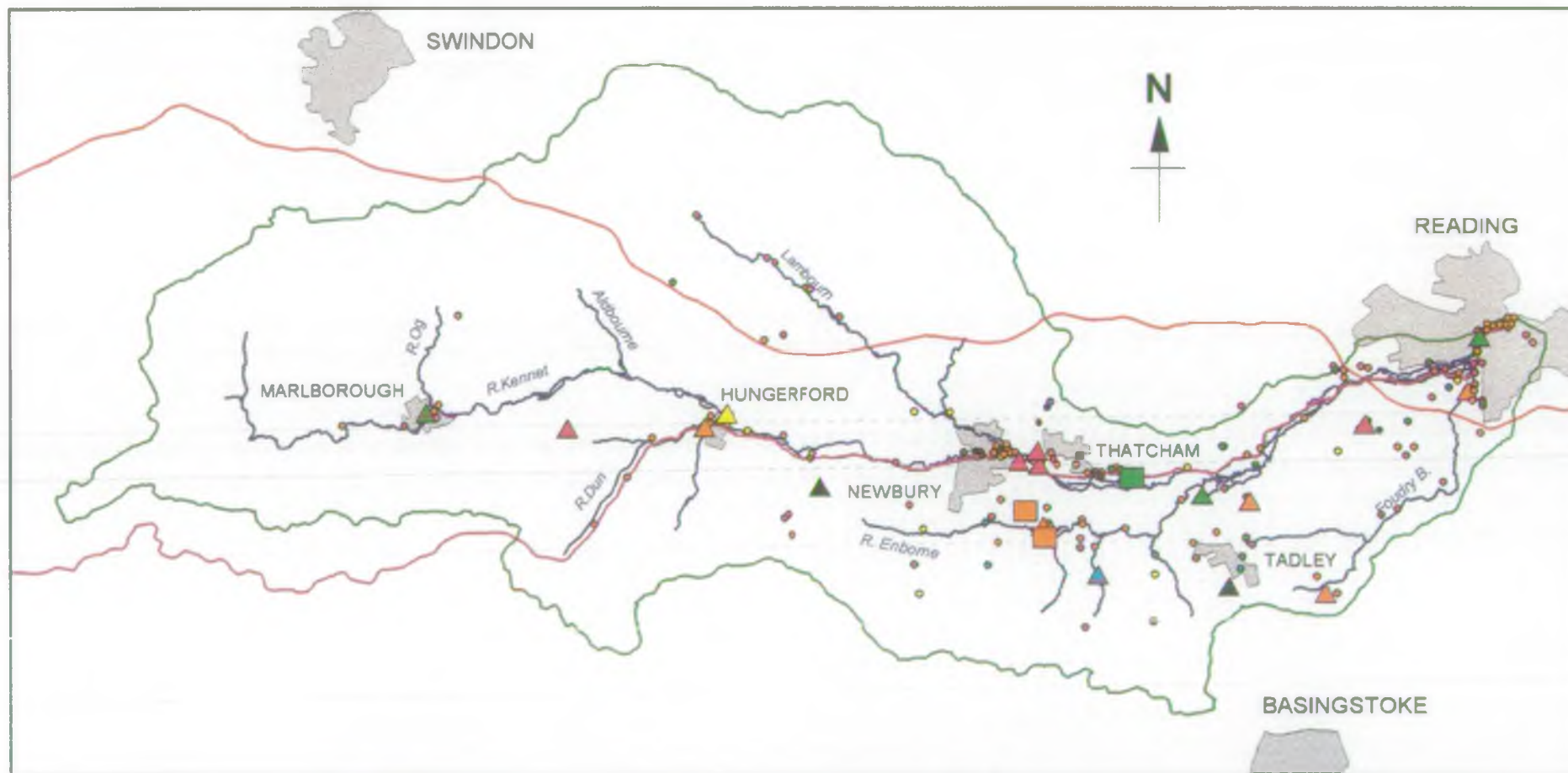
About half of the recorded pollution incidents in the catchment occur in ditches and drainage channels. Of the classified watercourses in the catchment the River Kennet suffers from the most pollution incidents. The majority of pollution incidents reported in the catchment are oil related.








Pollution incidents are classified into three categories: major, significant and minor. Appendix III describes the criteria upon which these categories are based. The location and nature of all pollution incidents for the period 1990-92 are shown on the map on page 3.11. Clusters of pollution incidents can be noted in the urban areas, notably Reading and Thatcham, and in and around the valley of the River Enborne.

In 1989 there were two major incidents and thirty three significant incidents in the Kennet catchment. The major incidents involved pig slurry and a chemical spillage.

Over the last 3 years the number of major and significant incidents in the Kennet catchment has stayed fairly constant and is considerably less than in 1989.

In both 1990 and 1991 there were six significant and one major incidents. The major incidents both involved oil, spilling into the River Kennet in 1990 and to ground in 1991. In 1992 there were five significant and three major incidents, one involving oil and two caused by chemicals.



<div><div>KEY</div><div>SCALE</div><div>010 Km</div></div>		Catchment Boundary	POLLUTION INCIDENTS 1990 - 1992 (BY IMPACT AND TYPE)							
		Watercourses	□	Major Incident		Agricultural		Sewage		Natural
		Kennet and Avon Canal	△	Significant Incident		Chemical		General		Urban Run Off
		M4 Motorway	◦	Minor Incident		Oil		Not Known		

3.2 WATER QUALITY (ctd)

Details of all the incidents recorded in the period 1990 -1992 are given in the table below.

Pollution Type	Kennet	Lambourn	Enborne	Foudry Brook	K + A Canal	Other Waters	Ground Waters	Total
Oil	38	1	13	2	11	52	5	125
Chemical	7	0	0	0	0	10	3	20
Sewage	19	4	0	3	0	33	0	57
Natural	0	1	1	0	0	1	0	3
Agricultural	0	0	0	0	0	7	0	7
General	8	3	1	1	0	12	0	25
Urban run-off	3	0	0	0	0	0	0	3
Not known	1	0	1	0	0	7	0	9
TOTAL	76	8	16	6	11	122	8	248

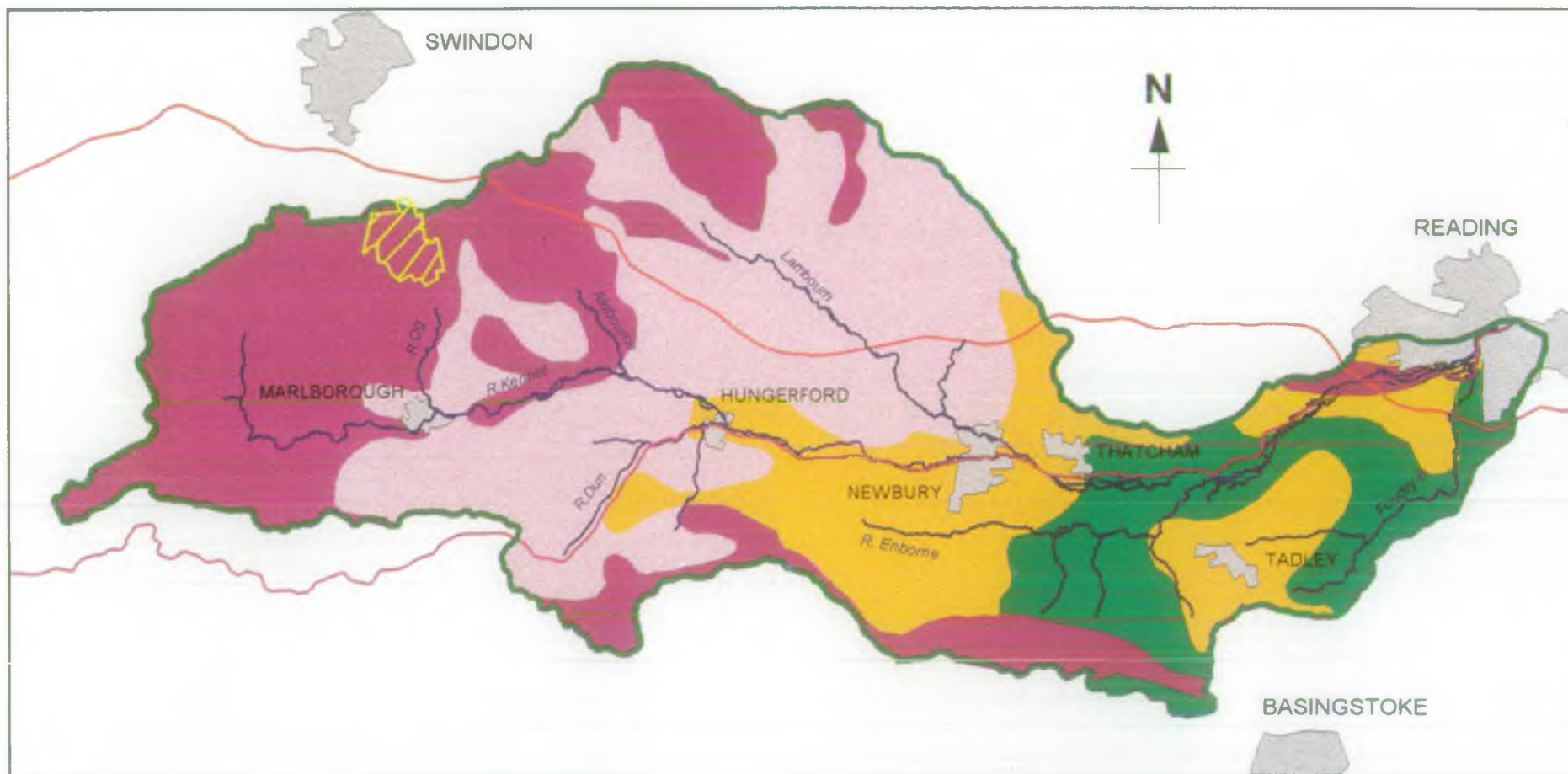
The NRA also has the power to prosecute polluters of the water environment. Since 1989 successful legal action has been taken on eight occasions against polluters in the Kennet catchment. The largest fine imposed was for £15 000. A list of prosecutions is included in Appendix III.











Groundwaters

The quality of groundwaters is receiving increasing attention. However, the development of a national classification scheme for groundwater quality similar to the proposed SWQO scheme for surface waters will be a significant undertaking - not only in developing the scheme itself but also in establishing a national network of sampling points. The NRA's document 'Policy and Practice for the Protection of Groundwater' establishes a comprehensive framework for protecting groundwater which will gradually be given geographical perspective through the phased publication of groundwater vulnerability maps (see map opposite) and

source protection zones for major public water supply sources. The establishment of 'nitrate sensitive areas' around appropriate drinking water abstraction points is already progressing and a pilot area has been established around the public water supply abstraction point at Ogbourne St. George (see map opposite). Here nitrate levels have risen above the relevant standards necessitating the water to be blended with water from other sources.

Monitoring of raw water abstractions from aquifers by Thames Water and Southern Water indicates that there are generally no significant groundwater quality problems at present.



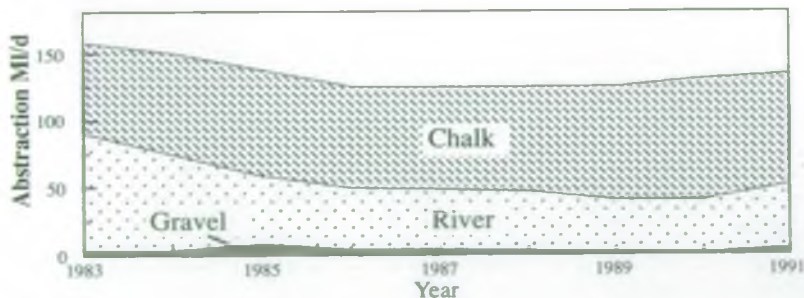
<div><div>KEY</div><div>SCALE</div><div><div>0</div><div>10 km</div></div></div>		Catchment Boundary		Urban Area	Groundwater Vulnerability Classification					
		Watercourses		Ogbourne St. George Nitrate Sensitive Area		Major Aquifer (High Vulnerability Soil)		Non - Aquifer		
		Kennet and Avon Canal				Major Aquifer (Intermediate Vulnerability Soil)				
		M4 Motorway				Minor Aquifer	Note : Map is indicative only			

3.3 WATER RESOURCES

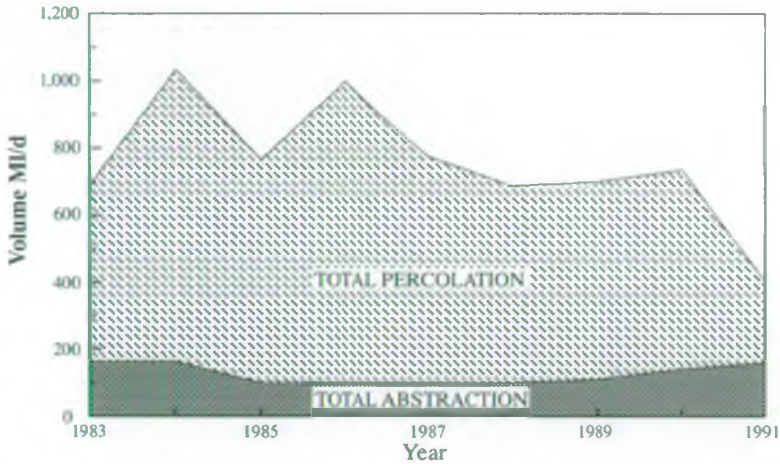
In carrying out our water resources activities we have to meet our general duties for environmental conservation and have particular regard to the statutory obligations of the water undertakers. Proper use of water resources includes meeting not only the legitimate demands of abstractors but also the important demands of aquatic life within the river system itself. A national strategy for water resources will be produced by us within the year. This paper will look at how demand management measures (e.g. increased leakage control, recycling, metering) can be used to defer the need for new major resource schemes, as well as the opportunities that exist for new schemes to meet increases in forecast consumption.

In the interim we have prepared a regional 'Abstraction Licensing Policy' to ensure that we meet our water resources duties. We are also preparing a detailed paper on the current and future water resources situation for the River Kennet catchment as part of our Action Plan for the 'Upper Kennet River Levels/Flows' issue (see Section 4.2). This will be available in April 1993. Work is also progressing on a computational groundwater model for the catchment.

The uses made of water abstracted from the ground and rivers in the catchment were described in Section 2.13. The graph below illustrates how the volume abstracted (excluding fish farms) has varied over the period 1983 to 1991.



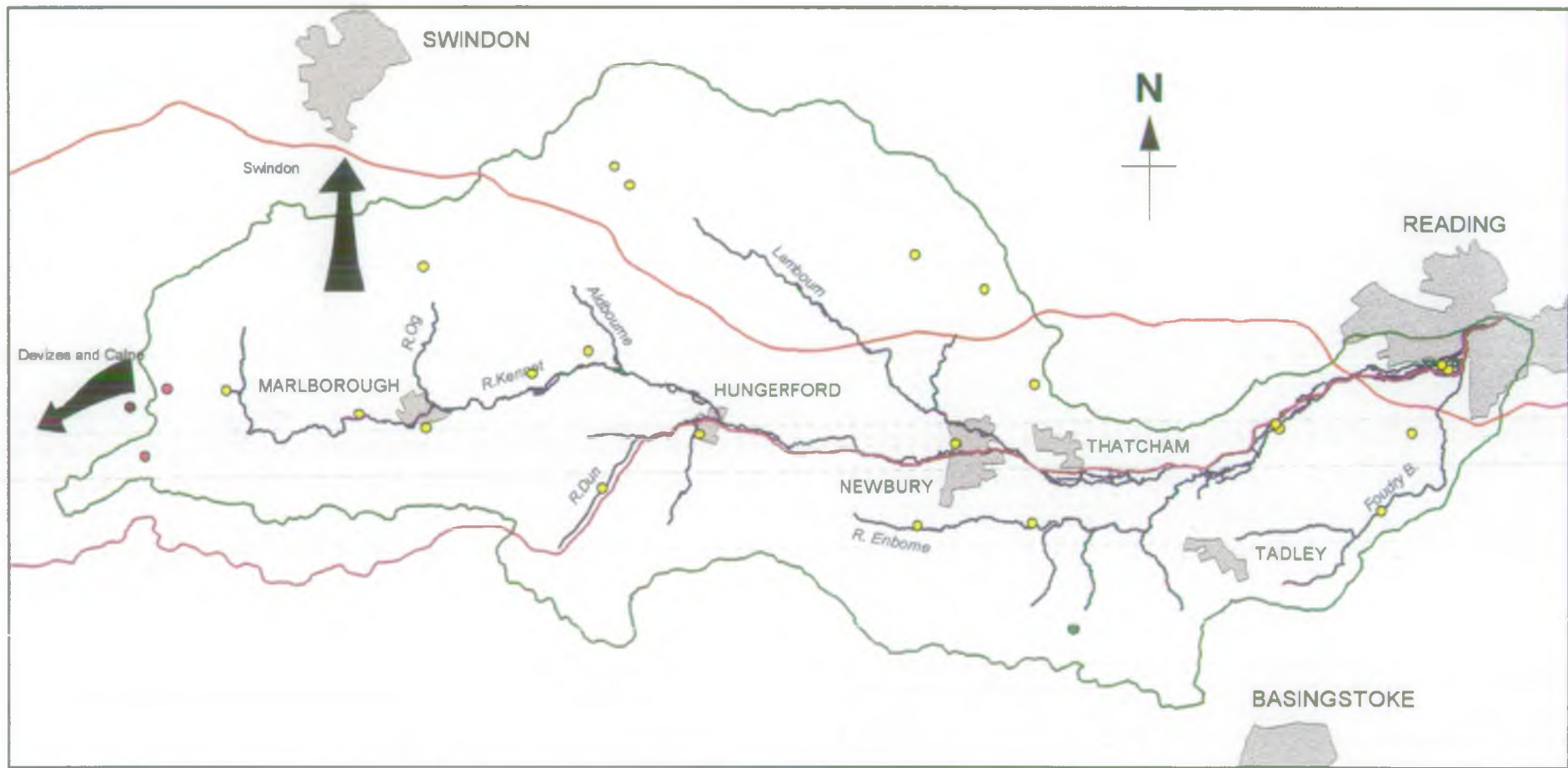
The figure below compares abstractions from the catchment (excluding fish farms) with total percolation to the ground over the same period.



This graph indicates the variable nature of both abstraction rates and percolation, which is related to the amount of effective rainfall (see Section 2.6).

The map opposite highlights the location and ownership of the public water supply abstractions. Several sources in the west of the catchment (e.g. Axford, Shepherds Shore, Yatesbury, Ogbourne St. George) are used to provide water to Swindon, Devizes and Calne.

Targets or standards for water resource management have not been set for the catchment.



<div>KEY</div> <div>SCALE</div> <div>010 km</div>		Catchment Boundary		Urban Area	Public Water Supply Abstractions				
		Watercourses		Direction of Public Water Supply exported from the catchment		Thames Water			
		Kennet and Avon Canal				Wessex Water			
		M4 Motorway				Southern Water			

Flood Defence

'Standards of Service for Urban and Rural Flood Defence' is a system prepared by us to assess appropriate standards of service and to plan for providing a consistent approach towards service provision. A key feature of the system is that it relates flood defence standards of service to current land use in the floodplain. As land use varies so therefore do customer interests and the requirements for flood defence and land drainage. Different land uses have been brought together into five land use banks which range from A (heavily urbanised) to E (unintensive agriculture). Each land use band has a 'target range' of service levels. Within the River Kennet catchment the main river system has been divided into forty reaches which are described in Appendix III and shown on the map opposite.

This system depends on an appropriate length of historic data to be fully effective and since the system has only recently been introduced the relevant amount of data has not been collected. The actual standard of service cannot yet be assessed therefore.

We have recently adopted a Non-Tidal Floodplain Policy and will be working with local planning authorities to ensure its implementation. The purpose of this policy is to protect the catchment's flood storage areas and routes as defined by the 1 in 100 year flood event from new development. Hydraulic studies we are currently undertaking for the Rivers Kennet and Lambourn will help us identify the area covered by this policy.

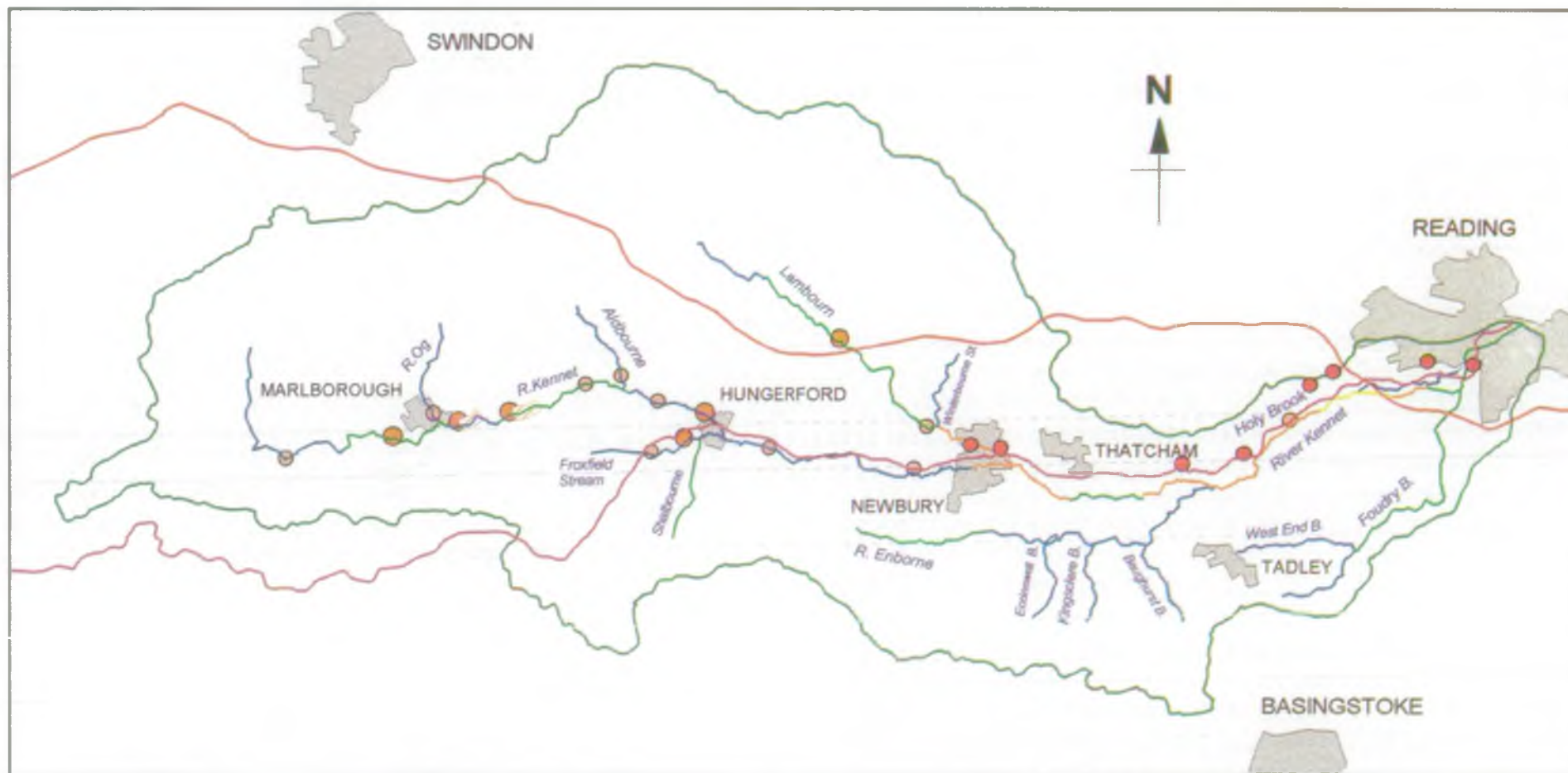
Riverine and Water Dependent Habitats

The status of the physical structure of the river bed, banks, margins and floodplain and other water dependent habitats can in part be

assessed through an evaluation of their capability to support a range of habitats typical of rivers with similar characteristics (e.g. flow, geology, historic management). Survey data can be used to monitor changes in the status. No overall set of standards/targets currently exist for this area of concern although we are undertaking research to formulate a general environmental classification system for river corridors.

The lack of comprehensive baseline data on the status of the water environment in respect of ecology, landscape, morphology and to a lesser extent fisheries precludes a systematic assessment of status at this stage. However, interpretation of fisheries survey data, biological monitoring results (which reflect in part habitat quality) and past ecological surveys do provide an indication of some of the concerns. For example, our fisheries staff have in recent years initiated a programme of measures to improve the population of wild brown trout. These measures include habitat improvements in conjunction with a number of landowners on the Rivers Kennet and Lambourn. This work benefits the general ecology of the rivers and helps maintain both grayling and brown trout which are good indicators of the health of the river. These species are less likely to thrive in those reaches of the river system where put-and-take trout fisheries have been developed as although water quality is appropriate the broad expanses of water and bankside management in these areas are not.

We have identified a number of riverine sites at which habitat enhancement would be advantageous. These are shown on the map opposite as are sites where enhancement work has recently been undertaken. Some past flood defence and land drainage works, on the River Kennet upstream of Hungerford and on the River Enborne, are also candidates for future river enhancement schemes.



KEY		Urban Area		LAND USE BANDS AND TARGET STANDARDS OF SERVICE FOR FLOODPLAIN AREAS			
<p>SCALE</p> <p>0 10 km</p>		Catchment Boundary					
		Watercourses					
		Kennet and Avon Canal					
		M4 Motorway					
				A = (1 in 50 Years on average)		E = (3 times a year on average)	
				C = (1 in 10 Years on average)		Urban areas at Flood Risk	
				D = (1 in 2 Years on average)			

3.5

REVIEW OF SECTION

Where possible the condition of the water environment has been reviewed against objective criteria or standards. In respect of water resources and physical features, objective criteria or standards are not generally available. The NRA are pursuing research which will develop criteria in these areas but at the present the identification of areas of concern must be by more subjective means.

For water quality the following areas of concern have been identified:

- the failure of several reaches to achieve their River Quality Objectives in 1992;
- the regular failure of certain reaches (e.g. Kennet and Avon Canal at its summit) to meet their River Quality Objectives;
- the need to undertake further monitoring and investigations to establish the reasons for certain river reaches (e.g. the upper River Kennet) failing their River Quality Objectives;
- the failure of the River Enborne to meet standards associated with the EC fisheries directive in 1992;
- the failure of several river reaches to achieve a BMWP score above or close to their predicted scores in 1991;
- the causes of regular algal blooms in the River Kennet;
- the clusters of pollution incidents in certain areas of the catchment;

-
- the vulnerability of large areas of the catchment to groundwater pollution;
 - the lack of data on the chemicals stored and used throughout the catchment which may pose a risk to surface and ground waters;
 - the impact of overflows from the sewerage network on surface and groundwaters (i.e. Aldbourne and Pope's Hill, Kingsclere);
 - the occurrence of sewage related debris in the River Kennet downstream of Newbury and Reading sewage treatment works; and,
 - the amount of rubbish in certain urban watercourses (e.g. Holy Brook).

For water resources the following areas of concern have been identified:

- river levels/flows in the upper River Kennet, River Og, Lambourn and Winterbourne Stream;
- use of the NRA's West Berkshire Groundwater Scheme;
- water supply to the Kennet and Avon Canal;
- the influence of mineral extraction and backfilling with inert material on groundwater flow patterns in the Kennet valley downstream of Newbury;

3.5 REVIEW OF SECTION (ctd)

- the need for improved river flow monitoring on the Foudry Brook, Shalbourne and Kingsclere Brook;
- the potential impact of future development in areas west of Theale on water resources and/or water supply infrastructure; and,
- the implications of the recent drought for discharge consent and abstraction licence settings;
- the impact that control structures (e.g. sluices, weirs, mills) can have on the distribution of low, normal and flood flows in certain reaches of the River Kennet, River Dun and Kennet and Avon Canal.

- the capability of widened and deepened sections of river to maintain their natural cleansing capacity to remove silt;
- the existing flood risk to a number of urban areas, notably Newbury; and,
- the potential for inappropriate development (e.g. mineral working, urban development) to alter the natural response of the floodplain and increase flood risks and reduce the frequency of flooding to flood meadows.

Some of the above concerns are based on subjective assessments and it is likely that further investigations would be necessary before they could be confirmed.

For physical features the following areas of concern have been identified:

- no overall assessment of the value of the river corridors in natural resource terms;
- the possibility of the middle and lower River Kennet corridor becoming fragmented through the cumulative impact of developments;
- the availability of habitats on the River Kennet suitable for native brown trout;
- impact of increased boat movements on the Kennet and Avon Canal on habitats and hence fisheries;

Section 4
CATCHMENT ISSUES

4.1 INTRODUCTION

Through the preparation of this Consultation Report we have been able to identify a number of issues which require consideration by all those interested in the future of the catchment's natural water environment. These are as follows:

- Upper Kennet River Levels/Flows
- Newbury and Thatcham
- West Berkshire Groundwater Scheme
- Kennet and Avon Canal
- Fisheries and Conservation Management
- Water Quality Protection
- Changes in Catchment Status
- Communications.

Each issue is presented in the following manner:

- (i) a page (or pages) of text divided into the following sections:

Overview - a brief summary of the issue.

Issue - a detailed discussion of the issue.

Way Forward - a review of the options which might be developed to address the issue and the general implications (in the smaller text) of adopting particular options. In some cases we have proposed a single course of action. Detailed action plans, involving costs and timetables, will only be established after the consultation phase.

Implementation - identification of the partners who may be involved in implementing action plans; and,

- (ii) a colour synoptic map designed to enhance the points raised in the text and highlight the geographical context of the issue.

This Consultation Report has identified a large number of potential areas of activity. In a number of cases investment by the NRA and others will not need to be significant - what is required is a will to jointly work together to deal with matters. In other cases significant resources will be required to be invested, by us and others. In producing our Final Plan we will therefore need to have regard to what can be realistically achieved by us and others. The general principles we will work to were covered in Section 3.1

An overview of the issues is now presented to explain the reasons for their inclusion and the degree of inter-action that exists between the eight specific titles.

Overview of Issues

In developing the catchment issues we have sought to consolidate the many 'key points' and 'areas of concern', identified in Sections 2.19 and 3.5 respectively, into a small number of integrated issue headings. In some cases these issue headings have a geographical perspective (e.g. Upper Kennet River Levels/Flows) and in others share a single theme such as managing change (e.g. Changes in Catchment Status).

Each issue must not be viewed in isolation, however, since they all contribute towards a single objective - the future environmental well-being of the River Kennet catchment - and are therefore fundamentally inter-related.

Public concern over water levels in the upper River Kennet (upstream of Ramsbury) prompted the NRA to commission an investigation in May 1992 into groundwater levels, surface water flows, water quality, flora and fauna in the area. The **Upper Kennet River Levels/Flows** issue reflects this work and describes the background to the study, the initial results and the first action plan to deal with the issue which is due to be completed by September 1993. The action plan is being implemented primarily by NRA staff. The **Fisheries and Conservation Management** and **Changes in Catchment Status** issues are both particularly relevant to this issue.

The **Newbury and Thatcham** issue is primarily about the flood risks for these areas. However, in coping with this concern it will be important to ensure that opportunities for meeting broader objectives are taken. The **Fisheries and Conservation Management**, **Kennet and Avon Canal** and **Changes in Catchment Status** issues are all relevant in this respect.

The management of water resources is reflected in the **West Berkshire Groundwater Scheme** issue which is about how we should use this asset in the future. Points raised in the **Changes in Catchment Status** and **Fisheries and Conservation Management** issues overlap. The Groundwater Scheme covers a number of catchments other than the Kennet.

Recently re-opened, the **Kennet and Avon Canal** has been the subject of extensive study by British Waterways who have established their own policy objectives for the canal. This issue deals with aspects such as management of structures and water resources. The **Fisheries and Conservation Management**, **Newbury and Thatcham** and **Changes in Catchment Status** issues all relate to this issue.

The integrated management of natural resources in the key river corridors of the Rivers Kennet and Lambourn is dealt with in the **Fisheries and Conservation Management** issue. The integration of natural resource management with other aspects such as amenity and recreation, mineral extraction and urban development are brought out in the issue. Catchment wide influences such as water resources management strategies have a substantial influence on the health of the river corridors and there are therefore very strong links between this issue and the **Changes in Catchment Status** issue. Links with all the other issues can also be identified for similar reasons.

Pollution prevention, groundwater quality monitoring and protection issues and concerns over raw water quality for public supplies are dealt with in the issue **Water Quality Protection**. This is a catchment wide issue and therefore relates to all the other issues.

Changes in Catchment Status embraces a range of concerns whose common link is that they are about how we manage change in the catchment. Changing circumstances may be linked to new knowledge and information which helps us understand and deal with current water quality and resource concerns. Planning for future land use changes and influencing them so the water environment is protected and enhanced is a key concern and is also reflected in this section. The integrated management of the lower River Kennet is of particular concern.

Very few of the issues dealt with can be successfully tackled by a single organisation, group or individual. A number of groups and/or fora have been established to improve communications between parties. Some of these are of a local nature whilst others are specific to certain interest groups. The **Communications** issue looks at options for taking forward activity in the River Kennet catchment.

4.1 INTRODUCTION (ctd)

A number of the concerns raised in Section 3.5 will be dealt with through the routine work of the NRA. Failures of waterways to meet River Quality Objectives and the provisions of EC Directives fall into this category, for instance.

Most of the issues described involve conflicts: between competing uses; between different activities; or, between the conservation of natural resources and activities/uses harmful to them. The information provided on the issues in this Report does not aim to resolve all these conflicts, rather it raises them so that they can be debated and a common way forward found.

The first issue presented, **Upper Kennet River Levels/Flows** is one on which much work has already been done. A policy framework and action plan are therefore presented and these may serve as an example of how the Final Plan may look.

4.2 UPPER KENNET RIVER LEVELS/FLOWS

Overview

In May 1992 a report commissioned by ourselves to look at the issue was produced. This report has formed the basis of a published action plan "Upper Kennet - First Action Plan" which will be implemented by September 1993. This issue is one which has therefore been widely debated and on which progress is being made.

Issue

Changes in the upper River Kennet river levels and geographical upper limits of flow have become a focus of concern over recent years. Public understanding has attributed changes to groundwater abstraction and a net loss of water from the catchment. To address the mounting public debate and concerns, we commissioned a detailed study of the upper River Kennet catchment in terms of groundwater levels, surface water flows (including river levels and upper limits of flow), water quality, flora and fauna. These parameters were assessed for evidence of change in characteristics using historical perspectives, public perception and factual data.

The principal findings of the study outlined the following changes that have taken place:

- a) The perennial head of the River Kennet is situated at Marlborough. The source of the River Kennet has moved down to Marlborough about once every ten years during this century.
- b) The catchment upstream of Marlborough reportedly deteriorated in the fifty years prior to the 1940s.

-
- c) There are no data to show changes in surface flow rates in the River Kennet to Marlborough. There appears to be a reduction in flow at Knighton, further downstream, dating from the mid 1970s.
 - d) The aquatic plant community has changed, with a gradual reduction in numbers of submerged plants reflected by an increase in emergent and encroaching vegetation.

The study highlighted the following possible causes for these changes, based upon the information available:

- a) Changes in river management (i.e. the reduced use of mills, weirs, water meadows etc).
- b) Effects of the 1990-92 drought which was the worst for 70 years.
- c) Past river maintenance activities (e.g. channel widening, dredging).
- d) The river downstream of Marlborough is principally affected by the drought. Abstraction reduces flow by upto one fifth of expected flows.
- e) Reduced flows lead to increased siltation, reducing submerged plant habitat and encouraging the growth of emergent and encroaching plants. Loss of a substantial submerged plant community is known to reduce levels by up to 50% in similar rivers.

4.2 UPPER KENNET RIVER LEVELS/FLOWS (ctd)

Action Plan Details

Aim: To ensure no long-term decline of river flows and to identify a programme of cost effective actions to improve degraded habitats, fisheries and amenity.

Specific Objectives:

1. Identify and progressively implement a programme of remedial and improvement actions consistent with the Catchment Management Plan and Statutory Water Quality Objectives. Both these projects will involve public consultation.
2. Sustain and improve the diversity of wildlife including the restoration, where realistic, of degraded habitats.
3. Sustain and, where possible, improve the natural population of brown trout, a key biological indicator for this type of river.
4. Establish a flow regime along the river consistent with habitat, fishery and amenity requirements within the bounds of natural variation and an acceptable use of water for supply. Ensure no long-term decline of low flows.
5. Ensure a quality regime along the river consistent with habitat, fishery and amenity requirements.
6. Co-operate with ripariwn owners in developing schemes to improve river management practices.

Actions

1) **Abstraction**

- a) The Kennet groundwater model will be refurbished and used to study:
 - (i) the effects of existing groundwater abstractions
 - (ii) possible alternative future patterns of groundwater abstraction at normal and low flows. (Timescale: by April 1993)
- b) Discuss with Thames Water Utilities the future licensing of the Axford and Ogbourne St George sources with a view to lessening the impact on low flows. Part of the Axford licence expires 31st December 1994. (Timescale: by September 1993)

2) **Channel Restoration and Management**

- a) Carry out a geomorphological survey of the channel from source to Knighton gauging station to define present channel shape. (Timescale: by April 1993).
- b) NRA functions to collaborate to identify, cost and prioritise sites where habitat enhancements could be implemented by channel reshaping. (Timescale: by September 1993).

4.2 UPPER KENNET RIVER LEVELS/FLOWS (ctd)

3) Weed Growth

Establish a programme comprising the following elements:

- a) systematic survey of problem sites and analysis of process. (Timescale: Summer - Autumn 1993).
- b) a management programme closely linked with fisheries requirements. (Timescale: by September 1993).

4) Fisheries

- a) Maintain the programme of 5-year surveys (next due 1993) at all existing sites and add a further site at Axford plus a model site at the Wilderness fishery, downstream of Knighton.
- b) Habitat enhancements - see item 2)b) above.

5) Conservation

- a) Carry out full river corridor survey to identify instream and riparian vegetation and collaborate in the identification and specification of habitat enhancements (see item 2)b) above). (Timescale: Summer 1993).
- b) Habitat enhancements - see item 2)b) above.

-
- c) Investigate the possibility of reinstating water meadow systems to further nature conservation through the Countryside Stewardship Scheme of the Countryside Commission. (Timescale: Report by September 1993).

6) **Water Quality**

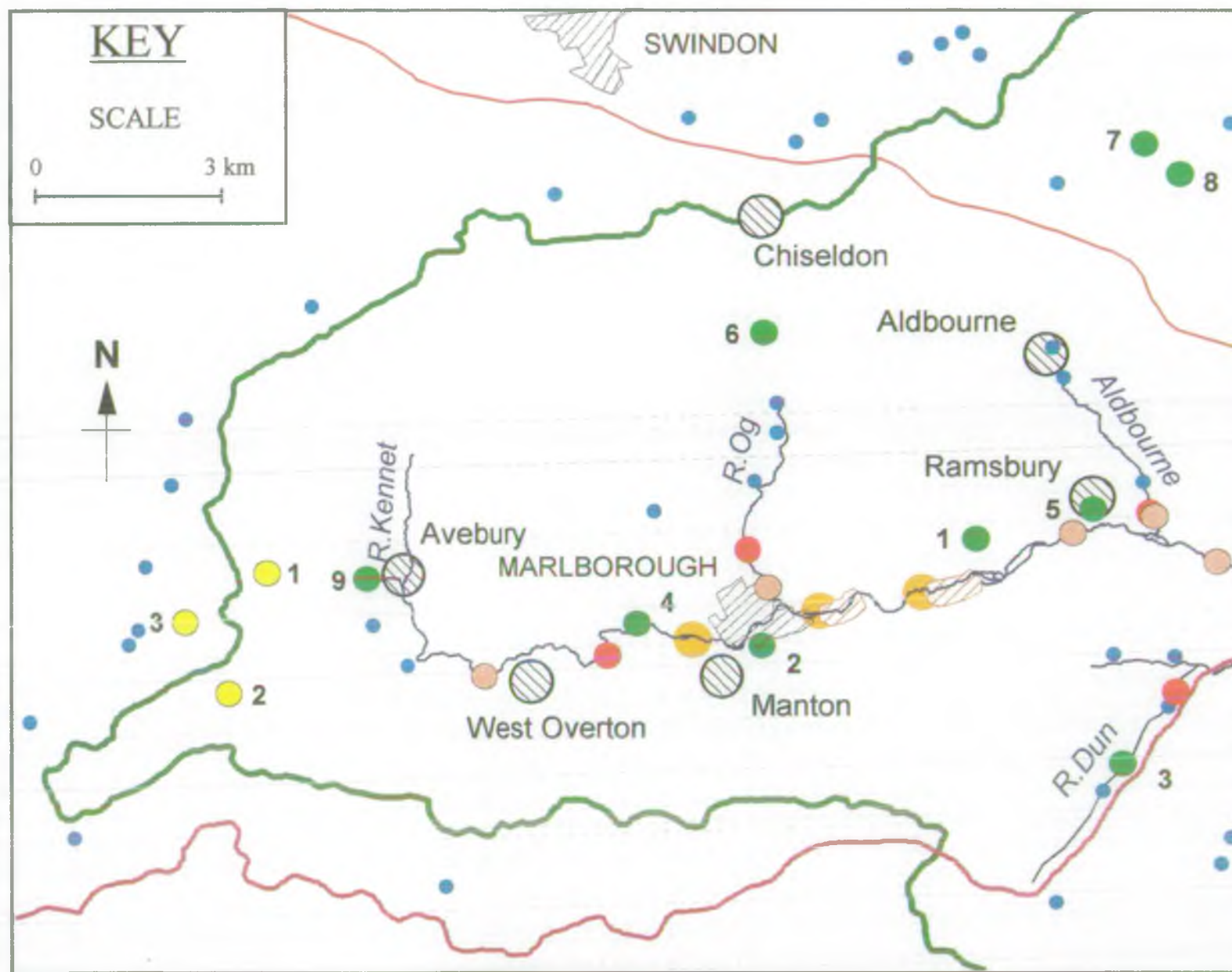
- a) Enhance monitoring by:
 - (i) an additional water quality monitoring site at Knighton
 - (ii) installing dissolved oxygen (DO) meters.
- b) Assess the correlation between DO and low flows. (Timescale: by April 1993).

7) **General**

- a) Public perception survey. (Timescale: by September 1993).

The NRA presented the above action plan at a public meeting in Marlborough Town Hall on 28th January, 1993.

	Catchment Boundary
	Watercourses
	Kennet and Avon Canal
	M4 Motorway
	Urban Area
	Town / Village
	Perennial Head of Watercourse
	Spring
	River Habitat Enhancement Schemes
	Possible River Habitat Enhancement Schemes
Licenced Public Water Supply Abstractions	
	Public Water Supply (Wessex)
	1 Yatesbury 2 Shepherds Shore 3 Cherhill
	Public Water Supply (Thames)
	1 Axford 2 Marlborough 3 Bedwyn 4 Claford 5 Ramsbury 6 Ogbourne 7 Ashdown 8 Fognam Down 9 Avebury



4.3 NEWBURY AND THATCHAM

Overview

Development on and close to the floodplain of the River Kennet over the last 30 years has potentially increased the flood risk to people and property in Newbury and Thatcham were the 1947 flood event to be repeated.

Issue

Newbury and Thatcham have been the focus for substantial residential, commercial and infrastructure development in recent years. This growth is planned to continue and significant amounts of speculative development have also been proposed around both Newbury and Thatcham. Although no serious flooding of the town has occurred in recent years the NRA and others are concerned to ensure that the flood defence standard of service is appropriate to the potential risk.

In addition, management of the towns' waterways is very complex due to the number of sluices, weirs, locks and inter-connecting channels. This system is difficult to manage effectively and could contribute to the flood risk were key operators not available.

The NRA are currently developing a computational model of the floodplain of the Rivers' Kennet and Lambourn in the area to assess the risk to people and property. This is due to be completed by late 1993.

Way Forward

We believe that others should us in:

1) Preparing an integrated floodplain protection policy

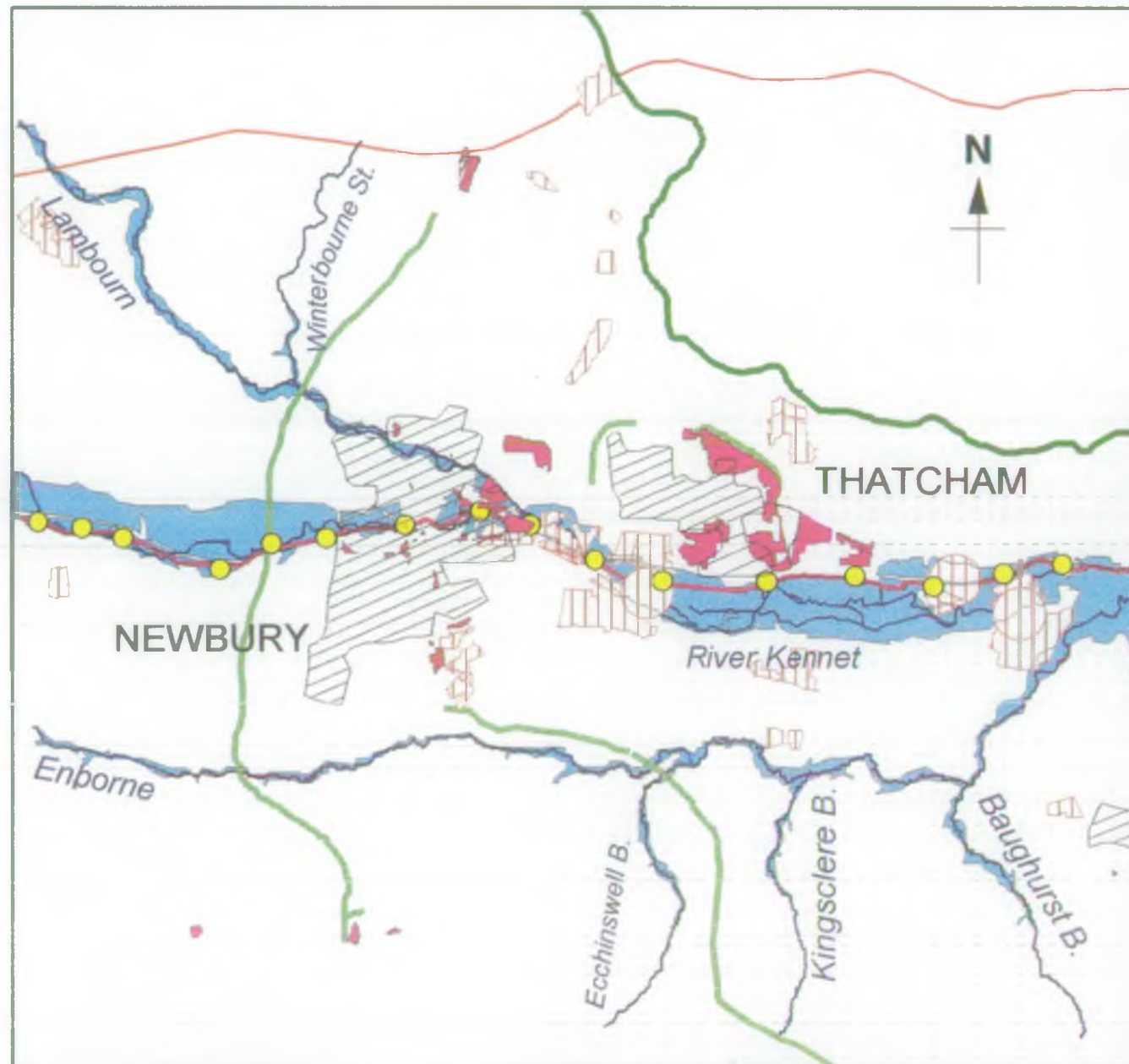
- * minimises future potential for increases in the flood risk
- * necessitates NRA and inter-local planning authority co-ordination of development likely to affect the floodplain
- * ensures investment in built flood defences is minimised
- * could be linked with river corridor initiatives in respect of conservation, recreation, fisheries and landscape.

2) Evaluating flood defence scheme options

- * need to assess role of A34 by-pass on any options
- * need to assess upstream (e.g. flood meadow storage) as well as local (e.g. flood embankments, improvements to structures) works
- * studies will be costly and time consuming and may not lead to investment if flood protection is not economically and environmentally viable
- * may enable local structures to be improved for the benefit of other users (e.g. navigation)
- * options for action could be dependent upon mineral working proposals.

Implementation

The NRA in conjunction with District and County Councils, British Waterways, Department of Transport and all other parties involved in the 'Kennet and Avon Canal', 'Fisheries and Conservation Management' and 'Changes in Catchment Status' issues (see Sections 4.5, 4.6, and 4.8).



KEY

SCALE

0 3 km

	Catchment Boundary
	Watercourses
	Kennet and Avon Canal
	M4 Motorway
	Urban Area
	Areas Known To Have Flooded
	Locks
	Highway Proposals / Improvements
	Residential / Commercial Development Proposals
	Mineral Extraction Sites (Past, Present and Future)

4.4 WEST BERKSHIRE GROUNDWATER SCHEME

Overview

The scheme is owned and operated by the NRA primarily to support water supply abstractions on the River Thames. Its future use is currently under review and close attention will need to be paid to the balance between security of water supplies, the economic benefits of the scheme and potential impacts on natural river flows. The scheme incorporates a number of criteria to prevent abstraction which would damage the environment.

Issue

In 1956 studies were carried out to assess the suitability of using boreholes in the River Kennet and adjacent catchments to augment stream flows and flows in the River Thames during times of drought. It was not until 1967 that a pilot scheme was set up in the Lambourn catchment and pumping tests were carried out between 1967 and 1969.

Completion of the pilot scheme in 1969 was followed by the planning of Stage I of the scheme which culminated in a Public Enquiry in 1972. The full scheme was divided into 4 Stages, 3 in the Chalk and 1 in the Middle Jurassic Limestone. Stage I was in the unconfined chalk of the Berkshire Downs in the Lambourn and Pang catchments with some limited development in the Confined Chalk to the south in the River Loddon and River Enborne valleys.

Stage I, which is the only phase of the scheme to be completed, consists of 33 abstraction boreholes grouped into seven wellfields joined by 89km of pipeline. The scheme can produce up to 130 ml/d although the output falls as the duration of pumping increases. The water is discharged via 4 major watercourse outfalls from composite

wellfields and individually at 6 stations directly into adjacent rivers. The scheme was first used operationally in the drought of 1976 when it was pumped for 3 months continuously. It was also operated briefly in 1989 and 1990 and isolated boreholes have been used from time to time to support local water supply or to deliver environmental benefit. Much work has been carried out on the scheme over the past 18 months to reduce future maintenance costs.

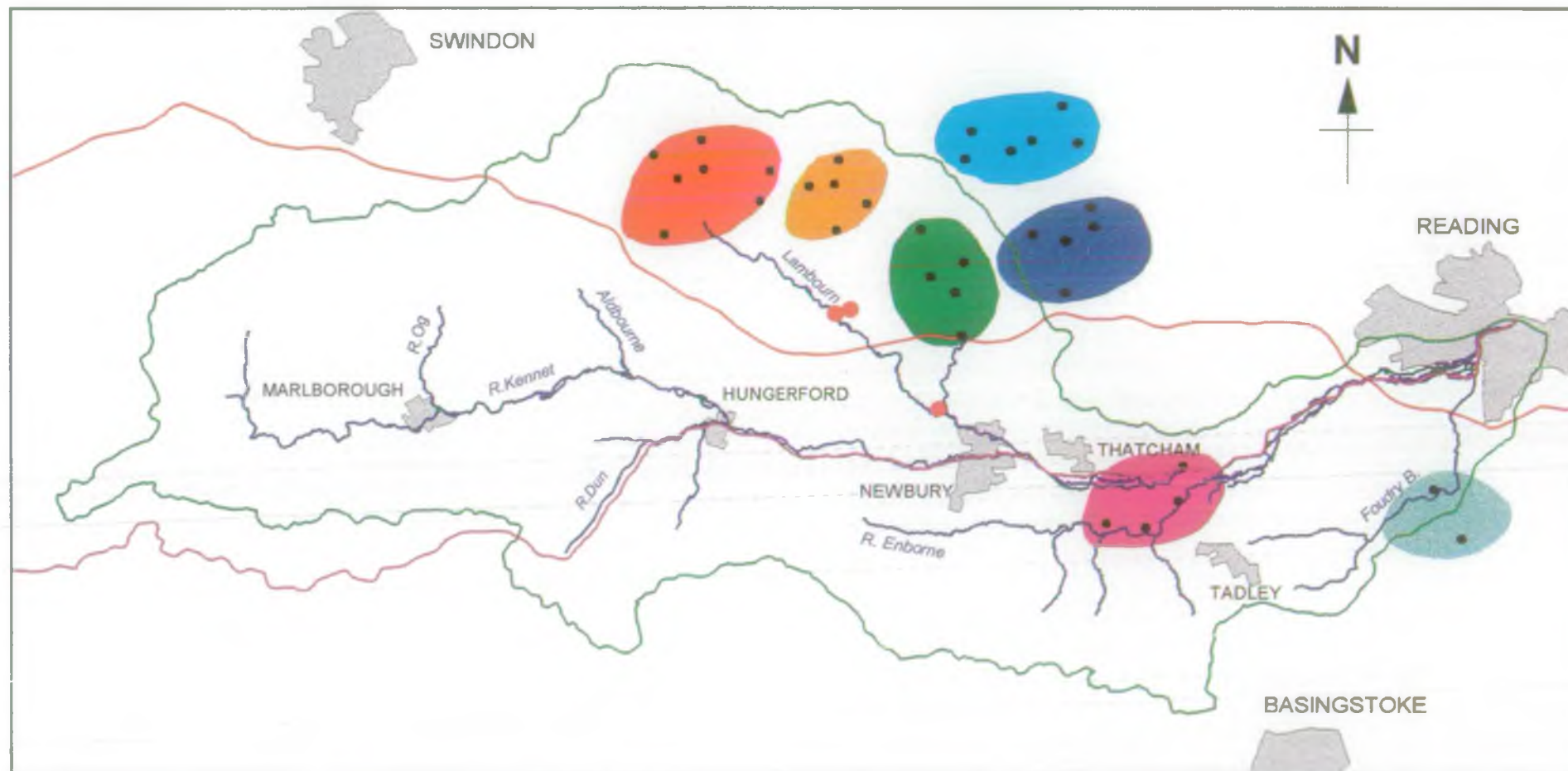
Way Forward

We believe the following options need to be considered:

- 1) **Use of Scheme for strategic water supply.**
 - Could support baseflows in the River Kennet at Fobney water supply intake.
 - Supports water supply needs of the Region.
- 2) **Use of Scheme for Local Water Supply.**
 - The scheme can support local public water supplies at Childrey, Fogham and Compton. The Scheme can provide groundwater resources of 110 to 120 MI/d but only on an occasional basis.
- 3) **Use of Scheme for Environmental Benefit.**
 - Can augment flows in order to flush out rivers after pollution incidents.
 - Development and enhancement of sites as conservation areas.
 - Could augment flows in the Lambourn, Enborne, Foudry Brook and Lower Kennet during low flow periods in order to protect natural habitats. The scheme cannot be used over long periods of time in the same well field for two successive years.
- 4) **Not Used.**
 - The proposed new reservoir at Abingdon would have a much greater capacity to effect/augment River Thames flows than the groundwater scheme, if available from 2010 onwards.

Implementation

The NRA in conjunction with Thames Water Utilities.



KEY		Catchment Boundary		Urban Area		Groundwater Scheme Wellfields and Features					
<p>SCALE</p> <p>0 10 km</p>			Catchment Boundary		Urban Area		Lambourn		Lower Pang		Upper Pang
			Watercourses				Shefford		Enborne		Abstraction Boreholes
			Kennet and Avon Canal				Winterbourne		Loddon		Major Outfalls
			M4 Motorway								

4.5 KENNET AND AVON CANAL

Overview

After thirty years of effort from voluntary and statutory organisations the Kennet and Avon canal was reopened in 1990. Restoration cost some £9.5m (1990 prices) but the future success of the waterway will depend very much on increasing revenue from commercial users of the navigation and its attractions.

Issue

Water supply to the canal is not assured in the pounds west of Hambridge and almost as soon as the canal was re-opened in 1990 restrictions had to be placed on the number of boat movements in order to conserve water. This issue is a constraint on the future use and development of the waterway. The NRA will wish to ensure that demands for water to run the canal do not affect other abstractors or the natural environment.

The maintenance and running of the fabric of the navigation is absorbing significant resources. Many of the sluices, weirs and locks inter-relate with the natural river system and both British Waterways and the National Rivers Authority are concerned to achieve the best management of the waterway system for navigation, flood defence, water resources and conservation purposes.

Management of the technical issues is an essential pre-cursor to successful development of the canal's environmental, recreation and leisure potential.

Way Forward

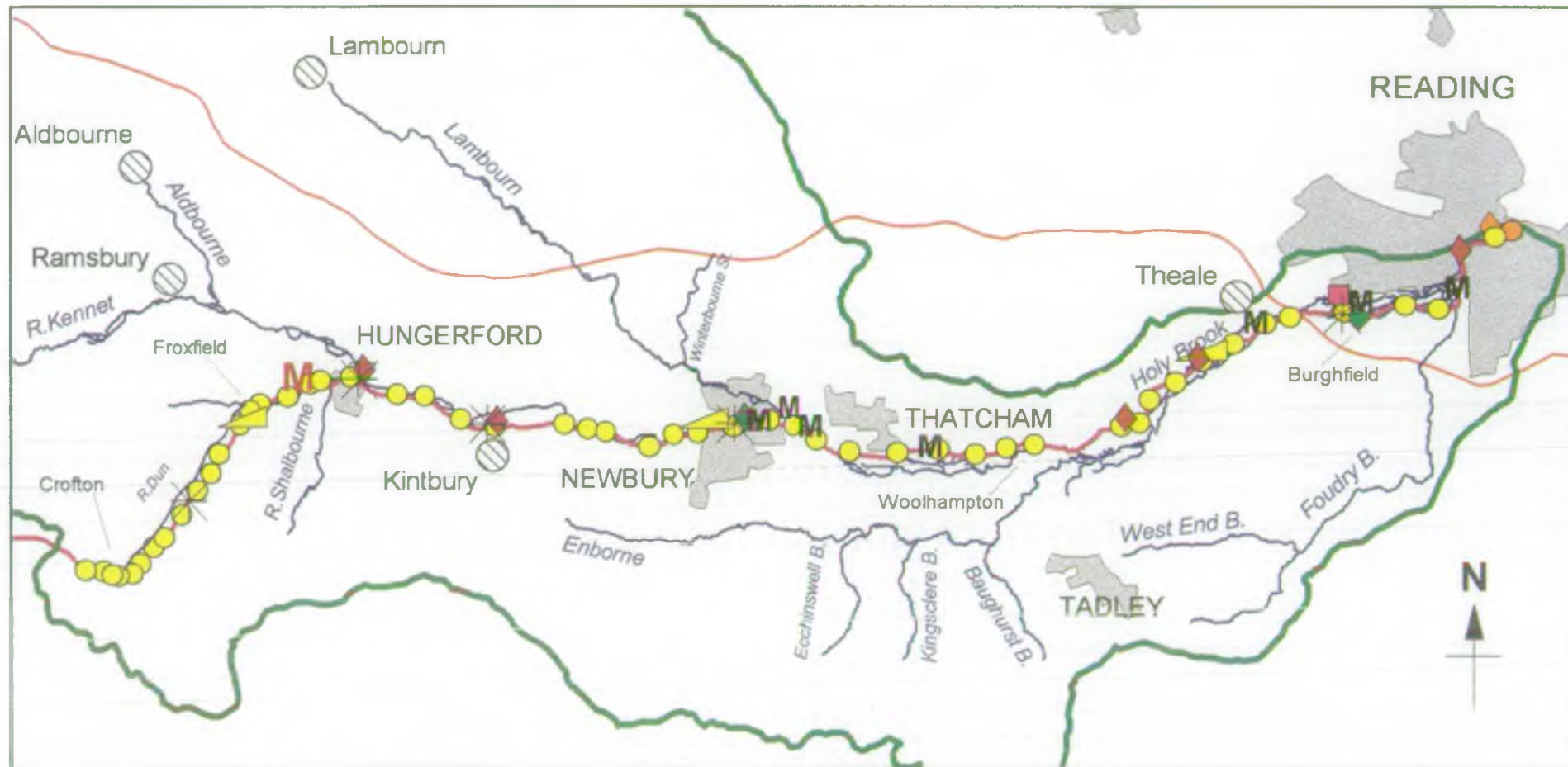
Prior to promoting the potential of the canal we believe we and others need to:

- 1) Evaluate water supply needs, water resource availability, water distribution and sustainable limit of development.
 - * will involve close liaison between BW, NRA and other key organisations.
 - * may require additional study investment to complement recent work by BW and NRA.

- 2) Prepare priority list of structures for improvement.
 - * will require close liaison between BW, NRA and riparian owners.
 - * cost-benefit analysis of multi-objective schemes will be difficult.
 - * agreement on funding likely to be difficult to achieve.

Implementation

Both BW and NRA recognise the need to better co-ordinate the management of the navigation and the natural river system and will need to work closely with District Councils, riparian owners, conservation groups and user groups.



<p>KEY</p> <p>SCALE</p> <p>0 ————— 7 Km</p>		Catchment Boundary		Urban Area	M	Proposed Marinas		Boatyard and Holiday Boat Hire		
		Watercourses		Town / Village		Boatyard		Public Boat Trips		
		Kennet and Avon Canal		Lock (BW Operated)		Slipway		Holiday and Public Boat Hire		
		M4 Motorway		Lock (NRA Operated)		Long - term mooring	M	Approved Marina Site		

4.6 FISHERIES AND CONSERVATION MANAGEMENT

Overview

In Section 2.9 the quality of the catchment's natural resources is clearly apparent: trout fisheries in the upper River Kennet and Lambourn; coarse fisheries in the lower River Kennet, Kennet and Avon Canal and stillwaters; instream habitats of the middle River Kennet which have been identified as a potential riverine SSSI and regularly achieve high biological monitoring scores; and, the nationally recognised quality of much of the landscape in the upper and middle sections of the catchment.

The corridors of the Rivers Kennet and Lambourn do need managing, however, if the character and value of the natural resource is to be maintained. This management must take two forms. Clearly, we need to positively work with the river and its floodplain, maintaining sluices, cutting weed, restoring habitats, creating footpaths and removing debris. However, we also need to plan what we want to do and how we are going to achieve it. Critically, we need to look at the ways in which other activities we are involved in might conflict with our aspirations for the natural resources of these river corridors.

Issue

The River Kennet catchment forms a unique fisheries, ecology and recreation asset. Parts of the catchment provide key habitats that support a range of flora and fauna that form rich, diverse communities. Some factors that demonstrate this value are the range and number of invertebrate species present, the relative success of native brown trout and grayling populations and the good survival of re-introduced juvenile salmon.

In some areas, the ecological value of the catchment is maintained by extensive ongoing river maintenance work, following patterns set by river keepers over the years. This can involve weed cutting, river structure management and works to the bed and banks of a watercourse. This maintenance is carried out by the NRA flood defence section in conjunction with landowners, local councils, British Waterways, river keepers and conservation bodies.

In the upper reaches of the catchment, changes in water and land use are altering the rich, diverse floral community resulting in a concomitant loss of key habitat which affects both fish and invertebrate populations. The decline of the water meadow channel systems, the poor state of many river control structures and the impacts of past river management schemes have also reduced the quality and range of riverine and river corridor habitat. These changes have recently been exacerbated by the severe drought.

Estate managed fisheries on the River Kennet between Ramsbury and Newbury depend upon introduction of large numbers of farm reared trout. At many sites within this zone, the river tends to be managed solely for the benefit of commercial trout fisheries, which are an important element of the local economy; aquatic plant and animal communities that do not benefit the fishery tend to be actively discouraged. These activities can range from the removal of coarse and other fish from the river to the widespread mowing of the banks. This zone has limited public access, and entry to the fishery is strictly controlled.

4.6 FISHERIES AND CONSERVATION MANAGEMENT (ctd)

The lower reaches of rivers in the catchment offer some of the best river coarse fishing in the UK and support excellent, diverse fish communities. Public access is better, and entry to the fishery is controlled by a number of angling clubs. There is concern that impacts upon these reaches from a number of sources are damaging the fisheries and conservation value, yet are not obvious due to the size of the river masking any immediate impact.

The proposed SSSI on the River Kennet stretches from downstream of Marlborough to downstream of Thatcham. On the Lambourn it stretches as far downstream as the outskirts of Newbury. Water quality, the water level/flow regime and the physical attributes of these rivers have combined with the techniques used to manage them to create not only areas of ecological value but also landscape value. The river corridors contrast strongly with the characteristics of the upland areas of the Downs.

Downstream of Newbury the landscape changes and over the last 40 years or so the particular traits of this area - floodplain gravel deposits, proximity to areas of urban, commercial and industrial growth, flat land of lower agricultural value - have meant that the valley of the lower River Kennet has seen much change. Thatcham, Newbury, Reading and Theale have all grown substantially in size. Gravel extraction to the north and south of the river has been followed in places by backfilling with waste or the creation of lakes. Many of these lakes have matured to form important habitats supporting excellent fisheries. Several provide water based recreation facilities which are of importance to people throughout the immediate region.

The opening of the Kennet and Avon Canal has recently added a new dimension creating opportunities for recreation and amenity in the valley. British Waterways have recognised the importance of planning for the future of the canal as indeed many other organisations have for their own particular area of interest.

A number of the management plans and statements produced do look at the wider situation. However, no plan to-date has looked at the full range of interests within the river corridor of the River Kennet or Lambourn from source to outfall. We believe there is a need for such a comprehensive management plan which would draw on existing professionally, organisationally or geographically specific initiatives in order to form an integrated whole. Such an approach will offer the opportunity to achieve more benefits for the water environment than can be presently achieved.

An example of this would be the use of the agricultural set-aside scheme to not only take land out of production but also create a buffer strip adjacent to the river or its existing corridor. This would reduce the silt and pollutant load in the river and reinforce the ecological value of the corridor.

On the planning side, the use of river corridor designations in development plans offers the opportunity to focus attention on the areas of concern. These designations should have the dual role of protecting and enhancing the total river corridor, including the floodplain, from inappropriate land uses. The implementation of a river corridor policy would be the responsibility of a range of organisations. This is because the policy should also seek to direct appropriate development and action to certain areas for implementation by the private, public and voluntary sectors.

4.6 FISHERIES AND CONSERVATION MANAGEMENT (ctd)

Way Forward

A coordinated fisheries and conservation management plan will be developed that builds upon the close relationship developed in recent years between the NRA, riparian owners and other interested parties. It must encompass long term strategies as well as short-term action. It is likely that this plan will involve a number of other organisations (e.g. British Waterways, County Wildlife Trusts, English Nature, County Fishery owners, Borough and Town Councils) who will have responsibility for setting and achieving some of the aims.

The following points set out our view of the way forward. Some actions have been programmed or have commenced already.

- 1) Prior to the development of a plan, a full assessment of the existing natural resources is required, including:
 - i) Fisheries Survey
 - . Programmed by NRA for 1993 with additional sites to previous surveys.
 - ii) River Corridor Survey
 - . Most recent NRA survey completed in 1987, only covered river channel and banks in detail.
 - . Upper Kennet planned to be surveyed by NRA in 1993 - other reaches likely to follow soon after.
 - . Essential to identify critical sites where habitat enhancement is needed.
 - iii) Landscape Survey
 - . No review of riverine features available.
 - . Provides key information for planning.
 - iv) Geomorphology Survey
 - . Identifies key sites for habitat enhancement.
 - v) Integration of natural resource survey information.

-
- 2) Identify, evaluate and contrast the management and land use plans of other organisations with an interest in the river corridor to identify both the opportunities and constraints. Ensure that strategic issues which may impinge on the river corridor (e.g. water resources strategy and changes in rural land use) are considered.
- 3) Using the information gained from investigations above, establish a baseline or datum against which progress may be measured and develop a plan encompassing the following elements and aims:
- i) Sustain the value of existing conservation sites and improve the diversity of habitats within the river corridor.
 - . Resolve conflicts with other water users.
 - . Requires a wider remit for the NRA with respect to development control.
 - . Will require the development of catchment specific and river corridor specific land use policies.
 - ii) Maintain, improve and develop fish populations (including the rehabilitation of salmon).
 - . Implications for commercial fisheries management.
 - . Potential conflicts with aims of other institutions and NRA functions.
 - iii) Develop a policy covering the introduction and removal of fish in rivers in the catchment.
 - . Potential conflict with commercial fisheries.
 - . Costly to monitor.
 - iii) Assess the value of undertaking otter habitat rehabilitation.
 - . Potential conflicts with other water users.

4.6 FISHERIES AND CONSERVATION MANAGEMENT (ctd)

- iv) Support the designation of part of the River Kennet as SSSI or ESA.
 - . Implications to fisheries management.
 - . Implications to habitat enhancements design and construction.
 - . Potential conflicts with other land and water users.
 - . Implications to Flood Defence operations, Standards of Service etc.
 - v) NRA Conservation Section to support and promote schemes such as the Countryside Stewardship Scheme along the river corridor in order to create buffer zones and the restoration of watermeadows (e.g. at Knighton).
 - . Implications to water resources.
 - . Costs.
 - . Benefits for Conservation, Fisheries and flood management.
 - vi) Carry out habitat improvement works (e.g. instream work at The Wilderness, channel narrowing on River Lambourn u/s M4) at critical sites identified in the baseline study.
 - . Implications to flood flows.
 - . Possible benefits to all functions.
 - . Potentially costly.
 - . Some works programmed, under way or completed.
 - vii) Establish shared ownership of the plan and seek its promotion and achievement in conjunction with other organisations.
 - . Land Use policy mechanisms.
 - . Forum discussions and working parties.
 - . Avoid duplication of effort and share information and knowledge.
- 4) Assign priority to aims and objectives and implement them. Monitor progress and actions against baselines developed in 3) and CMP action plan monitoring systems.

Implementation

All interested parties.

4.7 WATER QUALITY PROTECTION

Overview

The identification and monitoring of potential pollution problems within the Kennet catchment is needed to ensure that future risks to the water environment are minimised.

Issue

The River Kennet catchment is an important source of drinking water from ground and surface sources. In order to protect this resource it is essential to identify and monitor substances likely to give rise to water quality problems. In particular, the abstraction at Fobney (which supplies drinking water to much of Reading) is vulnerable as no contingency supply (e.g. bankside storage) has been provided. Possible emergency supplies have been considered in the past and include bankside storage, boreholes and the River Thames at Cow Lane, Reading.

Currently little is known about groundwater quality in the catchment and a comprehensive groundwater database is being established to complement the comprehensive data already available for surface waters. It is recognised that close to the junction of the Reading Beds and the Chalk (see Section 2.5) there is always the possibility of swallow holes which provide a rapid flow path for pollutants. Further monitoring may help to identify the scale of the problem.

A catchment quality review is needed in order to identify and assess the environmental significance of particular chemicals of concern. An accurate inventory of chemicals used and stored in the catchment would assist in the protection of water quality. Continued pollution prevention campaigns and inspections of industrial estates and farms, would enable the risks to surface and groundwaters to be identified

and appropriate action taken.

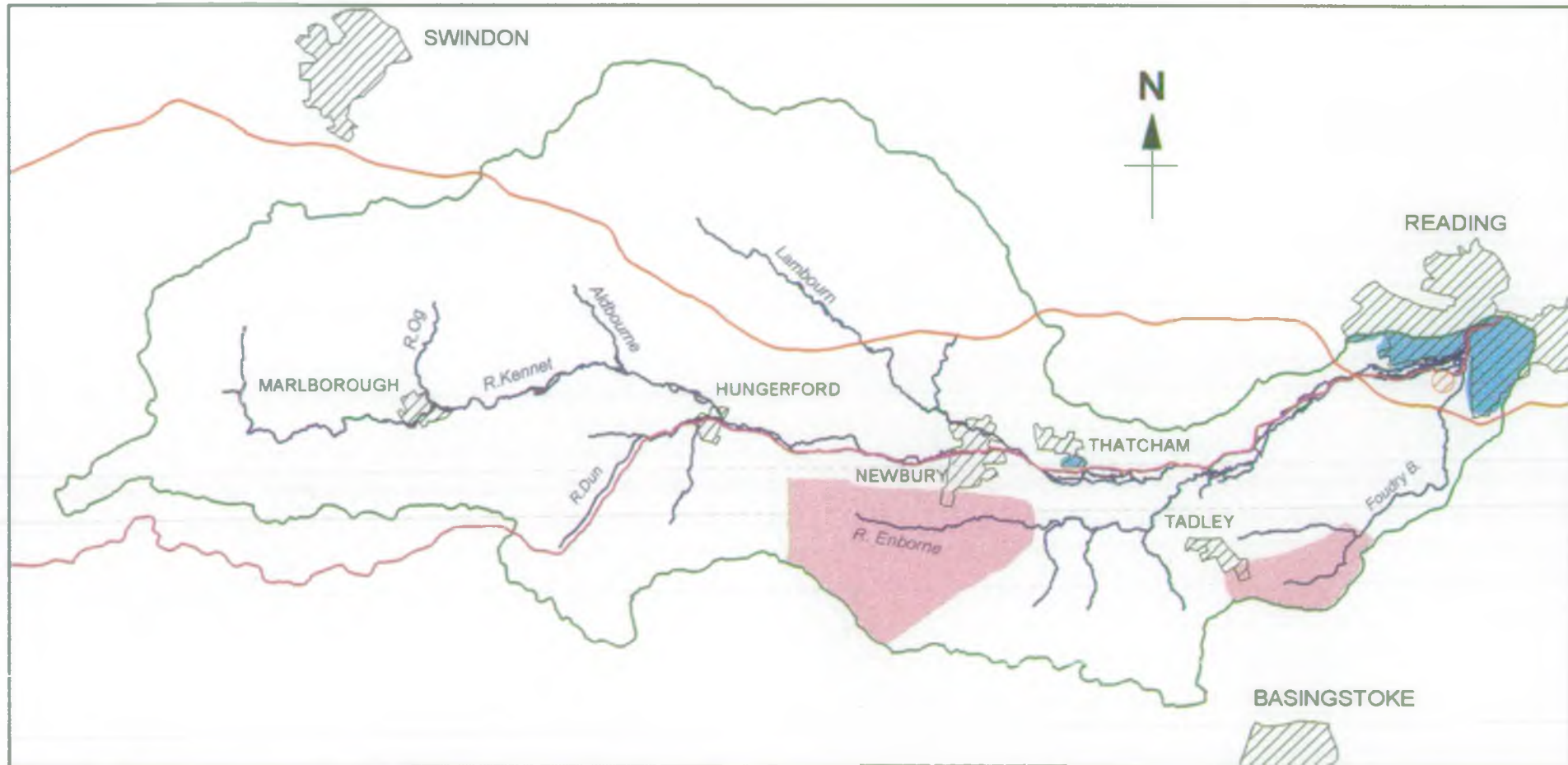
Way Forward

We and/or others could:

- 1) Provide a contingency water supply to Reading
 - . Cost involved in securing a contingency supply
 - . Reduced vulnerability of Reading's water supply
- 2) Continue to establish groundwater sampling network
 - . Creates a database for monitoring changes in groundwater quality
 - . Identifies groundwater pollution problems
- 3) Share information on quality of raw water supplies
 - . Saves duplication of time and effort in acquiring the information
 - . Reduces independence of regulators
- 4) Assess chemicals used and stored throughout the catchment
 - . Provides a basis for further monitoring and pollution prevention work
 - . Would require co-ordination of several authorities
- 5) Increase monitoring to assess the extent and distribution of pollution including pesticides and List II substances
 - . Identify water quality problems and instigate action to remedy them
 - . Improved surface and groundwater quality
- 6) Undertake campaigns to identify and educate potential polluters
 - . Minimise future pollution risks
 - . Save costs and time in the clean-up of pollution incidents

Implementation

NRA, Water Supply Companies, Local Authorities and Ministry of Agriculture, Fisheries and Food.



<p>KEY</p> <p>SCALE</p> <p>0 10 km</p>		Catchment Boundary		Urban Area							
		Watercourses		Industrial areas being targeted for pollution prevention visits							
		Kennet and Avon Canal		Farming areas being targeted for pollution prevention visits							
		M4 Motorway		Fobney Water Treatment Works							

4.8 CHANGES IN CATCHMENT STATUS

Overview

Low flow criteria which are used to help set discharge consents, in water resource planning and setting standards for the protection of fauna and flora, need to be re-assessed as a result of the last four years of drought. This along with other changes in the catchment has meant that the planning baseline for managing the catchment needs to be reviewed. However, any review of abstraction licences and discharge consents must also take into account any future development within the catchment and identify opportunities for alleviating any other concerns connected with the water environment.

Issue

Over the past few decades conditions in the River Kennet catchment have changed in several respects. These include changes in river management, an increase in population with a consequent increased demand on water, changes in agricultural practices, the opening of the Kennet and Avon Canal and an increased awareness by the public of environmental issues.

In the light of these changes our knowledge about the catchment in some key areas is inadequate in respect of the responsibilities we now have. There is thus a need to update existing data, establish new data bases and integrate ideas and information on a multi-functional basis within the NRA and with other organisations and groups.

Future changes must also be accounted for and this would include the development of a comprehensive and co-ordinated approach to future rural and urban development. County and District Council Planning

Authorities are responsible for proposed development within the catchment, but the NRA is a statutory consultee in this process and must seek to maximise its influence in order to protect and enhance the water environment.

As a consequence of the last four years of drought low flow statistics for the catchment now need to be re-assessed along with any criteria, such as discharge consents, which are based on them. River flows have been monitored within the catchment for a number of years, but the adequacy of the monitoring network now needs to be reviewed.

The increased demand for water within parts of the catchment (due to both population growth and forecast increases in per capita demand) has meant that there is now a need to review the water resources situation and determine how future water resources needs will be met and existing resources distributed. Future urban development will not only increase demand for water but will also increase the output of waste from STWs. Increased urbanisation also has the potential to effect flood defence interests in that it can increase urban runoff and decrease available storm water storage on the flood plain.

The natural heritage is another aspect of the catchment which needs to be addressed. This includes the conservation of current sites or areas of interest and their restoration, and the creation of new sites. Section 4.6 has already dealt with this aspect in some detail.

4.8 CHANGES IN CATCHMENT STATUS (ctd)

Way Forward

We believe that the following points will need to be addressed if we are to fully cope with the changing situation in the catchment:

Issue:- Re-assessment/Enhancement of Baseline Data

- 1) Monitoring of groundwater flows in the Enborne near public water supply abstractions and in the Upper Kennet especially in spring fed tributaries.
 - . This work will enable a better assessment of the water resources situation
- 2) Conservation survey information needs updating.
 - . More survey data is needed in order to ascertain areas that need conservation work.
- 3) No overall assessment of the value of the river corridor landscapes is available.
 - . Protection and enhancement of the landscape requires knowledge of existing status.
- 4) No overall assessment of the morphological sensitivity of the river system is available.
 - . Assessment of sensitivity of the rivers will help both fisheries and conservation studies and the planning of flood defence work.

Issue:- Review of Abstraction/Discharge Licences

- 5) Review abstraction licences especially Axford.
 - . Enable the management of water resources and assist in planning for future demands.
- 6) Review discharge consents and abstraction licence conditions in the light of available dilution in the lower River Kennet and new catchment wide low flow data.
 - . Assist in maintaining and improving water quality.
- 7) Set up oxidation of surface water flows in the Upper Kennet during drought conditions to prevent algal blooms.
 - . The cost involved.
 - . Problem which may only occur occasionally and is a natural phenomena.

Issue:- Plan for Future Development in the Catchment

- 8) Proactive action plan for lock, weir and structure operation.
 - . The study would allow better control of rivers both in high and low flow situations
- 9) Assess Hungerford and Newbury as potential water pressure points in the future with respect to water supply.
 - . Detailed assessment will help avoid water supply problems in the future.
- 10) Flood defence schemes to alleviate potential flooding problems due to increased urbanisation and reduced storm water storage as a result of development on the flood plain.
 - . Increased public investment needed to overcome problems.
- 11) Ensure that NRA objectives are reflected in development plans prepared by County and District Authorities.
 - . Failure to achieve this will mean problems in terms of flood defence, conservation and possibly fisheries activities and damage to the water environment.
- 12) Prepare a Regional Water Resources Strategy and River Kennet Catchment Water Resources Strategy.
 - . will cover demand management issues and the possibility of developing new schemes.
 - . will identify the balance to be achieved between the environment and users of water.

Issue:- Preservation/Enhancement of the Water Environment

- 13) Maintain existing conservation sites; create new conservation sites; conserve species diversity and rare species by protecting unique and important habitats.
 - . Requires many organisations, landowners and funders to work closely together towards a common goal.
- 14) Promote the integrated management of natural resources, rural and land use activity and recreation.
 - . In conjunction with other bodies.

4.9 COMMUNICATIONS

Overview

Successful achievement of any plan of action involving a range of organisations will depend in part on ensuring that good communications between the groups involved is possible and achievable.

Issue

The concerns of local interest groups and communities for the water environment vary across the catchment. Many of the issues identified are catchment wide in their impact but are not the responsibility of a single 'professional' organisation. For example land use planning is the responsibility of several local planning authorities. The NRA therefore has a key role to play in ensuring that local concerns or otherwise fragmented issues are properly co-ordinated in respect of the water environment.

In undertaking this role it will be important to make the most of existing fora and groups which already bring together most - if not all - of those interested in particular issues. Groups such as Action for the River Kennet, Cleaner Kennet Campaign, Reading Waterways Forum, Kennet Valley Fisheries Association and Upper Thames Fisheries Consultative Committee may all be useful in helping to define action plans, monitor and review actions and help the NRA achieve its co-ordinating role. New proposals, such as that of Berkshire County Council for a standing conference for the lower Kennet, must all be taken into account.

Way Forward

Views are sought on the merits of establishing an NRA led forum or issue orientated working groups to help develop and implement actions plans on either a catchment or issue related basis.

In considering your views we will have three objectives in mind:

- the benefits to be gained from using existing groups rather than creating new ones;
- minimising the amount of time people will need to attend meetings;
- achieving integration across artificial geographical boundaries and disciplines.

Implementation

All interested parties.

Appendix I
Description of Responsibilities

APPENDIX I - DESCRIPTION OF RESPONSIBILITIES

Introduction

The supply of water for domestic consumption and industrial use is not the responsibility of the NRA but of **water and sewerage undertakers** and **statutory water companies**. 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 **Local 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 Council**. **District and Borough Councils** may also manage on behalf of **water and sewerage undertakers** surface water drains leading to rivers and watercourses.

British Waterways are responsible for navigation on the Kennet and Avon Canal whereas the NRA are responsible for navigation on the River Thames.

The responsibilities of the above organisations are described further opposite. The responsibilities of the NRA are then described in detail.

Water and Sewerage Undertakers and Statutory Water Companies

These private companies are responsible for providing water supplies and the management of sewage treatment works. Thames Water Utilities, Wessex Water Services, Southern Water Services and Mid-Southern Water Company (the only Statutory Water Company amongst the four) all 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 sewage treatment works 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.

APPENDIX I - DESCRIPTION OF RESPONSIBILITIES (ctd)

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 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 (see p2-13).

British Waterways Board (BWB)

Created by the Transport Act 1962 BWB is the largest navigation authority in the country. The Kennet and Avon Canal is run by the BWB (South-East Area).

National Rivers Authority (NRA)

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, taking account of the needs of the water environment and those of abstractors.
- To tackle with vigour the short-term and serious problems raised by the drought.
- To collect, validate, store and provide hydrometric data and water quality data to support the duties of the water resources function and to support other functions as necessary.
- To apply a nationally consistent approach to abstraction licensing, including licence determination, charging, policing, enforcement and variation.
- To investigate problems caused by authorised excessive abstraction from water resources and to implement a consistent approach to the alleviation of these problems.
- To apply statutory powers with the objective of protecting the quality of water resources.
- To develop and implement a groundwater protection policy.

APPENDIX I - DESCRIPTION OF RESPONSIBILITIES (ctd)

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 advise the Secretary of State on the setting of Statutory Water Quality Objectives (SWQOs) and standards.
- . To ensure that monitoring of controlled waters is adequate to demonstrate that SWQOs, once set, will be met.
- . To introduce measures to ensure that the regulation of point-source discharges will lead to the achievement of SWQOs.
- . To utilise the pollution prevention powers set out in the Water Resources Act 1991 to the fullest extent, to ensure SWQOs are maintained.
- . To extend the pollution prevention activities carried out by others, by influencing bodies such as planning authorities to take account of pollution prevention needs.
- . To further the study of cost/benefit and cost effectiveness in relation to pollution control practices, and apply such methods as they become available.
- . To improve pollution alleviation activities and emergency procedures.
- . To improve methods for financing, and accounting for, pollution control activities.
- . To improve the provision of information to the public and official bodies in order to further the management of the water environment.

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.

APPENDIX I - DESCRIPTION OF RESPONSIBILITIES (ctd)

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.
- . Establish a sound charging system for NRA sites which is sensitive to the needs of the public.
- . 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.

APPENDIX I - DESCRIPTION OF RESPONSIBILITIES (ctd)

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 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. The NRA has recently introduced a single national rod licence which covers England and Wales.

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 estuary and, where appropriate, coastal waters.
- Formulate policies to maintain, improve and develop fisheries and restore and rehabilitate damaged fisheries.
- Provide a fisheries service which is responsive to the needs of the public 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 the risk to existing and future uses (e.g. 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 Thames Water Utilities plc.

The standard of flood protection can be measured in terms of the frequency at which (e.g. 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. These activities 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 non main river tributaries that would otherwise affect the flow.

APPENDIX I - DESCRIPTION OF RESPONSIBILITIES (ctd)

Our Strategic Objectives are:

- . To develop and implement our draft 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 advance the development of strategies and 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 operating methodology, increasing efficiency and enhancing value for money.
- . To heighten general awareness of the need for development controls 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 and District Councils on mineral workings, waste disposal issues, infrastructure works, works within river corridors or floodplains, and any activities likely to pollute surface or groundwaters or increase the demand for water resources.

Report on

Appendix II
Informal Liaison

APPENDIX II - REPORT ON INFORMAL LIAISON

During October and November, 1992 we wrote to all County, District and Parish Councils in the catchment and over 40 other organisations with an interest in the water environment of the catchment. The purpose of this period of informal liaison was to secure relevant information and gain an appreciation of the issues related to the water environment concerning those closely associated with the area. This period of informal liaison was not intended to be a substitute for the planned period of formal consultation.

The response rate of over 50% provided much useful information and enabled us to incorporate local concerns within this catchment management plan.

Issues of concern to local communities ranged widely but two issues attracted particular attention. In the west and north of the catchment the inter-relationship between river flows and groundwater resources/levels and public water supply abstraction concerned many. Our work, reported in Section 4.2, considers further this issue in relation to the upper River Kennet. Further east the primary concern related to the impact of mineral extraction, waste disposal and residential/commercial development on the floodplain and groundwater flows. A number of Parish Councils identified particular local flood defence issues and opportunities for enhancing 'damaged' sections of watercourse.

The concerns of professional organisations differed from those of the representatives of local communities. Of most concern was the need to protect the ecology of the river corridors from detrimental effects and an interest in seeking enhancements to restore damaged habitats.

Several local action groups have been formed with a particular focus on the water environment as follows:

(1) Action for the River Kennet (ARK)

Concerned with the River Kennet and its tributaries in the area upstream of Chilton Foliat.

(2) Cleaner Kennet Campaign

Concerned with the valley of the River Kennet downstream of Newbury.

(3) Friends of the Lower Kennet (FOLK)

Concerned with the valley of the River Kennet between Theale and Reading.

(4) Winterbourne Stream Action Group

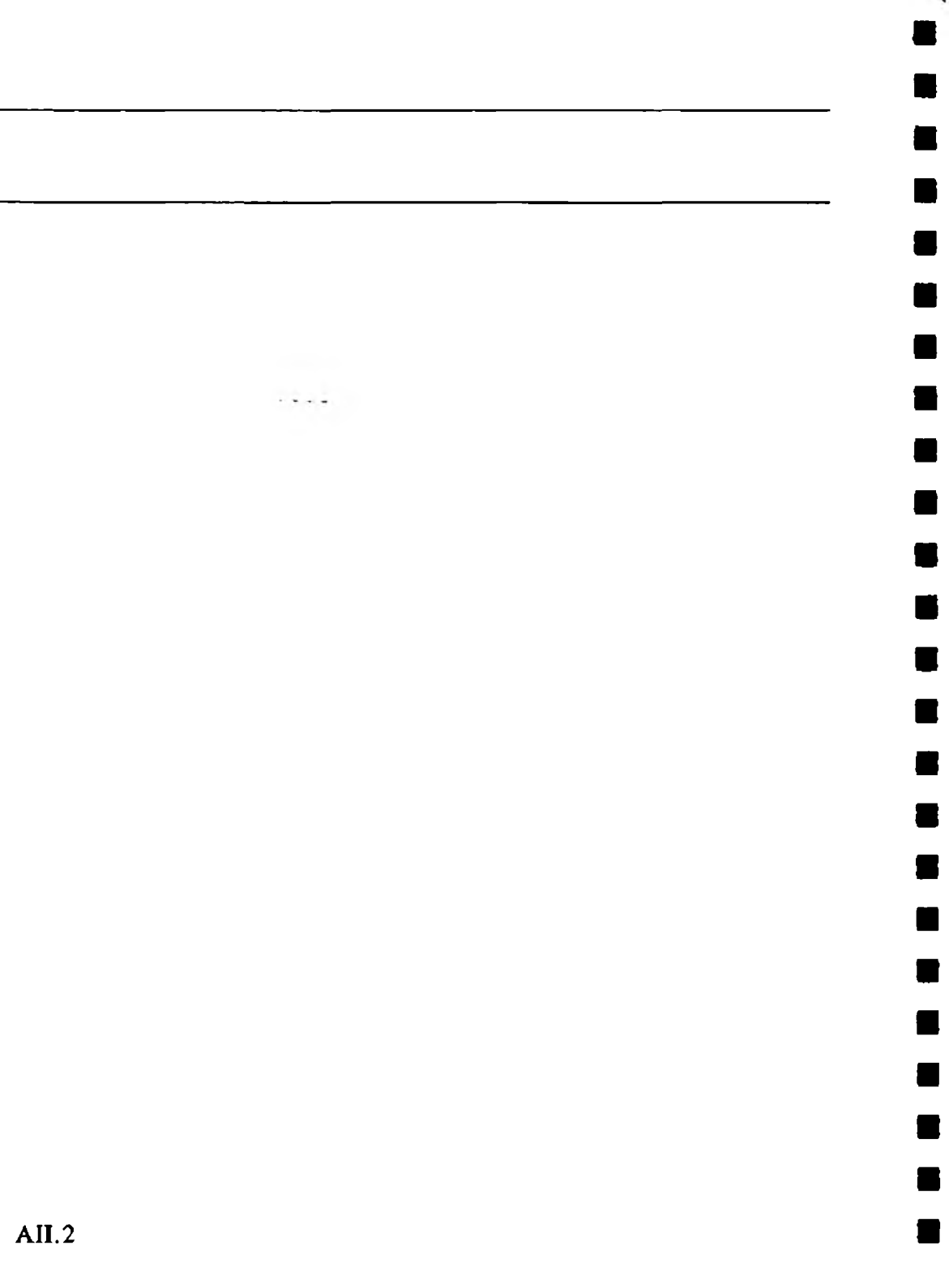
Concerned with the valley of the Winterbourne Stream.

Groups (1), (2) and (4) are led and run by members of the local community whereas the Cleaner Kennet Campaign has the direct support of Reading Borough Council and Newbury District Council.

APPENDIX II - REPORT ON INFORMAL LIAISON (ctd)

The following table summarises the level of response received from different groupings of consultees:

Consultee Group	Number Contacted	Number Responding	% Response
(A) County, District & Parish Councils in:			
(1) Berkshire	48	16	33
(2) Hampshire	14	8	57
(3) Oxfordshire	11	5	45
(4) Wiltshire	40	16	40
(B) Other organisations, groups & individuals	45	35	78
(C) TOTAL	158	80	51



Appendix III
Lists and Standards

APPENDIX III - TABLE OF RIVER QUALITY OBJECTIVES AND NUTRIENT CONCENTRATIONS (Section 3.2)

RIVER/ WATERWAY	REACH	LENGTH (metres)	OBJECTIVE CURRENT/FUTURE	ACHIEVEMENTS (MEAN VALUES 1989 - 92 IN mg/l)				AVERAGE NUTRIENT CONCENTRATIONS		
				1992	1991	1990	1989	NH3-N	TON	ORTHO-P
Kennet	West Kennet to Marlborough STW	13,570	1A 1A	2A	1B	1B	1B	0.08	5.41	0.05
Kennet	Marlborough STW to Hungerford	20,140	1A 1A	2A	1B	1B	1B	0.10	5.19	0.42
Kennet	Hungerford STW to Newbury STW	17,390	1A 1A	1A	1A	1A	1A	0.06	4.00	0.12
Kennet	Newbury STW to Aldershot Stream	5,940	1B 1B	1A	1A	1A	1A	0.07	4.35	0.41
Kennet	Aldershot Stream to Enborne	6,090	1A 1A	1B	1A	1A	1A	0.23	3.94	0.50
Kennet	Enborne to Sulhamstead Stream	8,950	1A 1A	2A	1A	1A	1A	0.07	4.23	0.57
Kennet	Sulhamstead Stream to Foudry Brook	8,300	1A 1A	2A	1A	1A	1A	0.07	3.75	0.37
Kennet	Foudry Brook to Holy Brook	2,820	1B 1B	1B	1A	1B	1B	0.20	6.50	1.36
Kennet	Holy Brook to Thames	1,310	1B 1B	2A	2A	1B	1B	0.19	5.09	0.92
Kennet & Avon Canal	Crofton (Summit)	19,470	1A 1A	2A	1B	1B	1B	0.09	2.85	0.03
Kennet & Avon Canal	Widmead Lock to Woolhampton	6,840	1B 1B	1B	1B	1A	*	0.07	3.83	0.35
Kennet & Avon Canal	Woolhampton to Ufton	4,450	1A 1A	2A	1A	2A	1B	0.06	3.24	0.29
Og	Bay Bridge to Kennet	2,120	1A 1A	1B	1B	1A	1B	0.05	5.99	0.04
Aldbourn	Whittonditch to Knighton Loop	1,300	1B 1B	*	*	1B	*	*	*	*
Dun	East Grafton to Kennet	16,190	1A 1A	1A	1A	1B	1A	0.06	3.86	0.05
Shalbourne	Shalbourne to Dun	6,500	1A 1A	1A	1B	1A	1A	0.05	3.59	0.16
Lambourn	Lambourn to Boxford STW	16,120	1A 1A	1A	1A	1A	1A	0.05	5.63	0.04
Lambourn	Boxford STW to Lambourn FFm	5,050	1A 1A	1A	1A	1A	1A	0.05	5.95	0.18
Lambourn	Lambourn FFm	4,530	1A 1A	1A	1B	1A	1A	0.05	4.93	0.14
Winterbourne Stream	Winterbourne to Bagnor Stream	3,900	1A 1A	1A	1A	1A	1A	0.06	6.41	0.05
Enborne	West Woodhay to Bishops Grm STW	13,030	1A 1A	1B	1A	1B	1B	0.27	2.25	0.08
Enborne	Bishops Grm STW to Baughurst	7,880	1A 1A	1A	1A	1A	1A	0.10	3.9	0.62
Enborne	Baughurst Brook to Kennet	6,050	1A 1A	1B	1A	1B	1A	0.07	4.96	0.66
Ecchinswell Brook	Ecchinswell to Enborne	6,620	1A 1A	1B	1A	1B	1A	0.11	3.93	0.28
Kingsclere Brook	Kingsclere to Enborne	7,000	1A 1A	1A	1A	1B	1A	0.08	5.21	1.00
Baughurst Brook	Pound Green to Enborne	5,700	3 2B	2A	1B	2A	3	0.60	2.66	0.09
Foudry Brook	Devil's H-Way to S. Mortimer STW	2,190	1B 1B	1B	1B	1B	1B	0.26	9.37	4.10
Foudry Brook	S. Mortimer STW to Kennet	10,470	1B 1B	1A	1B	1B	2A	0.15	9.68	3.95

- Notes:
- 1) Thames Region have uniquely split Class 2 into 2A and 2B. The national system uses only Class 2.
 - 2) The River Quality Objective (RQO) classes are as follows:
Class 1A/1B - High quality waters
Class 2A/2B - Fair quality waters
Class 3 - Poor quality waters
Class 4 - Bad quality waters
 - 3) The objectives and standards associated with these classes are defined in on page AIII.4.
 - 4) Nutrient parameters are:
NH3-N : amount of nitrate in the form of nitrogen.
TON : total oxidised nitrogen.
ORTHO-P: orth-phosphate.

APPENDIX III - TABLE OF BIOLOGICAL MONITORING SCORES (Section 3.2)

RIVER	SITE	NATIONAL GRID REF	1991 BMWP SCORE	PREDICTED BMWP SCORE	NUMBER OF TAXA (1991)
Aldbourn	At Ramsbury	SU29007160	156	103	31
Aldershot Stream	Below Colthrop Mills	SU54406600	163	91	29
Baughurst Brook	Below Ashford Hill Tip	SU55606310	69	130	N/A
Burghfield Brook	Above Foudry Brook	SU69906920	68	93	15
Clayhill Brook	Above Burghfield STW	SU65506840	79	110	16
Clayhill Brook	Below Burghfield STW	SU66006880	34	126	10
River Dun	At Gauging Station, Hungerford	SU33206850	159	106	32
Ecchinswell Brook	At A339 Headlwy	SU50706340	116	142	21
River Enborne	At Gauging Station, Brimpton	SU56806480	162	126	30
Foudry Brook	At Hartley Court Farm, Grazely	SU70206880	140	107	29
Froxfield Stream	Above Dun	SU30566778	71	91	17
Holy Brook	Above Kennet	SU72007350	130	102	25
River Kennet	At Stitchcombe Mill	SU22706950	177	109	32
River Kennet	At Hambridge Road, Newbury	SU49106730	203	113	34
River Kennet	Above Aldershot Water	SU54406590	223	124	38
River Kennet	At Water Intake, Fobney	SU70507100	216	127	38
River Kennet	Above Thames	SU73107380	110	130	23
Kennet & Avon Canal	At Froxfield Bridge	SU30603780	113	119	23
Kennet & Avon Canal	At Midgeham Bridge	SU55106620	91	109	20
Kennet & Avon Canal	At Ufton Bridge (Wool-Uft)	SU61806870	138	138	26
Kingsclere Brook	Below Tan House Farm, Hadley	SU52906280	125	113	24
River Lambourn	At Bagnor	SU45306910	163	106	30
River Og	Above Kennet	SU19506960	119	103	24
Padworth Stream	At Bridge, 368 Padworth	SU61106600	54	135	12
Shalbourne	At Smitham Bridge	SU33006820	89	92	19
Silchester Brook	Below Silchester STW	SU62406070	81	130	17
West End Brook	At Tanhouse Bridge	SU65806330	58	*	15
Winterbourne Stream	At Gauging Station, Bagnor	SU45306950	157	95	29

Notes:

- 1) '*' Indicates sites not suitable for prediction
- 2) BMWP - Biological Monitoring Working Party

APPENDIX III - TABLE OF BACTERIOLOGICAL QUALITY (Section 3.2)

SITE	NATIONAL GRID REFERENCE	<u>1st Quarter</u>	
		T.C	<i>E. coli</i>
<i>River Kennet Sites</i>			
Gauging Station, Marlborough	SU 1870 6860	8400	810
Stitchcombe Mill	SU 2270 6950	8000	4500
Hungerford Bridge	SU 3420 6900	3800	410
Kitsbury	SU 3870 6755	500	210
Hambridge Road, Newbury	SU 4910 6730	6000	290
Thatcham Railway Station	SU 5270 5520	30000	160
Woolhampton	SU 5730 6650	8600	330
Inlet, Padworth Fisheries	SU 6050 6660	15200	810
Padworth Bridge	SU 6080 6740	12000	170
Gauting Station, Theale	SU 6480 7080	21000	530
Water Intake, Fobney	SU 7050 7100	5900	20
Berkeley Avenue, Reading	SU 7140 7260	4000	550
100m u/s Thames	SU 7310 7380	49000	580

Tributary Sites

Dun d/s Berks Trout Farm, Hungerford	SU 3520 6830	1400	160
Lambourn at A4, Newbury	SU 4870 6740	5700	200
Enbourn at Gauging Station Brimpton	SU 5680 6480	18000	2400
Foudry Brook d/s Reading S.T.W	SU 7115 7080	136000	4000

- Notes: 1) All results for 1991/92 (April - March)
 2) T.C. = Total coliforms and *E.coli* = *Escherichia coli*
 3) European Commission Directive 76/160/EEC on Bathing Waters has the following requirements for *E. coli* and Total Coliforms:
 - Guide 100 and 500 respectively
 - Mandatory 2000 and 10 000 respectively

<u>2nd Quarter</u>		<u>3rd Quarter</u>		<u>4th Quarter</u>	
T.C	<i>E. coli</i>	T.C	<i>E. coli</i>	T.C	<i>E. coli</i>
46000	830	5800	490	1000	170
71000	1700	99000	4000	57000	7100
4600	250	600	180	1500	450
14000	420	4300	70	100	90
3500	170	2200	390	2500	240
7200	380	1600	210	100	80
5500	240	3100	250	3200	530
21000	1600	3700	180	3600	690
7500	110	2600	170	2400	560
5200	80	< 100	10	1400	130
3400	150	1700	170	2000	190
30000	1590	6200	1300	54000	9600
72000	4300	3500	430	68000	8900
5600	350	100	90	800	260
2500	330	1000	390	200	30
105000	580	9000	1200	62000	5800
312000	22400	636000	53000	1380000	85000

APPENDIX III - RIVER QUALITY OBJECTIVE (RQO) STANDARDS (Section 3.2)

River Class	Quality Criteria	Remarks	Current potential uses
	Class limiting criteria (95 percentile)		
1A	(i) Dissolved oxygen saturation greater than 80% (ii) Biochemical oxygen demand not greater than 3mg/l. (iii) Ammonia not greater than 0.4mg/l. (iv) Where the water is abstracted for drinking water, it complies with requirements for A2** water. (v) Non-toxic to fish in EIFAC terms (or best estimates if EIFAC figures not available).	(i) Average BOD probably not greater than 1.5mg/l. (ii) Visible evidence of pollution should be absent.	(i) Water of high quality suitable for potable supply abstractions and for all other abstractions. (ii) Game or other high class fisheries. (iii) High amenity value.
1B	(i) DO greater than 60% saturation. (ii) BOD not greater than 5 mg/l. (iii) Ammonia not greater than 0.9 mg/l. (iv) Where water is abstracted for drinking water, it complies with the requirements for A2** water. (v) Non-toxic to fish in EIFAC terms (or best estimates if EIFAC figures not available).	(i) Average BOD probably not greater than 2 mg/l. (ii) Average ammonia probably not greater than 0.5mg/l. (iii) Visible evidence of pollution should be absent. (iv) Waters of high quality which cannot be placed in Class 1A because of high proportion of high quality effluent present or because of the effect of physical factors such as canalisation, low gradient or eutrophication. (v) Class 1A and Class 1B together are essentially the Class 1 of the River Pollution Survey (RPS).	Water of less high quality than Class 1A but usable for substantially the same purposes.
2	(i) DO greater than 40% saturation. (ii) BOD not greater than 9 mg/l. (iii) Where water is abstracted for drinking water, it complies with the requirements for A3** water. (iv) Non-toxic to fish in EIFAC terms (or best estimates if EIFAC figures not available).	(i) Average BOD probably not greater than 5 mg/l. (ii) Similar to Class 2 of RPS. (iii) Water not showing physical signs of pollution other than humic colouration and a little foaming below weirs.	(i) Waters suitable for potable supply after advanced treatment. (ii) Supporting reasonably good coarse fisheries. (iii) Moderate amenity value.
3	(i) DO greater than 10% saturation. (ii) Not likely to be anaerobic. (iii) BOD not greater than 17 mg/l*.	Similar to Class 3 of RPS.	Waters which are polluted to an extent that fish are absent or only sporadically present. May be used for low grade industrial abstraction purposes. Considerable potential for further use if cleaned up.
4	Waters which are inferior to Class 3 in terms of dissolved oxygen and likely to be anaerobic at times.	Similar to Class 4 of RPS.	Waters which are grossly polluted and are likely to cause nuisance.
X	DO greater than 10% saturation.		Insignificant watercourses and ditches not usable, where objective is simply to prevent nuisance developing

APPENDIX III - RIVER QUALITY OBJECTIVE (RQO) STANDARDS (Section 3.2) (ctd)

Notes to Table on AIII.4

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|--|---|
| <p>(a) Under extreme weather conditions (e.g. flood, drought, freeze up), or when dominated by plant growth, or by aquatic plant decay, rivers usually in Classes 1, 2 and 3 may have BODs and dissolved oxygen levels, or ammonia content outside the stated levels for those classes. When this occurs the cause should be stated along with analytical results.</p> <p>(b) The BOD determinations refer to 5 day carbonaceous BOD (ATU). Ammonia figures are expressed as NH_4.</p> <p>* This may not apply if there is a high degree of re-aeration.</p> <p>** EEC category A2 and A3 requirements are those specified in the EEC Council Directive of 16 June 1975 concerning the Quality of Surface Water intended for Abstraction of Drinking Water in the Member States.</p> | <p>(c) In most instances the chemical classification given above will be suitable. However the basis of the classification is restricted to a finite number of chemical determinands and there may be a few cases where the presence of a chemical substance other than those used in the classification markedly reduces the quality of the water. In such cases, the quality classification of the water should be downgraded on the basis of the biota actually present, and the reasons stated.</p> <p>(d) EIFAC (European Inland Fisheries Advisory Commission) limits should be expressed as 95% percentile limits.</p> |
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APPENDIX III - NRA DEFINITIONS OF POLLUTION INCIDENT CATEGORIES (Section 3.2)

MAJOR

A major incident involving one or more of the following:

- a) potential or actual persistent effect on water quality or aquatic life;
- b) closure of potable water, industrial or agricultural abstraction necessary;
- c) extensive fish kill;
- d) excessive breaches of consent conditions;
- e) extensive remedial measures necessary;
- f) major effect on amenity value.

SIGNIFICANT

- a) notification to abstractors necessary;
- b) significant fish kill;
- c) measurable effect on invertebrate life;
- d) water unfit for stock;
- e) bed of watercourse contaminated;
- f) amenity value to the public, owners or users reduced by odour or appearance;
- g) breach of consent conditions.

MINOR

Minor suspected or probable pollution which, on investigation, proves unlikely to be capable of substantiation or to have no notable effect.

APPENDIX III - POLLUTION PROSECUTIONS AND CAUTIONS (Section 3.2)

PROSECUTIONS

<u>Location</u>	<u>Incident Date</u>	<u>Pollutant</u>	<u>Polluter</u>
Clayhill Brook, Burghfield	25/10/89	Silt	ARC Ltd
Tributary of K + A Canal, Kintbury	15/1/90	Slurry	John Holmes
R. Kennet, Theale	11/10/89	Silt	Lean & Higgin Ltd
R. Kennet, Marlborough	13/11/90	Gas Oil	TWUL
Silchester Brook, Bramley	1/8/91	Transformer Oil	The National Grid Co.
R. Enborne, Bishops Green	13/2/92	Red Diesel Fuel	TWUL

CAUTIONS

R. Kennet, Winterbourne Monkton STW	5/3/92 & 27/4/92	Consent breach	Kennet DC
R. Kennet, Winterbourne Bassett STW	28/7/92	Consent breach	Kennet DC

<u>Court Date</u>	<u>Fine</u>	<u>Costs</u>
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2/8/90	£1700	£150
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29/8/90	£300	£175
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30/8/90	£750	£150
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23/5/91	£1000	£225
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30/1/92	£15000	£290
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18/1/93	£7500	£320
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13/11/92		
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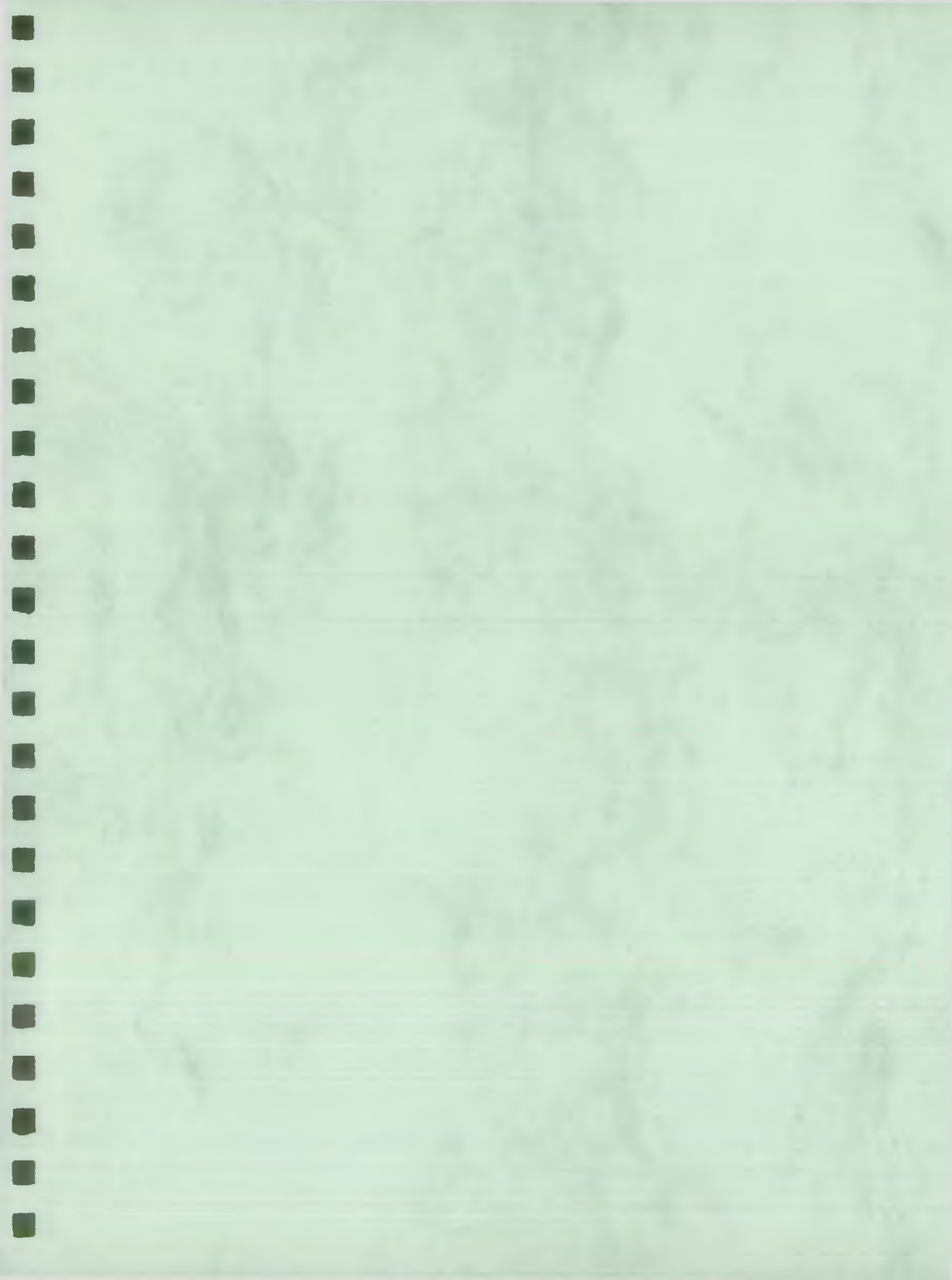
13/11/92		
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APPENDIX III - STANDARDS OF SERVICE FOR FLOOD DEFENCE AND LAND DRAINAGE (Section 3.4)

<u>RIVER</u>	<u>REACH</u>	<u>REACH</u> <u>LGTH</u> <u>(km)</u>	<u>FLOOD</u> <u>PLAIN</u> <u>AREA(ha)</u>	<u>LAND</u> <u>USE</u> <u>BAND (1)</u>	<u>RIVER</u>	<u>REACH</u>	<u>REACH</u> <u>LGTH</u> <u>(km)</u>	<u>FLOOD</u> <u>PLAIN</u> <u>AREA(ha)</u>	<u>LAND</u> <u>USE</u> <u>BAND (1)</u>
ALD BOURNE	MRL to Knighton Loop	5.53	28	E	BAUGHURST BRK	MRL to River Enbourne	5.85	32	E
YATESBURY B'NE	MRL to River Kennet	1.12	0	E	KINGSCLERE BRK	MRL to River Enbourne	5.50	21	E
KENNET	Fobney Water Works to River Thames	4.65	126	D	ECCHINSWELL BRK	MRL to River Enbourne	5.20	29	E
KENNET	M4 to Fobney Water Works	5.10	430	C	LAMBOURN	Bagnor Bridge to River Kennet	4.65	58	C
KENNET	Ufton Bridge to M4	4.75	383	A	LAMBOURN	Boxford to Bagner Bridge	4.55	59	D
KENNET	A340 to Ufton Bridge	4.55	332	C	LAMBOURN	Elton Lane to Boxford	4.95	68	D
KENNET	Kings Bridge to A340	4.50	313	C	LAMBOURN	East Garston to Elton Lane	5.15	64	D
KENNET	Chamberhouse Cottage to Kings Bridge	4.65	282	D	LAMBOURN	MRL to East Garston	4.05	8	E
KENNET	Northbrook Street to Chamberhouse Cottage	5.90	236	C	WINTERBOURNE	MRL to Bagnor Mill	4.43	11	E
KENNET	Railway to Northbrook Street	4.35	220	E	STREAM				
KENNET	Kintbury Station to Railway	5.50	300	E	DUN	Froxfield Stream to River Kennet	5.62	57	E
KENNET	Denford Mill to Kintbury Station	4.00	168	E	SHALBOURNE	MRL to River Dun	5.75	21	D
KENNET	Knighton Loop to Denford Mill	6.75	238	E	FROXFIELD STM	MRL to River Dun	3.15	26	D
KENNET	Axford Bridge to Knighton Loop	6.80	145	D	OG	MRL to River Kennet	6.29	45	E
KENNET	Railway Marlborough to Axford Bridge	4.95	80	E	HOLY BROOK	MRL to Holy Brook	0.15	0	E
KENNET	Lockeridge to Railway Marlborough	7.25	170	D	(Coley Ann)				
KENNET	Silbury Hall A4 to Lockeridge	6.30	70	E	Notes:	(1)	Target Service Levels and Land Use Bands are defined on p. AIII.9.		
KENNET	MRL to Silbury Hill A4	5.55	14	E		(2)	MRL - main river limit		
FOUDRY BROOK	Foudry Bridge to River Kennet	5.70	69	D					
FOUDRY BROOK	West End Brook to Foudry Bridge	5.95	82	D					
FOUDRY BROOK	MRL to West End Brook	5.20	25	E					
WEST END BROOK	MRL To Foudry Brook	6.35	20	E					
ENBOURNE	Able Bridge to Aldemaston o/d Mill	4.75	156	E					
ENBORNE	Thornford Bridge to Able Bridge	6.65	75	E					
ENBORNE	A34 to Thornford Bridge	5.83	42	E					
ENBORNE	MRL to A34	7.52	48	D					

APPENDIX III - STANDARDS OF SERVICE FOR FLOOD DEFENCE AND LAND DRAINAGE (Section 3.4)

Land Use Band	Description of Typical Land Use	Target Standards of Service
A	A reach containing the urban elements of residential and non-residential property distributed over a significant proportion of its length, or densely populated areas over some of its length. Any agricultural influence is likely to be over-ridden by urban interests. Amenity uses such as parks and sports fields may be prominent in view of the floodplain's proximity to areas of population density.	These heavily built-up areas should be protected to a standard such that the risk of flooding in any one year is no greater than 1 in 50. In some areas higher standards may be applied.
B	Reaches containing residential and/or non-residential property either distributed over the full length of the reach or concentrated in parts but characterised by lower densities than Band A.	Buildings should be protected to a standard such that the risk of flooding in any one year is between 1 in 20 and 1 in 50. However, agricultural or amenity land found in these areas should remain susceptible to regular flooding.
C	Limited numbers of isolated rural communities or urban fringe at risk from flooding, including both residential and commercial interests. Intensive agricultural use could also be included.	The chance of flooding of property in any one year would be between 1 in 10 and 1 in 50 years. Agricultural or amenity land, however, could be susceptible to more regular flooding.
D	Isolated, but limited number of residential and commercial properties at risk from flooding. Agricultural use will probably be the main customer interest with arable farming being a feature. In undeveloped pockets of largely urban use, amenity interests may be prominent.	Agriculture and amenity land in this band should be protected to a standard such that the chance of flooding or prolonged bankfull events in any one year, at a time when crops are normally susceptible to damage (i.e. March to October inclusive), is between 1 in 2 and 1 in 5.
E	There are likely to be very properties and major roads at risk from flooding in this reaches. Agricultural use will be the main customer interest with either extensive grassland or, where the flood plain extent is small, arable cropping being the most common land uses. Amenity interests are likely to be limited to public footpaths along or across the river.	Agricultural land in this category could be susceptible to yearly waterlogging and/or flooding, possibly occurring on several occasions throughout the year. Protection should be maintained to a standard which reduces the risk of either type of event to between one and three times per year at a time when crops are normally susceptible to damage.



Appendix IV
Glossary

APPENDIX IV - GLOSSARY

Acronyms

AOD	-	above Ordnance Datum
BC	-	Borough Council
BOD	-	Biochemical Oxygen Demand
CC	-	County Council
CMP	-	Catchment Management Plan
DC	-	District Council
DoE	-	Department of the Environment
DO	-	Dissolved Oxygen
EC	-	European Commission
MAFF	-	Ministry of Agriculture, Fisheries and Food
MRL	-	Main River Limit
NRA	-	National Rivers Authority
NRA TR	-	National Rivers Authority Thames Region
RQO	-	River Quality Objective
SSSI	-	Site of Special Scientific Interest
SWQO	-	Statutory Water Quality Objective
TWU	-	Thames Water Utilities

Units

Length - 10mm = 1 cm (equivalent to 0.394 inches)

100cm = 1m (equivalent to 39.37 inches)

1000m = 1km (equivalent to 0.621 miles)

Area: 10 000 m² = 1 ha (equivalent to 2.47 acres)

Density: 1 000 ng/l = 1 ug/l (equivalent to 3.53 x 10⁸ ounces)

1 000 ug/l = 1 mg/l (equivalent to 3.53 x 10⁵ ounces)

Flow: 1 000 l/s = 1 m³/s (equivalent to 35.31 cusecs)

1 000 m³/d = 11.6 l/s (equivalent to 0.41 cusecs)

1 Ml/d = 11.6 l/s (equivalent to 0.224 mgd)

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RIVER KENNET CATCHMENT MANAGEMENT PLAN
NATIONAL RIVERS AUTHORITY, THAMES REGION
KING'S MEADOW HOUSE, KING'S MEADOW ROAD
READING, BERKSHIRE RG1 8DQ

MARCH 1993