



THE WARWICKSHIRE AVON CATCHMENT MANAGEMENT PLAN CONSULTATION REPORT



NRA

*National Rivers Authority
Severn-Trent Region
March 1994*

NATIONAL RIVERS AUTHORITY
SEVERN TRENT REGION

National Rivers Authority
Information Centre
Head Office
Class No
Accession No *AKAR*

WARWICKSHIRE AVON CATCHMENT MANAGEMENT PLAN
CONSULTATION REPORT

The Information Centre
National Rivers Authority
Waterside Drive
Aztec West
Almondsbury
Bristol BS12 4UD

Due for return

5/7/94

23/11/95

National Rivers Authority
Lower Severn Area
Riversmeet House
Newtown Industrial Estate
Northway Lane
Tewkesbury
Glos
GL20 8JG

"The current that with gentle
murmur glides."

William Shakespeare



This report

and Board



Warwickshire Avon Catchment Management Plan Consultation Report

March 1994

FOREWORD

The National Rivers Authority was created in 1989 to preserve and enhance the natural water environment and to protect people from flooding. In its role as 'Guardian of the Water Environment', the NRA is committed to preparing a sound plan for the future management of the region's river catchments and consulting with those who have an interest.

This Consultation Report is the first stage in this process for the Avon Catchment. It provides a framework for consultation and also a means of seeking commitment from those involved to realise the full environmental potential of this special catchment.

We look forward to receiving comments and contributions from interested organisations and individuals. These will enable a Final Plan to be produced, balancing the conflicting demands placed upon the natural water environment.

Richard Bailey
Area Manager
Lower Severn Area

WARWICKSHIRE AVON CATCHMENT MANAGEMENT PLAN
CONSULTATION REPORT

CONTENTS

		<u>PAGE No.</u>
	CONCEPT	1
1.0	OVERVIEW	4
1.1	Introduction	5
	1.2 Geology	5
	1.3 Hydrology	6
	1.4 Monitoring Network	6
	1.5 Flood Defence	6
	1.6 Water Resources	7
	1.7 Water Quality	8
	1.8 Fisheries	10
	1.9 Land Use and Landscape	11
	1.10 Conservation	11
	1.11 Recreation	12
	Catchment Details	14
2.0	VISION FOR THE CATCHMENT	15
3.0	ISSUES AND OPTIONS	
	3.1 Changes in ecology of the river by increasing nutrient levels derived from sewage effluents and agricultural discharges.	18
	3.2 Cches with River Quality Objectives.	21
	3.3 Effect of agricultural activity on compliance with EC Directive on quality of water abstracted for drinking water and general river ecology.	27
	3.4 Pollution of rivers and groundwater arising from urban storm overflow incidents.	30
	3.5 Pollution of rivers and groundwater arising from contaminated land sites and industrial sites.	33

	<u>PAGE No.</u>
3.6 Determination and enforcement of consent conditions for major sewage treatment works	36
3.7 Pollution from inadequate rural sewerage.	38
3.8 Water quality and contact sports.	41
3.9 Foaming at Weirs in the Lower Avon.	42
3.10 Water Quality issues associated with canals and river navigation.	43
3.11 Operation of the Avon sluices for maximum benefit to river users.	45
3.12 Inadequate definition of the flood plain.	46
3.13 Control of development, including caravan sites, in flood plain.	48
3.14 Flooding problems on ordinary watercourses.	50
3.15 Extensions to Main River.	52
3.16 Flood alleviation schemes on Main River.	53
3.17 Maintenance of weirs and other structures.	55
3.18 Increased pressure for the development of hydropower.	57
3.19 Responsibility for Flood Defence duties and powers.	59
3.20 The effect of sand and gravel extraction from the Avon Valley.	60
3.21 Assessment of the water resources capacity of the Cotswold Limestones and Offenham River Gravels.	62
3.22 Abstraction licence policy in the Coventry Groundwater Unit.	64
3.23 Groundwater abstractions for potable supply affecting surface water flows in the River Sherbourn and Bow Brook.	65
3.24 Lack of water for spray irrigation in summer months.	67
3.25 Improved data required for better management of flood warnings, low flows and the setting of consents to discharge to watercourses.	69
3.26 Specification of environmental requirements of the river and its plant, animal and fish life: setting prescribed conditions.	71
3.27 Low flows in the Upper Avon.	73
3.28 Diversion of sewage treatment works flows to lower reaches of the catchment.	76
3.29 Loss of supply water and river support in the Lower River Leam.	78
3.30 Creation of a Management Strategy to resolve conflicts between Recreation, Navigation and Conservation Uses and to ensure sustainability of the resource.	80
3.31 Conservation and rehabilitation of river corridors.	83

	<u>PAGE No.</u>
3.32 Requirement for a review of European Community (EC) designated areas for salmonid and cyprinid fisheries.	87
3.33 Licence evasion and unlawful fishing during the close season particularly in the Coventry area.	88
3.34 The protection and improvement of Trout, Coarse Fish and Eel Stocks.	89
3.35 Effect of the water environment of urban and infrastructure development.	91
3.36 Changes in Local Government Structure.	94
APPENDIX 1 Catchment Uses	96-138
APPENDIX 2 Catchment Targets and Current Status	140-160
APPENDIX 3 Flood Defence Roles	161-163
APPENDIX 4 Model Policies for use in Development Plans	164-166
APPENDIX 5 River Quality Objectives (National Water Council Classification)	167-168
APPENDIX 6 Biological Classification of Rivers	169-170
APPENDIX 7 Lists of Organisations responding to issues consultation	171
APPENDIX 8 NRA Personnel involved in report preparation	172
APPENDIX 9 Glossary	173-175

**FOLLOWING
PAGE No.**

MAPS

1 Catchment Location	3
2 Avon – River network and sub-catchments	4
3 Location of river level and flow measurement stations	6
4 Administrative boundaries	96
5 Infrastructure	100
6 Flood Alleviation and Warnings	100
7 Structure locations	102
8 Ecology	103
9 Landscape, heritage and ancient monuments	106
10 Recreation and navigation	108

11	EEC Fishery waters and other fisheries
12	Surface water abstractions
13	Groundwater abstractions
14	Sewage and industrial discharges
15	Landuse
16	Mineral sites
17	Tip sites
18	River Quality Objectives
19	Present River Quality (1992)
20	River Quality (1990)
21	Biological Quality
22	Pollution incidents
23	Groundwater vulnerability
24	Groundwater units
25	Licence Policy areas
26	Dry Weather Flow
27	Flood Defence Land Use Bands
28	Main River

Fig. 1 Fishery Survey results between Warwick and Tewkesbury

**FOLLOWING
PAGE No.**

112

117

119

128

131

135

137

145

146

146

146

146

147

149

151

153

156

159

157

CONCEPT OF THE CATCHMENT MANAGEMENT PLAN

CONCEPT

The National Rivers Authority (NRA) is the major environmental agency responsible for safeguarding and improving the natural water environment of England and Wales. Its responsibilities are wide and include:-

- * Control of pollution and improving the quality of rivers, canals, groundwaters and coastal waters.
- * Flood defence, including the protection of people and property.
- * Flood forecasting and flood warning.
- * Effective management of water resources.
- * Maintenance, development and improvement of fisheries.
- * Promoting the conservation of the natural water environment.
- * Promotion of water-based recreation.

A river catchment is a discrete geographical area which is drained by a single surface water system. The 21,600Km² covered by the Severn Trent Region of the NRA consists of only two principal catchments, the River Severn and the River Trent. Because of their large surface area they have been divided for management purposes, into sub-catchments.

Catchment Management assists the NRA to use its powers and work with others to ensure that the rivers, lakes and underground waters are protected and where possible improved for the benefit of future

generations. River catchments are subject to increasing use for a variety of activities. Many of these interact and some conflicts arise. The competing requirements and interests of the users must be balanced.

This Consultation Report highlights options and actions required to address the major issues in the Avon Catchment. The report is laid out as follows:

Catchment Overview

This section summarises the key uses and present situation in the catchment. It also gives a brief introduction to the regional objectives.

Vision for the Catchment

A short summary of how the NRA would wish to see the Avon Catchment in the future.

Issues and Options

This section is the most important part of the plan. The nature of the problems are discussed and the impact on uses and conflicts between them are considered. Options for resolving these problems are suggested together with the benefits and constraints. The bodies responsible for actions required are also identified together with priority sites.

Appendices

Appendix 1 details the Uses of the Catchment while Appendix 2 describes the Current State of the Catchment and relevant targets. Other technical appendices are included for reference.

Consultation

This report is intended to form a basis for consultation between the NRA and all those with interests in the catchment. Consultees may wish to:

- * comment on the issues and options identified in the report
- * suggest alternative options for resolving identified issues
- * raise additional issues not identified in the report
- * comment on priorities and relevant sites for action.

Following the consultation period all comments will be considered in preparing the Final Plan. Timescales, targets and estimated costs will be added to the plan at this stage. This will then form the basis for the NRA's actions within the catchment. It will also provide a public document which will form the framework for the NRA's action with other organisations.

The NRA intends that the Plan should influence the policies and action of developers and planning authorities as well as assisting in the day to day management of the catchment.

We have tried to avoid technical terms as far as possible. However

an explanation of some of the technical terms that remain can be found in Appendix 9 at the end of this plan.

A short issues document was sent to Local Authorities, National Organisations and other representative bodies in November 1993. Their comments have been incorporated into this document where possible. A list of organisations which have commented is given in Appendix 7.

The NRA is grateful for the useful suggestions received.

Comments on the consultation report should be sent to:

**Dr R A Bailey
NRA Lower Severn Area
Riversmeet House
Northway Lane
Tewkesbury
Gloucestershire
GL20 8JG**

All contributions should be made in writing by: 28th June 1994

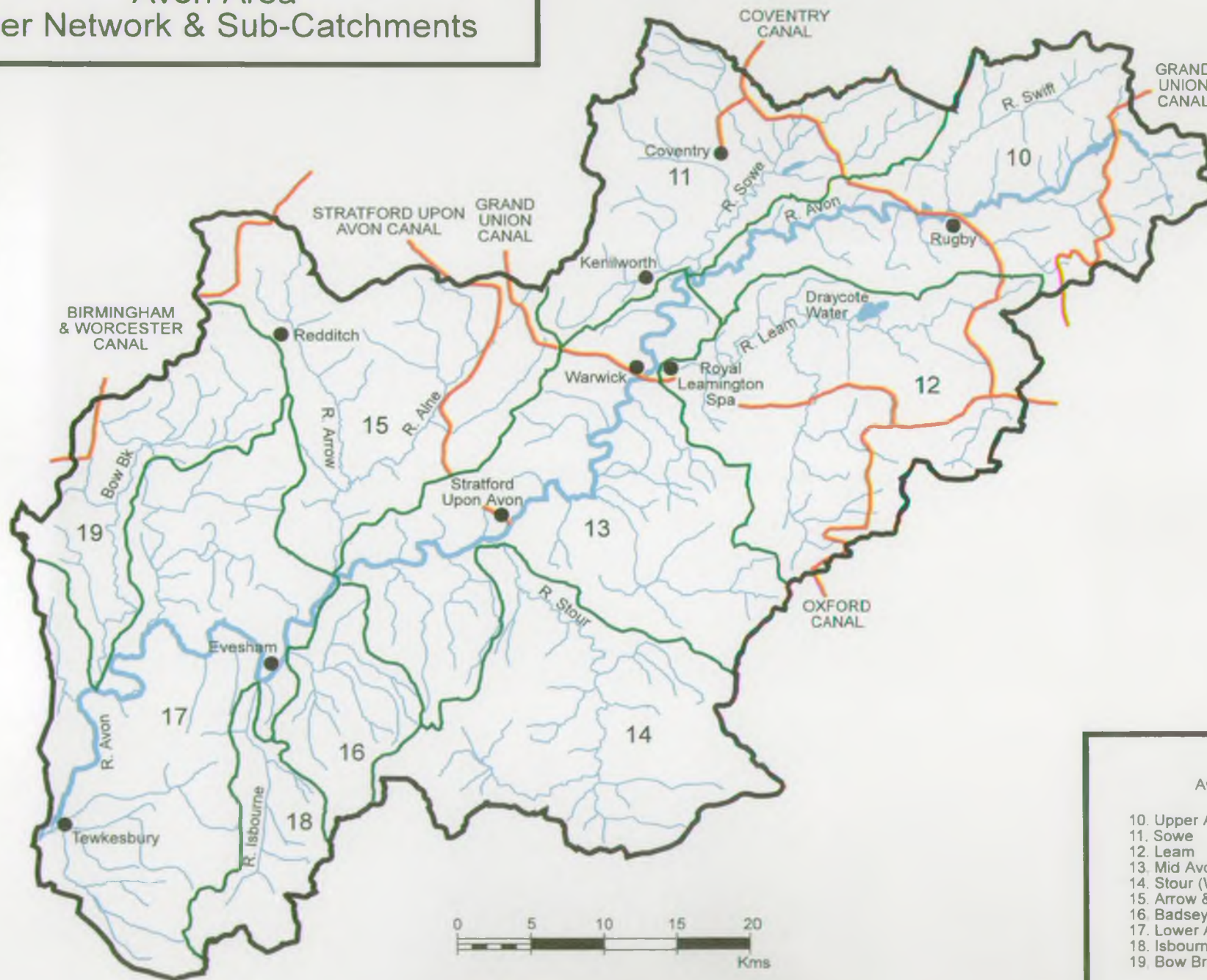
If you or your organisation want further information, discussions, exhibition material or speakers please contact Roger Wade at the above address or by telephone on 0684 850951.



SECTION 1
CATCHMENT OVERVIEW

Avon Area River Network & Sub-Catchments

Map 2



Avon Sub-Catchments

- 10. Upper Avon (above Sowe Confluence)
- 11. Sowe
- 12. Leam
- 13. Mid Avon (Sowe confluence-Bidford)
- 14. Stour (Warwickshire)
- 15. Arrow & Alne
- 16. Badsey Brook
- 17. Lower Avon (Below Bigford)
- 18. Isbourne
- 19. Bow Brook

1.0 CATCHMENT OVERVIEW

1.1 Introduction

The source of the River Avon is near the Civil War battlefield of Naseby (190m AOD) on the Northamptonshire and Leicestershire borders. From here it flows in a South Westerly direction towards Stratford and Evesham, finally joining the River Severn at Tewkesbury after a distance of 179km. The main tributaries are the Rivers Leam and Arrow. Important smaller tributaries are the Rivers Sowe, Stour, Isbourne and Dene and the Badsey and Bow Brooks.

The Avon Catchment drains an area of approximately 2,900 km² and is mostly rural in character, although the City of Coventry and the towns of Rugby, Leamington, Warwick, Stratford, Evesham, Lutterworth, Kenilworth and Redditch all lie within the catchment. The population of the catchment is around 900,000 of whom some 600,000 live upstream of where the M40 crosses the river near Warwick. Full details of the administrative boundaries and population together with proposals for development contained within local plans are given in Appendix 1.1.

The Avon is a river of great natural beauty representing the very best in English landscape. It provides the perfect habitat for a wide range of birds, such as the kingfisher and the marsh warbler. Many riverside plants, mammals and trees thrive in the catchment. Throughout its route the Avon is therefore recognised as a river of very special environmental importance.

The Avon is a major amenity enjoyed by many thousands of people and between Tewkesbury and Stratford the river is extensively used by canal holiday boats. Along the whole river the local economy benefits greatly from the tourism which the river generates. The

Avon is a major coarse fishery and has been the venue for the World Coarse Fishing Championships.

The river and tributaries have often been used as a source of water supply as well as a source of power. The protection of water resources from the effects of urbanisation and modern agricultural practises is very important in the Catchment. The river banks and floodplain also need protection. The environment has been adversely affected in the past by development, river drainage practices, use of pesticides and herbicides and extensive recreational use.

While there are undoubtedly many problems to overcome, the river is in a better condition now than it has been for many decades. Only 20 years ago there were no fish immediately below Rugby or the Sowe confluence at Coventry. Banks of foam were a common sight. Today there are fish along the whole river and foaming is restricted to small patches below weirs.

1.2 Geology

Impermeable clays and mudstones dominate over 80% of the Catchment. The clays are found south east of a line running from Tewkesbury northeastwards through Stratford-upon-Avon to the north of Rugby. To the northwest of this line lie the Mercia Mudstones. Both the clays and the mudstones provide only small quantities of groundwater, usually obtained from the minor sandstone bands in the mudstones and thin limestone beds in the clays. This predominant impermeable geology leads to fast run-off under heavy rainfall and low flows in summer with implications for flood defence, river quality and water resources.

For the remaining parts of the catchment more permeable strata occur which, in many places, provide important underground water supplies. Sherwood Sandstones are found in small areas to the west of Redditch and outcropping in a long narrow strip running from Warwick northeastwards to the immediate east of Coventry city centre. The sandstones are also found at depth in the Stratford-upon-Avon area. Rocks of the Permo-Carboniferous age, comprising many thick sandstone beds, are found extensively in the Coventry-Meriden-Kenilworth area. Along the southeastward part of the catchment limestones of the Inferior Oolite Series form the highground of the Cotswolds Edge.

Over-abstraction of groundwater has led to low flows in the upper reaches of Bow Brook and on the River Sherbourne at Coventry. A major groundwater resource lies directly beneath Coventry and this has been contaminated in places by waste disposal from industrial processes.

1.3 Hydrology

There is little variation in average rainfall across the catchment. Rainfall is recorded at 11 intensity rain gauge sites. The range is from 600mm/year at Milcote to 752mm/year at Chipping Campden. The average catchment rainfall is 672mm/year and the normal loss through evaporation is 464mm/year.

The effective rainfall, together with the inputs from large sewage works such as Coventry, provide an average flow of 2,660 million litres per day (Ml/d) at the confluence with the Severn at Tewkesbury. This is some 30% of the average flow of the River Severn at Gloucester.

The average July soil moisture deficit of 80mm means that in most

years irrigation is required for crops in the catchment.

With the variation in geology, rivers have different low flow characteristics. The dry weather flow in the Arrow, for example, is three times higher on a proportional basis than in the Bow Brook. During dry weather, flows rapidly fall away causing concern for water resources, water quality and fishing interests.

1.4 Monitoring Network

Within the Catchment there are 12 flow gauging stations, 8 level gauges, 11 intensity rain gauges and two water quality monitors which record continuously. (Map 3). The data is captured by a computer controlled system at Regional Headquarters, Solihull.

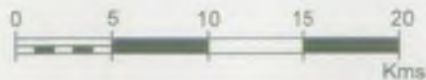
In addition to these continuous recordings some 8,000 chemical samples and 500 biological samples are taken each year to monitor the state of the catchment.

1.5 Flood Defence

The Avon and its tributaries are prone to regular flooding which is not confined to winter months. Floods of note occurred in 1900, 1936, 1947, 1960, 1968, 1979, 1981, 1992 and 1993.

The NRA's flood defence powers relate to the control of structures on all watercourses, and the carrying out of maintenance and improvement schemes on Main River. The extent of main river is shown on Map 28 (Appendix 2).






Locations of River Level, Flow Measurement & Rainfall Telemetry Stations



Map 3



Key

	Flow Measurement Station With Telemetry
	Level Measurement Station With Telemetry
	Level Measurement Station Without Telemetry
	Rainfall Telemetry Stations
	Flow & Quality Measurement Station

In addition to records at gauging stations, there are flood level records at most bridges on the Avon and all its major tributaries. Aerial photographs were taken of the 1968, 1979, 1981 and 1992 floods on the Avon, on the Leam in 1979 and on the Swift in 1992. On watercourses which are not main river ('ordinary watercourses'), information is not so detailed and the extent of flood plains has not been mapped.

There are 13 established flood alleviation schemes in the Avon Catchment protecting over 250Ha of land and more than 300 houses and businesses. The locations of these schemes is given in Appendix 2.(Map 6).

There are 514km of main river in the Avon Catchment. While most main river urban flooding has been reduced by flood alleviation schemes the problem of frequent flooding on ordinary watercourses still exists. One significant issue is the consideration by the NRA of including problem watercourses as extensions to the main river network.

Where flood alleviation schemes are not practicable, and where catchment response times allow, a flood warning scheme operates to lessen the damage from floods. Warnings are issued by the NRA on the Rivers Avon, Leam, Stour and Arrow. Map 6 in Appendix 2 shows the warning reaches.

The NRA maintains sluices on the Avon and Arrow to control flood water and, where applicable, maintain water levels within navigable limits for as long as possible. It also undertakes work in main river channels including dredging, tree and brush work, debris removal and weed cutting. These all help to maintain the flow capacity of the river.

The NRA issues consents for structures in, over, under or near a watercourse and works through the Local Planning Authority to control developments in the flood plain or those likely to cause flooding problems. Of special interest in the Avon Catchment at present is development around the River Swift at Rugby, mixed development draining to minor watercourses at Stratford, continuing expansion of Redditch New Town and substantial development at Tewkesbury where flood plain storage is at risk.

The numerous road schemes with their consequent problems of watercourse crossings and increased run-off are of concern. Examples are the M1-A1 link, M1 widening, M6 widening, Norton Lenchwick By-pass, and the A435 and A46 improvements.

1.6 Water Resources

Surface waters and groundwaters are extensively abstracted across the Avon Catchment. There are a total of 1,548 abstraction and impoundment licences, of which 753 relate to surface waters and 795 are from groundwater. The volumes licensed for abstraction are 79,532 million litres per annum (Ml/a) for surface water and 50,074 Ml/a from groundwater giving a total potential abstraction of 129,606 Ml/a. The main uses of surface waters are public water supply (68%), cooling water (11%) and spray irrigation (10%). Groundwater uses are public water supply (76%), industrial (13%), mineral washing (6%) and spray irrigation (2%). For surface abstraction licensing purposes the Avon is split into 10 hydrometric sub-catchments and the number and type of licence issued in each is given in Appendix 2. The sub-catchments can be divided into categories of criticality depending on the extent of abstraction, dry weather flow and impact on the environment. The Upper Avon, Leam, Badsey Brook and Bow Brook are very critical and are either

closed for new licences or restricted to winter use only. In the Sherbourne, Arrow and Isbourne new licences can only be used when the flow in the river is greater than that which is considered adequate to protect the river's uses (a prescribed flow). There are no restrictions at present on the Middle or Lower Avon as the flows here are greatly enhanced by discharges from sewage works further up the catchment. The main sewage works discharge at Finham near Coventry adds around 120 million litres per day (ML/d) of water initially abstracted from the River Severn.

The Upper Avon is a critical sub-catchment owing to abstraction for water supply and diversion of water to canals. Water is taken directly from the Avon at Stanford Reservoir and a further abstraction takes place just above Rugby at Brownsover. In the Upper Avon water is also diverted into the British Waterways canal system under old agreements, such as the Bevan James Agreement of 1811. While these are primarily agreements between Severn Trent Water and British Waterways, the NRA tries to ensure the environment is not affected. The NRA has no direct control over British Waterway's abstractions.

Two major water supply intakes are found on the River Leam, one feeding Draycote Reservoir and the other at Leamington. Draycote is filled during the winter and can then be used to support the River Leam to allow abstraction at Leamington in the summer.

The Badsey Brook is a critical catchment as there are 158 licences for spray irrigation on what is a comparatively small river. Most of these licences are Licences of Right which means they cannot easily be restricted. The licensed volume is greater than the dry weather flow in the river. The water is primarily used for extensive horticultural activity in the Vale of Evesham.

The major groundwater areas in the Avon Catchment are shown in Appendix 1 (Map 24). For management purposes there are nine groundwater units within the Avon Catchment and the resource capacity has been assessed on the units of Sherwood Sandstone and the Coal Measures near Coventry and Warwick. No assessment of capacity has yet been made of the Cotswold Aquifer.

Three of the nine units are currently considered to be over abstracted and no further licences will be issued in the Bromsgrove, Coventry or Avon Confined units. This over abstraction has led to low flows in the upper reaches of the Bow Brook at Redditch and the Sherbourne through Coventry.

Coventry is one of the last cities in the Midlands where significant quantities of drinking water are still obtained from local groundwater sources.

1.7 Water Quality

The Avon is essentially a lowland river characterised by a large population in the upper catchment. It is the sewage effluent derived from these settlements that provides the bulk of the flow under dry weather conditions. This can be as much as 80% of the flow for the upper Avon and is still 40-50% of the flow at Tewkesbury. The impact of sewage effluent on the river has led to the catchment being nominated for sensitive area status under the European Community Urban Waste Water Directive (EC)*.

* Note - While the European Community is now called the European Union all relevant Directives have 'EC' as part of their designation title. For the purposes of this report the European Union will remain the European Community.

Within the Avon Catchment, 996km of rivers and canals are classified for water quality purposes. Most of the rivers are Class 1B or 2 (402 and 534km respectively) which is a good or fair quality. 33.5km are very good (Class 1A) and 30.7km poor (Class 3). Full definitions of the classification by sub catchment are given in Appendix 2 (Table 7). These classifications are based on 1992 quality data and are presently being updated to allow for the use-related classification associated with Statutory Water Quality Objectives (see Appendix 2).

In 1992 85km of river failed to meet quality objectives. Of these 50.2km were new failures since 1990. There are currently capital schemes in progress that should remedy some of the failures caused by sewage treatment works in 1990. Newer failures caused by sewage treatment works are unlikely to be remedied unless there is a requirement to meet quality conditions under an EC Directive. This is due to the tighter financial framework which is being imposed by the Government on water company expenditure. Any expenditure to improve water quality above that required to meet statutory obligations will have to be approved by the water industry's financial regulator OFWAT and the Department of the Environment.

Biological water quality (as measured by the distribution and occurrence of pollution sensitive and insensitive macro invertebrates) is generally good (Class 1A or 1B) in the River Avon throughout its length except at two sites, (Little Lawford and Ashow) which are affected by sewage effluent. Twelve of the sixteen biological monitoring sites are of higher biological than chemical class especially in the lower reaches.

The Rivers Isbourne, Itchen, Leam, Dene and the Bow and Finham Brooks are all of good biological water quality (Class 1B). The Rivers Arrow and Swift and the Badsey Brook are of moderate

quality (Class 2).

The Rivers Alne, Stowe and Stour are all generally of better biological quality than their chemical classification. However, the Rivers Sherbourne, Sowe and Cam and the Bretforton, Cow Honeybourne, Gran, Marchfont and Noleham Brooks have poorer biological quality than expected from their chemical classification. There are a number of factors which give rise to this effect on biological quality including urban run-off, sewage effluents, agricultural inputs and run-off.

The 137km of canals in the catchment include the Stratford, Worcester and Birmingham, Coventry, Grand Union and Oxford canals. Pleasure boating on canals and the Avon between Stratford and Tewkesbury gives rise to some oil and sewage disposal problems. The canals themselves are fairly static water bodies and are prone to blue-green algal blooms. Overflows from the canals may then affect the Avon. As the Avon exists for much of its length as a series of interconnecting lakes, it has also been classified in recent dry summers as blue-green algae positive. The Upper Avon is also a sensitive sub-catchment in this respect. Blue green algae may be toxic to man, harmful to wild life and give rise to treatment problems for abstracted water.

The possible extension of navigation on the River Avon upstream of Stratford is of concern, as the reach from Barford to Tiddington is the one remaining stretch where the river enjoys its original course and this provides much-needed self purification.

Protecting the surface water abstractions on the Avon and Leam is of major importance in the catchment. There is an increasing risk of spillages resulting from motorway accidents (Junction. 19-M1/M6/A1 intersection is immediately over the River Avon). There

is also the threat of pesticides and nitrates from agricultural point discharges and diffuse run-off. For example, there is a significant seasonal nitrate problem on the River Leam.

High nitrate levels are also found in some groundwater sources. The major concern for groundwater, however, relates to problems from land contaminated by industrial processes such as metal finishing, historic tipping and petrol storage.

There are 373 consented discharges of sewage, storm overflows, pumping stations and village drains issued to Severn Trent Water.

There are 420 private sewage discharges, 69 consented industrial discharges and around 150 agricultural discharge consents in the Catchment.

Between 1991 and 1993 there were approximately 2,500 reported pollution incidents in the catchment of which around 90 were considered to be major incidents.

1.8 Fisheries

The River Avon is recognised as an important coarse fishing venue by angling clubs and individual pleasure anglers alike. Over most of its length the river supports healthy populations of both coarse fish and eels. The eels are caught by both rod and line anglers and commercial fishermen who use licensed fyke nets, putcheons and eel weir traps. For many years the river has been an important match venue and the World Championships were held at Luddington (between Stratford and Evesham) in 1981.

Several tributaries of the Avon, such as the Alne, Stour, Isbourne and Bow Brook contain stable mature wild brown trout populations,

especially in their upper reaches. Some rod and line fishing for these trout is carried out, but the majority of trout anglers are to be found on stillwaters in the catchment. Reservoirs and lakes of suitable quality can be stocked with trout, often rainbow trout, and make very popular trout fishing venues. Draycote Reservoir near Rugby is an example of such a water.

Within the Avon Catchment there are 401km of river and canal designated under the EC Fisheries Directive as cyprinid (coarse) fishery. The majority of classified water is on the Avon itself although the Leam is also a significant fishery.

There are 71km of designated salmonid fishery within the Alne, Stour and Isbourne.

Designated EC fisheries are shown on Map 11 in Appendix 1.8.

During the 1992-93 season, 76 Angling clubs were known to lease, rent or own water on the main River Avon between Rugby and Tewkesbury. Most fishing rights are in private ownership though the NRA does own the rights to some sections of the Avon.

Fish populations are very much dependent on the variety and quality of the habitat and the quality and quantity of water present. The control of demand for water and the maintenance of water quality standards are therefore of paramount importance to fisheries. Low flows have been identified as a problem in the Avon and a number of its tributaries, and long term solutions are needed to alleviate these problems.

The quality of waters supporting both salmonid (trout) and cyprinid (coarse) fish should be maintained to comply with standards set in the EC Fisheries Directive. Fish populations will be monitored and

managed where necessary to maintain the fishery potential.

Fishery habitat has been degraded in the past by the construction of weirs, use of the river for navigational purposes, and bankside and channel works for flood alleviation purposes. Some of the resident coarse fish spawn on submerged aquatic plants, others over or in gravel. These spawning and nursery areas need to be protected from disturbance at critical times of the year. Trout spawning gravels on some tributaries have been degraded by sedimentation and improvement of these gravels is planned for example the River Alne, by fencing to prevent cattle poaching and by scarification of the gravels.

1.9 Land Use and Landscape

The Avon Catchment lies to the south of the Midlands conurbation and it is bounded to the south by the northern scarp of the Cotswolds.

The main Avon valley is broad and meandering, flowing through a large floodplain, but occasionally constrained by steep wooded hills. Intrusions of sand and gravel occur and these have given rise to extensive extractions.

The Catchment has some of the finest stretches of natural lowland river habitat anywhere in the Midlands and has an extremely varied character.

While in urban areas the river is straightened and channelled, it also has some of the most scenic reaches on any British river. In some parts there is no public access and this results in very quiet, secluded and undisturbed habitats.

Predominantly rural, the river basin landscape is characterised by an agricultural and parkland landscape with a settlement pattern of small villages. Many are of high conservation value, carrying conservation area or archaeological designations.

Early settlements were clustered along rivers as communication links, focusing on the location of bridging points and the use of water for power. The Stour, for example, abounds in mills and control structures, many of which have now fallen into disrepair.

The northern tributaries are protected in part by green belt and landscape designations; to the south of the main Avon, protection is afforded by the Cotswold Area of Outstanding Natural Beauty and further landscape designations.

Satellite photography shows 7 % of the catchment to be urban, 49% arable and 31% grassland. Full details of landscape designation and land use are shown in Appendix 1, Maps 9 and 15.

1.10 Conservation

The catchment is of high conservation value with rich flora and fauna. It supports a wide variety of habitats, including woodland, scrub, parkland, marshy grassland, water meadows, marsh, reedbed and natural rock exposures.

The quality of habitat improves generally towards the headwaters of the tributaries and away from settlement and the availability of public access.

The most special areas for nature conservation, Sites of Special Scientific Interest (SSSI's), occur mainly in the more remote parts, away from the main Avon, with the exception of those related to the

River Avon marsh warbler habitat. Of the 89 SSSI's in the catchment, 55 are water dependent.

By contrast, the distribution of the county prime sites shows clearly that all watercourses are valuable nature conservation resources.

The rivers are abundant in plant communities, both submerged and emergent. Particularly notable are the widespread growths of yellow water lily, common clubrush, arrowhead and amphibious bistort.

Birdlife is rich. Kingfishers and herons are seen frequently and the catchment supports a varied bird population, including mute swan, mallard, moorhen, coot, snipe, curlew and lapwing. In the lower catchment, the very rare marsh warbler still maintains a small population.

The creation of appropriate habitat and artificial holts has recently encouraged the return of the otter to the catchment.

The catchment is known generally to provide excellent invertebrate habitat. Within the last few years, the rare club-tailed dragonfly has extended its range from its previous territory on the Severn to the Lower Avon as far upstream as Evesham.

The Upper Avon and tributaries are small to medium sized rivers, naturally well-vegetated, but too often showing the impact of man's presence in loss of habitat and degraded channel profiles.

The lowland agricultural landscape of the flood plain and river basin is predominantly pastoral, but intensifies in the horticultural holdings of the Vale of Evesham. Agricultural practices have, over the years, encouraged a loss of bank and marginal habitat, and all forms of river-related vegetation, such as wetland, marsh or reedbed.

The use of fertilisers, herbicides and pesticides to boost productivity and diffuse pollution from silage and slurry storage may have affected the ecology of the Avon and its tributaries. Wildlife cover in the form of hedgerows, scrub, copses and banktop vegetation has been lost.

1.11 Recreation

The catchment provides an easily accessible recreational resource for the West Midlands conurbation.

The Avon itself is navigable by means of locks to Alveston, immediately up-stream of Stratford. The Avon ring provides a useful circular route by using the Grand Union or Stratford Canals, the Worcester and Birmingham Canal and the River Severn, resulting in a total loop of 109 miles.

Boat traffic is heavy, particularly in summer, and speed limits are frequently disregarded, resulting in eroded banks and a loss of marginal vegetation. Active recreation such as sailing and canoeing occurs sporadically as far upstream as Warwick, often highlighting conflicting objectives between recreational uses and the natural environment.

Angling is a major recreational activity presenting its own conflicts in terms of bank erosion and vegetation loss. During the fishing season, watercourses are lined with both match and pleasure anglers.

A number of caravan sites are located in the floodplain of the Avon as well as some of the tributaries. They may be visually unattractive and take up some of the best watermeadows. These sites are at risk from flooding and may increase flooding elsewhere.

Footpath access to the Avon is restricted. Few linear footpaths exist, probably due to the pattern of land ownership and agricultural holdings.

Human intrusion, through navigation, angling, and other forms of access puts pressure on habitat and wildlife. One activity is often in conflict with another, for example, angling and navigation or recreational access with nature conservation.

The management of the catchment is vital to provide a sustainable resource to all users.

WARWICKSHIRE AVON

CATCHMENT DETAILS

Area 2,893 km²
Population (Estimate) 912,000

TOPOGRAPHY

Source of Avon 190m (AOD)
Confluence with Severn 11m (AOD)
Highest point in Catchment 330m (AOD)

MAIN TOWNS AND LANDUSE

Main towns and cities are Coventry (300,000), Warwick and Leamington (73,000), Redditch (62,000), Rugby (60,000) and Stratford (21,000).

The urban area accounts for 7% of the catchment while 49% is arable and 31% is grassland.

WATER QUALITY

Length of river in National Water Council Class, comparing present Quality with River Quality Objective (RQO).

<u>Present Quality(km)</u>	<u>ROO (km)</u>	
Class 1A (Very Good)	33.5	27.5
Class 1B (Good)	402.8	468.8
Class 2 (Fair)	534.4	499.4
Class 3 (Poor)	30.7	8.5
Class 4 (Bad)	None	None

Number of Discharge Consents 1012
comprising:-

373 sewage and storm overflows (water undertaker)
420 private sewage works
69 industrial
150 agricultural.

WATER RESOURCES

Average annual rainfall 672 mm/year
Total licensed abstraction 208,606 Megalitres per year
Mean flow of Avon at Tewkesbury 2,660 Megalitre per day

Number of licensed abstractions 1,548
of which:-
Groundwater 795
Surface water 753

FLOOD DEFENCE

Length of main river in catchment 514 Km
No. of Flood Alleviation Schemes 13
Operational sluices/pumping stations 10

FISHERIES

Length of watercourse designated under EC Directive for Freshwater Fisheries (78/659 EEC)

Salmonid 71.4 Km
Cyprinid - River 263.0 Km
- Canal 138.0 Km

CONSERVATION

Sites of Special Scientific Interest 89
(Water based 55)

SECTION 2

CATCHMENT VISION

- * To ensure water quality is appropriate for the current and potential uses of the Catchment and the River Severn downstream of the confluence at Tewkesbury.
- * To reduce nitrate and phosphate input from sewage treatment works and agricultural sources such that the ecology of the river is closer to the natural state and to reduce the potential for blue-green algae formation.
- * To ensure that present and future navigation operations do not adversely affect the ecology of the river.
- * To ensure that the flow in the watercourses is not taken below an environmentally acceptable level by abstractions from the river or groundwater sources.
- * To ensure legitimate water resource demands are met where possible.
- * To ensure that the river corridor and groundwater resources in the catchment are protected from the effects of new development by close liaison with Local Authorities and developers.
- * To ensure that new development does not increase the risk of flooding by increased run-off or loss of flood plain.
- * To provide flood defences to people and property at risk of flooding where this is cost effective and environmentally acceptable.
- * To maintain and develop the existing good coarse and trout fisheries and to improve eel stocks by the provision of eel

and elver passes.

- * To enhance wildlife and see otters common throughout the Avon Catchment.
- * To seek removal of unsatisfactory storm overflows in urban areas.
- * To identify and work towards the elimination of pollution from contaminated land.
- * To maintain weirs and other structures which are essential for navigation and conservation interests by assisting the owners in all practicable ways.
- * To encourage further recreation and conservation use of the catchment where this is compatible with other uses of the river.
- * In all areas to work towards a sustainable water environment in the Avon Catchment.

SECTION 3

ISSUES

Issues have been identified in four ways:-

- (1) By comparing targets with the current state of the catchment (see Appendix 2).
- (2) By consideration of pollution incidents, flooding complaints and resource deficits.
- (3) By an 'issues' consultation process with selected organisations within the catchment.
- (4) By utilizing the local knowledge of NRA staff.

While many issues cover all the NRA's functions they have been grouped according to the function with most involvement as follows:-

Issues 1-10 Water Quality and Pollution Control.
Issues 11-19 Flood Defence.
Issues 20-29 Water Resources.
Issues 30-35 Fisheries, Conservation, Recreation.
Issue 36 Planning Liaison.

There is no implied order of priority in these issues.

3.1 Changes in the ecology of the river by increasing nutrient levels derived from sewage effluents and agricultural discharges.

Nature of the Problem

Over the past few decades, the River Avon Catchment has been the subject of diverse and intense urban, rural and agricultural development. As a result, both water use and nutrient rich waste discharges have increased substantially. The resulting process (Eutrophication) has changed the ecology of the main river and some of its tributaries, particularly the Rivers Arrow, Leam, Dene and Bow Brook.

In recent dry summers low river flows have caused the River Avon to resemble a series of impoundments behind the many locks and weirs. Under these conditions the combination of decreased flow rates and increased nutrient levels has allowed algal blooms to develop.

The Avon and Arrow were watercourses proposed as Candidate Sensitive Areas under the provision of the European Community Urban Waste Water Directive. Confirmation of the final list of the UK Sensitive areas is awaited from the Department of the Environment but both rivers are expected to be included. Designation will require the installation of phosphate removal plants at the larger sewage treatment works in the catchment.

Impact on Uses and Conflicts

The increase of nutrient in a watercourse leads to increased growth of plants and algae. The increase in plant growth may constrict channels and restrict the potential for navigation. Algal blooms lead

to discolouration of the water and may be seen as floating algal mats. They may also cause daily variations in the concentrations of dissolved oxygen leading to fish distress or death. The decay of plants and blooms may also cause a depletion in oxygen levels.

Where the algal blooms are of blue-green type the aesthetic appearance of a waterbody is often affected by the presence of scums. The recreational and amenity use of affected waters, especially for water contact sports such as canoeing and sailboarding, may be restricted or prohibited due to the public health risk. Scums clog anglers' nets and adhere to lines and floats causing a nuisance.

Waters affected by blue-green algal blooms are difficult to treat for water supply purposes and the algae may impart unpleasant tastes and odours to drinking water. Bankside grazing by farm animals and stock watering may be restricted if scums are present due to their toxicity to these animals. Bankside storage would be discouraged as standing water may prolong the bloom. The use of abstracted water for spray irrigation could also present possible hazards to farm workers.

The following waterbodies and canals have been affected by blue-green algae in recent years:

- Upper and Lower Bittell Reservoirs
- Naseby Reservoir
- Sulby Reservoir
- Welford Reservoir
- Stanford Reservoir
- Willes Meadow Reservoir

Grand Union Canal
Stratford-upon-Avon Canal
Worcester and Birmingham Canal

The River Avon has been 'seeded' with blue-green algae from a British Waterways (BW) canal overflow at Radford Semele (via the River Leam) and from the BW Bittell Reservoirs (via the River Arrow). (See Issue 3).

Solutions and Options for Action

3.1.1 Treatment of Sewage Effluents for Phosphate .

Responsibility

Under EC Urban Waste Water Directive 91/271/EEC implementation would be by Severn Trent Water on the basis of consent limits set by the NRA.

Benefits

- * Improvement to river ecology.
- * Fewer blue-green algal blooms.

Constraints

- * High cost, eventually feeding through to water bills.
- * NRA may request the designation but do not make the final decision.
- * Increased monitoring required to establish benefits of treatment.

Sites for Action

The prime works for treatment would be Coventry, Warwick, Rugby, Redditch and Stratford.

3.1.2 Encourage use of Code of Good Agricultural Practice and Designation of Nitrate Vulnerable Zones.

Responsibility

NRA to encourage good agricultural practice.

MAFF designation of vulnerable zones on advice from NRA.

Benefits

- * Farmers required to observe Code of Good Agricultural Practice.
- * Reduction in nitrate run-off from farms.

Constraints

- * NRA staff resource required to enforce Code of Practice.
- * Possible reduction in crop yields for farmers.

Sites for Action

Promotion of good agricultural practice across the catchment.

Nitrate Vulnerable Zones for consideration are Leam Catchment and the Avon above Rugby.

3.1.3 Research and monitoring of Algal Bloom formation.

Responsibility

NRA.

Benefits

- * Better understanding of causes.

Constraints

- * Benefits may be some years away.

3.1.4 Use of Chemical or Biological methods to control Algae

Responsibility

NRA, British Waterways, Riparian Owners.

Benefits

- * Low cost, effective short term control.

Constraints

- * Only of local benefit.

Sites for Action

Detailed studies could be tried in feeders or outlets from reservoirs and canals such as Bittell Reservoirs and Grand Union Canal overflow to the Leam.

3.1.5 Monitor occurrence of blooms and provide warnings and advice to owners and users.

Responsibility

Lake owners, Local Authorities, NRA.

Benefits

- * Protecting users from danger at relatively low cost.

Constraints

- * Does not provide solution to problem.
- * Closure of lakes and loss of uses continue.

Sites for Action

Canals, reservoirs and Lower River Avon.

3.2 Compliance of river reaches with River Quality Objectives.

Nature of the Problem

The 1990 survey of River and Canal Quality identified 68km of river in the Avon Catchment that did not achieve the required River Quality Objective under the N.W.C. Scheme 1979 (See Appendix 4).

Full water quality summaries are undertaken each year using three year data sets. Significant improvements in quality have been observed in the period 1990 to 1992. The most important of which have resulted in major reaches of River Avon and River Arrow being restored to their required quality. These improvements reflect major capital schemes to extend treatment facilities at Coventry (Finham) STW and Redditch (Spernal) STW.

In 1992, 85km of river failed to meet their objectives, but the bulk of these (50.2km) were new failures, that is to say they were satisfactory in 1990. This reflects how the pressures and priorities in a catchment change in a relatively short period of time. There are currently a number of further capital schemes in progress which should ensure that several outstanding failures (based on 1990 data) are addressed, but with the present tight fiscal situation it is unlikely that 1992 failures caused by sewage treatment works will generate capital expenditure unless there is a requirement to meet quality conditions dictated by an EC Directive. All such costs will be subject to approval by Government via OFWAT.

Appendix 2 includes a full summary of quality performance for the Main River Avon, its tributaries, and canals in tabular format, while the reaches that failed their objectives are shown in Table 1.

Impact on Uses and Conflicts

The impacts of lower water quality can best be assessed by reference to the current and potential uses given in the N.W.C. Scheme of Chemical Classification (See Appendix 5).

TABLE 1 RQO FAILURES

Watercourse	Reach	Present	River Quality Objective	Reason where known	Failure	Failure
Breach Brook	Mary Landy Wood to Confl. River Sowe	3	2	Corley STW	/	/
Smite Brook	U/s Bell Inn Lane to A427 Rd Br	2	1B	Monks Kirby STW		/
Bell Brook (Sherbourne Brook)	Snitterfield Heath End	3	2	Snitterfield STW New works under construction	/	/
River Dene	Wellesbourne Mill to confl. River Avon	2	1B	Wellesbourne STW Extensions under construction	/	/
The Cam	Chipping Campden STW to confl. Knee Brook	2	1B	Chipping Campden STW	/	
Marchfont B Brook	Confl. Gran Brook to Cliff.d Chambers Rd Brk	2	1B		/	/
Gran Brook	Mickleton Brook to Long Marston Depot	3	2		/	/

Watercourse	Reach	Present	River Quality Objective	Reason where known	Failure	Failure
River Arros	Cofton Hacket to Alvechurch	2	1B	Research project approved	/	/
River Alne	Wootton Wawen STW to Little Alne	2	1B	Wootton Wawen STW		/
Badsey Brook	Buckland Wood House Bury end	2	1BB	Snowhill STW	/	/
Bully Brook	Downtrip to confl. Bury end	1BB	1A			/
Bretforton Brook	Ditch Willersey Barn Stoneford Barn	2	1A	Farm pollution remedial schemes in place	/	/
	Stoneford Barn to confl. Cow Honeybourne Brook	2	1A	As above	/	/
Merry Brook	Haselor House to confl. River Avon	2	1BB			/

Watercourse	Reach	Present	River Quality Objective	Reason where known	Failure	Failure
Bow Brook	A422 Upton Snodsbury to Pershore STW	2	1B			/
Bow Brook	Pershore STW to confl. River Avon	3	2	Pershore STW	/	/
River Swilgate	lane br. Marle Hill to Hyde BBrook confl.	3	1BB	Contaminated land	/	/
Wymans Brook	Hyde Brk confl. to Stoke Orchard Road Brook	2	1B		/	/
	Stoke Orchard Road Brook to confl. Tirlle Brook	2	1B		/	/
	Confl. Tirlle Brook to confl. River Avon	2	1B		/	/
Tirlle Brook	Lower Farm	2	1B			/

Solutions and Options for Action

3.2.1 Extensions to existing sewage treatment works after NRA consent review.

Responsibility

Severn Trent Water/NRA.

Benefits

- * Improvement of water quality.

Constraints

- * Cost of additional treatment to be agreed by OFWAT.

Sites for Action

Corley, Monks Kirby, Snitterfield, Wellesbourne, Chipping Campden, Wootton Wawen, Snowhill, Pershore.

3.2.2 Recommended planning embargo in sewage works catchment area until remedial works are undertaken.

Responsibility

Local Authority on advice from the NRA.

Benefits

- * Ensures no further deterioration in water quality from increased sewage loads.
- * Low cost option.

Constraints

- * Precludes development in area.

Sites for Action

Corley, Monks Kirby, Snitterfield, Wellesbourne, Chipping Campden, Wootton Wawen, Snowhill, Pershore.

3.2.3 Investigate Farm Pollution Problems.

Responsibility

Landowner/Tenant to comply with provisions of Water Resources Act 1991 and subsequent farm waste regulations.

Benefits

* Improvement in water quality. Partial grant aid available.

Constraints

* Cost of treatment.

Sites for Action

Bretforton Brook.

3.2.4 Investigate Diffuse Source Pollution.

Responsibility

NRA to investigate.

Benefits

* Improvement in water quality.

Constraints

* Major resource implications.

Sites for Action

Upper Arrow catchment.

3.2.5 *Encourage Remedial Measures on Contaminated Land.*

Responsibility

Often not easy to determine - Owners or Local Authority.

Benefits

- * Improved water quality.

Constraints

- * Cost of remedy may exceed value of land affected. *
- Major resource implications.

Sites for Action

River Swilgate - Marle Hill Tip.



3.3 Effect of agricultural activity on compliance with EC Directive on quality of water abstracted for drinking water and general river ecology.

Nature of the Problem

In the River Avon Catchment, water is abstracted from both ground and surface water sources for potable supply. The quality of this abstracted water is required to meet the levels set down in the EC directive 75/440/EEC. The levels of both nitrate and pesticides in the rivers and groundwaters have occasionally exceeded the levels required. Nitrates and pesticides also affect the ecology of the river.

Nitrate levels are increasing in both ground and surface waters due to the application of mineral fertilizers, animal slurries and changes in farming practices over the last 40 years. The ploughing of grassland in the 1940's to facilitate a change to arable cropping is thought to be one of the main causes of increased nitrate levels in groundwater. Nitrate from agriculture usually enters surface waters from drainage water percolating through the soil, from land run-off, from erosion of soil and by direct spillage. Nitrate is soluble and therefore follows the movement of water in ground and surface waters. There are also non agricultural inputs of nitrate to ground and surface waters such as sewage effluents and the application of sewage sludge to land.

Pesticides include herbicides, insecticides, fungicides and several other categories of chemical including wood preservatives. Pesticides are widely used by the agricultural industry but other main users include local authorities, industry, transport authorities and the general public. The agricultural pesticide pollution of ground and surface waters can occur as a result of crop spraying (too close to watercourses and boreholes or wind drift), sheep dips, spillages and inappropriate storage and disposal.

There were 104 confirmed pollution incidents from farm wastes in the Avon Catchment between May 1990 and November 1993.

Impact on Uses and Conflicts

When nitrate levels in their raw water source exceed permitted levels Severn Trent Water have to take action to ensure that the water does not pass into supply. This means either not using the source or blending with water of much lower nitrate level. This is both costly and time consuming. Intakes have been affected on the Leam and the Upper Avon. Small groundwater sources to the east and northeast of Warwick have also been abandoned due to high nitrate levels.

High levels of pesticides or herbicides cause similar problems. Severn Trent Water have to find alternative supply sources or install costly treatment to ensure the quality of water passed to the consumer is safeguarded. The new water treatment works at Draycote, for example, includes an activated carbon filter to ensure trace levels of pesticides and herbicides are removed. Areas affected are the Avon at Rugby, the Leam at Leamington and Coventry boreholes. There may also be an effect on abstractions outside the catchment on the River Severn.

Where the supply is small with only basic treatment this may not be possible. Severn Trent Water had to abandon their supply from Cleeve Catchpits which served Charlton Abbots and Winchcombe in June 1992 due to pesticide contamination.

The effects of nitrate on river ecology have been discussed in Section 3.1.

Discharges of pesticides from point sources commonly cause fish and invertebrate mortalities. Further research is needed to establish what sub-lethal effects diffuse impacts have on aquatic flora and fauna. This is particularly important for the objective to re-introduce otters.

There are no EC directives requiring maximum acceptable concentrations of pesticides with regard to freshwater flora and fauna.

Solutions and Options for Action

3.3.1 Promotion of Code of Good Agricultural Practice, farm waste management schemes and requirements for pesticide usage by farm visits and provision of advice to farmers.

Responsibility

NRA in conjunction with the Ministry of Agriculture, Fisheries and Food (MAFF) and the National Farmers Union (NFU).

Benefits

- * Reduction of nitrate loading to rivers.
- * Improvement in pesticide disposal and reduced river concentrations of pesticides.
- * Liaison with farmers improves notification of pollution incidents.
- * Use of buffer zones near rivers would give conservation benefits.
- * Improved farm pollution prevention measures (especially if waste plans became a pre-requisite for grant support).

Constraints

- * Heavy resource requirement for advisory visits to relevant farmers.

Sites for Action

Upper Avon above Rugby, Leam Catchment.

3.3.2 *Support the proposed EC Directive on Control of Nitrate from agricultural sources and full utilisation of the provisions of the Water Resources Act 1991 and Control of Pollution (Silage Slurry and Agricultural Fuel Oil) Regulations 1991.*

Responsibility

NRA to implement Water Resources Act and 1991 regulations. NRA to advise MAFF on designation of Nitrate Vulnerable Zones.

Benefits

- * Nitrate Vulnerable Zone designation would require statutory compliance with Code of Good Agricultural Practice.
- * New or substantially enlarged farm structures built to minimise risk to water environment.
- * Prosecution for pollution is often the most effective deterrent to others.

Constraints

- * Restriction on farming practices and costs to farmers.
- * Costs to the NRA for enforcement activity.

Sites for Action

The most likely area for designation as a Nitrate Vulnerable Zone is the Leam Catchment.

3.3.3 Research into pesticide impact on flora and fauna and alternative methods of pest control.

Responsibility

NRA, MAFF and pesticide industry.

Benefits

- * Protection of aquatic flora and fauna from pesticide toxicity by setting correct environmental standards.
- * Knowledge of individual pesticide toxicities would allow targeting of resources to real problems.
- * Promotion of methods of control not using pesticides.

Constraints

- * High cost of research and long time scale.
(note: this could be offset if the pesticide manufacturers' levy was extended to fund research and development).

3.4 Pollution of rivers arising from urban storm overflow incidents.

Nature of the Problem

Many of the original sewers constructed to carry sewage in the Avon Catchment had inadequate capacity for storm flows and were allowed to overflow under storm conditions. In 1955 a detailed survey of urban storm overflows showed that 37% of storm sewage overflows in England and Wales were unsatisfactory and this led to many improvements in their design. However, many older sewers still have problems.

There were 404 pollution incidents arising from sewage within the catchment between May 1990 and November 1993.

Coventry STW has a population equivalent of 424,145. It receives sewage from combined and separately drained areas through two very large trunk sewers situated at opposite ends of the site. The Sherbourne valley sewer drains the central and western areas of the City and overflows under storm conditions through automatic screens to a large storm tank (nominal capacity 4.5 million litres) and six rectangular units before discharging to Finham Brook and then the River Sowe.

The Sowe Valley sewer overflows to two smaller settlement tanks before discharging to the River Sowe. Although this trunk sewer has significant flow balancing capacity, there are still quality problems.

Impact on Uses and Conflicts

In Evesham there are problems with combined sewer overflows and old pumping stations which are inadequately sized to cope with

increased residential development.

Water Quality monitors situated at Stoneleigh on the River Sowe and Rock Mill on the River Avon have shown that a rainstorm event can lead to a rapid increase in ammonia levels probably due to urban storm overflows. These levels fall as the river flow increases. Oxygen levels also drop significantly in the watercourse for a short time before rising again with increased river flow. High ammonia and low dissolved oxygen levels can affect fish and other river life under certain conditions. There is often a discharge of solids associated with storm overflows and this affects the recreational use of the river. NRA biological monitoring often shows up the effects of these intermittent discharges on the number and diversity of species found. Considerable investigatory work and expense on infrastructure is required to rectify these problems. Where work cannot be quickly undertaken the NRA will recommend a planning embargo to the Local Authority delaying further development in the area.

Solutions and Options for Action

3.4.1 Develop modelling techniques to estimate impact of storm overflows on watercourses and to initially appraise requirements for overflows.

Responsibility

NRA/Severn Trent Water and agents. While the water companies and their agents have responsibility to meet consents set by the NRA, the NRA needs to define these consents and be in a position to appraise requests for new overflows.

Benefits

- * Improvement of design and control of storm discharges to sensitive watercourses.
- * Separate sewerage systems may be shown in some cases to be economically viable alternatives to overflows.

Constraints

- * Considerable resource implications.

Sites for Action

The first modelling work would be for storm overflows in Evesham.

3.4.2. Imposition of temporary consents on all storm overflows until Severn Trent Water's drainage area studies determine whether the overflow can be removed.

Responsibility

NRA

Benefits

Provides a level of control on discharges.

Constraints

- * Not a long term solution.
- * NRA staff resources required for 'one-off' activity.

3.4.3 Control first flush storm sewage from sewage treatment works and sewer outlets

Responsibility

Severn Trent Water or their agents. The NRA's responsibility is to identify the priority sites for action and persuade Water Companies that action is needed.

Benefits

- * Improved quality of storm discharge leading to better river conditions.

Constraints

- * Costs to Severn Trent Water and customers.
- * Expenditure to be agreed by Government subject to regional priorities.

Sites for Action

Storm Tanks at Coventry STW and Spenal (Redditch) STW.

3.4.4 Objection to further residential or industrial development in areas where there are continuing problems with combined sewers or inadequately sized pumping stations.

Responsibility

Local Authority Planning Departments or advice from NRA/Severn Trent Water.

Benefits

- * Prevention of further quality problems in watercourses.

Constraints

- * Prevents local development.

Sites for Action

Evesham.

3.4.5 *Better liaison with Severn Trent Water and agents to obtain information from Drainage Area Studies and Rural Asset Management Plans.*

Responsibility

NRA in consultation with Severn Trent Water.

Benefits

- * Better advice to Local Authorities and developers on when development may be occupied or developed.

Constraints

- * Severn Trent Water may consider information confidential.

3.5 Pollution of rivers and groundwater arising from contaminated land sites and industrial sites.

Nature of the Problem

Many of these problems are directly attributable to urbanisation of the catchment that followed in the wake of the industrial revolution. Contaminated land is usually defined as an area where the soil or sub-soil is affected by a polluting substance which gives rise to an actual or potential risk of pollution to surface or groundwater. These sites often became contaminated as a consequence of past activities such as town gas production, chemical manufacture, engineering, metal finishing, mining, landfill and waste disposal operations. These operations have in the past been subject to few effective regulatory measures, this is particularly so in the case of landfill where there was no legislation in place before 1972. Many of the sites are now disused and only come to NRA's attention when re-development or re-use is proposed. Contamination of water resources can occur in the dormant or derelict state but is more likely as a result of disturbance during site investigation or re-development. The construction of foundations may release contaminants as may the removal of top soil or site capping material.

Impact on Uses and Conflicts

The impact of contaminated land sites on the water environment depends on whether the pollution is actually occurring or is a potential risk, and whether the effect is or will be on groundwater or surface water. The nature of the pollutant also has a bearing on its impact. Some of the problems in the catchment are listed below:

- * Extensive contamination of groundwater with hydrocarbon solvents in the Coventry area has caused problems with some water supply boreholes. The contamination is believed to be due to the widespread use of solvents in the engineering industry in the past. Removal of the pollutants requires sophisticated additional treatment.
- * A site and surrounding area in Redditch is contaminated with cadmium which is polluting the Upper Ipsley Brook via the surface water sewerage system serving the area. The owners and Redditch Borough Council are anxious to develop the site which is no longer used but since this may exacerbate the existing pollution, extensive investigations and consultations are in progress with a view to addressing the existing and potential problems.
- * A fire at an Agricultural Chemical store in the Evesham area some years ago resulted in pollution of the site with stable DDT/Dieldrin type pesticides which polluted the local groundwater.
- * Catthorpe Tip is privately owned and discharges leachate through the capping layer to a tributary of River Avon upstream of the Brownsover water supply intake. The high ammonia concentrations associated with this discharge may jeopardize this use.
- * Many urban areas in the Avon Catchment contain old gasworks, derelict industrial sites, abandoned mines, old landfill sites which contain areas of contamination. The majority of these sites are stable until disturbed by development.

- * The discharges from the disused Marle Hill Tip near Cheltenham contain high levels of ammonia and have been partly responsible for a failure of River Swilgate to meet its quality objective. (See issue 3.2.)

Solutions and Options for Action

3.5.1 Impose planning conditions and agree associated Section 106 agreements on redevelopment of affected sites.

Responsibility

Local Authority with advice from NRA (NRA would seek to be a statutory consultee but this requires legislative change).

Benefits

- * Sets up requirement for monitoring.

Constraints

- * Resource implications.

3.5.2 Encourage Engineering and Waste Management solutions.

Responsibility

Site owners in consultation with NRA, Local Authorities, HMIP, Waste Regulation Authorities.

Benefits

- * Controls existing problem and avoids continuing pollution.
- * Can make site fit for future development.
- * Good schemes can save money and energy.

Constraints

- * Requires co-operation of landowners.
- * Initial capital costs.

Sites for Action

Catthorpe Tip, Hawkesbury Tip.

3.5.3 *Maintain liaison with Waste Regulation Authorities.*

Responsibility

NRA and Waste Regulation Authorities.

Benefits

- * Better inspection and monitoring of sites.
- * Enforcement of remedial actions.

Constraints

- * None identified.

3.5.4. *Maintain database of information on existing contaminated land sites .*

Responsibility

NRA in co-operation with Local Authorities.

Benefits

- * Identify possible problems with development proposals.
- * Identifies possible source of pollution problems.

Constraints

- * Very sensitive issue for landowners.
- * Contaminated land register has been rejected by government.
- * Reduction of value of land if data is misused.

3.5.5. *Recommend Environmental Assessment and scope of study on significant planning applications concerning contaminated land*

Responsibility

Local Authority with advice from NRA.

Benefits

- * Full identification of environmental problems.

Constraints

- * The full environmental assessment procedure is very costly and time consuming and may not be relevant to smaller sites.

3.5.6 *Close co-operation with Fire Services to ensure that environmental hazards at industrial sites in relation to fire fighting operations are known and action plans agreed*

Responsibility

NRA, Local Fire and Rescue Services, Industrial Site Owners.

Benefits

- * Minimise implications of fire to water environment.

Constraints

- * Resource required for site surveys.

3.6 *Determination and enforcement of consent conditions for major sewage treatment works*

Nature of the Problem

The major population centres situated high in the catchment produce very large volumes of sewage effluent and this dictates river water quality. The Avon at Warwick may be as much as 80% sewage effluent under dry weather conditions.

It was the poor performance of several of these sewage treatment plants that led to the downgrading of River Avon for a number of years in the mid-eighties. However, a major programme of capital expenditure has recently been completed at Rugby, Coventry, Warwick and Redditch which has improved effluent compliance with consent conditions and restored all affected reaches of Rivers Avon and Arrow to their ascribed objective quality.

Consents are normally drafted in such a way that sewage effluents should meet quality conditions for 95% of the time with additional absolute limits where necessary to provide adequate safeguards against both gross breaches and also toxic constituents.

Mathematical models are used to set consent conditions so that effluent discharges do not jeopardise downstream uses. This will assume greater significance with the introduction of Statutory Water Quality Objectives as these will be based on a use-related classification system. The Catchment Management Plan is one of the first steps in the process of formally identifying these uses and within this framework rivers will have target quality conditions.

Maintenance of river water quality will therefore require periodic

review of effluent consent conditions to take account of these target conditions, the growth of the population and also the implications of legislation such as Urban Waste Water Treatment Directive.

Impact on Users and Conflicts

Water Companies are obliged to meet consent conditions but are also under considerable pressure from OFWAT to keep costs down. There is likely to be a measure of conflict in such a situation and it is imperative that the NRA do not allow the river to be the loser in such a contest, especially when under pressure to accept the principle of self-regulation.

Solutions and Options for Action

3.6.1 Regular review of flow and quality data associated with major sewage works to ensure that the most appropriate consent standards with upper tier conditions are not only applied but enforced effectively.

Responsibility

NRA

Benefits

- * Improvement and maintenance of river water quality.

Constraints

- * Cost of increased data collection.
- * Availability of data on direct toxicity may take a long time.
- * Dependent on Statutory Water Quality Objectives set by the Department of the Environment.

Sites for Action

Coventry, Rugby, Stratford, Warwick and Redditch.

3.6.2. *Maintain monitoring capability by installation of continuous recording quality monitors on river sites.*

Responsibility

NRA

Benefits

- * Warning of high concentrations of pollutants in river would improve enforcement of consents at works.
- * Provides long term data on trends in quality of river.

Constraints

- * Expensive to install and maintain.
- * Only relate to a limited range of possible pollutants.

Sites for Action

Monitors exist at Bromsover, Stoneleigh and Rock Mill. These may be upgraded and possible new sites are planned for River Arrow and Lower River Avon.

3.6.3 *Develop a strategy for appraising self monitoring by dischargers including the acquisition of expertise in continuous monitoring equipment.*

Responsibility

NRA

Benefits

- * Ensures that any self-monitoring does not reduce environmental standards.
- * Possible reduction of NRA resource demand.

Constraints

- * Public acceptability of self-monitoring of discharges.

3.7 Pollution from inadequate rural sewerage.

Nature of the Problem

All towns and most villages in the Avon Catchment are networked to public sewers and sewage treatment works. Outside the sewered areas, properties are served mainly by individual septic tanks with soakaways for effluent disposal. Although these are adequate for the majority of cases, several communities have growing pollution problems caused by the concentration of properties, poor ground conditions for soakaways, increased water consumption, and infilling development.

High costs and changes to financial mechanisms for providing sewerage have stopped District Councils taking an active role to resolve these matters.

Sewage pollution caused by lack of sewerage has been identified from 50 communities in the Avon Catchment. These are mainly rural villages, but the list includes housing developments on the outskirts of Coventry. In most cases, the pollution affects local watercourses, but groundwaters can also be affected.

Impact on Uses and Conflicts

The major impact is on streams and ditches near the community involved. The pollution caused reduces chemical and biological quality and can affect the value of wildlife habitats. It may also impinge on the potential use of the water for irrigation and agricultural purposes.

Recreational value and amenity are affected and this is often the main cause of complaint to the NRA and to Environmental Health

Officers of District Councils.

The cumulative impact is significant in the context of the Catchment. Where groundwater is involved, the impact can adversely affect long term use of water resources. Development pressures have a major effect where sewerage is inadequate since every additional house adds to the problem. Individual solutions, such as package sewage treatment plants for individual houses can be effective in purifying sewage to a standard suitable for discharge to a watercourse, but suitable watercourses are not normally available in a village environment and the effect is to add to and extend the existing pollution. Sealed cesspits also offer a solution, but the high cost of emptying (over £1000 a year) is a major burden on householders. This can lead to misuse and illegal connections to ditches and watercourses.

Like many environmental problems, this pollution will continue to grow and cannot be resolved without concerted action.

The preferred technical solution is provision of a public sewerage system. This would normally be done through a Requisition served by the District Council on the Water Company. The system is constructed to Water Company standards, the Council pays the bulk of the cost and the system is adopted on completion by the Water Company.

While this is a proven method, costs for first time sewerage have grown dramatically over the past twenty years and the schemes must compete with other Council priorities in the constrained financial environment of the public sector.

Solutions and Options for Action

3.7.1 Identification of impact of rural sewerage in the Catchment

Responsibility

NRA, Severn Trent Water, Local Authorities, private sewage treatment works operators.

Benefits

- * Identify extent of the problem.

Constraints

- * Requires co-operation from many organisations.

Possible Sites for Action

Rural fringe of Coventry, Peopleton and many others.

3.7.2 Identification of methods of finding provision for rural sewerage.

Responsibility

NRA, Department of the Environment (DoE), Severn Trent Water and Local Authorities.

Benefits

- * More schemes should prevent pollution problems.

Constraints

- * Time consuming to organise and research.
- * Cost to householders.

3.7.3 Press for a change in the law on funding provision.

Responsibility

DoE/NRA.

Benefits

* Money may be available for areas presently not addressed.

Constraints

* Legislative change usually takes some time.

3.7.4 Include policies in Local Plans to ensure new developments do not place additional burden on critical areas.

Responsibility

Local Authorities - with advice from NRA.

Benefits

* Existing problem areas do not become worse.

Constraints

* Not a long term solution.

3.7.5 Enforce legislation where polluting discharges are located.

Responsibility

NRA.

Benefits

- * Improvement in Water Quality.
- * Removal of nuisance.

Constraints

- * Responsibility and ownership is not always clear.

3.8 Water quality and contact sports.

Nature of the problem

Water quality is of particular significance for the recreational use of the Avon. Pressure for sailing, rowing, canoeing, raft racing or simply pleasure boating is constant. The level of risk from water-borne infection varies with the amount of contact with the water. Other recreational users, such as anglers, have limited contact with the water and therefore run a lesser risk.

New water quality objectives may include a use-related quality standard for contact sports. The only relevant standards at present relate to the EC Bathing Water Directive which are primarily bacteriological in nature. As sea water itself kills bacteria these standards would be hard to apply to fresh water situations. Viral contamination may also be of more consequence than bacteria.

Impact on Uses and Conflicts

The health risk associated with such sports and recreations must be a constraint on development of their full potential. The public's perception of the nature of the risk may not be informed enough to enable them to take appropriate precautions and they may therefore contract infections through lack of knowledge. The NRA may be wrongly blamed if people contract infections such as leptospirosis.

Whilst the NRA has no duty to warn of the presence of waterborne pathogens it seeks to promote awareness of the dangers of contact sports including those related to bacterial and viral infections.

Solutions and Options for Action

3.8.1 Education concerning the health problems of contact sports in relation to water quality.

Responsibility

Local Authority, Environmental Health Department with advice from NRA.

Benefits

- * Prevention of possible health problems.

Constraints

- * Still an unknown area.
- * Not statutory NRA responsibility.

Sites for Action

Those lengths of River Avon used for canoeing - Fladbury and Bredon.

3.8.2 Identify appropriate water quality standards for contact sports.

Responsibility

Local Authority Environmental Health Department with advice from NRA.

Benefits

- * Identification of suitable reaches of river for water sports.

Constraints

- * Not statutory NRA responsibility.
- * Some liability may be implied.

3.9 Foaming at Weirs in the Lower Avon.

Nature of the Problem

The Avon below Evesham is affected by foam under certain conditions, particularly after rain when the river is rising. It is clearly associated with the increased energy and turbulence at weirs as flow rises, but other contributory factors include the presence of detergents in low concentrations, clay particles, insect skins and algae.

Impact on Uses and Conflicts

The foam 'slicks' cause visual offence, may carry insect eggs and can foul boats. The number of pollution complaints associated with foam has risen significantly over the past five years and impacts on the amenity and recreational value of the river. Most reports originate from the Lower Avon, below Evesham.

Solutions and Options for Action

3.9.1 Continue analysis of detergents in sewage treatment works and rivers and investigate pollution complaints on Avon to establish cause of foaming.

Responsibility

NRA

Benefits

* Helps to establish causes and main sources of foam.

Constraints

- * Cost of analysis and sampling.

Sites for Action

Coventry, Warwick, Rugby and Redditch sewage treatment works.

River samples below Evesham.

3.10 *Water quality issues associated with canals and river navigation.*

Nature of the Problem

Water quality problems associated with canals and river navigation in the Avon Catchment include the presence of blue-green algae, nutrient enrichment from agricultural run-off and treated sewage discharges, and discharges from old or current industrial sites adjoining canals. Problems arising directly from pleasure boat traffic are oil and detergent contamination from boats and their associated service stations. While some of these problems may similarly be affecting brooks and rivers in the catchment the ability of canals to self purify is much reduced by their characteristic sluggish flow regime. Where a canal overflows to a brook or river any of the problems may be transferred to the receiving watercourse.

There is also the direct problem of oil arising from maintenance activities or bilge pumping entering the Avon directly in its navigable reach below Stratford.

Impact on Uses and Conflicts

During the dry summers of 1990-1992 there were numerous problems concerning the seeding of brooks and rivers with blue-green algae by canal overflows. (See 3.1)

The main uses affected are cattle watering on the River Arrow and the quality of water for abstraction on the River Leam.

The maintenance of high water quality standards in canals is hindered by the large number of low volume discharges from

pleasure craft. While the toilet waste is collected, the sink waste is discharged directly to the canal or river and bilge pumping can often cause oil contamination. It is specifically not an offence under the Water Resources Act 1991 to cause or permit any discharge of trade or sewage effluent from a vessel. The principal use affected by these discharges is the recreational and amenity use of the canals and rivers by boat users, walkers and anglers. This problem represents a politically and economically complicated conflict of recreational interests.

Pollution incidents occurring in canals can be 'spread' to brooks and rivers where the overflow structures take the form of side weirs which cannot easily be blocked off. In October 1993, for example, a farm pollution incident in the Grand Union Canal caused, via an overflow, an elevation in ammonia levels in the River Leam such that the water supply intake at Leamington was adversely affected.

Over 90% of the reports of oil on the navigable Avon result from boats. The oil fouls river banks, vegetation and water birds and affects amenity and recreational value.

Individually many incidents are of little significance but the impact is increased by their frequency.

Solutions and Options for Action

3.10.1 Control of canal overflow location and structures such that adverse water quality impact is minimised. This could take the form of canal overflows being discharged to brooks and rivers via pond structures.

Responsibility

NRA to initiate discussions with British Waterways and the

Department of the Environment.

Benefits

- * Control spread of algal blooms or pollution.

Constraints

- * Operating agreement with British Waterways may be needed.
- * Changes in legislation may be needed.
- * Control structures could be costly.

Sites for Action

Overflow from Grand Union Canal to Leam near Warwick.

3.10.2 Diversion of overflow to less sensitive watercourses

Responsibility

British Waterways in consultation with NRA.

Benefits

- * Removes impact on water supply abstractions.

Constraints

- * Cost of building new overflow.

Sites for Action

Overflow from Grand Union Canal to Leam near Warwick.

3.10.3 Press for polluting discharges from vessels to become an offence under Section 85 of the Water Resources Act 1991.

Responsibility

Department of the Environment.

Benefits

- * Quality improvement in rivers and canals.

Constraints

- * Requires legislative action at Government level and would be politically contentious.

NB. A possible alternative is to require containment of all foul waste as an operating condition for fleet pleasure boat companies.

3.10.4 Compliance of boats with standards published by British Waterways to prevent oil contamination of bilge water.

Responsibility

British Waterways, Upper Avon Navigation Trust, Lower Avon Navigation Trust.

Benefits

- * Prevent oil contamination of bilge water and river water.

Constraints

- * Costs to builders and owners of existing boats.
- * Not in NRA's own jurisdiction.

Sites for Action

Upper Avon Navigation Trust Area (Evesham to Stratford)
Lower Avon Navigation Trust Area (Evesham to Tewkesbury).

3.11 Operation of the Avon Sluices for maximum benefit to river users

Nature of the Problem

The NRA operates sluices on the River Avon to reduce the risk of flooding and to maintain, where possible, conditions in the river between Stratford and Tewkesbury which are suitable for navigation. Operation of these sluices is subject to the conflicting interests of farmers and the navigation lobby.

Impact on Uses and Conflicts

In general, farmers and landowners wish the sluices to be operated such that the flooding of agricultural land is minimised. This means keeping the level in the river low and tends to increase the current speeds. Low river levels and high current speeds are not favourable to navigation and may not be welcomed by anglers or other boat users.

Solutions and Options for Action

3.11.1 The NRA, in consultation with Navigation Trusts, farming representatives and other interested parties to review operating guidelines for the Avon sluices.

Responsibility

NRA, Upper Avon Navigation Trust, Lower Avon Navigation Trust, National Farmers Union, Recreational user representatives.

Benefits

- * Sluices operated to the best advantage for all river users.

Constraints

- * May result in requirement for greater instrumentation and maintenance by NRA.

Sites for Action

Alveston, Pershore, Nafford, Tewkesbury etc.

3.11.2 Farmers should be made aware of risks in growing high value cash crops in the flood plain.

Responsibility

NRA, National Farmers Union.

Benefits

- * Agricultural losses on flooding would be minimised.
- * Conflicts with navigation would be reduced.

Constraints

- * Loss of income from high value crops.

3.12 Inadequate definition of the flood plain.

Nature of Problem

The extent of the definitive (1 in 100 year return period) flood plain is not mapped for all major watercourses in the catchment.

Impact on Uses and Conflicts

Rivers have a natural flood plain which provides capacity for out of bank flow and storage of large volumes of flood water. Any loss of flood plain capacity can cause an increase in flood levels.

The NRA, as a consultee of the Planning Authorities, seeks to prevent development encroaching into the flood plain to avoid any increase in flood risk to people and property.

Flooding in certain areas is well documented and information is gathered during and after flood events by both the NRA and Local Authorities. In order to control the flood plain effectively it is necessary to have an accurate definition of its extent. Where actual flood information is not available computer models can be used to calculate flood levels. This is both costly and time consuming and resources need to be allocated on a priority basis. (See also Section 3.13).

Solutions and Options for Action

3.12.1 Install more level and flow gauges in the catchment to gather data during flood events.

Responsibility

NRA

Benefits

- * Improved data for development control purposes.
- * Improved emergency planning.
- * Improved definition of the flood plain.

Constraints

- * Cost of installing and operating more gauges.

Sites for Action

Include River Alne, River Swift, sluice sites on River Avon, Piddle Brook.

3.12.2 Survey and computer modelling of the main river network to assess flood risk.

Responsibility

NRA

Benefits

- * Improve knowledge of the flood plain.
- * Improve data for development control purposes.
- * Improve emergency planning.

Constraints

- * Cost of the Programme.
- * Time taken to achieve full coverage.

Sites for Action

Initially River Avon-Evesham to Stareton, River Arrow/Alne, River Leam, River Swift.

Ultimately whole of main river network in the catchment.

3.12.3 Update and extend flooding survey under Section 105 Water Resources Act 1991.

Responsibility

Local Authorities and NRA.

Benefits

- * Define flood plain of main river and ordinary watercourses.
- * Improved data for development control purposes.
- * Improved emergency planning.

Constraints

- * Difficult to gather reliable information, particularly in quick response locations.

Sites for Action

Wychavon District Council Area. (Contains a large number of reported flooding locations).

3.13 Control of development, including caravan sites, in flood plain.

Nature of Problem

Development in flood plains reduces the capacity of the flood plain, introduces risk to people and property associated with the development, increases risk and costs to the emergency services and increases flood levels elsewhere.

Caravan sites present special problems. Many large sites exist within the flood plain, examples are at Salford Priors, Stratford, Offenham and Evesham. Touring sites are generally occupied by those unfamiliar with the area and the risk of flooding, and these caravans are very prone to being washed away. With the Avon Catchment being subject to summer flooding as well as winter events, it is important that no further sites are allowed in flood risk areas.

In addition, there is the danger of the progression from touring sites with limited licences to all year round occupation, then to static caravans, mobile homes, and ultimately permanent housing.

At Welford on Avon and Tiddington, for example, there are properties which were originally built as weekend summer huts for fishermen that are now being occupied on a year round basis.

Impact on Uses and Conflicts

Control of all development in the flood plain is through the Planning Authorities. The NRA is a consultee on these matters and objects to all development in flood plain unless it is felt that adequate remedial measures are feasible. At Tewkesbury the NRA, the Borough and

the County Councils have worked together to produce a strategy for flood plain management. This has led to policies being included in the Local Plan which will safeguard flood plain storage capacity whilst allowing extensive development around the town.

As flood plain flow and storage is vital to ensure no increase in flood levels the NRA seek to not only prevent further loss, but to achieve the removal of redundant structures which have historically encroached into the natural flood plain.

The impact of the NRA's policy is to ensure that there is no increase in flood risk and wherever possible reduction of existing risk.

Solutions and Options for Action

3.13.1 Press for policies to be included in Statutory Plans to avoid encroachment of development land into the flood plain where compensatory works to prevent increased flood risks cannot be achieved.

Responsibility

Local Authorities/NRA.

Benefits

- * Maintain and improve the flood flow capacity of the river system.
- * NRA interests taken into account in the development control process.
- * Flooding is not increased.

Constraints

- * Requires action by Local Authorities.
- * Polices should be in accordance with Circular 30/92 of the Department of the Environment.

3.14 Flooding problems on Ordinary Watercourses.

Nature of problem

Ordinary watercourses are those not designated as main river under the terms of the Water Resources Act 1991. The majority of legal powers of control over these watercourses lie with the Local Authorities. The storms of 1992/93 highlighted many problems on these watercourses for example over 200 flooding problems in Wychavon District alone, some of which were caused by poor maintenance, blockages or inadequate structures.

Impact on Uses and Conflicts

Flooding problems can be due to a variety of problems including:-

- * Inadequate maintenance of channels
- * Undersized /illegal structures such as culverts, weirs etc.
- * Blockages for example on grilles, build up of debris etc.
- * Buildings in flood plain
- * Increased run off from development

Notice can be served by Local Authorities on riparian landowners to carry out remedial works, where appropriate, or the Councils can undertake works themselves (often recharging those who benefit). There are cost implications associated with all remedial works. The NRA is unable to spend money for flood defence purposes on ordinary watercourses as it has no legal powers to do so.

Solutions and Options for Action

3.14.1 Encourage riparian landowners to maintain watercourses to an adequate standard.

Responsibility

Local Authorities/NRA.

Benefits

- * Alleviation of flood risk from poorly maintained watercourses.

Constraints

- * This option will not alleviate all flooding problems.

Sites for Action

General.

3.14.2 Local Authority to serve notice on landowners for the removal of illegal structures.

Responsibility

Local Authorities.

Benefits

- * Risk of flooding may decrease.

Constraints

- * This option will not alleviate all flooding problems.

Sites for Action

As necessary.

3.14.3 District Councils to undertake Flood Alleviation Schemes/Improvement works to watercourses. Where possible to remove grilles, or if needed for public safety reasons, maintain to prevent blockages.

Responsibility

Local Authority.

Benefits

- * Alleviation of local flood problems.

Constraints

- * Some Local Authorities may not have the money, or be willing to use their powers, for flood defence work.

Sites for Action

Beoley Papermill, Redditch; Yelvertoft; Battleton Brook, Evesham; Racecourse Brook, Stratford.

3.14.4 Improve control through the Planning process to ensure no new problems arise and existing problems are not exacerbated.

Responsibility

Local Authority/NRA

Benefits

- * Risk of flooding is not increased.

Constraints

- * It is a Local Authority decision. The NRA only control culverts etc. through Flood Defence Consents.
- * Planning controls should be in accordance with Department of the Environment Circular 30/92.

3.15 Extensions to Main River.

Nature of Problem

There is strong pressure to extend the main river network particularly as Local Authorities budgets for drainage works have been cut. Potential maining proposals include Battleton Brook, Bitteswell Brook, Racecourse Brook, Sow Brook and Peopleton Brook.

The NRA can carry out works to watercourses which are designated main river, and has wider controls over works to such watercourses. (Note: flood plain control, even on main river, is mainly through planning laws).

In order for a watercourse to become main river an application has to be made to the Ministry of Agriculture Fisheries and Food (MAFF) for variation of the main river map. A watercourse must meet certain criteria if it is to be mained, mostly relating to the land use through which it runs and the type of area it drains.

Impact on Uses and Conflicts

There is a tendency for riparian owners to believe that the NRA is responsible for all maintenance work to main river. It is not widely appreciated that the Authority only has permissive powers to undertake work but does not carry the legal responsibility. Maintenance responsibilities remain with riparian landowners.

Even if a watercourse is main river, flood alleviation and maintenance works can only be carried out by the NRA if the benefits of such work outweigh its costs, and it is environmentally acceptable.

Solutions and Options for Action

3.15.1 Variation to the main river map to include watercourses currently designated as ordinary.

Responsibility

NRA(in consultation with Local Authorities).
MAFF to agree to the extension.

Benefits

- * The NRA would have greater powers of control on the main watercourse. The NRA would have the power to carry out maintenance and improvement works.

Constraints

- * Increased cost to the NRA, requiring adjustments in income from Council Tax.

Sites for Action

Battleton Brook, Bitteswell Brook, Racecourse Brook (Stratford),
Sow Brook (Rugby).

3.16 Provision of Flood Alleviation Schemes on Main River.

Nature of Problem

Flooding occurs from main river watercourses in several urban areas, for example Stratford, Evesham, Warwick and Himbleton.

Impact on Uses and Conflicts

Flooding puts people and property at risk, endangers emergency service workers and causes disruption to traffic with consequential costs to the country.

The potential for Flood Alleviation Schemes relies on economic justification and these are subject to MAFF grant aid rules.

Flood alleviation can only reduce the risk of flooding, it can never completely eliminate the risk. There is a danger that schemes will give a false sense of security to those they protect, and also encourage the granting of Planning Permission on land which is still at flood risk.

Flood alleviation measures may not be acceptable for many reasons; economic, ecological, aesthetic or the effect on Tourism.

Solution and Options for Action

3.16.1 To improve the 'in-bank' capacity of the main river by channel works and/or the construction of raised defences.

Responsibility

NRA

Benefits

- * The capacity of the river to accept flood flows is increased. *
- The risk of flooding is decreased.

Constraints

- * Possible damage to habitat.

Possible Sites for Action

Stratford, Evesham, Wolston, Himbleton, Beoley.

3.16.2 Alleviate local flooding by use of preventative measures upstream of the area for example, flood water storage areas.

Responsibility

NRA

Benefits

- * Helps to alleviate local flooding problems.
- * Flood water storage areas can provide a valuable habitat for fauna and flora, and can act as a “buffer” to filter out pollutants.

Constraints

- * Available space needs to be found for flood water storage areas.
- * Future maintenance of areas needs to be agreed. Should be held by a responsible body for example, Local Authority.

Sites for Action

New developments in Redditch.

3.16.3 Installation of pumping stations in connection with raised defences as the local situation dictates.

Responsibility
NRA

Benefits

- * Allows surface water to be discharged over raised defences into the watercourse when levels are high.

Constraints

- * Cost of installing pumping stations.
- * Need for future maintenance if system is to be effective.

3.16.4 Undertake channel works that do not involve straightening or enlarging for example, weed clearance, tree maintenance.

Responsibility
NRA

Benefits

- * Improves capacity of the watercourse to accept flood flows in an environmentally acceptable manner.

Constraints

- * Will only affect low to medium flows.
- * Need to consult conservation bodies.

Sites for Action

Ongoing maintenance programme across whole of main river network.

3.17 Maintenance of weirs and other structures.

Nature of Problem

The Avon and its tributaries have many weirs and sluices associated with former mills and various recreational and amenity purposes. (Fig 7 shows the most significant structures in the catchment).

As the commercial need for these structures disappears, and the structures get older, they are falling into disrepair. The Stour is one example of a river with numerous structures in poor condition.

The NRA owns few structures, the responsibility for most lies with private individuals. Repair of structures can be very expensive.

A charitable organisation, The Avon Weirs Trust, has been established to raise money for the maintenance of privately owned weirs on the River Avon.

The NRA owned sluices on the Avon have an important role in maintaining levels and alleviating flood impacts. They require a continuing maintenance and repair programme.

Any work to weir or other structures requires the NRA's consent.

Impact on Uses and Conflicts

Failure of structures can have both advantages and disadvantages:

Advantages:

- Increased capacity for drainage upstream.

- Change in ecosystem allowing different species to inhabit the drained stretch.
- Reduced risk of frequent flooding

Disadvantages:

- Loss of navigation or conservation interest
- Decreased bank stability by initial rapid drawdown, and by increased velocities
- Change in ecosystem preventing certain species from surviving in the drained stretch
- Change in river regime which may have been in existence for centuries

Cost of repairing/maintaining the structure can fall on individuals.

Solutions and Options for Action

3.17.1 Assess each structure in relation to benefits against cost of repair. If no detriment to the river is likely, allow either gradual collapse or removal of the structure.

Responsibility

Riparian owner

Benefits

- * Increase capacity for drainage.

Constraints

- * Bank stability upstream and downstream of the structure is affected by the collapse of the structure, due to rapid drawdown.
- * Changes the local habitat for plants and wildlife.

Sites for Action

River Stour and some structures on main river watercourses.

3.17.2 Repair or rebuild the structure to original standard.

Responsibility

Owner with consent from NRA.

Benefits

- * Retains previous uses and the river environment.

Constraints

- * Cost of repairs could be prohibitive.
- * The repair may be re-instating a problem such as an obstruction to flow.

Sites for Action

River Stour and some structures on main river watercourses.

3.17.3 Rebuild the structure to a different standard.

Responsibility

Owner with consent from NRA.

Benefits

- * Retains the uses of the stretch of the watercourse.
- * Some problems associated with the structure may be removed, for example, flood risk.

Constraints

- * Cost of repair could be prohibitive.

Sites for Action

River Stour and some structures on main river watercourses.

3.17.4 Support the Avon Weirs Trust in all feasible ways where structures need to be retained.

Responsibility

NRA and other interested parties.

Benefits

- * Enables the uses and safety of structures .

Constraints

- * Resource implications for the NRA and others.

Sites for Action

River Avon between Alveston and Tewkesbury.

3.18 Increased pressure for the Development of Hydropower.

Nature of the Problem

There is increasing pressure for development of low-head hydropower on weirs and structures on the Avon and its tributaries. The potential impact of such developments is recognised within the European Community Regulations on Environmental Assessment as hydropower is listed as an issue which may be considered for formal assessment. However, as a sustainable non-fossil fuel source of energy, as yet untapped in the Avon Catchment, hydropower clearly has environmental benefits.

Impact on Uses and Conflicts

The potential impacts of hydropower are

- * Changes in river flow patterns.
Without adequate control the flow downstream of a structure can be reduced as the operator builds up enough head to generate electricity. This has obvious implications for aquatic life, navigation and abstractions downstream and raised water levels upstream can impair drainage or cause minor flooding. The sudden large release of impounded water can have adverse implications for downstream landowners and can remove animals living in the bed of the river by the scouring action.
- * Sterilisation of upstream resource.
If an abstraction licence is required the volume licensed is normally several times the dry weather flow of the river. As the NRA has a duty to protect this flow it is difficult to licence further consumptive water uses upstream.

- * **Impact on Landscape.**
The profitability of operating a hydropower installation could lead to a proliferation of proposals at existing and new impoundments.
- * **Impact on Fish Migration.**
Low level turbines of the type commonly installed can cause very high mortality rates in any fish that pass through them.
- * **Impact on Flood Defence**
The alteration of a weir to accept a hydropower installation may affect levels of the river upstream and increase the potential for flooding. Installation may require building in the flood plain thereby potentially affecting water levels elsewhere.
- * **Impact on Water Quality.**
Whilst directly benefiting the water environment by increasing dissolved oxygen levels, the installations could exacerbate the problem of foaming on the Lower Avon.

Due to the potential impact on the environment and possible conflict with river uses, regulating authorities need to be aware of the views of all relevant parties so that appropriate guidelines and policies can be developed that can be applied consistently across the river catchment. The guidelines may need to be developed separately for privately owned sites and sites owned by the NRA.

Recognising the potential environmental benefits of hydropower schemes the NRA will seek, where appropriate, to facilitate them.

Solutions and Options for Action

3.18.1 To develop policies detailing the NRA's and Local Authorities approach to hydropower and planning applications for hydropower. Established river user groups, trusts and interested parties to be formally consulted in the process of developing the policies.

Responsibility

Local Authorities, NRA.

Benefits

- * There would be a consistent approach to planning applications.
- * Guidance could be issued to developers from the NRA and Local Authorities. This could be in the form of a joint strategy.

Constraints

- * Pressure for development is immediate and formal consultation may not be possible in this timescale.

Sites for Action

Winchcombe, Burmington, Wellesbourne.

3.18.2 Investigate viability of incorporating hydropower installations in any refurbishment scheme.

Responsibility

NRA/riparian owners/power companies.

Benefits

- * Introduction of hydropower.

Constraints

- * Cost.

Sites for Action

Stanchard Pit sluices (Tewkesbury).

3.19 Responsibility for Flood Defence duties and powers.

Nature of Problem

In relation to flood defence, both at normal times and during floods, the responsibilities for various actions are split between the NRA, Local Authorities, Emergency Services and riparian landowners.

This split is often unclear, particularly to the general public.

In some cases Local Authorities are reluctant to exercise their powers.

Note Appendix 3 - contains a brief summary of the role of various bodies in relation to: Flood events and general flood defence matters.

Impact on Uses and Conflicts

Lack of knowledge or acceptance of duties, powers and responsibilities leads to:

- * Delays in response to flood emergencies as requests for assistance are directed to the wrong body.
- * Deterioration in river channels due to lack of maintenance.
- * The carrying out of unsuitable works to watercourses which can increase the risk of flooding.

Solutions and Options for Action

3.19.1 Provide information on duties, powers and responsibilities for flood defence to all responsible parties.

Responsibility

NRA, Local Authorities.

Benefits

- * Increased awareness of responsibilities.
- * Increased management of river system.

Constraints

- * There is no guarantee that increased awareness leads to action to maintain the watercourse.
- * Difficulties in reaching all responsible parties.

3.19.2 Encourage all bodies with flood defence roles to realise the necessity of watercourse management and to exercise their powers and responsibilities.

Responsibility

NRA

Benefits

- * Increase correct management and maintenance of the river system.

Constraints

- * The NRA has few powers of control over some bodies.

3.20 The effect of sand and gravel extraction from the Avon Valley.

Nature of Problem

There is intensifying pressure for quarrying of minerals (gravel and sand) from river valleys. Details of existing and proposed schemes are given in the Hereford and Worcester, Northamptonshire and Warwickshire Minerals Local Plans and existing sites are shown in Appendix 2. (Map 16).

These operations cause disruption to the river regime both during and after quarrying. In addition, the quarrying for sand and gravel often involves the dewatering of the site to enable mineral extraction. This can affect other local abstractions and the flows of nearby streams. The process is, however, exempt from the abstraction licensing system.

The quarrying is also liable to give rise to increased solids run-off and oil contamination of surface waters unless carefully controlled.

Impact on Uses and Conflicts

- * Workings in flood plains are often bunded to prevent them from being flooded. This is a loss of flood plain storage with consequent increase in flood risk elsewhere. The drainage of land through the quarry towards the river can also be disrupted causing flooding.
- * The effect of the loss of a water supply varies with the extent of the loss and its use. Small unlicensed private water supplies are sometimes the most vulnerable. While it may be

possible to provide new water supplies to such a site, the time required and loss of a valued resource can cause local anger.

- * The changes in nature of flow patterns in streams near a mineral working can cause ecological changes as well as affecting the viability of some surface water abstractions. Increased solids and oily run-off have a direct impact on the ecology of the watercourse.

Controls on dewatering can obviously have cost implications for the company. It may also limit the extent of the resource which may be exploited.

Solutions and Options for Action

3.20.1 Increase input to Mineral Local Plans and site planning consultations.

Responsibility

NRA/County Councils

Benefits

- * Prevention of immediate or long term impact on the environment by identifying constraints on potential sites.
- * Ensuring restoration and future use commensurate with position and impact on river regime.

Constraints

- * Resource requirement.

3.20.2 Investigate use of conservation notices as defined in Section 32 of Water Resource Act 1991.

Responsibility

NRA/Local Authorities

Benefits

- * May give alternative control to planning legislation, under NRA jurisdiction.

Constraints

- * Little experience of use to date.

3.20.3 Adequate protection measures for prevention of pollution by oil and solids.

Responsibility

NRA/DOE who need to implement regulations covering industrial fuel oil storage.

Benefits

- * Prevention rather than amelioration of pollution.

Constraints

- * Legislation to implement fuel oil regulations required.

3.20.4 If de-watering occurs flow should be directed to watercourses with critical uses.

Responsibility

Local Authority, NRA, Site Owners.

Benefits

Safeguards critical fisheries and abstractions.

Constraints

Extra pipeline/pumping costs may be incurred.

3.21 *Assessment of the water resources capacity of the Cotswold Limestones and Offenham River Gravels.*

Nature of the Problem

Most major aquifer areas within the NRA's Severn-Trent region have been studied to assess the capacity of the aquifer to supply water resources without affecting river flows or other environmental requirements. This assessment has not been undertaken, however, for the Cotswolds limestone areas or Offenham river gravels.

There are no observation boreholes or spring monitoring sites in the Cotswold Aquifer to monitor groundwater levels. The Offenham gravels have a large number of small abstractors many of whom are unmetered. It is, then, difficult to enforce the conditions of the existing licences and calculate the actual volume of water being abstracted.

Impact on Uses and Conflicts

There has been public concern over the last few years over low flows in the Cotswold rivers (The Isbourne, Stour and Badsey Brook). There is also considerable pressure on the water resources of the Offenham gravels and further applications for abstraction here are being refused. The Badsey Brook itself is heavily over-abstracted (see issue 3.2) with consequences for the aquatic ecology. As the brook is supported by groundwater flow from the Offenham gravels it is important that the licensing policy is correct. A change in policy could involve expense (for abstractors or the NRA) in providing meters on small abstractions.

Solutions and Options for Action

3.21.1 Hydro-geological investigation of Cotswold Aquifer with identification of suitable springs and boreholes for monitoring.

Responsibility

NRA.

Benefits

- * Assessment of water resource capacity and environmental need.

Constraints

- * May require inter-regional studies.

3.21.2 Hydro-geological investigation of Offenham gravels with identification of monitoring wells and boreholes.

Responsibility

NRA.

Benefits

- * Proper assessment of resource capacity.

Constraints

- * Present over abstraction may mean little positive results from investigation.

3.21.3 Vary licences in Offenham area to include requirements for meters.

Responsibility

NRA.

Benefits

- * Allows proper assessment of resource capacity and proper enforcement.

Constraints

- * Compensation may need to be paid to licence holders.

3.22 Abstraction licence policy in the Coventry Groundwater Unit.

Nature of the Problem

Rocks which contain significant water and can be abstracted by a borehole or well are known as aquifers. The aquifers in the Avon Catchment are shown in Map 24. Aquifers can be split into units on the basis of their geology, faults, and the local pattern of abstractions. To ensure that aquifers can continue to supply resources in addition to baseflow for rivers and streams an assessment of the recharge to the unit is made. This requires a knowledge of the area of exposed aquifer and the local rate of percolation during the year.

The Coventry Permo-Carboniferous unit is theoretically over-licensed and over-abstracted. The aquifer is, however, multilayered and a water balance is needed for each major sandstone horizon to determine whether the unit is really over-abstracted and over-licensed. There is also a lack of long term observation borehole water level data which prevents detailed analysis of the aquifer level trends. However a number of disused boreholes have been brought into the monitoring network over the last eight years and trends are now being recorded. There is also concern within this aquifer on the discrepancy between the licensed quantity within the catchment and the smaller volume actually abstracted.

Impact on Uses and Conflicts

There has been some reduction in the use of groundwater for industrial purposes over the last 15 years. Most new demands for industrial abstraction are, however, being resisted on the basis that the unit is over-abstracted. This can have an effect on the viability of new enterprises.

Conversely, there could be a significant problem if all licence holders started to take volumes approaching their licensed quantities. This could then lead to derogation of existing sources and further reduction in base flows.

Solutions and Options for Action

3.22.1 Review aquifer recharge to assess water balance for each sandstone horizon.

Responsibility

NRA.

Benefits

- * Maximises the water resource without affecting environmental requirements.

Constraints

- * A complex aquifer could result in a resource intensive investigation.

3.22.2 Encourage revocation of unused licences and review of under-used licences.

Responsibility

NRA.

Benefits

- * Ensures that the situation does not deteriorate by further uptake of resources.

Constraints

- * Compensation payments may be needed for licence holders unwilling to give up an asset.

3.23 Groundwater abstractions for potable supply affecting surface water flows in the River Sherbourne and Bow Brook.

Nature of Problem

Low flows in the Bow Brook near Redditch and the Sherbourne through Coventry are caused by overabstraction of the Bromsgrove and Coventry aquifers. These abstractions are 'licences of right' which means the NRA cannot review them without paying substantial compensation.

While there is no direct evidence, concerns over flows in some of the Cotswold rivers such as the Isbourne have also been linked with groundwater abstractions.

Impact on Uses and Conflicts

Low flows in the Bow Brook have brought complaints from local amenity groups and is of concern to fishery groups who wish to protect the brown trout population in the brook. The issue was also high on the agenda at the recent Redditch Local Plan Inquiry.

The lower than acceptable flows in the Bow Brook also affect dilution available at Priest Bridge sewage treatment works and consequently the development capacity of the Upper Bow Brook Catchment.

For the Bow Brook and the Cotswold rivers the reduction in flow also impacts on the availability of water for summer spray irrigation abstractions as restriction levels are reached earlier than may otherwise have been the case. Low flows may also affect the water table in the Lower Bow Brook which contain water dependent

conservation sites.

Low flows in the Sherbourne affect a significant amenity in the parkland to the north of Coventry. There was no significant flow at all in this river during the dry periods of 1990 and 1991.

The main conflict is the possible cost of developing a new potable water supply to replace abstractions in the over-abstracted groundwater areas and the compensation payments payable by the NRA. Such works would be dependent on a cost-benefit analysis.

Solutions and Options for Action

3.23.1 Review licences in over-abstracted groundwater units to ensure river base flow is maintained.

Responsibility

NRA, Water Companies.

Benefits

- * The only real long term solution

Constraints

- * Costly to NRA in cost of compensation and may potentially pose problems for licence holders in obtaining alternative water.

3.23.2 Identify possible compensation boreholes to provide flow in rivers under dry weather conditions.

Responsibility

NRA and river users.

Benefits

- * Possible 'quick fix' solution that would allow public water supply abstractions to continue at substantially the same rate.

Constraints

- * Does not provide long-term solution and may possibly lead to further lowering of the groundwater table.

3.23.3 Promote large balancing ponds on new developments to provide support under low flow conditions.

Responsibility

NRA, Local Authorities and developers.

Benefits

- * Could be made a design feature of a development.

Constraints

- * The long term maintenance is a problem.

Sites for Action

New development at Norgrove, Redditch.

3.23.4 Encourage return of abstracted water upstream of groundwater abstraction site.

Responsibility

NRA.

Benefits

- * Maintains flow in rivers.

Constraints

- * Sewage works are usually downstream of groundwater abstraction areas.

3.24 Lack of water for spray irrigation in summer months.

Nature of Problem

There is insufficient water in critical sub-catchments of the Avon to supply the need for spray irrigation during dry summers. This has consequences for both holders of 'licences of right' where even remaining flows are inadequate and to holders of newer licences who may have to stop abstracting when the flow at the nearest gauging station falls below a prescribed flow (see Appendix 2). Consequently, in a dry year such as 1990, when irrigation is most important, many restrictions on abstraction were imposed and many new licences issued were of very limited use to the abstractor.

There are some 681 spray licences in the Avon Catchment of which most are licences of right but 135 are tied to a prescribed flow at a gauging station. Another 60 are tied to local flow restrictions.

Impact on Uses and Conflicts

While the impact on abstractors with a licence tied to a prescribed flow is direct, there are also problems in areas of severe resource depletion on holders of licences of right. In the Badsey Brook, the naturalised dry weather flow of the brook is 8.3 Ml/d, whereas the total volume of licences of right is 9.6 Ml/d.

For certain crops, irrigation is vital to provide both the quality and yield required. For some crops, lack of irrigation water can result in total loss of crop.

The volume that can be abstracted is large and none is returned.

The flow in a stream or river can be severely depleted, affecting also the conservation and fishery ecosystem of the river.

Solutions and Options for Action

3.24.1 Encourage winter storage of water by reservoir.

Responsibility

NRA/Abstractors/MAFF

Benefits

- * Security of supply.
- * Abstraction charges may be lower.
- * Reservoirs may have amenity or conservation use.

Constraints

- * The initial high capital cost of building a reservoir.

Sites for Action

Bow Brook, Badsey Brook, Upper Avon.

3.24.2 Provision of catchment or local reservoirs.

Responsibility

Water Companies/Water users. May be facilitated by NRA.

Benefits

- * Provision of reservoirs could release water for spray irrigation in summer on supported rivers.

Constraints

- * NRA are not able to provide finance.
- * Costs to abstractors liable to be higher than benefit.

3.24.3 Encourage local abstraction rotas.

Responsibility

NRA, NFU, Local abstractors.

Benefits

- * Best use of available resources.

Constraints

- * Requires high degree of local co-operation.

Sites for Action

Badsey Brook.

3.24.4 Encourage better irrigation techniques and crops which are less dependant on spray irrigation.

Responsibility

MAFF, NRA and NFU.

Benefits

- * Less requirement for abstracted water.

Constraints

- * There would be disruption to present practice and new markets would have to be found.
- * New irrigation equipment may be more costly.

3.24.5 Continued enforcement activity on licences, with installation of meters where possible.

Responsibility

NRA

Benefits

- * Fairer allocation of resources.

Constraints

- * NRA may need to pay compensation for installation of meters.

Sites for Action

Badsey Brook.

3.25 Improved data required for better management of flood warnings, low flows and the setting of consents to discharge to watercourses.

Nature of Problem

Flood warnings are issued for reaches of the Rivers Avon, Leam, Stour and Arrow based on a system of rainfall and river gauges and flood plain data. It is not possible to extend the coverage or improve the quality of the warning system with the present network of rainfall and gauging stations and extent of flood plain data.

Restrictions on abstraction licences are issued based on the flows at gauging stations (see Appendix 2). Sometimes, restricted licences are tied to gauging stations which are not on the same river. The basis for the restriction of these licences may not be the most appropriate.

Inadequate flow data also affects the ability to calculate consent conditions from discharges with the required level of confidence, as the calculation is based on knowledge of the dilution available.

Impact on Uses and Conflicts

With better flood plain definition (see 3.12) and more data available, it would be possible to improve the flood warning service to the public by better forecasting and flood risk assessment.

Extension of the warning service would increase costs to the Police, Local Authorities and Flood Wardens.

People who receive warnings would be able to take action to reduce their losses benefiting the emergency services, insurers and themselves.

When agricultural abstractors are told to stop taking water because the river flow has reached a critical level they may lose their whole crop and almost certainly suffer reduced yield. It is, then, very important to ensure that the initial flow identified is correct and measured accurately.

Data is required to set consent conditions for sewage, farm and industrial discharges. While estimates of a flow can be made by use of hydrological models a good base of flow data is usually more reliable and is also required to calibrate the models. The water quality of a stream is directly related to the validity and relevance of the flow data.

The main conflict for all these requirements is the increase in cost of installation and maintenance of gauges and also the cost of improving the calibration of the NRA's flow forecasting system.

Solutions and Options for Action

3.25.1 Increase number of interrogable river level flow and rain gauges.

Responsibility

NRA

Benefits

- * Improved flood forecasting, increased confidence in low flow restrictions and determining consents for discharges.

Constraints

- * Cost of new stations and maintaining data.

Sites for Action

The most likely sites for improvement are gauges on Alscot Park (Stour); the River Alne and the River Swift. Consideration to flow measurement also at Lilbourne (Upper Avon).

3.26 Specification of environmental requirements of the river and its plant, animal and fish life for setting prescribed conditions.

Nature of the Problem

The NRA is duty bound to issue an abstraction licence unless it can demonstrate that existing rights or the river environment will be adversely affected.

When determining an abstraction licence, consideration has to be given to the plant and animal life in the river. These interests are usually protected by putting conditions on licences which require abstraction to stop when the flow on the river falls below a critical level at a certain point. This is known in the Severn-Trent Region as a prescribed flow.

Ever since licences were first issued in 1965, it has been extremely difficult to assess how much water can be abstracted without adversely affecting the river environment. A number of pragmatic solutions have been used but these may not now be the most appropriate.

Any re-assessment of the prescribed flows for the Avon and its tributaries should also take into account the contribution of the Avon flow to the Severn and uses downstream of the confluence.

Impact on Uses and Conflicts

The 'prescribed flow' philosophy has been widely used throughout England and Wales, but may in some cases restrict abstractors unnecessarily at certain times of the year or, conversely, not offer

sufficient protection to the river environment at other times.

The existing prescribed flows in the Avon Catchment and the extent of restrictions imposed on them are listed in Appendix 2 and discussed in Issue 3.24.

Within the Avon Catchment there are examples of flows falling short of an estimated environmental requirement due to over abstraction of groundwater (Issue 3.23), over abstraction by spray irrigators with licences of right (Issue 3.24), abstraction for potable supply (Issue 3.27) and increased urbanisation (Issue 3.34).

The effects of over abstraction have been clearly demonstrated over the recent dry years. At one extreme, ALL other uses are affected by a dry river bed. At the other extreme, the effects of a very small abstraction in a big river will be undetectable. Somewhere in the middle there is a balance, and finding that point is critical - allowing abstraction without damaging the river environment.

Solutions and Options for Action

3.26.1 Fundamental research into flow requirements of the river and flora and fauna.

Responsibility

NRA

Benefits

- * Protection of river flora and fauna and best use of water resources.

Constraints

- * The suggested method is resource intensive and will be several years before generally applicable.

Sites for Action

Across catchment. Priority to critical catchments (Upper Avon, River Sherbourne, Bow and Badsey Brooks). A pilot study is under consideration for Bow Brook. The required residual flow in the Severn at Gloucester may also have implications for abstractors in the Mid and Lower Avon.

3.27 Low Flows in the Upper Avon.

Nature of the Problem

Under dry weather conditions the flow in the 30km of the River Avon above Rugby is less than half of its naturalised flow (see Glossary). Low flow condition research suggests that, to prevent harmful environmental consequences flows should not drop below 60% of the natural flow and that for rivers used for fishing the flows should be 80% of the natural flow or more. These are not official targets and required flows should be identified through the process described in Section 3.26.

The main reasons for the low flow are abstractions for canals and drinking water. At the headwaters of the Avon three reservoirs, Naseby, Sulby and Welford, provide water for the Grand Union Canal. Although there are compensation flows required to the River Avon through agreements such as the Bevan James agreement of 1811, these have not been maintained and were more appropriate to an era of water mills than current requirements for environmental protection. They are now primarily agreements between British Waterways and Severn Trent Water with the NRA having an interest in the environmental consequences but an untested legal role.

The situation in the Upper Avon has been exacerbated by diversions between canal and river and by lack of maintenance of culverts and other structures. These factors have further decreased the flow in the River Avon.

The second major abstraction by British Waterways occurs at Churchover on the River Swift. The whole flow of the Swift can be taken into an arm of the Oxford Canal at this point. This can leave

no flow at all in the last 2km of the Swift and depletes further the natural flow of the Avon. This abstraction is exempt from licensing.

The first public water supply abstraction on the Avon is from the Stanford Reservoir. A compensation flow from the reservoir is required which is based on the prevailing flow at Welford. Direct flow measurements at Welford have not been taken recently so the compensation flow has been difficult to enforce. There must also be a question on the adequacy of the compensation flow since the maximum required (around 5Ml/d) is less than 50% of the estimated dry weather flow at the outlet to the reservoir.

The water supply intake at Brownsover (28.2km below the source) formerly had a licence of right to take up to 36.4Ml/d. The natural dry weather flow at the point is around 20Ml/d. Recent changes to the licence have been agreed which will restrict the maximum daily abstraction to 15Ml/d with progressive restrictions at lower flows and no abstraction at very low flows.

Impact on Uses and Conflicts

Low flows in the Upper Avon are of concern on four main accounts:

- * Loss of water supply at Stanford Reservoir. The diversion of more water into the canals above Stanford reduces the supply available for Severn Trent Water from Stanford.
- * Spray irrigation licences are tied to the gauging station at Stareton. With lower than natural flows restrictions are brought in earlier than they should be with consequential effects on the farmers concerned.

- * Lack of dilution for sewage effluent. The quality of a river downstream of a sewage effluent discharge is critically dependent on the dilution available to the discharge. The dilution available at Rugby Sewage Treatment works under dry weather flow conditions is low, usually around 1:1, but could be even lower if more water was abstracted from the Brownsover intake.
- * General in-river requirements for aquatic plant and animal life. Current thinking suggests the prevailing dry weather flows are too low to maintain a natural ecological balance in the river.

Solutions and Options for Action

3.27.1 Ensure adequate dilution for major sewage treatment works so that RQO's can be met.

Responsibility

NRA

Benefits

- * River water quality is improved with increased flow.

Constraints

- * Pollution cannot be solved by increased dilution but a balance has to be found.

Sites for Action

Rugby Sewage Treatment Works.

3.27.2 *Ensure that the distribution of water between river and canals at least matches original agreements.*

Responsibility

Severn Trent Water, British Waterways, NRA.

Benefits

- * Maintain water for potable supply and in-river use.

Constraints

- * Enforcement of legal agreements unclear.

Sites for Action

Avon at Welford.

3.27.3 *Negotiate operating agreements with British Waterways or Severn Trent Water to provide more in-river flow.*

Responsibility

NRA, British Waterways, Severn Trent Water.

Benefits

- * Provide environmentally acceptable flow.

Constraints

- * Costs of alternative sources or back-pumping in canals.

Sites for Action

Avon at Stanford, River Swift at Churchover.

3.27.4 Enforcement of compensation flow from Stanford Reservoir.

Responsibility

NRA

Benefits

- * Increases flow in river downstream of Stanford.

Constraints

- * Difficult to enforce until problems further upstream are rectified.

3.28 Diversion of sewage treatment works flows to lower reaches of the catchment.

Nature of Problem

Water companies consider that the amalgamation of small sewage treatment works into larger works may reduce maintenance costs and overcome problems in meeting consent conditions. A new sewage treatment works is usually further down the catchment or in a separate catchment altogether. The effects of such diversions are not always beneficial to the water environment but the NRA has no direct control over the siting and discharge point of sewage treatment works.

Impact on Uses and Conflicts

Five small works in the Avon have been identified which may be diverted to larger works Frankton, Lighthorne Heath, Stockton, Tibberton and Wellesbourne.

In the past there has also been discussion on the possibility of a 'valley sewer' on the Bow Brook which could further reduce the already low flows in that Brook by diverting the sewage effluent to the lowest part of the catchment. The diversion of Hunt End Works in the mid 1970's significantly affected resources in the upper reaches of Bow Brook.

If abstraction downstream of a sewage effluent is dependent on the discharge, it may be impossible after a diversion.

Lowering of flow may also bring existing abstraction restrictions

into force for a longer period and could affect the in-river requirements for plant and animal life (see issue 3.26).

Other interests which may be affected by the diversion of sewage treatment works are hydropower generation and navigation.

There may be some internal NRA conflicts to resolve on this issue as the removal of a sewage treatment works could bring quality benefits at the expense of resource loss.

Solutions and Options for Action

3.28.1 Ensure that implication of consent reviews on the diversion of possible sewage treatment works are considered early.

Responsibility
NRA

Benefits

- * Remedial options can be considered early.

Constraints

- * Maintenance of water resources should not prejudice water quality improvement.

3.28.2 Diversions to be recommended for Environmental Assessment.

Responsibility
Local Authorities, NRA, Water Companies.

Benefits

- * Best option for the environment should be found.

Constraints

- * Costs of environmental assessment.
- * Some diversions may not be subject to planning.
- * Local Authority may not consider environmental assessment appropriate.

3.28.3 Maintain some flow from works by operating agreements.

Responsibility

NRA, Water Companies.

Benefits

- * Maintenance of adequate flow in river.

Constraints

- * Costs to NRA for agreement.

3.29 Loss of supply water and river support in the Lower River Leam.

Nature of Problem

Severn Trent Water abstract from the Leam at Eathorpe to fill Draycote Reservoir, an important part of the local water supply system. Under the provisions of the licences for the Leam, some of this water is released back into the Leam to support the abstraction lower down the river in Leamington. Under low flow conditions, water may only be abstracted at Leamington such that an 'environmental flow' requirement is maintained in the river.

Severn Trent Water are concerned that this water is then lost to them by:

- * mixing of Draycote water with poorer quality river water.
- * abstractions between Draycote and Leamington.

As a consequence, Severn Trent Water have now built a pipeline between Draycote and their Leamington Water Works. Although their present licence restricts the use of this pipeline there may eventually be less flow support to the river.

Impact on Uses and Conflicts

With the present controls on abstractions and discharges Severn Trent Water have expressed concern that they are not making best use of their resources. The NRA has concerns that there will be operational pressures within Severn Trent Water to use the direct pipeline between Draycote and Leamington as often as possible so

reducing flow support to the river. This could have implications on the local amenity and water quality.

Solutions and Options for Action

3.29.1 Target Lower Leam for abstraction enforcement activity under low flow conditions.

Responsibility

NRA.

Benefits

- * Ensures Severn Trent Water are able to take the majority of their water discharged from Draycote at Leamington.

Constraints

- * The NRA may be seen to make this a 'special case' when equal resource problems arise for farmers.

3.29.2 Encourage use of shared quality data on the Leam and investigate possibility of further continuous monitors.

Responsibility

NRA, Severn Trent Water.

Benefits

- * Better quality data should allow Severn Trent Water to discharge from Draycote at the most favourable time.

Constraints

- * Costly to run and maintain.

Sites for Action

Data from a monitor at Eathorpe would be most beneficial.

3.29.3 *Encourage Severn Trent Water to maintain support to the Leam whenever practicable.*

Responsibility

Severn Trent Water, NRA.

Benefits

- * Maintains good flow in the Leam under dry weather conditions.

Constraints

- * Severn Trent Water may prefer to use direct pipeline.

3.30 Creation of a Management Strategy to resolve conflicts between Recreation, Navigation and Conservation Uses and to ensure sustainability of the resource.

Nature of the Problem

The principal recreational uses on the Avon are angling and pleasure craft, plus, to a lesser extent, sailing, rowing and canoeing. These uses are all vying for monopoly of the same stretches of water. On the bank there is also demand for facilities such as sanitary stations similar to those at Strensham and Evesham, moorings, marinas, car parks or club sites.

The most densely navigated stretch of the Avon is between Evesham and Tewkesbury with correspondingly more mooring, marinas and caravan sites associated with the river.

The Avon is navigable as far upstream as Alveston weir. The 25 miles from Tewkesbury upstream to Evesham lock is controlled by the Lower Avon Navigation Trust and upstream, a further 21 miles from Evesham to Alveston is controlled by the Upper Avon Navigation Trust. There is a further proposal to extend navigation upstream to the aquaduct of the Grand Union Canal at Warwick.

There is also a demand from ramblers and walkers for more riverside footpaths.

The NRA has a responsibility to protect and enhance the recreational resource while minimising the impact on the natural environment. In order to do this, it is essential that recreational data is obtained in the Avon Catchment. The overall requirement is that a balance is maintained between conservation, recreation, navigation and the broad environment.

Impact on Uses and Conflicts

- * The pressure for recreational space leads to direct conflict between users. The general antipathy between anglers and boaters is well known and perhaps most significant on the heavily used stretches of the Avon.
- * The second type of conflict is more widespread and relates to the impact of recreational uses on the environment. The facilities which these uses need, such as moorings and car parks, are a threat to the environment because they mean loss of natural habitat. Once again anglers figure strongly because trampling of banks and destruction of vegetation makes an impact on wildlife and vegetation within the sensitive river margin. However, the careful planning of facilities, such as the car park and moorings at Eckington or the car park and canoe launch at Fladbury, should avoid most conflicts.
- * Most recreational uses contribute to this type of impact, from the key recreational uses previously mentioned to the more peripheral users such as caravan sites, walkers, campers and sightseers. This type of pressure may also affect the built environment in the small villages and hamlets which are so typical of the catchment in rural Warwickshire, Worcestershire and the Cotswold Scarp.
- * The proposal to extend navigation on the Avon is one which the NRA views with concern in that it would open up a relatively isolated length of the river with consequent loss of natural quality.

Solutions and Options for Action

3.30.1 Survey recreation, conservation and navigation uses and facilities and maintain data base of records.

Responsibility

NRA.

Benefits

- * Allows strategy to be based on current data.
- * General public interest.

Constraints

- * Other organisations may consider this their responsibility.

Sites for Action

Main River Avon between Alveston and Tewkesbury.

3.30.2 Evaluate conflicts between users and devise a strategy to protect the recreational resource.

Responsibility

NRA, Local Authorities, User Groups, Navigation Trusts.

Benefits

- * Protection of recreational resources and water quality.

Constraints

- * Requires the co-operation of many organisations.

3.30.3 Promote a greater interchange of information and understanding between bodies concerned with water related recreation.

Responsibility

NRA, User Groups.

Benefits

- * Better tolerance of other river users.

Constraints

- * Primarily dependent on user groups.

3.30.4 Educate users on impact of recreation on the environment.

Responsibility

NRA.

Benefits

- * Better use of resource by users.

Constraints

- * The large number of user groups to target in the Avon catchment.

3.30.5 Promotion of footpaths for walkers and ramblers where this does not conflict with conservation interests.

Responsibility

Local Authorities, Landowners, Countryside Commission, NRA.

Benefits

- * Beneficial to recreational use.

Constraints

- * Possible conflict with conservation and farming interests.

3.31 Conservation and rehabilitation of river corridors

Nature of the Problem

Any activity associated with the river corridor has the potential to degrade the environment and damage the wildlife resource. Such activities include urban development, pollution by discharge or run-off, abstractions, river construction and operational work, agricultural activity and recreational use.

Whilst it is accepted premise that river ecology is dynamic, the impact of these various influences must be assessed and balanced in terms of environmental loss and benefit.

Impact on Uses and Conflicts

Urban areas exert considerable pressures on the river corridor. The physical impact of intense public use and activity creates heavy wear and tear in urban areas. Often, people are unaware of the effect their individual actions are having on the ecosystem. Neglect and vandalism degrade both habitat and amenity value and vandalism, litter, abandoned shopping trolleys and a general air of decay sets in.

Past river operations have often resulted in a loss of diversity, both in channel shape and appearance. This has caused a loss of habitat diversity and therefore, a reduced range of species. Many channels have some reaches where banks or beds are of concrete or gabion baskets, such as the Swift and the Upper Avon at Rugby.

Trees, scrub and marginal vegetation near river banks have been lost for reasons related to agricultural practices, river work or simply landowners' wishes. The Upper Avon was once lined with trees and

scrub and linked into the landscape with hedgerows across the floodplain. Now, it is often cultivated or grazed up to the river bank.

The whole aquatic ecosystem may be affected by herbicide/pesticide use and residual effects.

Structures such as weirs, sluices and mills have fallen into disrepair with consequent loss of cultural and historic interest as well as their role in controlling water levels and therefore the local ecosystem.

Wear and tear on banks and vegetation can arise from recreational pressures. Sailing clubs are often keen to remove sheltering trees. Anglers can cause local damage to banks and may well conflict with other users such as walkers or canoeists.

A number of species are now rare or threatened. Loss of habitat, human interference and a decline in their natural range has seen a decline in the rare marsh warbler in the catchment. Birds generally can be affected by noise and disturbance of their nesting sites. Until very recently otters have been lost to the catchment.

The native black poplar, a typical tree of the flood plain, is rarely able to find appropriate conditions for seed germination in the wild now.

Non-native plant species such as Japanese Knotweed and Himalayan Balsam have been introduced. They have 'taken over' the natural plant life in many places. Other plants which are undesirable in public access areas must be eradicated locally, such as Giant Hogweed.

Solutions and Options for action

3.31.1 Assess impact of NRA's operational work on the environment including secondary impacts such as affect on the water table.

Responsibility

NRA.

Benefits

- * Ensures compliance with statutory obligations under EEC Directive 85/337.
- * Ensures best practice to protect the environment.

Constraints

- * Resources and staff training to achieve best practice.

3.31.2 Ensure relevant comments are made on appropriate planning applications.

Responsibility

NRA, Local Authorities

Benefits

- * Ensures development is compatible with sustainable wildlife resource and protection of river corridors.

Constraints

- * Comments not always taken up by Planning Authorities.

3.31.3 Monitor effectiveness of environmental input to licence and consent applications received by NRA.

Responsibility

NRA.

Benefits

- * Protection of nature conservation, archaeological and landscape features dependent on the water environment.

Constraints

- * May hold up processing of licences and consents.

3.31.4 Establish conservation strategy to ensure wise use of scarce resources.

Responsibility

NRA

Benefits

- * Determination of priorities and assessment of impacts.
- * Furthers baseline knowledge.
- * Reduction of invasive species.

Constraints

- * A long term goal - no 'quick fix' solution.

3.31.5 Encourage improvement to agricultural practice and creation of river corridor buffer zones.

Responsibility

NRA, Landowners, MAFF

Benefits

- * Reinstatement of river corridor vegetation and improvement in quality of habitat.
- * Restriction in use of herbicides close to river corridor.
- * Improvement to water quality by intercepting agricultural run-off.

Constraints

- * NRA advice may not be taken.
- * Need for audit.

Sites for Action

Avon above Rugby, River Leam.

3.31.6 Extend programme of river rehabilitation with particular reference to the Arrow at Redditch, the Swift and Avon at Rugby.

Responsibility

NRA, Landowners, Local Authorities.

Benefits

- * Restoration of natural river habitat and creation of urban recreational resource.

Constraints

- * Needs to be closely integrated with requirements of all NRA functions.

3.31.7 Collaborate with other organisations and agencies to promote and enhance the water environment, using grant schemes where appropriate.

Responsibility

NRA, Local Authorities, Landowners, Groundwork Trust, Countryside Commission, Ministry of Agriculture Fisheries and Food, Farming and Wildlife Advisory Group.

Benefits

- * Improvement of habitat associated with the water, environment and quality of landscape.

Constraints

- * Resources to provide advice.
- * Cost of operational works.

3.31.8 Re-survey river corridor habitats periodically.

Responsibility

NRA.

Benefits

- * Ensures validity of data.
- * Identifies opportunity for improvements.

Constraints

- * Resource requirement.

3.31.9 *Promotion of rare or threatened species such as the otter and native black poplar.*

Responsibility

NRA in collaboration with wildlife agencies.

Benefits

- * Increase of rare species.
- * Protection of threatened species.

Constraints

- * None identified.

3.31.10 *Collect archaeological data related to the water environment and survey river structures of historic or cultural interest. Assess impact of structures to ecosystem. Special reference will be made to the River Stour.*

Responsibility

NRA

Advantages

- * Ability to evaluate sensitivity of catchment to development or operational works.
- * Assess benefits of enhancement or rehabilitation.

Constraints

- * Cost/resource implication.

3.32 *Requirement for a review of EC designated areas for salmonoid and cyprinid fisheries.*

Nature of the problem

When reaches of the Avon Catchment were designated as cyprinid or salmonoid fisheries under the EC Directive for the Protection of Freshwater Fisheries (78/659/EEC) significant high quality fisheries were not included. If these reaches were to be designated, they would then be required to meet more stringent water quality conditions than under the National Water Council Classification Scheme (Appendix 5). Fish populations are very dependent on the quality of the water in which they live, the quantity of water available and the quality of the habitat. Many of the issues listed in this document have a direct or indirect impact on these factors and, in consequence, on fish stocks.

Impact on Uses and Conflicts

The higher water quality standards should maintain or improve fish stocks in any newly designated area. To comply with the directive, further sampling and an extended water analysis would be required. This has obvious implications for resources and manpower. Should the extended analysis identify problem areas, further resources and costs would be involved in tracing and rectifying the causes.

Solution and Options for Action

3.32.1 Investigate the possible designation of river lengths currently fished but not designated.

Responsibility

NRA, Department of the Environment.

Benefits

- * Improved protection by application of tighter water quality standards.

Constraints

- * Requirement for increased monitoring and possible further treatment of discharges.
- * May be subject to restrictions associated with new Statutory Water Quality Objectives.
- * Expenditure implications to be agreed by Department of the Environment.

Possible Sites for Action

Salmonid: Upper reaches of River Stour, River Isbourne and tributary of River Alne.

Cyprinid: River Avon between Rugby and Stratford, River Arrow.

3.33 Licence evasion and unlawful fishing during the close season particularly in the Coventry area.

Nature of the problem

The wide variation between NRA Regions in close season byelaws leads to confusion within the angling community and some disregard for the Severn Trent Region's close season regulations. Several pools in and around Coventry have caused particular problems in recent years. There is disagreement within the angling fraternity, let alone with other interested parties, as to whether the various close seasons should be retained, altered or dispensed with. In the Avon Catchment the current relevant close seasons for rod fishing are for brown trout (other than in enclosed lakes, ponds and reservoirs) from the 8 October to the 17 March inclusive and for freshwater (coarse) fish from 15 March to the 15 June inclusive. As eels return to sea to spawn, there is no close season for eels so anglers may fish for eels using certain specified baits and methods during the coarse fish close season. Coarse fish are caught accidentally (and intentionally) by these anglers and this tends to be a problem particularly in the Lower and Mid Avon.

Impact on Uses and Conflicts

Close seasons were introduced to reduce disturbance during the spawning period and to improve reproductive success. The close seasons do have an impact on the income available to fishery owners and fishing tackle shops as well as the impact on fishing time for anglers. Indirect benefits include reduced bankside disturbance during the coarse fish close season which coincides with the main nesting period of our British Birds.

Solutions and Options for Action

3.33.1 Maintenance of surveillance and patrol works by fisheries inspectors to detect and prosecute those fishing in contravention of the legislation.

Responsibility

NRA

Benefits

- * Protection of fishery resource.

Constraints

- * Enforcement of close season is not consistent between Regions.

3.33.2 Review fishery byelaws with regard to close season regional variations.

Responsibility

NRA in consultation with fishery interested parties.

Benefits

- * Greater respect for byelaws.

Constraints

- * Not likely to please all interests.

3.34 The Protection and Improvement of Trout, Coarse Fish and Eel Stocks.

Nature of the Problem

Angling match results have deteriorated on the Middle Avon, especially in recent months. Brown trout have shown reduced spawning success on the River Alne whilst zander are being caught in increasing numbers by pleasure anglers at a number of stillwater, canal and riverine locations in the catchment including the North Oxford Canal, Coombe Abbey Lake, Coventry and Stratford Canals.

Eel numbers in the Middle and Upper Avon are lower than would be expected for the habitat - probably due to the barrier to migration caused by the weirs.

Angling results provide some information on fish stocks and match results are monitored on the River Avon in the NRA's Angling Census programme. The NRA also carries out electric fishing, netting and echo-sounding surveys at sites throughout the catchment to provide information on stock levels. However, electric fishing is, best suited to smaller streams and rivers. (See Appendix 2).

Impact on Uses and Conflicts

The Avon is considered as a high class coarse fishery and any deterioration would have a significant impact on the angling fraternity. Some anglers blame the zander for the deterioration of angling match results on the Middle Avon and would wish to see a

zander cull. Other anglers enjoy fishing for and eating zander and do not consider it to be a problem. The protection and improvement of fisheries requires resources and commitment by the NRA and adequate funding for the fishery function. How the fishery works is best funded is a major issue in its own right but will necessarily be resolved nationally.

Solutions and Options for Action

3.34.1 Maintain and enhance natural brown trout populations by improving and protecting the habitat with fencing and improvement of gravel quality.

Responsibility

NRA

Benefits

- * Increased trout stocks and angling potential.

Constraints

- * Enhancements such as fencing may have local effect on access for angling.

Site for Action

River Alne

3.34.2 Enhance coarse fishery by improvements to habitat, water flow and quality, survey techniques and by management of predators, restocking and introduction of new species.

Responsibility

NRA

Benefits

- * Increased coarse fish stocks and angling potential.

Constraints

- * Resource requirement.

Sites for Action

Predator control in Evesham to Strensham reach followed by restocking with chub and dace.

3.34.3 Maintain and enhance eel populations in Lower Avon by construction of eel passes on weirs and sluices.

Responsibility

NRA

Benefits

- * Improve eel fishery.

Constraints

- * Some continuing maintenance requirement.

Sites for Action

Eel passes at Chadbury, Fladbury, Evesham and Stratford.

3.35 *Effect on the water environment of urban and infrastructure development.*

Nature of the Problem

Routes of watercourses are now being recognised as 'green corridors' through the urban sprawl; they can provide a pleasant breathing space between houses and factories, a viable habitat for a wide range of species of flora and fauna and in some cases traffic free arteries for pedestrians and cyclists.

Developments and their associated roads, bridges, culverts etc inevitably create pressures on this water based environment. These pressures fall into three categories:

- (a) Construction phase
- (b) Physical presence
- (c) Aftercare.

Impact on Uses and Conflicts

During the construction phase there can be disturbance and temporary loss of habitat, pollution due to the discharge of silt laden or contaminated drainage and obstruction of flood plains by storage of topsoil or building materials.

The physical presence obviously entails permanent loss of 'green field' areas, the narrowing of river corridors and culverting of watercourses. This can lead to increased rates of run-off, diminution of groundwater recharge, loss of flood plain and flood flow capacity and the total abandonment of the area by certain species of wildlife.

Where development close to boreholes is proposed there is an increased risk to the groundwater source.

The lack of aftercare can result in the watercourse corridors becoming dumping grounds for a wide range of debris - including garden rubbish, fly tipping, and discharge of foul effluent via surface water drainage systems.

The need to avoid flood plain areas and to provide remedial measures may increase the cost to developers and can lead to the abandonment of some proposals.

Solutions and Options for Action

3.35.1 Encouragement of Pre-Planning Consultation with Developers.

Responsibility

NRA

Benefits

- * Forestalls abortive work by developers.
- * Minimises need for last minute intervention by NRA.

Constraints

- * May be increased number of speculative enquiries leading to wasted staff time.

3.35.2 Better liaison with Local Authorities and inclusion of appropriate policies in Local Plans.

Responsibility

NRA, Local Authorities.

Benefits

- * Clarification of NRA's objectives.
- * Less effect of developments on aquatic environment.

Constraints

- * Variable response from Local Authorities.
- * Long timescale solution.

3.35.3 In appropriate cases developers to use surface water balancing areas and/or the channelling of roof water to soakways.

Responsibility

NRA, Local Authorities, Developers. (This can be encouraged both through planning and NRA's own Land Drainage powers).

Benefits

- * Controls rate of surface water run-off (reducing risk of flooding).
- * May ensure construction of aquifer recharge.

Constraints

- * Possible pollution of aquifers.
- * Acceptance of new approach may take time.

Sites for Action

Redditch.

3.35.4 *Encourage Local Authorities and Developers to design the developments so that they make use of the watercourses on the site as features.*

Responsibility

Local Authority/Developers with advice from NRA.

Benefits

- * Reduction in vandalism.
- * Reduction in dumping of rubbish.
- * Creation of safer environment for children.

Constraints

- * If poorly maintained may become an eyesore.

Sites for Action

New developments in Redditch and Swift Valley, Rugby.

3.35.5 *Owners to ensure a well managed after care programme for the watercourse environs: Ideally this would be vested in one or more responsible bodies.*

Responsibility

Local Authorities, owners, developers.

Benefits

- * Maintain attractive watercourse environs and flood capacity.

Constraints

- * Owners may not wish to take on responsibility.
- * Increased NRA expenditure if development is 'main river'.

***3.35.6 Increased involvement in the scope and review of
Environmental Assessments, Development Briefs and
Planning Agreements.***

Responsibility

NRA in consultation with Local Authorities and Developers.

Benefits

- * Identification of areas of concern.
- * Proper specification of mitigation measures.

Constraints

- * Requirement for staff time and additional skills.

Sites for Action

Across the catchment.

3.36 Changes in Local Government Structure.

NRA Planning Liaison Officers comment on around 2,000 planning applications per year within the Avon Catchment. This liaison protects and improves the water environment and also highlights areas where the Authority needs to use its own powers. The Local Government Commission is reviewing the structure of Local Councils over the five year period of this plan.

The Councils that emerge may be responsible for the complete range of services in their area rather than the existing split of functions between County and District Council level.

Impact on Uses and Conflicts

- * Removal of existing arrangements for formal planning consultations together with loss of appropriate contact officers; after four years in existence these were beginning to bear fruit.
- * A multiplicity of existing Development Plan policies, both in Structure Plan and Local Plan format, that will be applicable for different parts of the same Council area.

Both cases are bound to have a short term detrimental effect on our ability to influence the Planning process.

Eventual benefits should be a one stop shop for all liaison within an area.

Solutions and Options for Action

3.36.1 Establish liaison with new authorities as rapidly as possible.

Responsibility

NRA and Local Authorities.

Benefits

- * Maintain contacts on development control and Local Plan issues.

Constraints

- * Disruption caused by establishment of new organisations and loss of contacts.

3.36.2 Establish database of policies in Local Plans to cover individual council areas.

Responsibility

NRA

Benefits

- * Locate policies applicable to new areas.
- * Improve efficiency of comment on development control issues.

Constraints

- * Still difficulty of assigning 'old' Local Plan policies to new council areas.

APPENDICES

INTRODUCTION

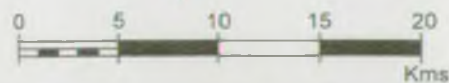
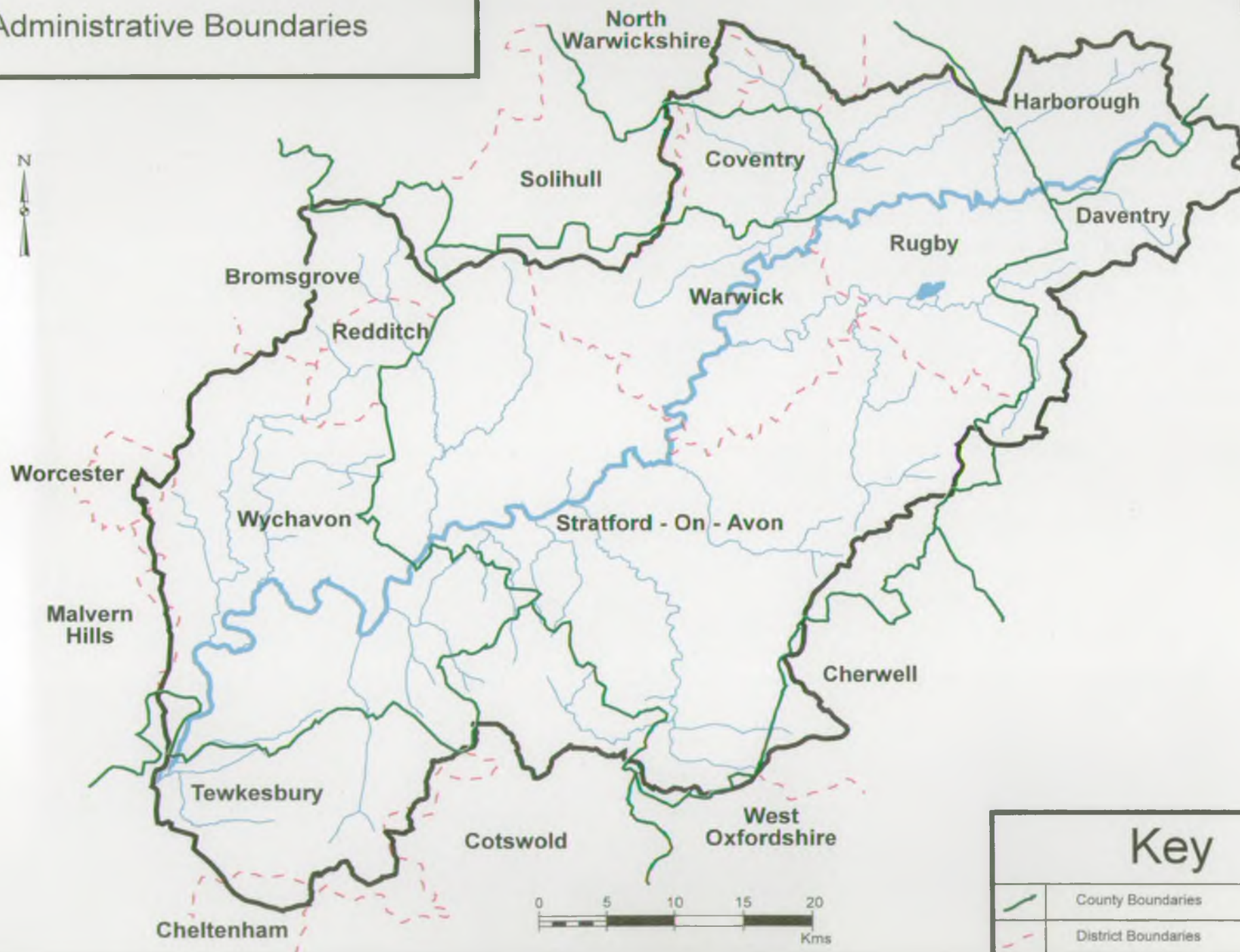
The 'uses' of the catchment are identified in this Appendix. The term 'use' is used quite loosely. It includes human 'uses' of the catchment, as well as the use made of the catchment by the plants, animals, fish and birds that live in and around and depend upon the rivers, streams, lakes and ponds.

The 'Requirements' of each use identify the water quality, water quantity and physical features that the particular use requires. There are some cases where the requirement of one use conflicts with the requirements of another. These conflicts are not dealt with in this Appendix but are highlighted in Section 3. This is one of the main purposes of this plan, i.e. to identify problems and conflicts, so that they can be resolved.

Units

We have used metric units throughout. When dealing with water quantity, the range is so great that we have expressed volumes in either cubic metres or megalitres (one thousand cubic metres).

Administrative Boundaries



Key

	County Boundaries
	District Boundaries

APPENDIX 1.1

DEVELOPMENT (Housing, Industry, Commerce and Infrastructure)

General

Development, either residential, commercial or industrial, can have a major impact on other uses of a river catchment. County structure plans and district local plans identify policies against which the Planning Authorities consider development proposals.

The NRA intends that the Catchment Management Plan should positively influence the policies and actions of the planning authorities and developers.

The NRA is a statutory consultee of the Planning Authorities and provides advice on development proposals that may have an impact on the water environment.

The NRA seeks to pursue its aims and policies in relation to development through the planning consultation process. Although the final decision on planning matters rests with the planning authority, government guidelines advise of the need to consider the NRA's concerns when determining proposals. The NRA's Model Land Use Policies are summarised in Appendix 4.

Local Perspective

Parts of six Counties fall within the Avon Catchment but those of Warwickshire and Hereford & Worcester predominate. There is a good mix of other types of local authorities for example Unitary City

Council (Coventry), former New Town (Redditch), Metropolitan Borough (Solihull), compact Borough (Cheltenham) and Rural District Councils (Wychavon) - see Map 4.

With the exception of Leicestershire, all the County Councils plus Coventry City are operating under adopted Development Plans whilst the District Councils are at various stages in the production of district-wide Local Plans. For the most part, strategic allocations of development both in relation to housing and employment are to be catered for in-and around the periphery of the large centres of population. However, some villages in the northern portion of Stratford District Council are being considered for significant expansion, for example Stockton and Lighthorne Heath.

Table 2 gives the allocation of housing and industrial land and the present status of the relevant local plans.

TABLE 2**Local Authorities: Population Plan Status and Proposed Development**

District Council	Estimated Population in Catchment	Current Status of Development Plan	Dwellings	Employment Land (Ha)
Bromsgrove	8,000	Draft	NS	NS
Cheltenham	30,000	Public Inquiry Completed	NS	NS
Cherwell	1,000	Public Inquiry	NS	NS
Cotswold	10,000	Deposit Draft	NS	NS
Daventry	10,000	Draft	NS	65.3
Harborough	5,000	Not Started	NS	NS
Malvern Hills	NS	Draft	NS	NS
Nuneaton	20,000	Adopted	-	22.3
Redditch	79,000	Inspector's Report	2,250	60
Rugby	86,000	Draft	3,000	80
Stratford-on-Avon	106,000	Public Inquiry	4,406	75
Tewkesbury	40,000	Issues Report	1,700	32.5
Warwick	115,000	Public Inquiry Completed	6,900	90
Worcester	2,000	Draft	NS	NS
Wychavon	102,000	Public Inquiry Completed	5,500	20
Unitary Council Coventry	300,000	Adopted	5,000	162

Note: NS = Not Significant

Historically the heavy industry has been centred in Coventry (Motor Vehicles and Coal), Rugby (Railway, Cement and Electrical) and to a lesser extent Leamington and Redditch.

With the rapid decline of old industrial base, new initiatives for large scale employment have centred on High-Tech Business Parks and their associated retail/leisure facilities; these are usually to be found at 'edge of town' green field sites (ie Tachbrook near Warwick). So far difficulties connected with contaminated land and access to city centre sites have generally discouraged the wholesale regeneration of former industrial land. An isolated greenfield site that is actively being investigated for the creation of a large Channel Tunnel railfreight terminal and distribution centre is at Crick, very close to Junction 18 of the M1 (43 hectares of rail orientated development and 22 hectares of business sites).

The area is well served by a network of motorways, trunk roads and railways plus the airports of Birmingham and Coventry. These provide good, quick communications. Map 5 shows the infrastructure of the catchment.

The M40 Motorway, was planned as a long distance artery of communication between London and Birmingham and an alternative to the overloaded M6/M1 corridor. It was not intended to be a magnet for development clustered around the interchange points; both its design and the allocations in the Warwickshire Structure Plan reflect this.

Major road schemes currently under consideration throughout the Avon Catchment are the widening of the M1, M6 and M42 together with the continued uprating of the Ashchurch (M5) to Warwick (M40) corridor. The motorway schemes occur at critical points in the headwaters of the catchment and will require careful monitoring at

-all stages of the design if detrimental effects on the water based environment are to be avoided.

Objectives

The NRA's objectives for development are:

- * To ensure that development does not affect the ability of existing users of surface and groundwater to abstract water.
- * To ensure that development does not cause pollution of surface and groundwaters.
- * To ensure that adequate pollution prevention measures, such as bunding of oil and chemical storage tanks, installation of correctly designed farm slurry and silage storage systems, are incorporated into new developments.
- * To ensure that developments comply with the Groundwater Protection Policy.
- * To seek the adoption of NRA model policies in Local Authority Development Plans.
- * To ensure that the risk of flooding of new developments is kept within national standards of service.
- * To ensure that any new development does not increase the risk of flooding to others.

- * To recommend that any work which is needed to reduce the risk of flooding created by a new development is financed by the developer and not the public.
- * To ensure that adequate access exists for proper maintenance of watercourses and structures with them, including flood defence schemes.
- * To protect the conservation interests of the water environment from any detriment due to development.
- * To enhance the conservation, recreation and amenity value of the water environment in conjunction with any development where possible.

Avon Catchment, Area Infrastructure



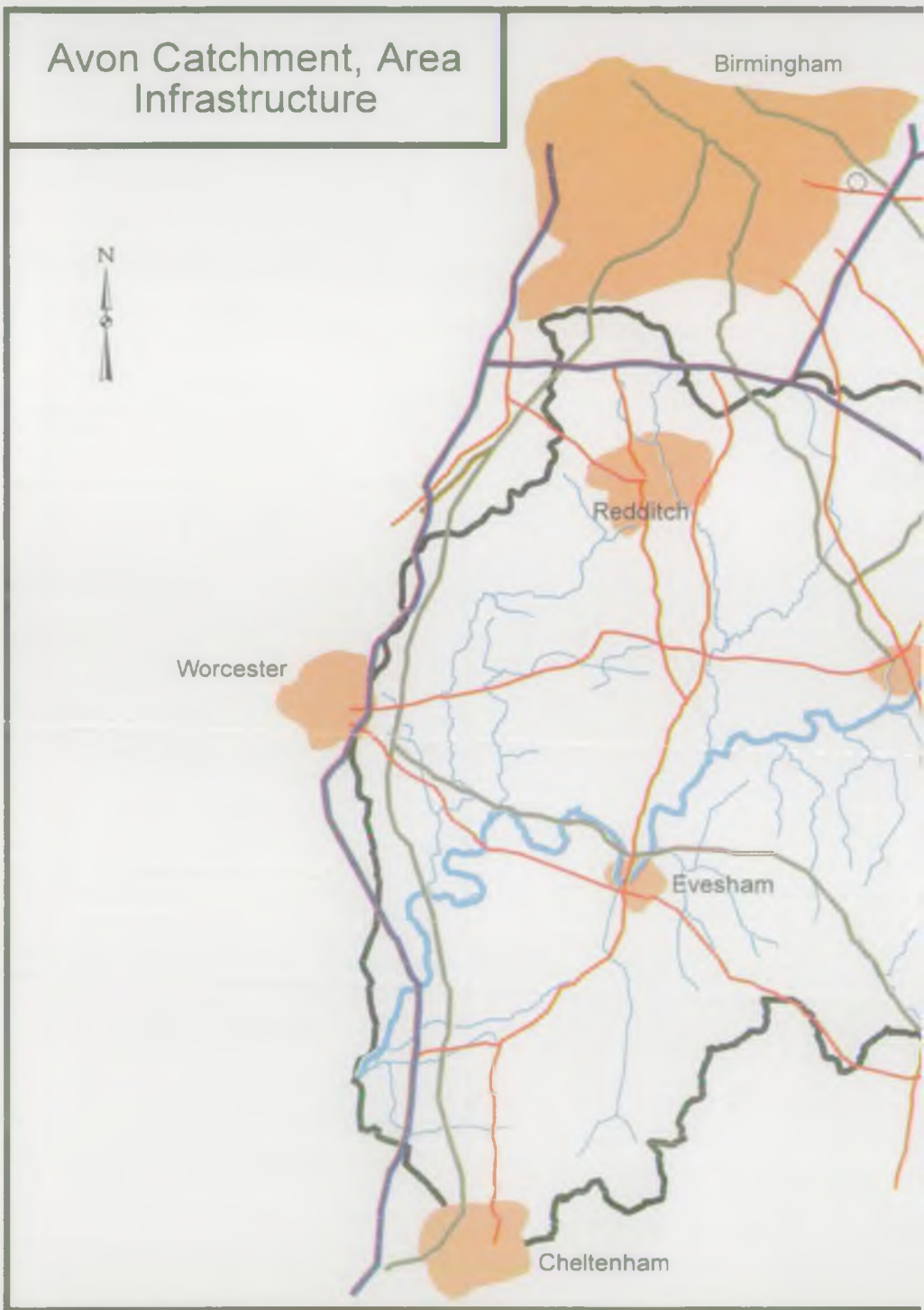
Worcester

Redditch

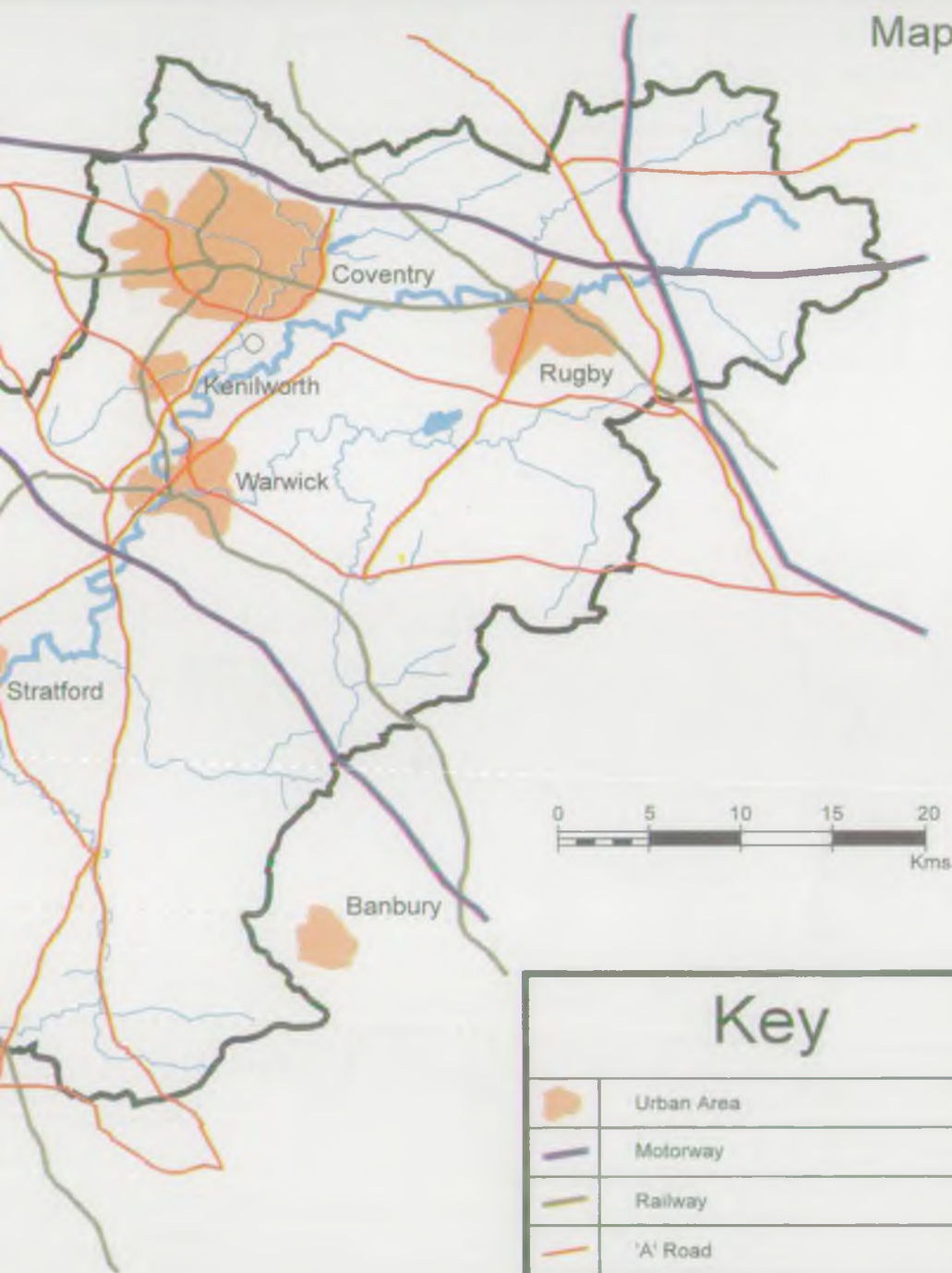
Evesham

Cheltenham

Birmingham



Map 5



Key

	Urban Area
	Motorway
	Railway
	'A' Road
	Airport

Flood Alleviation Schemes, Flood Storage & Flood Warning



Map 6



Note: The Natural flood plain of each river provides vital fluid storage but, due to scale, is not shown on this map.

Key

—	Extent of Flood Warning Reach
×	On-line Flood Storage Area
FAS Location & Type	
●	Flood Banks & Channel Works
●	Flood Banks, Walls & Channel Works
●	Flood Banks, Walls & Pumping Station
●	Flood Banks, Walls, Channel Works & Pumping Station
●	Flood Banks
○	Flood Banks, Walls, Channel Works & Flood Relief Channel
Flood Alleviation Schemes	
1. Alcester	
2. Henley-in-Arden	
3. Wootton Waven	
4. Long Itchington	
5. Barton	
6. Badsey	
7. Clay Coton	
8. Sedgeberrow	
9. Hinton	
10. Wellesbourne	
11. Rugby	
12. Birlingham	
13. Pensham	

FLOOD WATER CONVEYANCE AND STORAGE

General

In respect of Flood Defence the NRA has a supervisory role over all matters relating to water courses. It has direct powers of control over the construction or alteration of structures in, over, under or within 8 metres of those watercourses classed as main river, and over the construction or alteration of culverts, mill dams, weirs or other like obstructions in any watercourse.

Whilst the responsibility for the maintenance of any watercourse normally rests with the riparian owner (i.e. the owner of the river bank and bed), certain reaches of the river are formally designated as "Main River" (see Glossary at the end of this Plan). On main river, the NRA has permissive powers to construct and maintain defences and to control the actions of others through byelaws and the issue of Consents. District and County Councils have permissive powers to carry out works on Ordinary Watercourses (i.e. those not designated as main river), and to make Byelaws, although even their work requires NRA consent.

Wider controls over the river system are achieved through the Town and Country Planning Acts (Appendix 1.1).

Normally flooding is a result of prolonged heavy rainfall or rapid snowmelt. The peak flow of a flood is described in terms of the frequency at which it is likely to be exceeded, which is usually expressed as a return period in years for example 1 in 50 years.

Floods flow onto the flood plain which is as much a part of the river as the channel which carries normal flows.

These natural flood plains of the river system provide 'on-line' storage of flood water. If significant areas of flood plain are embanked, tipped or built upon, the lost storage volume leads to higher river levels elsewhere. For this reason it is not possible to alleviate flooding in all areas.

In addition to in-channel structures there are many structures on the flood plain which affect flood flows. Roads, railways, embanked canals, buildings all divert flood water to a greater or lesser degree as well as reducing the volume available for flood storage. As well as objecting to new development in flood risk areas the NRA believe that 'redundant' structures should be removed from the flood plain. The flood plain is also an important habitat for plants and animals and is part of the 'river corridor'.

Flood defences are designed to protect an area against a flood of a particular return period. Different types of land use (for example urban and rural areas) are protected against different sizes of flood, with the target 'Standard of Service' are detailed in Appendix 2.7 (Table 9).

Local Perspective

The Avon and its tributaries are prone to regular flooding which is not confined to the winter months. Floods of note occurred in 1900, 1936, 1947, 1960, 1968, 1979, 1981, 1992 and 1993.

In addition to records at gauging stations, there are flood level records at most bridges on the Avon and all its major tributaries. Aerial photographs were taken in the 1969, 1979, 1981, and 1992 floods on the Avon and on the Leam in 1979 and on the Swift in 1992. Information on ordinary watercourses is not so detailed, nor is the full extent of the flood plain mapped - even on the majority of main river watercourses (main river in the catchment is shown on Map 28 Appendix 2).

A change of emphasis from land drainage for agriculture to the defence of urban areas against flooding led to the construction between 1960 and 1990 of flood alleviation schemes at Alcester, Henley-in-Arden, Wootton Wawen, Long Itchington, Barton, Badsey, Claycoton, Sedgeberrow, Hinton, Wellesbourne and Rugby (See Map 6). These schemes consist of a combination of raised defences, channel works and pumping of surface water.

Flood waters and river levels are also controlled by a series of sluices on the Avon. These are shown together with weirs and other structures on Map 7.

Whilst most main river urban flooding has been reduced by Flood Alleviation Schemes the problem of frequent flooding from ordinary watercourses still exists. The NRA has few powers relating to these watercourses and relies on the appropriate Local Authority to exercise their flood defence powers. The NRA may consider including 'problem' watercourses as extensions to the main river

network to aid the longer term solution of flooding problems.

In some locations flooding cannot be reduced and in others to do so would exacerbate problems elsewhere. Even where flood alleviation schemes exist, flooding is not prevented, only reduced. For these reasons a Flood Warning Scheme is in operation for the Rivers Avon, Leam, Stour and Arrow to lessen the damage when floods occur. Warnings are issued by the NRA to the Police who disseminate the information, via the County or District Councils and Flood Wardens to those in danger. Map 6 shows the warning reaches. Councils have powers to provide assistance to those at risk eg. provision of sandbags, evacuation etc.

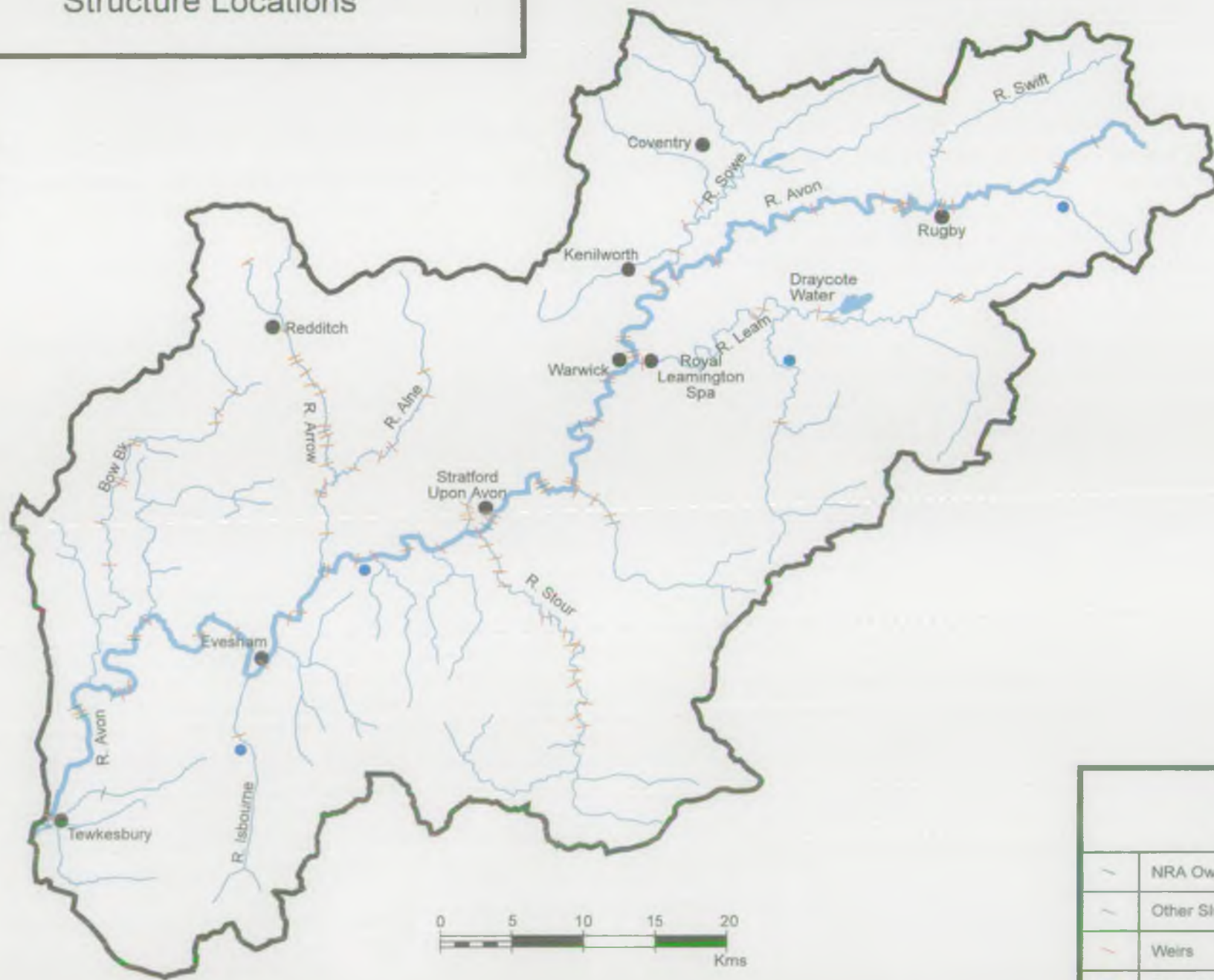
One method of flood alleviation is storage of flood water in artificially created 'balancing' or 'flood storage' areas. This has been used in the upper reaches of the River Arrow and Bow Brook catchments to cater for the increase in run-off from Redditch New Town. In addition to numerous off-line balancing areas there are three on-line storage areas on Shell Brook (The Wharrage). The effectiveness and use over a long period of time of some off-line areas is questionable in terms of run-off control. Both on and off-line storage areas can provide environmental opportunities in terms of visual and ecological enhancement and as a method of controlling the quality of water reaching the river system.

The headwaters of the Avon and Arrow contain many reservoirs which are used to provide water for the canal network. These can have effects on flooding in the catchment in two ways:

- (i) If they are full, excess water draining from them can send a surge of water downstream.

Structure Locations

Map 7



Key

	NRA Owned Sluices
	Other Sluices
	Weirs
	Pumping Stations

- (ii) If they are not full they can provide storage thus reducing flood peaks (in effect acting as balancing areas).

This latter case occurred in 1992 when Stanford Reservoir had been drained so that work could be carried out on it. Flood water from the Upper Avon Catchment drained into the reservoir reducing the peak volume reaching Rugby.

A further example of flood storage is at Tewkesbury on Carrant Brook where a specially constructed storage area compensates for lost flood plain nearby.

The NRA may seek balancing of run-off from new development to reduce the impact of increased flow on the watercourse downstream. Balancing is mostly required in the upper reaches of catchments or on smaller watercourses for example, Shottery Brook, Racecourse Brook at Stratford, Canley Brook and the Upper Sowe in Coventry.

Objectives

- * To provide effective flood defences on main rivers for the protection of people and property to a standard appropriate to the land use. (The land use bands are described in Appendix 2 and Map 27).
- * To provide adequate flood forecasting and flood warning service and to respond to flood events.
- * To ensure where possible that the effectiveness of the flood plain to store and convey flood waters is not impaired.

Requirements

Water Quality

- * To ensure that increased run-off from new development, or any other works, does not increase the volume of water entering the draining watercourse to the extent that the ecology of the watercourse is detrimentally affected.

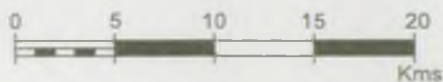
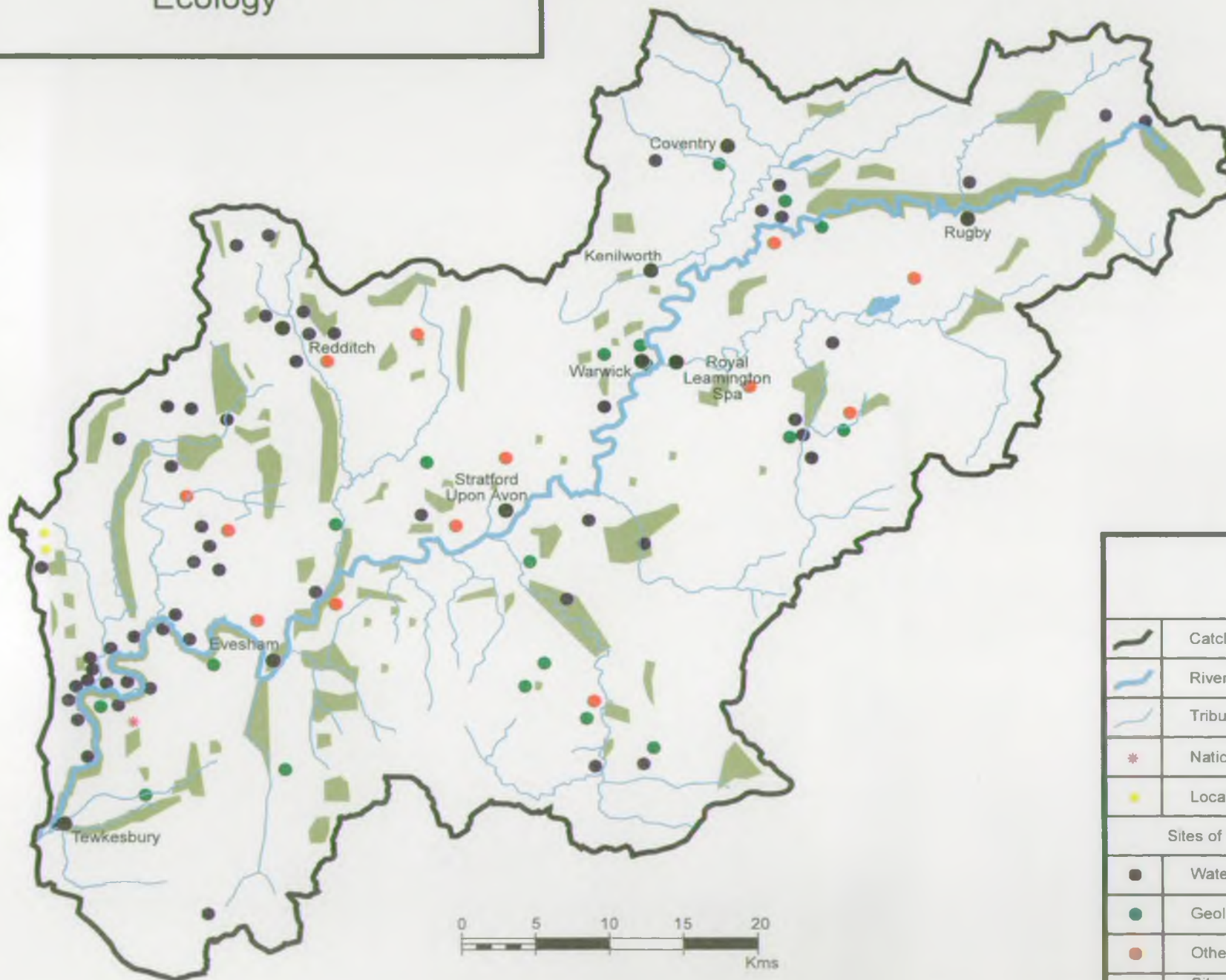
Water Quantity

- * To ensure that run-off from new development does not affect aquifer recharge or support for base flows in local watercourses.

Physical Features

- * The flood plain is kept free from development which creates additional flood risk.
- * Standards of protection are maintained by the upkeep of flood defence schemes.
- * Maintain 'Main Rivers' to ensure their flood carrying capacity is appropriate to the land use in the vicinity.
- * Environmental requirements are taken into consideration when undertaking flood defence works.





Key

	Catchment Area
	River Avon
	Tributary
	National Nature Reserve
	Local Nature Reserve
Sites of Special Scientific Interest	
	Water Dependent
	Geological
	Other Biological
	Sites of Importance for Nature Conservation

CONSERVATION – ECOLOGY

General

The NRA, whilst carrying out its own operational work and dealing with proposals by others, has a duty to 'promote conservation to enhance the quality of the aquatic and related environment for the benefit of wildlife and people'. This duty stems from the Water Resources Act 1991.

It is also required to 'ensure that (its) regulatory, operational and advisory activities take full account of the need to sustain and further conservation'. This is achieved by assessment of the environmental impact of its own works and proposals put forward by others under the Town and Country Planning (Assessment of Environmental Effects) Regulations SI 1199.

Every effort is taken to minimise adverse impacts and, wherever possible, to carry out any enhancements which can be identified.

As part of a national initiative, River Corridor Surveys have been carried out for all rivers in the catchment. These surveys describe the principal physical and biotic characteristics, and hence habitats, of the river corridor and will assist the NRA in carrying out its conservation duties by providing an initial means of identifying areas and features requiring protection or enhancement.

The Wildlife and Countryside Act 1981, protects a wide range of plants and animals.

This use deals with:

- * The protection of flora and fauna in the river corridor.
- * The protection of areas formally designated as being of particularly high conservation value which include National Nature Reserves and Sites of Special Scientific Interest (SSSIs).
- * The protection of sites which, although valuable in ecological terms, are not formally protected, for example Nature Reserves and County Trust Sites of Nature Conservation Interest.

(The 'use' of the river by fish is dealt with in Section 'Fisheries Ecosystem', although it is accepted that there is an overlap between the two sections).

Local Perspective

The catchment is of high conservation value with a rich flora and fauna. It supports a wide variety of habitats, including woodland, scrub, parkland, marshy grassland, water meadows, marsh, reedbed and natural rock exposures. Some of these features are the relics of a river landscape management system dating back several hundred years. The quality of habitat improves generally towards the

headwaters of the tributaries and away from settlement and the availability of public access.

The most special areas for nature conservation, the SSSI's occur mainly in the more remote parts, away from the main River Avon, with the exception of those related to the River Avon marsh warbler habitat. Of the 89 SSSI's in the catchment, 55 are water dependent.

By contrast, the distribution of the county prime sites shows clearly that all watercourses are valuable nature conservation resources. The standards used to select these sites vary considerably between counties. In Worcestershire, the vast majority of river corridors are classified as County Trust Site quality and yet in adjacent Warwickshire, far fewer river corridors are designated in this way. In view of what appears to be a disparity between standards of county classifications, those river corridors which have high quality of habitat and ecosystem, but no formal designation, have also been shown on Map 8.

The rivers are abundant in plant communities, both submerged and emergent. Particularly notable are the widespread growths of yellow water lily, common club rush, arrowhead and amphibious bistort.

Birdlife is rich. Kingfishers and herons are seen frequently and the catchment supports a varied bird population, including mute swan, mallard, moorhen, coot, snipe, curlew and lapwing. In the lower catchment, the very rare marsh warbler still maintains a small population.

The creation of habitat and artificial holts has recently encouraged the return of the otter to the catchment.

The catchment is generally known to provide excellent invertebrate

habitat. Within the last few years, the rare club-tailed dragonfly has extended its range from its previous territory on the Severn to the lower Avon as far upstream as Evesham.

Objective

- * To protect and promote the conservation and enhancement of the water environment, and ensure the sustainability of the resource.
- * Seek to maintain river corridors in as natural a state as possible, conserving their individual character and evaluating the various pressures which threaten their quality.
- * Assess the environmental impact of all NRA operational activities and ensure that any adverse impacts are mitigated for.
- * Carry out enhancements wherever possible.
- * Assess all applications for consents and licences for which the NRA is responsible or is consulted.
- * Offer sound advice on conservation, enhancement and education.

Requirements

Water Quality

- * Relevant surface waters (i.e. rivers, streams, lakes and ponds)

to comply with the standards for amenity protection and other site specific water quality criteria. (Appendix 2.2 Table 4)

Water Quantity

- * Flow regimes not to be significantly altered from the monthly natural historic flow conditions in the river.
- * All significant new net abstractions to be subject to a prescribed flow condition where necessary.
- * Groundwater levels not to be artificially lowered where it is likely to adversely affect flora and fauna dependent on those water levels.

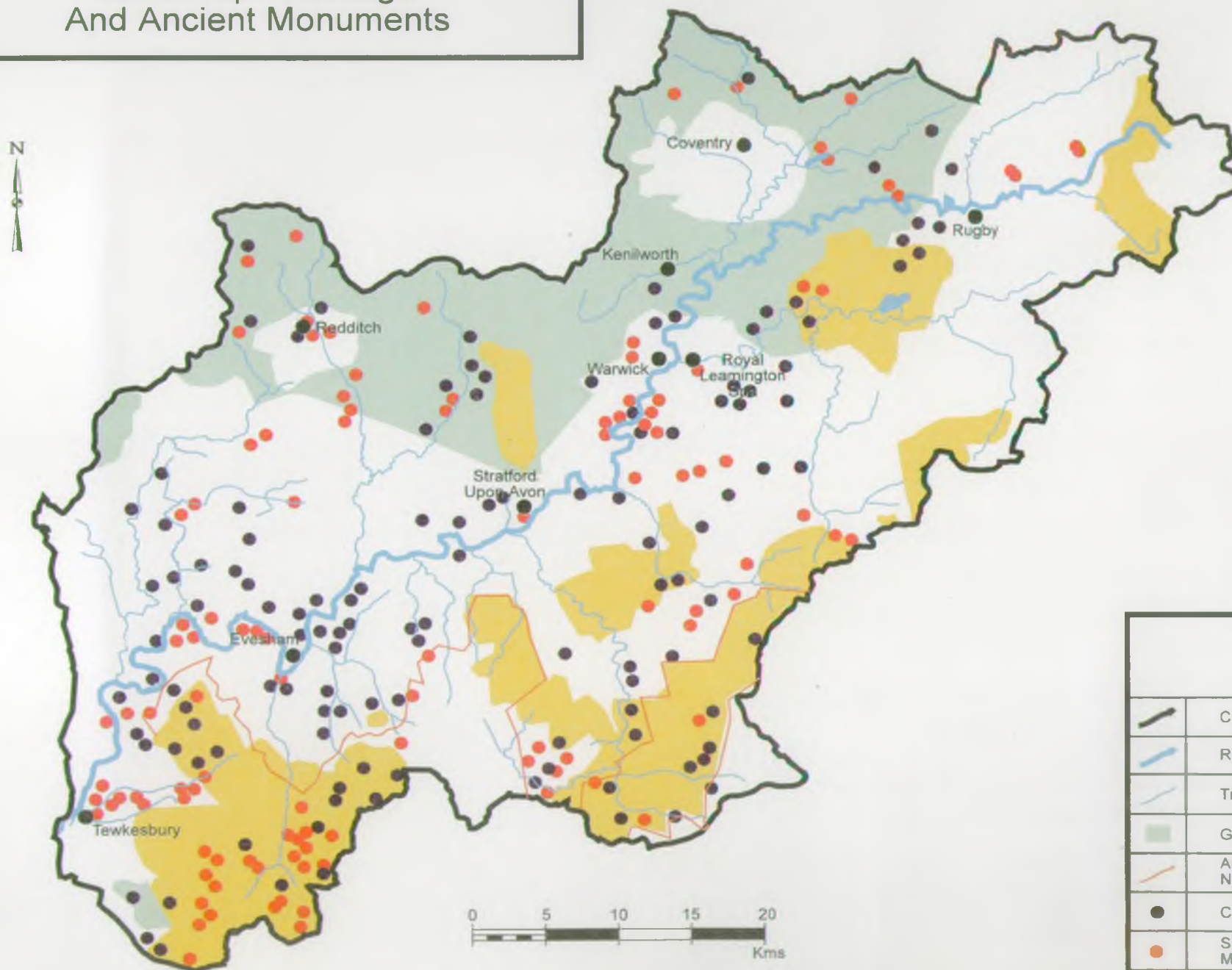
Physical Features

- * The variety of natural river features (such as meanders, pool and riffle sequences and the presence of aquatic vegetation) to be maintained, and enhanced where this is compatible with other uses.
- * A variety of river corridor and other wetland habitats (including marsh, fringe and overhanging vegetation, bankside trees and hedges and grassland) to be maintained and enhanced where possible. The special characteristics of designated conservation sites to be preserved.
- * Any works to the river channel to retain the channel form appropriate to the natural flow regime where possible.
- * NRA river maintenance operations and consented land drainage works to cause minimal damage to the flora and

fauna of the river corridor and enhance them where possible.

Landscape Heritage And Ancient Monuments

Map 9



Key

	Catchment Area
	River Avon
	Tributary
	Greenbelt
	Area of Outstanding Natural Beauty
	Conservation Area
	Scheduled Ancient Monument
	Area of Landscape Value

CONSERVATION – LANDSCAPE AND ARCHAEOLOGY

General

The NRA has a duty to conserve and enhance the water related landscape and any archaeological, architectural or historic features which may be affected by its own operational works or those which it consents or licences. This includes statutorily designated sites as well as those designated by Local Planning Authorities, for example:

- Designated sites, such as Areas of Outstanding Natural Beauty, Environmentally Sensitive Areas, Scheduled Ancient Monuments, Listed Buildings, Conservation Areas and areas designated in Planning Authority structure plans as being of special landscape value. A further category of sites of special archaeological interest are designated by County Authorities.

Local Perspective

The main Avon valley is broad and meandering, flowing through a generous floodplain, but occasionally constrained by steep wooded scarps. The area near Cleeve Hill on the eastern bank of the Avon between Bidford and Evesham is typical. Intrusions of sand and gravel are not unusual and these have given rise to extensive extractions. At Brandon Marsh, such a site has been reclaimed for nature conservation use and is designated as an outstanding SSSI.

The Avon has some of the finest stretches of lowland river habitat

anywhere in the Midlands and has an extremely varied character, changing regularly between deep pools and riffles with beaches, cliffed banks, wooded slopes and numerous islands.

In spite of its sometimes heavily engineered urban character, it also has some of the most scenic reaches on any British river. In some parts there is no public access and this results in very quiet, secluded and undisturbed habitats. This is particularly true on some of the smaller tributaries such as Bow Brook.

Predominantly rural, the river basin landscape is characterised by an agricultural and parkland landscape with a settlement pattern of small nucleated villages. Many are of high conservation value, carrying Conservation Area or archaeological designations.

Early settlements were clustered along rivers as communication links, focusing on the location of bridging points and the use of water for power. The Stour, for example, abounds in mills and control structures, many of which have now fallen into disrepair.

The northern tributaries are protected in part by green belt and landscape designations; to the south of the main Avon, protection is afforded by the Cotswold A.O.N.B. and further landscape designations. Sites of interest in the catchment are shown in Map 9.

Objective

- * To appraise and identify features of landscape, historical or archaeological interest when assessing NRA or other proposals.
- * To protect the landscape, archaeological, architectural and historical features associated with rivers and the water related elements of the catchment and to safeguard the special interest for which sites have been designated.
- * To conserve any features of historic or archaeological interest related to the water environment, whether designated or not, if protection is needed.

Requirements

Water Quality

- * All surface waters to comply with the standards for amenity protection and aesthetic criteria. (Appendix 2.2, Table 4)

Water Quantity

- * Flow regimes not to be significantly altered from the monthly natural historic flow conditions in the river.
- * Groundwater levels not to be reduced at archaeological sites which are dependent on a stable groundwater level.

Physical Features

- * The variety of river corridor habitats (including marsh, fringe and overhanging vegetation, bankside trees, hedges and grassland) which contribute towards the landscape value of the catchment to be preserved.
- * River works not to affect adversely sites of archaeological, architectural and historical interest and landscape importance.













Recreation & Navigation



Map 10



Key

	Catchment Area
	River Avon
	Tributary
	Focal Access Point
	Significant Riverside Footpath
	Regular Angling
	Sailing Lake (above 4 h.a.).
	Navigable Canal
	Rowing
	Sailing
	Canoeing
	Marinas / Moorings

APPENDIX 1.5

AMENITY/RECREATION

General

Rivers provide a valuable recreational resource, and potentially provide surroundings which are visually attractive and are enjoyable.

Local Perspective

The catchment provides a an easily accessible recreational resource for the West Midlands.

Active recreation such as sailing and canoeing occurs spasmodically as far upstream as Warwick, often highlighting conflicting objectives between recreational uses and conservation.

Angling is a major recreational activity on most of the main Avon, the Stour, Arrow and Leam, presenting its own conflicts in terms of bank erosion and vegetation loss. During the fishing season, watercourses are lined with both match and pleasure anglers (see also Appendix 1.9).

A number of caravan sites are located in the flood plain of the Avon as well as some of the tributaries and the validity of such location, especially for static caravans must be questioned. The increase of such a use could cause visual intrusion and take up some of the best water meadows.

Opportunities for informal recreation abound in the historic towns

along the Avon and the many villages throughout the area. Much of this attraction stems from the presence of rivers and water-related landscape.

Designated parks and gardens such as Charlecote, Warwick, Stoneleigh and Stanford Hall have developed on the river Avon.

Footpath access to the Avon is restricted to well spaced focal points where small car parks exist. These are often used by anglers. Few linear footpaths exist, probably due to the pattern of land ownership and agricultural holdings.

Human intrusion, through navigation, angling, and other forms of access puts pressure on habitat and wildlife. One activity is often in conflict with another, for example, angling with navigation or recreational access with nature conservation. Amenity recreation and navigation sites are shown on Map 10.

Objective -

To promote recreational use of the water for boating commensurate with the interests of other uses.

To manage the catchment to provide a sustainable resource, and to resolve potential conflicts.

To encourage the establishment of off-river moorings, marinas etc

and reduce where possible the amount of on-river moorings.

Requirements

Water Quality

- * Water to be free from surface films and extraneous floating material, deposited noxious material or associated growths, discolouration and unpleasant odour.

Water Quantity

- * Flow regimes not to be significantly altered from the monthly natural historic flow conditions in the river.
- * Water resources to be managed where possible in such a way as to meet reasonable amenity abstraction demands (i.e abstractions to maintain amenity and conservation ponds and lakes).

Physical Features

- * Maintain existing and encourage additional riverside footpaths, picnic sites and access points.
- * Bankside to be free of litter.
- * Protection of the river bed and banks whilst retaining those features which are attractive to users.
- * Formalised sites for launching and retrieving canoes.

APPENDIX 1.6

NAVIGATION

General

The NRA is not the navigation authority for the Avon, but it clearly has a duty to take the requirements of navigation into account when planning its activities or deciding policies.

Local Perspective

The Avon itself is navigable by means of locks from Tewkesbury to Alveston, immediately upstream of Stratford. The Avon ring provides a useful circular route by using the Grand Union or Stratford Canals, the Worcester and Birmingham Canal and the River Severn resulting in a total loop of 109 miles. The Upper Avon Navigation Trust has navigation responsibility between Evesham and Alveston Weir and the Lower Avon Navigation Trust has responsibility between Evesham and Tewkesbury.

Boat traffic is heavy, particularly in summer and speed limits are frequently disregarded, resulting in eroded banks and a loss of marginal vegetation.

Associated with the navigation are moorings and marinas on the navigable reach, inevitably intruding on the wildlife corridor. These become more frequent further downstream towards the confluence with the Severn, where boat traffic also becomes increasingly heavy.

Human intrusion, through navigation, angling, and other forms of

access puts pressure on habitat and wildlife. One activity is often in conflict with another, for example, angling and navigation or recreational access with nature conservation.

Objective

To ensure that present or future navigational use does not prejudice other users of the river.

To safeguard the quantity and quality of the water, sufficient for this use.

To ensure that works to the channel do not prejudice these activities as far as practicable..

Requirements

Water Quality

- * Water to be free from surface films and extraneous floating material, discolouration and unpleasant odour.

Water Quantity

- * Flow regimes not to be significantly altered from the monthly natural historic flow conditions in the river.

CONTACT SPORTS

General

A number of water based sports and pastimes involve the participant in contact with river or lake water. Contact sports include canoeing, raft racing and to a lesser extent, boating and angling.

The NRA discourages swimming in all rivers primarily because of the risk of drowning but also because of the possibility of swimmers catching water borne diseases.

Local Perspective

Total immersion sports are not a significant use of the Avon. However, canoeing can at times result in total immersion and local people occasionally swim in the river. Canoeing is most common near Tewkesbury and at Fladbury.

Risks due to blue-green algae can be locally significant.

Objective

- * To raise public awareness of the public health problems associated with contact with river water containing sewage effluent and the dangers of Weil's disease. This is a particular problem on the River Avon because of the high proportion of sewage effluent in the river, particularly at times of low flow when water based activities are at their

peak.

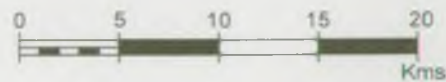
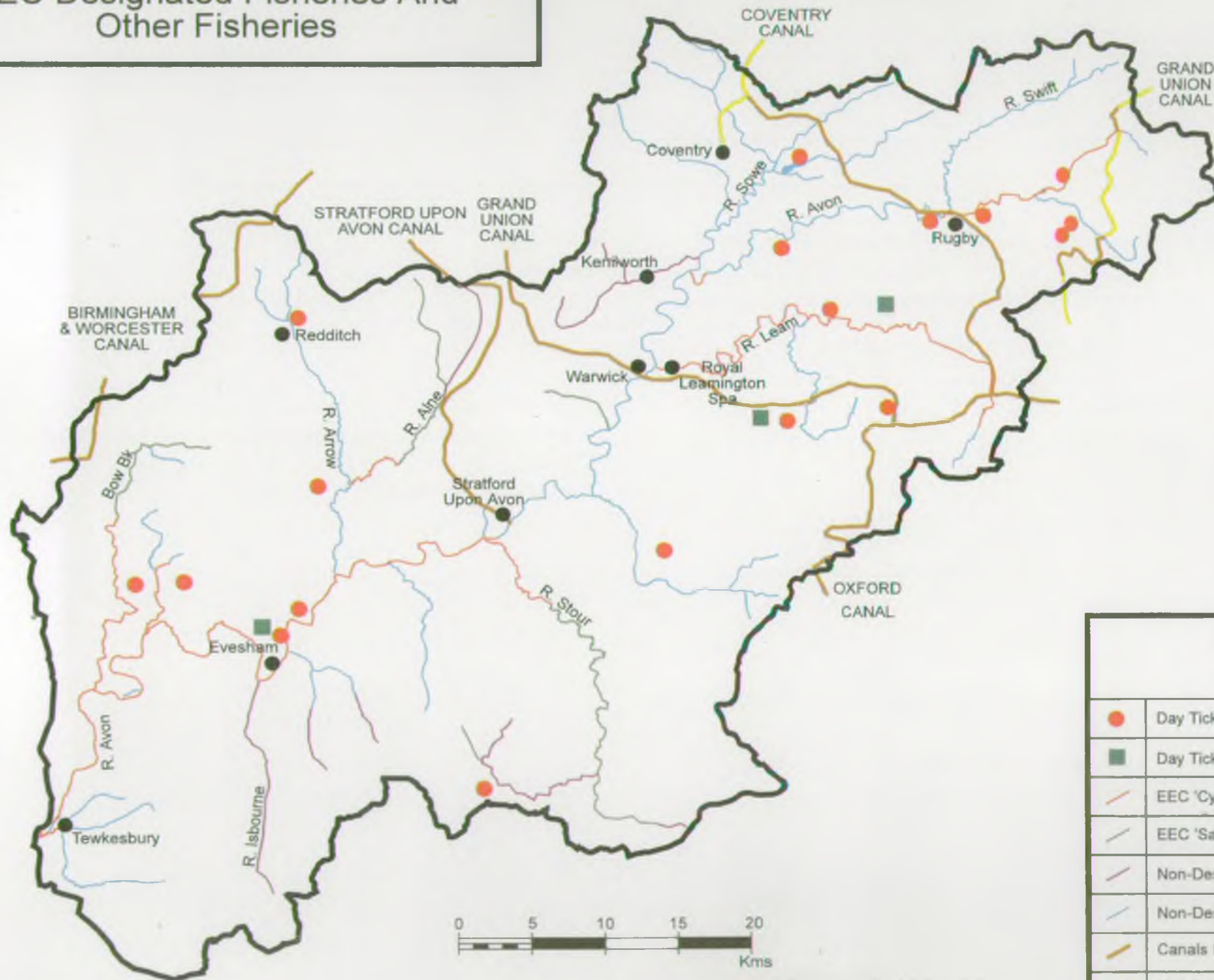
Requirements

Water Quality

- * There are no quality standards or classification schemes which specifically cover the health risks associated with water sports. Some health related studies are in progress, the results of which will assist in the development of a classification system.

EEC Designated Fisheries And Other Fisheries

Map 11



Key

	Day Ticket Coarse Angling Pool/Lake
	Day Ticket Trout Fishing Lake/Reservoir
	EEC 'Cyprinid'
	EEC 'Salmonid'
	Non-Designated Brown Trout Waters
	Non-Designated 'Cyprinid' Waters
	Canals EC 'Cyprinid'
	Non-Designated Cyprinid

FISHERIES ECOSYSTEM

General

The NRA has duties to maintain, improve and develop fisheries. Fish populations are affected by the quality and quantity of water as well as by the availability of suitable physical habitat features. Fish are therefore important indicators of the overall health of the river.

In many cases, the water quality objectives are set according to the use made of the watercourse. This use will in future be monitored against appropriate water quality objective standards. Fisheries Ecosystem is one of the pilot uses proposed by the Government which are being tested in selected catchments, but not yet in the Avon.

Coarse and game fish are protected under the EC Freshwater Fisheries Directive (78/659/EEC), which sets water quality criteria to protect fish life in designated freshwater reaches of inland watercourses.

This use deals with:

- * Game fish, i.e. the maintenance of breeding populations of brown trout.
- * Coarse fish, i.e. the maintenance of breeding populations of coarse fish.

-
- * The ecosystem that supports fish life.

Local Perspective

Game Fish Wild brown trout are naturally common in a number of Avon tributaries including the Alne, Bow Brook, Isbourne and Stour. In contrast salmon and sea trout are generally absent from the catchment. Some restocking with brown trout is carried out to supplement stocks in flowing water whilst both rainbow trout and, to a lesser extent brown trout, are stocked into a number of pools, lakes and reservoirs on a 'put and take' basis. Concerns include over exploitation, water quality and quantity, loss of habitat (including clean spawning gravels), mammalian predators (such as mink) and avian predators including cormorant and heron.

Coarse Fish Most British coarse fish species are to be found in the Avon Catchment including barbel, bleak, common bream, brook lamprey, bullhead, chub, common carp (including mirror, leather and wild), crucian carp, dace, grayling, gudgeon, minnow, perch, pike, roach, rudd, ruffe, silver bream, stickleback (3 and 10 spined), stoneloach, tench, eels and zander. Some of these species are typically found in rivers. Others, such as eels, have been legally stocked into a number

of stillwater ponds/lakes only, whilst others, such as zander, are illegal introductions.

***Migratory
Fish***

Elvers enter the Severn every year and migrate up through the Avon during their lifetime. At maturity, after about 7 to 15 years, adult eels return to the sea (typically during the Autumn).

***Fish
Introductions***

Introductions of fish are controlled by the NRA through the issue of stocking consents under Section 30, Salmon and Freshwater Fisheries Act 1975. Non-indigenous species also require consent under the Wildlife and Countryside Act 1981. The NRA has a coarse fish farm at Calverton, near Nottingham. Fish have been introduced to the Avon and its tributaries by the NRA as and when required, from Calverton, other fish farms and from netting operations in the area.

Fish

Fish distribution, shown in Map 11, is monitored by Distribution electric fishing surveys, echo sounding surveys, angler catch data and the returns of commercial (eel) fishermen. (See also Appendix 2.8)

Objective

- * To sustain a natural fish population appropriate to the catchment.

Requirements

Water Quality

- * River stretches designated for trout to comply with the standards specified in the EC Fisheries Directive (78/659/EC) for salmonid fish (salmon and trout).
- * River stretches designated for cyprinid fish to comply with the standards specified in the EC Fisheries Directive.
- * In the future all surface waters to comply with appropriate Statutory Water Quality Objectives for fisheries ecosystems.

Water Quantity

- * The pattern of flows not to be significantly altered from the natural variable pattern of flows, within the limitation of the licensing policy.

Physical Features

- * A variety of natural river features and habitats and where necessary artificial structures to optimise the production of fish populations. These will include gravel spawning areas, instream marginal vegetation and variation in depth within the limitations of the existing level control structures.
- * Access to suitable streams for spawning.
- * Maintenance and improvement of bankside vegetation for shade and cover.

- * NRA river maintenance operations and consented land drainage works to cause minimal damage to fish populations and improve the variety of habitats where practical.
- * The provision of eel and elver passes to improve upstream migration of eels.

APPENDIX 1.9

ANGLING AND COMMERCIAL FISHING

General

This relates specifically to the use of the catchment by anglers and commercial fishermen principally commercial eel fishermen.

Local Perspective

The River Avon is recognised as an important coarse fishing venue by angling clubs and individual pleasure anglers alike. Over most of its length the river supports healthy populations of both coarse (cyprinid) fish and eels. Eels are caught by both rod and line anglers and commercial fishermen who use licensed fyke nets, puncheons and eel weir traps. For many years the river has been an important match venue and the World Championships were held at Luddington (between Stratford and Evesham) in 1981. The main species of coarse fish of interest to the river angler are roach, chub, bream, dace, barbel, perch, bleak, gudgeon, eels and pike. Barbel were introduced, in numbers, to the river in 1964 and are now well distributed and relatively common. Zander were illegally introduced to the river, probably in the mid 1970's and are now regularly caught in some reaches but are absent or rare in others.

Several tributaries of the Avon, such as the Alne, Stour, Isbourne and Bow Brook contain stable mature wild brown trout populations, especially in their upper reaches. Some rod and line fishing for these trout is carried out but the majority of trout anglers are to be found on stillwaters in the catchment. Reservoirs and lakes of suitable

quality may be stocked with trout, often rainbow trout, and make very popular trout fishing venues. Draycote Reservoir near Rugby is an example of such a water.

Most fishing rights are in private ownership though the NRA does own the rights over some sections of the River Avon. Commercial fisheries are shown on Map 11. (Appendix 1.8)

Introductions of fish are controlled by the NRA through the issue of stocking consents under Section 30, Salmon and Freshwater Fisheries Act 1975. Non-indigenous species also require consent under the Wildlife and Countryside Act 1981.

Objectives

- * To provide suitable conditions for successful angling and commercial eel fishing.
- * To improve angling by implementing measures to increase fish stocks.
- * To maintain and improve water quality for the protection and enhancement of the watercourse for successful angling.

Requirements

Water Quality

- * River stretches designated for salmonids to comply with the standards specified in the EC Fisheries Directive (78/659/EC) for salmonid fish (salmon and trout).
- * River stretches designated for cyprinid fish to comply with standards specified in EC Fisheries Directive.
- * Water to be free from surface films and extraneous floating material, discolouration and unpleasant odours.

Water Quantity

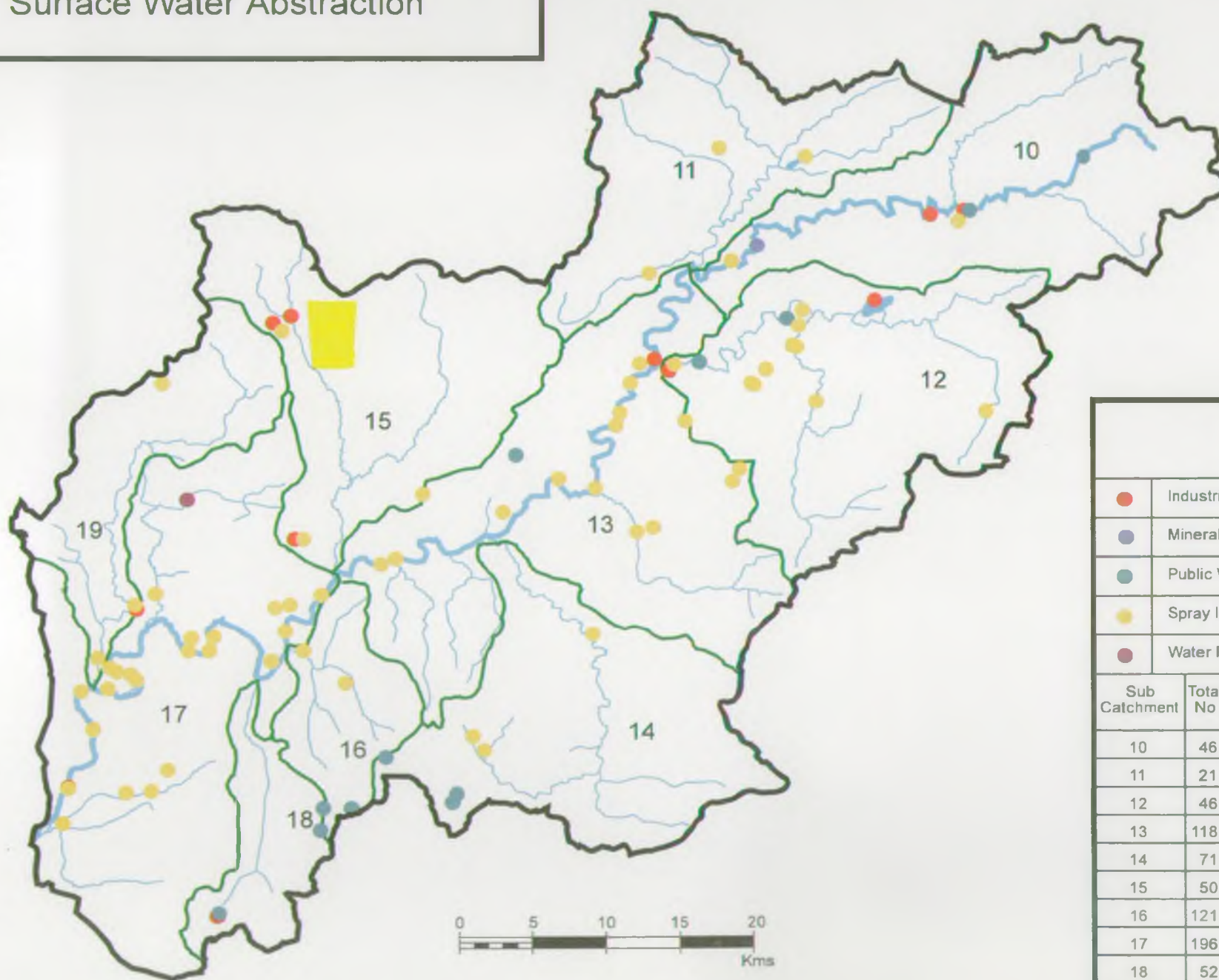
- * The pattern of flow not to be significantly altered from the natural variable pattern of flows, within the limitations of the licensing policy.

Physical Features






- * A variety of natural river features to ensure a varied habitat which maximises the production of fish populations within the limitations of the existing level control structures.
- * The presence of bankside vegetation to provide adequate shade and cover.
- * River works to cause minimum damage to fish populations and to improve the variety of river habitats where practical.

Surface Water Abstraction

Map 12



Key

	Industrial				
	Mineral Washing				
	Public Water Supply				
	Spray Irrigation				
	Water Power				
Sub Catchment	Total No	Public Water Supply	Spray Irrigation	Industrial	Total Vol MI/a
10	46	2	32	1	14042
11	21	-	15	-	310
12	46	4	26	1	46743
13	118	-	81	3	3460
14	71	3	38	-	5893
15	50	1	28	1	2363
16	121	2	103	-	1253
17	196	-	149	4	4965
18	52	9	22	3	3082
19	31	-	24	-	566

ABSTRACTION FOR POTABLE (DRINKING) WATER – SURFACE WATER SOURCES

General

Public water supply abstractions require a licence from the NRA to authorise the abstraction of water. Domestic abstractions for private use do not require a licence.

A licence stipulates the total daily and annual quantities that may be abstracted. It may also include a condition that the abstractor has to leave a minimum flow in the river to protect existing uses and users of water.

Public supply sources developed before 1963 were granted licences of right under the Water Resources Act 1963. Since then licences have been granted only if they do not adversely affect existing uses and users of both ground and surface waters.

The issue of an abstraction licence does not guarantee that the volumes authorised by it will be available at all times, nor that the quality of the water will be fit for the purpose for which it is intended. However, there are water quality standards for potable water abstractions, which are therefore quality objectives for river stretches where this use takes place.

Local Perspective

Within the Avon Catchment a total of 54,272 Million litres per annum (Ml/a) may be abstracted for public water supply from

surface water sources.

The major abstractions are taken within the Leam catchment where a total of 40,563 Ml/a may be abstracted. The two main abstractions are for Draycote Water (from Eathorpe) and at Willes Meadow, Leamington for the water works at Campion Hills. Some of the water abstracted to Draycote Water has, in the past, been discharged back to the Leam in summer to allow abstraction at Willes Meadow. Severn Trent Water have recently built a direct link between Draycote and Willes Meadow and this river support may no longer be available at all times.

There is concern over high nitrate levels in the Leam catchment from agricultural run-off. Parts of the catchment are being considered for Nitrate Vulnerable Zone status to ensure that the Code of Good Agricultural Practice is followed.

The other major abstractions for potable supply are in the Upper Avon at Stanford Reservoir and Brownsover (Rugby). There is also concern for quality in this reach as the Water Company do sometimes have to treat this abstraction for algal growths. These abstractions are partly responsible (entirely legally) for reducing the flow in the river to below 50% of its natural flow under dry weather conditions. Partly as a concern for the impact on the environment Severn Trent Water have agreed to a revised licence which should improve the situation.

Other significant surface potable supply catchments are the rivers Stour and Isbourne. Map 12 shows the surface water abstractions of larger than 1Ml/day for all uses together with a table of uses by sub-catchment.

In 1991 a tentative enquiry was made by Severn Trent Water for an emergency abstraction from the Avon just above the confluence with the Severn. While this has not been followed up any such abstraction would require significant re-appraisal of the quality targets in the Lower Avon.

Objectives

- * To manage water quality and water resources to safeguard potable water supply.
- * To encourage efficient water use including leakage reduction and appropriate water conservation measures.
- * To encourage abstractions to be made as far down a river or stream as is practical to minimise the effect of the abstraction on river flows.
- * To increase and redistribute water resources where appropriate to meet potable water demands to appropriate standards of reliability.
- * To actively enforce the conditions of abstraction licences to protect the rights of other abstractors and the aquatic environment.

Requirements

Water Quality

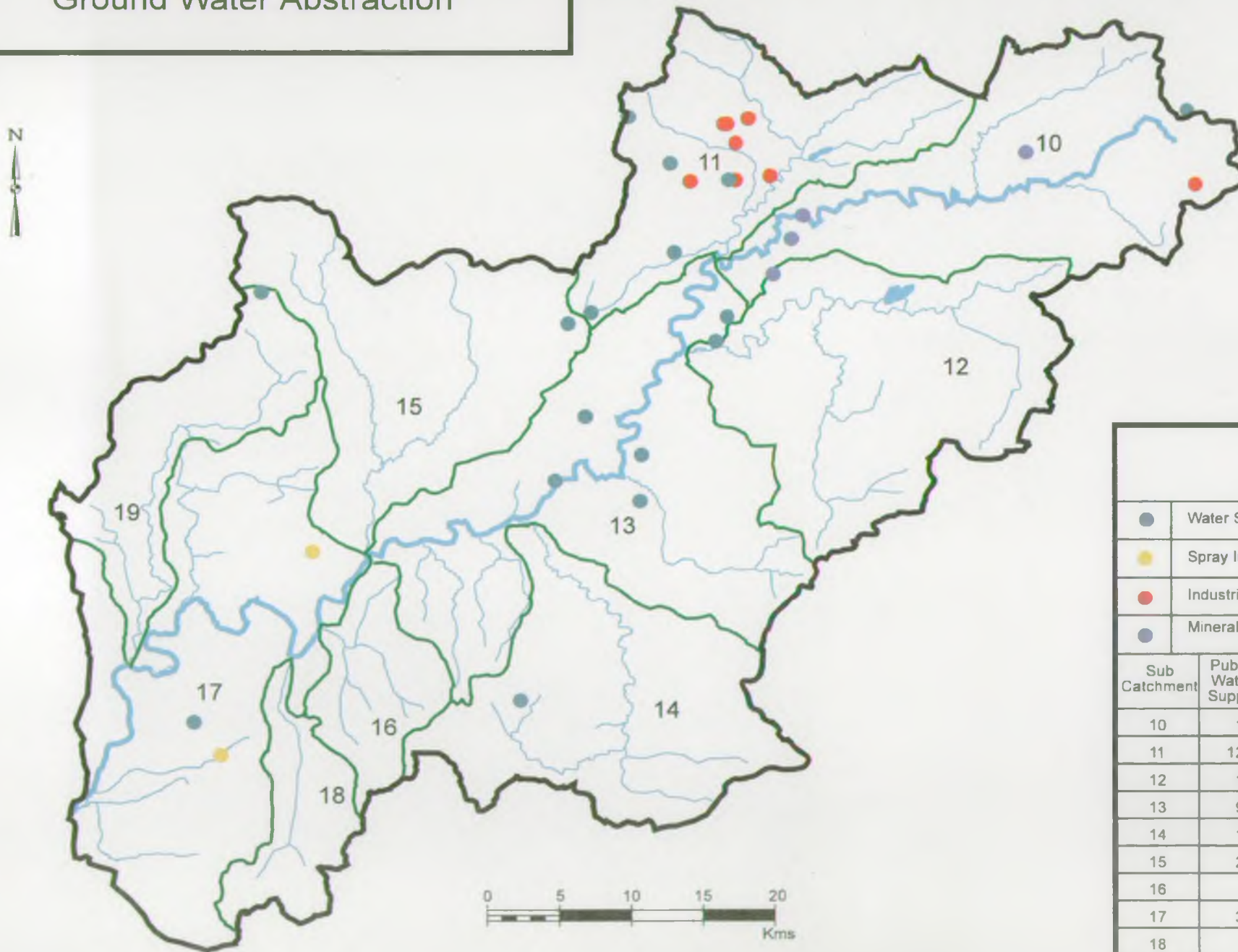
- * All surface waters used for public supply, at its abstraction point, to comply with appropriate standards set in EC Directive 75/440/EC.

Water Quantity





- * Water resources to be available within the terms specified in the abstraction licences.

Ground Water Abstraction

Map 13



Key

	Water Supply
	Spray Irrigation
	Industrial
	Mineral Washing

Sub Catchment	Public Water Supply	Spray Irrigation	Industrial	Total	Total vol MI/a
10	1	3	4	69	2036
11	12	2	11	47	29225
12	1	4	-	38	3281
13	9	7	-	95	5892
14	1	1	-	43	434
15	2	7	1	107	4168
16	-	44	-	101	121
17	3	73	1	220	34
18	-	5	-	24	2843
19	2	2	1	50	795

ABSTRACTION FOR POTABLE (DRINKING) WATER – GROUNDWATER SOURCES

General

Public water supply abstractions require a licence from the NRA to authorise the abstraction of water. A licence specifies the maximum quantities that may be abstracted in a day and in a year. Many small, domestic abstractions do not need a licence from the NRA and the NRA does not hold any record of these.

Abstractions in use before 1965 were granted licences of right under the Water Resources Act 1963. Since then licences have been granted only if they do not adversely affect existing uses and users of both ground and surface waters.

The issue of an abstraction licence does not guarantee that the volumes authorised by it will be available at all times, nor that the quality of the water will be fit for the purpose for which it is intended.

The NRA has developed a National Groundwater Protection Policy to safeguard both individual potable sources and groundwater resources in general.

Local Perspective

The total abstraction for public water supply from groundwater in the Avon is 38,200MI/a, (31 licences), while licensed private water supplies account for some 500MI/a (48 licences). Many private

water supplies do not require a licence so the actual volume is higher. Records of unlicensed abstractions are kept by Local Authorities for Environmental Health purposes.

The major abstractions for public water supply occur within the Coventry, Kenilworth and Warwick areas from rocks of the Permo-Carboniferous age. There are also abstractions from the Sherwood sandstones on small areas to the west of Redditch.

Although most of the water used for public supply is returned to the catchment through sewage treatment works this is often well below the abstraction point and groundwater abstractions have led to lowering of base flows in the Bow Brook (Redditch) and the River Sherbourne at Coventry.

Private water supplies occur predominately in the Cotswolds and more rural areas which do not have mains water supply. While mostly impermeable strata dominates over 80% of the catchment, small quantities of groundwater can be obtained from minor sandstone bands in the mudstones and the limestone beds of the clay. Fig 13 shows the location of groundwater abstractions of over 1MI/d for all uses together with a table of uses by sub-catchment.

There is some concern over the possible contamination of bore holes by organic solvents historically used in the engineering works in and around Coventry and by leachate from contaminated land and tip sites.

Objectives

- * To manage water quality and water resources to safeguard potable water supply.
- * To protect aquifers from over-commitment (i.e. where abstraction exceeds the average amount of replenishment to the aquifer) and ensure groundwater abstraction does not have an unacceptable effect on surface water flows or levels.
- * To develop and publish a clear licensing policy for abstractions in the catchment.
- * Not to issue licences to abstract water which adversely affect existing protected rights.
- * To encourage efficient water use including leakage reduction and appropriate water conservation measures.
- * To protect the quality of groundwaters by implementing NRA's Policy and Practice for the Protection of Groundwater.
- * To actively enforce the conditions of abstraction licences to protect the rights of other abstractors and the aquatic environment.

Requirements

Water Quality

- * Groundwater quality standards have not been set. In the absence of national guidelines, water quality standards for

potable abstractions from surface waters are used as targets for groundwater quality (given in EC Directive 75/440/EC).

Water Quantity

- * Water to be available to allow abstraction up to the amounts authorised in the abstraction licences.

AGRICULTURAL ABSTRACTION

General

All agricultural uses, with the exception of some small (less than 20 cubic metres per day) general agricultural uses from surface waters, require an abstraction licence.

This use deals with:

- * Abstraction from ground and surface waters for agricultural use. This includes general agricultural use (e.g. stock watering, crop spraying), as well as fish farms and spray irrigation.

Local Perspective

The Avon Catchment has a very rural character and has a large amount of market gardening. As a result there is a heavy demand on water especially for spray irrigation purposes. There are 666 licences for spray irrigation and 587 for other agricultural purposes.

Spray irrigation accounts for the majority of abstracted water and quantities can exceed 8,700Ml/a of which 7,729Ml is licensed from surface water and 971Ml from groundwater.

Agricultural abstractions occur mostly in the Mid and Lower Avon sub catchments and the Badsey Brook (sub catchment 16). The Badsey Brook near Evesham is notable with 147 spray irrigation

licences and 63 other agricultural licences on a very small brook. The licensed quantity is greater than the dry weather flow.

There are three fish farm licences with a total licensed quantity of just over 300MI/a.

The net effect of spray irrigation is that no water is returned to the river or groundwater. As there is an ever increasing demand for this use it is a major concern for water resources in areas presently over abstracted.

Section 57 of the Water Resources Act 1991 can allow the NRA to restrict abstraction in times of low flow. In the Avon there are 12 gauging stations with a restriction flow to which licences can be tied. As a spray irrigator this can have drastic effects on the crops as irrigation is most often required when there are drought conditions and restrictions are required.

Objectives:

- * To manage water quality and water resources to safeguard agricultural abstractions.
- * To manage water resources where possible in such a way as to meet all reasonable future demands.

- * In respect of spray irrigation to prevent abstraction reducing river flows below acceptable limits.
- * To encourage efficient water use including reducing wastage and efficient irrigation plans.
- * To enforce actively the conditions of abstraction licences to ensure abstractors' rights are not affected by others.
- * To ensure that groundwater abstraction does not significantly affect flows or levels of surface waters.
- * To ensure that the discharge from fish farms is returned as close as possible to the point of abstraction.

Requirements

Water Quality

- * Relevant river stretches to meet standards set for the protection of waters used for irrigation and agricultural abstraction.

Water Quantity

- * Water resources to be available within the terms specified in the abstraction licences.

LIVESTOCK WATERING

General

The watering of livestock from a river, stream or pond does not require an abstraction licence.

Local Perspective

An abstraction licence is not required for livestock to drink from a river or pond so long as no more than 20m³ of water is abstracted per day.

When an abstraction licence application is received its use must be considered together with all existing licensed sources. This can prove quite difficult when there is no information on existing users and the catchment is reaching its resource limit.

The majority of rivers and streams in the catchment are used, or have a potential to be used, by livestock for drinking.

Objective

- * To manage water quality and water resources so that the ability of livestock to drink from surface waters is not impaired.

Requirements

Water Quality

- * To meet the standards set for livestock watering. (See Table 4, Appendix 2.2)

Water Quantity

- * Flows in watercourses not to be artificially reduced such that livestock are unable to drink.

Physical Features

- * The public to be encouraged not to leave litter, particularly dangerous litter such as glass bottles, drinks cans, fishing line, which might endanger livestock.
- * Farmers to be encouraged to provide specific livestock drinking areas wherever possible to reduce erosion of river bank.

INDUSTRIAL ABSTRACTIONS

General

Abstraction of water from ground and surface water sources for industrial and commercial uses requires a licence.

Local Perspective

There are 31 licences for industrial processing water of which 13 are from surface water and 18 from groundwater. The main use is around Coventry. There are also 10 cooling water licences from surface water and 2 from groundwater, and in addition, 7 mineral washing licences. The licences of greater than 1Ml/d are shown in maps 12 and 13 together with other major uses.

The total volume of water in this category abstracted from the catchment is 7080Ml/a.

With the reduction in industrial activity in the Coventry area, less water is being abstracted. However, the groundwater resource near Coventry is still theoretically over abstracted which means that new applications for licences related to industrial activity are being refused. The NRA is uneasy with this situation and would prefer to revoke unused licences so that new applications are acceptable. This cannot be done without compensation payments to the licence holder unless they have not paid abstraction charges or not used the licence for seven years. The capacity of the groundwater storage also needs to be reviewed.

The Severn Trent Region has recently published a Regional Resources Strategy which identifies future demands for water and how these can best be met.

Objectives:

- * To manage water quality and water resources to safeguard industrial and commercial water supplies.
- * To manage water resources where possible to meet reasonable industrial demand.
- * To encourage efficient water use, including appropriate water conservation measures.
- * To enforce the conditions of abstraction licences to ensure abstractor's rights are not affected by others.
- * To ensure that groundwater abstraction does not adversely affect flows or levels of surface waters.

Requirements

Water Quality

- * There are no general water quality standards for industrial abstractions.

Water Quantity

- * Water resources to be available within the terms specified by the abstraction licences.

WATER POWER (INCLUDING MILL RIGHTS)

General

Water power is used for the generation of hydro-electric power and as a means of providing power to drive machinery, for example, mills. Mills are becoming increasingly popular as tourist attractions. Use of water for hydropower can result in rapid changes in flow and large diurnal variations in flow which can have high impacts on the downstream channel and its flora and fauna.

The NRA cannot issue an abstraction licence which adversely affects another abstractor, unless that abstractor agrees to it. Hydropower abstractions often use the whole river flow, so that any later abstraction upstream of it will inevitably affect the hydropower user. This can mean that no-one else would be granted a licence to abstract water upstream of a hydropower site. Where this is the case, the NRA opposes hydropower abstractions unless the developer agrees to allow a certain amount of derogation and to having a licence which runs for a specified period.

Where the hydropower unit is in-line with the river an impoundment licence only is needed. This can control the operation of the hydropower unit.

This use deals with:

- * Alteration/repair of existing impounding structures.

-
- * Water power as the primary motive force in energy production

Local Perspective

The Avon and its tributaries have many weirs and sluices associated with former mills and various recreational and amenity purposes. (See Map 7, Appendix 1.2). Three licences have been issued in the Avon to date for a total volume of 3,182 Mla. These sites are shown in Map 12(Appendix 1.10).

The condition of many structures is poor, particularly where their initial uses for example milling, have gone. When a structure collapses it causes loss of the impounding and a change in the river conditions both upstream and down. Whilst the lowered water levels may improve drainage there is a danger of bank instability and increased erosion due to higher velocities on the unimpounded reach.

Maintenance of structures is the responsibility of the riparian landowner although any work to them is subject to the NRA's consent, as are any proposed new structures.

Hydroelectric power is not yet a major use in the Avon Catchment but with the move towards more environmentally friendly power sources it may become more prevalent and there have been at least two general queries within the last year on hydropower development in the Avon. Both the use of existing structures and the creation of

new ones is of interest and concern to the NRA. Historic structures which demonstrate cultural and technological practices of bygone days are also of increasing interest. Every effort will be made to advise and guide the restoration of such structures where at all practicable. No works should cause detriment to either third parties or the riverine environment.

Objective

- * To facilitate hydropower developments where possible.
- * Hydropower developments, which restrict the ability to use upstream water resources, to be opposed unless the licence authorising the abstraction for hydropower is subject to an agreed volume of derogation and a time limit.
- * To allow hydropower developments in such a way that they do not prevent use of upstream water resources for other purposes and do not have significant downstream impacts.
- * To ensure that discharge is made as close as possible to the point of abstraction.
- * To ensure that the downstream impacts of hydropower developments are minimised.
- * To advise and guide restoration of historic structures.

Requirements

Water Quality

- * There are no general water quality standards for water power.

Water Quantity

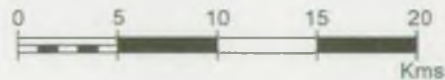
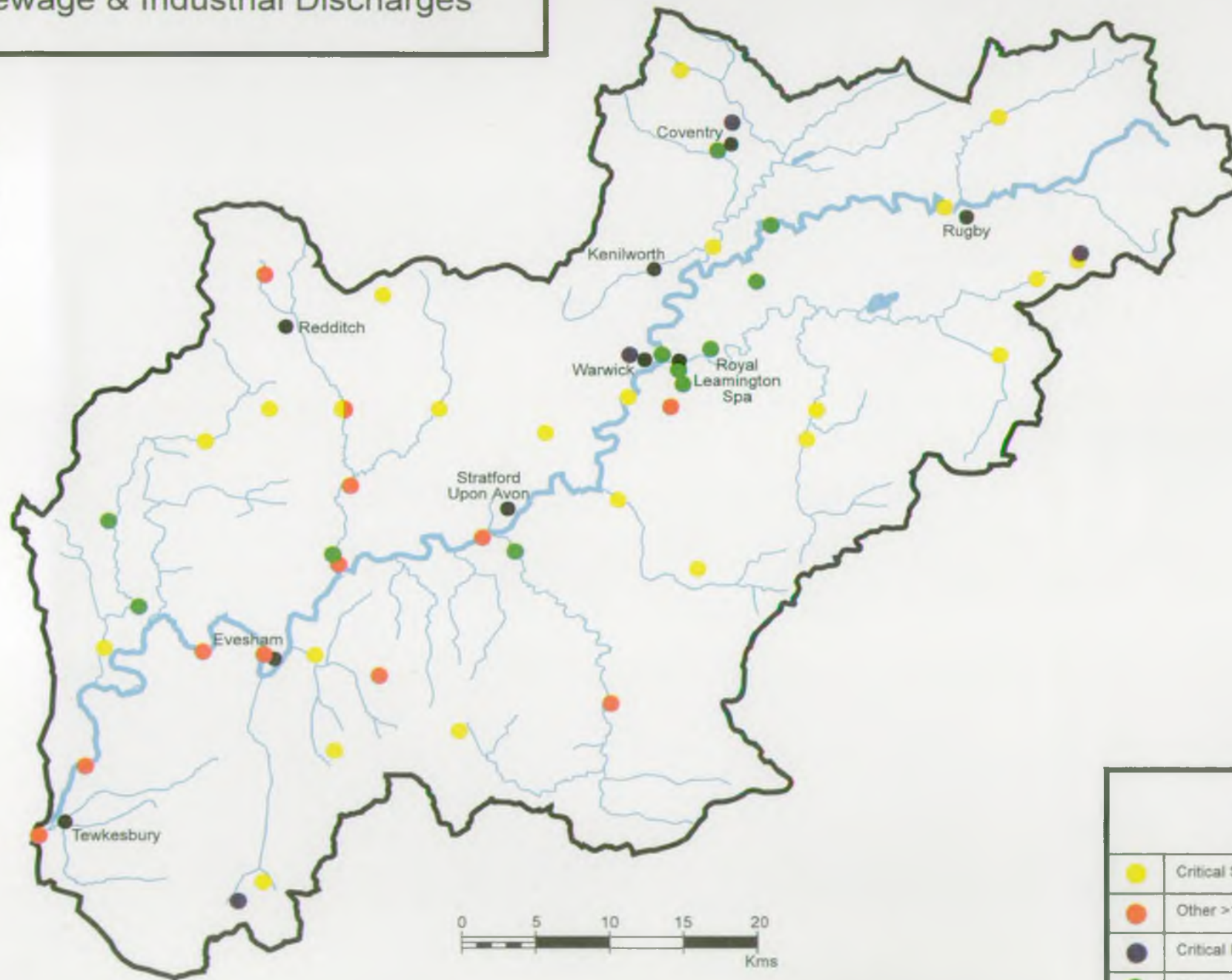
- * That use of water for power generation does not adversely affect other users.

Physical Features

- * Use of existing structures or creation of new areas must not increase the risk of flooding or cause detriment to the riverine environment.

Sewage & Industrial Discharges

Map 14



Key

	Critical Sewage Discharges >100m ³ /d
	Other >1000m ³ /d
	Critical Industrial
	Other Industrial >1000m ³ /d

APPENDIX 1.16

SEWAGE AND INDUSTRIAL EFFLUENT DISPOSAL

General

All discharges of sewage and industrial effluent require a consent from the NRA. The consent specifies the volume that can be discharged and what it may contain. The conditions are calculated by:-

- (a) taking into account the quality of the receiving water and the volume available to dilute the effluent at the point of discharge.
- (b) by ensuring that downstream water quality remains acceptable for all its many uses and meets the relevant water quality standards.

Spillages of pollutants and dumping of waste are dealt with under the provisions of the Water Resources Act 1991.

This use deals with:

- * The authorised and unauthorised disposal of polluting effluent to surface waters and underground strata.

Local Perspective

Sewage Effluent Disposal

Many sewage treatment works are situated in the headwaters of the river system where dilution is limited and the impact is therefore large. The problem of large volumes of treated sewage discharged to the upper reaches of the catchment is compounded by the clay/mudstone soil type and topography which is very responsive to run-off in times of high rainfall and produces low base flows. The result is poor quality in the upper reaches and high levels of nutrient causing eutrophication and algal problems. However, significant refurbishment of Coventry, Rugby, Redditch and Warwick sewage treatment works has taken place with associated tightening of consents and improvement of river quality during the period 1990-1993.

Sewer overflows in the Victorian sewerage systems of old towns such as Evesham and storm overflows at sewage treatment works continue to be a problem in the catchment. While the effect on quality is generally localised such discharges can adversely affect amenity use of large stretches of river.

There are 373 consented discharges of sewage, storm overflows, pumping stations and village drains issued to Severn Trent Water.

Many areas in the catchment are not sewered and there are a number of private sewage treatment plants discharging to minor tributaries. There are 420 consented private sewage discharges but only the major discharges cause significant problems catchment wide. Smaller discharges are responsible for many localised problems. Major and critical discharges are shown in Map 14.

Many villages have inadequate sewerage disposal systems and because of heavy clay sub-soils are unsuitable for septic tank soakaway systems. There are many situations where illegal discharges of septic tank waste to streams and ditches are causing localised pollution and require solutions. A sewerage project officer is surveying pollution from rural drainage systems to assess the scale of pollution.

Industrial Effluent Disposal

Some significant industrial discharges are made to the headwaters of the catchment and these can cause problems. The decline in the motor manufacturing industry in Coventry has resulted in a decrease in the number of effluent discharges and, as a result, pollution from the remaining discharges no longer presents such a large problem. Re-development of the redundant sites has revealed a major problem with contaminated land and drainage protection works must be implemented.

The proliferation of small industrial and commercial estates has now resulted in widespread low volume contamination of watercourses and groundwater with solvents and oil. Regulations are urgently required so that pollution prevention measures can be imposed at industrial sites.

There are currently 69 consented industrial discharges and the most

significant are shown on Map 14.

Trade effluent discharges, dumping and spillages to public sewers have caused problems with above background levels of listed substances such as toxic metals and pesticides being discharged from the major sewage treatment works.

HMIP authorisations are being issued for many of the potentially toxic discharges containing listed substances. The HMIP control system is based on an integrated approach dealing with the authorisation of processes.

During 1993, 58 applications were received for consent to discharge in the catchment.

Pollution results from discharges from public surface water sewers in Coventry, due to systems being contaminated as a result of industrial discharges or cross connections of sewage.

Objective

- * To allow the discharge of effluent to surface and groundwaters whilst maintaining downstream water quality standards so that other users are not affected.
- * To allow discharge of effluent to underground strata in a manner which does not adversely affect water quality.
- * To ensure that effective pollution prevention measures are carried out for safe storage and use of chemicals, oils and other organic pollutants.

- * In the case of pollution incidents, to take effective steps to forestall and prevent further pollution and mitigate the effects of the existing pollution.

Requirements

Water Quality

- * Impose consent conditions which adequately safeguard downstream water quality for users and prevent targets of EC Directives being exceeded.
- * Ensure that discharges are made at a point where the risk to other users is minimised.
- * Implement the NRA's Policy and Practice for the Protection of Groundwater so that discharges to underground strata (land) comply with the guidelines.
- * Enforce compliance with Consent Conditions.
- * Survey to identify potential pollutants and implement pollution prevention measures.
- * Ensure effective remedial work following pollution incidents.

Water Quantity

- * Discharges to be made as high up the catchment as feasible to conserve water, provided there is no adverse effect on quality.

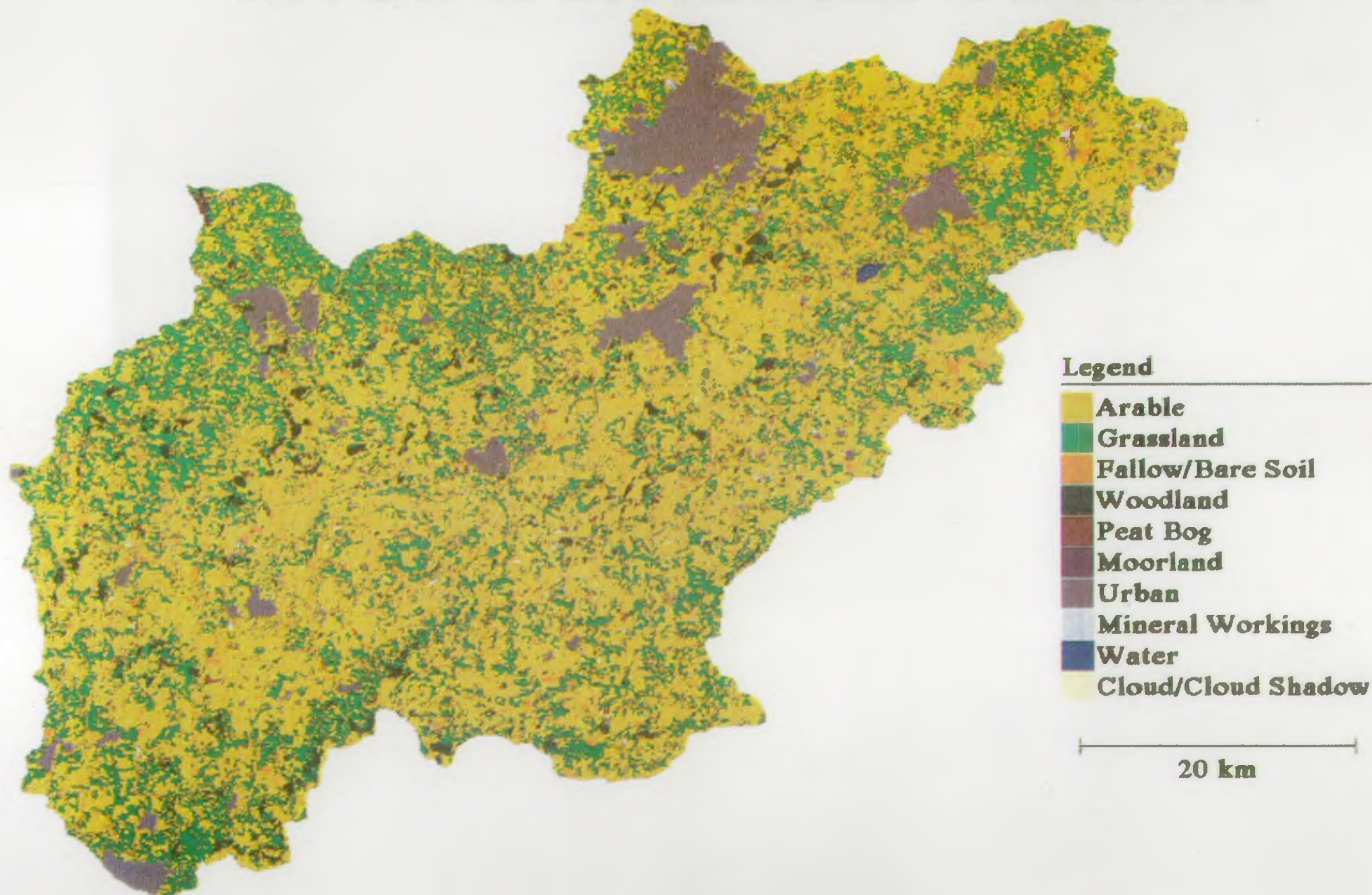
- * Ensure that upstream flows are not reduced by over abstraction of surface or groundwater to the point where the dilution of the effluent discharges is inadequate.

Physical Features

- * The discharge must be controlled so that it does not alter the channel shape or size which could affect conservation interests.

- * Effluent outfalls should be sited so that they allow adequate mixing of the effluent and river water, but must not divert the flow or present a barrier to river flow.

Avon Catchment Landuse



AGRICULTURAL ACTIVITY

General

Modern Farming practices involve the use of a wide range of agrochemicals, including pesticides, herbicides, artificial fertilizers and sheep dips. Large amounts of animal waste and effluent from silage storage and slurry pits have to be disposed of to land.

In September 1991, the Government implemented the Control of Pollution (Storage of Slurry, Silage and Agricultural Fuel Oil) Regulations which set down minimum standards for the design, construction and operation of storage and disposal systems for these substances. The NRA is required to enforce these regulations.

It is also an offence under Section 85 of the Water Resources Act 1991 'to cause or knowingly permit any poisonous noxious or polluting matter or any solid waste matter to enter any controlled waters'.

The Ministry of Agriculture Fisheries and Food have produced a Code of Good Agricultural Practice which gives practical advice on a range of farming practices to minimise the risk of water pollution.

Local Perspective

Farming is a significant land use in the catchment. Cereals take up 36% of the catchment area while grass land occupies 30%. Root crops (7%), oil seed rape (5%), beans and peas (2%) are also

significant crops. Only around 4% of the catchment is wooded. Map 15 is a LANDSAT photograph of the land use within the catchment.

Significantly higher levels of cereal growing are found in the Leam, Mid Avon, Stour and Badsey Brook catchments while high grasslands take a higher proportion of the Upper Avon, Arrow/Alne, Badsey Brook and Bow Brook sub-catchments. Grassland gives an indication of dairy and beef farming activity.

Table 3 gives the full breakdown of land use from satellite data.

Continuing concentration of stock rearing and dairying activities is causing extreme pressure on the areas of land used for effluent disposal. Many areas are of predominantly clay soil where there is a tendency to use less suitable sites for disposal and overdose on good sites. Both trends inevitably lead to diffuse and in some locations, gross nutrient enrichment of watercourses.

Some small watercourses are grossly affected by farm effluent discharges.

Diffuse pollutants, such as nitrates, are a problem in the autumn in many parts of the catchment and are giving rise to general enrichment and, together with sewage discharges, are causing eutrophication of receiving waters.

In the arable parts of the catchment, farming gives rise to diffuse water quality problems associated with elevated nitrate and pesticide levels, which are of particular importance to water supply intakes.

Nitrate levels have exceeded the EC limit of 50mg/l at Willes Meadow intake in autumn, and herbicides, particularly MCPA, Mecoprop and Tri Fluralin levels, have exceeded EC drinking water limits on occasions. The Leam intake at Willes Meadow has been affected as has the Avon intake at Brownsover. The Water Research Centre (WRC) are carrying out a DOE funded study on the economics of restrictions on the use of pesticides and the River Leam Catchment has been chosen for the study.

Parts of the Avon may be put forward as Nitrate Vulnerable Areas. This would require farmers to conform to the code of Good Agricultural Practice under the EC Nitrate Directive particularly in the Leam.

The increased use of set aside will help alleviate diffuse pollution problems.

Since 1991 there have been 121 reported pollutions from farms in the catchment, seven of which were serious pollutions.

Agricultural practices have, over the years, encouraged a loss of bank and marginal habitat, and all forms of river related vegetation such as wetland, marsh or reedbed.

The use of fertilisers, herbicides and pesticides to boost productivity as well as the discharge of silage waste and slurry has raised nutrient levels and altered the aquatic ecology. Wildlife cover in the form of hedgerows, scrub, copses and bank top vegetation has been lost.

Objective

- * To ensure that farming practices are carried out in a manner which does not compromise the use of surface and groundwaters.
- * To ensure that agricultural practices do not threaten the sustainability of the river corridor ecosystem.
- * To encourage the use of set aside.

Requirements

Water Quality

- * To achieve minimum standards specified in the 1991 farm regulations.
- * To encourage farmers to follow the advice given in the Code of Good Agricultural Practice.
- * To control the use of agrochemicals so that pollution of surface water or groundwaters does not occur.
- * To press for Nitrate Vulnerable Zone Status where this is appropriate in critical areas.

Physical Features

- * Control farming activities such that drainage ditches and watercourses are not blocked with slurry and debris or used as disposal outlets.
- * Encourage conservation of river corridors and their margins by farmers and other landowners.

TABLE 3 – AVON CATCHMENT LANDUSE

Class	Legend	Area %	Cumm* Area %
7	Winter Wheat	10.60	10.60
12	Winter Wheat Stubble	12.76	62.42
13	Winter Barley	3.66	16.42
14	Winter Barley Stubble	4.09	20.51
15	Spring Wheat	4.10	24.61
17	Spring Barley	0.41	25.02
18	Spring Barley Stubble	1.24	26.26
19	Oats	1.66	27.92
20	Maize	3.17	31.09
21	Winter Rye	4.69	35.79
29	Oil Seed Rape Flowering	0.33	36.11
30	Oil Seed Rape Senescent	2.56	38.68
31	Oil Seed Rape Stubble	1.98	40.66
32	Sugar Beet	0.27	40.93
33	Potatoes	0.62	41.54
34	Field Beans	1.45	43.00
35	Peas Dried	0.38	43.37
37	Carrots	2.40	45.78
38	Swedes	2.96	48.74
40	Grass Cut (Ley)	1.75	50.48
41	Grass Grazed	9.96	60.44
42	Grass Cut and Grazed	9.20	69.64
43	Semi Natural Grass Cut	6.69	76.33
44	Semi Natural Grass Uncut	3.50	79.83
45	Fallow	6.71	86.54
50	Woodland Coniferous	0.17	86.71
51	Woodland Deciduous	4.10	90.81
52	Peat Dog	0.30	91.11
53	Grass Moorland	0.00	91.11
54	Heather	0.07	91.18
55	Upland Pasture	0.04	91.22
56	Heath/Rough Grass	0.21	91.43
57	Bracken	0.00	91.43
60	Urban	7.19	98.62
61	Mineral Workings	0.38	99.00
70	Water	0.09	99.10
71	Cloud	0.00	99.10
72	Cloud Shadow	0.02	99.12
74	Bare Soil	0.88	100.00
Total of 39 classes		100.00	
* Cumulative			

%

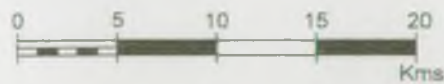
Area (km2)

306.62
62.42
105.83
118.38
118.68
11.87
35.79
48.13
91.08
135.74
9.44
74.19
57.20
7.81
17.88
42.03
10.90
69.54
85.60
50.54
288.00
266.18
193.64
101.14
194.03
5.03
118.56
8.60
0.03
2.05
1.10
6.10
0.02
207.98
11.09
2.74
0.01
0.64
25.53

2892.86

Mineral Sites

Map 16



Key

	Sand and Gravel
	Hard Rock
	Clay

MINERAL WORKING

General

For mineral extraction and quarrying to take place, a valid planning permission is required and the NRA has to be consulted about each application. The planning permission contains conditions which control the operations and include the NRA's requirements.

Any effluent produced by the operation and discharged will require a consent from the NRA and the consent will specify quality criteria to be met.

Extraction sites can cause water pollution by leaching suspended solids and metals. They can also affect groundwater by pumping out flooded workings which lowers the water table so affecting other abstractions.

Local Perspective

There are about 15 active sand and gravel quarries in the catchment and all have consents for wash water and site drainage. Sand and gravel extraction takes place along the Avon Valley specifically in the Bidford, Warwick and Rugby areas. Warwickshire, Hereford and Worcester and Northamptonshire have all produced Mineral Local Plans showing the present areas of extraction and future proposals. Map 16 shows the approximate locations of known active sites.

The preferred method of operation is to recirculate water on site

through a lagoon system and only discharge settled effluent.

Stone quarrying operations tend to be confined to the Cotswold area. Sites in Coventry are used for clay extraction for brick manufacture.

All site operations require that control and oil storage facilities must be bunded as groundwater pollution can result.

A potential problem associated with quarrying is the proposed use of landfill to re-instate redundant workings where these sites are totally unsuitable for landfill. Opportunities for wildlife habitat, lakes and wetland creation should be taken where possible.

Objective

- * To ensure the mineral extraction activity does not compromise water quality or water resources.

Requirements

Water Quality

- * Discharge Consents to adequately safeguard water quality.

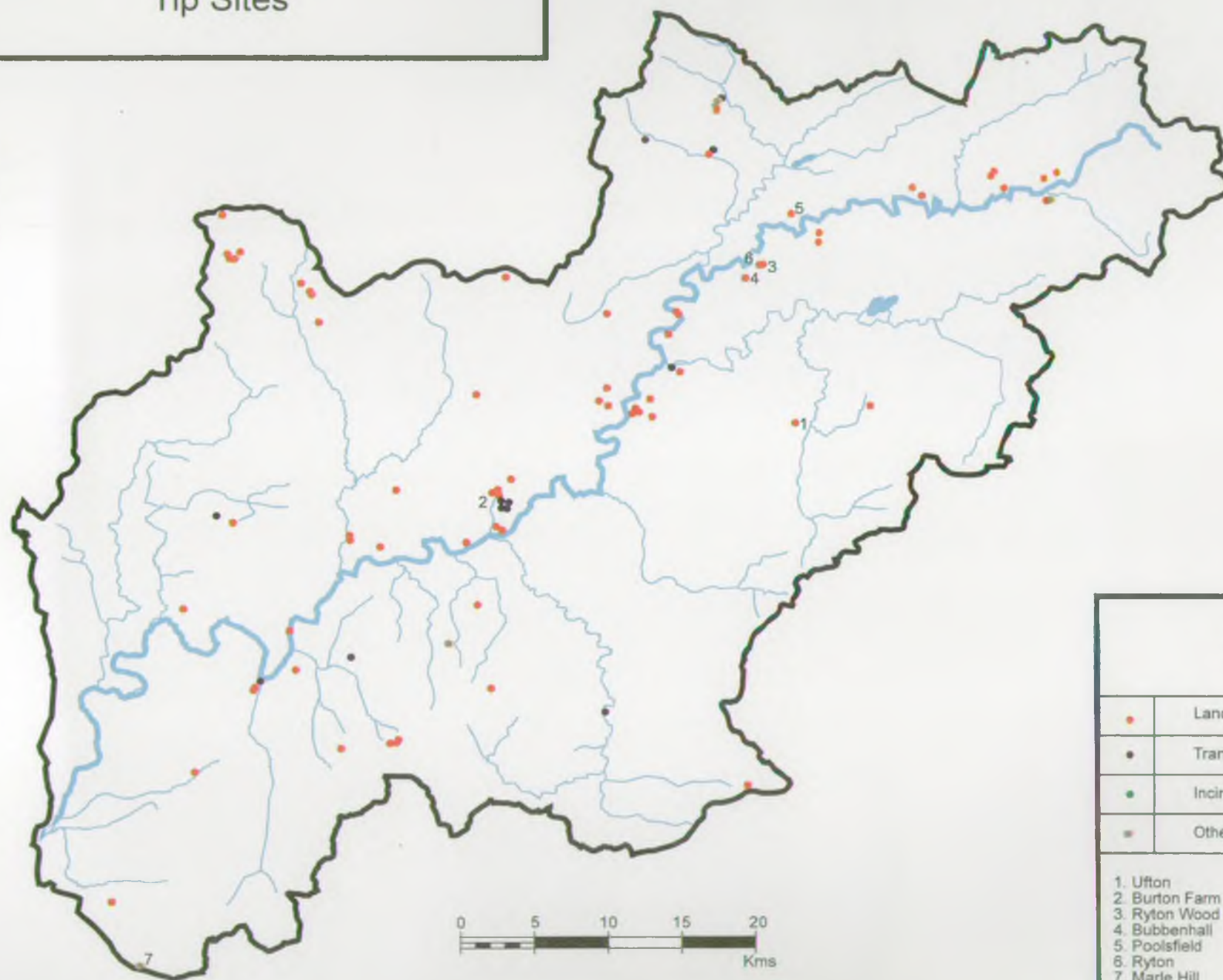
- * Operations to be carried out in accordance with advice given in the NRA's Policy and Practice for the Protection of Groundwater.
- * Restored sites not to pose a long term risk to Water Quality by inappropriate use of landfill materials.

Water Quantity

- * The operation to be carried out so no significant derogation of groundwater resources results.

Tip Sites

Map 17



Key

●	Landfill
●	Transfer
●	Incinerator
●	Other

1. Ufton
2. Burton Farm
3. Ryton Wood
4. Bubbenhall
5. Poolsfield
6. Ryton
7. Marle Hill

WASTE DISPOSAL TO LAND

General

Waste disposal to land requires a licence issued by the Local County Council. The NRA has to be consulted about each application for a licence. The Waste Disposal Licence details how the site is to be constructed and operated. A valid planning permission is also required before a Waste Disposal Licence can be issued. The Planning Permission contains conditions which control the way in which the site is restored and monitored to prevent the closed site for causing future damage to the environment.

Land fill sites can cause water pollution. This is because rain falling on the site can become contaminated and drain from the site (called leachate) into groundwater or streams. If the site is properly managed, long term harm to the environment can be avoided. This can be achieved by either collecting the leachate for disposal elsewhere, treating it, or allowing it to be diluted in the groundwater where it may naturally break down. Detailed studies are being carried out to help decide on the best way to deal with leachate. Badly managed sites can lead to serious pollution problems.

Local Perspective

The NRA has records of some 80 landfill operations in the Avon Catchment, 17 transfer stations, 11 'other' sites and 1 incinerator.

These records commenced around 1972 although licensing itself was not required until 1976. The records are a mixture of current and past sites and the full record should best be found in the County Waste Disposal Plans when published. Map 17 shows the known sites with the named sites shown on the key.

The current domestic refuse disposal sites are mostly operated by County Councils and utilise clay lined cells. Problems do still arise from leachate control and regular monitoring is carried out. An example of concern regarding a current site is the Burton Farm Landfill Site near Stratford. This site has caused some contamination of Shottery Brook through Stratford. This causes a problem in a very tourist orientated area.

The majority of Solid Waste Disposal Sites are a consequence of the current road and urban development programme and are infills of inert soil and building wastes which do not give rise to any problems if operated correctly. Scrap yards and Waste Transfer Stations are currently being licensed after consultation with the NRA. The potential for contamination has been reduced but only a small number of these sites have so far been visited.

Abandoned sites and bankrupt operators cause the most serious problems, as the sites become the responsibility of the Local Authority who have restricted funds to make them safe or prevent pollution. They also have to deal with contamination of land caused by unauthorised or illegal dumping.

Examples of areas of concern in the catchment are:

- * The abandoned Hawkesbury Tip north of Coventry. This large area of contaminated land caused pollution problems in the nearby Wyken Slough and the upper reaches of the Sowe Sub-Catchment.
- * The discharges from the disused Marle Hill Tip near Cheltenham contain high levels of ammonia and have been partly responsible for a failure of the River Swilgate to meet its quality objective.
- * The Redditch area is known to have many old tip sites. Although some of these sites may have been identified, others have not and the idea of a contaminated land register has now been abandoned. Care needs to be taken in development of such sites to prevent mobilization of pollutants.

Objective

- * To ensure that waste disposal storage and transfer activities do not adversely affect water quality or water resources.

Requirements

Water Quality

- * EC Directives on dangerous substances discharged to surface and groundwaters to be complied with.

- * Landfill to be carried out in accordance with advice given in the NRA's Policy and Practice for the Protection of Groundwater.
- * Restored sites not to pose a long term risk to the water environment.
- * Pollution prevention measures on bunding and drainage to be fully implemented at waste transfer sites and scrapyards.

Physical Features

- * To control disposal such that watercourses and ditches are not infilled, restricted or altered.

CATCHMENT TARGETS AND CURRENT STATUS

A comparison of the targets set for Water Quality, Water Quantity and Physical Features with the current state of the catchment shows how some of the issues described in Section 2 of the report were identified. This section also provides a more detailed background to the issues.

A2.1 SURFACE WATER QUALITY TARGETS

River Quality Objectives

In 1979, River Quality Objectives (RQOs) were set for river lengths throughout England and Wales, based on the National Water Council (NWC) River Quality Classification. A limited range of criteria were used, i.e. dissolved oxygen, biochemical oxygen demand and ammonia. The classification includes a broad indication of the fisheries and water supply uses which might be made of rivers in each class. For example, Classes 1A and 1B would be considered suitable for salmon and trout fisheries and water supply with conventional treatment, whereas Class 2 would be suitable for coarse fisheries and would only be suitable for water supply after advanced treatment. The classification system is shown in Appendix 5.

These objectives set the overall 'targets' for the quality of rivers and streams. Pollution control measures were aimed at improving rivers which had sub-standard quality to bring them up to their water quality objective. Where a river met its 'objective', then the aim was

to ensure that the river quality did not deteriorate such that it failed to meet its objective.

The RQOs set in 1979 were 'long term' RQOs. The target was to achieve these quality standards by the year 2001. The Water Resources Act 1991 (which incorporates the relevant sections from the Water Act 1989) includes provision for 'statutory water quality objectives', normally referred to as SWQOs. The NRA has recently developed a framework for specifying the SWQOs of rivers and other controlled waters. This approach may be used in future and will be more specifically related to a wider range of the water uses. The setting of SWQOs will involve local consultation. The process was due to have commenced already, but the Government now consider the financial implications on the water companies to be such that the timescale should be longer. The scheme itself is also subject to review.

Although the existing RQOs should eventually be superseded by the use-related SWQOs, they are currently established management objectives and are therefore considered in this Catchment Management Consultation Report.

A biological classification in the form of quality bands is used to support this general overview of water quality. It is based on the presence of river animal (invertebrate) groups and is used as an indication of water quality.

It complements the chemical assessment and Appendix 6 shows how the classification is derived.

Use-related Water Quality Criteria

Lists of relevant water quality criteria and standards have been developed or are to be developed for each of the major river uses. These are shown in Table 4.

Water quality at the abstraction points used as sources of raw water for potable (drinking water) supply should comply with the European Union Abstraction Directive Standards. European Union Directives also apply to the quality of freshwater to support fish life and discharges of dangerous substances. These are summarised in Table 5.

To tie in with the new approach to SWQOs the NWC classification is now to be replaced by the General Quality Assessment Scheme (GQA). This involves six separate assessment bands (A-F). While these bands are very similar to the fisheries uses classification they will not themselves be used for targets. Targets will be use-related but may no longer be statutory for all uses. Table 6 shows the proposed GQA scheme.

Local Perspective

The upper part of the catchment is used to supply drinking water and there are two abstractions each from the Avon and Leam. The quality objectives for the upper reaches is Class 1B which is appropriate to this use.

The first major discharge of treated sewage is in the higher reaches of the catchment at Rugby and below this the river system is extensively used for recreation (boating and angling). This activity is characteristic of the Avon and continues throughout the mid and lower parts of the catchment.

The quality objective of Class 2 has been set downstream of Rugby to permit recreational activity.

Overall Target

The attached map (Map 18) shows the current RQOs for the catchment.

TABLE 4

Use Class	Water Quality Criteria							
	<p>Note: whilst criteria are set out below for several Use Classes, they do not in these cases necessarily represent final proposals: as indicated in the main text, further work is in some cases continuing to refine the standards. There will be a further opportunity to comment on detailed standards as they are proposed to be incorporated into Classification Regulations.</p>							
1. Fisheries Ecosystem	Class	DO % sat 10%ile	BOD (ATU) mg/l 90%ile	Total Ammonia mg N/l 90%ile	Un-ionized Ammonia mg N/l 95%ile	pH 95%ile	List II Substances (based on Appendix 2 to DoE Circular 7/89; WO Circular 16/89)	Class Description
	1	80	2.5	0.2	0.021	6-9	Standards for "sensitive" aquatic life	Water quality suitable for high class salmonoid and cyprinid fisheries
	2	70	4.0	0.6	0.021	6-9	Standards for "sensitive" aquatic life	Water quality suitable for sustainable salmonoid and high class fisheries
	3	60	6.0	1.3	0.021	6-9	Standards for "other" aquatic life	Water quality suitable for high class cyprinid fisheries
	4	50	8.0	2.5	-	6-9	Standards for "other" aquatic life	Water quality suitable for sustainable cyprinid fisheries
	5	20	15.0	9.0	-	-	-	Some species may be present but water quality unsuitable for sustainable fishery
	6	<20	-	-	-	-	-	Fish unlikely to be present
2. Abstraction for Drinking Water Supply	<p>Hierarchical classifications based (in part) on Surface Water (Classifications) Regulations 1989, SI 1989/1148 arising from EC Directive 75/440/EEC for classifications DW1, DW2 and DW3. Standards for List II substances for 'Direct Abstraction to Potable Supply' (DoE Circular 7/89, WO Circular 16/89)</p>							

TABLE 4 – Continued

Use Class	Water Quality Criteria
	<p>Note: whilst detailed criteria are set out below for several Use Classes, they do not in these cases necessarily represent final proposals; as indicated in the main text, further work is in some cases continuing to refine the standards. These will be a further opportunity to comment on detailed standards as they are proposed to be incorporated into Classification Regulations</p>
3. Agricultural Abstraction*	*All standards applied as annual averages; standards for metals as total concentrations
a. Irrigation	<p>pH 5-8.5</p> <p>Chloride 100-600mg Cl/l } dependent on crop type and volume of water applied</p> <p>Boron 2-8mg B/l }</p> <p>Chromium 2.0mg Cr/l</p> <p>Copper 0.5mg Cu/l</p> <p>Iron 1-2mg Fe/l</p> <p>Lead 2.0mg Pb/l</p> <p>Nickel 0.15mg Ni/l</p> <p>Zinc 1.0mg Zn/l</p> <p>Molybdenum 0.03mg Mo/l</p> <p>Selenium 0.02mg Se/l</p> <p>Vanadium 0.08mg V/l</p>
b. Livestock Watering (Requirements may be more stringent for poultry)	<p>pH 6-9</p> <p>Chloride 1,000mg Cl/l</p> <p>Sulphate 250mg SO₄/l</p> <p>Fluoride 2.0mg F/l</p> <p>Dissolved Oxygen 30% saturation</p> <p>Arsenic 0.2mg As/l</p> <p>Chromium 1.0mg Cr/l</p> <p>Copper 0.2mg Cu/l</p> <p>Lead 0.05mg Pb/l</p> <p>Nickel 1.0mg Ni/l</p> <p>Zinc 5.0mg Zn/l</p>
4. Industrial Abstraction	Standards being considered by NRA: given the many different types of industrial abstractions, and their differing quality requirements, standards may need to be drawn up on a generic basis.
5. Special Ecosystem	Standards being developed by English Nature and NRA according to the special requirements of sites requiring protection for nature conservation reasons. It is likely that these standards would cover organic pollutants and nutrient levels, and take the form of a matrix of possible standards, from which individual standards would be selected on a site-specific basis.
6. Watersports	Standards based on health-related risk associated with watersports – to be developed.

TABLE 5

EC DIRECTIVE	STATUTORY INSTRUMENT	RELEVANT CLASSIFICATION	APPLYING TO
1. Surface Water Abstracted for Drinking Water, 75/440/EEC	Surface Waters (Classification) Regulations 1989, SI 1989/1148	DW1, DW2 and DW3	Designated abstraction points
2. Quality of Freshwater to Support Fish Life 78/659/EEC	(Regulations being prepared)	Separate Classes for Salmonoid and Cyprinid Waters	Designated stretches of water
3. Dangerous Substances legislation arising from 76/464/EEC	Surface Waters (Dangerous Substances) (Classification) Regulations 1989 and 1992, SIs 1989/2286 and 1992/337	DS1, DS2 and DS3 Classifications for List II substances in Circular 7/89	All waters receiving discharges of these substances

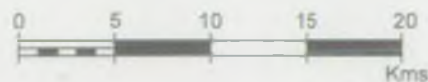
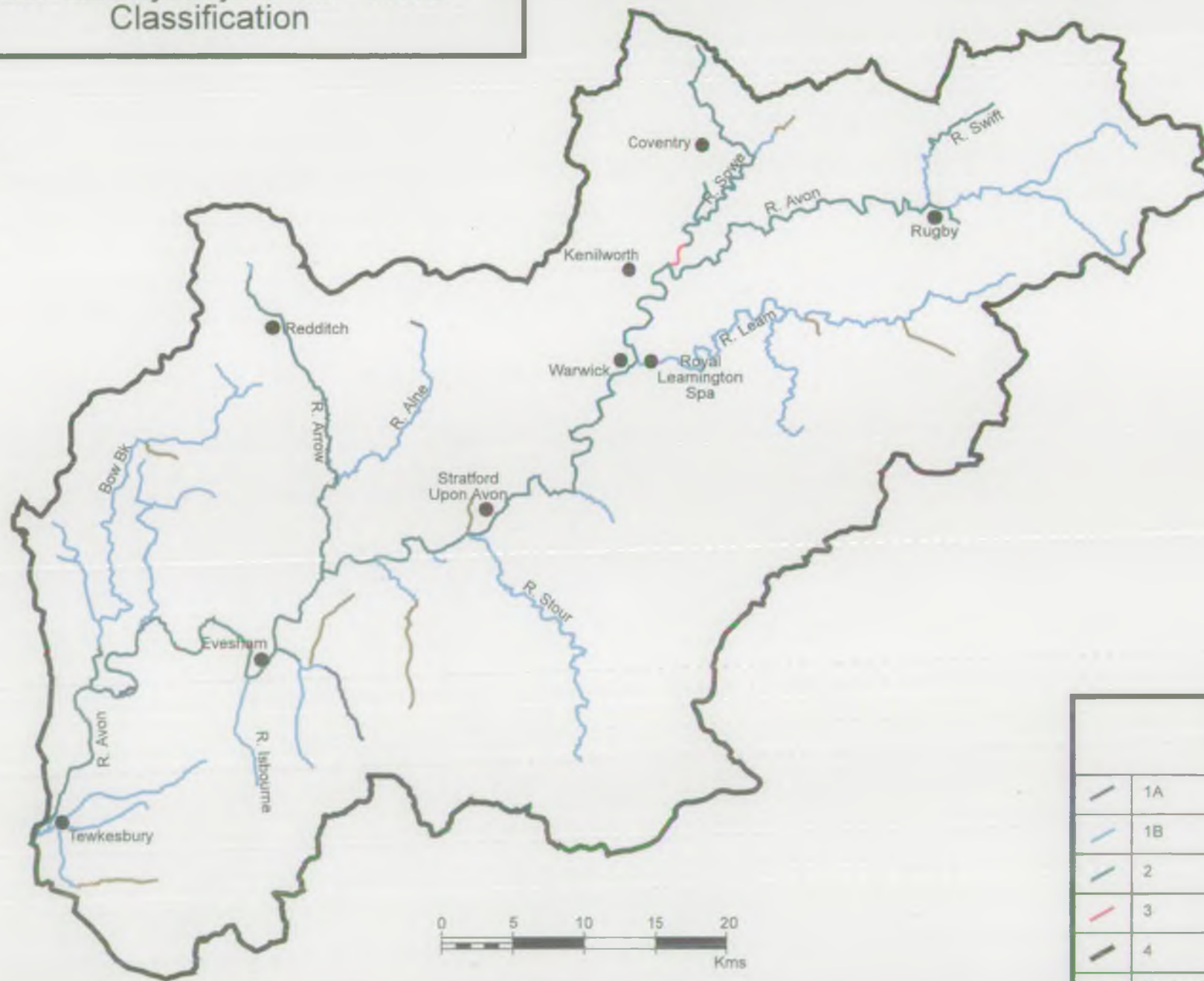
TABLE 6

Class	Chemical Classification			Biological Classification EQI (indicative – to be finalised)	Aesthetic Classification Basic Amenity Score (indicative – to be finalised)	Nutrient Status Classification – to be developed
	DO % sat 10%ile	BOD mg/l 90%ile	Ammonia mg N/l 90%ile			
A	80	2.5	0.2	0.95	10	
B	70	4.0	0.6	0.75	8	
C	60	6.0	1.3	0.50	6	
D	50	8.0	2.5	0.20	2	
E	20	15.0	9.0	<0.20	2	
F	<20	–	–	–		

Note: This table sets out the standards (in some cases, only in indicative form) proposed for the GQA. A further element of the GQA will be the introduction of standard approaches to sampling, data handling, statistical analysis and so on. These aspects will be formally set out in a “procedures manual” to accompany the final published GQA, but are not spelt out in detail in the present paper. The principles were set out in the consultation paper published by the NRA in December 1991.

River Quality Objectives - NWC Classification

Map 18



Key

	1A
	1B
	2
	3
	4
	Unclassified

A2.2 CURRENT STATUS - SURFACE WATER QUALITY

Data from routine water quality and biological sampling have been used to assess the current state of the catchment.

Map 19 shows the 1992 quality and Map 20 the 1990 quality. Both are included as the 1990 quality is to be used as a base line for future quality assessments.

Map 20 identifies 'current' quality and Table 7 shows the classification of rivers by sub-catchment together with the lengths of river which do not meet their class.

A number of stretches in the catchment have been designated under the EC Fisheries Directive.

Data from routine biological monitoring has been used to assess the catchment and is presented as Quality Bands (see Appendix 6) in Map 21. The classification uses data for 1990 as this is to be used as the baseline for further surveys and may be compared with the chemical data presented for the same period (see Map 20). More recent biological data is available (up to, and including, 1993) which shows a significant improvement in biological quality throughout the catchment.

Pollution Incidents

A reflection of the problems in each sub-catchment is the number and type of pollution incidents reported.

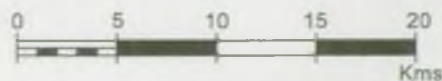
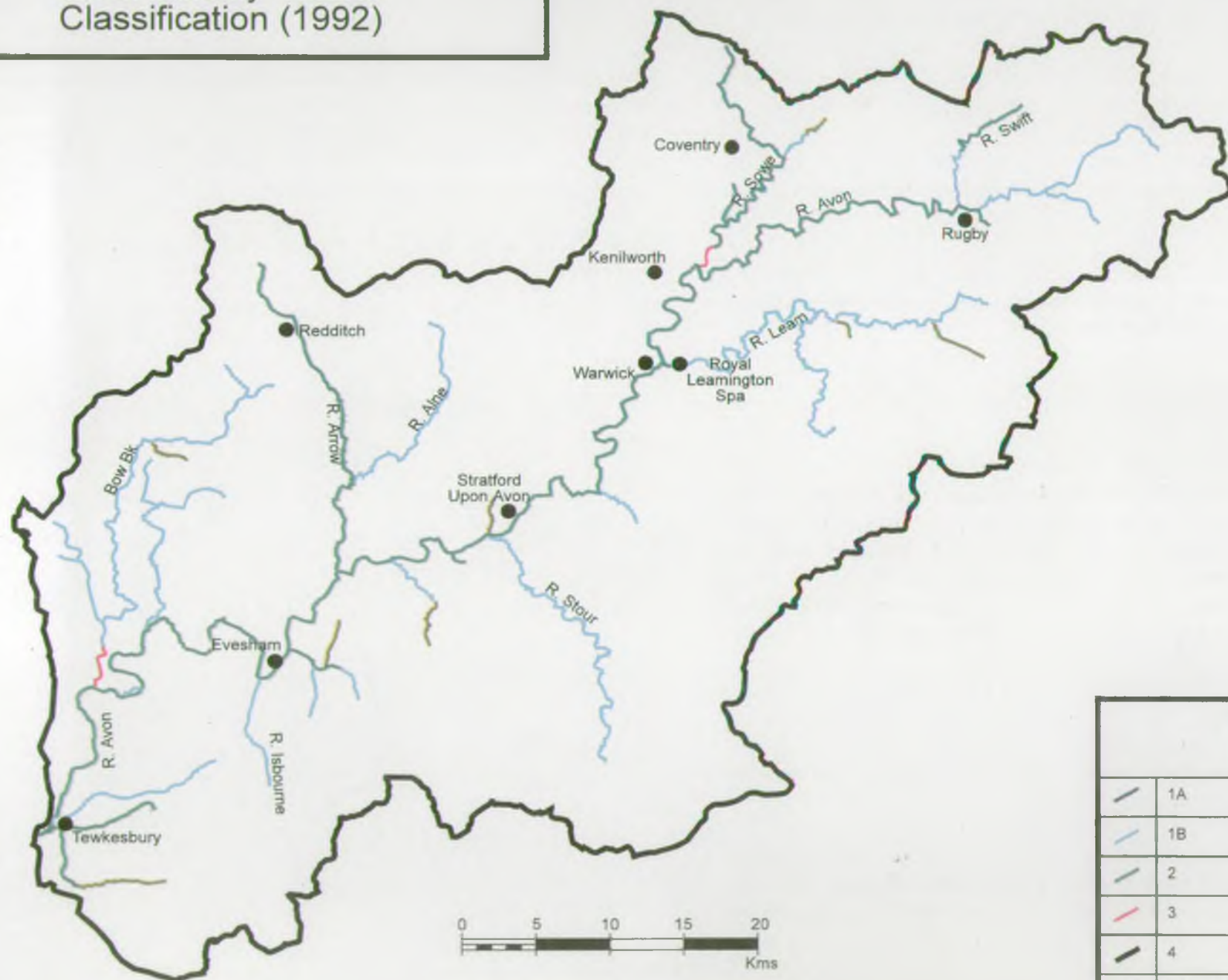
From May 1990 to November 1993 there were 2,486 reported incidents in the catchment of which 1,714 were confirmed. The sub-catchment with the highest number of incidents was the Sowe

(through Coventry) while the Badsey Brook had the lowest number of recorded incidents. Oil was the cause of 579 of the incidents while sewage (404), chemical (138) and farm wastes (104) were also significant. Of the 1,714 confirmed incidents 80 were major, 404 were significant and 1,230 were minor.

Map 22 shows the distribution of pollution incidents by catchment and cause.

River Quality - NWC Classification (1992)

Map 19

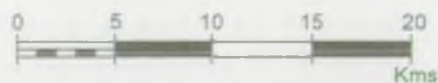
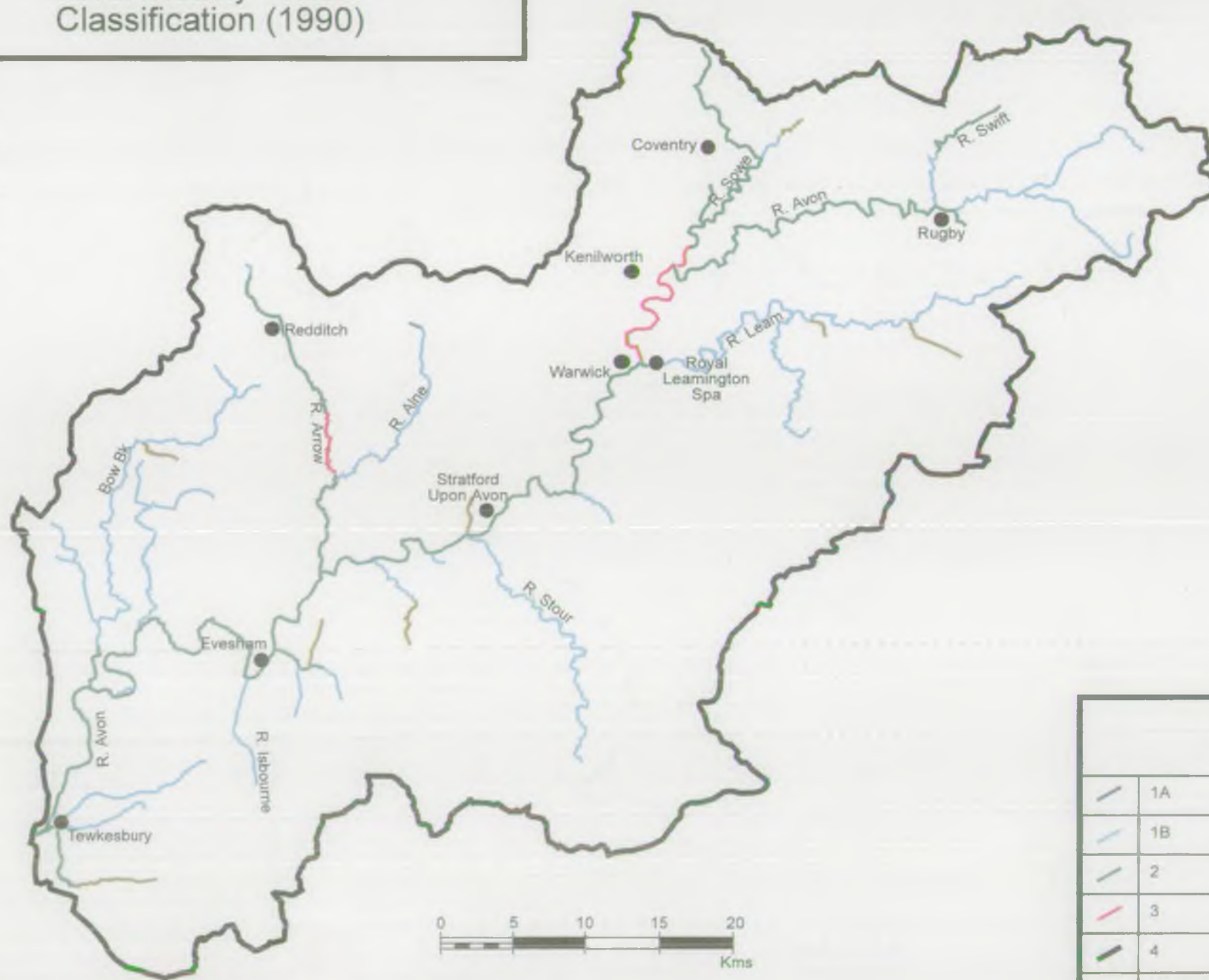


Key

	1A
	1B
	2
	3
	4
	Unclassified

River Quality - NWC Classification (1990)

Map 20

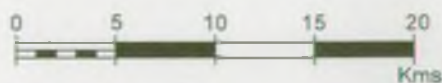


Key

	1A
	1B
	2
	3
	4
	Unclassified

Quality Banning From Biological Data

Map 21



Key

	Band A
	Band B
	Band C
	Band D
	Not Sampled

Pollution Incidents - 1990/1993



Map 22



Key





	0-100			
	100-200			
	200-300			
	>300			
SUB	1	2	3	Total
10	12	59	180	251
11	41	139	235	415
12	7	18	123	148
13	7	49	160	216
14	1	18	77	96
15	5	22	161	188
16	0	4	32	36
17	1	70	188	259
18	6	14	34	54
19	0	11	40	51
	80	404	1230	1714

TABLE 7

1992 Quality Summary

Sub catchment (excluding Main R. Avon & Canals)	Present (Km) 1A	Objective (Km) 1A	Present (Km) 1B	Objective (Km) 1B	Present (Km) 2	Objective (Km) 2	Present (Km) 3	Objective (Km) 3	Total (Km)	Complying Km	Compliance %	Cyprinid Km	Salmonid Km
10 (Upper Avon)			25.4	22.6	14.3	17.1			39.7	39.7	100		
11 (Sowe)			39.6	25.4	44.6	62.6	8.1	4.9	92.3	84.5	92		
12 (Leam)	11.5	11.5	71.3	71.3	20.2	20.2	1.0	1.0	94.0	94.0	100	49.6	
13 (Mid Avon)			25.5	30.3	37.4	31.2	1.2	2.6	64.1	58.1	90	14.3	13.0
14 (Stour)	16.6	1.8	42.3	60.4	6.7	6.0	2.6		68.2	62.3	91	12.4	31.5
15 (Arrow)			37.1	37.8	62.3	61.6			99.4	91.4	92	13.0	12.5
16 (Badsey Brook)		8.2	20.2	16.7	6.7	2.0			26.9	16.9	65		
17 (Lower Avon)			46.8	75.7	34.6	13.3	6.0		89.0	60.1	68	31.3	
18 (Ishbourne)	1.5	1.5	21.6	21.6	4.0	4.0			40.6	40.6	100		
19 (Bow Brook)			19.4	34.8	15.4	3.5	3.5		38.9	20.0	51	18.9	14.4
Main River Avon	4.5	4.5	21.0	21.0	149.9	149.9			175.4	175.4	100	99.6	
Canals*			65.5	85.7	93.9	82.0	8.3		167.7	116.0	69	137.9	
Totals	33.5	27.5	402.8	468.8	534.4	499.4	30.7	8.5	996.0	881.0	88	401.0	71.4

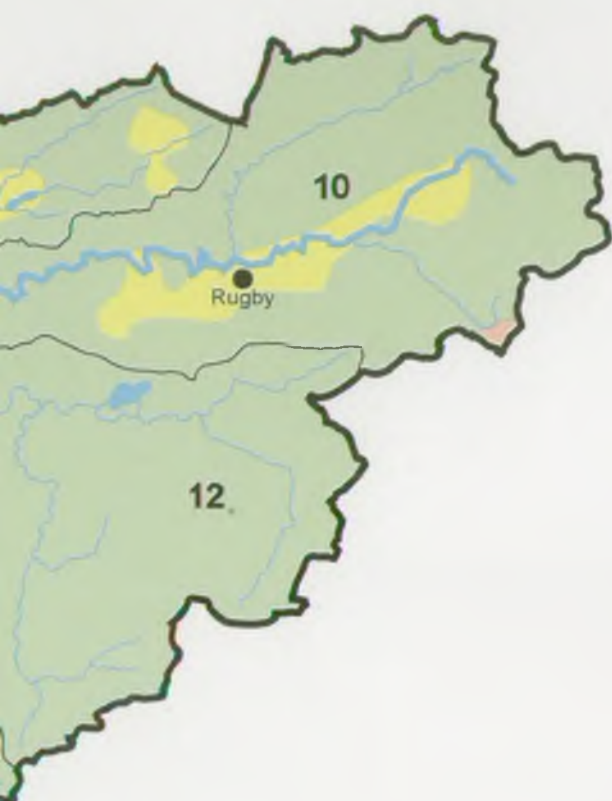
* Stratford Upon Avon, Worcester and Birmingham, Coventry, Grand Union and Oxford Canals








Groundwater Vulnerability Map



Map 23



Key

	Geological Class	Soil Class
	Major Aquifer	High
		Intermediate
		Low
	Minor Aquifer	
	Non Aquifer	

A2.3 GROUNDWATER PROTECTION TARGETS

General

The NRA has produced 'Policy and Practice for the Protection of Groundwater' (PPPG) which provides advice on the management and protection of groundwater on a sustainable basis. This new policy deals with the concepts of vulnerability and risk to groundwater from a range of human activities. It considers both source and resource protection, i.e. protection around the point of abstraction (source) and protection for the area which drains to the abstraction point (resource).

It deals in particular with:

- * discharges to underground strata
- * waste disposal to land
- * disposal of slurries and sludge to land
- * contaminated land
- * diffuse pollution and unacceptable activities in high risk areas.

The implementation of the policy relies in part on the construction of a series of maps showing the location of the sources to be protected (protection zone maps).

The policy recognises three groundwater source protection zones, which are currently being defined. These are:-

Zone I (Inner Source Protection): Immediately adjacent to the source area defined by a 50 day travel time from any point below the water table to the source (based on biological contaminant decay).

Zone II (Outer Source Protection): Area defined by 400 day travel time (based on the delay and attenuation of slowly degrading pollutants).

Zone III (Source Catchment): The complex catchment area of groundwater source. The controls to be exerted on a given activity will be more stringent the more vulnerable the resource and the nearer the source.

A resource protection map has been produced after considering how vulnerable groundwater is to pollution, based on the nature of the strata and type of soil and drift cover (Map 23).

Resource Capacity

The NRA's Severn Trent Region categorise areas of groundwater (aquifers) on basis of their capacity to provide further groundwater resources. The classification is:-

- A: No resources available
- B: Special study needed and presumption against large licences
- C: Special study - no presumption
- D: Resources available.

Local Perspective

NRA Severn Trent Region is implementing this national framework policy for the protection of groundwater which will manage

groundwater protection effectively in the area of the Avon Catchment.

The NRA does not have previously published maps delineating protection zones around groundwater abstractions. However, for internal purposes to assist in the assessment of risk to major groundwater sources from specific development proposals, sensitive areas are drawn around abstractions. These zones were defined on limited information available with due regard given to local knowledge and experience.

These existing zones are used in the consideration of proposals that could pose a risk to a particular source. Refinement of a zone would be undertaken if more detailed hydrogeological information became available. Developers in connection with specific proposals may submit appropriate data which will be considered by the NRA for the modification of the existing zone.

A2.4 GROUNDWATER QUALITY AND QUANTITY

Groundwater Quality

Work is currently underway to develop a groundwater classification scheme for inclusion in Statutory Water Quality Objectives.

Within the Avon Catchment, groundwater contamination of boreholes has occurred by nitrates (the South Coventry aquifer has nitrate levels above the drinking water level of 50mg/l), by solvents from the engineering industry in Coventry and to a lesser extent by pesticides on the Cotswold Limestone escarpment.

The bulk of the catchment is classified as a non-aquifer.

Groundwater Quantity

The areas of groundwater abstraction are shown on Map 24. Listed below is the current status of each groundwater unit in terms of the classification described in section A2.3.

Permo-Carboniferous

Coventry	A
Meriden	C
Kenilworth	C

Sherwood Sandstones

Bromsgrove	A
Whitley	D
Warwick	D
Avon Confined	A
Longbridge	D

Inferior Oolites

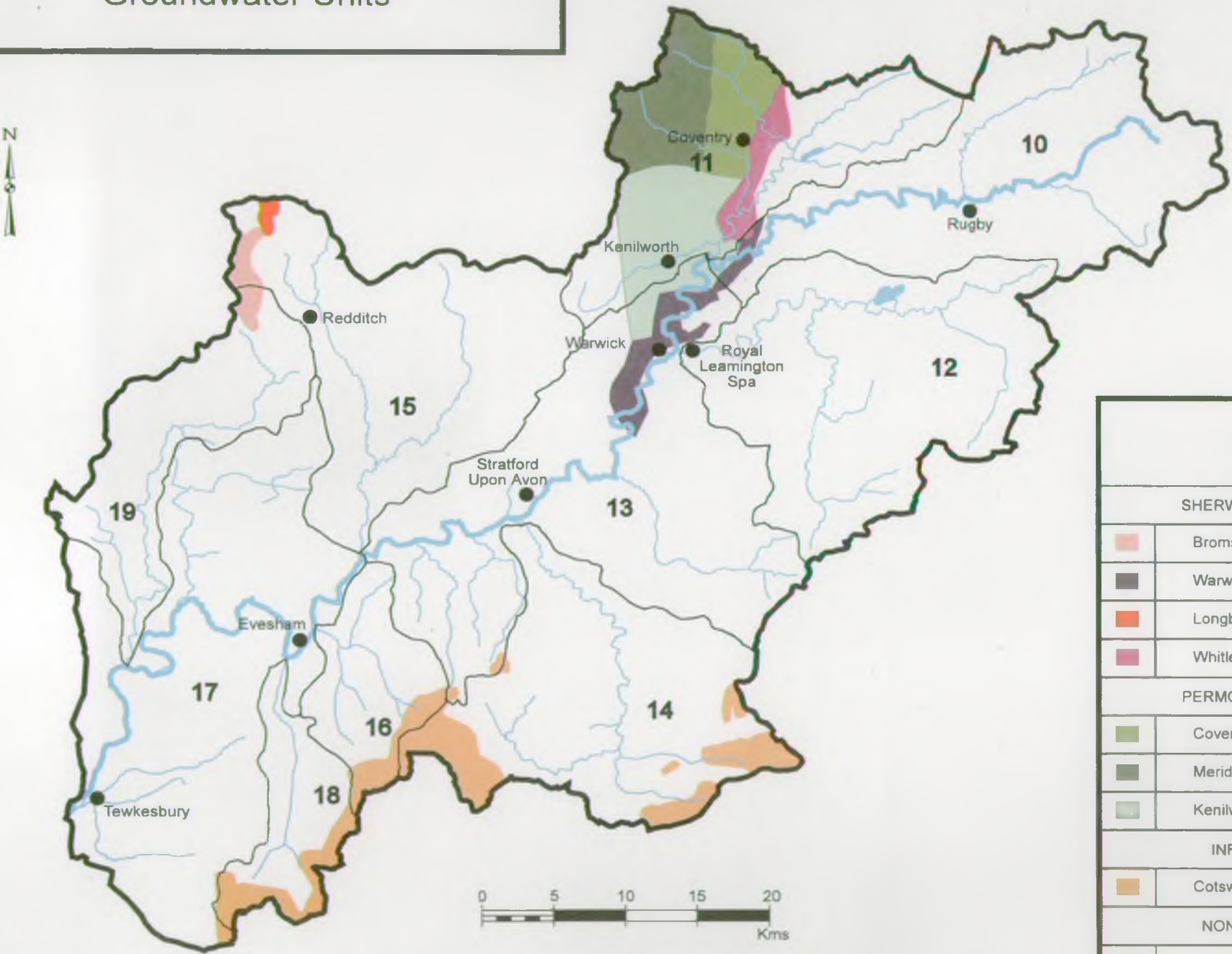
Cotswolds - unclassified

A local target is to reduce abstraction in the over abstracted units.

For the aquifer around Coventry a special study is required to determine resource availability. A study is also to be undertaken on the resource capacity of the Cotswold Limestones.



Groundwater Units



Key

SHERWOOD SANDSTONES:	
	Bromsgrove
	Warwick
	Longbridge
	Whitley
PERMO-CARBONIFEROUS:	
	Coventry
	Meriden
	Kenilworth
INFERIOR OOLITES:	
	Cotswolds
NON-AQUIFER AREAS:	

A2.5 WATER QUANTITY TARGETS

There are four main use types which affect the natural flow regime of a river. These are:-

- * Abstractions
- * Discharges
- * Reservoirs and Impoundments
- * Developments

Abstractions can reduce the quantity of water in rivers and streams. Discharges increase the flow. Reservoirs and impoundments affect flow and levels in a more complex manner. Where an impoundment is used for water power, for example, a head may be built up to generate electricity over a short period. This has the effect of cutting down the flow in the river while the reservoir fills, then increasing flow during generation.

Abstraction licences have been issued in their present form since 1965. Initially, 'licences of right' were issued to anyone who was abstracting at that time. Conditions protecting the environment or other abstractors could not be imposed on the licences. Since then, applications to abstract have been determined on an individual basis and conditions imposed to protect the environment and other abstractors' rights.

However, since abstraction licences were first issued it has been very difficult to assess how much water may be abstracted without adversely affecting the environment. The NRA is therefore undertaking a number of research projects to help answer this question. In reality, it will be several years before answers are available. When concluded, it will be possible to set flow targets throughout the catchment.

Surface water flows to watercourses are also affected by increased development in the catchment. Development reduces the amount of infiltration thus increasing the quantity of run-off and decreasing the amount of rainwater which is absorbed into the ground. The time taken for the rain to reach watercourses is reduced, particularly where the developed area is sewered direct to the watercourse system. These two aspects affect the flow regime in a catchment often leading to increased flood peak flows and reduced base flows. This problem is particularly encountered in the upper reaches of the catchment.

Through liaison with Planning Authorities, the NRA seeks to ensure that the effects of development on the flow regime of the catchment's watercourses are minimised. The use of source control ie. infiltration methods and surface water balancing, will be encouraged where these techniques are appropriate.

Local Perspective

Surface Water Sources

The geology of the catchment gives rise to rapid run-off and low base flows. There are major inputs to the main river Avon and Arrow from discharges at Coventry, Rugby, Warwick and Redditch Sewage Treatment Works. Most of this water is brought in from outside the catchment. The main uses that are affected by the existing abstractions are:

- * Other abstractions downstream
- * Conservation
- * Amenity
- * Fisheries Ecosystem

It is the aim of the NRA to determine a range of seasonal river flows which are appropriate for maintaining the characteristic habitat and river ecosystems - the things that give the river its character.

New Abstractions

The NRA will determine new abstraction licence applications within the framework of the Water Resources Act 1991. The impact of new abstractions will be carefully considered in the light of sensitive issues and problems specific to the Avon Catchment.

Map 25 shows the present licensing policy in the ten sub-catchments of the Avon. In the Upper Avon, Leam, Badsey Brook and Bow Brook only winter licence applications for consumptive use are now considered. In the Sowe, Stour, Arrow and Isbourne new licences are tied to a prescribed flow to ensure that existing downstream abstractors' protected rights are not affected. These restrictions have most impact on spray irrigation licences which usually need water at low flow periods.

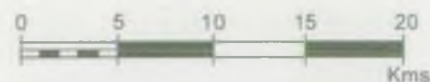
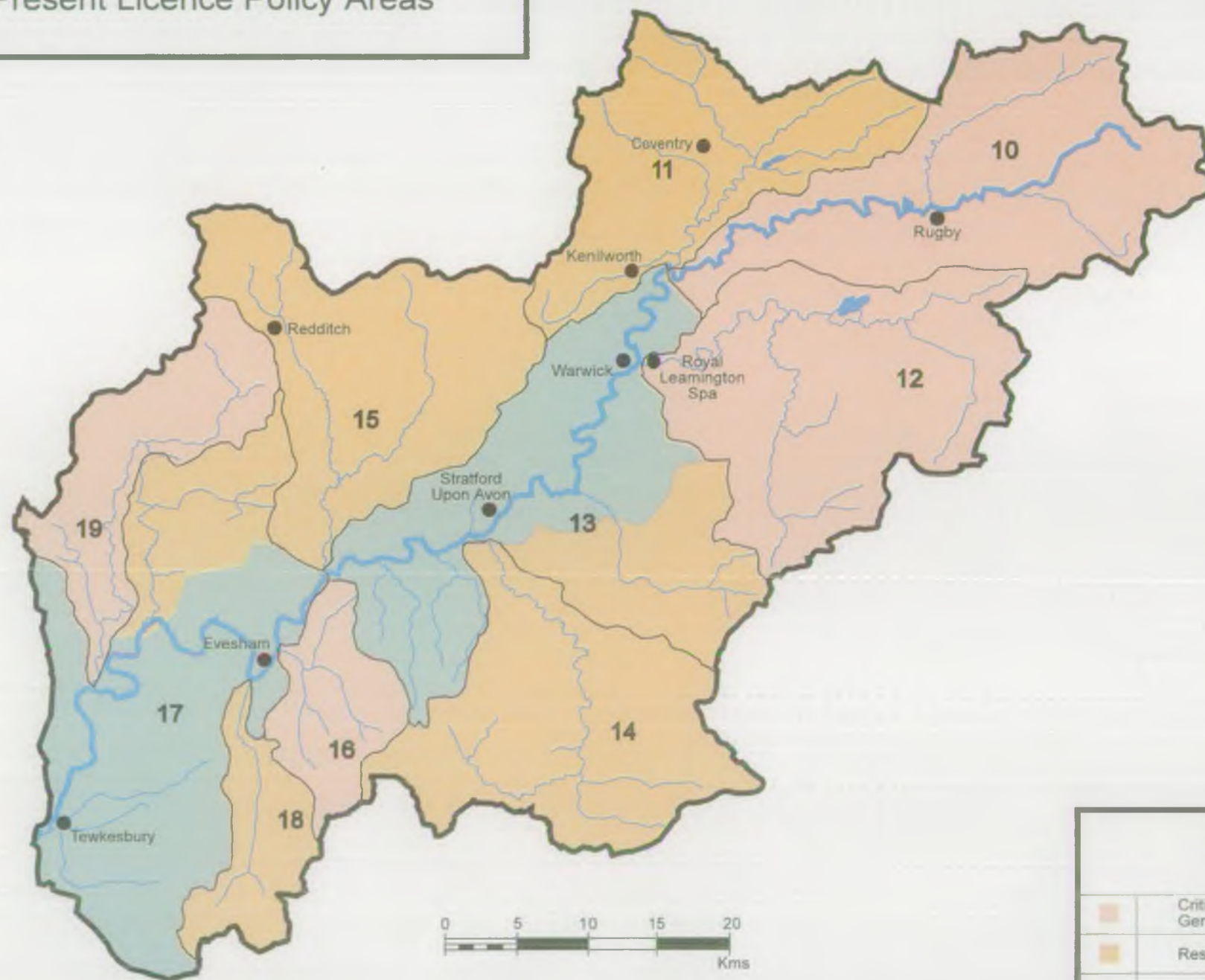
For most of these sub-catchments the prescribed flow is set at, or close to, the Dry Weather Flow (DWF) of the river at the gauging site. This flow is defined as the average of the annual census of the minimum mean weekly (seven consecutive days) flows, which can be thought of as the driest week in the average summer.

In the Middle and Lower Avon there are presently no restrictions on new licences as the flows are supported by sewage effluent discharges. Consideration is being given to imposing prescribed flow conditions on new licences to protect flows in the Lower River Severn when releases from reservoirs in Mid Wales are needed to support all the uses of the Severn.

Table 8 shows the restrictive flows at gauging stations, the natural and existing dry weather flows and the number of days per year the restrictions should be in force (based on analysis of data from 1972-1990).

Present Licence Policy Areas

Map 25



Key

	Critical Catchment Generally no Summer Abstractions
	Restricted Catchment
	Unrestricted

TABLE 8

Avon Sub-Catchment Restriction Thresholds

River	Gauge (Ml/d)	Restriction(1)	Natural(2) DWF (Ml/d)	DWF(3) (Ml/d)	Nature of(4) Threshold	Average Days(5) Below Threshold
Badsey Brook	Offenham	14.0	8.2	8.2	2	103.0
Leam	Leamington	43.2	20.7	18.2	Winter	102.9
Badsey Brook	Offenham	12.5	8.2	7.3	1	91.1
Isbourne	Hinton	13.6	13.5	10.2	1	86.8
Dene	Wellesbourne	11.4	4.5	5.0	1	77.7
Avon	Stareton	54.0	50.2	42.1	2	61.3
Avon	Evesham	409.0	270.0	393.0	—	41.4
Avon	Stareton	48.0	50.2	42.1	1	93.2
Bow Brook	Besford	10.5	9.0	10.4	2	35.8
Leam	Leamington	18.2	20.7	18.2	Summer	7.5
Arrow	Broom	75.0	64.2	82.9	1	1.5

- (1) The flow at the gauging station where restrictions on abstractions are imposed.
- (2) Natural DWF - is the flow that would be found if there were no discharges or abstractions.
- (3) DWF - Mean of the annual lowest weekly flow.
- (4) Threshold - some licences are restricted to lower (Primary) flows (1) some to higher (Secondary) flows (2).
The Leam has a Winter/Summer variation to safeguard abstractors to Draycote Reservoir in winter.
- (5) The average number of days per year the flow is below the stated threshold.

There are some obvious variations to the use of dry weather flow as a prescribed flow. The Dene at Wellesbourne, for example, has a restricted flow of more than twice the dry weather flow to take account of a dilution requirement for Wellesbourne Sewage Treatment Works. It is also clear that issuing new licences will bring restrictions to existing licences earlier in the year.

To overcome this, it has been the practice in the NRA Severn Trent Region to restrict licences to different flow rates. The more recent the licence then the earlier is the likelihood of a licence restriction being imposed.

Older licences are restricted to a 'primary' restriction level while the newer licences on the Badsey Brook, Avon at Stareton and Bow Brook at Besford are restricted at the higher, 'secondary' threshold. There is also a winter restriction on the Leam to protect the water supply abstraction to Draycote Reservoir.

While these restrictions help to provide protection to the environment they are not in themselves targets. The extent to which the actual flow is less than the dry weather flow is clearly shown in the table. As detailed earlier this is caused by 'licence of right abstractions' over which the NRA has little control except in extreme conditions. It is only by gradual control of some of these licences of right that future quantity targets are likely to be achieved. One measure of environmental requirement for rivers that has been suggested is a minimum of 60% of the dry weather flow. This is discussed in section A2.6.

Surface Water Control

Surface water control is vital in expanding urban areas for example, Coventry, Redditch, Stratford and Rugby, where the strategic

implications of individual balancing projects must be taken into account to avoid exacerbation of existing flooding problems or creation of new problems.

Where development areas are significant in relation to the catchment area of the draining watercourse, or where existing flooding occurs downstream, source control should be included.

The heavy clay areas of the catchment may not be suitable for infiltration techniques.

Future Demands for Water Use

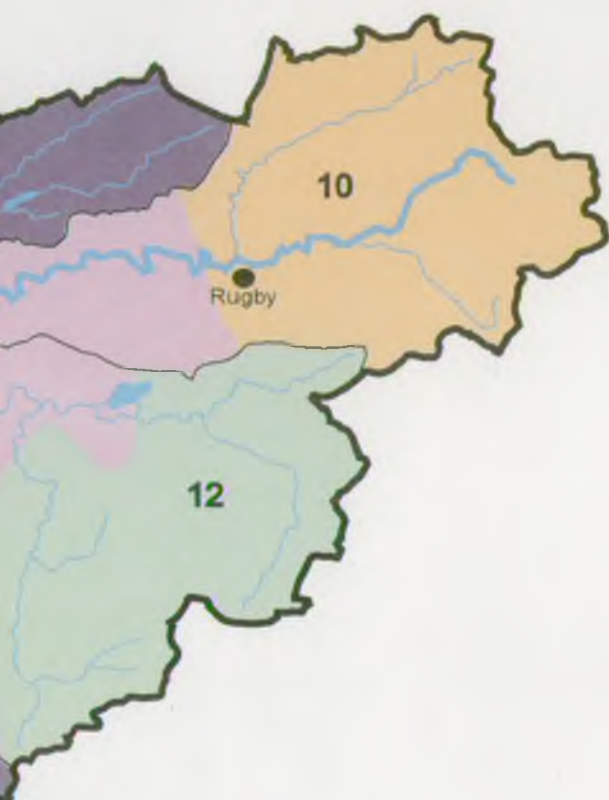
The NRA has analysed information on water use and has prepared a Regional Water Resources Strategy.

For public water supplies the NRA expects the fullest opportunities will be taken for effective demand management, particularly in the area of leakage control and in the introduction of domestic metering in zones of resource shortage. In all dealings with potential new abstractions, the NRA will seek to achieve environmental benefits from any new arrangements, whether for minor local improvements or from strategic considerations associated with conjunctive use of major sources.

Dry Weather Flow



Map 26



Key

Total Flow as %
of Naturalised DWF.



<50%



50 - 100%



100 - 150%



>150%

A2.6 WATER QUANTITY - STATE OF THE CATCHMENT

Map 26 shows the prevailing dry weather flows in the catchment as a percentage of the 'natural' dry weather flow. The differences are accounted for by abstractions where the percentage is less than 100% and sewage effluent discharges where the percentage is greater than 100%.

In terms of the 60% requirement (Section A2.5) the critical areas appear to be the Avon above Rugby (abstractions for water supply and canals), the River Sherbourne and Bow Brook (over abstraction of groundwater). Areas of concern are the Upper Arrow, Badsey Brook, the Upper Isbourne and Lower Stour.

Another measure of concern is the number of days per year the river is below its restriction threshold. These figures were given in Table 8 in section A2.5.

Significant restrictions on use and possible environmental consequences due to over abstraction are likely on the Badsey Brook, Isbourne, Dene, Upper Avon and Bow Brook. Where flows are below the restricted flow (or natural Dry Weather Flow) for most of the summer irrigation season there is little point in issuing new summer licences and the river flow regime is most likely to have affected the natural ecology.

Full details on total licensed volumes for abstraction are given in the Uses of the Catchment (Appendix 1).

Surface water storage has been extensively used as a strategic solution to the problems posed by the development of Redditch New Town. Elsewhere in the catchment individual sites involve infiltration (mostly soakaways) and balancing areas. The NRA seeks

to discuss the needs of each watercourse at an early stage of development proposals and welcome pre-planning discussions with developers and their consultants.

A2.7 PHYSICAL FEATURES TARGETS

General

This section considers targets for physical features on rivers and river corridors in the catchment. Fishery, Conservation and Recreational matters and Flood Defence works are dealt with under this heading. The term conservation includes flora, fauna, features of archaeological, architectural, historic and physio-graphical interests.

Requirements for specific uses identified in Appendix 1 have been considered and targets set to meet these requirements.

Use Related Targets

For the relevant uses, physical feature targets are as follows:

Conservation (including wildlife, landscape and archaeological interest)

The NRA is currently developing a National Conservation classification scheme for rivers that will assist in setting targets for conservation. Until specific targets are set the following are used:

- * Ensure that future development does not reduce the conservation value of the river corridor and where possible improves it.

- * Undertake environmental assessment of all NRA works and identify all opportunities for improving the quality of the water-related landscape in association with these works.
- * Carry out NRA consenting practices and respond to development proposals in a manner that ensures that natural features such as emergent vegetation, meanders, pools and the landscape are preserved and enhanced where appropriate.
- * Carry out NRA consenting and respond to development in a manner that ensures that features of archaeological, architectural and historic interest are preserved.
- * Seek opportunities for the NRA to carry out capital projects to protect or improve the physical character of the water environment.
- * Promote and support initiatives for the maintenance of wetland, in-stream and bankside habitat.
- * Further the collection of River Corridor Survey data to external knowledge on conservation and enhancement matters.

Livestock

- * To seek opportunities, where appropriate, to control stock access to river banks, thus minimising bank damage and allowing regeneration of bankside vegetation to ensure habitat, shade cover and natural vegetation are maintained for the wildlife in the river corridor.

Fisheries

Fisheries targets for trout, coarse fish and eels have not been set. The aim is a sustainable level of fish exploitation while conserving the natural history of the stock.

Trends in stock abundance can be identified and comparisons made with 'expected' abundance based upon habitat characteristics.

In the absence of specific targets the following are used:

- * Control illegal fishing by use of a bailiff force
- * Maintain an abundance of brown trout which is related where possible to the carrying capacity of the catchment based upon habitat characteristics
- * Maintain an abundance of coarse fish which is related to the carrying capacity of the catchment
- * Ensure that fish predator population does not significantly affect stocks of other species
- * Maintain a monitoring programme which quantifies accurately stock abundance.

Recreation/Amenity

Targets are:

- * To collect data on the recreational source to help resolve existing conflicts and plan for the future
- * Support opportunities to improve existing public amenity access where appropriate

Flood Defence

The NRA use a system of land use identification for flood defence purposes which is based on the concept of House Equivalents (HE). This takes each type of land use in the flood plain for example housing, commercial, retail, manufacturing, rural (arable, pasture, horticulture) and using the potential losses due to flooding equates them to HE figures. The HE figure also takes into account the flooding of transport routes and the resultant costs to the community of alternative transport arrangements.

The land use bands are related to Standards of Service (SOS) which define an 'acceptable' level of protection in terms of frequency of flooding of land or property. This frequency is expressed as a return period for example, 1 in 50 years. This is a measure of the likelihood of a flood where a 1 in 50 year flood has a 2% chance of occurring in any year.

Map 27 shows the land use bands for main river in the Avon Catchment and full definitions are given in Table 9.

Improvement and maintenance works are targeted towards those watercourses which are underserviced (i.e. do not meet their SOS), particularly where the higher land use bands (A to C) are involved.

The NRA seeks to ensure that development does not take place in flood risk areas. It does this by close liaison with local planning authorities. Successful development control ensures no increase in the number of properties at risk and that the resources available to the NRA can be used to alleviate existing flooding rather than having to solve new problems.

Local Perspective

As part of its capital works programme the NRA is undertaking a detailed survey of all flood defences and assets. The existing flood alleviation schemes in the Avon Catchment should be surveyed and assessed in the financial year 1994-1995. The assets currently identified for renewal or improvement and other capital projects in the programme are:-

- River Avon - Safety Barriers
- Abbey Mill Tewkesbury - Sluice Gate
- Strensham weir and sluice
- Lucy's Mill Sluice, Pershore Sluices
- Nafford Sluices, Stanchard Pit Sluice
- River Avon Weirs
- Stratford flood alleviation scheme - feasibility study
- River Avon flood plain mapping

Flood Defence Land Use Bands



Map 27



Key






	BAND A
	BAND B
	BAND C
	BAND D
	BAND E

TABLE 9 – Standards of Service for Flood Defence and Land Drainage

Land Use Band	Description of Typical Land Use
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 flood plain's proximity to areas of population density.
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.
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.
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 developed pockets of largely urban use, amenity interests may be prominent.
E	There are likely to be very few properties and major roads at risk from flooding in these 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.

Target Standard of Service

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 high standards may be applied.

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.

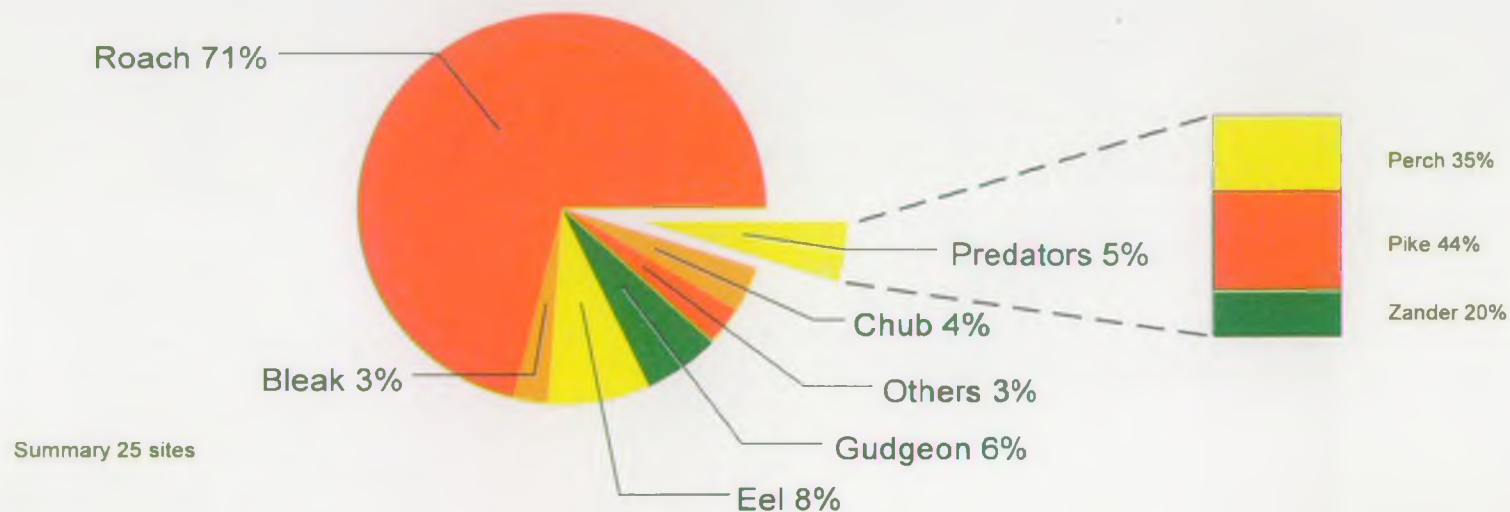
The change of flooding of property in any one year would be 1 in 10 and 1 in 50 years. Agricultural or amenity land, however, could be susceptible to more regular flooding.

Agriculture and amenity land in this bank should be protected to a standard such that the chance of flooding or prolong bankfull events in any one year, at a time when crops are normally susceptible to damage (ie March to October inclusive), is between 1 in 2 and 1 in 5.

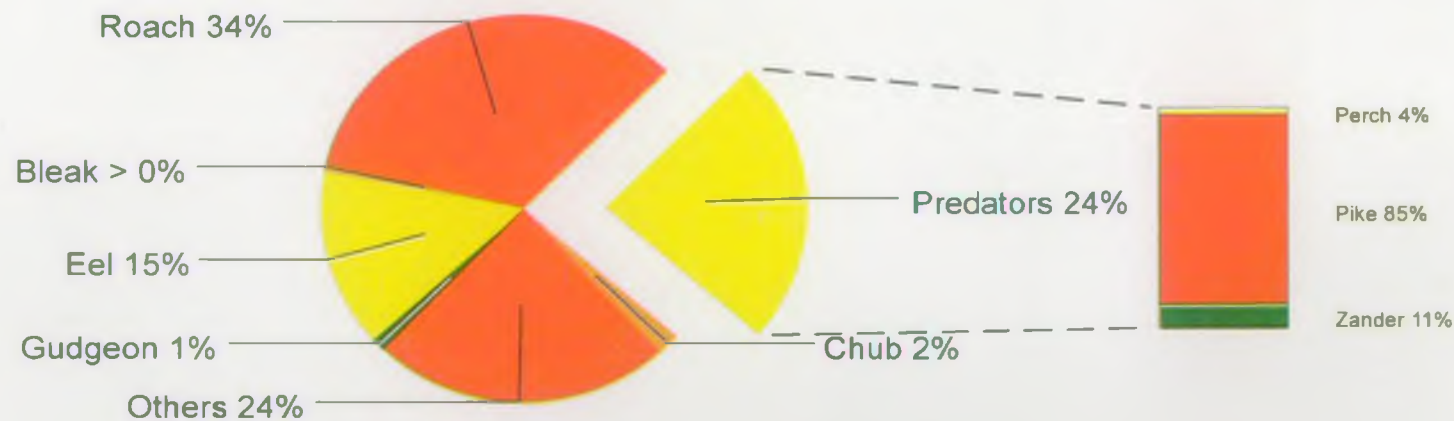
Agricultural land in this category could be susceptible to yearly waterlogging and/or flooding, possibly occurring on several occasions throughout the year. Protection should be maintained to a standard which reduces the risk of either type of event to between one and three times per year at a time when crops are normally susceptible to damage.

Fig 1

R. AVON 1993
Species Composition - % by number



R. AVON 1993
Species Composition - % by weight



A2.8 PHYSICAL FEATURES - CURRENT STATE OF CATCHMENT

Conservation

The status of the catchment has been described in terms of SSSIs, (in Appendix 1). In addition, all stretches of main river in the catchment have now been surveyed. The river corridor surveys were undertaken in lengths averaging 500m and the physical features, land use, vegetation and points of interest described for each section. Management suggestions to improve conservation in the stretches have also been made.

As previously mentioned, a proposed conservation classification for corridor survey is presently under development by the NRA based on 4 bands: Critical, Important, Good and Poor. These categories are attributed separately to the river and adjacent habitats.

The Avon data has not yet been classified in this manner but it is a high priority to do so. Once this has been done it will be possible to direct resources to areas with the highest potential for improvement.

Fisheries and Angling

Information on the current status of the catchment is known from Electric Fishing Surveys, Echo Sounding Survey, Angler Catch Data and the returns of Commercial (Eel) Fishermen. Results of the most recent electric fishing survey of 25 sites on the Main River Avon between Warwick and Tewkesbury are summarised in Fig 1.

The average minimum biomass based on a single run confirmed there were 4.5g of fish per square metre. As electric fishing in large

rivers is rarely more than 10% efficient the actual figure is likely to exceed 45g per square metre, comparing favourably with other waters. The Avon fish population is dominated by roach, both in terms of numbers and weight.

Analysis has been undertaken of 439 match results, totalling 43,372 man hours of angling on the River Avon, for the 1990, 1991, 1992 and early 1993 seasons. The results corroborate reports of a general deterioration in match results with fish being generally harder to catch, though there are exceptions eg at Bredon and Twynning. Overall, for all reaches, the average catch rate fell from 148 grams per angler per hour in 1990, to 120 grams in 1992 and 73 grams at the start of the 1993 season. This situation improved significantly towards the end of 1993.

Examination of the results for individual species shows very little change in the relative importance of roach, chub, bream and pike in the anglers catch. However, perch, barbel and eel have increased slightly in importance whilst dace, ruffe, gudgeon and, to a lesser extent, bleak have declined slightly.

Complaints of reduced angling success in the Evesham area are thought to have been caused by the natural decline of the old, large and numerous individual chub born in 1969. Elsewhere on the River Avon chub stocks are good and give no cause for concern whatsoever. Some sections of the Avon are showing an imbalance in the predator to prey ratio and the removal of zander and (small) pike from these sections remains the current recommended NRA policy, together with the restocking of chub and dace in the Evesham area.

Some anglers are still evading the requirement for a licence in the Avon Catchment and in some cases, prosecutions have followed. This is more marked in the Coventry area where there are also

problems with fishing in the close season. This obviously has implications for other anglers and NRA fishery activity.

Flood Defence

A detailed description of flooding problems was first undertaken in 1980 to satisfy Section 24(5) of the Water Act 1973. This has now been updated several times with the most recent update in 1990 (now under Section 105 of the Water Resources Act 1991). The problems are too numerous to identify clearly on a map in this Catchment Management Plan but the breakdown by council is shown in Table 10. A further update is in progress and will include those problems identified during the winter of 1992/93.

The defined 'main river' in the catchment is shown on Map 28.

Main River



TABLE 10

FLOODING PROBLEMS (1990 Survey)

District Council	Total	Main River	Ordinary Watercourse	Outstanding*
Bromsgrove	3	-	3	1
Redditch	10	3	7	10
Wychavon	50	18	32	46
Tewkesbury	4	-	4	2
Cotswold	9	-	9	7
Daventry	9	9	6	7
Rugby	31	11	20	23
Stratford	90	19	71	77
Warwick	23	4	19	21
North Warwickshire	2	-	2	2
City of Coventry	14	-	14	11
Harborough D. C.	5	-	5	4
* Some of the problems are highway issues which need to be addressed by other authorities				

APPENDIX 3

FLOOD DEFENCE ROLES

A 3.1 DURING FLOOD EVENTS

A3.1.1 National Rivers Authority

The NRA forecast likely flood levels, issue warnings to the Police and give advice to the public. We also patrol main river and remove any blockages, inspect formal flood defences and carry out any necessary remedial works.

The flood warning system is operated on the following main rivers in the Avon catchment:

River Avon : Lilbourne to Tewkesbury

River Leam : Eathorpe to Leamington Spa

River Stour : Shipston to Stratford

River Arrow : Studley to Salford Priors

Warnings are issued for three phases (Yellow, Amber and Red) each of which is associated with increasing flood risk. Details can be obtained from the Lower Severn Area office at Tewkesbury.

A3.1.2 Emergency Services

A3.1.2.1 Police

The Police receive flood warnings from the NRA and either contact those directly at risk, or pass the warning to Local Authorities of

flood wardens.

They can also advise on which roads are closed due to flooding.

A3.1.2.2 Fire Service

The fire service provide help in flood emergencies if they are able to do so. The local station will be able to advise the public on what help is, or is likely to be available and whether or not a charge will be made.

A3.1.2.3 RSPCA

This organisation can provide assistance with rescuing animals in danger from floods.

A3.1.3 Local Authorities

A3.1.3.1 District Councils

These have permissive powers to offer assistance (eg. sandbags) during floods. Each Council has a different policy on the amount and type of help they give. Details are available direct from each Council.

Some District Councils are involved in dissemination of flood warnings, generally via flood wardens. These systems have been set

up by the councils in consultation with the NRA. Flood Wardens are local residents who each contact several other residents to pass on flood warnings.

A3.1.3.2 County Councils

County Councils are the Authorities responsible for Public Highways and any flooding problems associated with road drainage should be referred to them.

All County Councils have Emergency Planning Officers who may become involved in more serious flood events.

In Warwickshire the County Emergency Planning Office disseminates flood warnings to flood wardens.

The Councils' Social Services Departments can become involved in providing assistance in the event of evacuation of people from flooded areas.

A3.1.4.3 Water Companies

Public surface water sewerage systems are the responsibility of Water Companies, who sometimes use District Councils as their Agents. Any problems relating to flooding, other than from watercourses, should be directed to the local Water Company.

A3.2 GENERAL MATTERS

A3.2.1 National Rivers Authority

The NRA's Flood Defence powers are contained in the Water Resources Act 1991, the Land Drainage Act 1991 and the

Authority's Land Drainage Byelaws.

The Authority has a supervisory role over all matters relating to land drainage and has a duty whilst carrying out this function to:

“further the conservation and enhancement of natural beauty and the conservation of flora, fauna and geological or physiographical features of special interest”. It must also “have regard to the desirability of protecting and conserving buildings, sites and objects of archaeological, architectural or historic interest”

Any work in, over, under or within 8 metres of main river requires the consent of the NRA, as does the construction or alteration of a culvert, mill dam, weir or like obstruction on any watercourse.

The Authority is a statutory consultee of the Local Planning Authorities for statutory plans and planning applications. The Planning Authorities are not obliged to incorporate NRA requirements or comments in their planning decisions but must consider them. It should be noted that control over development in the flood plain, even main river, is through the Planning Act not under Flood Defence legislation.

The NRA has powers to maintain and improve main river watercourses and construct flood defences. Any such work must be both financially viable and environmentally acceptable. The NRA does not carry out erosion protection unless a formal flood defence is likely to be affected.

A3.2.2 Local Authorities

Both County and District Councils have powers which relate to and affect the river system.

As stated above they have the power to control development by use of the Planning Act.

In addition they have direct powers under the Land Drainage Act 1991 to take action against riparian landowners, or others, who cause obstructions to watercourses. They are also empowered to carry out watercourse improvements that will benefit the community but need to obtain the NRA's consent for such work.

A3.2.3 Riparian Landowners

Riparian landowners are those people who own land adjacent to watercourses. Generally ownership is taken to be up to the centre line of a watercourse, unless deeds show otherwise.

Riparian landowners are responsible for maintaining their watercourses, and under common law may not diminish the flow in terms of quantity nor "throw water back" on upstream landowners.

Erosion is a natural process which can cause significant loss of land. If the landowner wishes to carry out protection work to the river bank, or indeed any alteration to a watercourse, then the NRA must be consulted as a Land Drainage Consent may be required.

APPENDIX 4

MODEL POLICIES FOR USE IN DEVELOPMENT PLANS

The NRA has a wide range of direct powers to prevent and control water related problems and where appropriate will use them. However, these are not always adequate to protect against all of the potential problems surrounding development, and rarely offer preventative measures. Many of these measures are material to Town and Country Planning and it is for this reason that the NRA is involved in the planning process. When consulted on Draft Plans the NRA will comment on issues related to specific sites but for the process to be fully effective it is important that policies which cover NRA interests are incorporated in Development Plans. Model policies have been prepared, as set out below, but it is appreciated that to meet individual plan styles the exact format may need to be modified.

Policy 1 - Flood Defence

The Council recognises the importance of the natural watercourse system for providing essential drainage of land and will protect that function against adverse forms of development, specifically to prevent:-

- i) Development in areas liable to flooding.*
- ii) The loss of access to watercourses for future maintenance.*
- iii) The loss of natural floodplain except in exceptional*

circumstances and when compensatory measures are provided as agreed with the Local Planning Authority.

- iv) Drainage from development giving rise to substantial changes in the characteristics of surface water run-off unless adequate off-site works can be provided.*
- v) Adverse effects upon the integrity of tidal and fluvial defences.*

These policies are necessary to ensure new development is itself not at risk from flooding and also does not put other areas at risk, endangering both life and property. Floodplains and areas of low lying land adjacent to a watercourse are by their very nature liable to flood under certain conditions. These areas also provide for storage of flood water and consequently not only are people and property at risk but development also reduces the capacity of the floodplain, impedes the flow of water and increases the risk of flooding elsewhere. Development in upper parts of a catchment can also have a significant impact upon others downstream by increasing surface run-off. An obligation to provide suitable mitigating measures is therefore necessary where this applies. A guarantee of future access to watercourses is required. However, the NRA's own powers under Land Drainage legislation extend only to designated main rivers and, even where these exist, are in practical terms very limited when development has proceeded in accordance with Local Plan policy.

Policy 2 Contaminated Land

The Council will only allow development on contaminated land where it can be demonstrated that it will not cause or increase pollution of watercourses and groundwater resources.

The disturbance of contaminated land can mobilise pollutants and either cause first time pollution or exacerbate existing problems. Leachates and drainage from contaminated land sites pose serious risks of major pollution to both rivers and groundwaters.

Policy 3 Groundwater Protection

The Council will have regard to the NRA's "Policy and Practice for the Protection of Groundwater" and will not allow development which could damage groundwater resources and prevent use of those resources.

Groundwater resources are a vital component of the potable water supplies but once polluted the damage is invariably irrevocable. It is essential therefore that development which threatens these resources is prevented.

Policy 4 Water Pollution Prevention

The Council recognises the importance of maintaining the quality of the water based environment and will not permit development which could damage the quality and ecology of watercourses, or compromise statutory water quality objectives. The Council will ensure that all development is served by satisfactory arrangements for disposal of foul sewage, trade effluent and surface water and specifically:-

- i) *For the development sites where connection to existing main sewerage is practicable, the Council will oppose any development incorporating independent sewage treatment facilities.*
- ii) *The Council will seek to promote and co-ordinate public sewage disposal facilities or require developers to demonstrate that the multiple use of individual facilities such as septic tanks is feasible especially where there is a potential for high density infill without causing a public health nuisance and possible water pollution.*
- iii) *The Council will ensure that where increased sewerage and/or sewage treatment capacity is required development will not be allowed to be occupied in advance of the completion of the improved facilities.*
- iv) *The Council will ensure that no development involving the storage of oils and chemicals shall take place unless adequate measures have been taken to prevent discharge to watercourses in the event of spillages and/or leaks.*

These policies seek to ensure the most environmentally effective means of disposal of foul sewage, contaminated surface water and trade effluents is used for any development. The Authority would wherever possible wish to see sewage and trade effluents disposed of via a recognised sewage treatment facility where capacity exists. Alternatively the Council could promote the necessary infrastructure, together with the utilities companies, where there would otherwise be multiple use of small treatment plants. It is often in practical terms difficult to guarantee a consistent quality of effluent from small privately operated treatment plants and the problems are often then compounded by having many units in close proximity giving

rise to environmental health nuisance as well as potential water pollution problems.

With increasing population and water use, sewerage systems and treatment works become overloaded. Where development is allowed to continue despite overloading, pollution of watercourses will occur. The Authority has powers to control the standards of effluent from treatment works, with the ultimate sanction of prosecution. However, this may be too late to prevent damage and a reasonable approach would be to phase development to coincide with increased treatment capacity.

Equally, there are circumstances where development cannot be achieved without detriment to quality or ecology and the Authority will seek refusal of planning consent on principle in such cases.

Policy 5 Water Environment

The Council recognises the importance of the natural watercourse system and wetland areas as valuable wildlife habitats and for their amenity interests and will:-

- i) Protect those interests against adverse forms of development.*
- ii) Encourage the development of water based recreation and public access whenever appropriate and where it will not conflict with the ecological value of the area.*

The Water Resources Act 1991 (Section 16) places upon the Authority a duty not only to further the conservation of landscape, flora, fauna and geological features but also to take measures to enhance it as far as any of its functions are concerned. It also has duties to promote recreation and to have regard to the conservation

of historic and archaeological features. Clearly, developments can severely threaten these interests. - - -

Policy 6 Water Resources

The Council will not allow development to proceed prior to the availability of the necessary water resources, the use of which has no detrimental effect on the environment.

The development of water resources for the public water supply is becoming increasingly difficult in some areas. The Authority has a duty to ensure that providing water for new development does not have a detrimental impact on existing users, nature conservation or recreation.

APPENDIX 5

RIVER QUALITY OBJECTIVES – (NATIONAL WATER COUNCIL SCHEME)

River Class	Quality Criteria	Remarks	Current Potential Uses
1A	Class limiting criteria (95 percentile) <ul style="list-style-type: none"> 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) 	<ul style="list-style-type: none"> i) Average BOD probably not greater than 1.5mg/l ii) Visible evidence of pollution should be absent 	<ul style="list-style-type: none"> i) Water of high quality suitable for potable supply abstractions and for all other abstractions ii) Game or other high class fisheries
1B	<ul style="list-style-type: none"> i) DO greater than 60% saturation ii) BOD not greater than 5mg/l iii) Ammonia not greater than 0.9mg/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 EIFC figures not available) 	<ul style="list-style-type: none"> i) Average BOD probably not greater than 2mg/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 purpose
2	<ul style="list-style-type: none"> i) DO greater than 40% saturation ii) BOD not greater than 9mg/l iii) Where water is abstracted for drinking, it complies with the requirements for A3** water iv) Non-toxic to fish in EIFAC terms (or best estimate if EIFAC figures not available) 	<ul style="list-style-type: none"> i) Average BOD probably not greater than 5mg/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 	<ul style="list-style-type: none"> i) Water suitable for potable supply after advanced treatment ii) Supporting reasonably good coarse fisheries iii) Moderate amenity value
3	<ul style="list-style-type: none"> i) DO greater than 10% saturation ii) Not likely to be anaerobic iii) BOD not greater than 17mg/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.

River Class	Quality Criteria	Remarks	Current Potential Uses
4	Waters which are inferior to Class 3 in terms of dissolved oxygen and likely to be anaerobic	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

Notes

- a) Under extreme weather conditions (eg. 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 BOD and dissolved oxygen levels, or ammonia content outside the stated levels of those classes. When this occurs the cause should be stated along with analytical results.
- b) The BOD determination refer to 5 day carbonaceous BOD (ATU). Ammonia figures are expressed as NH_4 .
- c) In most instance the chemical classification given above will be suitable. However the basis of the classification is restricted to a finite number of chemical determinants 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 reason stated.
- d) EIFAC (European Inland Fisheries Advisory Commission) limits should be expressed as 95% percentile limits.
- * This may not apply if there is a high degree of reaeration.
- ** EEC category A2 and A3 requirements are those specified in the EEC Council Directive of 16th June 1975 concerning the Quality of Surface Water intended for Abstraction of Drinking Water in the Member States.

APPENDIX 6

BIOLOGICAL CLASSIFICATION OF RIVERS

The NRA uses a method called the 'Biological Monitoring Working Party' (BMWP) scheme to classify the biological quality of rivers. The system produces a BMWP 'score'.

Samples are taken of the very small animals that live in and on the bed of the river. Some of these animals are more sensitive to pollution than others. An animal which is sensitive to pollution will not be present in polluted water. If a particular animal group is present, it is given a score. The score ranges from 10 for those which are most sensitive to pollution, to 1 for those which are most tolerant. The BMWP score is worked out by adding the scores for all the animals found in a sample. The higher the score, the cleaner the water and the better the biological quality. Clean waters have high scores and polluted waters have low scores.

BMWP scores have been compared with the NWC Water Quality Classification (detailed in Appendix 5). A comparison can then be made between the biological and chemical qualities. This is shown below. Therefore, the Biological Score range which is equivalent to each water quality class can be estimated from this table.

The long term River Quality Objective for each stretch of river is known, and is shown on Map 21. By using the conversion table, we can therefore give a biological score objective for each stretch. These objectives are used as the biological targets.

If the small animals in the river are sampled, and we find that the score is less than predicted, then it means that the stretch being sampled is affected either by occasional pollution incidents not detected by the routine chemical monitoring, or is affected by pollutants which are not looked for when the water is analysed. The biological quality can therefore be used as a check on the chemical quality.

Comparison of the Chemical and Biological Classification System for Rivers

NWC Chemical Class	BMWP Biological Score Range
1A	>88
1B	66-138
2	43-127
3	21-82
4	<21

Quality Bands

The objective of the banding scheme is to provide a nationally applicable indication of the degree of biological stress to the population of invertebrate animals at each site.

The calculated BMWP Score can also be compared with the RIVPACS (River Invertebrate Prediction And Classification System) predictions for that site. The ratio of the observed values divided by the predicted values are known as Ecological Quality Indices (EQI). The RIVPACS predictions are based on the physical and geographical characteristics for each site eg. altitude and substratum composition. This therefore, allows comparison of sites with very different habitats. The ratio for an unpolluted or unstressed site should be close to unity.

The EQI's are divided into Bands A, B, C and D. It should be noted that these bands do not correspond to the Chemical Classes 1a, 1b, 2 etc.

APPENDIX 7 - List of organisations and individuals responding to Issues Consultation

Avon Weirs Trust
Birmingham Anglers Association Ltd.
British Waterways
Cheltenham Borough Council
Cotswold District Council
Country Landowners Association
Daventry District Council
Gloucestershire Constabulary
District of Harborough
Hereford and Worcester County Council
The Lower Avon Navigation Trust
Malvern Hills District Council
Ministry of Agriculture Fisheries and Food
The National Association of Water Power Users
North Warwickshire Borough Council
National Farmers Union
Rugby Borough Council
Severn Trent Water
Solihull Metropolitan Borough Council
Mr B E Sutton
The Upper Avon Navigation Trust
Warwick District Council
Warwickshire Fire and Rescue Service
Warwickshire Wildlife Trust
West Mercia Fire Service
Worcestershire Nature Conservation Trust Ltd.
Wychavon District Council

APPENDIX 8

WARWICKSHIRE AVON CATCHMENT MANAGEMENT CONSULTATION REPORT

Project Manager/Editor Roger Wade

Administration
Sub-Editors

Vicky Shipton, Trixie Burnett, John Batty

Project Team

Jackie Banks
Bill Blake
Jill Dickson
Liz Galloway
John Harris
Alan Starkie
Chris Ward
Amanda Wright

Project Board

Richard Bailey
Paul Bailey

Jill Dickson
Roger Wade

Keith Wagstaff

Area Contributors

John Batty
Peter Buckland
Mick Hyde
John Kelly
Martin Langdon

Reg Marks
Dawn McGinn
Kate Nowell
Nick Saunders
Charles Tucker

HQ Contributors

Gordon Davies
Bob Harris
Andrew Heaton
Paul Lidgett

Richard Mains-Smith
Steve Morley
Elvyn Parry
Peter Robinson

Chris Thomas
Peter Whalley

APPENDIX 9 - GLOSSARY

Algae

Microscopic (sometimes larger) plants. Algae occur in water and are often discussed in the context of eutrophication.

Ammonia

A chemical compound found in water often as a result of pollution by sewage effluents. It is widely used to determine water quality. Ammonia detrimentally affects fish.

Aquifer

A rock layer which will absorb water and allow it to pass freely through.

Area of Special Landscape Value (ASLV)

Area of Special/Great Landscape Value. Designated by Local Authorities and shown in Development Plans.

Base flow

The flow in a river derived from groundwater sources.

BOD

Biochemical Oxygen Demand. A measure of the amount of oxygen consumed in water (over 5 days), usually by organic pollution. Oxygen is vital for life so the measurement of the BOD tests whether pollution could affect aquatic animals.

Cyprinid Fish

Coarse fish belonging to the carp family, like roach, dace and bream.

Derogation

The permitted relaxation of water quality standards where the target class for one or more standards is not achievable because of natural conditions.

Discharge Consent

A statutory document is issued by the NRA which defines the legal limits and conditions on the discharge quality and volume of an effluent to a water.

DO

Dissolved Oxygen. The amount of oxygen dissolved in water. Oxygen is vital for life so this measurement is a test of the health of a river.

EC Directive

A type of legislation issued by the European Community which is binding on Member States in terms of the results to be achieved but which leaves to Member States the choice of methods.

Ecosystem

A functioning, interacting system composed of one or more living organisms and their effective environment, in biological, chemical and physical sense.

Environmental Quality Standard (EQS)

That concentration of a substance which must not be exceeded if a specific use of the aquatic environment is to be maintained.

Eutrophication

The process of nutrient enrichment of waters. This enrichment can cause unsightly growths of algae and other biological changes in the water environment.

Flood Plain

Land adjacent to a watercourse that is subject to flooding.

Macrofauna

The invertebrate fauna large enough to be seen without the aid of a microscope.

Macrophytes

Plants clearly visible without the aid of a microscope but excluding fungi, lichens, mosses and algae.

Main River

The watercourses shown on the statutory 'Main River maps' held by NRA and MAFF. The NRA has permissive powers to carry out works of maintenance and improvement on these rivers.

Management Units

Administrative sub-divisions of aquifers, defined on geological and hydrological criteria, which form the basis for groundwater resource management and licensing policy decisions.

Mercia Mudstone

A thick sequence of relatively impermeable red-brown mudstones of Triassic age, with interbedded thin siltstones and sandstones which can provide limited supplies of groundwater.

Nitrification

The conversion of ammonia to nitrate by bacteria.

Nutrient

A chemical essential for life. If present in excess nutrients can produce the effects of eutrophication. In this report the term, nutrient, implies plant nutrients, primarily, nitrate and phosphate.

Ordinary Watercourse

Means a watercourse that does not form part of a main river.

95 Percentile

A level of water quality, usually a concentration which is exceeded for 5 percent of the time.

Physiographic

Pertaining to the physical structure of the river and surrounding land.

Quality Standard

A level of a substance or any calculated value of a measure of water quality which must be achieved. The pairing of a specific concentration or level of a substance with a summary statistic like a percentile.

River Quality Objective

The statement or category of water quality that a body of water should match, usually in order to be satisfactory for use as a fishery or water supply etc.

Salmonid Fish

Game fish of the Salmon Family, for example, trout and salmon.

Sherwood Sandstones

A thick sequence of poorly cemented red-brown sandstones with interbedded marls and conglomerates deposited during the Triassic era, and constituting one of the main aquifers in the British isles.

SINC

Site of Importance for Nature Conservation. Also known as Prime Sites, Key Sites, Special Wildlife Sites. Designated by county Conservation/Wildlife Trusts and in some cases English Nature and Local Authorities. Non-statutory.

SSSI

Site of Special Scientific Interest. Designated by English Nature or the Countryside Council for Wales for their biological interest of at least regional importance or their earth science interest of at least national importance. Statutory - set up under National Parks and National heritage or advice from English Heritage or by the Access to the Countryside Act 1949 and Wildlife and Countryside Act 1981.

STW

Sewage Treatment Works.

Statutory Water Quality Objective (SWQO)

A Quality Objective given a statutory basis by Regulations made under the Water Resources Act 1991.

Upper Carboniferous

Clays, marls, sandstones and coal seams deposited during the period 325-280 million years ago.