UPPER BRISTOL AVON CATCHMENT MANAGEMENT PLAN CONSULTATION REPORT

NRA

National Rivers Authority

South Western Region

UPPER BRISTOL AVON

CATCHMENT MANAGEMENT PLAN

CONSULTATION REPORT

JUNE 1994

ENVIRONMENT AGENCY

YOUR VIEWS

The Upper Bristol Avon Catchment Management Plan Consultation Report is the NRA's initial analysis of the issues facing the catchment.

We want to hear your views.

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

  If so, we would like to hear from you.

Comments on the Upper Bristol Avon Catchment Management Consultation Report are best sent in writing and should be received by Tuesday 6 September 1994.

To comment, please write to:

Alan Turner
North Wessex Area Catchment Planner
NRA South Western Region
Rivers House
East Quay
Bridgwater
Somerset
TA6 4YS

Tel: Bridgwater (0278) 457333 Ext 4765

THE NATIONAL RIVERS AUTHORITY

The NRA's mission and aims are as follows:

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

AIMS

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

UPPER BRISTOL AVON CATCHMENT MANAGEMENT PLAN

CONTENTS

UPPER BRISTOL AVON CATCHMENT

1 CATCHMENT MANAGEMENT PLANNING - CONCEPT AND PROCESS

1.1 The National Rivers Authority

The National Rivers Authority (NRA) is responsible for protecting and improving the water environment within England and Wales. It has a wide range of responsibilities which include:

- Flood Defence, including the protection of people and property
- Flood Warning
- Effective management of water resources
- Control of pollution and improving the quality of rivers, groundwaters and coastal waters
- Maintenance and improvement of fisheries
- Promotion of water based recreation including navigation
- Conservation of the natural water environment

To achieve its aims, the NRA must work with or seek to influence central government, local government, industry, commerce, farming, environmental organisations, riparian owners and the general public. Successful management of the water environment requires consideration of a wide range of interests and requirements which may sometimes be in conflict.

To assist in its work, the NRA has developed the concept of **Catchment Management Plans (CMPs).** These allow the full range of water management issues to be identified and considered within a geographical area which is relevant and meaningful.

1.2 Scope and Process of Catchment Management Planning

The model for the production of Catchment Management Plans within the NRA has two stages:

- Catchment Management Consultation Report and
- Catchment Management Final Plan

The **Consultation Report** includes the following sections:

- Uses

The uses of the catchment are identified and discussed. Information is normally presented in the form of a map with one or more pages of supporting text. Uses may have impacts on the water environment and/or impose requirements on the water environment. Wherever appropriate, objectives and targets are identified in terms of:

- water quality requirements
- water quantity requirements
- physical features requirements

1 CATCHMENT MANAGEMENT PLANNING - CONCEPT AND PROCESS

1.2 Scope and Process of Catchment Management Planning (continued)

- Objectives

  By taking the objectives and targets relevant to the area where each use takes place, overall objectives and targets for the catchment are derived. At any location it is the most stringent use related target which must be achieved.

- State of the Catchment

  The state of the catchment is assessed against the objectives and targets which apply. Areas where objectives are not met and issues which need to be addressed in order to meet objectives are identified.

- Issues and Options

  The identified issues are discussed and where possible some options for their resolution are proposed. A tabulated summary of issues and options concludes this section. The organisation responsible and also some advantages and disadvantages of the suggested options are proposed.

The Catchment Management Consultation Plan is intended to form a basis for consultation between the NRA and all those with interests in the catchment. Consultees may wish to:

- raise additional issues not identified in the plan
- comment on the issues and options identified in the plan
- suggest alternative options for resolving identified issues

The NRA recognises that many of the options for action identified by the Consultation Plan will involve organisations or individuals other than the NRA and their views will be crucial to the preparation of the Final Plan.

The **Final Plan** will be produced following consultation and will have regard to the comments received. The Final Plan will form a basis for the NRA's actions within the catchment and also provide a public document which will form a framework for the NRA's interaction with other organisations. The NRA will be seeking commitment to planned actions by others wherever possible.

1.3 Limitations

The finished CMP will inevitably be subject to some limitations, the major examples of which are as follows.

1.3 Limitations (continued)

Where improvement works are required to overcome catchment problems, these works will in many cases be the responsibility of other organisations or individuals. This Authority may have no powers to control the necessary actions directly. Therefore we must ensure that this plan is perceived as an agreed strategy for realising the environmental potential of a catchment within the prevailing economic and political constraints. Improvements required to address catchment problems must be prioritised in the context of the funds available to the appropriate agency. This may be a Company or individual who may see little or no financial benefit in carrying out the actions, Local Authorities with government capping or Water Service companies with investment programmes approved by OFWAT and the DOE.

It will inevitably be the case that the achievement of some objectives will depend upon the Town and Country Planning Policy of the County or District Council. The NRA is a consultee to such policy, but it is recognised that the Councils are subject to many other constraints in meeting their obligations to the Planning process and will not always be able to put needs of the river catchment first.

The land-use within a catchment is obviously a major contributor to the state of that catchment, as is apparent from this report. In area terms, the largest land use is agriculture, over which apart from restricted areas (such as SSSI) there are few relevant controls. In cases where farming practice will need to change to permit the catchment improvements to proceed, it will be necessary to obtain the support of the landowners concerned and for them to make such changes voluntarily.

While these limitations will inevitably hamper the achievement of some of the plan objectives, it is essential that these objectives should still be set and striven after. Alternative means of achieving them might be identified, or the very fact of their identification and publication might bring the necessary pressure to encourage those involved to work towards their achievement.

2.1 GENERAL

The Bristol Avon has a large, complex catchment and for the production of catchment management plans has been divided into two sections, the Upper and Lower Catchments. This report deals with the Upper Bristol Avon from its sources down to the Avoncliff Weir just west of Bradford-on-Avon.

The Bristol Avon is a major resource being used to convey floodwater to the sea, as a water resource, for the disposal of effluents, and for recreation and amenity. The river corridor provides a valuable variety of wildlife habitats, is a major landscape feature and contains a number of structures of historic and archaeological importance.

The largest part of the catchment is in Wiltshire but small areas are in Avon and Gloucestershire. The Kennet and Avon Canal, which is managed by British Waterways, crosses the south of the catchment. The Upper Bristol Avon catchment has three different geological areas which generate three distinct river types; those that drain the oolitic limestone in the west, those that drain the chalk escarpment in the south and east and those that drain the Oxford and Kimmeridge Clay lowlands in the north and central areas. The impervious clays result in "flashy" streams with a rapid time to achieve peak flow and high peak flows - the Brinkworth Brook being a prime example. The colloidal properties of the Oxford Clay result in a reduction of clarity which is noticeable downstream of Malmesbury. By contrast chalk streams such as the River Marden have clear water and firmer, gravelly stream beds. Base flow is higher with a slower time to achieve peak flow. The water is clearer and more alkaline than clayland stream water and has a more constant temperature.

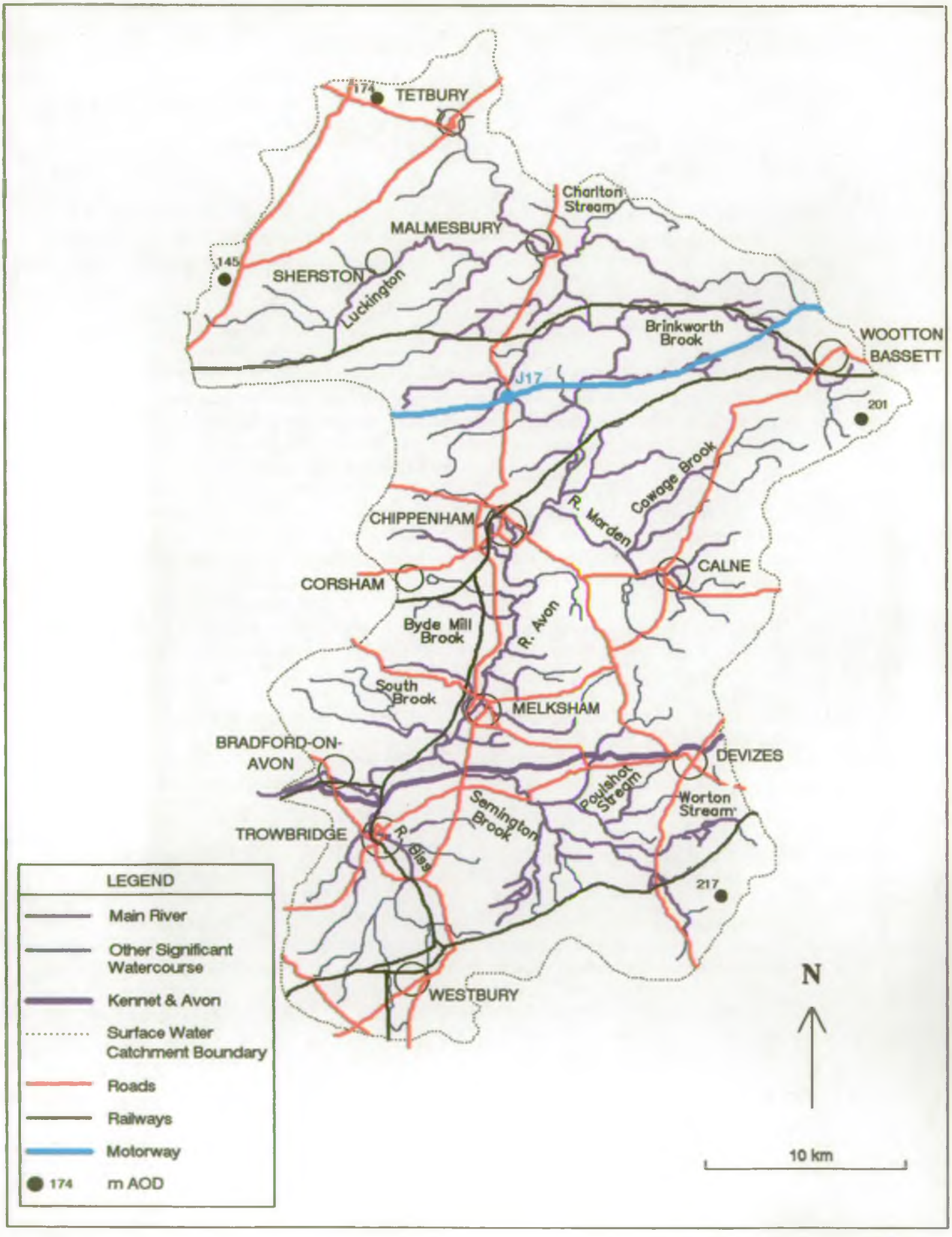
The three different types of stream each have their own characteristic community of plants and invertebrates - that of the chalk streams is particularly diverse and abundant. Several species of uncommon and rare plants and invertebrates are to be found.

The main River Avon is a slow flowing lowland clay river, which has been modified by historical impoundment, river engineering for land drainage and flood alleviation and intensive agriculture in the flood plain, so there are very few wetlands remaining in the catchment. However, the river corridor acts as a vital link between other scattered habitats and wildlife corridors in the wider countryside and is a valuable habitat in its own right.

Historically the river was impounded (ponded) to serve the many water mills along its length, but the subsequent siltation and change of depth brought about changes in plant communities.

The river corridor has within it many listed and important structures including bridges, water mills, weirs and hatches, as well as other archaeological features, because the development and wealth of the area was intimately linked with the river. In the wider catchment, changes in land use have brought about an impoverishment of the landscape so that the river corridor has become an increasingly important linear landscape element, which must be conserved and enhanced where it has become degraded.

UPPER BRISTOL AVON CATCHMENT



NRA SOUTH WESTERN REGION

2.1. GENERAL, CONTINUED

The river corridor provides opportunity for recreation and amenity. In addition to angling, the river itself is used for a small amount of sailing and canoeing whilst in some places public footpaths and open spaces allow access to the banks for bird-watching and walking. The NRA will seek to develop, with others, the amenity and recreational potential of the Upper Bristol Avon.

Although no surface water is extracted for public potable supply from the Upper Bristol Avon abstractions do occur from the Lower Bristol Avon in the Bath area, so both quality and quantity must be maintained at an adequate level in the river.

It has been recognised that the river and several of its tributaries suffer from low flows. Groundwater from the head of the catchment is abstracted by both Bristol Water Company and Wessex Water plc for public supply. The licence granted to Wessex Water provides for stream support to be provided by pumping groundwater into tributary streams to compensate for the effect of abstractions on river flows. The NRA is currently conducting a study in the Malmesbury area to investigate the adequacy of these arrangements.

The Upper Bristol Avon has a good reputation as a high quality coarse fishery throughout its length and supports a wide range of fish species. This is due to the diversity of habitats afforded by a number of weirs which provide deep, slow flowing reaches interspersed with fast flowing shallow reaches. Roach, chub and dace are the dominant species but the river is also renowned nationally as a barbel fishery. In the upper reaches between Malmesbury and Dauntsey, brown trout co-exist with the coarse fish and grayling are also present. Several of the tributaries support self sustaining populations of brown trout, in particular the Sherston Avon, Tetbury Avon, River Marden and the Semington Brook. Other tributaries support good stocks of coarse fish.

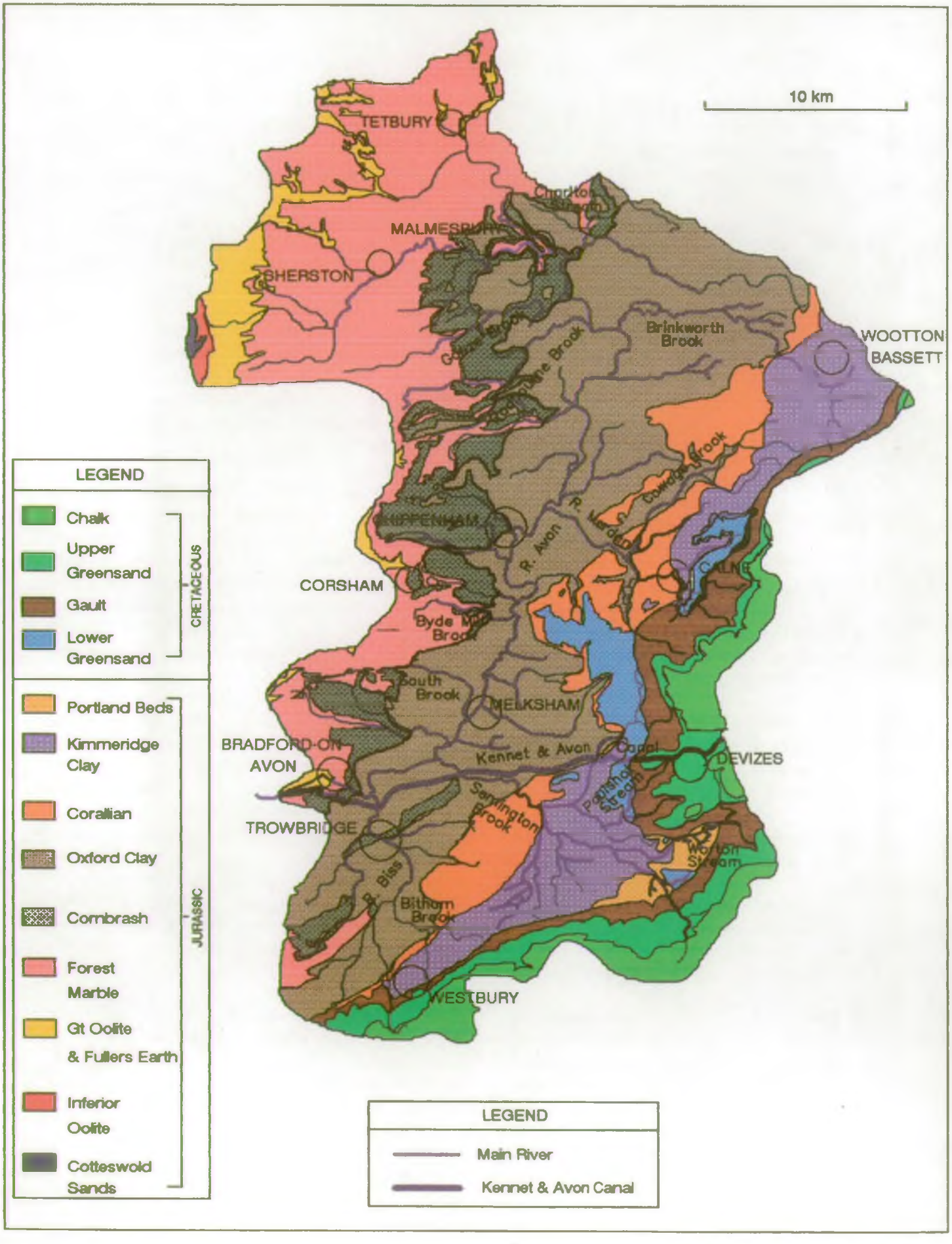
The major settlements within the catchment are Trowbridge (population 27,800), Chippenham (25,400), Devizes (13,850), Melksham (13,300), Calne (11,670), Wootton Bassett (10,850), Corsham (10,289), Westbury (9,512), Bradford-on-Avon (8,990) and Malmesbury (4319). The river system receives effluent from 35 sewage works, the largest of which is Trowbridge STW. Other works which are locally significant include Chippenham, Devizes, Wootton Bassett and Malmesbury. County Structure Plans allocate large areas of housing development to these towns which as a consequence are expanding rapidly.

Catchment land use is mainly agricultural. In the Cotswolds and on the Salisbury Plain escarpment arable farming is predominant, with dairy and other livestock farming in the lower clay area in the valley and lower part of the catchment. Intensive agriculture brings problems of pollution from farmyard slurry, silage effluent, fertilisers, and pesticides.

Most industrial activity within the catchment is agriculture related. There are dairy and food processing plants in several of the settlements. In recent years light industry such as light engineering has become more widespread. The development of industrial estates has increased the problems of surface water runoff and chemical spillage in addition to the consented discharges to the river.

This consultation report considers the various demands made on this considerable natural resource and suggests management options to achieve a sustainable use of the river system.

UPPER BRISTOL AVON CATCHMENT
GEOLOGY



NRA SOUTH WESTERN REGION

2.2 GEOLOGY

With a generalised east to south-easterly dip, the rocks of the catchment become younger in this direction. The whole sequence is confined to rocks of Jurassic and Cretaceous age (150 - 70 million years old). See map opposite. The oldest rocks in the extreme north-west of the catchment comprise fine-grained, impure sandstones on which has been deposited a thick sequence of limestones (oolites), mudstones and marls. The limestones vary from thick beds to thin, discontinuous lenses.

By far the largest outcrop of rock in the catchment is that of the Oxford Clay which forms a broad band stretching from the north-east to south-west extremes. Above this is situated a sequence of interbedded limestones and sandstones of the Corallian, Kimmeridge Clays, and limestones and sandstones of the Portland Beds. These form an erosional surface upon which younger, Cretaceous rocks have been deposited in the south-east part of the catchment. The Cretaceous comprises the Lower Greensand, upon which another erosional surface exists, Gault Clay, Upper Greensand and Chalk. The Greensands are soft sandstones, usually clayey near the base, that obtain their colour from the presence of the green mineral glauconite. The chalk is a very pure limestone that is divided into three units. The Lower and Middle Chalk form a steep escarpment on top of which the Upper Chalk outcrops.

Drift deposits exist along the major river valleys in the form of alluvial coverings and, within the Avon valley as terrace deposits formed during higher flow regimes of the past. Due to the instability of the rocks and steepness of the land, extensive areas of landslipping have occurred in many of the river valleys.

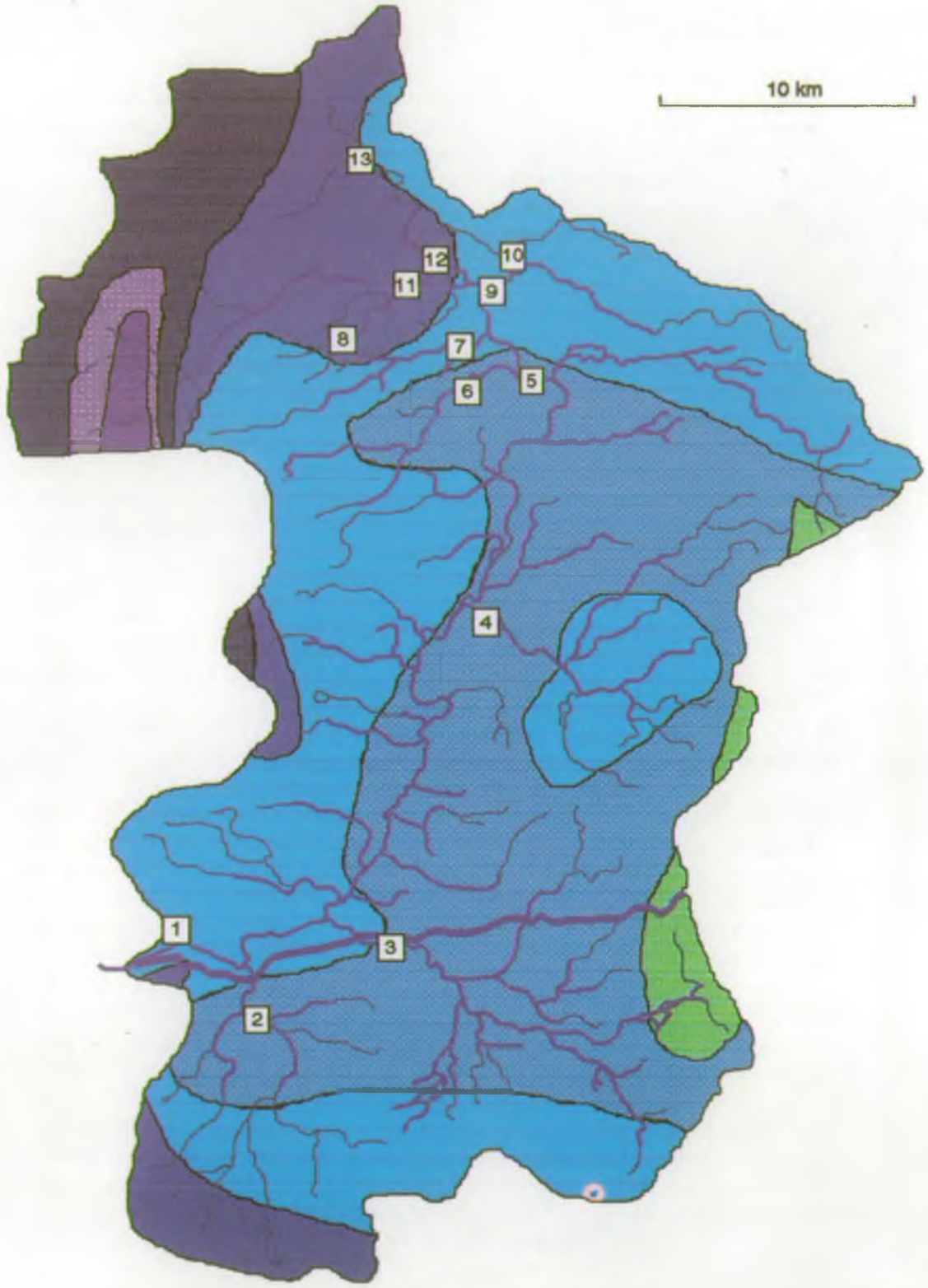
2.3 HYDROGEOLOGY

Two main aquifers are located within the catchment area, namely the Chalk and the Jurassic limestones. The Chalk aquifer outcrops as a scarp slope along the south-eastern boundary of the catchment. It has a high primary porosity but individual pores are not well connected, because of their small size. Groundwater flow is dominant in fissures, joints and bedding planes and within these permeability can be high, especially if some enlargement of fissures by solution has occurred. The Upper and Middle Chalk are generally more permeable than the less well fissured and more marly Lower Chalk. Connected to the Chalk and in hydraulic continuity with it is the underlying Upper Greensand in which groundwater flow is mainly intergranular but can also occur in fissures developed in cherty beds. Numerous springs emerge at or near the boundary of the Upper Greensand and the impervious Gault and Kimmeridge Clays beneath.

The Jurassic limestones are extensively developed within the north and west of the catchment. The Great and Inferior Oolites, like the Chalk, are fissured aquifers that are separated by a sequence of relatively impervious clays, although some leakage between the two aquifers does occur through fissuring and faulting within these clays. Flow can be extremely rapid in solution enlarged sections of these oolitic limestones, giving more rapid recharge after rain as well as rapid discharge. A slight dip towards the east/ south-east has created a westerly unconfined zone where recharge occurs and a more central confined zone beneath the Oxford Clay characterised by extensive potable water storage under artesian conditions.

Minor aquifers are also present. The Lower Greensand and Portland Beds are restricted by their relatively small outcrops whilst the Cornbrash, Forest Marble and Fuller's Earth each consist of, or contain, thin beds of limestones with solution enlarged fissures.

UPPER BRISTOL AVON CATCHMENT
HYDROLOGY



LEGEND

River Gauging Stations

1 Bradford-on-Avon (level only)
2 Trowbridge
3 Semington
4 Stanley
5 Gt Somerford
6 Startley
7 Rodbourne
8 Carriers
9 Crabb Mill
10 Garsden Mill
11 Fosse Way
12 Brokenborough
13 Slads Farm

Annual Average Rainfall (mm)

- < 700
- 701 - 750
- 751 - 800
- 801 - 850
- 851 - 900
- 901 - 950
- 951 - 1000

NRA SOUTH WESTERN REGION

2.4 HYDROLOGY

Rainfall

The map opposite depicts how the average annual rainfall (1941 - 70) varied across the catchment. Highest rainfall occurred in the north-west on the high ground of the Cotswold Hills where annual averages were as much as 950mm per annum. Rainfall decreased south and eastwards with the majority of the catchment experiencing between 700mm and 800mm per annum on average. In the far east this figure fell to below 700mm.

River Flow

River flow is influenced, by the geology and hydrogeology of the catchment (see sections 2.2 and 2.3). The length of the river system actually flowing varies with seasonal changes in the groundwater level.

Baseflow from the Great and Inferior Oolite aquifers provides a significant proportion of the flow to the western tributaries of the Upper Bristol Avon. In a normal spring and summer, stream flows will decrease across these aquifers as groundwater levels fall below the level of these streams. Only the spring-fed permanent streams such as the Tetbury Avon and Luckington Brook retain significant flows.

In a normal winter, the full drainage network across the impervious clays (Oxford and Kimmeridge Clays, Fuller's Earth and Forest Marble) is active. Surface run-off contributes the main component of flow in these streams which exhibit a "flashy" nature resulting from their rapid response to rainfall.

The flow hydrographs overleaf contrast the characteristic peaky flow regime of a clayland stream, at Crabb Mill gauging station No. 9 on the Woodbridge Brook, and the more consistent flow of the nearby, but groundwater fed Luckington Brook at Fosse Way gauging station No.11.

The nature of stream flows within the northern part of the catchment has been somewhat altered since 1980 with the provision, through the Malmesbury Groundwater Scheme, for augmentation from groundwater abstractions at a number of locations to keep flows above a prescribed quantity.

Many of the south-eastern tributaries of the Upper Avon, such as the River Biss and Semington Brook originate from the Upper Greensand springs. Much of their course is subsequently across confining clays.

Thirteen permanent gauging stations are presently operating within the catchment (see map opposite).

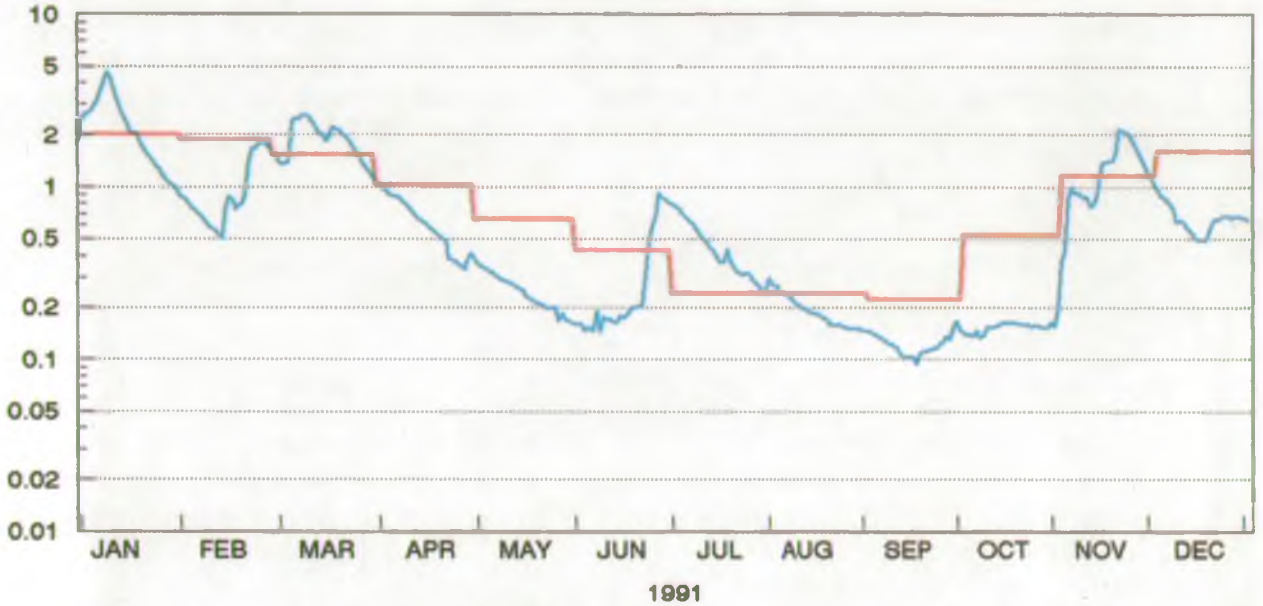
UPPER BRISTOL AVON CATCHMENT
HYDROLOGY

FOSSEWAY (NGR ST 891870)

Gauging Station No 11

MEAN DAILY FLOWS

DISCHARGE IN CUMECS

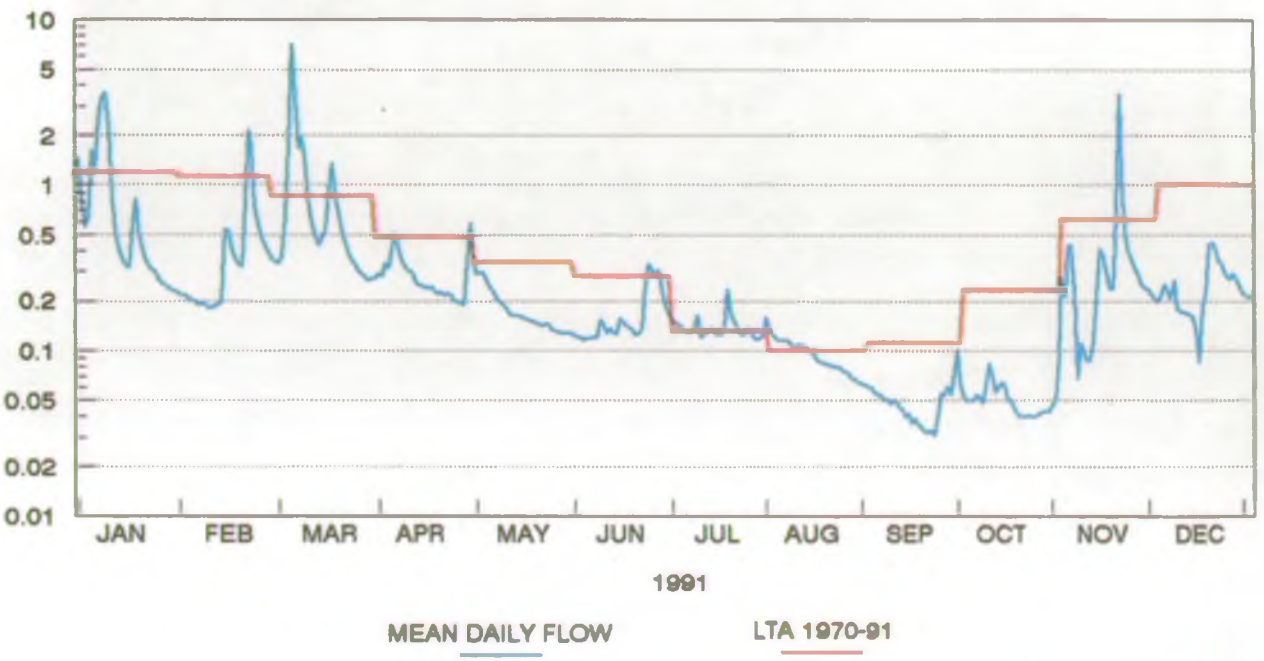


CRABB MILL FMS (NGR ST 946866)

Gauging Station No 9

MEAN DAILY FLOWS

DISCHARGE IN CUMECS



LTA - Long Term Average

2.5 CATCHMENT FACTS

General

Area	978 km^2
Population	216,500

Water Resources

Average Annual Rainfall (at Hardenhuish, 1941-1970 data)		761 mm
Average Annual Recharge		272,862 Ml
1 in 10 Year Drought Annual Recharge (based on MORECS Effective Rainfall data 1961-1991)		147,552 Ml
Dry Weather Flow from Catchment		1.771 m^3/sec
Total Licensed Abstraction	Daily	344.1 Ml
	Annual	97,993.8 Ml
Net Abstraction	Daily	126.1 Ml
	Annual	42,460.9 Ml

(NB: Net = public water supply; private water supply; commercial water supply; and one or two industrial processes)

Flood Defences

Length of Statutory Main River	763 kms

2.6 VISION

* To ensure water quality is appropriate for the current and potential uses of the catchment.

* To reduce nitrate and phosphate input from sewage works and agricultural sources such that the ecology of the river is closer to the natural state and reduce the potential for blue-green algae formation.

* To ensure that the flow in the watercourse is not taken below an environmentally acceptable level by abstractions from the river or ground.

* 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 from flooding where this is cost effective and environmentally acceptable.

* To maintain and develop the existing good coarse and trout fisheries.

* To conserve and enhance wildlife, landscape and archaeological features throughout the river corridor.

* To identify and work towards the elimination of pollution from contaminated land.

* 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 catchment.

WATER QUALITY ISSUES

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
ISSUE NO. 3.1 WATER QUALITY DOWNSTREAM OF SEWAGE TREATMENT WORKS			
Take measures to increase flows (see Issues 3.5 & 3.8) where quality is poor due to low dilution resulting from low flows.	NRA/Water Companies	Improved quality.	Cost to NRA/Water Companies.
Review and tighten STW consents where appropriate.	NRA/DoE	Improved quality.	Cost to Water Companies and ultimately their customers.
Aerate pumped borehole compensation water downstream from Tetbury STW.	NRA/Wessex Water	Improvement in Dissolved Oxygen.	-
Continue survey work to establish nutrient status of Upper Bristol Avon, and work with MAFF towards designating the Catchment as a Sensitive Area under Urban Waste Water Treatment Directive.	NRA	Provides the necessary information to enable designation as a Sensitive Area, allowing nutrient removal at qualifying STWs.	Lack of information could lead to the failure of Bristol Avon to qualify for Sensitive Area status making nutrient removal at STWs difficult to establish.
ISSUE NO. 3.2 FARM DISCHARGES			
Identify farms causing pollution and ensure steps are taken to eliminate the polluting discharges.	Farmers/NRA	Eliminates one of the major sources of pollution.	Cost to farmers (MAFF grants available).
Work with MAFF and other bodies towards the establishment of riverside buffer zones.	MAFF/NRA/ Riparian owners	Reduced silt, excess fertiliser and pesticide runoff to river.	MAFF scheme to compensate farmers is in the pilot stage and not in this catchment.
Continue to investigate sources of pesticide inputs to river. Liaise with pesticide users to improve their practice and switch to less persistent pesticides.	NRA/Pesticide users	Reduction of pesticide input. Improved long term quality.	Cost to NRA. Success is dependent on voluntary cooperation of pesticide users.

WATER QUALITY ISSUES Continued

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
ISSUE NO. 3.3 DISCHARGES FROM RAF LYNEHAM			
Negotiate with MoD to improve performance of STW and schedule the appropriate works.	MoD/NRA	Improved water quality.	Cost to MoD.
Ensure RAF Lyneham has improved emergency measures to deal with accidental spillages.	MoD/NRA	Improved water quality.	Cost to MoD.
Negotiate with MoD to prevent pollutants eg de-icing fluid and aircraft fuel entering watercourse.	MoD/NRA	Improved water quality.	Cost to MoD.
ISSUE NO. 3.4 COMPTON BASSET SAND EXCAVATION AND LANDFILL SITES			
Negotiate with Hills of Swindon to achieve the necessary consent compliance for sand quarry dewatering discharge.	Hills of Swindon/ NRA	Reduced pollutants into the Honeyball Stream/Rivers Brook.	Difficult to establish control effectively. Enforcement work is necessary.
Negotiate with Wiltshire County Council Waste Regulation Authority (WRA) to have improved groundwater monitoring and leachate management provisions within the site licence.	Wiltshire CC WRA/ NRA/Wiltshire CC Waste Disposal Operations	Improved groundwater quality. Lower risk of leachate breakout.	Cost to Wiltshire CC Waste Disposal Operations if licence provisions are made.

WATER QUANTITY ISSUES

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
ISSUE NO. 3.5 IMPACTS OF ABSTRACTION ON RIVER FLOWS			
Study findings of the W S Atkins report. Formulate action plan. Options include:-	NRA	Short and long term improvements in river environment.	Costs
a) increase augmentations of headwaters from pumped boreholes and improve flow control;	NRA/Water Companies	Water Companies may be able to continue using groundwater sources whilst giving higher minimum flows.	Water Companies may seek compensation.
b) downward variation of licensed amounts in public supply groundwater abstraction licences;	NRA/Water Companies	More stream flow in dry conditions.	As above.
c) both a) and b) combined with increased surface water abstraction from the Lower Avon which would include riverside storage facilities.	NRA/Water Companies	As in b) but Water Companies able to abstract as much or more water in total than at present.	As above plus difficulty of finding a suitable site/ obtaining planning consent.
ISSUE NO. 3.6 INCREASING DEMAND FOR WATER RESOURCES			
Increase licensed amount of Wessex Water's unused surface abstraction downstream from Bath to compensate for reduced groundwater abstraction higher up the catchment and to meet further demand for resources.	NRA	Wessex Water encouraged to switch to lower catchment surface water abstraction. Increased river flows in upstream reaches.	Higher treatment cost. A water storage facility required at treatment point. Water Companies may seek compensation.
Promote demand management measures including leakage control and metering where appropriate.	NRA/Water Companies/OFWAT	Target a reduction in the wasteful use of water.	Costs to Water Companies and consumers.

WATER QUANTITY ISSUES Continued

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
ISSUE NO. 3.6 INCREASING DEMAND FOR WATER RESOURCES Continued			
Licence Bristol Water to abstract from the Lower Avon to augment Chew Valley Lake in compensation for any reduction in groundwater in the Malmesbury area and to meet the need for additional resources.	NRA	Encourages Bristol Water to switch to lower catchment surface water abstraction. Increases river flows in upstream reaches already affected by abstraction.	Higher treatment cost. Water Companies may seek compensation.
Meet increasing need for resources in the Bristol Water area by trans-regional supplies ie increasing the amount taken from the River Severn via Gloucester and Sharpness Canal.	NRA/Bristol Water	Water is shared around the country from areas of surplus supply to areas of deficit.	Higher costs. Water Quality considerations.
ISSUE NO. 3.7 KENNET AND AVON CANAL			
Extend the back pumping arrangements to source the Long Pound from Claverton, near Bath.	Bristol Waterways/ NRA	Water obtained from the Lower Avon rather than the vulnerable headwaters of the Bristol and Hampshire Avons.	Higher costs of pumping.
Improve the condition of the Long Pound to reduce leakage.	British Waterways	Less demand on water resources.	High cost of works to British Waterways. Loss of leakage water at present finding its way into the headwaters of the Bristol and Hampshire Avons.

WATER QUANTITY ISSUES Continued

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
ISSUE NO. 3.8 IMPROVING FLOW DISTRIBUTION			
Tetbury Avon, Malmesbury Through the NRA Malmesbury Avon Liaison Group, agree on flow apportionment, evaluate options and implement.	NRA/Owner of Wynyards Mill /Malmesbury Civic Trust/Riparian Owners	Improved amenity from improved flow levels in Back River.	Possible reduced flows to Wynyards Mill. Cost of works to NRA.
Semington Brook/Carrier to Mill Farm Trout Lakes, Great Cheverell Formulate action plan in consultation with Mill Farm owner to address flow problems. Revoke present abstraction/impoundment licences. Replace with new abstraction licence covering required changes.	NRA/Owner of Mill Farm	Return more flow to by-passed section. Prevent siltation.	Cost of revoking licences and replacing with a new abstraction licence. Cost of works.

PHYSICAL FEATURES ISSUES

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
ISSUE NO. 3.9 RIVER RESTORATION			
Rural restoration Draw up restoration plans for identified rural stretches ie Dauntsey Brook; Somerford to Malmesbury, along the lines of the Brinkworth Brook Project. Prioritise and proceed with restoration work.	NRA/Riparian Owners/Countryside Commission	Greatly improved visual amenity and diversity of habitat. Improved conservation interest.	Cost. Loss of agricultural land. Maintenance more difficult.
Urban restoration Liaise with Local Authorities to draw up Urban River Corridor Plans for identified towns ie Malmesbury, Melksham, Chippenham. Prioritise and proceed with necessary work.	Local Authorities/ NRA	Enhanced amenity. Reduced siltation in Melksham. Improved water quality in Malmesbury.	Cost. Disruption of town centres. Flushing improvements at Malmesbury could have a detrimental effect on water quality downstream.
Periodically dredge stretch used for sailing at Monkton Park, Chippenham.	NRA or Chippenham Sailing Club	Continued use of existing recreation facility.	Cost to NRA or Sailing Club. Lack of natural channel over short stretch.
ISSUE NO. 3.10 THE EFFECTS OF INTENSIVE AGRICULTURE			
Improve assessment of land use changes. Establish buffer zones. Schemes to restore/enhance waterside landscapes in floodplain meadows.	NRA/MAFF/ Riparian Owners	Reduced siltation. Restored waterside biodiversity and conservation interest.	Cost/loss of land to Riparian Owners.

PHYSICAL FEATURES ISSUES Continued

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
ISSUE NO. 3.11 RIVER CHANNEL MANAGEMENT			
Identify redundant structures and remove.	NRA/Riparian Owners/ Local Authorities	Natural channel restored. Reduced maintenance cost to NRA. No need to operate structure in flood events.	Possible perceived loss of visual amenity especially in times of low flow.
Give riparian owners clear guidance on modifications to river channels and their management, preferably in the form of guidance notes or Codes of Practice.	NRA	Uniform approach to river channel management Guidance notes reduce number of enquiries.	Cost of production/ distribution of leaflets. Danger of using out of date information.
Encourage riparian owners to carry out maintenance work by means of grants.	Countryside Commission/ MAFF/NRA	Increased maintenance work undertaken.	Cost to government.
NRA to carry out the work independently or as joint venture with riparian owners.	NRA NRA/Riparian Owners	NRA can control the works.	Cost to NRA. Limited resources delay completion of projects.
Designate additional stretches as Statutory Main River.	NRA	Improved maintenance.	Cost to NRA.
ISSUE NO. 3.12 MACROPHYTE AND ALGAL GROWTH			
Promote all initiatives to reduce nutrient enrichment such as MAFF set-aside to create buffer zones, phosphate stripping at STW's consent reviews, no go areas for septic tank use.	NRA/MAFF/ Farmers/ Water Companies	Restrict rate of macrophyte growth and, in conjunction with other measures, might eliminate algal blooms.	Buffer zones require grant-aid from MAFF and have their own management problems. Cost to Water Companies of phosphate stripping at STWs. No-go areas for septic tanks severely limits rural development.

PHYSICAL FEATURES ISSUES Continued

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
ISSUE NO. 3.12 MACROPHYTE AND ALGAL GROWTH Continued			
Increase minimum flows through changed Water Company abstractions.	NRA/Water Companies	Reduced chance of algal blooms. Improved range of macrophytes.	Major costs involved.
Remove redundant impounding structures and improve flushing arrangements at essential structures.	NRA/Riparian owners	Increased flow rates; reduced algal growth.	Cost to NRA and Riparian Owners. Lack of perceived amenity (ie lack of artificial high water levels).
River bank tree planting for shade.	NRA/Riparian Owners	Lack of light will reduce rate of growth of macrophytes and algae.	Cost. Increased difficulty of maintenance. In some cases loss of agriculturally productive land.
Investigate causes of algal blooms and monitor changes in macrophyte growth.	NRA		Cost. Lack of effective action.
ISSUE NO. 3.13 LITTER			
Formulate action plan, with Local Authorities to reduce littering in the river corridor.	Local Authorities/ NRA	Optimises use of available resources.	Cost to Local Authorities.
Encourage local river corridor litter picking exercises. NRA to supply litter picking kits.	NRA/Voluntary Groups	Minimum cost litter removal. Local pride in river environment.	Reactive. Relies on lasting enthusiasm of the public.
Set up programme of talks to schools emphasising need for a litter free environment.	NRA/Schools	Helps develop environmentally aware community.	Talks undertaken on voluntary basis by NRA Officers.
NRA carry out limited litter removal in selected areas, perhaps using fixed booms.	NRA	Ensures river structures not jammed by debris.	Cost to NRA. Booms unsightly.

PHYSICAL FEATURES ISSUES Continued

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
ISSUE NO. 3.14 ABSENCE OF TROUT RECRUITMENT ON SHERSTON AVON			
Investigate sediment deposits in Sherston Avon gravels and establish the cause of the problem.	NRA	Identifies cause of problem - enables best solution to be chosen.	Delay before action can be taken.
Investigate the impact of trout stocking on natural recruitment.	NRA	As above.	As above.
ISSUE NO. 3.15 DECLINE OF NATIVE WHITE CLAWED CRAYFISH ON UPPER BRISTOL AVON			
Establish that the crayfish plague has died out and then reintroduce native crayfish (as per Tetbury Avon, 1987).	NRA	Native crayfish can once more be part of the river ecosystem.	Cost to NRA.
Establish stock of native crayfish in gravel pit lakes for further reintroductions.	NRA/Gravel pit owners	Ensures availability of reserve stock of native crayfish.	Cost to NRA.
ISSUE NO. 3.16 CONSERVATION AND ENHANCEMENT OF LANDSCAPE AND ARCHAEOLOGICAL FEATURES ASSOCIATED WITH WATERS UNDER NRA CONTROL			
Work with Local Authority Planners to get suitable policies included in Local Plans to ensure all riverside developments incorporate enhanced/ conserved landscape, and that archaeological features are conserved.	Local Authority Planning Departments/NRA	Uses powerful planning controls for all developments.	Not under direct control of NRA.
NRA to use fisheries and conservation improvement techniques to enhance degraded landscapes when carrying out works.	NRA	NRA can effect enhancements directly.	Cost to NRA.

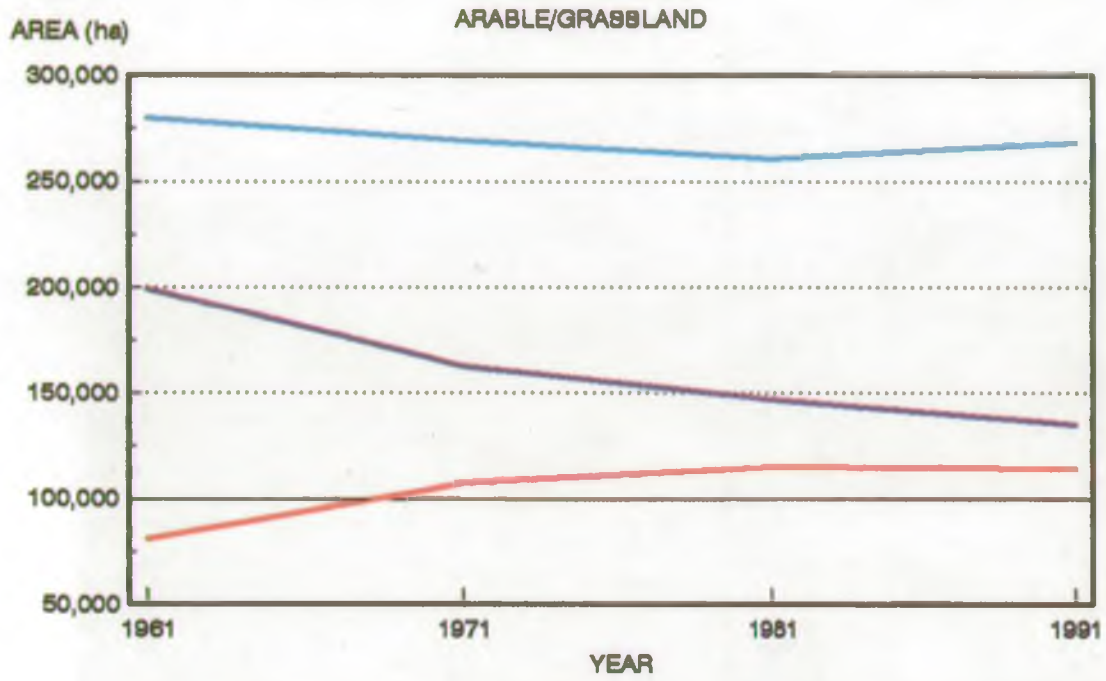
PHYSICAL FEATURES ISSUES Continued

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
ISSUE NO. 3.17 CONFLICT BETWEEN CANOEISTS AND OTHER RIVER USERS			
Liaise with British Canoe Union (BCU) and angling clubs to achieve better access agreements.	NRA/BCU/Local Canoe & Angling Clubs	Reduced detriment to canoeists, anglers and the environment. More access to rivers by canoeists.	NRA has no powers to enforce any policies or agreements.
Through talks to schools and other groups, encourage canoeists to join the BCU and local canoe clubs, leading to a more responsible approach to their use of the river.	NRA	Reductions in number of 'pirate' runs. More canoeists know latest access arrangements.	-
Put information boards at key locations.	NRA/Riparian Owners	Better education of river users.	Cost to NRA. Vandalism.

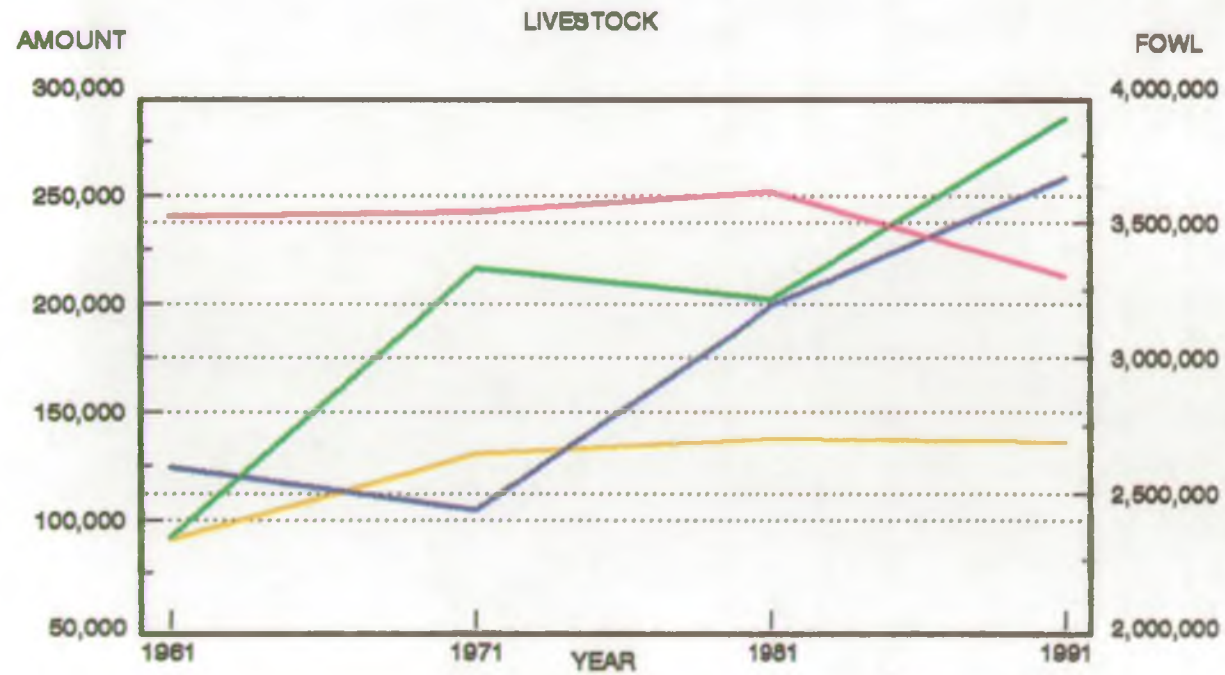
FLOOD DEFENCE ISSUES

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
ISSUE NO. 3.18 DEVELOPMENT PRESSURE WITHIN THE CATCHMENT			
Complete Catchment Drainage Plans for areas with known flood risk.	NRA	Improved Development Control for NRA and improved advice given by NRA to Planning Authorities.	Cost to NRA. Extra cost to developers.
Involvement at early stages of proposed new road schemes to assess impacts on water environment. If necessary to exert statutory control on water quality matters by serving prohibition notices.	Local Authorities/ NRA	Reduced adverse impact of new roads. NRA requirements can be designed in rather than added later thus reducing cost to Local Authority.	Resources may be wasted on unsuccessful new road proposals.

CHANGES IN LAND USE IN WILTSHIRE 1961 - 1991



	TOTAL AREA	GRASSLAND	ARABLE
% CHANGE 1961 - 1991	− 4	− 32	+ 41



	CATTLE	PIGS	SHEEP	FOWLS
% CHANGE 1961 - 1991	−12	+ 50	+ 107	+ 66

(based on MAFF statistics)

NRA SOUTH WESTERN REGION

4.1 RIVER CORRIDOR AND CATCHMENT USE

4.1.1 General

The Upper Bristol Avon catchment is predominantly rural and the land use, mainly intensive agriculture, has a strong impact upon the river. The chalk and limestone grasslands around the headwaters of the Sherston and Tetbury Avons and the River Marden are primarily used for beef cattle and sheep grazing, with dairy production on improved pastures over the majority of the catchment. Arable production takes place on the flat alluvial and clay soils in the central area. In Wiltshire, there has been a 41% increase in the area of land used for arable production from 1961-1991. This has led to increasing levels of nitrate and pesticides in the river. Semi-natural habitats are extremely sparse and this confers greater value on the few remaining wetlands in the flood plain.

The river corridors are of significant value to nature conservation because of their ecological diversity and integrity, particularly when compared with intensively farmed land and fragmented semi-natural habitat. In particular, the main Bristol Avon is the most important landscape and wildlife feature in the catchment and the river corridors are a vitally important component of the natural heritage resource of this large area of land. They make a strong contribution to the landscape and often bear the hallmarks of industrial development, with sites and features of archaeological value such as mills and bridges.

4.1.2 Management and Land-Use Change

The trend towards intensification and increasing agricultural production over the past 50 years has resulted in dramatic changes within the catchment. The land drainage schemes promoted by government policy have reduced seasonal flooding and groundwater levels, and hastened the passage of water from source to sea. This has permitted more intensive agriculture, diminishing the characteristic wetland elements of the flood plain ecosystem. Intensive agriculture also results in runoff from land which may contain silt and naturally occurring nitrate (released in greater amounts by ploughing), nitrate from slurry spreading and excess inorganic fertiliser and pesticides. Nitrate is a major plant nutrient which, when combined with phosphate from detergents present in STW effluent and fertiliser runoff, gives rise to excessive plant growth (see Issue No 3.12 Macrophyte and Algal Growth). The primary impact on nature conservation has been the loss of habitats and a sharp reduction in species and structural diversity, both within the river channels and on adjoining land. Many of these changes may be irreversible.

Land use changes are particularly difficult to quantify, but analysis of MAFF returns have revealed trends (see graphs opposite). River Corridor Survey data and aerial photographs may provide more detailed localised information. The NRA will need to support and work with local initiatives, eg the Malmesbury River Valleys Trust, which provide important contacts and local knowledge, plus active work forces to monitor rivers and achieve practical improvements.

The increase of pressure for development in the area (for housing, industrial and leisure use, road "improvement" schemes, supermarkets) places additional stress on the system both directly (through developments adjacent to river corridors) and indirectly (through increased flash flooding). The challenge will be to maintain the current landscape and ecological quality of the river corridors and actively seek their enhancement. The promotion of nature conservation in these instances can only be achieved by working in conjunction with local planning authorities and developers.

4.1 RIVER CORRIDOR AND CATCHMENT USE, CONTINUED

4.1.2 Management and Land-Use Change, continued

Landscape changes have included a general diminution in tree and shrub cover and an increase in cultivated land (typically 10-20% in the lowlands) with a concomitant loss of wet pasture. Hedgerow removal and the loss of hedgerow trees, particularly the elms, have resulted in a more open landscape, with an increase in new farm buildings. Open field drains have been filled in, and ridge and furrow meadows obscured by ploughing. Bankside management has resulted in increased fencing to keep stock out, and bed lowering has created a wider strip of tall bankside herbs.

Urban development and industrialisation have had more localised impact, as have transport routes and power lines.

4.1.3 Aims

In conjunction with appropriate organisations and individuals:

- to locate vulnerable landscape features which it is important to conserve, to identify those requiring improvements and to note those areas with the capacity to provide informal recreation;

- to restore flood plain habitats and enhance river corridors so as to restore biological and morphological diversity;

  This may be further defined as:

  i) the re-establishment of seasonally inundated flood plain meadows and woodlands, and the establishment of buffer zones alongside watercourses to reduce the impact of nitrate leaching into the system and the mobilisation of sediments;

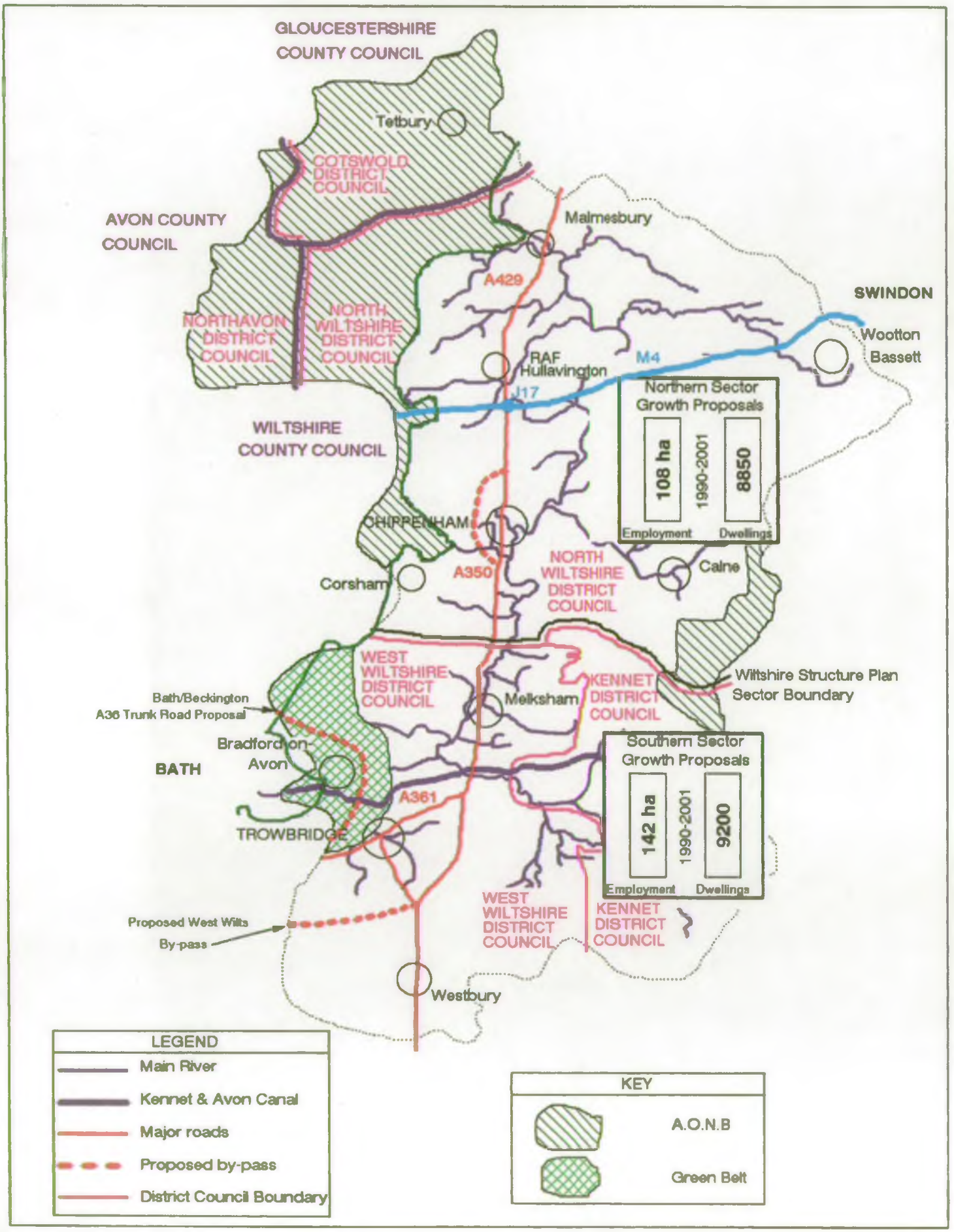
  ii) the maintenance or restoration of a varied river channel with features such as riffles, pools, meanders and shoals and natural bank profiles;

  iii) the restoration of tree and shrub cover through planting and natural regeneration to provide shade, suppress the growth of aquatic plants and reduce the need for intensive river maintenance;

- to complete the River Corridor Surveys for the whole catchment;

- to obtain and analyse aerial photos for the catchment.

UPPER BRISTOL AVON CATCHMENT DEVELOPMENT



NRA SOUTH WESTERN REGION

4.2 TOWN AND COUNTRY PLANNING STRATEGY

4.2.1 County Structure Plans

The largest part of the catchment is situated within the County of Wiltshire, with the extreme North West and West being within parts of Gloucestershire, Avon and Somerset, and covers parts of the Districts of North Wiltshire, West Wiltshire, Kennet, Cotswold and North Avon and also a small rural area within Mendip District.

The Approved Wiltshire Structure Plan (Western and North East Areas) and the Alterations No 2 contain policies for the period to 2001. The policies presume against developments which adversely impact the water environment, particularly regarding rivers, groundwater, ponds, wetlands, access to river corridors and water recreation. The Plan supports initiatives which seek to restore or enhance the natural elements of the river environment and improve water quality. In areas at risk from flooding there is a presumption against development and where flooding risks arise from increased run off, necessary protection and compensatory measures are required. Whilst conserving the quality of the environment, the Structure Plan balances the objectives of promoting economic growth and providing opportunities for housing.

The Plan aims to continue development of jobs and housing in Chippenham and Calne arising from the proximity of the M4 corridor, which runs East - West across the catchment. It also encourages positive measures to sustain the economic enhancement of Trowbridge, Melksham and Westbury.

In Malmesbury, Corsham, Bradford-on-Avon and Devizes, proposals will be a balance between the competing demands for development and the needs for protecting their special environments.

The north west of the catchment is within the Cotswolds Area of Natural Beauty, and a Green Belt Policy constrains development in the countryside eastwards of Bath to Corsham and Trowbridge.

The River Avon valley west of Bradford-on-Avon is defined as an Area of High Ecological Value where the aim is to protect wildlife habitats.

Comprehensive criteria are set for the working of minerals. The environmental safeguards include measures to minimise risks of damage to public water supplies and adverse effects on rivers and watercourses.

The County Structure Plan policies provide for improvements of major roads, principally the A350 North/South Route which includes a western bypass for Chippenham and an eastern bypass for Melksham. A "West Wiltshire Bypass" is proposed which would link the A350 to the south of Trowbridge to existing trunk routes to the west of the catchment area. The Department of Transport has recently published a new route for the A36 between Bath and Beckington mainly in "Green Belt". It crosses the floodplain of the River Avon between Trowbridge and Bradford-on-Avon and rejoins the existing A36 West of Bath. The NRA have expressed reservations because of its effect on the water environment. West Wiltshire District Council oppose the scheme indicating that the North/South A350 could form a basis for the strategic route network.

4.2 TOWN AND COUNTRY PLANNING STRATEGY, CONTINUED

4.2.2 . District Local Plans

Local Plans have been prepared for most of the catchment by the District Councils. However work is at various stages of progress by the District Authorities to update existing plans by the preparation of District Wide Local Plans (DWLP). These will interpret the County Strategy and identify land for residential, commercial, employment and other developments until 2001.

In 1991 the population of the catchment was approximately 216,500 residents. Interpretation of the County Structure Plans, existing Local Plans and DWLP drafts suggests that the population of the catchment could increase by 26,000 to 242,500 by 2001. The majority of this growth is already accounted for by existing commitments and current Local Plan allocations. Only some 2,500 extra dwellings are being provided for by new allocations in the DWLPs.

Provision for allocation of land for employment amounts to approximately 250 hectares and reflects a strategy for local economic enhancement and the provision of opportunities to reduce commuting. It is considered that this will provide enough scope to meet projected growth in jobs, workforce and provisions to reduce unemployment.

The north of the catchment is likely to receive special attention in planning for the longer term to 2011. The future role and growth of Swindon could impinge on the area with the possibilities of the expansion of existing towns or other sites such as the development at RAF Hullavington, which is on the Ministry of Defence (MoD) list for disposal. The Regional Planning Guidance and Review of the Wiltshire County Structure Plan are likely to address these issues.

Uncertainties exist about the future changes to other MoD and Department of Health establishments within the catchment. They might provide a focus for future housing or employment but certain MoD sites could be selected for more intensive military use.

The maintenance and enhancement of the major shopping centres of Chippenham and Trowbridge, and the smaller centres of Calne, Corsham, Bradford-on-Avon, Devizes, Malmesbury, Melksham, Tetbury, Westbury and Wootton Bassett are facets of Local Plans.

The character of the water environment is recognised in Local Plans where the County Structure Plan Policies covering groundwater, watercourse and flood protection are developed. Kennet, Cotswold and North and West Wiltshire DWLP Policies reflect a need to protect and enhance river corridors with appropriate developments and to ensure that redevelopment provides for accessible and enhanced "corridors" based on rivers. In particular Kennet DWLP defines "river corridors" on plans, where protection and conservation of wildlife, archaeology and recreational interests is intended. Positive river enhancement projects are suggested, with the involvement of the Ministry of Agriculture, Countryside Commission etc with the NRA being seen as the lead agency who should set priorities for action.

District Planning Authorities identify a need to work towards the concept of sustainable development with a requirement to protect ecology, hydrology and landscape interests. The abstraction of water from rivers and aquifers which could adversely affect flows of water to the detriment of water quality, wildlife, fisheries and amenity are issues of concern which are touched on in Policies. The Kennet and Avon Canal is seen as a major contribution to tourism and recreation with policies aimed at improving amenities and promotion, however water resource implications are considered a problem in certain lengths.

4.2 TOWN AND COUNTRY PLANNING STRATEGY, CONTINUED

4.2.3 Aims

- To ensure adequacy of water supply and sewage disposal facilities for growing residential and employment needs.

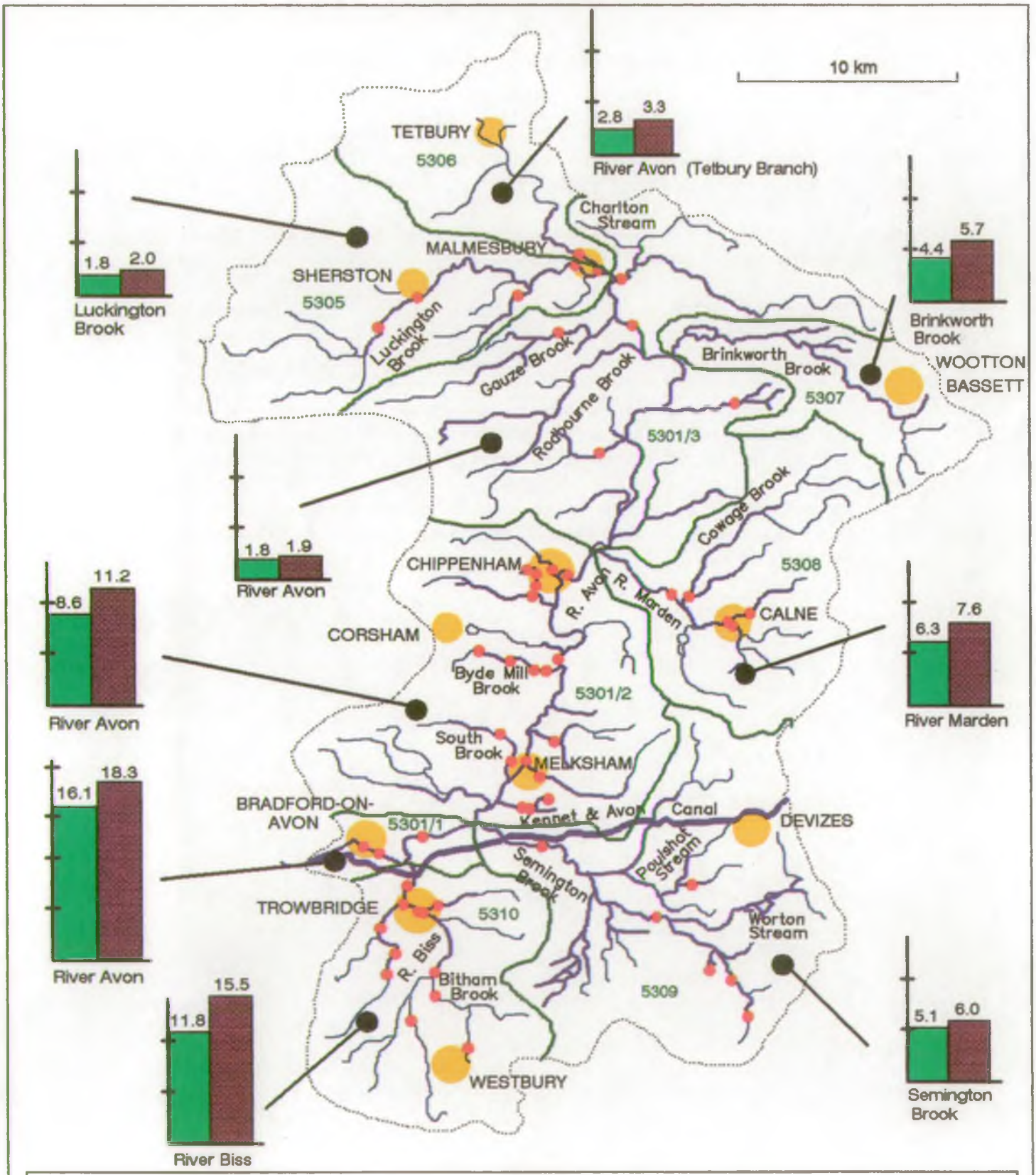
- To maintain and enhance the character of towns and environs including the characteristics of flows, quality of rivers, and physical setting in urban and rural areas.

- To use the increased runoff from developed areas to advantage and identify opportunities that occur including incorporation of water environment features within new development.

- To ensure that the options available for future growth, such as the expansion of towns and the development of new settlements and "brown field" sites, are examined to assess their potential impact in terms of the sustainability of the water environment.

- To work with Local Planning Authorities to ensure that new development proposals and District and County Structure Plans contain adequate provisions to safeguard, and where possible enhance, the water environment.

UPPER BRISTOL AVON CATCHMENT
CATCHMENT URBANISATION



LEGEND

Main River	Location of existing Flood Problems		Existing Urban % of Catchment Area
Kennet & Avon Canal	Sub-Catchment Boundaries		Projected Urban % of Catchment area at 2001
Principal Settlements	5310 National Catchment Number		

NRA SOUTH WESTERN REGION

4.3 CATCHMENT URBANISATION

4.3.1 General

The Government view is that development should be guided away from areas that may be affected by flooding and should be restricted where it would increase the risk of flooding. To achieve this, it expects Local Authorities to use their planning powers and the NRA to assist them by providing advice on development in relation to flood risk.

Under S23 (4) Water Act 1973, national surveys of flooding problems (Flood Plans) were sent to all Planning Authorities in accordance with DOE Circular 17/82. These surveys are to be replaced by new ones carried out under S105 Water Resources Act 1991. Consultation with Planning Authorities is to take place prior to the production of the S105 surveys to meet the requirements of DOE Circular 30/92 "Development and Flood Risk".

Catchment Drainage Plans (CDPs) are produced by the NRA to provide a strategic and local framework to assist in the control of surface water runoff from new developments. CDP's examine how normal and flood flow regimes may change with time and respond to activities within a catchment. Measures to mitigate any potential increase in flood risk can then be investigated and passed to the Local Authority. Such measures might involve local or strategic surface water attenuation, more widespread use of soakaways, increasing river capacity or flood protection works. To be approved, a measure must be environmentally acceptable.

4.3.2 Local Perspective

Development runoff is proportional to the amount of urban area within a catchment. The Table overleaf shows the size of existing areas within the Upper Bristol Avon Catchment by sub-catchment area, the existing development area, and the increases proposed in County Structure and Local Plans, which are also shown as a percentage of the corresponding sub-catchment area on the map.

This information, together with the number and location of known flooding problems, (see map) has been used to prioritise a programme of work to develop CDPs for the Upper Bristol Avon.

The CDP for the River Biss (Catchment 5310) has been completed and showed that development in Westbury would increase flood risk in Trowbridge. Consequently, the NRA has advised the Local Planning Authority on measures to mitigate this increase.

The next CDP to be developed will combine catchments 5301/1 and 5301/2, both of which are just upstream of Bradford-on-Avon and which have a known history of flooding.

A computer model for catchment 5308 has been completed and one for catchment 5309 is under construction. CDPs for these two catchments will follow in due course.

4.3.3 Aims

- Complete Catchment Drainage Plans (CDPs) for the catchment.
- Execute S105 Surveys and produce Flood Plans for the catchment.

4.3 CATCHMENT URBANISATION, CONTINUED

4.3.4 TABLE SHOWING SUMMARY OF FIGURES OBTAINED FOR THE UPPER BRISTOL AVON CATCHMENT MANAGEMENT PLAN

Sub-Catchment Number	Principal Town(s)	Sub-Catchment Area (ha)	Existing Development Area (ha)* 1991	Proposed area of Development (ha)to 2001 **					Development area as a percentage of the Sub-Catchment area		Catchment Drainage Plan - Order of Priority
				Housing ++ a		Employment Land (ha) b	Road Schemes (ha) c	Total (a+b+c)	Existing	Proposed	
				Units	Hectares						
5310	Trowbridge & Westbury Southwick & N. Bradley	9900.00	1167.20	5316	265.80	75.00	24.40	365.20	11.79	3.69	Completed
5309	Devizes	16526.00	840.00	2600	130.00	25.00	3.10	158.10	5.08	0.96	Processing
5301/1	Bradford-On-Avon	1688.00	272.50	612	30.60		5.20	35.80	16.14	2.12	1=
5301/2	Melksham, Corsham, Chippenham & Rural areas	16335.00	1405.00	6046	302.30	79.00	39.60	420.90	8.60	2.58	1=
5308	Calne, Lyneham, Cherhill & Derry Hill	10498.00	661.50	2335	116.75	15.00		131.75	6.30	1.26	Completed
5307	Wootton Bassett	5636.00	250.00	858	42.90	20.00	6.10	69.00	4.44	1.22	2
5301/3	Rural Areas only	18894.00	337.50	400	20.00	2.00		22.00	1.79	0.12	5
5305	Part Malmesbury + & Sherston	11326.00	200.00	450	22.50	7.00		29.50	1.77	0.26	4
5306	Tetbury & Part Malmesbury +	6970.00	192.50	500	25.00	10.00		35.00	2.76	0.50	3
Upper Avon Catchment Totals		**97773.00**	**5326.20**	**19117**	**955.85**	**233.00**	**78.40**	**1267.25**	**5.45**	**1.30**	

Note:

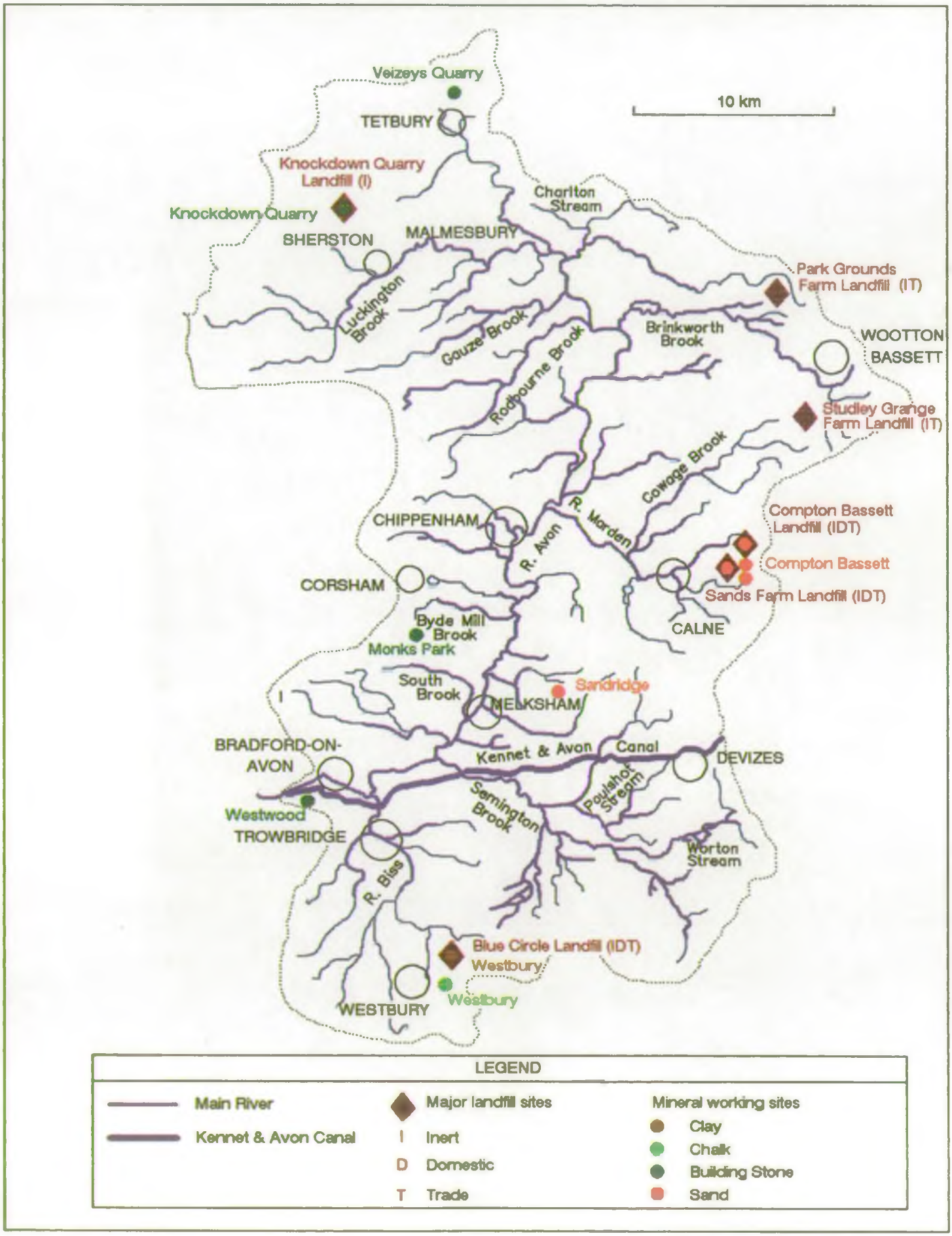
1)* Only Principal towns and villages used to compile existing housing and industrial numbers: Source WCC data and second series (1982) O.S. 1:50000 maps.

2)**Proposed housing and employment land projections taken from WCC structure plan consultative draft 1990.

3)+ Assumes Malmesbury urban area is divided equally (50/50) between catchments 5305 and 5306.

4)++Assumes that there are 20 units of housing to one hectare for proposed development.

UPPER BRISTOL AVON CATCHMENT
EXISTING MINERAL EXTRACTION AND WASTE DISPOSAL SITES



NRA SOUTH WESTERN REGION

4.4 MINERAL EXTRACTION AND WASTE DISPOSAL

4.4.1 General

Mineral extraction and solid waste disposal are interrelated to a significant extent in this catchment and have the potential to impact upon the water environment.

Mineral extractions can affect both groundwater quantity and quality. For instance, the lowering of groundwater levels to facilitate dry working can lead to the loss of water supplies from wells and boreholes, the removal of natural groundwater discharges to ponds and streams and the drying up of wetlands. The water table may in some cases be permanently lowered leading to an irretrievable reduction or loss of spring and stream flows. Also the loss of the unsaturated zone through extraction above the natural water table can reduce the purifying mechanisms that occur due to filtration and biological action. This can result in changing flow regimes due to loss of buffer storage which otherwise delays and attenuates flood peaks and allows contribution to dry weather flows.

Landfill is recognised as a potential threat to both groundwater and surface water systems should a polluting leachate enter the water environment.

4.4.2 Local Perspective

There are currently 60 landfill sites within the catchment operating under licence from the County Waste Regulation Authorities who are responsible, under the 1974 Control of Pollution Act, for ensuring that the sites do not endanger public health, cause water pollution or cause serious detriment to the local amenity. The NRA is a statutory consultee on all applications for Waste Disposal licences.

Principal locations in the catchment where landfilling is associated with restoration of on-going mineral workings are Compton Bassett, Westbury and Sherston.

The largest operation at Compton Bassett, is based on soft sand extraction from the Lower Greensand used for concrete block manufacture and the construction industry. Planning permissions exist for extraction and restoration by landfill of some 80 hectares. The landfilling is on a containment basis utilising underlying Kimmeridge clay for seals and is likely to continue over a 20 year period. Mineral extraction will proceed alongside restoration operations for some 15 years.

The clay extraction at Westbury for cement production use is associated with a domestic and commercial waste landfill restoration based on the containment principle. However, the chalk extraction at Westbury also associated with cement production has no proposals for restoration by landfill.

Stone extraction at Sherston is linked to restoration with strictly inert waste materials only as the quarry is within the Shipton Moyne public groundwater supply Source Protection Area. Wiltshire County Council are currently undertaking the first review of the Minerals Local Plan and early indications are that it is unlikely that there will be any major proposals affecting the catchment area. The NRA is a statutory consultee on all mineral planning applications.

4.4 MINERAL EXTRACTION AND WASTE DISPOSAL, CONTINUED

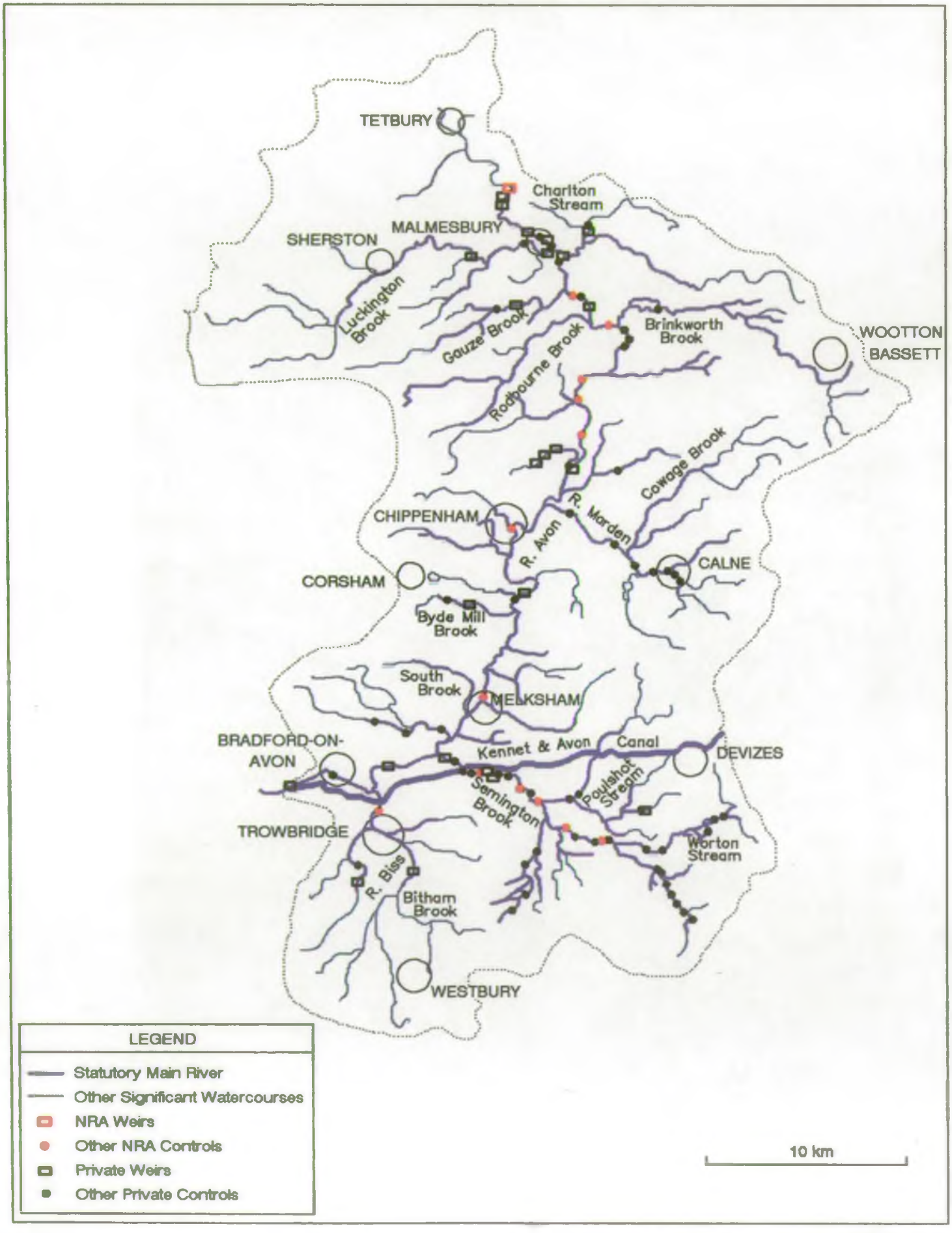
4.4.3 Aims

- To control and influence mineral extraction and solid waste disposal in such a way that other users are not compromised.

4.4.4 Environmental Requirements

Water Quality	-	Implementation of NRA Policy and Practice for Protection of Groundwater.
	-	Compliance with EC Groundwater Directive (80/68/EEC).
	-	Prevention of pollution of controlled waters.
Water Quantity	-	Implementation of NRA Policy and Practice for Protection of Groundwater.
	-	No detriment to the availability of water resources.
Physical Features	-	Minimise the occurrence of subsidence and slipping.
	-	Maintenance of the integrity of river channel adjacent to sites.
	-	Restoration of all sites to an acceptable environmental standard taking into account opportunities for conservation, recreation and amenity.

UPPER BRISTOL AVON CATCHMENT
RIVER CONTROL STRUCTURES AND STATUTORY MAIN RIVER



NRA SOUTH WESTERN REGION

4.5 CATCHMENT DRAINAGE - RIVER CONTROL STRUCTURES AND STATUTORY MAIN RIVER

4.5.1 General

This use identifies the basic role of the river as the conveyance of water from land in the catchment to the sea. There is a clear requirement for the provision of effective defence for people and property against flooding from rivers.

Normally, flooding is a result of extreme climatic conditions, such as very heavy rainfall. Flood events are described in terms of the frequency at which, on average, a certain severity of flood is exceeded. This frequency is usually expressed as a return period in years e.g. 1 in 50 years. The effectiveness of flood defences can be measured in terms of the return period up to which they prevent flooding. Different types of land use, for example urban areas and pasture land, require different levels of effectiveness for the defences.

4.5.2 River Control Structures and Statutory Main Rivers

The responsibility for the maintenance of any watercourse normally rests with the riparian landowner, whose ownership extends to the centre line of any such river, unless his Deeds specifically mention another interest.

The NRA has a flood defence operational maintenance department which deals with emergencies (flooding and some pollution control) together with 'permissive' powers to carry out river maintenance. This work is targetted at past flood alleviation and drainage schemes to ensure they function as required and maintenance work is carried out to a standard consistent with existing land use.

Certain channels in the river system are designated statutory Main River, by which means the NRA can use its powers for the maintenance of the channel. At the same time, powers to control the activities of others can be used.

Where reasonable, the NRA can control the construction of any structure in or close to the statutory Main River. This, and other activities likely to affect the bed or bank of the river, require the formal consent of the NRA.

In addition, the NRA has limited powers in respect of consents for weirs, dams, culverts and similar obstructions on watercourses which are not designated statutory Main River. District and County Councils have powers to carry out maintenance and improvement schemes on such watercourses, but no legal obligation to do so. They would require the NRA's consent under its requirements for overall supervisory duty of drainage matters.

4.5 CATCHMENT DRAINAGE - RIVER CONTROL STRUCTURES AND STATUTORY MAIN RIVER, CONTINUED

4.5.3 Local Perspective

Significant lengths have been designated Main River in the catchment, see map on previous page, and the NRA proposes to designate additional stretches as Main River in this catchment as a result of comments received from riparian owners.

Historically, river control structures were introduced to generate water power for milling, especially in the 13th and 14th Centuries when the river was the focus for the Nation's wool trade. Now these structures mainly provide amenity levels, with modifications to allow for more efficient passage of flood flows, whilst a few control private turbines and abstractions.

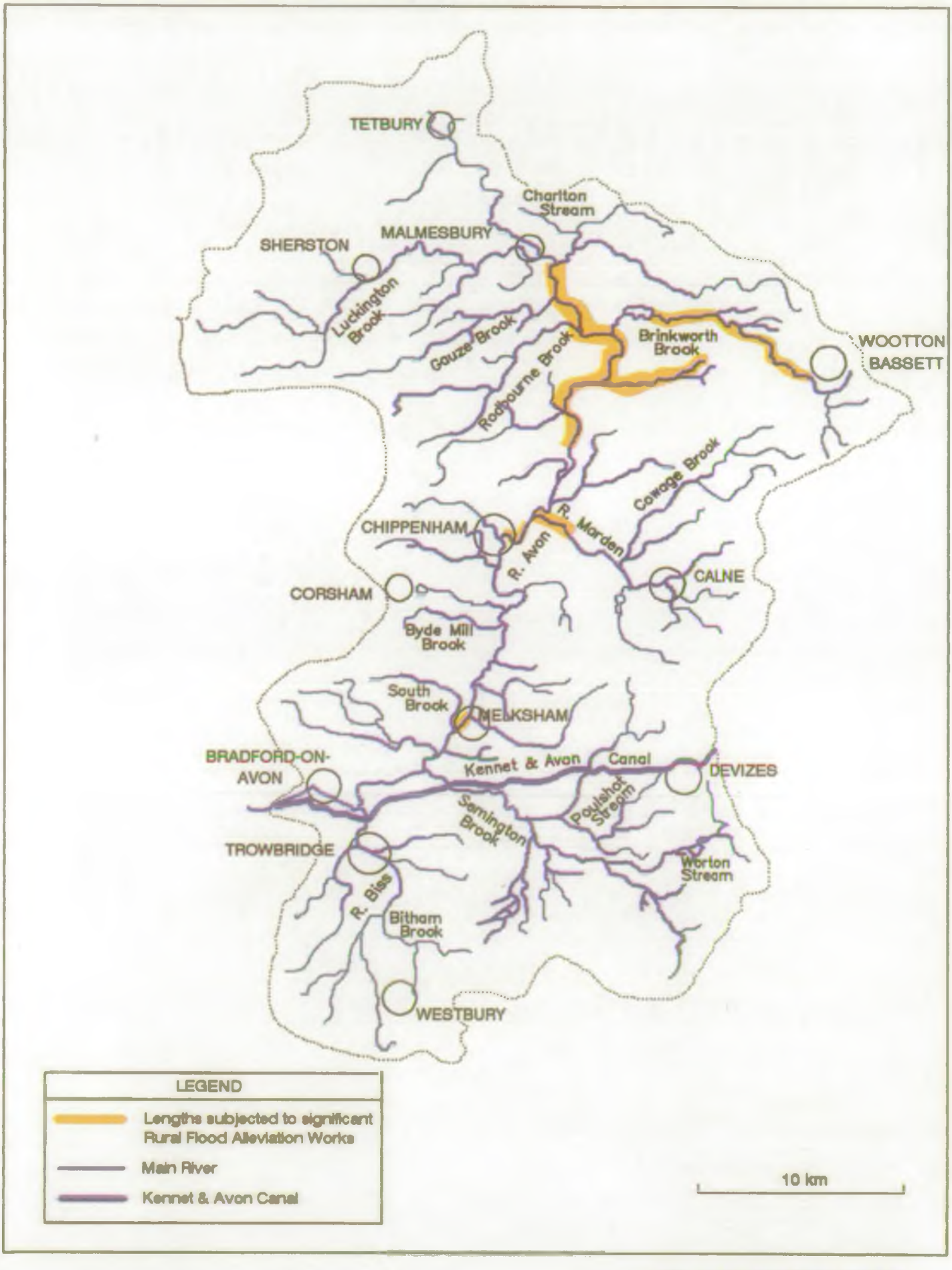
With regard to the operation of the river system, the plan indicates 90 control structures on the Main River channels of which only 14 are operated by the NRA. Conflict sometimes arises over the operation of hatches and sluices by private individuals.

At 10 of its sluice structures, the NRA has introduced automatic control ensuring a reliable way of providing a stable amenity level at all flows except flood flows.

4.5.4 Aims

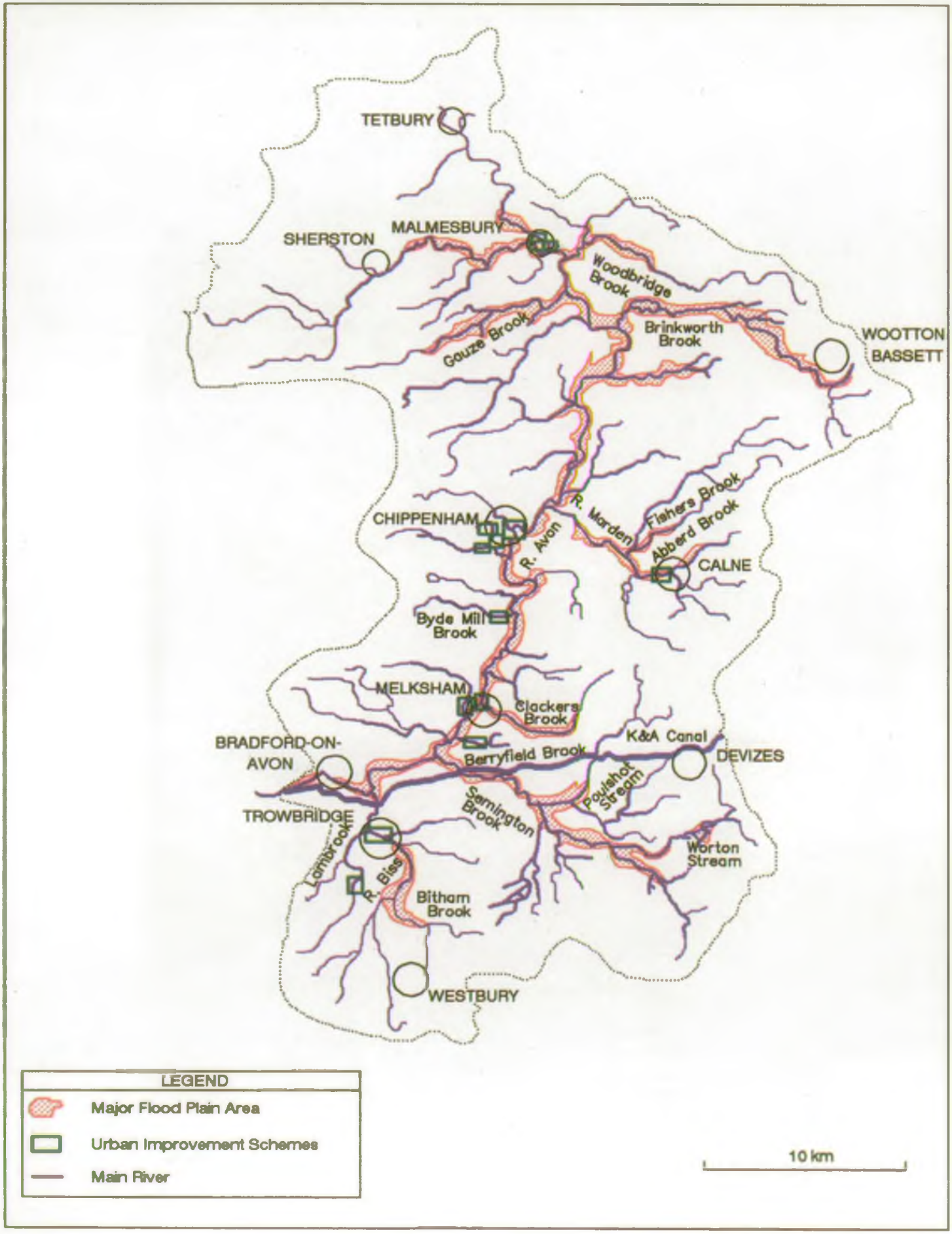
- To control development and works in or adjacent to Main River in accordance with the NRA's Flood Defence Byelaws.
- To ensure the correct operation of hatches and other water level controls under both flood and normal flows.
- Wherever justified, introduce automatic control of NRA control structures.
- To improve the maintenance of additional stretches designated Main River.

UPPER BRISTOL AVON CATCHMENT
FLOODING AND FLOOD ALLEVIATION - RURAL FLOOD ALLEVIATION WORKS



NRA SOUTH WESTERN REGION

UPPER BRISTOL AVON CATCHMENT
FLOODING AND FLOOD ALLEVIATION - URBAN IMPROVEMENT SCHEMES



NRA SOUTH WESTERN REGION

4.6 CATCHMENT DRAINAGE - FLOODING AND FLOOD ALLEVIATION

4.6.1 General

Flood Plain

The flood plain is an important element of the overall river system for the conveyance of flood flows. In a major flood event, water is 'stored' temporarily in the flood plain, thereby decreasing peak flows downstream. Normally, the wider the flood plain, the more important it is in attenuating flood levels. Within its Byelaws, the NRA can control any activity in the flood plain which is likely to worsen flood conditions unless planning permission has already been granted. Planning Authorities seek the NRA's advice and take this into account when deciding on planning consent for proposals within the flood plain.

Urban Flooding

Historically, the need for the river to provide transport, power supply and sewage disposal, led to towns developing in the flood plain and flood risk being accepted. However, since the Industrial Revolution, the concentration of wealth and commerce in these flood risk areas has meant that flooding is no longer so acceptable.

Rural Drainage

Until the 1980's, the overriding importance of agriculture meant that both capital schemes and major maintenance programmes were carried out to ensure reduced water levels and to minimise flood losses in order to increase agricultural production. Now, with the shift away from the need for intensive agriculture, NRA activity concentrates on the protection of urban communities from river and sea flooding.

4.6.2 Local Perspective

Above Chippenham, the western tributaries of the River Avon flow through fissured oolitic limestone, whilst the eastern tributaries drain from chalk hills. Both these underlying strata store rainfall resulting in a flat hydrograph with a long rise to peak. The main Avon below Malmesbury, and the tributaries below Chippenham, flow from the overlying clays and therefore steep upland slopes give a quick response, slowed only by the storage of significant flood plains on the Semington Brook, Biss and River Avon.

The response to rainfall is complicated by the predominance of storms from the south west which pass up the main channel.

Flood alleviation schemes of varying protection levels have been undertaken at many of the urban risk locations in the catchment (see map). All these schemes included channel widening and regrading and alterations to existing weir structures.

The last major events resulting in widespread property flooding were in 1960 and 1968. The highest recorded flood flow since these events, in December 1979, resulted in isolated property flooding and flood plain inundation only, except in Trowbridge and Bradford-on-Avon where schemes had not been carried out. Since then, a scheme has been completed in Trowbridge.

4.6 CATCHMENT DRAINAGE - FLOODING AND FLOOD ALLEVIATION, CONTINUED

4.6.3 Flood Warning

As part of the NRA's commitment to maintaining a good standard of flood warning, a set of procedures has been produced for the Region on a river by river basis.

In the Upper Bristol Avon Catchment, separate procedures exist for the Semington Brook and tributaries, River Biss and tributaries, Upper Avon and Middle Avon. Each procedure is documented and outlines the catchment type and response to rainfall, sites considered to be at special risk, data gathering points in the catchment and specific flood warning data, which will form the basis of any warning issued. Such procedures are re-assessed and modified if necessary in response to each flooding or near flooding event.

4.6.4 Operational Maintenance

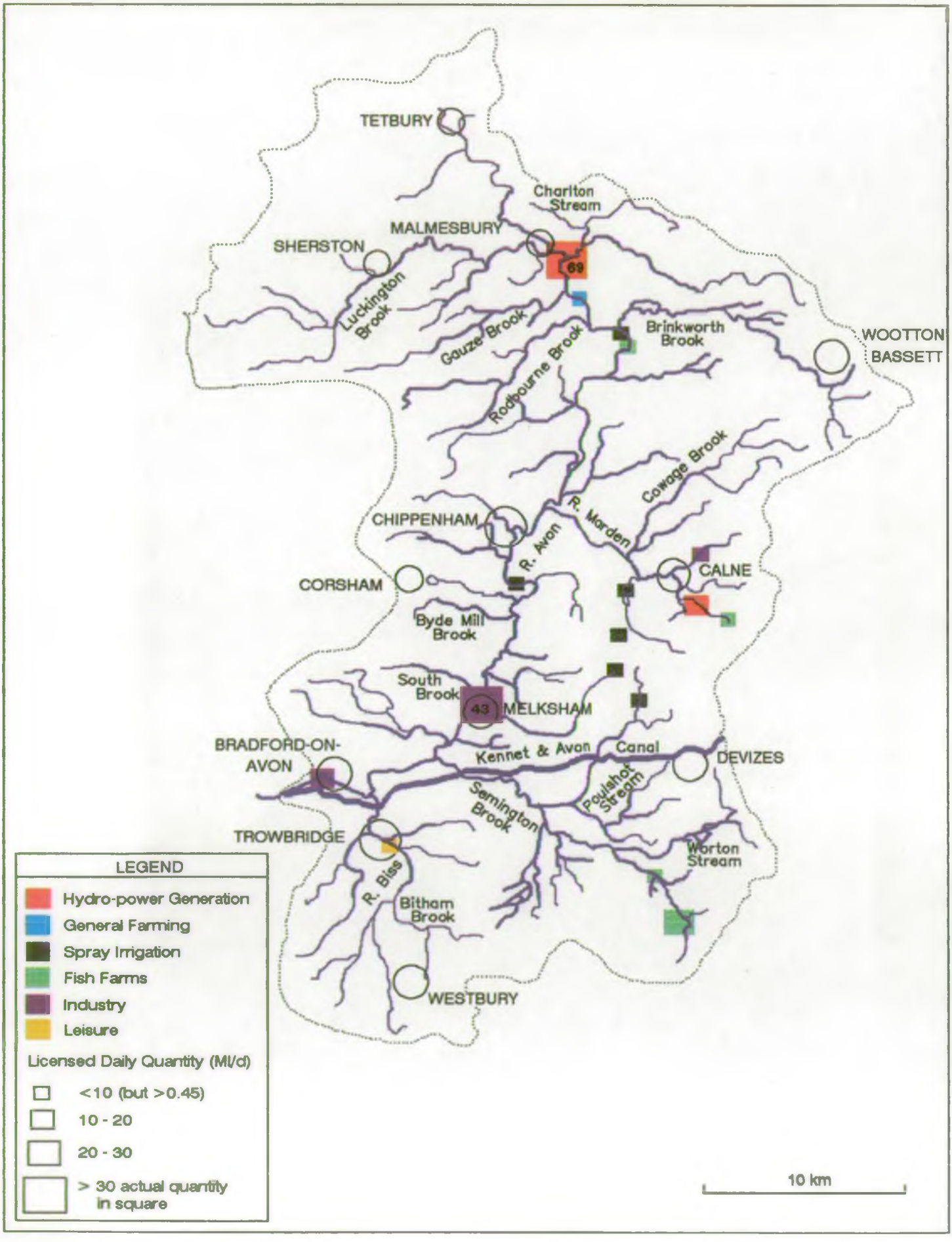
This involves a variety of activities, such as aquatic plant (weed) spraying, tree and debris removal, trimming of bankside vegetation, maintenance and operation of control gates, to ensure the efficient use of the river system for its basic purpose of conveying water.

In some instances, dredging will be required to maintain the carrying capacity of the channel. The frequency of this practice is reduced by controlling emergent weed growth in channel beds. To this end, annual herbicide spraying is being complemented by a programme of tree planting on south banks to reduce weed growth by providing shade.

4.6.5 Aims

- To control development and other works in rivers or the flood plain such that risks of flooding are not increased.
- To provide effective flood defences for the protection of people and property to a standard appropriate to land use (see section 5.5).
- To provide adequate arrangements for flood forecasting and warning.
- To reduce emergent weed growth in the long term.
- To take account of environmental requirements when undertaking Flood Defence works.

UPPER BRISTOL AVON CATCHMENT
SURFACE WATER ABSTRACTIONS



NRA SOUTH WESTERN REGION

4.7 SURFACE WATER ABSTRACTIONS

4.7.1 General

Spring-fed base flow and direct surface run-off contribute to stream flow within the catchment and provides the surface water resource from which licensed abstractions can be made.

Abstractions can be divided into two types, consumptive and non-consumptive, according to their impact on this resource. Consumptive uses involve an effective loss of water from the catchment as a consequence of abstraction. Non-consumptive uses are temporary abstractions that are returned to the river immediately or within a short distance downstream.

4.7.2 Local Perspective

Springs emerge from the Great and Inferior Oolite outcrops and from fissures within overlying confining strata, and such spring-fed streams as the Luckington Brook, Sherston Avon and Tetbury Avon maintain their flows even in dry summers. The non-spring fed clayland streams, such as Rodbourne and Braydon Brooks, have a more rapid reaction to rainfall but flows are negligible over confined areas in dry periods.

The location and purpose of the larger (>0.45 Ml/d) surface water abstractions from the catchment area are shown on the map opposite.

Consumptive Uses
Industrial processes are responsible for 34.7% of the total surface water abstractions in the catchment, 2.5% of which are totally consumptive. Other consumptive uses include general agriculture (1.9%), the leisure industry (0.9%), private water supply (0.1%) and spray irrigation (0.7%) Spray irrigation, whether the water is obtained from a surface or groundwater source, is a consumptive use which occurs principally at times of low river flows. Provision for the storage of winter flows, with subsequent use in summer is increasingly a required part of spray irrigation schemes.

Non-Consumptive Uses
Industrial processes such as cooling and washing are likely to involve water directly or indirectly being returned to the river. Two large licensed abstractions for private power generation (including one of 69 Ml/d from the Woodbridge Brook below Malmesbury) account for 40.6% of the surface water abstractions within the catchment, but involve negligible water loss. Fish farms abstract a further 21.1%, predominantly from small tributaries where they may have a major impact locally. Many fish farms are licensed to create on-stream impoundments using most of the river flow.

4.7.3 Aims

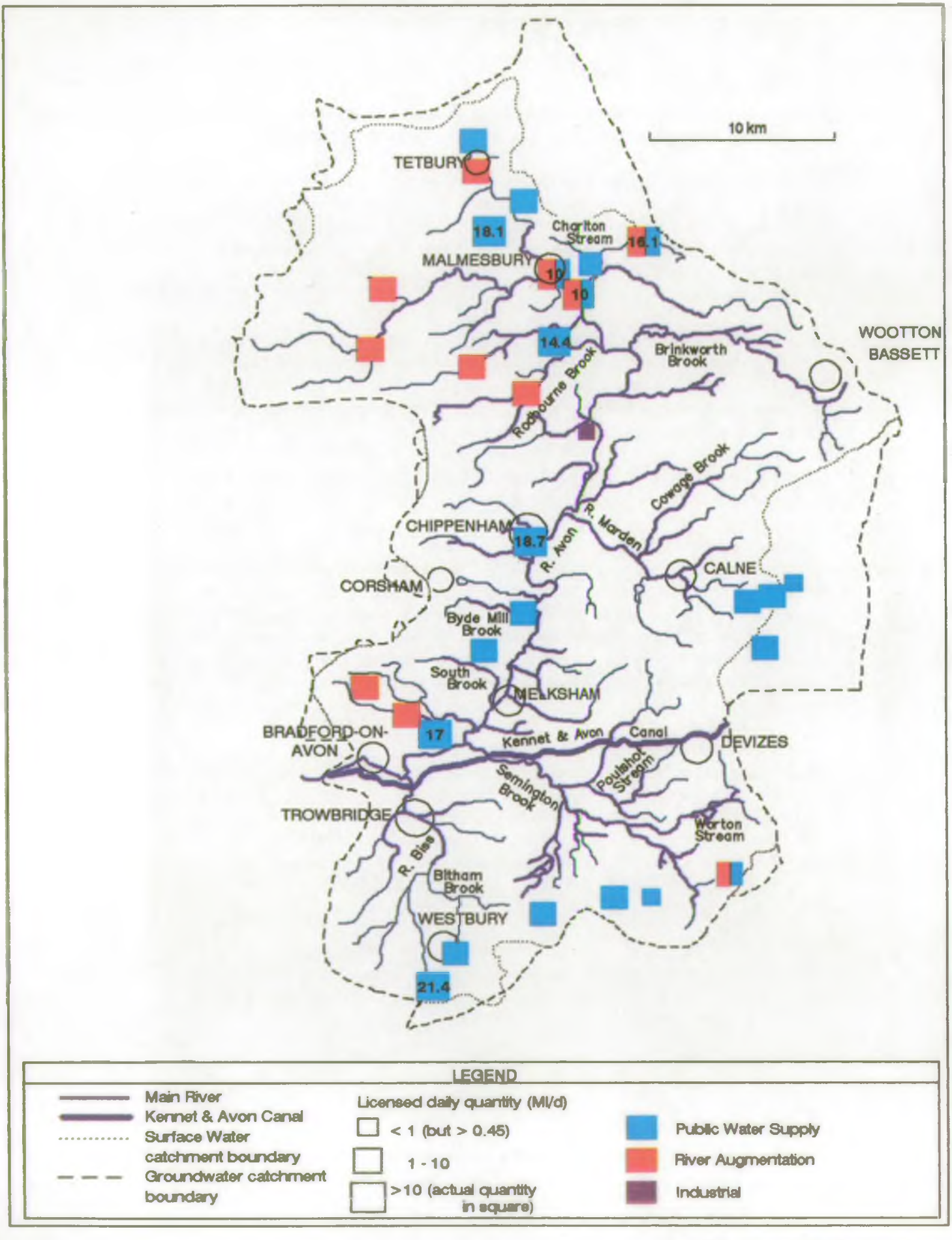
- To ensure that surface water resources are managed and developed in a way that protects existing licences, other water uses and environmental interests.

- To secure, where possible, appropriate measures for the benefit of the catchment within any new licences.

4.7.4 Environmental Requirements

Water Quality - compliance with EC Directive on the Quality of Water for Abstraction (75/440/EC) and Water Quality Objectives.

UPPER BRISTOL AVON CATCHMENT
GROUNDWATER ABSTRACTION



NRA SOUTH WESTERN REGION

4.8 GROUNDWATER ABSTRACTIONS

4.8.1 General

The groundwater use relates to abstraction of water via boreholes, wells and springs. Abstractions are controlled by a licence which specifies the maximum allowable annual and daily quantities which can be used. The governing legislation is the Water Resources Act 1991. In the management of this resource it is important that new abstractions should not derogate existing riparian rights, licensed sources, or affect surface water systems or environmental interests.

Groundwater abstraction licences for boreholes are normally issued following test pumping and an appraisal of any impacts on existing adjacent licences and the local hydrogeological regime. As with surface water abstractions, a number of licences were granted as "licences of right" upon implementation of the Water Resources Act 1963 and these licences may not have been subject to appraisal of their impact.

Groundwater makes an important contribution to the base flow component of river flow. This is especially important in the headwaters of rivers where groundwater can make up a large proportion of river flow.

4.8.2 Local Perspective

Groundwater is abstracted in varying quantities from most of the rock types within the catchment. Large abstractions occur within the major aquifers, namely the Great and Inferior Oolite and the Chalk and Upper Greensand, whilst smaller localised abstractions take place in less permeable rocks such as the Oxford and Kimmeridge Clays.

The largest use for which water is abstracted is that of public water supply and associated river compensation, which alone accounts for 97.92% of the total licensed abstractions. All public water supply/river compensation abstractions occur within the major aquifers. Other uses include industry (1%), general farming (0.91%), spray irrigation (0.08%) and horticulture (0.05%).

Concern has arisen that abstraction from the Great and Inferior Oolite aquifers in the north of the catchment is lowering groundwater levels and that stream flows are suffering because of the reduced base flow component and increased stream bed leakage.

In 1981 a scheme was licensed allowing the then Wessex Water Authority to abstract a further 18 Ml/d for public water supply from a number of boreholes in the Great Oolite around Malmesbury. To sustain stream flows, a further 26 Ml/d could be abstracted from the Great and Inferior Oolite for the purpose of supporting these flows if the flow at one or more of 6 gauging stations falls below a prescribed level.

4.8 GROUNDWATER ABSTRACTIONS, CONTINUED

4.8.3 Aims

- To safeguard existing licensed sources and the resources required for other catchment uses, including the protection of river surface water flows.

- To provide for the protection, and where possible the enhancement, of the water environment.

- To investigate the effect of existing groundwater abstractions on river flows and general aquifer groundwater levels and, where necessary, seek remedies for adverse effects.

4.8.4 Environmental Requirements

Water Quality	-	treated water supplied for human consumption must comply with the relevant parts of the EC Directive on the Quality of Water for Human Consumption (80/778/EC)
Water Quantity	-	availability of resources within the terms specified in licences, having regard for residual quantities required for other uses.

UPPER BRISTOL AVON CATCHMENT
EFFLUENT DISPOSAL

NRA SOUTH WESTERN REGION

4.9 EFFLUENT DISPOSAL

4.9.1 General

The particular feature of this use is that there is no intrinsic requirement for any particular environmental condition to be met; more important is the need to protect other uses from the effects of the discharges.

Continuous Effluents

This covers the disposal of domestic, industrial and agricultural effluents to the river system. The conditions to be met by a particular discharge are set out in a specific discharge consent. They are calculated based upon the upstream water quality and flow rate in the receiving watercourse, and the degree of downstream water quality degradation that can be tolerated before other uses are adversely affected. It follows that if there is any subsequent deterioration in upstream water quality, or river flow degradation beyond the values assumed in calculating the consent, then downstream uses could be put at risk.

Intermittent Discharges

This relates to both consented and non-consented intermittent polluting discharges received by the catchment. The sources of these intermittent discharges are varied in terms of both frequency and impact, and include not only consented stormwater overflows and surface water outfalls, but also accidental industrial, agricultural or road traffic spillages. Surface water drainage from some types of development is liable to contamination. Notable examples are surface water outfalls draining industrial premises or estates. Such discharges are normally required to pass through oil interceptors as a minimum.

This use also highlights the potential risks to the catchment from such sources as chemical stores, given the severe impacts which could occur as a result of accidents.

Pollution of groundwater aquifers also occurs and this can be a very significant problem due to the difficulty of removing the contamination once it has occurred.

Sewer and pumping station overflows are located on most sewerage systems in the catchment, and are subject to consents which aim to limit the frequency of the discharge to occasions when intense rainfall occurs. On many sewerage systems, particularly older systems, sewers may be overloaded and overflows may occur at greater than acceptable frequency. Wessex Water Services are working with the NRA to systematically survey sewerage systems and identify and improve, or eliminate, unsatisfactory overflows.

4.9 EFFLUENT DISPOSAL, CONTINUED

4.9.2 Local Perspective

Continuous Effluents

There are 36 sewage treatment works (STWs) in the catchment with dry weather flows (DWFs) greater than 20m^3/day. None are particularly large; the largest is Trowbridge (DWF = 15,300 m^3/d and population equivalent (p.e.) of 121,681, but more significant is the large number of medium sized works (14) with DWFs between 1000 and 9,999m^3/d. There are 11 STWs with a p.e. greater than 10,000.

A particular feature of the catchment is that a significant number of STWs discharge into the small headwater streams which provide very low dilution for the effluent (see Section 6.1).

Sewage effluents discharged within the catchment are predominantly of domestic origin with only a small trade effluent component, so most STWs have consent conditions aimed at controlling the loads of biochemical oxygen demand (BOD), suspended solids and ammonia which are discharged to the river. Sewage effluents contain high concentrations of plant nutrients and typically contribute up to 50% of the nitrate and the major part of the phosphate in the river under dry weather flow conditions.

There are three significant consented industrial effluent discharges, namely St.Ivel - Wooton Bassett (1500 m^3/d treated effluent as a DWF), Webb's Country Foods - Sutton Benger (1360 m^3/d treated effluent as a maximum) and Avon Rubber cooling water (36360 m^3/d as a maximum).

There are four fish farm discharges which are similar to those of STWs, i.e. mainly an organic load but sometimes contain veterinary products such as fungicides or zinc and disinfectants.

Intermittent Discharges

The four main surface water discharges are shown on the map i.e. the St Ivel factory at Wootton Bassett, RAF Lyneham (rubber, fuel, oil and de-icing fluids from runway runoff), and industrial estates in Calne and Westbury.

The industrial areas are the main source of accidental spillages giving rise to pollution incidents, but accidental discharges from agricultural sources can occur throughout the catchment.

4.9.3 Aims

- To control the discharge of domestic, industrial and trade effluent to watercourses in such a way that water quality objectives are met (for use-related water quality criteria see Appendix 1.) and other uses are not compromised.
- To seek improvements in water quality by the tightening of consents where appropriate.
- To prevent and/or control intermittent pollution in such a way that no other uses are compromised.

4.9 EFFLUENT DISPOSAL, CONTINUED

4.9.4 Environmental Requirements

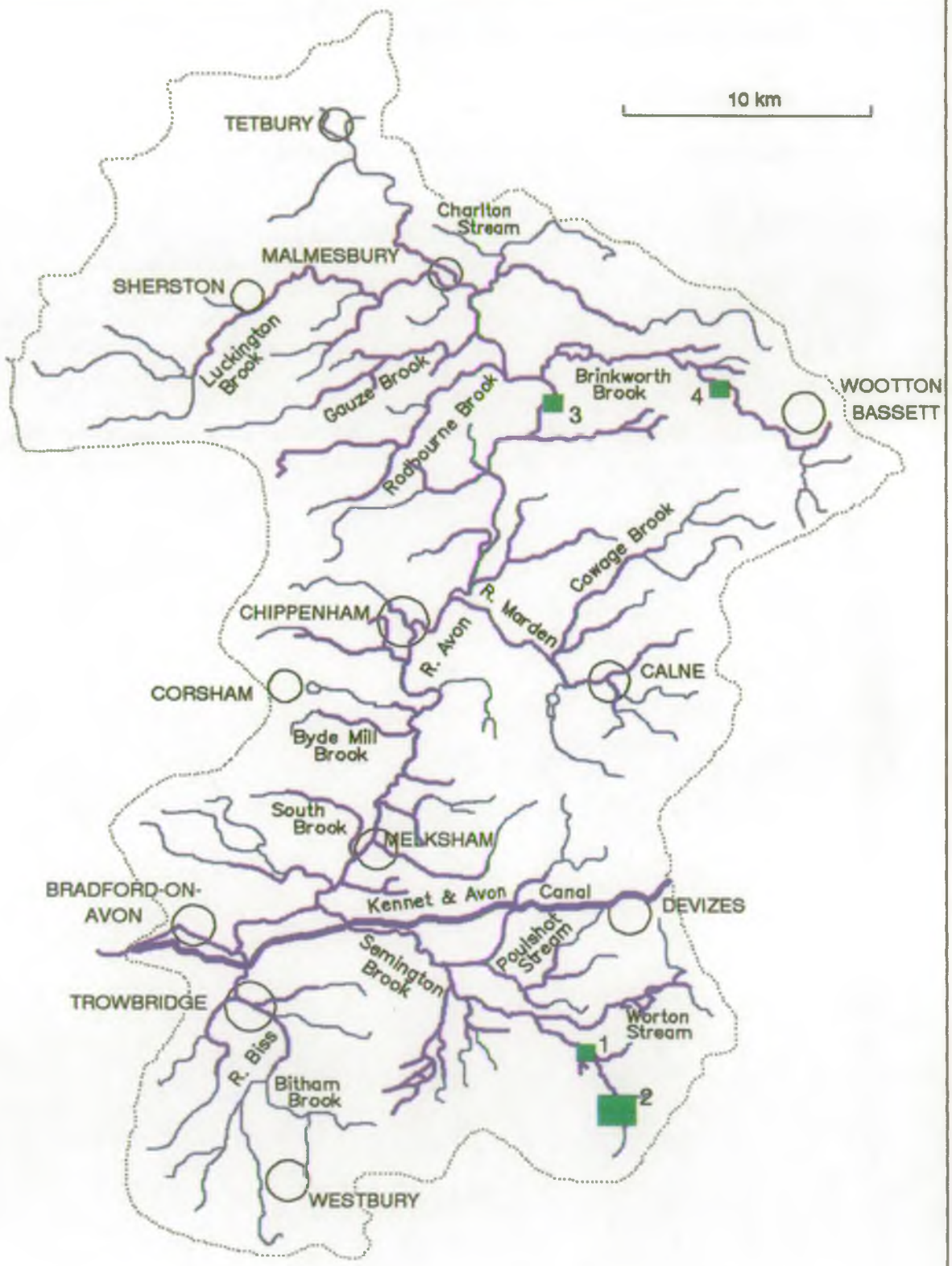
Water Quality - No deterioration in upstream water quality, beyond that assumed in setting the consent.

- Outfalls must be sited so as to achieve a specified degree of effluent mixing with the river contents within a specified distance.

Water Quantity - No diminution of the flow regime below that assumed in setting consents. Consents are normally set by reference to 95% exceeded river flows.

Note that where discharges are made to one channel in a multiple channel regime all of the above requirements may be affected by the portioning of flow between channels.

UPPER BRISTOL AVON CATCHMENT
AQUACULTURE



LEGEND		
Main River Kennet & Avon Canal	Fish Farms 1 Mill Farm, Great Cheverell 2 Park Farm, Littleton Panell 3 Somerfords Fishing Association Dauntsey 4 Ivy House Lakes	Size of Abstraction Licensed Daily Quantity Ml/d <10 (>0.45) 10-<20 20-<30

NRA SOUTH WESTERN REGION

4.10 AQUACULTURE

4.10.1 General

Aquaculture involves the operation of the river or riverside beds or ponds on a commercial basis for the production of watercress or the rearing of fish. An important feature of both uses is that they are non-consumptive, i.e. all the water used is returned to the catchment close to its point of abstraction.

There are two main types of fish farm; those using spring derived water (sometimes augmented by borehole supplies) which are located on the headwaters and smaller tributaries, and those which operate by diverting river water through pond systems. The effluent can be contaminated with organic matter from the large concentration of fish, or with chemicals and veterinary products if these are in use. In addition, escapes of farmed fish can disrupt wild fisheries, whilst the presence of the reared fish may compete with and adversely affect wild populations in the vicinity.

Effluents from fish farms are subject to control by consents to discharge and abstraction of water is also now controlled by abstraction licensing following amendments to the legislation introduced in the Water Act 1989.

4.10.2 Local Perspective

There are four fish farms licensed to abstract more than 0.45 Ml/d. Three are situated on the headwaters of tributaries, where they have a relatively major impact locally. The fourth is on the main Avon south of Malmesbury.

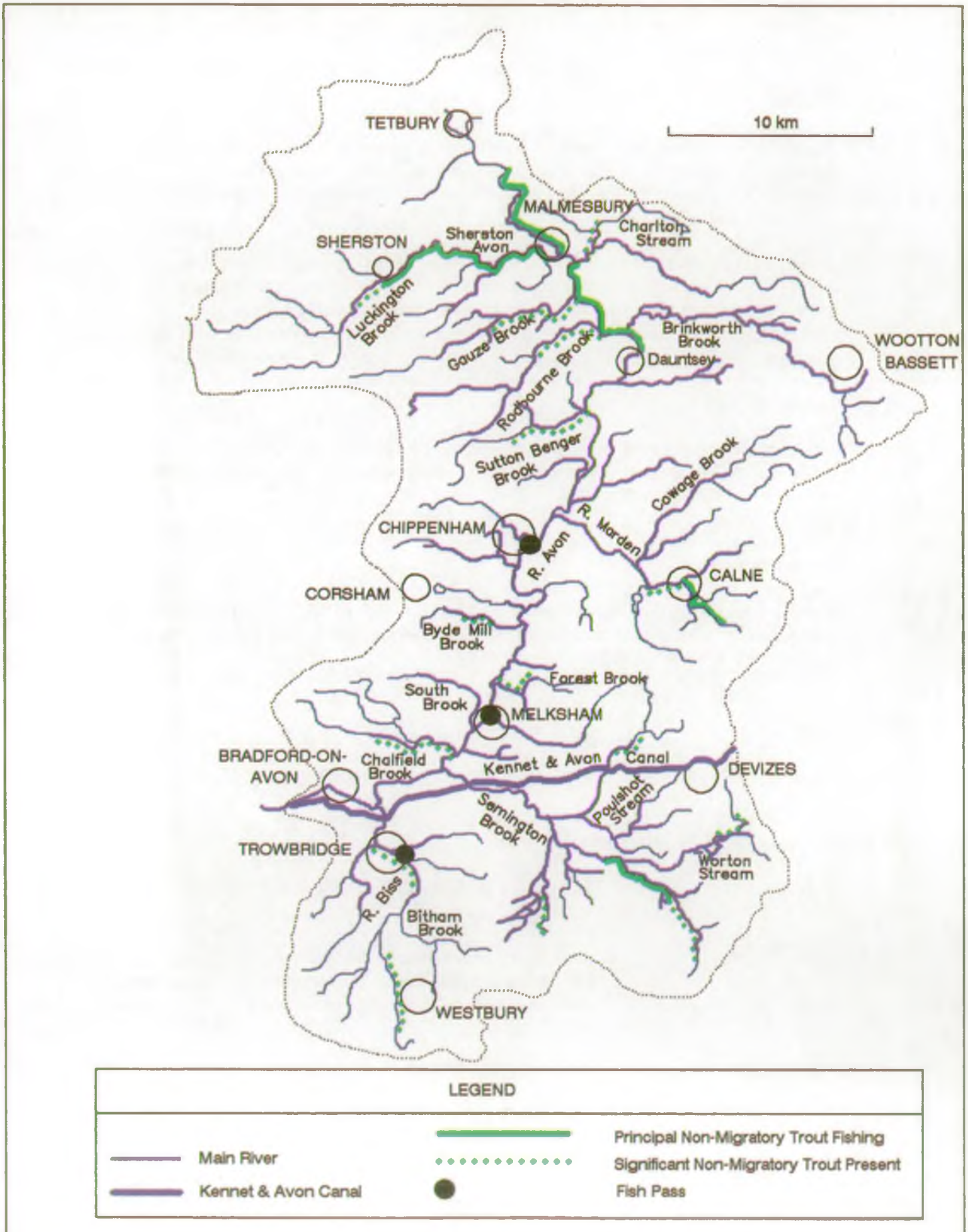
4.10.3 Aims

To ensure, by adequate monitoring, no detriment to other river uses.

4.10.4 Environmental Requirements

Water Quality	-	compliance with the Rivers Ecosystem Standards (see Appendix 1.1).
Water Quantity	-	availability of resources within the terms of specified licences whilst also having regard for residual quantities required for other uses and environmental interests.

UPPER BRISTOL AVON CATCHMENT
GAME FISHERY



NRA SOUTH WESTERN REGION

4.11 GAME FISHERY

4.11.1 General

This use refers to the conservation of wild populations of salmonid fish and their habitats and to recreational trout fisheries.

4.11.2 Local Perspective

A large number of the tributaries of the Upper Bristol Avon support brown trout and, although many are not significant as rod fisheries, these wild populations of trout are nevertheless worthy of conservation.

The main trout fishing lengths are shown on the map opposite. On the River Avon trout fishing takes place between Dauntsey and Malmesbury and is very much dependent upon regular stocking by angling interests; this includes both rainbow trout and brown trout.

The Sherston Avon and Tetbury Avon are spring fed from the limestone aquifer and are managed as trout fisheries throughout most of their length. Supplementary stocking is frequently carried out by angling interests.

The upper lengths of the River Marden and the Semington Brook are also managed as trout fisheries, and are greatly dependent upon spring flows from the Chalk and Greensand.

Wild brown trout are present in the River Biss, tributaries of the Semington Brook, Chalfield Brook, Forest Brook, Sutton Benger Brook, Gauze Brook, Rodbourne Brook and Charlton Stream, although they are not generally fished for.

It is the policy of the Authority to install fish passes into weirs during any reconstruction work and as a result both Chippenham and Melksham weirs have fish passes, although in isolation they have little benefit to salmonids. There is evidence that fish passes have some benefits for coarse fish. The same policy has been applied to the replacement of weirs by developers resulting in the installation of a fish pass on the River Biss during redevelopment.

Triennial electric fishing surveys of salmonids at selected sites throughout the catchment are undertaken to assess populations and any spatial or temporal changes. It is anticipated that more detailed studies will need to be carried out by the Authority into the habitat and flow requirements of the spawning and juvenile stages of trout in the Malmesbury area as an integral part of the low flow studies.

Stillwater trout fishing takes place at several lakes and gravel pits throughout the catchment.

4.11.3 Aims

- To maintain, improve and develop the wild salmonid resource of the upper Bristol Avon catchment in accordance with Regional and National policy (see NRA Fisheries Strategy document available from the Regional Office, Public Relations Department).

- To promote salmonid angling in the catchment in accordance with the NRA's own recreational strategies and codes of practice, and without prejudice to its other statutory duties.

4.11 GAME FISHERY, CONTINUED

4.11.3 Aims, continued

- To monitor salmonid populations and their habitats by means of periodic strategic surveys, investigate the cause of any significant changes in salmonid populations or habitat and take appropriate actions.

- To establish flow criteria for both juvenile and adult salmonids both to protect existing habitat against future abstractions and, when opportunities occur, to help mitigate existing low flow problems.

- To achieve the construction of fish passes, if considered appropriate, when weirs are altered or rebuilt by either the Authority or by the riparian owner.

- To achieve the efficient operation of river control structures in a manner that is beneficial to salmonids by the promotion of a code of good practice.

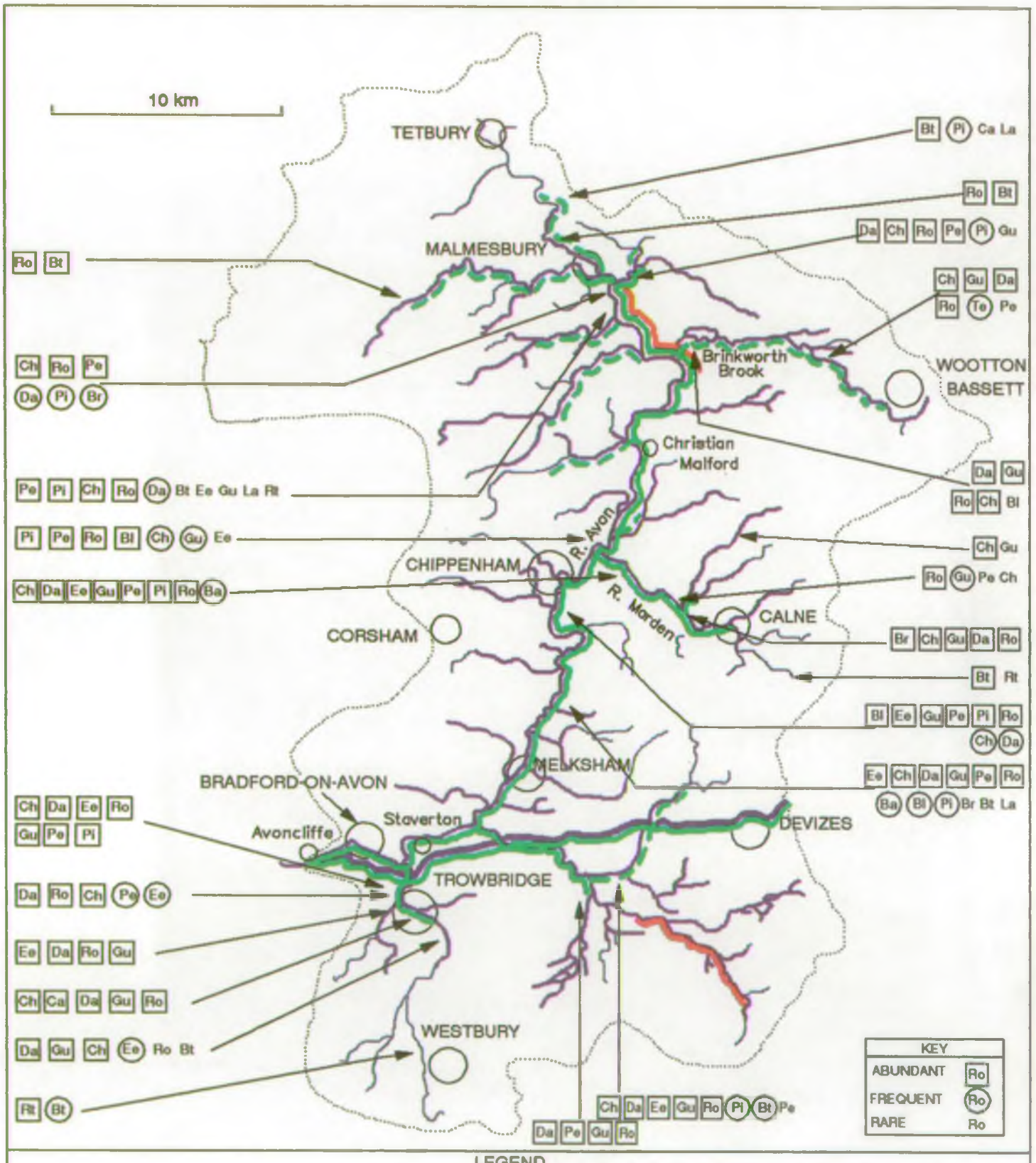
- To prevent habitat degradation, particularly resulting from siltation and/or a loss of river bed complexity, due to engineering works. In sensitive areas for salmonids, to arrange, whenever possible, that works of this nature should be undertaken outside the period November - April (inclusive).

4.11.4 Fisheries Requirements

Water quality, water quantity and physical habitat adequate to sustain wild populations of salmonids at a level appropriate for the river, more specifically:-

Water Quality	-	Chemical water quality not to deteriorate below the mandatory limits for pollutants as specified in the EEC Fisheries Directive (78/659/EEC) for salmonid fisheries. Ideally water quality should meet the more rigorous guideline limits for pollutants as specified in the EEC Fisheries Directive (78/659/EEC) (see Appendix 1.2).
Physical Features	-	Operation of river control structures in accordance with a code of good practice.
	-	Lack of siltation, especially in gravel spawning beds.
	-	River bed complexity to provide the necessary habitat.

UPPER BRISTOL AVON CATCHMENT
COARSE FISHERY



NRA SOUTH WESTERN REGION

4.12 COARSE FISHERY

4.12.1 General

This use refers to the conservation of wild populations of non-salmonid fish and their habitats, and to recreational fishing for species other than salmon and trout.

4.12.2 Local Perspective

The upper Avon catchment supports a diverse fish fauna and at least twenty species of non-salmonid fish are known to be present. The upper Bristol Avon is highly regarded as a coarse fishery and provides good sport for pleasure and match anglers and in some areas for specimen anglers. Important lengths for match fishing are at Bradford-on-Avon, Staverton, Melksham, and Chippenham. Notable areas for specimen barbel are between Christian Malford and Melksham and also at Avoncliffe. Between Malmesbury and Dauntsey there is some grayling fishing in addition to high quality coarse fishing.

The River Marden and Semington Brook also provide good coarse fishing. The Sherston and Tetbury branches of the Avon support coarse fish although fishing is confined to the area immediately in and around Malmesbury. Some coarse fishing is also carried out on the River Biss and Brinkworth Brook.

Triennial electric fishing surveys of coarse fish at selected sites are undertaken to assess populations and any spatial or temporal changes. On the main river this has proved difficult and no quantitative scientific data exists for the river downstream of Lacock, due to practical difficulties of effectively sampling a large deep river. In order to redress this deficiency in the data, the Authority is constructing a special electric fishing boat along similar lines to that used to survey fish population on the Hampshire Avon.

Stillwater coarse fishing takes place at a large number of ponds and lakes and a few gravel pits throughout the catchment. The Kennet and Avon Canal also provides a very significant coarse fishery. There is a great demand for recreational stillwater coarse fisheries and the Authority has taken an active role in promoting and to some extent, funding the development of new fisheries.

4.12.3 Aims

- To maintain, improve and develop the wild non-salmonid resource within the upper Bristol Avon catchment, in accordance with Regional and National policy. Without prejudice to its statutory duties the Authority will seek to promote the use of watercourses and stillwater within the catchment for non-salmonid angling in accordance with its own strategies and codes of practice (see NRA Fisheries Strategy document available from the Regional Office, Public Relations Department).

- To monitor coarse fish populations and their habitats by means of periodic strategic surveys, investigate the cause of any significant changes in coarse fish populations or habitat and take appropriate actions.

- Wherever possible, ensure that potentially harmful activities such as dredging and engineering works are undertaken in a manner likely to cause least harm to the fisheries resource and to its recreational value to angling.

4.12 COARSE FISHERY, CONTINUED

4.12.3 Aims, continued

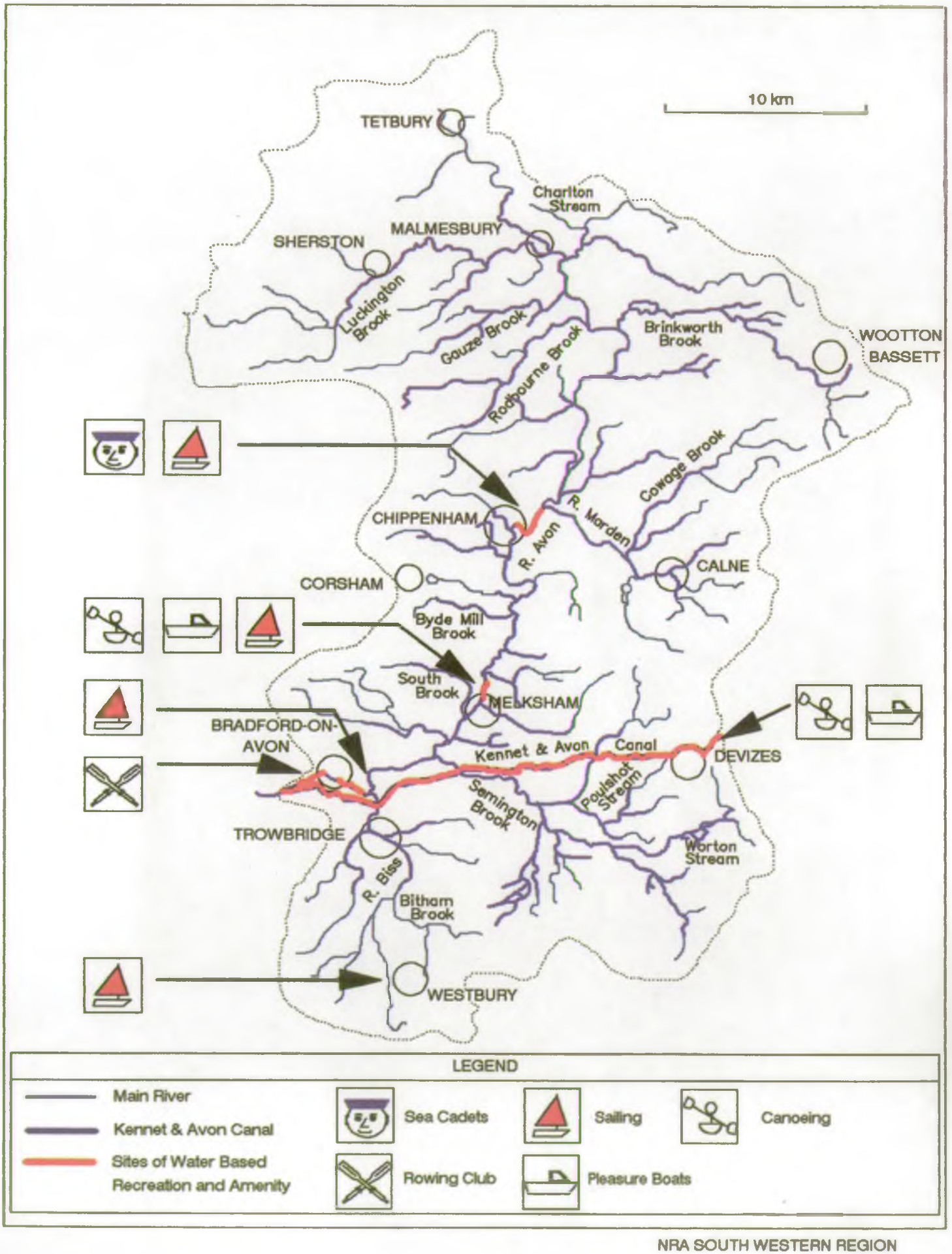
- To consider undertaking works to improve coarse fish habitats such as the renovation of weirs and hatches, providing sufficient potential fisheries benefits would be achieved to justify the expenditure and no prejudice to the NRA's other statutory duties results.
- Ensure adequate diversity of habitat to provide spawning, nursery and holding areas.
- Construct fish passes where physical barriers are found to constrain coarse fish populations, but only within their existing distribution range.
- Construct elver passes where physical barriers seriously impede their movement.

4.12.4 Fisheries Requirements

To maintain water quality, water quantity and habitat so as to sustain wild populations of non-salmonid fish at a level appropriate for the river, more specifically:-

Water Quality	-	Chemical water quality not to deteriorate below the mandatory limits for non-salmonid fisheries as specified in the EEC Fisheries Directive (78/659/EEC) (see Appendix 1.2).
Physical Features	-	Adequate diversity of habitat to provide spawning, nursery and holding areas.
	-	Fish passes where physical barriers are found to constrain coarse fish populations, but only within their existing distribution range.
	-	Elver passes where physical barriers seriously impede the movement of elvers.

UPPER BRISTOL AVON CATCHMENT
WATER BASED RECREATION AND AMENITY



NRA SOUTH WESTERN REGION

4.13 WATER BASED RECREATION AND AMENITY

4.13.1 General

This use refers to water based recreation (other than angling which is covered elsewhere) that takes place in the river corridor and to the more general enjoyment of the riverine environment.

The water environment forms an important component of many leisure pursuits. Current participation data confirm walking as being the most popular outdoor pursuit, with around 19% of the population participating regularly. In an NRA survey water was mentioned as a feature in 1 in 3 of all trips which included walking as the main activity. It is estimated that more than 6 million people participate in sailing canoeing or boating and 7.6 million in bathing each year.

4.13.2 Local Perspective

The only formal navigation which exists in the catchment is the Kennet and Avon Canal, where British Waterways are the Navigation Authority. There is no public right of navigation on the upper River Avon; however listed below are places where sailing, boating and canoeing occur.

Chippenham

Chippenham Sailing and Canoe Club and Chippenham Sea Cadets use the River Avon between Chippenham Town Bridge and Black Bridge where the river is impounded by Chippenham weir. There is a canoe slalom here and also a public slipway on the left hand bank immediately downstream of Chippenham weir.

Melksham

There is a slipway at the adventure centre in King George Playing Field and the river between Melksham weir and Beanacre is used for sailing, boating and canoeing.

Bradford-on-Avon

Bradford-on-Avon Sailing Club use the River Avon at Pondfields upstream of the town in the impoundment formed by Greenland weir. Bradford-on-Avon Rowing Club operate from the town centre to Avoncliffe weir; some canoeing also occurs here.

Eden Vale Lake, Westbury

Sailing occurs on this lake. West Wiltshire Youth Sailing Association (Ages 8 - 18 years) sail dinghies between March and October. The Club has an open membership.

Canoeing

Canoeists occasionally use most parts of the main River Avon between Malmesbury and Bradford on Avon. This has led to conflicts between canoeists and anglers and riparian owners, particularly where access or passage has not been agreed (see Issue No. 3.17 Conflict between Canoeists and other River Users).

4.13 WATER BASED RECREATION AND AMENITY, CONTINUED

4.13.2 Local Perspective, continued

Bathing

Historically numerous sites throughout the catchment were used for bathing. With the advent of public swimming pools this use has declined, but some sites are still used. The NRA does not encourage bathing in rivers as waters are not intrinsically safe and it is not a sterile environment. There could be a danger of contracting Weil's Disease.

Amenity

There are several public open spaces where watercourses form an integral part of the amenity provided. The most significant of these are Barton Country Park (Bradford-on-Avon), King George Playing Field (Melksham), Monkton Park (Chippenham), Malmesbury Recreation Ground and Trowbridge Park. In addition to this there are numerous public footpaths which run adjacent to, or cross the River Avon and its tributaries throughout the catchment. Riverside footpaths are particularly important in the towns of Malmesbury, Chippenham, Bradford-on-Avon, Trowbridge and Calne. In Trowbridge further riverside walks and amenity have been provided through the development of a new supermarket site at Longfield. The towpath along the Kennet and Avon Canal forms an important public footpath throughout its entire length from Avoncliffe to Devizes. Bowood Lake and Corsham Lake form an important component of historic sites open to the public.

Countryside Access

A leaflet giving details of walks, rides, access areas, countryside parks and countryside car parks has been produced by Wiltshire County Council, with the support of the Countryside Commission, and is available from the 'Access to the Countryside Section' at County Hall, Trowbridge, B14 8JD.

4.13.3 Aims

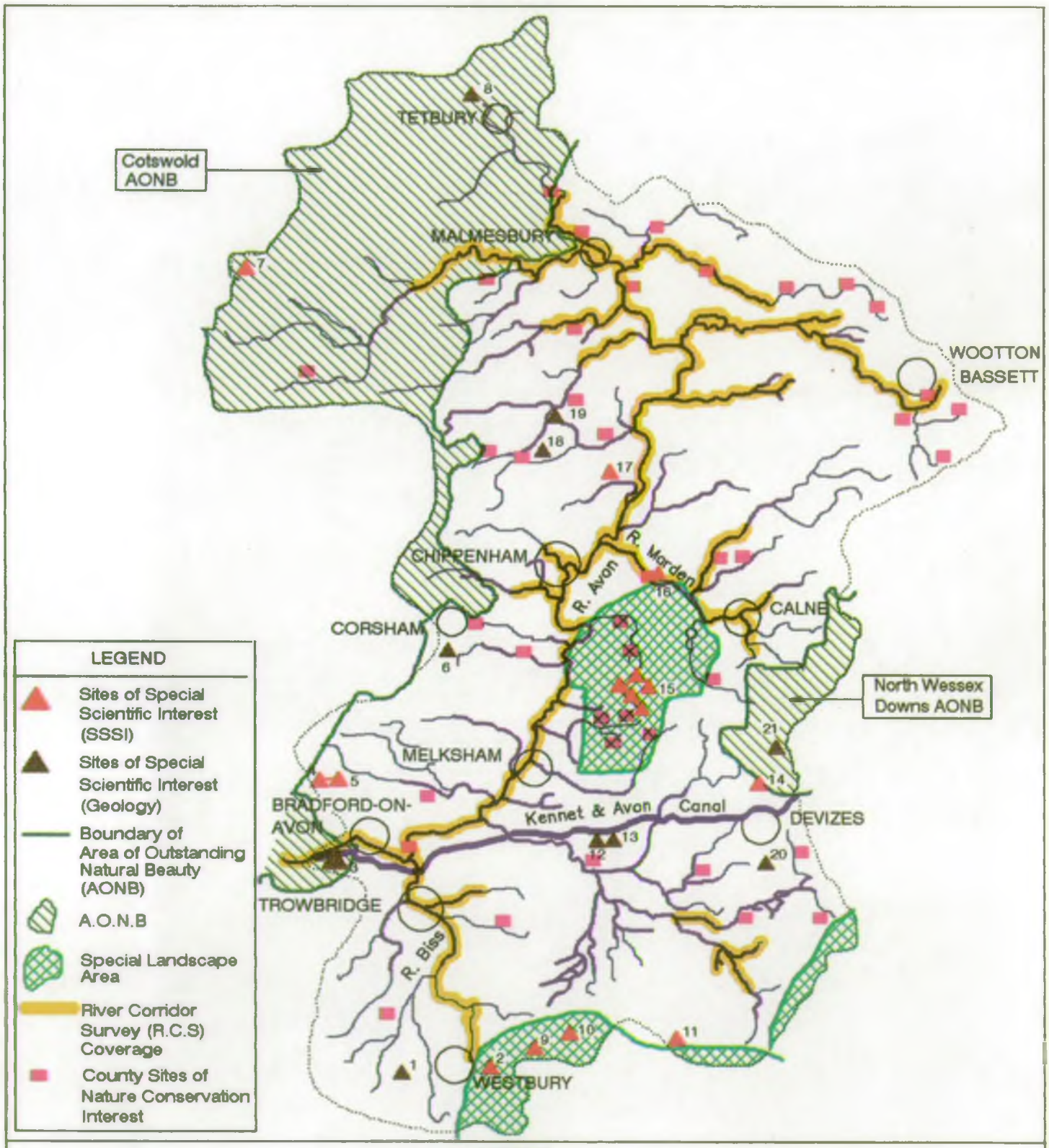
To promote the use of the catchment for waterbased recreation and amenity in accordance with NRA Regional and National policy without prejudice to its other statutory duties.

NRA policy is outlined in the national document "NRA Recreation Strategy" which is available from the Regional Office, Public Relations Department. The broad aims are to develop the amenity and recreational potential of inland and coastal waters and associated land.

Specific aims:

- To maintain, develop and improve recreational use of NRA sites
- To take account of recreation in proposals relating to any NRA function
- To promote the use of water and associated land for recreation purposes
- To improve its understanding of the demand for water based recreation and its impact on the environment.

UPPER BRISTOL AVON CATCHMENT CONSERVATION



LEGEND

1 Westbury Ironstone Quarry
2 Bratton Down
3 Gripwood Quarry
4 Inwood & Warleigh
5 Inwood & Warleigh
6 Corsham Railway Cutting
7 Midger Wood
8 Veizey's Quarry
9 Bratton Castle & Edington Wood
10 Baynton & Coulston Woods
11 Great Cheverell Hill
12 Seend Cleeve Hill
13 Seend Ironstone Quarry & Road Cutting
14 Roundway Down & Quarry
15 Spye Park
16 Bencroft Hill Meadow
17 Sutton Lane Meadows
18 Stanton St. Quintin Motorway Cutting
19 Stanton St. Quintin Quarry
20 Stert Brook Exposure
21 King's Play Hill

NRA SOUTH WESTERN REGION

4.14 DESIGNATED CONSERVATION AREAS

4.14.1 General

The primary aim of conservation related to the aquatic environment is the protection of the characteristic features of watercourses and the enhancement of their natural beauty, wildlife, landscape, archaeology and geomorphological features.

4.14.2 Local Perspective

The River Avon is essentially a slow-flowing lowland clay river which has been modified by historical impoundment, river engineering in the interests of land drainage and flood alleviation, and intensive agriculture in the flood plain. The river is alkaline and has an abundance of nutrients and fine sediments resulting from the rich geology. Each tributary has a different character, but the lack of complete strategic river corridor survey data hampers relative evaluation. Several of the tributaries have their major source of water from chalk and limestone aquifers, and are now being affected by low flows.

Of the 21 Sites of Special Scientific Interest (SSSIs) in the area, 8 are geological and there are no wetland sites. A geological exposure of Kellaways beds in the banks of the River Avon near West Tytherton is due to be notified as an SSSI, and the unique mud springs near Wootton Bassett are currently being evaluated by English Nature geologists.

There are very few wetland County Sites of Nature Conservation Importance (SNCIs) though it is possible that the Wiltshire Wildlife Sites Project may identify a small number of wet flood plain meadows. The network of non-statutory SNCIs is of fundamental importance in the protection of semi-natural habitats within the wider countryside. Planning policies and guidelines are increasingly recognising the value of these sites, and the Wiltshire Wildlife Trust and Local Planning Authorities are working to achieve their conservation and management.

There are 2 Areas of Outstanding Natural Beauty (AONBs), within the catchment, the Cotswolds in the North West and the North Wessex Downs to the East around Calne. In addition Local Authorities have designated 2 Special Landscape Areas (SLAs) within this catchment (see map opposite). The majority of the watercourses lie outside the AONB boundaries but are important landscape features in their own right. The rivers have played a large part in shaping the land form and now provide vital linking features in the network of habitats and corridors in the countryside. They add a lively and ever-changing dimension to the landscape which is strengthened by the diversity of plant and animal species they support.

There are many features of archaeological and historic interest associated with the rivers, principally those resulting from the woollen industry. The development and wealth of the County was intimately linked with the rivers, most of which have been utilised as a source of energy for powering mills to process fleece, cloth and feedstuffs. The Bristol Avon is therefore an artificially impounded river, water levels having been historically manipulated along much of its length. The major towns of Malmesbury, Chippenham, Calne, Trowbridge and Bradford-on-Avon developed around the woollen industry and retain historic buildings such as the teasel drying "shed" over the River Biss in Trowbridge. Wiltshire is known as the county of "chalk and cheese", with sheep and wool produced on the chalk and limestone downlands, and dairy production in the clay vales. Thus Melksham was a dairying centre, the name being derived from "Milksham".

4.14 DESIGNATED CONSERVATION AREAS, CONTINUED

4.14.2 Local Perspective, continued

The upper reaches of the Avon (Tetbury and Sherston branches) rise on Oolitic limestone and flow through relatively steep-sided valleys with good adjacent habitat in the form of several ancient woodlands and patches of limestone grassland. They represent a distinct river type, being relatively natural, fast flowing, calcareous small rivers on mixed substrates. The headwaters of the River Marden represent the only example of a true chalk stream in the catchment, with a particularly rich flora and fauna. The Gauze and Rodbourne Brooks flow over Cornbrash marls and clays. The Woodbridge Brook flows over Cornbrash and Oxford Clay. The Brinkworth Brook, Semington Brook and River Biss flow over Oxford and Kimmeridge clays, and are typical slow flowing lowland clay rivers.

As a result of these geological differences, each of the tributaries has its own character and particular assemblage of plants and associated animals.

The flora of the upper Bristol Avon is characterised by yellow water lily, arrowhead, common clubrush, branched bur-reed and flowering rush, with common reed on the banks. Several rare plants occur in the catchment including river water drop-wort, which Britain has an international responsibility to conserve as it is only found locally in Denmark and West Germany outside of the British Isles. Loddon pondweed is found downstream from Bradford-on-Avon town centre - this nationally rare plant species only occurs in 3 other rivers in Southern England. White water lily also occurs, but this is sparse. Marginal vegetation is most diverse where the flow regime is more natural and the river is shallower. The sections thought to be the richest in wildlife generally match those which are semi-natural and which were not intensively engineered, such as sections around Kingsmead and Lacock.

Two other uncommon plant species are known from the catchment - greater spearwort and narrow-leaved water plantain are both recorded from the Bourne and Dauntsey, a brook which has been greatly altered as a result of the construction of the M4. The smaller and fast flowing tributaries of the Sherston and Tetbury Avons, and the headwaters of the river Marden, are characterised by communities dominated by water crowfoot and water starwort.

Native crayfish are still known from the headwaters of Sherston Avon. This population could form a vitally important source for re-establishing the native crayfish which has been almost wiped out since the introduction of a fungal plague in 1981 (see Issue No. 3.15 Decline of Native White Clawed Crayfish on Upper Bristol Avon).

Adjacent unimproved or semi-improved pasture in the River Avon floodplain is rare, with a notable example of "fen" vegetation between Holt and Hilperton (where grass snake and the nationally rare scare chaser dragonfly were recorded recently), and near Great Bradford Wood to the east of Bradford-On-Avon. There is also an important heronry on this section.

Eleven species of Odonata were recorded in the 1988 Bristol Avon River Corridor Survey including 2 nationally rare species, the white-legged damselfly which was recorded throughout, and the scarce chaser which is known from Holt to Freshford (although its recent colonisation of the Avon between Bath and Keynsham in 1990 suggests an expansion of its former range). Comprehensive surveys of the Odonata supported by the tributaries have not been undertaken.

4.14 DESIGNATED CONSERVATION AREAS, CONTINUED

4.14.2 Local Perspective, continued

Characteristic bird species include heron and kingfisher, moorhen and mallard, grey and yellow wagtails, mute swan, sedge warbler and reed bunting. The drainage of most of the floodplain meadows has resulted in an almost total absence of suitable sites for ground-nesting birds such as snipe, redshank and lapwing. However, curlew still breed (remarkably) on fields adjacent to the Brinkworth Brook.

4.14.3 Aims

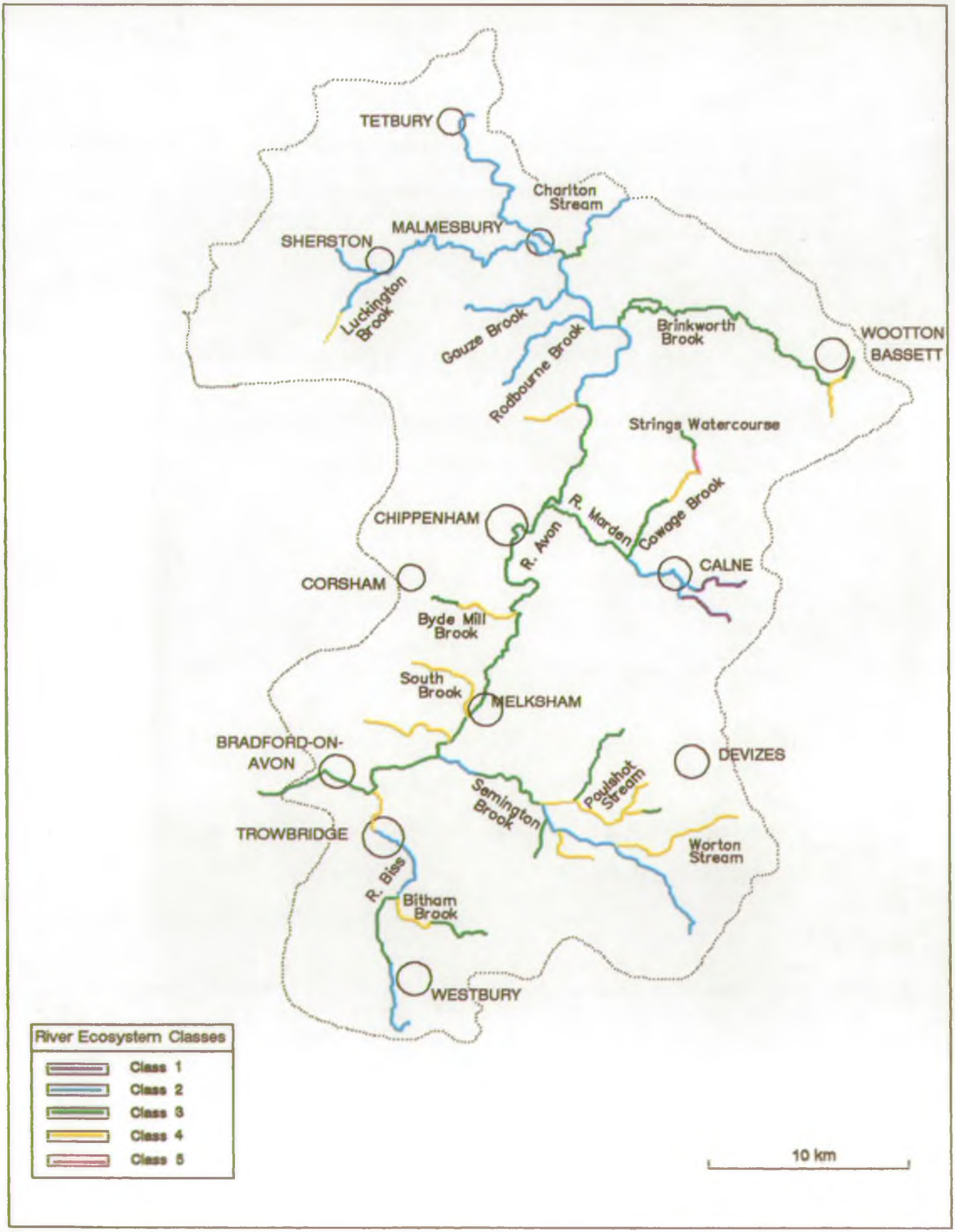
- To conserve the biodiversity of the upper Bristol Avon, its tributaries and associated watercourses.
- To safeguard all semi-natural habitats associated with wetlands and watercourses.
- To restore and enhance degraded wildlife habitats, particularly wetlands and bankside vegetation.
- To safeguard riverside landscapes, historical features and archaeological remains.
- To bring about the enhancement of the rivers which flow through town centres, and develop their potential for educational and recreational use.

NRA policy is outlined in the national document "NRA Conservation Strategy" (available from the Regional Office, Public Relations Department).

4.14.4 Environmental Requirements

- Minimum ecologically acceptable flows in all rivers in the catchment.
- Adequate bankside cover particularly reed, scrub and trees.
- Geomorphological diversity.
- Adequate wetland habitat such as seasonally inundated grassland, marsh and fen vegetation.
- Environmentally sensitive management of watercourses and bankside vegetation.

UPPER BRISTOL AVON CATCHMENT
WATER QUALITY TARGETS - RIVER ECOSYSTEM USE CLASSES



NRA SOUTH WESTERN REGION

5.1 WATER QUALITY OBJECTIVES

5.1.1 General

The NRA aims to maintain and improve, where appropriate, the quality of water for all those who use it. This is achieved by setting objectives for the catchment based on Water Quality Objectives to protect recognised uses and by ensuring compliance with the standards laid down in EC Directives.

An assessment of the water quality in the Upper Bristol Avon CMP is made against these standards in section 6.1.

5.1.2 Water Quality Objectives

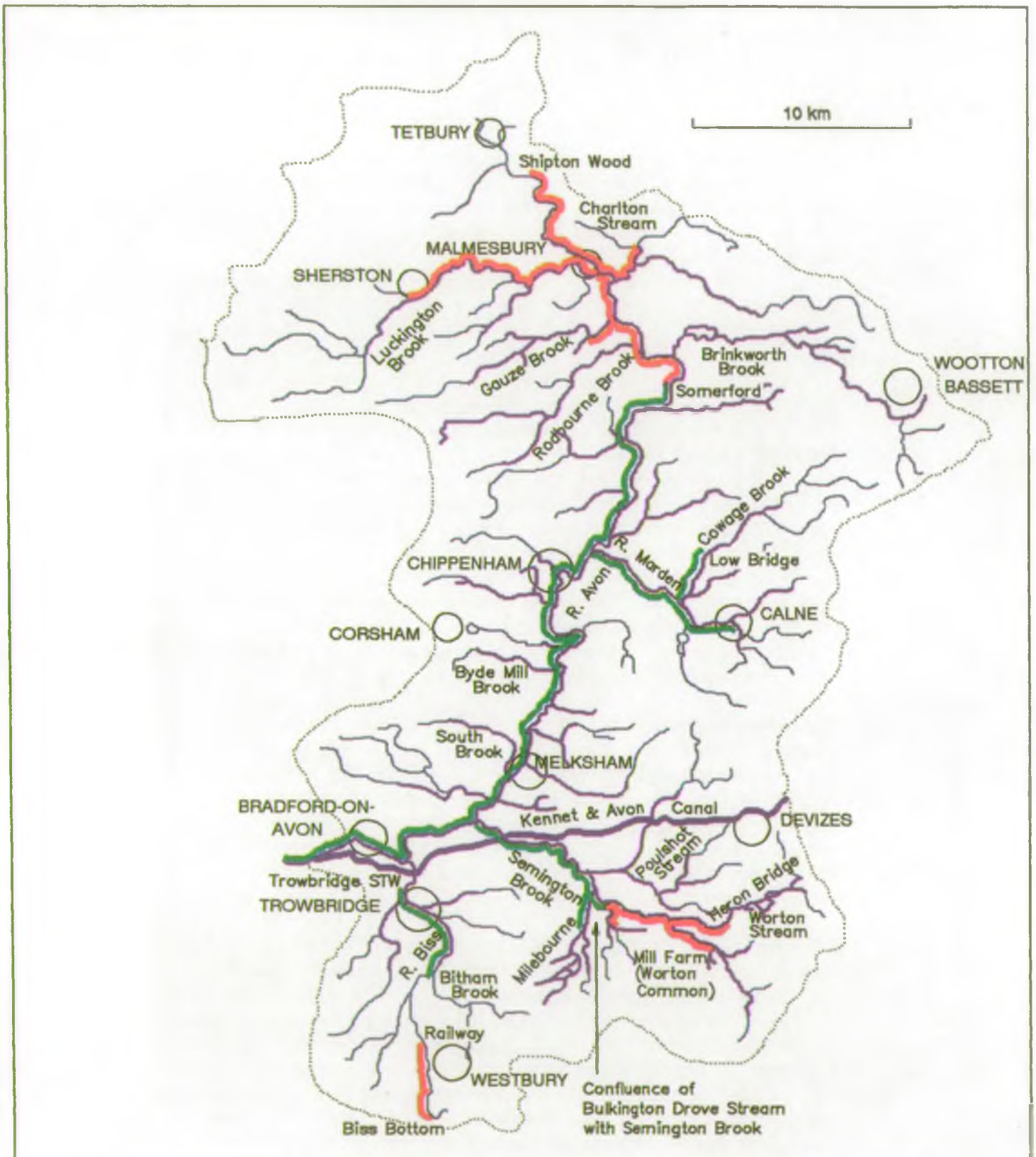
The Water Resources Act 1991 contains legislation which allows the Secretaries of State to prescribe classification schemes for water quality and to use them for the setting of Water Quality Objectives (WQOs). Previous references to water quality have been based on the National Water Council (NWC) classification system. Because of its limited range of chemical parameters and subjective interpretation it has been replaced with a dual system of use-related classifications, Statutory WQOs and a general quality assessment (GQA) system. These reporting facilities will operate in parallel and will represent a neutral translation in standards from the NWC scheme. Whilst the WQO system will examine compliance with EC Directives and specific use-related standards the purpose of the GQA is to provide a means of accurately assessing and reporting on the general state of controlled waters in a nationally consistent manner.

A Use-Related Scheme: The Classification Scheme proposed for establishing Statutory WQOs is based upon the recognised uses to which a river stretch may be put. These uses include River Ecosystem, Abstraction for Drinking Water Supply, Agricultural Abstraction, Industrial Abstraction, Special Ecosystem, and Watersports. The first phase of WQO implementation will be restricted to the River Ecosystem Use Class only; the standards for further uses are still under development. For each stretch, a target River Ecosystem Class will be proposed, including a date by which this level of water quality should be achieved.

River Ecosystem Use Class: There are five Classes within the River Ecosystem scheme, one of which will be applicable to every stretch of classified river. The term 'Ecosystem' is used in recognition of the need to protect the ecosystem that is sustained in a healthy river. The proposed standards for the five River Ecosystem Classes (contained in Appendix 1.1) are based on the chemical water quality requirements of different types of ecosystem, and consequently the types of fisheries they are capable of supporting. Assignment of a chemical quality class does not necessarily imply that particular types of fish will be present or absent from a river stretch - there are many complicated, non-chemical factors which affect the status of fish populations - merely that the chemical quality of the water is suitable for a given type of fishery.

The proposed water quality targets, 'The River Ecosystem Use Classes', for the Upper Bristol Avon are shown on the map opposite.

UPPER BRISTOL AVON CATCHMENT
DESIGNATED FISHERIES



SOUTH WESTERN REGION

5.1 WATER QUALITY OBJECTIVES Continued

5.1.3 EC Directives

There are six EC Directives that currently apply to the Upper Bristol Avon catchment.

The **Freshwater Fisheries Directive** "on the quality of waters needing protection or improvement in order to support fish life", 78/659/EEC, is concerned with ensuring that water quality in designated stretches of water is suitable for supporting fisheries. This Directive contains two sets of quality standards, one at levels to support a cyprinid fish population (ie coarse fish) and another set at stricter levels to support a salmonid fish population (eg salmon and trout) (Appendix 1.2). There are two sets of standards for each fishery type, imperative (I) standards, which must be achieved and guideline (G) standards which Member States should aim to achieve.

The designation of river stretches in this catchment is shown on the map opposite.

The **Dangerous Substances Directive** "on pollution caused by certain substances discharged in the aquatic environment of the community", 76/464/EEC, is concerned with controlling certain substances considered harmful which are discharged to the aquatic environment. The Directive established two lists of compounds. List I contains substances regarded as particularly dangerous because of their toxicity, persistence and bioaccumulation. Discharges of List I substances must be controlled by Environmental Quality Standards (EQSs) issued through Daughter Directives. List II contains substances which are considered to be less dangerous but which still can have a deleterious effect on the aquatic environment. Discharges of List II substances are controlled by EQSs set by the individual Member States (Appendix 1.4).

For the list of sites in this Catchment monitored for Dangerous Substances, see Appendix 1.4.

The **EC Directive "concerning urban wastewater treatment"**, (91/271/EEC) lays down minimum standards for the provision of sewerage collection systems and sewage treatment. Extracts from the Directive are contained in Appendix 1.6. The Directive specifies secondary treatment for all discharges serving population equivalents greater than 2000, but provides for higher standards of treatment for discharges to "sensitive" areas. Sensitive areas are those where waters are used for surface water abstractions; where the nitrate concentration exceeds the standards in the Surface Water Abstraction Directive (75/440/EEC); where surface waters are or may become eutrophic in the near future; or where more stringent treatment is required to fulfil the requirements of other EC Directives. Discharges below a population equivalent of 2000 must also receive "appropriate" treatment as defined in the AMP2 guidance note.

Although no stretches of the Upper Bristol Avon catchments have been identified as sensitive, studies are continuing from Chippenham STW downstream with a view to designating this part of the river as sensitive.

5.1 WATER QUALITY OBJECTIVES Continued

5.1.3 EC Directives, continued

The **EC Directive "concerning the protection of waters against pollution caused by nitrates from agricultural sources"** (91/676/EEC), requires Member States to identify waters affected by pollution from nitrates or which could be affected by pollution from nitrates if protective meesures are not taken. Extracts from the Directive are contained in Appendix 1.7. The land draining to these areas are designated as "nitrate vulnerable zones" (NVZ) and action plans must be established to reduce existing nitrate pollution and prevent further pollution. The identification of vulnerable zones has been limited to catchments around strategic public water supply sources where existing data shows that standards for nitrate in drinking water have been or will be exceeded by 2010. There are no potable surface water abstractions in the Upper Bristol Avon catchment, although the catchment is subject to diffuse nutrient inputs. However, high concentrations of nitrate have been found at the potable surface water abstractions downstream of the catchment boundary. Studies are continuing with a view to designating the catchment as an NVZ.

There is one other EC Directive which applies to surface waters but which does not currently have implications for improvements in the Upper Bristol Avon catchment.

The **Directive "concerning the quality required of surface water intended for the abstraction of drinking water in the Member States"** (75/440/EEC), ensures that surface water abstracted for use as drinking water meets certain standards and is given adequate treatment before entering public water supplies. The Directive sets out imperative standards which must be achieved, and guideline standards which Member States should aim to achieve, for water for public supply which is to be given different levels of treatment (Appendix 1.3).

Although there are no potable surface water abstractions within the Upper Bristol Avon catchment, there are major abstractions immediately downstream of the catchment boundary. It is suggested that the standards of the Directive should be applied to the lower part of the catchment.

The **Directive "on the protection of groundwater against pollution caused by certain dangerous substances"** (80/68/EEC), requires Member States to take the necessary steps to prevent the introduction to groundwater of 'List I' substances, and limit the introduction of 'List II' substances. (Directive extracts are contained in Appendix 1.5). Implementation of the NRA's Policy for the Protection of Groundwater, discussed in Section 5.3, is the means by which the NRA aims to ensure compliance with this Directive.

5.2 WATER QUANTITY OBJECTIVES

5.2.1 General

The management of water resources within the catchment, whatever the use, will be in accordance with the statutory duties of the NRA. This is to preserve or enhance the water environment whilst having regard for the legal obligations to licensed water abstractions.

5.2.2 Further Demands for Water Use

To optimise the usage of catchment water resources, demand management techniques such as leakage control and household metering should be introduced where they are likely to be of benefit. These will help reduce the number of new resources needed to meet increases in consumption.

Further resources that are required to satisfy increasing demands but which involve a significant loss of water from part or all of the catchment will be considered at downstream locations where the resources are more plentiful and the environment less sensitive.

5.2.3 River Low Flows

River flows that have declined to, or are at an unacceptable level as a consequence of licensed groundwater and surface water abstractions will be investigated. In some circumstances it will be appropriate to restore these flows to a more favourable condition. This could involve variations to existing abstraction licences or the introduction of a management scheme to provide a more balanced distribution of water resources, which may include alleviation from other resources together with the determination of prescribed flows where necessary. Consultation with the local communities regarding their needs and wishes will play an integral part in this procedure.

5.2.4 River Flow Protection

It has been customary for many years to set standards, commonly known as 'minimum prescribed flows' (mpfs), for the protection of rivers in dry weather conditions against losses from newly authorised abstractions of water. These mpfs have often been set with reference to some statistical measure of low flow occurrence but otherwise frequently on the basis of experienced judgement. In the past there has been difficulty in achieving a consensus in the scientific community on a suitable objective measure for environmental protection. The NRA is currently investigating the feasibility of methods for implementing statutory 'minimum acceptable flows', and is concurrently studying ways of assessing scientifically the habitat needs of a range of aquatic species. In the medium term it is to be expected that a national method will be available for prescribing the flows to be conserved on a seasonally varying basis. In the immediate future it will be normal to maintain as a minimum standard for river protection that newly authorised abstractions shall not diminish flows that on average would endure over 18 days of the summer low flow season.

5.2 WATER QUANTITY OBJECTIVES, CONTINUED

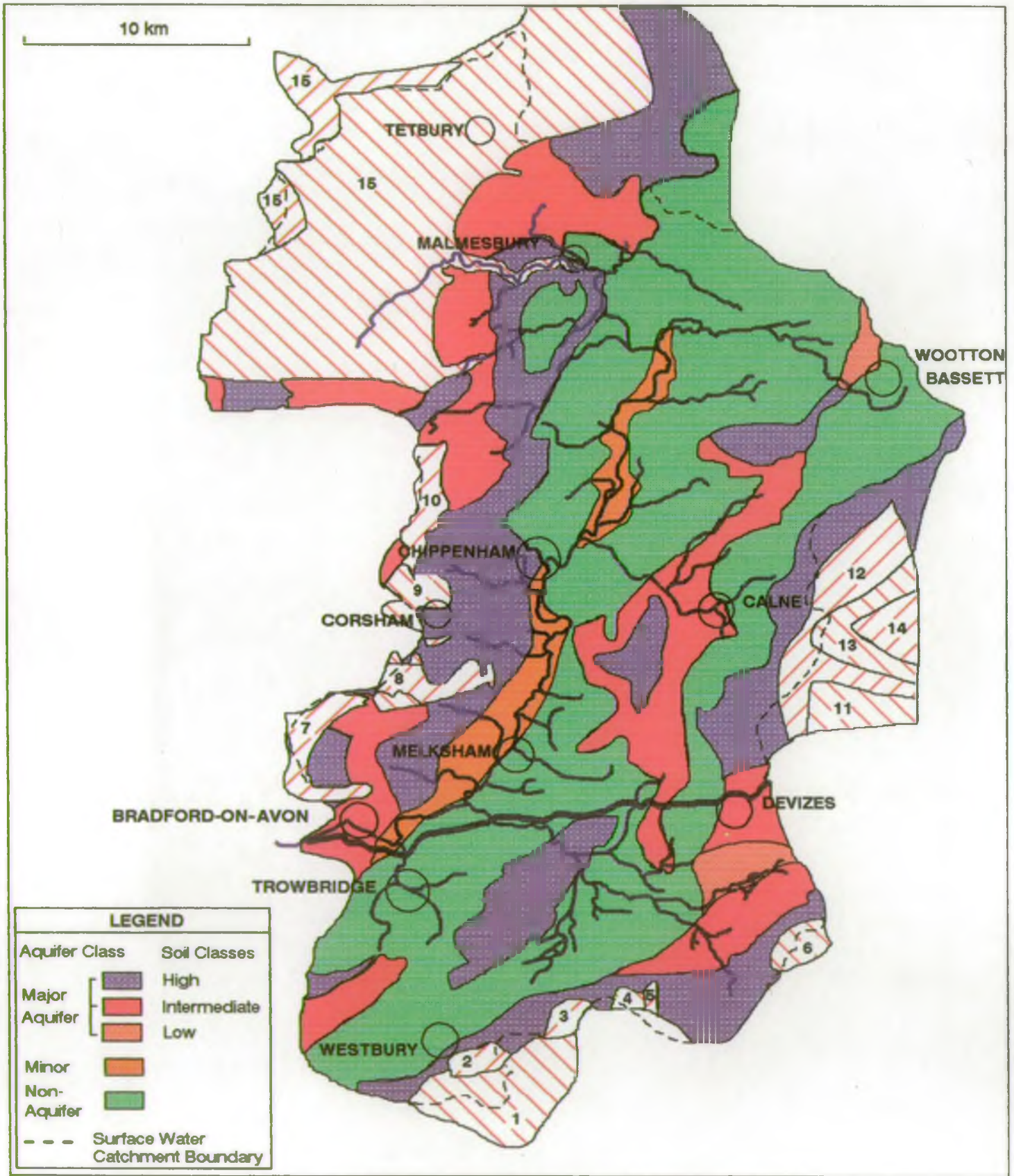
5.2.5 New Abstractions

The NRA will consider all applications for new licences to abstract water within the framework of the Water Resources Act 1991. However, licences may be restricted to maintain both the environmental quality of the catchment and the statutory obligations of the NRA to existing licence holders. In respect of this, there will be no further increase in water supply licences within the Malmesbury area where these could be prejudicial to river flows. Future new abstractions will be favoured in more downstream locations where adequate protection of the river flow regime can be demonstrated. It will remain acceptable to license minor abstractions that do not have a measurable impact upon existing water resources in upstream catchment areas, and prescribed minimum river flows should have regard for these. The NRA will also seek to improve controls on existing licences whenever the opportunity or need arises.

5.2.6 Water Storage Reservoirs

The intention of the NRA to restrict further major abstraction to the downstream reaches of the Bristol Avon catchment may require the construction of bankside storage facilities. Even at these downstream locations, new abstractions are likely to be available only at times of river flow excess and thus a continuous supply at other times would be dependent on the availability of previously stored water.

UPPER BRISTOL AVON CATCHMENT
GROUNDWATER PROTECTION POLICY



LEGEND - SOURCE CATCHMENT AREAS

1 Upton Scudamore	4 Erlestoke	7 Holt	10 Chippenham	13 Cherhill
2 Wellhead	5 Cheverell	8 Goodshill	11 Shepherds Shore	14 Yatesbury
3 Luccombe	6 Easterton	9 Lacock	12 Calstone	15 Malmesbury, Tetbury, Long Newnton, Charlton, Rodbourne, Shipton Moyne

NRA SOUTH WESTERN REGION

5.3 GROUNDWATER PROTECTION OBJECTIVES

5.3.1 General

A key objective of the NRA is to protect groundwater from all types of threat, large and small, from point and diffuse sources, and by both persistent and degradable pollutants. In the preparation of any CMP, the groundwater must form a major part of the considerations; thus the Authority's policy towards groundwater must form an integral part of that plan, which will in turn become one vehicle by which individual policies are implemented. In order to provide a framework on which to build individual policies, the NRA published its "Policy and Practice for the Protection of Groundwater" (PPPG) in December 1992.

The PPPG contains policy statements on the following aspects of groundwater protection:

- Physical disturbance of aquifers affecting quality and quantity
- Waste disposal to land
- Contaminated land
- Disposal of sludges and slurries to land
- Discharges to underground strata
- Unacceptable activities in the inner protection zone
- Diffuse pollution

The various policies are related to the risk posed by the activity, thus maps have been prepared for the whole country identifying major, minor, and non-aquifers. The major aquifers have been further sub-divided according to the relative vulnerability of their soil type into 3 classes: High, Intermediate and Low vulnerability. At a regional level, Source Protection Areas are currently being re-identified for major abstractions. Also, in accordance with the PPPG, these are being re-defined as three zones of increasing risk.

The Inner Source Protection Zone (Zone 1) will be that area defined by a 50 day travel time from any point below the water table to the source (and as a minimum of 50 metres radius from the source).

The Outer Source Protection Zone (Zone 2) is that area defined by a 400 day travel time from any point below the water table to the source.

The Source Catchment (Zone 3) is that area within which all groundwater will eventually discharge to the source.

The PPPG defines which activities will be excluded from each zone and which restricted by what conditions.

5.3.2 Local Perspective

The aquifers and source protection areas within this catchment are shown on the adjacent map. The PPPG document has a set of Regional Appendices which describe the local aquifers and detail the threats to them. Those for the former Wessex and South West Regions are available from the NRA Regional Office, Public Relations Department.

5.3 GROUNDWATER PROTECTION OBJECTIVES, CONTINUED

5.3.2 Local Perspective, continued

The policy areas listed earlier are now considered in more detail in the context of this plan.

- Physical disturbances of aquifers will include activities such as mineral extraction (the mineral must be worked where it is planned rather than put in a zone as with other industrial development) and construction projects involving excavation work. Other construction proposals can only be considered as and when they are put forward. The NRA can influence the proposals through its role as a Planning consultee and, where appropriate, through its own licences and consents. It should be noted that some gravel workings may offer opportunities for water storage and play a role in water resources development.

- Waste disposal on land takes place at a number of locations in the catchment. The major impact on NRA interests is in respect of groundwater, but there is also the possibility of pollution to surface water, and the interruption of surface water drainage. The NRA is a statutory consultee to both the Planning and Waste Regulation Authorities for such proposals, and will exercise the PPPG through these controls.

- Contaminated land has not been identified as a particular problem in the catchment. If any sites are identified, the relevant policies will be implemented.

- Disposal of sludges and slurries to land includes wastes from agriculture, industry and sewage treatment. Provided the activities conform to certain criteria, there are no statutory controls governing them, other than EC legislation covering sewage sludge disposal. Nevertheless, the NRA is committed to limiting this activity in Source Protection Areas, which is being achieved by enlisting the co-operation of disposal contractors in their use of land.

- Discharges to underground strata include both surface water and effluents from agriculture and industry. In many instances this is positively encouraged, as for example where roof drainage from new developments is directed to soakaways to assist aquifer recharge and reduce the 'flashy' discharge to watercourses. Nevertheless, there will also be areas where the aquifer is vulnerable to long term contamination. "No-go areas" for septic tank use are already in force.

- Diffuse pollution is difficult to control but the NRA is working with MAFF to:

  * establish Sensitive Areas under the provision of the Urban Waste Water Treatment Directive, see Appendix 1.6

  * establish Nitrate Vulnerable zones under the provisions of the Nitrate Directive

  * enable the EC 'Set Aside Scheme' to be used to establish buffer zones (see glossary)

5.4 PHYSICAL FEATURES OBJECTIVES

5.4.1 General

To secure the natural fluvial geomorphological processes of the river and its ecological and landscape value against further adverse modification.

To provide the necessary variety of channel conditions, including depth, flow and substrate type, to support the plant and animal communities characteristic of the catchment.

To preserve and protect historic and archaeological features within the river corridor.

To enhance the landscape features and character of the river corridor.

The NRA will operate on the principle of maintaining rivers of high landscape and ecological quality, and rehabilitating those sections which have been degraded.

5.4.2 Local Perspective

Impoundment

The River Avon has been extensively impounded as discussed in Section 4.5 The NRA will aim to review in conjunction with landowners, the need for each impoundment and, consider whether or not they could be removed or replaced with, for example, stepped weirs. In doing so consideration will be given to reducing obstructions to both salmonid and coarse fish.

The River Marden, the Semington and Biss Brooks are also impounded in places. A precedent has been set on the Biss Brook, with the recent removal of 2 sluices.

This review would be consistent with the aim of restoring diversity and naturalness. Further impounding structures will not be encouraged, particularly on those very limited sections which are not currently impounded, as for example at Kellaways.

Restoration of Flood Plain Habitats

The restoration of flood plain wet meadows is seen as a priority, but can only be achieved by working in close co-operation with landowners and grant aiding bodies such as MAFF and the Countryside Commission. Any restoration will need to be achieved without causing additional undesirable impoundment to watercourses.

A suitable strategy would be to concentrate on the conservation of all existing examples, and explore the possibilities of expansion from these sites. A model has already been established on the Summerham Brook, where the NRA has installed a sluice to raise the water table in a field adjacent to an unimproved wet meadow. The landowner has used seed from this site to successfully diversify the floral composition of a previously improved field. The project was grant aided by the Countryside Stewardship Scheme.

5.4 PHYSICAL FEATURES OBJECTIVES, CONTINUED

5.4.2 Local Perspective, continued

Habitat Rehabilitation

To rehabilitate habitats on rivers and sections of rivers where extensive works and intensive agriculture have resulted in a loss of diversity and naturalness. These include the Brinkworth Brook, already the subject of a multi-functional enhancement scheme aimed at restoring 10 km over a 5 year period, and the Dauntsey Brook which supports plant species known to be rare in the Region.

Rehabilitation works which may be appropriate will include the restoration of pool and riffle sequences, alterations to channel shape (particularly in those rivers where past regular dredging has resulted in steep and uniform bank profiles), trees and shrub planting and the creation of buffer zones which will be particularly relevant in the areas of intensive agriculture and arable cultivation.

Wherever possible old river courses should be restored where straightening work has been carried out. Examples exist at Summerlands Farm, downstream of Sutton Benger (Avon Weir) and at Melksham, providing useful models for rehabilitation schemes.

Rivers with high landscape and ecological quality

Those rivers which are of high landscape and ecological quality should be maintained as important features in their own right. This will be achieved through resisting damaging proposals and working closely with riparian owners and users.

Historic Features

To support where appropriate the conservation of historic features associated with the watercourse in the catchment. Some of these structures are scheduled ancient monuments, others are listed. All require to be kept free of damaging vegetation such as trees, shrubs and ivy, as a minimum.

Planning

The NRA will, so far as is possible, ensure that all new and proposed developments within the catchment result in enhancements of river corridor habitats, as is consistent with its stand-alone duty to promote nature conservation. This will involve continuing close co-operation with local authorities and developers. Some Local Authorities have already incorporated these objectives into their Structure or Local Plans.

Enhance riverside environments through town centres and improve their value for education, recreation and landscape amenity. Continue to actively support local action groups and Local Authorities to promote the concept of town centre riverside walks.

5.4 PHYSICAL FEATURES OBJECTIVES, CONTINUED

5.4.2 Local Perspective, continued

Agriculture

Aim to ensure grant aided schemes are targeted effectively. This will include working closely with the Countryside Commission (landscape improvement grants, Countryside Stewardship) and MAFF (long term set-aside and buffer zones).

Increase proportion of bankside tree and shrub cover to help suppress the growth of invasive marginal plants and control bankside erosion.

Increase the area of reedbeds and ensure the conservation of uncommon aquatic plant species.

Fish Passes

When opportunities arise, to provide, if appropriate, fish passes to facilitate the spawning movements of trout and some species of coarse fish.

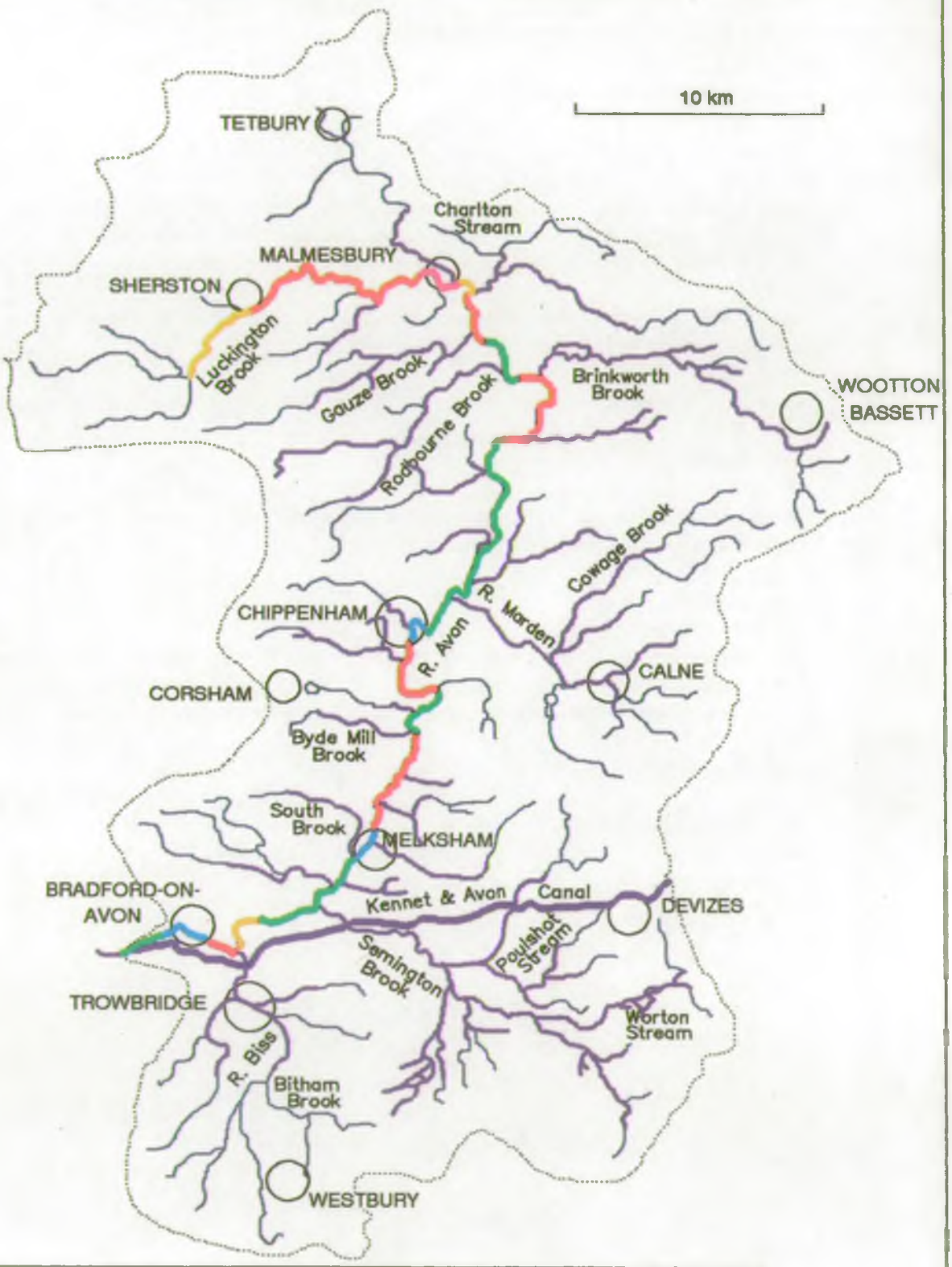
Conservation

Increase knowledge of the catchment by completing River Corridor Survey coverage, obtaining aerial photographic coverage and species information, particularly birds, odonata, mammals, rare plants and crayfish distributions in order to inform decisions on conservation and enhancement.

Recreation

To safeguard access to the rivers for recreation and provide facilities such as riverside open spaces, car parks, landing stages, moorings, angling stages and paths, where appropriate and within budget.

UPPER BRISTOL AVON CATCHMENT
FLOOD DEFENCE - OBJECTIVES



LEGEND		
Main River	Band A	50 or more
Kennet & Avon Canal	Band B	25 to 49.99
	Band C	5 to 24.99
	Band D	1.25 to 4.99
	Band E	0.01 to 1.24

NRA SOUTH WESTERN REGION

5.5 FLOOD DEFENCE OBJECTIVES

5.5.1 General

A system is under development by the NRA to determine the appropriate standard of service, for Flood Defence maintenance. The river system is divided into reaches. An assessment is made of the "land use" by considering the flood plain for each reach, and for each element within it (e.g. road, house, intensive grazing) a score of "House Equivalents" (h.e.) is given. Depending on the score achieved, the reach is placed into one of several Land Use Bands. (see table)

Land Use Band	Description of Typical Land Use
A 50+ he/km	A reach containing the urban elements of residential and non-residential property distributed over a significant proportion of its length, or densely populated areas over some of its length. Any agricultural influence is likely to be over-ridden by urban interests. Amenity uses such as parks and sports fields may be prominent in view of the floodplain's proximity to areas of population density.
B 25-49.99 he/km	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 5-24.99 he/km	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 1.25-4.99 he/km	Isolated, but limited number of residential and commercial properties at risk from flooding. Agricultural use will probably be the main customer interest with arable farming being a feature. In undeveloped pockets of largely urban use, amenity interests may be prominent.
E 0.01-1.24 he/km	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 use. Amenity interests are likely to be limited to public footpaths along or across the river.

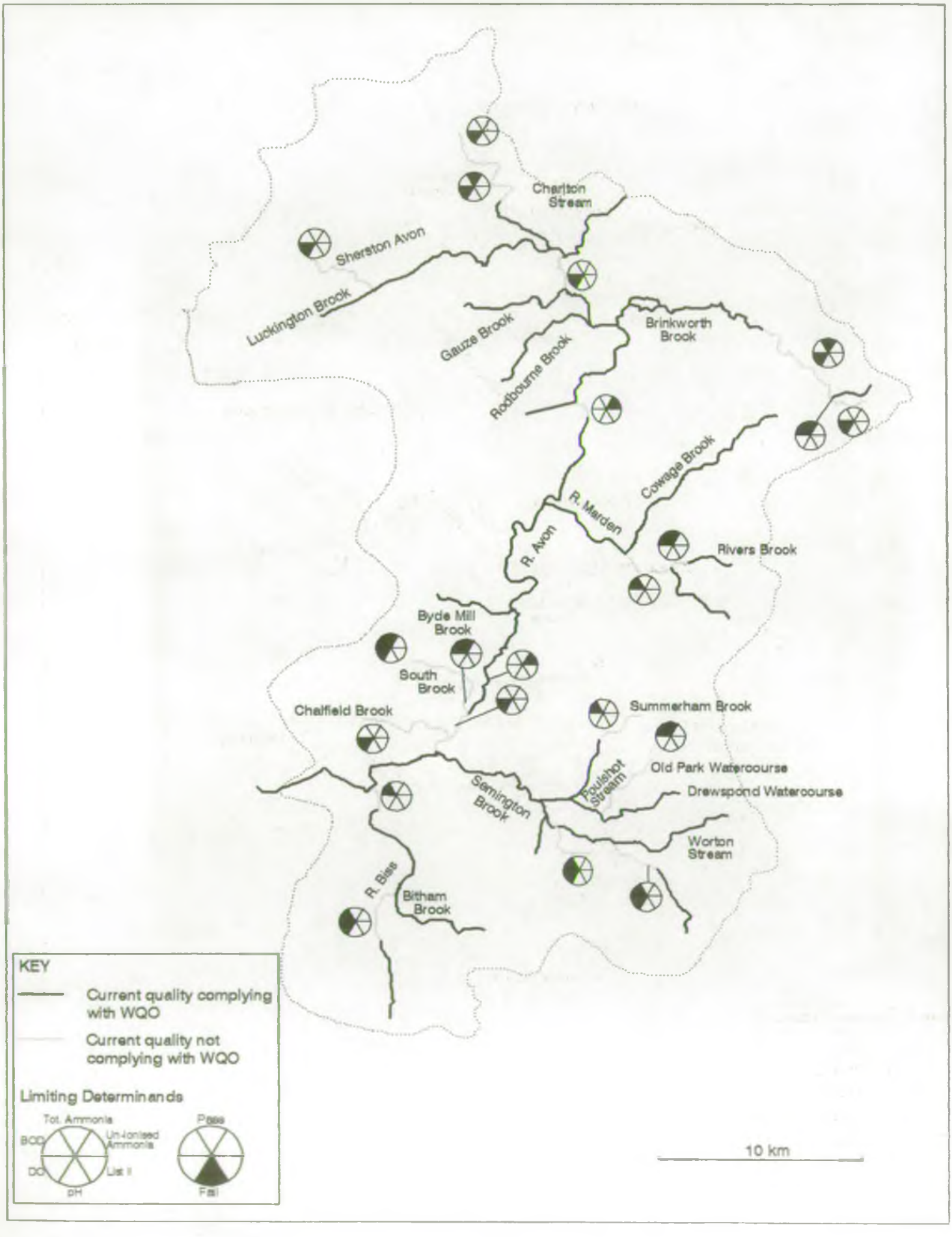
5.5.2 Local Perspective

The River Avon Land Use Bands are shown on the map. The tributaries are still to be assessed. The target standards for each Land Use Band are still being developed. The target standard for urban flood defence schemes is protection against a flood of return period 100 years or more although a lower standard can be accepted if a different level of capital investment resulted in a reasonable Benefit/Cost ratio.

UPPER BRISTOL AVON CATCHMENT
STATE OF CATCHMENT - RIVER ECOSYSTEM USE CLASSES

NRA SOUTH WESTERN REGION

UPPER BRISTOL AVON CATCHMENT
COMPLIANCE WITH RIVER ECOSYSTEM USE CLASS TARGETS



6.1 STATE OF THE CATCHMENT : WATER QUALITY

6.1.1 General

The state of Water Quality in the catchment is assessed against the targets identified in Section 5.1.

6.1.2 Water Quality Objectives

An assessment of current water quality based on the River Ecosystem use classes (Appendix 1.1) in the catchment has been made using data from the routine water quality sampling programme taken over the three year period 1990 to 1992 inclusive, and is shown on the map on the previous page. A comparison of current water quality with the targets identified in section 5.1 shows that there are several stretches where current water quality in certain stretches does not comply with the target for that stretch.

Of the 92 classified river stretches in the catchment, 20 do not meet their objective, of which 7 were caused by STW effluent discharges, 6 by farm effluent discharges, 4 by industrial discharges, 3 by sewerage and related problems, 3 by low flows causing low dissolved oxygen concentrations and low dilutions and 1 by the discharges from a fish farm. The total number of causes is greater than the number of affected stretches as in some cases there is more than one contributory factor. A map showing the non-compliant stretches and determinands is shown opposite.

There are other stretches where the targets are achieved, however, water quality may still be affected locally by man-induced inputs such as farm discharges or by environmental factors such as algal blooms. There is a general problem of diffuse farm effluent discharges causing pollution in the catchment. The Semington Brook and Chalfield Brook catchments are particularly affected in this manner.

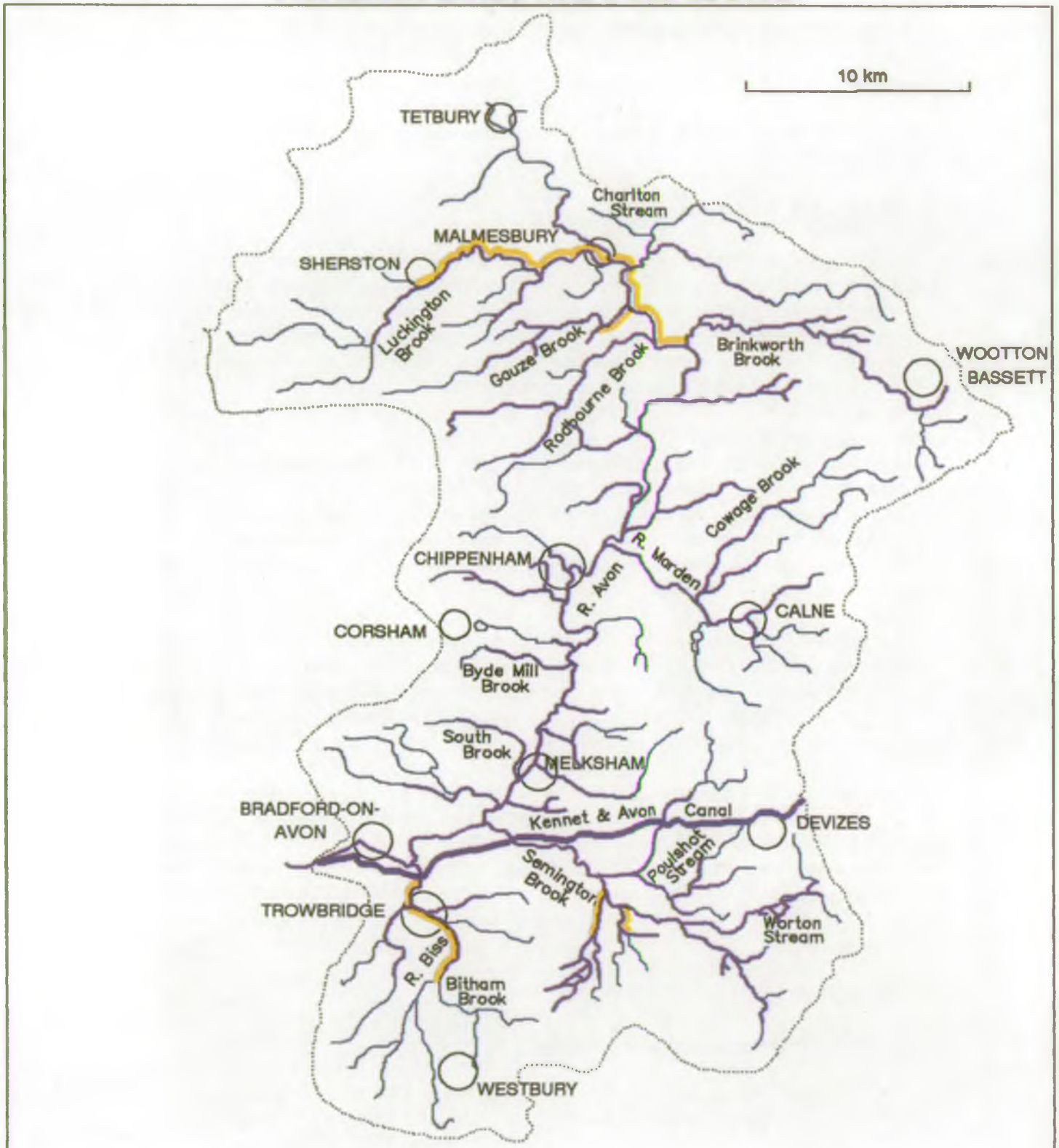
Abstractions occur within the major aquifer in the catchment for public supply, particularly in the north of the catchment. This can result in low flows, especially in the headwaters. Therefore groundwater is pumped into some tributaries to maintain streamflow. This compensation water often has low dissolved oxygen and is not always in adequate quantities. There are a number of large STWs in the catchment. The effluent discharged from these can cause water quality problems, especially when flows are low and there is little dilution.

6.1.3 EC Directives (see Appendix 1)

(i) EC Freshwater Fisheries Directive

In 1992, the water quality at several designated salmonid (game) and cyprinid (coarse) sites exceeded imperative standards laid down in the Directive (see map overleaf and table below).

UPPER BRISTOL AVON CATCHMENT
STATE OF CATCHMENT - WATER QUALITY
FISHERIES DIRECTIVE COMPLIANCE



NRA SOUTH WESTERN REGION

6.1 STATE OF THE CATCHMENT : WATER QUALITY Continued

6.1.3 EC Directives Continued

RIVER STRETCHES NOT ACHIEVING STANDARDS FOR THE EC FRESHWATER FISHERIES DIRECTIVE (1992 SURVEY)		
Stretch	**Failed Parameter**	**Reason**
(i) Salmonid Fishery		
River Avon Somerford	Temperature	Hot weather and low flow
River Avon Westport	Temperature	Hot weather and low flow
Gauze Brook	Dissolved Oxygen	Low flow and diffuse pollution from farms
(ii) Cyprinid Fishery		
Millbourne Stream at Keevil	Non-ionised ammonia	Farm discharges
Semington Brook Semington Mill	Non-ionised ammonia	Silage pollution and wet period following long dry spell
River Biss Brook House	Total ammonia	Farm pollution incident

(ii) EC Dangerous Substances Directive

In 1992 the Rivers Brook downstream of Compton Bassett near Calne exceeded the List II EQS for dissolved iron, resulting from Hills of Swindon sand extraction and de-watering. A new consent has been issued to include iron, zinc and nickel and the quality of the discharge is improving towards full compliance.

Apart from the above failure, all standards were met at all the sites monitored for this directive in 1993.

(iii) EC Urban Wastewater Directive

Orthophosphate and chlorophyll-a concentrations from archive data and from studies carried out in 1993 in the catchment suggest that the river is becoming eutrophic, although diurnal variations in dissolved oxygen concentrations measured in 1993 indicate that exaggerated diurnal cycles in dissolved oxygen associated with eutrophic waters do not occur. Further data is required to establish whether the catchment should be designated as sensitive, and whether high phosphate concentrations in the catchment are attributable to STWs.

6.1 STATE OF THE CATCHMENT : WATER QUALITY Continued

6.1.3 EC Directives Continued

(iv) EC Nitrate Directive

Diffuse nitrate pollution is a problem within the catchment. In the Upper Bristol Avon catchment concentrations of nitrate have exceeded 50 mg NO_3/l at Bradford-on Avon, Monkton House, Melksham, Lacock, Chippenham, Somerford; Malmesbury and upstream of Tetbury STW. Immediately downstream of the catchment boundary, concentrations of nitrate have exceeded 50 mg NO_3/l at the potable supply abstraction at Newbridge, Bath. However, further data is required to support the designation of this catchment as a Nitrate Vulnerable Zone.

(v) EC Surface Water Abstraction Directive

Although there are no designated sites in the Upper Bristol Avon Catchment, the quality of water leaving the catchment should be suitable for abstraction for potable supply because of the presence of the potable supply abstraction at Newbridge. Nitrate concentrations at this abstraction have exceeded the imperative standards laid down in the Directive five times since 1980, ie 1985, 1989, 1990, 1991 and 1992. However, the site passed in 1993.

(vi) EC Protection of Groundwater Directive

Applying the National Groundwater Protection Policy has successfully reduced inputs of List I and II pollutants (see Appendix 1.5) to groundwater such that the Water Companies have not reported any problems with raw water quality at any of their many public supply boreholes in the catchment.

Biological Quality

The ecological quality of the Upper Bristol Avon catchment is monitored using benthic macroinvertebrates. These are small animals which inhabit the river sediments. They are unable to move far and so respond to long-term conditions within the watercourse throughout the year. They provide an overall indication of the ecological condition of the river which complements information on the state of water quality in the catchment provided by chemical monitoring.

Samples are collected from the sites shown in Appendix 2 during Spring, Summer, and Autumn, and are analysed to give a complete list of macroinvertebrate families (taxa) present. The diversity of taxa found is related to water quality using the Biological Monitoring Working Party (BMWP) scoring system. The actual score is compared to a predicted score for a physically similar river of good ecological quality and the difference between what was found and what was predicted is used to classify the river given below:

Biological Class	Description
A	Good
B	Moderate
C	Poor
D	Very poor

The biological classification for the catchment for 1990 to 1992 are shown in Appendix 2. Most of the waters in the Upper Bristol Avon were of good ecological quality, and there have been no stretches which have shown a deterioration in class between 1990 and 1992.

6.1 STATE OF CATCHMENT: WATER QUALITY, CONTINUED

6.1.4 Issues Identified

Issue 1 - Water Quality Downstream of Sewage Treatment Works

a) Poor dilution of organic load resulting in low Dissolved Oxygen, high Ammonia and BOD.

Low dilution is a result of one or more of the following:-

(i) increasing organic load due to growth in the connected population causing the STW to be overloaded;

(ii) low flow due to over-abstraction and below average rainfall.

Those STWs which are degrading downstream water quality are:-.

STW

(i) Wootton Bassett
(ii) Devizes
(iii) Tetbury
(iv) RAF Lyneham
(v) Melksham
(vi) Trowbridge
(vii) Bowerhill

Thingley STW effluent was reducing the water quality in the Byde Mill Brook but its consent has been tightened recently. Improvements in quality have now been achieved and the situation is being monitored to see if quality can be improved sufficiently to sustain the population of brown trout, which were historically present.

Badminton STW discharges to Luckington Brook which suffers from low flows, and in the summer the main composition of the stretch is compensation water and STW effluent. The NRA will liaise with Wessex Water Services to establish the extent of the effect of the discharge from Badminton STW on the water quality of Luckington Brook, and the NRA will also investigate the low flow in Luckington Brook.

Urchfont STW discharges to Worton Stream which has poor water quality, the NRA will carry out investigations to determine the effects of the discharge from the STW, however it is already know that farm pollution affects the water quality of Worton Stream.

Options

Improvements to Wessex Water's STWs are subject to available funding approved by OFWAT. Strategic Business Plans for the next 10 to 15 years' investment (AMP2) have been submitted and OFWAT will declare the associated customer charging base in July 1994. It should be emphasised therefore that any improvements identified under AMP2 can only be provisional until a financial commitment is established.

6.1 STATE OF CATCHMENT: WATER QUALITY, CONTINUED

6.1.4 Issues Identified - continued

STW	Proposed Action
(i) Wootton Bassett	The consent for Wootton Bassett STW has recently been reviewed and tightened. A further tightening of the consent is proposed under AMP2.
(ii) Devizes	The consent for Devizes STW has recently been reviewed and tightened. A further tightening of the consent is proposed under AMP2.
(iii) Tetbury	Introduce aeration into the pumped borehole compensation water downstream from Tetbury STW; and/or Negotiate for Tetbury STW to be upgraded under AMP2 in preference to another site of less importance in terms of impact on water quality; and/or Have a phased approach to the improvement of water quality and extend the timetable for achievement to beyond 2005.
(iv) RAF Lyneham	See Section 3.3
(v) Melksham	Consent for STW is due for review
(vi) Trowbridge	Carry out a consent review with the aim of tightening the consent under AMP2
(vii) Bowerhill	STW has been upgraded and a new consent will be issued.

(b) Nutrient Enrichment

STWs are a major source of the nutrients phosphate and nitrate which can lead to eutrophication of our rivers (see Macrophyte and Algal Growth Issue No 3.12. In order to control this problem, the EC Urban Wastewater Directive (inter alia) seeks to establish "Sensitive Areas", ie those which are worst affected by nutrient enrichment. The UK Government has chosen criteria to identify such areas on the basis of DO, chlorophyll-a, orthophosphate and biological impact. There is also a requirement that the removal of these nutrients before discharge from the STW will result in a significant environmental improvement. Survey work is being carried out to see if the Upper Bristol Avon catchment qualifies as a potential "Sensitive Area". If the Upper Bristol Avon is identified as a potential Sensitive Water then, under current proposals, official designation will be made in 1997. A Water Company would then have five years to introduce nutrient removal at all works above 10,000 population equivalent.

6.1 STATE OF CATCHMENT: WATER QUALITY, CONTINUED

6.1.4 Issues Identified - continued

Those STWs affected would be subject to assessment of their population equivalent (pe) in 1997 but the following 11 STWs are likely to be on the list based on their 1991 population equivalent Malmesbury (10,111); Bradford-on-Avon (10,291) etc.

STW	pe (1991)	STW	pe (1991)
Malmesbury	10,111	Thingley	17,148
Bradford-on-Avon	10,291	Wootton Bassett	17,740
Potterne	10,731	Calne	18,348
Westbury	11,408	Chippenham	30,897
Devizes	15,619	Trowbridge	121,681
Melksham	16,199		

Options

Continue survey work to establish nutrient status of the Upper Bristol Avon with a view to designating it as a Sensitive Area under the Urban Waste Water Treatment Directive.

Issue 2 - Farm Discharges affecting Water Quality

Polluting agricultural discharges are a major problem in this largely rural catchment. The discharges may be accidental discharges of slurry or silage effluent or may be diffuse pollution entering the river via runoff from the land. Excess inorganic fertiliser may contain nitrate and phosphate. Ploughing releases both silt and nutrients normally bound in the soil. Pesticides may also be washed into the watercourses.

Options

Identify farms causing pollution and ensure steps are taken to eliminate the polluting discharges.

Work with MAFF and other bodies towards the establishment of riverside buffer zones.

Continue to investigate sources of pesticide inputs to river. Liaise with pesticide users to improve their practice and switch to less persistent pesticides.

Issue 3 - Discharges from RAF Lyneham

This large RAF station is situated at the headwaters of the Cowage Brook. Here a relatively large STW (950 m^3/d D.W.F connected population approximately 4,600) directs its final effluent into the Strings Watercourse which offers very low dilution (0.3). Also the STW, being an MOD site, is exempt from the requirement for a discharge consent. This is the main reason for the upper reaches of the Cowage Brook and the Strings Watercourse having an unacceptably low standard of water quality.

A further problem is that of the surface water discharges from the runway which contain rubber, oil and, in winter, de-icing fluids. There are also occasional large scale fuel spillages. These discharges have a damaging impact on the small watercourse.

6.1 STATE OF CATCHMENT: WATER QUALITY, CONTINUED

6.1.4 Issues Identified - continued

Options

Negotiate with the MoD to improve the performance of the STW and schedule the appropriate works.

Ensure RAF Lyneham has improved emergency measures to deal with accidental spillages.

Negotiate with the MoD to prevent pollutants eg de-icing fluid and aircraft fuel entering watercourse.

Issue 4 - Compton Bassett Sand Excavation and Landfill Sites

There has been a long term history of sand extraction with restoration by landfill in the Compton Bassett area. The 'Old' Sands Farm landfill was adopted by Wiltshire County Council (WCC) in the early 1970's and was operated as a 'dilute and disperse' landfill with no containment measure for leachate. A further landfill facility known as the Compton Bassett Landfill Site was initiated by WCC at this time within sand excavations adjacent to Sands Farm.

During 1983 some evidence of leachate contamination of groundwater moving off-site into adjacent sand workings and to surface watercourse resulted in remedial works taking place including the containment, abstraction and treatment of leachate. Subsequent landfill operations have been based on containment principles using the underlying Kimmeridge Clay to provide containment bunds.

Hills Aggregate have excavated sand deposits for the past 10 years from a 12 ha site to the south of the Compton Bassett Landfill. The deposits are worked dry, the groundwater abstracted is discharged after settlement to the Honeyball watercourse and is controlled by a consent to discharge. There have been problems in consent compliance over recent years necessitating improved treatment for suspended solids, pH control and iron removal. The consent has been revised to include limits for List II metals and enforcement work is on-going to achieve consent compliance.

There is some evidence that groundwater to the north and up hydraulic gradient of the Hill's sandworking may be contaminated by past or on-going landfill operations. This matter has been brought to the attention of WCC Waste Disposal Operations who have installed a groundwater interception sump to retain groundwater flowing from the vicinity of the 'old' Sands Farm landfill. The NRA has issued a consent to discharge groundwater to local surface waters to Wiltshire County Council.

The NRA has also made representations to WCC Waste Regulation Authority (WRA) to modify the existing waste disposal site licence for the Compton Bassett landfill to require the provision of a comprehensive groundwater monitoring regime. WCC Waste Disposal Operations are presently preparing a Leachate Management Plan which, subject to NRA and WRA approval, will be incorporated into a modified site licence. The NRA has requested that the plan should make provision for contingency measures to treat or dispose in an approved manner groundwater that fails to meet discharge consent standards.

6.1 STATE OF CATCHMENT: WATER QUALITY, CONTINUED

6.1.4 Issues Identified - continued

Options

Negotiate with Hills of Swindon to achieve the necessary consent compliance for the sand quarry dewatering discharge.

Negotiate with Wiltshire County Council Waste Regulation Authority to have improved groundwater monitoring and leachate management provisions within the site licence.

UPPER BRISTOL AVON CATCHMENT
STATE OF CATCHMENT - WATER QUANTITY

LEGEND

- Main River
- Kennet & Avon Canal
- Length of river influenced by abstraction
- River flow influenced by Oolite drainage into Box Tunnel - lost to catchment

NRA SOUTH WESTERN REGION

6.2 STATE OF THE CATCHMENT: WATER QUANTITY

6.2.1 General

Where water abstraction requirements are competing directly with other river uses and/or aquatic needs, it is essential that the available water resources are apportioned to sustain a suitable balance. The charts overleaf illustrate the main inputs and abstraction of water from each of the sub-catchments within the Upper Bristol Avon catchment. These are only an initial assessment of the quantitative availability of water resources within the catchment and do not attempt to examine the environmental consequences resulting from these abstractions.

There does appear to be scope for further development of resources if this can be undertaken without detriment to both the water environment and other water users. This is likely to involve a move from up-catchment groundwater supplies to downstream surface-water intakes that afford greater and more extensive protection to other river uses. This would however involve the need for water storage facilities near the intake points.

Another increasing demand for water is coming from the restoration of canals in the catchment. These are the Kennet & Avon Canal which is already open (see Issue 3.7 below) and the Wiltshire and Berkshire Canal which is gradually being restored over a 30 year period.

6.2.2 Rainfall

Residual rainfall, or that portion of the rainfall that is not lost through evapotranspiration, together with the catchment's ability to store water, are the dominant factors affecting the availability of water resources within the catchment. This availability is then somewhat reduced by the exploitation of resources through surface and groundwater abstractions.

The annual rainfall fluctuates to a great extent from year to year (see graph) and also within longer-term trends.

Sub-surface storage within the Jurassic (Oolitic) limestones and Chalk/Upper Greensand aquifers becomes important during periods of low rainfall, however, over longer drought periods even these vast underground storage chambers begin to suffer from exploitation. This will in turn affect rivers that rely on groundwater to supplement their flows.

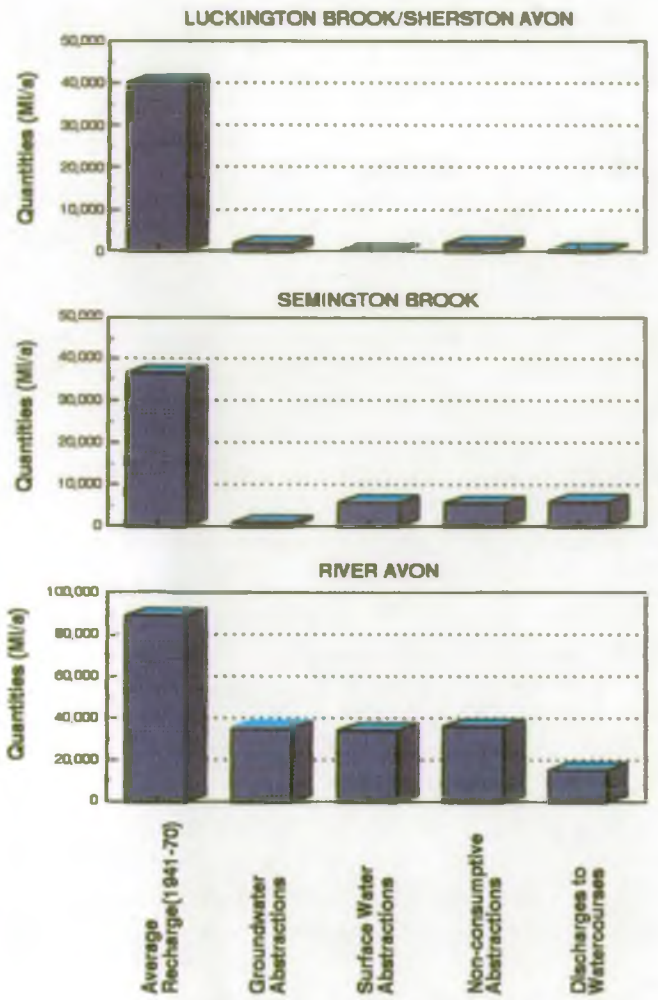
6.2.3 Abstraction Licences

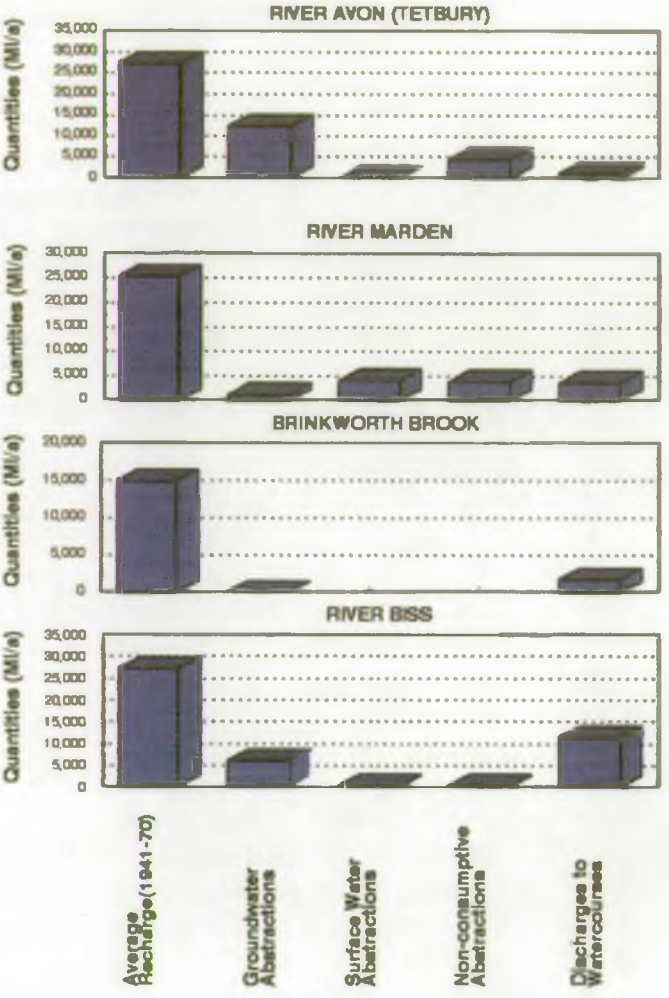
The majority of water abstracted from resources within the catchment is used for either public water supply/river compensation, local power generation, fish farming or industrial purposes. Each of these uses is subject to licensing requirements even if, as in many situations, the abstraction involves negligible water loss since the abstracted water is returned to the water body. In granting new licences, existing licences must be safeguarded as must the other uses of the river environment.

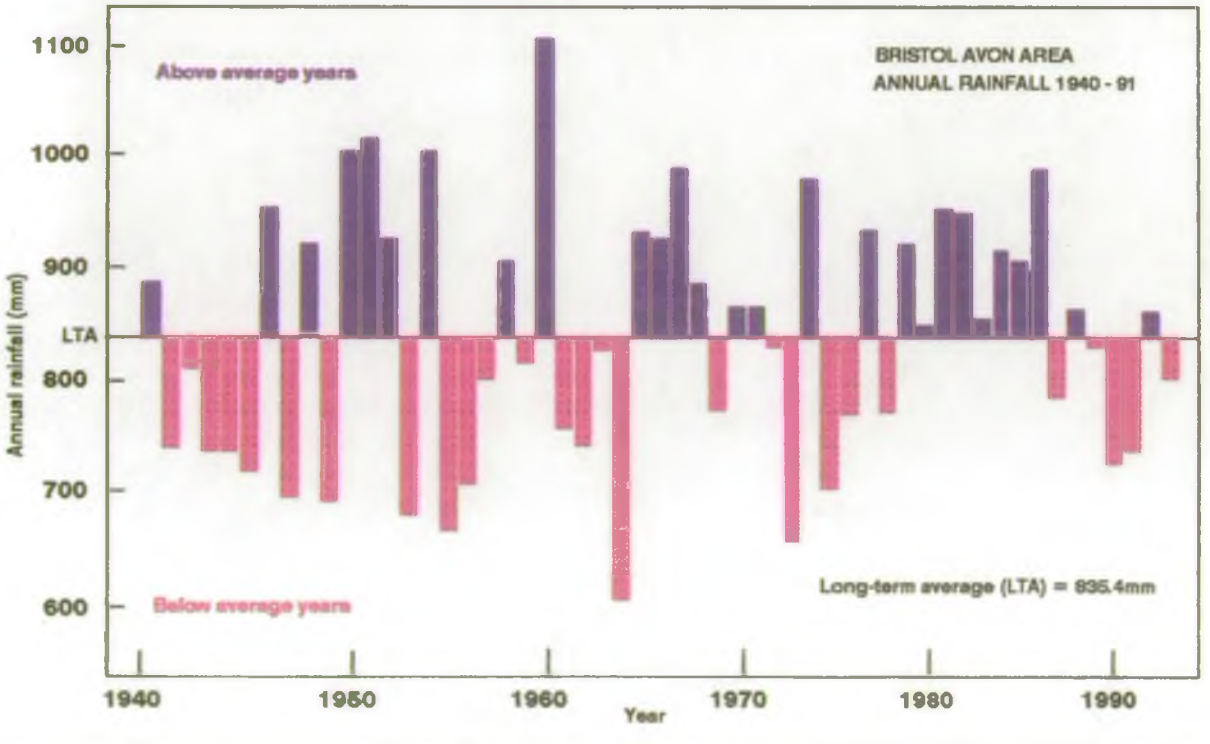
6.2.4 Groundwater Resources

The high quality and low cost of development of groundwater sources has ensured that they are used in preference to surface water alternatives wherever appropriate and available. This provides an explanation as to why all the major public water supply abstractions within the catchment are taken from the ground.

UPPER BRISTOL AVON CATCHMENT
WATER QUANTITY CHARTS







NRA SOUTH WESTERN REGION

6.2 STATE OF THE CATCHMENT: WATER QUANTITY, CONTINUED

6.2.4 Groundwater Resources - continued

Large abstractions occur within the two major aquifers. Use of aquifer storage for abstraction purposes can modify the regime of streams and rivers that are in hydraulic connection with the underlying rocks. Concern is being expressed at the amount of water that is being abstracted from the Oolite aquifers beneath the upper reaches of the Avon and its tributaries. The onset of the Malmesbury Groundwater Scheme, licensed in 1980, increased abstraction from the Oolites whilst providing stream compensation (see the map on opposite page for the sections of river affected by abstractions). The main concerns and beliefs are that the period of low flows is increasing because of abstractions reducing groundwater heads and hence baseflow contributions from the Oolites to surface streams. Conditions are now being reviewed within a river management study endorsed by the NRA.

6.2.5 Surface Water Resources

Most large surface water abstractions within the catchment do not involve any significant losses of water, although small reaches may be affected where the abstracted water is returned downstream of the abstraction point. None of these non-consumptive abstractions, used for fish farming, industry and local power generation, are restricted by protected river flows. However, some of the abstractions are limited in summer months.

6.2.6 Issues Identified

Issue 3.5 - Impacts of abstraction on river flows

For several years concerns have been expressed about the effect on river flows of the wellfield providing public water supplies from the Limestones in the Malmesbury area. These groundwater resources provide supplies both for Bristol Water and Wessex Water and comprise a significant component of the aggregate resources available to these companies. Bristol Water is authorised to abstract up to 22 Ml/d while Wessex Water may abstract up to 34 Ml/d for water supply purposes. In addition Wessex Water has obligations to compensate river flows by pumping up to 26 Ml/d to the river from a maximum of 8 boreholes when critical low flows occur.

The consequences of groundwater abstraction are a reduction to the discharges that would naturally issue from springs and an extension of the season of low river flows. Augmentation of rivers by pumping from boreholes needs to succeed in a strategy of sustaining seasonal low flows at an environmentally acceptable level. Over the past decade this success has not been witnessed.

Action Taken

The situation was reviewed by the NRA's predecessors with no clear conclusion as to the need for further work. The NRA re-examined the evidence and in 1991 concluded that there were significant defects in the design and management arrangements for the wellfield which led to unsatisfactory provisions for river flow. The techniques employed in the NRA study were, however, highly dependent on historical assumptions of catchment behavioural responses which failed to give an adequate explanation of the virtual drying-up of the Sherston Avon at Malmesbury in 1990.

6.2 STATE OF THE CATCHMENT: WATER QUANTITY, CONTINUED

6.2.6 Issue 3.5 - Impacts of abstraction on river flows - continued

Action Taken

A more detailed investigation was initiated by the NRA in 1992. For this purpose Consultants W S Atkins were engaged to provide a comprehensive computer model of catchment responses and to use new data available from groundwater pumping tests and from exploratory boreholes constructed by the NRA to re-examine localised geological characteristics. During the course of this investigation great attention was given to consultation with the local population, particularly with those who know the river system well from a historical perspective or from objective recent observation.

The W S Atkins final report was received in April 1994. It reports on the evidence of declining conditions of the river environment with respect to habitat and amenity value and includes a plan of action to secure necessary improvements. The report is not confined purely to water resources aspects but embraces other matters such as water quality and land-use management practices which may have contributed to any environmental detriment.

Options

From the conclusions of the preliminary NRA study it is clear that changes will be necessary to current authorisations for water abstractions. These may take the form of NRA proposals for a change to abstraction licences held either by Wessex Water or Bristol Water, or both. It is too early to declare the extent or nature of such changes or how these will be economically justified within the context of the improvements to the aquatic environment which might result.

It is however quite clear that unless such changes are unopposed by the water supply companies the financial cost to the NRA in the form of compensation payments may be very considerable. For this reason the NRA advised both companies in November 1992 of the wisdom of submitting plans to OFWAT for an increase in their allowable charges; that they might accommodate increased costs internally without detriment to shareholders and manage a period of change to a plan and timetable in agreement with the NRA objectives.

If changes were required only to the rules for augmentation of river flows, without adjustment of the groundwater used for public supplies, then an early solution could be expected. If, however, downward variation is required of the quantities used for public water supplies the implications are far-reaching and tied with the issue of meeting the increasing demand for water resources (Issue 3.6). A loss of water resources to the water supply undertakings would ultimately need to be made good at an alternative location. One option is that of recovering the lost quantities from a direct river intake lower in the catchment, with the possibility of seasonal variation in groundwater consumption and indeed further augmentation of river flows in the headwaters from the boreholes used currently for public water supplies. There is an evident need for surface water storage facilities in the Lower Avon for an acceptable transfer from groundwater to surface water dependency.

6.2 STATE OF THE CATCHMENT: WATER QUANTITY, CONTINUED

6.2.6 Issue 3.6 - Increasing demand for Water Resources

Increased abstraction of water from surface and groundwater sources by water supply companies has been a trend in the Wessex Region for decades. It reflects the increasing population and the higher consumption by individuals as well as, to a lesser degree, an increase in industrial use. Direct abstractions by other users, notably for industrial or agricultural purposes, are a regular consideration but rarely emerge as proposals that might have other than a localised impact on water resources.

Current forecasts of future water consumption indicate a continuing increase in demands for public water supplies. Predictions of the needs for private abstractions are difficult (they anticipate market forces vulnerable to external change) but it may be inferred that these also will increase if County Structure Plan aspirations for economic development are realised.

The sole supplier of public water supplies to the Upper Avon area is Wessex Water Services, abstracting groundwater from a number of boreholes in the area. Bristol Water also abstracts groundwater from the area and these supplies, together with some of Wessex Water's, are not returned to the river system within the catchment area.

In order to satisfy reasonable increased demands in public water supplies and for private abstraction it will be necessary to identify potential new sources of water whence abstractions will not be at the expense of other river users.

Action Taken

The NRA is conducting an examination of future water resource development strategies at two levels : regional and national. These studies are being conducted in parallel. The National Water Resources Development Strategy was published in March 1994 and the Regional Strategy will be published in the summer of 1994. The intention is to provide a coherent framework for the development of environmentally acceptable sources of water to meet demands expected up to the year 2021.

Forecasts of public water supply consumption prepared at the inception of the NRA are being reviewed and refined, incorporating a nationally consistent set of procedures, with the object of agreeing the results as far as is possible with all water supply companies. These forecasts will have regard to the potential for improved management of water consumption through improved leakage control and domestic metering.

The Regional Strategy pays particular regard to the extent to which new sources may be available for licensed abstraction on the local scale. The National Water Resources Development Strategy examines the scope and need for trans-regional developments which may involve the transfer of water resources over large distances to satisfy anticipated deficits which would otherwise be difficult to make good from new regional sources.

Options

While it is premature to pronounce on the optimum arrangement for resolving this issue it is pertinent to this catchment management plan to convey the basic principles to which the NRA adheres at the present time.

6.2 STATE OF THE CATCHMENT: WATER QUANTITY, CONTINUED

6.2.6 Issue 3.6 - Increasing demand for Water Resources - continued

In considering the need for future new sources of water it is essential that the full implications of the situation described in Issue 3.5 are acknowledged. If a downward variation to the quantities licensed either to Wessex Water or to Bristol Water, or both, is a requirement to remedy low flow problems in the Upper Avon and its tributaries then this would accentuate the deficit emerging from the balance of resources to meet future demands. Wessex Water has a licence to abstract water from the Lower Avon downstream of Bath which could justifiably be increased to abstract any water sacrificed by a commensurate decrease in groundwater abstractions; in fact a positive gain may be allowable should a scheme be developed that could include the use of existing groundwater sources as instruments for periodically enhancing river flow augmentation. The difficulties for Wessex Water concern the provision of a satisfactory volume of storage in the Lower Avon as a buffer to pollution incidents and the additional costs associated with higher levels of water treatment and with changes to the distribution system.

Bristol Water has been identified as a major beneficiary to be considered within the National Strategy for trans-regional supplies. Already a large element of its total water resources is derived from the Gloucester and Sharpness Canal as supported from the regulated River Severn and its dependency on this source will increase. The Company has also considered a future option of augmenting its Chew Valley Lake by pumping from the Lower Avon. In the event of a requirement to reduce its abstraction of groundwater in the Malmesbury area, the Lower Avon option affords the opportunity for no detriment to its aggregate resources, though similar extra costs to those confronting Wessex Water would apply.

In any event the options to be examined in order to sustain the high standards of public water supplies provided by the two relevant water supply companies must include a rational perspective of the genuine need for water rather than an assumption that it is not a finite resource. Control of leakage and pricing of excessive use are legitimate requirements in the interests of the community as a whole.

Issue 3.7 - Kennet and Avon Canal

Restoration of the Kennet and Avon Canal, largely stimulated by the Kennet and Avon Canal Trust, has progressed steadily over the past few years to leave one major section in North Wiltshire due for completion. This section, the 15 mile 'Long Pound', between Devizes and Crofton Peak, is currently being examined by British Waterways with a view to structural repairs and water supplies to provide all-seasons navigation. In the absence of a currently effective water supply system, water resources are required to maintain the navigation. Even with improvements to the waterway the residual leakage rates and requirements for locks will still leave a substantial water demand.

6.2 STATE OF THE CATCHMENT: WATER QUANTITY, CONTINUED

6.2.6 Issue 3.7 - Kennet and Avon Canal - continued

Action Taken

The NRA South Western Region and its predecessor Authority have been in periodic discussion with British Waterways since 1986 when it was first decided that the Canal should be resourced by back pumping from the Lower Avon at Claverton near Bath and this system has been implemented to the foot of the Devizes flight of locks. To the east of the Long Pound water is supplied from the Kennet catchment in Thames Region with water from Wilton Water Springs near Wootton Rivers being available to service the flight of locks at Crofton Summit at the eastern end of the Long Pound. Additional water to maintain a navigable depth in the Long Pound and to service the Devizes flight of locks is required and the NRA was requested to consider whether this should be sourced from the Bristol Avon or the Hampshire Avon Catchment.

Options

A significant proportion of a new water supply to the Long Pound would be used to operate the locks at Devizes. For this reason the options of groundwater abstractions from the Hampshire Avon Catchment or the interception of streams in that catchment or the Upper Bristol Avon area were considered to be unacceptable since the residual lockage water would be lost to headwater areas that can ill afford it. At the same time it is apparent that the present condition of the 'Long Pound' should be improved to minimise leakage.

The NRA has recommended that the 'Long Pound' be sourced by a continuation of the present sequence of back-pumping arrangements starting at Claverton on the Lower Bristol Avon. This would eliminate interference with headwaters streams and provide a reliable source in all but the driest seasonal weather, when it might reasonably be expected that a public water supply licence downstream of Bath should have priority of entitlement over recreational purposes. The impact on the Upper Bristol Avon would be negligible though some minor benefits emerge from any leakage from the canal in the section between Devizes and Bradford-on-Avon.

Issue No. 3.8 - Improving Flow Distribution

Nature of Problem

There are locations where river flows are diverted between two or more channels as a result of man-made structures. In some cases the distribution of flows suffers from inadequate flow control resulting in improper flow distribution. Two such locations provide opportunities for improvements.

a) Tetbury Avon - Holloway Bridge to Wynyards Mill/Back River

Problem: Inadequate flow currently reaching the Back river.

Options

In cooperation with riparian owners and the NRA-Malmesbury Avon Liaison Group, review the operation of the relevant structures and action identified agreed improvements.

6.2 STATE OF THE CATCHMENT: WATER QUANTITY, CONTINUED

6.2.6 Issue 3.8 - Improving Flow Distribution - continued

b) Mill Farm Trout Lakes, Great Cheverell. Semington Brook/Corner Channel.

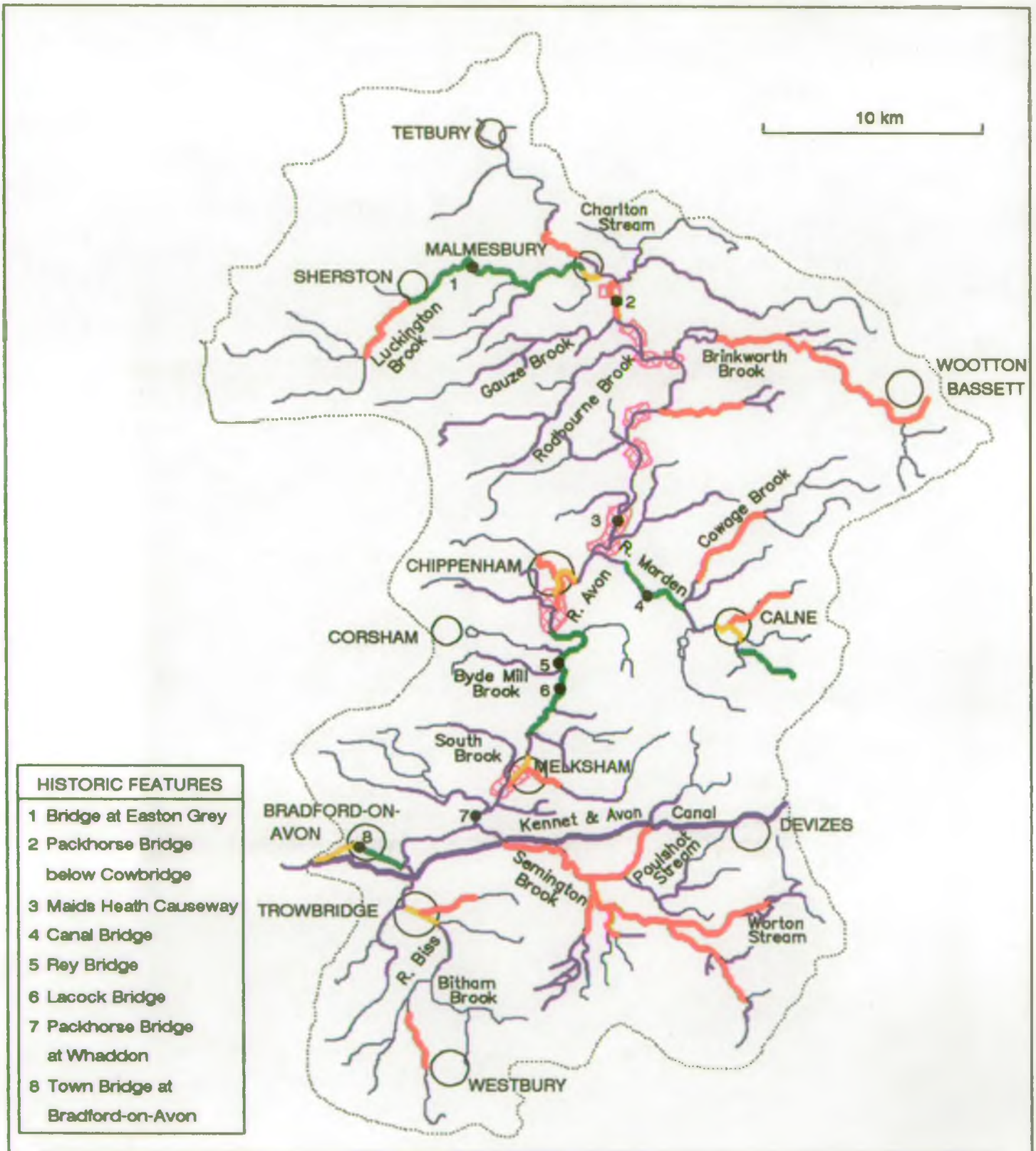
Problem: Excessive flow diversion from the Semington Brook. An existing boulder dam which is used to divert flows from the Semington Brook into a Corner Channel does not permit satisfactory flow control. The diversion of water is authorised by licences issued in 1989 and 1990, which contain inadequate conditions for flow control.

Options

In cooperation with the riparian owners to develop an action plan which would include:

(i) The replacement of the existing licences with a new Abstraction licence, containing adequate conditions for control of water distribution.
(ii) The removal of the existing boulder dam.
(iii) The development of a river channel management programme for this reach of river.

UPPER BRISTOL AVON CATCHMENT
STATE OF CATCHMENT - PHYSICAL FEATURES



HISTORIC FEATURES
1 Bridge at Easton Grey
2 Packhorse Bridge below Cowbridge
3 Maids Heath Causeway
4 Canal Bridge
5 Rey Bridge
6 Lacock Bridge
7 Packhorse Bridge at Whaddon
8 Town Bridge at Bradford-on-Avon

LEGEND	
Main River	Stretches with high quality habitat
Kennet & Avon Canal	Stretches where habitat rehabilitation may be appropriate
Unimpounded section	Stretches with recreational/educational potential
	Historic features (see above left)

NRA SOUTH WESTERN REGION

6.3 STATE OF CATCHMENT - PHYSICAL FEATURES

6.3.1 General

The aspects of Physical Features for which objectives were identified in Section 5.4 are considered here and issues which arise are then outlined.

6.3.2 Local Perspective

Impoundment

The River Avon is an historically impounded watercourse, modified initially by past industrial use as a power source for milling, and more recently by extensive land drainage schemes and agricultural intensification. The change in the use of the river from a power supply to principally an amenity resource brings with it the need to review the function of each impounding structure. The flood gate structures installed from 1950 - 1970, particularly those in prominent town centre locations such as Chippenham and Melksham are visually intrusive, potentially dangerous and expensive to maintain.

Flood Plain Habitat

As a result of the extensive land drainage schemes of the past there are very few wetland habitats remaining in the catchment. This has an indirect effect on the conservation of water resources and makes the Avon more prone to flash flooding as well as accentuating the problem of low summer flows in periods of drought.

Habitat Rehabilitation

A high proportion of watercourses in the catchment have been subject to land drainage and flood alleviation schemes often involving dredging, straightening and the removal of features, for example, works at Chippenham. The channel modifications have resulted in a loss of diversity and landscape value.

There is considerable scope for physical improvements through habitat rehabilitation work, with major potential benefits to conservation, fisheries and flood defence maintenance e.g. Dauntsey Brook, River Avon - Monkton Park, Chippenham, Great Somerford to Malmesbury, and below Melksham.

Rivers with high landscape and ecological quality

The map opposite identifies river reaches which are of high quality habitat. Of particular interest are the Sherston Avon which flows over the Oolitic Limestone and represents an uncommon river type within the catchment, the headwaters of the River Marden which is the only section of true chalk stream, and the unimpounded sections of the Bristol Avon from Kellaways to Peckingell and at Lacock.

6.3 STATE OF CATCHMENT - PHYSICAL FEATURES, CONTINUED

6.3.2 Local Perspective, continued

Historic Features

There are very few historic features associated with watercourses in the catchment. All are therefore of importance and worthy of conservation. They include: the bridge at Easton Grey, the Packhorse Bridge at Cowbridge and at Whaddon on the River Avon, the town bridge at Bradford-on-Avon, the bridges at Lacock and Reybridge, the old canal aqueduct over the river Marden and Maud Heath's causeway at Kellaways. There is also a medieval village at Whaddon.

Agriculture

There has been a significant increase in intensive farming and conversion of pasture to arable in the catchment over the last 50 years. The resultant gradual diminution in bankside tree and shrub cover has led to a widespread build up of invasive aquatic plant species, whilst the increased silt loading has an adverse effect on plant communities and water quality. The loss of corridor vegetation has reduced diversity and led to bank instability in many places. This loss of bankside cover has led to the need for a Flood Defence maintenance programme of regular spraying to reduce aquatic plant growth which traps excessive amounts of silt. The removal of this aquatic plant (weed) growth is severely limiting to the recolonisation of the river by species such as the otter.

Planning

The earlier lack of Local Plan policies to define, protect and enhance river corridors, particularly through town centres and industrial areas, has led in the past to environmental degradation, with developments backing onto and obscuring the rivers. The town centre flood alleviation schemes of the past, carried out when environmental awareness and legislative duties were less strong, have in general tended to exacerbate the situation. However since then, greater understanding of environmental problems has been demonstrated by the Local Planning Authorities (LPAs) in carrying out their development control function which has led to improvements in the design of recent schemes. The DoE/Government have also encouraged the LPAs to take more stringent measures in the design and control of such schemes.

Fish Passes

The Upper Bristol Avon does not support migratory salmonids and there is therefore no urgent requirement to construct fish passes or improve existing passes. However there are numerous obstructions throughout the catchment which may impair the spawning movements of brown trout and some species of coarse fish. When opportunities arise the NRA will seek to ensure that fish passes are provided when appropriate.

6.3 STATE OF CATCHMENT - PHYSICAL FEATURES, CONTINUED

6.3.3 Issues

Issue 3.9 - River Restoration

General

Issues concerning erosion, silt deposition and excessive aquatic weed growth have been identified at several locations in the catchment, described below.

1) Brinkworth Brook Restoration Project - Nature of Problem

Past adverse alterations to the river, principally as a result of the construction of the M4 when the brook was realigned and its profile changed to take increased flows.

Options

The NRA has an ongoing initiative, started in 1992/93 to enhance the watercourse in collaboration with landowners and with assistance from grant-aiding bodies. The aim is to restore the wildlife and landscape value of the brook whilst reducing the amount of regular maintenance that is required.

Principal tasks envisaged which have general applicability include:-

- Installation of low boulder weirs to add diversity to channels.
- Planting native species of trees and shrubs to provide shade to suppress the growth of aquatic plants (weeds).
- Excavation of new cattle drinking areas.
- Development of ponds in cut-off meanders.
- Creation of marsh land areas.
- Creation of high level flood relief channels.
- Persuade farmers to pull back fencing from bank top and change management of bankside shrubs so that they are able to grow more naturally.
- Pollarding old willows in danger of collapsing.
- Conservation and enhancement of old meander loops, including restoration of flow.

2) Dauntsey Brook - Nature of Problem

a) The watercourse was diverted and reprofiled between 1968-70 to take increased runoff from the M4 motorway. All tree cover was removed.

b) Property at Dauntsey Green is at risk from a one in ten year return period flood. Intensive maintenance of the Brook is thus required (silt removal, weed cutting, bank cutting, riverside spraying). However there is a long term need to reduce this maintenance requirement.

Options

Tree planting for shade to suppress weed growth.

6.3 STATE OF CATCHMENT - PHYSICAL FEATURES, CONTINUED

6.3.3 Issues, continued

3) Malmesbury Avon - Nature of Problem

Local residents of Malmesbury have expressed concern regarding the amenity value of the river believing it to be adversely affected by river widening at Old Station Yard car park and the replacement of Old Mill hatches with a weir. These changes are reported to preclude a previously available river flushing mechanism and have resulted in a lowering of water levels.

Options

A study is required to review the options available for modification of present arrangements and to assess their effectiveness in bringing about an improved amenity value for the Town. This must allow for involvement of the public, Town Council, Civic Trust, Malmesbury River Valleys Trust and other interested parties to obtain a consensus view on the way forward.

4) Monkton Park, Chippenham - Nature of Problem

The River Avon through Monkton Park, Chippenham, was regraded as part of the Chippenham scheme. By 1963, the channel was already silting up, and was dredged by the River Authority, later the Water Authority, on average once every five years. The new channel created a wide ponded section which encouraged a Sailing Club to be set up. Since ceasing dredging as it is not necessary for flood defence purposes, the Sailing Club and local fishermen have regularly complained about the channel's attempts to revert to a natural one. The Sailing Club carries out occasional weed clearance with NRA consent and would like the NRA to resume dredging to keep a length open for sailing.

Options

It is understood that the wildlife and landscape potential of the riverside through Chippenham is under consideration by North Wilts District Council. The NRA will seek to work positively in bringing about rehabilitation measures with interested parties.

5) Somerford to Malmesbury - Nature of Problem

From 1931 to 1950 the River Avon (Bristol) Catchment Board carried out a programme of clearance of bushes and trees along the River Avon. The river was realigned, resectioned and regraded between Seagry Mill and Dodford Farm, (1950 to 1952), between Great Somerford and Dauntsey, (1955 to 1960), and Great Somerford and Kingsmead Mill (1962). Hatches between Great Somerford and Kingsmead Mill were replaced by tilting gates. Regrading was carried out for the whole of the River Avon between its source and Avonmouth. From the end of the scheme until 1985, as the river started reverting to its natural channel, the River Authority, (later Water Authority), received many complaints about bank slips and silt build-ups. The last revetment work to try to counter this erosion was completed with the introduction of large boulders downstream from Kingsmead Mill in 1987. Since 1988, the channel instability has ceased. Another problem is that low flows and lack of shade encourage significant emergent weed growth on this length.

6.3 STATE OF CATCHMENT - PHYSICAL FEATURES, CONTINUED

6.3.3 Issues, continued

5) Somerford to Malmesbury - Nature of Problem, continued

Options

Rehabilitation of the river corridor with tree planting for shade and the provision of marginal shoals and reed beds. The NRA seeks to work positively with organisations such at the Malmesbury River Valleys Trust to bring about these improvements.

6) River Avon, Melksham - Nature of Problem

In 1963, the Bristol Avon River Authority completed improvement works to the River Avon in the vicinity of the Town Bridge at Melksham. It was envisaged that to adequately protect Melksham, further works from Melksham to Staverton would be necessary, and this was borne out when Melksham was flooded in 1968, albeit to a lesser extent than 1960.

When the Melksham Western Relief road was constructed between 1971 and 1983, the River Avon bridge crossing was constructed on the alignment of the proposed Melksham to Staverton scheme and the river realigned between the Town Bridge and the South Brook confluence.

In 1978, a report presenting the cost and benefits of the remaining work between Melksham and Staverton was produced. Based on the report's findings, proposals for further works were abandoned as economically and environmentally unjustified. This left a 30 metre wide channel which terminated at a right angle bend into a 12 to 15 metre wide channel. One month after its completion, the channel in the vicinity of the Western Relief Road had silted significantly, and this process has continued, raising many complaints about the unsightliness of the channel.

Options

River rehabilitation is clearly desirable and proposals for Town Centre re-development will be explored to try to rectify this situation.

Issue 3.10 - The effects of intensive agriculture on river corridor

Nature of Problem

Agricultural intensification and accompanying land drainage schemes since the 1940's have resulted in the loss of wet meadows and the reduction of the river corridor in many places to a thin strip of bankside trees, shrubs and tall herbs. The associated river engineering works were unsympathetic to landscape and nature conservation resulting in long stretches of the Bristol Avon being artificially straightened and having unnaturally regular bank profiles.

River corridor biological diversity is reduced by the increasing use of chemicals; land ploughed to the river bank increased silt loading in the river and can lead to pressure to remove/trim bankside trees. Intensive (over) grazing impoverishes bankside vegetation reducing dominant species to nettles and tall herbs.

The restoration of the Bristol Avon flood plain habitats and river corridor biological and morphological diversity poses a major challenge.

6.3 STATE OF CATCHMENT - PHYSICAL FEATURES, CONTINUED

6.3.3 Issue 3.10 - The effects of intensive agriculture on river corridor, continued

Options

Work with MAFF, the Countryside Commission and riparian landowners to limit the effects of intensive agriculture on the river corridor. This is likely to include:

1. Improving the quantification and assessment of land use changes.
2. Permanent set-aside/buffer zones.
3. Schemes to enhance waterside landscapes.
4. Schemes to restore seasonally inundated flood plain meadows, managed without the use of chemicals.

Issue 3.11 - River Structures - Nature of Problem

There are a number of river structures in the Bristol Avon catchment which were originally installed to provide impounded reaches for past water use and amenity. Some of these are now redundant river structures. The problems caused are:-

a) Reduces the reaches of natural flow in the river
b) Can create a build up of marginal silt and the encroachment of one or two dominant aquatic plant species (eg branched bur-reed and arrowhead)
c) Can cause the loss of clean gravels which is detrimental to fisheries.

Privately owned structures may be operated very infrequently and although not owned by the NRA, require substantial NRA commitment for their repair and maintenance to ensure satisfactory operation under flood conditions.

Options

In collaboration with riparian owners, to review the function of all structures and remove those that are redundant.

NRA and riparian owners to review "best-practice" operation of privately owned structures.

Provide grants for riparian owners, direct NRA works or joint NRA/riparian owner to fund action.

A suggested example river for a pilot study is the Sherston Avon.

6.3 STATE OF CATCHMENT - PHYSICAL FEATURES, CONTINUED

6.3.3 Issue 3.12 - Macrophyte and algal growth - Nature of Problem

Complaints have been received over the past two decades regarding excessive macrophyte and /or algal growth in the upper Avon and some tributaries. There appear to be two different types of algae which have given cause for concern. Firstly the filamentous algae, predominantly *Cladophora spp.*, which usually grows attached to the river bed and macrophytes and sometimes breaks away to form large floating mats on the surface of the river. Secondly, unicellular algae, most notably diatoms which form significant "blooms" in the spring and early summer. Also in recent years excessive growth of duckweed (*Lemna spp.*) has been apparent particularly in the area around Malmesbury. It is difficult to quantify or confirm these perceived changes, however there seems to be little doubt that changes in aquatic plant growth have occurred and the issue has been raised in relation to the Malmesbury Low Flow study where a study of aquatic plant growth has been undertaken by consultants. The reasons for any changes are unclear and there are several interacting factors which may be responsible:-

1. Eutrophication: an increase in plant nutrients may be responsible for an increase in growth of algae, duckweed and to a lesser extent other macrophytes.

2. Low flows: caused by low rainfall and/or groundwater abstraction. A number of possible effects on plant growth may be caused through low flows. Reduced water velocity may bring about changes in dominant macrophytes, for example the replacement of water crowfoot by watercress. Low flows also increase residence time and encourage the formation of algal blooms in the spring and rafts of duckweed in the summer and autumn.

3. Flood defence schemes: schemes involving the widening and deepening of river channels may have influenced plant communities in various ways. During low flows larger channels will have increased residence time and therefore contribute towards algal and duckweed growth. In addition to this, gradual changes which occur over many years following such schemes, particularly the deposition of silt, has led to gradual changes in the plant community.

4. River maintenance: recent years have seen significant changes in the way that the NRA's Flood Defence function carries out maintenance. A reduced need to protect agricultural land from flooding and an increased duty towards conserving the river environment have led to a more tolerant attitude towards aquatic vegetation and allowing a more natural flora to exist. It is inevitable that some stretches will have increased macrophyte growth as a result.

5. Reduction in tree cover: it is recognised that a reduction in tree cover and associated shade has occurred from the 1950s. Although this is a trend which has now been reversed the reduction in shade afforded by bankside trees may have contributed towards a general increase in plant growth.

6.3 STATE OF CATCHMENT - PHYSICAL FEATURES, CONTINUED

6.3.3 Issue 3.12 - Macrophyte and algal growth, continued

Options

Aim to develop a management strategy to maintain a balanced aquatic flora. This would include:

the identification of the natural changes resulting from past flood defence schemes and through less intensive river maintenance;

the identification of adverse effects occurring resulting from increased nutrients or reduced flows.

Issue 3.13 - Litter

Nature of Problem

Litter is a problem both in the river and in the river corridor. It seriously detracts from the amenity value of the river environment especially in town centres such as Calne and Chippenham, where the problem is particularly noticeable. In rural areas there may be discarded rubbish left by anglers or walkers.

There is also the problem of litter removal which is very costly to the community. Dead animals have to be removed by the Local Authority Environmental Health Department. Although the NRA receives many complaints about litter, its removal is the responsibility of the Local Authority, unless the litter is of a polluting nature. Hard rubbish such as supermarket trolleys and old bicycles have to be removed and disposed of to a licensed waste disposal facility during river dredging works.

Many types of litter can be harmful to wildlife. Wildfowl get caught in plastic bags and discarded fishing line. Hedgehogs and birds get caught up in the plastic binders used to hold cans together. Small animals can get trapped in bottles.

Options

Liaise with District Councils to develop better ways of dealing with litter prevention and removal, eg to encourage supermarkets to use deposit lockable trolleys. Other measures might be the provision of adequate litter bins plus a programme for their regular emptying.

Encourage local conservation groups, youth group, civic amenity societies etc to carry out voluntary litter picking in their local areas.

Continue or increase the programme of talks to schools by NRA Officers and emphasise the need for a litter free river environment.

Liaise with commerce and industry to solve the problem of light packaging such as plastic bags and polystyrene which easily gets blown about.

6.3 STATE OF CATCHMENT - PHYSICAL FEATURES, CONTINUED

6.3.3 Issue 3.14 - Absence of trout recruitment on Sherston Avon.

Nature of Problem

Investigations by the NRA using electrofishing techniques have identified differences in the distribution of juvenile trout on the Sherston Avon compared with the Tetbury Avon. Poor recruitment appears to be linked to the stretch of the Sherston Avon between Fosseway Gauging Station and Malmesbury Town where water is lost through the river bed into the aquifer.

Options

Bed losses may result in the transport of sediment and silt down into the gravel and this adversely affects the hatching rate from eggs buried in the gravel during the winter. An investigation into the sediment and silt deposits in the gravel to assess the likely impact is underway.

Another influence that needs to be investigated is the effect that stocking the river with trout has on the dynamics of natural recruitment.

Issue 3.15 - The decline of native white clawed crayfish on the Upper Bristol Avon

Nature of Problem

Historically native crayfish have been present in very large numbers on the upper Avon and its tributaries for many years. Research has shown that an extensive population existed at the end of the 19th century. From the 1920s through to the 1960s a small industry existed exploiting these crayfish and such were the numbers present that they supported this industry without any noticeable decline in their numbers. Crayfish were caught using dip pan nets, held in cages and sold on to dealers where they were distributed to colleges and schools for biological studies. A small number were also sold to local hotels. Crayfish were also caught by local people for personal consumption. As a result of these activities it has been possible through local knowledge to document accurately the continuity of crayfish populations on the upper Bristol Avon and their impact on the local inhabitants.

Between 1981 and 1983 the Sherston and Tetbury branches of the Bristol Avon became infected with Crayfish plague - *Aphanomyces astaci.* This fungus is an extremely virulent disease and is lethal to the native species. The infection came from an unknown source but its effect on the crayfish populations was such that it had totally destroyed them with the exception of the upstream end of the Sherston Avon and where small pockets avoided infection and survived in tributary streams. Although our native crayfish are not regarded as occupying a key position in the environmental chain they do occupy an important niche in recycling nutrients, controlling plant (weed) and in the conversion of detrital and plant material into body tissue thus providing an important food source for fish, mammals and birds.

The problem of declining native crayfish populations has now become a nationwide problem affecting all the major river systems south of the Pennines. Because of this the NRA has commissioned an R&D project with Nottingham University. The overall objectives of the project are to assess the impact of introductions of alien crayfish and outbreaks of crayfish plague on freshwater ecosystems and to formulate a strategy for the conservation of our native species.

6.3 STATE OF CATCHMENT - PHYSICAL FEATURES, CONTINUED

6.3.3 Issue 3.15 - The decline of native white clawed crayfish on the Upper Bristol Avon-Options

Once crayfish plague has infected a watercourse that has a population of native crayfish nothing can be done to prevent their demise. However crayfish plague will only survive in a watercourse if a host is present. Providing no alien crayfish such as American Signal crayfish are present in the system, crayfish plague will eventually die out with the native populations. The NRA successfully re-introduced native crayfish back into the Tetbury Avon in 1987 and so far this re-introduced population has not become re-infected with crayfish plague and appears to be expanding. Further re-introductions should be made at Malmesbury on the Sherston Avon and downstream to Somerford. The setting up of "Noah's Ark" populations in gravel pits would ensure a plague free supply of native crayfish for any further re-introductions.

6.3.3 Issue 3.16 Conservation and enhancement of landscape and archaeological features associated with waters under NRA control - Nature of Problem

Land use and development often play a major part in degrading river landscapes. There is a need to conserve existing attractive landscapes and features of archaeological interest and protect them from damaging development, such as road schemes and golf courses. Archaeological features include bridges, mills, weirs and hatches. Some notable features on the Upper Bristol Avon are the Pack Horse Bridge at Waddon, the Town Bridge at Bradford-on-Avon, the Old Bridge below Cowbridge and the Bridge at Easton Grey. The enhancement of town centre landscapes and restoration of degraded landscapes is also a problem which should be resolved.

Options

Ensure river corridor developments are not detrimental to landscape and archaeological features.

Encourage the owners of monuments, bridges and other archaeological features on the river to ensure that they are free of damaging vegetation, and in a good state of repair.

Using existing conservation and fisheries improvement techniques to restore and enhance degraded landscapes. This can be achieved by :-

- restoring more natural bank profiles
- restoring wetland features such as ponds, wet meadows and reedbeds
- restoring in-channel features such as pool and riffle sequences and aquatic vegetation
- the planting of trees and shrubs.

In partnership with Local Authorities and others, enhance town centre landscapes where opportunities for amenity use and interpretation are high.

Work with Local Authorities to develop suitable policies to include in their Local Plans and the "Action Plans and Proposals" that derive from them.

6.3 STATE OF CATCHMENT - PHYSICAL FEATURES, CONTINUED

6.3.3 Issue 3.17 - Conflict between Canoeists and other River Users

Nature of Problem

Use of the river by canoeists appears to be increasing and this has on occasion led to conflict with anglers. In common with almost all of Britain's rivers, the Upper Bristol Avon has no navigation rights. In order to canoe a stretch of river, canoeists must obtain permission from **all** riparian owners. Often this could be several owners in a short stretch with often different owners for opposite banks. The riparian owners' names and addresses are very difficult to obtain so it is clearly impractical to obtain the necessary permissions. Most canoeists belong to clubs affiliated to the British Canoe Union (B.C.U.) which is the governing body for the sport. It is B.C.U. policy that rivers should only be paddled with prior agreement of the riparian owners usually through a Local Access Agreement. It actively discourages "pirate" runs on rivers by non-members of the B.C.U. The B.C.U has Local Access Officers who negotiate Local Access Agreements but some canoeists are not aware of this.

Anglers usually pay to use the river and may resent the unauthorised and "free" use of the river by canoeists. Although conflict can occur between angling and canoeing interests, the two activities are not mutually exclusive and there is considerable potential for authorised canoeing by riparian agreement without detriment to angling or damage to the fishery or the environment.

Options

Liaise with angling groups, canoeing clubs and the B.C.U to explore ways of increasing access to the river for canoeing whilst reducing the perceived detriment to angling.

Publicise key information, for example by means of noticeboards at popular canoeing sites, such as local canoe clubs, B.C.U Access Officers, and details of any access agreements pertaining.

Work with others to encourage "pirate" canoeists to join canoe clubs and the B.C.U.

6.4 STATE OF THE CATCHMENT - FLOOD DEFENCE

6.4.1 Maintenance

As described in Section 5.5, the formal system for assessing compliance with maintenance Standards of Service is not yet in operation, but initial results do not suggest a large variation from current practices and frequencies, all of which have been reassessed in the last 5 years.

6.4.2 Capital Schemes

The various urban flood alleviation schemes that have been carried out are shown on the map included with Section 4.6. The schemes completed since the 1970s all afford protection against a 100 year return period flood, whilst earlier works in Melksham and Chippenham were carried out without any such assessment of design standard.

6.4.3 Continuing Flood Risk

The presence of a flood alleviation scheme does not remove entirely the risk of flooding. Whatever the level of protection afforded, there is always a risk of some event exceeding that level. In addition, no matter what type of scheme has been implemented, a continuing programme of maintenance will be required to maintain the level of protection. All existing schemes have performed satisfactorily in flood events following their construction.

Some locations at risk from flooding have been the subject of feasibility studies which concluded that there was no financial or environmental justification for further improvements, and therefore the level of protection is below standard. These are:-

- Bradford-on-Avon, where some 30 properties, mostly commercial, are at risk, initially from an event of return period 1 in 10 years. Here particular attention is given to the de-silting of the major hydraulic shortfall, the restricted arches of the historic Town Bridge.

- Melksham, where River Avon improvements in the 1960s and 1970s have still left some 25 properties at risk from a 1 in 25 year return period event. The justification for some flood protection works is currently being investigated.

- Chippenham, where River Avon improvements in the 1960s provided protection to some 30 commercial properties to a level of 1 in 50 year return period only. Protection is very much dependent on the operation of an automatic radial gate.

- Calne, where the demolition of a factory straddling the River Marden, and flood-protection works in 1989 gave a 1 in 50 year return period protection to 50 commercial and residential properties.

- Malmesbury, where improvements between 1968 and 1985 gave varying levels of protection on both the Sherston and Tetbury Avon, including less than 1 in 100 year return period risk at Burnivale on the Sherston Avon, and Staines Bridge on the Tetbury Avon.

6.4 STATE OF THE CATCHMENT - FLOOD DEFENCE

6.4.4 Issue 3.18 - Development Pressure within the Catchment

Flood Risk From New Development

Nature of Problem

The catchment location between Bristol and Swindon in the M4 corridor is likely to place the area under more pressure for development. With an upturn in the economy North and West Wiltshire towns, ex-MoD land and derelict land sites could be exposed to development proposals.

A major consideration within the urban areas of the catchment is the siting of future development to minimise the effect of flooding on the development and to minimise the effect of the development on existing flood risk areas.

Examples of towns where the potential for redevelopment may have flood risk implications are Calne, Bradford-on-Avon and Westbury. In addition, any significant increase in development upstream of Bradford-on-Avon and Calne must be considered in the light of the effect of increased runoff exacerbating any downstream problems.

Also uncontrolled runoff from further development in Westbury would reduce flood protection to downstream properties on the Bitham Brook, Biss Brook and River Biss in Trowbridge itself.

Option

The NRA is carrying out a series of studies of sub-catchments, modelling runoff from various projected levels of development in order to formulate Catchment Drainage Plans which will provide the basis of Development Control Strategy both through the implementation of NRA statutory powers and through advice given to Planning Authorities.

A Catchment Drainage Plan has been completed for the River Biss which has shown that development in Westbury would increase flood risk in Trowbridge. Measures to mitigate this increase have been devised and NRA advice to the Local Planning Authority regarding surface water from new development in Westbury is now based on this Catchment Drainage Plan. The two catchments upstream of Bradford-on-Avon which has a known history of flooding are to be combined to develop the next Catchment Drainage Plan. The River Marden Catchment (Calne) will follow.

Impact of New Road Schemes

Nature of Problem

New road schemes can pose a variety of adverse impacts on the water environment. There is the possibility of increased flood risk from runoff, loss of flood plain storage, risks to groundwater through discharge of roadside drainage to underground strata via soakaway systems especially from spillage after accidents, risks to surface water quality and adverse affects to the ecology of the river corridor through direct shading and modification to banks. There is also the possible loss of flood plain habitat through construction of embankments.

6.4. STATE OF THE CATCHMENT - FLOOD DEFENCE

6.4.4 Issue 3.18 - Development Pressure within the Catchment, continued

Currently there are four road schemes under consideration within the catchment:-

- Bath - Beckington A36 Improvements
- Melksham Eastern By-pass
- Chippenham By-pass
- West Wiltshire By-pass

Options

The NRA seeks increased involvement at the earliest stages of Development Plan preparation.

The NRA seeks early discussion on proposed new road schemes so that the possible impacts on the water environment can be fully evaluated and any necessary modifications obtained. With regard to water quality requirements, all new road schemes and road enhancements are reviewed to determine the appropriate level of protection required for the watercourse/ groundwater and the design of the drainage system is agreed with the design engineers. The use of reed bed filtration should be considered to slow the flow and improve water quality. Where necessary the NRA can exert statutory control over these water quality matters by serving a prohibition notice.

APPENDIX 1.1

STANDARDS FOR RIVER ECOSYSTEM USE CLASSES

Use Class	DO % sat 10%ile	BOD (ATU) mg/l 90%ile	Total Ammonia mgN/l 90%ile	Un-ionised Ammonia mgN/l 95%ile	pH 5%ile & 95%ile	Hardness mg/l $CaCO_3$	Dissolved Copper µg/l 95%ile	Total Zinc µg/l 95%ile	Class Description
1	80	2.5	0.25	0.021	6.0 - 9.0	≤10 >10 and ≤50 >50 and ≤100 >100	5 22 40 112	30 200 300 500	Water of very good quality suitable for all fish species
2	70	4.0	0.6	0.021	6.0 - 9.0	≤10 >10 and ≤50 >50 and ≤100 >100	5 22 40 112	30 200 300 500	Water of good quality suitable for all fish species
3	60	6.0	1.3	0.021	6.0 - 9.0	≤10 >10 and ≤50 >50 and ≤100 >100	5 22 40 112	300 700 1000 2000	Water of fair quality suitable for high class coarse fish populations
4	50	8.0	2.5	-	6.0 - 9.0	≤10 >10 and ≤50 >50 and ≤100 >100	5 22 40 112	300 700 1000 2000	Water of fair quality suitable for coarse fish populations
5	20	15.0	9.0	-	-	-	-	-	Water of poor quality which is likely to limit coarse fish populations

EC DIRECTIVE 'ON THE QUALITY OF FRESHWATERS NEEDING PROTECTING OR IMPROVEMENT IN ORDER TO SUPPORT FISH LIFE' (78/659/EEC)

DETERMINAND	SALMONID WATERS 'G'	SALMONID WATERS 'I'	CYPRINID WATERS 'G'	CYPRINID WATERS 'I'
Dissolved Oxygen as mg/l 0_2 [*a]	100% > 7	50% > 9	100% > 5	50% > 7
pH as pH units	-	6.0-9.0	-	6.0-9.0
Suspended Solids at mg/l [*b]	25	-	25	-
BOD (Total) as mg/l 0_2	5	-	8	-
Nitrite as mg/l N	0.150	-	0.460	-
Non-ionised Ammonia as mg/l N	0.004	0.021	0.004	0.021
Ammonia (Total) as mg/l N	0.030	0.780	0.160	0.780
Total Residual Chlorine as mg/l HOCl	-	0.005	-	0.005
Zinc (Total) as mg/l Zn				
Water Hardness 0- 50	-	0.03	-	0.30
(mg/l $CaCO_3$) 50-100	-	0.20	-	0.70
100-250	-	0.30	-	1.00
>250	-	0.50	-	2.00
Copper (Dissolved) as mg/l Cu				
Water Hardness 0- 50	0.005	-	0.005	-
(mg/l $CaCO_3$) 50-100	0.022	-	0.022	-
100-250	0.040	-	0.040	-
>250	0.112	-	0.112	-

[*a] For dissolved oxygen, 50% median and 100% minimum standard.
[*b] For suspended solids, the 'G' value is an annual average concentration.

For application of these standards, reference must be made to Article 6 and the Annexes of the Directive, and the appropriate DoE Implementation Guidelines.

'G' = Guideline

'I' = Imperative

EC DIRECTIVE 'CONCERNING THE QUALITY REQUIRED OF SURFACE WATER INTENDED FOR THE ABSTRACTION OF DRINKING WATER IN THE MEMBER STATES' (75/440/EEC)

Definition of the Standard Methods of Treatment for Transforming Surface Water of Categories A1, A2 and A3 into Drinking Water

Category A1

Simple physical treatment and disinfection, eg rapid filtration and disinfection.

Category A2

Normal physical treatment, chemical treatment and disinfection, eg pre-chlorination, coagulation, flocculation, decantation, filtration, disinfection (final chlorination).

Category A3

Intensive physical and chemical treatment, extended treatment and disinfection, eg chlorination to break-point, coagulation, flocculation, decantation, filtration, absorption (activated carbon), disinfection (ozone, final chlorination).

I	=	**imperative**
G	=	**guideline**
O	=	**exceptional climatic or geographical conditions**

APPENDIX 1.3
Continued

CHARACTERISTICS OF SURFACE WATER INTENDED FOR THE ABSTRACTION OF DRINKING WATER			CATEGORIES					
			A1		A2		A3	
PARAMETERS			G	I	G	I	G	I
23	Selenium	mg/l Se	-	0.01	-	0.01	-	0.01
24	Mercury	mg/l Hg	0.0005	0.001	0.0005	0.001	0.0005	0.001
25	Barium	mg/l Ba	-	0.1	-	1	-	1
26	Cyanide	mg/l Cn	-	0.05	-	0.05	-	0.05
27	Sulphates	mg/l SO_4	150	250	150	250 (0)	150	250 (0)
28	Chlorides	mg/l Cl	200	-	200	-	200	-
29	Surfactants (reacting with methyl blue)	mg/l (laurylsulphate)	0.2	-	0.2	-	0.5	-
30	Phosphates	mg/l P_2O_5	0.4	-	0.7	-	0.7	-
31	Phenols (phenol index) paranitraniline 4 aminoantipyrine	mg/l C_6H_5OH	-	0.01	0.001	0.005	0.01	0.1
32	Dissolved or emulsified hydrocarbons (after extraction by petroleum ether)	mg/l	-	0.05	-	0.2	0.5	1
33	Polycyclic aromatic hydrocarbons	mg/l	-	0.0002	-	0.0002	-	0.001
34	Total pesticides (parathion, BHC, dieldrin)	mg/l	-	0.001	-	0.0025	-	0.005
35	Chemical oxygen demand (COD)	mg/l O_2	-	-	-	-	30	-
36	Dissolved oxygen saturation rate	% O_2	> 70	-	> 50	-	> 30	-
37	Biochemical oxygen demand (BOD_5) (at 20°C with nitrification)	mg/l O_2	< 3	-	< 5	-	< 7	-
38	Nitrogen by Kjeldahl method (except NO_3)	mg/l N	1	-	2	-	3	-
39	Ammonia	mg/l NH_4	0.05	-	1	1.5	2	4 (0)

APPENDIX 1.3
Continued

CHARACTERISTICS OF SURFACE WATER INTENDED FOR THE ABSTRACTION OF DRINKING WATER			CATEGORIES					
			A1		A2		A3	
PARAMETERS			G	I	G	I	G	I
1	Ph		6.5 to 8.5	-	5.5 to 9	-	5.5 to 9	-
2	Coloration (after simple filtration)	mg/l Pt scale	10	20 (0)	50	100 (0)	50	200 (0)
3	Total suspended solids	mg/l SS	25	-	-	-	-	-
4	Temperature	°C	22	25 (0)	22	25 (0)	22	25 (0)
5	Conductivity	$\mu s/cm^{-1}$ at 20°C	1000	-	1000	-	1000	-
6	Odour	(dilution factor at 25°C)	3	-	10	-	20	-
7	Nitrates	mg/l NO_3	25	50 (0)	-	50 (0)	-	50 (0)
8	Fluorides	mg/l F	0.7 to 1	1.5	0.7 to 1.7	-	0.7 to 1.7	-
9	Total extractable organic chlorine	mg/l Cl	-	-	-	-	-	-
10	Dissolved Iron	mg/l Fe	0.1	0.3	1	2	1	-
11	Manganese	mg/l Mn	0.05	-	0.1	-	1	-
12	Copper	mg/l Cu	0.02	0.05 (0)	0.05	-	1	-
13	Zinc	mg/l Zn	0.5	3	1	5	1	5
14	Boron	mg/l B	1	-	1	-	1	-
15	Beryllium	mg/l Be	-	-	-	-	-	-
16	Cobalt	mg/l Co	-	-	-	-	-	-
17	Nickel	mg/l Ni	-	-	-	-	-	-
18	Vanadium	mg/l V	-	-	-	-	-	-
19	Arsenic	mg/l As	0.01	0.05	-	0.05	0.05	0.1
20	Cadmium	mg/l Cd	0.001	0.005	0.001	0.005	0.001	0.005
21	Total Chromium	mg/l Cr	-	0.05	-	0.05	-	0.05
22	Lead	mg/l Pb	-	0.05	-	0.05	-	0.05

APPENDIX 1.3
Continued

CHARACTERISTICS OF SURFACE WATER INTENDED FOR THE ABSTRACTION OF ORINKING WATER			CATEGORIES					
			A1		A2		A3	
PARAMETERS			G	I	G'	I	G	I
40	Substances extractable with chloroform	mg/l SEC	0.1	-	0.2	-	0.5	-
41	Total organic carbon	mg/l C	-	-	-	-	-	-
42	Residual organic carbon after flocculation and membrane filtrations (5 μ) TOC	mg/l C	-	-	-	-	-	-
43	Total coliforms 37°C	/100 ml	50	-	5000	-	50000	-
44	Faecal coliforms	/100 ml	20	-	2000	-	20000	-
45	Faecal streptococci	/100 ml	20	-	1000	-	10000	-
46	Salmonella		Not present in 5000 ml	-	Not present in 1000 ml	-	-	-

APPENDIX 1.4
continued

EC DANGEROUS SUBSTANCES DIRECTIVE 'ON POLLUTION CAUSED BY CERTAIN SUBSTANCES DISCHARGED IN THE AQUATIC ENVIRONMENT OF THE COMMUNITY', (76/464/EC)

LIST I SUBSTANCES (INLAND WATERS)

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

Proposals have been published for the following List I substances but these have not, so far, been adopted:- trifluralin, endosulphan, simazine, triorganotin compounds(tributyltinoxide,triphenyltin acetate, triphenyltin oxide, triphenyltin hydroxide), atrazine, organophosphorus substances (azinphos-methyl, azinphos-ethyl, fenitrothion, fenthion, malathion, parathion and parathion-methyl, dichlorvos).

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

LIST II SUBSTANCES (INLAND WATERS) (1)

Parameter	Units	Value (3)		Hardness (mg $CaCO_3$/l)	Status (2)
		A Std	B Std		
Lead	µg Pb/l	4	50	0 to 50	AA,D
		10	125	50 to 100	
		10	125	100 to 150	
		20	250	150 to 200	
		20	250	200 to 250	
		20	250	>250	
Chromium	µg Cr/l	5	150	0 to 50	AA,D
		10	175	50 to 100	
		20	200	100 to 150	
		20	200	150 to 200	
		50	250	200 to 250	
		50	250	>250	
Zinc	µg Zn/l	8	75	0 to 50	AA,T
		50	175	50 to 100	
		75	250	100 to 150	
		75	250	150 to 200	
		75	250	200 to 250	
		125	500	>250	
Copper	µg Cu/l	1	1	0 to 50	AA,D
		6	6	50 to 100	
		10	10	100 to 150	
		10	10	150 to 200	
		10	10	200 to 250	
		28	28	>250	
Nickel	µg Ni/l	50	50	0 to 50	AA,D
		100	100	50 to 100	
		150	150	100 to 150	
		150	150	150 to 200	
		200	200	200 to 250	
		200	200	>250	
Arsenic	µg As/l	50		All	AA,D
Boron	µg B/l	2000		All	AA,T
Iron	µg Fe/l	1000		All	AA,D
pH	pH values	6 to 9		All	95% of samples
Vanadium	µg V/l	20		0 to 200	AA,T
		60		>200	
Tributyltin	µg/l	0.02		All	M,T

Parameter	Units	Value (3)		Hardness (mg $CaCO_3$/l)	Status (2)
		A Std	B Std		
Triphenyltin	µg/l	0.02		All	M,T
Polychlorochlormethyl-sulphonamidodiphenyl ether (PCSDs)	µg/l	0.05		All	T, 95% of samples
Sulcofuron	µg/l	25		All	T, 95% of samples
Flucofuron	µg/l	1.0		All	T, 95% of samples
Permethrin	µg/l	0.01		All	T, 95% of samples
Cyfluthrin	µg/l	0.001		All	T, 95% of samples

Notes:

(1) National environmental quality standards recommended for the UK.

(2) AA=Annual Average; D=Dissolved; T=Total; M=Maximum Allowable Concentration

(3) A Std denotes standards for the protection of sensitive aquatic life
B Std denotes standards for the protection of other aquatic life.

APPENDIX 1.4
Continued

SITES MONITORED FOR DANGEROUS SUBSTANCES IN THE UPPER BRISTOL AVON CATCHMENT		
Site Name	**Site Number**	**NGR**
Blackwell Hams STW	01012103	ST 91807110
Avon Chippenham	01012204	ST 91907330
Avon Lackham	01012101	ST 92407030
Trowbridge STW	10340108	ST 85105870
Biss downstream Trowbridge STW	10340179	ST 85504940
Devizes STW	09390202	ST 99406110
Old Park watercourse	09390201	ST 98406020
Drews Pond Jenny	09400102	ST 98305910
Potterne STW	09400114	ST 98805910
Semington Brook Becketts	09370428	ST 99905470
Park Farm Fish Farm	09370429	SU 00105450
Rivers Brook Wessington	08480239	SU 00607030
Compton Bassett STW	08480205	SU 01507010
Hills x 2 sites	08480273	SU 01767044
	08480229	SU 01807060
Honeyball watercourse	08480243	SU 01707040
Honeyball upstream Hills	08480251	SU 01907060
Melksham STW	01450105	ST 89706400
South Brook Melksham	01450103	ST 89806380
Marden Stanley	08480103	ST 95607280
Calne STW	08480219	ST 97607150
Marden Conigre	08480204	ST 98007130
Brinkworth STW	07500138	SU 01108400
Box STW	04170104	ST 82306880
Bradford on Avon STW	01011504	ST 81506040
Bowerhill STW	01440102	ST 90406240
Berryfield STR	01440101	ST 89606230

EC DIRECTIVE 'ON THE PROTECTION OF GROUNDWATER AGAINST POLLUTION CAUSED BY CERTAIN DANGEROUS SUBSTANCES' (80/68/EEC)

EXTRACTS

Article 1

1. The purpose of this Directive is to prevent the pollution of groundwater by substances belonging to the families and groups of substances in List I or II in the Annex, hereinafter referred to as 'substances in Lists I or II', and as far as possible to check or eliminate the consequences of pollution which has already occurred.

2. For the purposes of this Directive:

   (a) 'groundwater' means all water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil;

   (b) 'direct discharge' means the introduction into groundwater of substances in Lists I or II without percolation through the ground or subsoil;

   (c) 'indirect discharge' means the introduction into groundwater of substances in Lists I or II after percolation through the ground or subsoil;

   (d) 'pollution' means the discharge by man, directly or indirectly, of substances or energy into groundwater, the results of which are such as to endanger human health or water supplies, harm living resources and the aquatic ecosystem or interfere with other legitimate uses of water.

Article 3

Member States shall take the necessary steps to:

   (a) prevent the introduction into groundwater of substances in List I; and

   (b) limit the introduction into groundwater of substances in List II so as to avoid pollution of this water by these substances.

ANNEX

LIST I OF FAMILIES AND GROUPS OF SUBSTANCES

List I contains the individual substances which belong to the families and groups of substances enumerated below, with the exception of those which are considered inappropriate to List I on the basis of a low risk of toxicity, persistance and bioaccumulation.

Such substances which with regard to toxicity, persistance and bioaccumulation are appropriate to List II are to be classed in List II.

1. Organohalogen compounds and substances which may form such compounds in the aquatic environment.

2. Organophosphorus compounds.

3. Organotin compounds.

4. Substances which possess carcinogenic mutagenic or teratogenic properties in or via the aquatic environment([1]).

5. Mercury and its compounds.

6. Cadmium and its compounds.

7. Mineral oils and hydrocarbons.

8. Cyanides.

---

[1] Where certain substances in List II are carcinogenic, mutagenic or teratogenic, they are included in category 4 of this list.

ANNEX Continued

LIST II OF FAMILIES AND GROUPS OF SUBSTANCES

List II contains the individual substances and the categories of substances belonging to the families and groups of substances listed below which could have a harmful effect on groundwater.

1. The following metalloids and metals and their compounds:

1.	Zinc	11.	Tin
2.	Copper	12.	Barium
3.	Nickel	13.	Beryllium
4.	Chrome	14.	Boron
5.	Lead	15.	Uranium
6.	Selenium	16.	Vanadium
7.	Arsenic	17.	Cobalt
8.	Antimony	18.	Thallium
9.	Molybdenum	19.	Tellurium
10.	Titanium	20.	Silver

2. Biocides and their derivatives not appearing in List I.

3. Substances which have a deleterious effect on the taste and/or odour of groundwater, and compounds liable to cause the formation of such substances in such water and to render it unfit for human consumption.

4. Toxic or persistent organic compounds of silicon, and substances which may cause the formation of such compounds in water, excluding those which are biologically harmless or are rapidly converted in water into harmless substances.

5. Inorganic compounds of phosphorus and elemental phosphorus.

6. Fluorides.

7. Ammonia and nitrites.

APPENDIX 1.6

EC DIRECTIVE 'CONCERNING URBAN WASTE WATER TREATMENT' (91/172/EEC)

EXTRACTS

Article 4

1. Member States shall ensure that urban waste water entering collecting systems shall before discharge be subject to secondary treatment or an equivalent treatment as follows:

   - at the latest by 31 December 2000 for all discharges from agglomerations of more than 15,000 pe;

   - at the latest by 31 December 2005 for all discharges from agglomerations of between 10,000 and 15,000 pe;

   - at the latest by 31 December 2005 for discharges to fresh-water and estuaries from agglomerations of between 2,000 and 10,000 pe.

2. Urban waste water discharges to waters situated in high mountain regions (over 1500m above sea level) where it is difficult to apply an effective biological treatment due to low temperatures may be subjected to treatment less stringent than that prescribed in paragraph 1, provided that detailed studies indicate that such discharges do not adversely affect the environment.

3. Discharges from urban waste water treatment plants described in paragraphs 1 and 2 shall satisfy the relevant requirements of Annex I B. These requirements may be amended in accordance with the procedure laid down in Article 18.

4. The load expressed in pe shall be calculated on the basis of the maximum average weekly load entering the treatment plant during the year, excluding unusual situations such as those due to heavy rain.

Article 5

1. For the purposes of paragraph 2, Member States shall by 31 December 1993 identify sensitive areas according to the criteria laid down in Annex II.

2. Member States shall ensure that urban waste water entering collecting systems shall before discharge into sensitive areas be subject to more stringent treatment than that described in Article 4, by 31 December 1998 at the latest for all discharges from agglomerations of more than 10,000 pe.

3. Discharges from urban waste water treatment plants described in paragraph 2 shall satisfy the relevant requirements of Annex I B. These requirements may be amended in accordance with the procedure laid down in Article 18.

4. Alternatively, requirements for individual plants set out in paragraphs 2 and 3 above need not apply in sensitive areas where it can be shown that the minimum percentage of reduction of the overall load entering all urban waste water treatment plants in that area is at least 75% for total phosphorus and at least 75% for total nitrogen.

5. Discharges from urban waste water treatment plants which are situated in the relevant catchment areas of sensitive areas and which contribute to the pollution of these areas shall be subject to paragraphs 2, 3 and 4.

In cases where the above catchment areas are situated wholly or partly in another Member State Article 9 shall apply.

6. Member States shall ensure that the identification of sensitive areas is reviewed at intervals of no more than four years.

7. Member States shall ensure that areas identified as sensitive following review under paragraph 6 shall within seven years meet the above requirements.

8. A Member State does not have to identify sensitive areas for the purpose of this Directive if it implements the treatment established under paragraphs 2, 3 and 4 over all its territory.

Table 1

Requirements for discharges from urban waste water treatment plants subject to Articles 4 and 5 of the Directive. The values for concentration or for the percentage of reduction shall apply.

Parameters	Concentration	Minimum Percentage of Reduction (1)	Reference Method of Measurement
Biochemical Oxygen Demand (BOD5 at 20°C) without nitrification (2)	25 mg/l O_2	70-90 40 under Article 4 (2)	Homogenized, unfiltered, undecanted sample. Determination of dissolved oxygen before and after five day incubation at 20°C ± 1°C, in complete darkness. Addition of a nitrification inhibitor.
Chemical Oxygen Demand (COD)	125 mg/l 0_2	75	Homogenized, unfiltered, undecanted sample Potassium dichromate.
Total suspended solids	35 mg/l (3) 35 under Article 4 (2) (more than 10,000 pe) 60 under Article 4 (2) (2,000-10,000 pe)	90 (1) 90 under Article 4 (2) (more than 10,000 pe) 70 under Article 4 (2) (2,000-10,000 pe)	- Filtering of a representative sample through a 0.45 µm filter membrane. Drying at 105° and weighing - Centrifuging of a representative sample (for at least five mins with mean acceleration of 2,800 to 3,200g), drying at 105°C and weighing

(1) Reduction in relation to the load of the influent.
(2) The parameter can be replaced by another parameter : total organic carbon (TOC) or total oxygen demand (TOD) if a relationship can be established between BOD5 and the substitute parameter.
(3) This requirement is optional.

Analyses concerning discharges from lagooning shall be carried out on filtered samples : however, the concentration of total suspended solids in unfiltered water samples shall not exceed 150 mg/l.

ANNEX 1

REQUIREMENTS FOR URBAN WASTE WATER

EXTRACTS

B. Discharge from urban waste water treatment plants to receiving waters (1)

1. Waste water treatment plants shall be designed or modified so that representative samples of the incoming waste water and of treated effluent can be obtained before discharge to receiving waters.

2. Discharges from urban waste water treatment plants subject to treatment in accordance with Articles 4 and 5 shall meet the requirements shown in Table 1.

3. Discharges from urban waste water treatment plants to those sensitive areas which are subject to eutrophication as identified in Annex II A (a) shall in addition meet the requirements shown in Table 2 of this Annex.

4. More stringent requirements than those shown in Table 1 and/or Table 2 shall be applied where required to ensure that the receiving waters satisfy any other relevant Directives.

5. The points of discharge of urban waste water shall be chosen, as far as possible, so as to minimise the effects on receiving waters.

---

1 Given that it is not possible in practice to construct collecting systems and treatment plants in a way such that all waste water can be treated during situations such as unusually heavy rainfall. Member States shall decide on measures to limit pollution from storm water overflows. Such measures could be based on dilution rates or capacity in relation to dry weather flow, or could specify a certain acceptable number or overflows per year.

Table 2

Requirements for discharges from urban waste water treatment plants to sensitive areas which are subject to eutrophication as identified in Annex II A (a). One or both parameters may be applied depending on the local situation. The values for concentration or for the percentage of reduction shall apply.

Parameters	Concentration	Minimum Percentage of Reduction (1)	Reference Method of Measurement
Total phosphorus	2 mg/l P (10,000-100,000 pe) 1 mg/l P (more than 100,000 pe)	80	Molecular absorption spectrophotometry
Total nitrogen (2)	15 mg/l N (10,000-100,000 pe) 10 mg/l N (more than 100,000 pe) (3)	70-80	Molecular absorption spectrophotometry

(1) Reduction in relation to the load of the influent.

(2) Total nitrogen means : the sum of total Kjeldahl-nitrogen (organic N + NH_3), nitrate (NO_3)-nitrogen and nitrite (NO_2)-nitrogen.

(3) Alternatively, the daily average must not exceed 20 mg/l N. This requirement refers to a water temperature of 12°C or more during the operation of the biological reactor of the waste water treatment plant. As a substitute for the condition concerning the temperature, it is possible to apply a limited time of operation, which takes into account the regional climatic conditions. This alternative applies if it can be shown that paragraph 1 of Annex I D is fulfilled.

EC DIRECTIVE 'CONCERNING THE PROTECTION OF WATERS AGAINST POLLUTION CAUSED BY NITRATES FROM AGRICULTURAL SOURCES'

(Directive notified in December 1991)

EXTRACTS

Article 1

This Directive has the objective of:-

- reducing water pollution caused or induced by nitrates from agricultural sources and

- preventing further such pollution.

Article 3

1. Waters affected by pollution and waters which could be affected by pollution if action under Article 5 is not taken shall be identified by the Member States in accordance with the criteria set out in Annex 1.

2. Member States shall, within a two-year period following the notification of this Directive, designate as vulnerable zones all known areas of land in their territories which drain into the waters identified according to paragraph 1 and which contribute to pollution. They shall notify the Commission of this initial designation within six months.

3. When any waters identified by a Member State in accordance with paragraph 1 are affected by pollution from waters from another Member State draining directly or indirectly into them, the Member State whose waters are affected may notify the other Member State and the Commission of the relevant facts.

   The Member States concerned shall organize, where appropriate with the Commission, the concertation necessary to identify the sources in question and the measures to be taken to protect the waters that are affected in order to ensure conformity with this Directive.

4. Member States shall review and if necessary revise or add to the designations of vulnerable zones as appropriate, and at least every four years, to take into account changes and factors unforeseen at the time of the previous designation. They shall notify the Commission of any revision or addition to the designations within six months.

5. Member States shall be exempt from the obligation to identify specific vulnerable zones, if they establish and apply action programmes referred to in Article 5 in accordance with this Directive throughout their national territory.

Article 6

1. For the purpose of designating and revising the designation of vulnerable zones, Member States shall:

   (a) within two years of notification of the Directive (December 1993), monitor the nitrate concentration in freshwaters over a period of one year:

      (i) at surface water sampling stations, laid down in Article 5(4) of Directive 75/440/EEC and/or at other sampling stations which are representative of surface waters of Member States, at least monthly and more frequently during flood periods;

      (ii) at sampling stations which are representative of the groundwater aquifers of Member States, at regular intervals and taking into account the provisions of Directive 80/778/EEC;

   (b) repeat the monitoring programme outlined in (a) at least every four years, except for those sampling stations where the nitrate concentration in all previous samples has been below 25 mg/l and no new factor likely to increase the nitrate content has appeared, in which case the monitoring programme need be repeated only every eight years;

   (c) review the eutrophic state of their fresh surface waters, estuarial and coastal waters every four years.

ANNEX 1 - CRITERIA FOR IDENTIFYING WATERS REFERRED TO IN ARTICLE 3(1)

A. Waters referred to in Article 3(1) shall be identified making use, inter alia, of the following criteria:

   (1) whether surface freshwaters, in particular those used or intended for the abstraction of drinking water, contain or could contain, if action under Article 5 is not taken, more than the concentration of nitrates laid down in accordance with Directive 75/440/EEC;
   (2) whether groundwaters contain more than 50 mg/l nitrates or could contain more than 50 mg/l nitrates if action under Article 5 is not taken;
   (3) whether natural freshwater lakes, other freshwater bodies, estuaries, coastal waters and marine waters are found to be eutrophic or in the near future may become eutrophic if action under Article 5 is not taken.

B. In applying these criteria, Member States shall also take account of:

   (1) the physical and environmental characteristics of the waters and land;
   (2) the current understanding of the behaviour of nitrogen compounds in the environment (water and soil);
   (3) the current understanding of the impact of the action taken under Article 5.

APPENDIX 2

BIOLOGICAL QUALITY - ROUTINE MONITORING

Watercourse	Site	'90 Class	'91 Class	'92 Class	Status
Bristol Avon	Cow Bridge	A	A	A	
Bristol Avon	Great Somerford	B	A	A	Border-line
Bristol Avon	Summerlands Farm	A	A	A	
Bristol Avon	Kellaways	A	A	A	
Bristol Avon	Chippenham	A	A	A	
Bristol Avon	Lacock	A	A	A	
Bristol Avon	Melksham	C	B	A	Improve-ment
Bristol Avon	Frying Pan Farm	A	B	A	Border-line
Bristol Avon	Staverton	A	A	A	
Bristol Avon	Bradford-on-Avon	B	A	A	Border-line
Charlton Stream	Charlton	A		A	
Charlton Stream	Malmesbury		A	A	
Forest Brook	Forest Farm		C		
Gauze Brook	Rodbourne Pumping stn	A	A	A	
Lam Brook	Woolley	A			
Lam Brook	Lambridge		A		
Rodbourne Brook	Rodbourne	A		A	
Sutton Benger Stream	Sutton Benger		A		
Woodbridge Brook	Garsdon	B		B	
Luckington Brook	Sherston - Luckington	A			
Luckington Brook	Sherston			B	
Sherston Avon	Sherston	A		A	

BIOLOGICAL QUALITY - ROUTINE MONITORING CONTINUED

Watercourse	Site	'90 Class	'91 Class	'92 Class	Status
Sherston Avon	Easton Grey	A	A	A	
Sherston Avon	Malmesbury		A	A	
Tetbury Avon	Back Bridge	A	A	A	
Brinkworth Brook	Wotton Bassett		C		
Brinkworth Brook	Brinkworth	A	A	A	
Brinkworth Brook	Somerford Bridge	A	A	A	
Abberd Brook	Calne		C		
Cherhill w/c	Cherhill	B		B	
Cowage Brook	Goatacre	C		B	Border-line
Cowage Brook	Ratford	B	A	A	Border-line
Fishers Brook	Lower Whitley		B		
River Marden	Quemerford			A	
River Marden	Buck Hill	B	B	B	
River Marden	Stanley	B	A	A	Border-line
Rivers Brook	Quemerford	A			
Bulkington Drove w/c	Gaston Green			A	
Bulkington Drove w/c	Marston	C			
Drewspond w/c	Potterne	C		B	Border-line
Millborne Stream	Pinkney Farm			A	
Poulshot Stream	Jenny Mill	C		C	
Poulshot Stream	Five Lanes Farm	B		A	
Poulshot Stream	Townsend	B	B	B	

BIOLOGICAL QUALITY - ROUTINE MONITORING CONTINUED

Watercourse	Site	'90 Class	'91 Class	'92 Class	Status
Semington Brook	Littleton Panel	A		A	
Semington Brook	Mill Farm	A		A	
Semington Brook	Bulkington			A	
Semington Brook	Pantry Bridge	A	A	A	
Semington Brook	Seend Head			A	
Semington Brook	Semington	A	A	A	
Summerham Brook	Wick Farm	B			
Summerham Brook	Seend			B	
Summerham Brook	Seend Bridge	A	A	A	
Worton Stream	Cuckolds Green	B		B	
River Biss	Penleigh House	B	B	B	
River Biss	North Bradley	A	B	B	Border-line
River Biss	Ladydown Mill	C	B	C	Border-line
Bitham Brook	Dursley	C	C	C	

Key:

A	GOOD
B	MODERATE
C	POOR
D	VERY POOR

Based on Ecological Quality Indices

APPENDIX 3

CHANGES IN LAND USE IN THE COUNTY OF WILTSHIRE 1961 - 1991

	1961	1971	1981	1991	% CHANGE 1961-1991
No of cattle	241093	243029	252350	212920	- 12
No of pigs	90661	130246	136928	135873	+ 50
No of sheep	124430	104660	199073	257703	+107
No of fowls	2337003	3328110	3213918	3885851	+ 66
Arable	80366	107108	114138	113581	+ 41
Area of grassland	198990	162113	146242	134644	- 32
Total area	279356	269221	260380	248225	- 4

NATURE CONSERVATION AND ARCHAEOLOGICAL DESIGNATIONS

Area of Outstanding Natural Beauty (AONB)
Designated by the Countryside Commission under the National Parks and Access to the Countryside Act 1942, to conserve and enhance the natural beauty of the landscape, mainly through Planning controls.

Local Nature Reserve (LNR)
Nature reserves established, and usually managed, by district/borough councils. Local authorities are empowered to designate such sites under the National Parks and Access to the Countryside Act 1949.

National Nature Reserve (NNR)
Sites owned or leased and managed by English Nature and established as reserves under the National Parks and Access to the Countryside Act 1949.

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

Scheduled Ancient Monument (SAM)
Sites of national importance designated under the Ancient Monuments and Archaeological Areas Act 1979.

Sites of Nature Conservation Interest (SNCI)
Sites selected (usually by County Trusts) as sites of 'County' ecological importance.

Sites of Special Scientific Interest (SSSI)
Sites of national importance designated under the Wildlife and Countryside Act 1981. Usually in private ownership, habitats, sites for individual species, geology and land forms may be designated.

Special Landscape Areas (SLAs)
Areas of special landscape quality, designated by the County (ie not nationally endorsed), justifying the adoption, by the County, of particular development control policies and other safeguarding measures.

Special Protection Areas (SPAs)
Sites identified by UK Government under the EC Directive on the Conservation of Wild Birds (79/409/EC).

APPENDIX 5

ABBREVIATIONS

AONB	-	Area of Outstanding Natural Beauty
BOD	-	Biochemical Oxygen Demand
BOD(ATU)	-	Biochemical Oxygen Demand with nitrification suppressed by allylthiourea
CDP	-	Catchment Drainage Plan
CMP	-	Catchment Management Plan
DO	-	Dissolved Oxygen
DoE	-	Department of the Environment
DWLP	-	District Wide Local Plan
DWF	-	Dry weather flow
EIFAC	-	European Inland Fisheries Advisory Commission
ESA	-	Environmentally Sensitive Area
IFE	-	Institute of Freshwater Ecology
MAFF	-	Ministry of Agriculture, Fisheries and Food
MOD	-	Ministry of Defence
NNR	-	National Nature Reserve
NRA	-	National Rivers Authority
NSA	-	Nitrate Sensitive Area
NVZ	-	Nitrate Vulnerable Zone
PSA	-	Property Services Agency
SAM	-	Scheduled Ancient Monument
SLA	-	Special Landscape Area
SNCI	-	Site of Nature Conservation Interest
SPA	-	Special Protection Area
SSO	-	Sewer Storm Overflows
SSSI	-	Site of Special Scientific Interest
STW	-	Sewage Treatment Works
SWQO	-	Statutory Water Quality Objectives
WQO	-	Water Quality Objective
WWS	-	Wessex Water Services
%ile	-	Percentile
%sat	-	% saturation (of oxygen)
mg/l	-	milligrams per litre
m^3/d	-	cubic metres per day
Ml/d	-	Megalitres/day (one million litres per day)

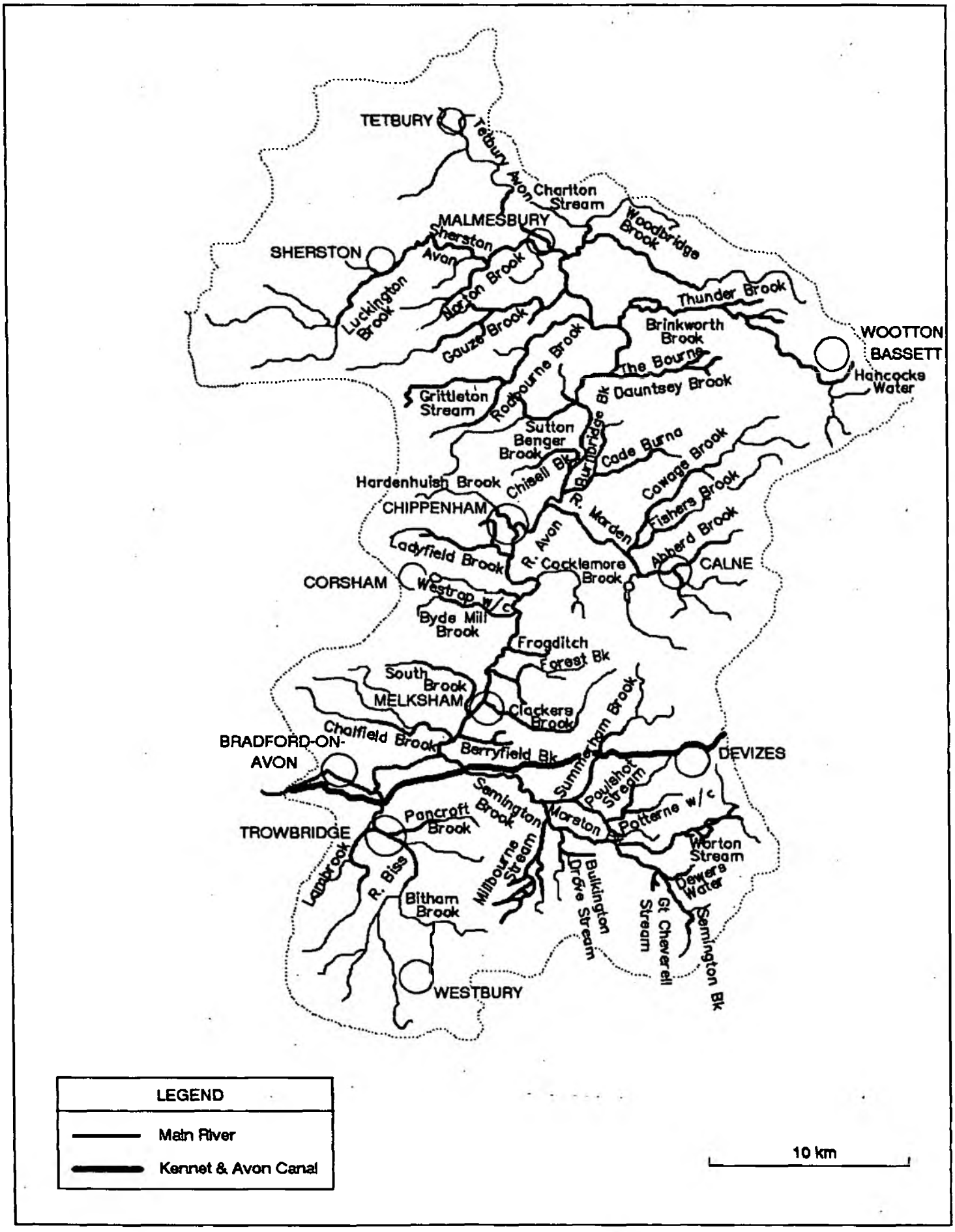
GLOSSARY

Aardvark	Water Quality data statistical analysis package.
Aquifer	Rock which holds substantial amounts of water in structure or fissures eg chalk, sandstones, limestones.
Bed Loss	Loss of water through a permeable stream bed.
Brown Field Site	Piece of land in rural context that has been subjected to some sort of development, eg airfield, tip etc.
Buffer Zone	Strip of land, 10-100m wide, alongside rivers which is removed from intensive agricultural use and managed to provide appropriate habitat types. Benefits include reduction of inputs into the river such as silt, nutrients, livestock waste, as well as improving habitat diversity and landscape.
Calcareous	Of, or containing, carbonate of lime or sandstone.
Consent (Discharge Consent)	A legal document raised by the National Rivers Authority which specifies the conditions under which a discharge may be made.
Containment Bund	An earth bank intended to retain liquids.
Derogate	Loss or impairment of water resource, action causing such loss or impairment.
Dry Weather Flow (DWF)	When sewage flow is mainly domestic in character, the average daily flow to the treatment works during seven consecutive days without rain (excluding a period which includes public or local holidays) following seven days during which the rainfall did not exceed 0.25mm on any one day. With an industrial sewage the dry-weather flow should be based on the flows during five working days if production is limited to that period. Preferably, the flows during two periods in the year, one in the summer and one in the winter, should be averaged to obtain the average dry-weather flow.
Eutrophication	Nutrient enrichment of water, eg increased nitrogen input leaching into rivers from soil treated with chemicals, this chemical enrichment resulting in increased productivity.
"Flashy"	Watercourse which has a rapid response to rainfall. Typical has long periods of low flows and high flows may be several hundred times low flow.
Geomorphological	The natural processes which produce river features such as channel form.
Improved Pasture	Regularly reseeded grassland on which fertilizers and herbicides are typically applied.
Marly	made up of marl - a calcareous mudstone.

GLOSSARY

Non-Salmonid	see Salmonid - fish not belonging to the salmonid family - coarse fish.
Nutrient	Chemical essential for plant growth, eg nitrate, phosphate.
Odonata	Group of insects comprising dragonflies and damselflies.
Percentile	One of 99 values of a variable dividing its distribution into 100 groups with equal frequencies.
Prescribed Minimum Flow (PMF)	Prescribed Flow is the flow which is used to control abstractions to prevent adverse impact on other users, the environment or water quality.
Population Equivalent (pe)	The volume and strength of an industrial waste water expressed in terms of an equivalent population, based upon a figure of 0.060 kilogramme BODper capita per day; the population equivalent of an industrial waste water is therefore calculated using the relationship: $\text{population equivalent} = \frac{\text{5-day BOD (mg/l) x flow}(m^3/d)}{0.060 \times 10^3}$
Primary Porosity	A measure of the capacity of a rock to store water in natural intergranular voids.
Riffle	Stony or gravelly part of stream or river bed shallow in dry flow (opposite of pool). Fast streams on most non-chalk areas have alternating riffles and pools.
Riparian Owner	Owner of land next to river; normally owns river bed and rights to mid-line of channel.
Salmonid	Fish belonging to the family salmonidae (salmon, trout, grayling).
Semi-Improved Pasture	Reseeded or undisturbed grassland which contains some species typical of unimproved pasture. Receives relatively little artificial fertilizers or herbicides
Special Landscape Area	A non-statutory designation used by County Planning Authorities.
Substrate	Material making up bed of stream. Gravels, silts etc
Unimproved Pasture	Permanent grassland which has not been disturbed for many decades and typically receives no artificial fertilizers or herbicides. Rich in grasses, sedges and flowers.
Unsaturated Zone	That part of an aquifer, above the water table, in which cracks, fissures and other large voids are normally air-filled.
Weil's Disease (Leptospirosis)	Disease associated with rats' urine. Infection can enter through broken skin or eyes, nose, mouth, etc. River users may be at risk.

UPPER BRISTOL AVON - RIVERS AND STREAMS



NRA SOUTH WESTERN REGION