ENVIRONMENT AGENCY

BEDFORD OUSE (Lower Reaches)

ENVIRONMENT OVERVIEW

JUNE 1999

ENVIRONMENT AGENCY
ANGLIAN REGION
CENTRAL AREA
BROMHOLME LANE
BRAMPTON
HUNTINGDON
CAMBS
PE18 8NE

EA-Anglian LEAPs

Contents

Viewpoint 6: Aesthetic Quality

Maps

Tables

Figures

PREFACE

This Environment Overview has been prepared to provide supporting information to the Bedford Ouse (Lower Reaches) Draft Local Environment Agency Plan (LEAP). It is a factual description of the local environment and the associated environmental stresses and strains. It is intended to be used in conjunction with the Draft LEAP or in isolation as a reference on the state of the local environment. From this overview a series of issues have emerged which have been carried forward into the Draft LEAP for consideration by the Agency, its partner organisations and those individuals and organisations generally interested in the local environment.

We are committed to reporting on the State of the Environment (SoE) and have a duty to form an opinion on the state of pollution of the environment under the Environment Act (1995). SoE reporting will look at pressures placed on the different environmental media (land, air and water) individually and as a whole, and should help to identify trends that can assist in establishing overall operational priorities. The framework for measuring the SoE comes from the Agency publication 'Viewpoints on the Environment' (1998). From this, six 'Viewpoints' have been derived:

- Environmental Resources;
- Flood Defence and Land Use;
- Key Biological Populations, Communities and Biodiversity;
- Compliance with Environmental Standards and Targets;
- The Health of the Environment; and
- Aesthetic Quality.

The pressures on the environment can be thought of as different sets of 'stresses' and the manner in which they affect the environment as causing different 'strains' upon it. The 'Viewpoints' listed above have been examined in terms of the 'stresses and strains' put on them as identified below:

- Natural Forces;
- Societal Influences;
- Abstractions and Removals;
- Uses, Releases and Discharges;
- Waste Arisings and Disposals; and
- Illegal Practices.

From this Environment Overview, areas where actions are required to restore or improve the environment to a sustainable condition have been identified and brought forward into the Draft LEAP.

The Agency's Corporate Plan details set targets for environmental improvements which we will continue to refine so that we can fully demonstrate the effect that society is having on the environment. These targets indicate priorities and the extent to which we plan to deliver the actions set out in the document 'An Environmental Strategy for the Millennium and Beyond' (1998). All LEAPs will identify local actions for environmental improvements that support and contribute to national targets set out in the Corporate Plan.

VIEWPOINT 1: ENVIRONMENTAL RESOURCES

1.1 Water Resources

We have duties under the Water Resources Act 1991 to conserve, redistribute, augment and ensure the proper use of water resources. This is achieved by the issuing of abstraction licences. These duties must be achieved within our wider duties under the Environment Act 1995 to contribute to sustainable development and to conserve and enhance the environment.

The Government has undertaken a review of the abstraction licence system and a revision of the Water Resources Act 1991. In March 1999, having considered over 200 responses to a consultation paper, the Government's final decisions were published in 'Taking Water Responsibly: Government Decisions Following Consultation on Changes to the Water Abstraction Licensing System in England and Wales.'

1.1.1 Natural Forces

(Geology and Hydrogeology are discussed in Appendix A)

CLIMATE AND CLIMATE CHANGE

The balance of evidence suggests that man's activities are influencing the world's climate; the most publicised effect is a rise in average global temperature. However, the likely impacts for water resources at a regional scale for East Anglia are uncertain. Current predictions are that summers will become warmer and drier and winters wetter and stormier, with the possibility of greater variability between years.

The effects on surface water resources are likely to include reduced summer river flows and higher peak flows in winter. The effects on groundwater resources are less clear. Current scenarios suggest there may be little overall change to aquifer recharge on average. However, hot dry summer conditions could extend into autumn, delaying the seasonal recharge of aquifers and sequences of dry winters could pose a greater threat.

Warmer, drier summers will lead to greater demands for water for public supply and for irrigation. The combination of these possible effects could put greater stress on our water resources and emphasises the need for careful management. Agency policies and plans for water resources include consideration of the potential impacts of climate change and ways to accommodate these flexibly. The increased use of farm storage reservoirs to capture higher winter river flows is one example of the way in which some of the possible impacts of climate change can be reduced.

Average rainfall throughout the LEAP area is low (540 – 590 mm) compared to the 1961-90 average for the UK (1082 mm). Figure 1.1 shows the deviation from the long-term average rainfall value. Since 1988 there have been several years of below average rainfall.

Figure 1.2 shows average monthly rainfall and evaporation for this LEAP area. It can be seen that during most summers, as with other areas in the Anglian Region, evaporation far exceeds rainfall. Therefore there is a seasonal imbalance for limited water resource for environmental and abstraction needs.

Figure 1.1: Deviation from Long Term Average Rainfall at Silsoe, Bedfordshire

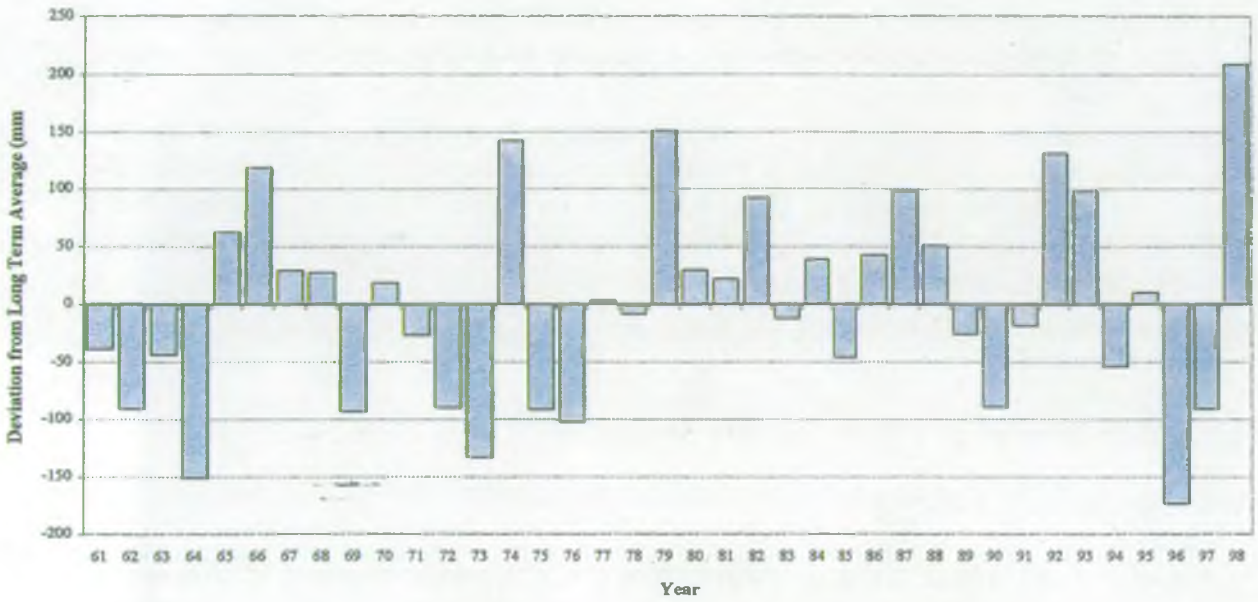
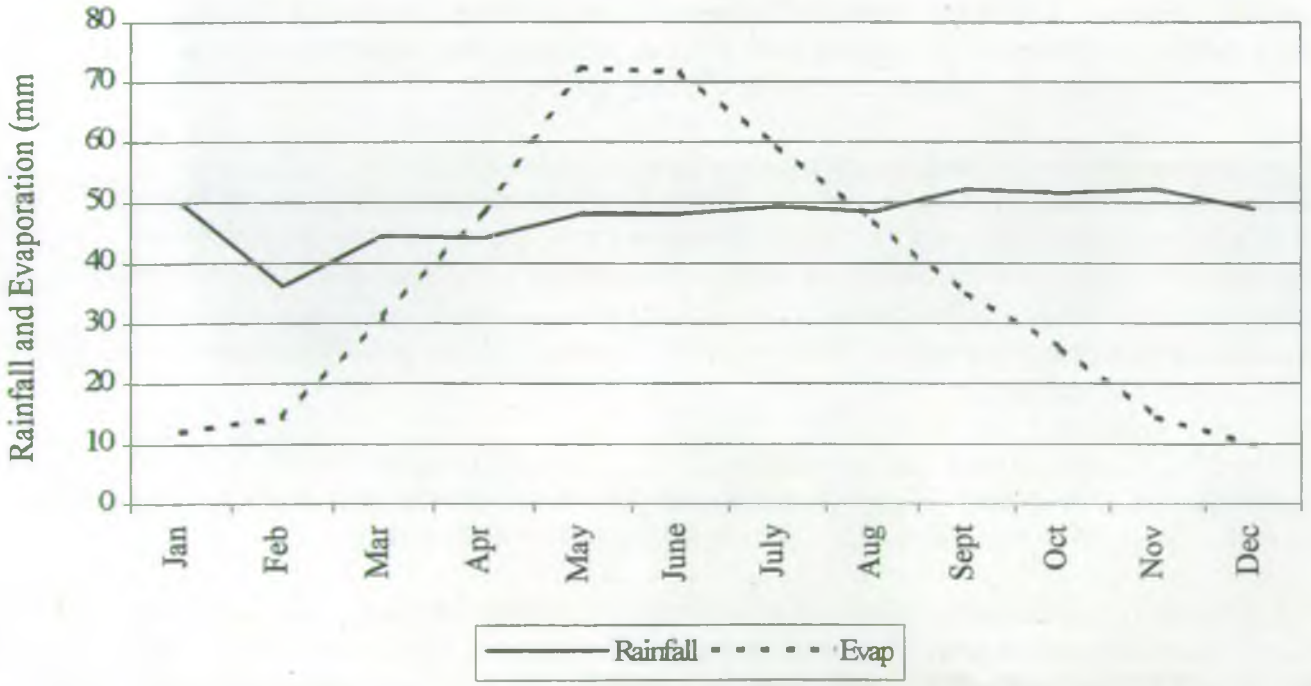


Figure 1.2: Average monthly Rainfall and Evaporation in the Bedford Ouse LEAP area (1967 – 1996)



The topography of the LEAP area is characteristic of a lowland river with chalk and sand escarpments in the south-east and Jurassic clays to the north and west. The land elevation varies from land close to sea level, at Earith in Cambridgeshire, to an elevation of 184m AOD, south-west of Hitchin.

SURFACE WATER HYDROLOGY AND RIVER FLOW

The Bedford Ouse LEAP area is a combination of fifteen river sub-catchments, covering 1556 km^2. The sub-catchments of the Rivers Hiz, Ivel and Flit and their associated tributaries drain the Chalk and Woburn Sands in the south east of LEAP area. The Bedford Ouse, Kym, Ellington Brook and Alconbury Brook drain the clay catchments in the north and west of the LEAP area.

River flows are comprised of two principal natural components. These are run-off, resulting from rainfall, surface or near-surface drainage, and baseflow, derived from spring flows from groundwater. It is spring flows, in particular from the Chalk and sewage effluent returns that maintains most rivers' flow in the LEAP area through dry periods. The upland rivers, above the spring line to the east of the catchment, are susceptible to drying, as they are not in receipt of Chalk baseflow.

There are 11 permanent river flow gauging stations and 13 river level stations within the catchment. At present, flows at Offord Gauging Station on the Great Ouse are multiplied by a factor based on catchment area to estimate the flow for the river downstream to Earith. This provides an estimate of flows, but a more accurate flow record could be gained by construction of a new gauging station further downstream. Table 1.1 shows flow statistics for key gauging stations located on the major watercourses in this LEAP area. The river levels in many instances are controlled by weirs and other structures built to hold water back.

Table 1.1: Key River Statistics

Gauging Station NGR Period of Record	River	Max Flow (m^3/s)	Min Flow (m^3/s)	Mean Flow (m^3/s)	Flow Exceeded for 95% of the time (Q_{95})
Bedford TL 055 495 1933 – 1999	Bedford Ouse	278.10	0.01	5.42 error! =10·2 mean.	0.72
Arlesey TL 190 379 1973 – 1999	Hiz	6.30	0.07	0.78	0.36
Shefford TL 143 393 1966 – 1999	Flit	13.54	0.14	1.06	0.45

Gauging Station NGR Period of Record	River	Max Flow (m^3/s)	Min Flow (m^3/s)	Mean Flow (m^3/s)	Flow Exceeded for 95% of the time (Q_{95})
Blunham TL 153 509 1959 – 1999	Ivel	32.60	0.41	3.83	1.29
Roxton TL 160 535 1972 – 1999	Bedford Ouse	135.00	0.21	16.76	2.62
Meagre Farm TL 155 631 1960 – 1999	Kym	34.00	0.00	0.63	0.02
Offord TL 216 669 1970 – 1999	Bedford Ouse	148.40	0.00	13.92	1.95
Brampton TL 208 717 1963 – 1999	Alconbury Brook	36.30	0.00	0.78	0.01

The Agency maintains a network of recording stations where hydrometric information such as rainfall, river flows and levels, and groundwater levels are collected. This information enables the Agency to carry out its duties and provides the basis for water resource assessments and management (for example in licence determination and controls). It also has a wider application in the Agency's other functions such as flood defence and environment planning.

1.1.2 Societal Influences

This section describes the influence of people, in particular their demand for water and how the Agency manages this demand. The current allocation of water for abstraction purposes is given in the next section. Our overall framework for water resources planning and development is set by our National and Regional Water Resources Strategies. The document 'Water Resources in Anglia', published in 1994, reviewed the resource-demand balance in the Region for the following 30 years. This remains the main statement of water resources in Anglia at present. The National and Regional Water Resources Strategies will be revised and updated in 1999/2000.

The Agency is a public authority that is accountable to society and the elected Government. It also acts on behalf of society by enforcing the legislation considered necessary to meet

society's requirements concerning water allocation and the protection of the water environment. The current legislation is the Water Resources Act 1991, (which formally superseded the Water Resources Act 1963) and the Environment Act 1995.

The demands of society change and the present Government, in recognition of this, undertook a review of water resources legislation as discussed in Section 1.1.

At present, we operate according to four objectives: Meeting Demands, Protect Resources, Proper Use and Conserve Resources (refer to Viewpoint 4.1). In addition to this, the Agency has responsibilities under the Habitats Directive. The Directive was adopted by the Council of European Communities on 21 May 1992 (ref. 92/43/EEC) with the aim of sustaining European biodiversity and protecting rare and threatened habitats, flora and fauna. The regulations apply to Special Areas of Conservation (SACs) which are primarily Sites of Special Scientific Interest (SSSIs), and Special Protection Areas (SPAs), which are designated under the Birds Directive 1979.

The Agency must ensure that these sites are not adversely affected by new abstraction licences or variations to existing abstraction licences; this is already part of the Water Resources Act 1991. However, under the Habitats Directive, the Agency is now obliged to review by 2004 all existing licences that may affect SACs and SPAs. The only candidate site (cSAC) in this LEAP area (to date) is Portholme Meadow.

1.1.3 Abstractions and Removals, And Uses, Releases and Discharges

Water is abstracted from rivers (surface water) and the ground (groundwater) and used for many purposes; described later in this section.

Abstractions of water (with some exceptions including general agricultural and domestic use less than 20 m^3/d) require a licence under the Water Resources Act 1991.

We only issue a licence if there is sufficient water available, the need for the water is justified, all rights of existing users are protected and the water environment (e.g. rivers, springs and wetland sites) is not unacceptably affected. Abstraction from surface water sources is subject to low level or flow restrictions in order to protect the river and downstream users (low flows may have an impact on the effects of any discharges). The final use of the abstracted water can be constrained by its quality. A licence holder should be aware that we do not guarantee the quality of ground or surface waters for the suitability of its use e.g. there may be a naturally high content of minerals such as iron.

Viewpoint 4.1 describes the current policies with respect to water availability and Table 4.2 lists the current cessation clauses that are applicable.

Abstraction classes are divided into potable water supply, agricultural use, industrial use and raw water transfer. The information is summarised in Figures 1.3 and 1.4 below:

Figure 1.3: Volume of Water Licensed (excluding PWS)

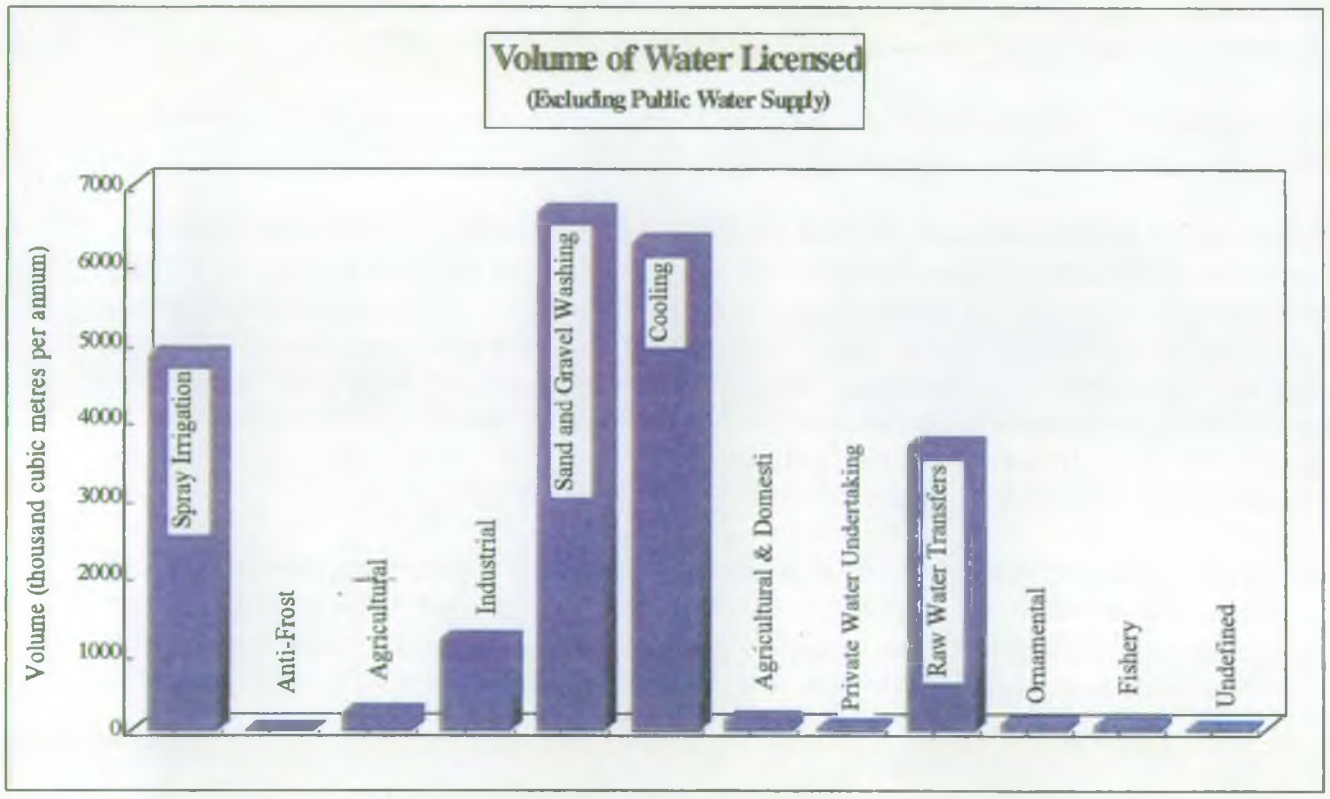
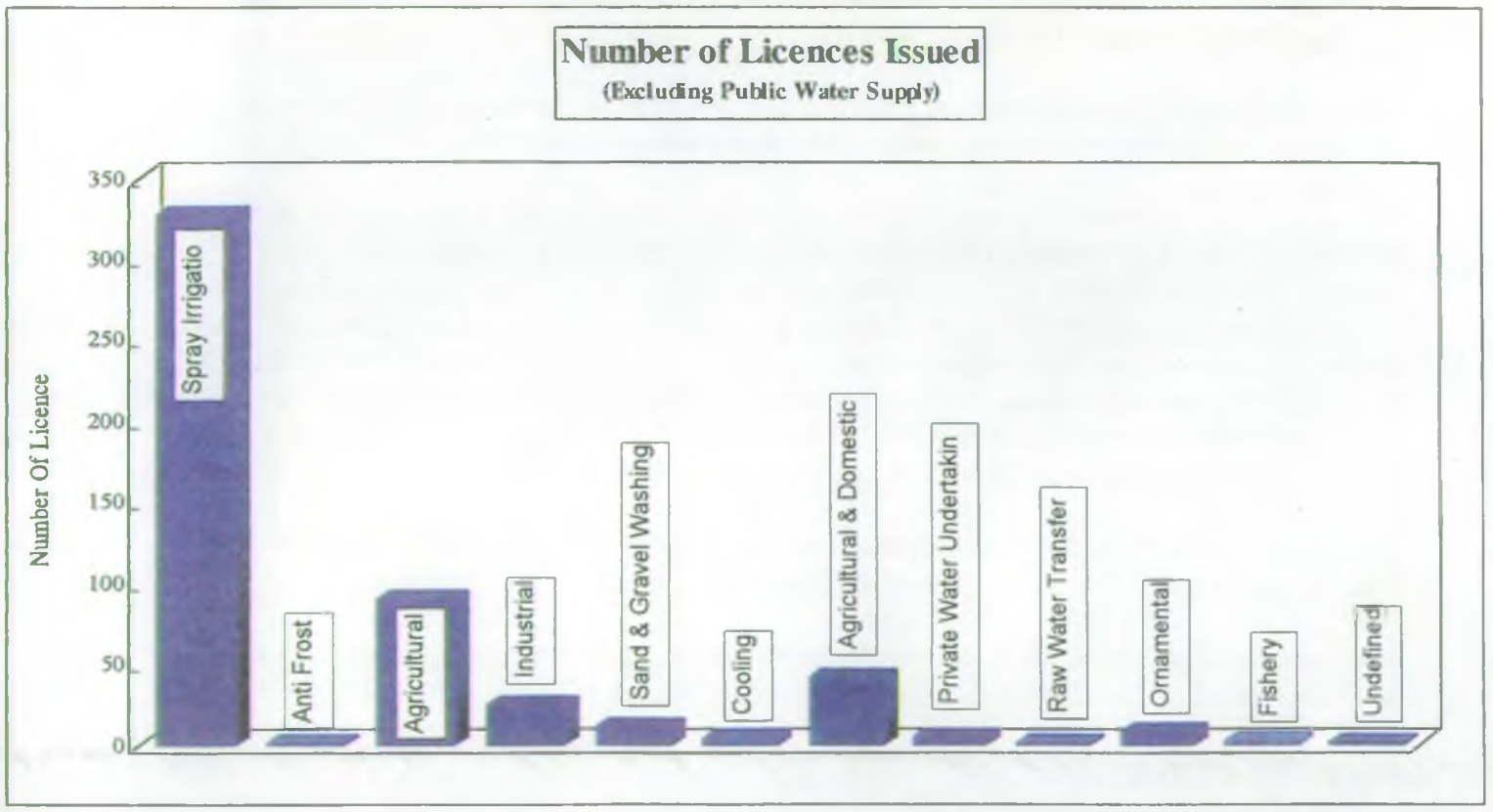


Figure 1.4: Number of Licences Issued (excluding PWS)



POTABLE WATER SUPPLY

The abstraction of water for PWS represents approximately 142 million cubic metres per year, which is 86% of the total volume licensed for all uses in the LEAP area. The locations of the public water supply abstraction sites are shown on Map 1.1.

Anglian Water Services Ltd (AWS) supplies water to most of the population within this LEAP area; their abstraction licences represent approximately 91% of the volume licensed for PWS in the area. The company operates a comprehensive water supply mains network. The water can be distributed from the borehole or river sources via storage and treatment to the point of demand. After use, approximately 90% the water is returned to rivers via sewage treatment works.

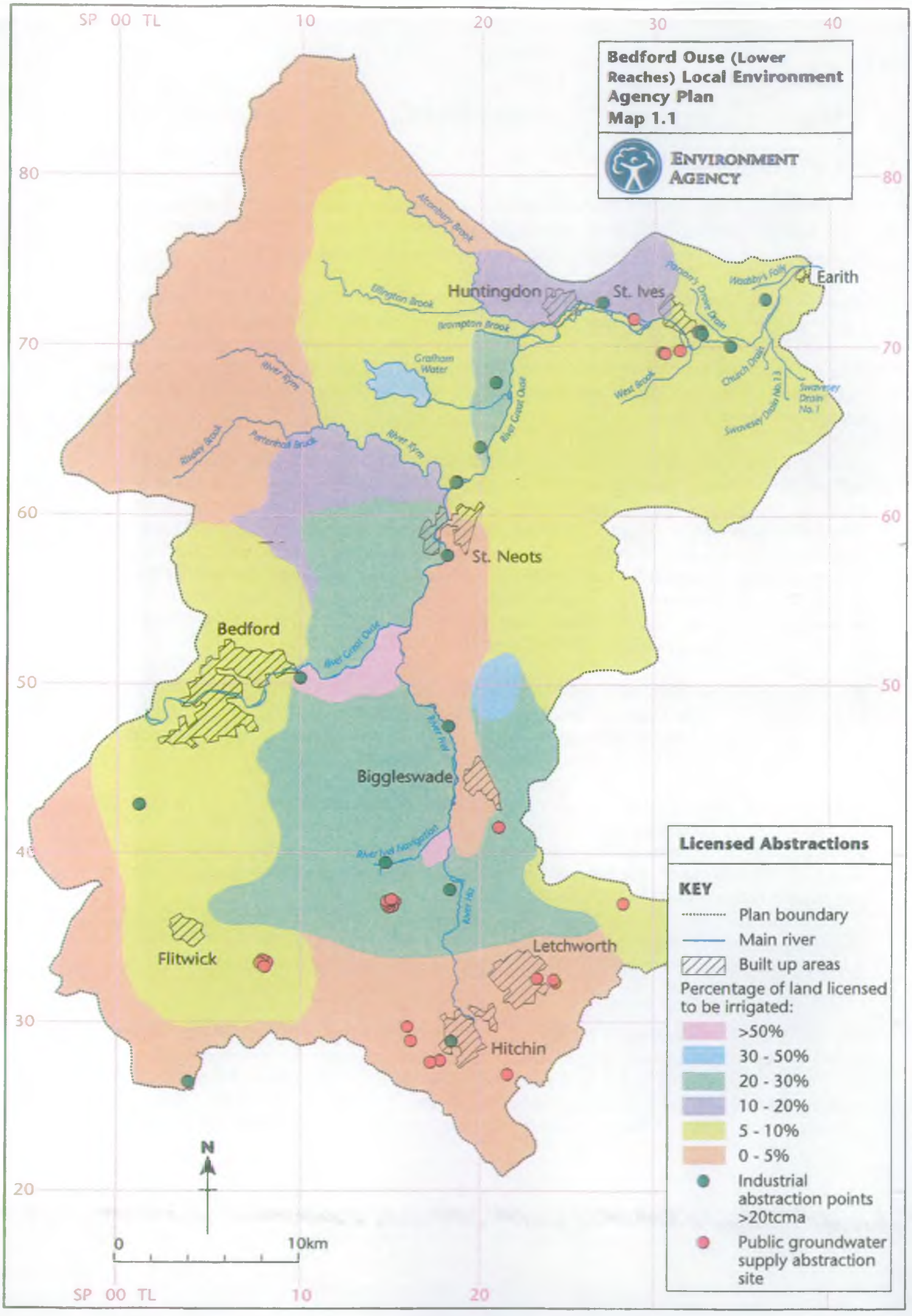
AWS abstract water from both surface and groundwater sources. The company has a surface water licence that allows abstraction from the Bedford Ouse at Offord to fill Grafham Water; this licence contains conditions to protect the downstream flow of the river. Grafham Water is part of a much larger system - including Rutland Water and Pitsford Reservoir - known as the Ruthamford system, allowing water to be moved around the West Anglian region to meet demand. The company also has another licence to abstract from the Bedford Ouse at Brownshill Staunch, although this licence is not used at present. The total volume of surface water licensed to AWS is about 122 million cubic meters per year, which represents 95% of their supply in this LEAP area.

AWS are also licensed to abstract groundwater from the Woburn Sands aquifer in the south of the LEAP area (see Maps 1.1 and A1) and from the gravels at Houghton in the north-west. AWS have a total of just under 7 million cubic metres of groundwater licensed for PWS, representing 5% of their supply total in this LEAP area.

Three Valleys Water (TVW) supplies water in the south-west of the LEAP area. All abstraction by this company is from boreholes into the Chalk aquifer. The company holds seven licences in the area, authorising abstraction of just over 12 million cubic metres of water. TVW will supply the proposed development to the west of Stevenage, which lies just outside of the boundaries of this LEAP area.

Cambridge Water Company supplies water in the north-west part of the LEAP area. The company operates two boreholes in the river valley gravels, which are licensed for up to 750 000 cubic metres.

The LEAP area also supports a number of groundwater sources used for private domestic supply. These abstractions are principally from the Chalk aquifer but there are some shallow wells into sand and gravel deposits. The majority of private domestic supply sources are exempt from licensing under the Water Resources Act 1991. The small quantity that is licensed for this purpose accounts for only 0.01% of the total licensed volume.


Bedford Ouse (Lower Reaches) Local Environment Agency Plan
Map 1.1
Environment Agency
SP 00 TL
10
20
30
40
80
70
60
50
40
30
20
Huntingdon
St. Ives
Earith
St. Neots
Bedford
Biggleswade
Flitwick
Letchworth
Hitchin
Alconbury Brook
Ellington Brook
Brampton Brook
Gratham Water
River Kym
Ridgey Brook
Pertenhall Brook
River Great Ouse
West Brook
Church Drain
Swavesey Drain No 1
Swavesey Drain No 1 3
Hoadley's Folly
Parson's Drove Drain
River Ivel
River Ivel Navigation
N
0
10km
Licensed Abstractions
KEY
Plan boundary
Main river
Built up areas
Percentage of land licensed to be irrigated:
>50%
30 - 50%
20 - 30%
10 - 20%
5 - 10%
0 - 5%
Industrial abstraction points >20tcma
Public groundwater supply abstraction site

AGRICULTURAL ABSTRACTION

Agricultural use of water comprises of stock watering, crop spraying, anti-frost spraying and spray irrigation. The LEAP area is rural in nature and it is not surprising that the out of the 535 abstraction licences in this area, 454 (85%) are for agricultural uses. However, the quantity licensed for abstraction for agricultural uses is only 3% of the total volume licensed and this reflects the large volumes of water licensed for PWS and industry in this area.

Water abstracted for spray irrigation is considered as a total loss to resources as the water is not returned the to river after use; the water is taken up by the crops or evaporates. Both rivers and groundwater are used for spray irrigation. The water resource is fully allocated for the groundwater and most summer surface waters in the LEAP area. Hence, in most cases, the only scope to meet the future needs of abstraction, in particular for spray irrigation, is to construct reservoirs in order to store winter river water when available to be used for the following summer.

There are 27 licences related to the storage of water during the winter, authorising abstraction of approximately 1.5 million cubic metres of water. The remaining 327 licences for spray irrigation are for abstraction during summer months.

Five of the 27 winter storage licences have been granted since the issue of the Catchment Management Plan (CMP) in April 1994. These licences represent 7% of the total volume of winter licensed water in this LEAP area. Currently, the Agency is also considering other applications for winter water, in particular in the Marston Vale area, where an application has been made to abstract water for use in the creation of wetlands.

INDUSTRIAL ABSTRACTION

Water companies supply most industrial need, and the water is licensed as public water supply. The 40 licences that are held by individual companies refer to supplies from boreholes or the river directly for industrial use. Industrial use in this LEAP area includes sand and gravel washing, cooling and other industrial processing such as brick and concrete manufacture, brewing and laundries. The quantity licensed for all industrial purposes is approximately 14 million cubic metres per year in this LEAP area, of which 54% is licensed from surface water and 46% from groundwater.

The use of water for sand and gravel washing is the biggest use of water for industry in the LEAP area, representing 47% of the licensed industrial use (nearly 7 million cubic metres per year). Most of this water is taken from the shallow sand and gravel aquifers and much of the water is re-circulated during use. The estimated loss to the resource is 5% of the quantity abstracted.

Just over 6 million cubic metres of water are used for cooling in this LEAP area, representing 45% of the industrial water use in the catchment. Much of this is licensed to National Power PLC for use at the Little Barford Power Station south of St Neots and much of the water used is returned to source. The location of the large (>20 000 m^3 per

year) industrial abstraction points is also shown in Map 1.1.

RAW WATER TRANSFERS AND RIVER SUPPORT

The Agency has a responsibility to conserve, redistribute and protect water resources and we therefore undertake raw water transfers to redistribute water from areas of surplus to areas of local deficit. There are raw water transfers between catchments and within the same catchments. Where possible, the schemes use existing watercourses to redistribute the water.

The River Hiz Low Flow Alleviation Scheme, launched in 1996, is the main river support scheme operational in this LEAP area. The scheme was devised to help alleviate low flows in the upper Hiz and the River Oughton near Hitchin. Low flows have been attributed to abstraction of groundwater for PWS to meet the growing demands for water in the area. Spring flows have been reduced in the Upper Hiz, resulting in the drying out of the stream, particularly during periods of drought. The scheme is operated by the Environment Agency and Three Valleys Water (TVW), and the primary objectives are:

- to enhance the wetland ecology of Oughtonhead Common (a former SSSI);
- to improve the amenity of the upper River Hiz; and
- to maintain secure water supplies for the residents of Hitchin.

Support for the River Hiz involved modification of an existing PWS borehole owned by TVW, to pump water into the Hiz at Charlton Mill Pond. A disused public supply well at Bath Spring, Charlton, was also modified to pump water into the Hiz at the Windmill public house pond. This borehole is operated by the Agency. The River Oughton is supported by water pumped into it at Oughtonhead Springs. This water comes from two PWS boreholes connected by a pipeline and operated by TVW. The scheme also involved construction and repair of sluices to allow better control of water levels on the former SSSI.

Following this work, a three-year ecological monitoring programme was devised to measure the success of the scheme. The monitoring of the impacts is complete, and analysis of the results will be undertaken in 1999/2000.

The Agency also holds a licence that allows transfer of water from the River Great Ouse at Earith Sluice into the Old Bedford/River Delph for transfer into the Middle Level Drainage area (which is not within the LEAP area). The purpose is to supplement the water resources in the Middle Level to meet summer demands, mostly for spray irrigation. However, the transfer rarely takes place due to navigation constraints that require water levels at Earith to be maintained above 2.13 m AOD.

1.1.4 Illegal Practices

ENFORCEMENT

The Agency's Enforcement staff make routine visits to abstraction licence holders in order to ensure that:

- the licence holder understands the conditions of the licence and is complying with the conditions;
- to ensure that monitoring measures are in place and working; and
- to ensure that records are properly maintained.

The Agency's policy is to inspect all licence holders abstracting more than 20 m^3 per year every five years, but some will be inspected more frequently than others. To help schedule the visits, licences have been divided into categories. Table 1.2 below indicates the category of the licence and the frequency of visit:

Table 1.2: Licence Types and Inspection Frequencies

Class	Indicative Licence Type	Inspection Frequency
Highly Critical	(i) Licences requiring positive action by licence holder to augment or maintain flows to support abstractions (ii) Licence involved in river regulation schemes (iii) Licences requiring continuous telemetered monitoring as part of river or groundwater management scheme (iv) Abstraction or impounding licences subject to restriction conditions based on minimum prescribed flows or levels that vary with season	At least once a year but more frequently: (a) During periods of greatest importance to the water environment (e.g. dry periods); (b) As dictated by seasonal licence conditions
Critical	(i) Abstraction or impounding licences subject to restriction conditions based on minimum prescribed flows or levels that do not vary seasonally; (ii) Spray irrigation licences subject to two part tariff charges; (iii) Licences with a potentially significant environmental impact.	Once a year
Less Critical	All other abstraction and impounding licences - mostly licences not more than 20 m^3/d	Every 5 years
Small	Licences not more than 20 m^3/d	2% of such licences to be visited annually on a random basis
New Licences	New licences, major variations and successions	'As soon as possible' within 2 weeks of issue, if possible.

Source: Licensing Manual Chapter 9, Table 1

Under Section 57 of the Water Resources Act 1991, the Agency is able to restrict the quantity abstracted for spray irrigation during dry periods, in order to protect river flows. When restrictions are in force the Enforcement Team is informed and they visit the areas concemed to ensure the restrictions are understood and adhered to.

The Environment Agency prosecutes abstractors for non-compliance with abstraction licence conditions and for illegal abstraction. We would prefer to prevent this course of action by the system of visits and education as previously described. Compliance with

these targets has been met in this LEAP area, and no prosecutions have been necessary.

1.2 Habitats

In the LEAP area, there are natural, semi-natural and urban habitats. Agricultural, industrial and development pressures have accelerated the loss of a variety of habitats with a consequent loss of biodiversity. This is true of the UK as a whole, but is particularly acute in the densely populated south-east of England. Maintaining a variety of habitats in this area is essential.

At the 1992 United Nations' Earth Summit, the Convention on Biodiversity included a commitment to the rehabilitation and restoration of degraded ecosystems and the promotion of recovery of threatened species through the development and implementation of biodiversity plans. The UK response to this commitment was the document 'Biodiversity: The UK Action Plan', which recognised that 'biodiversity is ultimately lost or conserved at the local level'. Local Action Plans are therefore an essential part of the process.

As part of the national biodiversity action planning process, a number of key habitats were identified. These key habitats had to meet one or more of the following criteria:

- habitats for which the United Kingdom has international obligations;
- habitats at risk, such as those with a high rate of decline;
- habitats important for key species; and
- habitats which may be critical to species inhabiting wider areas.

From these criteria, county steering groups in Bedfordshire, Cambridgeshire, Hertfordshire and Northamptonshire identified the relevant habitat types:

- Waterways and Wetlands;
- Woodlands;
- Farmland;
- Grassland;
- Heathland; and
- Urban Areas

WATERWAYS AND WETLANDS

Rivers, ponds and other wetlands are an important part of our biodiversity. Rivers and canals provide green corridors for wildlife in an often intensively developed urban or agricultural landscape. As well as conserving freshwater sites, there are opportunities for encouraging wildlife through the creation and restoration of wet habitats.

In the Bedford Ouse the rivers are slow flowing clay and alluvial rivers although the headwaters of the River Hiz rise in the Chilterns and are chalk streams. Rivers shape the landscape and the lives of people who live along their banks. The rivers in this area have carved wide river valleys, where many of the major settlements are located, and have

deposited vast quantities of alluvial sands and gravels. There are few rivers in the area which have not been modified, either directly, to improve drainage and navigation, or indirectly, by changes in adjoining land use.

Ponds are small water bodies, either natural or man-made with distinctive communities of animals and plants, including rare and protected species such as the great-crested newt. Ponds have a popular appeal and are often used for environmental education. Ponds in gardens and school grounds provide a valuable refuge for plants and animals, including dragonflies and frogs.

Canals were built in the seventeenth and eighteenth centuries to carry freight, are now a focus for angling and walking and are high quality refuges for wildlife. The River Ivel in Bedfordshire was made a navigation (canalised) between Biggleswade and Shefford in 1810, and was locally known as the Shefford Canal. Navigation was finally closed in 1876.

Water storage reservoirs have added considerably to the amount of open water and marginal wetland habitat for plants, birds, dragonflies and other aquatic wildlife, e.g. Grafham Water (a PWS storage reservoir managed by Anglian Water). This has been designated as an SSSI for the nationally important number of passage migrants, wintering bird species and breeding wetland birds. The construction of winter storage reservoirs, primarily for agricultural irrigation, can be designed with habitat creation in mind (both the Agency and Farming and Wildlife Advisory Group (FWAG) can advise on this).

The river valleys of the Great Ouse, the Ivel and Elstow Brook have yielded rich mineral resources in alluvial sands and gravels and clay (see Map A1). The flooded pits that are left behind provide an opportunity for imaginative habitat restoration projects, such as the extensive reedbed creation proposals for the proposed Needingworth Quarry. There are already well established flooded gravel pits that have SSSI status (such as Little Paxton Pits) and many more in the LEAP area that are recognised as County Wildlife Sites (CWS). Exhausted brick clay pits in the Marston Vale, alongside the Elstow Brook, have a rich wildlife interest and form part of a community forest proposal for the Vale.

Fens (valley mires, swamps, and reedbeds) are scattered throughout England, but in East Anglia, they have declined dramatically in the past century. Fens are a key habitat in the UK Biodiversity Action Plan. Significant areas of fen habitat are protected as SSSIs, for example, Flitwick Moor, which is a remnant of a eutrophic valley mire and the largest area of wetland in the LEAP area.

Lowland wet grassland is pasture and meadowland in river flood plains, usually with networks of ditches that retain high water levels. Important wetland habitats have been created in the flood plain washlands of the rivers in the Bedford Ouse. Wet grassland and grazing marsh are important in terms of their capacity to control flood waters and provide an important source of water storage. Most is grazed or cut for hay and silage. Traditionally, winter flooding by rivers deposited silt, which fertilised cattle pastures. Semi-natural wet grassland, such as flood meadows and other neutral grasslands, with their characteristic plants, are rare because of drainage and agricultural improvement.

Wet grassland contains a variety of habitats, ranging from drier to wetter areas, which are important breeding grounds for wading birds and also support winter feeding areas for wildfowl. Some of the ditch systems are rich in plants and invertebrates, providing an important stronghold for species which formerly inhabited shallow waterbodies and wetlands which been lost through drainage. This mosaic of habitats makes wet grasslands extremely valuable for wildlife and some have been designated as candidate Special Areas of Conservation (cSAC) under the European Habitats Directive, egg Portholme Meadow. Channels of the River Great Ouse surround the meadow, and the Alconbury Brook is close by, so in the winter and early spring Portholme is inundated by floodwaters. It is the largest areas of this grassland type in the country managed on traditional lines as a 'lammas' meadow. This traditional management and the seasonal flooding maintain the diversity of the alluvial flood meadow plant communities.

The stretch of the River Great Ouse between St Neots and Earith supports a number and variety of flood plain meadows with SSSI status (see Table 1.3 below):

Table 1.3: Flood Plain Meadows Between St Neots And Earith

SSSI	Grid Reference	Habitat Type
St Neots Common	TL 183 613	Alluvial grassland with ponds, ditches and willow carr.
Portholme Meadow	TL 238 708	Alluvial flood meadow
Godmanchester Eastside Common	TL 270 716	Calcareous loam and calcareous clay pasture types
Houghton Meadows	TL 293 717	Ridge and furrow neutral grassland
Berry Fen	TL 378 745	Washland habitat of neutral grassland

The Local Biodiversity Action Plan for rivers and wetlands in this area will consider the following types of actions:

- Conserve existing fen sites and create large new fen sites where possible;
- Restore river flood plains to their rivers, wherever possible, to create new areas of wetland by ensuring seasonal flooding;
- Restore high water tables and seasonal flooding on flood plains, wherever possible, to sustain a variety of wildlife;
- Restore the natural course of rivers, where appropriate, and promote the creation of in-river habitat diversity such as riffles and pools;
- Maintain and, where necessary, restore high water quality standards in rivers, streams and drains;
- Enhance, where possible, bankside management to encourage more wildlife;
- Ensure there is no further loss of existing wetland habitat and, where appropriate, enhance the interest of the habitat;
- Maintain riverside pollards as a familiar feature of our valleys and as an important wildlife haven;
- Encourage retention and restoration of field ponds and appropriate management and excavation of new ones;

- Ensure that the afteruse of gravel pits makes provision for nature conservation interests; and
- Increase the accessibility and availability of information on river and wetland management to land managers.

The wetland SSSIs in the LEAP area are shown on Map 1.2.

WOODLANDS

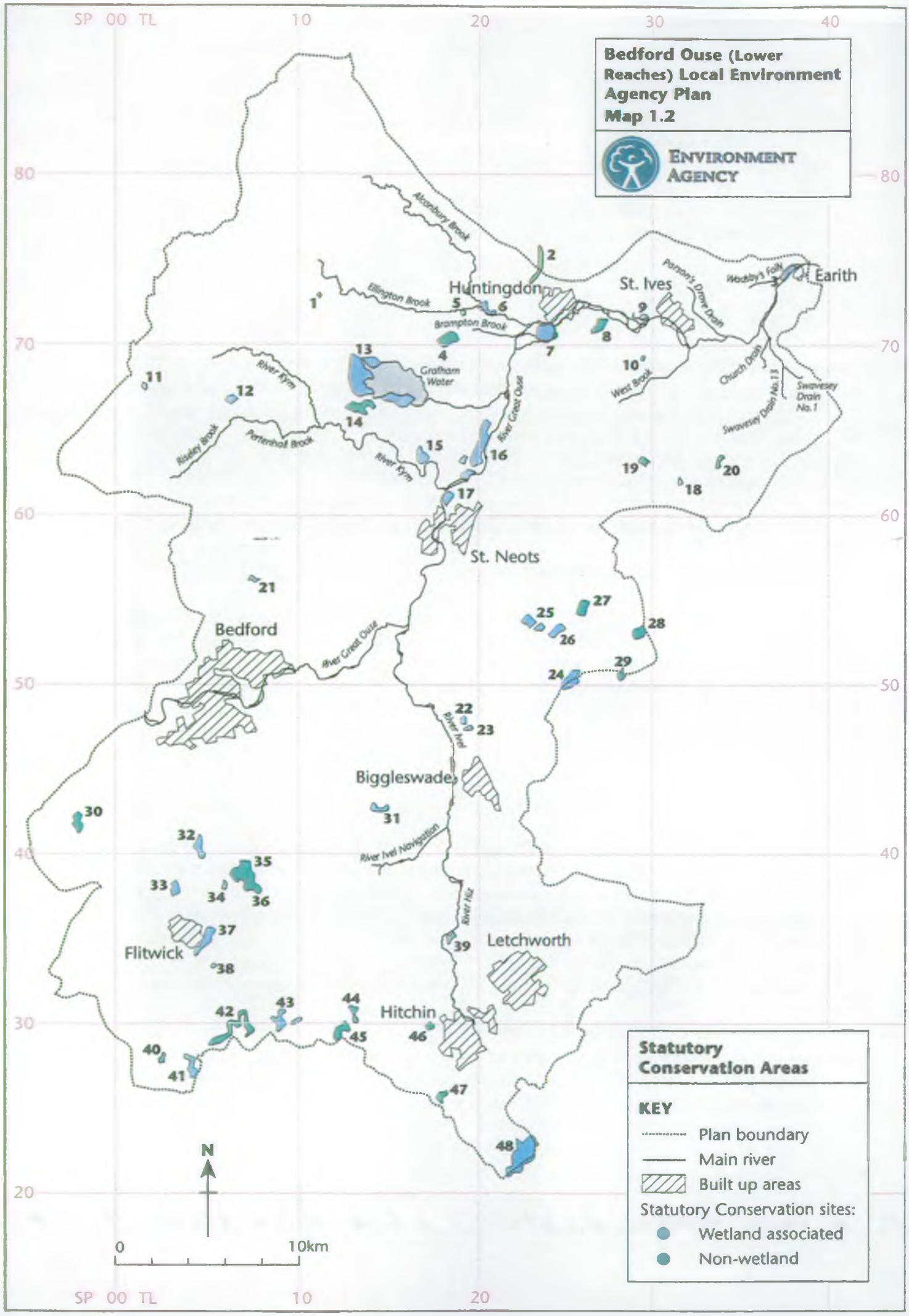
Britain is one of the least wooded countries in Europe, and the LEAP area is one of the least wooded in the country. The county of Bedfordshire has only 7% woodland cover and Cambridgeshire, with its predominantly arable landscape, has less. Of this woodland cover, nearly half is plantation and the remainder broad-leaved, very little of which - perhaps 1% of the LEAP area - is ancient woodland.

Many of the ancient woodlands in the Bedford Ouse have some form of protection, by way of a conservation designation. For example, Odell Great Wood, Marston Thrift, Brampton Wood and Hayley Wood all have SSSI status (see Map 1.2). There are also many remnants of ancient woodland with CWS status.

Wet woodlands (carrs) are defined as woodland that exists in a waterlogged environment for all or most of the time. The tree species particularly associated with carrs are willow and alder and, in drier circumstances, birch and oak. Carrs occur infrequently in this area and are smaller and more isolated than in other parts of the UK. Although carr is one of the rarest habitats in the area, the LEAP area is home to one of the most important carr sites in the south-east of England, on Flitwick Moor SSSI. Other carr sites in the area are fragmented, mainly along the River Flit, and one or two sites on the River Great Ouse. Southill Wood is a wet woodland SSSI, specifically designated as a wet valley alder wood. Many other carrs and wet woodlands are classified as part of a CWS.

Coniferous plantation woodland is usually made up of stands of a single species, but here, they tend to be of mixed species. In thinned older stands and at edges and glades, a variety of native trees and shrubs can develop as an understorey. Many first rotation forests are reading for harvesting age and this could provide an opportunity to restructure the habitat to improve the diversity of plants and therefore the species dependent on them. Conifer plantations can help support several important bird species. In this LEAP area, there are no conifer plantations with SSSI designations, but some SSSIs have areas of plantation within them.

Wood pastures and parklands contain large numbers of veteran trees. They can be of international importance for invertebrates that live in dead wood habitats. Southern England once had a vast expanse of these estate parklands, but it is thought that only remnants of most sites remain. One large park, at Woburn, lies on the edge of the Bedford Ouse LEAP area and at one time occupied perhaps 3200 hectares. Wrest Park, Southill Park and Chicksands Priory probably all exceeded 200 hectares. Woburn Park is a present day example of working wood pasture with large herbivores (cattle and venison) grazing acid/neutral grassland beneath trees of mixed ages, including some veterans.


Bedford Ouse (Lower Reaches) Local Environment Agency Plan
Map 1.2
Environment Agency
SP 00 TL
10
20
30
40
80
70
60
50
40
30
20
Huntingdon
St. Ives
Earith
St. Neots
Bedford
Biggleswade
Flitwick
Letchworth
Hitchin
Alconbury Brook
Ellington Brook
Brampton Brook
Grafham Water
River Kym
Ridgey Brook
Portenhall Brook
River Great Ouse
West Brook
Church Drain
Swavesey Drain No.13
Swavesey Drain No.1
Parson's Drove Drain
Healey's Folly
River Ivel
River Ivel Navigation
River Hiz
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
N
0
10km
Statutory Conservation Areas
KEY
Plan boundary
Main river
Built up areas
Statutory Conservation sites:
Wetland associated
Non-wetland

Key to Map 1.2 Statutory Conservation Areas

Wetland associated	Non-wetland
3 Berry Fen (Low Priority Site)	**1** Little Catworth Meadow
6 Brampton Racecourse	**2** Great Stukeley Railway
7 Portholme Meadows (WLMPs, prepared, endorsed)	**4** Brampton Wood
9 Hougton Meadows (WLMP - prepared, endorsed)	**5** Brampton Meadow
12 Swineshead Wood	**8** Godmanchester Eastside Common
13 Grafham Water	**10** Hemingford Grey Meadow
15 Little Paxton Wood	**11** Yeldon Meadows
16 Little Paxton Pits (WLMP site)	**14** Perry Wood
17 St Neots Common (WLMP Site)	**19** Papworth Wood
18 Elsworth Wood	**20** Overhall Grove
21 Tilwick Meadow	**27** Waresley Wood
22 Sandy Warren	**28** Hayley Wood
23 Sandy Meadows	**29** Buff Wood
24 Potton Wood	**30** Marston Thrift
25 Weaveley & Sand Woods	**35** Maulden Heath
26 Gamlingay Wood	**36** Maulden Wood & Pennyfather's Hill
31 Southill Lake & Woods	**40** Fancott Woods & meadows
32 Kings Wood & Glebe Meadows	**42** Smithcombe,Sharpenhoe & Sundon Hills
33 Cooper's Hill	**44** Knocking Hoe
34 Maulden Church Meadow	**45** Deacon Hill
37 Flitwick Moor	**46** Oughtenhead Lane
38 Pulloxhill Marsh	**47** Wain Wood
39 Arlesey Brick-Pits	
41 Sundon Chalk Quarry	
43 Barton Hills	
48 Knebworth Woods	

The Local Biodiversity Action Plans for woodlands in the Bedford Ouse LEAP area has a number of objectives including:

- Protection and enhancement of all ancient semi-natural woodland;
- Creation of new native woodland, with due attention to local distinctiveness, landscape, history and soil types;
- Implementation of management strategies for profit and economic viability with increasing biodiversity as the key aim; and
- A broader public understanding of woodland processes and woodland management strategies.

FARMLAND

The Bedford Ouse LEAP area is predominantly an agricultural landscape. Consequently, the futures of many species of plant and animal are inextricably linked to the way farmland habitats such as cereal field margins, hedgerows and pastures are managed. Common Agricultural Policy (CAP) reforms over the coming years, starting with Agenda 2000, may develop opportunities that will help to encourage species of conservation value. This may halt the decline of formerly widespread and common species, such as the skylark and the brown hare.

The majority of farms are intensive arable holdings, with wheat as the dominant crop. Post-war agricultural practices have contributed to the decline in once-common species of birds, mammals and plants. MAFF's Agri-Environment Policy is demonstrating how, given the suitable incentives, farming practices can be both environmentally friendly and economically viable.

The Local Biodiversity Action Plan for farmland will consider some of the following actions:

- Encourage additional subsidies for less intensive 'wildlife friendly farming';
- Encourage the amendment of the set-aside regulations to enable them to become more beneficial to wildlife;
- Work for payments which encourage the creation of winter stubble;
- Promote the creation of wildlife headlands adjacent to arable crops;
- Seek the creation of a series of nature reserves for corn field annuals to conserve this endangered group of plants;
- Encourage appropriate management of existing hedgerows;
- Encourage hedgerow trees to be grown as standards;
- Promote the planting of new hedges using native species where appropriate;
- Encourage the promotion of buffer zones adjacent to water courses; and
- Encourage appropriate management of existing farm ponds and appropriate restoration of derelict ones.

GRASSLAND

There are three main types of unimproved, wildlife rich grasslands found in the area:

NEUTRAL GRASSLAND

At one time much of the area would have been dominated by this habitat, which would have supported grazing stock. Unimproved neutral grassland contains a rich variety of flowering plants and grasses that in turn provide home and food for a variety of insects, birds and mammals. Glebe Meadows SSSI is adjacent to Kings Wood in Bedfordshire and exhibits the species richness typical of unimproved neutral grassland, traditionally managed for hay and grazing. Parts of the meadows exhibit ridge and furrow with abundant cowslips (*Primula veris*) throughout.

CALCAREOUS GRASSLAND

Calcareous grassland is a very important habitat type within the Bedford Ouse area, supporting unique and extremely rich plant communities. A single square metre of calcareous grassland, for example, may contain in excess of 30 different species of plants.

In the Bedford Ouse LEAP area, calcareous grasslands are predominantly associated with the steep scarp slopes of the Chilterns chalk outcrop. Historically they formed part of the traditional sheep walks, e.g. Barton Hills SSSI and Sharpenhoe Clappers within the Chilterns Area of Outstanding Natural Beauty.

ACID GRASSLAND

Acidic grasslands are associated with soils which are acidic in nature and low in nutrients and are found mainly on the Woburn Sands. Traditionally, acidic grasslands formed a mosaic with heath which is also characteristic of this area. Today only small fragments remain e.g.

Maulden Heath SSSI, which is situated on a gentle south-facing slope of the Lower Greensand Ridge near Clophill.

The Local Biodiversity Action Plan for grasslands will consider the following actions:

- Contact all owners of grassland CWS to advise on management;
- Raise public awareness of the importance of existing grasslands and the threats of mismanagement such as woodland planting and the use of agrochemicals;
- Target Countryside Stewardship to County Wildlife Site grasslands;
- Promote the creation of new areas of chalk and limestone grassland; and
- Develop a strategy to conserve wildlife on grass roadside verges.

All grassland SSSIs are shown on Map 1.2.

HEATHLAND

Lowland heath is a threatened habitat. It is highly valued, both as an important wildlife habitat and as a culturally beautiful and distinctive landscape, with its purple heather and yellow gorse. It contains distinctive flora and fauna. Areas of heath occur as a result of historic woodland clearance. The acidic soils support a range of plant species which are highly specialised. Traditionally, heathland was managed for sheep grazing or as rabbit warrens, but the loss of former areas of heathland has been caused by conifer afforestation, mineral extraction, agricultural improvement and the decline of traditional management practices.

Heathland sites in the LEAP area are confined along the geological outcrop of the lower greensand rock known as the Greensand Ridge and its associated sandy soils. This is a distinct 'Natural Area' as defined by English Nature and the Countryside Commission. Those heathland sites which fall within the Bedford Ouse areas are at Ampthill and Sandy, some of which have SSSI status (see Map 1.2), e.g. Cooper's Hill SSSI. This is also a designated Local Nature Reserve (LNR) and the best remaining example in the area of the once extensive heathland habitat. The heathland flora is dominated by heather (*Calluna vulgaris*) and fine grasses: common bent grass (*Agrostis capillaris*), wavy hair grass (*Deschampsia flexuosa*) and sheep's fescue (*Festuca ovina*). Other characteristic species include heath bedstraw (*Galium saxatile*), wood sage (*Teucrium scorodonia*) and mouse-ear hawkweed (*Hieracium pilosella*). Sandy Warren SSSI is owned by the RSPB and managed as a nature reserve, again this site is one of the few remaining examples of the extensive heathland that once covered the Greensand Ridge.

There are other relict heathlands along the Greensand Ridge recognised as CWSs. A heathland restoration plan is underway at Sandy Heath Quarry agreed between Bedfordshire County Council and Redland Aggregates. The Bedfordshire Wildlife Trust has carried out heath seed spreading (from Cooper's Hill) in the worked out areas and a management plan is currently being produced.

The Draft Local Biodivesity Action Plan for Heathland in Bedfordshire has set a number of objectives and targets for this habitat:

- To maintain and increase heather cover and reduce woody and shrub species on all existing heathlands by appropriate management;
- To increase the amount of heathland in the county by 50% by 2005, using various methods such as linking of sites, enlargement of existing sites and creation or re-creation of new sites;
- To ensure no further loss of heathland to development or other changes; and
- Ensure that local authorities include heathland habitat protection in Local Plan reviews.

URBAN HABITATS

The Bedford Ouse contains substantial urban areas. The wildlife that survives in these areas is considerable and there are many opportunities for enhancement, e.g. garden ponds are now extremely important habitats for amphibians such as frogs and newts. Habitat creation on existing open space and through development could increase the number of areas of wildlife friendly habitat as well as gardens. The involvement of local communities in encouraging wildlife in towns and villages is very important.

Green space in urban areas falls into three broad categories:

- Habitats which are also found in rural areas, such as ancient woodland, meadows, ponds and lakes;
- Managed green space such as gardens, churchyards, parks, playing fields and allotments; and
- Naturally re-colonised areas such as industrial sites and derelict land.

Buildings and other structures can be of importance to wildlife, such as churchyards for lichens and attics for bats. Urban habitats often occur in mosaics of different types and this can support quite high biodiversity in relatively small areas. Blocks and linear corridors of habitat can also provide important linkage for mobile species, allowing movement within an otherwise hostile environment and sometimes connecting with larger areas of semi-natural habitat in the wider countryside. These blocks and corridors include woodland, copse, hedgerow, flood meadows, gravel pits, abandoned land and riverine corridors.

Wildlife in towns and villages is an essential link with the countryside. It provides a refuge for some of the species and habitats that are under pressure in rural areas. It also provides people with a local connection to nature that might otherwise be unavailable.

The Local Biodiversity Action Plan for urban areas will consider the following types of actions:

- Encourage wildlife-friendly gardening;
- Promote the appropriate management of village ponds;
- Encourage sympathetic management of churchyards;
- Encourage the appropriate management of town parklands;
- Promote the use of vacant and derelict land, either temporarily or permanently, as wildlife habitat;
- Take advantage of opportunities for habitat creation offered by development;

- Raise awareness and a sense of ownership for wildlife and habitats within local communities;
- Encourage schools and colleges to use, and where appropriate, establish, wildlife areas;
- Encourage the provision of Pocket Parks and Local Nature Reserves;
- Encourage the imaginative use of native trees and woodland in landscaping schemes; and
- Safeguard important wildlife sites in our towns and villages

Habitats in the Bedford Ouse area are subjected to a variety of stresses and strains, some of which threaten their continued existence. Agricultural, industrial and development pressures continue to be a major threat, with climate change now posing a new strain for habitat survival.

1.2.1 Natural Forces

Natural forces have historically shaped the landscape and habitats that now exist in the area; ice ages and changes in the courses of rivers over geologic time have affected the topography, geology and soils that exist today.

Natural variation in the weather patterns through periods of extreme (dry and wet) will affect the survival of certain species and course changes.

Fens and other wetland habitats have suffered severe drying due to drought conditions. Groundwater levels have significantly decreased over the period of the drought, leading to substantial losses of plant and animal communities. Even changes of 2 or 3 centimetres can seriously damage wetland biodiversity.

Climatic changes will have a lasting effect on species and habitats, especially those on the limit of their distribution range, which may be lost entirely.

1.2.2 Societal Influences

AGRICULTURAL PRACTICES

Agricultural change associated with the post-war drive for productivity and the CAP has caused widespread changes to habitats.

Wetlands, especially lowland wet grasslands, have been lost at a significant rate in the last 60 years. Losses have been mainly attributable to a shift from traditional pastoral farming, with grazing stock and hay making, to intensive arable farming. This conversion of grassland to arable land through clearance of vegetation and drainage has put pressure on wetland wildlife. Mechanised arable farming has resulted in a period of high loss of, for example, hedgerows, woody copses and headlands, to create larger fields.

Old farm ponds have been filled in over the years and the effects of diffuse inputs from agro-chemicals have also had an impact on a variety of adjacent habitats.

LAND DRAINAGE

Where rivers have been dredged, straightened or re-profiled (generally for drainage or navigation), stable beds which supported submerged and floating plants have been lost, along with pools, undercut banks and other natural features which gave shelter to otters, fish and birds.

Land drainage and flood defence schemes have separated rivers and streams from their flood plains. As rivers have been deepened, their flood plains have been drained so that they no longer retain floodwater on a regular basis. There is often an abrupt transition from the river channel (and any wetlands within raised floodbanks) to adjacent dry land. This causes a loss of wetland areas for plants and animals dependent on seasonally high water tables. Unless conservation measures to retain wetland areas are in place, with emphasis on the maintenance of water levels, flooding regimes and appropriate grazing and cutting, most wetland sites will deteriorate.

RECREATION

The country's waterways and waterbodies have been increasingly used for recreation and watersports. Careful management may be required to prevent conflict between the recreational enjoyment of our waterways and their conservation importance.

MANAGEMENT

The deterioration of many habitats with a high conservation value can be due to lack of management or inappropriate management. Ponds will often succeed from shallow water to dry land as dead leaves and silt accumulate. Sympathetic management can delay this.

Fens (valley mires, swamps and reedbeds) are semi-natural systems often modified by centuries of traditional farming and other types of management e.g. reed-cutting for the thatching industry. Nowadays, deliberate management - mowing, grazing, and scrub clearance - is needed to maintain them. Lack of management or changes in management such as reduced harvesting of reedbeds, have led to their drying out, followed by natural succession to scrub and woodland.

Heathlands developed as a result of woodland clearance within historic times and low-intensity grazing, especially on commonland and pasture. The acidic soils were agriculturally poor and many areas were used for grazing stock. Absence of management such as grazing, cutting, mowing or burning has resulted in the majority of sites becoming overgrown with birch scrub or dense stands of bracken. Many interesting heathland species are dependent upon open, sunny conditions and they quickly disappear from unmanaged heathland. Many of the Woburn Sands heaths in Bedfordshire have been planted with coniferous plantations. Such sites, managed primarily for timber production, may be quite species-rich in the early growth years of the young trees, but quickly become extremely impoverished due to shading by the dense conifer canopy that completely alters the heathland community.

DEVELOPMENT

Urban and road development puts increasing pressure on the countryside, including important habitats. Sites with important conservation designations such as SACs, SPAs and SSSIs are generally protected from inappropriate development by Strategic Planning Policies (PPG 9, County Structure Plans and Local Development Plans). However, where 'overriding' social and economic need can be demonstrated, then these sites can be affected. For example in the recent upgrade of the A1(M) and the link with A14, Brampton Meadows SSSI in Cambridgeshire was significantly reduced in size to a small area of ridge and furrow meadow.

Habitats of conservation value at the local level are given CWS status. As these sites are non-statutory sites, they are not afforded the same level of protection in Strategic Polices and Local Plans and they are therefore more likely to be threatened by development pressures.

Urban areas too are coming under increasing threat, as government policy leans towards the redevelopment of brownfield sites. These brownfield sites, often derelict sites or disused land, can be wildlife enclaves within the surrounding built-up area.

1.2.3 Abstractions and Removals

WATER ABSTRACTION

In the last two centuries, increasing pressure has been placed on England's rivers and groundwaters to meet the increasing demands of the growing population. Therefore, legislation was introduced to manage this demand, protect the water environment and achieve the right balance. Recent years of extreme low rainfall have placed significant natural stress on the water resources. This has caused reduction of river flows and the drying of wetlands, changing their characteristic plant assemblages. In some cases, these natural stresses may have been exacerbated by the effects of abstraction.

GRAVEL AND CLAY EXTRACTION

The alluvial sands and gravels along the Bedford Ouse River valley have been excavated for the construction industry. An aerial view of the area shows a river system with an extensive network of open water bodies dotted alongside. Gravel extraction has often caused a change in the valuable river corridor habitats. However, where low-grade agricultural land has been used to win aggregates the restoration of sites can lead to the creation of new open water areas or reed beds bringing an overall benefit to biodiversity.

The extraction of clay for the brick industry in the Marston Vale has similarly created numerous open water bodies and some have been developed into valuable habitats and are designated as CWSs.

1.2.4 Uses, Releases and Discharges

EUTROPHICATION

Our river systems are carriers for human, industrial and agricultural waste. In fresh waters, eutrophication is caused by inputs of phosphate and nitrate, from sewage effluent and agro-chemicals. Characteristic plants are stressed and replaced by blanket weed and other algae, with consequent changes to animal communities.

Siltation, caused by run-off from agriculture and overgrazing, as well as by suspended solids in sewage and trade effluents, has similar effects, including the smothering of spawning gravels. Lakes are particularly vulnerable to pollution, and eutrophication in shallow lakes causes algal growth to proliferate, resulting in the loss of higher plants. The populations of zooplankton which graze on and can control algae, no longer find a refuge in plant leaves and stems and become more easily predated by fish. Eventually systems become dominated by algae, and higher plants disappear completely. In deeper lakes, stratification occurs whereby excessive nutrients can cause deoxygenation in the deeper areas unless there is mixing through wave action or flushing by rivers.

Wetland areas affected by surface water and fluctuating water tables can be affected by water quality. Water rich in nutrients, may have a detrimental effect on wetland plant communities as enrichment causes an increase in the growth of vigorous plant species leading to a loss of diversity.

1.2.5 Waste Arisings and Disposal

LANDFILL

Increasing amounts of household waste has led to pressure for new sites for landfill. Open pits created by aggregate operations are suitable for this purpose, particularly where they occur in claylands. Many of the clay brick pits in the Marston Vale have been turned over to landfill sites. Occasionally, at the expense of a well established open water body, providing habitat for a variety of plants and animals, with a CWS designation.

1.2.6 Illegal Practices

FLY-TIPPING

Fly-tipping seems to be a problem throughout Britain's countryside. Whilst rarely posing a threat to the ecology of a habitat, it will detract from the aesthetic qualities of some of the remnants of once widespread, natural environments.

The Agency's Enforcement officers regularly carry out checks to ensure compliance with land drainage consents. During 1998, 153 such checks were undertaken. This work is essential to ensure that applicants are complying with the conditions of the consent.

VIEWPOINT 2: FLOOD DEFENCE AND LAND USE

2.1 Flood Defence

The River Great Ouse (Bedford Ouse) between St Ives and Earith is, in the main, embanked on both sides. These earth embankments are generally maintained by the Agency. Earth embankments also exist along the drains in the Swavesey area and adjacent to the River Bedford Ouse at Hemingford Grey and Houghton. The embankment at Houghton protects the village from the type of flooding that occurred in 1947. Embankments also exist along the River Ivel between Tempsford and Langford. South Cambridgeshire District Council maintains some of the embankments around Swavesey. The total length of main river in the LEAP area is 221 km and the total length protected by embankments is 32 km. Embankments protect a total area of 34.2 km^2, leaving 189 km of the River Bedford Ouse not protected by embankments. The total area of flood plain within the LEAP area is 59.7 km^2.

The Agency has a Flood Defence Direct Services Group which deals with emergencies (flooding, structural malfunctions etc.) together with permissive powers to carry out river maintenance. This regular work includes activities such as maintenance dredging, weed control, bank maintenance, bankside vegetation works, obstruction removal and structures operation and maintenance.

2.1.1 Natural Forces

The river conveys water from land in the LEAP area to the sea.

There is a clear requirement for the provision of effective defence for people and property against flooding from rivers and the sea. Normally flooding is a result of extreme meteorological conditions, such as very heavy rainfall, high winds and/or rapid snow melt. Flood and rainfall events are described in terms of frequency at which, on average, a certain severity of flood/rainfall is exceeded. This frequency is usually expressed as a return period in years. For example, a 1 in 50-year flood is a flood event which, on average, can be expected to occur only once in any 50-year period.

The effectiveness of flood defences can be measured in terms of the return period up to which they prevent flooding. It is clear that different types of land use - for example, urban areas and pasture - require different levels of effectiveness for the defences.

THE BEDFORD OUSE AREA

The Bedford Ouse (Lower Reaches) LEAP area covers the catchment of the River Great Ouse (also known as the Bedford Ouse) between Kempston and Earith. The LEAP area covers 1556 km^2 and the River Bedford Ouse generally flows in a north-easterly direction downsteam of Bedford.

The countryside downstream of the town is gently undulating, supporting a mixture of arable farming and pasture. Around St Neots, the river flows through gently undulating countryside with extensive river valley flood plains. Around St Ives the land is generally

flat with consequently larger areas of flood plain on both sides of the river. Around Earith (Cambridgeshire) low-lying land is around sea level. The Bedford area is generally 25-50 metres Above Ordnance Datum Newlyn (AODN). The highest land in the LEAP area is 184 metres AODN and is found in the chalk outcrop area south-west of Hitchin. Map 2.1 shows the topography of the LEAP area.

The Bedford Ouse is navigable from Kempston in Bedfordshire to Earith (66.6 km).

The Alconbury & Ellington, Bedfordshire & Ivel, Bluntisham, Houghton & Wyton, Over & Willingham and Swavesey Internal Drainage Boards (IDBs) maintain and control an extensive network of tributaries and minor watercourses that drain into the River Great Ouse, Hiz, Flit and Upper Ivel. Map 2.2 shows the areas drained by IDBs.

BEDFORD OUSE LEAP AREA CHARACTERISTICS

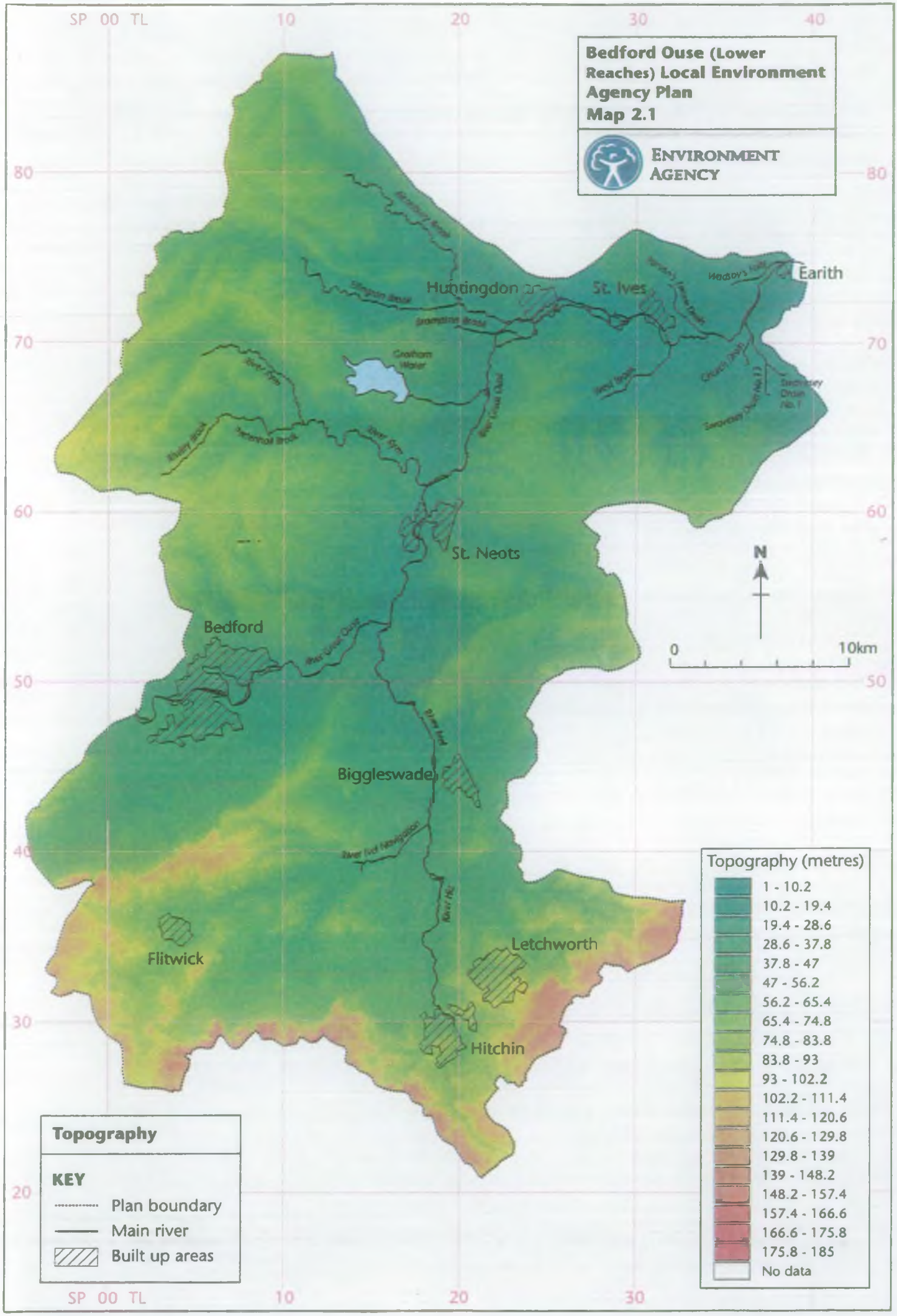
The underlying geology of an area determines stream gradients and density, sediment types and run-off characteristics. The variation in geology accounts for the natural physical variability of rivers. In the LEAP area, rivers generally flow through clay-covered catchments, apart from the Hiz, Flit and upper Ivel, which flow over chalk and Woburn Sands rocks (see Map A1).

The properties of the soil types in the area are important. If the soil has an ability to absorb a lot of water (with a high infiltration capacity) then this can help attenuate very heavy rainfall events. However, if the soil is unable to absorb much water (for example, if it has a high clay content or is very compacted or hard and dry, as in drought conditions), then the amount of surface run-off may be high and a significant proportion of precipitation can enter the river system quickly. Similarly, if the soil is already saturated or very near to full infiltration capacity, then a smaller amount of precipitation can lead to high river flows.

Vegetation cover can also change run-off characteristics. If the vegetation is dense, then it can intercept and delay a high proportion of the precipitation falling on an area. Sparse vegetation can increase the run-off over the land and increase the input to the river system, field drains and road drainage. It can also increase the susceptibility of the land to erosion.

The area, drainage network and channel characteristics are important in determining the rate with which flood waters will flow at any given location. River discharge depends on characteristics such as the width, depth and velocity of flow (which itself is determined by hydraulic radius, channel slope and bed roughness). The area of the river catchment also influences peak discharge. Normally the larger the area, then the more precipitation will fall that will ultimately be drained by the river.

The amount of storage within the area can also reduce the peak discharge from a river. Features such as ponds, sand and gravel pits, meander cut-offs and the channels themselves, can store river water and intercept precipitation, thus potentially reducing the amount of water entering the river and reducing the peak discharge.


Bedford Ouse (Lower Reaches) Local Environment Agency Plan
Map 2.1
Environment Agency
SP 00 TL
10
20
30
40
80
70
60
50
40
30
20
Huntingdon
St. Ives
Earith
St. Neots
Bedford
Biggleswade
Flitwick
Letchworth
Hitchin
Grafham Water
N
0
10km
Topography (metres)
1 - 10.2
10.2 - 19.4
19.4 - 28.6
28.6 - 37.8
37.8 - 47
47 - 56.2
56.2 - 65.4
65.4 - 74.8
74.8 - 83.8
83.8 - 93
93 - 102.2
102.2 - 111.4
111.4 - 120.6
120.6 - 129.8
129.8 - 139
139 - 148.2
148.2 - 157.4
157.4 - 166.6
166.6 - 175.8
175.8 - 185
No data
Topography
KEY
Plan boundary
Main river
Built up areas

WEATHER CONDITIONS

The sudden release of water, perhaps from the thawing of snow cover or from a channel blockage, may cause an area to be flooded. During the autumn, winter or spring periods snow can fall on frozen ground, resulting in the soil being unable to absorb much water. If the weather conditions suddenly turn mild and rain occurs, snow can melt extremely rapidly, resulting in a large quantity of water flushing into the river and possibly causing flooding.

Heavy precipitation, usually associated with a depression or thunderstorm in Britain, can also result in the saturation of soils and a high rate of run-off to rivers. The recent Easter 1998 flooding incident occurred when heavy rainfall fell on the near-saturated River Great Ouse catchment. As a result, much of the heavy rain ended up in the river system and flooding occurred widely across the area. The duration of a storm is also important in determining how much precipitation falls. At Easter, heavy rainfall fell during Thursday, 9th April into Friday, 10th April. The return period of the rainfall event in the Bedford area has been estimated at 1 in 35 years. However, rainfall return periods between 1 in 6 and 1 in 140 years were experienced around the whole of the River Great Ouse catchment. Around St Ives, the return period for the rainfall event has been estimated at 1 in 25 years. Areas of major flooding are shown on Map 2.2.

CLIMATE CHANGE

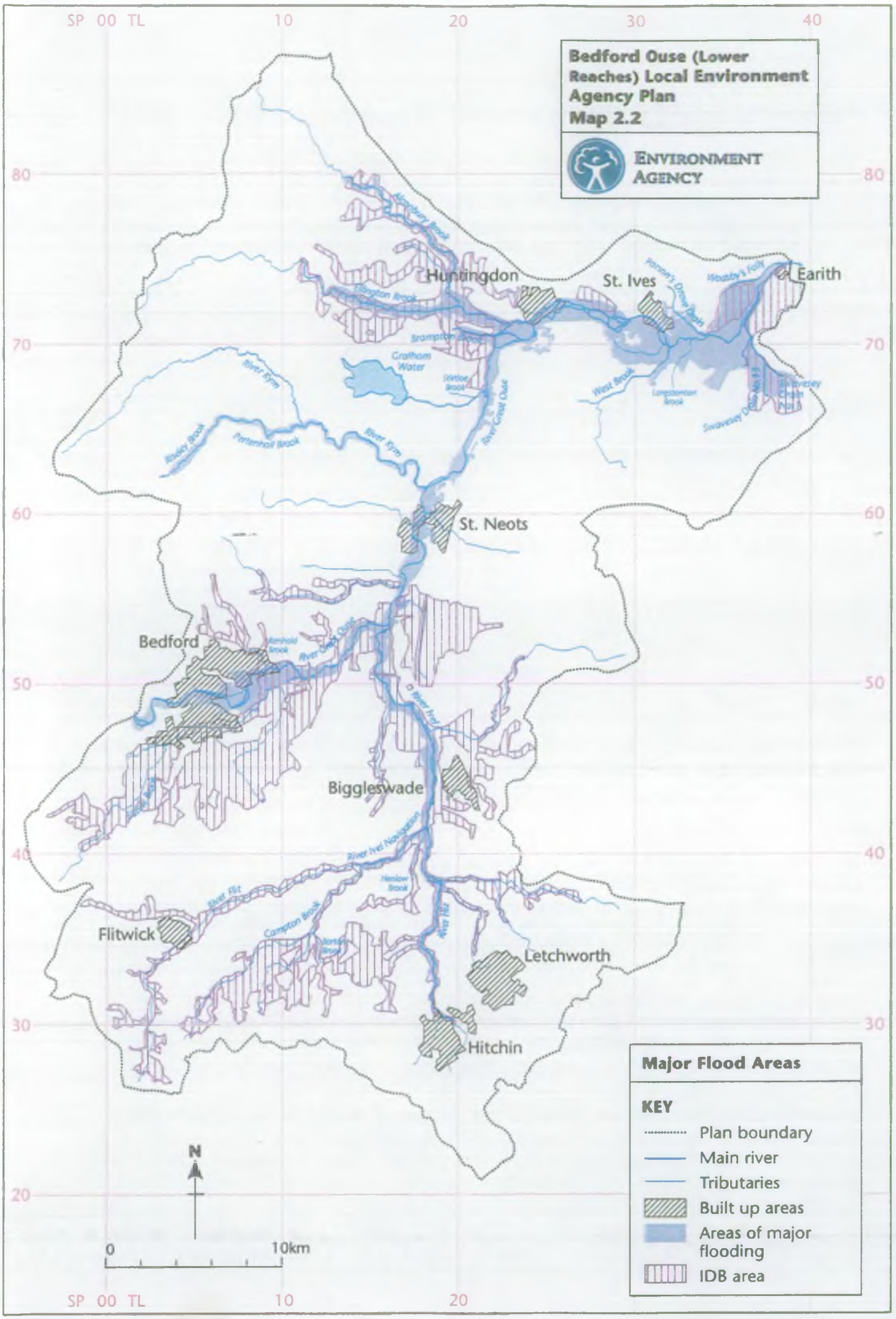
The balance of evidence suggests that man's activities are influencing the world's climate; the most publicised effect is a rise in average global temperature. However, the likely impacts for flood defences are uncertain. Current predictions are that our summers will become warmer and drier and winters wetter and stormier, with the possibility of greater variability between years. This could lead to the more frequent occurrence in the UK of extreme flood events such as those recently experienced in Germany and the United States.

The drought of 1995-7 saw just 86% of the long-term average. Drier summers and extended periods of drought will lead to lower river flows and increased weed growth, potentially impacting on land drainage by increasing levels of siltation and decreasing the efficiency of existing flood defences.

2.1.2 Societal Influences

DEVELOPMENT

Most, if not all, major urban centres have historically been built along watercourses because of the need for crossing points and easily accessible communications. Pressure for land in more recent history has led to the encroachment onto flood plains – for easy and cheaper construction of roads and railways and also for commercial and domestic development. Rivers however, have continued to flood and therefore there has been an increase in pressure for the supply of adequate flood defences.


Bedford Ouse (Lower Reaches) Local Environment Agency Plan
Map 2.2
Environment Agency
SP 00 TL
10
20
30
40
80
70
60
50
40
30
20
Huntingdon
St. Ives
Earith
St. Neots
Bedford
Biggleswade
Flitwick
Letchworth
Hitchin
Alconbury Brook
Ellington Brook
Brampton Brook
Gratham Water
Ouse Brook
River Great Ouse
River Kym
Riddy Brook
Pertenhall Brook
Parson's Drove Drain
Wheatley's Folly
West Brook
Longstanton Brook
Swavesey Drain No 13
Swavesey Drain No 1
Renhold Brook
River Ivel
River Ivel Navigation
Henlow Brook
River Hiz
River Flit
Compton Brook
Barton Brook
N
0
10km
Major Flood Areas
KEY
Plan boundary
Main river
Tributaries
Built up areas
Areas of major flooding
IDB area

The continuing development of land for housing, industry and roads impacts on river systems and therefore flood defences by increasing paved areas. This prevents the absorption of water into the ground, increasing both the amount of water draining directly into watercourses and the speed with which it runs-off the land. Development within the flood plain itself can further reduce the storage capacity of a river system and increase the likelihood of flooding elsewhere.

Significant population growth and urbanisation has occurred over the last few decades around Bedford, Letchworth, Hitchin, St Neots, Huntingdon, St Ives, Biggleswade, Flitwick and Shefford and is likely to increase in the future.

AGRICULTURE

Economic and commercial pressures in agriculture have influenced farming practices by decreasing the area of grassland (which have been ploughed up for arable crops), which in turn increases surface water run-off rates and the sediment loading of rivers. The misuse of fertilisers which contribute to the general nutrient enrichment of our watercourses increases weed growth, thus impacting on the ability of watercourses to discharge flood flows.

Low flows in rivers can impact on flood defences by reducing river velocities. This encourages silt deposition and reduces the ability of watercourses to flush silt accumulations from their beds.

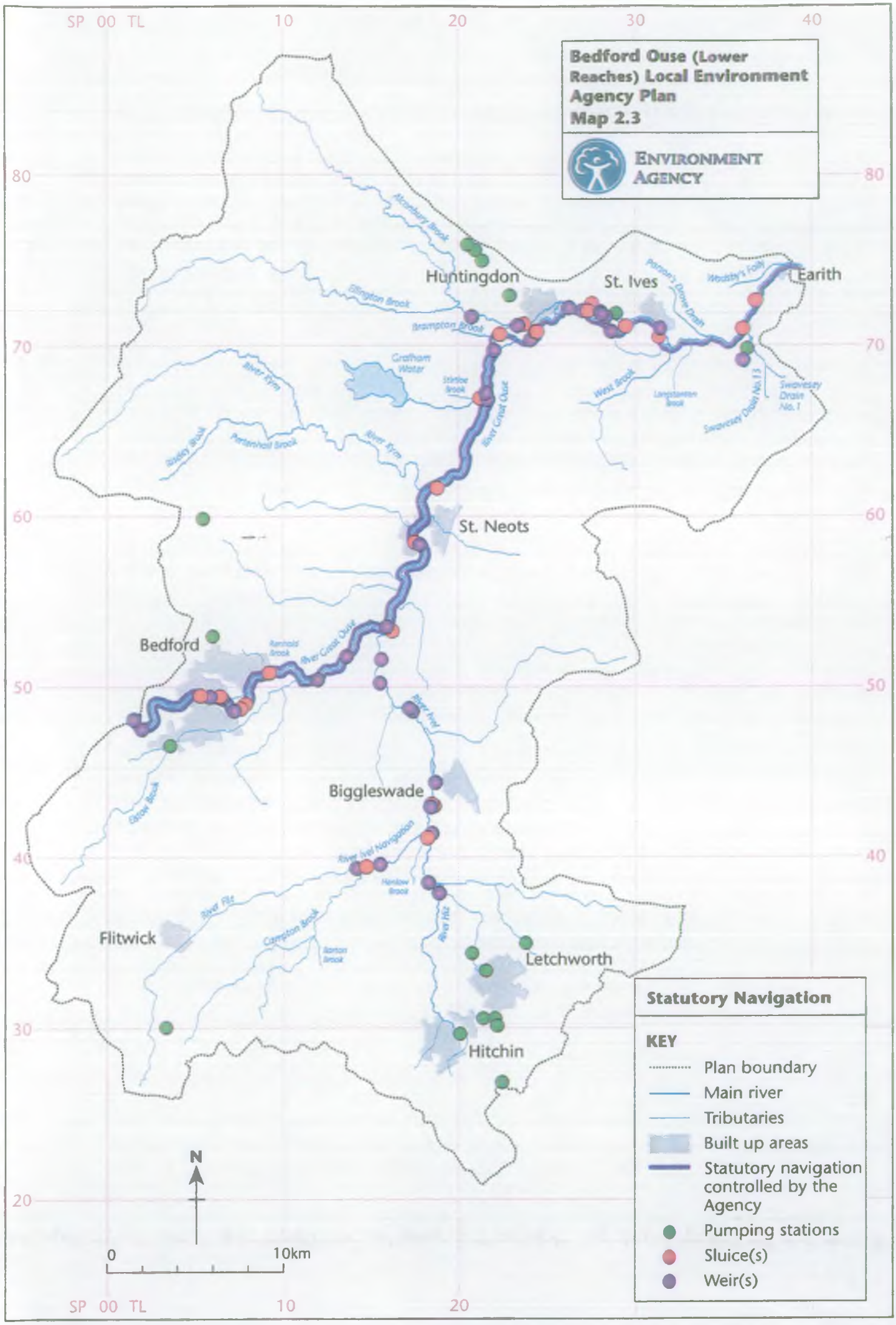
CURRENT STATE

The locks and sluices that exist in the LEAP area are shown on Map 2.3. Between Earith and Bedford there are 15 locks, which are normally used for navigation purposes. However, during periods of high flows they are used for controlling the river level/discharge and are thus not operable for navigation purposes.

Local Internal Drainage Boards (IDBs) maintain and control some watercourses within the LEAP area and carry out similar maintenance operations to the Agency. In the Swavesey area and at Houghton, the local IDB pumps water into the main River Great Ouse system in order to control river levels/flows. There are also a number of 'awarded' watercourses; responsibility for the maintenance of these rests with the relevant district council.

Between Houghton and Huntingdon, work is planned to carry out refurbishment works to four weirs (two upstream of Houghton and two downstream) in order to maintain river levels in accordance with the Houghton Meadows WLMP. There are five weirs, one of which, Stone Gull Weir, has been rebuilt within the last two years.

The weirs to be refurbished are Fischers Dyke, Rymers, Old Mill and Trout Stream Weir. The works will ensure the maintenance of river levels for amenity, navigation and recreation purposes and maintain river corridor habitats. Statutory navigation and weirs are detailed on Map 2.3.


Bedford Ouse (Lower Reaches) Local Environment Agency Plan
Map 2.3
Environment Agency
SP 00 TL
10
20
30
40
80
70
60
50
40
30
20
Huntingdon
St. Ives
Earith
St. Neots
Bedford
Biggleswade
Flitwick
Letchworth
Hitchin
Alconbury Brook
Ellington Brook
Brampton Brook
Graham Water
Stirtloe Brook
River Great Ouse
River Kym
Duloe Brook
Pertenhall Brook
Arnold Brook
River Ivel
Ivel Navigation
Hen Brook
River Hiz
Flit
Campton Brook
Barton Brook
Glebe Brook
Parson's Drove Drain
Woodsty's Folly
West Brook
Langtoncon Brook
Swavesey Drain No.1.3
Swavesey Drain No.1
N
0
10km
Statutory Navigation
KEY
Plan boundary
Main river
Tributaries
Built up areas
Statutory navigation controlled by the Agency
Pumping stations
Sluice(s)
Weir(s)

Since the major floods of 1947, some structures have been enlarged/replaced and automated with corresponding changes in channel capacity in certain reaches of river. These improvements offer improved levels of flood defence, but are unlikely to protect fully against major flooding events, such as those of 1947 and 1998. In addition, conditions in most sub-catchments have changed greatly over the last 50 years, with more roads and significant urban development. Therefore, the use of existing flood plains (and, where appropriate, the re-creation of flood plains) is essential to prevent increased levels of property flooding.

Following the 1998 Easter floods, the Agency commissioned an independent report into its performance during this emergency. This report (the Bye Report) made over 100 recommendations. The Agency has recognised these and has or is at present implementing improvements on a national and local basis. Self-help systems have already been set up in Alconbury, Alconbury Weston and Hemingford Grey. An automatic voice monitoring system was put in place in Alconbury and Alconbury Weston by December 1998.

Telemetry has been installed at a number of the Agency's river control structures in the past few years. This enables the Agency to monitor more closely river flows and the operation of structures. During the Easter 1998 flooding, numerous properties within the LEAP area were affected either directly by flood water or by disruption of access. The Bye Report recommended that the Agency 'analyse flood data to determine the return period' of the flood event and compare the flood event with indicative and existing standards on 'main river' for St Ives, St Neots, Hemingford Grey, Hemingford Abbots, Alconbury, Alconbury Weston and Bedford. Kempston, Riseley and Kimbolton were less severely affected and therefore not included in the Bye Report, but will be included in the Feasibility Study. Further actions will depend upon the outcome of the Feasibility Studies. Draft Feasibility Studies were completed for St Neots, Alconbury, Alconbury Weston, Bedford, Kempston, Riseley and Kimbolton by 31st January 1999. Similar studies for Hemingford Grey, Hemingford Abbots and St Ives were 31st March 1999. The number of recent non-main river ('ordinary' watercourse) urban flooding events during Easter 1998 has alerted the Agency to this risk of flooding. Some places that have been affected are Yeldon, Molesworth, Upper Dean and St Ives (Victoria Terrace and Houghton Field Drain). Schemes and maintenance to alleviate flooding are to be investigated. Flooding problems in Molesworth are being investigated.

Since September 1996, the Agency has taken the lead role in communicating flood warnings to people who are at risk.

2.1.3 Uses, Releases and Discharges

IMPORTANCE OF FLOOD PLAINS

The flooding of flood plain areas is both natural and desirable, where it can occur without risk to human life. The effectiveness of rivers and flood plains to convey and to store

flood water, and minimise flood risks, can be adversely affected by human activity, especially by development which physically changes the flood plain.

Before the Town and Country Planning system was established, there was little attempt to steer development away from rivers and flood plains. Indeed many settlements grew around river crossing points where transport routes converged. Consequently, the flood plains and channels of many major rivers became very restricted in urban areas. Inevitably, these restricted channels could not accommodate large storm flows and serious flooding of developed areas occurred. In some instances it has been possible, at considerable public expense, to reduce the flood risk in such areas by engineering works, but this is not always a viable option.

Only towards the end of the 20th Century have we begun to value properly the natural function of flood plains and accept that it can be more cost-effective to work with Nature rather than to fight it. Current uncertainties over future climatic changes and associated sea level rise make the need to safeguard flood plain areas particularly important.

Throughout England and Wales, a considerable amount of development has already take place on the coastal flood plain as well as on river flood plains. Consequently, people and property in these areas are already at risk from flooding. This leads to pressure for new or improved coastal and river flood defences, with consequent long-term maintenance cost implications.

There is an ongoing programme of both the Agency and local authority flood defence works, which is regulated and in part funded through the MAFF, and the Welsh Office. These works are in many instances necessary to provide or to ensure the continuing existence of physical defences to protect development, which has taken place in flood plain areas.

Traditionally, flood plains have also been used for agricultural purposes. River levels were controlled to aid drainage and to reduce the frequency of flooding of water meadows, thus boosting crop yields. Nowadays, there is a need to consider the control of water levels through WLMPs, to cater for the needs of a wide range of flood plain interests in a way that is both balanced and sustainable.

At many locations, the increasing recognition of the ecological value of flood plains, together with changing agricultural policies, is providing opportunities to re-establish the natural functions of flood plains. Much flood plain land is already recognised to have high ecological value and many river valleys have statutory wildlife and conservation status. The Agency will encourage planning authorities to make use of the potential environmental, recreational and amenity opportunities which flood plains provide.

2.1.4 Waste Arisings and Disposal

The Agency, in order to ensure that river flow and navigation is not affected, removes debris such as fallen trees, shopping trolleys, sunken boats and man-made items from designated main rivers as and when considered necessary.

Anything that is removed from the river is either disposed of on site or, if appropriate, taken to a licensed waste disposal site.

When the Agency carries out maintenance dredging works, excavated silt/reeds are buried in a suitable trench along the river bank and recovered with top soil (re-seeded if necessary), deposited on adjacent ground or, if required by the Agency's Environmental Planning function, transported off the site to a local licensed waste disposal site.

2.1.5 Illegal Practices

RIVER STRUCTURES AND STATUTORY MAIN RIVER

In the river system certain channels are designated as statutory 'main river', by which means the Agency takes a greater responsibility for the maintenance and control of the channel.

The responsibility for the maintenance of any watercourse, main river or non-main river, (also known as 'ordinary' watercourses) normally rests with the riparian land owner, whose ownership, as a general rule, extends to the centre line of any such watercourse. However, under the Water Resources Act 1991 (and the bylaws made thereunder) the Agency has control of the construction of any structure in or close to any statutory 'main river'. This and other activities likely to affect the bed or bank of the river or affect the Agency's access to the river for maintenance works requires formal prior consent from the Agency.

The Agency has powers (under the Land Drainage Act 1991) in respect of any work that will affect the flow of water in a non-main river watercourse (e.g. weirs, culverts, dams, revetments). Any illegal activities that cannot be resolved with the Agency via its Flood Defence function can be pursued by the Agency's Enforcement function. This could lead to illegal works having to be removed or action taken by the Agency via the courts. Illegal works on a main river or non-main river could lead to blockages in the channel resulting in the flooding of nearby land and property.

Provided the required legal consent is granted, the works can be carried out. However, works do take place without the Agency's prior approval, e.g. culverting, headwall construction, depositing heaps of spoil in a flood plain, fencing and tree planting. Tree planting and fencing in particular can cause serious access difficulties for Agency vehicles and machinery and can result in enforcement action being taken if prior agreement for any work has not been obtained. Activities such as these can either be undertaken deliberately or through lack of awareness of the legal requirements.

The majority of river control structures are owned and maintained by the Agency. It is illegal to fish off or swim near these structures. However, these activities do take place (particularly at weekends and during school holidays). Vandalism of locks can also occur and the above activities have to be investigated and resolved by the Agency's Enforcement function, sometimes in co-operation with the police.

2.2 Agriculture

This section has been compiled with the assistance of MAFF and the Farming and Rural Conservation Agency (FRCA).

2.2.1 Natural Forces

The drift deposits that cover the underlying geology of the Bedford Ouse LEAP area are mainly chalky till with the dominant soil types comprising low-permeability calcareous clayey soils and some non-calcareous clayey soils.

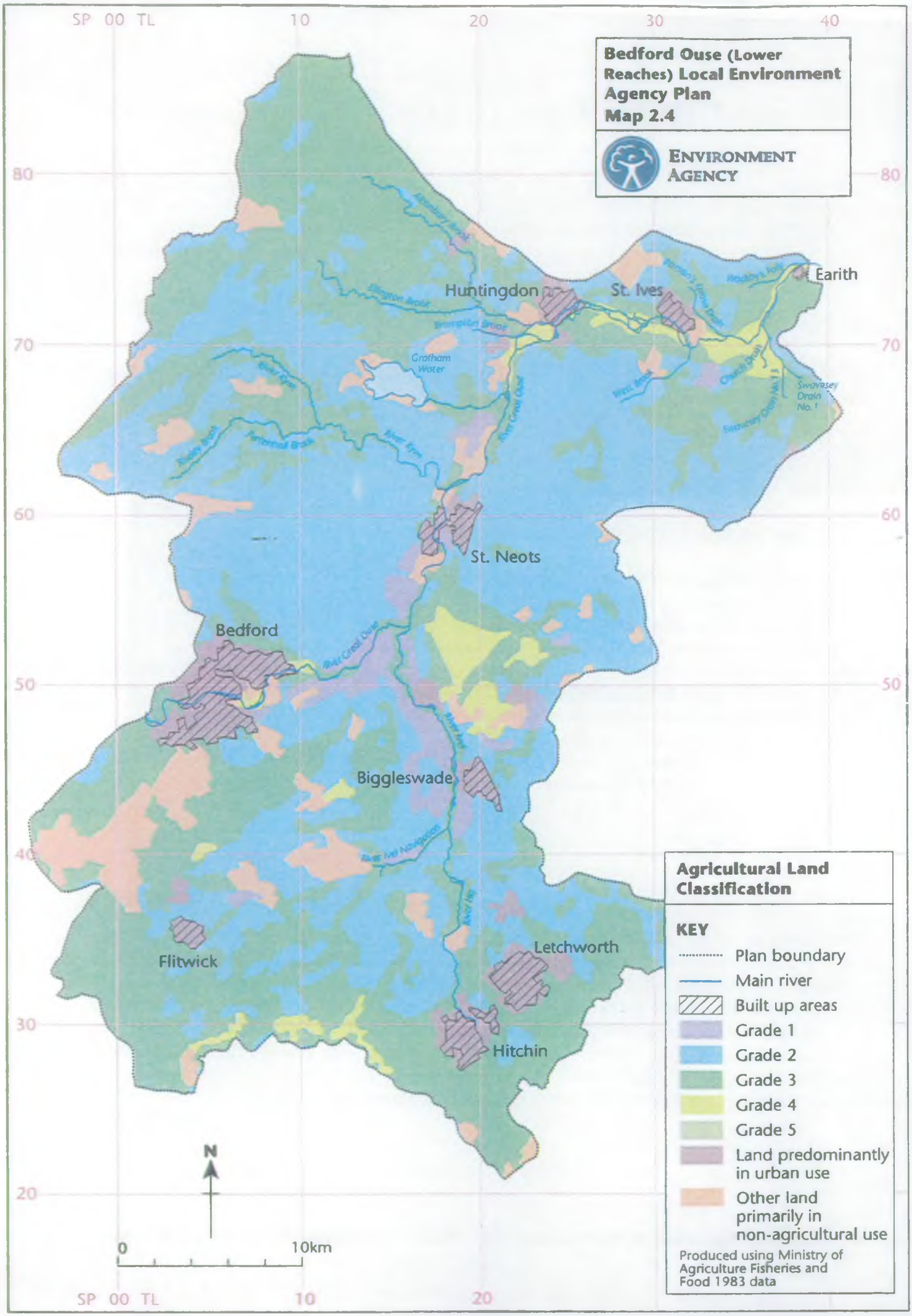
Long-term average rainfall for the LEAP area varies from 540-590 mm against a long-term average for Great Britain of 1082 mm. The Bedford Ouse LEAP area is therefore one of the driest in the country, with consequent implications for the types of agricultural practices that are possible. The LEAP area comprises 42.9% of Grades 1 & 2 land (see Map 2.4) - most of which is Grade 2 - compared to England as a whole which comprises only 16.1% of these top-quality grades. This high-quality land is most suitable for the growing of arable crops such as cereals and potatoes and horticultural salad crops.

Although not as vulnerable as most of the Fenland to the north, the area around Earith is close to sea-level and is vulnerable to fluvial flooding. Soil erosion is not a major problem.

2.2.2 Societal Influences

GENERAL PERSPECTIVE

The structure of agriculture in the UK has undergone significant changes in the last ten years. Economic and legislative changes (such as to the Common Agricultural Policy and General Agreement of Tariffs and Trade) together with more stringent consumer requirements are likely to favour the larger producers who can make the necessary investment in developing new products, improving the quality of existing production and marketing competitively. Smaller agricultural units already in a weak financial position will have to amalgamate in order to remain viable. This will lead to lower demand for labour and the release of surplus farm buildings into the rural economy.


Bedford Ouse (Lower Reaches) Local Environment Agency Plan
Map 2.4
Environment Agency
SP 00 TL
10
20
30
40
80
70
60
50
40
30
20
Huntingdon
St. Ives
Earith
St. Neots
Bedford
Biggleswade
Flitwick
Letchworth
Hitchin
Grafham Water
River Great Ouse
River Ivel
River Ivel Navigation
Agricultural Land Classification
KEY
Plan boundary
Main river
Built up areas
Grade 1
Grade 2
Grade 3
Grade 4
Grade 5
Land predominantly in urban use
Other land primarily in non-agricultural use
Produced using Ministry of Agriculture Fisheries and Food 1983 data
N
0
10km

The Government has stated its commitment to the conservation and enhancement of the countryside and to its enjoyment by the public and continues to press for the incorporation of appropriate measures of environmental protection into the CAP and the various agricultural support schemes. MAFF promotes the view that farmers are not only food producers but also custodians of the countryside. They must reconcile the demand for efficiently produced food with the demand for the countryside to be protected and cared for. Whilst it is the responsibility of farmers and other land managers to care for their land, Government policies assist them to reconcile agricultural and environmental objectives through a combination of guidance, protection measures and financial incentives.

MAFF promote a number of measures to encourage farmers to conserve and enhance the rural environment. For example the current set-aside rules impose environmental conditions which require cutting/cultivation of the set-aside green cover to be delayed beyond the bird nesting season, and also allow more flexible use of non-residual herbicides as a less damaging alternative to cutting/cultivation. The set-aside rules also require the protection of environmental features on set-aside land. In addition, the introduction of non-rotational set-aside (land taken out of arable production for five years) offers farmers greater opportunities to enhance their set-aside land as habitat for wildlife in the longer term. Land taken out of production under agri-environment and forestry schemes can now count as set-aside, therefore encouraging farmers to enter into these schemes.

Where farmers are expected to go beyond normal good practice, there is a case for providing payments from public funds for farmers to enter into the following schemes:

- Enyironmentally Sensitive Areas (ESAs);
- Nitrate Vulnerable Zones (NVZs);
- Habitat Scheme, Countryside Access Scheme;
- Organic Aid Scheme;
- Farm Woodland Premium Scheme;
- The Countryside Stewardship Scheme;
- Arable Stewardship Pilot Scheme; and,
- The Woodland Grant Scheme.

Details of the other agri-environment schemes can be obtained from the Farming and Rural Conservation Agency (FRCA).

The role of the Environment Agency in agricultural issues includes:

- the control of pollution from agricultural sources;
- the licensing of water abstractions under the provisions of the Water Resources Act 1991;
- the prevention of pollution through the enforcement of the Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) Regulations 1991;

- the control of land spreading of wastes as an exemption from the Waste Management Licensing Regulations 1994; and
- the licensing of schemes that impact upon the drainage of land under the Land Drainage Act 1991.

The Health and Safety Executive works with the Agency in adopting a pollution prevention philosophy in respect of the storage and use of chemicals.

LOCAL PERSPECTIVE

In 1996, the total agricultural area extended to 121 625 hectares, of which 12 094 hectares was set-aside from food production. Although this land is not currently in use for agricultural production, it is national policy to safeguard it for the benefit of future generations.

Changes in agricultural land use between 1986 and 1996 are summarised in Table 2.1. Of particular significance is the decrease in short-term grassland over the 10 year period, with large increases in farm woodland, other land and rough grazing. The reasons for this shift include the introduction of set-aside (which is compulsory for farmers wishing to claim Arable Area Payments), government encouragement for the planting of trees under the Woodland Grant and Farm Woodland Premium Schemes, and farm diversification, taking some land out of agricultural use. The amount of tree-planting on agricultural land may increase further as this is now counted towards farmers' set-aside requirements.

Table 2.1: Changes in Agricultural Land Use

Agricultural Land Use	1986 (ha)	1996 (ha)	Change 1986-96 (%)
Grassland for less than five years	3145	2442	-22.4%
Grassland for more than five years	10 085	11 324	12.3%
Rough Grazing	1310	997	24.8%
Crops and Fallow	98 249	89 463	-8.9%
Farm Woodland	1263	2108	66.9%
Other Land	2189	3197	46%
Set-aside	0	12 094	n/a
Total	**116 241**	**121 625**	**4.6%**

Farm types are classified by the dominant activity on each holding; Table 2.2 details farm types by number in the LEAP area. The statistics show a fall in the number of dairy farms from 20 to 17 from 1991-1996; this has resulted from the introduction of quotas, falling

consumption and the replacement of the Milk Marketing Board with Milk Marque, which has brought lower prices to farmers. Cattle and sheep farms have increased over the ten-year period by 12%; this is most likely to be due to farmers utilising grassland no longer needed for dairying, but not suitable or eligible for arable conversion. The number of pig and poultry holdings fell steeply from 1991-1996, although the actual number of birds in breeding and laying flocks has increased significantly. This is because of both the general trend in recent years from red meat to white meat consumption (for dietary reasons) and also in the wake of the BSE crisis. By the third quarter of 1998, however, pig prices had dropped to an all-time low, with devastating effects on the livelihoods of pig farmers. The low prices in 1999 are being caused by the combined effects of the strong pound (sterling), pig meat surpluses, high feed prices and the strict welfare legislation that UK producers have to comply with. This puts them at a severe disadvantage with European competitors who do not have similar welfare legislation.

Table 2.2: Farm Types by Number

Farm Type	1991	1996	% Change1986-1996
Dairy	20	17	-15%
Cattle & Sheep	113	126	11.5%
Pigs & Poultry	55	32	-41.8%
General Cropping	178	147	-17.4%
Horticulture	232	165	-28.9%
Mixed	78	82	5.1%
Other types	177	209	18.1%
Total	**1498**	**1412**	**-5.7%**

Cropping farms have fallen in number; this is likely to be a result of farms being sold off to extend the size of other holdings. Table 2.3 outlines the significant changes in cropping patterns over the ten-year period 1986-1996. The hectarage of cereals within the area has fallen by 9%, largely due to set-aside. Cereals, however, still amount to 66 526 ha or 55% of the total agricultural area and, therefore, are the mainstay of the arable rotation. This is unlikely to change as cereals are a staple agricultural product, required in large amounts for both human and animal consumption and the dominant soil types in the area are well suited for cereals and other combinable crops.

Table 2.3: Cropping

Cropping	1986 (ha)	1996 (ha)	% Change1986 –1996
Wheat	56 974	52 890	-7.3%
Winter Barley	13 357	9781	-26.8%
Spring Barley	6169	3185	-48.4%
Other Cereals	703	670	-4.7%
Potatoes	1082	818	-24.4%
Sugar Beet	695	653	-6%
Horticultural Crops	3830	2080	-45.7%
Field Beans & Peas	4022	7052	75.3%
Oilseed Rape	10 007	10 272	2.6%
Linseed	0	908	n/a
Other crops & fallow (inc. maize)	1410	1154	-18.2%
Total	**98 249**	**89 463**	**-8.9%**

Potato crops have decreased by a quarter over the period, probably as a result of the demise of the Potato Marketing Board, which controlled the growing of potatoes and disposed of surplus crops in high-yielding years. With the potato market now open to market forces, some smaller producers have been unable to compete in lean years and the industry is presently undergoing a period of rationalisation. The production of field beans and peas (grown mostly as a protein constituent for animal feeds) increased by 75%, largely due to the ban of meat and bone meal in animal feeds and continuing environmental concerns over the use of fish meal.

The growing of linseed has become a popular inclusion in the rotation, not least because of the attractive subsidy available. Other crops such as oilseed rape and linseed have seen relatively minor changes in cropped areas over the ten years, although reductions in EU support levels and the strong pound are expected to restrict the areas grown in the next few years. The inclusion of new crops (both food and industrial) into the cropping rotation is set to increase in the future as farmers explore new markets.

Overall horticultural production has fallen significantly in the LEAP area, due to a combination of economic and environmental factors. The prime reasons are the shifting demands of the market and the changing preferences of the public. In addition, horticultural crops are not eligible for support payments through the EU and horticultural cropping is both specialist and capital/labour intensive. The market is a constantly fluctuating one, typified by wide seasonal price fluctuations and changes in eating habits

fluctuating one, typified by wide seasonal price fluctuations and changes in eating habits allied to weather conditions. Consequently, many farmers now prefer 'safer' alternative cropping rotations. The introduction of the Working Time Directive and the National Minimum Wage (both in 1999) is expected to reduce profit margins further, especially for smaller operators who rely on casual labour working long hours to harvest crops at certain times of the year. Finally, there is the issue of drought in the LEAP area - one of the driest parts of the country. The severe and prolonged droughts from 1989-1993 and 1995-1998 have forced many growers to re-assess the viability of growing horticultural crops, which usually require high levels of irrigation.

RURAL ECONOMY

In arable areas, agricultural production has become increasingly mechanised in the last fifty years, such that workforce numbers have declined phenomenally. In the period 1986 - 1996, the agricultural workforce in the Bedford Ouse LEAP area has declined by 27.7% and stands at 4,057. As farmers strive to become more efficient, especially in times when profits are reduced, they may not replace workers when they leave but employ contractors instead and/or increase their level of mechanisation. With new economic pressure affecting farm finances, the need for farmers to try to supplement their incomes in order to survive has increased. Past agricultural changes have already prompted many farmers to adapt to meet the new market place. This has led to a more diverse range of activities carried out both on and off the farm using assets that may have been under-utilised. The rural economy has benefited in recent years from farm diversification, which will become more and more important. It can take many forms and ranges from adding value to primary agricultural produce to non-agricultural enterprises:

- Farmer-to-farmer services e.g. contracting out services;
- Farm-based processing - adding value e.g. smoked meats, home cooking, butchery;
- Farm-based tourism e.g. bed & breakfast, holiday cottages, caravans and camping (bed & breakfast is worth nearly £300 million a year to farmers in the UK);
- Sport and recreation e.g. golf courses, equestrian facilities, nature trails, fishing;
- Farm-based retailing e.g. farm shops, pick-your-own, craft centres;
- Renewable energy resources e.g. short-rotation coppice, bio-diesel; and
- Alternative crops e.g. *Miscanthus* (elephant grass), evening primrose.

2.2.3 Abstractions and Removals

Nitrate Vulnerable Zones (NVZs) have now been designated and are discussed in more detail in Viewpoint 3.1 and include measures to reduce nitrate pollution from agricultural sources. Catchment areas surrounding public abstraction points of both surface and ground water supplies have been designated NVZs where public water supplies exceed 50 mg per litre of nitrate, or in the case of groundwater, are likely to exceed this limit by the year 2010. The designation of NVZ boundaries has now been finalised. The action programme of measures proposed became compulsory, without compensation, in these zones on 19 December 1998. In principle, the criteria to be included in these programmes are as below:

- farmers will be required to limit their applications of organic manure;
- farmers will have to ensure that they have adequate manure storage capacity to allow them to observe the time limits for application of organic manure; and
- farmers will have to limit their applications of inorganic fertilisers to levels which are consistent with the net nitrogen requirement of the crop, after allowance for nitrogen from residues in the soil and from other sources.

2.2.4 Uses, Releases and Discharges

As stated above, agricultural land in the Bedford Ouse LEAP area is utilised for growing and rearing a wide range of crops and animals. These include wheat, sugar beet, potatoes, salad vegetables, cows (dairy and beef), sheep, chickens and pigs. Common agricultural uses include fertilisers, pesticides/insecticides/fungicides and irrigation/watering. Releases and discharges from the agricultural industries typically includes slurry, silage and fertiliser/nitrate run-off, although odours and noise are also commonly produced.

2.2.5 Waste Arisings and Disposal

Animal-rearing can produce significant amounts of waste; this is particularly the case where animals are reared indoors for all or part of the year, such as battery-farmed chickens or farrowing pigs. A significant proportion of all liquid and semi-liquid agricultural wastes are disposed of them by spreading them onto land. The disposal of agricultural wastes was, until recently, exempt from any controls, other than those relating to their storage and general guidelines within the Ministry of Agriculture 'Code of Good Agricultural Practice for the Protection of Water'. However, the new Groundwater Regulations, fully implemented as of April 1st 1999, will extend control to certain agricultural wastes, such as spent sheep dip and pesticide washings. Attempting to assuage public concern about the harmful effects of sheep dip, the Government announced in November 1998 that unlicensed dumping of sheep dip is now punishable by a maximum four-year jail sentence and fines of up to £20 000.

Riparian buffer strips should be considered as one of a range of land management techniques to reduce diffuse pollution. Buffer strips act as sediment sinks; by reducing the velocity of run-off, they allow time for nutrients and pesticides to be removed, transformed and/or assimilated before reaching the watercourse. They can reduce pollution in two ways:

- They distance agricultural land from the riparian area, thus reducing direct pollution (e.g. spray drift); and
- They intercept run-off.

Buffer strips, whilst a valid option to reduce diffuse pollution, are not a solution to the root cause of the problem. The best results in reducing diffuse pollution will be achieved by good agricultural practice. For buffer strips to be effective, it is fundamental to know the type of pollution that needs to be controlled and to know the pollutant pathway in the environment. The most appropriate location for buffer strips is near the source of potential pollution (e.g.

adjacent to headwater streams draining agricultural land). They can provide a number of land management benefits to the farmer:

- Beetle banks and habitat for other predators of crop pests;
- Prevention of migration of harmful weeds (the establishment of less vigorous plant species and fine grasses will prevent more pernicious weeds growing close to the crop edge);
- Access for traffic (however, wheel ruts may compromise the ability of the buffer strip to reduce pollution because water will follow man-made tracks and bypass the strip);
- Cost savings by not farming field margins with poor yields;
- Reduction in the need for trimming hedges, which would normally be carried out to reduce shading of crops;
- Creation of regular field areas which are more easily worked with machinery;
- Bank stabilisation to prevent loss of valuable agricultural land; and
- Enhanced numbers of game birds and improved fisheries.

As well as protecting watercourses, buffer strips provide the following benefits:

- Diverse habitats for terrestrial and aquatic wildlife;
- Corridors for wildlife movement;
- Attenuation of the release of organic matter to rivers from adjoining land;
- Control temperature in the water body through shading;
- Enhance the visual quality and amenity of the landscape; and
- Public access to waterside habitats without affecting the agricultural operations in the surrounding fields.

2.2.6 Illegal Practices

Fly-tipping on farmland has becoming an increasing problem since 1996, when the Landfill Tax was brought in. A tax is now levied on most products to be disposed of at landfill sites, with the aim of encouraging more recycling and re-use of products and materials. Unfortunately, the tax has encouraged unscrupulous operators to dump rubbish to maximise their profits and deserted farm lanes and fields are convenient locations for illicit rubbish disposal. This places extra costs on farmers, who have to pay to have the rubbish taken away; the costs can be substantial in cases where medical waste or asbestos has been dumped.

Agricultural pollution incidents can often be the result of illegal practices, such as not maintaining pipes, ditches or storage containers to a sufficiently high standard. Deliberately illegal activities, as opposed to carelessness or lack of maintenance, are much rarer but when they occur, they can be very serious. An example of such an activity is the disposal of spent pesticides/fungicides/insecticides straight into drains or watercourses.

2.3 Development

LAND USE

The continual development of our cities, towns and countryside is the single most significant influence on the environment. Development includes most construction works including buildings and roads, mineral extraction and waste management facilities and certain changes of use.

The development of land and certain changes in the use of land is controlled by planning authorities under the Town and Country Planning Act 1990 (the Act) as amended by the Planning and Compensation Act 1991. The Act sets out the procedure through which planning authorities determine applications for development and the requirement for the production and alteration of plans at county and local level to guide development. The plans to be produced at a County level are Structure Plans, Minerals Local Plans and Waste Local Plans. At the district and borough level Local Plans are to be produced. Together the Structure, Minerals, Waste and Local Plans form the Development Plan for an area.

The Agency's own powers to control development are extremely limited. However, the Agency is a statutory consultee to the planning authorities and is required to be consulted on certain categories of proposed development and in the preparation of Development Plans. It is on this basis that the Agency seeks to form a close working partnership with planning authorities to address mutual concerns.

To assist planning authorities in guiding development and determining applications for planning permission the government has produced a series of guidance notes and Circulars covering the government's planning policy, minerals planning and regional planning. The guidance identifies as the fundamental basis for planning the objective of sustainable development.

Our policies are derived from government guidance and legislation and address the areas of waste management, uses of the water environment and pollution prevention. These policies address such particular issues as water resources, water quality, air quality, flood defence, biodiversity, foul and surface water drainage and recreation amongst others. We seek the inclusion of policies within development plans to address these issues so that they become material considerations in guiding development and in the determination of planning applications. We also apply our policies when considering development proposals and schemes. Map 2.5 gives examples of where our policies have been applied to a range of development proposals and other schemes.

2.3.1 Natural Forces

Historically, development and land use has been guided to a large extent by the physical characteristics of the area including the geology, hydrogeology and topography. For example

Bedford Ouse (Lower Reaches) Local Environment Agency Plan
Map 2.5

ENVIRONMENT AGENCY

BIODIVERSITY
We seek to conserve biodiversity by avoiding the erosion of existing habitats and associated species and encouraging the provision of new habitats in appropriate locations. These principles are to be implemented through proposals at Spring Common, Huntingdon.

MINERALS
We seek to ensure that proposals for new mineral extraction are resisted where they are likely to adversely affect the water environment and associated habitats. We also seek to encourage restoration works that result in environmental enhancement. The restoration of a mineral extraction site east of Needingworth and north east of Over village to a wet fen nature conservation area is supported in principle by the Agency. Current proposals would provide nearly 500ha of reed beds as well as wet grassland, woodland and other nature conservation features.

CONTAMINATED LAND
We seek to encourage the reclamation and re-use of contaminated land where the degree and nature of the contamination have been assessed by appropriate site investigation and risk assessment and appropriate remediation measures are carried out. This is important when considering potential development sites, for example the development of a new settlement at Elstow, south of Bedford.

WASTE MANAGEMENT
We seek to encourage re-use and recycling where environmentally beneficial and ensure waste disposal schemes do not have an adverse impact on the environment. The waste management facility at Brogborough includes the utilisation of biogas for electricity generation to feed to the National Grid.

FLOOD RISK
We seek to ensure that floodplains are protected and development that would be at unacceptable risk from flooding or would increase the risk of flooding elsewhere is prevented. We also encourage the protection of the existing flood defences and the prevention of development that would require additional flood defence works. Development at Meadow Lane, St Ives, enabled floodplain capacity that had been lost in the past to be regained through the lowering of ground levels. Additional environmental benefits were gained through improvements to the drainage system.

RIVER CORRIDORS
We seek to protect and enhance river corridors and ensure that development makes a positive contribution to the value of these areas in terms of nature conservation and amenity. This was an important consideration in the provision of a low lying berm adjacent to the River Ivel at Langford. This berm was planted to enhance its nature conservation value and a footpath provided for the residents of adjacent development site.

WATER RECREATION
We seek to ensure that development does not harm the recreational and amenity potential of inland waters. We seek to balance nature conservation while preventing the loss of waterside recreational space and improving public access. This principle has been important in the Agency's support for a project to provide paths and bridges over the River Hiz in Hitchin as part of a retail outlet development.

FOUL AND SURFACE WATER DRAINAGE
We seek to ensure that adequate foul and surface water drainage provision is available to serve new development and that the discharge does not adversely affect surface or groundwater quality. Such considerations are important in areas of vulnerable aquifers. This will be a major consideration at the development to the west of the A1(M) at Stevenage in developing a comprehensive drainage infrastructure.

WATER RESOURCES AND SUPPLY
We seek to ensure that development is located where adequate water can be supplied without detriment to the water environment. This is important when considering large scale development such as that proposed to the west of the A1(M) at Stevenage.

Huntingdon
St. Ives
Earith
St. Neots
Bedford
Biggleswade
Flitwick
Letchworth
Hitchin
Alconbury Brook
Ellington Brook
Brampton Brook
Grafham Water
River Kym
Bluntisham Brook
Ouse Fen Drain
River Great Ouse
River Ivel
Elstow Brook
River Ivel Navigation
Hambrook
River Flit
Comptons Brook
Barton Brook
River Hiz
Parson's Drove Drain
Woodstry's Fold
West Brook
Longstanton Brook
Church Drain
Swavesey Drain No. 1
Swavesey Drain No. 1.1

N

0 10km

Development and Environmental Constraints

KEY

- Plan boundary
- Main river
- Tributaries
- Built up areas
- Development allocations as identified in the Local Plans

it is evident that watercourses have been important in the establishment of settlements in the plan area including Bedford, St Neots and Huntingdon.

The physical characteristics may still be influential for certain land uses but they are now generally reduced in their influence over development patterns with the development of engineering solutions to such issues as land drainage and water supply. More latterly, social and economic factors have become the main drivers for land use and the location of development from national to local level including this plan area. This plan area contains an excellent example of this. Letchworth has the distinction of being the world's first Garden City. It was based on Ebenezer Howard's concept by combining the best of town and country.

However the physical environment can still be influential on the location of development. This is most evident in the case of mineral extraction for brick as, clearly, minerals can only be worked where they are found. Natural forces can also be influential on land use at a local level, for example flood plains may limited the range of uses that can be made of an area of land with its consequential effect on the value attached to land.

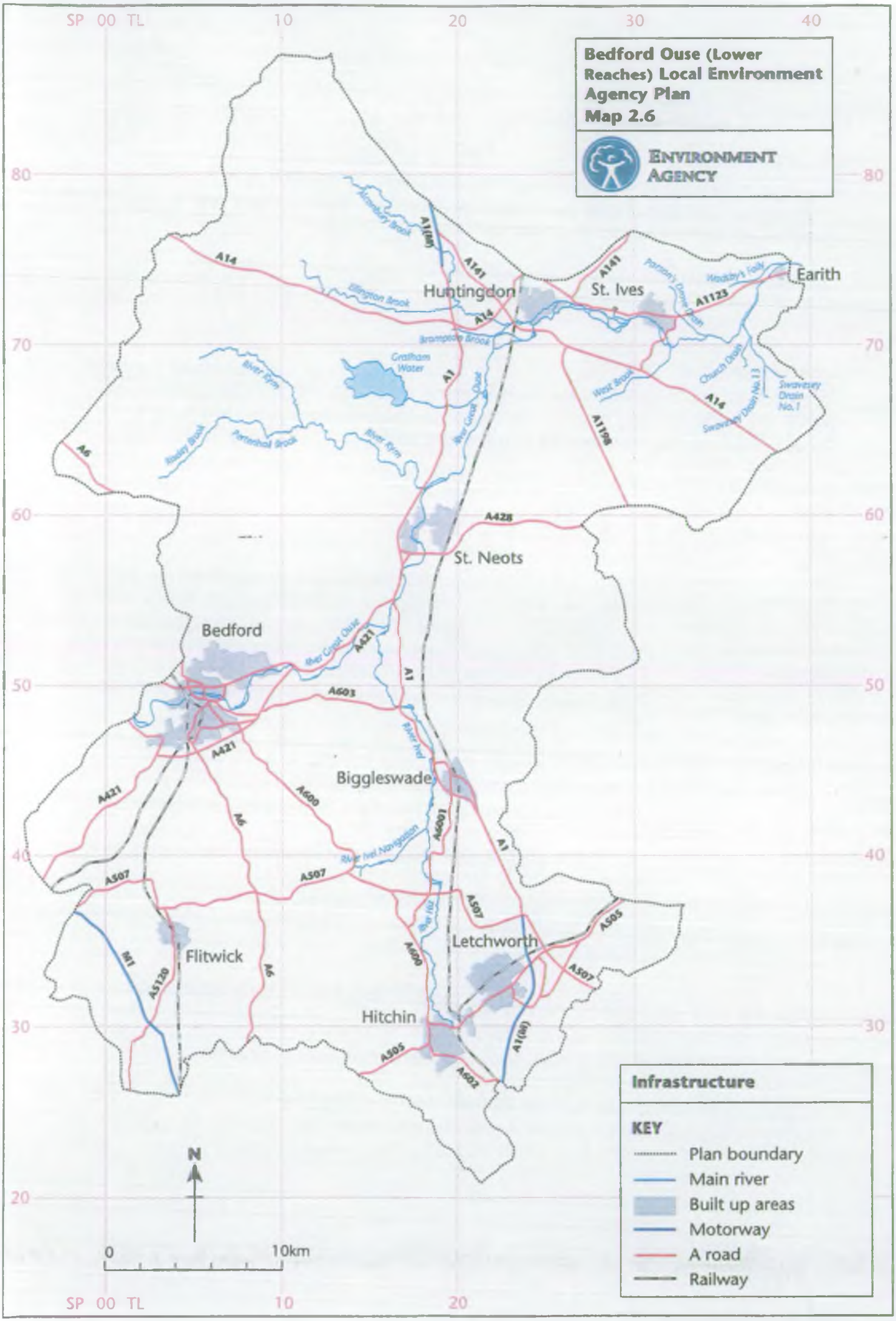
Rivers and flood plains are fundamental parts of the environment. Generally their existence is a result of natural forces and processes which must be respected. The flooding of flood plain areas is both natural and desirable, where it can occur without risk to human life. The effectiveness of rivers and flood plains to convey and store flood water, and minimise flood risk can be adversely affected by human activity, especially by development which physically changes the flood plain. (More detail is given in 2.1.3)

The Agency has an overall supervisory role over land drainage matters under the Water Resources Act 1991 and a direct responsibility for drainage in designated Main Rivers. The Agency's objectives are to ensure that:

- development should not take place which has an unacceptable risk of flooding, leading to danger to life, damage to property and wasteful expenditure on remedial works;
- development should not create or exacerbate flooding elsewhere;
- development should not take place which prejudices possible works to reduce flood risk;
- development should not cause unacceptable detriment to the environment; and
- natural flood plain areas are retained and where practicable restored in order to fulfil their natural function.

2.3.2 Societal Influences

The needs of society have increasingly become the greatest influence over patterns of development. Many settlements in the area have undergone considerable development along with the development of a complex transport infrastructure. Map 2.6 shows the infrastructure of the LEAP area.


Bedford Ouse (Lower Reaches) Local Environment Agency Plan
Map 2.6
Environment Agency
SP 00 TL
10
20
30
40
80
70
60
50
40
30
20
Huntingdon
St. Ives
Earith
St. Neots
Bedford
Biggleswade
Flitwick
Letchworth
Hitchin
A14
A1(M)
A141
A1123
A1198
A428
A421
A1
A603
A600
A6001
A6
A507
A505
A602
M1
A5120
River Great Ouse
River Ivel
River Ivel Navigation
River Kym
Ellington Brook
Alconbury Brook
Brampton Brook
Grafham Water
Rowley Brook
Portholme Brook
West Brook
Church Drain
Swavesey Drain No. 1.3
Swavesey Drain No. 1
Parson's Drove Drain
Headley's Folly
N
0
10km
Infrastructure
KEY
Plan boundary
Main river
Built up areas
Motorway
A road
Railway

Much of the change this century has been driven to population increase with national population growth being faster this century than any preceding century. Between 1931 and 1979 the national population grew by 21.5% to 55.9 million. This has resulted in increased housing and employment needs along with concomitant services and facilities.

The increase in population has also coincided with many other societal changes that have also added to the need for development in the plan area. These drivers for development are complex but include elements that often act in combination. These elements are:

- Increased prosperity which has enabled increased independence leading to more people being able to live in separate homes and from and earlier age, this has also lead to more people being able to afford larger homes and be more demanding in their requirements;
- Improvements in general standards of living and health have also led to people living longer and often on their own; and
- Changes in social behaviour, in particular in relation to attitudes to marriage have produced more households often requiring and being able to afford larger accommodation.

These elements are set out simply in the Department of the Environment (now Department of the Environment, Transport and the Regions (DETR)) Green Paper entitled 'Household Growth: where shall we live?' published in November 1996. This document has stimulated debate about the latest population and household forecasts that estimate a growth in households in England of 4.4 million by the year 2016. This represents an increase of 40 to 50% in the number of households in Cambridgeshire, 30 to 40% in Bedfordshire and 20 to 30% increase in Hertfordshire.

This forecast for household growth is a major concern for planning authorities in assessing future development needs at all tiers in the planning process and consequently in the plan area. It places pressure on the existing housing stock leading to its replacement, subdivision or extension and increases pressure for new housing stock. Household growth at the levels suggested along with concomitant needs for employment, services and transport infrastructure would add to the stresses on the environment, as most development will lead to a fundamental change in the use of land that cannot easily be reversed.

THE LEAP AREA

The LEAP area traverses the regional boundary of East Anglia and South-East of England, it also includes a very small part to the East Midlands. In all it incorporates parts of four counties. Most of the plan area is within Bedfordshire and Cambridgeshire with a smaller portion in Hertfordshire and a very small portion of Northamptonshire. In addition, the plan area covers portions of eight local authority areas; these are Huntingdonshire, South Cambridgeshire, East Northamptonshire, Bedford, Mid Bedfordshire, South Bedfordshire, North Hertfordshire and Stevenage. The Agency liaises with all these planning bodies with regard to development planning. Map 2.7 shows the local authority boundaries.


Bedford Ouse (Lower Reaches) Local Environment Agency Plan
Map 2.7
Environment Agency
SP 00 TL
10
20
30
40
80
70
60
50
40
30
20
NORTHAMPTONSHIRE
Huntingdon
St. Ives
Earith
CAMBRIDGESHIRE
St. Neots
Bedford
BEDFORDSHIRE
Biggleswade
Flitwick
Letchworth
Hitchin
HERTFORDSHIRE
Alconbury Brook
Ellington Brook
Brampton Brook
Grafham Water
River Kym
Ruddy Brook
Perry Brook
River Great Ouse
West Brook
Hobbs's Folly
Pattern's Drove Drain
Church Drain
Swavesey Drain No.1.3
Swavesey Drain No.1
River Ivel
River Ivel Navigation
River Hiz
N
0
10km
Plan Area Overview - Local Authorities
KEY
Plan boundary
Main river
Built up areas
County Council boundary
District Council boundary
Stevenage
North Bedfordshire
North Hertfordshire
Mid Bedfordshire
South Bedfordshire
South Cambridgeshire
Huntingdonshire
East Northamptonshire

Development planning is guided by Regional Planning Guidance (RPG) produced by the Government and by strategies produced by the London and South East Regional Planning Conference (SERPLAN), East Midlands Regional Planning Forum and Standing Conference of East Anglian Local Authorities (SCEALA). However, as the portion of this LEAP area in the East Midlands area is small (approximately 3% of the plan area) and rural in nature, the focus will be on planning guidance for East Anglia and the South East. The current RPGs for the East Anglia and the South East were produced in July 1991 and March 1994 respectively and provide the framework for assisting the updating of Structure Plans to 2006 and 2011 respectively. The guidance identified environmentally sustainable growth as the central theme and overall objective of the updating of Structure Plans.

Government guidance identifies that the South East is one of the most densely populated areas of the country. The overall population has grown slowly over the last 20 years with a higher increase in the number of households. Housing provision for the whole of the South East is to be an annual average of 57,000 between 1991 and 2006. Of this the Bedfordshire and Hertfordshire proportion is to be 5,800 per annum (2,467 pa in Bedfordshire and 3,333 pa in Hertfordshire). This gives rise for the need for approximately 37,000 dwellings in Bedfordshire and approximately 50,000 dwellings in Hertfordshire between 1991 and 2006.

Government Guidance identified that in East Anglia the population has increased by 20,000 per annum with an expected population of over 2.3 million by 2011. On this basis it sets housing provision requirements between 1986 and 2011 for Cambridgeshire of 74,000.

The current regional planning framework for development in East Anglia is the dispersal of economic opportunities from the west to the east and north of the region with the intention of addressing the regional economic disparities and reducing the remoteness of these areas. Land releases for the improvement to the trunk road network and for residential and commercial development are identified as coming from agriculture as it is the predominant land use in the region and opportunities for reuse of brown field land is limited.

More recent government strategy for accommodating the levels of growth predicted is to focus development on to previously developed sites. The aim of this is two-fold, firstly, to reduce the pressure for the development of greenfield land (land previously undeveloped) that is given over to built development, and secondly, to bring under used and/or derelict back into productive use. The government has set the target of 60% of new development on brownfield sites. Parts of the Government's strategy is to encourage urban living at higher density through better design and layout and supply of facilities, services and transport infrastructure. The Agency encourages the reclamation and re-use of contaminated land where the degree and nature of the contamination has been assessed. We require appropriate site investigations and risk assessments to be carried out on land suspected of being contaminated and request appropriate remediation measures will be carried out prior to redevelopment of a site.

In April 1998 SERPLAN produced a consultation draft of a Sustainable Development Strategy for the South East which is a review of its Regional Strategy. This document will form the basis for a review of Regional Planning Guidance in May 1999. It sets out

sustainable development themes for environmental enhancement and natural resource management, encouraging economic success, opportunity and equity, regeneration and renewal, concentrating development in urban areas and for sustainable transport. To support these themes the strategy proposes a sequential approach to planning the location of development giving a general preference to the reuse of developed areas. The extent to which this approach is applicable will depend on the capacity of urban areas to accommodate development and on the need to ensure that a 'complementary pattern of movement both within and between urban areas' is provided.

The draft strategy document does not address the overall level and distribution of housing provision in the period to 2016. To consider this SERPLAN has also produced a review of housing provision. This review addresses the information and assumptions used in deriving the projected household growth figures and considers different potential levels of growth.

SCEALA has produced strategy documents since 1991 that are advice to the Secretary of State for the Environment on the content of revised regional planning guidance. The latter of these documents was produced in 1997. This latest guidance reiterates sustainable development as a national objective. It also notes that the previous strategy of dispersal and an increased trunk road network is now seen as leading to an energy inefficient form of development. This places increased strain on the environment and therefore it is not considered a sustainable form of development. It also notes that the existing guidance has largely committed development patterns until 2006 and that these existing trends need to be modified if the region is to move to sustainable development.

The SCEALA sustainable development strategy is to balance societal needs for housing and economic opportunities with the need to conserve and enhance the environment. In broad terms this is to be achieved by focusing further development in larger urban areas as this will assist in reducing the need to travel, maintain their vitality, aid the reuse of derelict land and reduce the pressure on countryside greenfield sites. Where it is not possible to locate further development at existing urban areas then new largely self-contained, mixed-use development is to be located in strategic transport corridors. This approach is intended to reduce the need to travel. Where travel is required it is intended to improve accessibility and enable the supply of quality public transport through an integrated transport network. It will also support existing services and facilities while limiting inappropriate development in rural areas and maintaining biodiversity. The concept of sustainable development is the key theme and driving force for strategies in the developing Structure Plans to guide the location of new development.

The strategy intends to increase travel opportunities by modes other than the private car. The SCEALA strategy document also sets out housing requirements for the period up to 2016 in response to the Government's estimated requirements. These are set out in the table below.

Table 2.4: Net dwelling requirement 1991 - 2016

Housing Requirement 1991 - 2016	Cambridgeshire	Bedfordshire	Hertfordshire
RPG[1]	92,500	61,675	83,325
Government Projections[2]	122,000	64,000	89,000
SCEALA and SERPLAN Projections	61,400	52,300[3]	73,950[3]

[1]RPG annual rates projected
[2]DoE 1992 based projections
[3]Average of SERPLAN upper and lower level growth figures

This level of development is to be met in accordance with the regional sustainable development frameworks through structure plan allocations to local planning authorities. Planning authorities, at all tiers, incorporate sustainable development principles into their guidance and plans. This manifests itself in an approach to guiding development that is broadly similar in all county adopted and emerging Structure Plans. The new household growth figures for Cambridgeshire were considered at an Examination in Public of Regional Planning Guidance for East Anglia that was held in February 1999. The household growth figures for Bedfordshire and Hertfordshire are to be considered at an Examination in Public of Regional Planning Guidance for the South-East that is to be held in May 1999. SERPLAN notes that even the levels of development that they have considered exceed the currently identified capability of the South East and adverse environmental impacts will result.

Pressure for development is exerted not only by the needs of the existing population within the LEAP area but also by adjoining areas. The location of the LEAP area just north of London means that London exerts the greatest external influence on development in the LEAP area. The established settlement pattern and the continued growth in high technology industries at and around Cambridge results in commuting pressure on the LEAP area, this is evident through the congestion experienced on the A14 between Huntingdon and Cambridge during commuting periods of the day. In addition the continued development of Milton Keynes influences the commuting patterns of the area, the potential levels of future development and the strategy of urban concentration of development may reinforce this situation.

To address the of increased housing requirements up to 2016 Cambridgeshire County Council undertook a capacity study that put forward a number of options for managing this growth. The options included concentration of development at larger centres and development along transport corridors and introduced the option of new settlements. These options could lead to over 13,000 additional dwellings within that portion of Cambridgeshire within the plan area. This capacity study assisted the county council in making its submission to the Regional Examination in Public to determine Regional Planning Guidance for East Anglia. It will also assist the County Council in the review of their structure plan that will begin in earnest when the Government produces revised regional planning guidance for East Anglia.

The Structure Plans for the three counties set out the strategies that they have adopted to meet the development requirements set out in regional planning guidance. The principal target for

these councils is to achieve more sustainable forms of development. In simple terms this is to be implemented through concentrating development at existing urban centres rather than dispersing development throughout the counties. This is intended to locate housing close to employment areas so reducing the need to travel and assisting in the promotion of public transport options. Where this concentration is not appropriate development will be focused in transport corridors. Only limited development in rural areas to maintain or enhance the vitality or rural settlements will be countenanced.

Within the LEAP area there are 11 settlement identified as the foci of further development in line with the above strategy. These settlements are Huntingdon, St Ives and St Neots (in Cambridgeshire), Hitchin, Letchworth and Baldock (in Hertfordshire) and Bedford, Sandy, Biggleswade, Ampthill and Flitwick within Bedfordshire.

Strategic development corridors identified in the LEAP area are to the south-east of Bedford through the Marston Vale area and along the A1 and the north-east railway route including Sandy and Biggleswade and extending south to the Bedfordshire county boundary. These strategic corridors are to accommodate 15 800 additional dwellings. Of these, strategic allocations are made for 4 500 dwellings on Elstow storage depot to the south of Bedford and 2 700 houses to the west of Bedford (about 2180 of which will be in the LEAP area).

Several of these settlements are constrained by Green Belt and landscape designations, these settlements are Ampthill, Flitwick, Hitchin, Letchworth and Baldock. To meet housing requirements in Hertfordshire the county Structure Plan identifies the need to roll back the Green Belt and identifies a strategic housing location to the west of the A1(M) at Stevenage. This development is initially for 5000 dwellings and concomitant associated development with, in the longer term, the possibility of additional 5000 dwellings and associated development.

Local Plans seek to identify locations for the levels of development brought forward in Structure Plan strategies within the overall guiding principle of sustainable development.

South Cambridgeshire is under great development pressure due to its good accessibility and the high technology employment area around Cambridge. This has led to a policy of restraint on development so that it is limited to that required to maintain or enhance the viability of settlements so that their character and the high quality environment can be maintained. The development allocations of note in South Cambridgeshire in the LEAP area are at Longstanton and Papworth Everard. Approximately 500 dwellings are allocated at both these settlements along with 6.3 ha for research and development use at Longstanton and 10.8 ha for employment at Papworth Everard. Bypasses for both these settlements are proposed in the LEAP area.

The Bedford Borough strategy set out in the Deposit Draft plan (amended by the pre-inquiry changes) is to move the weight of new development to the north of the county and to identify sites within the urban areas and in the strategic development corridors for redevelopment to meet development requirements. As it is not possible to meet the required level of development purely from these sites other sites are identified on the periphery of the main

urban areas at a new settlement. There are four development allocations of note within Bedford Borough in the LEAP area. These are to the west and south west of Bedford in the Kempston/Biddenham area (approximately 2180 dwellings), at Wootton (790 dwellings) and Stewartby (330 dwellings) in the south-western corridor and at the Elstow Storage Depot (375 dwellings). Only a small proportion of the ultimate 4500 dwellings at the Elstow site are to come forward in Bedford Borough during the five-year lifetime of this LEAP. The developments to the west of Bedford are to fund the construction of a western bypass for Bedford.

The extensive existing brickclay and waste disposal developments along with the potential levels of future development and the aspirations of the Marston Vale Community Forest (MVCF) team led to the formation, in November 1997, of the Marston Vale Working Group. The membership of this group includes the Bedfordshire and River Ivel Internal Drainage Board (IDB), the MVCF team, the Environment Agency and the local planning authorities.

The IDB and the MVCF team jointly produced a document entitled 'Water Management and the Environment in the Marston Vale' in July 1998. The document considers the relationship between the land drainage concerns of the IDB and the aspirations of the MVCF especially in relation to the MVCF 'Forest Plan 1995' and the proposal for a Country Park at Stewartby Lake. The IDB seeks to ensure that land drainage is not adversely affected by any of the proposals while seeking to take opportunities for environmental improvements.

Mid Bedfordshire strategy set out in the Deposit Draft plan as amended by the Pre-inquiry changes is to identify a settlement hierarchy. Development is focused on 'Selected Settlements' which are the larger urban settlements with the highest overall levels of community and service provision, also within the strategic development corridors and at Elstow Storage Depot. Within this LEAP area there are eight Selected Settlements. Of these four are within the East Bedfordshire strategic corridor. Within the south-western corridor 810 dwellings and 14 ha of employment land are allocated including 600 dwellings at the Elstow site allocated for the plan period. In the eastern corridor 2 825 dwellings and approximately 13 ha of employment land are allocated. Ampthill, Flitwick, Potton and Shefford are allocated 330 dwellings.

The Huntingdonshire strategy set out in the Deposit Draft Local Plan alterations is to focus development in urban areas to reduce the need for travel, make best use of existing infrastructure and constrain development in the countryside. This approach continues the approach in the currently adopted Local Plan and does not pre-empt the outcome of the review of the Structure Plan. The key areas allocated for development in Huntingdonshire in the LEAP area are Huntingdon/Godmanchester (19.75 ha), St Neots (54.92 ha) and St Ives (17.90 ha). These settlements are allocated in excess of 1600 dwellings, which is over 70% of the total dwelling allocation in the Local Plan. The largest allocations are at St Neots where approximately 420 dwellings are allocated at Barford Road, Eynesbury and approximately 400 proposed at Priory Road.

North Hertfordshire strategy is set out in the Adopted Local Plan for the district. This is to maintain the existing pattern and character of settlements and countryside. Allocations are made at Baldock (79 dwellings), Hitchin (265 dwellings) and Letchworth (71 dwellings). North Hertfordshire District and Stevenage Borough Councils are undertaking reviews of their Local Plans to replace plans which are coming to the end of their plan periods and to take account of the strategy and policies of the recently adopted Structure Plan. A key element of these Local Plan reviews is likely to be the accommodation of further housing development and concomitant infrastructure and services in particular at to the west of the A1(M) at Steveange which lies within both North Hertfordshire District and Stevenage Borough planning areas.

East Northamptonshire and South Bedfordshire Districts have not been considered here as the portions of these district council areas within the LEAP area are small, rural in nature and without key Local Plan housing or employment allocations.

TRANSPORT

The LEAP area is under immense development pressure which is partly due to comprehensive transport links within it and with other areas, in particular with London to the south, Cambridge to the east and Milton Keynes to the west. The LEAP area includes the major transport corridors of the M1, A1, A428 and the A14. It also includes three railway routes. Two of these are from London to the North-East; the first is via Hitchin, Biggleswade, Arlsey, Sandy, St Neots and Huntingdon (in the LEAP area) and onto Peterborough, the North-East and Soctland and the second is the Midland Mainline via Flitwick and Bedford to the Midlands and the North. The third route is from Swindon to Bedford via Milton Keynes, Lidlington and Stewartby. In addition, London Luton Airport is adjacent to the LEAP area and is recognised as being important to the economy of Bedfordshire.

Regional Planning Guidance identifies the great reliance made on the road transport network in the South-East. The population of the South-East makes greater use of the transport infrastructure than any other part of the country. In the South-East, outside London, the average mileage travelled per person is 8000 miles. Of this figure 6466 miles (approximately 81%) are by car. This is facilitated by the highly developed road and rail networks in the South East. Regional guidance notes that increased road capacity is not sustainable. It sets a series of objectives to be addressed through the Structure Planning process including:

- the use of demand management measures to reduce congestion, providing a safe and efficient transport system; and
- increasing the range of modes of transport available and reducing the reliance on the motor car and lessening the environmental impact of using the transport infrastructure. The focus should be on co-ordinating development with transport modes and infrastructure.

In Cambridgeshire, economic growth has lead to increased prosperity and traffic increases above the national average. In accordance with this, government guidance emphasises the importance of the transportation infrastructure to economic and general travel needs and

identifies the need to increase the capacity of the trunk road network to remove traffic from congested roads.

The government's white paper 'A New Deal for Transport: Better For Everyone' (Cm 3950 July 1998) set out the government's integrated transport policy. A key element of this is to focus investment in trunk roads to improve maintenance and to make better use of the existing network through a programme of improvement schemes. The roads review for the Eastern Region identifies two Trunk Road schemes in this LEAP area these being the A421 Great Barford bypass which is expected to remove 75% of traffic from Great Barford and the A6 Bedford western bypass. The latter of these two schemes is being funded by developer contributions. In addition nearly all of the LEAP area is within the area of two transport studies. Subject to consultation with the regional planning conference it is proposed to undertake a study of the congestion problems in the M1 and A1(M)/A1 corridors and the congestion and safety problems on the A14 between Huntingdon and Cambridge.

It is clear that it is Government policy to curtail the number of new roads built, to channel spending on roads into the maintenance and improvement of the existing road infrastructure and to promote the development of alternative travel modes, where appropriate, as part of an integrated transport system. This is being adopted and developed by the regional planning conference in its Sustainable Development Strategy for the South-East and by the emerging development plan for this LEAP area. Many trunk road schemes have been removed from the road building and improvements programme but those that remain, identified above, will require full environmental appraisal.

Development can inflict a range of strains on the environment. These strains can be ameliorated if properly located, designed, constructed and regulated. The Agency seeks to reduce the strains put on the environment by working with planning authorities at all tiers to aid the identification of appropriate sites for development and assist in the identification of the strains a development will place on the environment. The Agency's concerns address water quality and resources, drainage infrastructure and flooding, recreational use and conservation of watercourses and their corridors.

2.3.3 Abstractions and Removals

The levels of housing, employment and transport infrastructure development allocated by the development plan for this plan area and required for the period up to 2016 and beyond will necessitate the future exploitation of natural resources. The effect of this land use and development on water abstraction is discussed in Viewpoint 1.1. We seek to guide the location of development to areas where adequate water resources are available or where it can be made available without detriment to the water environment. We also seek to reduce the demand for water and ensure that new development has an adequate means of water supply.

Through MPG 6 (1994) the Government requires County Councils as Minerals Planning Authorities to maintain landbanks of aggregate minerals sufficient for at least seven years supply. It also notes that there are increasing constraints on land won aggregates and there

will need to be a change in approach so that less reliance is made on land won aggregate. The 1997 SCEALA guidance document seeks to increase the contribution to minerals supply made by recycled material but recommends that increased reliance on dredged marine aggregates should be treated with caution until the consequences of the dredging are fully understood. It also seeks to make more use of the rail network for the transportation of aggregates around the region.

The sustainable development strategy produced by SERPLAN stresses a need to employ demand management measures in the supply of aggregates. This will allow more emphasis on the environmental capacity of an area to absorb aggregate development and will allow the promotion of secondary aggregate use so conserving primary aggregate reserves.

The operation of mineral extraction sites can have a wide range of adverse impacts on the environment if not adequately controlled. The Agency seeks to resist proposals for new mineral extraction where there is likely to be an adverse effect on groundwater, surface waters and other water bodies and associated habitats, and encourages restoration works that result in environmental enhancement and encourages the provision of water based recreation where appropriate.

There are a large number of minerals extraction sites and large minerals consultation areas in this LEAP area. Within this LEAP area in Cambridgeshire aggregate extraction sites are located in the river valley of the River Great Ouse where the adopted aggregates plan identifies eight sites to contribute to maintaining the county's aggregates landbank. Bedfordshire contains extensive deposits of a variety of minerals that form an important local and national resource. As a consequence large parts of the county are within minerals consultation areas to prevent the sterilisation of mineral resources by other forms of development. The consultation areas are the Marston Vale, Ivel Valley, east of Bedford and the area between Flitwick and Chicksands. The adopted Minerals Local Plan does not anticipate a shortfall in the provision of brickclay, industrial sand or chalk in the plan period, it does however include proposed sites for sand and gravel extraction at land west of Willington, Salford and in the Ivel Valley.

The principle areas for mineral extraction in the LEAP area are Marston Vale, Ivel Valley and in the Willingham/Over area. The Marston Vale is seen as a significant resource for the LEAP area and will remain so for many years. The extraction of clay for brick making and the use of the subsequent voids for waste disposal are of at least regional significance. The brickworks at Stewartby are reputedly the largest in the world and has a maximum brick production capacity of 375 million bricks per year. The brickworks at Stewartby and Kempston Hardwick extract approximately one million tonnes of Oxford Clay per annum and have permitted reserves of approximately 100 million tonnes. Map A1 shows the sites of mineral extraction in the LEAP area.

The restoration of mineral extraction sites to a beneficial after use is a fundamental concern to the planning authorities. Normally restoration is to agriculture, forestry, nature conservation or amenity use. The Marston Vale has a history of industrial use that has resulted in areas of dereliction. Extraction and disposal will proceed for some time due to the extent of

remaining mineral reserves and the significance of the area for waste management for the south east of the country. As a result the county council has identified the Vale as a priority area for environmental improvement. The Marston Vale Partnership of planning authorities and minerals and waste management operators has produced a strategy for achieving these improvements. The Marston Vale Community Forest Project is key in achieving this. The Community Forest in Bedfordshire was announced in 1991, it is one of twelve in the country and will cover 61 square miles. The county council will seek to implement the Community Forest objectives when considering restoration proposals for minerals and waste management sites. The joint IDB and MVCF report will assist the county council in this respect.

The Ivel valley has a history of use for the extraction of sand and gravels and for waste disposal. This may continue through the proposals (not allocations) in the Minerals and Waste Local Plan. The Ivel valley also includes the brickworks at Arlesey which, until in was mothballed in 1992; extracted approximately 50 000 tonnes of Gault Clay per annum. The area is now the subject of the Ivel Valley Countryside Project which seeks to improve access and recreation opportunities in the countryside, resolve conflicts between users, protect and enhance the landscape and wildlife value, support countryside management work and provide a land management advisory service.

Another restoration scheme of particular note is that proposed for a sand and gravel extraction site at Needingworth on the western boundary of this plan area. The site covers 945 hectares and the proposed restoration scheme would provide a nature conservation scheme of approximately 876 hectares includes open water, wet grassland and reed beds. The proposal would supply a nationally significant area of reed bed and make a significant contribution to the UK Biodiversity Plan target for reed bed creation.

2.3.4 Waste Arisings and Disposals

The envisaged development in the region and consequently in this LEAP area is also likely to lead to an increase in the generation of waste. However, due to the nature of the waste management industry it is not possible to determine accurately the amount of waste that is produced in the LEAP area, the where that waste is managed and how much is managed within the LEAP area. Waste strategy and planning matters are more appropriately dealt with at national, regional and county levels.

In December 1995 the government produced a strategy for sustainable waste management in England and Wales. The strategy is considered in Viewpoint 4.7. This strategy sets a number of objectives and targets to be addressed and worked towards at regional and county level. The objectives set include reducing the amount of waste produced and making best use of this waste. The targets include reducing the proportion of controlled waste going to landfill to 60% from 70% by 2005, to recover 40% of municipal waste by 2005 and recycle or compost 25% of household waste by the year 2000. The Government is currently in the process of reviewing this strategy document.

The Government has provided guidance on planning for waste management. This is currently contained in PPG 23 'Planning and Pollution Control' but it is intended to produce

in the near future a new PPG that currently has the draft title of 'Waste Disposal and Management'. Government planning guidance in these documents includes two key elements these are the Proximity Principle and Regional Self-Sufficiency. The Proximity Principle requires waste to be managed as close as is practical to the point at which it is generated as this will:

- encourage more responsibility for the waste generated;
- is more likely to accord with the principles of sustainable development;
- it may assist the local economy; and
- keep down costs.

Regional Self-Sufficiency suggests that most waste generated in a region should be managed in that region. It is advised that the region should provide facilities with capacity to manage the expected waste arisings for at least 10 years.

A SERPLAN report in 1994 indicated that it was likely that the region as a whole would run out of suitable non-inert waste sites by 2010. Current figures indicate that landfill continues to be filled faster than it is created. SERPLAN identified the need for radical change in waste management practice by implementing other waste management options. Waste management facilities for inert waste are considered to be available in the SERPLAN planning period, that is, until 2010 but non inert landfill capacity is expected to run out between 2005 and 2010.

All shire counties are to work towards being self sufficient in reduction, treatment and disposal for non-inert wastes at the earliest practicable date. London has historically exported approximately seven million tonnes of non-inert waste per year. While the target of reducing this to three million tonnes by 2005 and to only treated residues by 2010 has been set there will inevitably be exports in the future and these will need to be managed in the surrounding counties.

Regional Planning Guidance for East Anglia identifies landfill as the main means of waste disposal but states that development plan policies should take account of alternative means of waste disposal such as recycling which should reduce the dependency of landfill. The SCEALA Regional Planning Guidance document identifies that there has been a continued upward trend in waste generated. The average recycling rate for household waste in 1994/95 was only 6.6% which compares with a government target of 25% by the end of the century. The SCEALA document accepts that landfill will remain the principal means of waste disposal in some areas and that there is likely to be an acute shortage of suitable sites in the medium to long term. SCEALA intend to produce Integrated Waste Management Strategies and Sustainable Waste Management Plans to address this issue.

The principle areas of waste management in the LEAP area are located in the Marston Vale in Bedfordshire and in Huntingdonshire. Within the Marston Vale there is a number of waste management facilities as a result of brickclay extraction. These extraction sites are geologically suited to restoration by waste disposal due to the impermeable nature of the surrounding clay and they that play a regionally significant role in waste management. These

sites accept wastes from a range of sources including London and Milton Keynes, with the majority of waste being derived from London. The Minerals and Waste Local Plan for the county seeks to concentrate major landfill sites in the Marston Vale and encourage the adoption of waste management options further up the waste management hierarchy.

There is also a concentration of waste management facilities in Huntingdonshire between St Neots, Huntingdon and St Ives. This area has within it 13 landfill sites, eight transfer stations and four household waste recycling centres. The Cambridgeshire Waste Local Plan identifies that there is in excess of 30 years supply of void space in Huntingdonshire for non-inert wastes and approximately 13 years supply in the county as a whole. It is therefore not proposed to identify further capacity for non-inert wastes and to focus in the development of waste management options further up the waste management hierarchy where they represent the best practicable environmental option.

2.3.5 Uses, Releases and Discharges

Most forms of development result in releases or discharges during their construction and/or their operation. The Agency and local authorities control many of these releases and discharges. The Agency has controls through the issue of discharge consents, waste management licenses and IPC authorisations.

Guidance on the role of the planning authorities and pollution control authorities is given in PPG23 'Planning and Pollution Control'. This states that planning authorities control the use of land and have a role in determining the location of a development that may give rise to pollution. The planning authority determines whether a development is an acceptable use of the land. The planning authority is not concerned with controlling the polluting process itself where it falls under the control of a pollution control authority. The potential for pollution, however, can be capable of being a material consideration in deciding whether to grant planning permission. Planning controls can complement pollution controls but not reproduce them.

We seek to maintain or improve the quality of ground and surface waters and resist development that poses an unacceptable risk to the quality of ground and surface waters. We seek to ensure that adequate foul and surface water drainage infrastructure is available to serve development and effective pollution prevention measures are incorporated into new developments so discharges do not cause environmental problems.

2.3.6 Illegal Practices

Development, which is not carried out in accordance with the details of the approved planning application, any attached conditions or legal agreements, can be subject to enforcement action by the local planning authority. The Agency can only control development that is within its bylaw distance adjacent to main rivers.

2.4 Waste Disposal

Everyone is involved in generating waste on a daily basis and its safe disposal is essential to protect the health of the environment. The disposal of waste to land always has been, and remains, the prime means of waste disposal. However, waste does not always go direct from its point of arising to its disposal site - it may be treated beforehand or may have materials recovered from it before the residues are sent on to disposal.

Wastes arising from households, commerce and industry are collectively referred to as 'controlled waste'. The management of these wastes is regulated under the Environmental Protection Act 1990 and the Environment Act 1995. The two main categories of waste not controlled by this legislation are agricultural waste and mine and quarry waste.

Under this legislation, a Waste Management Licence is required to keep, treat or dispose of controlled waste. Certain low-key activities are exempted from licensing, notably the storage of waste at the site of production and a number of recycling activities.

Sites that are required to be licensed include; landfill sites, waste transfer stations, household waste recycling centres (civic amenity sites), waste treatment plants and some scrap-yards. Conditions attached to licences seek to ensure these activities are carried out without causing pollution of the environment, harm to human health or serious detriment to the amenities of the locality.

2.4.1 Natural Forces

The location of waste management facilities, landfill sites in particular, is dependent on a number of factors. Hydrology and geology are both important; however, in the case of the LEAP area, the proximity of principal transport routes also plays an important part in their siting and scale. Historically, smaller sites were operated under the principle of 'dilute and disperse'. Polluting matter derived from the site was attenuated or treated naturally, as it passed through the sub-strata, reducing the risk of pollution of the environment. This method is now considered inadequate and for larger sites or those accepting a wide range of wastes unacceptable. This is discussed in more detail in Viewpoint 5.

As a consequence, there is a need to make use of the natural geology, or to engineer sites, to make them confine all leachate for collection and treatment prior to discharge to the environment. The geology of worked out brick pits of the Marston Vale and the Oxford Clays in general provide an ideal medium to contain leachate. Easy access to sites in the Marston Vale from the M1 motorway, Arlesey and Buckden from the A1 and Godmanchester from A14 made them prime sites for land filling. Rail access to the existing brick works at Stewartby has also been utilised.

No landfill can be guaranteed to be totally leakproof and therefore certain conditions have to be considered:

- the proximity of ground and surface water;

- the depth and nature of any unsaturated zone; and
- the possible impact that leachate reaching the groundwater may have.

Today, when considering the suitability of any site, other issues, such as sustainability, need to be addressed in addition to all the pollution prevention measures that may be required.

2.4.2 Societal Influences

Other waste management facilities, such as treatment plants, transfer stations and scrap-yards can still cause pollution even though they do not involve the disposal of waste. Spillage of oils and other liquid wastes as well as leachate from stored biodegradable waste must be prevented from reaching groundwater or surface water. This is achieved by locating potentially polluting activities on an impermeable pavement and ensuring that all surface water run-off drains to a purpose built sealed drainage system. The liquid can then be disposed of via a consented discharge to sewer, soakaway or surface water (if appropriate) or taken away to a suitably licensed disposal facility elsewhere.

The landfills in the Bedford Ouse LEAP area are amongst the largest and highest capacity sites in the country. They frequently serve not just the local community but also bring in large quantities of waste from other conurbations and towns such as London, Watford and the rest of the South-East. In the case of Stewartby, with its adjoining treatment plant, special waste from all over the UK is disposed of within its boundaries. Figures on waste arisings and remaining disposal capacity are not readily available by LEAP area, as they are prepared on a county basis. However, capacity at current rates should be available for the five-year lifespan of this plan.

Following the Rio Summit in 1992, the Government published a White Paper entitled 'Making Waste Work', which outlines the UK's approach towards sustainable waste management. At the heart of this is the objective to reduce the proportion of controlled waste going to landfill by:

- reducing waste at source;
- re-use of waste;
- recovery of materials or energy from waste; and
- disposal which comes at the bottom of what is referred to as the waste hierarchy (refer to page 4.43).

As a result of this, there have been a number of recycling initiatives in the LEAP area. Sites have been provided for the separation of the components of household waste at Elstow, allowing a greater proportion of this waste to be recycled. In addition, composting of shredded vegetation takes place at some landfills. Many transfer stations and householders waste sites provide material recycling facilities as well as facilities to dispose of waste. These complement facilities provided throughout the LEAP area by District Councils and others for household waste recycling. Scrap-yards and vehicle dismantlers have always been involved in the recovery and recycling of metals and vehicle

parts. Map 2.8 details the waste management facilities found within the Bedford Ouse LEAP area.

In 1997, The Producer Responsibility Obligations (Packaging Waste) Regulations were introduced. These require businesses involved in the manufacture or use of packaging to recover and recycle specific tonnages of packaging waste which are dependant upon the scale of their operation. The purpose of the regulations is to enable the UK to meet its EU-imposed obligation of re-utilising at least 50% of its packaging waste by the year 2001.

If enough initiatives such as this are successfully implemented, it will result in a reduction in the proportion of waste being landfilled but that is unlikely to translate into a reduction in the number of landfill sites in the short-term.

Further legislation, much of it implementing EU directives, is expected in the future and this is likely to be aimed at further reduction and recovery of waste as well as regulating waste disposal itself.

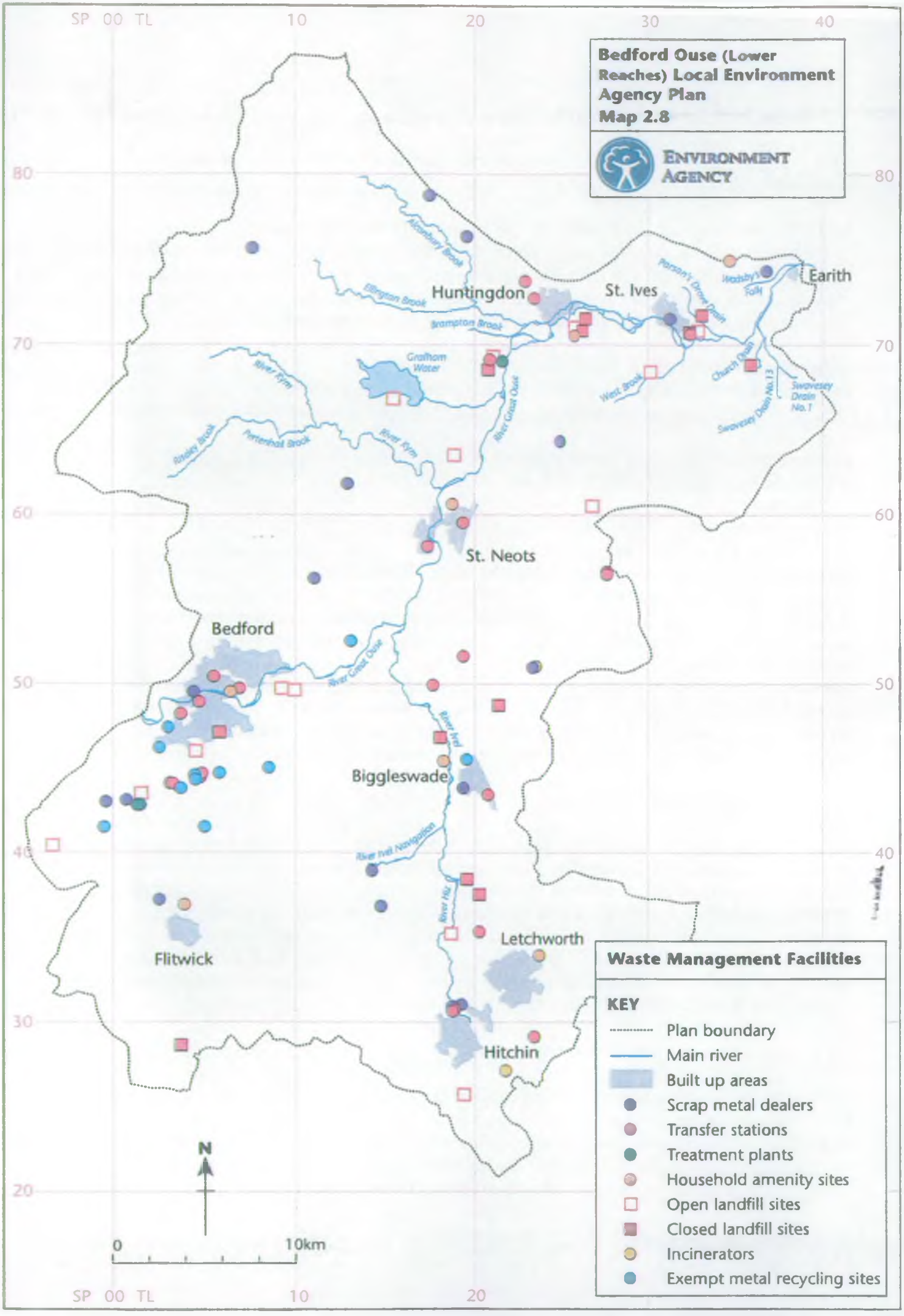
The concept of sustainable development has given rise to a new approach towards landfilling. Sites that are lined and capped to minimise the release of leachate and gas to the environment also minimise the ingress of rainwater into the site. Moisture is an essential component in the degradation process and waste, which has been entombed in such a manner, may take many decades to degrade and stabilise. The aim of sustainable waste management is to ensure that today's waste is dealt with by the present generation. This will only be achieved if waste is pre-treated before landfilling or if the biodegradation processes within the landfill are accelerated by, for example, encouraging leachate to form and then recirculating it through the waste in a controlled fashion. It may not be possible or practical to apply this retrospectively to existing sites but it should be considered at the design stage of future sites.

2.4.3 Abstractions and Removals

Land formerly used for mineral extraction has been used for waste management activities in the past, most notably for landfill. Sites used included chalk quarries, road construction borrow pits and sand/gravel quarries. The utilisation of any type of void space is not now generally acceptable due to the need to operate landfill for the disposal of non inert wastes on an engineered containment basis, due to the vulnerability of water resources and the dangers of landfill gas migration towards areas of development. This has considerably reduced the number of suitable voids able to be economically engineered and operated as landfill sites. Map A1 shows the location of mineral extractions.

2.4.4 Uses, Releases and Discharges

Old brickwork quarries provide the majority of the capacity for landfilling in the LEAP area, although old sand and gravel workings are also represented. The clay pits tend to be much deeper than the sand and gravel quarries and the final contours of the restored site will generally have to be significantly higher than the original ground levels. This re-contouring is required to provide sufficient gradients to encourage surface water to be shed


Bedford Ouse (Lower Reaches) Local Environment Agency Plan
Map 2.8
Environment Agency
SP 00 TL
10
20
30
40
80
70
60
50
40
30
20
Huntingdon
St. Ives
Earith
St. Neots
Bedford
Biggleswade
Letchworth
Hitchin
Flitwick
Alconbury Brook
Ellington Brook
Brampton Brook
Grafham Water
River Kym
Roxley Brook
Pertenhall Brook
River Great Ouse
Parson's Drove Drain
Wadsley's Folly
Church Drain
West Brook
Swavesey Drain No.13
Swavesey Drain No.1
River Ivel
River Ivel Navigation
River Hiz
N
0
10km
Waste Management Facilities
KEY
Plan boundary
Main river
Built up areas
Scrap metal dealers
Transfer stations
Treatment plants
Household amenity sites
Open landfill sites
Closed landfill sites
Incinerators
Exempt metal recycling sites

from the site. Waste once deposited will degrade and settle. This process is not precise and allowance needs to be made for possible uneven settlement. Allowing surface water to pond on the restoration cap can lead to a failure of the cap or increased infiltration with subsequent build up of leachate requiring removal and treatment. Allowance for settlement is proportional to the depth of filling and will therefore be greater in the clay fields rather than the shallower gravel quarries.

As biodegradable waste degrades in the landfill environment, landfill gas (consisting mainly of methane and carbon dioxide) is produced. As pressure within the landfill builds up, gas will escape from the site via the path of least resistance. If no controls are built into a site this could be through the surface of the site into the atmosphere or through fissures in the surrounding rock. In some circumstances landfill gas has been known to travel in excess of 100 metres from a site and if it then vents into a confined space, such as a building, it can give rise to an explosion risk.

Provided that the pressure within the site is relieved, lining of sites with low permeability material dramatically reduces the risk of lateral migration of gas. The simplest means of doing this is to provide venting chimneys in the site, which will allow the gas to vent passively to atmosphere. However, landfill gas is odorous and the methane component constitutes a potent greenhouse gas. It is now Agency policy to require the active collection and burning of the gas; this provides a more acceptable alternative where the quantity and quality of gas generated is sufficient to support it.

A more sustainable use of landfill gas is as a source of energy. This has been stimulated under the Non-Fossil Fuel Obligation under which electricity companies are required to secure a proportion of their electricity from non-fossil fuel sources. This is only viable on some sites; currently, sites at Stewartby, Brogborough and Arlesey have electricity-generating equipment and Buckden has been proposed for such a scheme.

The generation of leachate is an inevitable consequence of landfilling biodegradable waste, although its quantity and composition will vary both between different sites and during the lifetime of any one site. Escape of leachate from a site can be minimised by lining it with a low permeability liner and then keeping the head of leachate to a minimum by pumping it out. Options for its disposal include on site treatment followed by consented discharge to surface water, consented discharge to sewer with or without prior treatment, removal to an appropriate treatment plant (including STWs) and recirculation through the landfill. Quantities of leachate being generated within sites in the LEAP area are fairly high because of the large size of the sites. Treatment facilities for leachate have been provided at Buckden and Sundon and are proposed for Stewartby and Brogborough.
Other 'releases' from waste management sites include nuisance elements such as litter, dust, odour and noise and these may be as much of a problem on transfer stations and treatment plant as on disposal sites. Controls on these are usually imposed through the planning permission or waste management licence.

2.4.5 Illegal Practices

With a few exceptions, it is an offence under the Environmental Protection Act 1990 to deposit, treat, keep or dispose of controlled waste unless it is under and in accordance with a waste management licence. If convicted at a Magistrates Court the penalty may be a fine of up to £20 000 and/or imprisonment for up to 6 months. Unlimited fines and/or up to 2 years imprisonment are the penalties if convicted on indictment. However, some people are still prepared to take the risk in an attempt to avoid paying disposal costs and dump their waste by the roadside or in deserted lanes and fields.

Other offences may be committed through ignorance, such as the land spreading of waste without carrying out the necessary checks and prenotifying the Agency.

The Agency is committed to providing a high quality waste regulation service and devising means of combating fly-tipping, which includes prosecution where appropriate.

VIEWPOINT 3: KEY BIOLOGICAL POPULATIONS, COMMUNITIES AND BIODIVERSITY

3.1 Fisheries

Fish are very good indicators of the state of rivers and lakes. Healthy and abundant freshwater fish stocks demonstrate good water quality, water quantity and habitat.

The Agency has a duty to maintain, improve and develop fisheries for salmon, trout, coarse fish and eels. Our vision is that all waters become capable of sustaining healthy and thriving fish populations. A realistic objective is to reach the carrying capacity for each watercourse, based on habitat and channel size.

A balanced fish community should also be sought, where an appropriate diversity of species is achieved within the aquatic ecosystem. The control of exotic fish species and disease in a river catchment is paramount to protect the native inhabitants. The Agency regulates and protects fisheries through our powers defined under the Salmon and Freshwater Fisheries Act 1975 and the Environment Act 1991.

The recreational and, in some circumstances, commercial use of a fishery must be considered when developing integrated water management objectives. We aim to provide anglers with a diverse range of good quality fishing. Anglers over the age of 12 must buy a rod licence; the income generated funds our fisheries work.

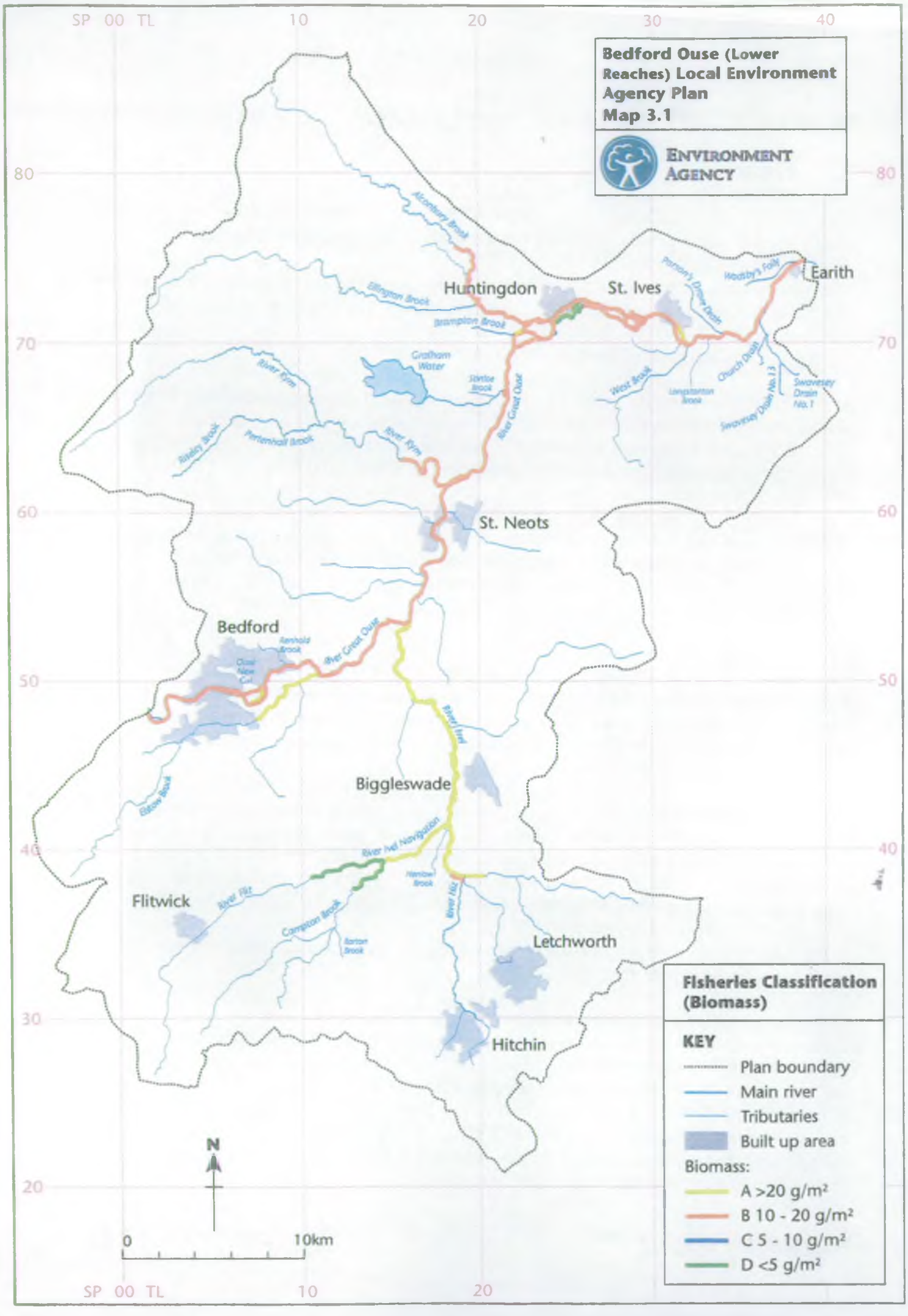
3.1.1 Natural Forces

Fish populations fluctuate according to environmental conditions that influence the physical, biological and chemical characteristics of the ecosystem. The fisheries of the Bedford Ouse and associated tributaries exhibit considerable variation in fish biomass, density and diversity in relation to these conditions.

In order to monitor fish stocks the Agency has a 5-year rolling fishery survey programme, which covers 190 km of coarse fishery and 3 km of game fishery. We have now accumulated 20 years of population data to assess the likely impacts of any proposed developments, pollution events or drought incidents. There are four fisheries biomass classifications, ranging from 'A' (good – greater than 20g/m^2) to 'D' (poor - 0 to 5 g/m^2).

In the Bedford Ouse area, angling is concentrated on the main river between Bedford and St. Ives and on the River Ivel.

The 1998 survey of the Ouse between Bedford and Brampton revealed a healthy class 'B' fishery dominated by roach and common bream (refer to Map 3.1). Of particular note was the site at Little Paxton, where a shoal of over 200 mature bream (>40 cm) was caught. Pike and perch were also widely distributed along this length of river, in total 15 different species were encountered plus roach/bream hybrids. The New Cut and Cardington Canoe Stream are backwaters of the Ouse downstream of Bedford both provide excellent off-river habitat. Juvenile barbels have been stocked at these locations with the hope that the suitable habitat will enable them to survive, grow and populate the river.


Bedford Ouse (Lower Reaches) Local Environment Agency Plan
Map 3.1
Environment Agency
SP 00 TL
10
20
30
40
80
70
60
50
40
30
20
Huntingdon
St. Ives
Earith
St. Neots
Bedford
Biggleswade
Flitwick
Letchworth
Hitchin
Alconbury Brook
Ellington Brook
Brampton Brook
River Great Ouse
Graham Water
Slerton Brook
River Kym
Ridley Brook
Perlenhall Brook
Patrion's Drove Drain
Woodby's Folly
West Brook
Church Drain
Langstanton Brook
Swavesey Drain No.1.3
Swavesey Drain No.1
Renhold Brook
Ouse Valley Cut
Elbow Brook
River Ivel
River Ivel Navigation
Hanslow Brook
River Flit
Comptan Brook
Barton Brook
N
0
10km
Fisheries Classification (Biomass)
KEY
Plan boundary
Main river
Tributaries
Built up area
Biomass:
A >20 g/m²
B 10 - 20 g/m²
C 5 - 10 g/m²
D <5 g/m²

The Elstow Brook joins the Bedford Ouse at Willington, it is a class 'A' biomass fishery. Sections of the watercourse are particularly suited to the dominant species - chub and pike. There is excellent bankside cover and in-stream features such as fallen trees and aquatic weed. The dace population appears to have been adversely affected by either the low summer flows or flood conditions experienced in recent years. There are no angling interests on this watercourse.

The River Ivel showed an improvement is biomass from the previous survey in 1995, it is now classified as a class 'A' biomass fishery. In particular the common bream populations have increased with large fish encountered at Girtford and Biggleswade. However, recruitment since 1990 has been poor, it is thought that, although the fish successfully spawn, there are few areas of the river conducive to juvenile bream survival. The roach are numerically dominant, but survival appears poor, with few fish caught more than 7 years old. The habitat of the Ivel is significantly more suited to chub, dace and barbel. It is pleasing to report that the stocking of this latter species, since 1994, has been a success. Large fish were caught indicating that they are surviving and growing. The capture of a one-year-old barbel indicates natural recruitment may now be taking place.

The collapse of the sluice at Tempsford Mill on the River Ivel, in 1993, resulted in low water levels for five years. A special investigation was undertaken to assess the impact of these low flows on the fish populations between the Mill and Twin Bridges at Blunham. It was pleasing to report several good shoals of roach, perch and dace plus good numbers of specimen pike and bream. It appears that the period of low water levels has not adversely affected the fishery. Maintenance work on the sluice is now complete and levels are back to normal.

Many of the tributaries of the Ivel can only be considered marginal fisheries. The Rivers Hit and Flit are only have class 'D' biomasses; whilst the category 'B' River Hiz has declined since the previous survey due to the capture of fewer large roach. The fish population of the River Hiz should benefit from the low flow alleviation scheme. The impact of this scheme, in which boreholes are supplementing headwater flows, is currently being monitored. Special fisheries surveys in the headwaters have shown that minor fish species predominate with the exception of a wild brown trout population in the River Oughton. 15 adult trout and 15 juveniles were present in 1998, indicating that the habitat and flow is able to sustain a breeding population.

The Ivel Navigation is an excellent class 'A' fishery; the numbers of chub, pike and roach have all increased in recent years, The habitat is generally limited, more akin to a 'straightened' canal, which results in fish forming shoals around isolated features, especially during the winter months.

High flows in September 1998 prevented the surveying of the lower reaches of the Bedford Ouse. In 1995 the river between Brampton and Earith was classified as a class 'B' fishery dominated by roach in terms of both weight and numbers. In response to the continual low biomass recorded below St. Ives in the 1992 and preceding surveys, the Agency has

undertaken a restocking programme. Approximately 17,000 coarse fish were introduced so it was encouraging to report that the biomass had doubled by the next survey.

Tributaries and backwaters of the Ouse around Huntingdon such as, Lees Brook, Cooks Backwater, and Brampton Stream all offer valuable habitats for fish off the main river channel. These are key spawning areas for cyprinid species and also provide a refuge during winter floods.

The Alconbury Brook and River Kym were both class 'B' biomass fisheries when surveyed in 1998. Historically, these watercourses were considered important recruitment areas for species such as chub and dace, which could then move into the Bedford Ouse. Pike, eel and roach were the most prevalent species with the occasional specimen chub caught in our surveys. The lack of small fish could be attributed to low flows and drought conditions experienced in recent years, or conversely the extreme high flows at Easter 1998. The low abundance warrants further investigation with the option of restocking.

The survey timetabled on the Houghton Stream for 1998 was delayed due to high flows. However, this has historically been an important tributary of the Ouse. In the last survey in 1994 the Stream recorded a class 'B' biomass dominated by chub and roach. Another important tributary of the Bedford Ouse, the St Ives Chub Stream, is a biomass category 'A' fishery. This relatively short but fast flowing water course offers considerable habitat diversity and ideal habitat for species such as chub.

There are a number of Internal Drainage Board (IDB) drains; although not supporting recognised fisheries, coarse fish populations are known to reside in most of these watercourses.

The Bedford Ouse is a typical lowland river; slow flowing, clear, with macrophytes growing in the margins. It is likely that the recent warm summers have benefited the annual recruitment of the dominant cyprinid species. There are a limited number of backwaters which provide spawning habitat and nursery areas. In addition, the marinas are important features on the river offering a winter refuge from the high flows. Bridges, boat moorings and overhanging trees may also attract fish.

The tidal limit of the Great Ouse is at Brownshill Staunch and although salt water does not penetrate this upstream, flounder are caught in our surveys of this section. There is some evidence that this, the first control structure on the river, presents a significant obstacle to all types of fish. It is extremely unlikely that coarse fish are able to move at will upstream. Dead smelt have been observed on a sluice gate sill, having failed to overcome the structure and in the past, sea trout have been seen congregating downstream.

Rivers in this LEAP area, like most in the Anglian Region, have been subject to environmental extremes in recent years. Low flows in drought years, associated with elevated summer water temperatures, will impact on resident fish populations. The warmer the water, the less dissolved oxygen can be held in it; the situation is worsened by algae and submerged plants. Plants respire at night, thus stripping oxygen from the water;

by morning some fish may have literally suffocated. This problem tends to be more prevalent in lakes and ponds, although in static drains and some rivers the impact is also observed.

High rainfall and the subsequent floods have the potential to displace small fish downstream, particularly in channelised environments. Our surveys this year suggest that survival of juvenile fish may not have been affected. A beneficial impact of high flows may be on the spawning areas in tributaries used by trout and chub, where gravel beds have been cleaned. Cyprinids who use plants and finer substrate for spawning may have fared less well because increased bank erosion and redistribution of silt beds occurred as a result of the floods. It will be of particular interest to monitor recruitment and survival from the 1998 yearclass.

The Easter floods did displace fish from gravel pits adjacent to the Bedford Ouse into the main river. We were made aware of large carp being lost from fisheries; the most extreme example was one lost from the Willington area, which was found 12 miles downstream in another stillwater. The loss of carp into running waters is of particular concern, where they have the ability to out-compete the natural riverine species. Through our routine fisheries survey program we intend to monitor this situation.

FISH DISEASES

The fish population in any river has a natural background of parasites and diseases. This loading only becomes apparent when the fish are subject to stress. As a result of spawning, where the fish's energies are channelled into producing progeny, a natural mortality sometimes results. The most obvious example is the migratory salmonids that cease feeding when re-entering freshwater to breed. Few adults survive the journey up and downstream at a time when they are susceptible to bacterial and fungal infections.

Reports of coarse fish suffering from diseases are regularly reported to the Agency; however, most individuals will survive 'blackspot' or an *Aeromonas* ulcer. However, diseases will influence the cyclic population patterns observed in our river fisheries. The Agency does not routinely sample the health of wild fish.

We regulate introductions of fish into rivers through our Salmon and Freshwater Fisheries Act consenting procedures; this ensures that serious diseases are not spread into rivers.

Disease problems in stillwater fisheries are much more common, where intensive angling and high stocking levels are causative factors. Outbreaks of infectious diseases that kill fish are of particular concern. For example, carp are prone to the viral disease Spring Viremia of Carp (SVC); the Agency provides angling clubs and owners of fishing lakes with advice on how to minimise the risk to their stock (and livelihood).

An interesting disease occurrence has taken place at Grafham Water, Anglian Water's trout fishing reservoir. Historically, many tonnes of coarse fish were removed each year, in 1995,

a health sample revealed the presence of *Paraergasilus longdigitus*. This parasite infects the nasal cavities of freshwater fish, and has only been recorded in this country over the last few years. The Agency immediately banned further movements of fish out of Grafham, and classified the novel parasite as a 'category 2', whose threat to British freshwater fish was considered significant. Subsequently, the parasite has been found to be, relatively, widely distributed so we would now allow fish transfers into other enclosed waters but would strongly advise against this practice.

PREDATION

A predator-prey imbalance is rare in a healthy aquatic environment. A number of piscivorous (fish-eating) species are present in the Bedford Ouse, namely pike, perch and zander. We are not aware of any serious problems where these fish significantly outnumber cyprinid prey fish.

In the 1980's the Agency had a policy of culling any zander caught during fisheries surveys because the species was thought to be having an impact on native populations. The cull was repealed when no increase in zander numbers was shown; the young individuals appear to have particular difficulty surviving over winter.

Fish are also food for avian predators and kingfishers and herons are an integral part of the aquatic ecosystem. However, the increase in cormorant numbers on inland waters in recent times is a matter of concern to anglers and ourselves. There is evidence that some stillwater fisheries, in particular, have been targeted as easy sources of food by the cormorants. This is the case at Grafham Water, where the large density of stocked trout has proved very tempting of the several hundred cormorants roosting at Little Paxton Pits. To overcome this problem, larger fish have been stocked; this fisheries management action has apparently reduced the numbers of fish taken by cormorants. Reports of the birds actively feeding on most of the rivers in this catchment have also been received. At present, we offer advice to angling clubs on the scaring methods available and the process involved in obtaining a MAFF licence to shoot the birds. In addition the Agency has invested in a £1million research project to investigate the extent of the problem and investigate the best ameliorative options.

Otters have increased their distribution in recent years; both through the elimination of polychlorinated biphenyls (PCBs), and related compounds, that previously led to their decline in the 1950's and through a programme of reintroducing reared animals. Their favoured prey is thought to be eels, however, analysis of their droppings have shown they will take a range of freshwater fish. Numbers of individuals are notoriously difficult to quantify; there is evidence that they are found along the River Ivel and on the Ouse through Bedford. We are not aware of any circumstances where the prey fish population has either been unable to sustain the needs of the otters, or where numbers have been significantly impacted. The otter is protected under a European legislation, so the Agency has a duty to conservation both the species and the habitat it needs.

Having escaped from fur farms, the American mink has now also established populations in the LEAP area. These animals eat fish, and tend to be more indiscriminate in their killing so

there is a need to control numbers. The Agency provides advice to angling clubs and riparian owners regarding procedures for fencing and mink capture.

3.1.2 Societal Influences

The historical activities of man in and around the rivers of the Bedford to a greater or lesser extent they will have affected the aquatic habitat and therefore the associated wildlife, including fish.

Perhaps the main threat to the riverine habitat has come from land drainage works for flood defence. Channel modifications and weed management operations will affect fish populations. For example, loss of gravel will limit the spawning opportunities of chub and dace and removal of weed cover, overhanging terrestrial vegetation or submerged trees will reduce the cover for predator species.

Heavy rainfall events result in high flows on an 'engineered' river could also be detrimental to fish populations. The absence of backwaters and natural flood plain means that off-main river refuge areas are absent and fish can be displaced downstream. Recent fisheries surveys seem to suggest that high flows experienced in 1998 have not had a drastic effect but the true impacts on juveniles will not be evident until later years. At Great Paxton on the Ouse the Agency has created a backwater to act as a refuge during flood events.

Where the river is a navigable watercourse there is a potential conflict between boating and angling interests. Boat traffic may result in increased bank erosion, reducing the quality of the marginal habitat and potentially affecting the stability of the bank and therefore the ability of the anglers to fish safely. On land owned by the Agency, revetment work has taken place and where possible the habitat protected, or enhanced, with 'soft engineering' and the seeding of aquatic plants to benefit fish and other wildlife. However, the duty to maintain the banks is down to the riparian owner.

River spanning structures such as sluices and weirs can limit natural fish movements. Each year coarse fish will move to their favoured spawning, feeding and overwintering areas. At present there are no fish passes in the LEAP area, and we must assume that the majority of the structures prevent coarse fish migrations and leave populations divided. However, a notch cut into one of the gates at Brownshill Staunch should allow passage of the limited populations of migratory salmonids. A national Research & Development project is presently investigating the extent of the problem that these weirs and sluices pose to our fish populations. The project will have particular regard for coarse fish where limited information on the fish pass needs of these species is known.

3.1.3 Abstractions and Removals

In recent drought years there have been a number of small streams in the catchment that have virtually stopped flowing and in extreme cases tributaries have become ponded. Fish in these circumstances, become more stressed and are more vulnerable to predation. In periods of

low flows, abstractions can exacerbate the conditions experienced by fish.

Water is abstracted from the Bedford Ouse at Offord by AWS for storage in the Grafham Water reservoir, which is a major public water supply source in the region. Their licence allows them to abstract 485 thousand cubic metres per day but contains clauses to protect the downstream flow of the river. The proposed drought order to reduce the threshold level below which water cannot be abstracted during the summer of 1997 was opposed by the Agency on ecological grounds.

The Cardington Canoe Slalom Channel run by the British Canoe Union abstracts water from the Bedford Ouse near Priory Country Park in Bedford. This abstraction has, during periods of low flow, significantly lowered river levels and stopped flows into the New Cut and the upper end of the Cardington Stream, causing the channels to dry out. The installation of an alarm system at the slalom course, triggered when flows reach a minimum threshold should reduce these impacts.

3.1.4 Uses, Releases and Discharges

THE EC FRESHWATER FISHERIES DIRECTIVE 78/659/EEC

The directive stipulates that the water quality of designated river stretches, is such, that they support certain types of fish. There are two sets of quality standards for the protection of cyprinid and salmonid fish populations.

The Agency is responsible for the monitoring and reporting the water quality to the DETR. Where the standards of the directive are not met we should investigate the sources of pollution and ensure the necessary improvements are made.

The following Bedford Ouse rivers are designated:

Cyprinid: Bedford Ouse - 9.7 km from Kempston to Bedford STWs
Bedford Ouse - 21.4 km from Godmanchester to Earith
Elstow Brook - 5.5 km from Harrowden to Great Ouse confluence

There are no salmonid designated stretches in the area. From the most recent sampling data, the three stretches comply with the requirements of the Directive.

UK WATER QUALITY OBJECTIVES

(Refer to Viewpoint 4.3 for more detail)

The Bedford Ouse receives enrichment from upstream STW effluent and the leaching of agricultural fertilisers into the watercourses. The summer growth of algae, duckweed and macrophytes is therefore increased, and the associated water quality problems affect the fish.

River stretches are subject to periodic monitoring as part of the General Quality Assessment

(GQA) programme that records chemical and biological parameters.

3.1.5 Illegal Practices

The Agency controls fisheries and angling activities through its duties under the Environment Act 1995 and associated legislation. We regulate freshwater fishing by a licensing system and enforcing bylaws; water bailiffs have extensive powers to deal with illegal fishing methods. The statutory duties of all Agency functions will greatly influence the quality of habitat available for fish and the potential value of a fishery.

Our enforcement staff are always keen to receive information of illegal fish movements and working with angling contacts we endeavour to catch the culprits. Loss of large fish from a population could affect the balance in a fishery or lead to the transfer of disease.

The impact of alien species on our native fish stocks is an ongoing concern. Imports of fish from abroad and the escapement of 'exotics' pose a serious disease threat plus the potential for competition and predation aspects. Zander are known to be present in the River Bedford Ouse and its tributaries; however, their numbers are low and are not thought to be having a significant impact on the native fish populations. There are also increasing numbers of carp in our rivers, which tend to be hardy and fast growing. We would not consent introductions of these species where there is an identifiable risk to the native population. Similarly, stocking rainbow trout into rivers inhabited by brown trout is strongly discouraged.

During the financial year 1/4/98 to 31/3/99 15,786 anglers were approached in the Central resulting in 159 prosecution files being forwarded to the Agency's Regional Legal Department.

3.2 Freshwater Biology

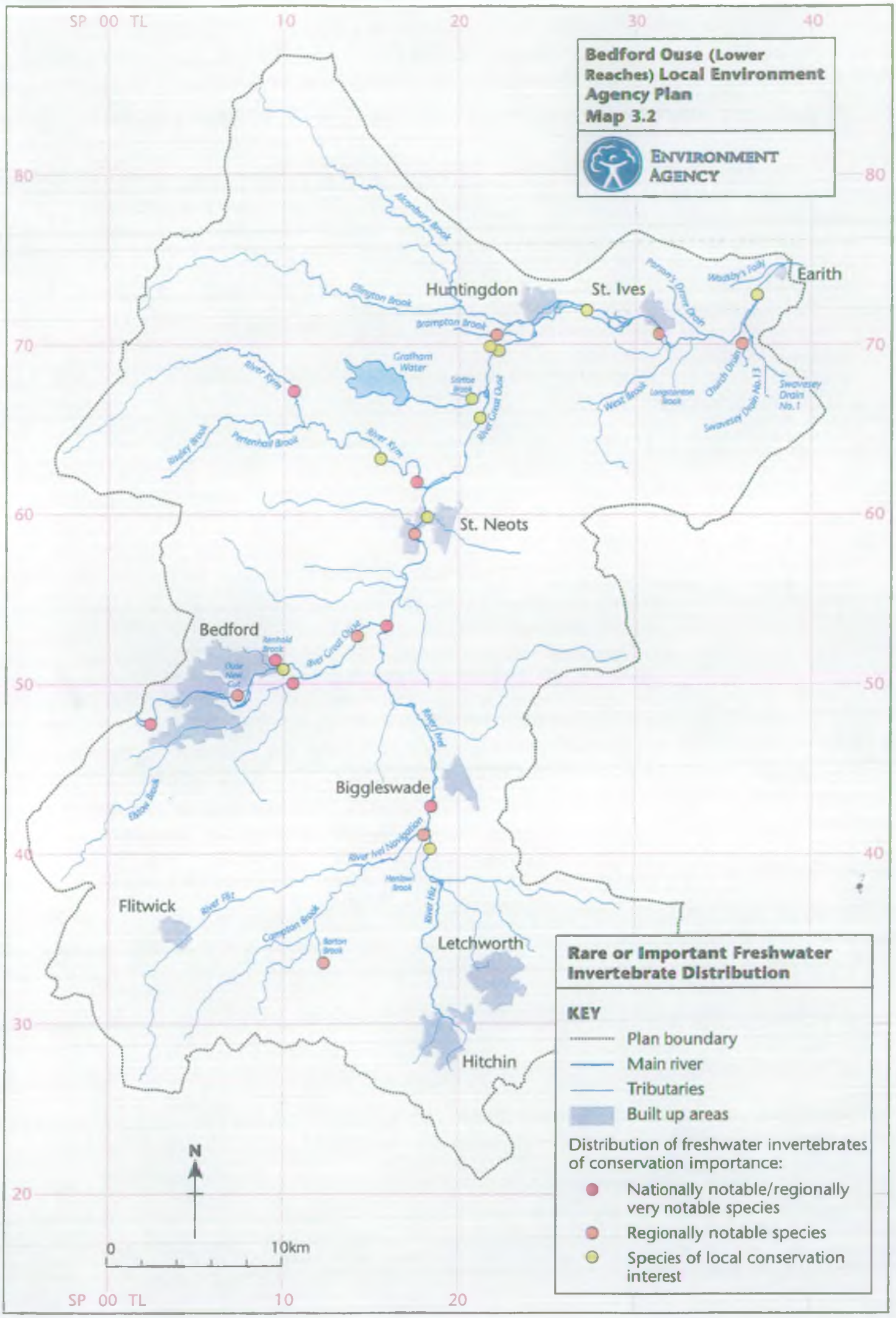
3.2.1 Natural Forces

Invertebrate populations are influenced by the physical, chemical and biological characteristics of the ecosystem. The physical substrate, flow type and plants present interact to produce a mosaic of habitat niches which different invertebrates can exploit. In general habitat rich sites, which have a combination of both riffle and pool areas and a good diversity of plants, have more diverse invertebrate communities.

The macroinvertebrate populations are monitored twice a year, in spring and autumn at 57 GQA sites, to cover the 250 km of river. The River Bedford Ouse is a wide, deep, slow flowing, channelised river, with riffle areas restricted to downstream of weirs. This is reflected in the invertebrate fauna that is dominated by pool type groups including beetles, bugs and damselflies (see Table 3.1 and Map 3.2 below).

Table 3.1: Aquatic Invertebrate Species of Conservation Interest in the LEAP Area

Invertebrate Species	Current Conservation status in Anglian Region	Location	Comments
Anacaena bipustulatus (Scavenger beetle)	Nationally Notable	River Kym	
Brachyton pratense (Hairy dragonfly)	Regionally Very Notable	River Kym	At edge of northern distribution Requires clean water and plenty of surrounding vegetation
Haliplus laminatus (Water beetle)	Nationally Notable	Elstow Brook River Ivel	
Aphelocheirus aestavalis (Saucerbug)	Regionally Notable	River Ouse	Requires very clean, well oxygenated water. Associated with fast flowing areas and gravel substrates. In this part of the Ouse found downstream of physical structures, such as weirs, which create appropriate habitat.
Centroptilum pennulatum (Large Amber Spinner or Large Summer Spur-wing mayfly)	Regionally Notable	River Ouse	Associated with pool/margins o running water and vegetation stands.
Platycnemis pennipes (White-legged Damselfly)	Regionally Notable	River Ouse Renhold, Elsto Barton, Henlow and Brampton Brooks.	At limit of north eastern distribution. Tends to prefer slower flowing rivers and canals.
Sigara scotti (Lesser waterboatman)	Regionally Notable	Longstanton Brook	
Anacaena lutescens (Scavenger beetle)	Local	Tributary of Ouse	
Bithynia leachi (Hydrobid snail)	Local	River Ouse Brampton and Longstanton Brooks.	
Corixa panzeri (Lesser waterboatman)	Local	Longstanton Brook	
Ilyocoris cimicoides (Saucer bug)	Local	River Ouse	Found in vegetation of slow-flowing waters.
Lymnea trunculata (Dwarf Pond snail)	Local	River Ouse	
Notonecta marmorea-viridis (Greater waterboatman)	Local	Stirtloe Brook	
Plea leachi (Lesser backswimmer)	Local	Longstanton Brook	Associated with dense vegetation in slow flowing areas.


Bedford Ouse (Lower Reaches) Local Environment Agency Plan
Map 3.2
Environment Agency
SP 00 TL
10
20
30
40
80
70
60
50
40
30
20
Huntingdon
St. Ives
Earith
St. Neots
Bedford
Biggleswade
Flitwick
Letchworth
Hitchin
Alconbury Brook
Ellington Brook
Brampton Brook
Grafham Water
River Kym
Bluntisham Brook
Pertenhall Brook
River Great Ouse
West Brook
Longstanton Brook
Church Drain
Swavesey Drain No.1
Swavesey Drain No.13
Weasley's Folly
Parson's Drove Drain
Bernhold Brook
Ouse Navigation Canal
River Ivel
Ouse Brook
River Ivel Navigation
Henlow Brook
River Hiz
River Flit
Compton Brook
Barton Brook
N
0
10km
Rare or Important Freshwater Invertebrate Distribution
KEY
Plan boundary
Main river
Tributaries
Built up areas
Distribution of freshwater invertebrates of conservation importance:
Nationally notable/regionally very notable species
Regionally notable species
Species of local conservation interest

3.2.2 Societal Influences

Flood defence works to protect both property and farmland, over a long period, have meant that the number of available habitats has been reduced, so while water quality remains good, the diversity of invertebrate species may have been affected.

Some habitat improvement schemes in the Bedford Ouse LEAP area have been undertaken to improve fisheries. Any increase in habitat diversity will encourage a greater range of macroinvertebrates, with the additional benefit of increasing the food available for fish. On the River Hiz at Arsley, riffle and groynes were installed, and a back-channel on the Ouse at Great Paxton was re-opened.

Eutrophication, both from diffuse and point sources, is of concern, both in the rivers and reservoir. (Refer to Section 1.2.4 Eutrophication)

Urban and industrial run-offs around the large conurbations are major contributors to poor biological quality of the rivers.

3.2.3 Abstractions and Removals

Low flows can cause siltation of the substrate reducing the number of available habitat types. The invertebrate community of a fast flowing riffle type area will change, over time, to have more representatives of slow flowing adapted fauna, e.g. beetles and bugs. It will also show a reduction in the numbers and varieties of faster flow adapted fauna e.g. certain mayflies and caddis, as flows are at a reduced level.

The spring flows have been reduced in the upper Hiz resulting in drying out of the stream, particularly during periods of drought. As discussed in Section 1.1.3 (Raw Water Transfers and River Support) a low flow alleviation scheme was instigated in 1996 to augment flows in the Hiz and Oughton. Macroinvertebrate communities have been monitored to assess any improvements in the Hiz and Oughton and any change the Purwell. Little change in the invertebrate communities has been found, which may in part be due to several years of drought negating the additional flow, so flow levels have been maintained rather than increased.

3.2.4 Uses, Releases and Discharges

EUTROPHICATION

(Refer to Viewpoint 1.2.4)

Macrophyte communities reflect the degree of eutrophication of a watercourse. Some macrophytes are more tolerant of eutrophic conditions than others. In a highly eutrophic system damage to the ecosystem is shown by a tendency to domination of the community by a few tolerant macrophyte species, and excessive plant growth, often of filamentous algae.

Under the Urban Waste Water Treatment Directive qualifying discharges from large STWs are monitored. If a detrimental impact from the effluent discharge on the receiving waters can be demonstrated, then there is a requirement to reduce the amount of phosphate discharged. Plant surveys are carried out on the Bedford Ouse, Ivel and Hiz, upstream and downstream of STW final effluent discharges that serve populations of 10,000 or greater. Monitoring of these and the Sensitive Areas (Eutrophic) that they discharge into is continuing, as phosphate stripping to reduce the high loads from some of these point sources is introduced. More difficult to control are diffuse phosphate inputs, which also contribute to the eutrophication problem.

Another problem associated with excessive eutrophication is algae blooms, which can cause diurnal fluctuations in dissolved oxygen levels. When extremely low oxygen levels are experienced this can lead to reduction in the overall biological quality. Blue-green algae at bloom levels can have ecological, aesthetic and commercial consequences. When it breaks down, it can release toxins into the water that can be harmful to both humans and animals. Thick scums can often form on the shoreline and the affected waters can be closed for several weeks, which can lead to loss of income for owners/managers, particularly with respect to recreational activities. Blue-green algal blooms regularly occur in the summer at water bodies such as Grafham Water and Stewartby Lake, whilst in the summer of 1995 the whole length of the River Bedford Ouse was affected by a bloom of *Oscillatoria agardhii.*

Grafham Water is also designated as a sensitive area (eutrophic). Excessive eutrophication is a contributory factor to both the blooms of blue-green algae (which occur each summer) and the degradation of the macrophyte community at Grafham Water. A tripartite group with representatives from The Environment Agency, English Nature and AWS has been working together on Action Plans for three reservoirs, including Grafham Water.

3.2.5 Illegal Practices

Macroinvertebrate communities can be used to determine the nature and severity of biological impact, along with the extent and location of pollution incidents. Biological evidence is used in conjunction with chemical evidence in the prosecution of illegal dischargers. Large proportions of incidents in the LEAP area are due to organic pollution. Typical effects of longer-term organic input on the invertebrate community include a tendency to domination by tolerant taxa, which have increased in abundance, as there are few limits on their numbers. Taxa that cannot tolerate the pollution are not found downstream of the discharge.

Table 3.2: Definition of Conservation Status Categories

Conservation Status Category	Definition
NOTABLE	Taxa which do not fall into Red Data Book (RDB) categories 1-3 but which are nonetheless scarce in Great Britain and are thought to occur in fewer than a hundred 10 km squares of the National Grid.
REGIONALLY NOTABLE	Taxa which are too common nationally to fall within the Notable category but which are uncommon in some parts of the country. Uncommon in this case means found in five or fewer localities
LOCAL	Those species not uncommon enough to fall into the preceding categories, but that are of some interest. A species may qualify by being, for example, very widely distributed but nowhere common; restricted to a specialised habitat such as brackish pools but being a common component of this habitat; or simply being uncommon but not uncommon enough to be Notable.

3.3 Biodiversity

The Environment Agency has been given responsibility as a contact point or the lead partner for 'chalk river' habitats and the species outline in Table 3.3 below:

Table 3.3: UK Priority Biodiversity Species
(For which the Agency is contact point and/or lead partner)

Species	Latin name	Contact	Lead Partner
Allis Shad	*Alosa alosa*	MAFF	Agency/MAFF
White-Clawed Crayfish	*Austropotamobius pallipes*	Agency	Game Conservancy
Depressed River Mussel	*Pseudanodonta complanata*	Agency	Agency
Freshwater Pea Mussel	*Pisidium tenuilineutum*	Agency	Agency
Freshwater Pearl Mussel	*Margaritifera margaritifera*	SNH	Agency
Marsh Warbler	*Acrocephalus palustris*	Agency	RSPB/Wildlife Trust
Glutinous Snail	*Myxas glutinosa*	Agency	Agency
Little Whirlpool Ram's Horn Snail	*Anisus vorticulus*	Agency	Agency
Otter	*Lutra lutra lutra*	Agency	Agency/Wildlife Trusts
Cut Grass	*Leersia oryzoides*	English Nature	Agency
Triangular Club-Rush	*Scirpus triqueter*	English Nature	Agency
Greater Water Parsnip	*Sium latifolium*	English Nature	Agency
Burbot	*Lota lota*		
Ribbon Leaved Water Plantain	*Alisma graminea*	Agency	Agency/English Nature
River Jelly Lichen	*Collema dichotomum*	Agency	Agency

Species	Latin name	Contact	Lead Partner
Shining Ram's Horn Snail	*Segmentina nitida*	Agency	Agency
Southern Damselfly	*Coenagrion mercuriale*	Agency	Wildlife Trusts
Twaite Shad	*Alosa fallax*	MAFF	Agency/MAFF
Vendace	*Coregonus albula*	Agency	Agency
Water Vole	*Arvicola terrestris*	Agency	UK Water Vole Group

Otter, water vole and white-clawed crayfish are nationally important species with a high profile.

OTTER

Otters are protected under the Wildlife & Countryside Act 1981 and were once widespread throughout the UK. As discussed in Section 3.1.1 (Predation) their numbers declined between the 1950s and the 1980s. Other factors affecting their decline include:

- Impoverished bankside habitat features needed for breeding and nesting, because of river maintenance and land drainage practices; and,
- High mortality rates associated with road accidents.

Local surveys carried out by the Agency, Wildlife Trusts and other organisations have established present populations in the LEAP area, whilst identifying the potential areas for future spread. Conservation management by local groups such the Ivel Valley Countryside Project in creating log piles and artificial holts has proved successful.

WATER VOLE

The water vole is found throughout Britain, but is confined mainly to lowland areas near water. Once common and widespread, this species has suffered a significant decline in numbers and distribution. The decline in water vole populations is thought to be due to:

- Loss and fragmentation of habitats;
- Disturbance of riparian habitats by maintenance works and land-use change;
- Predation by mink; and
- Pollution of watercourses and poisoning by rodenticides.

Local surveys carried out by the Agency, Wildlife Trusts and other organisations have established the potential for water vole habitat enhancement in the catchment. In 1998 the water vole received legal protection through its inclusion on Schedule 5 of the Wildlife & Countryside Act 1981 (as amended). This is limited inasmuch as the Act seeks to protect the water vole's places of shelter, but does not protect the water voles themselves.

WHITE-CLAWED CRAYFISH

In Europe, this crayfish was formerly widespread in France, Spain and Italy, but

populations are now confined to a diminishing number of areas. It is the only species of freshwater crayfish that is native to the UK. It is widespread in clean, calcareous streams, rivers and lakes, but many populations have been lost since the 1970s. The factors thought to be causing the loss or decline include:

- Crayfish plague, a disease caused by the fungus *Aphanomyces astaci* that is carried by some introduced North American crayfish (including the signal crayfish *Pacifastacus leniusculus*). Spores from the fungus can also be transmitted by a variety of other means, including water, fish and damp equipment;
- Direct competition for food and habitat from non-native crayfish: three non-native crayfish species are now breeding in the wild;
- Habitat modification and management of waterbodies; and
- Pollution, particularly by pesticides and sewage.

The Agency in collaboration with local Wildlife Trusts, Countryside Management Organisations and the Beds & Ivel IDB, is undertaking surveys for crayfish in numerous catchments, including the Bedford Ouse LEAP area. Whilst much of the river system in the Bedford Ouse is lowland clay rivers, the headwaters of the River Hiz rise in the chalk escarpment of the Chilterns. Similarly, the headwaters of tributaries of the River Flit (a non-main river) rise in the Chilterns south of Barton-in-the-Clay. These calcareous streams are thought to contain the white-clawed crayfish. The species is protected under the Wildlife & Countryside Act 1981 in respect of taking from the wild and selling.

Table 3.4 below shows the status of national priority biodiversity species in the LEAP area.

There are many other biological species associated with the aquatic environment, not targeted by the UK Biodiversity Action Plan, but which, have high conservation priority. The Agency has great potential to influence favoured habitats in the course of fulfilling its statutory duties. Research & Development Projects have identified appropriate management and protection measures to maintain and enhance these biological populations. Table 3.5 below shows other species in the Bedford Ouse for which Management Guidelines have been produced.

Table 3.4: Status of National Priority Biodiversity Species in the LEAP area

Species	Habitat	Presence in the LEAP area	Threats
White-Clawed Crayfish	Clean, calcareous rivers & streams.	Headwaters of the River Hiz & Flit rising in the chalk escarpment of the Chilterns. A survey is currently underway.	Crayfish plague carried by non-native species, together with competition from these non-native species.
Depressed River Mussel	Rivers & streams.	Unknown.	Water pollution, physical disturbance of riverbanks and channels, drought and the collection of individuals for ponds and aquaria.
Freshwater Pea Mussel	Rivers & streams.	Unknown.	Decline in water quality and inappropriate water channel management.
Marsh Warbler	Rough grassland adjacent to rivers.	None. Mainly confined to sites in the Midlands and Kent.	River channel modification. Climate; in Britain this species exists on the northern limit of its range. Habitat fragmentation and isolation.
Little Whirlpool Ram's Horn Snail	Unpolluted water in ponds and streams.	Unknown.	Unknown.
Otter	Rivers & Streams.	Populations have been recorded on the River Great Ouse upstream of Roxton, and a breeding pair has been released on the River Ivel.	Water pollution, habitat degradation and road casualties.
Greater Water Parsnip	Wet ditches and tall herb fens and swamps.	Unknown.	Over-engineering of ditches. Site drainage. Dereliction of ditches leading to reed and scrub invasion.
Ribbon Leaved Water Plantain	Lakes, rivers & streams.	Unknown.	Eutrophication and competition from more vigorous aquatic species.
Shining Ram's Horn Snail	Unpolluted calcareous water in ponds & drains of grazing marshes.	Unknown.	Unknown.
Southern Damselfly	Heathland Streams.	Unknown.	Loss of suitable habitat due to lack of appropriate heathland management, drainage and dredging of breeding sites.
Water Vole	Bankside burrows on lowland watercourses.	Unable to confidently indicate current status. Preliminary surveys have been undertaken to establish suitable habitat in the catchment.	Habitat degradation and predation by mink.

TABLE 3.5: Management Guidelines

Species	Habitat Requirements	Management Guidelines
	Mammals	
Shrew	Burrows in well-vegetated banks bordering rivers, streams, watercress beds, drainage ditches, pond edges and reedbeds. Feeding predominantly on freshwater invertebrates, therefore prefer gravely substratum for locating prey	Trapezoidal bank profiles should be avoided, burrowing is preferred in heterogeneous bank topography. Low dense riparian vegetation for foraging, needs appropriate mowing regimes to be employed.
Daubenton's Bat	Roosts are usually in tree holes, buildings or bridges. Bats prefer to forage over pools or areas of smooth, calm, moving water bounded by trees and other riparian vegetation. They commute along linear landscape corridors such as rivers, hedgerows and woodlands.	Riparian woodland corridors and other vegetation should be created /maintained as foraging areas and roosting sites. Designation of tranquil areas on riverbanks, with a general policy of non-intervention could provide havens for bats. Appropriate roost site creation on bridges and in trees.
	Birds	
Kingfisher	Unpolluted rivers with good supply of small fish, and stretches of shallow, slow-moving clear water bordered by some reedy or woody cover for perching sites. Vertical banks of a fairly soft sand or clay material for nest burrows.	Retain cliff banks, eroding cliffs and upturned tree roots for potential nest sites. Fencing off riparian strips to prevent disturbance. Maintain riparian vegetation for perch sites. Excavating old ox-bow, back channels and new shallows as feeding sites.
Yellow Wagtail	Lowland rivers with broad flood plains. Prefer cattle grazed water meadows.	Agri-environment schemes to promote extensive pastoral farming. Creation of grass buffer strips along rivers. Sensitive flood defence management.
Grey Wagtail	Fast flowing streams and rivers, near weirs and mill races with riparian broadleaved woodland. Nest in steep banks and tree roots, crevices or ledges in bridges and riverside walls.	Sensitive flood defence maintenance to works to retain riparian trees/vegetation, shoals in appropriate areas. Provision of nest ledges under bridges and on walls.
Sand Martin	Eroding sandy riverbanks, worked cliffs at sand & gravel pits. Feeding on aquatic insects.	Retain existing vertical banks during flood defence works and allow new cliffs to erode.
Reed Bunting	Wetland edges with good growth of emergent vegetation such as reed *Phragmites australis*, in which to nest and *Salix spp* for perching. Feeding on aquatic and terrestrial invertebrates and insects, together with weed seeds.	Sympathetic management of watercourses and flood plains, increasing emergent marginal vegetation. Creation of riparian buffer zones with low trees, scrub, wildflowers and weeds for perching and foraging.

Species	Habitat Requirements	Management Guidelines
	Reptiles & Amphibians	
Grass Snake	Closely associated with wetland habitats being good swimmers. They require a mosaic of tall vegetation for foraging and cover, short vegetation for basking, and sites for egg-laying and hibernating, such as rack line vegetation, cut reed, compost & manure heaps, leaf litter and log piles.	Maintain a structural diversity of vegetation with blocks of tall vegetation and short grass for basking. Banks & slopes facing south and south-west make good basking sites. Construction of egg-laying/hibernation sites from vegetation cut during maintenance works
Frogs/Toads/ Newts	These common amphibians are found in a variety of waterbodies of differing size and small drainage ditches with some emergent vegetation. A diversity of terrestrial habitats is important for supporting part of the amphibians' life-cycle, woodland & rough grassland being preferred to arable landscapes.	Retention and sensitive management of breeding ponds and drainage ditches, where straightening, steepening of banks, uniform cross-sections and removal of emergent vegetation will have detrimental effects. Terrestrial habitat should also be managed to retain diversity with areas for foraging, shelter and hibernation.
Great Crested Newt	More exacting habitat requirements than common amphibians, occupying waterbodies within an optimum range of sizes and depths. Calcareous waters are preferred with few/no fish present. They lay their eggs singly on leaves of submerged plants, which are folded over and sealed. Rough grassland, as adjacent terrestrial habitat preferred over woodland or arable. Suitable hibernation sites include crevices below ground, piles of rubble, compost heaps and log piles.	Breeding ponds and associated terrestrial habitats are protected through legislation and both should be managed with the species in mind. Agency conservation staff can provide protection through appropriate assessment of Agency authorisation applications for discharge consents, abstraction licences and fish stocking consents. There is also the opportunity to press for conservation of great crested newt sites through the planning liaison process.
	Fish	
Spined Loach	Rivers and streams with sandy substrates and abundant submerged vegetation as a refuge from predators. Macrophyte beds provide opportunity for feeding, refuge and spawning.	Engineering and maintenance activities should seek to maintain or create a mosaic of submerged vegetation and bare sandy substrate and active growth of marginal vegetation.
	Plants	
Black Poplar	The relict population of the sub-species betulifolia is intimately associated with river corridors, having been formerly common in flood plain forests, which were largely cleared in prehistoric times.	Replanting of this rare tree should be concentrated in target areas with full light, good moisture supply and a lowland climate. Well away from structures where damage caused by roots may occur. Locally provenanced trees should be planted and recorded by the Institute of Terrestrial Ecology.

3.3.1 Natural Forces

CLIMATE

Climate change will ultimately mean the loss of those populations existing on the limit of their distribution range. Severe winters, which cause prolonged freezing-over of ponds, lakes, canals and even watercourses, can often decimate populations of small birds and mammals. They cannot readily obtain prey and suffer high mortality.

Drought conditions mean that in some years smaller rivers and streams can dry up during the summer, e.g. the headwaters of the Rivers Purwell, Hiz and Oughton; conditions here are exacerbated by PWS abstraction. This creates stress for the entire flora and fauna of these watercourses, which may take some time to recover when higher flows return. A low flow alleviation scheme to augment flows in the rivers Hiz and Oughton has been operating since 1996 and an ecological monitoring project has been carried out to determine the success of the scheme.

SPECIES COMPETITION

Vulnerable biological communities can be put under pressure when in direct competition from more vigorous species that are better able to tolerate stressful conditions. Stressful conditions can be caused by any number of factors, both natural and anthropogenic, but the species competition that results is a natural evolutionary process to ensure that the most well adapted survive. For example, the non-native American Crayfish appears to out-compete the native White Clawed Crayfish in their habitat niche, and wetland plants may soon be overcome by more tolerant grass species that can survive periods of drought.

3.3.2 Societal Influences

LAND DRAINAGE

Land drainage for development, agriculture and navigation has resulted in rivers being dredged, straightened and re-profiled. Habitats have been modified, fragmented and sometimes destroyed, with a resulting decrease in numbers of key biological populations, e.g. the otter and the water vole, and other traditional riverside wildlife such as dragonflies and damselflies.

Traditional practices are being gradually replaced by sympathetic engineering approaches that incorporate conservation mitigation measures.

AGRICULTURAL PRACTICES

Post-war changes in agricultural practices have had an associated impact upon biological populations (see Viewpoint 1.2 Habitat). The clearance of riparian vegetation (including woodland) has compromised the refugia and foraging areas for countless mammals, birds

and insects, which once existed as an intricate ecological web, but have now been marginalised to relict habitats.

RECREATION

Recreation pressure from boat users means that certain waterways are kept open by dredging. The dredging causes repeated habitat change, and recreational boat-use creates further disruption by boat wash and human disturbance, which can put stresses and strains on riverside habitats and populations.

ALIEN SPECIES

The American mink was introduced to Britain because of the fur trade. Escapees from fur farms have established themselves along watercourses since the 1950s. In recent years these 'feral' populations have become very successful and the mink is now well established. There has been much concern about the effects of mink predation upon native animal species, particularly waterfowl and small mammals. A report on the water vole in Britain has suggested that the presence of mink has been a significant factor in the recent decline in water vole populations. Under the Wildlife & Countryside Act 1981, it is an offence to release American mink, or allow them to escape into the wild.

Many non-native plants were introduced to Britain in the 19th century, mainly for ornamental reasons. A few have become aggressively dominant, creating serious problems in some areas. Three such invasive plants are Japanese knotweed *(Fallopia japonica),* Himalayan balsam *(Impatiens glandulifera)* and giant hogweed *(Heracleum mantegazzianum).* Their spread is primarily the result of human activities that aid their dispersal along linear corridors such as railway tracks, rivers and road verges. These three invasive plants are a problem because they:

- grow extremely densely and shade out native plants;
- provide poor habitats for native insects, birds and mammals;
- devalue the natural landscape;
- increase the risk of river bank erosion when they die back in the autumn; and,
- create a potential flood hazard if dead stems fall into and clog up watercourses.

In addition, giant hogweed poses a serious health hazard. The Wildlife & Countryside Act 1981 makes it an offence to plant or cause Japanese knotweed and giant hogweed to grow in the wild. Himalayan balsam is not currently included in this legislation.

CRAYFISH PLAGUE

The introduction of the American signal crayfish (*Pacifastacus leniusculus*) into the UK through the restaurant trade, has contributed to the decline in numbers of our only native species of crayfish, *Austropotamobius pallipes.* Apart from direct competition between the two species, the signal crayfish is a vector for the fungus *Aphanomyces astaci,* more commonly referred to as the crayfish plague fungus. This has wiped out populations of

native crayfish in many rivers. Incidents of crayfish plague were first recorded in the early 1980s. It is believed that signal crayfish can carry the plague indefinitely (they are immune to it) and it is highly likely that the plague is still present in our waters. Human activities are widely recognised as the main agent for transferring crayfish plague.

3.3.3 Abstractions and Removals

The lack of rainfall during drought years, and abstraction, may cause low flows in rivers, which increases the concentration of pollutants. If rivers dry up it can reduce the available food prey in the aquatic environment. Ground nests can also be exposed leaving some species more vulnerable to predation.

Forestry activity and general woodland removal will impact upon bird and mammalian populations. Much of Britain's woodland was cleared centuries ago, but removal today can mean the difference between a sustainable population of a particular species and local extinction.

3.3.4 Uses, Releases and Discharges

Deterioration in water quality from contaminants of the freshwater and riparian environment, such as organo-chlorine insecticides and their metabolites, alkyl-phenols, polychlorinated biphenyls (PCBs), heavy metals and farm waste pollution, can affect the whole population ecology of the riparian zone. There is a reduced abundance of sensitive invertebrate species (caddisfly larvae and mayfly nymphs), which are prey to other species such as birds and aquatic mammals. Fish densities are also lowered, thereby reducing prey species further. Eutrophication (caused by nutrient loading), also causes algal blooms, to the detriment of aquatic macrophytes.

3.3.5 Illegal Practices

Crime in the countryside can have a most damaging effect on wildlife. The Agency's enforcement teams work in partnership with County Constabularies, the RSPCA, and other interested groups to act as 'eyes and ears' in areas which are not normally patrolled by the responsible authorities.

The Agency and many other wildlife organisations provide special advice to aid the police. Common incidents that occur include fly-tipping, illegal hare coursing, poisoning, badger digging, netting and baiting, deer poaching, egg stealing, obstruction of footpaths, by-ways and green roads and the theft and selling on of wild flowers. The Agency will work with the police to bring prosecutions against such criminal activities.

VIEWPOINT 4: COMPLIANCE WITH TARGETS AND STANDARDS

4.1 Water Resources

STATUTORY DUTIES AND POWERS

The Agency has duties and powers to manage water resources under the Water Resources Act 1991 and the Environment Act 1995. We have a duty to conserve, redistribute or otherwise augment water resources and secure their proper use. The principal mechanism for managing water resources is through the abstraction licensing system.

WATER ABSTRACTION LICENSING

Water is abstracted from rivers, lakes and groundwater for a range of uses including public water supply, agriculture and industry. The Agency is responsible for calculating the available water resource and allocating it, through an abstraction licensing system, on a first-come, first-served basis. The water resource is calculated for each catchment using records of rainfall and evaporation. A quantity is 'reserved' for the river and wetland environment before any is allocated for abstraction. The legislation is concerned with the protection of existing users and the environment. The Agency cannot ensure that the resources will always be available.

Abstractions (apart from a few statutory exceptions) require a licence under the Water Resources Act 1991. Licences enable the Agency to control abstractions by setting limits on the amount which may be taken, the purposes for which the water may be used and any necessary conditions to protect the environment and other users. Licences may be time-limited to allow for review. An abstraction licence is only issued by the Agency if there is sufficient water available, the need for the water is justified, all rights of existing users are protected and the water environment (for example river flows and wetlands) is not unacceptably affected. Details of abstraction licences are held on a public register at our regional office in Peterborough. Regular abstraction licence inspections are carried out to ensure that licence holders understand and comply with the terms and conditions for their licences (refer to Viewpoint 1.1.4). Map 1.1 shows the licensed abstractions in the LEAP area.

LICENCES OF RIGHT

The first abstraction licences were issued as the result of the Water Resources Act 1963. Any abstractor who could show that he had abstracted for the previous five years was issued a 'Licence of Right'. Many of the existing abstractions, in particular large public water supply sources, existed previous to 1963 and secured this type of abstraction licence.

DROUGHT ORDERS

At times of extreme water shortage, water companies may apply to the DETR for a Drought Order to relax abstraction licence conditions and/or the level of service they provide to their customers. This may allow, for example, the temporary reduction in mains pressure or even periodic closure of the supply. The terms of a Drought Order will also usually require the

water company to introduce demand reduction measures, such as hosepipe bans. The Agency can apply to DETR for Drought Orders to protect the environment.

The Water Industries Act 1991 (WIA91) places a duty on water companies to supply water to meet all existing and new domestic demands (regardless of the availability of water resources) if requested by landowners, occupiers or the local planning authority. This duty is currently under review. The WIA91 also requires water companies to plan effectively to provide water supplies in their areas in the future, and to protect and enhance the natural environment in carrying out its functions.

EUROPEAN LEGISLATION

UK legislation implements various European Directives many of which are concerned with the quality of drinking water and are the responsibility of the water companies. Of concern to the Agency are the Surface Water Abstraction, the Groundwater and the Nitrates Directives (refer to Sections 4.3, 4.4 and 4.4.1 respectively).

ENVIRONMENT AGENCY NATIONAL AND REGIONAL WATER RESOURCES STRATEGIES

The Agency has produced water resources strategy documents at a National and Regional level. Our national strategy (published 1994) established three principles:

- Sustainable Development;
- Precautionary Principle; and
- Demand Management.

The Anglian Region Strategy (also published in 1994) is a sustainable strategy for secure water supplies and a better water environment. This is due to be reissued in 1999/2000.

AGENDA FOR ACTION

In October 1996, largely as a result of the 1995/96 drought, the previous Government set out its framework of policy and strategy guidance for water management in England and Wales in 'Water resources and Supply: Agenda for Action'. The action required for Government, the Environment Agency, OFWAT, the Drinking Water Inspectorate (DWI), the water companies, manufacturers of water equipment and consumers were identified. The Agency was required to:

- Co-ordinate the fresh estimating of the reliable yields of water resource systems and publish the resulting information;
- Lead the testing of those estimates against climate-change scenarios;
- Revise, as necessary, its national and regional water resources strategies in consultation with the water companies; and
- Be fully involved with water companies' new resource development plans.

There are three particularly significant elements of this guidance:

- Availability of water resources and security of supply: the reliable yields of each water resource system need to be re-estimated and balanced against the maximum economic use of demand management. Re-estimates should take into account climate change and advances in hydrometric monitoring. However, it should be noted that our understanding of the hydrological/ecologicalbalance is still developing;
- Demand management: efficient use, effective and equitable charging and economic levels of leakage control; and
- Future need for new water resources: options for bulk transfers of water or redistribution of abstraction licences should be considered before new resource development takes place. Water companies are encouraged to co-operate with each other and the regulators in this respect and to draw up plans for timely development of new water resources where demand cannot be managed within the existing capability.

In May 1997, the new Government presented a 10-point action plan to help secure reliable, efficient and environmentally sustainable water supplies. Actions included the following:

- Reviews of water charging and the water abstraction licensing system;
- New regulations to improve water efficiency; and
- Mandatory targets on water company leakage.

Leakage control is a vital element of demand management, and new mandatory leakage targets for the water companies, for the three years 1997/98, 1998/99 and 1999/2000, were published by OFWAT in October 1998.

4.1.1 Compliance with Targets

The Water Resources Act 1991, as previously mentioned, requires the Agency to conserve, redistribute, augment and ensure proper use of water resources. The following section describes our local performance against these four objectives which are listed as:

- Meeting Demands;
- Protect Resources;
- Proper Use; and
- Conserve Resources

4.1.2 Meeting Demands

Objective: *To meet water demands to appropriate standards of reliability, including augmentation and/or redistribution of water resources where appropriate.*

Table 4.1: Target Level of Service and Status

Water Use	Level of Service	Local Status
Public Water Supply	The Agency accepts the reference levels of service used by OFWAT, which are: • a hosepipe ban not more than once in every 10 years; • voluntary savings of water on average not more than once in 20 years; and • the risk of rota cuts or use of standpipes on average not more than once in 100 years. Water companies may aim to provide higher standards than these.	There is no evidence that water resource targets for public water supply are not being met. A review of water resources and demands is now underway nationally involving the Agency, water companies, OFWAT, the DETR and the Drinking Water Inspectorate. This work has been required both by the DETR in 'Water Resources and Supply: Agenda for Action' (issued in October 1996) and as part of the OFWAT periodic review of water company financial limits.
Spray Irrigation	The target level of service in Anglian Region is that there should be risks of shortages not more than once in 12 years on average.	The 1 in 12 target is not met, with irrigation restrictions necessary in all recent drought years (1990 – 92, 1995 - 97) in order to protect river flows. The options available to improve the situation would be to store more water in reservoirs during the winter abstraction period (November 1 to March 31) or import water from other areas (this option would be expensive as there is little water available in nearby catchments, therefore pipeline costs will be a key factor). This is a common issue across most of Anglian Region.
Industry, Agriculture and Other Uses	There is no specific target level of service for these uses. However, appropriate reliability for individual circumstances will be examined when licence applications are considered.	There are no local issues related to reliability of supply for these types of water use.

4.1.3 Protect Resources

Objective: *To protect water resources from over-commitment and ensure water abstraction does not have an unacceptable effect on existing abstractors and the environment.*

The Agency will achieve this objective by:

- Providing the best assessment of water resource availability;
- Defining appropriate water levels, flows and quality required to maintain and enhance the river environment; and
- Protecting all groundwater as a future potential resource in accordance with the groundwater protection policy.

LOCAL STATUS

The summer surface water resources of most of this LEAP area are considered to be fully committed. The exception is the River Bedford Ouse, where additional abstraction is allowable during the summer as long as the rights of abstractors downstream, in particular the right of Anglian Water Services Ltd (AWS) to abstract into Grafham Water, are protected. Wherever possible, winter abstraction and storage (for subsequent use in the summer) is encouraged.

Renewals of existing entitlements to abstract summer surface water are currently recommended but are determined with reference to the current policy regarding time duration and cessation conditions. These conditions relate to flow/levels in the source rivers and abstraction is required to stop when the flow/level falls below this critical level. This has proved to be an effective way to control demand during drought years. Most licences are renewed for periods of 10 years.

Table 4.2: Cessation Clauses to Control Abstraction

Location	Cessation Flow	Gauging Site	Grid Reference
River Great Ouse	2900 l/s 926 l/s 13 l/s	Offord Intake Roxton Brampton Weir	TL 2150 6730 TL 1600 5350 TL 2205 6970
River Kym	29 l/s (summer) 153 l/s (winter)	Meagre Farm	TL 1550 6310

The management of the water resource is always under review and the reason that many licences are temporary is to allow the Agency to change the conditions for future licence documents, if needed.

There is winter surface water available for storage in reservoirs. The licences would be subject to conditions designed to protect flows, the water environment and downstream entitlements. The impact of each proposal is examined in detail, often by the abstractor in an Environmental Impact Assessment. Winter abstraction from rivers represents approximately 1.5 million m^3 or about 1% of the total water licensed for abstraction in this LEAP area. Applications under consideration request another 0.15 million m^3 and this type of demand is likely to increase in the future.

The two main rock strata that are used for groundwater abstraction in this LEAP area are the Chalk and the Woburn Sands. The resources of these aquifers are calculated by considering factors such as rainfall, evaporation and the geological structure of the aquifers. A portion of this quantity is then 'reserved' for environmental needs like providing flows to rivers and wetlands, and the remainder is available for abstraction. Records of volumes licensed allow periodic reviews of the situation to determine when there is no further water available to be licensed.

Groundwater in this LEAP area is considered to be fully committed to the water environment and existing abstractors. The groundwater balances are due to be revised in 1999/2000.

The river environment of the Rivers Hiz and Oughton is maintained during dry periods by the operation of a groundwater to river support scheme run by the Agency and Three Valleys Water Company.

The Agency has undertaken a programme of drilling observation boreholes in wetland sites in order to monitor water levels. 51 sites were identified across the Anglian Region. However, none of these are in this LEAP area.

Water Level Management Plans (WLMPs) were introduced by the Ministry of Agriculture Fisheries and Food in 1994. These plans provide the means by which water level requirements for a particular site can be discussed and the range of activities such as agriculture, flood defence and nature conservation can be balanced and integrated. The Agency has a responsibility to be involved in the production of WLMPs in association with English Nature, Drainage Boards, Land Owners and other interested parties. The WLMPs in this LEAP area are as follows:

TABLE 4.3: Water Level Management Plans

Water Level Management Plans: Priority Order	Site Name	National Grid Reference
High	None	
Medium	None	
Low	Berry Fen Houghton Meadows Little Paxton Pits Portholme Meadow	TL 378 745 TL 282 728 TL 195 626 TL 238 708

In addition to the above, the Agency has responsibilities under the Habitats Directive. The directive was adopted by the Council of European Communities on 21 May 1992 (ref. 92/43/EEC) with the aim of sustaining European biodiversity and protecting rare and threatened habitats, flora and fauna. The regulations apply to Special Areas of Conservation (SACs), (which are primarily SSSIs (Sites of Special Scientific Interest)) and Special Protection Areas (SPAs), which are designated under the Birds Directive 1979.

The Agency must ensure that these sites are not adversely affected by new or variations to abstraction licences. This is already part of the Water Resources Act 1991. However, the new aspect is the obligation by the Agency to review by 2004 all existing permissions which may affect SACs and SPAs. The only known candidate site for this LEAP (to date) is Portholme Meadow.

4.1.4 Proper Use

Objective: *To ensure the proper use of water resources*

The Agency will achieve this by:

- Defining a framework within which water users can plan to meet their needs and advising on possible constraints;
- Advising planning authorities on water resource aspects of their development plans, in accordance with the Agency's National and Regional Water Resource Strategies;
- Promoting the wise use of water and demand management; and
- Ensuring that any future requirement for water is reasonable, and that alternatives have been fully considered.

LOCAL STATUS

The current document describing the water resources issues for the Anglian Region is 'Water Resources In Anglia: A Sustainable Strategy for Secure Water Supplies and a Better Water Environment' published in September 1994. The work is to be revised in 1999/2000. This follows work currently being undertaken by the water companies (review of demands and supply) as part of the AMP3 process (the review of price limits with OFWAT).

The Agency is involved in the planning process and advises planners about the current and forecast water resource situation. In particular, the Agency has submitted information to SERPLAN (South East Regional Planning, which covers Essex, Buckinghamshire, Hertfordshire and Bedfordshire) as well as to county councils with respect to the production of county Structure Plans.

The need for water is examined when an abstraction licence is requested. The quantities recommended on any licence document are those considered to be reasonable and justified for the use proposed. In some cases, the quantities licensed are less than those applied for initially. Table 4.4 overleaf details the evaluation process that is carried out when considering a licence application.

Table 4.4: Quantity Evaluation

Water Use	Local Status
PWS	Water companies have a new duty, introduced by the Environment Act 1995, to promote efficient use of water by their customers. This duty is regulated by OFWAT, but the Agency is involved in consultation. OFWAT has required the companies to produce water efficiency plans to meet this duty and the Agency is keen for leakage control and demand management to be given high priority The licensing horizon is currently the year 2011: it is not considered reasonable to allocate water for needs beyond this. The water company must have demonstrated that they have carried out effective demand management, reduced leakage to economic rates and, where water resources are under stress, considered metering of domestic use before extra water resources are allocated. The current published leakage figures for the water companies in this LEAP area are given in Table 4.5 below. These figures relate to total losses in distribution including the losses on the customer side of the stop cock. The companies in this area achieve reasonably low levels of leakage
Spray Irrigation and Agriculture	The requirement of water needed with respect to the types of crops and soil conditions are taken into account when considering applications for spray irrigation. The number and type of animals and their associated water requirements are checked when determining agricultural licences. The Agency promotes good irrigation practice in association with MAFF. The type of advice would be to use boom irrigators instead of rain guns, irrigate at night to avoid evaporation losses, check the equipment is functioning well and to use methods to determine the water requirement of the soil in order to apply only that which is needed.
Industrial	The type of industrial process is considered as well as the life expectancy of the plant and equipment.

Table 4.5: Water Company Total* Leakage Figures for 1997/98

Water Company	%	Litres/property/day	Cubic metres/km of distribution main/day	Million litres/day
Anglian Water Services Ltd.	20	132.1	6.8	235
Three Valleys Water Services Plc	20	124.9	6.7	14.4
Cambridge Water Company	21	148.3	13.2	148.3

Source: OFWAT July Return 1998

* Note – Total leakage represents distribution losses plus underground supply pipe leakage.

4.1.5 Conserve Resources

Objective: *To conserve water resources*

The Agency will achieve this objective by:

- Applying the principles of sustainable development and the precautionary principle to future development and management of resources;
- Encouraging storage of surplus winter flows where appropriate; and
- Encouraging the local return of water to the environment after use, as well-treated effluent discharges, provided this can be done without detriment to water quality objectives.

LOCAL STATUS

The policies for water resources in this LEAP area have allocated water for the environment. Most of the water consumed in this area is returned to the local river system via STWs.

Understanding of climatic changes continues to evolve. The most significant recent development has been the statement by the Intergovernmental Panel on Climate Change in 1996 that 'the balance of evidence suggests there is a discernible human influence on the global climate'. It is still uncertain what effects will be for water resources in the UK or East Anglia (see Viewpoint 1.1.1 - Climate and Climate Change).

Table 4.6: Summary of Water Resources Status and Expected Trends

Objectives	Status
Meet demands	PWS and industrial demands are currently met and not forecast to rise significantly.
Protect resources	Cessation clauses are in place on most surface water abstraction licences to protect low flows. Water Level Management Plans to be produced. Review of permissions to be carried out under the Habitats Directive.
Ensure proper use	Time limited licences allow periodic review. Water Companies to achieve reasonable levels of leakage. Agency promotes good irrigation practice.
Conserve water resources	Winter storage to meet new demands or replace summer abstraction is encouraged by the Agency Climate change to be kept under review

4.2 Flood Defence

The standard of service provided by flood defences depends on the type of land being protected and the type of flood risk. Flood defences may be provided by natural features such as flood plain or high ground or by constructing formal flood embankments and other structures to increase protection in low-lying areas.

4.2.1 Objectives

Our aims for flood defence are to:

- provide effective flood defence for people and property from rivers (and the sea); and
- provide adequate arrangements for flood forecasting and warning.

We have commissioned a review of flood defence standards of service for main rivers whilst existing maintenance standards are based on historically determined criteria, return periods and frequencies. This review will assess 'land use' by considering agricultural or urban content within the flood plain along lengths of river divided into 4-7 km reaches. For each element (e.g. roads, housing, grazing land) a score is given and the reach is placed into one of several land use bands to guide assessments of priorities when determining maintenance programmes. The review will, therefore, influence maintenance requirements for the future and provide a rational basis for future flood defence priorities.

Flood defences do not provide absolute protection, but alleviate flooding up to a particular level of severity. The standard of protection provided normally relates to the land use of the area concerned; urban defence attracts a high priority.

The detailed Agency objectives for this activity with the LEAP area are:

- to provide effective defence for people and property against flooding. The standard of protection is appropriate to the land use, where this is economically viable;
- to control development and works in or adjacent to the main river in accordance with the Agency's Flood Defence bylaws, such that the risk of flooding is not significantly increased;
- to ensure that the river topography remains suitable for the efficient passage of high flows and that control structures are adequately operated and maintained (for both flood and normal flows);
- to provide adequate arrangements for flood forecasting and warning; and
- to carry out maintenance in main rivers, where necessary, to protect people and property to the appropriate standard.

SPECIFIC OBJECTIVES

- Flood Defence targets and appraisal work within the Bedford Ouse (Lower Reaches) LEAP is ongoing and related to the Flood Defence Objectives;
- Further investigation into non-main river (i.e.'ordinary' watercourse) flooding is

required in order to identify solutions and responsibilities;

- Implementation of the recommendations of the Bye Report, which include:-

(i) investigating current standards of protection for St Ives, St Neots, Hemingford Grey, Hemingford Abbots, Alconbury and Alconbury Weston. Bedford, Kempston, Riseley and Kimbolton were less severely affected and, although not included in the Bye Report, have been included in the Feasibility Studies;

Draft Feasibility Studies were completed by the 31st January 1999 for St Neots, Alconbury, Alconbury Weston, Bedford, Kempston, Riseley and Kimbolton. Hemingford Grey, Hemingford Abbots and St Ives will be completed by 31st March 1999;

(ii) Establish Flood Defence Asset database;

(iii) Implementation of Automatic Voice Messaging System in Alconbury and Alconbury Weston (NB: this was in place by December 1998);

(iv) Establish self-help system in Alconbury and Alconbury Weston (NB: established since Easter 1998 floods); and

(v) Investigate Flood Monitoring and Warning Arrangements for those towns and other areas affected by the Easter 1998 floods.

4.3 Quality of Surface Waters

Our aim for surface water quality is to maintain and, where appropriate, improve the quality of rivers, through the prevention and control of pollution.

The Water Quality monitoring activities of the Agency are diverse and vary according to the local circumstances; they include statutory requirements for assessing compliance with EC Directives and environmental quality standards. The analysis covers the key water quality parameters; dissolved oxygen (DO), ammonia, biochemical oxygen demand (BOD), chloride, nitrate, phosphate and other appropriate chemicals. The results of the analyses of these samples are available on the Public Register.

The EC Directives that have implications for water quality in this LEAP area are:

URBAN WASTE WATER TREATMENT DIRECTIVE (91/27/EEC) (UWWTD)

This EU Directive is concerned with urban waste water treatment and specifies certain treatment standards for sewage treatment and sewage collection systems. The level of treatment is dependent upon the type and sensitivity of the receiving water and discharge size, expressed as a Population Equivalent (PE). The UWWTD applies to discharges from STWs serving a PE greater than 2 000 to inland waters and estuaries and greater than 10 000

to coastal waters. Discharges below these levels should receive appropriate treatment as defined in Government guidance. The Agency is responsible for ensuring that discharges comply with standards as specified in the Directive.

The Directive specifies the criteria by which receiving water may be identified as 'sensitive' areas. The designation of an area is determined by the DETR on the basis of monitoring reviews undertaken by the Agency every 4 years. The designation of an area will dictate the standard of treatment required. The Agency also ensures that qualifying discharges to Sensitive Areas receive a higher level of treatment for total phosphorus and/or total nitrogen removal if justified.

The UWWTD imposes a duty on the Agency to monitor discharges to which the Directive applies or to appoint the waste water discharger to monitor their own processes. As the regulator, the Agency will continue to monitor compliance of discharges against their consents.

In the LEAP area there are 51 STWs with numerical consents. They are owned by AWS and the majority are sampled 12 times a year. However, to meet the terms of other Directives, twelve are sampled more frequently. These are Bedford STW (which is sampled 48 times a year) and Biggleswade, Chalton, Clifton, Flitwick, Hitchin, Letchworth, Poppy Hill, Huntingdon, St Ives, St Neots and Uttons Drove STWs (which are all sampled 24 times a year). Only Clophill STW failed, resulting in 98.1 per cent meeting their consent conditions during 1998.

AWS also owns and operates 16 smaller STWs in the LEAP area, which have descriptive consents. These works are inspected annually but the effluent is not routinely sampled. All 16 passed the most recent inspection.

There are 25 trade effluent discharges, of which eight are routinely sampled 12 times a year. The remainder are sampled less frequently, once or four times a year. There are six MoD effluent discharges, of which two are sampled four times a year and the other four sampled 12 times a year. Map 4.1 (overleaf) shows licensed discharges in the LEAP area.

SURFACE WATER ABSTRACTION DIRECTIVE (75/440/EEC)

This EU Directive is concerned with the quality required of surface water intended to be abstracted for drinking water. The Agency is responsible for monitoring the quality of designated surface water abstractions and reporting the results to the DETR, who decide whether the standards in the Directive have been met. Where standards are not met, the Agency is responsible for investigating the cause of failure and developing a proposed action plan for improvements.

There are two sample points that are required to meet this Directive, at Offord Intake and Grafham Water Reservoir. The sample point at Grafham Water Reservoir failed under this Directive for polycyclic aromatic hydrocarbons (PAHs) for the period ending 1997.

FRESHWATER FISHERIES DIRECTIVE (78/659/EEC)

This EU Directive is concerned with the quality of waters needing protection or improvement in order to support fish life.

The Directive contains two sets of quality standards. One set of standards protects cyprinid (coarse fish) populations (e.g. roach and chub). The other set of more strict standards protects salmonid (salmon and trout) populations.

The Agency is responsible for monitoring the quality of identified fisheries and reporting the results to the DETR, who decide whether the standards in the Directive have been met. Where the requirements of this Directive are not met, the Agency is responsible for investigating the cause of failure and developing a proposed action plan for improvements.

There are four sample points to meet this Directive, all of which are for cyprinid fisheries.

DANGEROUS SUBSTANCES DIRECTIVE (76/464/EEC)

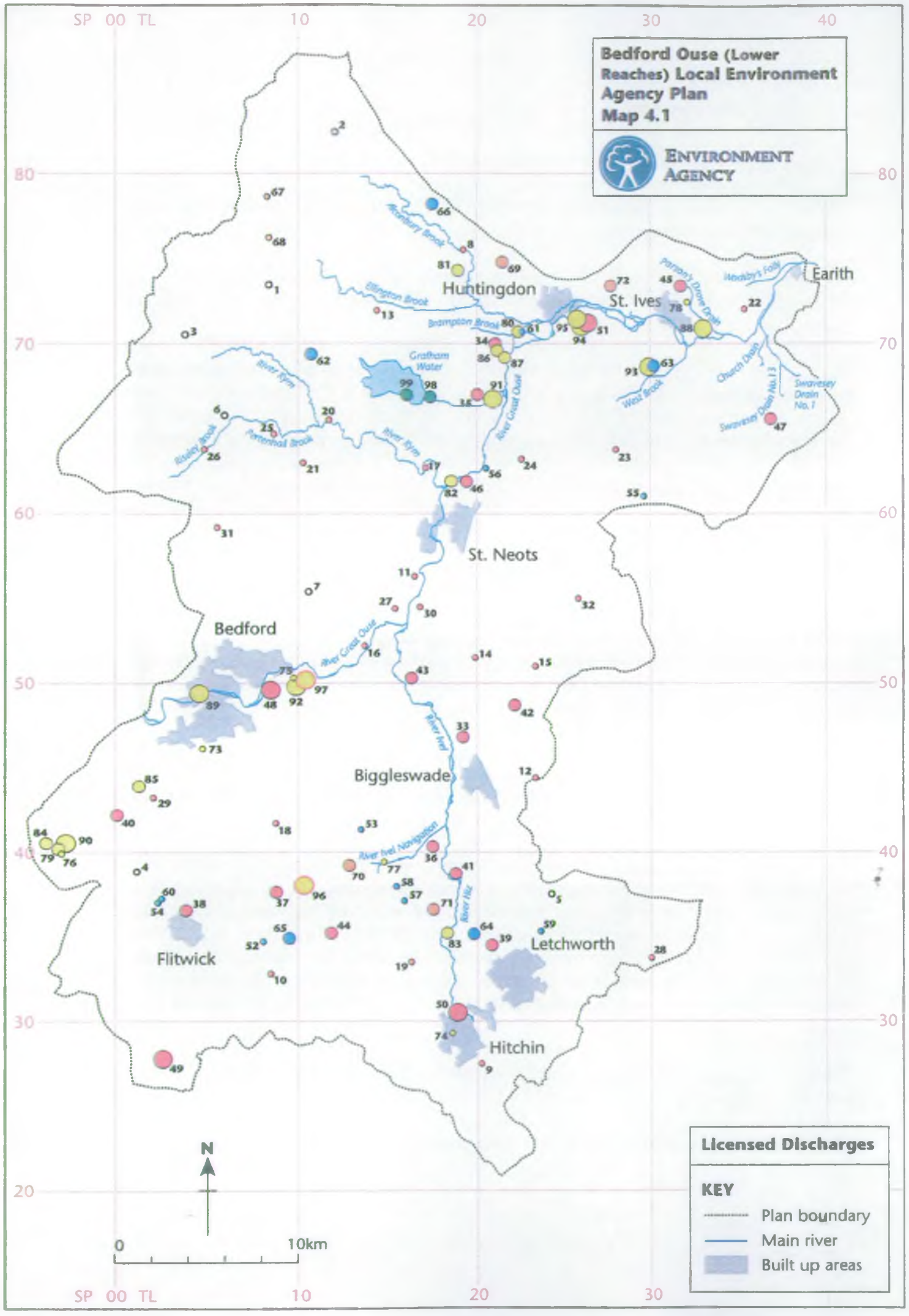
This EU Directive is concerned with pollution caused by dangerous substances discharged to the aquatic environment.

Under this framework directive, a series of further (daughter) directives has been adopted, addressing specific hazardous substances. The requirements of these directives are now enforced in UK legislation under the Surface Waters (Dangerous Substances) (Classification) Regulations. These regulations define Environmental Quality Standards (EQS) for a range of dangerous substances that have been split into two lists. List I contains substances regarded as particularly dangerous because they are toxic, they persist in the environment and they bioaccumulate (build up in living organisms). List II contains substances that are considered to be less dangerous but which still can have a harmful effect on the water environment.

The Agency is responsible for authorising, limiting and monitoring dangerous substances in discharges. We are also responsible for monitoring the quality of water receiving discharges which contain dangerous substances, and reporting the results to DETR. It is the DETR that decides whether the standards in the Directive have been met. Where the requirements of this Directive are not met, we are responsible for investigating the cause of failure and developing a proposed action plan for improvements. All discharges to rivers, estuaries and coastal waters consented for List I and/or II substances are monitored by the Agency.

There are 12 river sample points monitored for the Directive, nine for List I substances, one for List II substances and two for List I & II substances.

12 boreholes are sampled approximately once a quarter.


Bedford Ouse (Lower Reaches) Local Environment Agency Plan
Map 4.1
Environment Agency
SP 00 TL
10
20
30
40
80
70
60
50
40
30
20
Huntingdon
St. Ives
Earith
St. Neots
Bedford
Biggleswade
Flitwick
Letchworth
Hitchin
Ellington Brook
Brampton Brook
Alconbury Brook
Grafham Water
River Great Ouse
River Ivel
River Ivel Navigation
River Hiz
River Kym
Riseley Brook
Pertenhall Brook
West Brook
Church Drain
Swavesey Drain No. 1
Swavesey Drain No. 1.3
Meadley's Folly
Parson's Drove Drain
N
0
10km
Licensed Discharges
KEY
Plan boundary
Main river
Built up areas

Key to Map 4.1 Licensed Discharges

Sewage works discharges - Anglian Water Services:

DWF <100 m³/d:

1 Catworth Hostel
2 Great Gidding
3 Hargrave
4 Millbrook
5 Newnham
6 Swineshead (Beds)
7 Wilden

DWF 100 - 999 m³/d

8 Alconbury
9 Ashbrook
10 Barton Le Clay
11 Chawston
12 Dunton
13 Easton (Cambs)
14 Everton
15 Gamlingay
16 Great Barford
17 Hail Weston
18 Haynes
19 Holwell
20 Kimbolton
21 Little Staughton
22 Needingworth
23 Papworth Everard
24 Paxton
25 Pertenhall
26 Riseley
27 Roxton
28 Sandon (new)
29 Stewartby
30 Tempsford
31 Thurleigh
32 Waresley

DWF 1000 - 9999 m³/d

33 Biggleswade
34 Brampton (Cambs)
35 Buckden
36 Clifton
37 Clophill
38 Flitwick
39 Letchworth
40 Marston Moretaine
41 Poppy Hill
42 Potton
43 Sandy
44 Shillington
45 St Ives
46 St Neots
47 Uttons Drove

DWF >10 000 m³/d

48 Bedford
49 Chalton
50 Hitchin
51 Huntingdon

Sewage works discharges - Private:

DWF <20 m³/d

52 Barton Road, Silsoe
53 Black Horse. Nr Shefford
54 Buildform Ltd. Ind. Est., Ampthill
55 Caxton Gibbet Motel, Papworth
56 Harley Ind. Park, St Neots
57 J Willmott Prop. Ltd., Hitchin Road
58 Main House, Wren Park, Shefford
59 Nortonbury Activity Centre, Letchworth
60 Old Weldtite Site, Ampthill
61 The Olde Mill, Bromholme Lane, Brampton

DWF 20 - 999 m³/d

62 Bicton Properties Ind. Est., Kimbolton
63 Eden Park, Fenstanton
64 Fairfield Hospital, Arlesey
65 NIAEWrest Park, Silsoe
66 Rectory Park, Upton, Cambs

Sewage works discharges - Crown:

DWF <20 m³/d

67 RAF Molesworth North
68 RAF Molesworth South

DWF 20 - 999 m³/d

69 RAF Alconbury Southside
70 RAF Chicksands LT
71 RAF SEE Henlow, Beds
72 RAF Wyton Humus

Major trade discharges:

DWF <100 m³/d

73 Beds CCS, Elstow WDS VW
74 Ransome Ltd., Hitchin Outlet no.2
75 Redland Readymix Ltd., Cople
76 Shanks & McEwan, Brogbrough Vehicle Wash
77 Shefford Mill, Shefford
78 St Ives Food Produce

DWF 100 - 999 m³/d

79 Brogbrough DS No 2
80 Fish Diseases Unit, Brampton
81 Huntingdon Research Center
82 Samuai Jones & Co 2. Little Paxton Mill
83 Shanks & McEwan, Arlesey Landfill
84 Shanks & McEwan, Brogbrough
85 Shanks & McEwan, L Field Landfill
86 Station Farm North, Landfill, Buckden
87 Station Farm South, Landfill, Leachate

DWF 1000 - 9999 m³/d

88 ARC Central Ltd., Fen Drayton Pit
89 Beds CC County Hall, Bedford
90 Brogborough WDS No 1
91 Redland Aggregates, Buckden, Camba
92 Redland Aggregates, Dog Farm
93 Redland Aggregates, Wool Pack Farm
94 Redland Pit. Godmanchester outlet A
95 Redland Pit. Godmanchester outlet B

DWF >10000 m³/d

96 Laporte Ind. Ltd., Quarry, Clophill
97 Redland Aggregates, Willington

Water treatment works:

98 Grafham Pilot Plant
99 Grafham WTW Backwash

THE HABITATS DIRECTIVE

The Agency must ensure that new or varied consents do not cause significant impact on Habitats Directive sites. The only known candidate site for this LEAP (to date) is Portholme Meadow. Under the Habitats Directive the Agency is obliged to review all existing consents by 2004.

4.3.1 Objectives

General Quality Assessments (GQAs) of rivers are carried out to provide information at both local and national levels. The Chemical GQA is based on three years' analyses; the grade given for a particular river stretch is determined by BOD, ammonia and DO concentrations. Rivers within the LEAP area are naturally slow flowing, with the result that background levels of water quality appear lower than in fast-flowing rivers found in upland regions.

The biological assessment scheme is based on the incidence of groups (taxa) of aquatic macro-invertebrates such as mayflies, shrimps, beetles and bugs. Macro-invertebrates are good indicators of the quality of a watercourse for several reasons; they have relatively long life cycles, are generally sedentary (stay in the same location), and respond to the physical and chemical characteristics of a river. This means that they will be affected by infrequent pollution incidents (which might be missed by a chemical spot sample), as well as longer-term problems, and therefore provide an overall picture of the quality of the river over time. Some taxa are more tolerant to pollution than others. The GQA scheme uses the responses to organic pollution to determine the biological quality. Scores between 1 and 10 are allocated to each taxon, with pollution-tolerant taxa scoring 1 and the most pollution-sensitive taxa 10. A site with good water quality will have a balanced invertebrate community with representatives of both tolerant and sensitive taxa present. The number of scoring taxa present and the average score per taxon (ASPT) are calculated for each site. A mathematical model called RIVPACS (River Invertebrate Prediction and Classification System) has been developed to predict the taxa that would be expected at a site in the absence of pollution. By comparing taxa found at a site when sampling with those that would be expected if the river was unpolluted (generated by RIVPACS), rivers are classified into one of the six GQA grades (a-f) (see Table 4.7 below):

Table 4.7: Description of Chemical and Biological GQA Classes

Chemical Grade	Water Quality	Biological Grade
Grade A	Very good	Grade a
Grade B	Good	Grade b
Grade C	Fairly good	Grade c
Grade D	Fair	Grade d
Grade E	Poor	Grade e
Grade F	Bad	Grade f
Grade O	Unclassified	Grade O

The changes in river chemical and biological quality in the LEAP area over the last five years

are shown in figures 4.1 and 4.2, respectively.

Figure 4.1

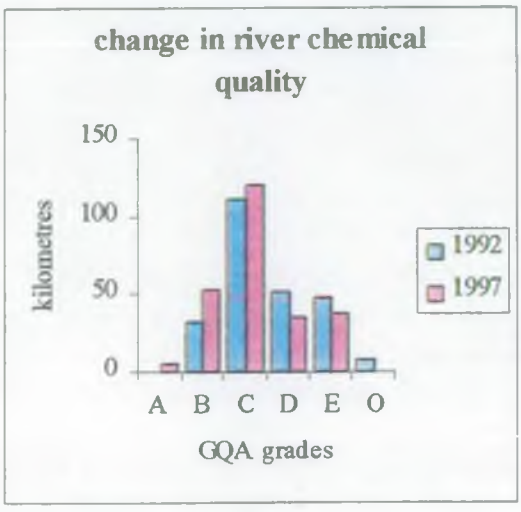
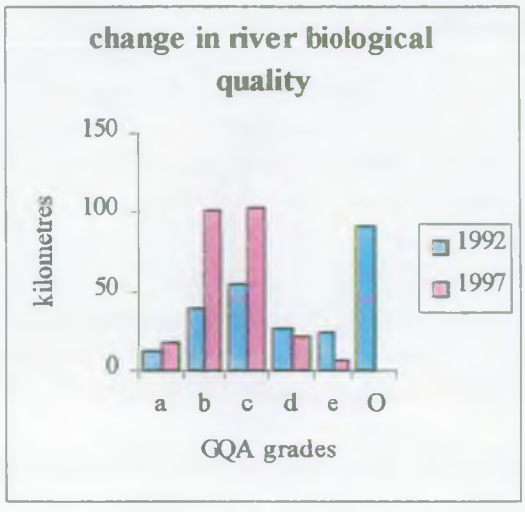


Figure 4.2



4.3.2 Water Quality Objectives

The Water Quality Objectives (WQO) scheme enables quality targets to be set according to what a watercourse is used for (e.g. fisheries, PWS), as well as ensuring no deterioration in quality and provides an agreed planning framework for both regulatory bodies and dischargers. The proposed WQO scheme is based upon the recognised uses to which a river stretch may be put. Uses that could eventually be included are: River Ecosystem, Special Ecosystem, Abstraction for Potable Supply, Agricultural Abstraction and Watersports. Standards defining the five River Ecosystem (RE) use classes were introduced by the Surface Waters (River Ecosystem) (Classification) Regulations 1994 (refer to Table 4.8). Standards for further uses are still under development. Until WQOs are established on a statutory basis by the Secretary of State, they will be applied on a non-statutory basis.

Table 4.8: Descriptions of the River Ecosystem Classes

Class RE1	Water of very good quality suitable for all fish species
Class RE2	Water of good quality suitable for all fish species
Class RE3	Water of fair quality suitable for high class coarse fish populations
Class RE4	Water of fair quality suitable for coarse fish populations
Class RE5	Water of poor quality that is likely to limit coarse fish populations
Unclassified	Water of bad quality in which fish are unlikely to be present or insufficient data available to classify water quality

The GQA grades A-E relate to the RE classes 1-5, showing the lengths of river of that

particular chemical quality and use.

The WQO scheme allows for short- and long-term objectives. Short-term objectives may have to be adopted where water quality fails to meet the long-term objective and there are no immediate solutions. In these cases a target date for achieving the long-term objective may be set. Costs of schemes to meet long-term WQOs will be considered against the likely benefits. This should ensure discharge licence holders do not incur excessive costs and that improvements are effectively targeted.

The long-term water quality objectives for the LEAP area are shown on Map 4.2. These have been set according to the current and potential future uses of the watercourses in the area. Compliance with these objectives is assessed using routine monitoring results from a rolling three-year calendar period. Map 4.3 shows compliance with the proposed long-term objectives for the period ending 1997.

It is important that long-term objectives reflect the likely uses of the watercourses in the area and a public view on the potential uses for specific watercourses would be valued.

By September 1998, 82.9% of the length of river in the LEAP area was compliant with its long- and short-term River Quality Targets.

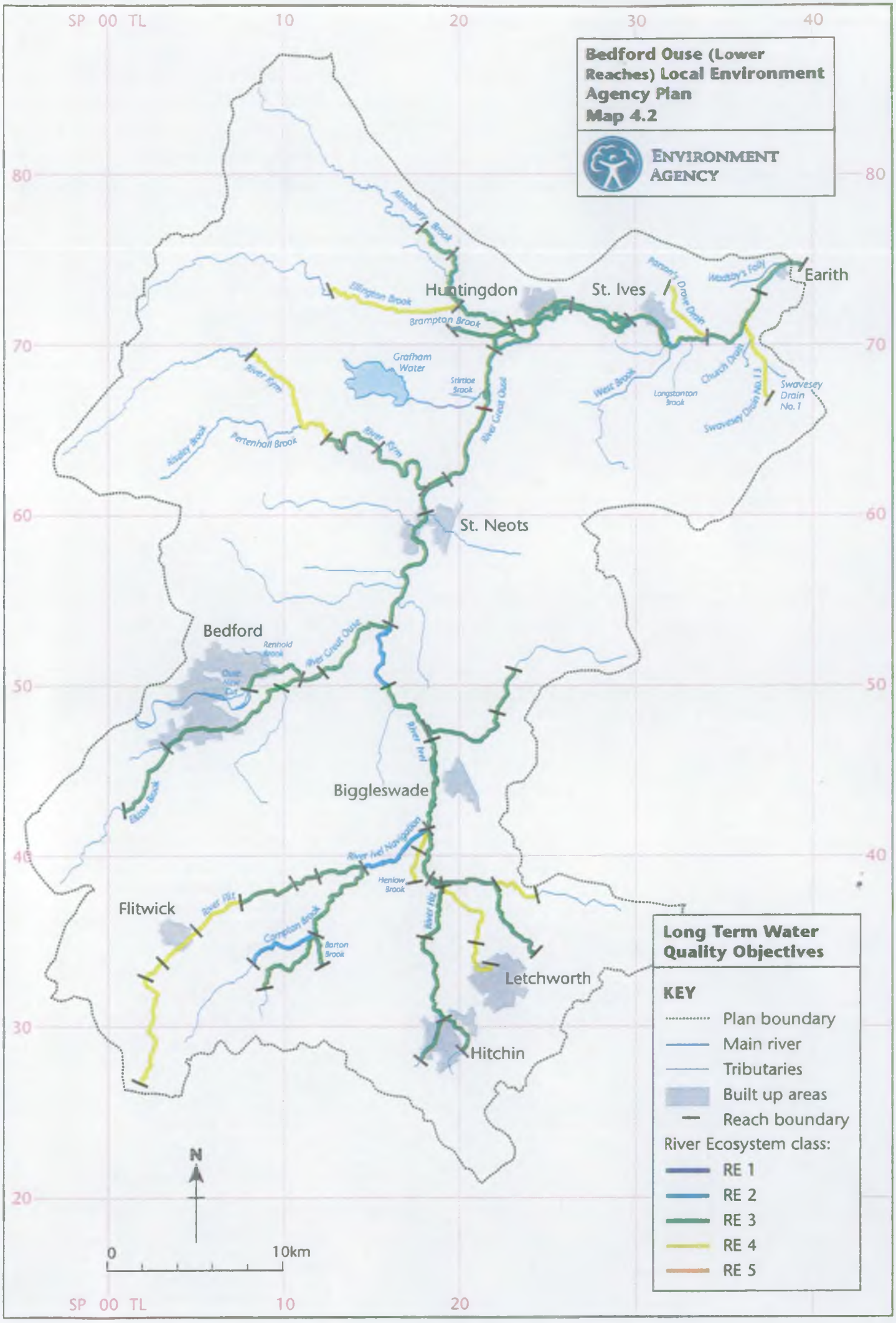
4.3.3 Chemical Water Quality

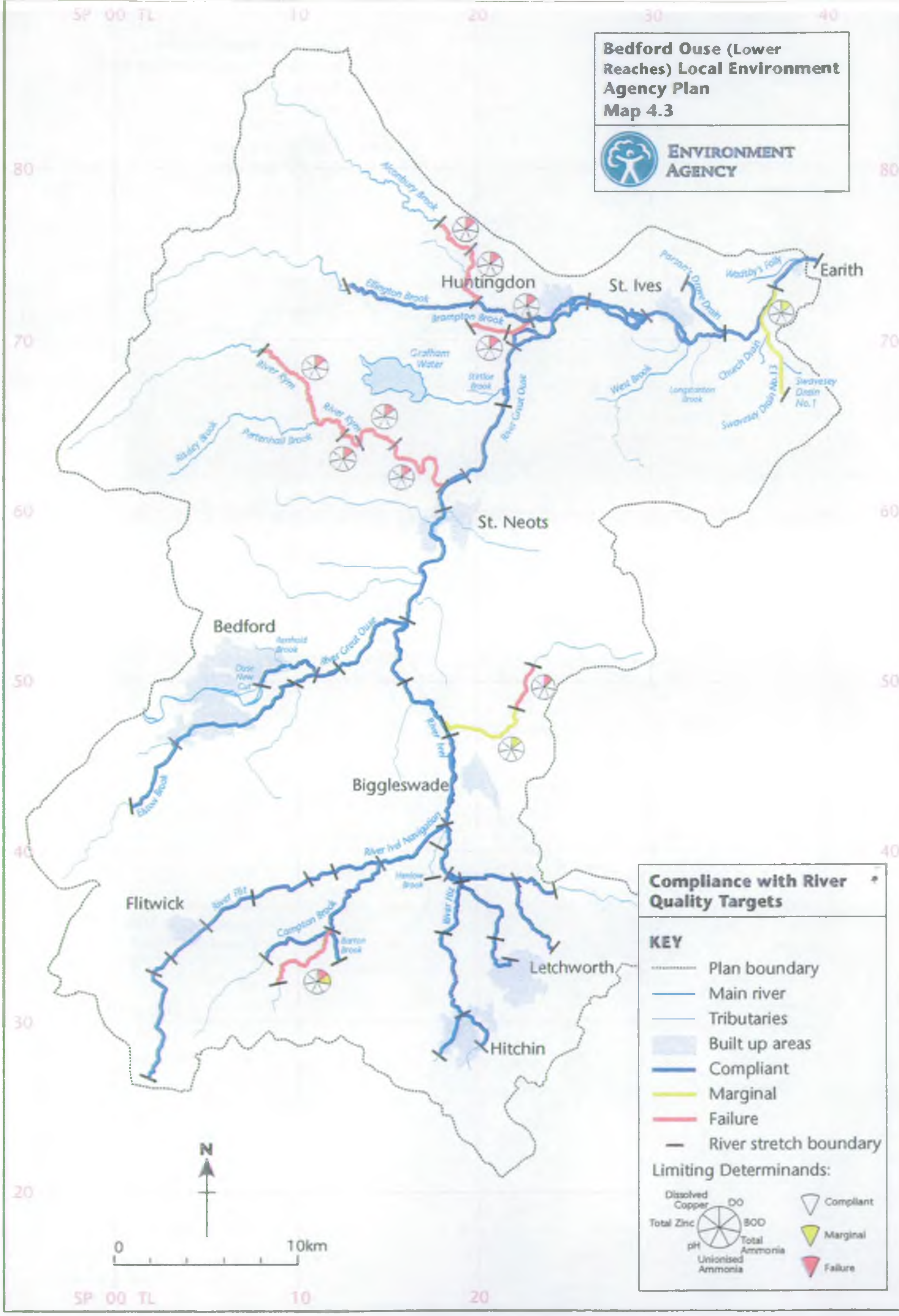
Chemical standards have been derived for each of these classes and details of these standards are given in Appendix B. Map 4.4 shows River Ecosystem Class (1997) Chemical Grades. Map 4.3 highlights failures to reach the long-term water quality objectives. All the failures in the LEAP area are due to low Dissolved Oxygen (DO) concentrations caused by low flow conditions, excessive plant growth and algal blooms. The rivers that have failed their water quality targets are: New Inn Brook, Millbridge/Common Brook, River Kym, Brampton Brook and Alconbury Brook.

4.3.4 Biological Water Quality

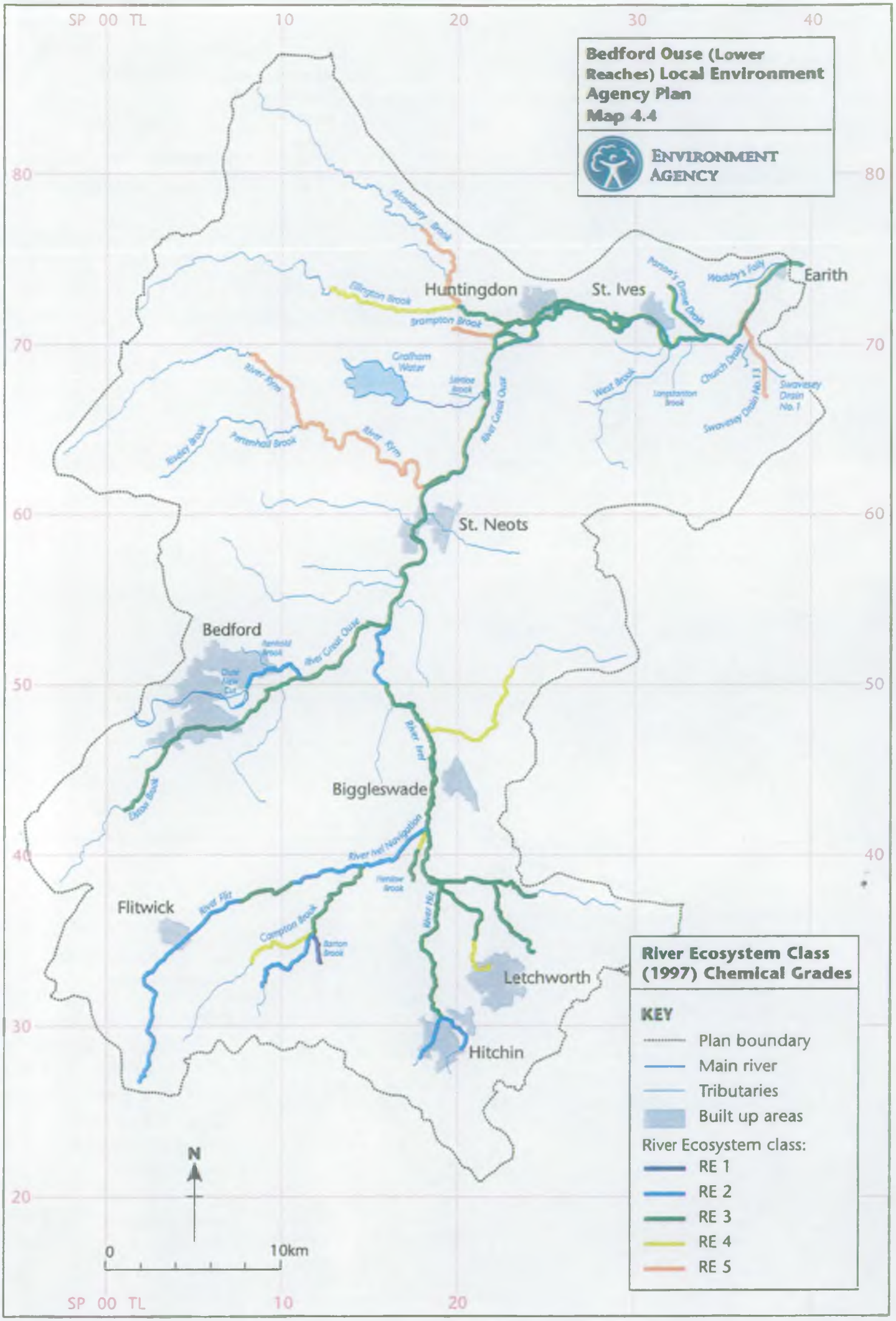
The Bedford Ouse area has over 88% of its rivers reaching Grade C or higher. Particularly good results - Grade A - are obtained on the Great Ouse downstream of Bedford and on the Ivel around Sandy. The River Ouse is generally of good quality, supporting a diverse invertebrate fauna including caddisflies and damselflies.

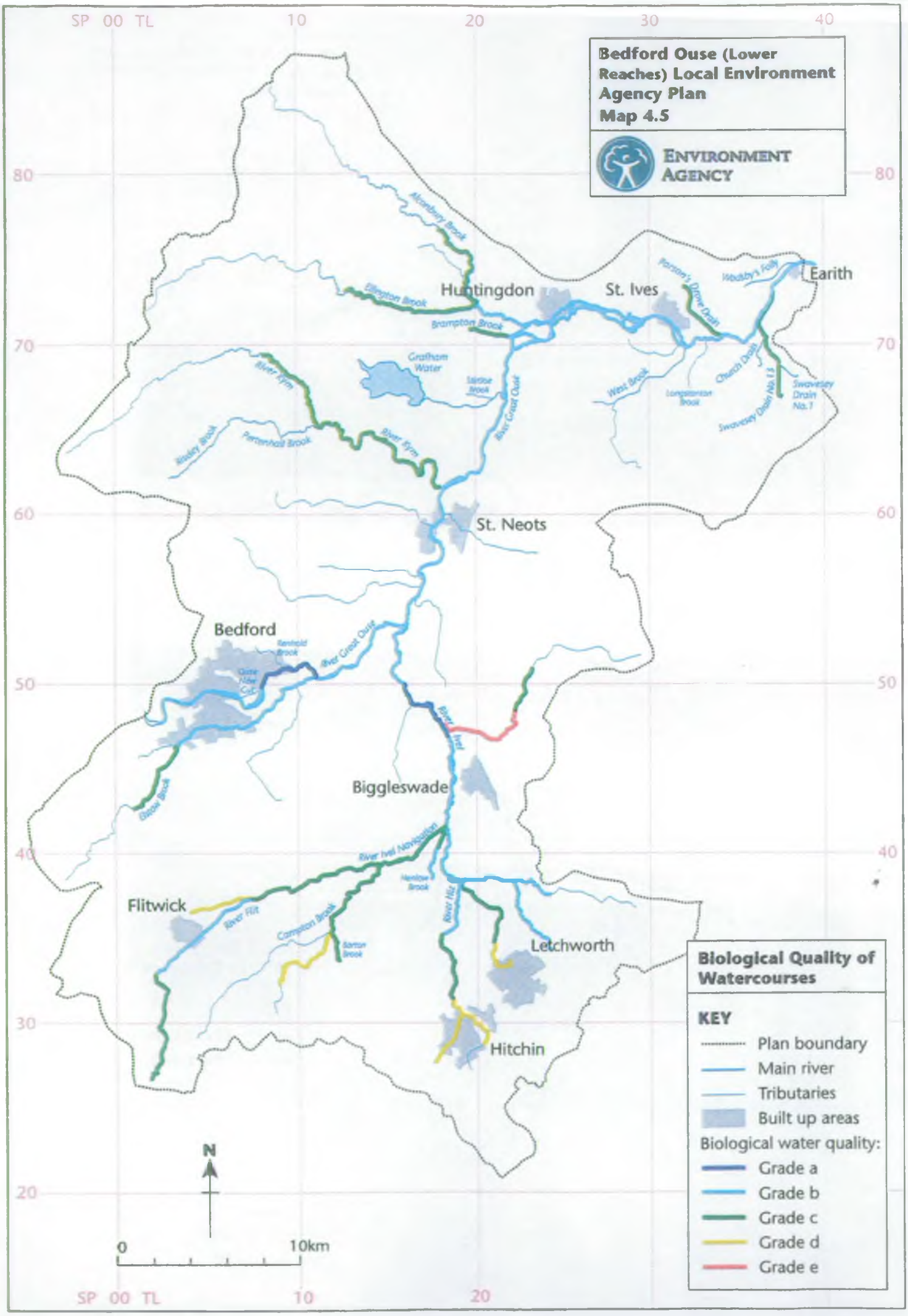
The River Hiz and a tributary in the Hitchin area are of poor biological quality. Special investigations into the quality problems have failed to pinpoint a cause, so it is thought likely to be due to diffuse urban or industrial run-off. A tributary of the Pix Brook near Letchworth is also of poor quality. Run-off from a nearby industrial estate is also thought to contribute to the problems at this site. Map 4.5 shows the biological quality of the watercourses.


Bedford Ouse (Lower Reaches) Local Environment Agency Plan
Map 4.2
Environment Agency
SP 00 TL
10
20
30
40
80
70
60
50
40
30
20
Huntingdon
St. Ives
Earith
St. Neots
Bedford
Biggleswade
Flitwick
Letchworth
Hitchin
Alconbury Brook
Ellington Brook
Brampton Brook
Grafham Water
River Kym
Pertenhall Brook
Stirtloe Brook
River Great Ouse
West Brook
Longstanton Brook
Church Drain
Swavesey Drain No. 1
Renhold Brook
Oakley Brook
River Ivel
River Ivel Navigation
Henlow Brook
River Flit
Campton Brook
Barton Brook
Elstow Brook
N
0
10km
Long Term Water Quality Objectives
KEY
Plan boundary
Main river
Tributaries
Built up areas
Reach boundary
River Ecosystem class:
RE 1
RE 2
RE 3
RE 4
RE 5



Bedford Ouse (Lower Reaches) Local Environment Agency Plan
Map 4.3
ENVIRONMENT AGENCY
SP 00 TL
10
20
30
40
80
70
60
50
40
30
20
Huntingdon
St. Ives
Earith
St. Neots
Bedford
Biggleswade
Flitwick
Letchworth
Hitchin
Alconbury Brook
Ellington Brook
Brampton Brook
Grafham Water
Diddington Brook
River Great Ouse
River Kym
Pertenhall Brook
Riseley Brook
West Brook
Longstanton Brook
Church Drain
Swavesey Drain
Wadsby's Folly
River Ivel
River Ivel Navigation
River Flit
Campton Brook
Barton Brook
Henlow Brook
River Hiz
Elstow Brook
N
0
10km
Compliance with River Quality Targets
KEY
Plan boundary
Main river
Tributaries
Built up areas
Compliant
Marginal
Failure
River stretch boundary
Limiting Determinands:
Dissolved Copper
DO
Total Zinc
BOD
pH
Total Ammonia
Unionised Ammonia
Compliant
Marginal
Failure


Bedford Ouse (Lower Reaches) Local Environment Agency Plan
Map 4.4
Environment Agency
SP 00 TL
10
20
30
40
80
70
60
50
40
30
20
Huntingdon
St. Ives
Earith
St. Neots
Bedford
Biggleswade
Flitwick
Letchworth
Hitchin
Alconbury Brook
Ellington Brook
Brampton Brook
Graffham Water
River Kym
Riddy Brook
Pertenhall Brook
Lavade Brook
River Great Ouse
Potton's Drove Drain
Wadsley's Folly
West Brook
Longstanton Brook
Church Drain
Swavesey Drain No. 1
Swavesey Drain No. 1.1
Renhold Brook
Duloe Lake Cut
Duloe Brook
River Ivel
River Hiz Navigation
Hamlow Brook
River Flit
Compton Brook
Barton Brook
River Hiz
N
0
10km
River Ecosystem Class (1997) Chemical Grades
KEY
Plan boundary
Main river
Tributaries
Built up areas
River Ecosystem class:
RE 1
RE 2
RE 3
RE 4
RE 5


Bedford Ouse (Lower Reaches) Local Environment Agency Plan
Map 4.5
Environment Agency
SP 00 TL
10
20
30
40
80
70
60
50
40
30
20
Huntingdon
St. Ives
Earith
St. Neots
Bedford
Biggleswade
Flitwick
Letchworth
Hitchin
Alconbury Brook
Ellington Brook
Brampton Brook
Grafham Water
River Ivel
River Great Ouse
River Flit
Compton Brook
Hexton Brook
Barton Brook
West Brook
Church Drain
Swavesey Drain No.1
Swavesey Drain No.1A
Parson's Drove Drain
Wadsley's Folly
Ampthill Brook
Percenhall Brook
Renhold Brook
Ouse Valley Cut
Ouzel Brook
River Ivel Navigation
N
0
10km
Biological Quality of Watercourses
KEY
Plan boundary
Main river
Tributaries
Built up areas
Biological water quality:
Grade a
Grade b
Grade c
Grade d
Grade e

PERFORMANCE OF DISCHARGES AGAINST CONSENT CONDITIONS

In the Anglian Region, 98.1% of AWS STW discharges are compliant with their current legal consent conditions (1998).

Not all discharges have consents that limit the amount of pollutants sufficiently to ensure WQOs are achievable. When the performance of these discharges is better than the legal requirement, water quality may not be seriously affected. However, if the performance of these discharges deteriorates to the legal limits, it is likely to cause unacceptable water quality and failure of the WQOs. Currently many STWs are performing well within the legal limits. for the quality and/or quantity of effluent discharged. This situation may deteriorate when population growth occurs and operational performance approaches the consent limits; this is being carefully monitored to identify candidates for the National Environment Programme for Water Companies 2000-2005.

The Agency is an independent regulator of the water industry and has a key role to play in the review of the prices charged by the water companies (the process is known as the periodic review). The Director General of the Office of Water Services (OFWAT) carries out the review. It sets the limit on the amount the water companies in England and Wales can charge to their customers. The Agency's role is to advise the Government on the programme of environmental improvements that should be carried out by the water companies. This programme is called the National Environment Programme and will include measures to improve water quality around our coasts as well as in rivers and lakes. It will also include a programme of measures to remedy the unacceptable impacts of abstraction on rivers and wetlands permitted by licences many years ago.

The River Needs Consent (RNC) is a working estimate of the consent which may be needed in future to achieve long-term WQOs. It has no legal force. Compliance as assessed against current Legal Consent and RNC is shown in Table 4.9.

Table 4.9: Discharges where more stringent consent limits are necessary to achieve compliance with the long-term WQOs. Compliance with legal and RNC targets is also shown for the year ending June 1998

STW	DWF m3/day	Current Legal Consent Standard	Compliance with Current Legal Consent	River Needs Consent (RNC)	Compliance with RNC
Alconbury	620	30/15/10	Pass	25/12/5	**Fail**
Barton le Clay	1143	30/15/6	Pass	30/15/5	Pass
Brampton	1300	25/13/13	Pass	20/10/5	Pass
Chalton	15000	20/12/5	Pass	20/10/5	Pass
Chawston	150	35/20/6	Pass	30/15/5	Pass
Clifton	1700	40/20/10	Pass	34/17/8	Pass

STW	DWF m3/day	Current Legal Consent Standard	Compliance with Current Legal Consent	River Needs Consent (RNC)	Compliance with RNC
Clophill	1800	80/45/15	Fail	50/25/10	**Fail**
Everton	100	50/20/20	Pass	40/20/-	Pass
Hail Weston	120	55/35/-	Pass	55/35/16	Pass
Hitchin	10290	30/20/10	Pass	30/15/5	Pass
Kimbolton	750	35/25/15	Pass	25/13/5	Pass
Letchworth	9900	25/13/5	Pass	24/12/5	Pass
Needingworth	550	25/15/10	Pass	22/11/5	**Fail**
Papworth Everard	500	40/20/10	Pass	30/15/6	Pass
Paxton	346	30/26/-	Pass	24/12/4	**Fail**
Potton	1200	30/15/15	Pass	30/15/8	Pass
Shillington	1100	60/40/15	Pass	40/20/8	Pass
St Ives	4200	20/11/8	Pass	20/11/5	Pass
St Neots	6100	90/55/-	Pass	90/50/25	Pass
Stewartby	290	50/25/-	Pass	50/25/15	Pass
Tempsford	520	30/30/10	Pass	30/20/10	Pass
Uttons Drove	3550	25/17/9	Pass	20/12/5	Pass
Waresley	361	40/35/20	Pass	30/15/6	**Fail**

Key: Consent standards are for Suspended Solids/BOD/Ammonia (mg/l) respectively.

The Public Register, housed at our Regional Office at Peterborough, includes details of water quality classifications, applications for consent to discharge to water and consents issued. It also includes water and effluent sample data and action taken as a result of this. Biological data are held at the Area and Regional offices together with quality assurance.

EUTROPHICATION

The definition of eutrophication, as adopted by the Agency, is: *the enrichment of waters, by inorganic plant nutrients, which results in the stimulation of an array of symptomatic changes. These include the increased production of algae and/or other aquatic plants, affecting the quality of the water and disturbing the balance of organisms present within it. Such changes may be undesirable and interfere with water uses.*

4.3.5 Monitoring and Status

Phosphate is an inorganic plant nutrient and levels in the River Great Ouse within this LEAP area and the River Ivel/Hiz exceed the concentrations in DETR guidance for the identification of Sensitive Areas (Eutrophication) under the UWWTD. Symptoms of eutrophication vary throughout the area, but include filamentous algal growths, algal blooms in the water column and associated extreme diurnal variation in dissolved oxygen levels.

A review of potential Sensitive Areas (Eutrophic) under the UWWTD was carried out in 1997 and as a result the DETR in July 1998 designated the stretch of the River Great Ouse within the LEAP area and the River Ivel/Hiz as Sensitive Areas (Eutrophic). The designation requires the installation of nutrient removal processes by 2004 at STWs serving a population of more than 10 000 and discharging into the designated areas, unless it can be demonstrated that the removal will have no effect on the level of nutrification. Under the AMP3 process prioritisation of the following STWs within the LEAP catchment where phosphate removal may be required is currently on going: St Neots, Huntingdon, St Ives, Uttons Drove, Letchworth, Hitchin, Clifton, Poppy Hill, Biggleswade, Sandy and Flitwick STWs.

Grafham Water was designated a Sensitive Area (Eutrophic) under UWWTD in 1994 and as a result Bedford and Chalton STW will require phosphate removal by the end of 1998.

These steps are unlikely in themselves to completely control eutrophication, but are an essential first step.

WATER POLLUTION INCIDENTS

In England and Wales there were 35 891 reported pollution incidents in 1995, of these 23 463 were substantiated. The national trend suggests an increase of more than 27% since 1990, but increased public awareness and the introduction of a freephone emergency hotline (0800 80 70 60) to report pollution incidents have influenced this.

Table 4.10: Pollution Incidents in the Bedford Ouse LEAP Area (1998)

POLLUTION TYPE	Category				
	1	2	3	4	
Oils	0	2	65	15	Category 1 are 'major' incidents, category 2 are 'significant', category 3 are 'minor' and category 4 are 'unsubstantiated'. A more detailed explanation of these is given in Appendix D.
Sewage	0	7	23	4	
Chemicals	1	0	17	4	
Organics	0	2	7	1	
Others	1	7	38	16	
TOTALS	**2**	**18**	**150**	**40**	

A total of 210 incidents were reported in the LEAP area during 1998, of which 19% were unsubstantiated. 71% of the incidents were classified as minor, having only a localised and temporary effect on water quality.

The largest number of reports, approximately 39% of the total pollution incidents reported, were due to oil pollution. The majority of these incidents were very small diesel spills (category 3 & 4). The Category 2 incidents were caused by a spillage of heating oil into the Stone Brook at Sandy, and heating oil entered the Holywell Brook at Holywell as a result of a leak in a below-ground pipe.

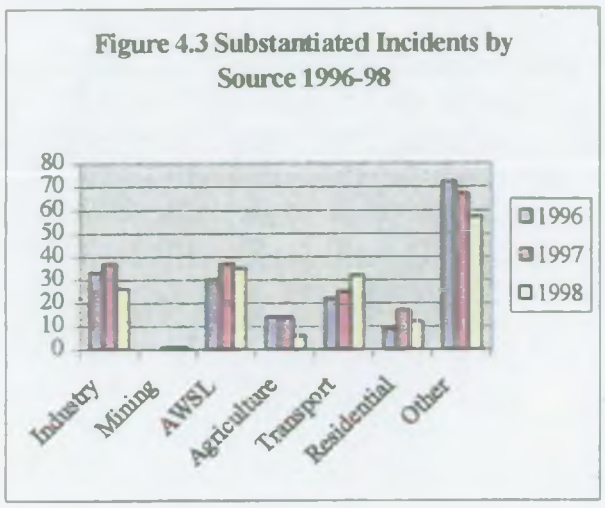
Sewage pollution accounted for 16% of the total incidents reported and 38% of the total number of Category 2 incidents. The majority of incidents were minor problems caused by blocked sewers, septic tanks and failures at sewage pumping stations. Of the seven Category 2 incidents, legal action is being considered with regard to three. The remaining four were associated with blockages on foul sewers and a failure at a sewage treatment works.

Incidents involving chemicals accounted for 10% of the total incidents. These were mainly small chemical spills from industry in general or road traffic accidents. The Category 1 incident resulted in the death of several thousand small fish in a small stream that feeds Stewartby Lake. The pollution was reported some time after the incident occurred and although an extensive investigation was undertaken the chemical that killed the fish was not identified.

Organic sources accounted for 5% of the total incidents reported. Most were minor incidents associated with farms. One of the Category 2 incidents resulted in the pollution of a tributary of the Abbotsley Brook with pig slurry. The other Category 2 incidents resulted from a discharge of trade waste from a food manufacturer; the company was prosecuted and fined £12 000 by the magistrates.

Approximately 29% of the total number of incidents reported were due to other reasons. These included natural causes of low dissolved oxygen during the summer, algal blooms and the discharge of silt. The category 1 incident resulted in the death of approximately 1000 small fish in the Renhold Brook in Wilden. The exact cause of the incident was not established due to the very transient nature of the pollutant. The discharge of silt laden water from sites has resulted in several Category 2 incidents, one of which resulted in the company being issued with a formal caution.

Figures 4.3, 4.4 and 4.5 illustrate the trends for pollution incidents over the last three years, broken down by Source (eg industry, transport, agriculture), by Category (1 to 4, as defined in Table 4.10), and by Type (eg oils, sewage, chemicals), respectively.



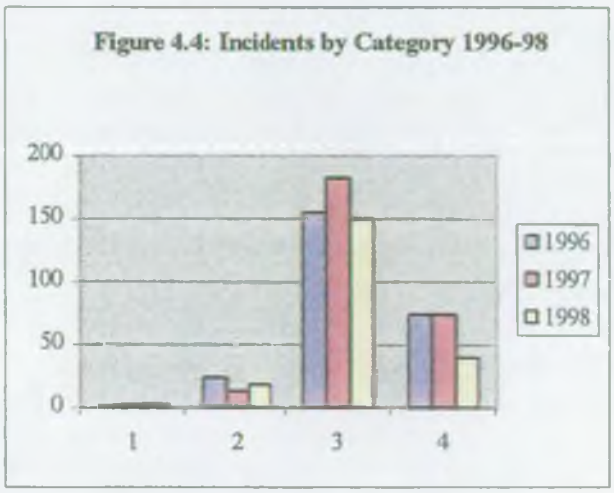
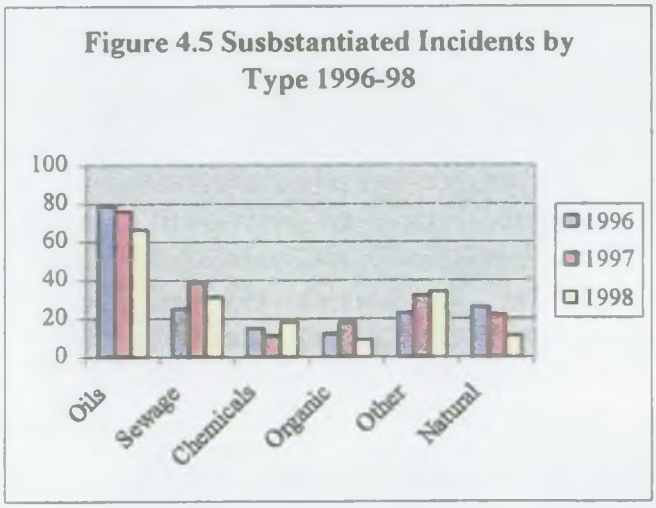


Figure 4.3 shows that although there was an overall reduction in pollution incidents between 1997 and 1998, those sourced by Transport increased. In this context, Transport includes all associated incidents involving, for example, vehicles, boats and long distance pipelines. Incidents that occurred as a result of road traffic accidents are also included in this category, as are incidents resulting from the discharge of bilge water from boats.



'Sewage' incidents include those associated with sewage works, pumping stations, sewers and septic tanks. 'Organic' incidents include farm waste and waste associated with the food industry. 'Other' incidents include foam, rubble, inert suspended solids, colour, tip leachate, urban run-off and fire water.

4.4 Quality of Groundwater

THE GROUNDWATER REGULATIONS 1998

The Groundwater Directive 80/68/EEC exists to protect groundwater by preventing the

entry of the most toxic (List I) substances into groundwater and restricting entry of other harmful (List II) substances. The Regulations introduce transitional provisions on the 1st January 1999 with full implementation coming into force on the 1st April 1999. These Regulations are likely to affect a wide sector of industry including premises or operations, which manufacture, handle, store or use List I or II substances where there is a risk of a discharge occurring. The agricultural sector will be affected where farmers dispose of waste pesticides and pesticide tank washings to land, including sheep dip, disposal of unused dilute pesticide, tank washings and washing water from equipment cleaning.

The new legislation will complement existing pollution control laws and help ensure that the quality of our groundwater and rivers is preserved for future generations.

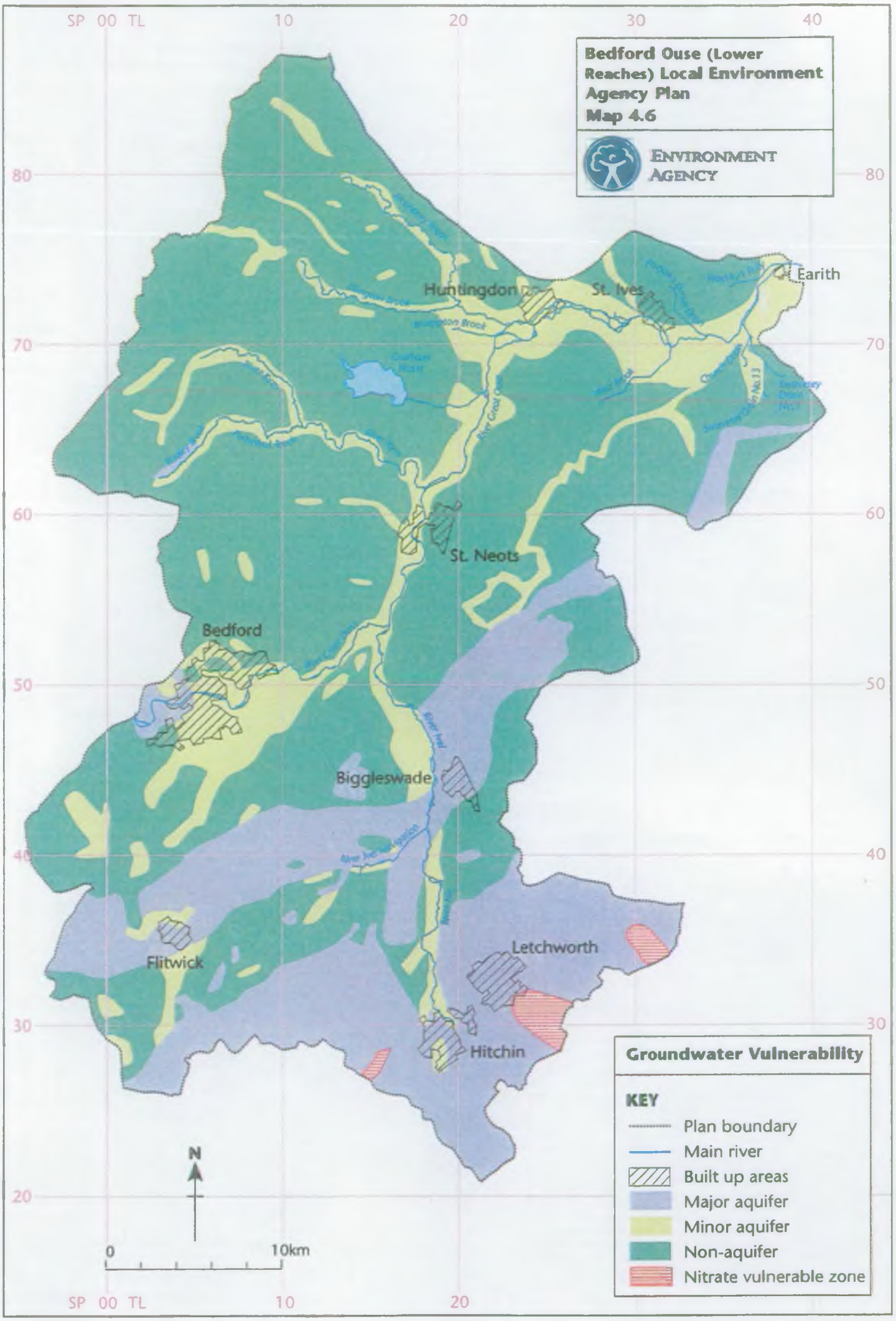
Our 'Policy and Practice for the Protection of Groundwater' (1992) provides advice on the management and protection of groundwater on a sustainable basis. This policy deals with the concepts of vulnerability and risk to groundwater from a range of human activities. It considers both source and resource protection e.g. protection for the land surface (source catchment) area which drains to the abstraction point (source) and protection for the total area of the aquifer irrespective of abstraction (resource). It deals in particular with:

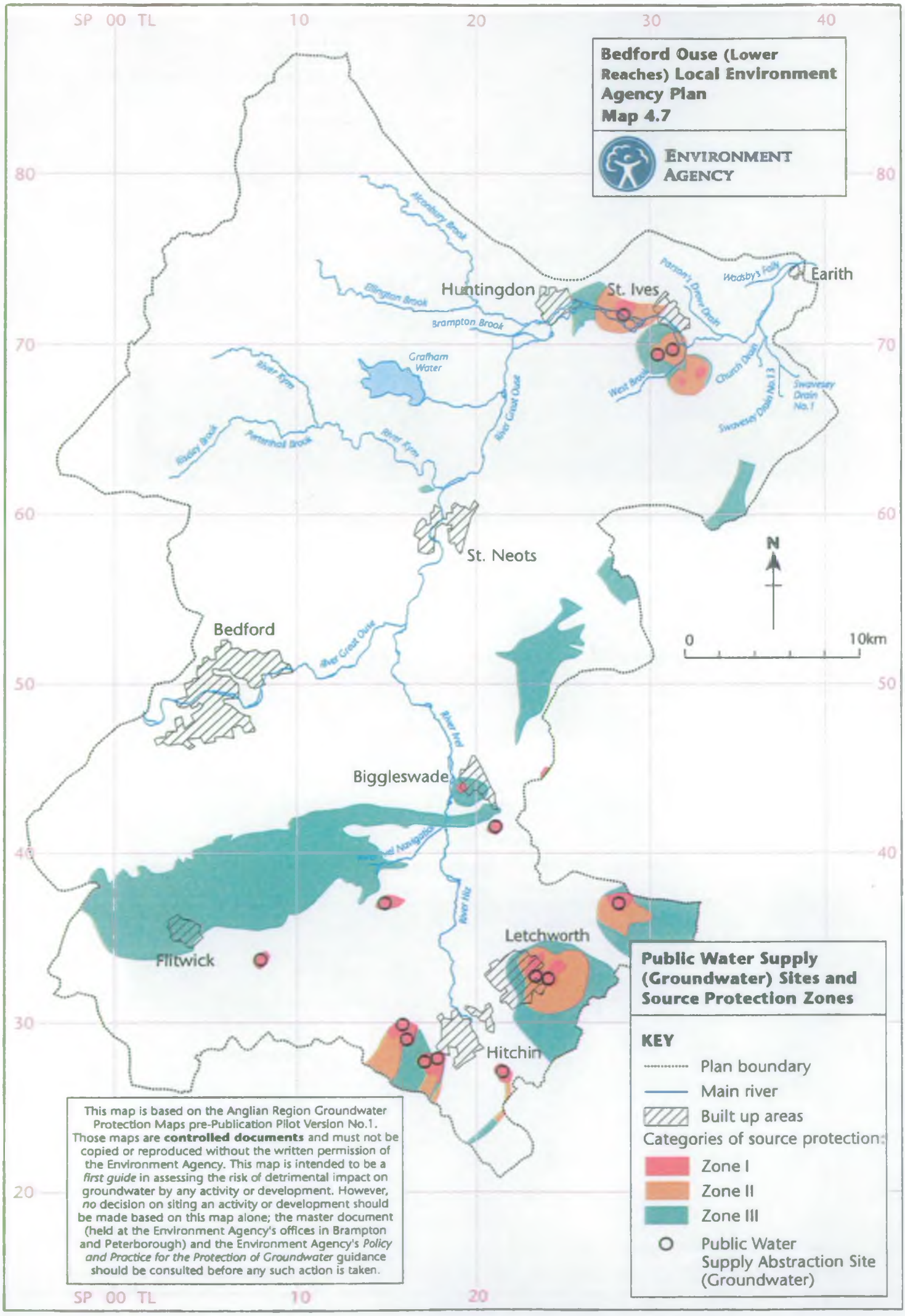
- control of groundwater abstractions;
- physical disturbance of aquifers and groundwater flow;
- discharges to underground strata;
- waste disposal to land;
- disposals of slurries and sludge to land;
- contaminated land;
- diffuse pollution; and,
- unacceptable activities in high-risk areas.

The implementation of the policy relies in part on the provision of a series of maps showing groundwater vulnerability (resource protection) (see Map 4.6). In addition, source protection zone maps have been created to define the catchments of individual abstractions so that we can protect water quality near these points (see Map 4.7).

In respect to resource protection, the policy recognises three types of aquifer:

- *Major aquifers* typically yield large quantities of water for public supply and other purposes. They are highly permeable formations, which can be highly fractured;
- *Minor aquifers* can be defined as fractured rocks that are not highly permeable or permeable deposits of limited extent. Although these aquifers will seldom yield large quantities of water for abstraction, they are important for local supplies and in supplying base flows for rivers.
- *Non-aquifers* are formations with negligible permeability, which do not contain groundwater in exploitable quantities.


Bedford Ouse (Lower Reaches) Local Environment Agency Plan
Map 4.6
Environment Agency
SP 00 TL
10
20
30
40
80
70
60
50
40
30
20
Huntingdon
St. Ives
Earith
St. Neots
Bedford
Biggleswade
Flitwick
Letchworth
Hitchin
N
0
10km
Groundwater Vulnerability
KEY
Plan boundary
Main river
Built up areas
Major aquifer
Minor aquifer
Non-aquifer
Nitrate vulnerable zone


Bedford Ouse (Lower Reaches) Local Environment Agency Plan
Map 4.7
Environment Agency
SP 00 TL
10
20
30
40
80
70
60
50
40
30
20
Huntingdon
St. Ives
Earith
St. Neots
Bedford
Biggleswade
Flitwick
Letchworth
Hitchin
Alconbury Brook
Ellington Brook
Brampton Brook
Grafham Water
River Kym
Bluey Brook
Perry Beck
River Great Ouse
Parson's Drove Drain
Woodsby's Folly
West Brook
Church Drain
Swavesey Drain No.13
Swavesey Drain No.1
River Ivel
River Hiz
N
0
10km
Public Water Supply (Groundwater) Sites and Source Protection Zones
KEY
Plan boundary
Main river
Built up areas
Categories of source protection:
Zone I
Zone II
Zone III
Public Water Supply Abstraction Site (Groundwater)
This map is based on the Anglian Region Groundwater Protection Maps pre-Publication Pilot Version No.1. Those maps are controlled documents and must not be copied or reproduced without the written permission of the Environment Agency. This map is intended to be a first guide in assessing the risk of detrimental impact on groundwater by any activity or development. However, no decision on siting an activity or development should be made based on this map alone; the master document (held at the Environment Agency's offices in Brampton and Peterborough) and the Environment Agency's Policy and Practice for the Protection of Groundwater guidance should be consulted before any such action is taken.

4.4.1 Objectives

Activities with the potential to cause water pollution present a greater risk the closer they are to wells and boreholes. We have designated Source Protection Zones (SPZs) around all large potable supply sources and those industrial sources used in commercial food and drink production. The size and shape of these zones for a particular source are dictated by such factors as soil type, geology, rainfall and the amount of water abstracted from the source. The zones are divided into three, based on proximity to the source (see Section 5.1.1).

Within the policy document (available on request) we have published standard policy statements which explain our policies on developments within each of these zones. This helps developers, landowners and others to understand groundwater protection issues and to gauge our likely response to any particular proposals, which may affect groundwater.

Groundwater quality objectives are difficult to set when compared to surface water quality. The EC Nitrate Directive approved in 1991 sets an upper limit of 50 mg/l for nitrates in groundwater and requires that member states designate Nitrate Vulnerable Zones (NVZs) around sources where this limit has been, or is likely to be exceeded. The objective of this is to reduce nitrate pollution from agricultural sources. The NVZ consists of the total groundwater catchment zone for the borehole, together with adjacent land where surface water drains into the catchment zone from clay-covered areas. The Directive also requires the production of a Code of Good Agricultural Practice to control nitrate leaching.

4.4.3 Monitoring and Status

Three NVZs have been designated in the LEAP area at Slip End, Weston and Great Offley (refer to Map 4.6). Map 4.6 also shows the status of groundwater vulnerability in the LEAP area and includes areas of aquifer outcrop and those areas where the aquifers are protected by surface 'drift' deposits, as well as areas of non-aquifer. We encourage activities with the greatest groundwater pollution potential to be sited on non-aquifer areas wherever possible. We have also designated Source Protection Zones (SPZs) for each public water supply source in the LEAP area (refer to Map 4.7).

In incidents of groundwater pollution, investigations are carried out in order to monitor the extent and course of contamination. In this area, groundwater contamination has been identified at the following sites:

FLITWICK

Flitwick landfill site is approximately 1.4 hectares in size and is close to housing near the centre of the town. It was originally worked as a sand pit and until its closure in 1982 had been used for the disposal of industrial and household waste over a twenty-year period. Large quantities of liquid waste such as cutting oils, detergents and solvents were deposited in two soakaway lagoons, causing pollution of the Woburn Sands aquifer. The site was never capped or restored. The Agency is working with the landowner and the

local authority to resolve the groundwater pollution issue and to find a way to restore the site to beneficial use.

LETCHWORTH

Elevated levels of the chlorinated solvent tetrachloroethene (PCE) were discovered in the Baldock Road supply borehole of the Three Valleys Water Company in 1990. The contamination appears to be deep-seated in the Chalk aquifer. Attempts to identify and eliminate the source of pollution through borehole investigations and aquifer modelling, as well as visits to industrial premises where the chemicals are in use, have proved unsuccessful. The water company is meeting demand by using alternative sources. The Agency is continuing to monitor groundwater in the area for any changes in solvent concentration.

4.4.4 Trends

Groundwater levels decreased as a consequence of the 1995-1998 drought and reached their lowest levels since monitoring began. The quality of the groundwater is generally good.

We now collate data on the use of agrochemicals on land and are modifying our monitoring strategy to target analysis on those chemicals that are applied in sufficient quantities to constitute a risk to aquifers.

The change in philosophy in landfilling wastes, away from 'dilute and disperse' to full containment, has resulted in the reduction of significant further risks to groundwater.

4.4.5 Comment on the Quality and Availability of Data

Groundwater is difficult to monitor in comparison to surface waters. However, we do collect data at observation boreholes, which are monitored normally on a quarterly basis.

We monitor groundwater to obtain information on quality locally and also to provide baseline information on the quality of water across the country. Nationally we are carrying out a review of our monitoring networks in order to provide a comprehensive national picture of groundwater quality. We intend to standardise our monitoring activities across regions and to form a reference network. This will give a good spatial indication of water quality across the country together with a local network, which will monitor pollution issues on a more local or site specific scale. We also intend to devote more effort to interpretation of data and reporting of information to provide better management of resources.

4.5 Air quality standards

INTERNATIONAL AND EUROPEAN STANDARDS

The Montreal Protocol on Substances that Deplete the Ozone Layer (1987) has now been ratified by over 100 countries and it aims to reduce and eliminate the use and emission of ozone-depleting substances. The Agency has regulatory responsibility for implementing and reporting on the Montreal Protocol for processes within its jurisdiction.

The emission of 'greenhouse gases' has increased substantially as a result of human activities, enhancing the natural greenhouse effect and widely thought to be causing global warming and climatic changes. The UN Framework Convention on Climate Change (1993) forms the basis for international action to address the problem of climate change and it includes phased targets to reduce emissions of greenhouse gases to 1990 levels by the year 2000. At the 1998 Kyoto Climate Summit, the UK Government made further commitments to reduce emissions of carbon dioxide (CO_2) and other greenhouse gases by 5% overall from 1990 levels by 2008-2012.

Various European legislation is concerned with control of air pollution: Directives control air quality limits on sulphur dioxide (SO_2) and suspended particulates (PM_{10}s), nitrogen dioxide (NO_2), lead and ozone (O_3) monitoring. A Framework Directive on Air Quality that actually mirrors the current UK National Air Quality Strategy (NAQS) will replace these with limits, objectives and action thresholds.

The Agency, through its regulation of the most complex and potentially polluting process industries, is responsible for delivering government obligations under European legislation including the Large Combustion Plant Directive and for industrial point and diffuse sources under the Oslo-Paris Commission. Local authorities are responsible for the implementation of the UK National Air Quality Strategy. The role of the Agency, as statutory consultee, is to work with the local authorities by providing information and advice on Integrated Pollution Control (IPC) processes.

LOCAL AIR QUALITY AND THE UK NATIONAL AIR QUALITY STRATEGY, 1997.

The UK National Air Quality Strategy was published in March 1997 to fulfil the requirement of the Environment Act 1995. Its aim was to describe, as far as possible, the future of ambient air quality policy in the UK to 2005 and beyond. This included proposals for health-based standards for eight main air pollutants and objectives for their achievement throughout the UK by 2005.

The Air Quality Regulations 1997 established the legal basis standards and objectives contained within the Strategy excluding those for ozone (due to its transboundary nature and the need for concerted international action). Local authorities in the LEAP area are currently undertaking air quality reviews and assessment to determine compliance with these regulations and are required to declare Air Quality Management Areas (AQMA) and establish Action Plans to ensure regulated pollutants meet prescribed levels by 31 December 2005. The Agency has produced 'Guidance for Estimating the Air Quality

Impact of Stationary Sources' to assist local authorities in this work. In the regulation of IPC processes the Environment Agency is required to take account of the National Air Quality Strategy and assist local authorities to meet statutory air quality targets.

Since publication of the Strategy, a Common Position has been reached upon Directive 96/62/EC on ambient air quality assessment and management (so called Framework Directive) and the first Air Quality Daughter Directive (AQDD). It is anticipated these will be formally adopted early in 1999. The AQDD has established legally binding limit values for SO_2, NO_2, PM_{10}s and lead to be achieved by 1 January 2005 and then 2010. The Directive also sets, for the first time, European limit values for oxides of nitrogen (NO_x) and SO_2 for the protection of vegetation and ecosystems.

To avoid the operation of two parallel systems of air quality assessment and monitoring it is essential the UK Strategy is consistent with that required under European law. A review of the Strategy is therefore being undertaken focussing upon revising the Objectives in order that these are consistent with the EU Daughter Directive requirements. It has also taken account of other European initiatives and understanding of the impacts, sources and transformations of pollutants, particularly PM_{10}s.

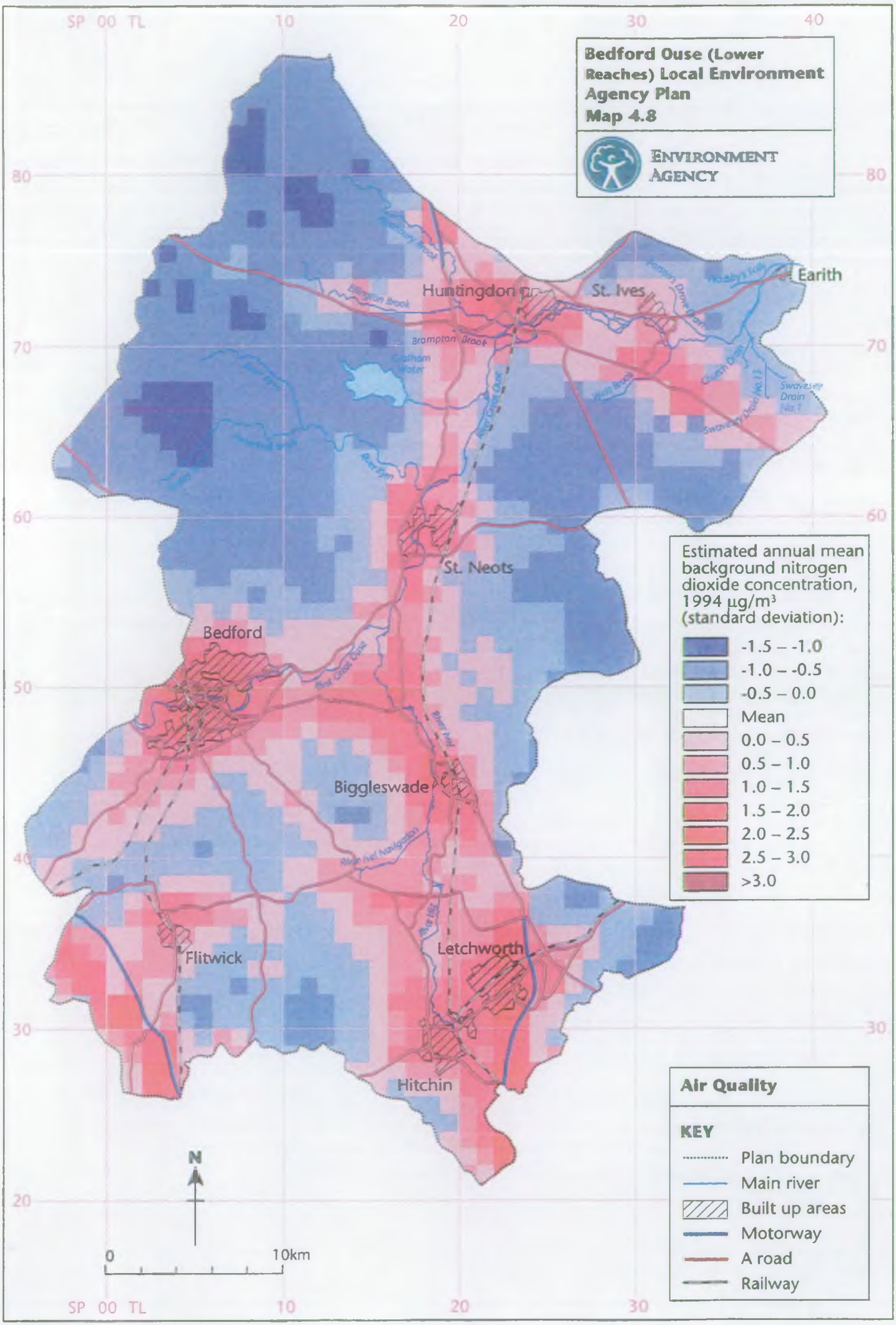
The area covered by this LEAP is essentially rural with major urban centres being Hitchin/Letchworth, Bedford, Eaton Socon/St, Neots, Huntingdon and St Ives. As air quality does not give rise to concern, little information is available from monitoring of air quality. Using data from other rural monitoring sites elsewhere in the country, it can be assumed that the quality of the air within the majority of the area is very good.

The Marston Vale area suffers from the characteristic odour of Fletton brickmaking under adverse meteorological conditions. This odour has no known health concerns but can be unpleasant to some people. There is ongoing research and trials taking place to reduce the odour from the use of the oxford clay in making bricks.

The effect of releases from other sources such as roads including the A1, A14, A421 and A428 and urban areas such as Bedford and Huntingdon may have an impact, especially under some meteorological conditions. Map 4.8 shows nitrogen dioxide concentrations in the LEAP area and it can be seen that the highest concentrations correspond closely with major settlements and roads.

GASEOUS EMISSIONS FROM LANDFILL SITES: THE ENVIRONMENTAL PROTECTION ACT 1990, WASTE MANAGEMENT LICENSING REGULATIONS 1994

Wherever biodegradable material is deposited in landfill sites, microbial activity will generate landfill gas, which is a mixture of flammable and asphyxiating gases. It therefore follows that all sites should be assessed, monitored and, where necessary, have control systems installed to prevent uncontrolled gas migration. The composition of the gas varies according to the type and phase of breakdown that is occurring within the site at any specific time. While mainly composed of CO_2 and methane, landfill gas can contain 350 trace components. It has the potential to cause odour nuisance and contribute to global warming; gram-for-gram, methane has 24 times the greenhouse warming potential of CO_2.


Bedford Ouse (Lower Reaches) Local Environment Agency Plan
Map 4.8
Environment Agency
SP 00 TL
10
20
30
40
80
70
60
50
40
30
20
Huntingdon
St. Ives
Earith
St. Neots
Bedford
Biggleswade
Flitwick
Letchworth
Hitchin
Estimated annual mean background nitrogen dioxide concentration, 1994 µg/m³ (standard deviation):
-1.5 – -1.0
-1.0 – -0.5
-0.5 – 0.0
Mean
0.0 – 0.5
0.5 – 1.0
1.0 – 1.5
1.5 – 2.0
2.0 – 2.5
2.5 – 3.0
>3.0
N
0
10km
Air Quality
KEY
Plan boundary
Main river
Built up areas
Motorway
A road
Railway

Together with the Agency, local authority Environmental Health Departments are responsible for these hazards. Action may be taken against odorous sites under the Environmental Protection Act 1990 Part I 'Statutory Nuisance' legislation.

It is the policy of the Agency, wherever suitable and sustainable, to require the combustion of methane; this converts it into the more benign (from a global warming viewpoint) CO_2. Gas should not be allowed to escape from a landfill in an unplanned or uncontrolled manner. It should be contained and vented within the perimeter of the site or flared in a secure compound, designed for that purpose. There are various methods of control available, including gas barriers, venting trenches and wells. When sites require gas-pumping systems, the collected gas should normally be flared off or preferably utilised. When it cannot be flared it may be vented in a safe manner. In this LEAP area there are three landfill sites where the gas is collected and used to generate electricity in power stations with the following capacities:

Arlesey	2.2 Megawatts (MW)
Brogborough	10.7 MW (extra 9MW to be installed 1999)
Stewartby 'L-Field'	12 MW
Buckden	2MW (installation: summer 1999 + 1MW in 2000)

The power generated is sold to the national grid at a guaranteed price under the Non Fossil Fuel Obligation in yearly tranches. The generation of power from landfill gas constitutes recycling at a fundamental level and is very environmentally beneficial, converting vast quantities of methane into CO_2.

PROCESS INDUSTRIES REGULATION

The Environmental Protection Act (EPA 90), as amended by the Environment Act (EA95), introduced the systems of IPC and Local Authority Air Pollution Control (LAAPC). IPC is concerned with the prevention and control of emissions to all three media of the environment: air, land and water. The industrial processes regulated under this system are the Part A prescribed processes, defined in regulations made under EPA 90 and they are the most technically complex and potentially most polluting industrial processes:

- Fuel production, combustion and associated processes;
- Metal production and processing;
- Mineral industries;
- Chemical industry;
- Waste disposal and recycling; and
- Other industries, e.g. paper making.

Operation of a prescribed process requires an IPC authorisation and the Agency is responsible for implementing IPC and regulating the most complex industrial processes. Less polluting processes (Part B processes) are authorised and regulated by the Environmental Health departments of local authorities under LAAPC.

The IPC system requires that prescribed processes should use the principle of best available techniques not entailing excessive cost (BATNEEC) to prevent or minimise polluting substance releases and render all released substances harmless. Regulators and operators should also have regard to the best practicable environmental option (BPEO) for the releases. The principles of BATNEEC and BPEO ensure that the needs of industrial processes are appropriately balanced with the costs and benefits of environmental protection.

The Agency and Business in the Environment developed the 3Es (Emissions, Efficiency, Economics) methodology as a structured technique to achieve improved environmental performance through process optimisation. The Agency has also developed the Operator and Pollution Risk Appraisal (OPRA) system to provide an objective and consistent assessment of the risk from IPC processes.

One of the basic principles of IPC is continuous improvement. The operator of a Part A prescribed process requires an IPC authorisation, which is subject to statutory review every 4 years. The IPC authorisation includes:

- Release limits;
- Reporting requirements;
- Operating conditions; and
- Improvement programmes.

In its 'Environmental Strategy for the Millennium and Beyond', the Agency has a commitment to address climate change and improve air quality. This includes reduction targets for CO_2, SO_2, NO_x, PM_{10}s, CO (carbon monoxide), dioxins, lead, non-ferrous metals, VOCs (volatile organic compounds) (excluding methane), ozone-depleting substances and other greenhouse gases. These emission reduction targets relate only to processes under the Agency's control and are subject to BATNEEC and BPEO.

Emissions data are collected by the Agency and published through the Chemical Release Inventory (CRI). This database is being further developed to enable monitoring of reduction targets. The routine monitoring carried out by the Agency supports, and checks, the monitoring which is carried out by the operator as a requirement of their authorisations.

The Agency must ensure that new or varied licences do not cause significant impact on Habitat Directive sites. The only known candidate site for this LEAP (to date) is Portholme Meadow. Under the Habitats Directive the Agency is obliged to review all existing licences by 2004.

COUNCIL DIRECTIVE 96/61/EC CONCERNING INTEGRATED POLLUTION PREVENTION AND CONTROL (IPPC)

The Integrated Pollution Prevention & Control (IPPC) EC Directive will be implemented into UK Law from the end of October 1999. It sets out a Europe-wide policy to improve the standard of environmental protection. It is similar to the IPC regime operated by the Agency since 1991. In accord with sustainable development, it consists of preventing,

reducing and eliminating pollution. It will do this by giving priority to pollution prevention at source and ensuring prudent management of natural resources, in compliance with the 'polluter pays' principle. The Directive covers emissions to all media (air, land & water), as well as heat, noise and vibration, energy efficiency, environmental accidents and site cleanup.

The Directive refers to integrated control and prevention of pollution from 'installations', where one or more of the following categories of activities, subject to certain capacity thresholds, are carried out:

- Energy industries e.g. power stations, oil and gas refineries;
- Production and processing of metals - ferrous and non-ferrous;
- Mineral industry e.g. cement works, glass works;
- Chemical industry – organic, inorganic, pharmaceuticals;
- Waste management e.g. landfill sites, any installation disposing of hazardous waste, some installations recovering hazardous waste, IPC authorisations for sewage sludge incinerators; and
- Other activities e.g. timber pulp production, slaughterhouses, food/milk processing, intensive pig/poultry units, organic solvent users and carbon production.

A case study for the implementation of an IPPC permit to a waste management facility has been initiated in this LEAP area.

The Shanks & McEwan (Southern Waste Services) Ltd Stewartby site in Bedfordshire has been chosen as an appropriate site for use in a case study. The study will be to identify the issues involved in implementing an IPPC permit. The site incorporates a co-disposal landfill site, a (proposed) leachate treatment plant, landfill gas extraction with 13MW power generation plant, a hazardous waste treatment plant and waste transfer station. The site has a potential cross-media environmental impact, involving releases to atmosphere and land and the potential for groundwater pollution. IPPC issues such as site restoration and prevention of pollution from accidents also draw on multi-functional disciplines from within the Agency.

The aim of this case study is to ensure that the Agency and Industry are alerted to key issues of implementing the IPPC Directive on a waste management site. A multi-functional team from the Agency was formed and met with representatives of Shanks and McEwan to identify issues relating to the implementation of IPPC including:

- environmental assessments of the nature, quantities and affects of emissions;
- permit conditions relating to nature, quantities and affects of emissions; and
- technology and techniques to prevent or reduce emissions.

The main objectives of the case study were:

- to develop and obtain feedback on an IPPC permit for a waste management facility;
  i) to ascertain what a permit needs to contain;

ii) to establish what data and guidance will be needed;
iii) to assess how much effort will be required by Agency and Industry;
iv) to consider probable mechanisms for applications and permitting;

- to identify possible indicators that will demonstrate the effectiveness if IPPC; and
- to identify areas of uncertainty/concern/confusion/interest to Industry and Agency staff for example:
  i) communications,
  ii) general and technical guidance
  iii) R&D needed.

The project will be progressed by the Agency putting together a proposal for consideration by both parties. This will be a protocol for the application and implementation of IPPC including new issues such as Best Available Technique (BAT).

The Agency has welcomed IPPC as a more holistic approach to environmental management and regulation.

LOCAL PERSPECTIVE

The area covered by this LEAP is largely agricultural in nature, with a number of urban conurbations. The only major industrial sites within the area are the brickworks of the Marston Vale. The smaller site is due to cease production in 1999. There are eleven sites that have authorisations issued under the Environmental Protection Act 1990 (EPA90) Part 1, given in Table 4.11 below.

There are no processes authorised under the IPC regulations beyond the boundary of the LEAP area that have a significant effect within the LEAP area.

Table 4.11: IPC Processes

Operator name	Local Authority	Process
Hanson Brick Ltd	Bedford	Mineral industry, brickmakers
Hanson Brick Ltd	Bedford	Mineral industry, brickmakers
Power Innovations Ltd	Bedford	Chemical industry
Woodbridge Foam Ltd	Bedford	Other industries, di-isocyanate process
National Power plc	Bedford	Fuel and power industry power station
Schlegel (UK) Ltd	Mid Bedfordshire	Other industries, di-isocyanate process
Mountstar Metal	Mid Bedfordshire	Metal production and processing, alloy
Transco Ltd	Huntingdonshire	Fuel and power industry, gas turbine
Anglian Water Services Ltd	Huntingdonshire	Activated Carbon Regeneration
Escol Products Ltd	Huntingdonshire	Mineral industry, glass production
National Power plc	North Hertfordshire	Other industry, timber processing

Table 4.12: IPC Authorisations by Industry Sector

Industry Sector	Number of IPC Authorisations
Fuel and Power production	3
Metal production & processing	1
Minerals (incl. cement)	3
Chemicals	1
Waste disposal and recycling	1
Other industries	3

Non-compliance with the conditions of an authorisation can result in enforcement action. Map 4.9 shows the location of IPC authorised processes in the LEAP area. Details of IPC authorisations are held on the Public Register at our regional office in Peterborough and on Public Registers held by the local authorities.

4.6 Radioactive Substances Regulation (RSR)

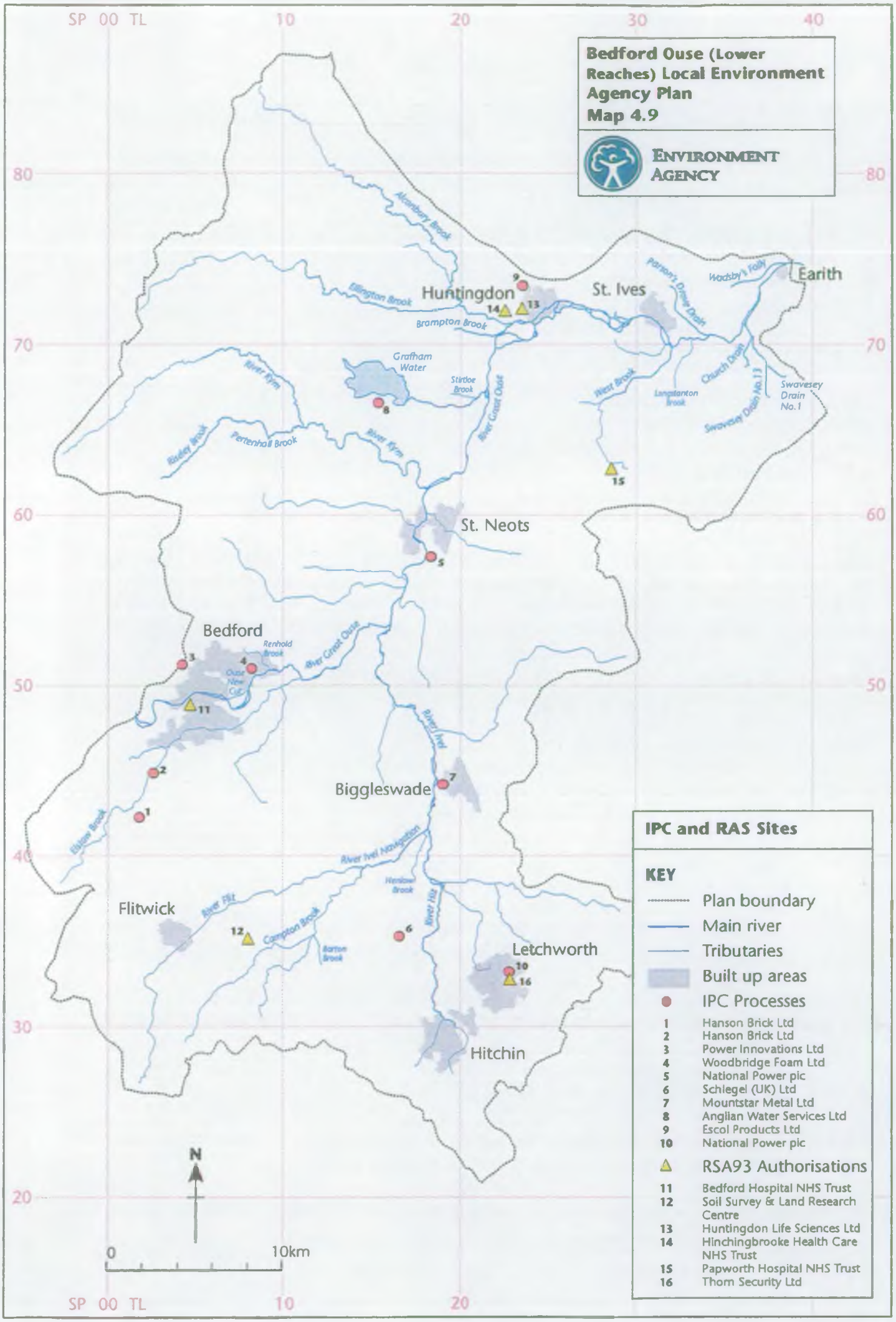
The Agency is responsible for regulating the storage, use and disposal of radioactive materials through the Radioactive Substances Act 1993 (RSA 93), as amended by EA95. Other legislation concerning radioactivity is regulated through the Health & Safety Executive (HSE), with whom the Agency maintains close liaison. There are three principles of radiological protection: justification, optimisation and limitation.

There are two main types of certificate granted in relation to RSA 93. Registrations are issued which regulate the storage and use of radioactive materials (including mobile sources). These tend to be associated with smaller users and are less environmentally significant since the radioactive substances are usually in sealed instruments. Authorisations are issued which regulate the accumulation and disposal of radioactive wastes and are usually associated with larger uses e.g. hospitals, universities and research facilities.

The RSA 93 authorisations in the LEAP area are shown in Table 4.13 and on Map 4.9.

Table 4.13: RSA 93 Authorisations

Operator Name	Local Authority
Bedford Hosptial NHS Trust	Bedford
Soil Survey & Land Research Centre	Mid Bedfordshire
Huntingdon Life Sciences Ltd	Huntingdonshire
Hinchingbrooke Health Care NHS Trust	Huntingdonshire
Institute of Terrestrial Ecology	Huntingdonshire
Papworth Hospital NHS Trust	South Cambridgeshire
Thorn Security Ltd	North Hertfordshire


Bedford Ouse (Lower Reaches) Local Environment Agency Plan
Map 4.9
Environment Agency
SP 00 TL
10
20
30
40
80
70
60
50
40
30
20
Huntingdon
St. Ives
Earith
St. Neots
Bedford
Biggleswade
Flitwick
Letchworth
Hitchin
Alconbury Brook
Ellington Brook
Brampton Brook
Grafham Water
Stirtloe Brook
River Ryrn
Ridley Brook
Perrenhall Brook
River Great Ouse
Parson's Drove Drain
Wadsby's Folly
West Brook
Langtanton Brook
Church Drain
Swavesey Drain No.1
Swavesey Drain No.1.3
Renhold Brook
Ouse New Cut
River Ivel
Elstow Brook
River Ivel Navigation
River Flit
Harlow Brook
Compton Brook
Barton Brook
N
0
10km
IPC and RAS Sites
KEY
Plan boundary
Main river
Tributaries
Built up areas
IPC Processes
1 Hanson Brick Ltd
2 Hanson Brick Ltd
3 Power Innovations Ltd
4 Woodbridge Foam Ltd
5 National Power plc
6 Schlegel (UK) Ltd
7 Mountstar Metal Ltd
8 Anglian Water Services Ltd
9 Escol Products Ltd
10 National Power plc
RSA93 Authorisations
11 Bedford Hospital NHS Trust
12 Soil Survey & Land Research Centre
13 Huntingdon Life Sciences Ltd
14 Hinchingbrooke Health Care NHS Trust
15 Papworth Hospital NHS Trust
16 Thorn Security Ltd

The non-nuclear use/source of radiochemicals in the LEAP area may be summarised as follows:

- Hospitals, academic and medical research;
- Industrial radiography;
- Sealed sources in measurement devices;
- Environmental tracers;
- Radioactively contaminated land; and
- Scrap metal recovery and recycling;

The Agency carries out a programme of inspections of all premises that hold RSA93 authorisations or registrations.

4.7 Special Waste

WASTE MANAGEMENT AND REGULATION

Sustainable development is at the heart of the Agency's plans for the management of waste. There has been and always will be discussion concerning waste management facilities such as what type they should be and where they are best located. The two main issues regarding waste are, firstly the efficient use of the resources needed to produce goods initially, the volumes we produce and consume and then the minimisation of the impact caused by the management of waste that is unavoidably generated.

The Government White Paper 'Making Waste Work' (DoE 1995) gave us the concept of a waste hierarchy with the objective of:

- reducing the amount of waste that society produces;
- making the best use of the waste that is produced;
- minimising the risks of immediate and future environmental pollution and harm to human health; and
- increasing the proportion of waste managed, by options towards the top of the waste hierarchy.

Taken together, these objectives define sustainable waste management as a concept that:

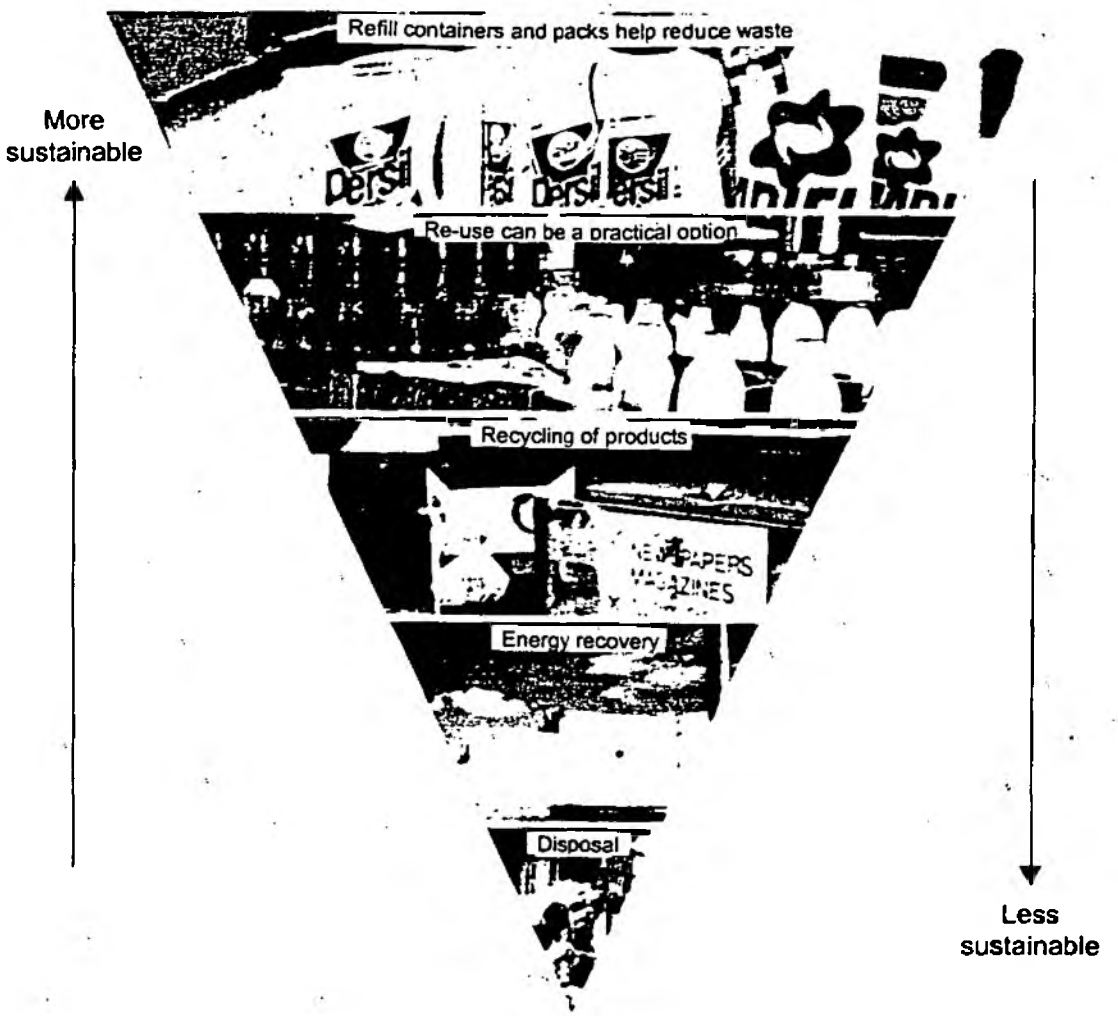
- uses waste to prevent or minimise the depletion of 'natural environmental capital'. This takes into account the substitution of fossil fuels with waste for energy recovery, the recycling and re-use of materials to a useful end product and the reduction of unnecessary waste transportation; and
- prevents long-term pollution effects of waste.

The Government has endorsed most of the principles in Making Waste Work but has taken a step further with the 1998 Green Paper 'Less Waste, More Value'.

The minimisation of waste sits at the top of the hierarchy of preferred waste management

solutions, followed by those options which recoup value, followed by final disposal. The overall aim of the strategy is to increase the proportion of waste managed by the options towards the top of the waste hierarchy. Figure 4.6 illustrates the waste hierarchy in order of sustainability.

Figure 4.6: Waste Hierarchy



The Agency works to promote waste minimisation, which is the reduction of waste at source, as it is preferable not to produce waste in the first place. However, the Agency recognises that there will be cases where the Best Practicable Environmental Option (BPEO) for particular wastes or locations will be lower down the hierarchy. The Agency is assisting the 'Bedlvel Waste Minimisation Club' that is run by Bedfordshire Business Link.

To help in assessing the options of BPEO the agency is carrying out an extensive programme of research and development into the environmental burdens and related impacts of waste management options from cradle to grave; this is known as Life Cycle Assessment (LCA). LCA allows the evaluation of environmental burdens associated with a product, process or activity by identifying and quantifying inputs to processes and

outputs to the environment, the impact of those inputs and releases on the environment, and to evaluate and implement opportunities to affect environmental improvements.

The Agency's role is one of regulator, data collector, information provider and impartial advisor. We are working with county councils (which in this LEAP area are Bedfordshire, Cambridgeshire and Hertfordshire) to take forward the concept of sustainable waste management. Any information the Agency supplies must take into account the needs of the different bodies and provide the data in a format that is of most use to them in discharging their duties. To enable us to achieve this we are currently working on the production of national estimates of controlled waste arising from industry and commerce; the 'National Waste Production Survey'. The type of information to be collected from this survey includes waste movements, existing facilities and their capacity, the relative environmental impacts of different types of waste when disposed of or recovered at different types of facilities. The results will be used to:

- inform the Secretary of State to enable him to prepare a statutory waste strategy in late 1999;
- assist Local Authorities in their consideration of regional planning guidance and preparation of development plans; and
- aid industry who develop and operate the waste treatment and disposal facilities.

Strategic Waste Management Planning is concerned with providing sound information and advice to assist decision making on waste management by the Agency, Local Authorities and the waste management industry.

More specifically, Waste Management Planning is concerned with:

- gathering information on the types and quantities of waste and their sources;
- gathering information on the availability and utilisation of waste management facilities;
- balancing the present and future waste management needs in relation to the waste types/quantities and facilities; and
- providing an assessment of the environmental and technical impacts of different waste management options for an area with a view to encouraging more sustainable waste management activities.

Prior to the creation of the Agency, Strategic Waste Management Planning was undertaken by Waste Regulation Authorities and manifested itself in Waste Disposal (Management) Plans required under Section 50 of the Environmental Protection Act 1990.

Information of this sort is of most use to the Planning Authorities as they prepare their waste development plans but is also of use to the other waste management aspects of local authorities (such as waste collection and disposal authorities) and the waste management industry.

The requirement to produce Waste Disposal (Management) Plans was repealed in April 1996. However, the responsibility for Strategic Waste Management Planning has

transferred to the Agency, and we are committed to the gathering and publication of information relevant to waste management decision-makers.

Under Article 7 of the Waste Framework Directive, the Government must produce one or more waste management plans including information on:

- the type, quantity and origin of waste to be recovered or disposed of;
- general technical requirements; and
- any special requirements for particular wastes.

In English law this requirement is now written into S44A of the Environmental Protection Act 1990 and provisions for the National Waste Strategy.

In July 1998, the Agency published a consultation paper setting out how we intend to improve the quality of information on waste and hence support the production of a National Waste Strategy. Central to this is:

- a national survey of waste generated by industry and commerce;
- a nationally consistent system of licence returns from waste management facilities;
- a national waste classification scheme; and
- a sound, scientific system for assessing the relative merits of dealing with wastes in different ways.

Strategic waste management planning information collected and analysed by the Agency will be published in the form of a Strategic Waste Management Assessment. There will be a Strategic Waste Management Assessment for each Planning Region.

The primary targets for the Waste Strategy are;

- to reduce the proportion of controlled waste going to landfill to 60 per cent by 2005; and
- to recover 40 per cent of municipal waste by 2005 which will include recycling, composting and energy from waste. The government will set targets for waste reduction by the end of 1998.

The Government's policies for waste management are underpinned by a legislative framework. This framework puts responsibility on nearly all parties involved in the production and ultimate fate of waste. In summary the key pieces of legislation from which we derive our duties and powers are:

- Control of Pollution (Amendment) Act 1989 [Registration of Waste Carriers];
- Environmental Protection Act 1990;
- Waste Management Licensing Regulations 1994 (as amended);
- Transfrontier Shipment of Waste Regulations 1994;
- Environment Act 1995;
- Special Waste Regulations 1996;

- Producer Responsibility Obligations (Packaging Waste) Regulations 1997; and
- The Sludge (Use in Agriculture) Regulations 1989.

Since the establishment of the Agency in April 1996, we have implemented, or been affected by, new legislative provisions which implement various aspects of UK and EU policy. These are the:

- Special Waste Regulations 1996;
- Producer Responsibility Obligations (Packaging Waste) Regulations 1997;
- UK Management Plan for the Export and Import of Waste; and
- Landfill Tax.

The Special Waste Regulations 1996 (SW Regulations) implemented the European Hazardous Waste Directive 91/689/EEC into UK Law and came into force on 1 September 1996. The purpose of the SW Regulations is to provide an effective system of control for wastes that are dangerous and difficult to handle, to ensure they are soundly managed from their production to their final destination for disposal or recovery. The system used for the control of movements of special waste is the consignment note procedure. A consignment note must accompany every movement of special waste. Prior to the movement of special waste, three days notice must be provided to the Agency.

The Transfrontier Shipment of Waste Regulations 1994 transposes Council Regulation (EEC) 259/93 (the Waste Shipments Regulation) into UK legislation. Transfrontier movements of potentially hazardous wastes (those that are designated as amber or red by the OECD – Organisation for Economic Co-operation and Development) require control. This control is effected by means of a system of notification between the competent authorities of the 'concerned countries' (exporting and importing countries and any countries of transit involved in a transfrontier movement of wastes). The competent authorities of the importing, exporting and transit countries are the regulatory authorities appointed by national governments. The competent authorities in the UK for dispatch and destination of the waste is the Environment Agency for England and Wales and the Scottish Environment Protection Agency for Scotland. The competent authority for the whole of the UK for transit is the Environment Agency.

The United Kingdom Management Plan for Imports and Exports of Waste sets out the Governments policies on exports out of and imports into the United Kingdom of waste for disposal and recovery. The plan incorporates technical guidance and assessment criteria designed to assist UK competent authorities in taking decisions on proposed shipments notified under Council Regulation (EEC) 259/93. The overriding objective of the plan is to ensure a high level of protection of the environment and human health at the same time ensuring a suitable balance whereby legitimate trade in waste, consistent with the of protection of the environment and human health, should be able to continue.

In the year April 1997 to March 1998 the Environment Agency Central Area granted consent to one notification which authorised a maximum of 75 tonnes of ashes and residues containing metal or metal alloy waste in 3 shipments to be exported out of the

LEAP area for recovery in Belgium.

Currently, figures for April 1998 to end January 1999 show that the Central Area Agency office has granted consent to one further notification in the LEAP area. This currently authorises a maximum of 80 tonnes of ashes and residues containing metal or metal alloy waste in 4 shipments to be exported out of the LEAP area for recovery in Belgium.

No applications for consent to import waste into the LEAP area, or to export waste for disposal out of the UK from the LEAP area, were made over the above time-periods.

The Producer Responsibility Obligations (Packaging Waste) Regulations 1997 are made under Sections 93-95 of the Environment Act 1995. These regulations work on the polluter pays principle and are aimed at encouraging business to recover value from products at the end of their life and support the 'Producer Responsibility Initiative' that was launched in 1993. These Regulations set the following targets for packaging waste that the UK must meet by 2001:

- between 50% and 65% to be recovered; and
- between 25% and 45% to be recycled, with a minimum of 15% of each material recycled.

The Agency's role is to register packaging waste producers and monitor performance against their obligations. There are nine companies registered with the Environment Agency that have their registered office in this LEAP area.

The Landfill Tax was introduced in October 1996 to ensure that the price of landfill waste disposal more accurately reflected its environmental impact. This has resulted in an increase in the cost of landfilling of waste due to stringent engineering requirements to help prevent pollution of the environment but it still remains the cheapest of the disposal options.

Through these Regulations the Government aims to:

- achieve a more sustainable approach to dealing with packaging waste;
- reduce the amount of packaging waste going to landfill; and
- implement the recovery and recycling targets in the EC Directive on Packaging and Packaging Waste (94/62/EC).

Other legislation that we will need to implement in the future includes:

- the draft Landfill Directive;
- the IPPC Directive (October 1999);
- the Directive on Disposal of PCBs and PCTs; and
- The implementation of Section 57 of the Environment Act 1995 (expected July 1999).

The Integrated Pollution Prevention and Control (IPPC) Directive comes into force from

31 October 1999. It is a policy to improve the standard of environmental protection and consists of preventing, reducing and eliminating pollution by giving priority to prevention at source and ensuring prudent management of natural resources, in compliance with the 'polluter pays' principle. The Directive covers emissions to all media (air, land and water), as well as heat, noise and vibration, energy efficiency, environmental accidents and site cleanup.

The Agency has existing responsibilities relevant to land contamination under its pollution control functions, or wider statutory powers. The implementation of Section 57 of the Environment Act 1995 (expected July 1999) will provide a new legal framework for dealing with contaminated land. Under this regime, the Agency will have new duties and powers that complement those of local authorities. These will include:

- provide information to local authorities on land contamination;
- ensure remediation of special sites;
- maintain register of special sites remediation;
- preparing a national report on the state of contaminated land;
- providing advice to local authorities on identifying pollution of controlled waters; and
- to provide advice to local authorities on the remediation of contaminated land.

Past industrial and waste disposal practices were often subject to fewer controls than they are today. Consequently, land contamination occurred through a mixture of accidental spillage, casual waste disposal practices during the normal operation of a factory or plant and a lack of awareness of potential longer-term impacts of their actions. If these practices occurred where groundwater was present there was the potential for contamination of the water source. The Agency carries out pollution prevention visits to encourage good practice for the prevention of future contamination issues.

We expect other measures to be forthcoming, including possible directives on:

- end of life vehicles;
- hazardous household waste;
- batteries;
- waste electrical & electronic equipment; and
- tyres.

The Waste Management Licensing Regulations (1994) aim to ensure that waste facilities do not cause harm to human health, do not pollute the environment nor cause significant detriment to local amenities. The number and type of licensed sites in this LEAP area are shown in Table 4.14:

Table 4.14: Number and Type of Licensed Sites

Site type	Number in LEAP area
Landfill (operational)	12
Landfill (non operational)	14
Civic Amenity Sites	7
Transfer Stations	23
Scrap Metal	18
Treatment	3
Incineration	2
Total Licensed Sites	79

Where it can be proven that the soil will be enhanced, there will be benefit to agriculture or ecological improvements and where no environmental harm or harm to human health will be caused as a result, some waste may be suitable for spreading on land. This activity is controlled by two sets of regulations, both of which are presently being updated. The spreading of sewage sludge is controlled under The Sludge (Use in Agriculture) Regulations (1989), which require that sludge and soil are tested before spreading to ensure that certain limits are not exceeded and that records are maintained by the sludge producer which detail where and how much has been spread. The use of other wastes on land is controlled by The Waste Management Licensing Regulations (1994), which require that certain information is provided to the Agency before spreading takes place. Levels of pre-notification are lower than expected and overall we have insufficient information to establish the level of compliance with both sets of regulations.

Our principle aim is to achieve a continuing and overall reduction in the impact of wastes on the environment and we balance our regulatory role with education and promotion of the waste hierarchy to achieve sustainability and meet the targets set by the Government.

4.8 Nature Conservation Targets, Policies and Strategies

Nature conservation targets, policies and strategies are set out in the Agency's 'Environmental Strategy for the Millennium and Beyond' and in 'An Action Plan for Conservation'. One of the Agency's immediate concerns is to enhance biodiversity. The Agency will:

STATUTORY SITES

- Agree conservation strategies and consenting protocols for river SSSIs by 1999;
- Play a full part in implementing the EU Habitats Directive, including completing the review of consents by 2004;

BIODIVERSITY

- Play a full and active part in delivering the UK's Biodiversity Action Plan (BAP) by

acting as the lead and/or contact partner for the chalk rivers plan, and for 12 species of aquatic animals and plants, including the otter, the water vole, and rare species of fish, and by acting as the 'lead partner', either singly or in collaboration with others, for 10 of them;

- Ensure that all aspects of the BAP are incorporated into the Agency's guidance and become part of its LEAPs;
- Implement a series of regional projects, in partnership with local conservation groups, to deliver biodiversity targets at specific sites;
- Allocate specific resources to conservation projects aimed at increasing biodiversity;
- Control eutrophication, where feasible, in order to enhance biodiversity;
- Improve the management of wetlands for conservation purposes;
- Use and promote best environmental practice for the protection and restoration of river habitats;
- Develop and set conservation criteria for all of the Agency's environmental licensing activities;
- Implement specific projects to restore habitats in rivers and lakes, increase the area of reed beds and other water plants, and improve river banks;
- Ensure that there is no deterioration in the quality of the aquatic environment in particular, and deliver significant improvements in river and still water quality by tackling diffuse pollution of them; and
- Carry out research into the management of species in the aquatic environment in order to meet fully all BAP targets.

LANDSCAPE AND NATURAL BEAUTY

- Continue to develop landscape assessment as a key tool for environmental appraisal; and
- Improve river landscapes wherever the opportunity arises, using native grasses, wildflowers and trees.

ARCHAEOLOGY AND HISTORICAL INTEREST

- Agree with English Heritage appropriate procedures for conserving historic features that may be affected by the Agency's activities.

4.8.1 Biodiversity Action Plans

Biodiversity Action Planning initiatives have begun in Cambridgeshire, Bedfordshire, Northamptonshire and Hertfordshire. The habitat and species action plans that are being produced for each county will identify specific objectives and targets, and Agency Conservation staff will hold further information on the BAPs as they become available.

The Cambridgeshire Biodiversity Habitat and Species Action Plans have already been drafted. The Agency is the lead organisation, or jointly responsible as a BAP partner, for various Cambridgeshire BAP objectives and targets. For example, Water Level Management Plans (WLMPs) are to be developed and implemented for each of the habitat

areas. Also, links will be maintained with, and wetland creation promoted, through the 'Wet Fens for the Future' initiative. Other responsibilities are summarised below.

FENS

- Rehabilitate priority sites by 2005. The aim of rehabilitation should be to recreate the situation found in the late 19th Century;
- Ensure appropriate groundwater quality and quantity for all existing fen sites by 2005;
- Encourage creation of fen on land of low conservation interest, especially in areas close to or abutting present fens;
- Maintain and strengthen populations of key BAP species associated with fens; and
- Conduct research into the effects of abstraction and water quality upon fen communities.

GRAZING MARSH

- Maintain the existing habitat area and quality in Cambridgeshire as a minimum;
- Rehabilitate grazing marsh that is considered to underperform with respect to nature conservation objectives;
- Continue creating grazing marsh from arable land in targeted areas;
- Restore flood meadows with appropriate water regimes, so that they become a predominant feature of river valleys;
- Promote flood plain grazing marsh as a priority habitat for Countryside Stewardship Scheme;
- Ensure that flood defence work is ecologically sensitive, and takes the needs of flood plain grazing marsh into account;
- Take account of conservation needs in catchment planning and water resource management;
- Continue to promote and develop an integrated approach to flood plain management, including grazing marsh restoration and management through LEAPs, taking account of the role of the habitat in flood alleviation as well as for nature conservation;
- Remedy summer flooding problem at the Ouse Washes; and
- Review existing abstraction licences affecting SPA/cSAC grazing marshes.

REEDBEDS

- Rehabilitate the priority areas of existing reedbed in Cambridgeshire (targeting those of two hectares or more) and maintain this thereafter by active management;
- Create 600 ha of new reedbed on land of low nature conservation interest by 2020 in Cambridgeshire. The creation should ideally be in blocks of at least 20 ha with priority for creation in areas near to existing reedbeds, linking the beds wherever possible;
- Encourage smaller scale reedbed creation, e.g. as part of water purification systems;
- Ensure that flood defence work is ecologically sensitive and takes the needs of flood plain reedbeds into account;
- Take account of conservation needs in catchment planning and water resource management; and
- Continue to promote and develop an integrated approach to flood plain management,

including reedbed restoration and management through LEAPs.

DESMOULIN'S WHORL SNAIL (*Vertigo moulinsiana*)

- Seek to ensure that local flood defence activities and water level management plans take account of the requirements of the species; and
- Seek to ensure that local water abstraction policies take account of the need to protect the snail.

SHINING RAM'S HORN SNAIL (*Segmentina nitida*)

- Identify any existing populations in Cambridgeshire (part of) by the year 2001.

RIBBON-LEAVED WATER PLANTAIN (*Alisma grammineum*)

- Monitor water quality at all known existing and potential sites.

Species action plans for the water vole, otter and white-clawed crayfish are in an early draft and local objectives and targets have not been set. A number of generic objectives and targets, derived from the national action plan, are included. The habitat action plan for chalk rivers is currently being drafted; contact the Environment Agency for further details.

WATER VOLE *(Arvicola terrestris)*

- To encourage re-establishment of water voles at restored sites and aim to ensure that they are present throughout their 1970s range by the year 2010;
- Over substantial areas of Cambridgeshire there has been no local survey to help identify key areas for water voles; this situation must be remedied. Key sites, especially in existing protected sites, should be monitored; and
- Encourage the publication of research papers and features in the popular press, magazines and the broadcast media to raise the profile of the species.

OTTER (*Lutra lutra*)

- to restore otters to all major river catchments by 2010; and
- Where otters are already known to be present in a catchment, to enable otter populations to increase and expand into new areas.

WHITE-CLAWED CRAYFISH (*Austropotamobius pallipes*)

- Attempt to maintain the present distribution of this species by limiting the spread of non-native species and by maintaining appropriate habitat conditions. In Cambridgeshire (part of) this will require surveys to establish the status of white-clawed and non-native crayfish; and
- Increase public awareness of the presence of this species in local rivers and the threats to its existence. Publicise the need for conservation and how the public can help by contributing records to the databases on distribution.

COMMUNITY INVOLVEMENT

Habitat and species action plans are evolving from a process involving many interest groups, such as farmers, wildlife trusts, local naturalists, government agencies, local authorities and individuals. The success of the BAP initiatives and implementation of the objectives and targets identified in the above HAPs and SAPs will ultimately depend on the co-operation and commitment of the community of the LEAP area.

VIEWPOINT 5: THE HEALTH OF THE ENVIRONMENT

5.1 Land and Groundwater Contamination

Land is a complex medium and its use will depend upon its physical and chemical properties. Sites may be affected by the presence of substances within the land. These may be natural, such as methane from coal measures or metals from mineral deposits, or may have been introduced by the activities of man. Past industrial and waste disposal practices were often subject to fewer controls than they are today and less account was taken of the by-products of manufacturing and extractive processes. Consequently, contamination of both land and groundwater has occurred. This has been through a mixture of accidental spillage, casual disposal during the normal operation of a factory or plant and a lack of awareness of potential long-term impacts of their actions.

Contaminated land in a general sense would include any site where non-natural materials have been introduced and are present within the ground. This definition would incorporate virtually the whole of the UK as most sites could be shown to have traces of man-made materials present within them. Section 57 of the Environment Act 1995 has therefore introduced a legal definition of 'contaminated land'. This new legislation focuses on sites that could cause problems in their current use. The implementation of Section 57 of the Act (expected in July 1999) will provide a new legal framework for dealing with contaminated land. Under this regime, the Agency will have new duties and powers that complement those of local authorities. These will include:

- providing information to local authorities on land contamination;
- ensuring remediation of special sites;
- maintaining a register of special sites remediation;
- preparing a national report on the state of contaminated land;
- providing advice to local authorities on identifying pollution of controlled waters; and
- providing advice to local authorities on the remediation of contaminated land.

Special sites are a sub-group of contaminated land sites; as defined in the regulations they include Ministry of Defence (MoD) sites and sites where water pollution with persistent toxic chemicals has taken place.

The Agency also has existing responsibilities relevant to land contamination under its pollution control functions and wider statutory powers.

Under the Water Resources Act 1991 the Agency has a duty to monitor and protect the quality of groundwater (Section 84) and to conserve its use for water resources (Section 19). The document 'Policy and Practice for the Protection of Groundwater' has been published describing the non-statutory policies that will be used in decision-making on groundwater issues. This document includes a definition of Source Protection Zones (SPZs), concepts of vulnerability and risk and a description of vulnerability of groundwater resources as well as the Groundwater Protection Policy Statements.

The Groundwater Directive 80/68/EEC exists to protect groundwater by preventing the entry of the most toxic (List I) substances into groundwater and restricting entry of other

harmful (List II) substances. The Government reviewed the existing legislation and decided to introduce new Groundwater Regulations to more effectively transpose the terms of the Groundwater Directive. The Regulations introduce transitional provisions on the 1st January 1999 with full implementation coming into force on the 1st April 1999. These regulations are likely to affect a wide sector of industry including premises or operations, which manufacture, handle, store or use List I or II substances where there is a risk of a discharge occurring. The agricultural sector will be affected where farmers dispose of waste pesticides and pesticide tank washings to land, including sheep dip, disposal of unused dilute pesticide, tank washings and washing water from equipment cleaning.

5.1.1 Natural Forces

Land is a key environmental resource. The nature and quality of land is fundamental in determining its use. Soil types will determine which agricultural practices predominate and soil stability, composition and chemistry will affect development. Soil types and geology also determine the presence or absence of groundwater and its vulnerability to contamination. If land and/or groundwater are contaminated it may put human health, surface water and groundwater, ecosystems and man-made structures at risk. The vulnerability of a groundwater source depends upon the natural characteristics of a site. It is assessed on the physical, chemical and biological properties of the soil and rocks beneath the site, which control the ease with which any unprotected hazard can affect groundwater.

The natural factors which together define the vulnerability of groundwater resources to a given pollutant or activity are:

- the presence and nature of overlying soil;
- the presence and nature of Drift deposits;
- the nature of strata; and
- the depth of unsaturated zone.

Any or all of these factors can be relevant in assessing a specific risk to groundwater resources. Criteria have been developed based on soil, geological and hydrogeological characteristics to identify vulnerability in each of the above factors. Together these factors define the vulnerability of all underground waters, whether they are exploited or not. (Refer to Section 4.4 for more detail.)

The northern half of the LEAP area is characterised by thick deposits of clay above limestones of Jurassic Age (Cornbrash and Blisworth Formations). There are no major aquifers in this part of the LEAP area, although sand and gravel deposits along the valley of the River Great Ouse and River Ivel are classified as minor aquifers.

The clay deposits in this area tend to contain contamination by inhibiting its migration and therefore protecting the underlying aquifers. For this reason, where the clays have been extracted (e.g. for brick-making) the resulting voids make good sites for waste disposal landfills.

In the south of the LEAP area the geology is different, with two major aquifers being present. The Woburn Sands outcrop in the Flitwick area across South Bedfordshire to Cambridgeshire, and the Chalk is exposed in north Hertfordshire. In these areas, infiltration and migration of contaminants are more likely. These aquifers are used for water supply including public drinking water supply.

The proximity of an activity to a groundwater abstraction is one of the most important factors in assessing the risk to an existing groundwater source. All sources, including springs, wells and boreholes, are liable to contamination and need to be protected. The Agency has designated SPZs around all large potable supply sources and those industrial sources used in commercial food and drink production (see Map 4.7). Three groundwater SPZs are recognised and the size and shape of these is due to such factors as soil type, geology, rainfall and the amount of water pumped from the source;

Zone I: (Inner Source Protection) is the area immediately adjacent to the source where any pollution incident would have the most immediate effect. It is defined by the area within which groundwater would reach the borehole within 50 days. This '50-day travel time' is based on the time normally taken for biological contaminants to decay.

Zone II: (Outer Source Protection) is larger than Zone I and is defined by a 400-day travel time which is based on the time required to provide delay and attenuation of slowly degrading pollutants.

Zone III: (Source Catchment) represents the complete catchment area of the source. Groundwater within this area will eventually arrive at the source.

The hydrogeological characteristics of the strata and the direction of groundwater flow determine the orientation, shape and size of the zones. The groundwater vulnerability for this LEAP area is shown on Map 4.6.

5.1.2 Societal Influences

Contaminated land is largely a historic feature. Past activities and industries will determine the nature and extent of contamination likely to be present in an area. Even though the LEAP area is predominantly rural, there are likely to be hundreds of sites that may fall within the legal definition of contaminated land. The Agency becomes aware of some of these sites through its other regulatory and advisory work. These sites include former gas works, fuel storage stations, vehicle depots, plating shops, landfill sites, pigment manufacturing plants, iron works, STWs, scrap yards and photographic manufacturers. Better information on the number and nature of sites within the LEAP area will become available following the implementation of Section 57 of the Environment Act 1995.

There is increasing public awareness of the issues relating to land contamination and this is likely to grow with implementation of the new regulations. Coupled with this is an ever-increasing pressure for development. Government policies are increasingly encouraging the re-use of previously developed brownfield sites. This relieves pressure on greenfield sites but

introduces many other strains into the planning and development process. Where brownfield sites are contaminated, there will be a requirement to clean these sites up to a standard appropriate for the proposed end use and to ensure that re-development does not result in the release of the contaminants into the wider environment.

Many human activities present a potential hazard to groundwater. In trying to assess the level of risk of contamination from any given activity in order to make judgements about its acceptability, it is necessary to assess the total exposure of the groundwater system to that hazard. Exposure of groundwater to hazard may be mitigated by preventative measures such as bunding of storage tanks, lining of landfills or by specific management practices.

Groundwater is vulnerable to pollution from activities such as spreading of sludges and manures. The predominant land use in the LEAP area is agriculture, the area of urbanisation being comparatively small. The LEAP area contains farmland, in the grades I-IV as classified by MAFF. Arable farming is the general rule with the fen deposits forming the highly productive Grade I land in the lowland part of the area. Agriculture is discussed in more detail in Viewpoint 2.2.

As required by the European Directive (EEC) No. 676/91, which is designed to protect water from nitrate pollution from agricultural sources, the Government has designated 68 areas in England and Wales as Nitrate Vulnerable Zones (NVZs). These zones cover the catchments of polluted waters where the nitrate limit of 50 mg/l set by the Directive at PWS sources has been exceeded, or in the case of groundwater, where exceedence is likely in the future. Within the NVZs, farmers will be required to implement 'action programmes' in order to reduce nitrate pollution. The measures will include limitations on the application of fertilisers and manures. The Agency has been designated as the competent authority with regard to enforcement of the action programme measures. The NVZs in this LEAP are shown on map 4.6.

Development and use of land is the one consistent element in the list of potential threats to groundwater quality. Land use planning policies and procedures therefore play a significant role in effective groundwater protection. This process begins at the Development Plan level. The Agency has incorporated groundwater protection objectives into its own model planning policies for Local Planning Authorities to consider as part of the development planning process. The three county Structure Plans that cover the LEAP area recognise the need for development to meet the requirements of a rising population, in terms of both housing and employment.

Many developments may pose a direct or indirect threat to groundwater resources. Where planning permission is required (e.g. for chemical stores, residential development, mineral extraction, industrial development) the only control is often by means of conditions on the permission document, an obligation (agreement or undertaking) under Section 106 of the Town and Country Planning Act (1990), or by refusal of permission. It is, therefore, important to recognise developments that may be a potential risk to groundwater.

The Agency's objective within any projected development growth will be to protect groundwater from pollution arising from that development. This is addressed by a presumption against development including changes in land use, which in the opinion of the Agency will pose an unacceptable risk to the quality of groundwater.

Two groundwater areas in the LEAP have been confirmed as contaminated under the Agency's existing powers and will need investigation under the new powers. These are at The Baldock Road borehole source at Letchworth and at the former landfill site at High Street, Flitwick. These sites may also meet the definition of contaminated land under Section 57 of the Environment Act 1995.

Land quality is a vital component of sustainable development and to progress in a sustainable manner, we cannot leave large quantities of land damaged, depleting its capability to fulfil its functions and meet our various needs. Bringing contaminated land back into beneficial use helps conserve land as a resource and reduces pressures on greenfield sites, thus conserving agricultural land and natural habitats.

The Agency's vision is to see more contaminated land made safe and brought back into beneficial use, and an integrated approach to preventing and controlling new land contamination.

5.1.3 Abstractions and Removals

Water abstraction is discussed in more detail in Viewpoint 1.1.

Industrial uses in this LEAP area include brewing, sugar refinement, cooling, vegetable washing, poultry processing, concrete manufacture, vehicle washing and food processing.

One of the Agency's objectives is to meet the water quality criteria set for industrial abstraction and to prevent abstraction having an adverse impact on water quality. Problems that exist within this LEAP area are:

- *Pesticides*: There are a few cases of contamination by pesticides. and their sources are difficult to define and in general are of diffuse origin, coming from both agricultural and non-agricultural sources;

- *Nitrates*: Some PWS sources have nitrate concentrations above the 50 mg/l limit set for human consumption. These are either blended (with cleaner water) or treated before supply. There are also private sources and wetland conservation sites where blending is not an option;

- *Solvents*: These are generally associated with military airbases, industrial areas and laundries. For example, the probable source of the contamination at the Baldock Road borehole source is the historical industrial presence in the local area causing land contamination that has resulted in pollution of the groundwater source.

5.1.4 Uses, Releases and Discharges

Groundwater makes up a very high proportion of the freshwater resources of England and Wales. Approximately 75% of all abstracted groundwater is used for public supply and it makes up 35% of the total public supply. Groundwater is also an important source for industry and agriculture as well as sustaining the baseflow of rivers.

Therefore, groundwater is not only protected to maintain water supplies from aquifers but also to sustain river baseflows. Its presence is often essential in supporting wetlands and their ecosystems. Removal or diversion of groundwater can affect total river flow; a reduction in either the quantity or the quality of the contributing groundwater can significantly influence surface water and the achievement of water quality standards. Surface water and groundwater are thus intimately linked in the water cycle, with many common issues.

Mineral extraction can affect both groundwater quantity and quality by restricting recharge to an aquifer and diverting flow. Where the near surface deposits have been removed e.g. by land filling and quarrying, the vulnerability of the aquifer to pollution increases. The purification that occurs as water percolates through the unsaturated zone cannot occur if the gravel strata have been removed. Subsequent use of mineral extraction sites for landfill also poses a significant threat to groundwater quality.

Under the Water Resources Act 1991, dewatering of mineral workings is exempt from the need to obtain an abstraction licence. However, under Section 30 of the Act, the Agency can issue a Conservation Notice to the mineral extraction company in order to conserve water in the dewatering process, but these powers are limited, and cannot be used to prevent mineral extraction.

The majority of quarry sites are found along the main river corridors where valley sands and gravel deposits are extracted. Limited chalk extraction occurs to the south of Bury St Edmunds, Brandon and Barton Mills. Peat is also extracted in some limited areas.

The majority of county councils within the Bedford Ouse LEAP have produced Mineral Plans as required under the Town and Country Planning Act 1990, in accordance with Planning Policy Guidance Note 12. The Agency, as a statutory consultee, makes representation to any Mineral Plans.

Through mineral extraction and changes in land use, humans can also affect the future availability of groundwater resources by restricting recharge and diverting flow. Demand for aggregates means that until well into the next century, extraction of sand and gravel will continue at least at the existing rate. There is a need to encourage a reduction in the use of primary aggregates by promoting efficiency and greater use of secondary waste and recycled products.

Whenever possible, groundwater resources must be conserved and protected and mineral workings operated within the guidance given in the Agency's Groundwater Protection Policy.

5.1.5. Waste Arisings and Disposal

Where contaminated land has been identified or re-development of a contaminated site is proposed, it is often necessary to undertake some clean-up of the site. Although methods of on-site treatment are becoming more advanced and more widespread, the most common approach is still to remove the contaminated soils for controlled landfill elsewhere. This practice is not sustainable and presents difficult regulatory decisions. The Agency would prefer, where practicable, to see the contamination dealt with *in situ*.

The risk of pollution to groundwater is increasing both from the disposal of waste materials and from the widespread use by industry and agriculture of potentially polluting chemicals in the environment. Pollution can occur either as discrete or point sources such as from the landfilling of wastes, or from the wider, more diffuse use of chemicals such as the application to land of fertilisers and pesticides.

In recent years there has been a major change in the philosophy of landfilling waste. Previously a policy of 'dilute and disperse' was applied: this assumed that any leachate generated could be accepted in an aquifer provided that no local use was threatened, taking into account attenuation mechanisms. Nowadays, all new sites taking any potentially polluting waste must be designed on a containment basis in order to protect all groundwater, as required by the EC Directive on the protection of groundwater quality.

The increasingly common practice of dewatering prior to commencement of landfill operations may have an impact upon the groundwater and surface water resources of an area. All sites must satisfy Regulation 15 of the Waste Management Licence Regulations 1994 in order to protect groundwater.

Leachate generated by the decomposition of wastes in landfill sites has the potential to contaminate ground and surface waters. This is more likely to be an issue at closed sites or the older parts of current sites which were filled when controls were not as stringent as they are today and no form of barrier was placed between the waste and the environment. A current holder of a Waste Management Licence for a landfill site is not able to surrender their licence unless the Agency is satisfied that certain conditions are met. One condition is that the site is unlikely to cause pollution of the environment or harm to human health; the licence holder will retain responsibility for the site until that time. Responsibility for sites that closed before 1995, when licences could be surrendered at any time, and even older sites, that operated when there was no requirement to be licensed, lies largely with the landowner.

Following the transfer of disposal responsibilities for domestic waste to the county councils in 1974, waste disposal was concentrated in fewer, larger sites, and it is these that may pose a longer-term risk to water quality rather than large numbers of small sites.

In practice, any disposal site in use prior to 1972 could have taken virtually any type of waste as there was no control of dangerous wastes, and the records for many sites are poor or non-existent.

Changes in society's expectations and quality of life during the last forty years have resulted in an exponential increase in waste arising from both domestic and commercial sources. We have become a 'throw away' society with consequent pressure to increase the provision of collection and disposal services and therefore locations. The Agency's response to this pressure is a multifunctional approach, which includes clarification and regulation of the legislative initiatives; this includes The Packaging Regulations 1997, the Waste Minimisation Strategy and the development of local project initiatives in partnership with others.

The baldock road borehole source at Letchworth continues to be out of use as a PWS source due to chlorinated solvent concentrations which exceed the water supply regulations standard. The most probable source of this is the historical industrial presence in the local area causing land contamination, which has resulted in contamination of the groundwater. There were extensive pollution prevention visits carried out during 1996 with substantial improvements to waste disposal systems and practices being introduced at relevant sites. This groundwater source is still monitored but no significant decline in the contamination has been recorded. The monitoring will continue on a twice-yearly basis.

The former landfill site at High Street, Flitwick, is monitored by the Agency for its impact on the groundwater. It is also a site that will meet the definition of contaminated land under Section 57 of the Environment Act 1995. The Agency is currently in consultation with the owners and the Local Authority with regard to future monitoring and options for remediation.

VIEWPOINT 6: AESTHETIC QUALITY

6.1 Landscape and Archaeology

Aesthetic qualities include the appearance of the landscape, the presence of archaeological and cultural elements and how people value the landscape. Although the Agency's landscape remit is limited to watercourses and their flood plains, its regulatory and operational responsibilities have a fundamental effect on the wider landscape. Litter and fly-tipping in urban and rural areas and the presence of sewage debris and foams in watercourses are unattractive and spoil people's enjoyment of their own surroundings and the areas they visit for recreational purposes.

The maximising of a river's recreational potential as one part of the rural environment can lead to economic and social benefits for the local area. Despite the considerable importance that the general public places upon the aesthetic qualities of the environment, there are few national programmes to assess current states and trends over time. Two programmes that have taken place are the Council for the Protection of Rural England's Tranquil Areas analysis and the Countryside Commission's Character Area maps provide an indication of trends and current states in the English Countryside.

CURRENT STATE

The current state of the landscape has been assessed and classified into Character Areas by the Countryside Commission. A character area is a geographic area with a distinct pattern or combination of landscape elements that occurs consistently within a defined area. A summary of the character areas for the LEAP area is given in Table 6.1 and these are shown on Map 6.1.

Table 6.1: The Character of the Bedford Ouse LEAP Area

Character Area (No.)	Natural Area	Character Area Description
Bedfordshire and Cambridgeshire Claylands (88)	West Anglian Plain (part of)	The Bedfordshire and Cambridgeshire Claylands lie between the Fens and the Chilterns with the Upper Thames Clay Vales to the south west and the Yardley-Whittlewood Ridge and Northampton Vales to the north. Chalk and limestone till, which gives rise to calcareous clay soils, underlies the area. To the east of Bedford and north of Shefford, the broader river valleys comprise well-drained soils over marine alluvial and river terrace gravels. The area has a gently undulating relief with plateaux divided by broad, shallow valleys and is characterised by arable cultivation. Woodland cover is generally sparse, resulting in an open landscape, although there are some plantations within the river valleys and small ancient woodlands scattered infrequently on the plateaux. The effects of clay extraction for the brick industry dominate a broad valley at Marston Vale. Chimney-stacks punctuate the skyline and large pits are often flooded for nature conservation value after extraction has ended.

Character Area (No.)	Natural Area	Character Area Description
Bedfordshire Greensand Ridge (90)	Bedfordshire Greensand Ridge	The Bedfordshire Greensand Ridge is a narrow elongated area that extends in a north-east to south-west direction from below Leighton Buzzard in Buckinghamshire, across Bedfordshire, to Gamlingay in Cambridgeshire and is encompassed by the Bedfordshire and Cambridgeshire Claylands. The outcrop of Greensand, interspersed with sandstone, forms a natural island that contrasts with the vales and low hills of the surrounding claylands, and gives rise to a variety of sandy, acidic soils. Boulder clay is located mainly on the crest of the ridge, but also forms a complicated mix with sandy soils in some other areas, giving rise to poorly drained soils. Both types of soils have a strong influence on the vegetation that occur in the area.
Chilterns (110)	Chilterns	The Chilterns form a belt of high ground stretching from Oxfordshire in a north-easterly direction, through Buckinghamshire and Hertfordshire to Bedfordshire. The area includes substantial low-lying settlements such as Luton, Dunstable, Hemel Hempstead and High Wycombe. The Chilterns are formed from an outcrop of chalk that is exposed on the smooth slopes of the valleys and on a steep scarp slope above Aylesbury Vale. The chalk strata of the plateau are overlain by extensive deposits of clay with flints and glacial drifts which give rise to acidic and calcareous soils. These soils contrast with the chalk soils of the valley floors and sides. A series of parallel river valleys flowing to the south east, together with numerous dry tributary valleys, dissect the plateau to form roughly rectangular blocks.
The Fens (46) (part of)	The Fens (part of)	The Fens cover the large area of Cambridgeshire, Lincolnshire, Norfolk and Suffolk that drains slowly towards the Wash, its boundaries typically drawn along a series of catchwater drains, dykes and canalised rivers. Glaciation is responsible for the scouring of the Fen Basin and the area now occupied by the Wash. The ice sheet deposited glacial sands and clays across the area, leaving a shallow basin in which peat and marine clays accumulated. These peat and clay deposits have largely given the area its distinctive character. The Upper Jurassic clays and limestones are rich in fossils and are of particular geological interest. With the subsequent rise in sea level since the last Ice Age and reclamation of land from the sea from Roman times, the balance of habitats and settlements found within the area have altered. Soils over the central and coastal fens are fertile, stoneless calcareous silty soil which those associated with inland fens consist of dark, friable fen peat. All the fens have artificial canalised courses, which run in straight lines for miles and are bounded by high embankments built to contain the watercourses from lower adjacent fields.
East Anglian Chalk (87) (part of)	East Anglian Chalk (part of)	The East Anglian Chalk lying within Cambridgeshire, Bedfordshire, Hertfordshire and Essex forms a narrow, easterly extension of the Chilterns. The area is bounded to the north-west by The Fens and the Bedfordshire and Cambridgeshire Claylands, and to the south-east by the South Suffolk and North Essex Clayland. Breckland and the Chilterns form the northern and southern boundaries of this area respectively.

Character Area (No.)	Natural Area	Character Area Description
Yardley-Whittlewood Ridge (91) (part of)	Yardley-Whittlewood Ridge (part of)	The Yardley-Whittlewood Ridge area is located between Northampton and Bedford, running on a south-west to north-east axis. The Northamptonshire Vales bound the area to the north with the more open landscape of the Bedfordshire and Cambridgeshire Claylands to the south. The underlying geology is dominated by glacial till with a high chalk content giving rise to fertile soils suitable for the extensive arable cultivation that dominates the area. River valleys of the Ouse tributaries bisect the area and provide a contrast to the landscape of the gently undulating ridge. The area is well endowed with historic parklands and broad-leaved woodlands, historically used for hunting deer.

TRANQUIL AREAS

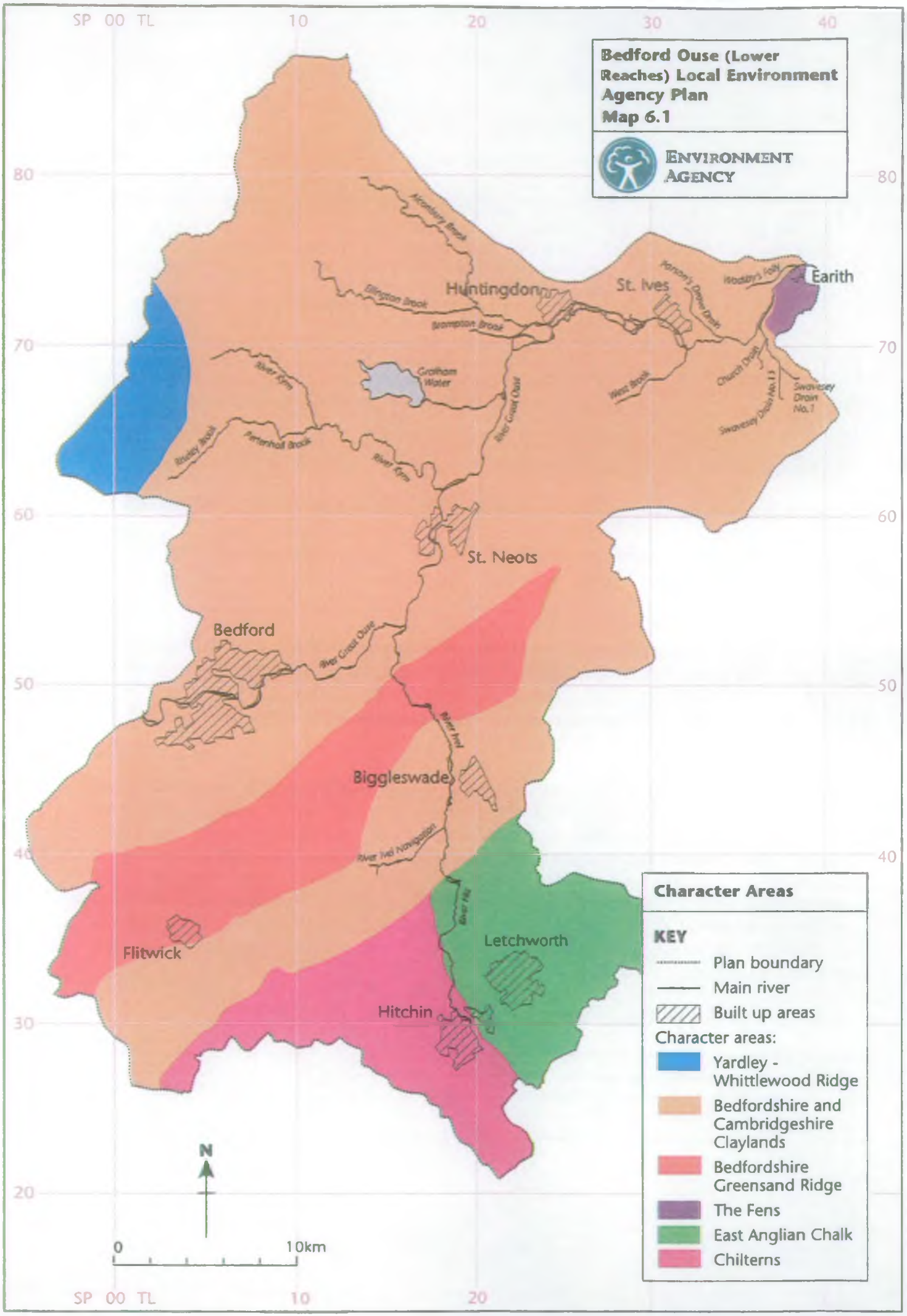
The Tranquil Areas concept was developed by the Countryside Agency. It describes areas that are sufficiently distant from the visual or noise intrusion of development or traffic to be considered unspoilt by urban influences. Tranquil Areas are determined by considering the distances from various disturbance criteria. To be 'tranquil', an area must be at least:

- 4 km from the largest power station;
- 3 km from the most highly trafficked road, large town and major industrial area;
- 2 km from most other motorways and major trunk roads such as the A1 and from the edge of smaller towns;
- 1 km from medium disturbance roads and some main line railways; and
- beyond military and civil airfield/airport noise and extensive opencast mining.

The Tranquil Areas analysis was carried out at a regional level by comparing data from the early 1960s with that from the early 1990s. Regional maps were produced illustrating the percentage change over the period; data is not available for individual counties. The LEAP area falls into both the East Anglia and East Midlands regions. The regional change in tranquillity has been used as a proxy to represent the changes in the LEAP area. The LEAP area has undergone development changes, such as road building, increases in traffic flow, and the expansion of settlements, consistent with the two regions as a whole. Table 6.2 illustrates the declining areas of tranquillity in the LEAP area by comparison with the estimated situation in the early 1960s:

Table 6.2: Changes in Tranquil Areas in the LEAP Area

	PERCENTAGE OF REGION WHICH IS TRANQUIL		
Region	**1960s**	**1990s**	**Percentage Change**
East Anglia	72	64	-8
East Midlands	70	56	-14


Bedford Ouse (Lower Reaches) Local Environment Agency Plan
Map 6.1
Environment Agency
SP 00 TL
10
20
30
40
80
70
60
50
40
30
20
Huntingdon
St. Ives
Earith
St. Neots
Bedford
Biggleswade
Flitwick
Letchworth
Hitchin
Grafham Water
River Great Ouse
River Ivel
River Kym
Brampton Brook
Ellington Brook
Alconbury Brook
Ruddy Brook
Pertenhall Brook
West Brook
Church Drain
Swavesey Drain No.1
Swavesey Drain No.1.1
Forson's Drove Drain
Hoddy's Hole
River Ivel Navigation
N
0
10km
Character Areas
KEY
Plan boundary
Main river
Built up areas
Character areas:
Yardley - Whittlewood Ridge
Bedfordshire and Cambridgeshire Claylands
Bedfordshire Greensand Ridge
The Fens
East Anglian Chalk
Chilterns

In the western part of the plan area, including the areas around Bedford, tranquil areas have declined by 14% since the 1960s. The eastern part of the LEAP area has seen an 8% decrease. The reduction in tranquil areas has occurred as a result of new developments, including the construction and upgrading of new roads such as the A14 and A1 and the general increase in traffic on the road network. The expansion of settlements and industrial sites into their rural hinterland, such as those at Bedford, St Neots, Huntingdon and Hitchin has also contributed to the overall loss of tranquillity. In contrast, the cessation of flight operations at airfields such as Alconbury and Molesworth would increase tranquillity in these areas.

ARCHAEOLOGY AND CULTURAL HERITAGE

The heavy soils and dense woodland of the claylands deterred prehistoric farmers and Roman settlers, who first congregated along the lighter soils in the valleys of the rivers Great Ouse and Ivel. Archaeological evidence is abundant in these valleys, including the use by Viking ships of the Great Ouse as far upstream as Willington (east of Bedford), where there is evidence of a harbour and docks. The first Roman and medieval settlements were at the river crossings of the Ouse, including Huntingdon/Godmanchester, St Ives and St Neots.

With the improved ploughs of the Middle Ages, the population pressure grew on the higher, heavier claylands and the pattern of agricultural landscapes developed. Many settlements from this time have subsequently either shrunk or been deserted, which has led to a richness of archaeology in a more sparsely populated landscape. Remains include moated sites, deserted villages and ruined or isolated churches, such as Bushmead Priory.

In comparison with the adjacent claylands, the poor fertility and lightness of the Greensand Ridge soils led to the attraction of the area for the creation of parkland estates, where hunting formed an important activity. The mosaic of medium- and large-scale woodlands, fields and pasture around the larger houses is still retained and gives the impression of stepping back into an earlier century, as at Old Warden.

Some of the estates are retained in their traditional form, for example, Southill, where the Whitbread family is the owner. Specialist users have also arisen; for example, Sandy Lodge is where the Royal Society for the Protection of Birds (RSPB) have their headquarters, set in the grounds of acidic woods and heathland. Through the 20th century, considerable afforestation using conifers has taken place at Millbrook. Increased public access through the creation of country parks, Forestry Commission woodland and the Greensand Ridge Way, which follows the length of the ridge, have widened the public perception of this relatively private landscape.

In the north of the LEAP area around Earith and Needingworth there is a small area of Fenland. The human history of the Fens has been a battle of man against the forces of nature to bring out the full agricultural potential of the land. Much of the early archaeological evidence is now becoming apparent with shrinking peat levels exposing well-preserved remains from the Bronze Age.

This rich archaeological heritage is reflected in the large number of Scheduled Ancient Monuments (SAMs) (see Map 6.2) and Conservation Areas that have been designated in the plan area.

LANDSCAPE ASSESSMENTS

Cambridgeshire County Council, with the assistance of the Countryside Commission and local authorities, produced 'The Cambridgeshire Landscape Guidelines' in 1991, to provide guidance to individuals and organisations that manage or impact on the landscape. The Guidelines also constitute supplementary planning guidance. Local nature conservation groups have also undertaken landscape assessments.

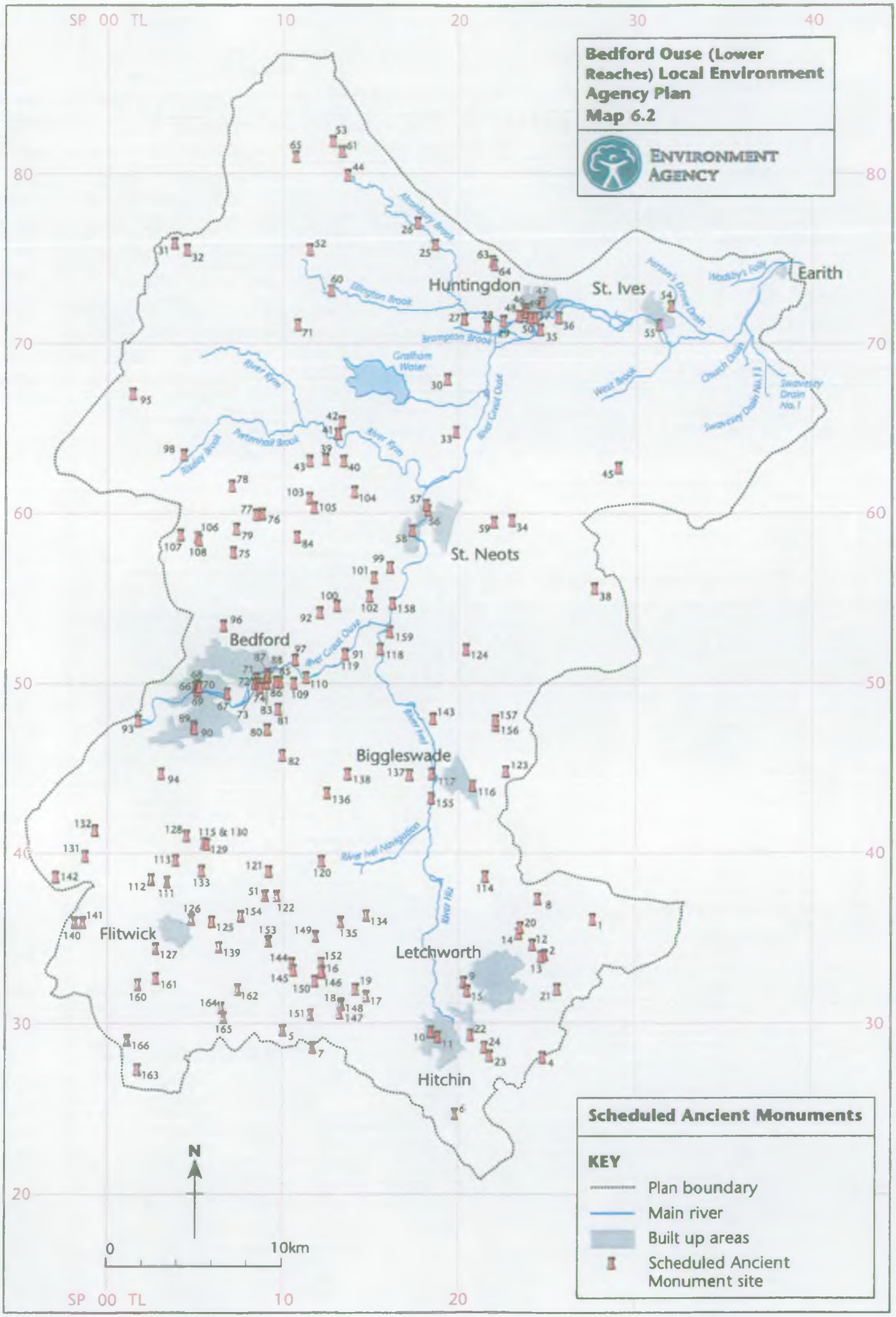
6.1.1 Natural Forces

The weather can affect the appearance of the landscape; for instance, the "hurricane" of October 1987 felled millions of trees. The outbreak of Dutch elm disease in 1970s and 1980s also had a major impact on many woodlands and hedgerows.

6.1.2 Societal Influences

From shortly after the end of the last Ice Age (~10 500 years ago), man has modified the landscape of the LEAP area. In particular, the 20th century has seen an acceleration of these modifications. Some of these modifications are summarised below:

- Agricultural intensification and farm amalgamation, particularly to create larger arable fields;
- Loss and fragmentation of habitats, including grassland, ponds, ditches, spinneys and hedgerows due to new infrastructure and agricultural practices;
- Creation of open water-bodies, most notably Grafham Water;
- Development along transport and infrastructure corridors e.g. M1, A1 and A14;
- Sprawl and coalescence of towns and settlements, often in river valleys;
- Growth of horticulture and associated glasshouses in the Ivel valley. Subsequent decline of smallholdings. Growth of 'pony paddock' culture, stables and residual areas on the edges of villages and towns, creating a piecemeal appearance;
- Reduction of heath habitats by coniferisation and neglect leading to scrub invasion;
- Past and continuing shrinkage, oxidation and wind erosion of peaty fens due to drainage and cultivation;
- Dyke and embankment upgrading to aid flood protection. Some over-management of ditches, reducing aquatic and marginal vegetation;Severance of rivers from their flood plains by flood defence structures; and
- Light pollution resulting from intensive agriculture and growth of settlements - particularly apparent in the flat terrain of the Fens.


Bedford Ouse (Lower Reaches) Local Environment Agency Plan
Map 6.2
Environment Agency
SP 00 TL
10
20
30
40
80
70
60
50
40
30
20
Huntingdon
St. Ives
Earith
St. Neots
Bedford
Biggleswade
Flitwick
Letchworth
Hitchin
Alconbury Brook
Ellington Brook
Brampton Brook
Graham Water
River Kym
Pertenhall Brook
Ridley Brook
River Great Ouse
West Brook
Church Drain
Swavesey Drain No.1
Swavesey Drain No.1 3
Forty's Drove Drain
Hobby's Folly
River Ivel
River Ivel Navigation
River Hiz
N
0
10km
Scheduled Ancient Monuments
KEY
Plan boundary
Main river
Built up areas
Scheduled Ancient Monument site

Key to Map 6.2 Schedule Ancient Monuments

1 Two bowl barrow at Bygrave
2 Late Iron Age and Roman Settlement Clothall
3 Moated Site - Clothall
4 Chesterfield Church, Graveley
5 Ravensburgh Castle - Langley
6 Minsden Chapel - Langley
7 Barrow & Telegraph Hill - Lilley
8 Ring ditch and enclosure - Newnham
9 Wilbury Hill Camp
10 21a Bancroft - Nitchin
11 Manor House Galleries, Bancroft
12 Settlement site - Blackhorse Farm
13 Romano - British Settlement - Clothall
14 Barrow - S of Radwell
15 Ickleford Bowl Barrow
16 Pirton Grange moated enclosure
17 Toot Hill Motte and bailey castle and shrunken medieval village at Pirton
18 Bowl Barrow at Knocking Knoll
19 Moated site/enclosure at Rectory Farm - Pirton
20 Roman Villa - S of Bury Farm, Radwell
21 Henge NW of Bush Wood - Weston
22 Rowan Villa
23 Wymondly priory, barn, moat, associated earthworks, enclosures, platforms, hollow way and conduit head
24 Great Wymondly Castle: a motte and bailey castle and associated memorial enclosure
25 Alconbury Bridge
26 Footbridge at W end of Alconbury Weston
27 Sites discovered by aerial photography N of Brampton
28 Milestone at Bell End
29 The Nun's Bridge, Hinchingbrooke
30 Buckden Palace
31 Keyston Tumuli, NW of Manor Farm
32 Site of Old Manor House, Keyston
33 Deserted village of Boughton, NW of Manor farm, Diddlington
34 Site of deserted village at Weald
35 Moated site SE of St Mary's Church, Godmanchester
36 Site N of Rectory Farm, Godmanchester
37 Huntingdon Bridge
38 Great Gransden Windmill
39 Two barrows adjoining Fox Covert, Gt Staughton
40 Roman Site, Rushey Farm
41 Village Cross, Gt Staughton
42 Staughton Green, Moated Site
43 The Old Manor House, Cretingsbury, a motte castle and moated manor house
44 Hamerton Bridge
45 The maze and monument on Hilton Green
46 St Johns Hospital, Huntingdon
47 Earthworks E of Huntingdon Cemetry
48 Earthwork on Mill Common, Huntingdon
49 Huntingdon Town Hall
50 Huntingdon Castle (Castle Hills): a motte and bailey castle and civil war fieldwork
51 Castle Hill Kimbolton Park
52 Earthworks SE of Church, Leighton
53 Site of deserted village at Little Gidding
54 Obelisk - Stocks Bridge
55 Priory Barn - remains Benedictine Priory
56 St Neots Priory
57 The Maltings (Kiln)
58 The Hillings: ringwork castle
59 Deserted village at Wintingham
60 Spaldwick Bridge
61 Site of deserted village at Steeple Gidding
62 Stow cross
63 Tumulus, E of Ermine Street
64 Tumulus, W of Ermine Street
65 Moated site and medieval village at Winwick
66 Remains of the George Inn
67 Site of Newnham Priory
68 Medieval lime kiln off Castle Lane
69 Bedford Bridge
70 Bedford Castle motte and bailey
71 Mortuary enclosure NW of Octagon Farm: part of a Neolithic and Bronze Age mortuary complex
72 Barrow and mortuary enclosure WNW of Octagon Farm: part of a Neolithic and Bronze Age mortuary complex
73 A barrow NW of Octagon Farm: part of a Neolithic and Bronze Age mortuary complex
74 A mortuary enclosure W of Octagon Farm: part of a Neolithic and Bronze Age mortuary complex
75 Mavoum moated site, with associated fishponds, enclosures and deserted settlement site
76 Turnpike farm moated enclosure and associated cultivation earthworks
77 Manor Farm iron Age univallate hillfort and medieval moated enclosure
78 College Farm moated site and associated banked enclosure and fishpond
79 Greensbury Farm moated site
80 Site discovered by aerial photography S of village
81 Settlement site N of Chapel End Farm
82 Manor Farm moated site
83 Neolithic and Bronze Age mortuary complex NW of Octagon Farm
84 Manor Farm moated, enclosure, fishponds and fowling earthworks
85 Two barrows NE of Octagon Farm: part of a Neolithic and Bronze Age mortuary complex
86 A barrow N of Octagon Farm: part of a Neolithic and Bronze Age mortuary complex
87 Three barrows and a rectilinear enclosure NNW of Octagon Farm: part of a Neolithic and Bronze Age mortuary complex
88 Mortuary enclosure NNWof Octagon Farm: part of a Neolithic and Bronze Age mortuary complex
89 The Moot Hall
90 Elstow Manor House (remains of)
91 Barford Bridge
92 Brichfield Farm moated site and associated fishponds and leats
93 Paved ford SE of Kempston Church
94 Kempston Hardwick moated site
95 Yielden Castle: a motte and bailey castle, fishponds and associated enclosures
96 Earthworks on Mowsbury Hill
97 Howbury ringwork and medieval trackway
98 Hall Close moated site, fishponds, trackway, field system and dovecote
99 Moated enclosure and associated building platforms, the Lane, Wyboston
100 Palaceyard Wood medieval moated enclosure and associated enclosures, woodland bank and cultivation earthworks
101 Chawston Manor moated site and associated fishpond
102 Bowl barrow, known as the 'Round Hill' WNW of College Farm
103 Buchmead Priory (uninhabited parts)
104 Bassmead Manor farm moated enclosure
105 Moated site known as 'The Camps' and associated fishpond
106 Thurleigh churchyard cross
107 Blackburn Hall moated site, associated fishponds and quarries
108 Bury Hill Camp: a motte and bailey castle with three fishponds
109 Willington stables and dovcote
110 "The Ducks" moated site and dock
111 Pump and signpost in Market Place
112 Ampthill Castle: A medieval magnate's residence
113 Houghton House: a 17th century mansion and associated courtyard and formal garden remains
114 Astwick Bury moat and associated moated mound
115 Long barrow SE of Bury Farm
116 Stratton Park moated ecnlsoure and associated manorial earthworks
117 A ringwork and bailey castle, ring ditch and enclosures E of Brookland Farm
118 Blunham Bridge
119 Barford bridge
120 Chicksands Priory and Orangery
121 Old St Mary's Church
122 Cainhoe Castle: a motte and bailey with associatd moated site, fishponds and field system
123 Newton Bury moated site
124 Story Moates moated enclosure, outer enclosures, drainage leats and ponds
125 The De Grey Mausoleum
126 Moated site a Ruxox Farm
127 The Mount: a motte and bailey castle
128 Moated site and two fishponds at the rectory
129 Long barrow SE of Bury Farm
130 Bowl barrow SE of Bury Farm
131 Medieval village and moated sites at Thrupp End
132 Moat Farm moated enclosure and associated settlement earthworks
133 Bolebec Farm moated enclosure, associated platforms and enclosures
134 St Thomas's Chapel
135 'The Hills' motte and baileys
136 Warden Abbey
137 Moated site, near Hill House
138 Quince Hill ringwork
139 Upbury moated site and associated fishponds
140 All Saints Church, Segenhoe
141 Malting Spinney medieval moat, associated outer enclosure and cultivation eartchworks
142 Ringwork at The Round House, Brogborough Park Farm
143 Iron Age camp on Galley Hill
144 Castle mound (The Camp)
145 Settlement site S of The Camp
146 Pirton Grange moated enclosure and associated settling pond, Pirton
147 Bowl barrow in Tingley Field Plantation, near Pegsdon
148 Bowl barrow at Knocking Knoll, E of Pegsdon Common Farm
149 Moated site at Church Panel
150 Apsley Bury moated site and fihspond S of Apsley End
151 Moated site in Pegsdon belt
152 Moated site N of Apsley End
153 Wrest Park 18th century outbuildings, statues and gardens
154 Newbury Farm moated enclosures and their associated fishponds and leats
155 Holme Mill Iron Bridge
156 Sutton Packhorse bridge
157 John O'Gaunt's Hill
158 Tempsford Bridge
159 Gannocks castle moated site
160 Wood End moated site
161 Moated site and fishponds SE of Westoning Manor
162 Moated site at Faldo Farm
163 Fishponds SE of Chalgrave Manor
164 Moated site at Bury Farm
165 Sharpenhoe Clappers: an Iron Age promontory fort, medieval warren and associated medieval cultivation earthworks
166 Conger Hill, a motte and bailey castle

6.1.3 Abstractions and Removals

Wetland habitats were affected during the recent drought years when there was limited water supply from rainfall and reduced spring flows from groundwater. It is recognised that for particular sites, over-abstraction may be an issue and studies are underway to assess the possible impact (refer to Viewpoint 4.1). In addition to the ecological impacts, the loss of wetland habitats is a significant landscape impact as these features are a valued component of the landscape.

Extensive sand, gravel and clay extraction operations have taken place in the Ouse Valley and the Marston Vale. The cumulative effects of these activities have resulted in a change to the landscape character of the river valleys.

6.1.4 Waste Arisings and Disposal

Disposal of waste in landfill sites, often as an after-use to extraction projects, has taken place in river valleys of the plan area. Waste disposal sites change the appearance of the landscape and if not adequately designed and integrated into the landscape can generate significant landscape impacts.

6.1.5 Uses, Releases and Discharges

Discharges from STWs can have a negative impact on water quality and the aesthetic value of the river. Sewer outfalls with little screening, macerating of waste or treatment may release organic (including faecal) and inorganic matter into the river which can be deposited onto the riverbanks and/or give rise to unpleasant smells.

6.1.6 Illegal Practices

The principal illegal practice affecting the landscape is the fly-tipping of waste in rural and urban areas. These activities spoil the environment and people's enjoyment of the landscape.

6.2 Navigation

The Agency operates a licensing system for all boat users on the Great Ouse System. Over 3,000 boats are registered with the Agency in Anglian Region. There is over 66 km of navigable river available to boaters in this LEAP area (see Map 2.3).

We manage our navigation responsibilities as an integral part of the river basin management process, balancing the demands with the capacity of the environment. Sluices and other control structures maintain the required water levels for navigation (see Map 2.3 for their location).

CURRENT STATE

Pleasure boating is the main recreational activity on the river - particularly during the summer months - consisting of both privately owned boats and hire craft. Most boat owners are members of a local boat club and are represented by the Great Ouse Boating Association (GOBA).

The most popular stretch of river extends from Eaton Socon to Earith, and enables boaters to explore some of the most traditional landscapes of East Anglia. These are important for their nature conservation value in an area rich in historical and visual appeal. Popular destinations on the river include the market towns of St Neots, Huntingdon and St Ives as well as a number of popular riverside public houses and restaurants. Boaters are well catered for along this stretch of river with a number of Agency and GOBA moorings and numerous marinas, some of which have pump-out facilities and drinking water points.

Canoeing is another popular recreational activity on the river. It takes place throughout the navigable length of the river, although it is discouraged at weirs and sluices on safety grounds. The River Bedford Ouse contains Britain's first artificial white water slalom course located near Cardington Lock, which has proved to be a great success.

6.2.1 Natural Forces

The peak navigation season on the Bedford Ouse is from Easter to late September/early October. Boating in the winter period is regularly hindered by high flows; navigation is closed when the flow at Offord increases to 40 cubic metres per second.

During the widespread flooding of Easter 1998, navigation on the Bedford Ouse was closed for a number of weeks. Navigation is closed firstly for the safety of boaters, and secondly in preparation for utilising the locks for flood flow discharge. Following the Easter floods, the Bedford Ouse was fortunate in avoiding any significant damage to its locks and control structures. However, extensive shoaling occurred at a number of locations that reduced navigation depths; when appropriate these locations have been dredged. During periods of low flow, navigation of the river can also become difficult and more sediment can be deposited on the river bed.

6.2.2 Societal Influences

The Agency, through its capital expenditure programme, continues to provide and enhance waterside facilities for boaters. Working in partnership with GOBA, local marinas and boating interests, we have provided additional moorings, together with water and pump-out sites. These improvements, together with a promotional strategy, should encourage boaters to make the best use of the rivers in this LEAP area.

The river's levels and flows are controlled by weirs and sluices; the operation of these structures, which allow navigation, also help create the typical habitat and character of a slow-flowing lowland river. One effect of the 1998 Easter floods has been to instigate a review of

all our controlling structures (this was a recommendation of the Bye Report). This may identify the need to repair or replace some of the structures. The collapse of any structure would have serious implications for navigation, in addition to damage to wildlife, habitats and other recreational uses.

Historically, more of the rivers in the LEAP area were navigable. For example, navigation on the River Ivel from Tempsford to Shefford ceased in the late nineteenth century due to lack of industrial traffic. There are numerous organisations interested in restoring navigation routes throughout England and Wales. The Agency broadly supports these initiatives; however, justifying the level of financial support required and potential environmental impacts will prove to be the major obstacle.

Navigation structures can pose an obstruction to canoeists wishing to navigate the river. The Agency has a continual programme of providing canoe portage facilities around navigation structures. During 1998, the Agency provided several facilities along the Bedford Ouse River. We are currently liaising with the British Canoe Union regarding access matters.

Last financial year the Agency installed lock security devices at six locks throughout the area and further key-locking security boxes are planned for Godmanchester, Bedford and Brownshill Locks. Many of these locks have become prone to vandalism over the last few years and it is hoped that the extension of the key-locking system will help to alleviate such problems.

Last year the Agency deployed Enforcement Officers on the river most weekends throughout the summer. The officers were armed with speed guns to check boat speeds and reduce the speed of boats. Speeding boats not only cause environmental damage through increasing water turbidity and bank erosion through increased wash, but also present a real danger to moored craft.

6.2.3 Abstractions and Removals

During periods of low flow, navigation of the river can become difficult. As well as more sediment deposited due to the reduced velocity of the river, water levels can also be affected by major abstractions of water from the river. Due to the presence of old structures in the watercourse between St. Neots and Offord abstraction by Anglian Water at the Offord intake to fill Grafham Water can affect the depth of water available for navigation. This is a very difficult situation and requires careful management. Anglian Water have been co-operative in changing the pumping regime to attenuate changes in water level but the long-term solution will be to remove the old structures in the watercourse.

6.2.4 Uses, Releases and Discharges

The Bedford Ouse between St Neots and St Ives is the most popular stretch on the Great Ouse system with an estimated 10-30,000 boat passages per year. The Agency has a programme of lock enlargements on the Bedford Ouse. In previous years, St Ives, Houghton, Brampton and Eaton Socon locks have been enlarged to reduced congestion and waiting times and to allow

the passage of larger boats. The next locks scheduled for enlargement on the Bedford Ouse are at St Neots and Offord.

6.2.5 Waste Arisings and Disposal

Rubbish disposal from boaters has become an increasing problem due to lack of suitable disposal facilities. The facilities that are available cannot cope with demand and quickly overflow. Last year, the Agency provided rubbish disposal facilities during the navigation season at St Neots, Offord, St Ives and Hermitage locks and at Hemingford Grey village. These sites, along with potential new sites, will be used again during the forthcoming boating season.

6.2.6 Illegal Practices

Agency Enforcement Officers were out on the river most weekends during the summer of 1998. During the blitz, 1760 boats were checked. Of these boats, 60 were not registered and subsequently 40 boat owners registered their boats with the Agency. These staff will also investigate speeding offences and occurrences where boats stay for extended periods on 48-hour moorings.

6.3 Recreation

Household expenditure on recreation, entertainment and education has increased substantially in the last 30 years or so, reflecting the rise in household disposable incomes over this period. Part of this increase in recreational expenditure relates to time spent in the freshwater environment, consisting mostly of walking, angling and watersports. Within the Bedford Ouse area:

- extensive lengths of riverbank are actively fished with over one million anglers buying a licence annually;
- it is estimated that people enjoying water-based recreation make 180 million day-visits each year;
- there are 190km of coarse fisheries in the Bedford Ouse LEAP Area and a number of stillwater and commercial fisheries;
- several water parks offering a range of water-based recreation, such as Grafham Water; and
- long-distance footpaths such as the Ouse Valley Way and Kingfisher Way.

With respect to recreation, the Agency has a number of legal duties. We should:

- make best use of Agency land;
- have regard for areas of natural beauty and buildings or sites of historic interest when undertaking our work;
- maintain and improve public access to inland waters; and
- promote the use of water and associated land as an amenity.

The Bedford Ouse and its tributaries are a valuable recreational resource, renowned for its history, nature conservation and visual appeal. The river is a popular venue for those interested in angling, walking, boating, rowing, canoeing, wildlife and many other recreational activities.

6.3.1 Natural Forces

The character of the river will determine the range and intensity of its recreational use. The Bedford Ouse and Ivel are the most popular angling venues. The access for anglers is generally good with footpaths along riverbanks and flood plain on either side of the river permits safe fishing. There have been circumstances where anglers in order to fish at water level have excavated steps or areas to sit down into the actual bank. The Agency advises anglers to refrain from this activity since it undermines the flood defence integrity of the bank and increases erosion and siltation in the river.

We currently work with angling clubs to improve access to the river; appropriate advice is provided and fishing platforms and gates have been installed where a high priority need is identified. There are also lengths of flood bank in the area which the Agency has a duty to maintain; grass mowing keeps public rights of way open and at certain locations will assist with angling access.

Angling can be affected by weed growth in the summer. The Agency undertakes cutting of macrophytes and algae removal where there is a risk of flooding or where navigation is affected and we try to ensure, where possible, that the cut will benefit angling. It is a sensitive balance to extract enough weed from around angling pegs to improve an angler's 'swim', whilst retaining enough marginal habitat for the resident fish and other aquatic wildlife. There is evidence that some waters in the LEAP area suffer from eutrophication and weed growth. Symptoms observed have included algal blooms, excessive filamentous algal growth and fluctuations in the diurnal dissolved oxygen. In such cases, fish become stressed, to the detriment of the fishery.

The LEAP area contains numerous flooded gravel pits, which are rich in wildlife and provide venues for still water anglers. The fishing ranges from syndicate waters with only a few specimen-sized fish to heavily-stocked commercial ventures.

There are a number of riverside and country parks close to the major market towns along the river, allowing visitors to see the aquatic environment at close quarters. Of particular note is Hinchingbrooke Park and Paxton Pits Nature Reserve.

Two long-distance footpaths follow two of the main rivers in the area. The Ouse Valley Way runs from Eaton Socon to Earith and passes through St Neots, Huntingdon and St Ives and the Kingfisher Way follows the Ivel valley from Baldock to Tempsford, passing through Biggleswade and Sandy.

The Agency owns lengths of riverbank on the lower Bedford Ouse and over the summer months we cut the terrestrial bankside vegetation. This is primarily for flood defence

operations; however, it will retain access for the general public. Where statutory public rights of way exist, we work with the local authorities to ensure the footpaths and bridleways remain open, whilst considering the conservation value of our riparian land.

6.3.2 Societal Influences

The Bedford Ouse LEAP area offers a wide range of angling opportunities for the region's anglers. The River Bedford Ouse is fished by nearly 30 different clubs; those with the longest bank lengths are London Anglers Association (AA), Biggleswade, Hitchin and District AA and St Neots and District Angling Society (AS). The Agency leases its land between Needingworth and Earith to Over and Swavesey AS. The River Ivel is fished by 12 angling clubs, most of who are affiliated to the Ivel Protection Association. Shefford and District AA are the principal club on the Ivel Navigation.

Generally, access is good for anglers in this area. The Agency has installed some angling platforms on a particularly steep section of flood bank near Over on the Bedford Ouse and we are currently assessing the availability of locations for disabled anglers, with particular emphasis on town centre locations. We intend to install platforms at Huntingdon Riverside Park and hope to identify further sites for future work. Map 6.3 details the river and stillwater angling clubs.

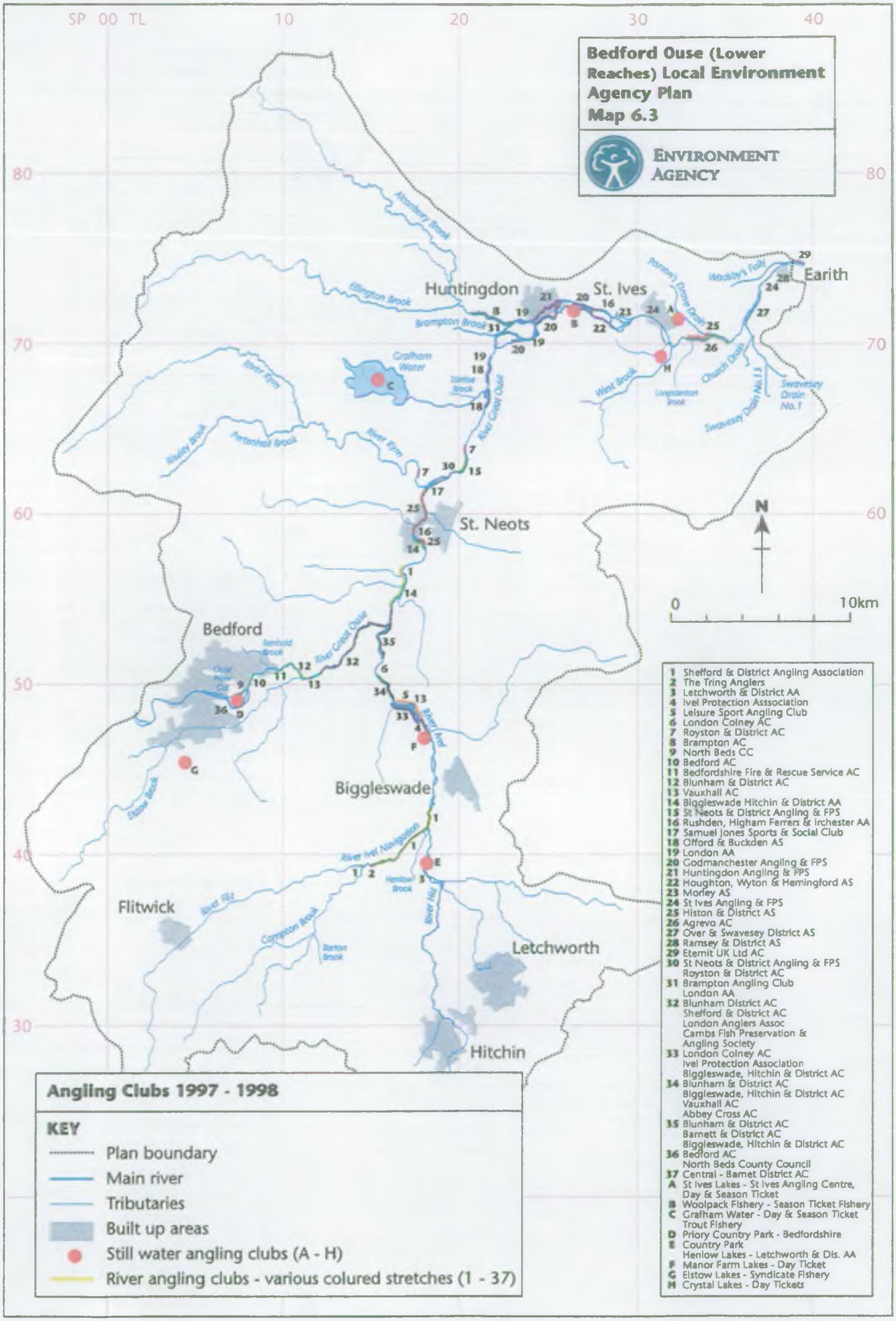
There are ten notable stillwater fisheries in the area. Most sell day tickets and are stocked with mixed coarse species or are carp-only waters. Grafham Water is a put-and-take trout reservoir.

Grafham provides facilities for sailing and wind surfing, other lakes in the area offer water-skiing and jet-skiing. Speed restrictions mean that these activities do not occur on rivers in the LEAP area. Canoeing and rowing is also a popular recreational activity on the Bedford Ouse with numerous rowing clubs along the river as well as opportunities to hire rowing boats and canoes for the day. Map 6.4 shows the water related recreation sites in the Bedford Ouse area.

The Agency discourages swimming in all rivers due the risk of drowning and of contracting water-borne diseases.

Houghton Mill, a National Trust property and the last example of a working water mill on the Bedford Ouse, is currently undergoing a refurbishment. The Agency is a partner in the £1.5 million scheme that has attracted Heritage Lottery funding. The mill is having its waterwheel reinstated and a water turbine is being installed which will provide an interesting comparison between new and old water use in the upgraded visitors centre.

The Ouse River valley and the stillwaters provide locations for birdwatchers, picnickers, and dog-walkers throughout the year.

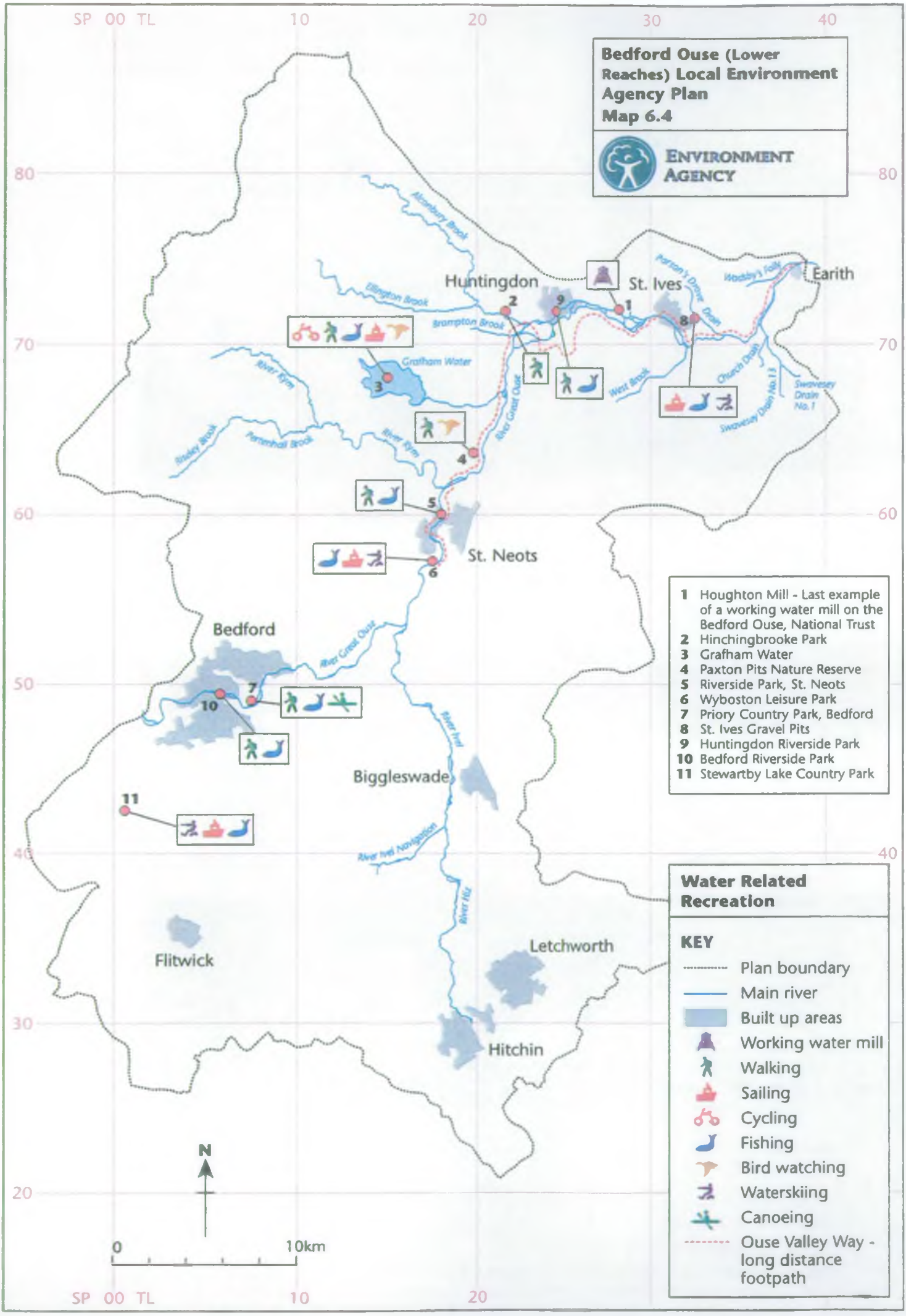


1 Shefford & District Angling Association
2 The Tring Anglers
3 Letchworth & District AA
4 Ivel Protection Asssociation
5 Leisure Sport Angling Club
6 London Colney AC
7 Royston & District AC
8 Brampton AC
9 North Beds CC
10 Bedford AC
11 Bedfordshire Fire & Rescue Service AC
12 Blunham & District AC
13 Vauxhall AC
14 Biggleswade Hitchin & District AA
15 St Neots & District Angling & FPS
16 Rushden, Higham Ferrers & Irchester AA
17 Samuel Jones Sports & Social Club
18 Offord & Buckden AS
19 London AA
20 Godmanchester Angling & FPS
21 Huntingdon Angling & FPS
22 Houghton, Wyton & Hemingford AS
23 Morley AS
24 St Ives Angling & FPS
25 Histon & District AS
26 Agrevo AC
27 Over & Swavesey District AS
28 Ramsey & District AS
29 Eternit UK Ltd AC
30 St Neots & District Angling & FPS
Royston & District AC
31 Brampton Angling Club
London AA
32 Blunham District AC
Shefford & District AC
London Anglers Assoc
Cambs Fish Preservation & Angling Society
33 London Colney AC
Ivel Protection Association
Biggleswade, Hitchin & District AC
34 Blunham & District AC
Biggleswade, Hitchin & District AC
Vauxhall AC
Abbey Cross AC
35 Blunham & District AC
Barnett & District AC
Biggleswade, Hitchin & District AC
36 Bedford AC
North Beds County Council
37 Central - Barnet District AC
A St Ives Lakes - St Ives Angling Centre, Day & Season Ticket
B Woolpack Fishery - Season Ticket Fishery
C Grafham Water - Day & Season Ticket Trout Fishery
D Priory Country Park - Bedfordshire
E Country Park
Henlow Lakes - Letchworth & Dis. AA
F Manor Farm Lakes - Day Ticket
G Elstow Lakes - Syndicate Fishery
H Crystal Lakes - Day Tickets

Angling Clubs 1997 - 1998

KEY

- Plan boundary
- Main river
- Tributaries
- Built up areas
- Still water angling clubs (A - H)
- River angling clubs - various colured stretches (1 - 37)


Bedford Ouse (Lower Reaches) Local Environment Agency Plan
Map 6.4
Environment Agency
SP 00 TL
10
20
30
40
80
70
60
50
40
30
20
Huntingdon
St. Ives
Earith
St. Neots
Bedford
Biggleswade
Flitwick
Letchworth
Hitchin
Alconbury Brook
Ellington Brook
Brampton Brook
Grafham Water
River Kym
Bradley Brook
Perrenhall Brook
River Great Ouse
Hobbey's Folly
Parson's Drove Drain
West Brook
Church Drain
Swavesey Drain No.1
River Ivel
River Ivel Navigation
River Hiz
1 Houghton Mill - Last example of a working water mill on the Bedford Ouse, National Trust
2 Hinchingbrooke Park
3 Grafham Water
4 Paxton Pits Nature Reserve
5 Riverside Park, St. Neots
6 Wyboston Leisure Park
7 Priory Country Park, Bedford
8 St. Ives Gravel Pits
9 Huntingdon Riverside Park
10 Bedford Riverside Park
11 Stewartby Lake Country Park
Water Related Recreation
KEY
Plan boundary
Main river
Built up areas
Working water mill
Walking
Sailing
Cycling
Fishing
Bird watching
Waterskiing
Canoeing
Ouse Valley Way - long distance footpath
N
0
10km

6.3.3 Abstractions and Removals

The sensitive restoration of mineral extraction sites can enhance the environment and/or provide water-based recreation. This is discussed in more detail in Viewpoint 2.

6.3.4 Uses, Releases and Discharges

When eutrophication happens as a result of nutrient enrichment excessive growth of algae or other aquatic plants can occur. It can result in a range of effects, such as, clogging of the waterways and sluices, a reduction in the enjoyment of water sports, deoxygenation of water-bodies and fish kills. In extreme cases, blooms of toxic blue-green algae can cause illness or death of wild, farm and domestic animals. Eutrophication is discussed in more detail in Viewpoint 4.

6.3.5 Illegal Practices

Pollution incidents will affect the quality of the water and discourage people from taking part in water-based recreation, as well as having a detrimental impact on habitat and wildlife.

Most anglers and other participants in water-based recreational pursuits will take their litter home and therefore not have a detrimental impact on the local environment. The danger to certain animals and the general unsightliness is well known, but these messages need to be reinforced.

APPENDICES

APPENDIX A: GEOLOGY AND HYDROGEOLOGY

The solid geology of the area (refer to Map A1) consists of the Combrash and Blisworth Formations and Oxford and Ampthill Clays from the Jurassic period, and Woburn Sands, Gault Clay and Chalk from the Cretaceous period. These strata dip gently (2°) to the south-east (see Map A1: Generalised Cross Section).

The Oxford Clay consists predominantly of pale grey, calcareous, silty mudstones with minor calcareous siltstones. The low discontinuous ridge of Woburn Sands extends from Shefford to Gamlingay, dividing the Jurassic clays from the Cretaceous Gault Clay. The Woburn Sands (formally known as Lower Greensand), overlying the Jurassic strata, are medium- to coarse-grained sands, with discontinuous layers of iron-cemented sandstone and Fuller's earth. The Gault Clay is comprised of pale- to medium-grey calcareous mudstones. The Chalk is a well-bedded, calcium-rich limestone with layers of flint nodules and marl.

Glaciation has left the LEAP area partially covered by deposits of chalky boulder clay, with glacial sand and gravel deposits in a channel running north from Hitchin to Sandy. Minor faulting has displaced the Chalk near the Hitchin-Stevenage Gap at the southern end of this channel. Elsewhere, the river valleys are lined by sand and gravel deposits of fluvial origin.

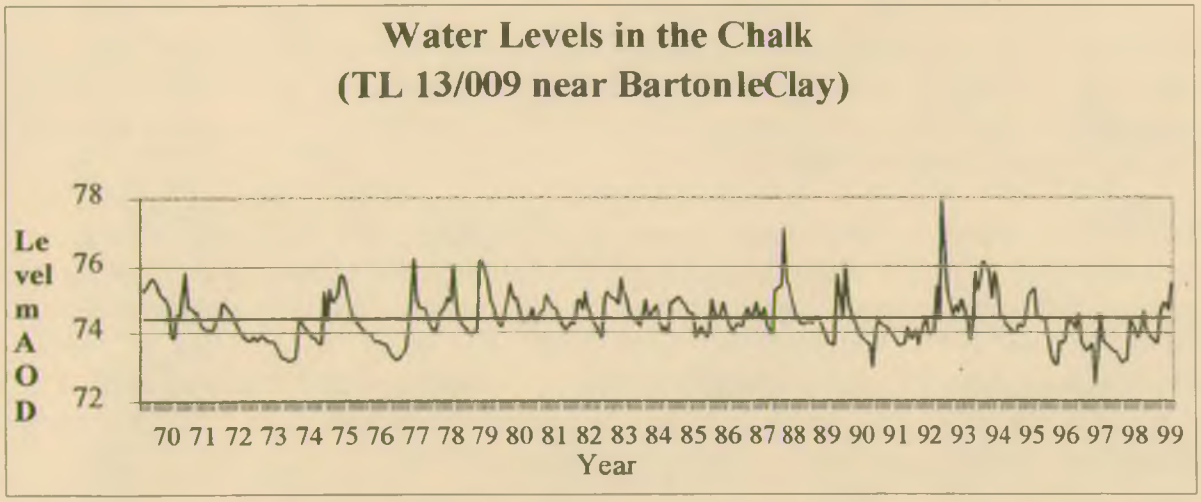
HYDROGEOLOGY

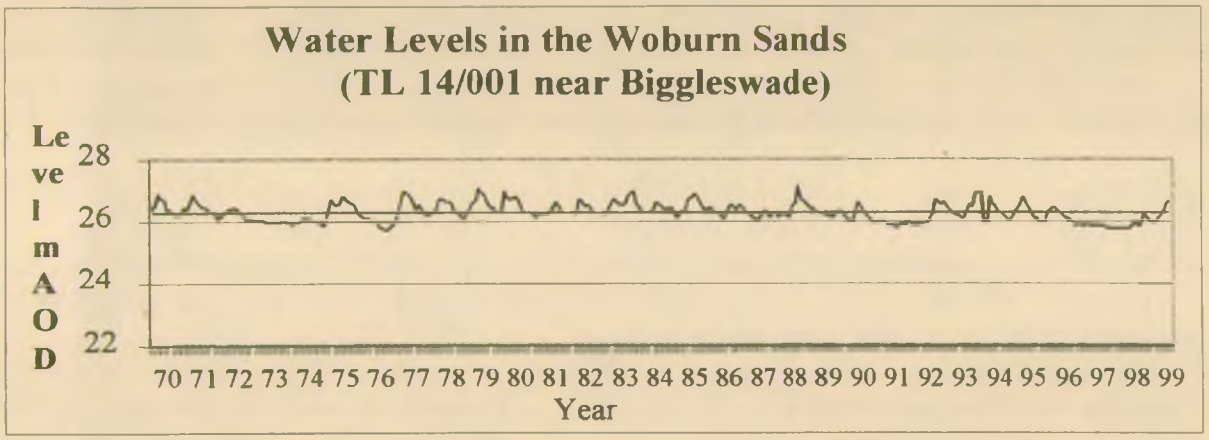
Groundwater occurs in saturated rocks known as aquifers. The principal aquifers of the region are the fractured Chalk aquifer and the intergranular Woburn Sands. Sand and gravel deposits also form aquifers that can be locally important.

These aquifers are recharged during periods of high rainfall where the rocks are exposed at the surface, or are covered by permeable deposits, which allow infiltration of water to the aquifers below. The partial cover of boulder clay and the Gault Clay to the south-east limits recharge to the Woburn Sands. The Chalk is also covered by boulder clay at the south-east edge of the LEAP area.

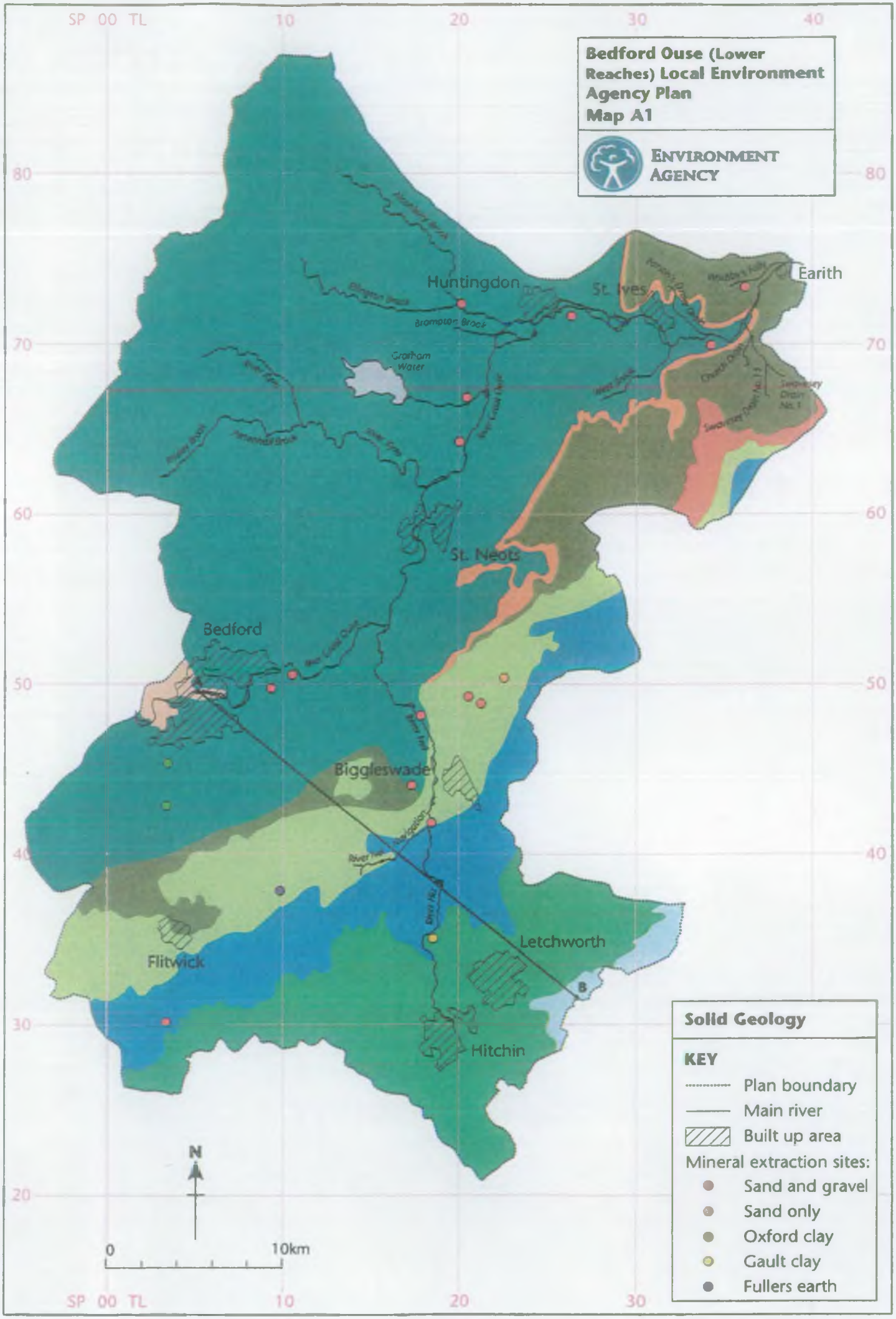
Unconfined groundwater levels in the Chalk and Woburn Sands show marked annual and seasonal fluctuations in response to rainfall and infiltration, reaching a spring peak in about April and their lowest levels in the autumn. Groundwater levels are also affected by abstraction from boreholes and if aquifers are in hydraulic continuity with any nearby surface water sources. Figures A1 and A2 below show groundwater levels in the chalk and Woburn Sands between 1970 and 1999:

Figures A1 and A2: Groundwater levels in the Chalk and Woburn Sands



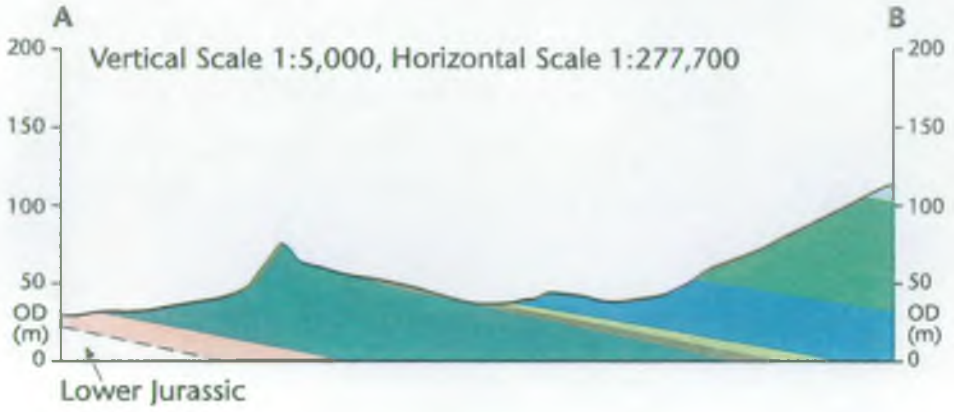


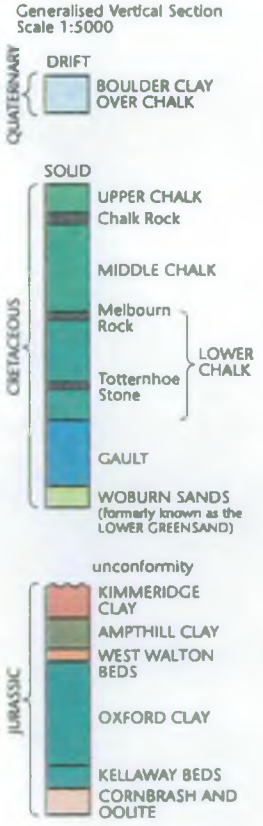
The average is indicated by ————————


Bedford Ouse (Lower Reaches) Local Environment Agency Plan
Map A1
Environment Agency
SP 00 TL
10
20
30
40
80
70
60
50
40
30
20
Huntingdon
St. Ives
Earith
Grafham Water
St. Neots
Bedford
Biggleswade
Flitwick
Letchworth
Hitchin
N
0
10km
Solid Geology
KEY
Plan boundary
Main river
Built up area
Mineral extraction sites:
Sand and gravel
Sand only
Oxford clay
Gault clay
Fullers earth

Bedford Ouse Lower Reaches LEAP
Map A1
Generalised Cross Section

ENVIRONMENT AGENCY





APPENDIX B: WATER QUALITY

Class Limits for Biological Classification

Water Quality	Biological Class	RIVPACS Ratio for ASPT	RIVPACS Ratio for taxa
Very Good	a	1.00	>0.85
Good	b	0.90	0.70
Fairly Good	c	0.77	0.55
Fair	d	0.65	0.45
Poor	e	0.50	0.30
Bad	f	-	-

General Quality Assessment (GQA)

Chemical Grading for Rivers and Canals

Water Quality	Grade	Dissolved oxygen (% saturation) 10-percentile	Biochemical oxygen demand (ATU)[1] (mg/l) 90-percentile	Ammonia (mgN/l) 90-percentile
Very Good	A	80	2.5	0.25
Good	B	70	4	0.60
Fairly Good	C	60	6	1.30
Fair	D	50	8	2.50
Poor	E	20	15	9.00
Bad	F[2]	-	-	-

[1] as suppressed by adding allyl thio-urea
[2] quality which does not meet the requirements of Grade E in respect of one or more determinands

Pollution Incident Classification

Category	Description
1	Persistent effect ≥1 week, closure of abstraction (pollution reached or near), >100 fish deaths of notable species, excessive consent breach + environmental impact, extensive remedial measures, affect on amenity value and effect on conservation value
2	Notification of abstractors (precautionary closure), 10-100 fish deaths of notable species (lower limit can be reduced if species of particular importance (eg, migratory salmonids), readily observable effect on invertebrate life, water judged unfit for stock watering, stream bed heavily contaminated and reduction in amenity value.
3	Notification of abstractors not necessary, fish kill <10, no observable effect on invertebrates, OK for stock watering, stream bed locally contaminated (at discharge point) and minimum environmental impact.
4	No evidence of pollution incident.

River Ecosystem Classification

Water Quality	Class	DO % saturation 10%ile	BOD mg/l 90%ile	NH_3-N mgN/l 90%ile	Un-ionised NH_3-N mgN/l 95%ile	pH 5%ile to 95%ile	Hardness mg/l $CaCO_3$	Dissolved CU µg/l 95%ile	Total ZN µg/l 95%ile
Very Good	RE1	80	2.5	0.25	0.021	6-9	≤10 >10 and ≤50 >50 and ≤100 >100	5 22 40 112	30 200 300 500
Good	RE2	70	4.0	0.6	0.021	6-9	≤10 >10 and ≤50 >50 and ≤100 >100	5 22 40 112	30 200 300 500
Fairly Good	RE3	60	6.0	1.3	0.021	6-9	≤10 >10 and ≤50 >50 and ≤100 >100	5 22 40 112	300 700 1000 2000
Fair	RE4	50	8.0	2.5	-	6-9	≤10 >10 and ≤50 >50 and ≤100 >100	5 22 40 112	300 700 1000 2000
Poor	RE5	20	15.0	9.0	-	-	-	-	-

APPENDIX C: GLOSSARY AND ABBREVIATIONS

Glossary

Above Ordnance Datum	Land levels are measured relative to the average sea level at Newlyn in Cornwall. The average level is referred to as 'Ordnance Datum'. Contours on Ordnance Survey maps of the UK shows heights in metres above Ordnance datum.
Abstraction	The removal of water from any source, either permanently or temporarily.
Abstraction Licence	A statutory document issued by the Agency to permit removal of water from a source of supply. It is usual for both daily and annual limits to be set.
Algal blooms	Rapid growth of phytoplankton in marine and/or fresh waters, which may colour the water and may accumulate on the surface as a green scum. Decomposing cells consume large quantities of oxygen in the water, which may result in the water becoming anaerobic. Some blooms (such as certain species of blue-green algae) may also be toxic.
Alluvial	Sedimentary deposits resulting from the action of rivers. Typically composed of fine-grained material (eg, silt) carried by the river and deposited in areas such as floodplains.
Aquifer	A water bearing-stratum situated below ground level. The water contained in aquifers is known as groundwater.
Arable Stewardship	A MAFF pilot scheme which offers payment to arable farmers in parts of East Anglia and the west Midlands to manage their land in ways which encourage wildlife.
Awarded Drains	Awarded watercourses are classed as non-main river and their maintenance responsibility usually rests with the local district council.
Biochemical Oxygen Demand	A standard test which measures over 5 days the amount of oxygen taken up by
Biodiversity	Diversity of biological life; the number of species present.
Biomass	Total quantity or weight of organisms in a given area or volume, eg, fish biomass is measured as grams per square metre (gm^{-2}).
Borehole	Well sunk into water-bearing rocks.
Boulder Clay	Rock-type deposited under glaciers as they move. It consists typically of a mixture of rock fragments, clay, sand and gravel.
Brownfield Site	Old housing or industrial area currently unused but which could be redeveloped for housing and ancillary development.
Brundtland Report	Report of the 1987 World Commission on Environment and Development.
Buffer Strip	Strip of land 10–100 m wide, which is used and managed to provide appropriate habitat types.
Catchment	An area of land which collects and drains the water which falls on it. It is usually composed of a single river system and its tributaries
Coarse Fish	Freshwater fish other than salmon and trout.
Combined Sewer Overflow	An overflow structure that permits a discharge from the sewerage system during wet weather conditions. It consists of both foul and surface water discharge.
Controlled Waste	Industrial, household and commercial waste, as defined in UK legislation. Controlled waste specifically excludes mine and quarry waste, wastes from premises used for agriculture, some sewage sludge and radioactive waste.
Controlled Waters	All rivers, canals, lakes, groundwater, estuaries and coastal waters to three nautical miles from the shore, including the bed and channel (which may be dry for periods of time).

Countryside Stewardship Scheme	Scheme run by MAFF in which landowners are grant aided to manager their land in an environmentally sensitive manner.
Cumecs	Cubic metres per second: equivalent to 86.4 thousand cubic metres per day.
Cyprinid fish	Coarse fish of high angling value (except pike and perch) such as roach, dace, bream and chubb.
Discharge Consent	A statutory document issued by the Agency. It can authorise entry and indicate any limits and conditions on the discharge of an effluent to a Controlled Water. A land drainage consent is an approval for specified structural works in areas under Agency control.
Dissolved Oxygen	The amount of oxygen dissolved in water. Oxygen is vital for life so this measurement is an important, but highly variable, indicator of the 'health' of the water. It is used to classify waters.
Drift	Transported superficial deposits, especially those transported by ice.
Dry Weather Flow (STW)	For STWs, this is calculated by adding estimates of the domestic sewage discharge (which is the population multiplied by the per capita consumption) plus any industrial discharge plus infiltration into the sewer.
Dry Weather Flow (river)	For the river, the dry weather flow is taken to be what is known as the 95 percentile low flow (or Q95) which means the river is higher than Q95 for 95% of the time.
EC Directive	Legislation issued by the European Union that is binding on Member States in terms of the results to be achieved. It leaves to Member States the choice of methods.
EC Regulation	European Community legislation having legal force in all Member States.
Ecosystem	A functioning, interacting system composed of one or more living organisms and their natural environment, in biological, chemical and physical senses.
Effluent	Liquid waste from industry, agriculture or sewage treatment plants.
Emergency Overflow	Discharge of crude sewage from a sewerage system because of mechanical or electrical breakdown of pumps.
Environmental Protection Act 1990	Legislation controlling the protection of the environment in all its forms, including air, land and water.
Environmentally Sensitive Area	An area where traditional farming methods may be supported by grant aid from the Ministry of Agriculture, Fisheries and Food (MAFF) to support distinctive landscape, wildlife habitats or historic features.
Eutrophic	A description of water which is rich in dissolved organic and mineral nutrients. At worst, such waters are sometimes beset with unsightly growths of algae.
Fish Biomass	A measure of the quality of a fishery as found in terms of surveys. It is measured as mass per area (g/m^2).
Flood plain	This includes all land adjacent to a watercourse over which water flows, or would flow but for flood defences, in times of flood.
Fluvial	Relating to rivers.
Fly-tipping	The illegal dumping of waste in places such as hedgerows, lay-bys, fields, streets and parks.
Gauging Station	A site where the flow of a river is measured.

General Quality Assessment	A new scheme replacing the National Water Council Classification system. It provides a means of assessing and reporting environmental water quality in a nationally consistent and objective way. The chemical grades for rivers, introduced in 1994, use BOD, Ammonia and Dissolved Oxygen limits for water quality between A (Very Good) and F (Bad). Other grades for estuarine and coastal waters are being developed and aesthetic components will be measured and graded by a system under trial at present.
Global Warming	An increase in the average temperature of the Earth, thought to be caused largely by the build-up of greenhouse gases such as carbon dioxide in the atmosphere.
Habitat	The customary and characteristic dwelling place of a species or community.
Hydrogeology	Branch of geology concerned with water within the Earth's crust.
Hydrology	The study of water on and below the Earth's surface.
In-river needs	The totality of requirements for the water environment and effluent dilution before abstraction is taken into account.
Integrated Pollution Control	An approach to pollution control in the UK that recognises the need to look at the environment as a whole, so that solutions to particular pollution problems take account of potential effects upon all environmental media.
Internal Drainage Boards	Statutory bodies charged, under the Land Drainage Act 1991, with providing a flood protection and water level management service to both developed and agricultural areas within their defined drainage districts.
Invertebrate	Animals without backbones, eg, leeches, snails, worms and insects.
Landfill	The engineered deposit of waste into or onto land in such a way that pollution or harm to the environment is minimised or prevented and through restoration to provide land which may be used for another purpose.
Landfill Gas	A by-product of the digestion by micro-organisms of putrescible matter present in waste deposited in landfill sites. The gas is predominantly methane (64%) together with CO2 (34%) and trace concentrations of other vapours and gases.
Leachate	Liquor formed by the act of leaching.
Macrophytes	Any plant observed by the naked eye and nearly always identifiable. This definition includes all higher aquatic plants, vascular cryptograms and bryophytes, together with groups of algae, which can be seen to be composed of predominantly of a single species.
Main River	The watercourse shown on the statutory 'Main River Maps' held by the Agency and MAFF. The Agency has permissive powers to carry out works of maintenance and improvement on these rivers.
Nitrate Vulnerable Zones	An area where nitrate concentrations in sources of drinking water exceed, or are at risk of exceeding the limit of 50 mg/l set down in the 1991 EC Drinking Water Directive. Compulsory and uncompensated agricultural measures were introduced in December 1998 to ensure reduction in these levels.
Nutrient	Substance providing nourishment for plants and animals such as nitrogen, phosphorus and potassium.
Office of Water Supply	Regulator of Water Supply Companies.
Particulates	Fine solid particles found in the air or in emissions.
Permissive Powers	Powers which confer on the Agency the right (but not the duty) to do things
Pesticides	Substances used to kill pests such as weeds, insects or rodents.

Planning Policy Guidance Note23	Planning and Pollution Control. Notes which set out the Government's policies towards planning and pollution control, which must be taken into, account by Local Planning Authorities.
Potable Water	Water of a suitable quality for drinking.
Prescribed Process	Under IPC, processes described in regulations, that are the most potentially polluting or technologically complex industry.
Prescibed Substance	Under IPC, a potentially polluting or harmful substance discharge which should be prevented, minimised or rendered harmless.
Public Water Supply	The supply of water by companies appointed as Water Undertakers by the Secretary of State for the Environment under the Water Industry Act 1991.
Ramsar site	Wetland site of International Importance that is designated under the Ramsar (a town in Iran where the international convention originally agreed in 1975 to stem the progressive encroachment on, and loss of, wetland) convention.
Raw Water	Water in its natural state before treatment.
Red Data Book Species	The most threatened species in Great Britain.
Return Period	Refers to the frequency of a rainfall or flooding event. Flood events are described in terms of the frequency at which, on average, a certain severity of flow is exceeded. This frequency is usually expressed as a return period in years: a 1 in 50 year flood event would be expected to occur, on average, once every 50 years.
Riparian (Owner)	Owner of riverbank and/or land adjacent to a river. Normally owns riverbed and rights to mid-line of channel.
River Corridor	The continuous area of river, riverbanks and immediately adjacent land alongside a river and its tributaries.
River Needs Consents	Permissions for discharge of effluents, that often specify limits for certain potential pollutants and ensure that the discharge does not derogate any of the uses of the controlled water.
River Quality Objectives	The level of water quality that a river should achieve, in order to be suitable for its agreed use. Is being replaced by Water Quality Objectives (WQOs).
Scheduled Ancient Monument	A key site nationally for archaeology, designated by the Secretary of State for National Heritage, through English Heritage.
Section 105 Surveys	Section 105 of the Water Resources Act 1991 allows for Standards of Service, Assets and Flood Risk Surveys.
Septic tank	A tank used for the treatment of sewage from properties without mains drainage. The sewage is settled and some bacterial treatment occurs. Discharge of effluent is usually to a soakaway system.
Set-Aside	The EC set-aside scheme was first introduced for the crop year 1991/92 as part of the Common Agricultural Policy reform to allow farmers to remove land from production by receiving compensation. A wide range of arable crops, principally cereals. are eligible for the scheme.
Sewage	Liquid waste from cities, towns and villages which is normally collected and conveyed in sewers for treatment and/or discharge to the environment.
Sewerage	System of sewers usually used to transport sewage to a sewage treatment works.
Silage	A winter feed for cattle. Silage is produced throughout the summer by bacterial action on freshly cut grass or other crops stored in silos.
Siltation	Action of depositing silt at the bottom of a river or lake. A deposit of clays and silts can be difficult to remove naturally as it requires turbulent flow and high velocities.

Site of Special Scientific Interest	A site given a statutory designation by English Nature on account of its rare and/or important flora, fauna or geology.
Slackers	Pipe and valve systems through which water is transferred between high- and low-level watercourses.
Sludge	The accumulation of solids from treatment processes. Sludge can be incinerated or spread on farmland.
Sluice	Structure to control upstream river levels and downstream flows.
Slurry	Animal waste in liquid form.
Soakaway	System for allowing water or effluent to soak into ground. Commonly used in conjunction with septic tanks.
South Level Datum	The zero point is 100 metres below Ordnance Datum Newlyn (ie sea level). 100 m SLD = 0 m AOD. (Refer to Above Ordnance Datum.)
Special Area of Conservation	Areas (land and sea) that contribute most to the survival of species and habitats listed in the Habitate Directive.
Special Protection Area	Statutory protected habitats for wild birds under EC Regulations.
Spray Irrigation	The watering of crops by spraying, which can have high evaporative losses when compared with trickle irrigation or use of sluices.
Statutory Consultee	In both the Environment Agency's and other agencies' legislation there are requirements for consultation. Comments and objections that are received are noted but do not usually have the power, in themselves, to prevent the controlling authority from making a decision.
Strata	A term applied to rocks that form layers or beds. Can also be applied to successive layers of any deposited substance such as the atmosphere, or biological tissue.
Structure Plans	Statutory documents produced by County Councils outlining their strategy for development over a 10-15 year timescale.
Surface Water	Water collecting on and running off the surface of the ground.
Suspended Solids	The density of undissolved matter which is held by a water body. It will vary with the turbulence and velocity of the water.
Sustainable Development	'Development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (Brundtland definition).
Telemetry	A means of directly collecting data from remote sites.
Watercourse	A stream, river, canal or channel along which water flows.
Water Quality Objectives	Water quality targets to secure specific formal minimum quality standards for specific stretches of water by given dates. A new component of these is introduced by 'The Surface Waters (River Ecosystem Classification) Regulations 1994', a classification scheme to be applied by Agency to the rivers and watercourses of England and Wales. Other existing standards operate already to give effect to various EC Directives for water quality.
Water Resource	The naturally replenished flow of recharge of water in rivers or aquifers.
Water Table	Top surface of the saturated zone within the aquifer.
Wetland	An area of low lying land where the water table is at or near the surface for most of the time, leading to characteristic habitats.
Winter Storage Reservoir	Reservoirs built by farmers to store water during the winter months when there is generally more water available than in the summer. The water is used during the subsequent irrigation season.

Year Class	The year of birth of a fish. If fish of the same age survive this suggests that good spawning conditions in this year of birth and is referred to as a 'strong' year class.
1:10 Year Drought/Flood	A drought/flood event with a statistical probability of occurring once in a ten year period (other periods may be specified in a similar way).
95%ile Limit	A numerical limit specified in a discharge consent, which must be achieved or bettered for at least 95% of a specified time penod.

Abbreviations

AA	....	Angling Clubs
AOD	....	Above Ordnance Datum
AC	....	Angling Clubs
AMP	....	Asset Management Plan
AWSL	....	Anglian Water Services Ltd
BAP	....	Biodiversity Action Plan
BATNEEC	....	Best Available Techniques Not Entailing Excessive Costs
BC	....	Borough Council
BOD	....	Biochemical Oxygen Demand
BPEO	....	Best Practicable Environmental Option
CC	....	County Council
CO_2	....	Carbon dioxide
cSAC	....	Candidate Special Area of Conservation
CSO	....	Combined Sewer Outfall
DC	....	District Council
DETR	....	Department of the Environment, Transport and the Regions
DO	....	Dissolved Oxygen
EH	....	English Heritage
EPA90	....	Environmental Protection Act 1990
EN	....	English Nature
EQS	....	Environmental Quality Standard
FRCA	....	Farming and Rural Conservation Agency
gm^2	....	Grams per square metre (a unit of biomass)
GPZ	....	Groundwater Protection Zones
GQA	....	General Quality Assessment
ha	....	Hectare
IDB	....	Internal Drainage Board
IPC	....	Integrated Pollution Control
IPPC	....	Integrated Pollution Prevention and Control
IWA	....	Inland Waterways Association
IWAAC	....	Inland Waterways Advisory Council
km	....	Kilometre
km^2	....	Square Kilometre
LEAP(s)	....	Local Environment Agency Plan(s)
LPA	....	Local Planning Authority
m	....	Metre
m^3/s	....	Cumec: cubic metres per second
mg/l	....	Milligrams per litre
MAFF	....	The Ministry of Agriculture, Fisheries and Food
Ml/d	....	Megalitres per day (flow rate of millions of litres per day)
mm	....	Millimetre
MoD	....	Ministry of Defence
MRF	....	Minimal Residual Flow
NVZ	....	Nitrate Vulnerable Zones
OFWAT	....	Office of Water Services
PPG23	....	Planning Policy Guidance Note 23
PWS	....	Public Water Supply
R&D	....	Research and Development
RAF	....	Royal Air Force
RAS	....	Radioactive Substances
REC	....	River Ecosystem Class
RQO	....	River Quality Objective
RSPB	....	Royal Society for the Protection of Birds
(c)SAC	....	(Candidate) Special Area of Conservation
SAM	....	Scheduled Ancient Monument
SLD	....	South Level Datum
SPA	....	Special Protection Area
SSSI	....	Site of Special Scientific Interest
STW	....	Sewage Treatment Works
UWWTD	....	Urban Waste Water Treatment Directive
WLMP(s)	....	Water Level Management Plan(s)
WQO	....	Water Quality Objectives