ENVIRONMENT AGENCY

ELY OUSE

ENVIRONMENT OVERVIEW

FEBRUARY 1999

ENVIRONMENT AGENCY
ANGLIAN REGION
CENTRAL AREA
BROMHOLME LANE
BRAMPTON
HUNTINGDON
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ENVIRONMENT AGENCY

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PREFACE

This Environment Overview has been prepared to provide supporting information to the Ely Ouse 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;
- Usage, 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.

Contents

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. The principal mechanism for managing water resources is through the abstraction licensing system. 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 is undertaking a review of the abstraction licence system and a revision of the Water Resources Act 1991. To date, a discussion paper has been produced and numerous organisations, including the Agency, have responded to the DETR (Department of the Environment, Transport and the Regions).

1.1.1 Natural Forces

CLIMATE AND CLIMATE CHANGE

The balance of evidence suggests that human 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 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 effects could put greater stress on our water resources and emphasises the need for careful management. The revision of the Agency's Water Resources Strategy in 1999/2000 will include consideration of the potential impacts of climate change and ways to accommodate these flexibly. The increasing use of farm storage reservoirs to capture higher winter river flows is one example of the way in which the expected impacts of climate change could be reduced.

Rainfall is low throughout the LEAP area, and the average varies from 600 to 650 mm per year. Figure 1.1 overleaf shows the deviation from the long-term average rainfall value. It can be seen that between 1972 and 1977 and since 1989, there have been several years of below average rainfall; 1990, 1991 and 1996 were especially dry, receiving only about 75% of the average rainfall. During most summers, as with other areas in the Anglian Region, evaporation far exceeds rainfall and as a result there is a limited water resource for environmental and abstraction needs.

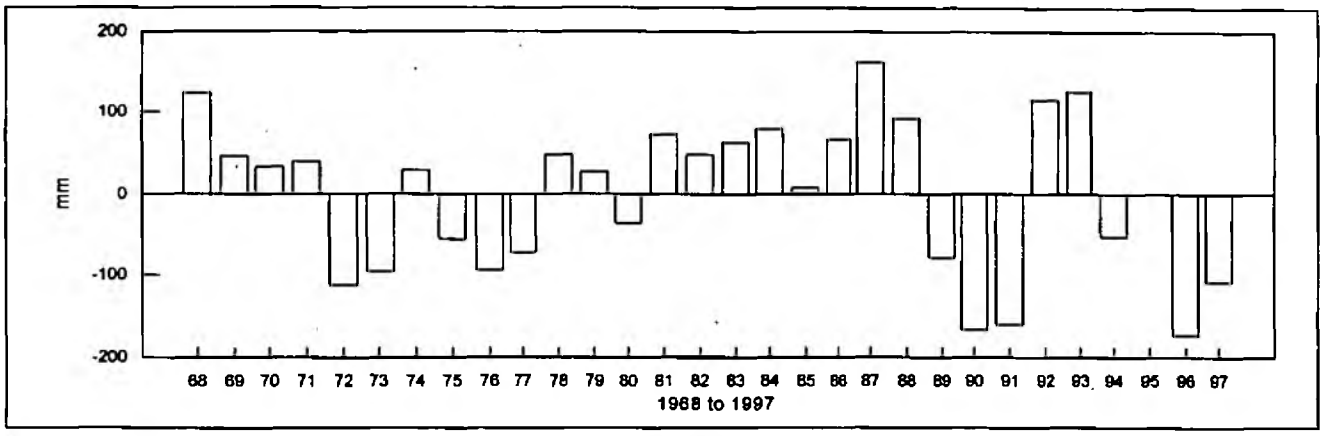


Figure 1.1: Deviation from Long Term Average Rainfall

SURFACE WATER HYDROLOGY AND RIVER FLOW

(The solid geology of the Ely Ouse LEAP area is discussed in detail in Appendix A.)

The Ely Ouse LEAP area is a combination of seventeen river sub-catchments, covering 2 510 km^2. The sub-catchments of the Rivers Wissey, Lark, Thet, Sapiston, Little Ouse and their associated tributaries drain the chalk uplands to the east of the area. In the west, specifically in the Lodes area north of Cambridge and within the fenland areas, the watercourses are embanked, flowing at a higher level than the surrounding farmland.

River flows are comprised principally of two natural components. These are run-off resulting from rainfall, surface or near-surface drainage and baseflow, derived from spring flows from groundwater. It is baseflow, in particular from the chalk, which comprises most of the rivers' flow during dry periods. The upland rivers, above the spring line to the east of the LEAP area, are more susceptible to drying-out as they do not have chalk baseflow to sustain them.

The Denver Complex forms the focus of the flood defence system that protects the low-lying lands of the Fens from inundation by the sea and fluvial floods. Two structures perform the flood defence role on the site). These are the Denver Sluice itself and the A G Wright (or Head) Sluice. Other structures are used for water resource transfer or for navigation

Water from the principal rivers either flows to the Ely Ouse or, in times of flood, is diverted by sluices into the Cut Off Channel and then to the Tidal River via the Relief Channel, downstream of Denver. The Ely Ouse normally discharges to the Tidal River through the Denver Sluice, but during times of flood the flow can be diverted into the Relief Channel. On average, the tributaries of the Ely Ouse contribute flow as follows: River Wissey, 17%; River Little Ouse, 36%; River Lark, 12% and inflow from outside the LEAP area (principally from the River Cam), 35%.

To the west of the Cut Off Channel is the South Level. This area is characterised by low-lying land, and river levels are increased due to the Internal Drainage Boards (IDBs) pumping land drainage water into the rivers. In the summer months the river flows may be reduced as water is drawn off into the low-level drains via slackers for crop irrigation.

To enable it to carry out its duties, the Agency maintains a network of recording stations where hydrometric information such as rainfall, river flows and levels and groundwater levels is collected. This information provides the basis for water resource assessments and management (for example in licence determination and controls) as well as wider application in the Agency's other functions such as flood defence and water quality. There are 22 permanent river flow/level gauging stations within the Ely Ouse area. Table 1.1 shows flow statistics for three gauging stations located on the Rivers Lark, Little Ouse and Wissey.

Table 1.1: Key River Statistics

River and Flow Gauging Stations (GS) **NGR** **Period of Record** **Catchment Area**	**Max flow (m^3/s)**	**Min flow (m^3/s)**	**Mean flow (m^3/s)**	**Flow exceeded for 95% of the time (Q_{95})**
Temple Weir TL 7580 7300 Jan 1961 - Dec 1995 282.8 km^2	20.02	0.164	1.269	0.47
Abbey Heath TL 8510 8440 Jan 1969 - Dec 1995 688.5 km^2	24.32	0.482	3.742	1.20
Northwold Mill TL 7710 9650 Jan 1957 - Dec 1995 274.5 km^2	12.86	0.149	1.818	0.45

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 Section 1.1.3. 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 which is accountable to society and its 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 with respect to water resources is the Water Resources Act 1991, which superseded the Water Resources Act 1963.

The demands of society change and the present Government, in recognition of this, is undertaking

a review of water resources legislation. A consultation paper has been prepared following comprehensive consultation with numerous organisations (including the Environment Agency) to the DETR. This matter has been widely publicised and it offers the opportunity for society to influence how water resources are managed in the future.

At present we operate according to four objectives; Meeting Demands, Protect Resources, Proper Use and Conserve Resources (refer to 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 SSSI sites (Sites of Special Scientific Interest controlled by English Nature) 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 abstraction licences that may affect SACs and SPAs. Table 4.5 and Map lists the Habitat Directive Sites for this LEAP area and shows which sites have been designated for water habitats and/or species.

1.1.3 Abstractions and Removals, Usage, Releases and Discharges

Water is abstracted from rivers (surface water) and the ground (groundwater) and used for several purposes that are outlined below. Abstractions of water, apart from a few statutory exceptions, 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 (eg, 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 will have an impact on the effect 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, eg there may be a naturally high content of minerals such as iron. Section 4.1 describes the current policies with respect to water availability, Table 4.2 shows current groundwater balances and Table 4.1 lists the current cessation clauses which are applicable.

The abstraction type is divided into potable water supply, agricultural use, industrial use and raw water transfer. The information is summarised in Figures 1.3 and 1.4.

POTABLE WATER SUPPLY

The abstraction of water for public water supply (PWS) represents over 37% of all water licensed for abstraction. The locations of PWS sites are shown on Map 1.1.

Anglian Water Services Ltd (AWS) supply water to most of the population within the LEAP area. The company operates a comprehensive water supply mains network and hence the water can be distributed from the borehole or river source to the point of demand. After use the water is returned

to the rivers via Sewage Treatment Works (STWs). The total quantity of water licensed from sources in this LEAP area to AWS is 52 million cubic metres per year. The majority of this concerns abstraction from boreholes into the Chalk aquifer. There is one surface water supply works at Stoke Ferry where water is abstracted from the River Wissey and the Cut Off Channel. The quantity licensed at Stoke Ferry is 6.5 million cubic metres per year.

Cambridge Water Company hold licences which enable them to operate three borehole sites near Thetford to meet the demands of people living in Cambridge. The total quantity licensed is 8.5 million cubic metres per year. Essex and Suffolk Water operate one source at Rickinghall for local needs. The total quantity licensed is 0.5 million cubic metres per year.

The water abstracted in this LEAP area for public supply meets the needs of the local population but is also exported to meet the needs of people in Kings Lynn, Narborough, areas near Diss, areas near Stowmarket and areas north of Sudbury and Cambridge.

The overall quantity licensed for PWS has fallen compared to the quantities quoted in the Ely Ouse Catchment Management Plan (CMP). This has been the result of site closures and variations to existing licences to link sites under group quantities in order to categorise sites according to water resource units and hence the water available within the units.

The LEAP area also supports a large number of groundwater sources used for private domestic supply. These abstractions are principally from the Chalk aquifer but there are some shallow wells into the sand and gravel deposits. The majority of this use is exempt from licensing under the Water Resources Act 1991. The small quantity that is licensed for private water supply is 0.3% of the total volume licensed.

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 quantity licensed for agricultural abstraction is over 25% of the total volume licensed.

Water abstracted for spray irrigation is considered as a total loss to resources as the water is not returned to the river after use. Instead, 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 summer surface waters. Hence 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 to be used for the following summer.

There are 54 licences for the storage of water during the winter, totalling 7.5 million cubic metres of water. The remainder of the 587 licences for spray irrigation are for abstraction during summer months (400 using surface water sources and 187 from groundwater).

48 of the 54 licences have been granted since the issue of the Ely Ouse Catchment Management Plan in 1992. These 48 licences represent 7.2 million cubic metres of water per winter (96.5% of winter abstraction for spray irrigation or 20% of the total licensed for spray irrigation in this LEAP.

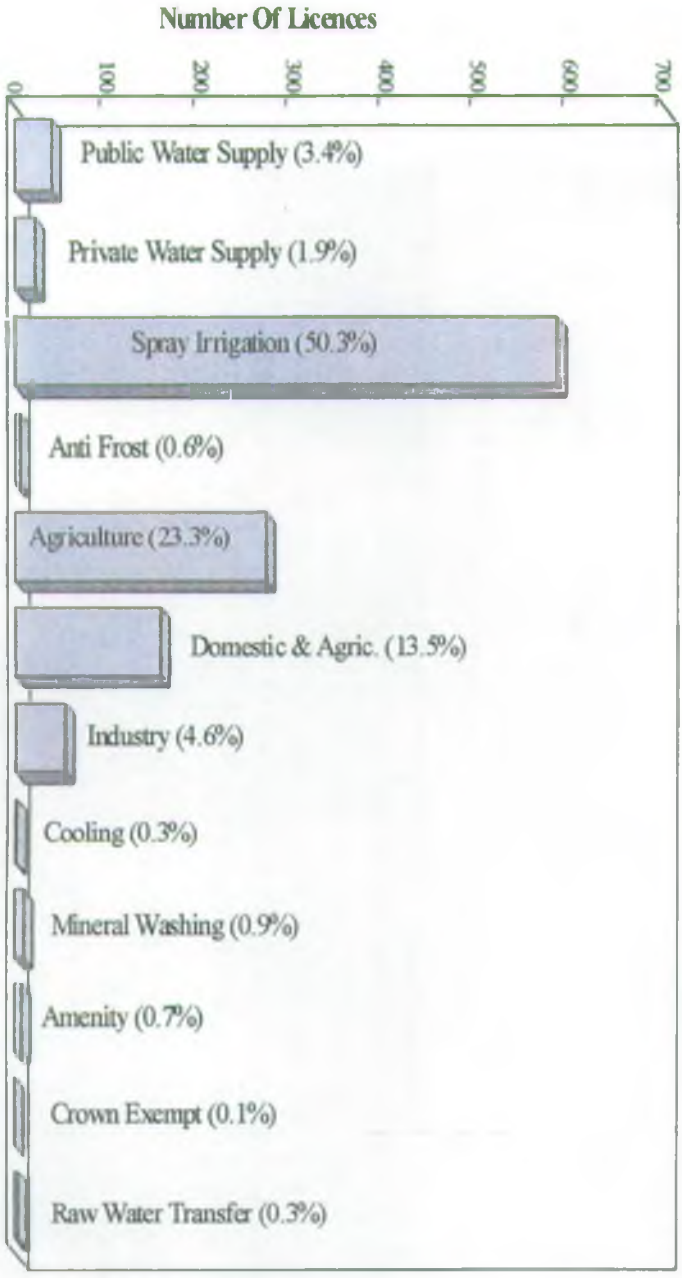
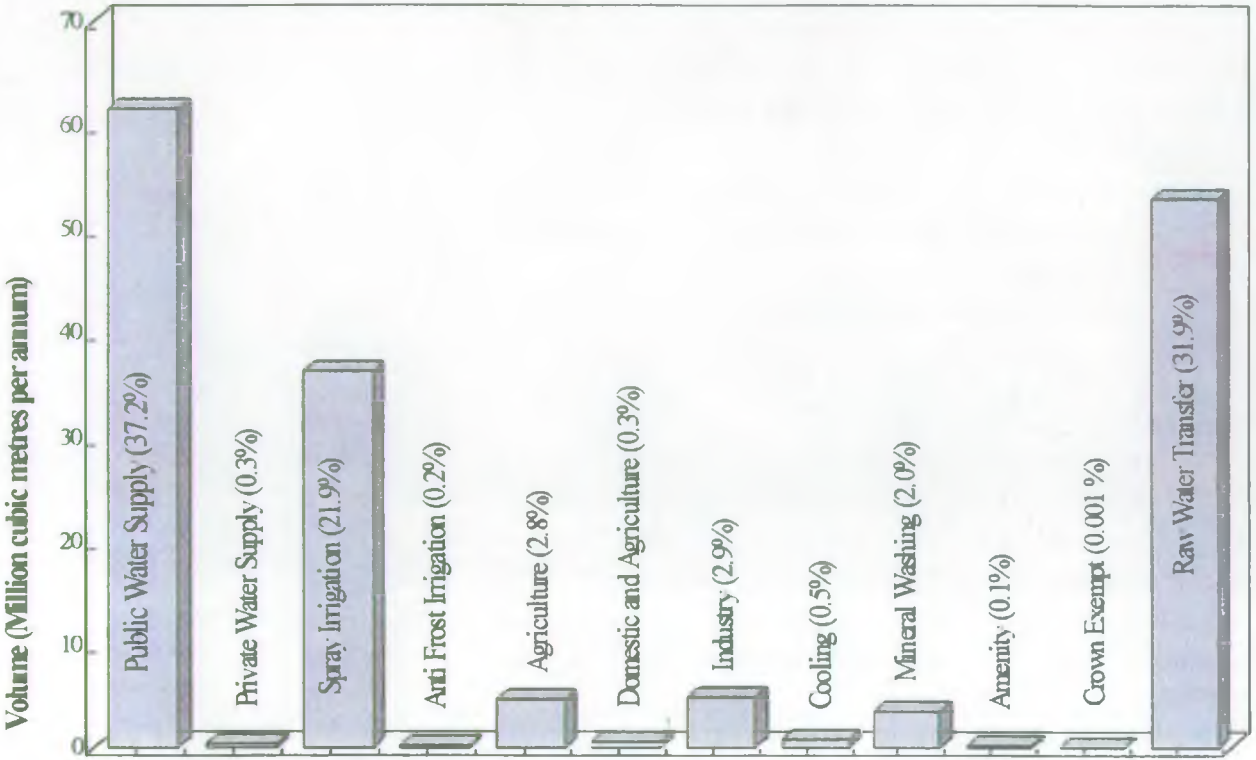


Figure 1.4: Number of Licences Issued

Figure 1.3: Volume of Water Licensed



area).

The majority of spray irrigation in the fen areas uses water from the drains controlled by Internal Drainage Boards (IDBs). Water is transferred to these drains via "slackers" (pipes and valves) from the main surface watercourses. This transfer of water supports both the use of spray irrigation and the water levels in the sub soil. The latter could represent up to ten times the quantity that is licensed for spray irrigation and is lost by evapotranspiration.

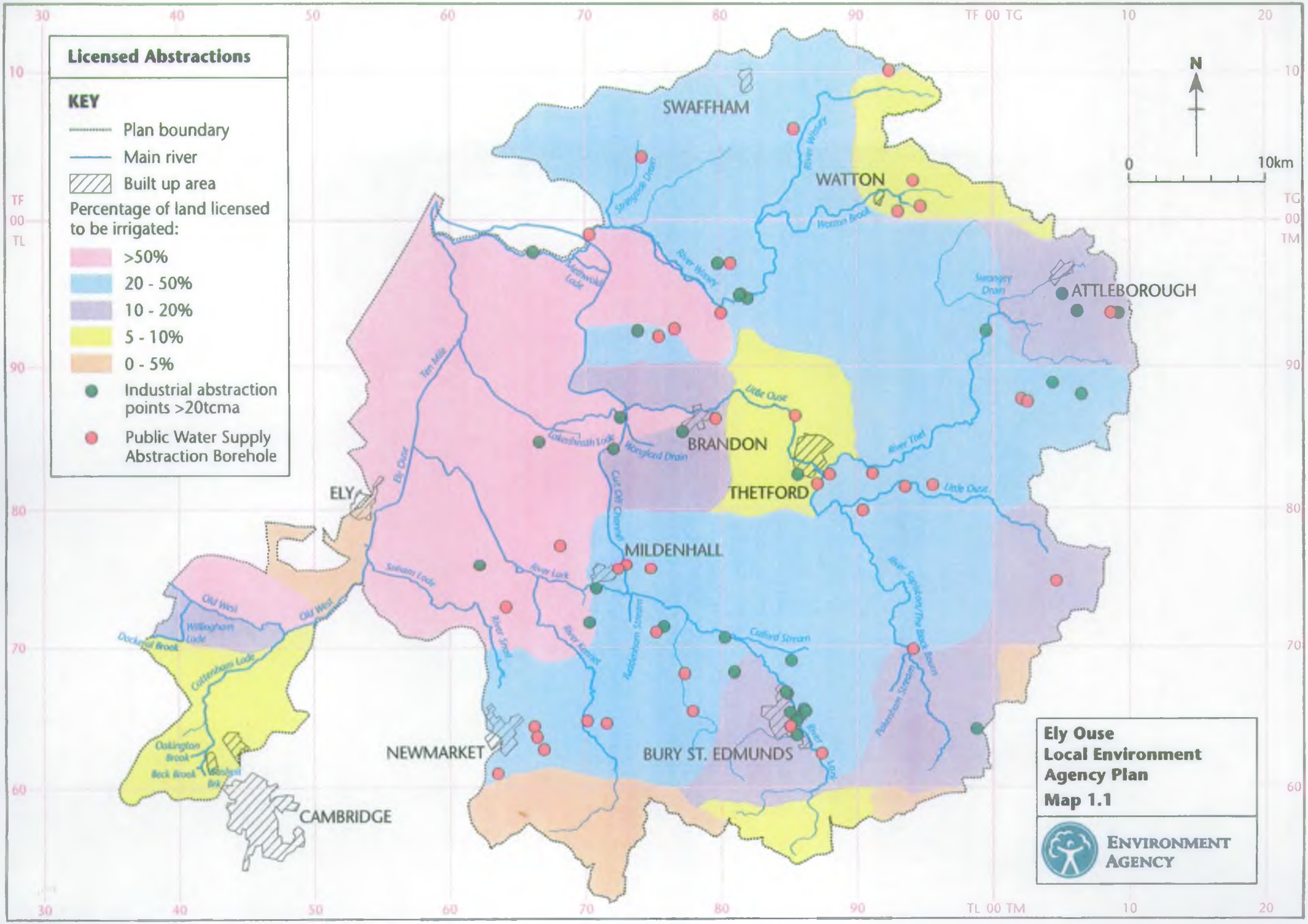
The Agency is unable to control the quantity of water transferred, as this abstraction does not require a licence. This is an important issue because during dry periods, up to 100% of the river flow could be transferred into the South Level system in this way. In practice, the Agency and the IDBs work in co-operation to ensure that the needs in the river are meet as well as the irrigation needs in the fen. Any new or renewed irrigation abstraction licences since 1992 now contain a cessation clause which is designed to stop irrigation when flows become critically low at Denver.

INDUSTRIAL ABSTRACTION

Most industrial needs are supplied by the water companies and the water is licensed as public water supply. The 68 licences held by individual companies refer to supplies from boreholes or the river directly for industrial use. The type of industrial use in this LEAP area include sand and gravel washing, cooling, vegetable washing, brewing, poultry processing, food processing (including sugar refinement), manufacture of drugs, bottling water and other manufacturing processes. The total quantity for industrial purposes is 9.2 million cubic metres per year.

The use of water for sand and gravel washing accounts for nearly 3.5 million cubic metres per year which is an increase of 2.3 million cubic metres since the Ely Ouse CMP. Most of this water is taken from the shallow sand and gravel aquifers and most of the water is recirculated during use. The estimated loss to the resource is 10% of the quantity abstracted.

The location of industrial abstraction points (greater than 20 thousand cubic metres per year (tcma)) is given on Map 1.1.


Licensed Abstractions
KEY
Plan boundary
Main river
Built up area
Percentage of land licensed to be irrigated:
>50%
20 - 50%
10 - 20%
5 - 10%
0 - 5%
Industrial abstraction points >20tcma
Public Water Supply Abstraction Borehole
N
0
10km
SWAFFHAM
WATTON
ATTLEBOROUGH
BRANDON
THETFORD
ELY
MILDENHALL
NEWMARKET
BURY ST. EDMUNDS
CAMBRIDGE
Ely Ouse
Local Environment
Agency Plan
Map 1.1
Environment Agency

RAW WATER TRANSFER

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

The main scheme - the Ely Ouse to Essex transfer scheme - was promoted in the 1960s and authorised by the Ely Ouse to Essex Water Act 1968. The works were completed in 1971. Water is diverted at Denver from the Ely Ouse River into the Cut Off Channel and is subsequently pumped from the Cut Off Channel at Blackdyke through tunnels and pipelines and into Essex watercourses to augment the supply to PWS reservoirs there. The abstraction at Blackdyke is limited by licence to 455 thousand cubic metres per day (tcmd) and 79.5 million cubic metres over an 18-month period. The transfer from the Ely Ouse at Denver is limited by a minimum flow requirement to the Tidal River Ouse. This minimum flow requirement has been varied for a period of five years from November 1997. The variation followed a Public Inquiry held in September 1997. This issue was raised in the Ely Ouse Catchment Management Plan (Issue 22). Table 1.2 below shows the original minimum flow requirements and the temporary requirements for five years:

Table 1.2: Minimal Flow Requirements for Water Transfers to the Tidal River Ouse

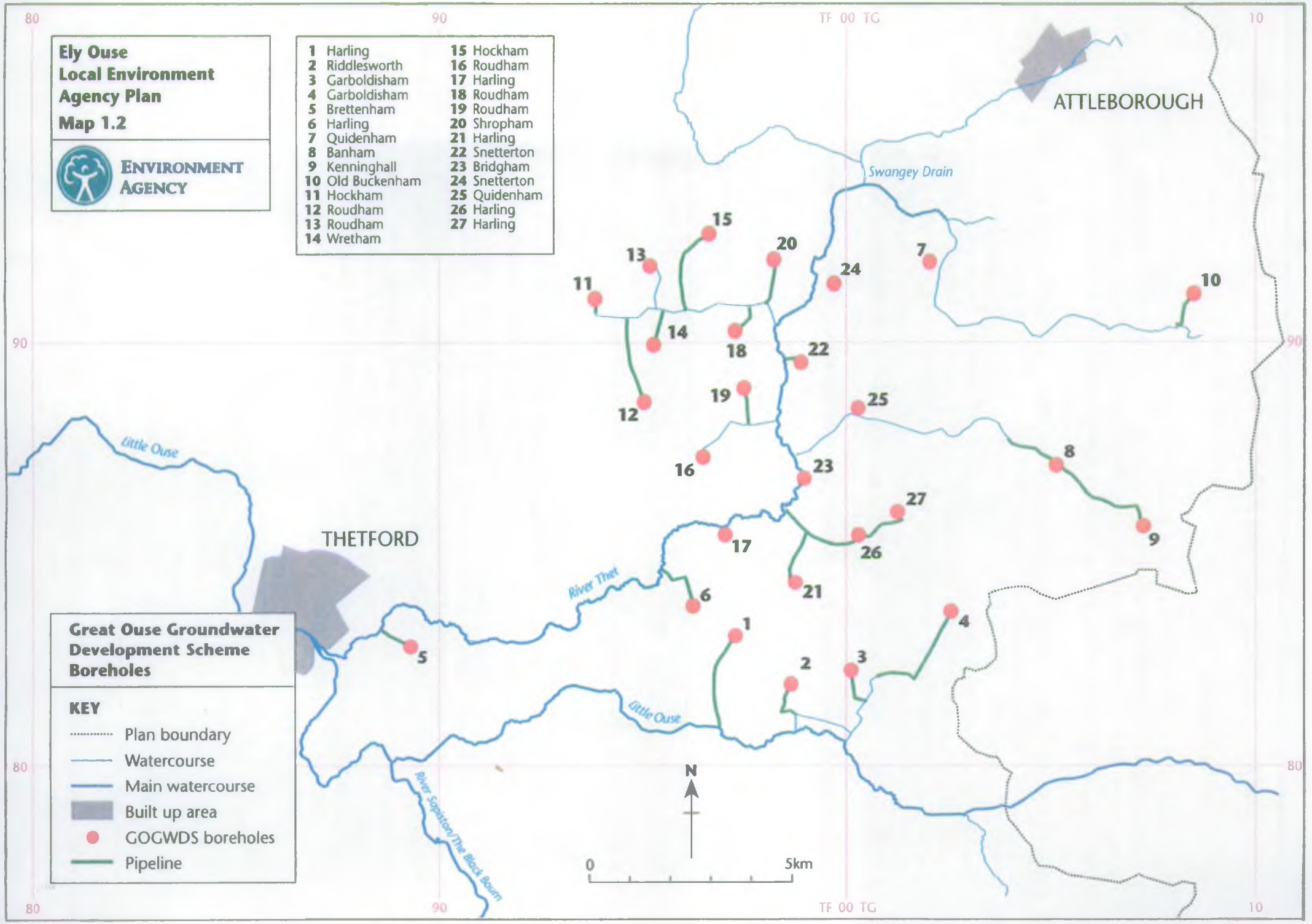
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Original	318	318	114	114	114	114	114	114	318	318	318	318
Temporary	318	318	318	318	114	114	114	114	318	114	114	114

All figures are in tcmd

At times of natural low flows, the water availability in the Ely Ouse is insufficient to meet demands in Essex and a supplementary scheme was designed. This is the Groundwater Development Scheme and the Hockwold Transfer. The Agency operates 27 Chalk boreholes (see Map 1.2) in order to pump water into the rivers Thet and Little Ouse. This water is subsequently transferred from the River Little Ouse to the Cut Off Channel at Hockwold, where the pipes have a capacity of 68 tcmd.

The boreholes were developed in the 1970s and authorised by the AWSL (Great Ouse Groundwater Development) Order 1976 following a Public Inquiry. Abstraction licences were issued and limit the quantity abstracted to 28.3 million cubic metres per year. The licences allow for more sites than have been drilled to date. In particular, the Agency has powers to drill 5 boreholes in the Sapiston sub catchment. The transfer at Hockwold was constructed in c.1985 and is licensed for 24.8 million cubic metres per year.

There is a small transfer of water into the LEAP from the Bedford Ouse at Earith into the Old West River through the penstocks of Hermitage Lock. The Old West River, which is the former course of the River Great Ouse, has no natural catchment and, therefore, during periods of dry weather the flow and level can become low. The transfer is undertaken to supplement the Old West River to retain navigation levels and prevent deterioration in water quality.


Ely Ouse
Local Environment
Agency Plan
Map 1.2
ENVIRONMENT AGENCY
1 Harling
2 Riddlesworth
3 Garboldisham
4 Garboldisham
5 Brettenham
6 Harling
7 Quidenham
8 Banham
9 Kenninghall
10 Old Buckenham
11 Hockham
12 Roudham
13 Roudham
14 Wretham
15 Hockham
16 Roudham
17 Harling
18 Roudham
19 Roudham
20 Shropham
21 Harling
22 Snetterton
23 Bridgham
24 Snetterton
25 Quidenham
26 Harling
27 Harling
ATTLEBOROUGH
THETFORD
Swangey Drain
Little Ouse
River Thet
River Sapiston/The Black Bourn
Great Ouse Groundwater
Development Scheme
Boreholes
KEY
Plan boundary
Watercourse
Main watercourse
Built up area
GOGWDS boreholes
Pipeline
N
0
5km
80
90
TF 00 TG
10

Water is transferred within the LEAP from the River Lark into the head of the Cut Off Channel at Barton Mills. The Cut Off Channel, for most of its length, has no natural catchment and intersects the Chalk aquifer, resulting in natural losses and gains of water. During the periods of normal or low groundwater levels, the Cut Off Channel between the River Lark and River Little Ouse loses its level along many of the reaches between the retaining weirs. The transfer is undertaken to provide a small flow and prevent deterioration in water level and quality. The quantity transferred is controlled by a penstock in the Lark Head Sluice at Barton Mills, and the quantity normally transferred is 4.3 tcmd.

1.1.4 Illegal Practices (Accidents and Non-Compliance with Regulations)

ENFORCEMENT

The Agency's Enforcement Team make routine visits to abstraction licence holders in order to ensure that they understand and comply with the conditions of the licence, monitoring measures are in place and working and records are being adequately maintained. The Agency's policy is to inspect all licence holdings every five years, but some will be visited more frequently than others. To help schedule the visits, licences have been divided into categories. Table 1.3 below indicates the category of the licence and the frequency of visit.

Table 1.3: Abstraction Licence Category and the Frequency of Visit

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 which vary with season.	At least once a year but more frequently - (a) During periods of greatest importance to the water environment (eg. 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 which 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

During dry periods, the Agency is able to restrict the quantity abstracted for spray irrigation under Section 57 of the Water Resources Act 1991 in order to protect river flows. When restrictions are in force the Enforcement Team are informed and they visit the area concerned to ensure the restrictions are understood and adhered to. The Agency prosecutes abstractors for non-compliance of 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.

1.1.5 Changes Since Ely Ouse CMP

In 1993, the National Rivers Authority (NRA) produced the Ely Ouse CMP, which contained details about the numbers of abstraction licences and the volumes of water licensed for different uses. Since this time there have been changes to the policies applicable to the area. The following Tables are presented to illustrate the changes that have occurred since 1992 when the figures for the CMP were collated. Table 1.4 illustrates the changes per use and Table 1.5 gives the changes to spray irrigation licences in detail. *It should be noted that the detail behind the 1992 figures has not been recorded and hence only a general comparison can be made. The 1998 figures have been retrieved from the Abstraction Licensing Computer Database. This database had not been fully developed in 1992 and hence the data may be less accurate.*

Table 1.4: Comparison of figures given in Ely Ouse CMP (1992) and this LEAP (1999)

Use	1992		1998		Difference	
	No. of licences	Volume Licensed (tcm)	No. of licences	Volume Licensed (tcm)	No. of licences	Volume Licensed (tcm)
Public Water Supply	47	64 708	40	61 763	-7	-2945
Private Water Supply	12	39	22	462	10	423
Spray Irrigation and Anti Frost	548	23 387	594	36 817	46	13 430
Agriculture, Domestic and Agriculture	420	2752	430	5153	10	2401
Industry and Cooling	60	7806	57	5770	-3	-2035
Mineral Washing	6	1156	11	3490	5	2334
Other eg,amenity, Crown property	3	51	9	223	6	173
Raw Water Transfer	4	53 140	4	53 140	0	0
TOTALS	**1100**	**153 039**	**1167**	**166 819**	**67**	**13 780**

In conclusion, there has been an overall increase of over 13 million cubic metres (m^3) of water licensed for abstraction. Further such increases are unlikely to occur in the future as policies of water availability have changed and the scope for increase is less. It is shown in Table 1.4 above that of the 13 million m^3 increase for spray irrigation, over 7 million m^3 has been for winter abstraction to fill reservoirs.

Table 1.5 Comparison of Spray Irrigation in 1992 and in 1998 (all volume figures in tcma)

Sub Catchment	1992		1998		Total Difference		Policy for sub-catchment for all uses
	No. of licences	Volume Licensed	No. of licences	Volume Licensed	No. of licences	Volume licensed (for Winter since 1992)	
35:Old West River & South Level Fen	57	486	47	813	-10	327 (88.6)	sw winter available only sw available in South Level Fen all year until Oct 1995 when embargo placed on applications for new or increased summer water
36:Soham Lode & SL Fen	31	1018	63	1731	32	713 (657)	sw winter only in Soham Lode sw available in South Level Fen all year until Oct 1995 when embargo placed on applications for new or increased summer water
37:Lark	66	4212	74	6189	8	1977 (1171)	sw winter available only no gw available from July 1992
38:Kennett	10	514	11	718	1	204 (159)	sw winter available only no gw available from July 1992
39:Lower Lark & SL Fen	99	2346	110	4940	12	2594 (981)	sw winter available only sw available in South Level Fen all year until Oct 1995 when embargo placed on applications for new or increased summer water no gw available from July 1992
continued...							

40:SL Fen	9	876	17	1279	8	403 (182)	gw winter available only sw available in South Level Fen all year until Oct 1995 when embargo placed on applications for new or increased summer water
41:Sapiston	23	1229	19	1375	-4	147 (143)	sw winter available only no gw available from December 1993
42:Little Ouse	21	1233	14	1271	-7	37 (-)	limited sw available all year in reaches augmented by GOGWS no gw available from September 1994
43:Mid Thet	3	326	5	336	2	10 (-)	limited sw available all year in reaches augmented by GOGWS no gw available from September 1994
44:Thet	47	3315	51	3962	3	648 (833)	limited sw available all year in reaches augmented by GOGWS no gw available from September 1994
45:Lower Little Ouse	9	813	12	1349	3	536 (318)	sw winter available only no gw available from September 1994
46:Little Ouse & SL Fen	26	222	20	937	-6	715 (-)	sw winter available only sw available in South Level Fen all year until Oct 1995 when embargo placed on applications for new or increased summer water
47:Great Ouse & SL Fen	40	816	54	2294	14	1478 (203)	sw winter available only sw available in South Level Fen all year until Oct 1995 when embargo placed on applications for new or increased summer water
48:Wissey	32	2003	35	4287	3	2284 (1882)	sw winter available only gw available
49:String-side and Gadder	8	500	10	772	2	272 (181)	sw winter available only gw available until February 1996
continued...							

50:Lower Wissey & SL Fen	23	1175	27	1622	4	446 (264)	sw winter available only sw available in South Level Fen all year until Oct 1995 when embargo placed on applications for new or increased summer water
56: Cut Off Channel	44*	2304	18	2683	23	379 (113)	sw winter available only sw available in South Level Fen all year until Oct 1995 when embargo placed on applications for new or increased summer water
TOTAL	**548**	**23 387**	**587**	**36 558**	**39**	**13 170 (7174)**	

Key:
SL = South Level, gw = groundwater, sw = surface water, GOGWS = Great Ouse Groundwater Development Scheme
* The number of licences appears to be that for the whole of area 56, however, only part is in this LEAP area. The volume quoted appears correct.

All surface water licences (summer or winter) contain cessation clauses to protect downstream abstractors and low river flows. The relevant cessation clauses are given in Table 4.1.

Changes have occurred for two main reasons:

- **Normal changes** - Abstraction licences can be varied for several reasons; to increase or decrease quantities, to change the type of use etc. In addition, new licences are granted and some licences are revoked or cease to have effect.

- **Changes in status of water availability** - One of the considerations when considering a licence application is whether the water is available from the river or aquifer. This aspect has changed since 1992 and in general, more areas of groundwater are now considered to be fully committed to existing abstractors and the environment. In particular, the Lark groundwater unit became fully committed in July 1992 and the Thet/Little Ouse in September 1994 (as published in the Regional Water Resources Strategy). Areas of the Wissey groundwater unit which contribute to the flows of the Rivers Stringside and Gadder were declared fully committed in February 1996.

Summer surface water has been limited throughout the period. The introduction of the 'Denver' clause onto licences from 1992 has enabled better management of surface water abstraction for spray irrigation. This clause, which relates to flows at Denver, requires abstraction to cease if the flow is reduced to the critical levels. All the cessation clauses used are listed in Table 4.1.

Abstraction during the winter is still encouraged throughout most of the area.

The water resources of the South Level Fen were recognised to be under stress in 1995. Our predecessor, the National Rivers Authority, issued a press release in November 1995 explaining that an embargo had been placed on all 'new summer water' applications (both daily and annual

quantities) received after 3 October 1995. All existing irrigators in the South Level Fens had been informed of the situation. It is the intention that a water resources study is completed for the South Level area in order to demonstrate whether water resources have been fully allocated (as suspected) or not. This is Issue 3 in the LEAP document. There are 18 applications in hand awaiting the decision of the study. All these are for more summer water for spray irrigation.

1.2 Groundwater (Protection)

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, concepts of vulnerability and risk and a description of vulnerability of groundwater resources as well as the Groundwater Protection Policy Statements. It is envisaged that this document will act as a framework for decision making on groundwater issues and 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

Groundwater is the part of the natural hydrological cycle which is present within underground strata (aquifers), out of sight and, unfortunately, all too often out of mind. If groundwater becomes polluted it can be very difficult and expensive to rehabilitate and therefore the active promotion of the policies for prevention and reduction of the risk to groundwater is better than dealing with any consequences.

1.2.1 Natural Forces

The vulnerability of a groundwater source depends upon the natural characteristics of a site and is assessed on the physical, chemical and biological properties of the soil and rocks beneath the site, which control the impacts a hazard can have on 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;
- presence and nature of drift;
- porosity/permeability of strata; and
- 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.

The Woburn Sands aquifer is also present at depth; recharge of water to this aquifer is extremely limited because it underlies the Gault Clay. In the lowland catchments there is some groundwater available from isolated river terrace and glacial sands and gravels.

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 vulnerable to contamination and need to be protected. The Agency has designated Source Protection Zones (SPZs) around all large potable supply sources and those industrial sources used in commercial food and drink production. 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.

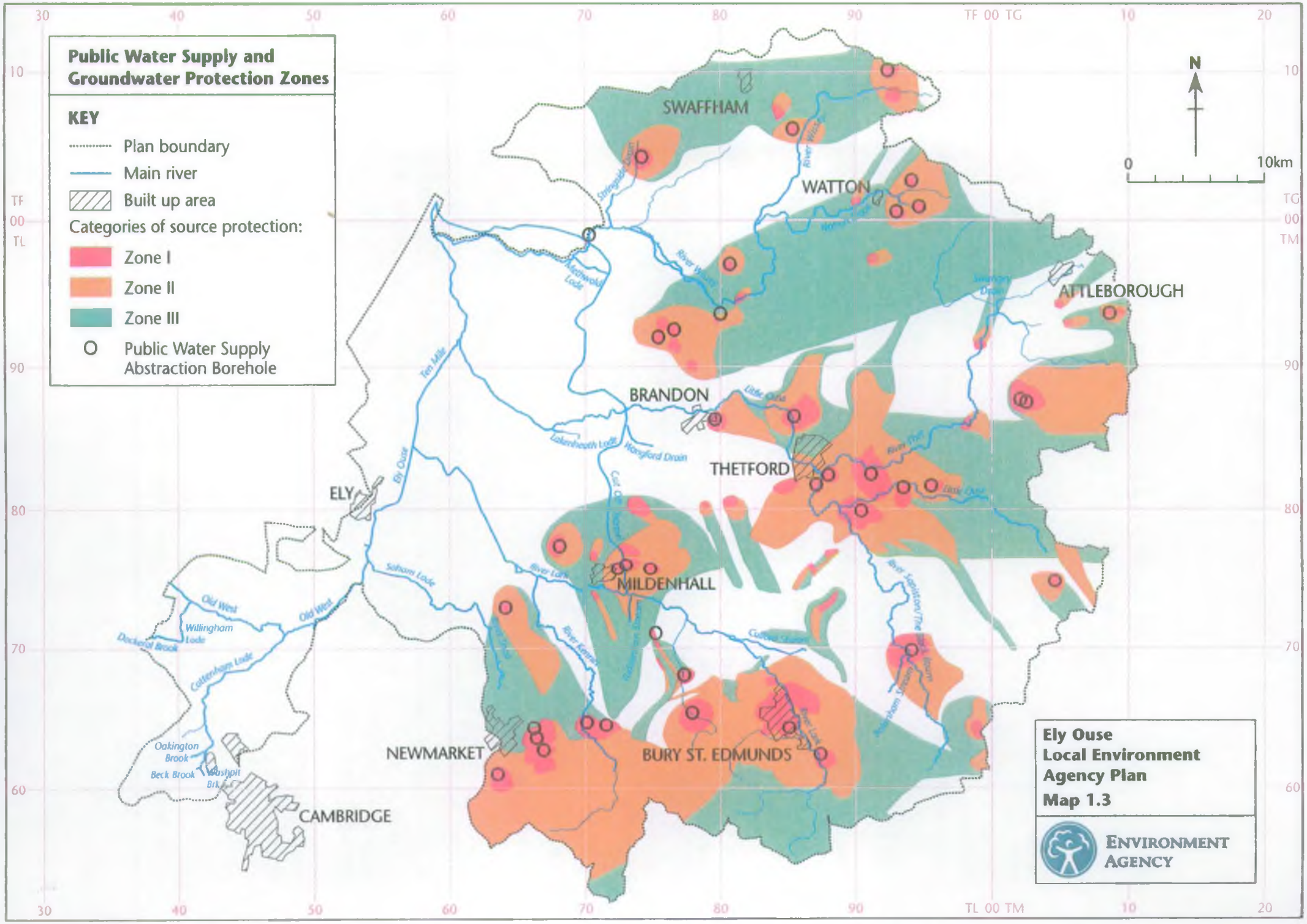
Public Water Supply sites and the SPZs for this LEAP area are shown on Map 1.3.

1.2.2 Societal Influence

Wherever groundwater is present there is the potential for it to be affected by human activity. No soil or rock is completely impermeable, no pollutant completely immobile. The concept of groundwater vulnerability recognises that risks of pollution from a given activity are greater in certain hydrogeological and soil situations than others.

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


Public Water Supply and Groundwater Protection Zones
KEY
Plan boundary
Main river
Built up area
Categories of source protection:
Zone I
Zone II
Zone III
Public Water Supply Abstraction Borehole
N
0
10km
SWAFFHAM
WATTON
ATTLEBOROUGH
BRANDON
THETFORD
ELY
MILDENHALL
NEWMARKET
BURY ST. EDMUNDS
CAMBRIDGE
Ely Ouse Local Environment Agency Plan
Map 1.3
ENVIRONMENT AGENCY

small. The LEAP area contains farmland of grades I - IV as classified by MAFF (with Grade I being the highest quality land). Arable farming is the general rule with the fen deposits forming the highly productive Grade I land in the lowland part of the area.

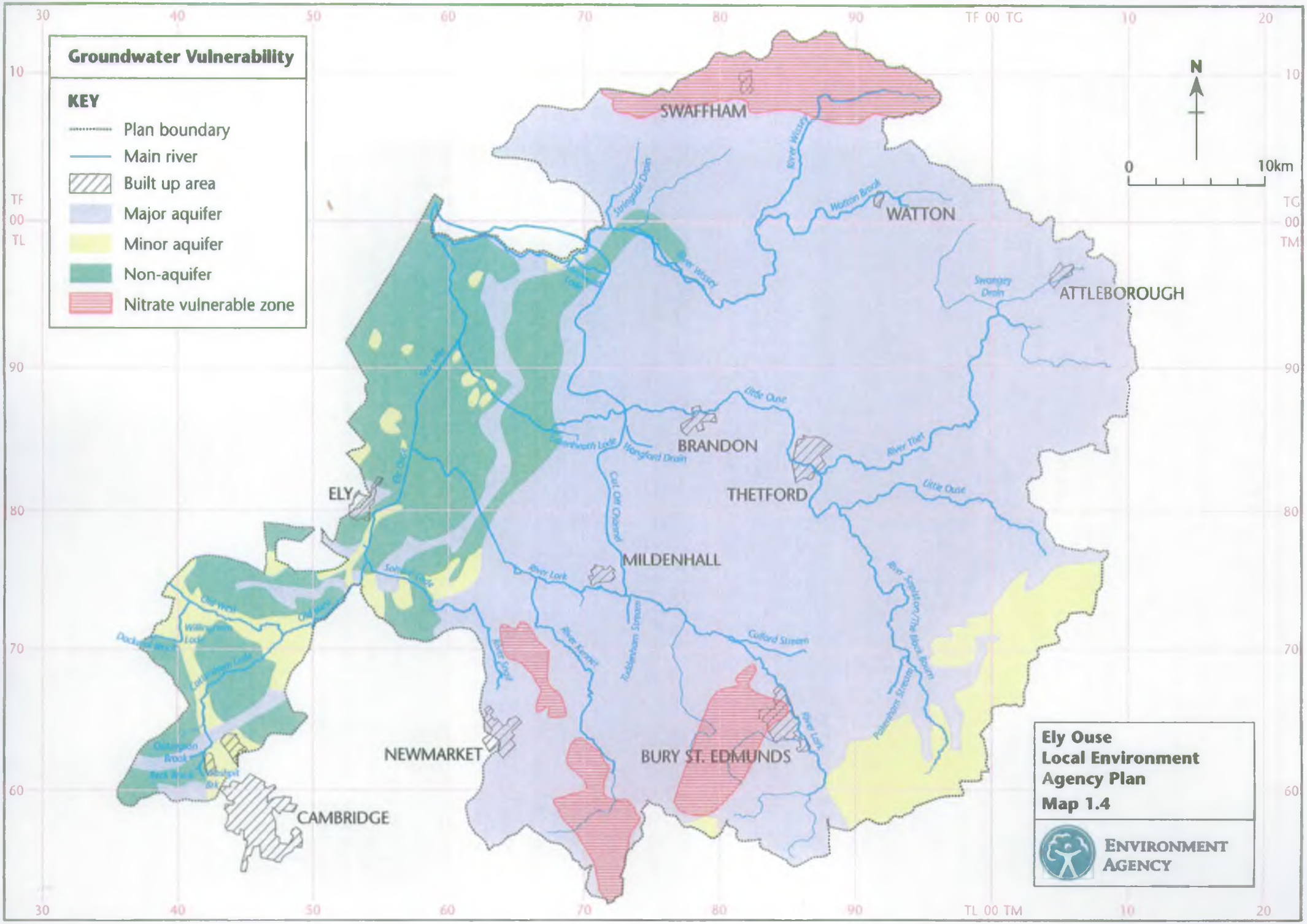
As required by the European Directive 676/91/EEC, which is designed to protect water from nitrate pollution from agricultural sources, the Government has designated 68 areas in England and Wales as Nitrate Vulnerable Zones (NVZs). These zones cover the catchments of polluted waters where the nitrate limit of 50mg/l set by the Directive at public water supply 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 1.4. The Two Mile Bottom source near Thetford and the River Wissey upstream of the Stoke Ferry intake are also under consideration for NVZ designation.

There are a number of intensive pig-rearing facilities in this LEAP area. These sites generate large quantities of manure and slurry, which needs to be disposed. This material represents a major potential source of pollution to surface and groundwater due to its high organic and nitrogen content. Nitrate enrichment of groundwater may occur due to soil leaching of waste spread on land, or from waste collection facilities which are not designed or maintained properly. In addition to measures introduced under the EC Nitrate Directive to control diffuse nitrate pollution from fertiliser application in NVZs, the introduction of the EC Integrated Pollution Prevention and Control (IPPC) Directive (96/61/EEC) in 1999 will bring large pig and poultry units under IPPC control (see Issue 23). The Government has produced draft regulations, which will establish the action programme measures; these are currently at the consultation stage.

Development and use of land is the one consistent element in the list of potential threats to the quality of groundwater. Land use planning policies and procedures therefore, play a significant role in effective groundwater protection. This process will begin 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 for 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 (eg, chemical stores, residential development, mineral extraction or industrial development) often the only control possible is 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 growth area will be to protect groundwater from pollution arising from 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.


Groundwater Vulnerability
KEY
Plan boundary
Main river
Built up area
Major aquifer
Minor aquifer
Non-aquifer
Nitrate vulnerable zone
N
0
10km
SWAFFHAM
WATTON
ATTLEBOROUGH
BRANDON
THETFORD
ELY
MILDENHALL
NEWMARKET
BURY ST. EDMUNDS
CAMBRIDGE
River Wissey
Watton Brook
Swangey Drain
Little Ouse
River Thet
Cut Off Channel
Hangford Drain
River Lark
Culford Stream
Robenham Stream
Pakenham Stream
River Blackbourn
River Linnet
Ely Ouse
Local Environment
Agency Plan
Map 1.4
Environment
Agency

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 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. This contamination may stay within the ground until sites are redeveloped; this redevelopment may release potentially harmful substances to the atmosphere or into ground and surface waters (see Issue 24). Any redevelopment of contaminated sites (including landfill sites) must be accompanied by a detailed site investigation (see Issue 7). Historic contamination of the Chalk aquifer by hydrocarbons and solvents has occurred at Mildenhall as a result of leakages of these substances from RAF Mildenhall and adjacent industrial areas (see Issue 5). The area is in a particularly sensitive location due to the presence of an important public water supply borehole at Beck Row. Poor groundwater quality led to the closure of this source between 1983 and 1989 and the RAF Mildenhall supply borehole was closed and replaced by a new borehole further to the east. The MoD has carried out a comprehensive groundwater investigation together with a land quality risk assessment.

Historic contamination of the Chalk aquifer by hydrocarbons, solvents and pesticides has also occurred at Lakenheath as a result of leakages from RAF Lakenheath (see Issue 6). Groundwater and contaminated land investigations have been carried out and a number of areas have been identified for further investigation.

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.

Until now the problems associated with contaminated land have tended to be addressed almost exclusively in the context of site redevelopment and the Agency and its predecessors have worked through the Town and Country Planning process to effect site clean-ups and protect the water environment. The Agency has existing responsibilities relevant to land contamination under its pollution control functions and 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, which will complement those of local authorities. These will include providing information to local authorities on land contamination by:

- ensuring remediation of special sites;
- maintaining registers of special sites remediation;
- preparing a national report on the state of contaminated land; and
- providing advice to local authorities on identifying pollution of controlled waters and on the remediation of contaminated land (see Issue 7).

There are several groundwater areas in the LEAP that have been confirmed as contaminated under the Agency's existing powers or will need investigation under the new powers. Mildenhall Industrial Estate, British Sugar at Bury St. Edmunds, Oil and Pipeline Agency (OPA) at Thetford, and RAF

Honington are amongst the sites where investigations have already commenced; other sites may become apparent once the Agency's powers under the new legislation are implemented. These may include areas such as Mildenhall and Lakenheath industrial estates and old landfill sites such as Ingham waste disposal site and the Agency will assist in investigations into areas such as these.

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.

1.2.3 Abstractions and Removals (see also section 1.1.3)

Industrial uses of groundwater 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. However, some problems do exist within this LEAP area:

- **Pesticides**: There are a few cases of contamination by pesticides. The 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 or treated before supply. There are also private sources and wetland conservation sites where blending is not an option;

- **Solvents**: There are several areas of local contamination by chlorinated solvents. These are generally associated with military airbases, industrial areas and laundries. Investigations are being carried out at RAF Mildenhall, RAF Honington and at industrial estates at Mildenhall and Bury St Edmunds; and

- **Organic Wastes**: There are a number of industrial sites where effluent from processing vegetables is discharged into lagoons and then soaks into the ground. Effluent from the British Sugar factory at Bury St Edmunds has been discharging into such lagoons for many years. Contamination of the aquifer has occurred and further investigation is needed to determine the extent of pollution and possible remediation measures.

1.2.4 Usage, 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 providing the base flow of rivers.

Therefore, groundwater is not only protected to maintain water supplies from aquifers but also to protect surface waters sustained by base flows. Its presence is often important in supporting wetlands and their ecosystems. Removal or diversion of groundwater can affect the 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 hydrological cycle, with many common issues.

Mineral extraction can affect both groundwater quantity and quality. It can restrict recharge to an aquifer and divert flow. Where the near surface deposits have been removed, eg, from landfilling and quarrying the vulnerability of the aquifer to pollution increases as the natural purification which occurs as water percolates through the unsaturated zone cannot occur if the gravel strata have been removed. Subsequent use of mineral extraction sites as landfills 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 three County Councils within the Ely Ouse LEAP area 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 the use of more 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.

1.2.5 Waste Arising and Disposal

Quarrying for (principally) sands and gravels together with excavation into glacial deposits in river valleys has provided void spaces for landfill, as has the chalk extraction industry.

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. 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.

The Agency is responsible for the issue of Waste Management licences under EPA 1990.

There is Agency involvement at three levels:

- On the Waste Disposal Plan which each County Council is required to produce;
- On the Planning Application for individual sites: this allows consideration of the principle of a waste disposal activity at a particular location and includes aftercare considerations; and
- On the Site Licence: this covers the operation of the site.

A wide range of operations require a licence; for example, transfer stations, waste storage facilities and scrap yards, all of which have potential to pollute water. In general, the greatest threat is from landfill sites.

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. Under Section 30 of the 1991 Water Resources Act, the Agency can issue a 'Conservation Notice' in order to conserve water in the dewatering process, but these powers are limited, and cannot be used to prevent landfill operations. 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 groundwater 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. Examples of such sites in this LEAP area are found at Ingham, Red Lodge, Waterbeach, Kentford, Kilverstone, Snetterton, Stretham, Aldreth and Fornham. A current holder of a Waste Management Licence for a landfill site will not be able to surrender their licence unless the Agency is satisfied that the site is unlikely to cause pollution of the environment or harm to human health. It 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 for even older sites (which operated when there was no requirement to be licensed), lies largely with the landowner. 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.

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. Currently, the main sites for domestic waste are at Barton Mills, Lackford, Knettishall and Wereham; however, they do take commercial wastes and in the past some may have taken industrial wastes.

There are two landfill sites where groundwater contamination has been confirmed: Ingham and Barton Mills. For many other sites, it is not possible to be confident that there is no pollution at present, or that

any will not arise in the future.

Waste disposal sites that have taken non-inert wastes may generate leachate, which presents a potential risk to groundwater quality. Through liaison with planning authorities and others, the Agency ensures that the type of waste deposited and the method of site operation reduce this risk to an acceptable level.

Changes in the expectations of our society 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 disposable 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 multi functional approach, which includes clarification and regulation of the legislative initiatives; this includes The Packaging Regulations 1997, Waste Minimisation Strategy and the development of local project initiatives in partnership with others.

1.3 Habitat

1.3.1 Natural Forces

This LEAP area contains a rich array of different habitats. These range from dry sandy heathland of the Brecklands to the peat soils of the fens. All rivers which flow from east to west in the LEAP area flow as chalk streams for at least part of their length and with the exception of Soham Lode flow through the Brecklands before reaching the fens and becoming part of the south level 'pond'.

In terms of in-stream habitat features, the headwaters and Breckland sections of the rivers are generally more diverse with numerous riffle – pool sequences throughout. Within the lower fenland, the rivers, ponded by control structures, form important 'green corridors' through mainly arable farmland. These lower sections of river are embanked, often with substantial areas of washland which contain areas of semi-improved grassland.

Erosion and flooding are natural processes and running water is the most important agent. Both can have a significant and detrimental impact on the built environment, and historically there have been attempts to limit and control these forces. Erosion and flooding rates inland, which can be sensitive to land use and flow regime change, can be significant. In more recent years the understanding of natural processes has increased. Where possible, the Agency tries to work with nature. However, continued development in the floodplain will commit future generations to the maintenance of an engineered flood defence at great cost.

The Brecklands is an area made up largely of free-draining sandy soils overlying chalk and it is recognised as being an area of national importance to nature conservation. Although the Brecklands is not given any statutory conservation designation as a whole, the area does contain a number of SSSIs and is designated as an Environmentally Sensitive Area (ESA).

The diversity in geomorphology underlies the ecological diversity and conservation value of the Brecklands. There are some 78 SSSIs within the catchment, 39 of which are wetland dependent (see Map 1.5). In addition to the SSSIs, there are a large number of County Wildlife Sites, which are also

of nature conservation importance.

The largest SSSI is the MoD-owned Stanford Training Area, covering 4,597 hectares. Located by the River Wissey, this site is the last remaining extensive area of Breckland grassland and heath, which also includes areas of wetland, springs, streams and standing water within it.

The Breckland Meres are uniquely characteristic to this LEAP area. These fluctuating water bodies are internationally important nature conservation features, being included in the Breckland candidate Special Area of Conservation (cSAC) under the Habitat and Species Directive as 'naturally nutrient-rich lakes or lochs, which are often dominated by pondweeds'. The principal meres are Ring Mere, Langmere, Fowlmere, Home Mere, West Mere and the Devil's Punchbowl, all of which fall within the East Wretham Heath and Stanford Training Area SSSIs.

The fluctuating Meres are unique hydrological features in Europe, which are rich in distinctive and unusual fauna and flora, including several rarities. They are an ecological system adapted to the unusual, natural fluctuating water level conditions, which respond to annual and longer term fluctuations in groundwater. The water regime leads to concentric zones of plant communities. These contain two scarce or declining aquatic pondweeds and, in the dry phase, two other nationally-scarce plants, together with a Red Data Book moss and nationally-scarce liverwort. The latter two are entirely reliant on the fluctuating conditions to provide competition-free growth conditions.

The Meres have a rich and particularly distinctive invertebrate fauna. There are two species presently known in Britain only from the Meres. These are included in at least 12 nationally endangered, vulnerable or rare species and a further 24 nationally scarce species present.

Mere water level is of primary ecological significance. Dry periods are a characteristic of the system but extending these through groundwater abstraction is of no ecological benefit; on the contrary, consistently detrimental impacts will occur with longer or more frequent dry periods. The ecology of the Meres is sensitive. By extending the naturally-occurring dry periods, increasing groundwater abstraction can lead to:

- reductions in open habitat areas for rare plant colonisation;
- disruption of the nutrient status caused by rank vegetation which encourages algae blooms and the suppression of aquatic macrophytes;
- disruption of the natural regime of higher summer and lower water levels affecting the seasonal invertebrate fauna; and
- increased predation in the dry phase of the drought-resisting life stages of some of the especially valuable species of invertebrates.

The upstream catchment of the River Little Ouse supports a number of valuable wetland SSSIs; the Blo Norton, Thelnetham, Hinderclay Weston and Hopton fens represent some of the remaining fragments of once extensive fen areas. The internationally important Redgrave and Lopham Fens lie at the source of the Little Ouse and is included in the Broadland Rivers LEAP.

Other important wetland areas, particularly within the Brecklands, are Ice Age landscape features

Wetland associated

13 Weston Fen
14 Knettishall Heath
15 Hopton Fen
16 Bugg's Hole, Thelnetham
17 Blo' Norton & Thelnetham Fens
25 West Stow Heath
27 Cavenham-Icklingham Heaths
38 Wangford Warren & Carr
40 Lakenheath Poors Fen
41 Stallode Wash, Lakenheath
43 Chippenham Fen & Snailwell Poors Fen
44 Snailwell Meadows
45 Brackland Rough
46 Soham Wet Horse Fen
48 Upware North Pit
51 Cam Washes
57 Stanford Training Area
58 Wretham Park Meres
59 East Wretham Heath
61 Thetford Golf Course & Marsh
63 Middle Harling Fen
64 Redgrave & Lopham Fens
65 Kenninghall & Banham Fens with Quidenham
67 Old Buckenham Fen
68 Swangey Fen
69 Cranberry Rough Hockham
70 Thompson Water, Carr & Common
72 Scoulton Mere
74 Great Cressingham Fen
75 Hookswell Meadows, Great Cressingham
78 Foulden Common
79 Didlington Park Lakes
81 Hilgay Heronry

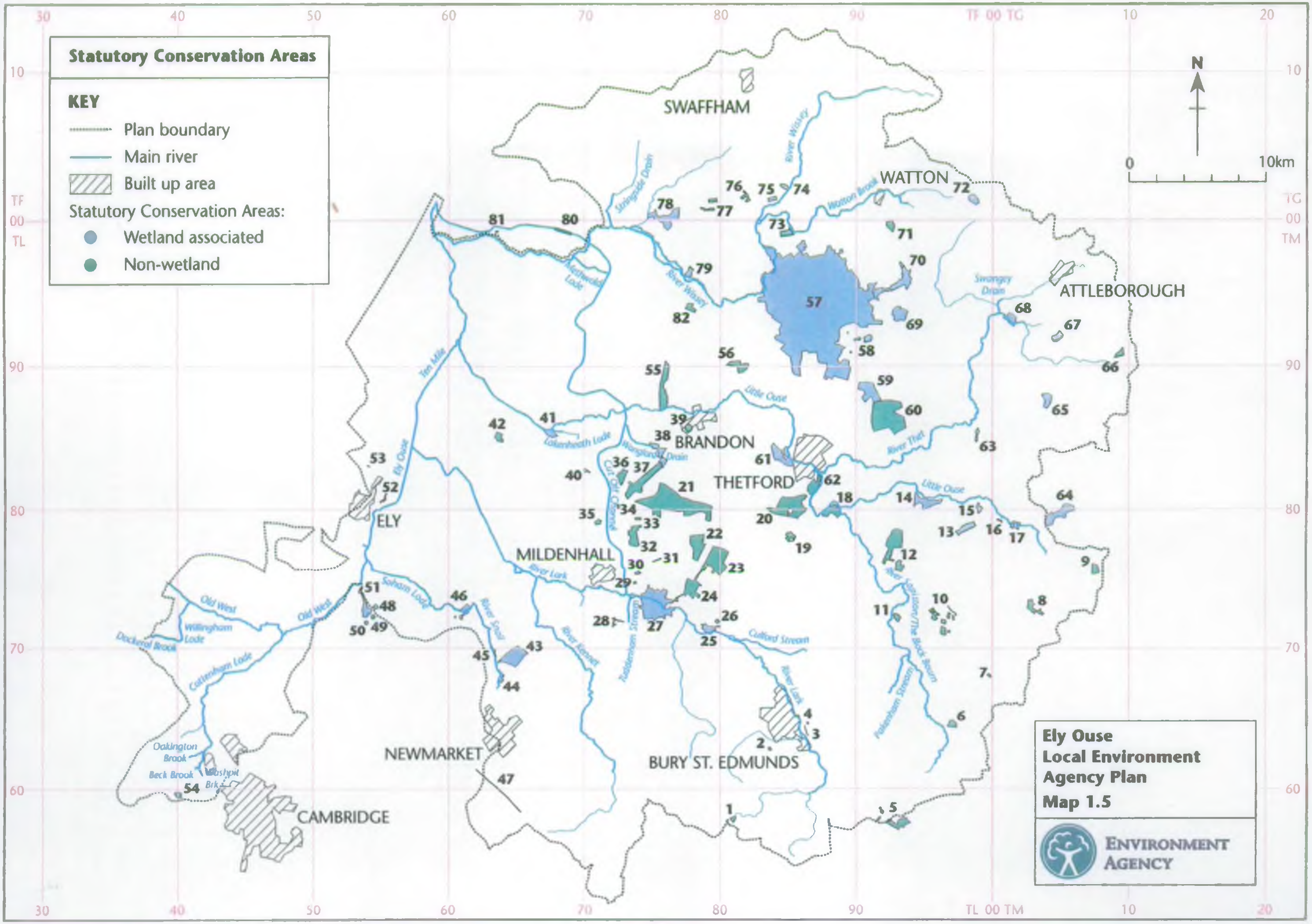
Non-wetland

1 Hay Wood, Whepstead
2 Horringer Court Caves
3 Shaker's Lane, Bury St Edmunds
4 The Glen Chalk Caves, Bury St Edmunds
5 Bradfield Woods
6 Norton Woods
7 The Gardens, Great Ashfields
8 Westhall Wood & Meadow
9 Burgate Wood
10 Stanton Woods
11 Bangrove Wood, Ixworth
12 Fakenham Wood, Euston & Sapiston Great Grove
18 Barnham Heath
19 Little Heath, Barnham
20 Thetford Heath
21 Lakenheath Warren
22 Weather & Horn Heaths, Eriswell
23 Berner's Heath, Icklingham
24 Deadman's Grave, Icklingham
26 Beeches Pit, West Stow
28 Cherry Hill & The Gallops, Barton Mills
29 Rex Graham Reserve
30 High Lodge, Mildenhall
31 How Hill Track
32 Foxhole Heath, Eriswell
33 Eriswell Low Warren
34 Lordswell Field, Eriswell
35 Wilde Street Meadow, Mildenhall
36 Maidscross Hill, Lakenheath
37 RAF Lakenheath
39 London Road Industrial Estate, Brandon
42 Shippea Hill
47 Devils Dyke
49 Upware Bridge Pit North
50 Upware South Pit
52 Roswell Pit
53 Chettisham Meadow
54 Madingley Wood
55 Weeting Heath
56 Grime's Graves
60 Bridgeham & Brettenham Heath
62 Barnhamcross Common
66 New Buckenham Common
71 Wayland Wood, Watton
73 Old Bodney Camp
76 Field Barn Heath, Hilborough
77 Gooderstone Warren
80 Wretton
82 Cranwich Camp

Ely Ouse Local Environment Agency Plan

Map 1.5 Legend

Environment Agency



Ely Ouse Local Environment Agency Plan Map 1.5

known as pingos (dome-shaped mounds originally formed during permafrost conditions).

1.3.2 Societal Influences

Sustainable development, which is defined as 'development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs', is increasingly being used by decision-makers as a framework to build policies around.

Rapid and extensive land-use change in the last 50 years though changes in agricultural practice and increased urbanisation has lead to a dramatic loss and deterioration of both wildlife habitats and species. For example, the straightening and over-deepening of watercourses has resulted in ecologically-degraded rivers through the loss of in-river habitat diversity e.g. river margins and spawning areas for fish, and caused floodplain wetlands to dry out.

While change in the natural environment has always been subject to evolutionary processes, the future threatens greater changes through, for example, global warming which is likely to have unpredictable consequences for both land and sea. Development and growth, wealth and employment must therefore ensure that society as a whole benefits and that progress runs in tandem with the conservation and enhancement of biodiversity.

Efforts made by local people, County Wildlife Trusts, RSPB, FWAG (Farming and Wildlife Advisory Group), local government and public bodies such as English Nature and the Agency can together make a difference in the wider countryside through better site management and understanding of the needs of biodiversity.

In 1992, the Brecklands Study Group, which comprised local authorities, conservation bodies, The Countryside Commission, MAFF and The Forestry Commission, addressed planning policy and environmental issues in the Brecklands. The resultant 'Brecks Study Report' emphasised the importance of co-ordinated action by the various organisations to promote the conservation value and recreation use of the Breckland area. Further, it identified the importance of river valleys and other wetland sites to the area and the potential for conflict between the natural environment and other legitimate water-users. The findings of this report were taken forward and have been addressed through the Brecks Countryside Project.

1.3.3 Abstractions and Removals

Of significant relevance to the Agency is the element of biodiversity that is dependent upon the water environment, both within the river corridor and in sites of conservation value that are water-dependent. The 'in-river needs' of the aquatic ecosystem and also the bankside community are directly related to water levels, flow velocity and water quality factors such as effluent dilution and siltation. The conservation of wetland sites is reliant both on maintaining a responsible surface water hydrological regime and monitoring abstractions within the wetland groundwater catchment area.

A number of smaller rivers in the catchment are not Main Rivers but are still of importance for wildlife. Whilst we do not undertake any maintenance work on these non-Main River watercourses,

they still require recognition and protection through the management of water resources and pollution prevention activities. For example, the protection of groundwater, upon which the spring fed rivers in this LEAP area rely, must be considered when managing water resources.

The Environment Agency has a statutory duty to have regard to and to further conservation. Some wildlife sites are not just of national importance but of European importance. These sites are known as SPAs (Special Protection Areas) and SACs. SPAs and SACs (such as the Breckland SAC) can be land-based, freshwater, coastal or marine and have been designated under the Birds and Habitats Directive, which came into force in the UK in 1994.

As 'Guardians of the Environment', the Agency is legally obliged to implement the Birds and Habitats Directive and has, therefore, to ensure that any activity in or adjacent to an SPA or SAC will not seriously damage or put at risk these sites (unless there is overriding public interest). This requires our consent, permission, authorisation or licence and potentially means that any discharge consent, abstraction licence, land drainage consent, net fishing licence, IPC consent and waste disposal licence must be assessed. Of these, water abstraction and waste discharges to air, land and water are likely to be the most important. The Agency is at present looking at the impact of all its authorisations on SPAs and SACs; modifications or revocations will be made in agreement with English Nature.

Gravel extraction has often meant the destruction of valuable river corridor habitats. Increasingly, however, restoration of these sites can lead to the creation of new wetlands and heathland. For example, a gravel extraction site at Needingworth and Over will be restored to approximately 876 hectares of wetland and will make a significant contribution to the UK Biodiversity Action Plan (BAP) for *Phragmites* reed beds.

1.3.4 Usage, Releases and Discharges

Our river systems have for a long time been used as carriers for human, industrial and agricultural waste. In fresh waters, nutrient enrichment is caused by inputs of phosphate and nitrate from sewage effluent and agrochemicals, which reduces plant diversity 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. The use of buffer strips adjacent to watercourses can act as an aid in controlling both nutrient enrichment and siltation.

Pollution is not only a problem in surface water systems but also causes contamination of groundwater. Wetland areas affected by fluctuating water tables are therefore, threatened from surface and groundwaters. Poor water quality, especially water rich in nutrients, may also have a detrimental effect on wetland plant communities.

1.3.5 Waste Arisings and Disposals

Increasing amounts of household waste has lead to pressure for new sites for landfills. Open pits created by aggregate operations are eminently suitable for this purpose. There is a major landfill site at Kilverstone 3 km south of East Wretham SSSI. If groundwater remediation is required, it

may have an impact on groundwater levels, which will have to be addressed.

1.3.6 Illegal Practices

Flytipping is 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.

VIEWPOINT 2: FLOOD DEFENCE AND LAND USE

2.1 Flood Defence

Rivers drain groundwater and surface water run-off from developed land. River channels have a limited capacity and when this is exceeded, flooding of the adjoining land known as the floodplain occurs.

Floodplain is the area of low-lying land adjacent to a river over which water flows in times of flood. Areas of floodplain are often under pressure from development. However, if buildings or other man-made objects obstruct floodplains, water cannot flow away efficiently and the effects of flooding are made worse. Through advice to planning authorities, the Agency has a policy of protecting floodplains from development (refer to section 2.3.1).

Floodplain storage reduces the peak flood flow in the river. The effect of this is to reduce flood levels and the risk of flooding downstream. Additionally, floodplains assist in the conveyance of floodwater, which can also have a bearing on flood levels and flood risks.

This use identifies the basic role of the river as the conveyance of water from land in the Ely Ouse 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 high winds or very heavy rainfall. Flood events are described in terms of frequency at which, on average, a certain severity of flood is exceeded. This frequency is usually expressed as a return period in years, eg 1 in 50 years. Areas of major flooding in the LEAP area are shown on Map 2.1.

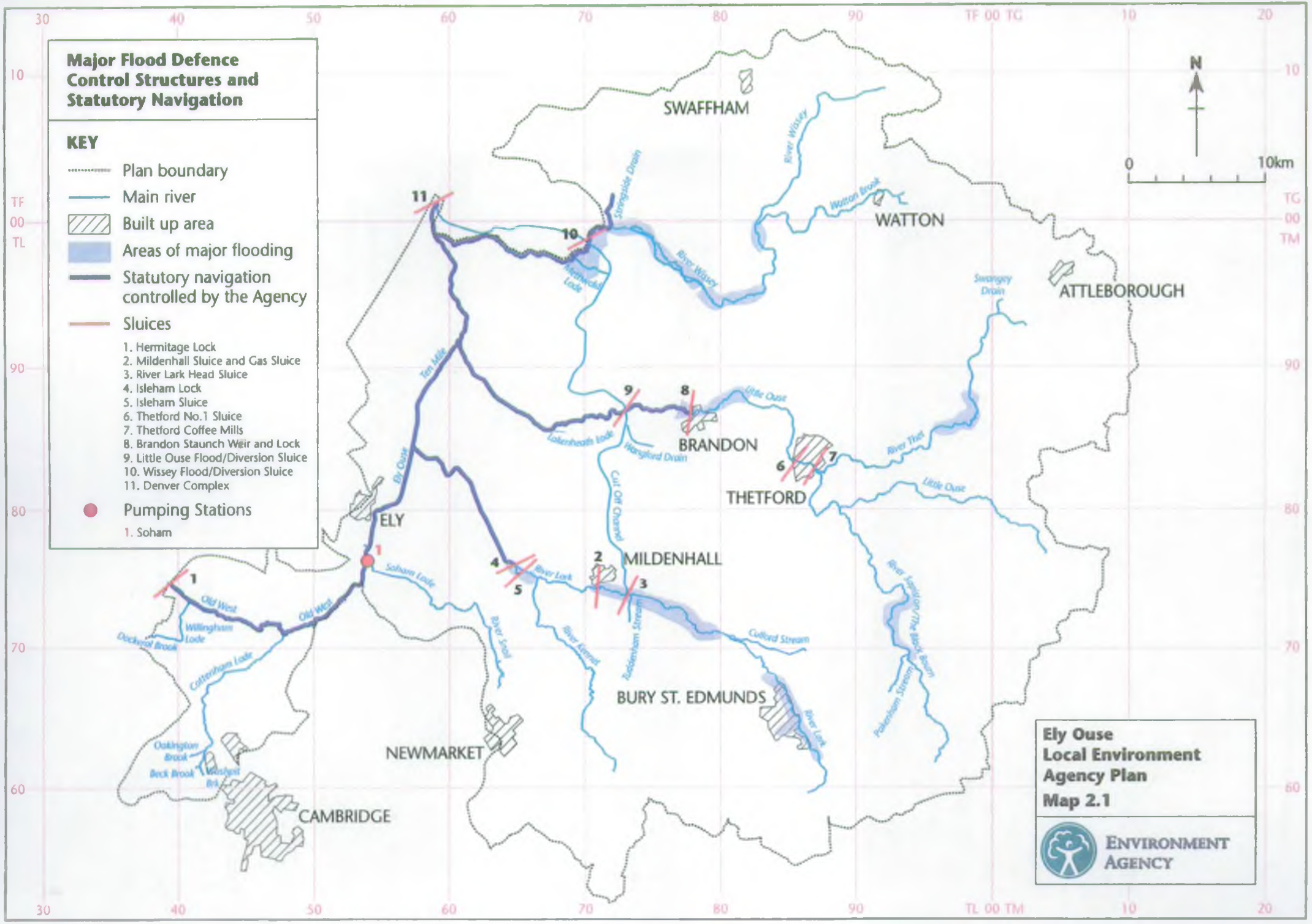
The effectiveness of flood defences can be measured in terms of the return period up to which they prevent flooding. It is clear that different types of land use, for example urban areas and pastureland, require different levels of effectiveness of the defences.

Rivers and floodplains are fundamental parts of the water environment. Generally, their existence is a result of natural forces and processes, which must be respected if land drainage and flooding problems are to be avoided.

2.1.1 Natural Forces

Parts of the fens are as much as 1.5 m below mean sea level; high flood levels can be 3.5 to 4 m above it. Thus the Agency's challenge is not fen drainage; it is the protection of the fens from flooding by the failure or overtopping of the river embankments. This would seem to suggest that the remedy is to make the flood banks high enough and strong enough to contain the floods. Unfortunately, the solution is not quite so straightforward because of the presence of buttery clay. This is the soft, silty clay that overlies most of the fenland floor beneath the upper coating of peat or silt.

From ground level to the hard Kimmeridge clay, Gault clay or chalk can be as much as 5 or 6 m. The flood embankments rest upon the peat and buttery clay layers, rendering them liable to sinking, instability and seepage below. The flood banks sink as the peat and the soft clay consolidate slowly under their weight. As they sink, the safe margin above flood level (freeboard) diminishes and they have to be raised. The weight of the clay added to them in the heightening starts off a new sinking


Major Flood Defence Control Structures and Statutory Navigation
KEY
Plan boundary
Main river
Built up area
Areas of major flooding
Statutory navigation controlled by the Agency
Sluices
1. Hermitage Lock
2. Mildenhall Sluice and Gas Sluice
3. River Lark Head Sluice
4. Isleham Lock
5. Isleham Sluice
6. Thetford No.1 Sluice
7. Thetford Coffee Mills
8. Brandon Staunch Weir and Lock
9. Little Ouse Flood/Diversion Sluice
10. Wissey Flood/Diversion Sluice
11. Denver Complex
Pumping Stations
1. Soham
N
0
10km
SWAFFHAM
WATTON
ATTLEBOROUGH
BRANDON
THETFORD
ELY
MILDENHALL
BURY ST. EDMUNDS
NEWMARKET
CAMBRIDGE
River Wissey
Watton Brook
Swangey Drain
Little Ouse
River Thet
Ten Mile
Old West
Willingham Lode
Cottenham Lode
Soham Lode
River Snail
River Lark
Cut Off Channel
Lakenheath Lode
Hangford Drain
Culford Stream
Rattlesham Stream
River Linnet
Oakington Brook
Beck Brook
Westgate Brk
Pakenham Stream
Ely Ouse
Local Environment Agency Plan
Map 2.1
Environment Agency

process - and so on. Thus it becomes obvious that continually raising the banks does not resolve the situation.

In the past, there was an obstacle to the discharge of the South Level waters through Denver Sluice. In times of flood the water level from the Old and New Bedford Ouse outside the Sluice was higher than the waters coming from the Ely Ouse and its South Level tributaries, preventing their discharge. However, the low water level at King's Lynn under high flood conditions is about 3.5 m lower than at Denver. Sir Murdoch MacDonald and Partners' report of 1939 identified this factor as the key to the dilemma. Although the problem was disputed at length for centuries, Sir Cornelius Vermuyden had actually suggested the solution more than 300 years earlier. It would seem that bypassing the Denver Sluice and bringing the point of discharge to King's Lynn would take advantage of this lower water level, thereby enabling the flood waters from the South Level rivers to 'get away'. Therefore, a relief channel was cut from Denver with sluice gates at each end. To ease the flood level in the Ely Ouse itself, the Cut Off Channel (which runs from the River Lark near Mildenhall, crossing the River Little Ouse and River Wissey), takes flood waters from all three rivers and conveys them to the Relief Channel for discharge at King's Lynn. In addition to the new channels, the Ely Ouse River was widened to increase its capability.

Figure 2.1: Aerial View of the Denver Complex

When the incoming tide rises, the Tail Sluice gate at King's Lynn closes and the outflow of the river water ceases. This water is then contained in the Relief Channel and rises inside the gates until the tide once again falls, the gates open and the discharge of the water is resumed.

The basic principles of this scheme were put forward by Vermuyden in 1638. With the completion of the scheme in 1964 the old problem of how to move excess water from the Fens into the sea was

finally largely overcome. Improvements continue on into the 1990s - projects have recently been completed to raise and strengthen the embankments of the Ouse Washes and the Tidal River, at a cost of around £20 million.

2.1.2 Societal Influences

RIVER CONTROL STRUCTURES AND STATUTORY MAIN RIVER

In the river system, certain channels are designated as statutory Main River, which means the Agency takes a greater responsibility for the maintenance and control of the channel. At the same time various powers to control the activities of others are also available.

The responsibility for the maintenance of any watercourse normally rests with the riparian landowner, whose ownership as a general rule extends to the centre line of the river. However, Agency powers include control over the construction of any structure in or close to the statutory Main Rivers. This and other activities likely to affect the bed or bank of the river require the formal consent of the Agency.
Under the Water Resources Act 1991, the Agency has powers to maintain and improve Main Rivers for efficient passage of flood flow and the management of water levels. These powers are permissive only, so there is no obligation on the Agency to carry out either maintenance or new works on Main Rivers. Maintenance of a watercourse for amenity only, or to stop erosion where this does not threaten the interests of the Agency, is unlikely to be carried out by the Agency.

The Agency has powers in respect of consents for weirs, dams and culverts and similar obstructions on watercourses, which are not designated statutory Main River. District and county councils have powers to carry out schemes on such watercourses, but no legal obligation to do so. They would require the Agency's consent under its requirements for overall supervisory duty of drainage matters. With a few minor exceptions, the Water Act 1989 did not change the basis of responsibility and powers in drainage and neither does the Water Resources Act 1991 or the Land Drainage Act 1991.

River control structures are operated for various reasons such as maintaining navigation and recreation levels, reductions in flood level, conservation, waterpower, aiding abstraction for public water supplies and irrigation (see Map 2.1). There is a percentage of river control structures that are in private ownership. Private owners of any structures that affect river levels and flow have particular responsibilities. By law they are required to operate the structure properly. In practice, the Agency will normally work in co-operation with owners of river control structures. Agency engineers are always willing to advise on maintenance and operation.

URBAN FLOODING

In pre-war years, the pressure for new development was very much less than occurs now. Individual communities were more stable and had accumulated local knowledge; thus building would not take place on land subject to flooding. Nowadays the pressures are greater and there is very much higher reliance on the intervention of Planning Controls to avoid unsuitable locations. The greater concentration of housing within modern developments, together with the much higher value of home contents, makes the potential losses through flooding very high indeed.

RURAL FLOODING

For many years, drainage improvements to increase agricultural production have been a major component of the work of the predecessor Authorities to the Agency. Both capital schemes and major maintenance programmes have been carried out to ensure reduced water levels and to minimise flood losses on agricultural land. This position has now changed such that most Agency activity is now centred on protection of urban communities from river and sea flooding.

LOCAL PERSPECTIVE

Non-Main River flooding is likely to be more frequent than that experienced from a Main River and solutions to this rest with the district and county authorities. The Internal Drainage Boards (IDBs) are responsible for drainage within their administrative areas and perform maintenance and flood protection duties.

Whilst schemes for the protection of property can be devised there is always the possibility of an event more severe than the design standard. Thus planners of future development close to the river corridor should be mindful of potential risks.

FLOOD RISKS IN THE LEAP AREA

Flood defences in this area are to a good standard. There are no areas with properties at risk from frequent floods although the following areas are at low to medium risk: Bury St Edmunds, Thetford, Dalham, Kentford, Moulton, Hengrave, Freckenham, Fornham All Saints, Ixworth, Lackford, Icklingham, and low-lying riverside properties in Ely.

Many rivers in the area have embankments to protect land and property from flooding. In major flood events embankments are put under severe pressure and some overtopping and breaching is possible. In these events the warning systems will be active and the Police will co-ordinate the emergency response. In addition to the aforementioned areas at risk, some localised problems elsewhere may result in flood events caused by surface run-off from urban areas and blocked culverts in small drains and dykes.

There is an increasing number of non-Main River urban flooding difficulties that have been brought to the Agency's attention. The necessary powers to carry out works lie with the Local Authorities but with reduced funding levels of available public money, relief for these locations may be seriously delayed. IDBs may also be involved in flood relief works within their administrative areas.

The Agency's duty is one of a general supervisory role over parties that have a responsibility for these watercourses. There is a increasing trend of lack of resources for these parties to be able to respond as riparian owners, or for local authorities (deciding upon involvement by use of their discretionary drainage powers) to rectify these localised events. IDBs may also become involved where problems occur within their administrative area.

FLOOD WARNING

The risk of flooding from rivers and the sea is constant. It can happen very quickly, often with little warning. After heavy rainfall, many rivers naturally flow over their banks and into the floodplain. Severe weather can alter sea conditions, causing tidal surges and flooding in estuaries and along the coast.

Flood defence schemes reduce the risk of flooding and protect those who live and work near rivers and the sea. While these defences provide a high level of protection, they can never completely remove the risk of flooding.

If you live near a river, or on the coast, you should be aware of how flood warnings will be issued and know what to do if a flood ever occurs.

The Agency operates a flood warning system across much of England and Wales. From 1 September 1996, it has taken the lead role in passing flood warnings to people who are at risk, so that they can take action to protect themselves and their properties. Over the next five years the Environment Agency will be improving the warning service so that more information reaches those who need it.

The Agency monitors rainfall, river levels, tides and sea conditions 24 hours a day throughout the year. When there is a risk that flooding could occur, flood warnings will be issued to the Police, local authorities and the media. In some areas there are arrangements in place for issuing warnings directly to those at risk. Details of these local warning arrangements are being made available to those in places most at risk from flooding.

Flood warning is not an exact science. The Agency uses the best information available to predict the possibility of flooding, but no warning system can cover every eventuality. It is the responsibility of those who live in flood prone areas to be aware of any risk and to know what action they should take to protect themselves in flood conditions.

The Environment Agency issues warnings for flooding from most major rivers and the sea. There are other types of floods for which a warning service cannot be provided. These include, for example, road flooding caused by blocked drains.

2.1.3 Uses, Releases and Discharges

IMPORTANCE OF FLOODPLAINS

The flooding of floodplain areas is both natural and desirable, where it can occur without risk to human life. The effectiveness of rivers and floodplains 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 floodplain.

Before the Town and Country Planning system was established, there was little attempt to steer development away from rivers and floodplains. Indeed many settlements grew around river crossing points where transport routes converged. Consequently, the floodplains 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 floodplains 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 floodplain areas particularly important.

Throughout England and Wales, a considerable amount of development has already take place on the coastal floodplain as well as on river floodplains. 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 Environment Agency and local authority flood defence works, which is regulated and in part funded through the Ministry of Agriculture, Fisheries and Food, 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 floodplain areas.

Traditionally, floodplains 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 water level management plans (WLMPs), to cater for the needs of a wide range of floodplain interests in a way that is both balanced and sustainable.

At many locations, the increasing recognition of the ecological value of floodplains, together with changing agricultural policies, is providing opportunities to re-establish the natural functions of floodplains. Much floodplain 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 floodplains provide.

2.1.4 Waste Arisings and Disposals

DISPOSAL OF SPOIL

The Agency undertakes dredging works for flood defence purposes as part of the annual maintenance programme and when the need for additional works is highlighted; land surveys and river inspections are carried out to identify sections where a river can benefit from dredging works. We also remove debris such as fallen trees, shopping trolleys, sunken boats and man-made items from designated Main Rivers, to ensure that river flow and navigation are not adversely affected.

Under Section 167 of the Water Resources Act 1991 the Agency may, without making payment, dispose of any spoil in the course of widening, deepening or dredging any watercourse and deposit any matter onto the banks of a watercourse or any adjoining land within the reach of a machine's

jib.

Where appropriate, excavated silt or reeds may be buried in a suitable trench along the river bank and recovered with top soil (re-seeded if necessary), or transported off site to a local licensed tip.

Figure 2.2: Dredging Work on the Ely Ouse at Ely

2.1.5 Illegal Practices

NON-MAIN RIVER

Under Section 23 of the Land Drainage Act 1991, where the Environment Agency is the responsible drainage authority, the Agency has a duty to consent culverting or erection of any structure in an ordinary watercourse; this is not a significant issue in the LEAP area. The Agency has a general supervisory role to ensure watercourses are maintained to a satisfactory standard by riparian owners or occupiers of the watercourse, and to ensure that any works within a watercourse do not significantly impact on the flow so as to cause an increase in flooding. Under Section 25 of the Land Drainage Act 1991 the Agency has the power to enforce riparian owners to carry out works to improve the flow of a watercourse if it can be proven the condition has caused or contributed to the flooding.

2.2 Agriculture

This section has been compiled with the assistance of MAFF/FRCA.

2.2.1 Natural Forces

The underlying geology of the Ely Ouse LEAP area is chalk or chalky drift with the dominant soil types comprising shallow, well-drained calcareous silty or loamy soils over chalk or chalk rubble in complex patterns. (The geology of this area is discussed in detail in Appendix A.) These soils are ideally suited for growing cereals and sugar beet. Large parts of the area are covered with glaciofluvial drift and till which comprises deep, well-drained sandy soils which are acid in places and suited for growing coniferous woodland and supporting lowland heath habitats.

As discussed in Viewpoint 1 (1.1.1 - Natural Forces) the Ely Ouse LEAP area is one of the driest in the country, with consequent implications for the types of agricultural practices that are possible. The LEAP area comprises 32.2% of Grades 1 & 2 land (see Map 2.2), 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.
The Fenland area within the Ely Ouse is not as vulnerable to tidal flooding as most parts of the Fenland. Some areas to the west, however, are at or below sea level and susceptible to fluvial flooding.

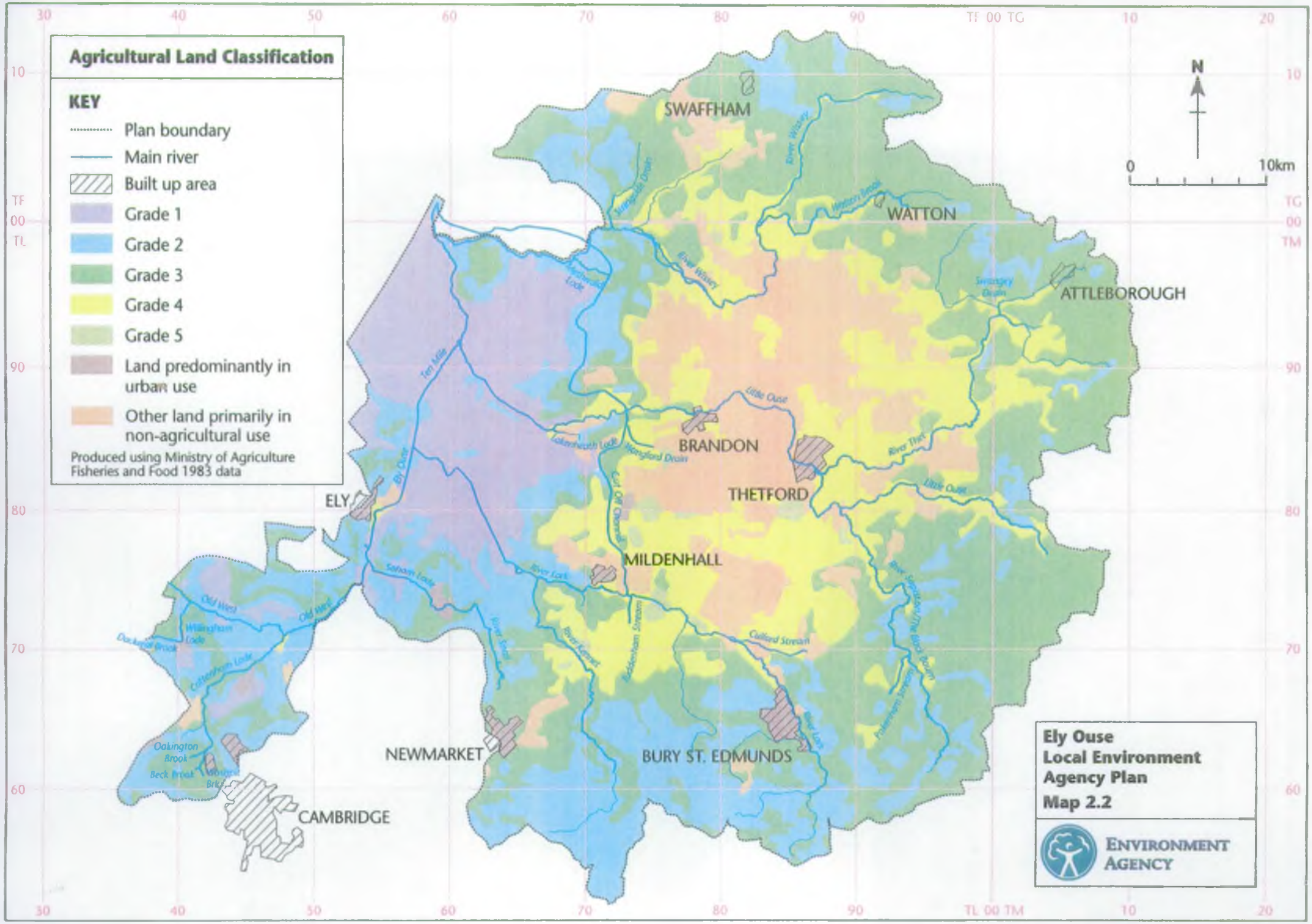
2.2.2 Societal Influences

GENERAL PERSPECTIVE

The structure of agriculture in the UK has undergone significant changes in the last ten years, as a result of the reform of the Common Agricultural Policy (CAP) and the introduction of the General Agreement on Tariff and Trade (GATT). Consequently production and markets are coming closer together and as the Government reduces subsidies, the farming industry has had to reduce food production, largely by setting aside land out of production. Further reform of the CAP and the next World Trade Organisation round of talks (due to start in 1999) are only likely to increase the cost/price squeeze facing farmers.

The strength of sterling has already had a substantial effect on aid payments and exports. All sectors are likely to suffer cuts in prices and aids, in order to bring the EU further in line with world market prices.

These economic changes, together with more stringent consumer requirements and legislation, 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 a reduced demand for labour and the release of surplus farm buildings into the rural economy.


Agricultural Land Classification
KEY
Plan boundary
Main river
Built up area
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
SWAFFHAM
WATTON
ATTLEBOROUGH
BRANDON
THETFORD
ELY
MILDENHALL
NEWMARKET
BURY ST. EDMUNDS
CAMBRIDGE
Ely Ouse
Local Environment
Agency Plan
Map 2.2
Environment Agency

The Government has stated its commitment to the conservation and enhancement of the countryside and to its enjoyment by the public. It also 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 policy assists them to reconcile agricultural and environmental objectives through a combination of guidance, protection measures and financial incentives.

MAFF promotes 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 5 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:

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

Details of the other agri-environment schemes can be obtained from the MAFF Regional Services Centre.

The role of the Environment Agency in agricultural issues includes:

- the control of pollution from agricultural sources and 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 (HSE) 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 195 202 hectares. 11 551 hectares of this total was set-aside from food production, the majority of which is considered to be 'best and most versatile' land (eg, Grades 1, 2 & 3a). 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.

Table 2.1: Changes in Agricultural Land Use

Agricultural Land Use	1986 (hectares)	1996 (ha)	Change 1986-96 (%)
Grassland<5 years	4313	4271	-1%
Grassland>5 years	15 087	13 972	-7.4%
Rough Grazing	6354	7263	20%
Crops and Fallow	141 460	142 546	0.8%
Farm Woodland	4664	8068	73%
Other Land	4223	7171	69.8%
Set-aside	0	11 551	n/a
Total	**176 101**	**195 202**	**10.8%**

Of particular significance are the increases over the 10-year period of farm woodland, rough grazing and other land, and the take-up of set-aside (which comprised 6% of the total agricultural area by 1996). The reasons for these shifts 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 the farmers' set-aside requirements. With the swingeing cuts in farm support schemes and the possible abolition of set-aside, both proposed for the latest CAP reforms, significant further changes in agricultural land-use may be expected in the coming years.

Farm types are classified by the dominant activity on each holding; Table 2.2 details farm types by number in the LEAP area:

Table 2.2: Farm Types by Number

Farm Type	1991	1996	% Change 1986-1996
Dairy	20	10	-50%
Cattle & Sheep	126	109	-13.5%
Pigs & Poultry	135	112	-17%
General Cropping	849	794	-6.5%
Horticulture	158	138	-12.7%
Mixed	135	138	2.2%
Other types	219	233	6.4%
Total	**2071**	**1924**	**-7.1%**

The statistics show a halving in the number of dairy farms from 20 to 10 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. The decrease in cattle and sheep farms by 14% is likely to be due to the increased profitability of cereals and other arable crops in the mid-1990s. Changes in the Arable Area Payment Scheme have led to large areas of grassland being ploughed and sown with arable crops and registered with Arable Aid.

The number of pig and poultry holdings fell by 17% from 1991-1996 (although because of consolidation and amalgamation in the industry, the actual number of birds in breeding and laying flocks has increased significantly). This is both because of the general shift in eating habits in recent years from red meat to white meat consumption 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 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 to comply with similar legislation.

Cropping farms have fallen in number; this is likely to be a result of farms being sold off to extend the hectarage of other holdings. Table 2.3, overleaf, outlines the significant changes in cropping patterns over the ten-year period 1986-1996:

Table 2.3 Cropping

Cropping	1986 (Ha)	1996 (Ha)	% Change 1986 -1996
Wheat	50 272	54 715	8.8%
Winter Barley	19 673	17 578	-10.6%
Spring Barley	15 699	7769	-50.5%
Other Cereals	1393	1475	5.9%
Potatoes	6525	7995	22.5%
Sugar Beet	25 363	26 444	4.3%
Horticultural Crops	12 403	11 688	-5.8%
Field Beans & Peas	4336	5186	19.6%
Oilseed Rape	3399	3691	8.6%
Linseed	0	2329	n/a
Other crops & fallow (inc. maize)	2397	3676	53.4%
Total crops & fallow	**141 460**	**142 546**	**0.8%**

The hectarage of cereals within the area has fallen by 6.3%, largely due to set-aside. Cereals, however, still amount to 81 537 ha or 42% 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.

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 20%, 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 remained stable in the LEAP area, although there was a 107%

increase in lettuce and celery and substantial reductions in areas of peas, beans, fruit and bulbs. This is 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 allied to weather conditions. Consequently, many farmers now prefer 'safer' alternative cropping rotations.

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 Ely Ouse LEAP area declined by 10.6% and stood at 8053. As farmers strive to become more efficient, especially in times when profits are reduced, they may not replace workers when they leave, but buy larger machines or employ contractors to undertake labour- and/or time-intensive activities such as ploughing, sowing and harvesting.

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 which 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, eg contracting out services;
- Farm-based processing - adding value, eg smoked meats, home cooking, butchery;
- Farm-based tourism, eg bed & breakfast, holiday cottages, caravans and camping;
- Sport and recreation, eg golf courses, equestrian facilities, nature trails, fishing;
- Farm-based retailing, eg farm shops, pick-your-own, craft centres;
- Renewable energy resources, eg short-rotation coppice, bio-diesel; and
- Alternative crops, eg, *Miscanthus* (elephant grass), evening primrose.

2.2.2 Abstractions and Removals

Nitrate Vulnerable Zones (NVZs) have now been designated (see Map 1.3) and include measures to reduce nitrate pollution from agricultural sources. Catchment areas surrounding public extraction points of both surface and groundwater 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 included in these programmes are as follows:

- 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.
- Farmers will have to limit their applications of inorganic fertilisers to levels that are consistent with the net nitrogen requirement of the crop, after allowance for nitrogen from residues in the soil and from other sources.

NVZs are discussed in more detail in Viewpoint 1 (1.2.2 - Societal Influences).

2.2.3 Uses, Releases and Discharges

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

If these discharges from agriculture are not managed appropriately they can cause both minor and major pollution incidents. Pollution from farms can contaminate drinking water and irrigation supplies and also devastate rivers and streams, rendering them lifeless. Many everyday farming activities can kill fish, destroy animal and plant life in rivers, poison livestock and contaminate water supplies if proper precautions are not taken:

- Slurry, manure, silage liquor and even dairy products cause the rapid removal of oxygen from any water they enter.
- Pesticides and sheep dip are extremely toxic to all river life and can render underground water supplies unfit for use, even in very small concentrations.
- Oils and chemicals, widely used on farms, are potentially very harmful.
- Fertilisers can cause serious damage to rivers and underground water sources if not stored safely and applied properly.

The number and nature of pollution incidents are discussed in more detail in Viewpoint 4 (4.2 - Quality of Surface Waters).

The most frequent causes of pollution from farms are:

- structural failure of slurry and effluent stores;
- mismanagement and lack of maintenance of slurry handling systems;
- inadequate wilting of silage;
- pesticides, either from mixing, spraying or rinsing operations;
- fertilisers;
- run-off from land-spreading and irrigation of farm waste; and
- problems with dirty water disposal.

Almost all pollution incidents can be avoided by careful planning. Better design, construction and

maintenance of storage systems also reduce the risk.

The Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) Regulations, introduced in 1991, set minimum standards of design and construction for such systems in England and Wales. They relate to Section 92 of the Water Resources Act 1991 and were amended in April 1997.

2.2.4 Waste Arisings and Disposals

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 is disposed of by spreading it onto land. The disposal of agricultural wastes is currently 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 Groundwater Regulations, brought into force during 1998, control 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 (eg spray drift).
- 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 (eg, 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;
- Organic matter to water courses;
- 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.

2.2.5 Illegal Activities

Agricultural pollution incidents often occur due to a lack of understanding/awareness, for example 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

The continual development of our cities, towns and countryside is the single most significant influence on the environment. Development encompasses 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 are 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. Each County Council is responsible for producing a Minerals Local Plan, a Waste Local Plan, and the overall Structure Plan for that county. Within a county, each District and/or Borough Council produces a Local Plan covering its own area of authority. 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 the objective of sustainable development as the fundamental basis for planning.

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 and air quality, flood defence, biodiversity, foul and surface

water drainage and recreation. 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 2.3 shows 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 an area, including the geology, hydrogeology, topography and rainfall. For example, it is evident that watercourses have been important in the establishment of settlements in the plan area, including Thetford and Bury St Edmunds. Thetford was effectively the 'capital' of East Anglia in the 10th century as it was a strategic location at a crossing of the River Thet. Ely, now the largest settlement in East Cambridgeshire District, was established on the largest of the Fen 'islands', which are areas of relative high land in a low lying, boggy area.

The physical characteristics may still be influential for certain land uses such as agriculture, but their influence over development patterns has generally reduced with the introduction 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.

However, the physical environment can still be influential on the location of development. This is most evident in the case of mineral extraction as, clearly, minerals can only be worked where they are found. Natural forces can also be influential on land use at a local level. An example is land found within a floodplain because the range of uses that can be made of that land is limited by the flooding risks; caravan or camping parks and sports fields/golf courses are likely to be more appropriate than residential or commercial development.

Rivers and floodplains are fundamental parts of the environment. Generally their existence is a result of natural forces and processes which must be respected. The flooding of floodplain areas is both natural and desirable, when it can occur without risk to human life. The effectiveness of rivers and floodplains to convey and store flood water, and minimise flood risk can be adversely affected by human activity, especially by development which changes the physical characteristics of the floodplain (Refer to Viewpoint 2.1 - Flood Defence).

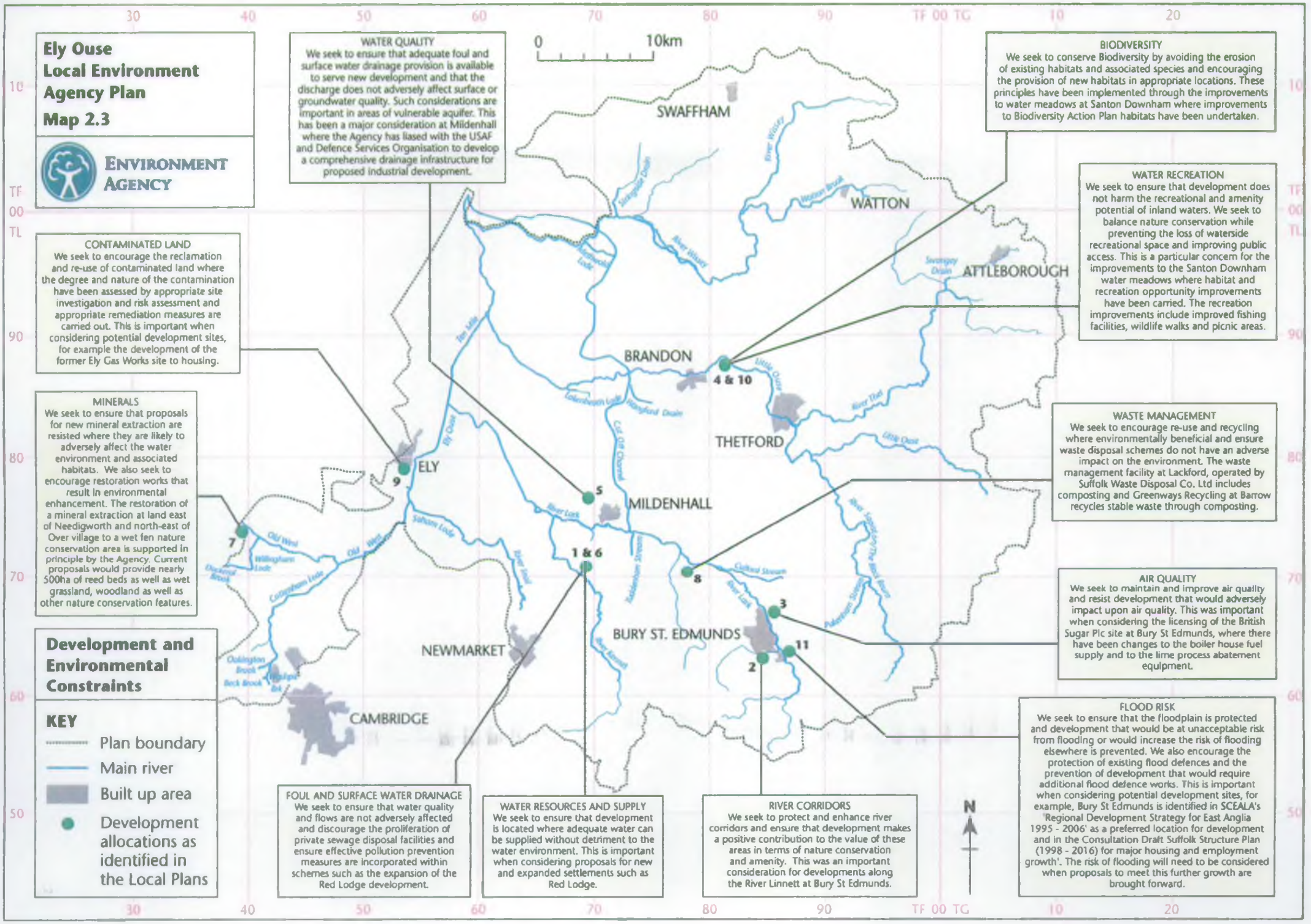
The Agency has an overall supervisory role over land drainage matters under the Water Resources Act 1991 and a direct responsibility for drainage in designated Main Rivers. The Agency's objectives are to ensure that:

- development does not take place if it has an unacceptable risk of flooding, leading to danger to life, damage to property and wasteful expenditure on remedial works;
- development does not create or exacerbate flooding elsewhere;
- development does not take place which may impact on maintenance or improvements of or to the river to reduce flood risk;
- development does not cause unacceptable harm to the environment;

Ely Ouse Local Environment Agency Plan

Map 2.3

ENVIRONMENT AGENCY



WATER QUALITY

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 aquifer. This has been a major consideration at Mildenhall where the Agency has liased with the USAF and Defence Services Organisation to develop a comprehensive drainage infrastructure for proposed industrial development.

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 have been implemented through the improvements to water meadows at Santon Downham where improvements to Biodiversity Action Plan habitats have been undertaken.

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 is a particular concern for the improvements to the Santon Downham water meadows where habitat and recreation opportunity improvements have been carried. The recreation improvements include improved fishing facilities, wildlife walks and picnic areas.

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 the former Ely Gas Works site to housing.

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 at land 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 as well as other nature conservation features.

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 Lackford, operated by Suffolk Waste Disposal Co. Ltd includes composting and Greenways Recycling at Barrow recycles stable waste through composting.

AIR QUALITY

We seek to maintain and improve air quality and resist development that would adversely impact upon air quality. This was important when considering the licensing of the British Sugar Plc site at Bury St Edmunds, where there have been changes to the boiler house fuel supply and to the lime process abatement equipment.

Development and Environmental Constraints

KEY

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

FOUL AND SURFACE WATER DRAINAGE

We seek to ensure that water quality and flows are not adversely affected and discourage the proliferation of private sewage disposal facilities and ensure effective pollution prevention measures are incorporated within schemes such as the expansion of the Red Lodge development.

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 proposals for new and expanded settlements such as Red Lodge.

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 for developments along the River Linnett at Bury St Edmunds.

FLOOD RISK

We seek to ensure that the floodplain is 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 existing flood defences and the prevention of development that would require additional flood defence works. This is important when considering potential development sites, for example, Bury St Edmunds is identified in SCEALA's 'Regional Development Strategy for East Anglia 1995 - 2006' as a preferred location for development and in the Consultation Draft Suffolk Structure Plan (1998 - 2016) for major housing and employment growth'. The risk of flooding will need to be considered when proposals to meet this further growth are brought forward.

- natural floodplain areas are retained and, where practicable, restored in order to fulfil their natural functions.

2.3.2 Societal Influences

The needs of society have increasingly become the greatest influence over patterns of development. Many settlements in the LEAP area have undergone considerable development and ther has been concurrent development of a complex transport infrastructure.

Much of the change this century has been driven by population increase, with national population growth being faster this century than in any preceding century. Between 1931 and 1979 the national population grew by 21.5% to 55.9 million. East Anglia experienced an uninterrupted increase throughout the 1970s, mainly due to in-migration. 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 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 greater independence for many people. This has led to more people being able to live in separate homes and from a younger age; it has also led to more people being able to afford larger homes and be more demanding in their requirements;
- improvements in general standards of living and health, which have led to people living longer and often on their own; and
- changes in social behaviour, particularly a greater acceptance of divorce, which 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, the UK's fastest growing county, and an increase of 20 to 30% in Norfolk and Suffolk.

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 LEAP 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 is within East Anglia and incorporates parts of three counties. Most of the area is within Norfolk (43%) and Suffolk (40%) with a smaller portion in Cambridgeshire (17%). In addition, the area is covered by nine local authorities; these are Breckland, East Cambridgeshire, South Cambridgeshire King's Lynn and West Norfolk, Forest Heath, St Edmundsbury, Mid Suffolk, South Norfolk and Babergh District or Borough Councils. The Agency liaises with all these planning sections with regard to development planning. Map 2.4 shows county and local authority boundaries.

Development planning in East Anglia is guided by Regional Planning Guidance (RPG) produced by the Government and strategies produced by the Standing Conference of East Anglian Local Authorities (SCEALA). The current RPG for East Anglia was produced in July 1991 and provided the framework for assisting the Cambridgeshire, Suffolk and Norfolk in the updating of their Structure Plans to 2006. This guidance identified environmentally sustainable growth as the central theme and overall objective of the updating of Structure Plans.

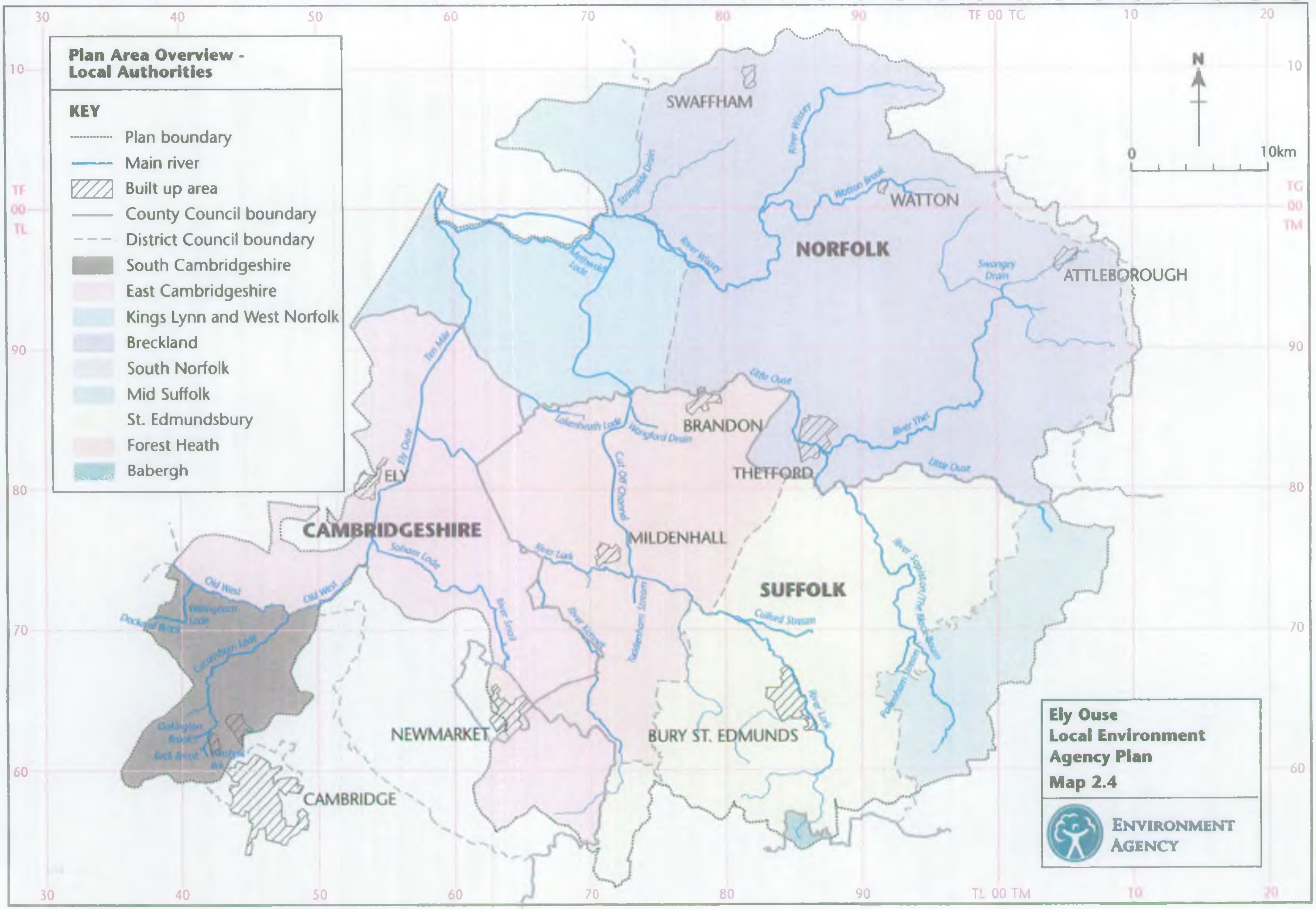
The Guidance identified that in East Anglia 40% of residents live in settlements with populations of up to 5 000 and that the population has increased by 20 000 per year with an expected population of over 2.3 million by 2011. On this basis it sets housing provision requirements between 1986 and 2011 for the three counties of 74 000 in Cambridgeshire, 62 000 in Suffolk and 69 000 in Norfolk.

The Guidance also notes that economic growth has led to increased prosperity and traffic increases above the national average. To reflect this, the 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 pressure placed upon the environment by tourism and recreation is identified, as is the importance of these activities in many areas.

The framework for development in the RPG is for greater economic opportunities in 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 re-use of brownfield land are limited.

SCEALA have produced two strategy documents since the RPG that are advice to the Secretary of State for the Environment on the content of revised regional planning guidance. The latter document 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 increases the 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 more 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


Plan Area Overview - Local Authorities
KEY
Plan boundary
Main river
Built up area
County Council boundary
District Council boundary
South Cambridgeshire
East Cambridgeshire
Kings Lynn and West Norfolk
Breckland
South Norfolk
Mid Suffolk
St. Edmundsbury
Forest Heath
Babergh
N
0
10km
SWAFFHAM
WATTON
NORFOLK
ATTLEBOROUGH
BRANDON
THETFORD
ELY
CAMBRIDGESHIRE
MILDENHALL
SUFFOLK
NEWMARKET
BURY ST. EDMUNDS
CAMBRIDGE
River Wissey
Wissey
Watton Brook
Little Ouse
River Thet
Ten Mile
Ely Ouse
Lakenheath Lode
Cut Off Channel
River Lark
Soham Lode
Old West
Cottenham Lode
Cavenham Brook
Culford Stream
Ely Ouse
Local Environment
Agency Plan
Map 2.4
ENVIRONMENT AGENCY

to travel, maintain their vitality, aid the re-use 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 Table 2.4 below:

Table 2.4: Net dwelling requirement 1995 – 2011 and 2016

Housing Requirement	Cambridge	Norfolk	Suffolk
1986 – 2011 (RPG)	74 000	69 000	62 000
Net New Dwelling Requirement 1995 – 2011 (SCEALA)	24 800	16 800	9 400
Net New Dwelling Requirement 1995 – 2016 (SCEALA)	45 000	32 700	21 800
Net New Dwelling Requirement 2011 – 2016	20 200	15 900	12 400

This level of development is to be met in accordance with the regional sustainable development framework 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 were addressed at an Examination in Public of Regional Planning Guidance for East Anglia that was held in February 1999.

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 concentrating development at larger centres and along transport corridors and introduced the possibility of new settlements at least as large as Cambourne (a new town of 3500 dwellings currently being constructed). These options could lead to up to 9 000 additional dwellings within that portion of Cambridgeshire in the LEAP area. This capacity study will assist the County Council in making their submission to the Regional Examination in Public to determine Regional Planning Guidance for East Anglia. Norfolk and Suffolk are addressing this issue through ongoing reviews of their structure plans.

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. Table 2.5 below sets out Structure Plan additional dwelling requirements derived from the RPG, the numbers remaining to meet these allocations in the adopted and emerging local plans along with the current allocations for industrial and commercial land. Babergh and South Norfolk District Councils have been omitted from the table as the portions of these district council areas within the plan area are small, rural in nature and without key local plan housing or employment allocations within them.

Table 2.5: Allocations to meet current RPG requirements

County	District/Borough	Housing (no. of dwellings) 1988 - 2006[1]	Housing Allocations to meet RPG figures[2]	Commercial and Industrial land area (ha)[3]
Cambridgeshire	East Cambridgeshire	7 500[4]	2700	36.6
	South Cambridgeshire	11 300[4]	3129	35.93
Suffolk	St Edmundsbury	9780	2505	72.9
	Mid Suffolk	7590	1355	19.6
	Forest Heath	4170[5]	2950 (+650)[6]	30.2
Norfolk	Breckland	10 600	192	114.44
	Kings Lynn and West Norfolk	13 500	4050	213

[1]Figures from Adopted Structure Plans
[2]Figures from adopted and emerging Local Plans
[3]Uses B1 to B8 only.
[4]1991 – 2006
[5]1988 – 2001
[6]Red Lodge 2001 – 2006

It is evident that there is a considerable number of allocations still to be fulfilled through the adopted and emerging local plans for the area to meet current RPG guidance; only a portion of the allocation, however, will actually be in the LEAP area. In applying the draft regional planning strategy to the area, it is evident that there is a focus for development in Cambridge and Bury St Edmunds, with development in other towns where this would lead to greater self-containment. Cambridge is on the boundary of the area but is likely to exert an influence over development patterns in the LEAP area.

The emerging Development Plan for the area identifies the settlements that are to receive development to enhance their vitality and self-containment. These sites and their allocations are identified in Table 2.6:

Table 2.6: The Key Allocations Made in the Plan Area

County	District/Borough	Key Settlements in plan area	Key Housing Allocations (dwellings and ha)		Key Comm/Indust allocations in plan area (ha)
Cambridgeshire	East Cambridgeshire	Ely	1702	84.7	0
		Littleport	650	35	19.5
		Soham	225	11.8	9.7
	South Cambridgeshire	Willingham	c32[1]	1.3	0
		Cottenham	c105[1]	4.2	0
		Girton	c222[1]	8.9	0
		Oakington	c32[1]	1.3	0
Suffolk	St Edmundsbury	Bury St Edmunds	885	29.4	7.4 (24.7)[3]
	Mid Suffolk	Woolpit	0	0	2.5
	Forest Heath	Newmarket	c100	4	8.0
		Mildenhall	c350[1]	14	0
		Brandon	c155[1]	6.2	12.0
		Lakenheath	c197[1]	7.9	0
		Red Lodge	850 (650)[2]	c34 (26)[1,2]	7.0
Norfolk	Breckland	Attleborough	670	26.5	19.1
		Swaffham	250	10	21.1
		Thetford	450	18	41.18
		Watton	169	6.8	12.17

[1] Assumes a density of 25 dwellings/ha
[2] Red Lodge 2001 – 2006
[3] Rural area allocations

Part of the Government's strategy for accommodating these levels of predicted growth is to focus development on 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 land back into productive use. The Government has set the target of 50% for new development on brownfield sites but a higher figure of 60% has also been suggested. 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.

However, due to the relatively rural nature of East Anglia, and this LEAP area in particular, it is unlikely that more than 30 to 40% of new development will be on brownfield sites. Attention has been drawn to the potential brownfield land that could come forward through redevelopment of certain former RAF airfields; however the contribution to be made by such sites is unclear at present and there has been widespread local opposition to the proposed redevelopment of some former RAF bases. It is likely therefore have most of this allocated development and future development up to 2016 will be on greenfield sites.

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 to be carried out prior to redevelopment of a site.

TRANSPORT

The draft regional strategy identifies the main highway network for the region. Three important elements of this network cross the plan area. These are the:

- A14, which links the A1, M1 and M6 to the west with Ipswich and the ports to the east via Cambridge, Newmarket and Bury St Edmunds;
- A11, connecting Newmarket, Mildenhall, Thetford and Attleborough to Norwich; and
- A10, connecting Cambridge, Ely and Littleport to King's Lynn.

Improvements to all three of these highways are priorities for improvements, with the A11 being a priority 1 highway.

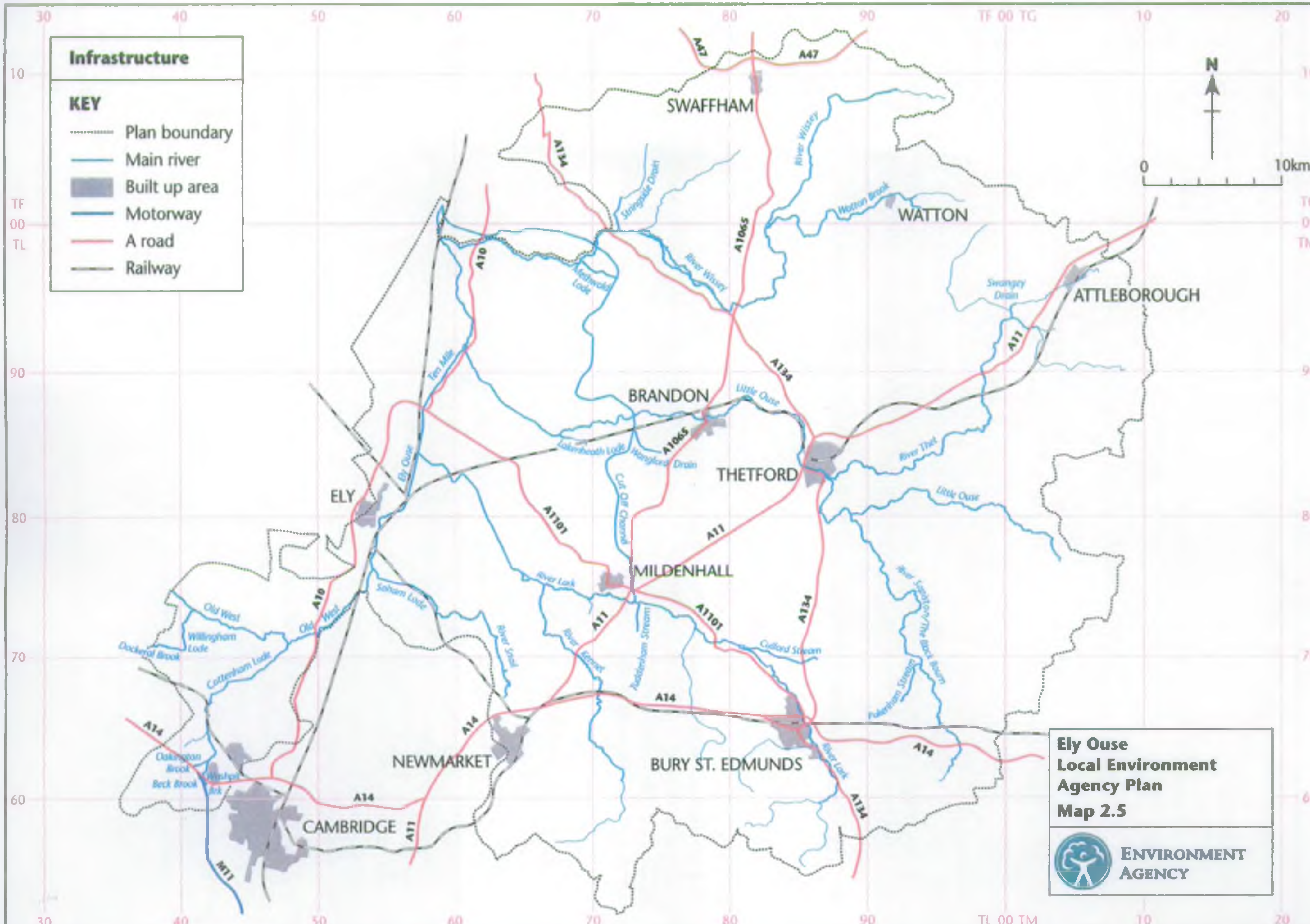
The main railway routes in the plan area are the routes from London Kins Cross and London Liverpool Street to Cambridge, Ely and King's Lynn and the cross-country route from Liverpool/Manchester through Ely and Thetford to Norwich. The priority route for rail improvement, however, is the line from Ipswich to Bury St Edmunds, Ely and Peterborough (refer to Map 2.5).

The Government's White Paper 'A New Deal for Transport: Better For Everyone' (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 several schemes in this plan area subject to full appraisal and SCEALA approval. One is the dualling of the remainder of the A11, including the stretch from Fiveways to Thetford and the Attleborough bypass. Improvements to the Rookery Lane junction of the A14 at Bury St Edmunds and on the A11 between Rougham Heath and Attleborough is also proposed.

Suffolk County Council is also promoting a bypass for Brandon on the A1065. There are a large number of road schemes proposed by the County Council in the adopted Structure Plan which are not brought forward into the Local Plans including a number of bypasses, road widening and dualling schemes.

It is clear that it is the Government's 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 by the development plan for the LEAP area. Many road schemes have been removed from the road building and improvements programme but those that remain, identified above, will require full environmental assessments.

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.


Infrastructure
KEY
Plan boundary
Main river
Built up area
Motorway
A road
Railway
Ely Ouse
Local Environment
Agency Plan
Map 2.5
ENVIRONMENT AGENCY
N
0
10km
SWAFFHAM
WATTON
ATTLEBOROUGH
BRANDON
THETFORD
ELY
MILDENHALL
NEWMARKET
BURY ST. EDMUNDS
CAMBRIDGE
A47
A134
A10
A1065
A11
A1101
A14
M11
River Wissey
Wissey
Watton Brook
Little Ouse
River Thet
Ely Ouse
Ten Mile
Lakenheath Lode
Cut Off Channel
River Lark
Soham Lode
River Snail
River Kennet
Old West
Willingham Lode
Cottenham Lode
Swangey Drain
Cavenham Stream
Fakenham Stream
Culford Stream
Hangford Drain
Stringside Drain
Methwold Lode
Dockeral Brook
Oakington Brook
Beck Brook
Washpit Brk
TF 00 TL
TG 00 TM
TF 00 TG
TL 00 TM
30
40
50
60
70
80
90
10
20
00

2.3.3 Abstractions and Removals

The levels of housing, employment and transport infrastructure development allocated by the development plan for the LEAP 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 (1.1 - Water Resources). 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.

Regional Planning Guidance for East Anglia in Mineral Planning Guidance (MPG 6) sets out the requirement for the supply of 145 million tonnes of aggregate between 1992 and 2006. Of this, approximately 135 million tonnes is to be sand and gravel and approximately 10 million tonnes is to be crushed rock. It is assumed that in addition to these requirements for aggregate in East Anglia the region will import approximately:

- 45 million tonnes of aggregate from the East Midlands;
- 10 million tonnes from outside England and Wales;
- 10 million tonnes from marine dredged sources; and
- 15 million tonnes from secondary or recycled material.

Table 2.7 below sets out the county apportionment of this aggregate supply.

Table 2.7: Aggregate Supply by County

Aggregate Supply 1992 - 2006	County		
	Cambridgeshire	Norfolk	Suffolk
Sand and Gravel (million tonnes)	48.6	49.9	36.5
Rock/Carstone (million tonnes)	5	5	0

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 such 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 operation of mineral extraction sites can have a wide range of adverse impacts on the environment if it is not adequately controlled. The Agency seeks to resist proposals for new mineral extraction where there is likely to be an adverse effect on ground and surface waters and other water bodies and associated habitats. Restoration works at former mineral extraction sites, that result in environmental enhancement, are encouraged, especially when provision for water-based recreation is

made.

Minerals Plans indicate that there are currently 17 permitted mineral extraction sites and 12 allocated sites/areas of investigation in this plan area. Thirteen of these are sand and gravel sites, two are chalk extraction sites and two are peat extraction sites (refer to Map A1).

The majority of these sites are to be restored for nature conservation value, including wetlands and heathland. Other restoration schemes include transforming landfill sites at the end of their working lives to agricultural land. A restoration scheme of particular note is that proposed for a sand and gravel extraction site at Needingworth on the western boundary of the LEAP area. The site covers 945 hectares and the proposed restoration scheme would provide a nature conservation area of approximately 876 hectares, including 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 the 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 plan area, where that waste is managed and how much is managed within the 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 and 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 from 70% to 60% by 2005, to recover 40% of municipal waste by 2005 and recycle or compost 25% of household waste by the year 2000.

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 shortly a new PPG that currently has the draft title of 'Waste Disposal and Management'. Government planning guidance in these documents includes two key elements; the Proximity Principle and Regional Self-Sufficiency. The Proximity Principle requires waste to be managed as close as is practicable to the point at which it is generated as this will encourage more responsibility for the waste generated. This is more likely to accord with the principles of sustainable development, 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. To assist with this, SCEALA intend to produce Integrated Waste Management Strategies and Sustainable Waste Management Plans.

Not surprisingly, considering the national figures, the 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 highlights that in

1994/95 that over 8.3 million tonnes of domestic, industrial and commercial waste was produced in East Anglia and that there has been a continued upward trend in generated waste. 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. There are currently 21 operating landfill sites and over 50 closed landfill sites and 20 waste transfer stations in the LEAP area. There are also 7 recycling centres, 2 treatment plants and 20 licensed scrap metal dealers (see Map 2.7).

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 regulate many of these releases and discharges. The Agency has controls through the issue of discharge consents, waste management licences 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 cannot 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 an environmental problem.

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 the maintenance of our society. The disposal of waste to land has always been 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 or 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' and 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 mines and quarries waste.

Under this legislation, a Waste Management Licence is required to keep, treat or dispose of controlled waste, although 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

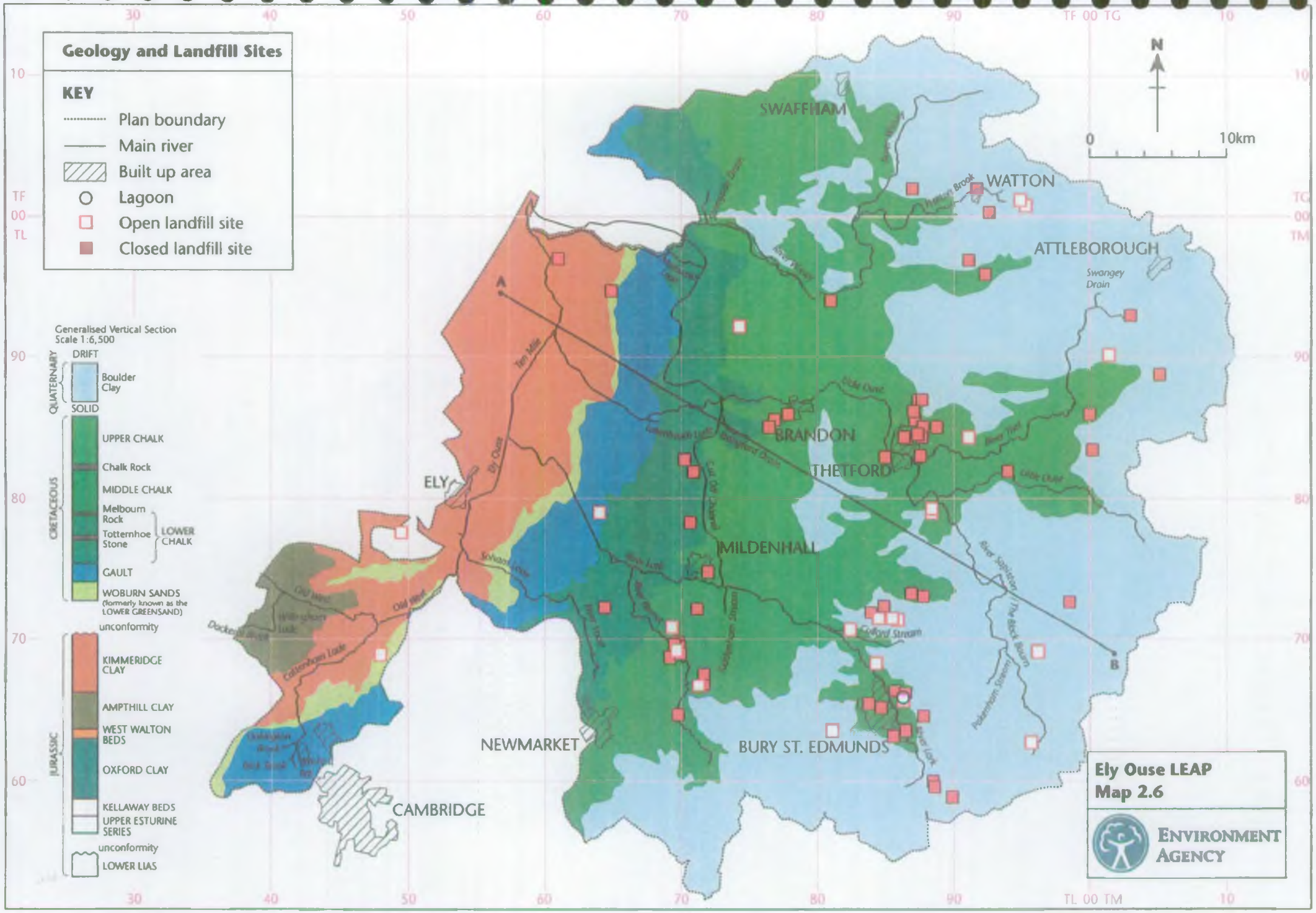
The location of waste management facilities - landfill sites in particular - is dependent upon a number of factors, but geology and hydrogeology are two of the most crucial (refer to Appendix A). Landfill leachate, formed as rainwater percolates through the decomposing waste, can be highly polluting and, if it enters groundwater or surface water in large enough quantities, can seriously impact upon the quality of the water and hence its potential for drinking water supply or other use.

Until the 1980s, most landfills were designed on the 'dilute and attenuate' principle, whereby leachate is allowed to migrate into the surrounding environment. Studies had shown that, in the right circumstances, leachate could be effectively treated by natural processes as it moved through unsaturated strata. However this approach was adopted universally without due regard to local circumstances and this has led to groundwater contamination in some locations, for example Ingham, Barton Mills, Red Lodge, Waterbeach, Lackford, Kentford, Kilverstone, Snetterton and Fornham St. Genevieve (all closed landfill sites). Map 2.6 shows the distribution of the open and closed landfill sites with relation to the surface geology.

Since the 1980s, much greater emphasis has been placed on isolating the waste from the environment either by locating landfills within low permeability strata or by lining sites with engineered low-permeability liners. Even so, leakage of leachate cannot be entirely eliminated and factors that must be considered when locating landfills include:

- the presence or absence of groundwater and surface water;
- the current and potential use of the water;
- the depth and nature of the unsaturated zone (the zone between the base of the site and the groundwater); and
- the possible impact that leachate reaching the groundwater or surface water would have.

Large parts of the Ely Ouse LEAP area are underlain by a major chalk aquifer. The Agency will oppose the siting of further landfills on the aquifer, unless detailed risk assessment demonstrates that


Geology and Landfill Sites
KEY
Plan boundary
Main river
Built up area
Lagoon
Open landfill site
Closed landfill site
Generalised Vertical Section
Scale 1:6,500
QUATERNARY
DRIFT
Boulder Clay
SOLID
CRETACEOUS
UPPER CHALK
Chalk Rock
MIDDLE CHALK
Melbourn Rock
Totternhoe Stone
LOWER CHALK
GAULT
WOBURN SANDS
(formerly known as the LOWER GREENSAND)
unconformity
JURASSIC
KIMMERIDGE CLAY
AMPTHILL CLAY
WEST WALTON BEDS
OXFORD CLAY
KELLAWAY BEDS
UPPER ESTURINE SERIES
unconformity
LOWER LIAS
SWAFFHAM
WATTON
ATTLEBOROUGH
BRANDON
THETFORD
ELY
MILDENHALL
NEWMARKET
BURY ST. EDMUNDS
CAMBRIDGE
N
0
10km
Ely Ouse LEAP
Map 2.6
ENVIRONMENT AGENCY

the specific circumstances for a given site are such that the risk is small enough to be considered acceptable.

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. Oil spillages 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.

2.4.2 Societal Influence

One of the major influences on the size and location of waste disposal sites is local demand. As the Ely Ouse LEAP area is largely a rural area without any major centres of population, it is not surprising to find that the area is served by few, relatively small landfills. Figures on waste arisings and remaining disposal capacity are not readily available by LEAP area as they are prepared on a county basis. However, taking the three counties of Norfolk, Suffolk and Cambridgeshire as a whole, landfill capacity appears to be adequate for the next five years at least.

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; and
- recovery of materials or energy from waste.

Disposal comes at the bottom of what is referred to as the waste hierarchy:

Figure 2.3: The Waste Hierarchy

As a result of this there has been a drive towards a number of recycling initiatives and this is reflected in the types of waste management facility in the Ely Ouse LEAP area. There is a site engaged in the recovery of waste oils for use as fuel (Malary Oils, Cottenham) and several sites where compost is made from waste (eg, Greenways, Barrow). Many transfer stations and householders waste sites, which were formerly used just as collection points for waste, are now operated as materials recycling facilities. Scrap-yards and vehicle dismantlers are engaged in the recycling of metals and vehicle parts. Map 2.7, at the end of this chapter, details the location of all waste management facilities in the Ely Ouse LEAP area.

In 1987, 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 amounts 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, in the short-term, it is unlikely to translate into a reduction in the number of landfill sites. Further legislation, much of it implementing EU directives and regulations, 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 landfill. 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 that has been entombed in such a manner may take many tens of years 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 Usage, Releases and Discharges

Old sand and gravel workings provide the location for the majority of landfill sites within the Ely Ouse LEAP area. In fact, it is often a condition of the planning permission that such sites are restored to their original contours, and the only practical way of doing this in most cases is by landfilling waste. Where quarry voids are unavailable for waste disposal, land-raising rather than landfilling may have to be considered. There are no examples of this in this LEAP area although some landfills located in old quarries do have agreed final contours that extend above the original ground level.

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.

Lining of sites with low permeability liners dramatically reduces the risk of lateral migration of gas provided that the pressure within the site is relieved. The simplest means of doing this is to provide venting chimneys in the site, which allow the gas to vent passively to the atmosphere. However, methane is a potent greenhouse gas and the active collection and burning of the gas provides a more acceptable alternative where the quantity and quality of gas generated is sufficient to support it. This is encouraged by the Agency as part of its commitment to addressing climate change. However, the burning of landfill gas to produce energy is a better solution. 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. Again, this is only viable on some sites and currently there are no examples of this within this LEAP area, although it is carried out at Milton landfill site (which lies just outside this LEAP area).

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 sewage treatment works) and recirculation through the landfill. Quantities of leachate being generated within sites in the Ely Ouse LEAP area are small, largely as a result of it being in a low rainfall area. Where leachate removal has been required, sites have generally relied upon recirculation rather than off-site disposal.

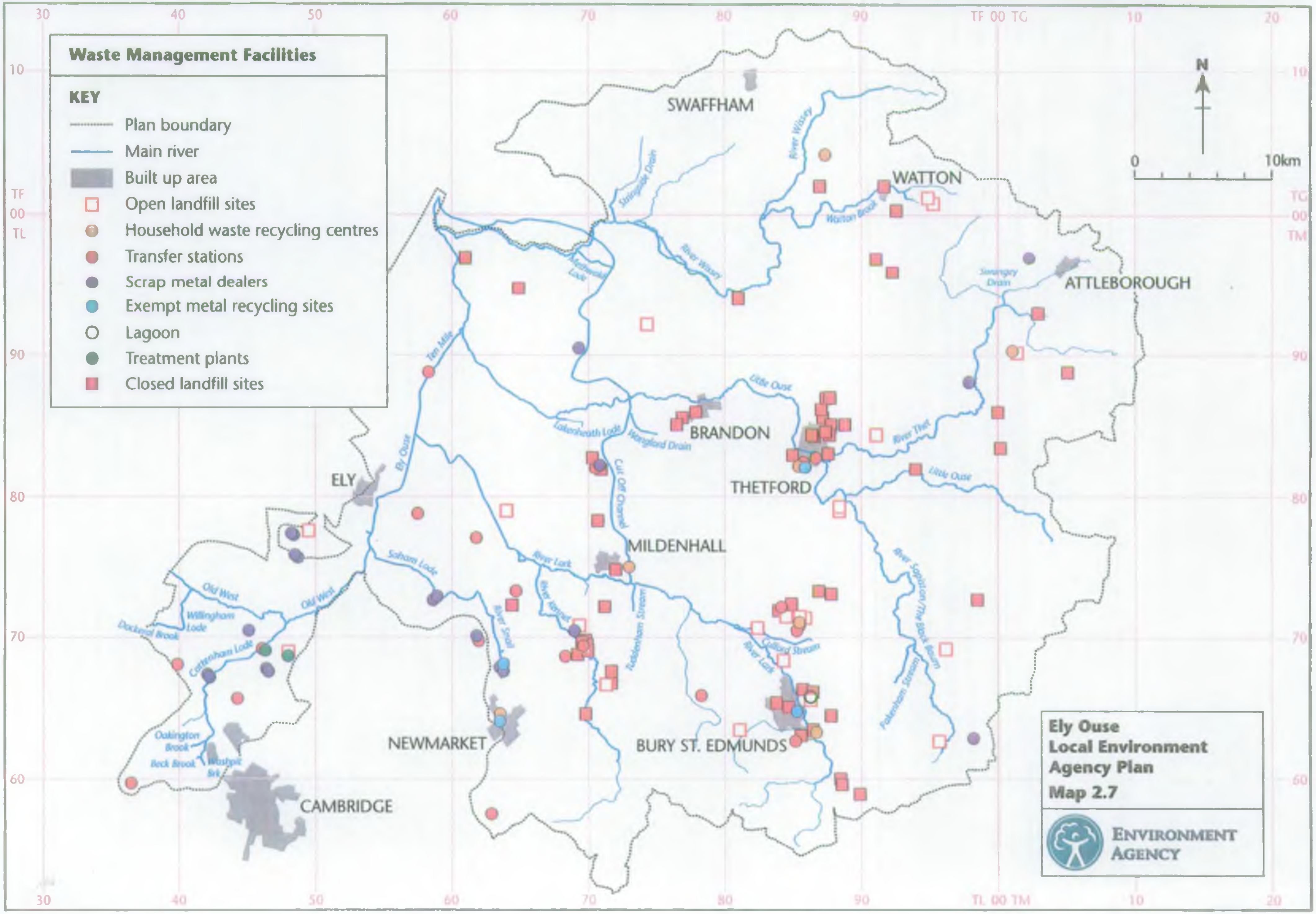
Other 'releases' from waste management sites include nuisance elements such as litter, dust, odour and noise and these may be as much of a problem on transfer stations and treatment plant as on disposal sites. Controls on these are usually imposed through the planning permission or waste management licence.

2.4.4 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 they fly-tip their waste by the roadside, in lay-bys or in deserted fields etc.

Other offences may be committed through ignorance, such as the land-spreading of waste without carrying out the necessary checks and pre-notifying the Agency (see Issue 4).

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



Waste Management Facilities
KEY
Plan boundary
Main river
Built up area
Open landfill sites
Household waste recycling centres
Transfer stations
Scrap metal dealers
Exempt metal recycling sites
Lagoon
Treatment plants
Closed landfill sites
N
0
10km
SWAFFHAM
WATTON
ATTLEBOROUGH
BRANDON
THETFORD
ELY
MILDENHALL
NEWMARKET
BURY ST. EDMUNDS
CAMBRIDGE
River Wissey
Walton Brook
Little Ouse
River Thet
Ten Mile
Ely Ouse
Lakenheath Lode
Cut Off Channel
River Lark
Soham Lode
Old West
Willingham Lode
Cottenham Lode
Oakington Brook
Beck Brook
River Snail
River Kennett
Tuddenham Stream
Cullford Stream
Fornham Stream
Little Ouse
River Sapiston/The Black Bourn
Ely Ouse
Local Environment
Agency Plan
Map 2.7
Environment
Agency

VIEWPOINT 3: KEY BIOLOGICAL POPULATIONS, COMMUNITIES AND BIODIVERSITY

3.1 Key Biological Populations

3.1.1 Natural Forces

The LEAP area contains a rich variety of different habitats. These range from the dry, sandy heathlands and grasslands of the Breckland to the peat-rich soils farmland of the fens and the expanse of Thetford Forest. This habitat variety allows a wide diversity of flora and fauna to exist in the LEAP area. Viewpoint 1.3 discusses habitat in more detail and Viewpoint 5 discusses fisheries in the LEAP area.

The aquatic environment is particularly important in the LEAP area with natural rivers and streams covering the upland areas and heavily-modified drainage systems in the fens providing different environments for aquatic life. Aquatic invertebrate populations are influenced by the physical, chemical and biological characteristics of their 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 74 GQA sites, to cover the 438 km of rivers in the LEAP area. The rivers of the area offer a wide range of habitats and these influences the types of invertebrates found. In the upper, faster-flowing parts of the rivers, stonefly, mayfly, caseless caddis and shrimp are characteristic whilst in the slower, lowland rivers, drains and lodes, cased caddis, dragonfly, damselfly, beetles, bugs and snails predominate. Map 3.1 and Table 3.1 show the rare or important freshwater invertebrate distribution in this LEAP area.

3.1.2 Societal Influences

Historically, flood defence works to protect both property and farmland have resulted in the channelisation of rivers in the LEAP area. The natural course of the Ely Ouse and in the lower reaches of the Rivers Wissey, Little Ouse and Lark has been over-deepened and channelised. Soham Lode and the Cut Off Channel are man-made. In both cases these watercourses are steep sided and uniform, hence while water quality remains good, the diversity of animal and plant species can be adversely affected through the lack of habitat diversity.

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

SPECIES	STATUS	LOCATION	COMMENTS
Bdellocephalus punctata **(Flatworm)**	Regional notable	Thompson Stream	Never abundant. Found under stones
Aplexa hypnorum **(Moss bladder snail)**	Locally rare	Willingham Lode	Associated with ponds and ditches prone to drying out and with larger waters
Bithynia leachi **(Snail)**	Locally rare	Soham Lode, Ely Ouse, Old West, Aldreth Canal, Cottenham Lode, Little Ouse	Calcareous water species

SPECIES	STATUS	LOCATION	COMMENTS
Ilycoris cimicoides **(Saucer bug)**	Locally rare	Thompson Stream, Wissey, Ely Ouse, Stretham Catchwater, Sapiston River, Little Ouse, 10 Mile River	Requires very clean water
Nepa cinerea **(Water scorpion)**	Locally rare	Wissey, Becks Brook, Stretham Catchwater	Never abundant. Associated with mud or thick vegetation in shallow(er) waters
Gerris argentatus **(Pond skater)**	Locally rare	10 Mile River	Associated with reed beds
Ranatra linearis **(Water stick insect)**	Locally rare	Ely Ouse, Old West	In thick vegetation in still waters
Plea leachi **(Lesser backswimmer)**	Nationally notable	Ely Ouse, Old West, 10 Mile River, Sapiston, Little Ouse	Associated with dense vegetation in slow flowing waters
Callocorixa wollastoni **(Lesser water boatman)**	Nationally notable	Wissey, Watton Brook	Associated with slow flowing water, moderate plant cover and acidic conditions
Notonecta maculata **(Water boatman**	Locally rare	Aldreth Canal	Associated with neutral, slow flowing or still waters. Vegetation not a prerequisite
Notonecta marmeorea–viridis **(Water boatman)**	Locally rare	Aldreth Canal	Associated with neutral, slow flowing or still waters. Vegetation not a prerequisite
Notorus crassicornus **(Diving beetle)**	Regionally notable	Wissey, Old West, Sapiston, Little Ouse, River Thet	Associated with still and slow flowing water, often in weed rafts
Gyrinus aeratus **(Whirlygig beetle)**	Regionally notable	Wissey, Little Ouse, Sapiston	Associated with still and slow flowing waters
Gyrinus urinator **(Whirlygig beetle)**	Regionally notable	Little Ouse	Associated with still and slow flowing waters
Anacaena bipustulata **(Scavenger beetle)**	Regionally notable	Beck Brook (Old West)	Prefers slow-flowing water
Haliplus laminatus **(Crawling water beetle)**	Regionally notable	Soham Lode	Associated with still and flowing waters often with silt
Orthotrichia **sp. (Cased caddis)**	Regionally notable	10 Mile River	Associated with dense vegetation and stillwaters
Beraeodes minutus **(Cased caddis)**	Regionally notable	Thompson Stream	Associated with the submerged roots of trees and other bankside vegetation
Ceraclea senelis **(Cased caddis)**	Regionally notable	River Gadder	Associated with slow or still waters
Silo nigricornis **(Cased caddis)**	Locally rare	River Snail	Associated with streams and rivers. Predominately a southern species

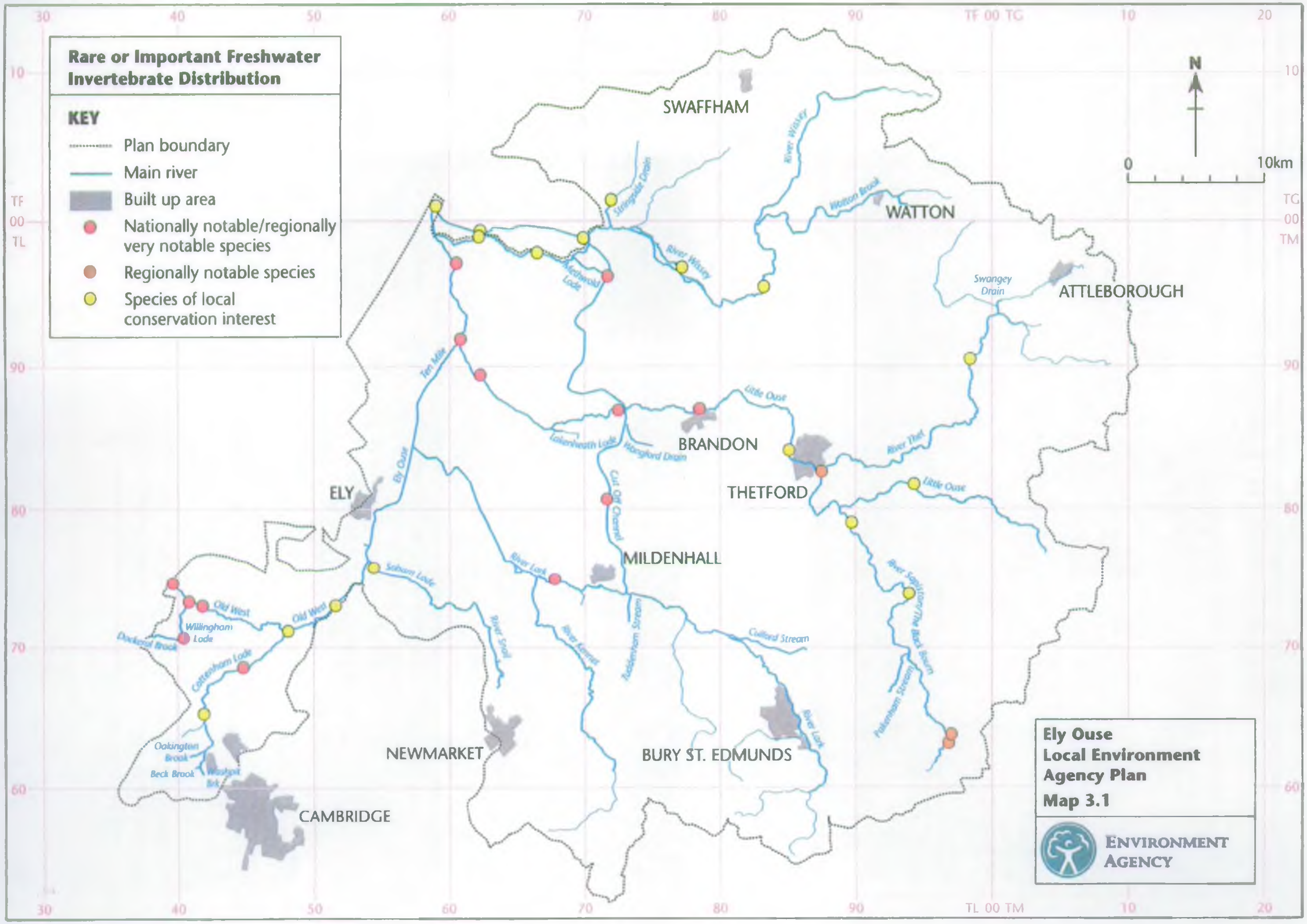
SPECIES	STATUS	LOCATION	COMMENTS
Polycentropus irroratus **(Caseless caddis)**	Locally rare	River Thet	Usually associated with lower reaches of river but also smaller rivers if these are productive
Polycentropus kingi **(Caseless caddis)**	Locally rare	Little Ouse	Usually associated with lower reaches of river but also smaller rivers if these are productive
Pyrrhosoma nymphla **(Large red damsel fly)**	BAP species	Little Ouse	Found in a slow flowing and still waters. Has declined in eastern England in the last 30 years
Brachytron pratese **(Hairy dragonfly)**	BAP species, Locally rare	River Sapiston	Found in clean, slow flowing and still waters, rich plant diversity. Post war decline in distribution being reversed
Leuctra nigra **(Stonefly)**	Regionally notable	Upper Wissey	Associated with clean gravels and flowing waters
Leuctra geniculata	Locally rare	Upper River Thet	A species of lowland rivers

Table 3.2: Definition of Conservation Status Categories

CONSERVATION STATUS CATEGORY	DEFINITION
Nationally Notable	Species 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	Species 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.
Locally Rare	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 as 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.

The categories of conservation status are from the 'Conservation of Aquatic Macroinvertebrate Populations – A Community Based Classification Scheme', Extence and Chadd (1996)

Management of nature conservation within the Agency and its predecessor bodies has focused on the general management of habitats and biological communities based largely on the incorporation of ecological principals into flood defence activities and the setting and enforcement of discharge consents, abstraction licences and other authorisations. Whilst this provides a sound basis for managing the aquatic environment more detailed attention to the ecological requirements of certain species and habitats of which conservation priority is required in order to protect the full diversity of native aquatic communities.



Rare or Important Freshwater Invertebrate Distribution
KEY
Plan boundary
Main river
Built up area
Nationally notable/regionally very notable species
Regionally notable species
Species of local conservation interest
SWAFFHAM
WATTON
ATTLEBOROUGH
BRANDON
THETFORD
ELY
MILDENHALL
NEWMARKET
BURY ST. EDMUNDS
CAMBRIDGE
River Wissey
Watton Brook
Stringside Drain
Methwold Lode
Swangey Drain
Ten Mile
Little Ouse
Lakenheath Lode
Hockwold Drain
River Thet
Cut Off Channel
Ely Ouse
Soham Lode
River Lark
River Snail
River Kennet
Tuddenham Stream
Cavenham Stream
River Sapiston/The Black Bourn
Pakenham Stream
Old West
Willingham Lode
Cottenham Lode
Oakington Brook
Beck Brook
Washpit Brk
N
0
10km
Ely Ouse
Local Environment
Agency Plan
Map 3.1
Environment Agency

'Biodiversity, the UK Action Plan', endorsed by the Government in 1996, is key in informing the need to sustaining biodiversity for present and future generations. In short this means not only maintaining existing levels of habitats and species but also restoring lost areas.

'Action for Wildlife in East Anglia' (1996), is a guide to biodiversity planning which has been prepared by a number of bodies, such as County Wildlife Trusts, English Nature, RSPB, local authorities and the Agency. This sets the context for the future production of local county-based Biodiversity Action Plans (BAPs).

Nationally the Agency has been given responsibility as a contact point and/or lead partner for the following habitats: chalk rivers, eutrophic lakes, salt marshes and fluctuating water bodies, and also the following species:

- Water vole;
- Otter;
- Vendace;
- White clawed (native)/Atlantic stream crayfish;
- Southern damselfly;
- Depressed river mussel;
- Shining ram's horn snail;
- Little whirlpool ram's horn snail;
- Glutinous snail;
- Freshwater pea mussel;
- River jelly lichen;
- Ribbon-leaved plantain;
- Marsh warbler;
- Triangular clubrush;
- Cut grass; and
- Greater water parsnip.

This LEAP Area covers the counties of Cambridgeshire, Norfolk and Suffolk. Each county-based BAP will comprise a series of Action Plans most of which will be published in 1999. Covering a range of naturally threatened and declining habitats (e.g. heathland, reedbed, woodland, grassland) and species (e.g. skylark, otter, beetles, fish and fungi), these Action Plans will have different priorities which will reflect the local values and conditions that impinge on these key habitats and species in each county.

The success of each Action Plan in securing a better future for our wildlife heritage and hence ourselves is dependant on a committed working partnership which will not only involve organisations such as the Agency, wildlife conservation groups, local authorities, companies, farmers and landowners, but also individuals.

In this LEAP area, otters, water voles and the native white-clawed crayfish are national priority species. Action to protect and conserve individual species such as otters, which involves the restoration of habitats, can often benefit a wider range of species, for example, damselflies, dragonflies and water shrews. Competition from non-native species, disease and damage to habitat, places the native white-clawed crayfish population under serious risk of extinction. It is

an important species in the freshwater ecosystem and a large dietary component of a number of fish species and otters.

In terms of broad habitats, fens, floodplain grazing marsh, reedbeds, heathland and cereal field margins are all important features of the local landscape and should be conserved and, where applicable, enhanced.

The Agency, through its own works and in partnership with others, has already completed and will continue to undertake numerous environmental and conservation projects. Such projects include in-river habitat enhancement at Knettishall Country Park and river restoration on the Little Ouse in Thetford and Garboldisham, all of which aim to increase or restore habitat diversity. BAPs will further aid this work by identifying actions, which will safeguard and enhance key habitats and species.

INVASIVE SPECIES

Invasive species are those plants and animals from other countries which having been introduced to the UK have spread and dispersed with such ease that they have invaded niches occupied by native species.

River Corridor Surveys (RCS) have identified that the invasive plants Japanese knotweed (*Fallopia japonica*), giant hogweed (*Heracleum mantegazzianum*) and Himalayan balsam (*Impatiens glandulifera*) are all present in this LEAP area. These plants spread very rapidly and their dense growth reduces habitat diversity for native insects, birds and mammals and devalues the landscape. There is a need to ensure that appropriate controls are set in place to limit, if not prevent, their spread. It is the responsibility of the landowner to control invasive plants (see Agency leaflet 'Guidance for the Control of Invasive Plants near watercourses').

The cultivation and sale of exotic non-native aquatic plants pose a significant threat to river, lake and pond ecosystems alike. The Australian swamp stonecrop (*Crassula helmsii*) and floating pennywort (*Hydrocotyle ranunculoides*) are aggressively invasive and great care should be taken to prevent their "escape" or introduction to the natural aquatic environment.

Invasive animal species can also be problematic to native animal populations. Non-native signal crayfish are thought to compete directly with native white-clawed crayfish for habitat and food and have contributed to the spread of crayfish plague (which is thought to be at least partially responsible for the decline in the native species).

3.1.3 Abstractions and Removals

Increased water demand as a result of a growing population and intensive farming and the drought conditions of recent years has led to some of the upper and middle reaches of the rivers of this LEAP area to suffer from low flows. Lower flows can cause siltation of riverbeds, reducing the number of available habitat types. The invertebrate community of a fast-flowing, riffle-type watercourse (eg, certain mayflies and caddis flies) will change, over time, to contain more representatives of slow-flow adapted fauna (eg, beetles and bugs) as flows fall.

The River Lark upstream and through Bury St Edmunds and the upper and middle River Kennet and the River Snail all have a degraded invertebrate fauna due to low flows. Demand for water

in this LEAP area may also prolong seasonal impacts that could have a deleterious impact on wetlands.

Quarrying for minerals such as sand and gravel in this LEAP area has resulted in numerous large waterbodies as these quarries flood after use. These are commonly used as recreational fisheries: for example, the Nunnery Fisheries in Thetford contain large carp and other mixed coarse fish. Artificially high fish densities mean that such water bodies are an attractive food source for otters A compromise has been reached whereby fencing has been deployed to deter otters from some of the lakes whilst allowing unrestricted access to others.

3.1.4 Uses, Releases and Discharges

Invertebrate populations are excellent indicators of water quality. They exhibit a range of responses to both organic and inorganic pollutants and most species have life cycles of sufficient length for long-term quality assessments to be made. As well as routinely monitoring 74 GQA sites in order to classify river stretches, a further 61 sites are sampled to specifically monitor effluents and discharges. The results of this work show that most of the rivers in the LEAP are of good to excellent biological quality. There are exceptions; the Watton Brook downstream of Watton, the River Snail downstream of Newmarket and the River Lark in and immediately downstream of Bury St Edmunds all show degraded invertebrate fauna due to a combination of effluent discharges, urban and industrial run-off and reduced dilution.

Releases and discharges with high phosphate and nitrate levels can also cause nutrient enrichment or eutrophication. Macrophyte (large plant) communities are the most notable elements of the biota to 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 excessive growth of a few tolerant macrophyte species, often of filamentous algae.

3.1.5 Illegal Practices

Aquatic macroinvertebrate communities can be used to determine the nature, severity, extent and location of pollution incidents. Biological evidence is used in conjunction with chemical evidence in prosecutions for illegal discharges. A large proportion of incidents in this LEAP area is due to organic pollution. A typical effect of longer-term organic input on an invertebrate community involves a decline in diversity whereby tolerant species increase in abundance and more sensitive species decline.

The Wildlife and Countryside Act 1981 makes it an offence to plant or cause Japanese knotweed and giant hogweed to grow in the wild.

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 WRA91 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 aquifers 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 WRA91. 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. Abstraction licence inspections are carried out to ensure that licence holders understand and comply with the terms and conditions of their licences (refer to Viewpoint 1, section 1.1.4 – Illegal Practices (Accidents and Non Compliance with Regulations)).

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 prior 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. WIA 91 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 their 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, Groundwater and Nitrates Directives (refer to Viewpoint 4.3).

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
- Demand Management

The Anglian Region Strategy (also published 1994) is a sustainable strategy for securing 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 actions 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/ecological balance is still developing.

- Demand management: efficient use, effective and equitable charging and economic levels of leakage control.
- Future need for new water resources: options for bulk transfers of water or redistribution of abstraction licences should be considered before new resource development. 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 on 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 1998-99 were announced by OFWAT in October 1997.

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.

MEETING DEMANDS

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

Target levels of service and local status vary according to the use for which the water is required, as follows:

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. Water abstracted in this LEAP area is exported to populations in Cambridge and Kings Lynn. A review of water resources and demands is now under way nationally involving the Agency, water companies, OFWAT, the Department of the Environment and the DWI. This work has been required both by the DoE 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.
continued...		

Water Use	Level of Service	Local Status
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 (1990-1992, 1995-1997) in order to protect river flows. The options available to improve the situation would be to store more water from the winter in reservoirs 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.

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.*

Level of Service

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 this area are considered to be fully committed. Renewals of existing entitlements to abstract are currently considered but they are determined with reference to the current policy regarding time duration and cessation conditions. These conditions relate to flows/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 4.1: Cessation clauses resulting in abstraction restrictions

Location	Cessation Flows	Gauging Site	Grid Reference
River Snail / Soham Lode	112 l/s	Fordham G.S.	TL 6310 7030
R. Kennet	54 l/s	Beck Bridge G.S.	TL 6620 7330
R. Sapiston	84 l/s (summer) 120 l/s (winter)	Rectory Bridge G.S.	TL 8950 7900
R. Little Ouse	94 l/s	County Bridge Euston G.S.	TL 8920 8010
R. Thet	353 l/s 146 l/s	Bridgham G.S. Redbridge G.S	TL 9570 9230 TL 9960 9230
R. Wissey	540 l/s (summer) 760 l/s (winter)	Northwold G.S.	TL 7710 9650
R. Gadder	70 l/s 87 l/s	Watermill Lane Bridge Whitebridge G.S.	TL 7710 0290 TF 7160 0060
For all licences	1315 l/s (summer) 3683 l/s (winter)	Denver Sluices	TF 5878 0100
Littleport & Downham IDB	97.25 m SLD 97.25 m SLD 96.80 m SLD	Hundred Foot P.S. Old Ten Mile P.S. Ten Mile P.S.	TL 5080 8910 TL 6000 9630 TL 6060 9400
Southery & District IDB / Feltwell Fen 2nd IDB	98.2 m SLD 97.3 m SLD	Catsholme P.S. Southery P.S.	TL 6830 9700 TL 6120 9320
Lakenheath IDB	99.8 m SLD	Lakenheath Poors Fen Dam	TL 7007 8285
Polver Drain	95 ft SLD	Polver Drain P.S.	TF 6080 1270
Breckland Meres	27.5 m AOD	Ringmere G.B.	TL 9090 8790
Old West River	101.58 m SLD	Hermitage Lock	TL 3950 7460
Cut Off Channel	40 l/s 99.6 m SLD	Tollgate Weir G.S. Black Dyke Intake	TL 7290 7570 TL 6910 8820

SLD: South Level Datum AOD: Above Ordnance Datum Newlyn
G.S.: gauging station G.B.: gauge board
P.S.: pumping station IDB: Internal Drainage Board

The management of water resources 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 required.

There is winter surface water available for storage 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 report. Winter abstraction from rivers represents over 7 million cubic metres or 4.5 per cent of the total water licensed for abstraction in this LEAP area. Applications under consideration represent

another 4 million cubic metres of water and this type of demand is likely to increase in the future.

Future licensed supply may be less reliable as existing users will need to be protected.

There are two main rock strata that are used for abstraction: the Chalk and the Woburn Sands. The groundwater that is available is considered to be fully taken up by existing abstraction licence holders and the water environment in most of the LEAP area. Groundwater is still currently available in areas of Chalk which contribute to the upper part of the River Wissey. The table below gives the groundwater balances as published in the Regional Water Resources Strategy 1994. These balances are to be revised in 1999/2000.

Table 4.2: Groundwater Balances (all figures in thousand cubic metres per day (tcmd))

Groundwater Unit	Gross Resource	Effective Resource	Environmental Allocation	Licensed Abstraction	Balance Nominally Available
Lark	159.4	127.5	46.9	83.1	-2.5
Little Ouse (including River Thet)	263.4	210.8	132.9	81.5	-3.6
Wissey (but water from areas contributing to Rivers Stringside and Gadder is not available)	177.7	142.2	75.0	44.9	22.3

Notes:
Gross Resource is calculated using long-term rainfall statistics and adjusted according to the geology of the catchment. Effective Resource is 80% of the Gross Resource for Chalk catchments. This reduction is made to reflect the inadequacy of the aquifer storage to fully even out the year-to-year fluctuations in recharge. The 20% contributes to river flow.

River environments can be maintained during dry periods by the operation of groundwater to river support schemes. In this LEAP area there is a scheme called the Great Ouse Groundwater Development Scheme (GOGDS), where water is pumped to support exports at Denver for the needs of people in Essex. GOGDS also supports flows in the Rivers Thet and Little Ouse (see the next section).

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. The 14 sites in this LEAP area are given in Table 4.3:

Table 4.3: Wetland Monitoring Sites

Site Name	NGR	Site Name	NGR
Caudle Common	TF 8610 0310	Swangey Fen	TM 0150 9320
East Harling Common	TM 0000 8790	Thompson Common	TL 9300 9550
East Wretham Heath (meres)	TL 9100 8820	Blo'Norton and Thelnetham Fens	TM 0170 7900
Foulden Common	TF 7620 0020	Cavenham/Icklingham Heaths	TL 7550 7330
Great Cressingham Fen	TF 8480 0220	Hopton Fen	TL 9900 8000
Kenninghall and Banham Fens	TM 0410 8750	Pashford Poors Fen	TL 7320 8350
Middle Harling Fen	TL 9890 8520	Weston Fen	TL 9810 7870

Water Level Management Plans (WLMPs) were introduced by the MAFF 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, IDBs, landowners and other interested parties. The WLMPs in this LEAP area are as follows:

Table 4.4: Water Level Management Plans

WLMP: Priority Order (those in *italics* have been completed)		NGR
High:	Blo'Norton & Thelnetham Fen	TM 017 790
	Cavenham & Icklingham Heaths	TL 755 733
	Swangey Fen	TM 015 932
	Great Cressingham Fen	TF 848 022
	Chippenham Fen	TL 648 697
Medium:	*Pakenham Meadows*	TL 923 668
	Stallode Wash	TL 675 853
	Wangford Warren	TL 758 833
	Didlington Park Lakes	TL 777 963
	Hooks Well Meadow	TF 838 011
	Thetford Golf Course & Marsh	TL 845 838
	Lackford Lakes	TL 795 710
	Little Ouse Washes	TL 675 856 - TL 730 869
Low:	Snailwell Meadows	TL 642 677
	Brackland Rough	TL 632 699
	St. Neots Common	TL 184 615

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 all SSSIs controlled by

English Nature, and Special Protection Areas (SPAs), which are designated under the Birds Directive 1979.

The Agency must ensure that new or varied abstraction licences do not adversely affect these sites. 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 table below lists the Habitats Directive Sites for this LEAP area and shows which sites have been designated for water features.

Table 4.5: Habitats Directive Sites

SAC/SPA Site Name SSSIs included	NGR	SAC/SPA Site Name SSSIs included	NGR
Breckland SAC		**Norfolk Valley Fens SAC**	
Barnhamcross Common	TL 865 813	Foulden Common*	TF 762 002
Berner's Heath, Icklingham	TL 800 765	Great Cressingham Fen *	TF 848 022
Bridgham and Brettenham Heaths	TL 924 865	Swangey Fen *	TM 015 932
Cavenham/Icklingham Heaths	TL 755 733	Thompson Water, Carr & Common *	TL 930 955
Cranwich Camp	TL 775 942		
Deadman's Grave, Icklingham	TL 780 744	**Little Ouse Valley Fens SAC**	
East Wretham Heath*	TL 910 882	Redgrave and Lopham Fens *	TM 050 797
Field Barn Heaths, Hilborough	TL 819 017	Blo'Norton & Thelnetham Fens *	TM 017 790
Foxhole Heath, Eriswell	TL 736 781	Weston Fen*	TM 981 787
Gooderstone Warren	TL 799 014		
Grime's Grave	TL 815 900	**Fenland SAC**	
Lakenheath Warren	TL 767 805	Chippenham Fen & Snailwell Poor's Fen *	TL 648 697
Maidscross Hill, Lakenheath	TL 726 825		
RAF Lakenheath	TL 740 820		
Stanford Training Ground*	TL 890 950		
Thetford Golf Course and Marsh	TL 845 838		
Thetford Heath	TL 864 801		
Wangford Warren and Carr	TL 758 833		
Weather and Horn Heaths	TL 784 774		
Weeting Heath	TL 757 884		

* Designated for water-related features under the Habitats Directive

Figure 4.1: Swangey Fen SSSI

PROPER USE

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

Level of Service

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).

VIEWPOINT 4: COMPLIANCE WITH TARGETS & STANDARDS ELY OUSE

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 SCEALA (the Standing Committee of East Anglian Local Authorities, which covers Cambridgeshire, Suffolk and Norfolk) 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 sought. The quantities authorised in any licence document are those considered to be reasonable and justified for the use proposed. In some cases the quantities are less than those applied for. The details of how the justification is evaluated are given in the following table.

Table 4.6: Quantity Evaulation

Water Use	Local Status
Public Water Supply	The 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 will be allocated. The current published leakage figures for the water companies in this LEAP area are given in Table 4.7. These figures relate to total losses in distribution including the losses on the customer side of the stopcock. The companies in this area do 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 4.7: Water Company Total Leakage Figures *

Water Company	%	Litres/property/day	m^3/km of distribution main/day	million litres/day
Anglian Water Services Ltd	20	132.1	6.8	235

Reference: OFWAT July Return 1998

* Total losses are distribution losses and underground supply pipe leakage.

CONSERVE RESOURCES

Objective: *To conserve water resources*

Level of Service

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 sewage treatment works (STWs).

Understanding of climate change 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 the effects will be for water resources in the UK and East Anglia (see section Climate and Climate Change).

Table 4.8 below summarises the current status of water resources in relation to the Agency's objectives and identifies anticipated trends:

Table 4.8: 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 against 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 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 Environment Agency's flood defence function aims to reduce risks to people and the developed and natural environment from flooding from rivers and the sea. In discharging its flood defence function, the Agency's concerns include:

- the natural catchment area of watercourses and rivers;
- the channels occupied by rivers and watercourses during times of normal flow;
- floodplains and washlands which accommodate water during periods of flood; and
- coastal floodplains, that is land at risk from flooding from the sea or tidal lengths of rivers, whether or not protected by sea defences.

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.

Objectives

Our aims for flood defence are to:

- provide effective flood defence for people and property against 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 (and sea defences), 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 floodplain along lengths of river divided into 4-7 km reaches. For each element (eg, road, house, grazing) 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.

Each land use band has a target for a maximum flood risk to which it should be exposed. The standards are expressed in terms of the frequency at which a flood is likely to occur which exceeds the magnitude for which protection is available or should ideally be provided. For example, a standard of 1 in 50 years means that, for any given year, the likelihood of a flood flow occurring which significantly affects key land use is 50 to 1, or 2%.

Details of targets and land use bands, showing indicative standards which the Agency uses as a guide for assessing the level of protection achieved and the design of future schemes, are given in Table 4.9.

Table 4.9: Standards of Service Land Use Bands and Targets

Land Use Band	Description of typical land use	Target of protection (Return Period)	
		Fluvial	Saline Sea/Tidal
A	Urban	1:50 – 1:100	1:100 – 1:200
B	Lower density Urban	1:25 – 1:100	1:50 – 1:200
C	Isolated rural communities	1:5 – 1:50	1:10 – 1:100
D	Isolated properties Intensive farming	1:1.25 – 1:10	1:2.5 – 1:20
E	Low grade agricultural land	< 1: 2.5	<1:5

The review will, therefore, influence maintenance requirements for the future and provide a rational basis for future flood defence priorities.

The detailed Agency objectives for this activity within 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 by-laws, 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;
- to carry out maintenance in Main River where necessary to protect people and property to the appropriate standard; and
- to maintain the long-term flood defence capacity of the Ely Ouse system and to provide protection for a fluvial flood event within a return period of up to 1 in 100 years.

Monitoring and Status

We undertake the general monitoring of those flood defences for which we are responsible as part of our ongoing work. We have a duty under Section 105 of the WRA91 to identify flood risk areas.

Major flooding in this area in 1947 and 1968 resulted in a number of improvement schemes, most notably the Flood Protection Scheme that was completed in 1964. Regular maintenance is carried out to preserve the flood carrying capacity of the Main River watercourses and maintain the integrity of the river flood embankments. Automation and telemetry have been installed at the major control structures.

There has been a need to evaluate how the Agency manages Denver Sluice following the low flow conditions experienced in recent years. These low flow conditions have contributed to the build-up of silt in the Tidal River, which influences three main problems:

- Sediment accumulation directly obstructing operations and the use of the waterway, eg, where shoaling or high bed level impedes navigation in the river, and where sluice outfalls or locks are

blocked by local silting;

- Siltation raises the river bed level, which in turn causes the low tide level to be higher and thereby impedes gravity discharge to the tidal waters, eg, for drainage of the Ouse Washes through Welmore Lake Sluices; and
- Operation of sluices, or other actions, to help overcome the main problem due to siltation can introduce disadvantages which would not otherwise arise; eg adverse effects in the Ely Ouse system arising from water level management which attempts to maximise discharge to tide through Denver Sluice.

The last problem is the main one concerning the Ely Ouse LEAP. Water level management in the Ely Ouse system may mean levels are raised higher, which affects two of the major river users in the following ways:

- Navigation: Higher levels reduce headroom at bridges and locks; and
- Internal Drainage Boards: Higher levels increase bank seepage and could reduce the boards' capacity to pump out from their systems.

The Agency has employed the services of a consultant to undertake a study into the management of Denver Sluice.

Although the study is centred around the Denver Sluice, it also considers the requirements and operating procedures of other sluices or river systems which may be affected by, or influence, any proposed changes. Conclusions will consider the diverse needs of all operators and users of the river system. The options which will be considered include operating with a higher upstream level, retaining water on the washes, improving flow gauging at Denver Sluice, additional telemetered level gauges, and/or implementation of revised interim river levels. The report findings will be based on initial studies plus consultation with Agency staff and external parties.

Protecting human life is the highest priority. The risk of flooding can be reduced but not removed, so there is a need to warn people when flooding is going to occur. A timely warning provides an opportunity for those at risk to seek safety and to reduce damage and distress.

The Ministry of Agriculture, Fisheries & Food (MAFF) and the Welsh Office (WO) are the Government departments with the responsibility for flood defence and place the greatest importance on flood warning.

The Agency was directed to formalise its arrangements for flood warning, with effect from September 1996. The introduction of effective systems to issue warnings direct to the public has been the highest flood warning priority. The Agency vision is to reduce risks associated with flooding wherever cost effective and environmentally acceptable measures are feasible and can be funded.

Flood warning is worthwhile if it results in life being safeguarded and property damage being reduced, and if the benefits exceed the cost of the services. A warning is of little value unless it is acted upon.

The Agency can only undertake limited emergency response itself, but seeks to prepare the public to help themselves.

A comprehensive campaign has been launched to raise the level of awareness in flood risk areas, so that people understand the flood warning service and know what action should be taken in an event.

Local Authority and emergency services are also kept informed and may take a leading role in emergency response in major incidents.

Flood warning presumes an ability to forecast. This means predicting with reasonable reliability, accuracy and forecast lead time, the occurrence of river and tidal floods.

River level and tidal measurements provide the main basis for forecasting, but may not give sufficient warning on upper reaches of small, steep river catchments. The Agency uses a variety of data, services and models, from weather forecasts to sophisticated rainfall, flow and tidal computer systems, to help it make forecasts on which warnings are based.

A key standard is the warning lead time provided to people at risk before the onset of flooding, since this determines how much damage can be avoided. The Agency sets this as a level of services against which performance can be measured.

Responsibility for the maintenance and operation of flood defence structures lies with the owner. In the event of the river levels either upstream or downstream causing damage to property owing to the operation or lack of operation of a structure, the owners are responsible.

Where private owners operate river control structures, the Agency has an overall supervisory function to ensure that the operation of the structure is undertaken effectively. The main aim of the Agency is to ensure that structures are maintained, controlled, and operated to a satisfactory condition. The Agency is always willing to meet owners of structures to advise on the operation and problems that may occur in the control of sluice gates.

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.

Water quality monitoring varies according to the local circumstances. Monitoring activities include statutory requirements for assessing compliance with EU Directives and environmental quality standards.

Urban Waste Water Treatment Directive *(91/27/EEC) (UWWTD)*

The EU Directive concerning urban waste water treatment 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 Population Equivalent (PE). The UWWTD only applies to discharges from STWs serving a PE greater than 10,000. Discharges below these levels should receive appropriate treatment as defined in Government guidance. The Agency

is responsible for making sure that discharges receive the appropriate level of treatment specified in the Directive.

We monitor the quality of the rivers within the LEAP area, which includes the discharges of treated sewage and trade effluents. The monitoring involves the chemical and biological analysis of samples taken from effluents, rivers, wells and boreholes. Chemical water quality is monitored routinely at monthly intervals at 95 locations in the LEAP area. There are 75 discharges of sewage effluent and 20 of trade effluent that are also sampled twelve times a year (refer to Map 4.1). Four of the river sample points are sampled more than twelve times a year and the Ouse at Earith is sampled sixty times a year. The Earith sample point is part of the Harmonised Monitoring Programme and must also comply with the requirements of the Paris Commission and the North Sea Conference - hence the high sampling frequency. Bury St Edmunds, Mildenhall, Newmarket and Thetford STWs are sampled twenty four times a year. Approximately 21 boreholes/wells are sampled every quarter. The analysis covers the key water quality parameters, dissolved oxygen, ammonia, BOD, chloride, nitrate, phosphate and other appropriate chemicals. The results of the analyses of these samples are available on the Public Register.

Biological monitoring is routinely carried out twice-yearly at 36 sites.

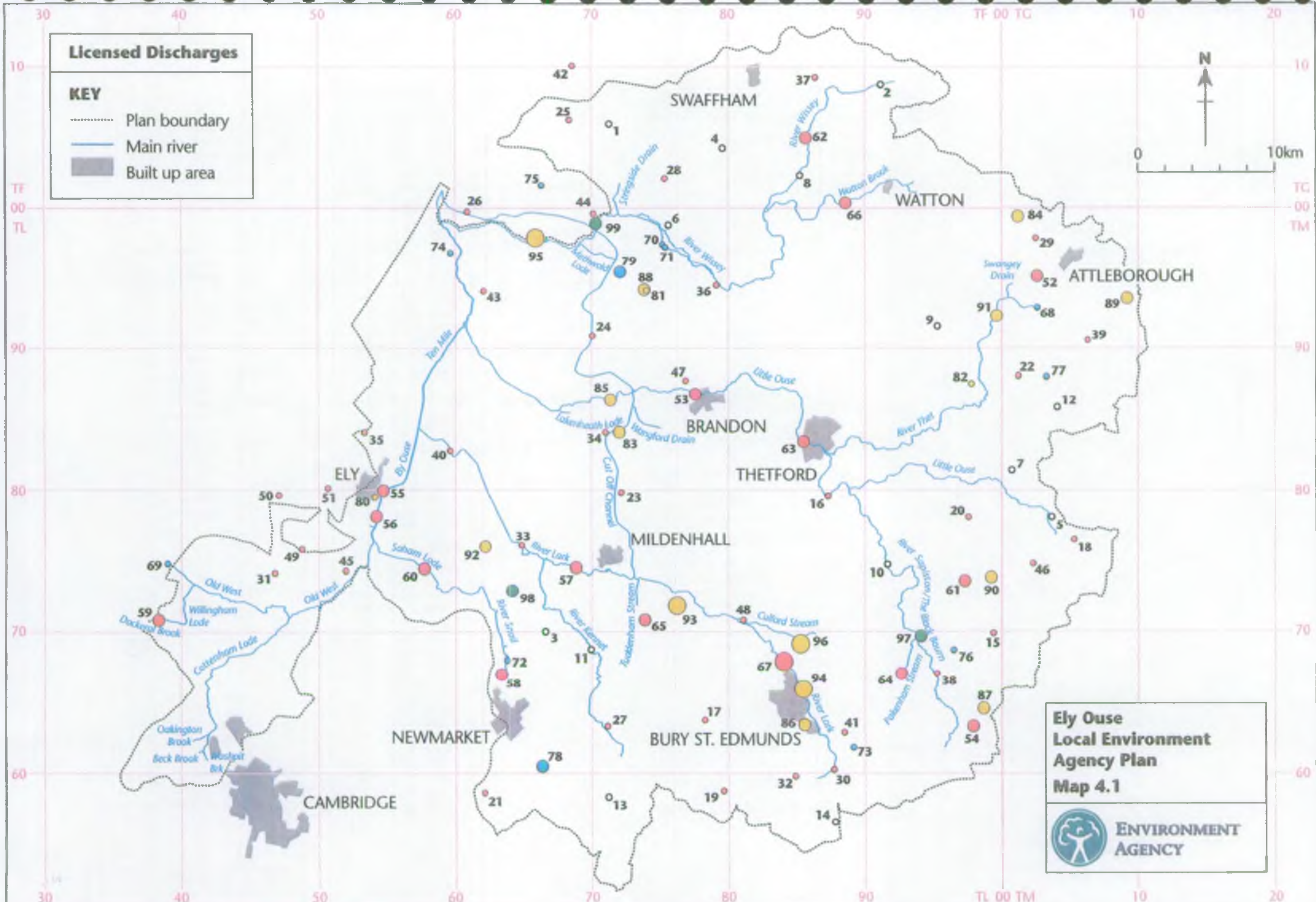
Under the UWWTD, waters identified as eutrophic can be designated as Sensitive Areas. When waters are designated, nutrient controls are required for discharges, unless it can be shown that this will have no effect on eutrophication. These are known as qualifying discharges. In this LEAP area, the DETR has agreed to the designation of the Cut Off Channel as a *Sensitive Area (eutrophic)* and phosphate removal was required at Bury St Edmunds STW by the end of 1998. The review carried out in 1997 resulted in the DETR agreeing designations for Soham Lode, River Lark and the Little Ouse and as a result Newmarket, Soham, Mildenhall, Thetford and Attleborough STWs may be required to meet limits for phosphate by 2004. A further review of data from the Ely Ouse will occur in 2001 for possible resubmission to the Agency's National Panel. Although the removal of phosphate from the discharges of STW will be an improvement it may not be sufficient to control the effects of eutrophication.

The Habitats Directive

The Agency must ensure that new or varied consents do not cause significant impact on Habitat Directive sites (refer to table 4.5). Under the Habitats Directive the Agency is obliged to review all existing consents by 2004.

Objectives

The Water Quality Objectives (WQO) scheme enables quality targets to be set according to the uses of a watercourse (eg, fisheries, public water supply) 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 4.10). Standards for further


Licensed Discharges
KEY
Plan boundary
Main river
Built up area
N
0
10km
SWAFFHAM
WATTON
ATTLEBOROUGH
BRANDON
THETFORD
ELY
MILDENHALL
NEWMARKET
BURY ST. EDMUNDS
CAMBRIDGE
River Wissey
Wissey
Watton Brook
Stringside Drain
Little Ouse
River Thet
Swangey Drain
Ten Mile
Ely Ouse
Lakenheath Lode
Wangford Drain
Cut Off Channel
River Lark
Soham Lode
Old West
Willingham Lode
Cottenham Lode
Oakington Brook
Beck Brook
River Snail
River Kennett
Tuddenham Stream
Cavenham Stream
Culford Stream
River Lark
River Sapiston/The Black Bourn
Pakenham Stream
Ely Ouse
Local Environment
Agency Plan
Map 4.1
Environment
Agency

Licensed Discharges

KEY

Sewage works discharges - Anglian Water Services:

DWF <100 m^3/d:

1 Barton Bendish
2 Bradenham
3 Chipenham
4 Cockley Cley
5 Crackthorn Bridge
6 Foulden
7 Garboldisham (Elm)
8 Great Cressingham
9 Hockham
10 Honington
11 Kennett
12 Kenninghall (school)
13 Lidgate
14 Stanning Field

DWF 100 - 999 m^3/d

15 Badwell Ash
16 Barnham
17 Barrow
18 Botesdale
19 Chedburgh
20 Coney Weston
21 Dullingham
22 East Harling
23 Eriswell (Lords Walk)
24 Feltwell
25 Fincham Outfalls
26 Fordham
27 Gazeley
28 Gooderstone
29 Great Ellingham
30 Great Welnetham
31 Haddenham
32 Hawstead
33 Isleham
34 Lakenheath
35 Little Downham
36 Mundford
37 Necton
38 Norton (Suffolk)
39 Old Buckenham
40 Prickwillow
41 Rougham (Suffolk)
42 Shouldham
43 Southery (Mill Dr)
44 Stoke Ferry
45 Stretham
46 Wattisfield
47 Weeting
48 West Stow
49 Wilburton
50 Witcham
51 Witchford

DWF 1000 - 9999 m^3/d

52 Attleborough
53 Brandon
54 Elmswell
55 Ely
56 Ely(New)
57 Mildenhall
58 Newmarket
59 Over
60 Soham
61 Stanton
62 Swaffham
63 Thetford
64 Thurston
65 Tuddenham
66 Watton

DWF >10000 m^3/d

67 Bury St. Edmunds

Sewage works discharges - Private:

DWF <20 m^3/d

68 Brecklnds Lodge motel, Attleborough
69 Cambs. CC Gypsy Site, Earith
70 KL & WN BC Mill Lane, Northwold
71 KL & WN BC Glebe Close, Northwold
72 Lynxcourt Ltd. Snailwell Rd, Fordham
73 Home Farm EO Rushbrooke Est, Bury St Eds
74 KL & WN BC Ten Mile Bank
75 KL & WN BC West Dereham
76 Stowlangtoft Hall, Bury St Edmunds
77 Carmelite Monastry, Quidenham

DWF 20 - 999 m^3/d

78 Dalham Hall Stud, Newmarket
79 Methwold Eldens Lane

Major trade discharges:

DWF <100 m^3/d

80 Arc Ltd Angel Drove, Ely
81 Howard Long International, Methwold
82 Roudham Transport, Roudham

DWF 100 - 999 m^3/d

83 B Palmer Potatoes Meadow Farm, lakenheath
84 Buxted Duckling, Little Ellingham
85 Freedom Farm, Hockwold
86 Greene King, Bury St Edmunds No2 Outlet
87 Harris Bacon New Outfall
88 Howard Long International
89 Penwood Country Chickens, Bunwell
90 Shepherd Grove Mushrooms
91 Watton Produce Redbridge, Shropham
92 Whitehall Farm, Isleham

DWF 1000 - 9999 m^3/d

93 Allen Newport Ltd Marstons Pit, Cavenham
94 BSC Bury St Edmunds
95 BSC Wissington
96 Ingham Quarry, Timworth

Water treatment works:

97 Ixworth
98 Isleham WTW Nitrate Removal Plant
99 Stoke Ferry WTW Lagoon

Ely Ouse Local Environment Agency Plan

Map 4.1 Legend

ENVIRONMENT AGENCY

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 4.10: Descriptions of the River Ecosystem Classes

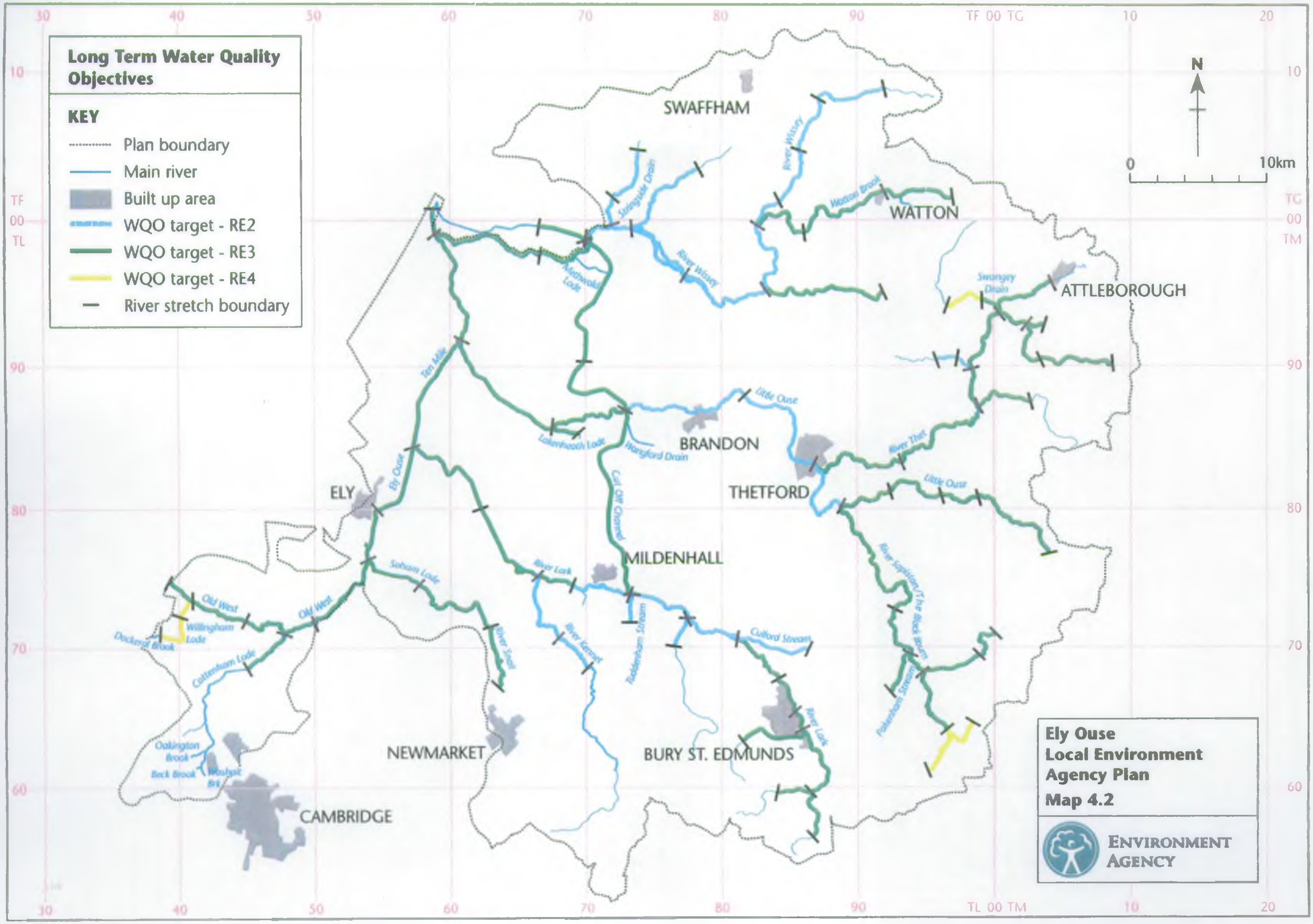
Class RE1	Water of very good quality suitable for all fish species
Class RE2	Water of good quality suitable for all fish species
Class RE3	Water of fair quality suitable for high class coarse fish populations
Class RE4	Water of fair quality suitable for coarse fish populations
Class RE5	Water of poor 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 by which to classify water quality

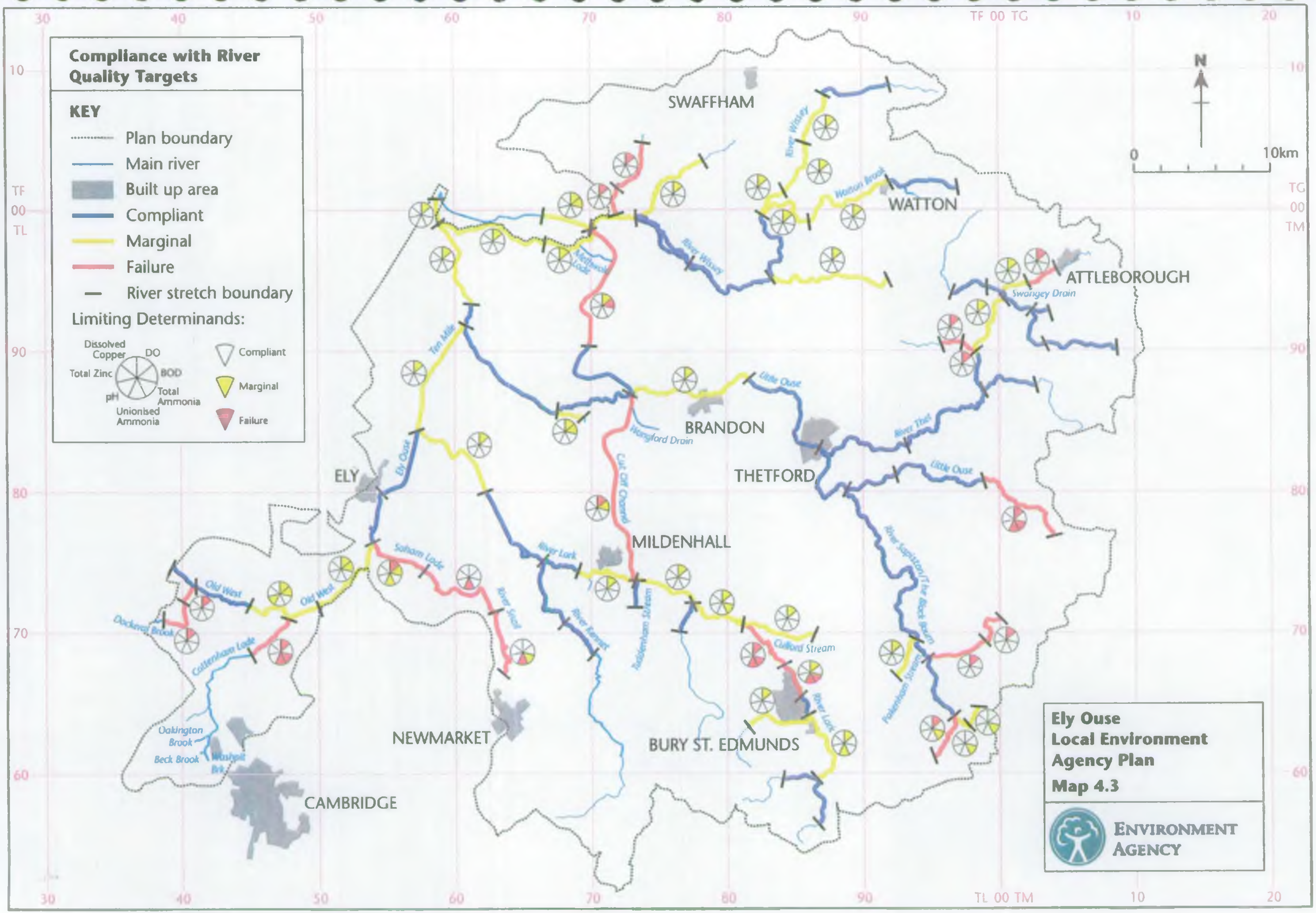
The WQO scheme allows for short- and long-term objectives. Short-term objectives may have to be adopted where water quality fails to meet the long-term objective and there are no immediate solutions. In these cases a target date for achieving the long-term objective may be set. The costs of schemes to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

The long-term water quality objectives for the plan 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.

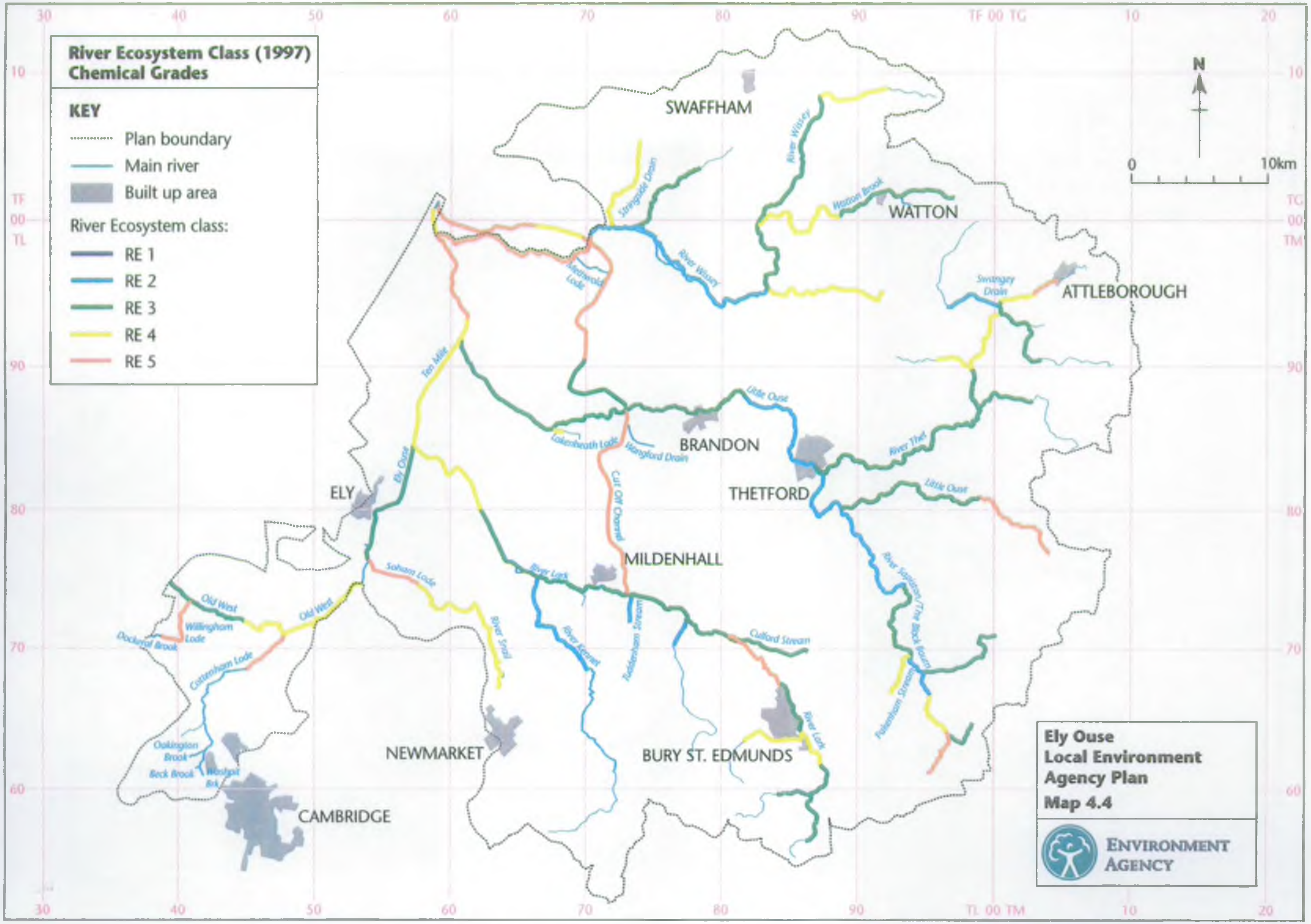
It is important that long-term objectives reflect the likely uses of the watercourses in the area and public views on the potential uses for specific watercourses would be valued.

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 and Map 4.5 shows the Biological Quality of Watercourses.


Long Term Water Quality Objectives
KEY
Plan boundary
Main river
Built up area
WQO target - RE2
WQO target - RE3
WQO target - RE4
River stretch boundary
SWAFFHAM
WATTON
ATTLEBOROUGH
BRANDON
THETFORD
ELY
MILDENHALL
NEWMARKET
BURY ST. EDMUNDS
CAMBRIDGE
River Wissey
Stringside Drain
Watton Brook
Swangey Drain
Ten Mile
Little Ouse
Lakenheath Lode
Hargford Drain
River Thet
Ely Ouse
Cut Off Channel
Soham Lode
River Lark
Old West
Willingham Lode
Dockerel Brook
Cottenham Lode
River Snail
River Kennet
Tuddenham Stream
Cavenham Stream
Oakington Brook
Beck Brook
Washpit Bk
Pakenham Stream
N
0
10km
Ely Ouse
Local Environment
Agency Plan
Map 4.2
ENVIRONMENT AGENCY



Compliance with River Quality Targets
KEY
Plan boundary
Main river
Built up area
Compliant
Marginal
Failure
River stretch boundary
Limiting Determinands:
Dissolved Copper
DO
Total Zinc
BOD
pH
Total Ammonia
Unionised Ammonia
Compliant
Marginal
Failure
N
0
10km
SWAFFHAM
WATTON
ATTLEBOROUGH
BRANDON
THETFORD
ELY
MILDENHALL
NEWMARKET
BURY ST. EDMUNDS
CAMBRIDGE
River Wissey
Watton Brook
Swangey Drain
Little Ouse
River Thet
Ten Mile
Ely Ouse
Wangford Drain
Cut Off Channel
River Lark
River Kennett
Tuddenham Stream
Culford Stream
River Linnet
River Sapiston/The Black Bourn
Pakenham Stream
Soham Lode
River Snail
Old West
Cottenham Lode
Oakington Brook
Beck Brook
Washpit Brk
Ely Ouse
Local Environment
Agency Plan
Map 4.3
Environment Agency


River Ecosystem Class (1997)
Chemical Grades
KEY
Plan boundary
Main river
Built up area
River Ecosystem class:
RE 1
RE 2
RE 3
RE 4
RE 5
N
0
10km
SWAFFHAM
WATTON
ATTLEBOROUGH
BRANDON
THETFORD
ELY
MILDENHALL
NEWMARKET
BURY ST. EDMUNDS
CAMBRIDGE
River Wissey
Watton Brook
Stringside Drain
Methwold Lode
Swangey Drain
Ten Mile
Little Ouse
Lakenheath Lode
Wangford Drain
River Thet
Ely Ouse
Cut Off Channel
Little Ouse
River Sapiston/The Black Bourn
Soham Lode
River Lark
Old West
Willingham Lode
Dockeral Brook
Cottenham Lode
River Snail
River Kennett
Tuddenham Stream
Culford Stream
Pakenham Stream
River Lark
Oakington Brook
Beck Brook
Westwick Brk
Ely Ouse
Local Environment
Agency Plan
Map 4.4
Environment Agency

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) has probably increased reporting of pollution incidents.

Table 4.11: Pollution Incidents in the Ely Ouse LEAP Area (1997)

POLLUTION TYPE	Category			
	1	2	3	4
Oils	0	2	30	12
Sewage	1	2	36	10
Chemicals	0	1	15	1
Organics	0	5	17	5
Others	3	0	24	13
TOTALS	**4**	**10**	**122**	**41**

Category 1 are 'major' incidents, category 2 are 'significant', category 3 are 'minor' and category 4 are 'unsubstantiated'. A more detailed explanation is given in Appendix B.

The largest number of reports - approximately 28% of the total pollution incidents reported - were due to sewage. These were mainly minor problems such as septic tank overflows, blocked sewers, mechanical failures at sewage pumping stations and misconnection of foul sewage to surface water drains. The Category 1 incident was due to low flows and high water temperature aggravating the accumulation of organic solids downstream of Bury St. Edmunds STW and resulting in oxygen depletion. The accumulation occurred in the period prior to the AMP2 investment by Anglian Water PLC to extend the STW to enable compliance with the river needs consent; the work was not due for completion until December 1998.

Oil pollution accounted for 25% of the total incidents reported, of which most were small diesel spills (categories 3 & 4). The Category 2 incidents were caused by 1000 gallons of spilled diesel, leading to pollution of 1.5 km of the River Thet at Gt. Ellingham and a spill of 10-20 gallons of oil from an industrial site in Thetford polluting the Little Ouse.

Incidents involving organics accounted for 15% of the total pollution incidents. Six of these incidents were attributed to one major abattoir company but each incident was a failure of a different part of their system. The company was successfully prosecuted for the incidents with total fines of £14 000 imposed by the magistrates. Other problems were related to discharges from farms or the rural-based food industry.

Chemical sources accounted for 10% of reported incidents. These were mainly small chemical spills from industry in general, or road traffic accidents.

Approximately 22% of the total number of incidents reported were due to other reasons. These include natural causes of low dissolved oxygen during the hot weather and algal blooms, run-off

water from fires and incidents where the cause was not known, eg, watercourse discolouration. Two of the Category 1 incidents were due to natural causes with (i) low dissolved oxygen resulting from the break down of an algal bloom and (ii) fish death due in part to disease. An operational problem at the Blackdyke water transfer intake on the Cut Off Channel resulted in a Category 1 loss of fish caught on the fish screens.

Figure 4.2: Blackdyke Intake on the Cut Off Channel

There are several villages in the LEAP area that are unsewered. The disposal of domestic foul sewage is usually by means of septic tanks, cesspools or small sewage treatment plants. The effluent from septic tanks should be soaked away into land within the confines of individual house plots. However, much of the area in the upper catchment is overlain by boulder clay and there are outcrops of Gault clay elsewhere. Soakaways do not work well in clay soils and there is a tendency for householders to direct effluent to ditches and streams. Cesspools are watertight storage tanks, the contents of which should be tankered away for disposal off site. Because of the distance from these unsewered villages to main watercourses, significant pollution of rivers does not occur. However, these discharges are illegal and do give rise to local ditch pollution resulting in complaints of odour and nuisance.

In some circumstances the solution may involve the installation of a private treatment plant, but the introduction of first-time rural sewerage for the whole village is often the preferred solution. There are

known difficulties due to restricted or lack of main drainage in the following villages: Boughton, Carbrooke, Chettisham, Gt. and Lt. Dunham, Gt. Ellingham, Kenninghall and West Dereham. However, certain specified conditions must be met before Anglian Water Services (AWS) are obliged to provide a public sewer. Under the AMP3 process, AWS has identified only Carbrooke as requiring first-time rural sewerage.

Biological Water Quality

The biological assessment scheme is based on groups (taxa) of aquatic macroinvertebrates such as mayflies, shrimps, beetles and bugs. Macroinvertebrates are good indicators of the quality of a watercourse for several reasons: they have relatively long life cycles, are sedentary (tend to stay in the same place), and respond to the physical and chemical characteristics of a river. This means that they will be affected by infrequent pollution incidents, which could easily be missed by a chemical spot sample, as well as longer-term problems, and they therefore provide an overall picture of the quality of the river over time.

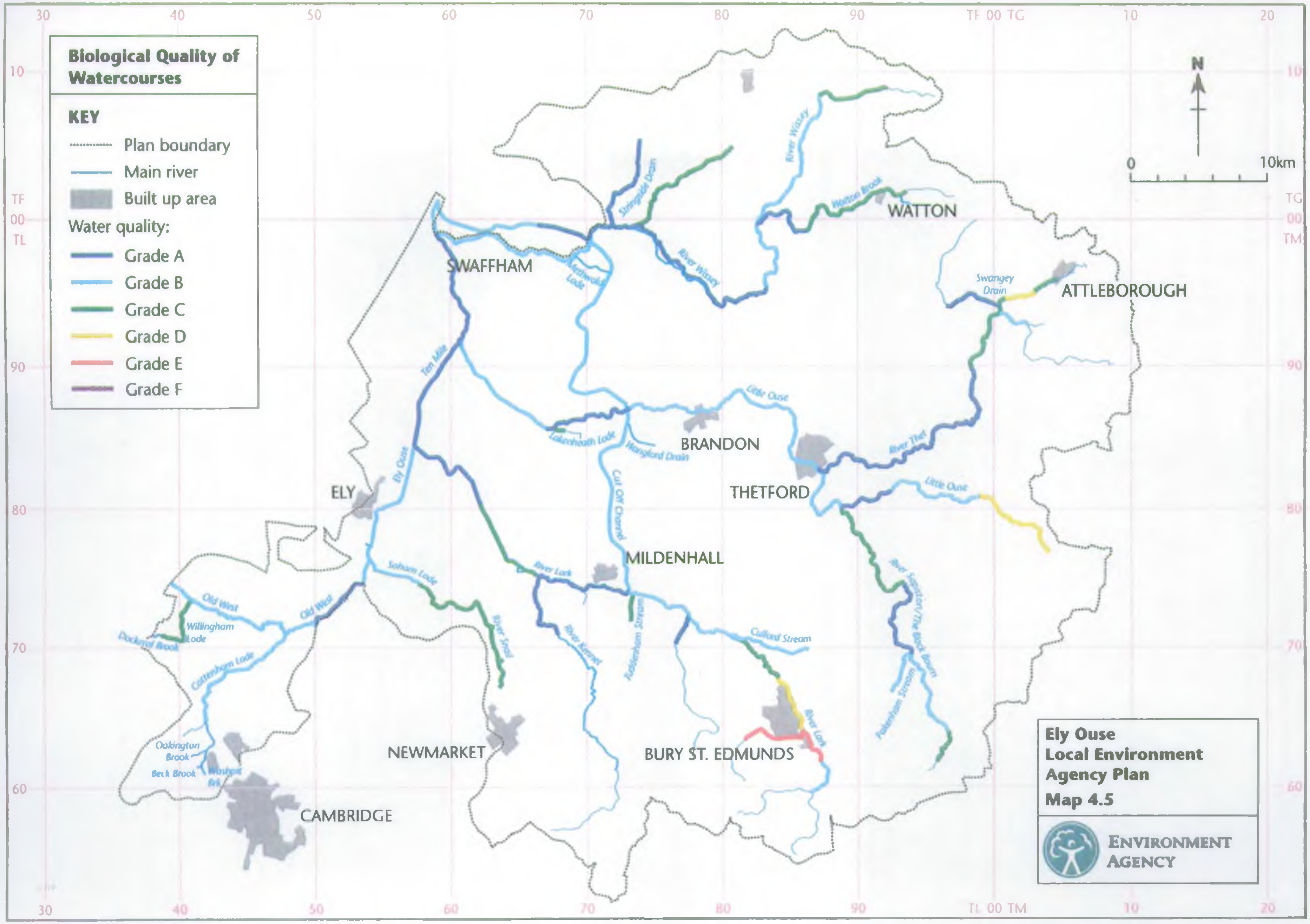
Some taxa are more tolerant of pollution than others. The GQA scheme uses the responses to organic pollution to determine the biological quality. Scores between 1 and 10 are allocated to each taxa, with pollution-tolerant taxa scoring 1 and the most pollution-sensitive taxa scoring 10. A site with good water quality will have a balanced invertebrate community, with representatives of both pollution-tolerant and pollution-sensitive taxa present. By comparing taxa found at a site when sampling with those that would be expected if the river was unpolluted, rivers are classified into one of the six GQA grades (A-F).

Biological GQA Grade	Description
A	Very good
B	Good
C	Fairly good
D	Fair
E	Poor
F	Bad

The Ely Ouse area has over 93% of its rivers reaching Grade C or higher. Grade A results are obtained on the River Thet and River Wissey; indeed, most of the sub-catchments are characterised by extensive lengths of either Grade A or Grade B (74% of the LEAP area).

Where biological quality falls significantly short of this predicted quality, this can largely be attributed to the effects of low flows. However, in the River Lark, in the vicinity of Bury St Edmunds, run-off from urban and industrial areas reduces the water quality.

Map 4.5 shows the biological quality of watercourses in the LEAP area.


Biological Quality of Watercourses
KEY
Plan boundary
Main river
Built up area
Water quality:
Grade A
Grade B
Grade C
Grade D
Grade E
Grade F
N
0
10km
SWAFFHAM
WATTON
ATTLEBOROUGH
BRANDON
THETFORD
ELY
MILDENHALL
NEWMARKET
BURY ST. EDMUNDS
CAMBRIDGE
Stringside Drain
River Wissey
Watton Brook
Methwold Lode
Swangey Drain
Ten Mile
Little Ouse
Lakenheath Lode
Hangland Drain
River Thet
Ely Ouse
Cut Off Channel
Soham Lode
River Lark
Old West
Willingham Lode
Cottenham Lode
Oakington Brook
Beck Brook
River Snail
River Kennet
Tuddenham Stream
Cavenham Stream
Culford Stream
River Sapiston/The Black Bourn
Pakenham Stream
Ely Ouse
Local Environment
Agency Plan
Map 4.5
Environment Agency

VIEWPOINT 4: COMPLIANCE WITH TARGETS & STANDARDS ELY OUSE

Chemical Water Quality

Map 4.2 highlights failures to reach the long-term water quality objectives. The failure to meet water quality objectives (WQOs) is widespread throughout the LEAP area. The majority of failures are due to low dissolved oxygen concentrations and elevated BOD values, both are adversely affected by low flow conditions, excessive plant growth and algal blooms.

Failures of WQOs along the following river stretches have highlighted the following areas:

- Cottenham Lode is a land drainage fed, lowland system. As a result of static flow conditions, the impact of Cottenham STW and the long-term accumulation of silts has been worsened.

- The River Snail and the Soham Lode (a lowland reach of the River Snail) both currently fail their WQOs with respect to ammonia and dissolved oxygen. This is due to the discharge from Newmarket STW via the Newmarket No. 1 drain.

- The River Lark from Bury St Edmunds A134 Road Bridge to West Stow fails with respect to ammonia. Further investigations are needed to identify the reasons for failure.

- Summer low flows combined with the direct and diffuse pollution from Kerry Foods have resulted in the headwaters of the Little Ouse failing to meet its WQOs with respect to dissolved oxygen and ammonia. Kerry Foods is currently addressing the problem.

- Failures of ammonia in the Elmswell Tributary are due to a consented discharge from Harris Foods.

Performance of Discharges against Consent Conditions

In the Anglian Region, 100% of AWS STWs discharges are compliant with their current legal consent conditions (1997). 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, they are 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 (this 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 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 consents and RNC is shown in Table 4.12:

Table 4.12: Discharges where more stringent consent limits are necessary to achieve compliance with the long-term WQO. Compliance with legal and RNC targets is also shown for the year ending June 1998.

STW	Dry Weather Flow (DWF) m^3/day	Current legal consent standard	Compliance with current legal consent	River needs consent (RNC)	Compliance with RNC
Attleborough	2500	25/15/6	Pass	25/13/4	Pass
Badwell Ash	540	45/30/10	Pass	30/15/6	Pass
Barnham	136	130/65/-	Pass	60/30/20	Fail
Barrow	363	50/25/20	Pass	30/15/5	Fail
Barton Bendish	50	80/40/-	Pass	80/40/25	Pass
Botesdale	280	30/15/7	Pass	30/15/5	Pass
Bradenham	80	60/30/15	Pass	40/20/5	Fail
Brandon	2006	50/35/-	Pass	50/35/25	Pass
Bury St Edmunds	11000	30/20/5	Pass	16/8/2	Fail
Chedburgh	400	60/30/35	Pass	20/20/10	Fail
Chippenham	51	40/20/-	Pass	40/20/15	Pass
Cockley Cley	23	45/35/-	Pass	45/35/25	Pass
Coney Weston	270	60/45/30	Pass	30/15/6	Pass
Dullingham	205	40/20/15	Pass	40/20/10	Pass
East Harling	470	35/20/20	Pass	40/20/7	Pass
Elmswell	1100	35/20/20	Pass	30/15/5	Pass
Ely	4350	50/25/15	Pass	30/15/8	Pass
Eriswell (Lords Walk)	561	90/85/-	Pass	30/15/5	Fail
Feltwell	470	50/25/-	Pass	25/15/9	Pass
Garboldisham (Elm)	7	40/25/-	Pass	40/20/-	Pass
Gazeley	200	60/45/20	Pass	30/15/5	Pass

Great Cressingham	54	100/70/-	Pass	100/70/25	Pass
Great Welnetham	190	80/60/12	Pass	60/10/45	Pass
Haddenham	630	35/20/17	Pass	30/20/10	Pass
Hockham	75	65/45/-	Pass	40/20/10	Pass
Honington	99	60/40/-	Pass	50/25/6	Pass
Lakenheath	760	20/10/8	Pass	20/13/5	Pass
Newmarket	6100	30/20/15	Pass	20/12/4	Pass
Over	2700	30/20/13	Pass	20/10/4	Pass
Prickwillow	100	60/30/-	Pass	60/30/15	Pass
Soham	2500	35/17/8	Pass	35/17/6	Pass
Southery (Mill Dr)	215	60/30/10	Pass	40/20/10	Pass
Stanton	1500	25/15/10	Pass	20/15/6	Pass
Swaffham	1000	20/15/10	Pass	20/10/3	Fail
Thetford	5256	50/35/-	Pass	50/35/25	Pass
Tuddenham (Bury St Edmunds)	1100	25/15/5	Pass	20/15/5	Pass
Wattisfield	120	50/25/-	Pass	40/20/10	Pass
Wilburton	225	50/20/-	Pass	50/20/10	Pass
Witcham	490	30/20/10	Pass	30/15/10	Pass

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 is 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.* Symptoms of eutrophication vary throughout the LEAP area, but include algal and filamentous algal growths, algal blooms in the water column and associated extreme diurnal (daily) variations in dissolved oxygen levels.

Monitoring and Status

The River Lark and the Cut Off Channel were designated as Sensitive Areas (eutrophic) under the UWWTD as they met the criteria laid down by the DETR. The River Lark feeds the southern end of the Cut Off Channel via Lark Head Sluice at Barton Mills; in turn, the Cut Off Channel transports water to the Essex reservoirs as an integral part of the Ely Ouse transfer scheme via the Blackdyke intake at Hockwold.

The slow-flowing nature of the Lark Head to Blackdyke stretch renders it vulnerable to the growth of algae and floating weeds in the summer period. This is a result of nutrient enrichment that has occurred annually for the last decade with particularly serious results, including fish deaths in 1996 and 1997. In 1997, the weed growth was so severe that it had to be removed to prevent serious collapse in water quality over a prolonged stretch.

AWS are working towards meeting the needs of the UWWTD by investment at the Bury St. Edmunds STW; the work was due for completion by the end of 1998.

4.4 The Quality of Groundwater

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 Government reviewed the existing legislation and decided to introduce new Groundwater Regulations to more effectively transpose the terms of the Groundwater Directive. The Regulations introduced 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, eg protection for the 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). 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.

With 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 but are 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 very low permeability, which do not contain groundwater in exploitable quantities.

Objectives

Activities with the potential to cause water pollution generally present a greater risk the closer they are to wells and boreholes. We have designated Groundwater Protection Zones (GPZs) 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 pumped from the source. The zones are divided into three, based on proximity to the source (see Viewpoint 1.2).

Within the policy document (available on request), we have published standard policy statements that 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 that 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.

Monitoring and Status

Three NVZs have been designated in the Ely Ouse LEAP area at Moulton, Bury and Swaffham. Map 1.3 shows the status of groundwater vulnerability in the LEAP area and shows areas of aquifer outcrop, including those areas where the aquifers are protected by surface 'drift' deposits, as well as areas of non-aquifers. We encourage activities with the greatest groundwater pollution potential to be sited on

non-aquifer areas wherever possible.

We have also designated GPZs for each public water supply source in the LEAP area (refer to Map 1.4). 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:

RAF Mildenhall

The storage and use of hydrocarbons and organic solvents at RAF Mildenhall over many years has led to contamination of the Chalk aquifer. The high water table and absence of any low-permeability cover make the groundwater vulnerable to pollution in this area. The contamination is largely historical and improvements in the storage and handling of fuel and chemical substances in recent years have minimised the risk of future spillages. This is a particularly sensitive location due to the proximity of an important public water supply borehole at Beck Row. The Defence Estate Organisation (United States Forces) [DEO (USF)], which is part of the Ministry of Defence, is currently engaged in a major programme of works to identify and clean up pollution. The work is being funded by the US Air Force. Extensive site investigation work has been carried out and a programme of risk assessment has begun with the object of identifying the most appropriate form of clean up.

RAF Lakenheath

RAF Lakenheath and RAF Mildenhall are only 5 km apart and there are a number of similarities between the groundwater contamination problems at both sites. The geological settings are similar and both have a long history of use as large military air bases. The DEO (USF) is carrying out investigation work at the base relating to groundwater, contaminated land and the industrial areas of the base. Initial findings suggest that groundwater contamination is less extensive than might have been expected at a site of this kind. The contaminated land study has identified several areas for further investigation. Further groundwater monitoring and aquifer testing is required before the programme can move on to the remediation stage.

Bury St Edmunds

Groundwater in the gravels that overlie the Chalk aquifer at Bury St Edmunds contains elevated levels of ammoniacal compounds; mercury and ammonia levels are also high in the River Lark, which runs through the town. Investigation work is required to identify and remove the source of this contamination.

We will improve the effectiveness of the inspection programme further by carrying out combined pollution prevention and waste minimisation inspections, and by initiating waste minimisation projects in partnership with industry. We will shift the balance of our work from regulation towards education and reduction of waste at source.

Trends

Groundwater levels have increased from the record low levels that were reached during the drought of 1995-1998. 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, which are applied in sufficient quantities to constitute a risk to the aquifers.

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

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 normally monitored 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

International and European Standards (*Global issues*)

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 almost certainly leading to 'global warming' and probably climatic change. 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 1997 Kyoto Climate Summit, the UK Government made further commitments to reduce emissions of carbon dioxide (CO_2) and other greenhouse gases by 5% from 1990 levels by 2008-2012.

Various European legislation is concerned with control of air pollution. There are directives controlling air quality limits on sulphur dioxide (SO_2), fine particles (PM_{10}), nitrogen dioxide (NO_2), lead and ozone monitoring. These will be replaced by a Framework Directive on Air Quality (which mirrors the current UK National Air Quality Strategy (NAQS)) that will detail 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 NAQS. 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.

The UK National Air Quality Strategy 1997

The Strategy sets out a framework for improving air quality through standards and objectives, which implement requirements of the Environment Act (EA95). The Strategy lists standards and guidelines that represent longer-term objectives to protect health and the environment. Combustion processes, such as waste incinerators, wood burning and coal burning, are a potentially significant source of toxic organic micro-pollutants. The standards and objectives aim to facilitate compliance with international and European commitments for national emissions.

Local authorities in the LEAP area are developing Air Quality Management Systems (AQMS) in recognition of the need for strategic and integrated assessment in sustainable development planning, in advance of Government requirements. The Agency has produced a 'Guidance for Estimating the Air Quality Impact of Stationary Sources'. This guidance is for making first estimates of the impacts of stationary pollution sources on local air quality. It will allow informed decisions to be made on whether or not it is necessary to do more refined analysis. It is intended to be used as part of the review and assessment of air quality as set out for local authorities under Part IV of the Environment Act 1995. This review and assessment is designed to help local authorities to achieve the objectives of the NAQS by 2005.

The LEAP area is essentially rural, with the major urban centre being Bury St. Edmunds. Air quality has not given rise for concern and, for this reason, 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.

However, the effects of releases from other sources such as roads (for example, A14, A10, A11, and A47) and urban areas outside of the area (for example, Cambridge or King's Lynn) may have an impact on the LEAP area under certain weather conditions.

Process Industries Regulation

The Environmental Protection Act (EPA90), 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 EPA90) 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, eg, paper making.

Operation of a prescribed process requires an IPC authorisation; 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 'Millennium Strategy', the Agency has a commitment to address climate change and improve air quality. This includes reduction targets for CO_2, SO_2, NO_x (oxides of nitrogen), PM_{10}, carbon monoxide, dioxins, lead, non-ferrous metals, 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 is 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 work carried out by the Agency supports and checks the monitoring which is carried out by operators as a requirement of their authorisations.

The Agency must ensure that new or varied licences do not cause significant impact on Habitat Directive sites (refer to table 4.5). Under the Habitats Directive the Agency is obliged to review all existing licences by 2004.

Local Perspective

The area covered by this LEAP is predominantly agricultural and contains a relatively small amount of large or complex Industry. Only nine sites have authorisations issued under the Environmental Protection Act 1990 (EPA90) Part 1. These are listed in Table 4.9 overleaf.

Table 4.9: IPC Processes

OPERATOR NAME	LOCAL AUTHORITY
British Sugar	St. Edmundsbury
British Sugar	Kings Lynn & W Norfolk
Fibrowatt Thetford Ltd	Breckland
Hydro Chafer Ltd	St. Edmundsbury
Inorgtech	Forest Heath
Hays Chemical Distribution Ltd	Breckland
Marlow & Co. Ltd	St. Edmundsbury
Mayer Parry Recycling Ltd	E Cambridgeshire
Witton Chemical Co. Ltd	Forest Heath

British Sugar plc: There are two sites within the LEAP area – Bury St. Edmunds and Wissington sugar factories – and both have authorisations for combustion process and lime-making process. These plants are integrated sugar factories and contain other processes regulated under Part 2 of EPA90.

Fibrowatt Thetford Ltd: This process is a combustion process from which electricity is produced by burning wood chips and small amounts of straw.

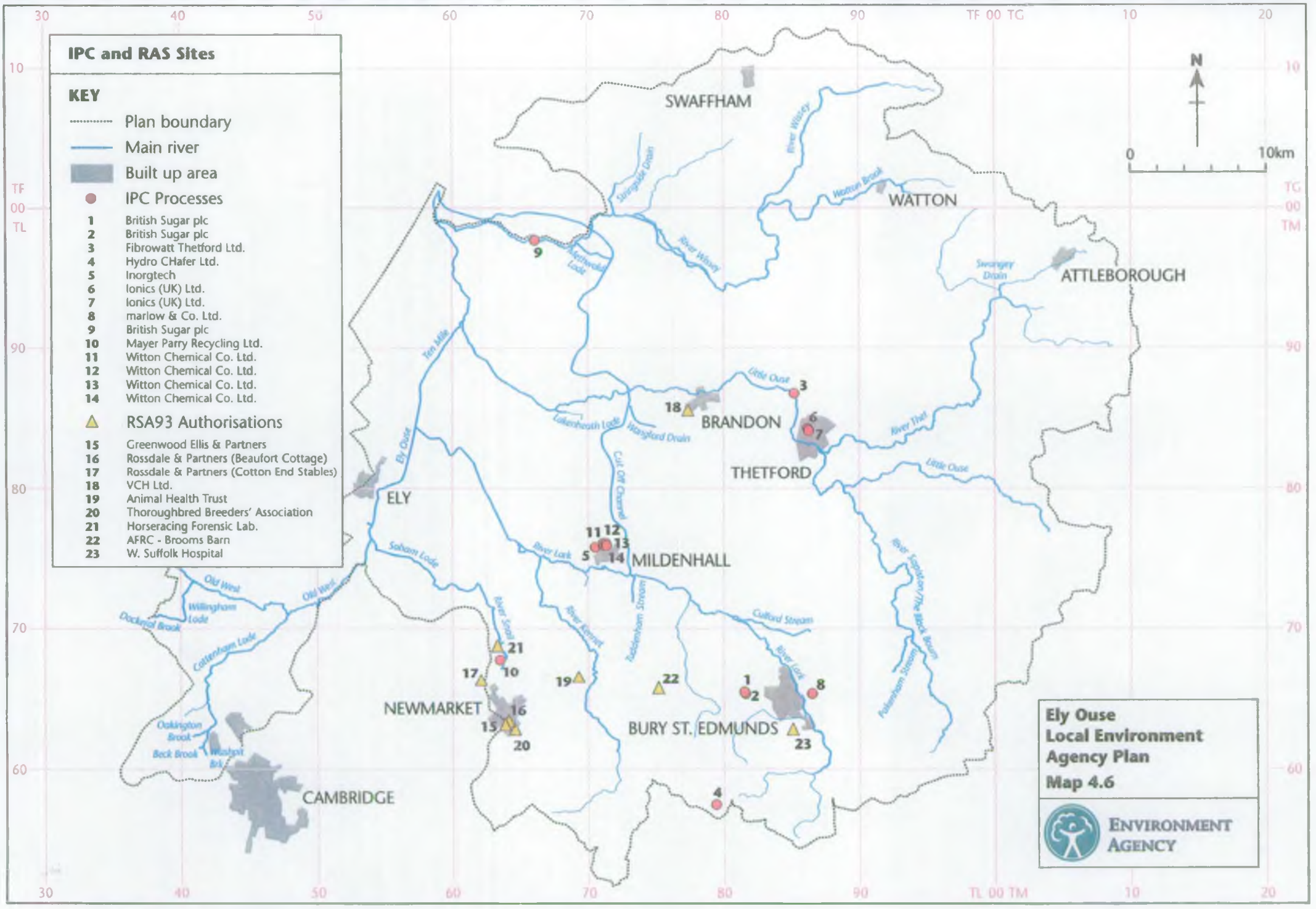
Mayer Parry Recycling Ltd: There is an asbestos stripping process authorised on this site but this is only a small part of the operations that are undertaken on the site. This facility permits old redundant/scrap railway carriages to have any asbestos contamination removed, before being broken up and the metal parts recycled.

Witton Chemical Co Ltd: This company has four authorisations issued under EPA90 Part 1 for the manufacture of various chemical products. A number of the raw materials have unpleasant odours and much care is taken to minimise their discharge to the environment both at delivery time and while in use.

Other authorised processes: There are three other small chemical companies with a total of four authorisations for manufacture of chemicals, and one company with a timber processing authorisation.

There are no authorised processes beyond the boundary of this LEAP area which are felt to have a major influence on the environment of this area.

Non-compliance with the conditions of an authorisation can result in enforcement action. Map 4.6 shows the location of IPC authorised processes in the LEAP area and Figure 4.2 details authorisation by industry sector. Details of IPC authorisations are held on the Public Register at the regional office in Peterborough and on Public Registers held by the local authorities.


IPC and RAS Sites
KEY
Plan boundary
Main river
Built up area
IPC Processes
1 British Sugar plc
2 British Sugar plc
3 Fibrowatt Thetford Ltd.
4 Hydro CHafer Ltd.
5 Inorgtech
6 Ionics (UK) Ltd.
7 Ionics (UK) Ltd.
8 marlow & Co. Ltd.
9 British Sugar plc
10 Mayer Parry Recycling Ltd.
11 Witton Chemical Co. Ltd.
12 Witton Chemical Co. Ltd.
13 Witton Chemical Co. Ltd.
14 Witton Chemical Co. Ltd.
RSA93 Authorisations
15 Greenwood Ellis & Partners
16 Rossdale & Partners (Beaufort Cottage)
17 Rossdale & Partners (Cotton End Stables)
18 VCH Ltd.
19 Animal Health Trust
20 Thoroughbred Breeders' Association
21 Horseracing Forensic Lab.
22 AFRC - Brooms Barn
23 W. Suffolk Hospital
N
0
10km
SWAFFHAM
WATTON
ATTLEBOROUGH
BRANDON
THETFORD
ELY
MILDENHALL
NEWMARKET
BURY ST. EDMUNDS
CAMBRIDGE
River Wissey
Watton Brook
Stringside Drain
Swangey Drain
Little Ouse
River That
Ten Mile
Ely Ouse
Lakenheath Lode
Wangford Drain
Cut Off Channel
Soham Lode
River Lark
River Snail
River Kennet
Isleham Stream
Cutlaw Stream
Fulmere Stream
River Stour/The Black Bourn
Old West
Willingham Lode
Dockerel Brook
Cottenham Lode
Oakington Brook
Beck Brook
Ely Ouse Local Environment Agency Plan
Map 4.6
Environment Agency

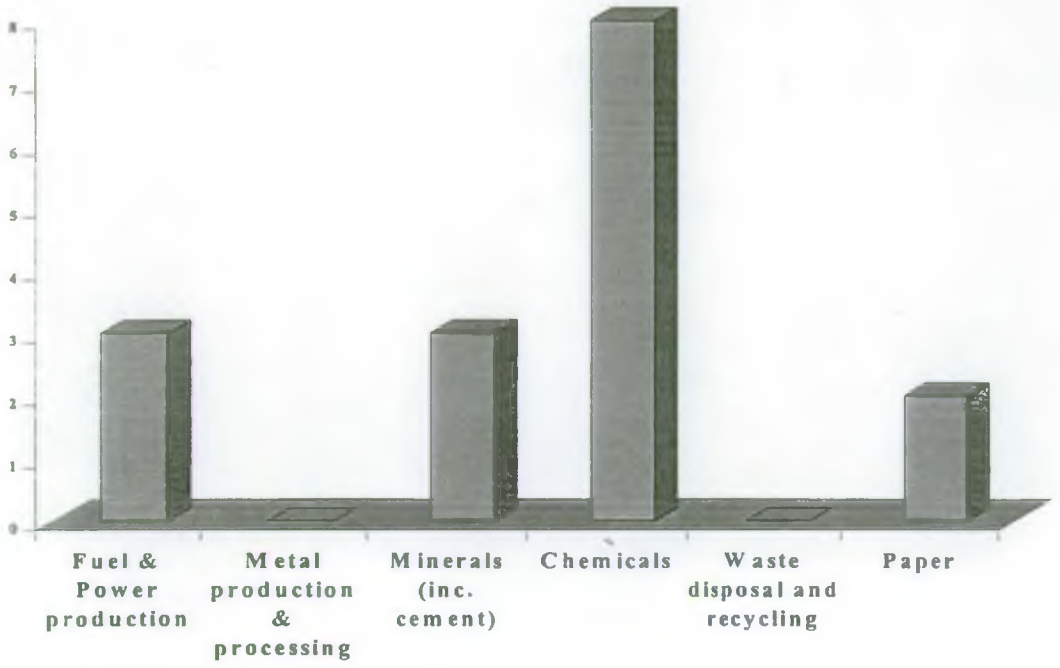


Figure 4.2: IPC Authorisations

4.6 Radioactive Substances Regulation

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 to 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 to regulate the accumulation and disposal of radioactive wastes and are usually associated with larger users, eg, hospitals, universities and research facilities.

The RSA 93 authorisations in the LEAP area are shown in Table 4.10 and on Map 4.6.

Table 4.10: RSA 93 Authorisations

OPERATOR NAME	LOCAL AUTHORITY
Greenwood Ellis & Partners	Forest Heath
Rossdale & Partners (Beaufort Cottage)	Forest Heath
Rossdale & Partners (Cotton End Stables)	Forest Heath
VCH Ltd	Forest Heath
Animal Health Trust	Forest Heath
Thoroughbred Breeders' Association	East Cambridgeshire
Horseracing Forensic Lab	East Cambridgeshire
AFRC Brooms Barn	St. Edmundsbury
West Suffolk Hospital	St. Edmundsbury

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 authorisations or registrations issued under the RSA93.

4.7 Special Waste Regulations

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 which 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 transpose Council Regulation (EEC) 259/93 (the Waste Shipments Regulation) into UK legislation. Transfrontier movements of potentially hazardous waste (those that are designated as amber or red by the Organisation for Economic Co-operation and Development (OECD)) 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 are 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 UK Management Plan for Imports and Exports of Waste sets out the Government's 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 should be able to continue.

In the year April 1997 to March 1998 the Agency's Central Area granted consent to some 7 notifications. These authorised a maximum of 6 300 tonnes of fragmentiser/non ferrous shredded waste in 214 shipments and 750 tonnes of pharmaceutical waste in 30 shipments to be imported into the LEAP area for recovery.

Currently, figures for April to December 1998 show that the Central Area Agency office has granted consent to some 9 notifications over this period. This currently authorises a maximum of 32 400 tonnes of fragmentiser/non ferrous shredded waste in 183 shipments and 2 500 tonnes of pharmaceutical waste in 104 shipments to be imported into the LEAP area for recovery.

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

4.8 Nature Conservation

River Corridor Surveys (RCS) and otter, water vole and riparian tree health surveys been carried out on all Main Rivers to ensure that all operational activities are undertaken in an environmentally sensitive manner. However, we cannot yet provide quantitative data in order to determine whether the species or habitat diversity is improving or deteriorating. Together with collaborative partners, we will ensure that the wildlife within the Ely Ouse area continues to be monitored with steps being taken to stop any future degradation. Compliance with targets will, however, be achieved in a significant way through the objectives and targets set for key habitats and species in each local county-based Biodiversity Action Plan (BAP).

Water Resources and Land Drainage legislation and more recently the Environment Act 1995 govern many of our conservation activities. The Wildlife and Countryside Act (1981) is also relevant.

We are entrusted through Section 4 of the Environment Act 1991 with the role of protecting sites and species of high conservation value and rehabilitating impoverished or degraded areas for the benefit of present and future generations. Working in partnership with other groups our remit may, in the future, extend beyond rivers and wetlands to include terrestrial habitats.

We have a duty to conserve and enhance the natural beauty of inland and coastal waters and associated land, plus the flora and fauna that are dependent on the aquatic environment. We should also seek to promote the conservation of natural beauty and wildlife dependent on the aquatic environment.

RCS have been undertaken extensively in Anglian Region in the last seven years. We undertake RCS to assess the ecological quality of all rivers classed as Main River. The surveys, collectively called

the Rivers Environmental Database (RED), have been completed for every 500 m section of Main River and record plants within the channel, on the banks and within the adjacent 50 m river corridor. Birds have also been recorded. We undertake aquatic invertebrate surveys to assess water quality and fishery surveys, which supplement the RCS information. RED has also been used to assist in the designation of river lengths as County Wildlife Sites (CWS) by the Wildlife Trusts in collaboration with the Agency.

The National River Habitats Survey (RHS) methodology classifies the environmental condition of rivers with regard to physical features such as riffles, pools, wet shelves and cliffs. RHS will compliment RCS, both of which are aimed at identifying degraded as well as important stretches of river in order to protect valuable features of landscape and wildlife interest and identify opportunities to rehabilitate and enhance degraded habitats.

Conservation Through Regulation

Applications for Agency consents and licences are screened to identify those that are likely to have an impact on wildlife and landscape or features of archaeological or historical interest. Once identified as such, then we apply conservation criteria as part of an environmental appraisal process. Consents can then be granted with or without conditions, or refused, on the basis of professional judgement as to whether the proposed activity will or will not cause an unacceptable impact on special conservation interest.

VIEWPOINT 5: THE HEALTH OF THE ENVIRONMENT

5.1 Fisheries

Fish are very good indicators of the state of rivers and lakes. Healthy and abundant freshwater fish stocks demonstrate our success in meeting water protection duties. Good water quality, water quantity and habitat are all vital for good fish stocks.

The Agency has a fisheries objective to sustain a natural, healthy fish population appropriate to the area and achieve a biomass Class 'A' fish population. It is, however, recognised that this level of population will not be achieved in some smaller streams or man-made channels where the primary function limits the habitat.

A balanced fish community should also be sought, where the optimum species diversity is achieved within the aquatic ecosystem. The control of exotic species and disease in a river catchment is paramount in protecting the native inhabitants.

The recreational, and in some circumstances commercial, use of a fishery must also be considered when developing integrated water management objectives. We aim to provide anglers with a diverse range of good quality fishing.

5.1.1 Natural Forces

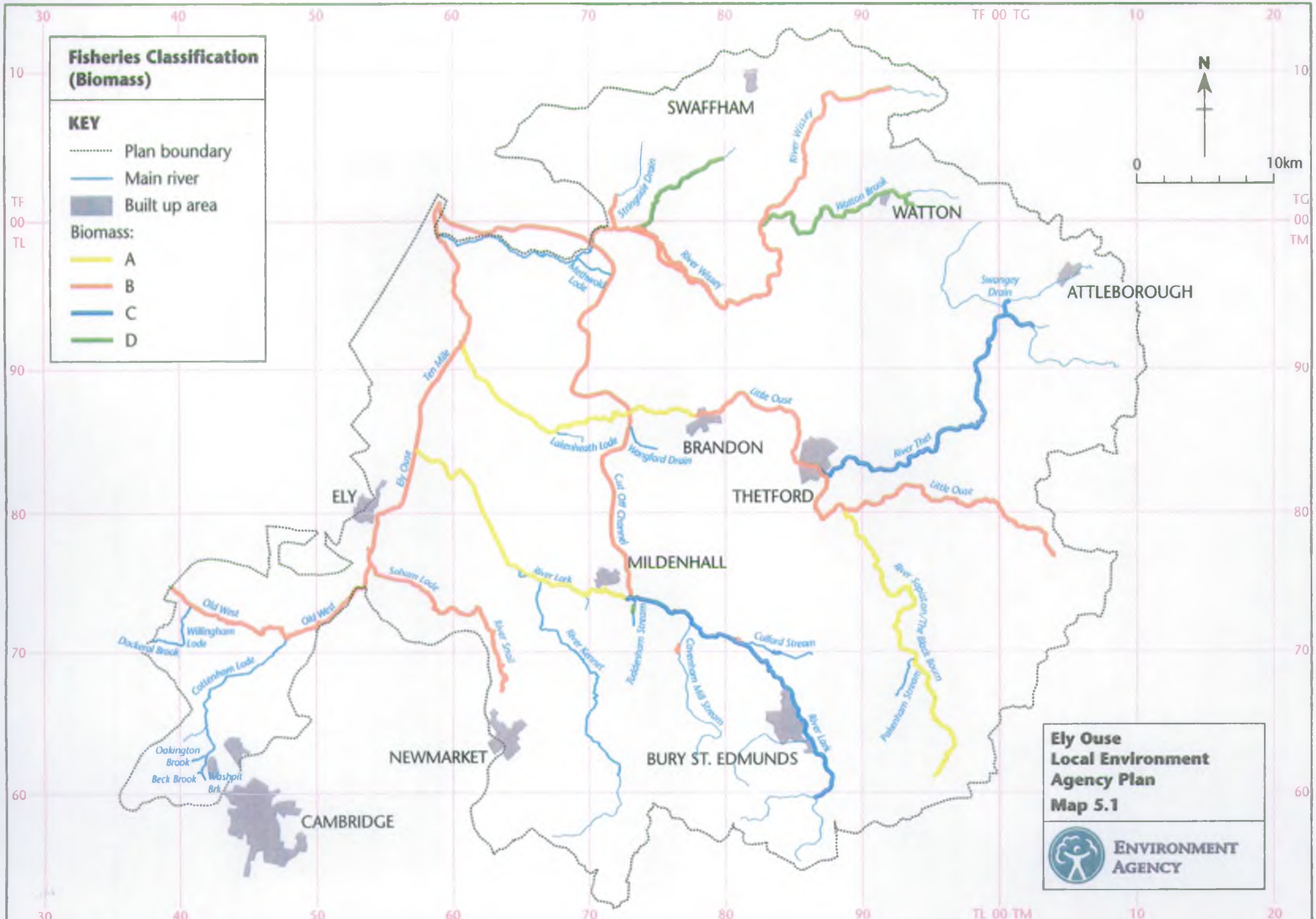
Fish populations fluctuate according to environmental conditions that influence the physical, biological and chemical characteristics of the ecosystem. The fisheries of the Ely Ouse and associated tributaries exhibit considerable variation in fish biomass, density and diversity in relation to these conditions.

Our five-year rolling survey programme covers 227 km of coarse fishery and 106 km of trout fishery. Population trends can be identified and impacts assessed from the 20 years of data that has been accumulated.

The Ely Ouse River, the Old West, the River Wissey below Oxborough, the Little Ouse below Brandon, and the River Lark below Isleham, are collectively known as the South Level 'pond'. There are no barriers to coarse fish movement within this 'pond'. The population is dominated by roach, with common bream and pike also widely distributed. The most recent surveys, 1995-1997, revealed some 20 species of fish in this section of the LEAP area.

The Ely Ouse River is the major coarse fishery and supports a good Class B fish population (12.8 grams per square metre (gm^{-2})). Recent warm summers have benefited the annual recruitment of the dominant cyprinid species. The increased numbers of mature roach and common bream surviving have improved the biomass, whilst strong young yearclasses, in particular the fish spawned in 1995, have improved the density. It is a similar picture in the lower River Wissey and Little Ouse; both support a Class B fish population. The lower River Lark is a Class A fishery. (Refer to Map 5.1)

These watercourses are typical of lowland rivers, being generally clear and slow-flowing; the marginal habitat is adequate in the provision of spawning and nursery areas. The limited number of backwaters places some importance on overhanging trees, bridges and boat moorings as habitat features for aggregations, especially during winter.


Fisheries Classification (Biomass)
KEY
Plan boundary
Main river
Built up area
Biomass:
A
B
C
D
SWAFFHAM
WATTON
ATTLEBOROUGH
BRANDON
THETFORD
ELY
MILDENHALL
NEWMARKET
BURY ST. EDMUNDS
CAMBRIDGE
River Wissey
Watton Brook
Stringside Drain
Methwold Lode
Swangey Drain
Ten Mile
Little Ouse
River Thet
Lakenheath Lode
Hengford Drain
Cut Off Channel
Ely Ouse
Soham Lode
River Lark
Old West
Willingham Lode
Dockeral Brook
Cottenham Lode
River Snail
River Kennet
Tuddenham Stream
Cavenham Mill Stream
Culford Stream
River Sapiston/The Black Bourn
Pakenham Stream
Oakington Brook
Beck Brook
Washpit Brk
N
0
10km
Ely Ouse Local Environment Agency Plan
Map 5.1
Environment Agency

The Old West River is a smaller watercourse, a Class B fishery dominated by small fish. The population is limited by the canal-type habitat of the river. The upstream sections of the major Ely Ouse tributaries see a gradual change in fish species to those more suited to the increased flow and erosive riffle/pool habitat.

The finest example is possibly the River Wissey, which supports a breeding brown trout population. The occasional sea trout has also been known to enter the upper section of the river to spawn. The low flows associated with the recent drought years may have reduced the ability of these migratory salmonids to move up the river to their favoured spawning sites.

The brown trout population extends into the Wissey's headwaters and tributaries, including the Watton Brook and Stringside Stream. Trout have not been recorded in the River Gadder and Old Carr Stream since 1990; extensive lengths of these watercourses have become dry in recent years.

Brown trout are present in the River Lark upstream of Barton Mills, from annual stockings by the angling clubs. The fish biomass is generally lower in the trout section than where coarse fishing takes place. Our most recent survey found a Class C biomass (8.3 gm^{-2}). This is partly due to habitat limitations and limited flows, but is also the result of a management regime to remove the competing cyprinid species. Some trout spawning occurs in the Lark. However, the small wild fish population in the Cavenham Stream is of greater value and warrants protection. The coarse fish populations elsewhere, in tributaries such as the Linnet and Kennet, suffer from low flows. During 1997, an exceptionally dry year, the River Lark itself dried out in Bury St Edmunds.

The Little Ouse catchment supports only coarse fish; roach, dace, chub and pike dominate the population. The River Sapiston has the best fish population; a Class A fishery (26.6 gm^{-2}) was recorded at our last survey. The remainder of the area was Class C. The moderate fish stocks are most likely limited by habitat.

The River Snail once supported a breeding trout population. However, limited water resources and water quality problems may have led to the loss of the species from this river.

The man-made Cut Off Channel, which flows from Barton Mills to Denver, supports a Class C coarse fish population throughout its length, although only the lower 9 km is actually used for angling. We have found that the biomass has deteriorated since the previous surveys. Excessive weed growth will have affected the accuracy of our survey methodology but has also probably caused fish mortalities during the warmer months. There are a large number of Internal Drainage Board (IDB) drains where, although recognised fisheries are not supported, coarse fish populations are known to reside.

Rivers in the Ely Ouse 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, impact on resident fish populations. As the water temperature increases, proportionally less dissolved oxygen can be held in the water. The situation is worsened by algae and submerged plants. Plants respire at night, thus stripping oxygen from the water, and by morning some fish may have suffocated. This problem tends to be more prevalent in lakes and ponds, although the impact is also observed in static drains and some rivers.

High rainfall and the subsequent floods have the potential to displace small fish downstream, particularly in channelised environments. Nevertheless, our surveys this year suggest that survival of juvenile fish has not been affected. Indeed, high flows may have had a beneficial impact 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; 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.

FISH DISEASES

Figure 5.1: Fish Mortality (Bream)

The fish population in any river has a natural background level of parasites and diseases. This loading only becomes apparent when the fish are subject to stress. As a result of spawning, when the fish's energies are channelled into producing progeny, a natural mortality sometimes occurs (see Figure 5.1). 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.

The Agency regularly receives reports of coarse fish suffering from diseases. In most instances the diseases do not have a significant impact on individual fish. However, certain diseases can influence the cyclic population patterns observed in our river fisheries. Although the Agency does not routinely sample the health of wild fish, the status and distribution of the eel parasite *Anguillicola crassus* has been closely monitored in recent years. The organism was first recorded in this country in 1987. Eels from all survey sites in the Ely Ouse area were infected, with around 80% of the individuals carrying the parasite in their swimbladder. The pathological impacts may be increased mortality and an effect on the eels' swimming capabilities. Whether the parasite is a factor in the reduced elver runs observed in recent years is still being investigated.

We regulate introductions of fish into rivers through the Salmon and Freshwater Fisheries Act 1975 consenting procedures. This ensures that more serious diseases are not spread into different river catchments.

Disease problems are much more common in stillwater fisheries, 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) and the Agency provides angling clubs and owners of fishing lakes with advice on how to minimise the risk to their stock (and livelihood).

PREDATION

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

We offer a service to the area's trout clubs of removing coarse fish from their stretches. In addition to the perceived problem of competition for food and space, pike and perch can prey on the juvenile trout.

In the 1980s, the Agency had a policy to cull any zander caught during fisheries surveys. Following its introduction into fenland drains, the zander was thought to be having an adverse impact on native species. The cull was repealed when no increase in zander numbers was shown; the young individuals appear to have particular difficulty surviving over winter. Although the zander has spread throughout the South Level 'pond', its numbers remain at a low, manageable level.

Fish are also food for avian predators. Kingfishers and herons are an integral and natural 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 by cormorants as easy sources of food. Reports of the bird actively feeding on most of the rivers in this LEAP area 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 £1million in a research project to investigate the extent of the problem and explore the best ameliorative options.

Otters have increased their distribution in recent years, both through the elimination of poly-chlorinated biphenyls (PCBs) and related compounds that had led to their decline in the 1950s, and through a programme of reintroducing reared animals. Their favoured prey is thought to be eels. However, analyses of their droppings have shown that they will take a range of freshwater fish. Numbers of individuals are notoriously difficult to quantify; however, there is evidence that otters are found throughout the area and are particularly well established on the Rivers Wissey and Sapiston. We are not aware of any circumstances where the prey fish population has been unable to sustain the needs of the otters or where numbers have been significantly impacted. The otter is

protected under European legislation, so the Agency has a duty to conserve both the species and the habitat it needs.

Nevertheless, we are aware of commercial stillwaters where problems have been experienced. A lake complex on the Little Ouse near Thetford has allegedly lost a number of valuable fish, despite attempts to protect the site by erecting fences. It is believed that otters may preferentially feed in lakes within the river corridor where the density of food is artificially high. This highlights the need for reintroductions to be carefully considered, especially with regard to the impact on local angling interests. We would welcome a greater level of consultation from organisations, such as the Otter Trust, that are rearing otters for release.

The American mink that have escaped from farms have also established populations in the Ely Ouse area. These animals will also 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.

5.1.2 Societal Influences

The historical activities of man in and around the rivers of the Ely Ouse system are easily apparent today in the growth of waterside towns, the intensive agricultural practices, and river engineering operations to straighten watercourses and raise floodbanks. Each of these activities will have had some effect on the aquatic habitat and the associated wildlife, including fish.

Perhaps the main threat to the riverine habitat has come from land drainage works for flood defence. In order to protect people and property effectively, much of the lowland river in the area has been deepened, widened or straightened. In addition, the in-stream plant growth is annually cut and removed. These modifications and weed management operations will limit 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 predators.

The impact of heavy rainfall and subsequent high flows on an 'engineered' river or drain can be to displace juvenile fish downstream. Survey results and angler comments both indicate that this has occurred. In 1996 we installed 12 artificial reefs in the lower reaches of the Ely Ouse to provide both shelter and habitat for small cyprinid fish.

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, as a consequence, the ability of the anglers to fish safely. Over the period 1995-1997 the Agency repaired 8km of revetment in the Ely Ouse at a cost of £1.5 million. Where possible, the habitat was protected, or enhanced, with 'soft engineering' and the seeding of aquatic plants to benefit fish and other wildlife.

River spanning structures such as sluices and weirs obstruct the connectivity of the rivers and can therefore limit natural fish movements. At present there are no fish passes in the Ely Ouse LEAP area so, although some of the control structures may be overcome by migratory salmonids, we must assume that the majority of them prevent coarse fish migrations. Each year coarse fish will move to favoured spawning, feeding and overwintering areas. The problem is not considered significant in the South Level 'pond' where the habitats upstream and

downstream of weirs and sluices are relatively similar. The issue is more of a concern in the smaller tributaries, where some of our survey results suggest that populations are divided.

The extent of the problem is currently being investigated as part of a national R&D project. Particular regard is being paid to the fish pass needs of coarse species, about which little information is available at present.

5.1.3 Abstractions and Removals

Water abstraction will have a direct impact on a river's flow regime and it will affect the water quality indirectly. Abstractions can exacerbate the conditions experienced by the fish during the warmer months and periods of drought. In recent years there have been a number of incidents where small streams have virtually stopped flowing and, in extreme cases, tributaries have become ponded. Under these conditions, fish become more stressed and are also more vulnerable to predation.

Major water intakes can also have an impact through drawing small fish into the pumps. On the Cut Off Channel we operate the Ely Ouse Transfer Scheme, and maximum flows can be up to 340Mld. This is equivalent to a nominal velocity of about 0.5 cumecs, enough to entrain young cyprinids. Weed growth around the intake adds to the problem. We have employed expert consultants and thoroughly investigated the issue and the options available, as well as consulting other interested parties. The most cost-effective solution is the use of a bubble curtain during the highest flows and to undertake a strategic weed-cutting operation.

The most serious mortality at the Cut Off Channel Intake occurred in 1993, when 100 000 fish were lost. These small roach and bream were sheltering from winter flows in the dark penstocks of the building. No pumping was taking place, so the tanks were isolated for cleaning and maintenance inspection; this resulted in the fish deaths. A procedure is now in place to ensure that this series of events does not recur.

5.1.4 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 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 river stretches in the Ely Ouse area are designated:

Salmonid:

River Wissey	13.5 km from Hilborough to Northwold Common

Cyprinid:

River Lark	20 km from Mildenhall Gas Pool to Ely Ouse
Ten Mile River	10 km from Little Ouse River to Denver
Little Ouse River	60 km from Broom Hills Botesdale to Ten Mile River
River Thet	34 km from Portwood Brook to Little Ouse River
River Wissey	19.5 km from Northwold Common to Ten Mile River

The most recent sampling data indicate that all these stretches comply with the requirements of the Directive.

UK Water Quality Objectives

Each river in the Ely Ouse catchment has a River Quality Objective (RQO) based on the River Ecosystem Classification (REC). These are long- or medium-term targets reflecting the chemical water quality requirements of fish. Five classes exist, as follows:

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

River stretches are subject to periodic monitoring as part of the General Quality Assessment (GQA) programme, which records chemical and biological parameters. (Refer to Viewpoint 4.3 – Quality of Surface Waters.)

A number of river stretches in the Ely Ouse system fail to meet their REC targets. Eutrophication is also a problem in some watercourses. These issues have been highlighted in the LEAP (see Issue 18).

The Ely Ouse receives some enrichment from the effluent of upstream STWs. However, the principal source of nutrients is probably 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.

The LEAP area has suffered some serious pollution incidents over the years, most notably on the Rivers Lark and Sapiston. Restocking of the upper Lark was necessary following major fish kills in 1979, 1986 and 1992. In 1989 the River Sapiston was left virtually fishless when pig waste entered the river's headwaters.

5.1.5 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 byelaws. 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 about illegal fish movements. Because of the remoteness of some of the fisheries in this area, they lend themselves to fish thefts and non-consented introductions. We are aware that fish have been stolen from the Cut Off Channel and nearby stillwaters in the past, and have worked with angling contacts to trace 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. Illegal imports of fish from the continent and the escape of 'exotics' pose a serious disease threat with the potential for competition and predation aspects. As mentioned previously, zander are present in the Ely Ouse, and our rivers also contain significant numbers of carp, which tend to be hardy and fast growing. We would not give consent to introductions of these species where there was an identifiable risk to the native population. Similarly, stocking rainbow trout into rivers inhabited by brown trout is strongly discouraged.

VIEWPOINT 6: AESTHETIC QUALITY

6.1 Landscape and Archaeology

6.1.1 Natural Forces

The landscape of this LEAP area is primarily agricultural and lacks dramatic relief. Nonetheless, the mosaic of habitat types, which includes heathland and forest with a mixture of pasture, hedgerow, Scots pine treelines and wetlands contribute to a landscape that is far from dull. It is important for the Agency to ensure that the water features of the area, and the habitats adjacent to them (such as reed bed and wet, unimproved pasture) are protected and maintained. Threats to such areas are likely to come from practices that are beyond the control of the local planning authorities. Environmentally Sensitive Areas (ESAs), such as the Brecks ESA, are approved by MAFF to safeguard traditional farming practices and the landscapes, which evolve from them.

COUNTRYSIDE CHARACTER AND NATURAL AREAS

A character map of England, produced by the Countryside Commission and English Nature, with support from English Heritage, splits the countryside into 120 different 'Natural Areas' and 181 different 'Character Areas'. Natural Areas are identified on the basis of local distinctiveness in geology, landscape character, wildlife habitats, historical influences and natural features. (Reports detailing the ecological character of the Natural Areas have been produced by English Nature.) Character Areas have a cultural and historical dimension which can sub-divide them within the larger Natural Areas. Table 6.1 shows the Natural and Character Areas and Map 6.1 shows the Character Areas in the Ely Ouse LEAP area.

The Government and the Countryside Commission are keen to emphasise the need to conserve local character. This principal applies whether or not the landscape has been designated for its national importance. While these areas are too broad to be used for development control purposes, and the Commission advocates more detailed landscape assessments at the local plan level, its assessment is very appropriate for the strategic planning at structure plan and LEAP scale.

LANDSCAPE ASSESSMENTS

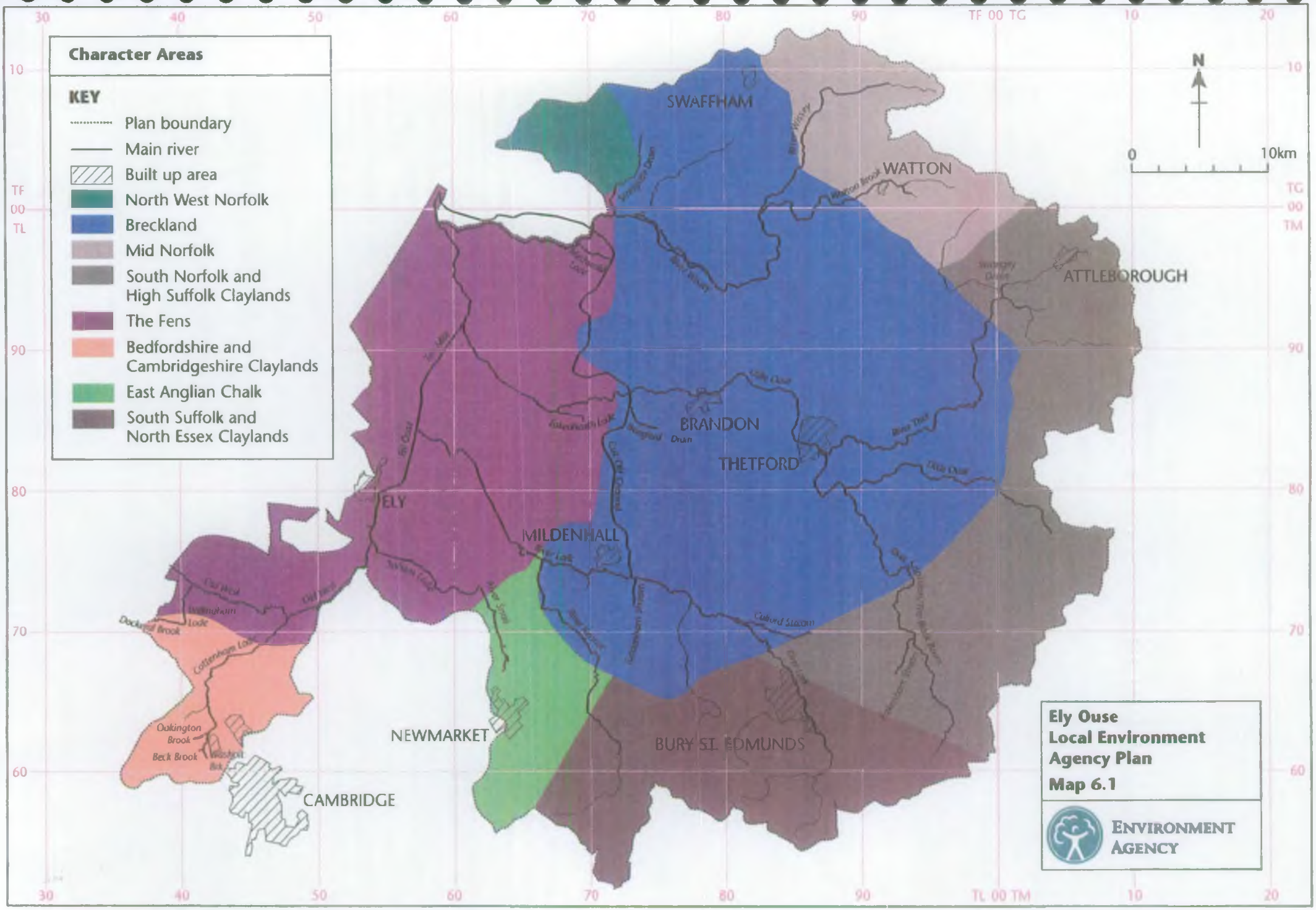
The Agency encourages the preparation of landscape assessments of river corridors in order to determine the character of such areas and to help the assessment of potential impacts of proposals for such areas. No such landscape assessments have yet been undertaken specifically for any rivers in this LEAP area.

ARCHAEOLOGY AND CULTURAL HERITAGE

This LEAP area holds a rich cultural heritage dating back as far as the Palaeolithic period (before 10 000 BC). In the Ely Ouse area, there are 166 sites designated as Scheduled Ancient Monuments (SAMs) (see Map 6.2). In addition to scheduled sites, there are a number of other sites, which are recognised as being of archaeological value. The archaeological sites most affected by the work of the Environment Agency are those sensitive to changes in groundwater levels. This is particularly important where reduced water tables result in the drying out of foundations.

Table 6.1: Natural and Character Areas

Character Area (No)	Natural Area	Landscape Description
The Fens (46)	The Fens	'Low lying, level terrain which except for fen islands such as Ely rarely reaches 10 m above sea level. The land is predominantly cultivated with little natural or semi-natural habitats remaining.'
NW Norfolk (76)	N Norfolk	'Large scale arable and grassland landscape on big rolling upland terrain ... remnant heath and ... mixed woodland; huge estates, large and widely spaced villages.'
S Norfolk & High Suffolk Claylands (83)	E Anglian Plain	'Undulating topography area of relatively small individual land holdings, with scattered parkland estates. Mix of remnant medieval ancient countryside ... and large modern fields devoid of hedges and trees.'
Mid Norfolk (84)	E Anglian Plain	'Predominantly arable, with variable field sizes, generally medium rather than large, relatively well wooded often a reflection of sporting interest within the estates ... Some areas of heathland, great density and variety of churches associated with villages and estates.'
Breckland (85)	Breckland	'Distinctive large scale landscape of pale coloured arable fields or open heath contrasting with vertical elements of pine lines, belts and forest. Long history of settlement but now sparsely populated.'
S Suffolk & N Essex Clayland (86)	E Anglian Plain	'An undulating topography ... dissected by small steep-sided valleys. Characterised by small medium scale fields, and numerous small farm copses and hedgerows with trees that create a wooded appearance. However, in places a large scale arable field pattern ... gives an open feel ..'
E Anglian Chalk (87)	W Anglian Plain	'Visually simple and uninterrupted character ... The smooth rolling chalkland hills have a landscape of large regular fields enclosed by low hawthorn hedges, few trees and straight roads. Both past and present evidence of mineral extraction can be found ... Cereal farming has now superseded the traditional practice of sheep farming'.
Bedfordshire & Cambridgeshire Claylands (88)	The West Anglian Plain (part of)	'Gently undulating relief with plateaux, divided by broad shallow valleys and characterised by arable cultivation. Woodland cover is generally sparse. A broad valley at Marston Vale is dominated by the effects of clay extraction for the brick industry ...'


Character Areas
KEY
Plan boundary
Main river
Built up area
North West Norfolk
Breckland
Mid Norfolk
South Norfolk and High Suffolk Claylands
The Fens
Bedfordshire and Cambridgeshire Claylands
East Anglian Chalk
South Suffolk and North Essex Claylands
N
0
10km
SWAFFHAM
WATTON
ATTLEBOROUGH
BRANDON
THETFORD
ELY
MILDENHALL
NEWMARKET
BURY ST. EDMUNDS
CAMBRIDGE
Ely Ouse
Local Environment
Agency Plan
Map 6.1
ENVIRONMENT AGENCY

6.1.2 Societal Influences

The Government's main advisor on landscape protection and the conservation of local landscape character is the Countryside Commission. Nevertheless, the Environment Agency has a direct role in maintaining the appearance of landscape features through:

- ensuring that water bodies are as attractive as possible, as well as being conductive to nature conservation and to recreation. This concern is not simply a question of landscape measures. It is also important to ensure that water appears acceptable for its use, so that films of oil, scum and algae, and sewage solids do not occur in water bodies and the sea.
- regulatory control over litter on coastlines and along rivers;
- regulatory control over combined sewer overflows to prevent the build up of sanitary and other waste;
- role as a statutory consultee and influencing the local planning process.
- regulatory control over the appearance of landfill and other waste disposal sites, to ensure litter, wind blow, or gull populations do not detrimentally affect an area.

The Agency also has an indirect control in that it takes a holistic view of environmental management and maintains strong liaison with the Countryside Commission, local planning authorities and others who are concerned about aesthetic matters.

TRANQUIL AREAS

A broad-brush indication of the aesthetic quality of England at a strategic level has been derived by the Council for the Protection of Rural England (CPRE), working in conjunction with the Countryside Commission. It has mapped "tranquil areas" as places "which are sufficiently far away from visual or noise intrusion of development or traffic to be considered unspoilt by urban influences". A tranquil area lies at least:

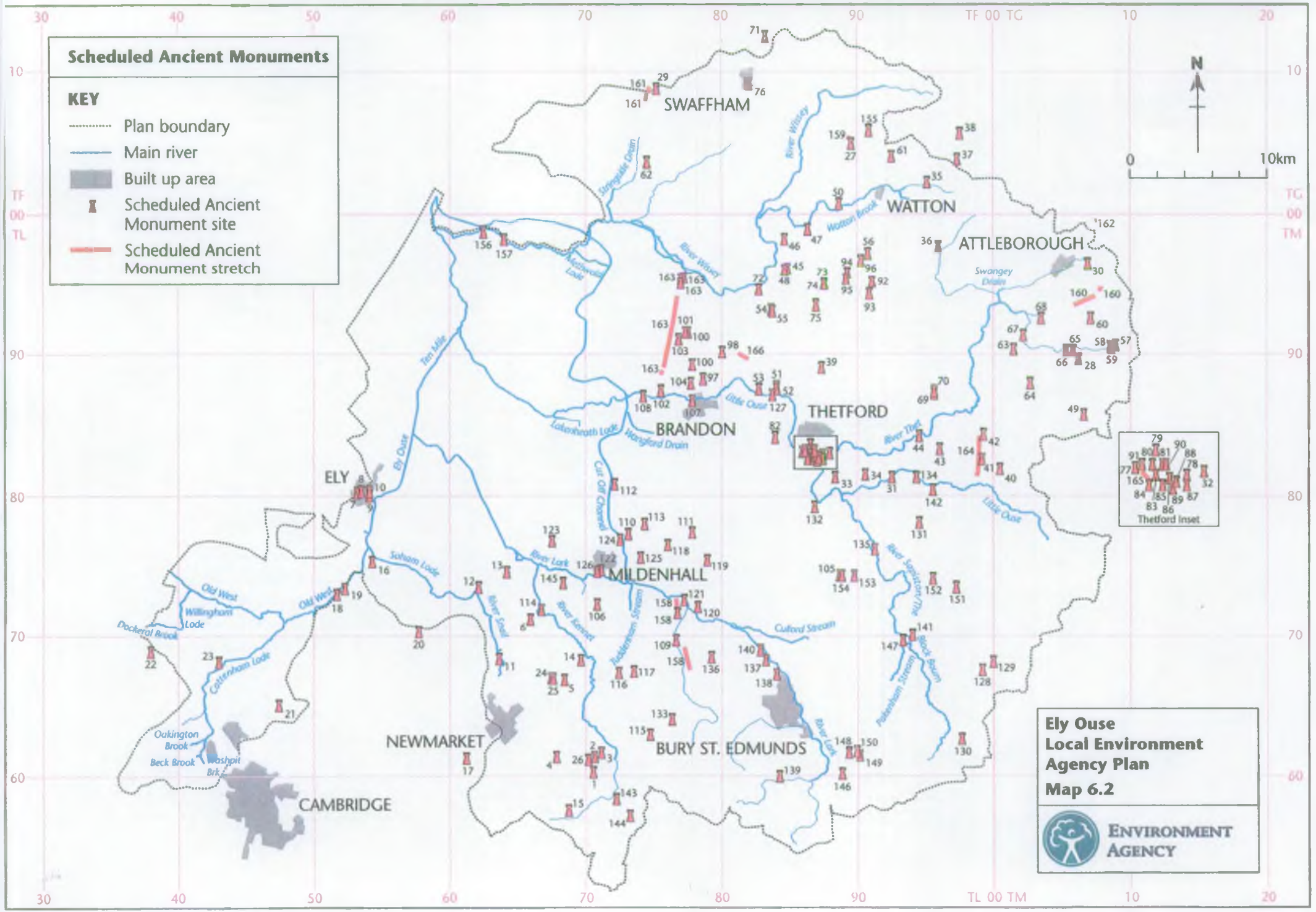
- 4 km from the largest power stations;
- 3 km from highly trafficked roads and from major towns;
- 2 km from other motorways and trunk roads and from the edge of smaller towns;
- 1 km from medium disturbance roads and some railways; and
- beyond the noise zones of military bases and civil airfields.

The map covering this LEAP area falls into the East Anglian Region, where tranquillity has, in general, decreased since the 1960s. This has been because of greater urban and rural development and particularly because of much busier roads, which now link many more settlements than in the 1960s.

6.1.3 Abstractions and Removals

Abstraction from surface and groundwater, combined with the droughts of recent years, is suspected to have caused the drying-out of wetlands and reduction of flows in rivers and streams. In addition to the ecological impacts, the loss of wetland habitats has a significant landscape impact, as these features are a valued component of the landscape.

Sand, gravel and clay extraction operations have taken place in the LEAP area. The cumulative


Scheduled Ancient Monuments
KEY
Plan boundary
Main river
Built up area
Scheduled Ancient Monument site
Scheduled Ancient Monument stretch
N
0
10km
SWAFFHAM
WATTON
ATTLEBOROUGH
THETFORD
BRANDON
ELY
MILDENHALL
NEWMARKET
BURY ST. EDMUNDS
CAMBRIDGE
Thetford inset
Ely Ouse
Local Environment
Agency Plan
Map 6.2
Environment Agency

1 All Saints Church (rems)
2 Moated site, Gesyns
3 St Mary's church (rems)
4 Cheveley Castle
5 Round Barrow SE of Waterhall Farm
6 Round Barrow in Isleham Plantation
7 Chapel at St John's Farm
8 Monastic Building at St John's Farm
9 'Cherry Hill' castle mound
10 Ely Cathedral, claustral building
11 Roman Villa S of Snailwell Fen
12 Round Barrow NE of Moor Farm
13 Isleham priory: an alien Benedictine priory W of St Andrew's Church
14 Howe Hill round barrow
15 Kirtling Tower: moated sites, earthworks and ponds
16 Roman site near Old Fordey Farm, Barway
17 Round barrow SW of Heath Stud Farm
18 Streatham Pumping Engine
19 Settlement site S of Tiled House Farm
20 Moated site S of Wicken Hall
21 Shrunken medieval village of Landbeach
22 Over Windmill
23 Giant's Hill: motte castle with part of and earlier medieval settlement and associated field system
24 Four Bowl Barows N of A11/A14 junction, part of Chippenham barrow cemetery
25 Hilly plantation bowl barrow, part of Chippenham barrow cemetery
26 Slyhall: moated site S of Elms Farm
27 Site of Panworth Hall and medieval settlement
28 Tumulus W of Leader's Spinney
29 Hangour Hill
30 Moated Site and earthworks N of Stubley Farm
31 Rushford Bridge
32 Melford Bridge
33 Tutt Hill barrow, near Thetford
34 'Seven Hills' (tumuli), Rushford
35 Site of Commandry of St John of Jerusalem
36 Village cross
37 Roman Villa W of Woodrising Wood
38 Deserted medieval village SE of Letton Hall
39 Mickle Hill
40 Tower of All Saints' Church
41 Round barrows on Garboldisham Hill
42 Round barrow on East Harling Heath
43 Tumuli on West Harling Heath
44 Remains of medieval church and village at Thorpe
45 Man Hill, Bodney
46 Round Barrow, Bodney
47 Group of round barrows near Hopton House
48 Round barrow ESE of North East Lodge, Buckenham Tofts Park
49 Double Moat called The Candle Yards
50 Roamn settlement at Woodcock Hall
51 Blood Hill, Santon
52 Site of St Helen's oratory
53 Santon House, site of
54 West Tofts deserted village
55 Caston Hall, site of
56 Group of tumuli on Sparrow Hill
57 Market cross and whipping post
58 Buckenham Castle
59 St Mary's Chapel
60 Buckenham Priory and Castle site
61 High Banks
62 Site of St Mary's Church, Caldecote
63 Gallows Hill tumulus
64 Vikings Mound, tumulus
65 Round barrow on Wilby Warren, Eccles
66 Earthwork on Wilby Warren
67 Moated site SE of All Saints' Church, Hargham
68 Round barrow on Hargham Heath
69 Ruins of St Andrew's Church
70 Roudham deserted medieval village
71 Deserted medieval village, Great Palgrave
72 Mound plantation round barrow
73 Sturston Hall, site of
74 Holy Cross Church
75 Barrow group at Sturston, NE of Waterloo Farm
76 Market cross
77 Red Castle
78 Cluniac priory
79 Castle Hill
80 Priory of the Canons of the Holy Sepulchre
81 Blackfriars
82 Warren Lodge
83 Site of Saxon town including site of St John's Churchyard
84 Site of town ditch: Icknield Way allotments
85 Site of Saxon town: primary school grounds, Hilary Road
86 Site of Saxon town: Bury Road allotments
87 Site of Saxon town: Nuns' Bridges open space
88 Site of St Ethelred's Church and adjoining area
89 Site of Saxon town: Plot on E side of Mill Lane, N of Nunthorpe House
90 Site of Saxon town: car park to N of Anchor Hotel
91 Area of Saxon town N of Red Castle
92 Round barrow, Waterhouse Lodge
93 Two barrows, Flag Heath
94 Moated site N of Reed Fen
95 Moated site S of church
96 Round barrow on Lowster Hill
97 Pepper Hill
98 Two round barrows SW of Snake Wood
99 Two round barrows, Mount Ephrain Plantation
100 Weeting Castle
101 Stump Cross, Mount Ephraim
102 Leylands Farm, Romano-British site, Hockwold
103 Round barrow on Bunker's Hill
104 Roman Building E of Fengate Farm
105 Two bowl barrows on Troston Heath, one known as Black Hill
106 Chalk Hill round barrow
107 Middle Saxon occupation on Chequer Meadow
108 Earthworks in Little Ouse Valley
109 Cavenham Bridge
110 Dale Hole round barrow
111 Round barrow on W edge of Gibson's Slip
112 St Peter's Church (rems)
113 Galley Hill round barrow
114 Freckenham Castle (rems)
115 Motte and bailey at Denham Castle
116 Pin Farm round barrow
117 Round barrow SW of Desning (or Desnage) Lodge
118 How Hill round barrow
119 Five round barrows near Bernersfield Farm
120 Roman villa SW of Weatherhill Farm
121 Civil War sconce near Farthing Bridge
122 Market Cross
123 Mildenhall Roman site
124 Hurst Fen Neolithic site
125 Old Keeper's Lodge W of High Lodge Farm
126 Remains of dovecote
127 Little Lodge Farm round barrow
128 Castle Hill motte
129 Cross in grounds of Ashfield House
130 Lady's Well (holy well and moat)
131 Length of Roman Road NE of Barningham Park
132 Round barrow at Mill House
133 Barrow Hall (site of)
134 Round barrow on Rushford Heath
135 Enclosure in Burnthall Plantation
136 Round barrows, Risby Poor's Heath East
137 Site SE of Fornham All Saints
138 Site NW of Fornham All Saints
139 Site of Hawstead Palace and associated fishpools
140 Settlement site W of Hengrave mill
141 Ixworth Roman Villa
142 Two round barrows on Hut Hill and in Brick Kiln Covert
143 Lidgate Castle
144 Roman villa SE of Lidgate
145 Sevenhills barrows
146 Remains of circular chapel E of church
147 Roman settlement S of Ixworth
148 Pumphouse in centre of village
149 Roman building SW of Lake Farm
150 East Low Hill tumulus
151 Stanton Upthorpe windmill
152 Roman villa at Stanton Clair
153 Troston Mount round barrow
154 Black Hill barrow
155 Roman enclosure NE of Panworth Hall
156 Moated site and earthworks
157 Roman farmstead and adjacent enclosures E of Rose Hill Farm
158 Black ditches
159 Devil's Dyke
160 Bunn's Bank
161 Devil's Dyke, E of Three Cornered Plantations
162 Bunn's Bank, SE of Walnut Tree Farm
163 Devil's Dyke (Fossdyke of Fendyke)
164 Devil's Ditch
165 Bank and ditch NE of London Road
166 Grimes Graves, including round barrow in Grimes Graves Plantation

Ely Ouse
Local Environment
Agency Plan
Map 6.2 Legend

ENVIRONMENT AGENCY

impacts of these activities has resulted in a change to the landscape character of the major river valleys, many of which now contain clusters of gravel pits.

6.1.4 Waste Arisings and Disposal

The Agency is concerned with the impact of litter on the environment because:

- a build up of litter can block drainage channels and lead to a danger of flooding;
- accumulated litter can comprise a fire risk, which in turn is detrimental to air quality;
- certain parts of litter can, if left, pose a potential water pollution problem;
- litter is aesthetically unpleasant, and can reduce people's enjoyment of recreation on or adjacent to water features, or ever deter them from visiting such sites; and
- litter can pose a health and safety risk.

In this section, reference to litter generally relates to the placing, by intent or otherwise, of materials in an illegal or unwarranted location by the public. It does not include discharges of material or tipping on sites of material by industrial concerns. Litter can arise from the following sources:

- Sewer outfalls with little screening or macerating, releasing faecal, other organic and inorganic matter into rivers and thence being deposited on river banks ,
- Fly-tipping;
- Accidental spreads of material from licensed sites; and
- Incremental collection of material dropped by individuals in the countryside. We are generally concerned only when this litter is deposited close to or at water bodies.

Whilst the problem may not be great in this LEAP area, the Tidy Britain Group indicates that there is a general concern over the appearance of watercourses because of increasing amounts of litter. To educate local residents to reduce litter and to reuse and recycle materials. It should be noted that responsibility for removal of litter lies with riparian owners and district councils, rather than the Agency (unless the litter has been produced by the Agency or is blocking a Main River).

6.1.5 Illegal Practices

Fly-tipping has becoming an increasing problem since 1996, when the Landfill Tax was brought in. The tax is now levied on most wastes to be disposed of at landfill sites, with the aim of encouraging reduction, re-use and recycling of wastes and materials. There is anecdotal evidence that the tax has encouraged unscrupulous operators to dump rubbish in order to maximise their profits; deserted farm lanes and fields are perfect locations for illicit waste disposal. This places extra costs on landowners, who have to pay to have this waste taken away; the costs can be substantial in cases where the waste can pose a significant risk to human health, such as medical waste or asbestos.

6.2 Recreation and Navigation

A diverse range of recreational activities exploit rivers and stillwaters:

- Angling - extensive lengths of river bank are actively fished and over 48 000 licences were purchased during 1997/8 in Central Area;
- Boating - there is over 100 km of navigable river available; and
- Water-based recreation – it is estimated that 180 million day-visits are made annually in UK.

The Agency has a number of legal duties related to recreation:

- We should make best use of Agency land;
- We should have regard for areas of natural beauty and buildings or sites of historic interest when undertaking our work;
- We should maintain and improve public access to inland waters; and
- We should promote the use of water and associated land as an amenity.

We manage our navigation responsibilities as an integral part of the river management process; balancing the demands with the capacity of the environment. Sluices and other control structures maintain the required water levels. The Agency operates a licensing system for all boat users on the Great Ouse System.

6.2.1 Natural Forces

The character of the river will determine the range and intensity of its recreational use. The Ely Ouse and the lower ends of its tributaries are all popular angling venues. Generally, the rivers are embanked with floodplain on both sides; these features allow safe fishing. Access is only constrained by the distance of roads and highways at some venues.

Angling is 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. 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 anglers' 'swim', whilst retaining enough marginal habitat for the resident fish and other aquatic wildlife. There is evidence that some waters in the Ely Ouse suffer from eutrophication; weed growth in the Rivers Lark, Little Ouse, Soham Lode and the Cut Off Channel is stimulated by inorganic nutrients. Symptoms observed have been algal blooms, excessive filamentous algal growth and fluctuations in diurnal dissolved oxygen levels. In such cases, fish become stressed, to the detriment of the fishery (refer to Viewpoint 4.3: Quality of Surface Waters).

In exceptional cases weed growth affects navigation on a watercourse. There have been occasions in the past where filamentous algae or 'blanket weed' has caused problems on the Little Ouse. This could only be alleviated by utilising a weed cutting boat throughout the summer. It is also recognised that a river overgrown with vegetation spoils the enjoyment for walkers and the general public who may be visiting a river for, amongst other things, its aesthetic beauty.

The Agency owns extensive lengths of riverbank in the Ely Ouse LEAP area and over the summer months we cut the bank-side vegetation. This is primarily for flood defence operations; however,

access for anglers is retained. Where statutory public rights of way exist, we work with the local authorities to ensure the footpaths and bridleways remain open.

The conservation value of the Agency's riparian land must be considered by all who use it. We seek to ensure that all users have respect for this land and encourage them to consider their impact on the environment as a whole. This includes groups such as angling clubs, ramblers and those entering formal lease agreements.

There have been occasions where anglers have dug into the flood bank to make their fishing more comfortable or safe. The principle concern here is that the integrity of the flood defence bank is affected, however, there is also a risk to habitat and wildlife at certain sites. 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.

Recent heavy rainfall during Easter 1998 resulted in extremely high flows in the Bedford Ouse River; the impact was less on the Ely Ouse, because the floodwaters were discharged down the Tidal River or diverted onto the Ouse Washes. However, navigation in the LEAP area was closed for a number of weeks. A flood event has the potential to damage control structures and the high flows will also redistribute silt; as a result, shoaling (thereby reducing navigation depths) can be dangerous for boaters.

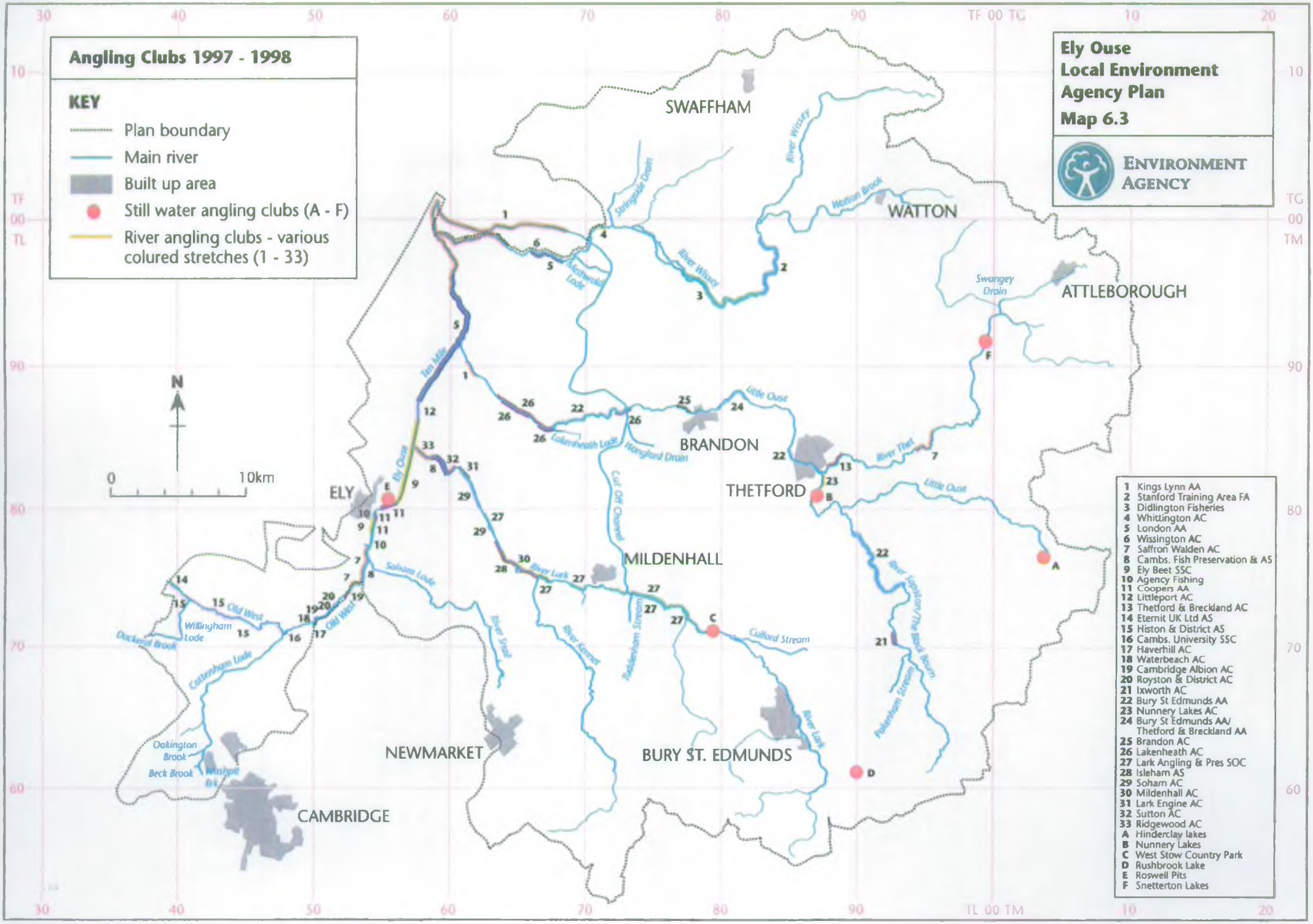
In contrast, periods of low flow can also make navigation difficult. The reduced velocity will exacerbate the siltation within the river channel. Of the navigable watercourses in this area, the Old West has some experienced some problems due to its shallowness and relatively narrow nature.

6.2.2 Societal Influences

The Ely Ouse LEAP area offers a wide range of angling opportunities for the region's anglers. The Ely Ouse is a nationally famous coarse fishery, used extensively by match and pleasure anglers. The river regularly hosts national angling championships, the last such one being in 1997. Most of the Ely Ouse banks are owned by the Agency; the two clubs with the longest leased lengths are Ely Beet Sports and Social Club and the London Anglers Association (AA). On the Old West, Histon and District Angling Club (AC) are the principal club. Kings Lynn AA lease an extensive length on the lower River Wissey and also the downstream end of the Cut Off Channel. The Lark Angling and Preservation Society is the main coarse angling club on the Lark, whilst on the Little Ouse and Sapiston it is Bury St Edmunds AA.

Bury AA also have interests in a number of stillwater fisheries in the Ely Ouse LEAP area. Ely Beet Sports and Social Club lease two large lakes at Roswell Pits, near Ely. There are commercial fisheries at Thetford, Hinderclay and Snetterton; these tend to have an artificially high stocking density to guarantee all anglers the chance of a good catch.

The upper reaches of the Wissey are fished by private, syndicate trout clubs and riparian owners. The Army controls fishing in the river as it runs through the Stanford Training Area, north of Mundford. Didlington Fisheries, who employ a river keeper, manage the next downstream section. There are also trout fishing interests on the River Lark near Lackford (refer to Map 6.3).


Angling Clubs 1997 - 1998
KEY
Plan boundary
Main river
Built up area
Still water angling clubs (A - F)
River angling clubs - various coloured stretches (1 - 33)
Ely Ouse
Local Environment
Agency Plan
Map 6.3
ENVIRONMENT AGENCY
N
0
10km
SWAFFHAM
WATTON
ATTLEBOROUGH
BRANDON
THETFORD
ELY
MILDENHALL
NEWMARKET
BURY ST. EDMUNDS
CAMBRIDGE
River Wissey
Stringside Drain
Watton Brook
Swangey Drain
Little Ouse
River Thet
Ten Mile
Ely Ouse
Lakenheath Lode
Hamford Drain
Cut Off Channel
Soham Lode
River Snail
River Kennet
River Lark
Culford Stream
Old West
Willingham Lode
Cottenham Lode
Duckend Brook
Oakington Brook
Beck Brook
River Stour/The Black Bourn
Polstead Stream
1 Kings Lynn AA
2 Stanford Training Area FA
3 Didlington Fisheries
4 Whittington AC
5 London AA
6 Wissington AC
7 Saffron Walden AC
8 Cambs. Fish Preservation & AS
9 Ely Beet SSC
10 Agency Fishing
11 Coopers AA
12 Littleport AC
13 Thetford & Breckland AC
14 Eternit UK Ltd AS
15 Histon & District AS
16 Cambs. University SSC
17 Haverhill AC
18 Waterbeach AC
19 Cambridge Albion AC
20 Royston & District AC
21 Ixworth AC
22 Bury St Edmunds AA
23 Nunnery Lakes AC
24 Bury St Edmunds AA/ Thetford & Breckland AA
25 Brandon AC
26 Lakenheath AC
27 Lark Angling & Pres SOC
28 Isleham AS
29 Soham AC
30 Mildenhall AC
31 Lark Engine AC
32 Sutton AC
33 Ridgewood AC
A Hinderclay lakes
B Nunnery Lakes
C West Stow Country Park
D Rushbrook Lake
E Roswell Pits
F Snetterton Lakes

The Agency leases the eel fishing rights in the Ely Ouse to commercial fishermen. Dutch fyke nets are usually set in the summer months to capture the adult eels. Some of the eels are destined for sale overseas.

The navigable watercourses are used extensively by motor-powered craft, both privately owned and hire boats. There are over 3,000 boats registered on the Great Ouse, with popular marinas at Ely and Littleport on the Ely Ouse, Hermitage and Twenty Pence on the Old West and Isleham on the Lark. The Ely Ouse and Old West provide a link between the Bedford Ouse and the Middle Level System, thereby avoiding a long alternative passage on the Tidal River.

The Agency has made a conscious effort to provide waterside facilities for boaters. Working in partnership with the marinas and other boating interests we have provided new slipways and moorings, together with water, electricity and pump-out sites. These improvements, together with a promotional strategy, should encourage boaters to make the best use of the rivers.

Weirs and sluices control the river's levels and flows; the operation of these structures, which allows navigation, also provides the typical habitat and character of a slow-flowing lowland river. One effect of the 1998 floods has been to instigate a review of all our controlling structures; this could lead to the identification of structures requiring repairs and replacement as some of them reach the end their normal lifespan. Collapse of any structure would have serious implications for navigation, in addition, to damage to the wildlife, habitat and other recreational uses. Map 2.1 shows flood defence control structures and statutory navigation in the LEAP area.

Historically, more navigation was available to boaters and there has been recent interest from organisations such as the Inland Waterways Authority to reopen some of these sections. Two lengths of particular interest are the River Lark, from upstream of Judes Ferry to Bury St. Edmunds and the Little Ouse, from Brandon to Thetford. The Agency broadly supports these initiatives; however, justifying the level of financial support required may prove to be the major obstacle. In the meantime, some of the dilapidated lock structures require attention; for instance, we are aware of at least two on the Lark which require attention to stop them literally falling into the river.

In 1998 the Agency secured some additional funding from the Europe Union for a navigation improvement project on the Little Ouse near Hockwold. We are raising a footbridge associated with a sluice structure, to allow longer boats to motor upstream to the navigation limit at Brandon.

Informal canoe use happens throughout the navigable section of the rivers in the LEAP area. Where the activity occurs in non-navigable sections approved access must be sought from the riparian owners. A good example of this type of agreement is near Santon Downham, where Forest Enterprise allow organised canoeing on the Little Ouse. Canoeing is discouraged near weirs and sluices.

Sailing within the Ely Ouse LEAP area is limited by the number of bridges over watercourses which require the mast to be lowered. A popular club sails on one of the lakes at Roswell Pits. Rowing occurs on the Ely Ouse, where Kings School, Ely have a boathouse and the Cambridge University rowing team also use the river for training.

Speed restrictions mean that water-skiing and jet-skiing are illegal on navigable rivers. The Agency also discourages swimming in all rivers, added to the risk of drowning is the possibility of

contracting a water-borne disease, such as Weil's Disease.

Recreational activities in the area are not just water-based and can include for example, walking or visiting country parks. Map 6.4 details the recreational activities available in the LEAP area.

6.2.3 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 (2.3.3: Abstractions and Removals).

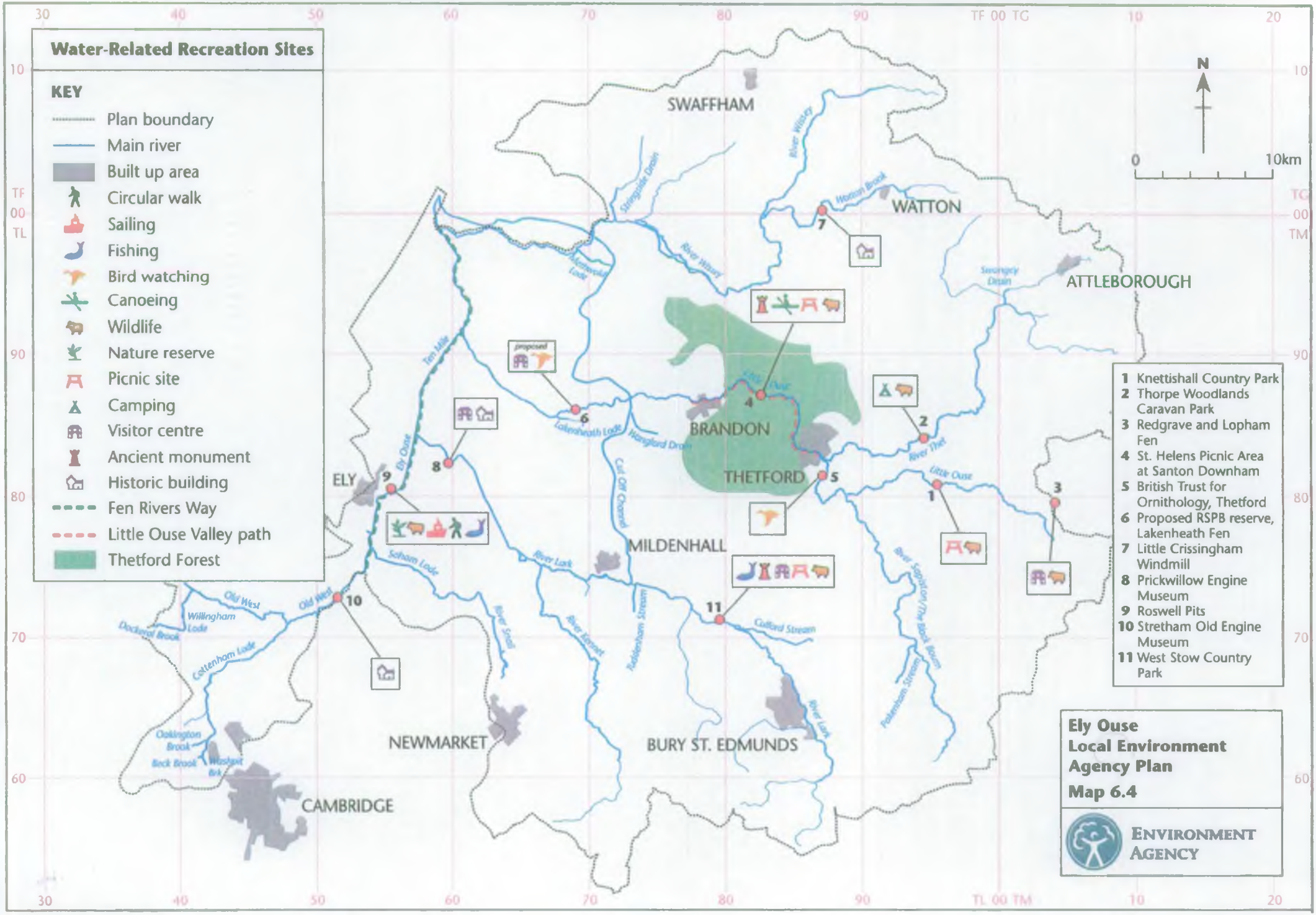
6.2.4 Usage, Releases and Discharges

Discharges from STWs can have a negative impact on water quality and the aesthetic value. Sewer outfalls with little screening or macerating 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.

When eutrophication results in excessive growth of algae or other aquatic plants 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 (4.3: Quality of Surface Waters).

6.2.5 Illegal Practices

Both fly-tipping and pollution incidents will impact on the aesthetic quality of a given area. These types of occurrences will discourage people from visiting the location 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. The danger to certain animals and the general unsightliness is well known, but these messages need to be reinforced.

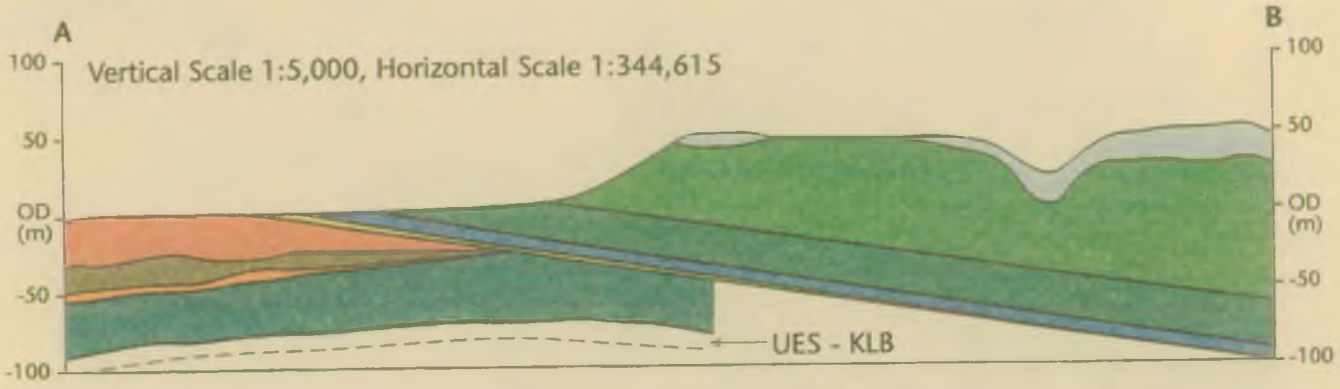

Water-Related Recreation Sites
KEY
Plan boundary
Main river
Built up area
Circular walk
Sailing
Fishing
Bird watching
Canoeing
Wildlife
Nature reserve
Picnic site
Camping
Visitor centre
Ancient monument
Historic building
Fen Rivers Way
Little Ouse Valley path
Thetford Forest
N
0
10km
SWAFFHAM
WATTON
ATTLEBOROUGH
BRANDON
THETFORD
ELY
MILDENHALL
NEWMARKET
BURY ST. EDMUNDS
CAMBRIDGE
River Wissey
Watton Brook
Stringside Drain
Swangey Drain
River Thet
Little Ouse
Ten Mile
Ely Ouse
Lakenheath Lode
Hangford Drain
Cut Off Channel
River Lark
Soham Lode
River Snail
River Kennet
Tuddenham Stream
Gallord Stream
River Stour/The Black Bourn
Fulmere Stream
Old West
Willingham Lode
Cottenham Lode
Oakington Brook
Beck Brook
Washpit Brk
proposed
1 Knettishall Country Park
2 Thorpe Woodlands Caravan Park
3 Redgrave and Lopham Fen
4 St. Helens Picnic Area at Santon Downham
5 British Trust for Ornithology, Thetford
6 Proposed RSPB reserve, Lakenheath Fen
7 Little Crissingham Windmill
8 Prickwillow Engine Museum
9 Roswell Pits
10 Stretham Old Engine Museum
11 West Stow Country Park
Ely Ouse
Local Environment
Agency Plan
Map 6.4
Environment Agency

APPENDICES

APPENDIX A: GEOLOGY

The solid geology of the area (see Map A1) consists of the Ampthill Clay, Kimmeridge Clay, Woburn Sands, Gault Clay and the Chalk formations. These formations dip gently (5°) to the east (see Figure A1).

Figure A1: Geology Cross-Section



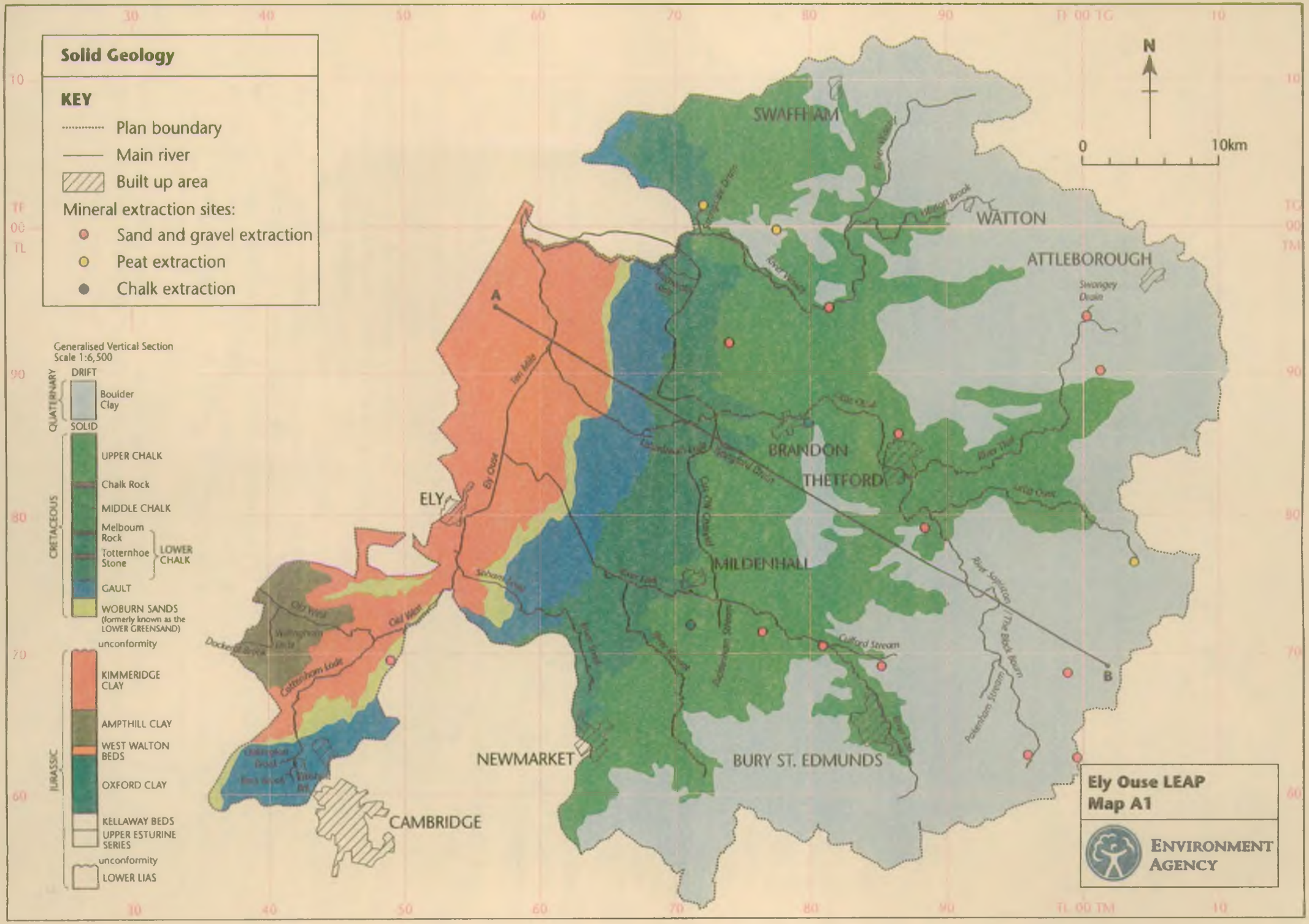
The Ampthill Clay is the oldest formation which outcrops at the surface in the LEAP area. It is a dark-grey calcareous clay with bands of muddy limestone and varies in thickness between 20 and 30 metres. Above the Ampthill Clay is the Kimmeridge Clay, which is a dark, shaly clay with several thin bands of limestone. The thickness of this stratum varies from about 5m in the valley of the River Great Ouse to 30m underneath Methwold Common.

The Woburn Sands (formerly known as the Lower Greensand) rests unconformably on Jurassic and older strata beneath. It consists of angular medium and fine-grained sands with pebbly layers common near the base. It reaches a maximum thickness of approximately 20m towards the south-west.

The Gault Clay, which is grey silty mudstones and pale grey calcareous mudstones, overlies the Woburn Sands. The Gault Clay outcrop runs in a south-west to north-east trend adjacent to the western edge of the chalk.

The Chalk is generally exposed or close to the surface towards the centre of the LEAP area while in the east, on higher ground, it is generally covered by thick glacial deposits of clayey till interbedded with sands and gravels of fluvio-glacial origin. The Chalk is composed of Lower, Middle and Upper formations. The thickness of the Lower Chalk varies from 40 to 57m, being thickest in the west, near Lakenheath. The Middle Chalk is a sequence of firm white shelly chalks passing up into slightly muddy chalks with scattered thin marl seams and bands of flint. The Upper Chalk is up to 120 m thick and is a firm white chalk with scattered bands of flints. The clayey till or boulder clay is a bluish grey sandy clay that weathers yellowish grey and contains abundant pebbles of chalk and flint. Its clay content and many of the erratics are derived from the extensive outcrops of Upper Jurassic and Cretaceous sediments that occur beneath the Fenland and the Wash. An ice sheet that overrode the chalk created and transported the boulder clay. The thickness, distribution and composition of boulder clay varies considerably. In general, it thickens south-eastwards towards the southern margin of the area, where the thickness reaches 45 m.

Within the LEAP area the principal aquifer is the Chalk, which occurs in the east of the area. On the higher ground, boulder clay and sands cover much of the Chalk. Additional sand and gravel deposits occur within the upland river valleys and may form small isolated aquifers.


Solid Geology
KEY
Plan boundary
Main river
Built up area
Mineral extraction sites:
Sand and gravel extraction
Peat extraction
Chalk extraction
Generalised Vertical Section
Scale 1:6,500
QUATERNARY
DRIFT
Boulder Clay
SOLID
CRETACEOUS
UPPER CHALK
Chalk Rock
MIDDLE CHALK
Melbourn Rock
Totternhoe Stone
LOWER CHALK
GAULT
WOBURN SANDS
(formerly known as the LOWER GREENSAND)
unconformity
JURASSIC
KIMMERIDGE CLAY
AMPTHILL CLAY
WEST WALTON BEDS
OXFORD CLAY
KELLAWAY BEDS
UPPER ESTUARINE SERIES
unconformity
LOWER LIAS
N
0
10km
SWAFFHAM
WATTON
ATTLEBOROUGH
BRANDON
THETFORD
ELY
MILDENHALL
NEWMARKET
BURY ST. EDMUNDS
CAMBRIDGE
A
B
Ely Ouse LEAP
Map A1
Environment Agency

Hydrogeology

Groundwater occurs in saturated rocks known as aquifers. The principal aquifers of the region are the Chalk and the Woburn Sands, although sand and gravel deposits also occur within the upland river valleys and represent locally important aquifers.

These aquifers are recharged during periods of high rainfall where the rocks are exposed at the surface or are covered by permeable deposits that allow the infiltration of water to the aquifers below. Recharge to the Woburn Sands is limited where the Gault Clay and clayey drift deposits cover it. The Gault Clay is not an aquifer but acts as a confining layer which means that the groundwater in the Woburn Sands aquifer is usually under artesian pressure and protected from pollution.

Recharge of the Chalk occurs within the whole of its area and the groundwater flows are generally towards the west. Water flows out of the aquifers either at discrete springs or gradually along the length of the Rivers Wissey, Little Ouse, Lark and Soham Lode; this flow contributes up to 70% of the total annual river flow.

The general flow direction within the Chalk is to the west. The permeability of the Chalk is low; the groundwater flows through fissures and fractures, associated with bedding planes, that are often in the top layers of the chalk.

In general, the Chalk water table is a modified reflection of the surface topography. In areas of groundwater recharge away from the river valleys, groundwater levels show annual and seasonal fluctuations in response to rainfall and infiltration. The highest levels are usually in the spring and the lowest levels normally in the autumn. The groundwater levels do not vary as much in the river valleys as the rivers often act as areas of discharge from the aquifer. Groundwater levels are also affected by abstraction from boreholes and by whether they are in direct hydraulic continuity with any surface water source.

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 Ordinance Datum	Land levels are measured relative to the average sea level at Newlyn in Cornwall. The average level is referred to as 'Ordinance Datum'. Contours on Ordinance Survey maps of the UK shows heights in metres above Ordinance 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.
Elver Run	Glass eels a few cms long have travelled across the Atlantic Ocean from the Sargasso Sea spawning ground. They are moving up rivers to freshwater to feed and grow.
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).
Floodplain	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.
Fyke Net	Series of conical nets, each with a progressively more constrictive aperture. Can be 4 m in length and vary in diameter from 0.25 to 1.2 m in diameter. The wings at the front end guide eels into the net entrance. They may be set by commercial fishermen in groups to intercept eels moving up or down stream.
Gauging Stations	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 uses 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	Authorities responsible for dealing with land drainage within a district. They are primarily concerned with agricultural land drainage but also may be involved with water supply to their district for agricultural purposes.
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	The key sites 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.
Slakers	Pipes and valves designed to take water away from the Fens.
Sludge	The accumulation of solids from treatment processes. Sludge can be incinerated or spread on farmland.
Sluice	Structure to control upstream river levels and down stream 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 Ordinance Datum Newlyn (ie sea level). 100 m SLD = 0 m AOD. (Refer to Above Ordinance 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 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 period.

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