Hydrological summary

for the United Kingdom

November 2001

General

November mild with anticyclonic conditions dominant across much of the UK. Although significant frontal rainfall occurred around month end, many catchments recorded well below average November rainfall totals. England and Wales recorded its driest November since 1989. The relatively dry interlude over the last five weeks has been beneficial in moderating the risk of flooding. Notably high flows were uncommon in November and the seasonal rise in groundwater levels stalled across much of the country - reducing (but not removing) the possibility of groundwater flooding later in the winter. Despite the limited late autumn rainfall, overall reservoir stocks for England and Wales remain well above average. However, significant rainfall deficiencies over the last 6 months have contributed to notably low levels in a few smaller reservoirs (e.g. Stithians in Cornwall and Silent Valley in Northern Ireland). Groundwater levels display considerable regional differences but overall resources remain very healthy for the early winter.

Rainfall

Throughout much of November rain-bearing frontal systems followed tracks remote from the English Lowlands. Northern Britain was more unsettled; low pressure systems, mostly on westerly or northerly airflows, brought significant precipitation - snow was reported as far south as London on the 9th. Large parts of the country registered 18, or more, dry days in the month, but a few notable precipitation totals were reported. Dalmally (Strathclyde) registered 51 mm on the 5th and a cold front crossing northern parts of the UK on the 20th brought substantial rainfall to most areas; Ballypatrick Forest in Northern Ireland reported 41 mm in 12 hours on the 21st. This heralded an unsettled end to the month with the passage of a typical late-autumn sequence of vigorous westerly low pressure systems. Capel Curig in North Wales, reported 32 mm on the 25th(and around 120 mm over 5 days) and Aultbea (Highland Region) 35 mm on the 27th. Only in parts of western Scotland and central Wales were November rainfall totals substantially above average. By contrast, rainfall was well below average across much of England (catchments bordering the English Channel especially, but parts of the Chilterns reported <35%). Provisionally, NI registered its second driest autumn since 1972 but for most regions of the UK Sept-Nov totals were within the normal range. Significant seven-month rainfall deficiencies linked to modest reservoir stocks may be recognised in parts of NI and the South-West. Elsewhere most accumulations are well within the normal range – and remain outstanding for periods of a year or more.

River flows

November began with spate conditions in parts of Scotland and a high risk of flooding in catchments throughout much of the UK. In the event, only very localised flooding was reported and the seasonal rise in runoff rates failed to gather momentum. In most rivers protracted recessions characterised much of the month; a steep but short-lived flow recovery occurred around month end. Flows in many spring-fed rivers in the English Lowlands returned to their normal range (albeit still well above average) after a year of exceptional runoff. The monthly mean flow in the Thames fell below average for the first time since March 2000. Above average November runoff totals were largely confined to rivers draining the Scottish Highlands and some groundwater-dominated streams in the South and East. Steep recessions in many impermeable catchments produced notably low November runoff totals, especially along the South coast – mean flows in the Lymington (Hants) and Kenwyn, for example, were only around 25% of the monthly average. Flows were also depressed in parts of Northern Ireland; the Annacloy reported its lowest November runoff since 1983. Autumn runoff totals were generally well within the normal range, but low in the South-West where medium term runoff deficiencies are significant; for the Taw catchment the June-November runoff total for 2001 ranks second lowest since 1978. Longer-term runoff accumulations remain very high throughout the English Lowlands.

Groundwater

Most western and northern areas remained close to saturation in November but soil moisture deficits declined only sluggishly in the eastern lowlands; significant deficits remained in some aquifer outcrop areas at month-end. Thus, as in normal in the late autumn, groundwater recoveries have yet to begin in parts of the eastern Chalk. Current levels in the Chalk display considerable geographical variation – reflecting differing aquifer characteristics as well as rainfall patterns. In the more westerly and northerly outcrops, levels are mostly below the late-autumn average. In the generally less responsive eastern and central outcrops levels remain seasonally very high, and close to monthly maxima in parts of the Chilterns and East Anglia. Levels remain notably high in the Essex Gravels also. Groundwater levels fell in some limestone index wells during November (e.g. at Alstonfield) but remain generally healthy, particularly in the Lincolnshire and Magnesian Limestones. In the Permo-Triassic sandstones, levels are close to, or below, the monthly average in the South-West. Elsewhere, as a result of the exceptionally high levels from which the 2001 recession began, current levels remain well above average in most outcrops, and appreciably above pre-2000 autumn maxima in many wells and boreholes (e.g. Heathlanes, Nuttall's Farm).

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Rainfall . . . Rainfall . . . Rainfall. .

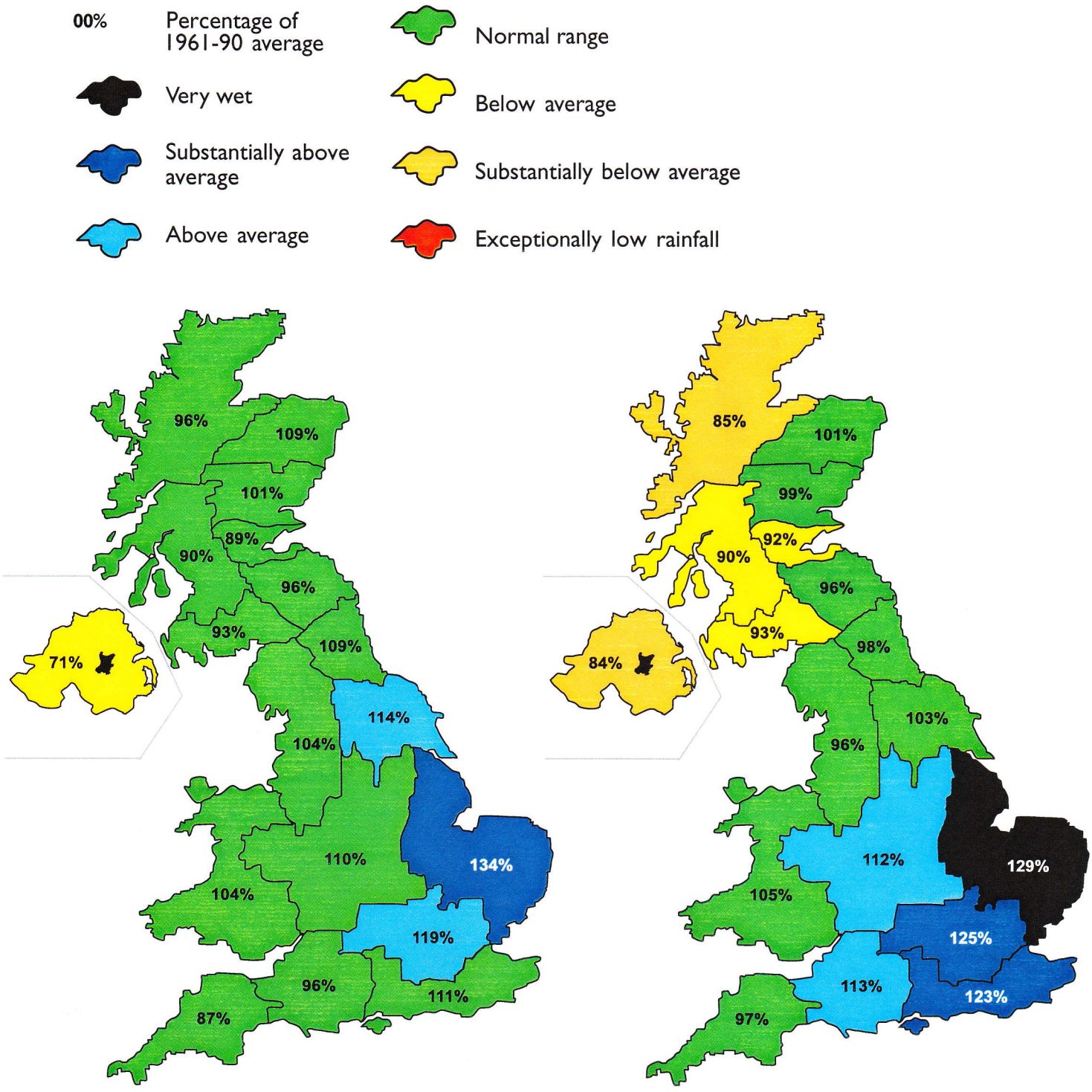
Rainfall accumulations and return period estimates

Area	Rainfall	Nov 2001	Sep01-Nov01	RP	Jun01-Nov01	RP	Mar01-Nov01	RP	Dec00-Nov01	RP
England & Wales	**mm**	**64**	**280**		**475**		**722**		**1047**	
	%	**69**	**109**	**2-5**	**103**	**2-5**	**109**	**2-5**	**115**	**5-10**
North West	mm	92	381		600		829		1159	
	%	75	104	2-5	94	2-5	94	2-5	96	2-5
Northumbrian	mm	61	257		448		597		840	
	%	71	109	2-5	101	2-5	95	2-5	98	2-5
Severn Trent	mm	49	219		394		612		845	
	%	69	110	2-5	104	2-5	111	2-5	112	2-5
Yorkshire	mm	48	252		426		604		843	
	%	60	114	2-5	103	2-5	100	<2	103	2-5
Anglian	mm	49	212		392		583		770	
	%	84	134	5-15	125	5-15	128	15-25	129	30-50
Thames	mm	42	222		384		599		858	
	%	65	119	2-5	110	2-5	117	5-10	125	10-20
Southern	mm	40	260		409		630		958	
	%	47	111	2-5	104	2-5	112	2-5	123	10-20
Wessex	mm	51	226		396		623		944	
	%	61	96	2-5	97	2-5	105	2-5	113	2-5
South West	mm	95	291		475		749		1139	
	%	76	87	2-5	85	2-5	94	2-5	97	2-5
Welsh	mm	126	408		666		977		1385	
	%	89	104	2-5	102	2-5	106	2-5	105	2-5
Scotland	**mm**	**134**	**435**		**726**		**912**		**1278**	
	%	**89**	**97**	**2-5**	**97**	**2-5**	**88**	**5-10**	**89**	**5-10**
Highland	mm	187	547		879		1098		1491	
	%	92	96	2-5	97	2-5	88	5-10	85	5-15
North East	mm	77	309		538		705		987	
	%	77	109	2-5	106	2-5	98	2-5	101	2-5
Tay	mm	84	368		626		804		1218	
	%	70	101	2-5	103	2-5	93	2-5	99	2-5
Forth	mm	82	301		549		711		1022	
	%	73	89	2-5	95	2-5	89	2-5	92	2-5
Tweed	mm	67	267		496		656		931	
	%	72	96	2-5	99	2-5	92	2-5	96	2-5
Solway	mm	112	412		679		890		1325	
	%	78	93	2-5	92	2-5	88	2-5	93	2-5
Clyde	mm	163	497		867		1075		1530	
	%	91	90	2-5	98	2-5	89	2-5	90	2-5
Northern Ireland	**mm**	**68**	**225**		**447**		**623**		**885**	
	%	**66**	**71**	**5-10**	**82**	**5-10**	**81**	**5-15**	**84**	**5-15**

RP = Return period

 All monthly totals since December 1998 are provisional (see page 12). The figures for England & Wales are derived by the Hadley Centre and are updates of the homogenised series developed by the Climate Research Unit; the other national figures are derived from different raingauge networks to those used to derive the CRU data series. The return period estimates are based on tables provided by the Meteorological Office (see Tabony, R.C., 1977, *The variability of long duration rainfall over Great Britain*, Scientific Paper No. 37) and relate to the specified span of months only (return periods may be up to an order of magnitude less if n-month periods beginning in any month are considered); RP estimates for Northern Ireland are based on the tables for north-west England. The tables reflect rainfall over the period 1911-70 and assume a stable climate. Artifacts, in the Scottish rainfall series in particular, can exaggerate the relative wetness of the recent past. * See page 12.

Rainfall . . . Rainfall . . . Rainfall

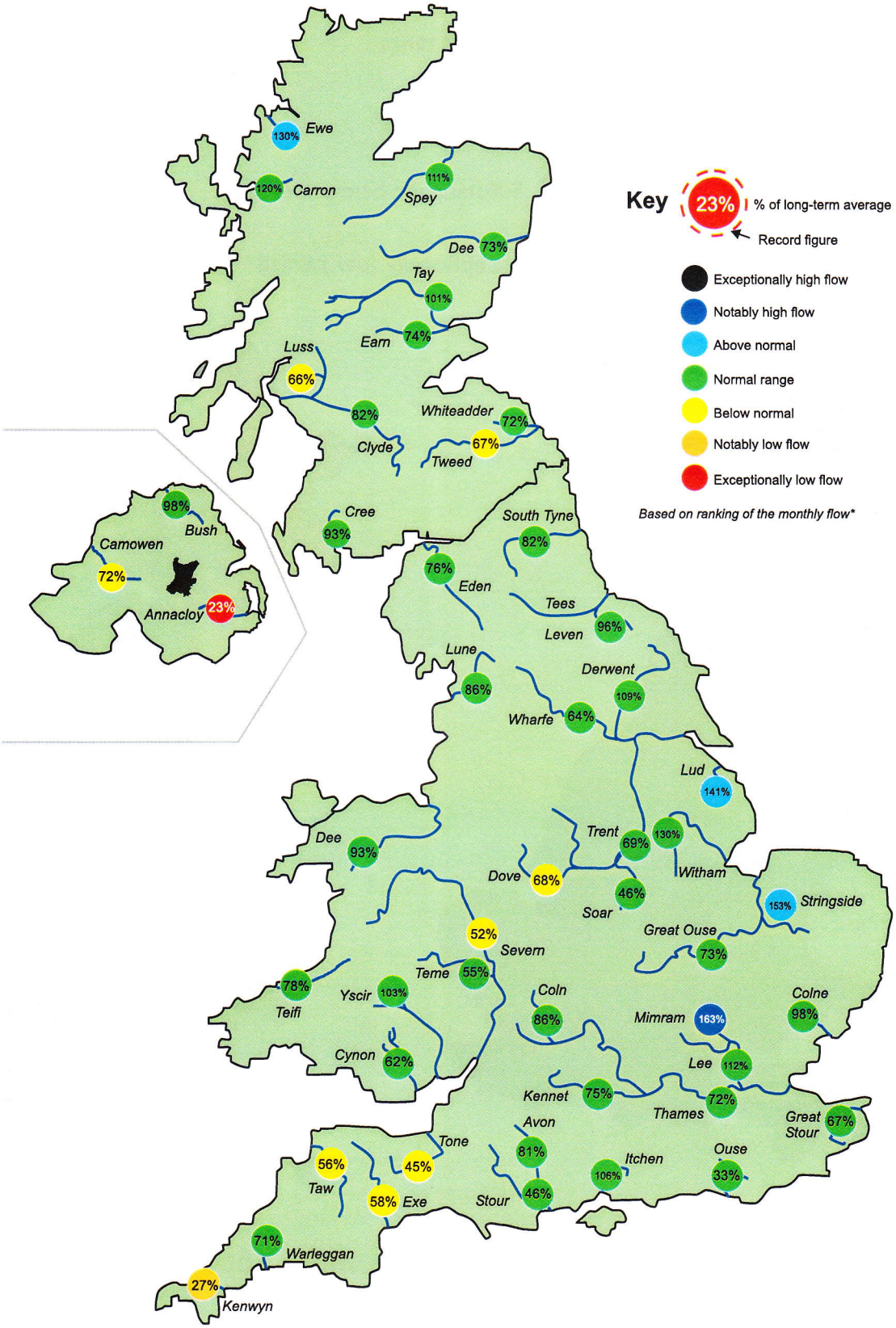


September 2001 -November 2001 **December 2000 -November 2001**

Rainfall accumulation maps

A moderation in the normal north-west to south-east rainfall gradient across the UK has been a feature of much of the last 15 months. This is evident in the autumn (September-November) regional rainfalls for 2001 and, with greater emphasis, the accumulated rainfall totals over the last 12 months. With the singular exception of 1999/2000, the December 2000-November 2001 rainfall total is the highest (in that timeframe) since 1960 over large parts of the English lowlands.

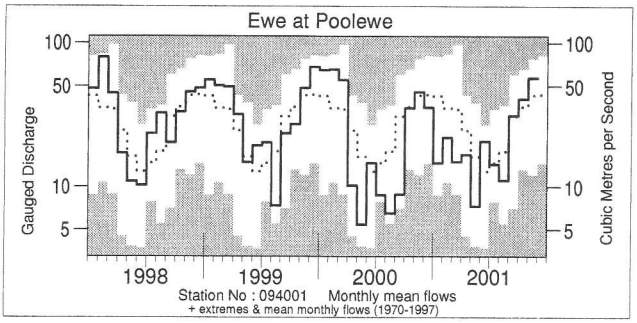
River flow . . . River flow . . .

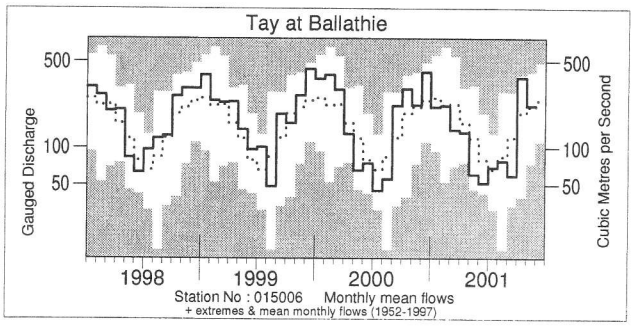


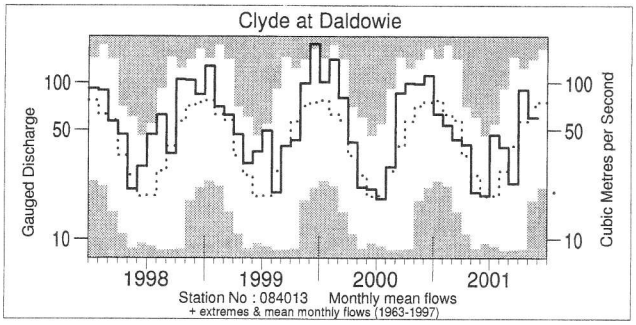
River flows - November 2001

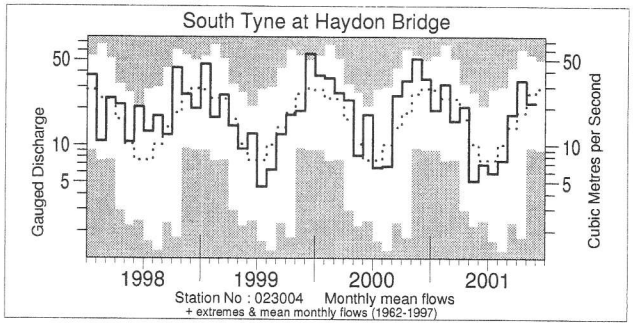
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much greater. Note: the period of record on which these percentages are based varies from station to station.

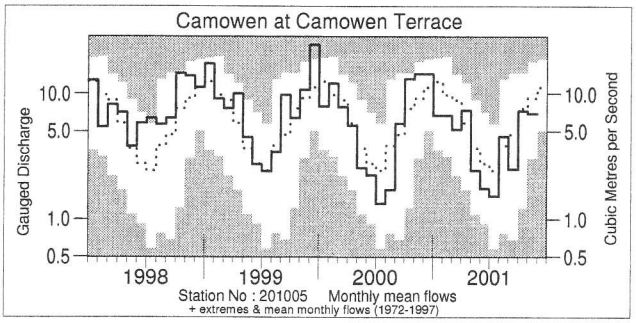
River flow . . . River flow . . .

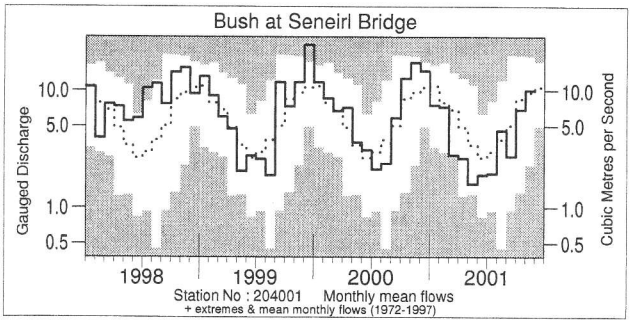


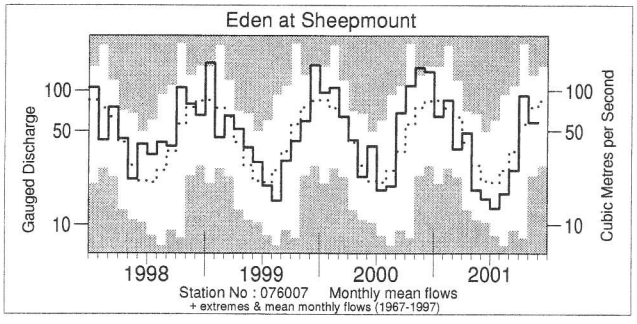


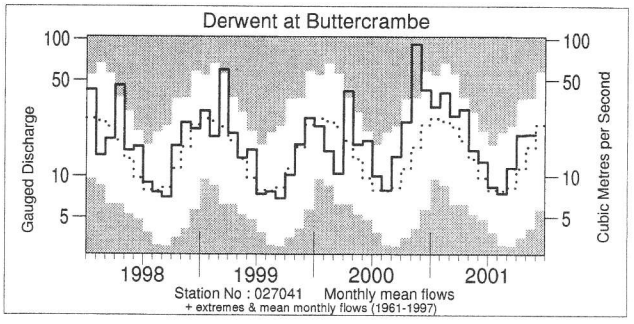


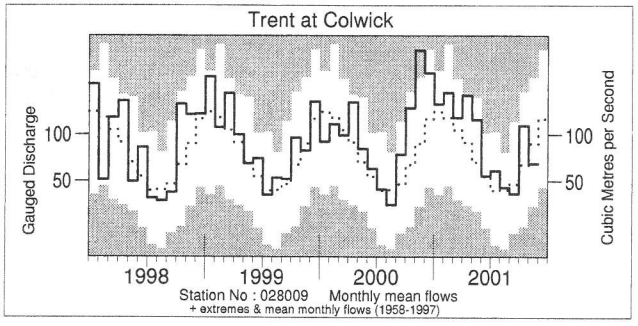


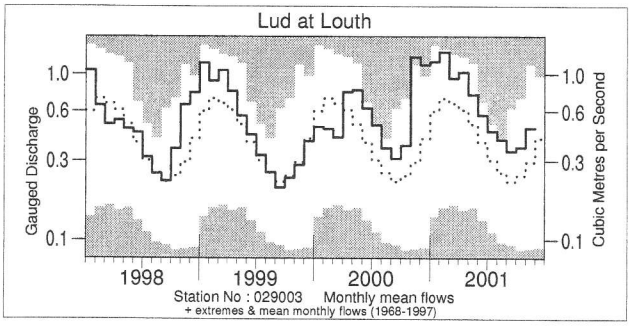








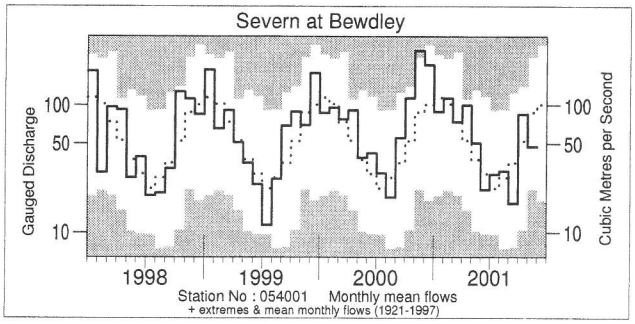


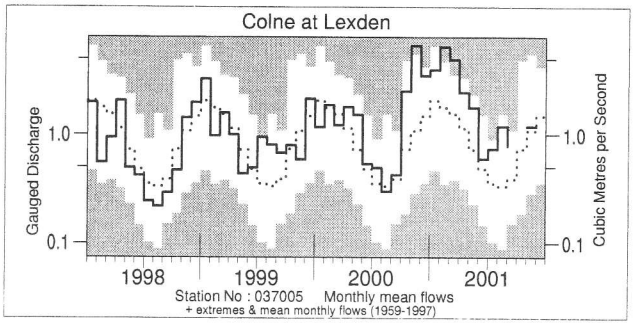


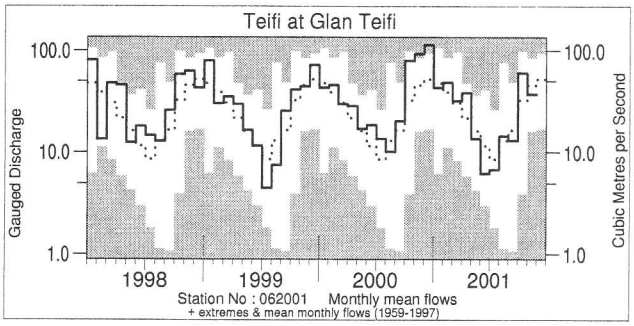
Monthly river flow hydrographs

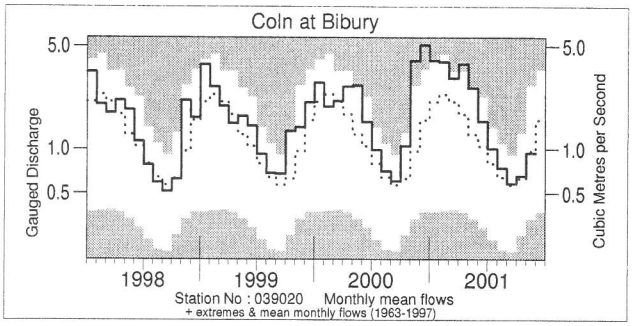
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 1998 (shown by the shaded areas). Monthly flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

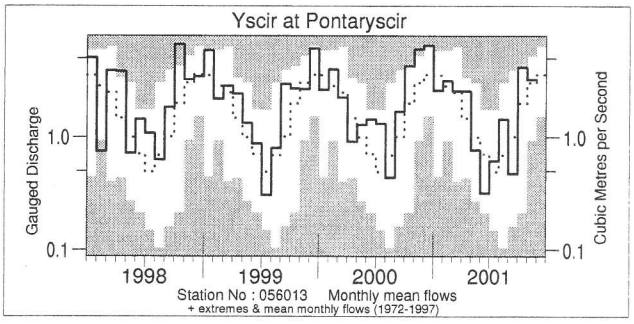
River flow . . . River flow . . .

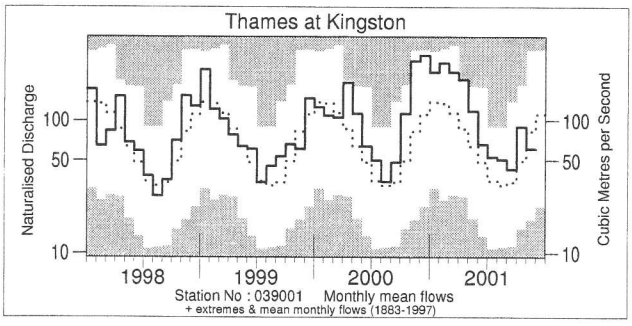


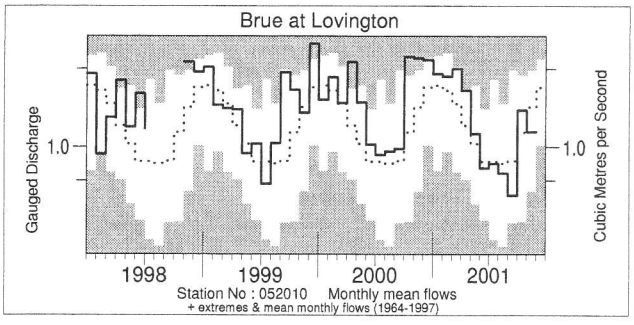


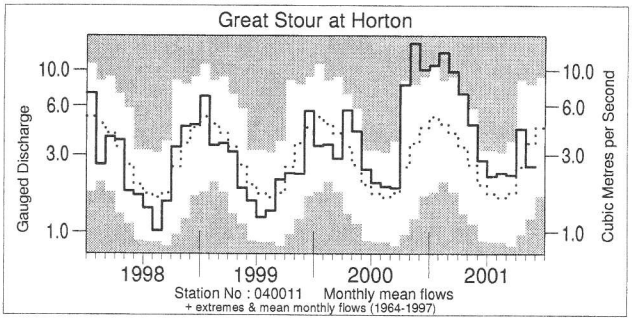


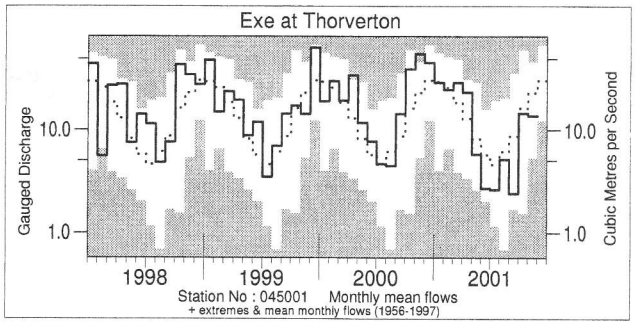


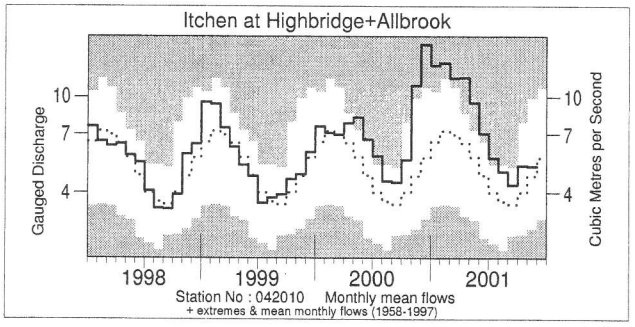










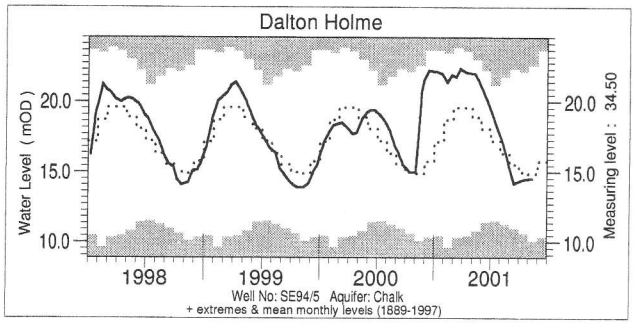


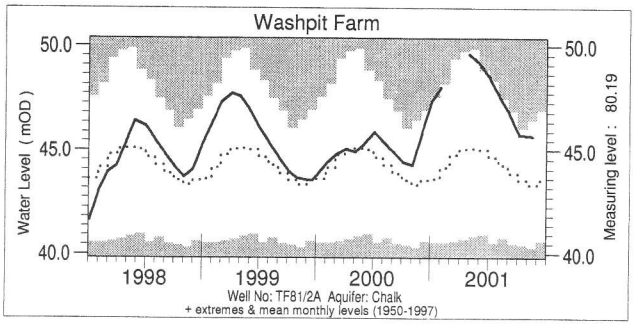
Notable runoff accumulations (a) September2001 - November 2001, (b) December 2000 - November 2001

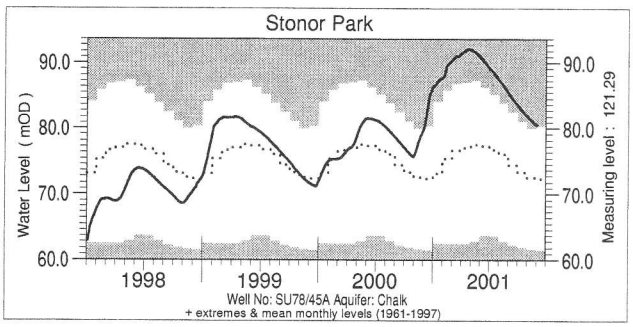
	River	%lta	Rank
(a)	Stringside	198	33/34
	Mimram	193	49/49
	Itchen	128	39/43
	Exe	62	5/46
	Kenwyn	54	6/33
	Tawe	49	5/43
	Luss	89	7/23
	Camowen	78	7/30
	Annacloy	44	3/22
(b)	Lud	167	33/33
	Bedford Ouse	196	68/68
	Thames	184	118/118
	Great Stour	183	34/34
	Hants. Avon	182	36/36
	Otter	136	39/39
	Luss	78	1/21
	Carron	83	4/22
	Ewe	81	4/31
	Naver	80	3/24
	Camowen	80	4/28

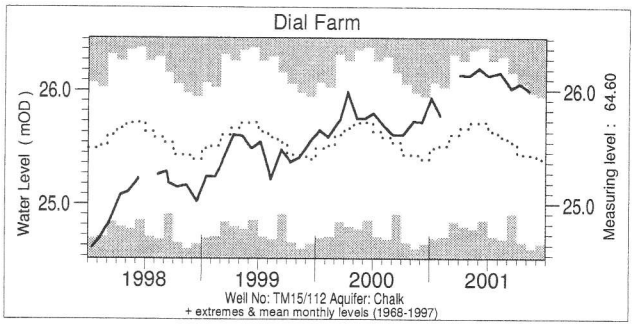
lta = long term average
Rank 1 = lowest on record

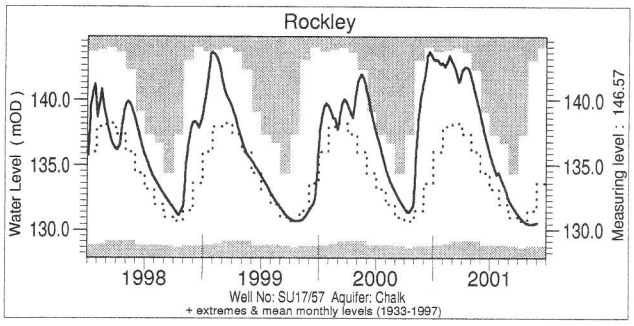
Groundwater . . . Groundwater

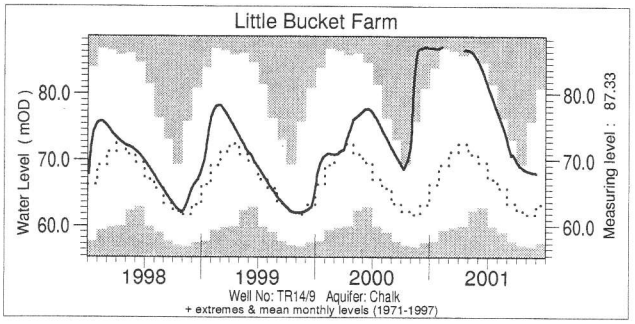


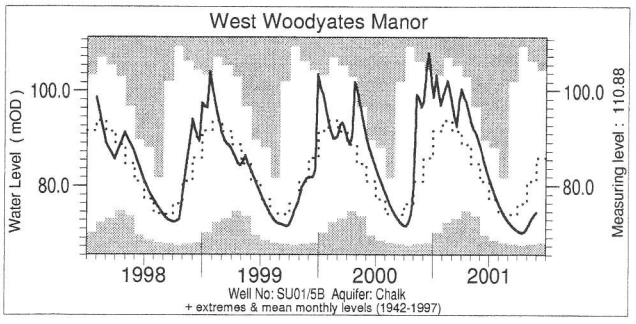


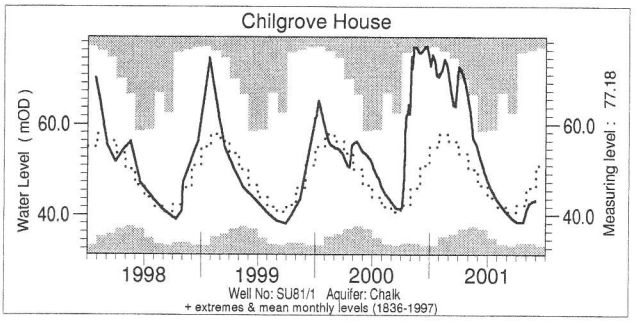


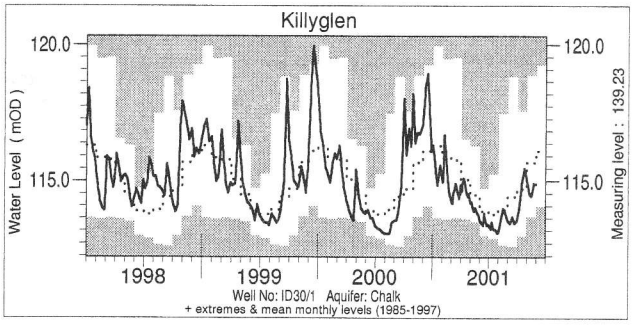


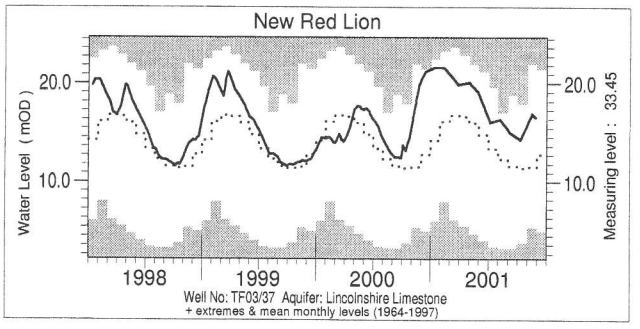








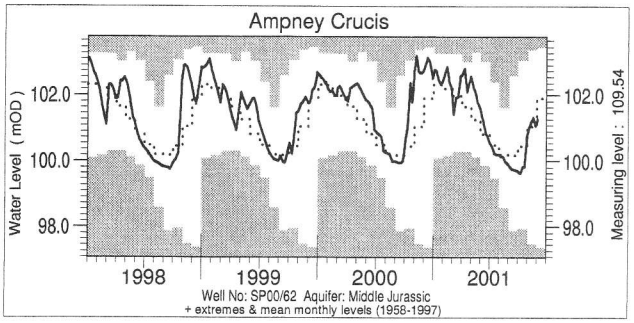


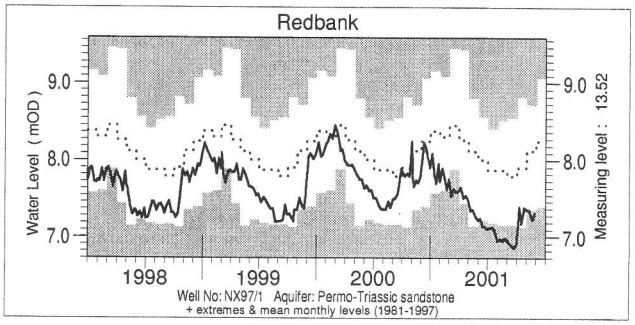


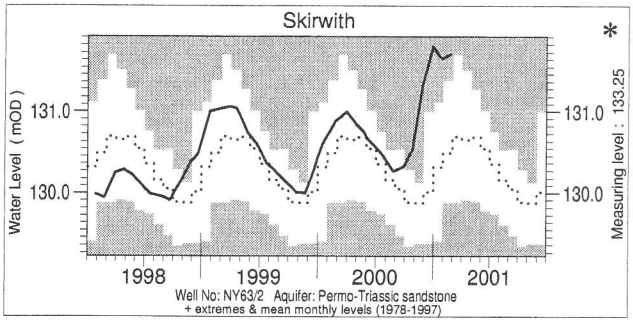
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined below overlying impermeable strata. The monthly max., min. and mean levels are displayed in a similar style to the river flow hydrographs. Note that most groundwater levels are not measured continuously – the latest recorded levels are listed overleaf.

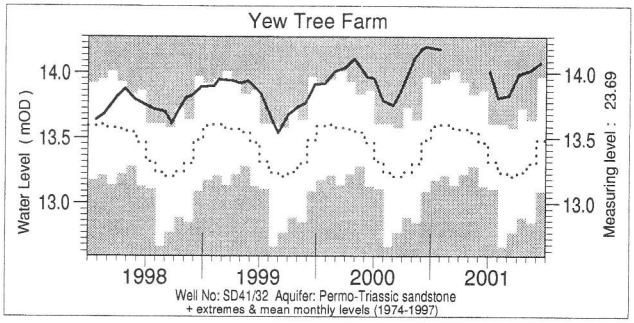
* No March - November groundwater levels available.

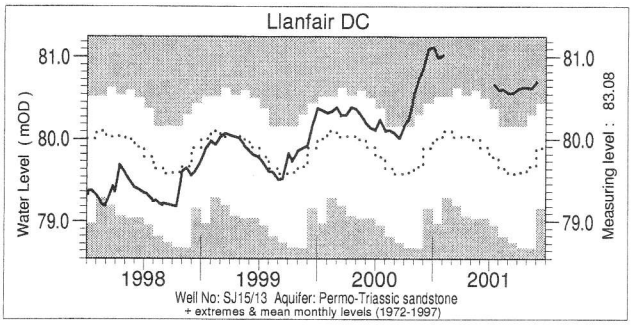
Groundwater . . . Groundwater

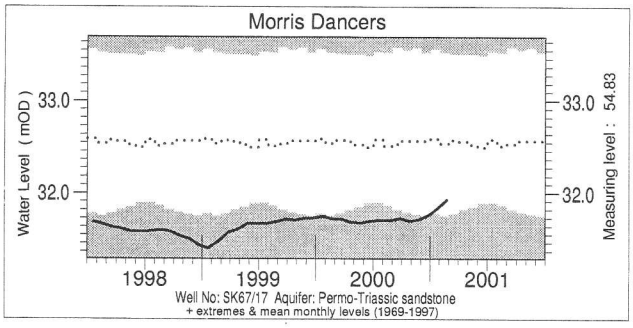


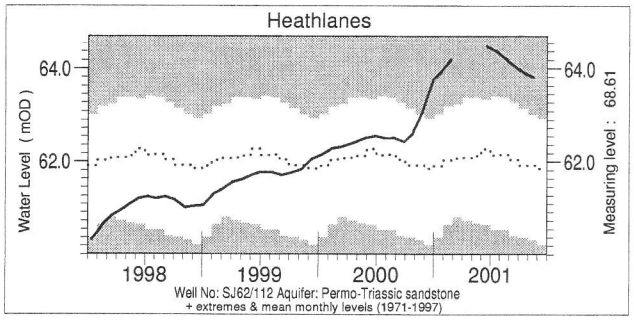


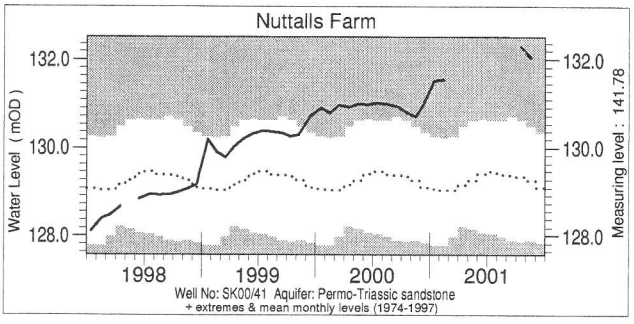


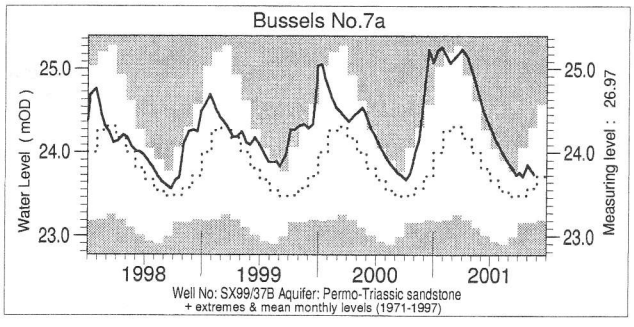


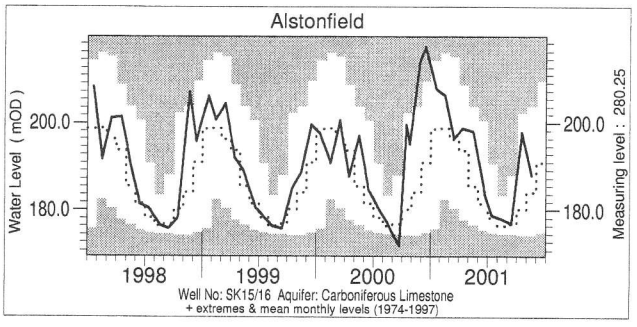












Groundwater levels November / December 2001

Borehole	Level	Date	Nov. av.
Dalton Holme	14.57	12/11	14.83
Washpit Farm	45.69	16/11	43.22
Stonor Park	80.46	03/12	72.40
Dial Farm	26.00	06/11	25.43
Rockley	130.56	03/12	131.61
Little Bucket Farm	68.02	30/11	63.09
West Woodyates	74.42	30/11	81.10

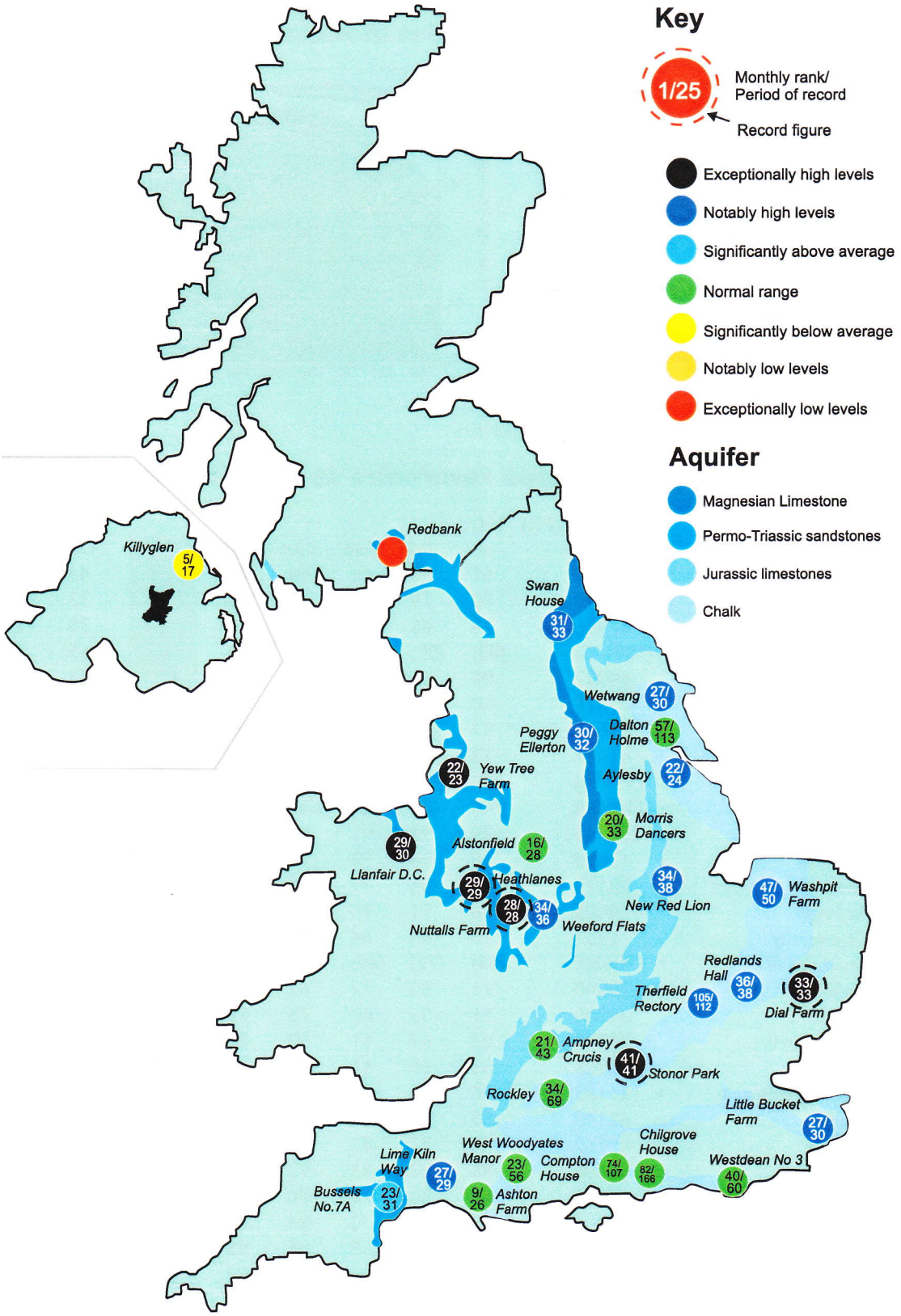
Borehole	Level	Dat	Nov. av.
Chilgrove House	43.28	29/11	46.68
Killyglen	114.88	30/11	116.05
New Red Lion	16.54	26/11	11.93
Ampney Crucis	101.29	03/12	101.19
Redbank	7.32	26/11	8.04
Yew Tree Farm	14.08	06/12	13.41
Llanfair DC	80.70	01/12	79.60

Borehole	Level	Date	Nov. av.
Morris Dancers	32.40	26/11	32.40
Heathlanes	63.82	19/11	61.86
Nuttalls Farm	132.04	15/11	129.42
Bussels No.7a	23.74	21/11	23.63
Alstonfield	187.94	15/11	186.27

Data missing due to Foot & Mouth restrictions

Levels in metres above Ordnance Datum

Groundwater . . . Groundwater

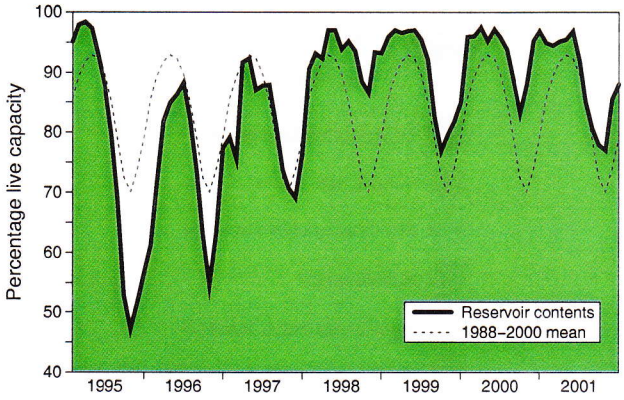


Groundwater levels -November 2001

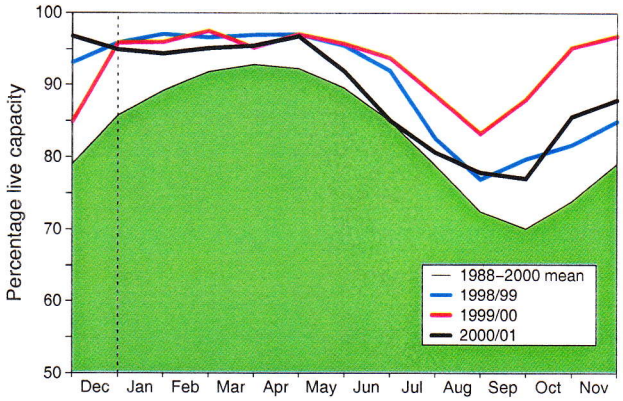
The rankings are based on a comparison between the average level in the featured month (but often only single readings are available) and the average level in each corresponding month on record. They need to be interpreted with caution especially when groundwater levels are changing rapidly or when comparing wells with very different periods of record. Rankings may be omitted where they are considered misleading.

(Note: Redbank is affected by groundwater abstraction)

Guide to the variation in overall reservoir stocks for England and Wales



Comparison between overall reservoir stocks for England and Wales in recent years



These plots are based on the England and Wales figures listed below.

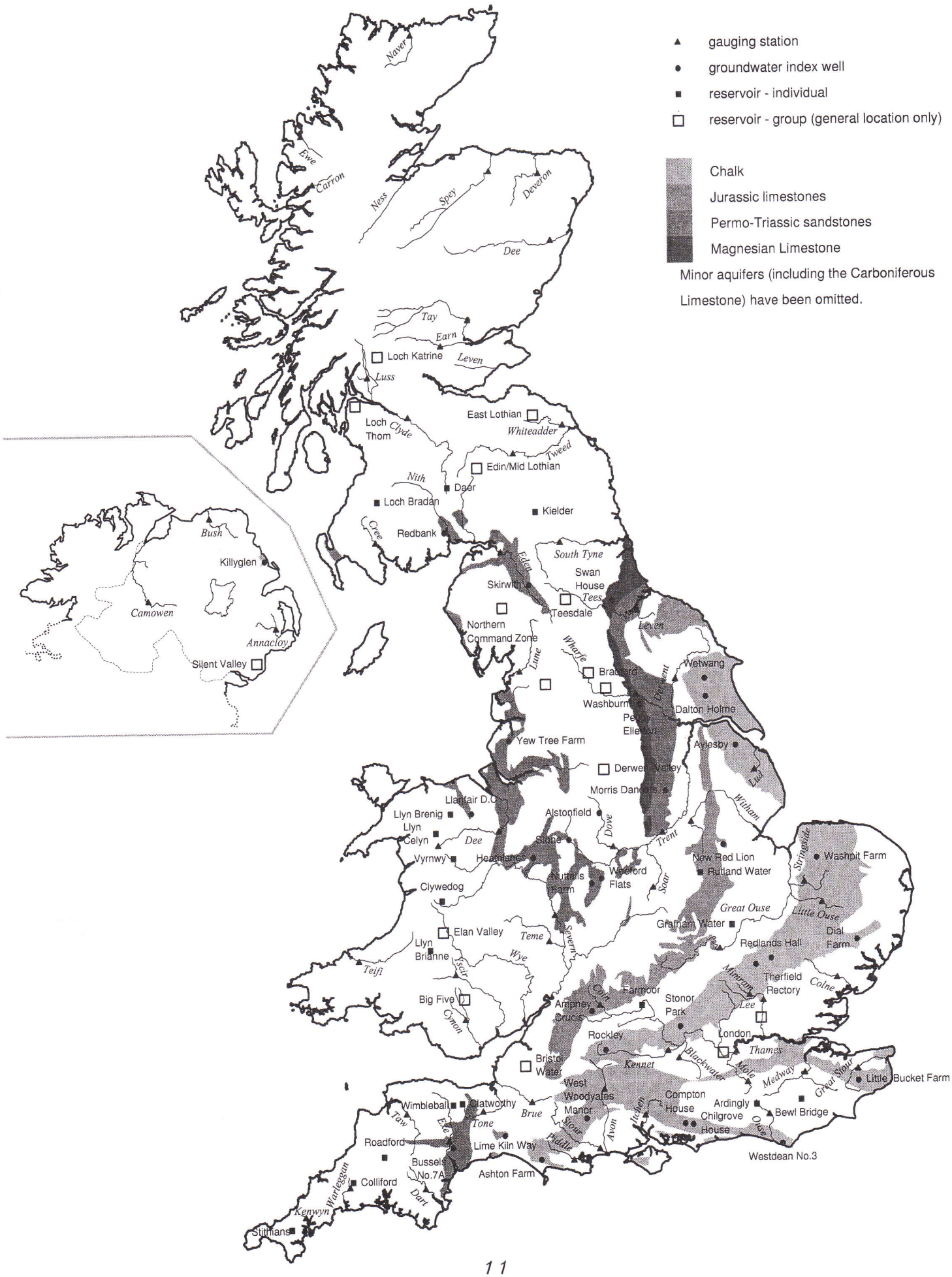
Percentage live capacity of selected reservoirs at start of month

Area	Reservoir	Capacity (Ml)	2001 Jul	Aug	Sep	Oct	Nov	Dec	Min. Dec	Year* of min
North West	N Command Zone	• 124929	61	50	44	44	75	84	44	1993
	Vyrnwy	55146	80	79	74	71	86	91	33	1995
Northumbrian	Teesdale	• 87936	76	65	57	63	96	83	39	1995
	Kielder	(199175)	(88)	(89)	(87)	(86)	(80)	(95)	65	1989
Severn Trent	Clywedog	44922	80	61	46	49	73	100	43	1995
	Derwent Valley	• 39525	80	71	69	81	99	86	9	1995
Yorkshire	Washburn	• 22035	81	75	69	69	89	92	16	1995
	Bradford supply	• 41407	77	64	61	64	86	90	20	1995
Anglian	Grafham	(55490)	(95)	(94)	(95)	(95)	(93)	(88)	47	1997
	Rutland	(116580)	(90)	(85)	(80)	(78)	(80)	(81)	57	1995
Thames	London	• 202340	94	91	91	90	90	87	52	1990
	Farmoor	• 13830	98	96	92	94	92	91	52	1990
Southern	Bewl	28170	93	85	79	72	74	74	34	1990
	Ardingly	4685	96	91	70	67	72	73	44	1989
Wessex	Clatworthy	5364	75	64	54	44	67	72	37	1989
	Bristol WW	• (38666)	(83)	(75)	(69)	(60)	(61)	(59)	27	1990
South West	Colliford	28540	91	82	72	62	60	62	42	1995
	Roadford	34500	91	85	80	73	73	73	19	1995
	Wimbleball	21320	82	69	61	50	52	54	34	1995
	Stithians	5205	83	66	51	37	32	29	29	2001
Welsh	Celyn and Brenig	• 131155	96	96	92	92	94	97	50	1995
	Brianne	62140	85	81	86	86	100	100	72	1995
	Big Five	• 69762	76	78	82	77	97	95	49	1990
	Elan Valley	• 99106	86	87	93	93	100	100	47	1995
East of Scotland	Edinburgh/Mid Lothian	• 97639	82	80	75	70	89	90	56	1998
	East Lothian	• 10206	93	91	90	84	97	100	43	1989
West of Scotland	Loch Katrine	• 111363	61	57	58	55	85	93	86	1997
	Daer	22412	70	64	55	48	91	100	87	1997
	Loch Thom	• 11840	70	66	66	62	84	93	82	1997
Northern Ireland	Silent Valley	• 20634	72	59	59	47	54	43	43	2001

() figures in parentheses relate to gross storage • denotes reservoir groups * last occurrence **updated gross capacity

Details of the individual reservoirs in each of the groupings listed above are available on request. The featured reservoirs may not be representative of the storage conditions across each region; this can be particularly important during droughts. The minimum storage figures relate to the 1988-2000 period only (except for West of Scotland and Northern Ireland where data commence in 1994 and 1993 respectively). In some gravity-fed reservoirs (e.g. Clywedog) stocks are kept below capacity during the winter to provide scope for flood attenuation purposes.

Location map . . . Location map



National Hydrological Monitoring Programme

The National Hydrological Monitoring Programme was instigated in 1988 and is undertaken jointly by the Centre for Ecology and Hydrology, Wallingford (formerly the Institute of Hydrology - IH) and the British Geological Survey (BGS). Financial support for the production of the monthly Hydrological Summaries is provided by the Department of the Environment, Transport and the Regions, the Environment Agency (EA), the Scottish Environment Protection Agency (SEPA), the Rivers Agency (RA) in Northern Ireland, and the Office of Water Services (OFWAT).

Data Sources

River flow and groundwater level data are provided by the regional divisions of the EA (England and Wales) and SEPA (Scotland), data for Northern Ireland are provided by the Rivers Agency and the Department of the Environment (NI). In all cases the data are subject to revision following validation (flood and drought data in particular may be subject to significant revision).

Reservoir level information is provided by the Water Service Companies, the EA, the West of Scotland and East of Scotland Water Authorities, and the Northern Ireland Water Service.

The National River Flow Archive (maintained by CEH Wallingford) and the National Groundwater Level Archive (maintained by BGS) provide the historical perspective within which to examine contemporary hydrological conditions.

Rainfall

Most rainfall data are provided by The Met Office (address opposite). To allow better spatial differentiation the rainfall data for Britain are presented for the regional divisions of the precursor organisations of the EA and SEPA. Following the discontinuation of The Met Office's CARP system in July 1998, the areal rainfall figures have been derived using several procedures, including initial estimates based on MORECS*. Recent figures have been produced by The Met Office, National Climate Information Centre (NCIC), using a technique similar to CARP. An initiative is underway with The Met Office to provide more accurate areal figures and, since October 1999, to include more raingauges in the analysis. A significant number of additional monthly rainfall totals are currently being provided by the Environment Agencies; over the coming months further monthly raingauge totals will be included for selected regions. Until the access to these additional data has stabilised the regional figures (and the return periods associated with them) should be regarded as a guide only.

*MORECS is the generic name for the Meteorological Office services involving the routine calculation of evaporation and soil moisture throughout Great Britain.

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The National Hydrological Monitoring Programme depends on the active cooperation of many data suppliers. This cooperation is gratefully acknowledged.

Subscription

Subscription to the Hydrological Summaries costs £48 per year. Orders should be addressed to:

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Selected text and maps are available on the WWW at http://www.nwl.ac.uk/ih

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