Note : much of the hydrometric data featured in this report is provisional; the Foot and Mouth outbreak has also restricted the amount of data available.

Hydrological summary for the United Kingdom

May 2001

General

May was a warm and, in most areas, a dry month, terminating a sequence of eight successive wet months across much of the English Lowlands. Nonetheless, accumulated rainfall totals in many regions remain remarkable. The flood threat diminished rapidly through May as warm and sunny conditions – associated with record evaporative losses in some areas – triggered very brisk increases in soil moisture deficits. Reservoir contents declined significantly over the month but remain, generally, very healthy, overall stocks for England and Wales as a whole still exceed 90% of capacity. The prolonged groundwater flooding which has afflicted many impermeable catchments also receded smartly as steep groundwater level recessions became established across most major aquifers. In relation to the seasonal average, spring outflows remain vigorous and, overall, groundwater resources are very healthy for the early summer.

Rain

Although parts of the Midlands were wet, most low pressure systems in May followed a track to the north of the British Isles. A wet interlude in mid-month aside, many areas were notably dry with barely more than a trace of rainfall over the final 14 days. Accordingly, May rainfall totals were well below average in most regions. Parts of the Cheshire Plain and East Midlands reported >120% of the May average but, to the north and south, rainfall totals were much more modest. Many localities in the South-West and across Scotland registered less than 35% of the 1961-90 average and totals below 20% characterised a few coastal districts in north-east England. For a few parts of the Highland Region, May was the seventh successive month with below average rainfall; some catchments have experienced their driest January-May period in at least 20 years. Rainfall for Northern Ireland was less than 70% and England and Wales had its second driest May since 1991 (and its lowest monthly rainfall since March 2000). However, one obvious legacy of the remarkable antecedent rainfall is that accumulated rainfall totals (over a broad range of timeframes) remain outstanding; the September-May total, for instance, exceeds any pre-2000/2001 nine-month total for England and Wales.

River flows

Across most of the UK, flow recessions were steep during May, and river flows were commonly well below average at month-end. But catchment geology was as influential as the rainfall patterns, and the runoff contrasts between permeable and impermeable catchments were often dramatic. In the Midlands, storms around the 18th provided a modest reminder of the recent flooding; the Trent registered it highest May flow for over 30 years. However, away from the English Lowlands, many rivers recorded their lowest May runoff for a decade. In Scotland, runoff in the Cree and Luss was well under 30% of the monthly average and the May mean flow for the Tay was the second lowest in a 49-year record. By contrast, the lagged response to the abundant winter aquifer recharge resulted in notably high flows continuing in spring-fed rivers, in southern England especially. The Mimram and Itchen were among a substantial number of Chalk rivers establishing new maximum May flows – and continuing the redefinition of high flow regimes which began in the autumn of 2000. Rivers recording new spring (March-May) runoff maxima were also common in southern Britain – they included the Test, Blackwater and Wallington with records of more than 40 years. Unprecedented runoff in the 6, 9 and 12-month timeframes showed a much wider distribution, testimony to the extraordinary autumn and winter runoff.

Groundwater

The saturated conditions which typified most outcrop areas over the preceding seven months, abated briskly in May as exceptional actual evaporation losses helped to establish significant soil moisture deficits across most of eastern and southern England. By month-end, above average smds signalled the end of what is expected to prove (when a more comprehensive analysis has been completed) the most productive recharge season in the instrumented era. Some modest local infiltration occurred in May (e.g. in the Carboniferous Limestone of Derbyshire) but the general picture (an incomplete one due to continuing Foot and Mouth restrictions) is of well-established groundwater levels recessions by the beginning of the summer, exceptions include some of the slower responding Permo-Triassic sandstones outcrops. Despite the recent recessions, May groundwater levels were above pre-2000 maxima (for any month) in parts of the Chalk (e.g. the Chilterns, where some residual 'clearwater' flooding remains), and well above the early summer mean throughout the aquifer. Levels were also well above the May average in the major limestone aquifers (a new May maxima was established in the Magnesian Limestone at Peggy Ellerton), and at record levels in parts of the less responsive Permo-Triassic sandstones. As in 2000, baseflow contributions to summer river flows will be very substantial.

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Rainfall . . . Rainfall . . . Rainfall.

Rainfall accumulations and return period estimates

Area	Rainfall	May 2001	Mar 01-May 01	RP	Jan 01-May 01	RP	Sep 00-May 01	RP	Jun 00-May 01	RP
England & Wales	mm	**42**	**247**		**435**		**1075**		**1248**	
	%	**65**	**124**	**5-10**	**122**	**5-10**	**152**	**>>200**	**137**	**>200**
North West	mm	56	230		411		1224		1506	
	%	74	95	2-5	94	2-5	132	30-50	125	25-40
Northumbrian	mm	16	149		296		795		993	
	%	26	79	2-5	90	2-5	123	10-15	116	5-10
Severn Trent	mm	60	218		340		836		986	
	%	102	125	5-10	114	2-5	145	120-170	131	30-50
Yorkshire	mm	33	178		315		862		1046	
	%	55	95	2-5	97	2-5	137	50-80	127	30-40
Anglian	mm	41	191		313		684		802	
	%	85	135	5-15	137	15-25	155	>>200	135	60-90
Thames	mm	39	215		370		855		971	
	%	69	133	5-10	136	10-20	162	>>200	141	110-150
Southern	mm	26	222		428		1062		1175	
	%	48	130	5-10	141	15-25	171	>>200	151	>>200
Wessex	mm	31	228		399		987		1126	
	%	51	124	2-5	119	2-5	149	120-170	134	40-60
South West	mm	26	274		480		1235		1411	
	%	37	114	2-5	100	<2	130	20-30	120	10-15
Welsh	mm	62	312		516		1378		1635	
	%	75	116	2-5	101	2-5	130	25-40	124	20-30
Scotland	mm	**42**	**187**		**374**		**1097**		**1330**	
	%	**49**	**65**	**20-35**	**69**	**30-50**	**96**	**2-5**	**93**	**2-5**
Highland	mm	63	219		417		1204		1441	
	%	68	63	20-30	63	50-80	84	5-15	82	10-20
North East	mm	32	166		325		880		1059	
	%	46	80	2-5	88	2-5	118	5-15	109	2-5
Tay	mm	36	178		410		1103		1331	
	%	43	70	5-10	83	2-5	112	2-5	108	2-5
Forth	mm	28	163		333		915		1152	
	%	38	72	5-10	78	5-10	105	2-5	104	2-5
Tweed	mm	22	160		312		843		1083	
	%	31	77	5-10	84	2-5	113	5-10	112	5-10
Solway	mm	37	211		414		1339		1628	
	%	44	76	5-10	77	5-10	119	5-15	115	5-10
Clyde	mm	40	208		433		1342		1623	
	%	44	65	10-20	69	20-35	99	2-5	96	2-5
Northern Ireland	mm	**48**	**176**		**297**		**882**		**1076**	
	%	**68**	**79**	**2-5**	**72**	**10-15**	**106**	**2-5**	**102**	**2-5**

RP = Return period

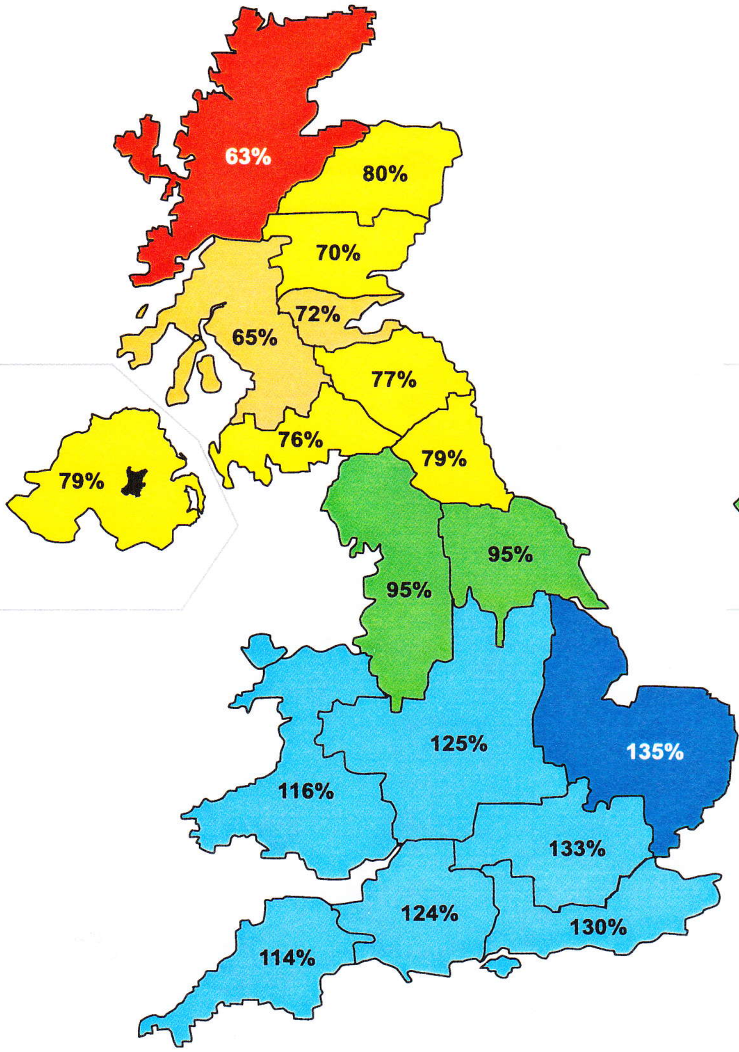
The monthly rainfall figures* are copyright of The Met. Office and may not be passed on to, or published by, any unauthorised person or organisation. **All monthly totals since December 1998 are provisional (see page 12).** The figures for England & Wales are derived by the Hadley Centre and are updates 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

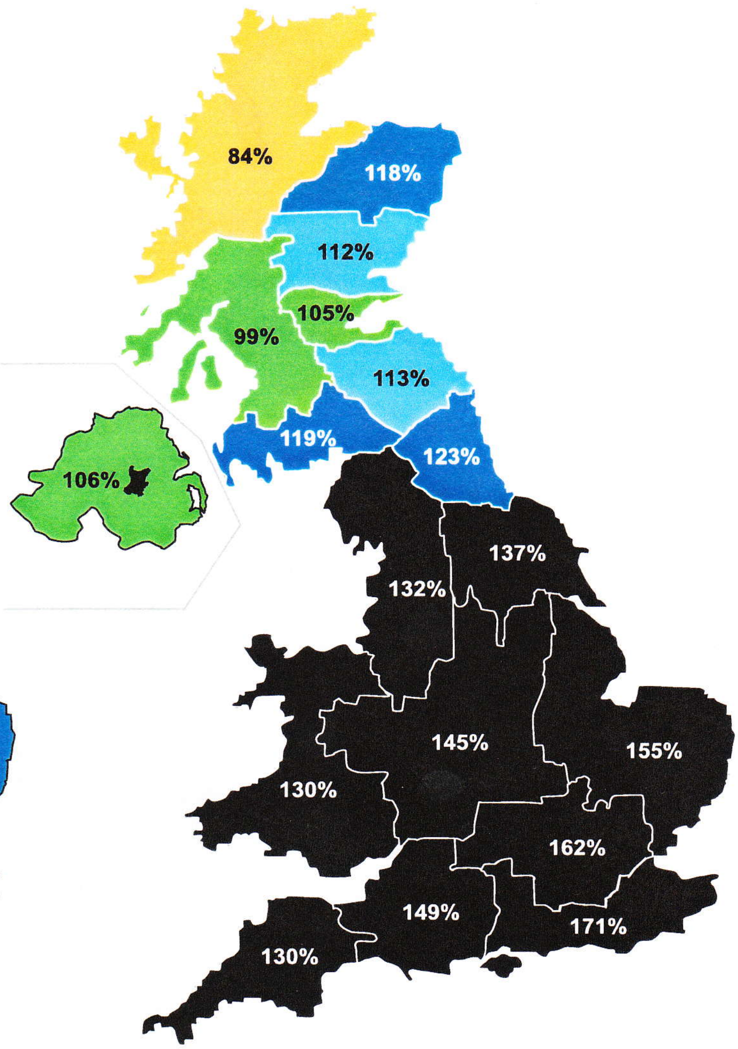
Key

00% Percentage of 1961-90 average

- Very wet
- Substantially above average
- Above average
- Normal range
- Below average
- Substantially below average
- Exceptionally low rainfall



March 2001 - May 2001

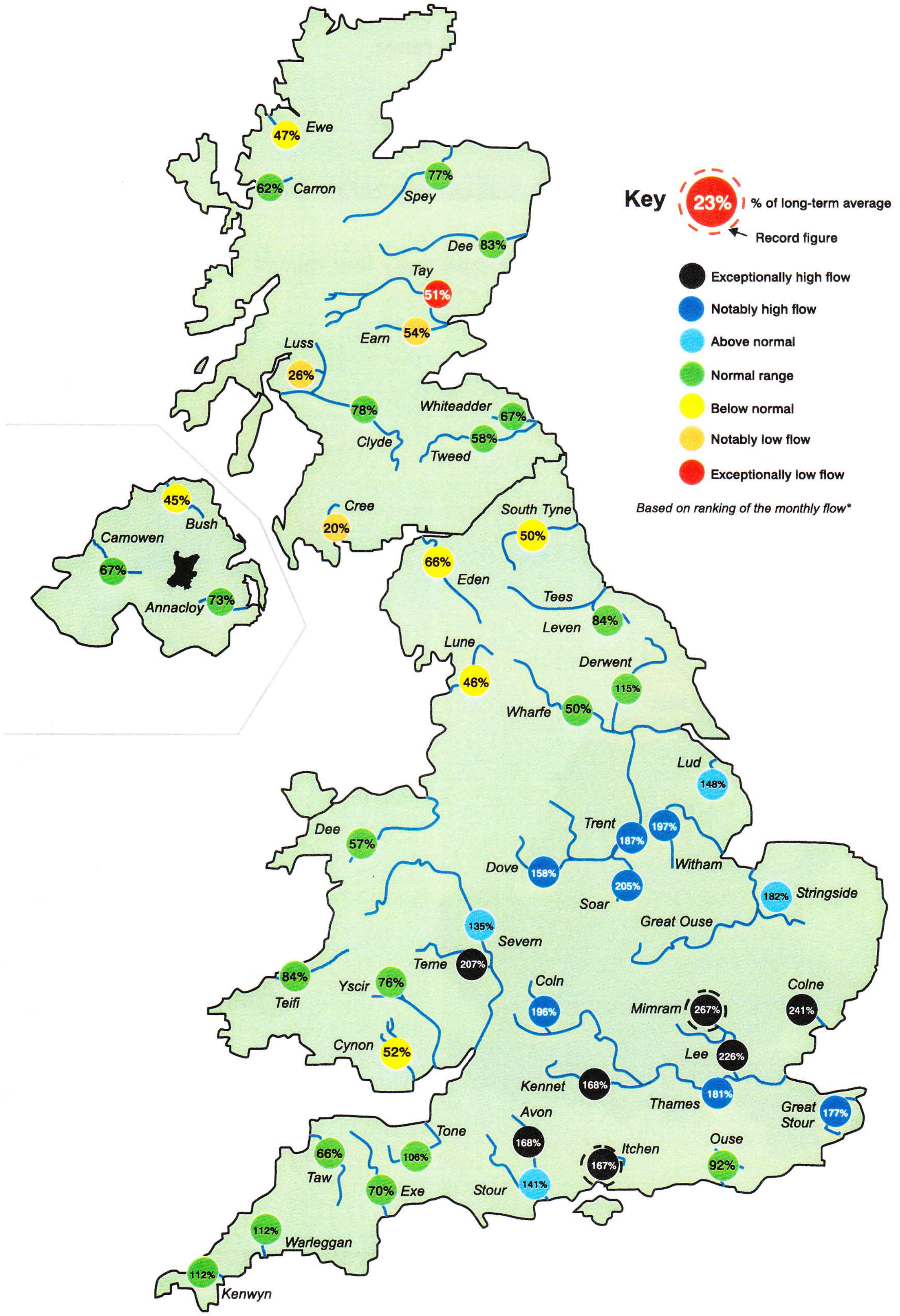


September 2000 - May 2001

Rainfall accumulation maps

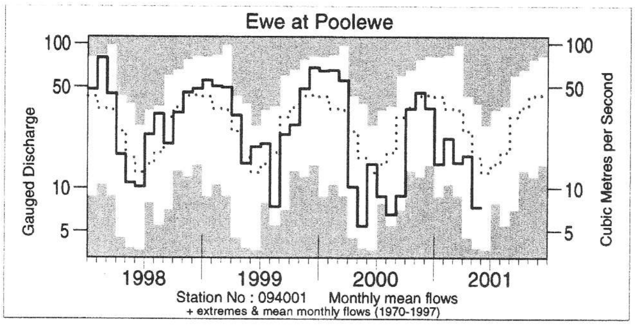
Three of the last four spring (March-May) periods have been notably wet across England and Wales. Rainfall totals were higher in both 1998 and 2000 but the 2001 spring rainfall still ranks amongst the highest eight in the last 50 years. Scotland, by contrast had its third driest spring in the same timeframe. Rainfall for Scotland over the last nine months is a little below average whilst the September -May total for E&W is unprecedented in a series from 1766.

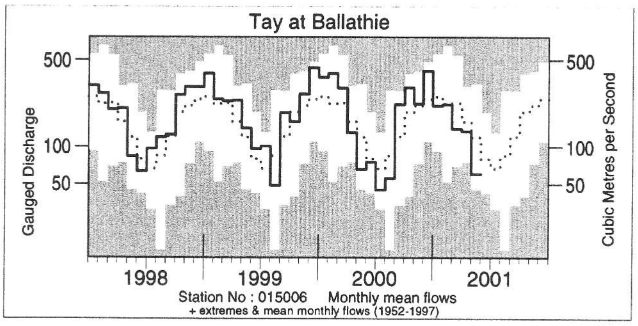
River flow . . . River flow . . .

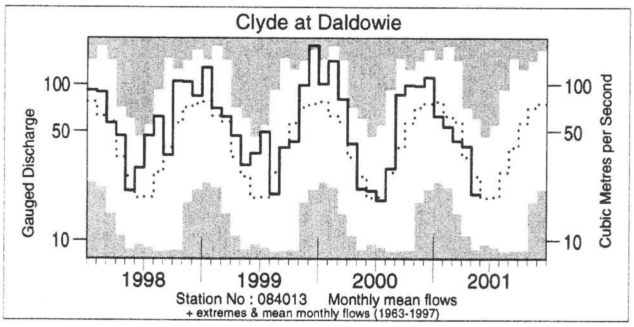


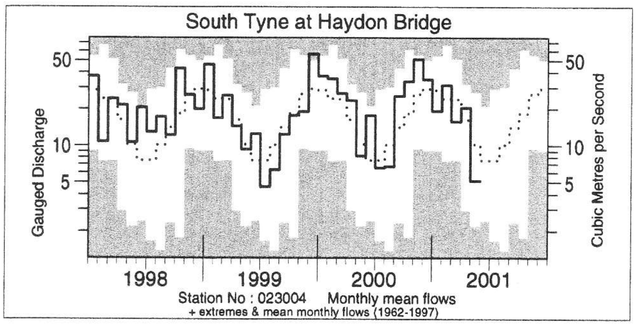
River flows - May 2001

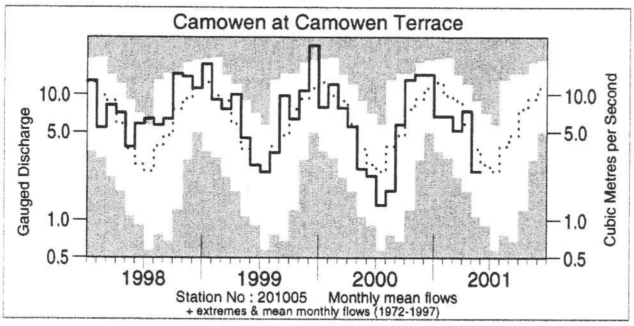
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

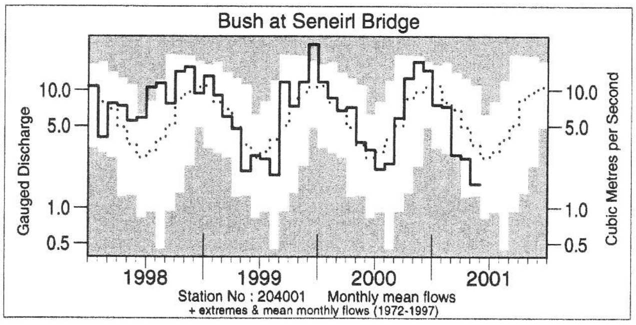


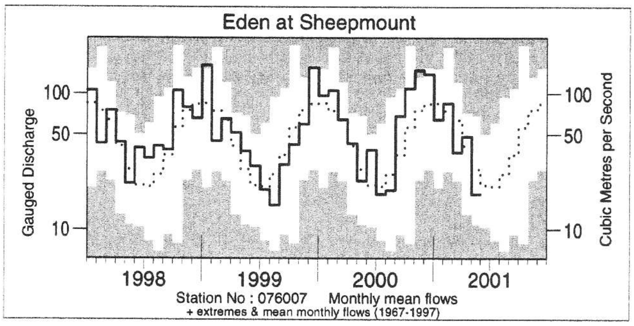


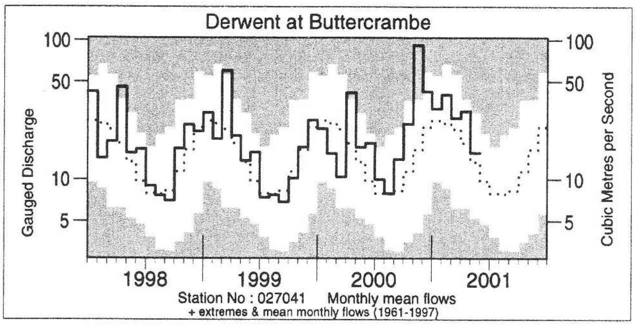


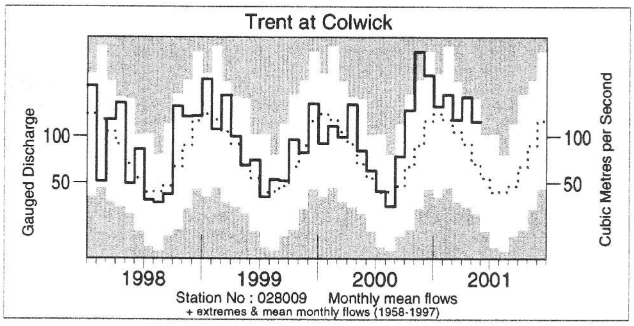


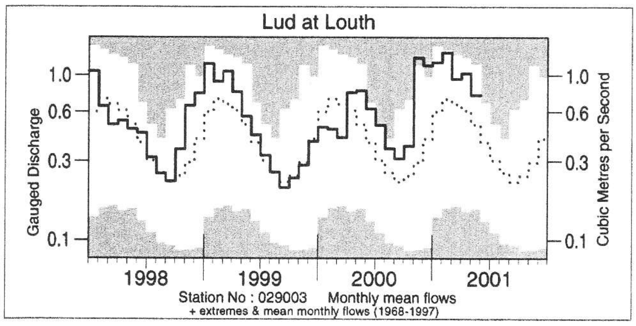






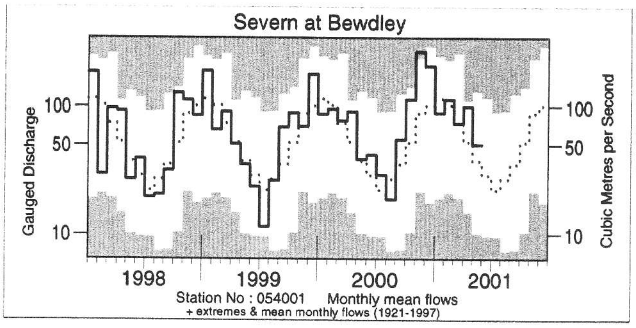


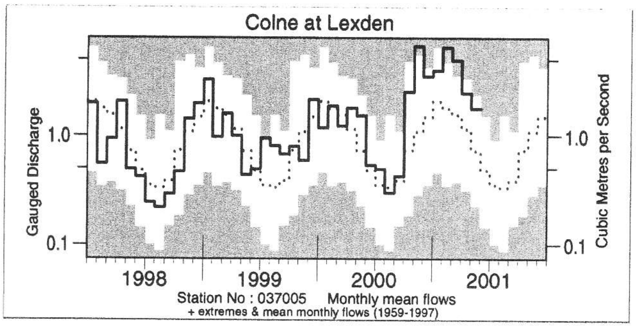


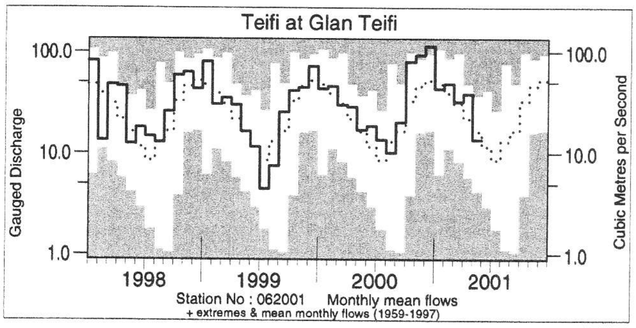


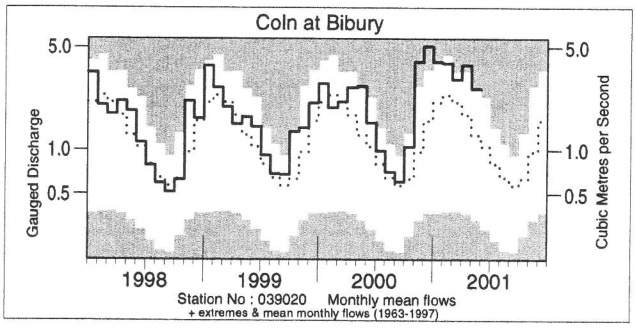
Monthly river flow hydrographs

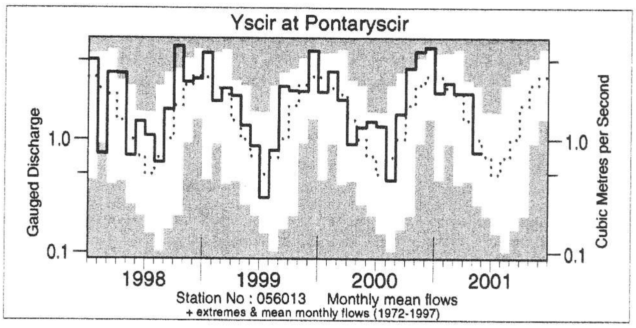
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 1998 (shown by the shaded areas). Monthly flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded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

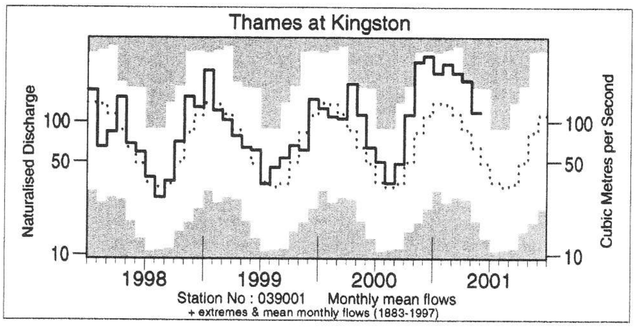


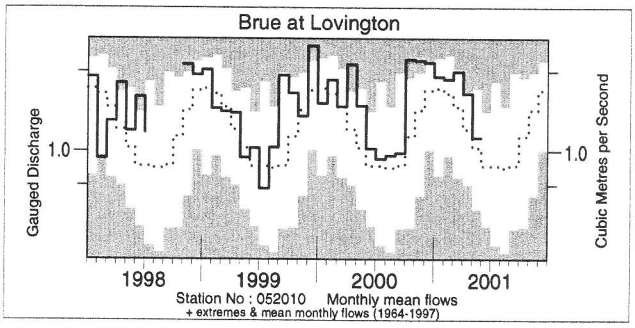


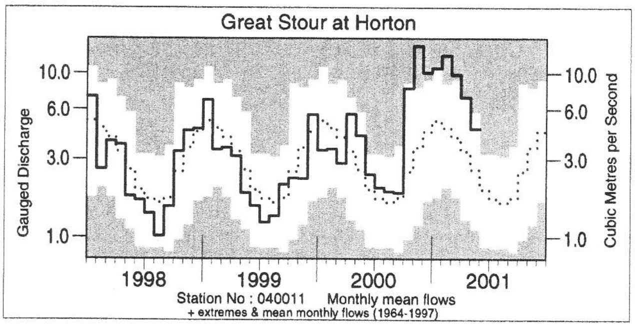


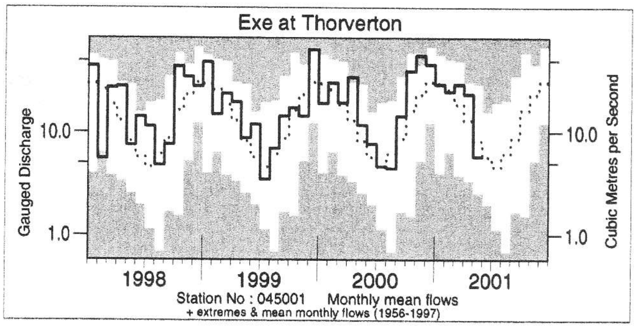


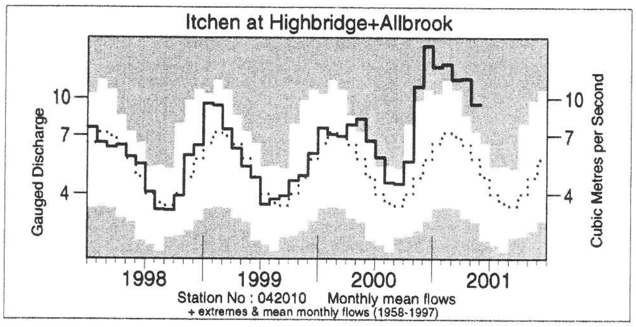










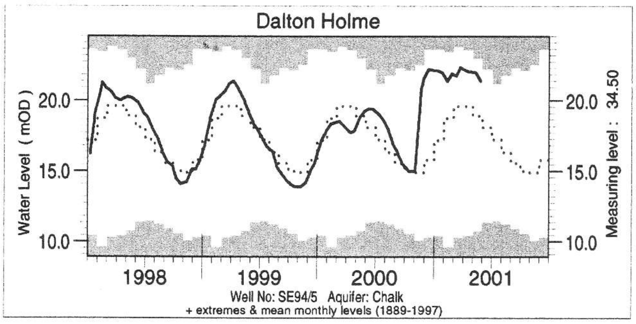


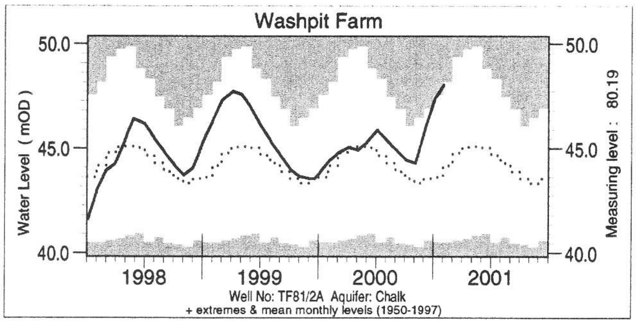
Notable runoff accumulations (a) March 2001 - May 2001, (b) September 2000 - May 2001

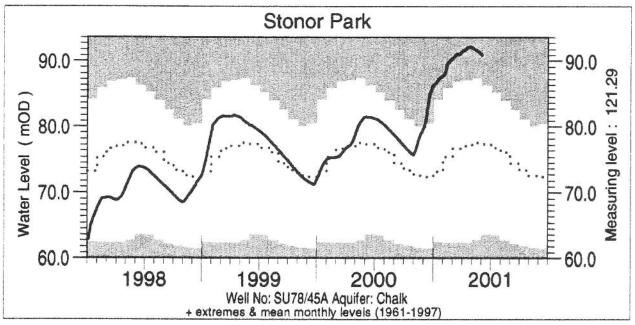
	River	%lta	Rank		River	%lta	Rank	River	%lta	Rank
(a)	Kennet	183	40/40	(b)	Whiteadder	158	32/32	Thames	219	118/118
	Itchen	172	43/43		Trent	180	42/42	Severn	160	80/80
	Otter	166	39/39		Stringside	201	34/34	Dee	147	63/63
	Luss	47	2/25		Colne	282	40/40	Annacloy	162	21/21
	Bush	47	2/29							

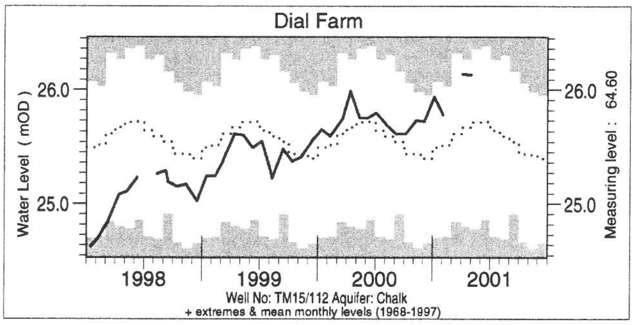
lta = long term average
Rank 1 = lowest on record

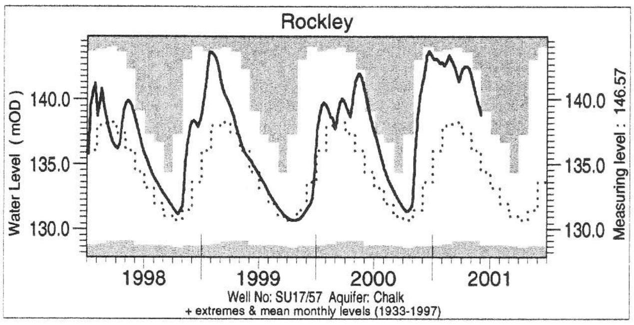
Groundwater . . . Groundwater

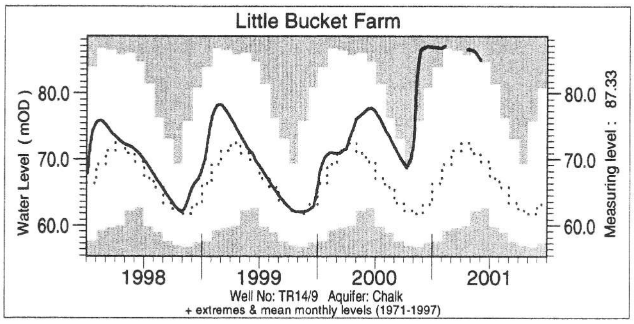


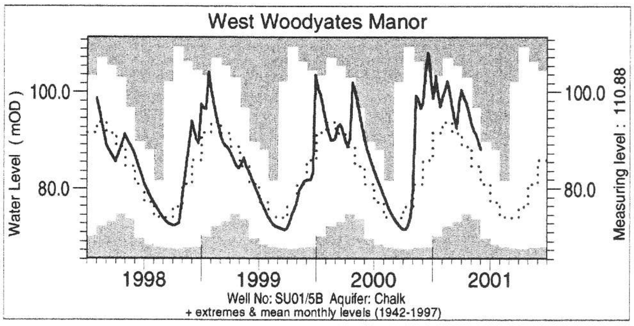


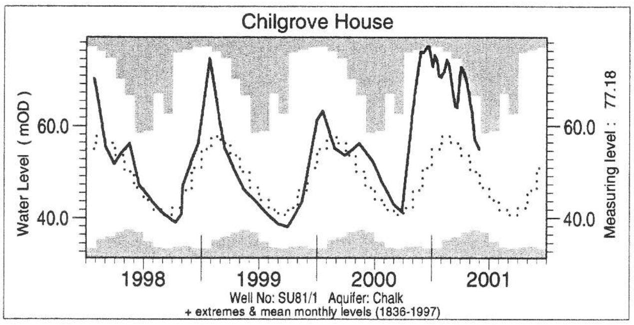


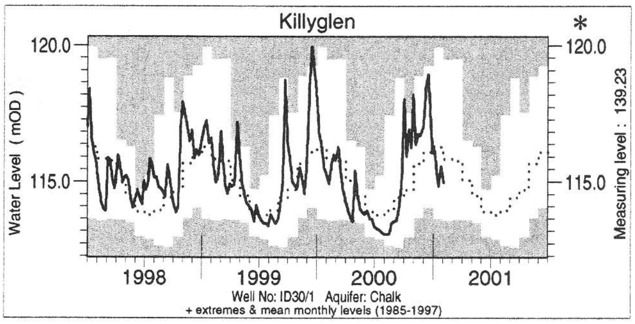


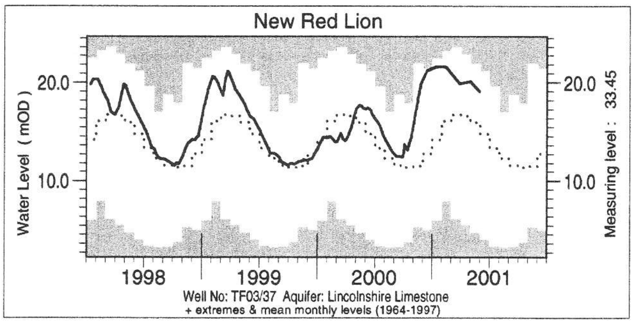






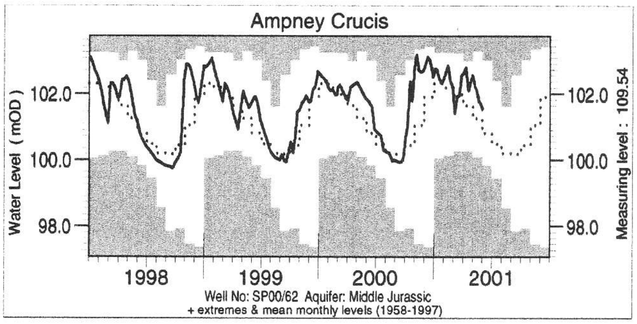


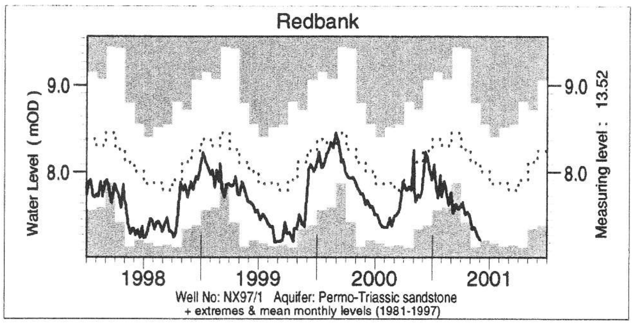


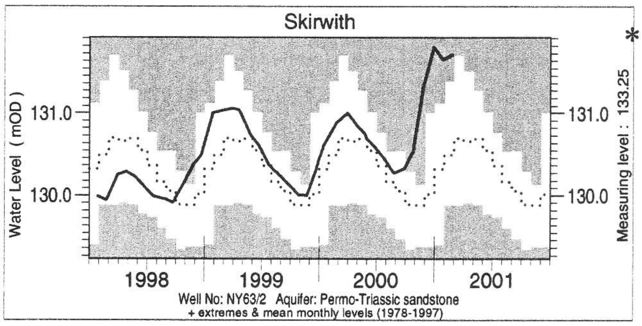


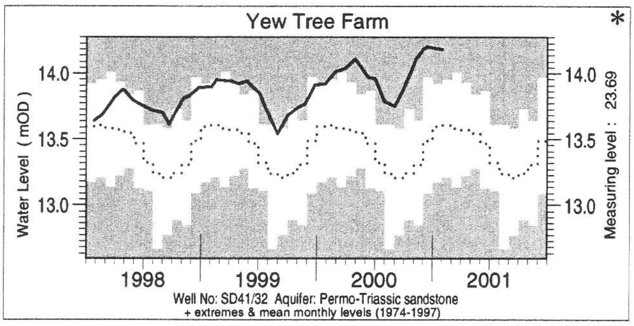
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined 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.

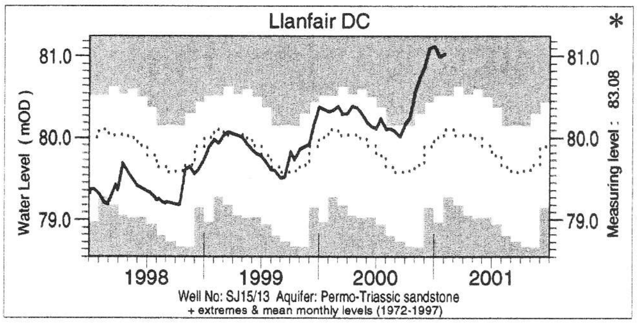
* No March / April / May/ June groundwater levels available.

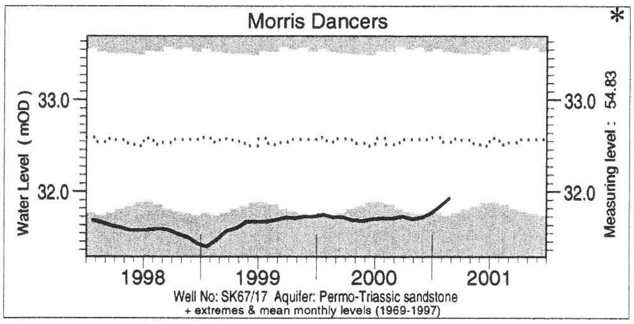


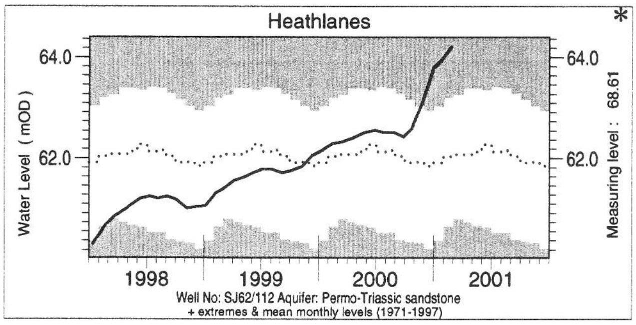


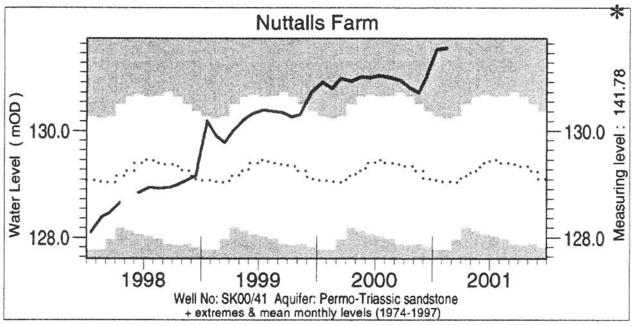


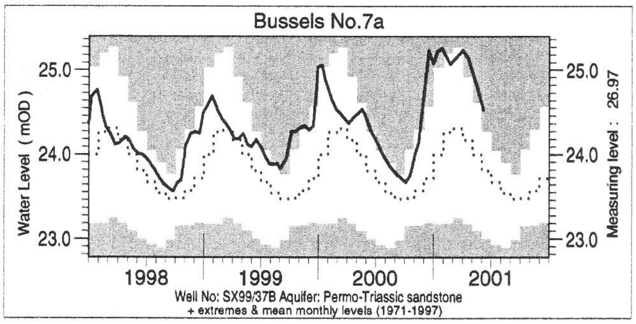


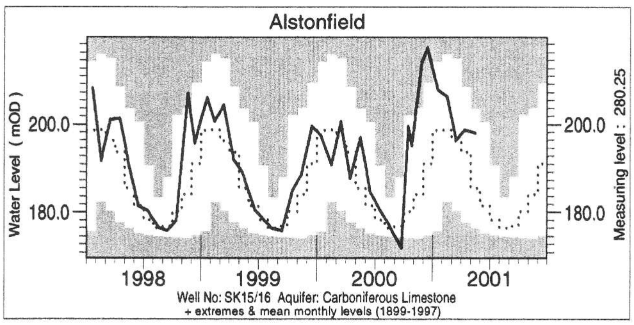












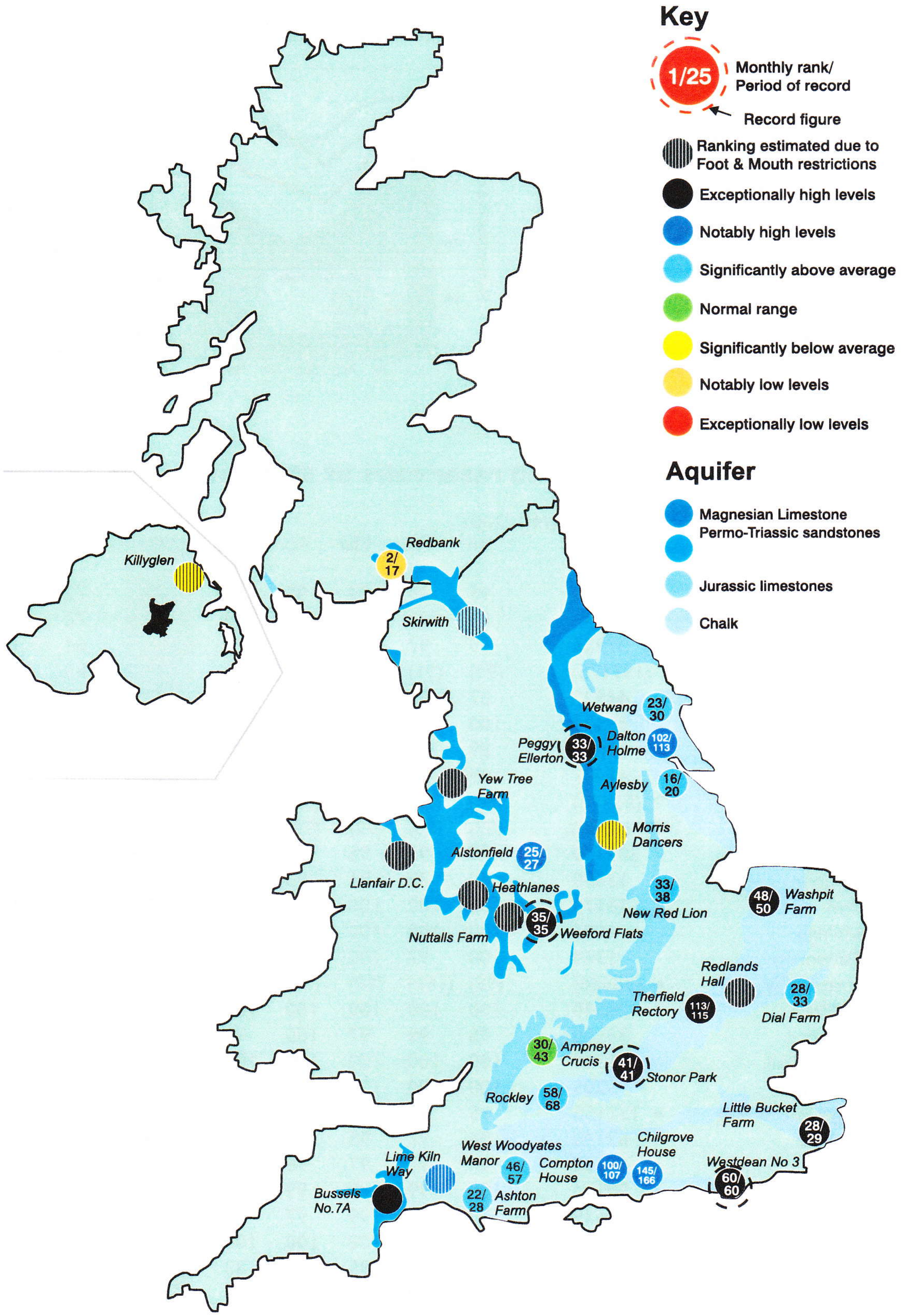
Groundwater levels May / June 2001

Borehole	Level	Date	May av.
Dalton Holme	21.37	25/05	18.94
Wetwang	25.57	25/05	23.50
Washpit Farm	49.21	31/05	45.32
Therfield Rectory	95.82	01/06	81.42
Rockley	138.81	01/06	136.17
Little Bucket Farm	84.98	31/05	72.04
Compton House	47.62	29/05	41.26

Levels in metres above Ordnance Datum

Borehole	Level	Date	May av.
Chilgrove	54.91	29/05	48.96
Westdean No.3	2.5	01/06	1.88
Ashton Farm	69.38	31/05	68.56
West Woodyates	88.19	31/05	84.59
Aylesby	19.68	29/05	16.27
Dial Farm	26.13	02/05	25.70
Stonor Park	90.90	01/06	78.01

Borehole	Level	Date	May av.
New Red Lion	19.08	30.05	15.99
Ampney Crucis	101.55	01/06	101.28
Redbank	7.22	31/05	8.08
Bussels No. 7A	24.53	05/06	24.01
Data Missing due to Foot & Mouth restrictions			
Peggy Ellerton	37.26	25/05	34.57
Alstonfield	198.04	16/05	186.61
Weeford Flats	91.65	16/05	89.94

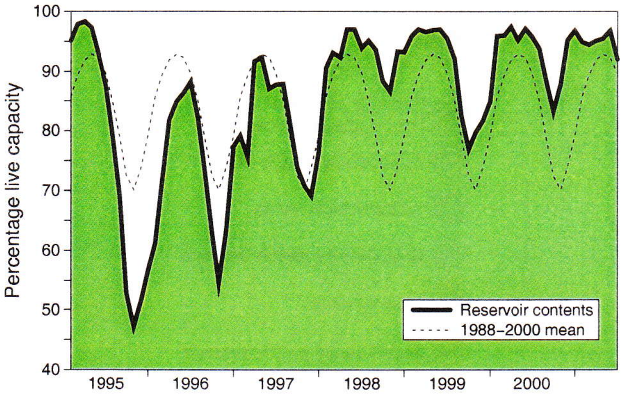


Groundwater levels - May 2001

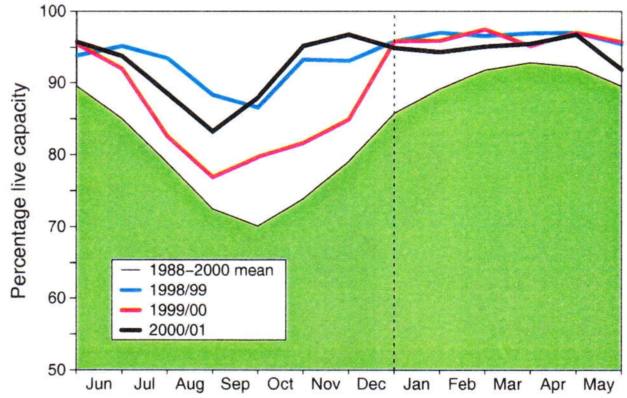
The rankings are based on a comparison between the average level in the featured month (but often only single readings are available) and the average level in each corresponding month on record. They need to be interpreted with caution especially when groundwater levels are changing rapidly or when comparing 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 of min	Reservoir	Capacity (Ml)	2001 Jan	Feb	Mar	Apr	May	Jun	Min. Jun	Year* of min
North West	N Command Zone	• 124929	95	94	94	85	89	73	72	1991
	Vyrnwy	55146	93	93	98	100	99	90	72	1990
Northumbrian	Teesdale	• 87936	99	97	91	92	98	84	64	1991
	Kielder	(199175)	(93)	(91)	(92)	(92)	(91)	(90)	85	1989
Severn Trent	Clywedog	44922	82	82	91	99	98	90	83	1989
	Derwent Valley	• 39525	100	94	98	100	100	97	56	1996
Yorkshire	Washburn	• 22035	89	95	97	99	97	89	72	1990
	Bradford supply	• 41407	99	99	97	99	99	85	70	1996
Anglian	Grafham	** (55490)	(88)	(88)	(88)	(92)	(96)	(96)	72	1997
	Rutland	**(116580)	(89)	(86)	(92)	(95)	(99)	(96)	75	1997
Thames	London	• 202340	98	97	96	95	97	98	83	1990
	Farmoor	• 13830	80	72	81	90	98	98	96	1999
Southern	Bewl	28170	100	100	100	100	100	98	57	1990
	Ardingly	4685	100	100	100	100	100	100	96	1990
Wessex	Clatworthy	5364	100	97	100	100	100	87	67	1990
	Bristol WW	• (38666)	(95)	(100)	(98)	(98)	(98)	(94)	70	1990
South West	Colliford	28540	100	100	100	100	100	97	52	1997
	Roadford	34500	98	98	97	100	99	95	48	1996
	Wimbleball	21320	100	100	100	100	100	94	76	1992
	Stithians	5205	100	100	100	100	100	94	66	1990
Welsh	Celyn and Brenig	• 131155	95	97	99	100	100	100	82	1996
	Brianne	62140	94	97	95	97	100	94	85	1995
	Big Five	• 69762	94	97	97	98	97	89	70	1990
	Elan Valley	• 99106	100	99	98	99	99	94	85	1990
East of Scotland	Edinburgh/Mid Lothian	• 97639	99	99	99	97	97	91	52	1998
	East Lothian	• 10206	100	100	100	100	100	100	84	1990
West of Scotland	Loch Katrine	• 111363	90	94	95	88	83	66	66	2001
	Daer	22412	100	100	100	93	96	81	70	1994
	Loch Thom	• 11840	100	100	98	93	89	74	74	2001
Northern Ireland	Silent Valley	• 20634	100	95	96	100	93	83	56	2000

() 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 where data commence in 1994). 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.

The Met. Office
Johnson House
London Road
Bracknell
RG12 2SY
Tel.: 01344 856849
Fax: 01344 854906

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:

Hydrological Summaries
CEH Wallingford
Maclean Building
Crowmarsh Gifford
Wallingford
Oxfordshire
OX10 8BB
Tel.: 01491 838800
Fax: 01491 692424

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

NATURAL ENVIRONMENT RESEARCH COUNCIL