Hydrological Summary
for the United Kingdom

February 2003

General

Weather conditions during February contrasted with those which typified most of the late autumn and early winter. With high pressure dominant the rainfall total for the UK was, provisionally, the second lowest – for February - in the last 18 years. Across most of the country the risk of flooding declined as sustained recessions characterised most river basins. Flood drawdown releases made a minor contribution to a significant reduction in overall reservoir stocks over the month, but they remain very close to the late winter average for England and Wales as a whole; with few exceptions, stocks in major impoundments currently exceed 90% of capacity. Though generally in decline from the January peaks, groundwater levels in most major aquifers remain well above average. The healthy water resources outlook is a reflection of the abundant rainfall (and recharge) over the autumn and early winter. Considerable early March rainfall generally eliminated modest soil moisture deficits – and provided a reminder that most catchments are likely to remain vulnerable to substantial rainfall well into the spring.

Rainfall

February was a dry, sunny month with many areas experiencing a notably wide range of temperatures; an unusual weather combination in the context of the preceding run of months. The infrequency of rain-bearing frontal systems resulted in below average precipitation across much the greater part of the UK. Damaging blizzards (e.g. on the 3rd) - with substantial snow accumulations - produced considerable transport disruption in Scotland. However precipitation totals were influenced more by the preponderance of dry days in mid-month; many areas reported little more than a trace of rain over the fortnight beginning on the 11th. A few localities (e.g. Milford Haven and Morecambe) reported marginally above average February rainfall but most catchments registered between 40% and 70% of average; parts of eastern Scotland were especially dry. Provisionally GB registered its third lowest rainfall total in the last 43 months. A continuation of a notable longer term rainfall deficiency in the north and west, contributed to the second lowest winter (Dec-Feb) rainfall total for Scotland since 1964. To the south, winter rainfall totals for all regions were within the normal range, but above average rainfall again characterised much of the English lowlands – many catchments reported their fifth successive wet winter. Western and northern Scotland aside, regional rainfall accumulations over the last 12 months are also above average – notably so for Thames and East Anglia; Northern Ireland is also relatively wet in this timeframe.

River Flow

In contrast to the exceptional flows - and associated high flood risk - that typified many rivers earlier in the winter, February saw recessions extending throughout most of the month – but with steep recoveries around month-end in many basins. February runoff totals displayed a clear distinction between the responsive, impermeable catchments in the west and north and baseflow-dominated rivers in the English Lowlands. In the former, February mean flows were well below normal – some Scottish and Welsh rivers registering only around 50% of average. Similarly modest runoff typified a few impermeable lowland catchments but spring-fed rivers – benefiting from the exceptional groundwater recharge earlier in the winter – remained close to seasonal maxima. Relative to the long-term average there was a strong SE/NW gradient in runoff for the winter as a whole. In western Scotland the river Nevis registered its second lowest Dec-Feb runoff on record, whilst the Stringside and Little Ouse (in East Anglia) recording new maximum winter runoff totals. In many more chalk streams the winter runoff ranks second only to 2000/01; over the last three winters runoff has typically exceeded the preceding average by 50% or more – corresponding to a substantial redefinition of the high flow regime at many gauging stations.

Groundwater

Rainfall was below 50% of the February average across large parts of the Chalk outcrop and the dry, mild spell in mid-month saw modest soil moisture deficits established in some eastern and southern areas. Infiltration rates were well below average for February – typically 25-50% of average - helping to avoid a repeat of the extensive groundwater flooding in early 2001 when late-winter water-tables reached the surface in many 'dry' valleys. Significant declines in groundwater levels were reported for a number of the more responsive Chalk wells and boreholes in February (e.g.Chilgrove and Rockley); nonetheless, levels remain notably high (Killyglen in Northern Ireland remains an exception). In many slower-responding wells (e.g. Therfield), levels are still rising and exceed pre-2000 February maxima in some areas, including the Chilterns. Levels in the Middle Jurassic of the Cotswolds have fallen to within the normal range but in most limestone outcrops, late-winter levels are close to seasonal maxima. Spatial variability is considerable across the Permo-Triassic sandstone outcrops but, aside from wells affected by abstraction (e.g. Redbank), levels remain high – exceptionally so for some index wells in North Wales, the North-West and the Midlands. The early March rainfall has arrested the development of soil moisture deficits but the length of the 2002/03 recharge season will be heavily dependant on rainfall over the next 4-6 weeks.

Centre for Ecology & Hydrology
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Rainfall . . . Rainfall . . .

Rainfall accumulations and return period estimates

Area	Rainfall	Feb 2003	Dec 02-Feb 03	RP	Sep 02-Feb 03	RP	Jun 02-Feb 03	RP	Mar 02-Feb 03	RP
England & Wales	**mm**	**39**	**278**		**639**		**864**		**1046**	
	%	**60**	**111**	**2-5**	**125**	**10-20**	**121**	**10-20**	**115**	**5-10**
North West	mm	51	288		656		959		1225	
	%	65	89	2-5	95	2-5	100	<2	102	2-5
Northumbrian	mm	24	217		489		731		892	
	%	40	97	2-5	107	2-5	110	2-5	105	2-5
Severn Trent	mm	27	195		459		641		794	
	%	50	97	2-5	115	2-5	111	2-5	105	2-5
Yorkshire	mm	34	231		505		763		909	
	%	59	105	2-5	115	2-5	120	5-15	111	2-5
Anglian	mm	20	189		414		591		715	
	%	53	133	5-10	138	25-40	130	20-30	120	10-20
Thames	mm	26	227		497		666		833	
	%	58	127	5-10	136	10-20	126	10-20	121	5-15
Southern	mm	34	272		587		749		922	
	%	63	126	5-10	130	10-20	123	5-15	118	5-10
Wessex	mm	42	252		632		786		990	
	%	64	103	2-5	132	10-20	120	5-10	118	5-10
South West	mm	84	358		776		953		1232	
	%	83	95	2-5	109	2-5	102	2-5	105	2-5
Welsh	mm	61	347		816		1028		1327	
	%	63	88	2-5	104	2-5	98	2-5	101	2-5
Scotland	**mm**	**58**	**294**		**672**		**1014**		**1333**	
	%	**57**	**73**	**5-15**	**79**	**10-20**	**88**	**5-10**	**93**	**2-5**
Highland	mm	70	339		669		1011		1378	
	%	55	66	10-20	62	120-170	71	50-80	78	30-40
North East	mm	26	221		628		937		1116	
	%	40	86	2-5	116	5-10	122	10-20	115	5-15
Tay	mm	47	266		667		1029		1343	
	%	50	73	5-10	91	2-5	106	2-5	109	2-5
Forth	mm	41	223		581		922		1196	
	%	52	73	5-10	90	2-5	105	2-5	108	2-5
Tweed	mm	31	225		559		837		1039	
	%	46	86	2-5	104	2-5	110	2-5	107	2-5
Solway	mm	70	315		812		1183		1533	
	%	69	78	5-10	96	2-5	104	2-5	108	2-5
Clyde	mm	77	314		760		1160		1569	
	%	65	65	10-20	73	15-25	84	5-10	93	2-5
Northern Ireland	**mm**	**65**	**242**		**649**		**921**		**1220**	
	%	**83**	**82**	**2-5**	**107**	**2-5**	**110**	**2-5**	**115**	**5-10**

RP = Return period

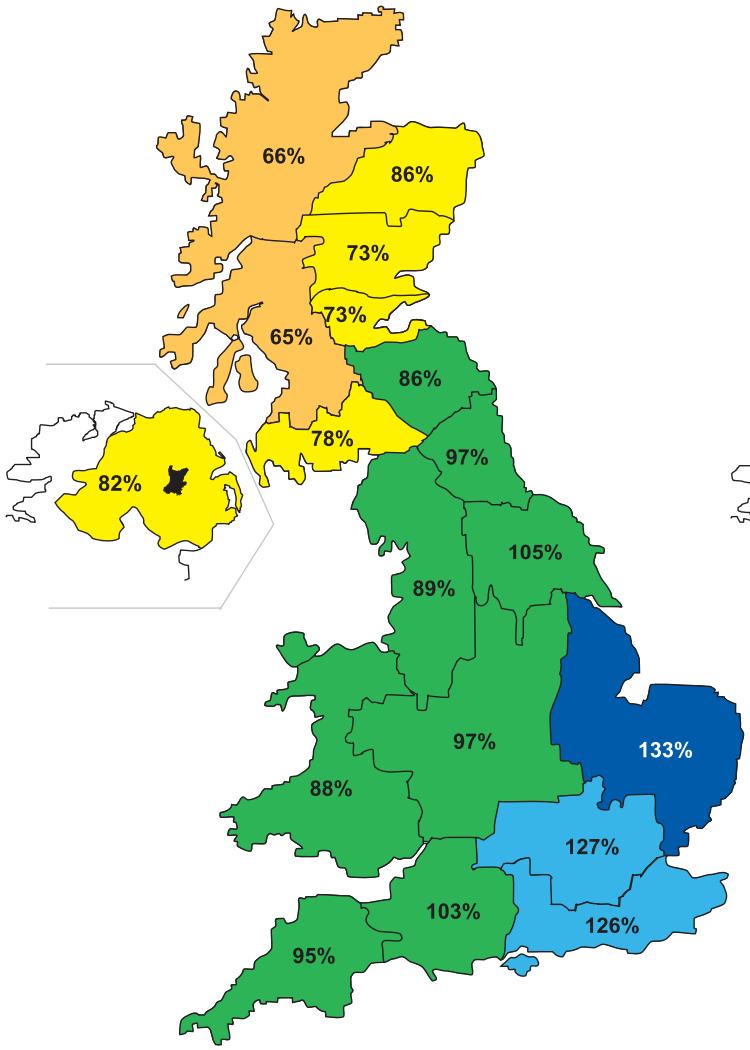
 All monthly totals since December 1998 are provisional (see page 12). The figures for England & Wales are derived by the Hadley Centre and are updates of the homogenised series developed by the Climate Research Unit; the other national figures are derived from different raingauge networks to those used to derive the CRU data series. The return period estimates are based on tables provided by the Met 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.

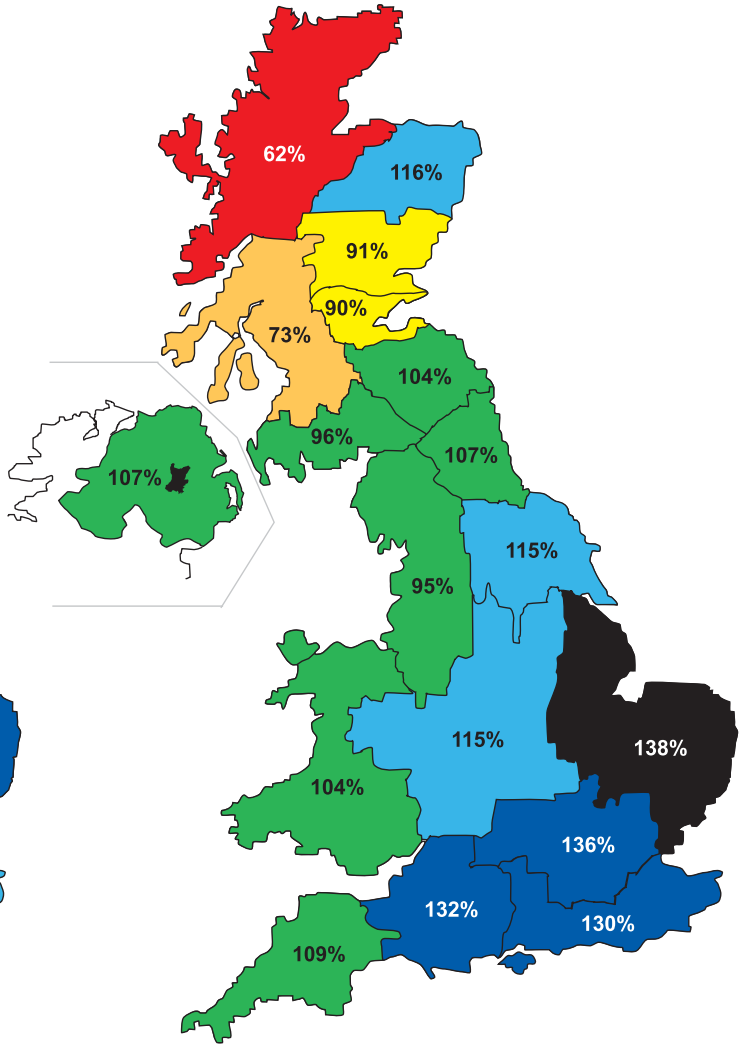
*See page 12.

Rainfall . . . Rainfall . .

Key

00%	Percentage of 1961-90 average
	Very wet
	Substantially above average
	Above average
	Normal range
	Below average
	Substantially below average
	Exceptionally low rainfall



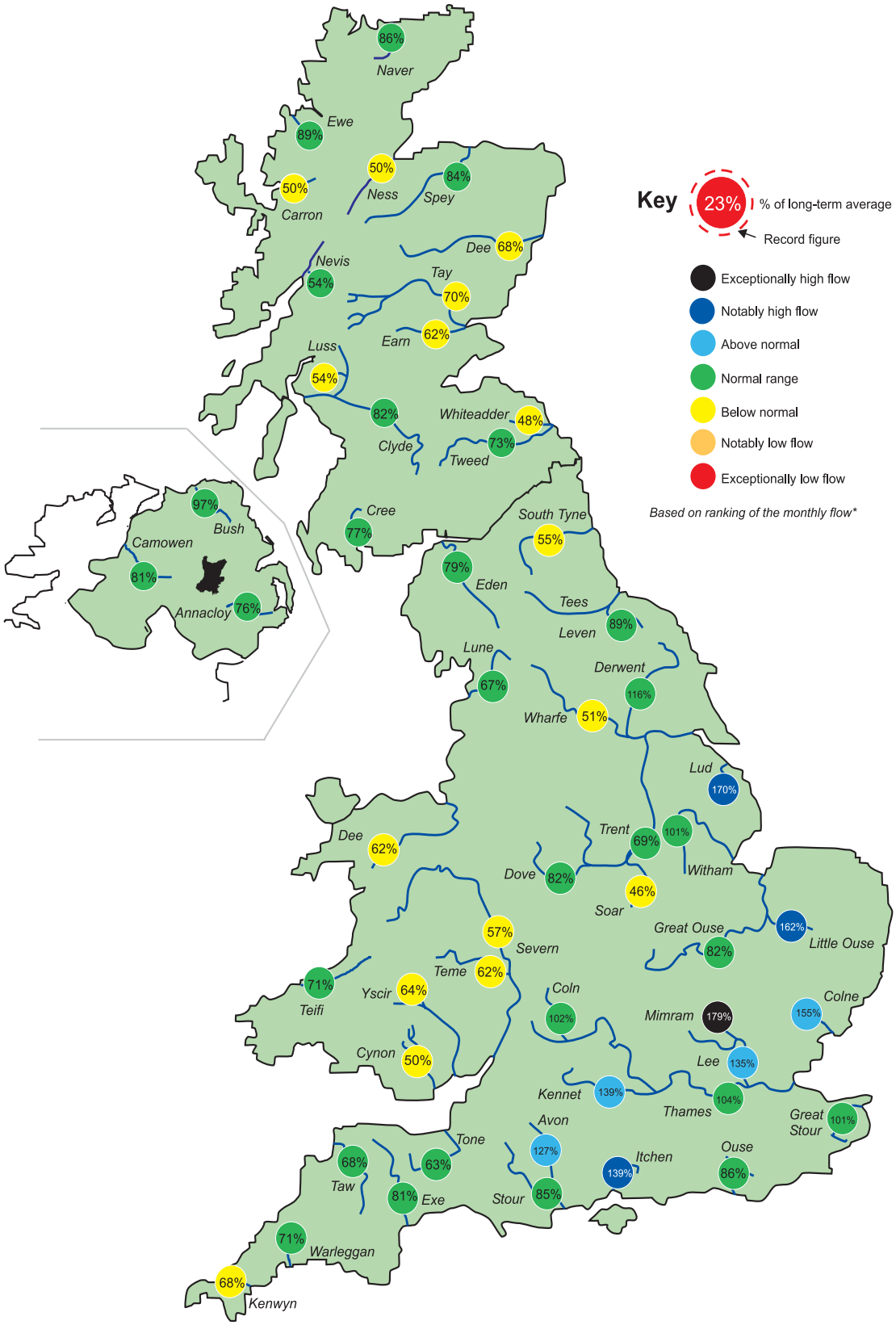


December 2002 - February 2003 **September 2002 - February 2003**

Rainfall accumulation maps

The wet December helped ensure the winter rainfall total for England and Wales was again above average - for the sixth successive year (although the average was only marginally exceeded in a couple of the winters). Like Scotland, Northern Ireland was relatively dry, provisionally the Dec-Feb rainfall total was the second lowest since 1985. Over the six-month timespan, rainfall was exceptionally low in much of northern and western Scotland; for the Highland Region the Sep-Feb total was the lowest in the 27-year regional series.

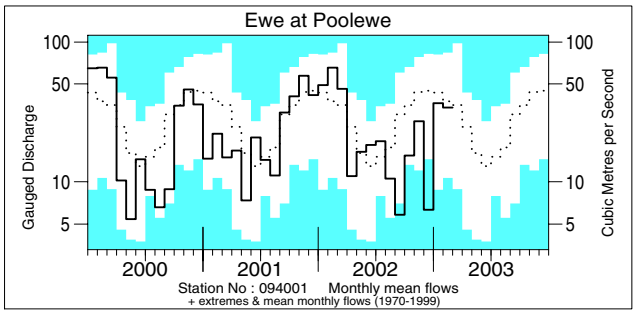
River flow . . . River flow . . .

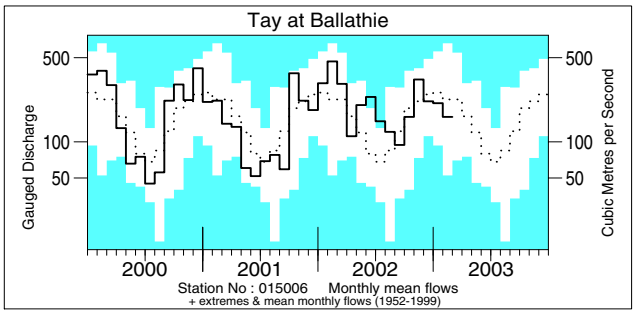


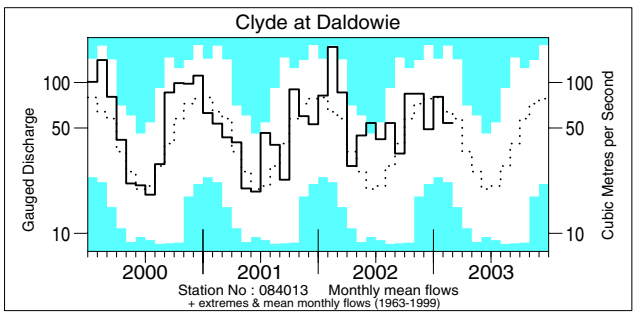
River flows - February 2003

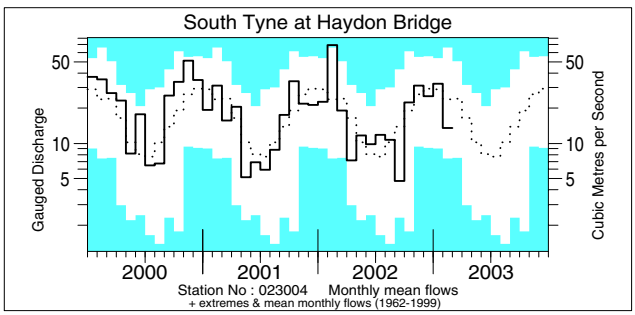
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

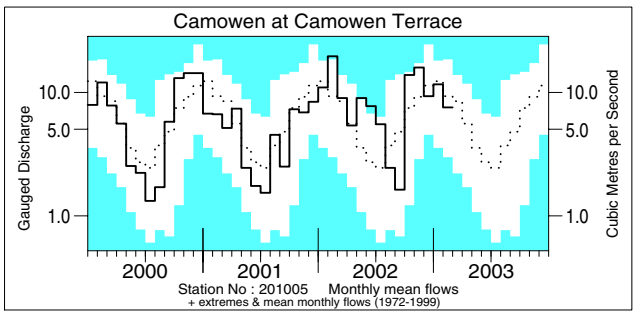
River flow . . . River flow . . .

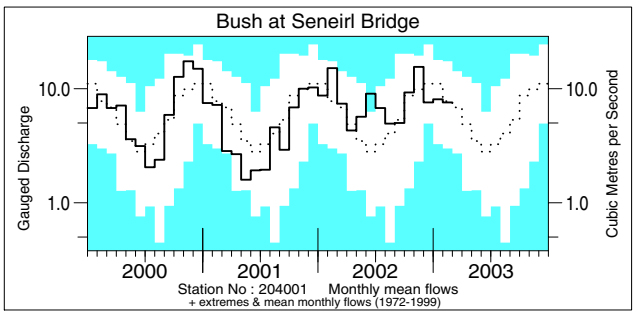


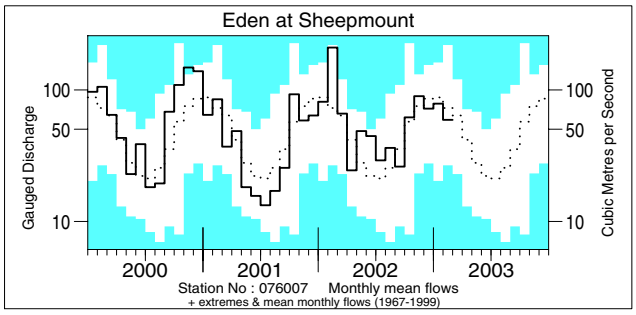


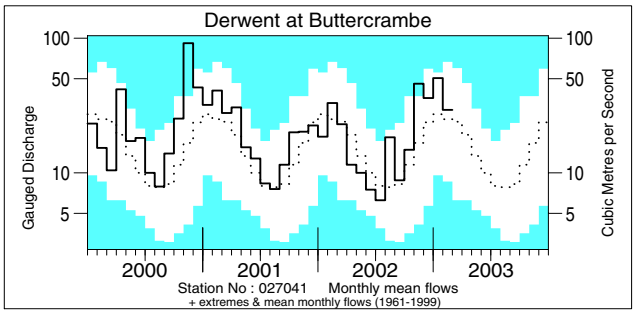


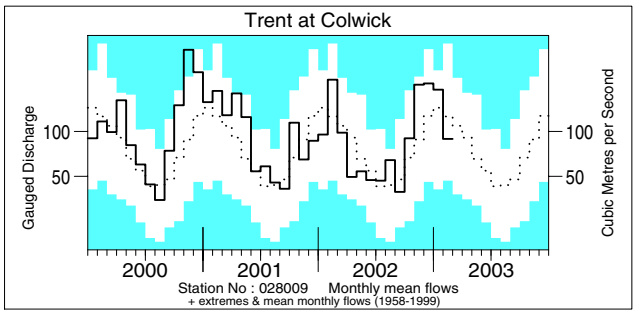


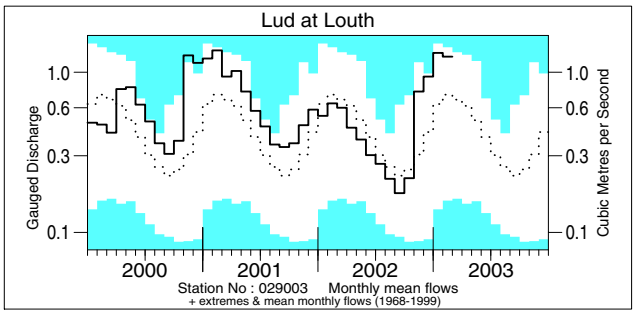








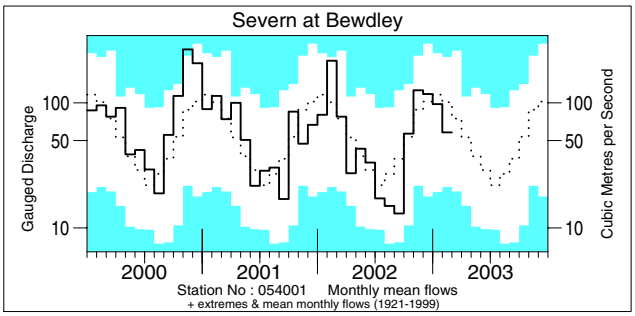


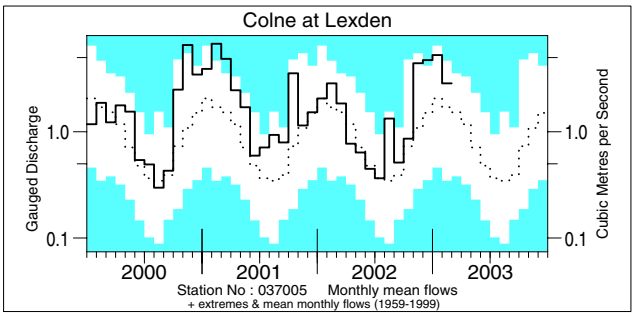


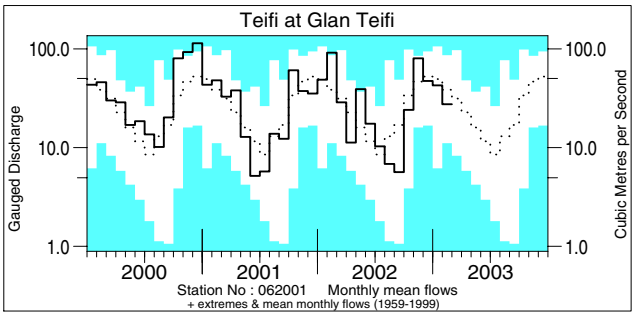
Monthly river flow hydrographs

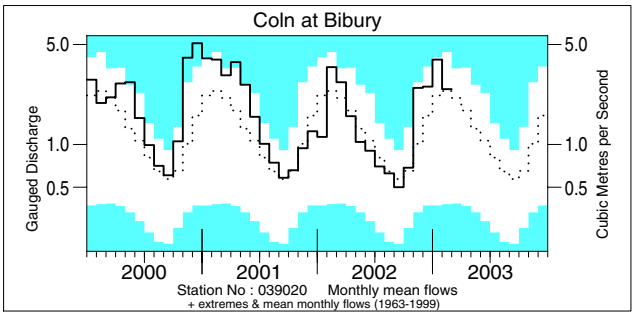
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 2000 (shown by the shaded areas). Monthly flows falling outside the maximum/ minimum range are indicated where the bold trace enters the shaded areas.

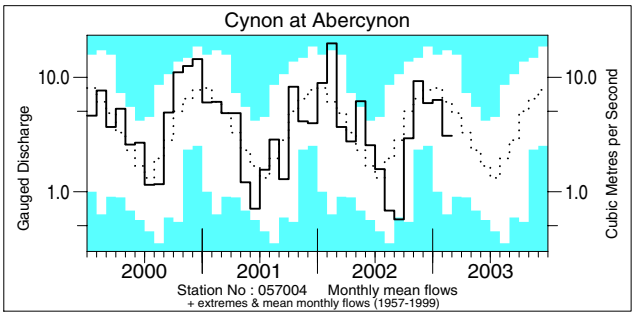
River flow . . . River flow . . .

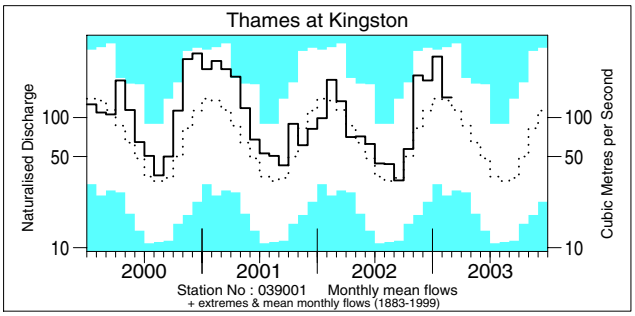


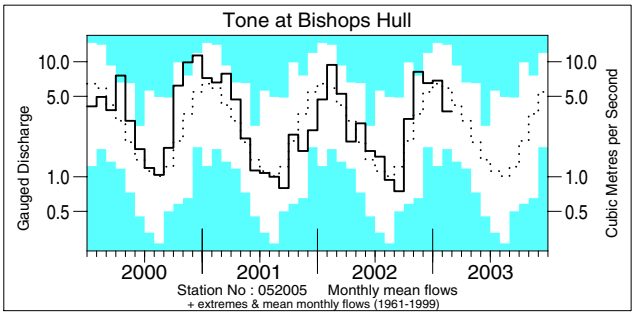


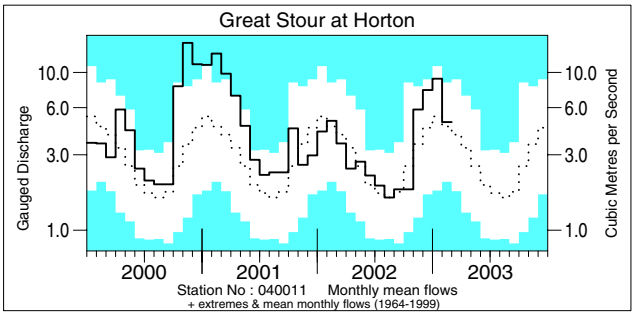


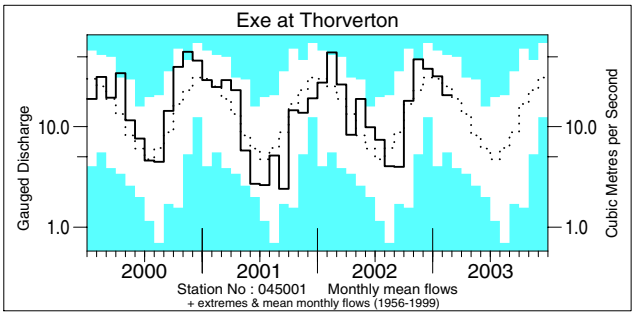


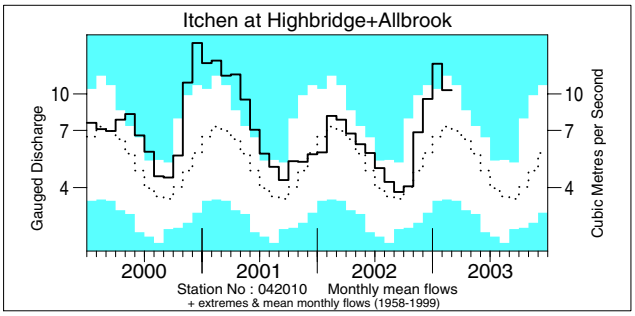












Notable runoff accumulations (a) December 2002 - February 2003, (b) September 2002 - February 2003

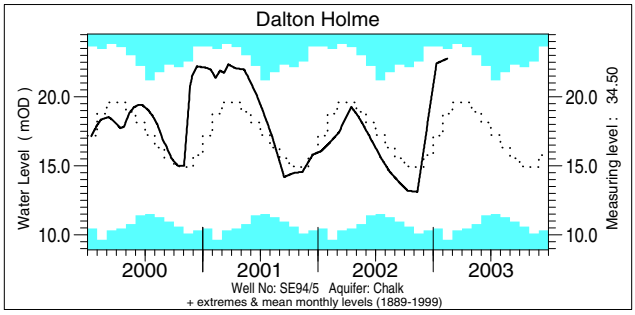
	River	%lta	Rank
a)	Dover Beck	177	27/28
	Bedford Ouse	183	68/70
	Stringside	220	37/37
	Little Ouse	189	33/33
	Colne	234	42/43
	Lee	196	114/118
	Blackwater	177	50/51
	Lambourn	207	40/41
	Nevis	63	2/21

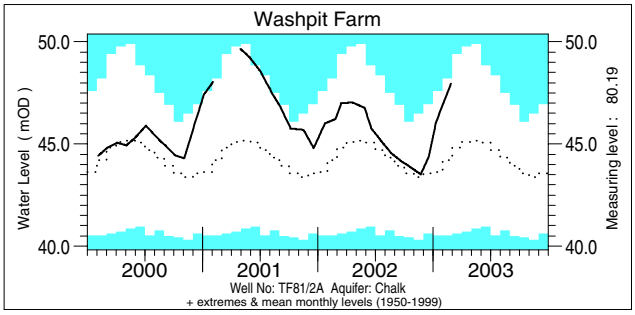
	River	%lta	Rank
b)	Ness	56	2/30
	Deveron	161	40/40
	Dee	148	29/30
	Torne	169	30/31
	Thames N	167	114/120
	Kennet	177	40/41
	Mole	166	27/28

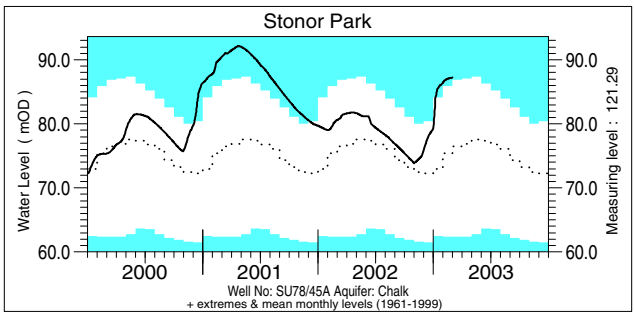
River	%lta	Rank
Lymington	198	39/40
Test	161	43/44
Stour (Dorset)	175	29/30
Cree	79	3/39
Luss	61	1/24
Carron	46	1/24
Naver	72	1/26
Annacloy	161	22/23

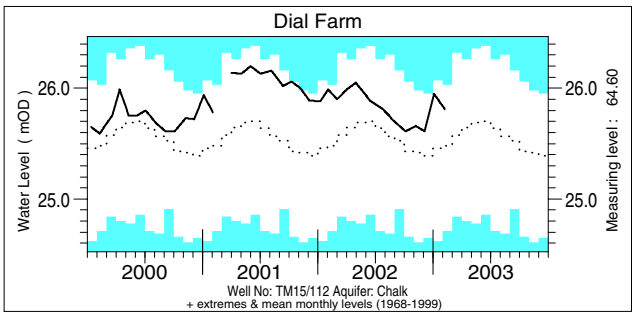
lta = long term average
Rank 1 = lowest on record

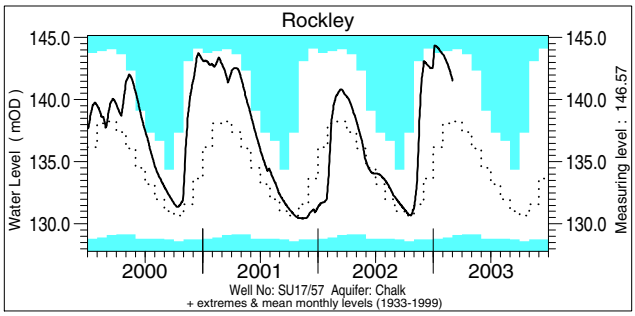
Groundwater . . . Groundwater

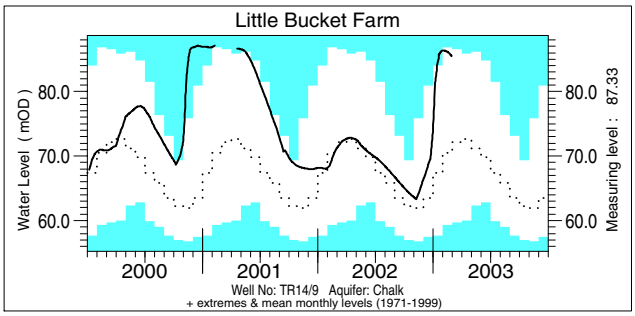


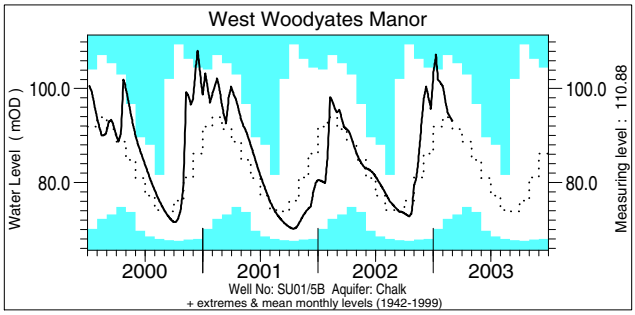


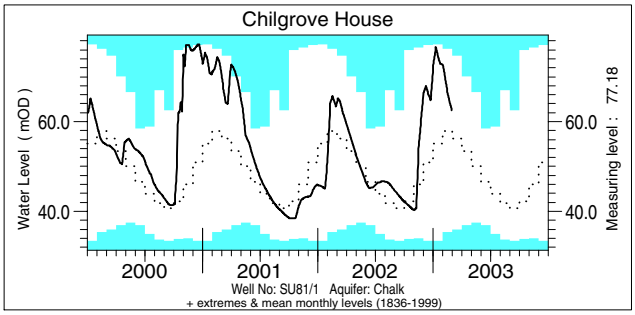


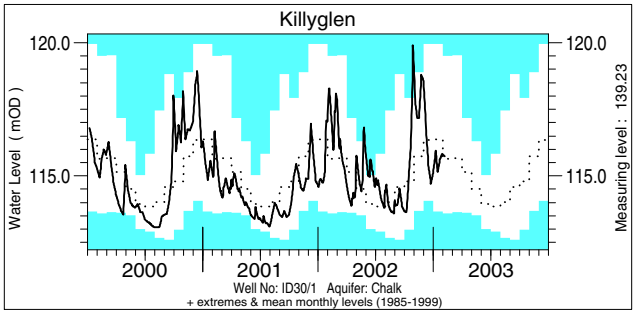


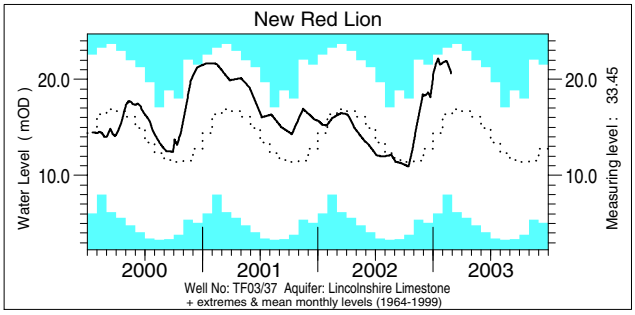






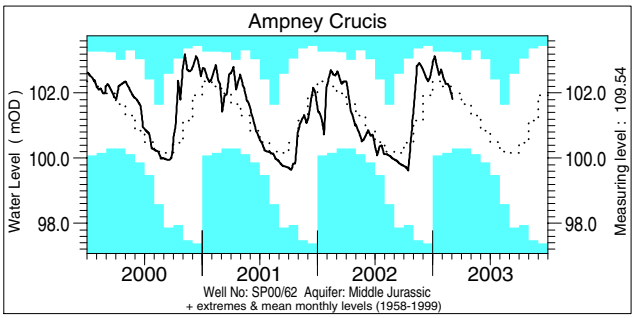


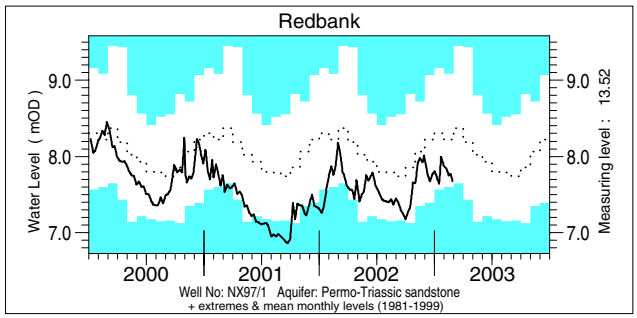


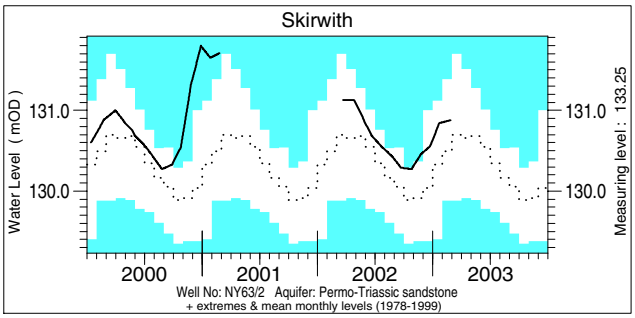


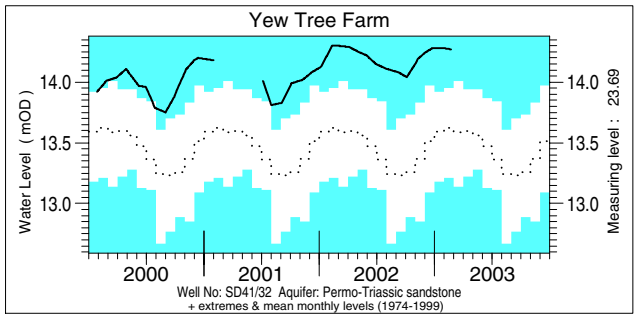
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

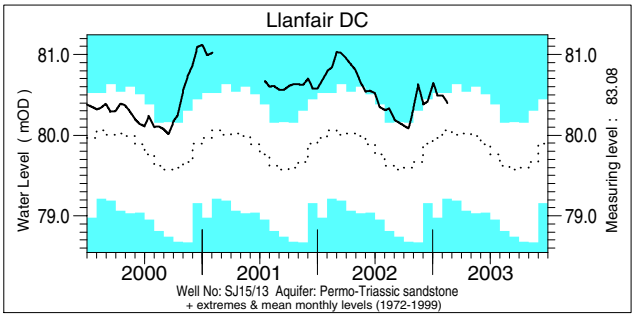
Groundwater . . . Groundwater

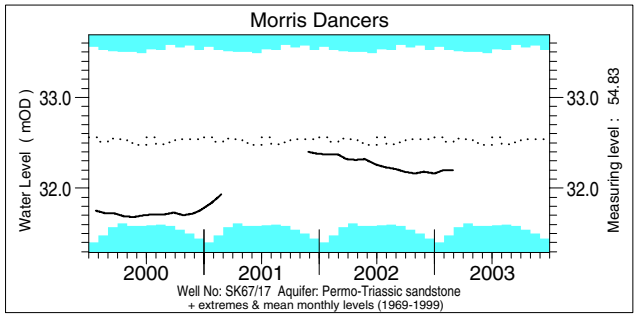


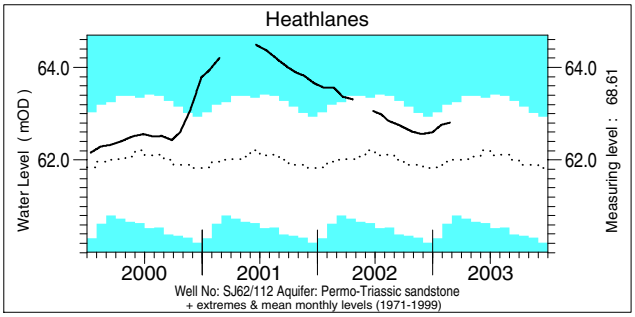


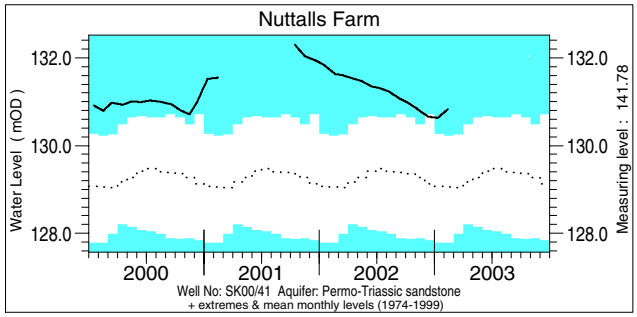


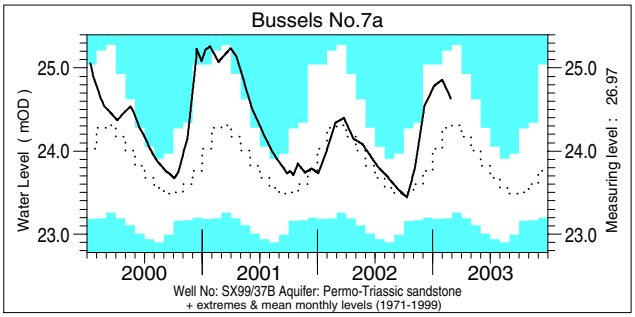


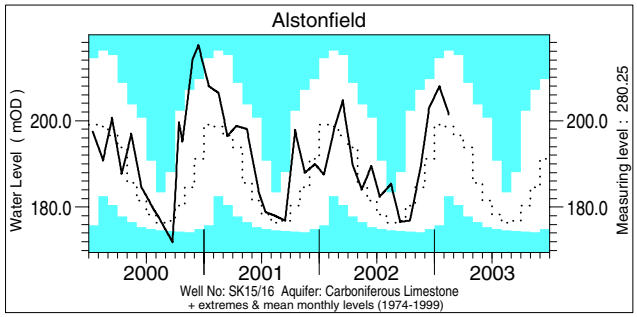










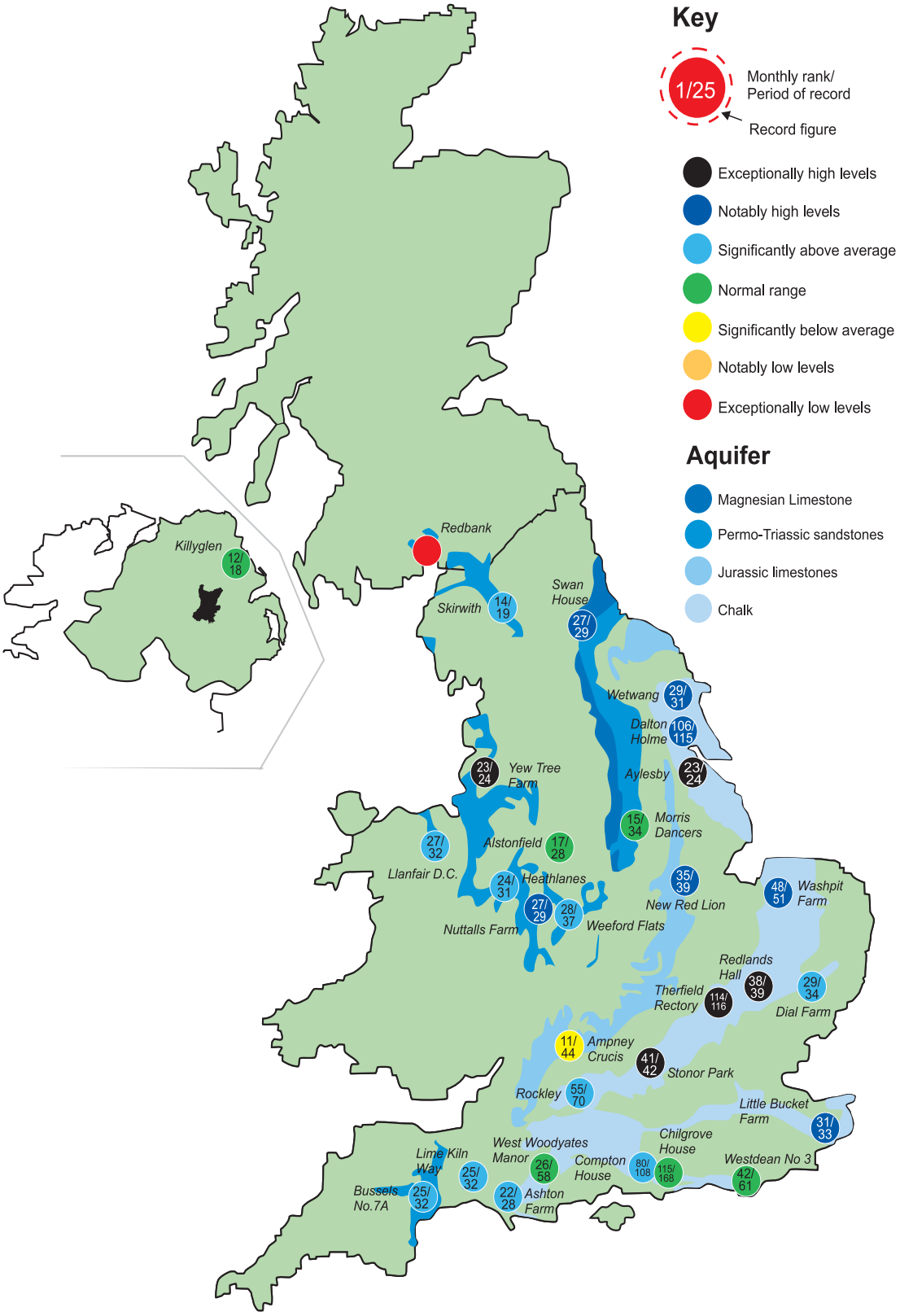


Groundwater levels February 2003 / March 2003

Borehole	Level	Date	Feb. av.	Borehole	Level	Date	Feb. av.	Borehole	Level	Date	Feb. av.
Dalton Holme	22.76	13/02	18.71	Chilgrove House	62.51	28/02	57.58	Llanfair DC	80.40	15/02	80.03
Washpit Farm	47.96	25/02	44.33	Killyglen	115.73	05/02	115.77	Morris Dancers	32.20	28/02	32.39
Stonor Park	87.23	02/03	75.75	New Red Lion	20.62	26/02	16.24	Heathlanes	62.81	24/02	62.02
Dial Farm	25.81	06/02	25.51	Ampney Crucis	101.81	03/03	102.23	Nuttalls Farm	130.83	11/02	129.41
Rockley	141.52	02/03	138.27	Redbank	7.67	26/02	8.30	Bussels No.7a	24.63	26/02	24.32
Little Bucket Farm	85.47	28/02	70.15	Skirwith	130.88	26/02	130.61	Alstonfield	201.45	14/02	198.62
West Woodyates	93.16	28/02	93.22	Yew Tree Farm	14.27	21/02	13.66				

Levels in metres above Ordnance Datum

Groundwater . . . Groundwater

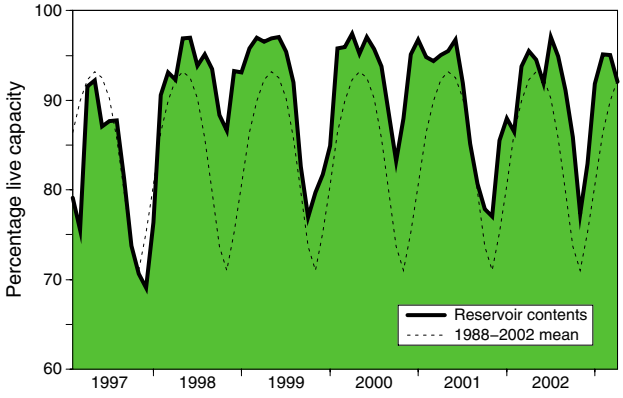


Groundwater levels - February 2003

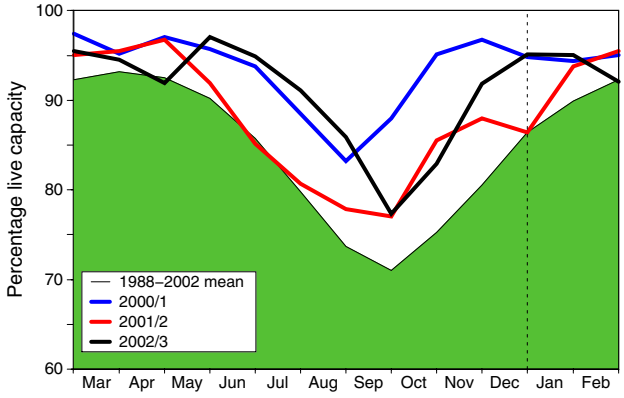
The rankings are based on a comparison between the average level in the featured month (but often only single readings are available) and the average level in each corresponding month on record. They need to be interpreted with caution especially when groundwater levels are changing rapidly or when comparing 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.

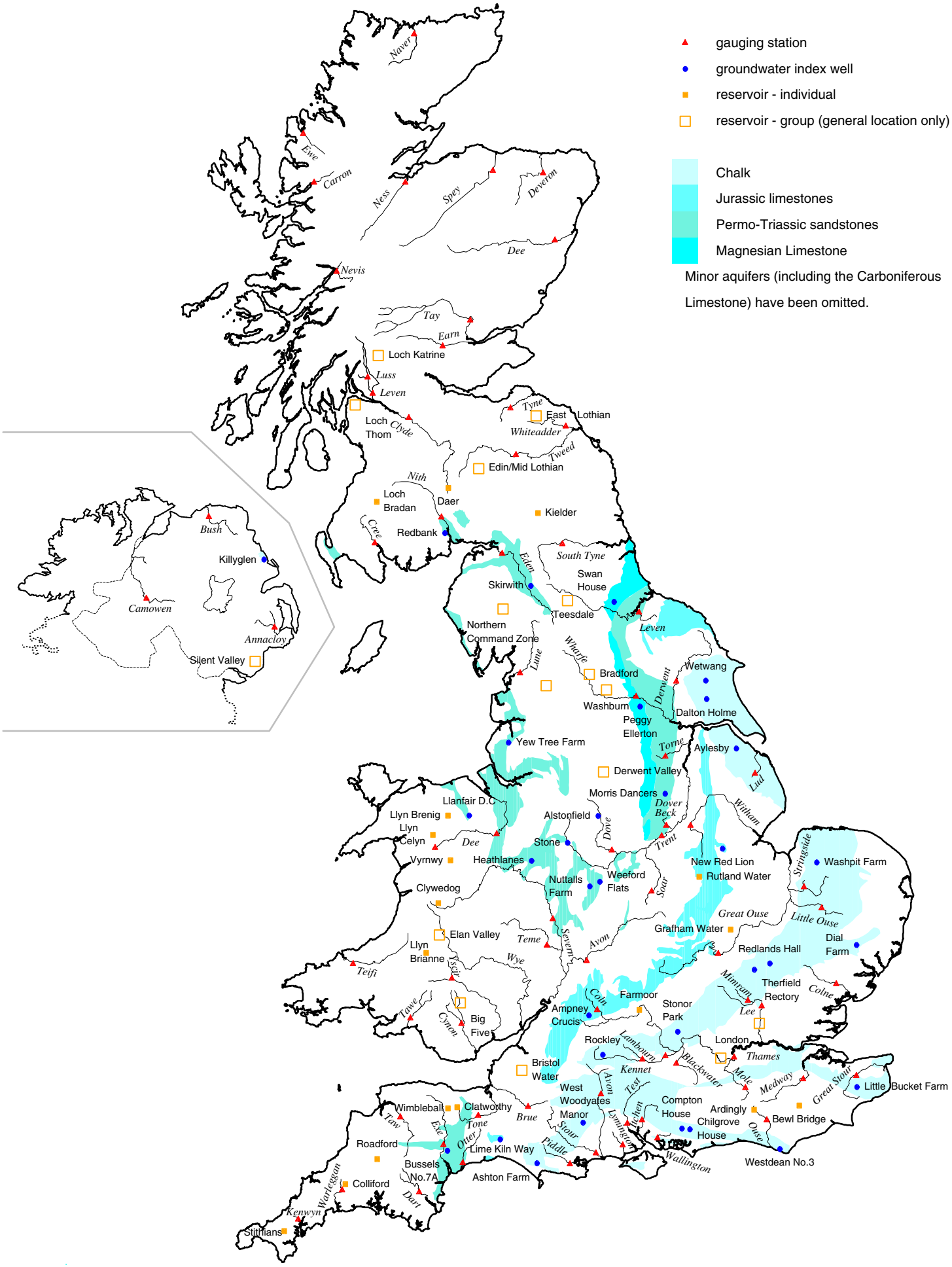
Percentage of live capacity of selected reservoirs at start of month

Area	Reservoir	Capacity (Ml)	2002 Oct	Nov	Dec	2003 Jan	Feb	Mar	Min. Mar	Year* of min.
North West	N Command Zone	• 124929	68	66	79	86	93	**89**	78	1996
	Vyrnwy	55146	62	86	99	99	94	**92**	59	1996
Northumbrian	Teesdale	• 87936	77	89	92	93	93	**79**	72	1996
	Kielder	(199175)	(86)	(94)	(90)	(99)	(99)	**(91)**	(81)	1993
Severn Trent	Clywedog	44922	71	86	78	88	81	**85**	77	1996
	Derwent Valley	• 39525	78	95	99	100	98	**98**	46	1996
Yorkshire	Washburn	• 22035	75	89	90	99	97	**97**	53	1996
	Bradford supply	• 41407	83	95	100	100	100	**96**	53	1996
Anglian	Grafham	(55490)	(89)	(88)	(90)	(89)	(84)	**(86)**	(72)	1997
	Rutland	(116580)	(85)	(89)	(94)	(93)	(90)	**(87)**	(71)	1992
Thames	London	• 202340	81	84	96	97	97	**92**	83	1988
	Farmoor	• 13830	91	83	94	91	91	**93**	64	1991
Southern	Bewl	28170	78	73	80	86	92	**92**	50	1989
	Ardingly	4685	92	88	100	100	100	**100**	89	1992
Wessex	Clatworthy	5364	62	73	100	100	100	**100**	82	1992
	Bristol WW	• (38666)	(71)	(78)	(93)	(99)	(98)	**(97)**	(65)	1992
South West	Colliford	28540	63	63	71	78	81	**83**	57	1997
	Roadford	34500	83	82	91	95	92	**92**	35	1996
	Wimbleball	21320	73	80	98	100	100	**100**	72	1996
	Stithians	5205	54	55	84	100	99	**100**	45	1992
Welsh	Celyn and Brenig	• 131155	88	90	94	96	96	**99**	69	1996
	Brianne	62140	80	83	98	99	99	**97**	94	1998
	Big Five	• 69762	53	62	89	96	99	**98**	85	1988
	Elan Valley	• 99106	64	68	100	100	100	**99**	88	1993
Scotland(E)	Edinburgh/Mid Lothian	• 97639	88	89	94	95	99	**96**	73	1999
	East Lothian	• 10206	92	100	99	99	100	**98**	91	1990
Scotland(W)	Loch Katrine	• 111363	74	77	88	89	97	**95**	93	1999
	Daer	22412	94	100	100	100	99	**95**		
	Loch Thom	• 11840	87	100	100	100	100	**100**	98	2001
Northern Ireland	Total+	•	75	95	100	99	98	**96**	82	2002
	Silent Valley	• 20634	69	93	100	98	98	**92**	57	2002

() figures in parentheses relate to gross storage • denotes reservoir groups +excludes Lough Neagh *last occurrence - see footnote

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 1988-2003 period only (except for West of Scotland and Northern Ireland where data commence in the mid-1990's). 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 for Environment, Food and Rural Affairs (Defra), 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, Scottish Water 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.

NATURAL ENVIRONMENT RESEARCH COUNCIL

*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.nerc-wallingford.ac.uk/ih/nrfa/index.htm
Navigate via Water Watch

02/03