Hydrological summary *for the United Kingdom*

February 2002

General

February was a very mild and notably wet month particularly in western and northern regions. Provisional data suggest that the February rainfall total was amongst the three highest for the UK in a record from 1900. Notwithstanding drawdown releases for flood alleviation purposes in some major impoundments, most reservoirs were at, or close to, capacity entering March (and a brisk recovery was underway at Silent Valley in Northern Ireland). Overall reservoir stocks for England and Wales are around 95% of capacity. Following heavy late winter aquifer replenishment water-tables are mostly well above the seasonal average. The general water resources outlook is very healthy. With most catchments saturated, the flood risk remained high throughout February; flood warnings were very common and floodplain inundations were widespread – adding to a notable cluster of high flow events over the last three years.

Rainfall

Weather patterns were dominated by a westerly airflow during February, bringing a sequence of vigorous – and damaging - frontal systems across the UK. A particularly active depression produced notable rainfalls in western areas on the 1st (approx. 75 mm at Shap in Cumbria) and regular pulses of significant rainfall continued throughout the month. Eskdalemuir (Borders) reported 11 days with rainfall > 38 mm and even across the English Lowlands dry days were rare. Below average February rainfall was confined to a few sheltered eastern coastal districts but most of the country reported more than twice the 1961-90 average. Some western upland catchments from the Cumbrian Mts to the western Highlands recorded more than three times the 1961-90 average (corresponding return periods exceed 200 years). An exceptionally wet interlude can be traced back to mid January; many western areas registered outstanding precipitation totals over the ensuing 7 weeks or so. At Bala (N Wales), a new 40-day maximum rainfall total was established – 522 mm, the equivalent of around four months average winter rainfall. Regional two-month rainfall totals are generally very high (see page 2) but the counterbalancing effect of the dry early winter means that Dec-Feb rainfall totals are mostly in the normal range; this is also true of most regional accumulations over the 4-12 month timespans.

Runoff

The month began with many flood warnings (both fluvial and tidal) in operation, and bankfull – or higher – flows were common throughout February. The rapid passage of frontal systems helped to moderate the risk of extreme flooding and, in many catchments, multiple spates were reported rather than outstanding flow maxima. The natural ability of the drainage network to cope with exceptional runoff was well demonstrated but, locally, flooding was severe (e.g. in Monmouth) and floodplain inundations were widespread in mid-month. On the 11th the Wharfe closely approached the peak of Oct 2000 (the highest in a record from 1955). In a broad zone from South Wales to the Southern Uplands, many rivers registered flows around the mean annual flood level (or greater) on four or more separate occasions. In the English lowlands, a combination of sustained rainfall and increasing groundwater contributions made for a brisk and sustained increase in streams draining permeable catchments. Monthly runoff totals were well above average in almost all index rivers and gauging stations establishing new maxima Feb runoff totals showed a wide distribution (from the Naver to the Exe). Runoff in February for the Welsh Dee was the highest for any month in a 65-year record (marginally exceeding the November 2000 figure). The much belated onset of a sustained seasonal recovery in river flows (mid-January in many areas) is reflected in the winter (December-February) runoff totals – most are well within the normal range). Continued unsettled weather saw the flood risk extend into March.

Groundwater

Very modest early winter infiltration rates have been followed by a surge in aquifer replenishment over the last eight weeks. Over wide areas the sustained February rainfall (mostly of moderate intensity) on near-saturated catchments resulted in two-to-three times the average infiltration for the month. A proportion of this has yet to reach water-tables but groundwater levels are rising briskly with a corresponding upturn in spring outflows. Groundwater levels in the Chalk are considerably below the remarkable 2000/01 peaks, but still well above average – notably so in some eastern units. In most index wells in the limestone aquifers, late winter levels are close to the seasonal average (and rising). Levels are well above average throughout most of the Permo-Triassic sandstones outcrops – notably so in the west where Yew Tree Farm and Nuttals Farm were amongst those wells and boreholes establishing new record February levels – a response both to recent rainfall and abundant recharge over the previous three winters. A strong recovery is also evident at Redbank where levels are influenced by significant abstraction. Around average spring rainfall would ensure a very healthy groundwater resources outlook – and sustained baseflow support for spring-fed rivers through the coming summer and autumn.

Centre for Ecology & Hydrology
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Rainfall accumulations and return period estimates

Area	Rainfall	Feb 2002	Jan02-Feb02	RP	Sep01-Feb02	RP	Jun01-Feb02	RP	Mar01-Feb02	RP
England & Wales	**mm**	**114**	**199**		**523**		**726**		**963**	
	%	**175**	**128**	**5-10**	**103**	**2-5**	**102**	**2-5**	**105**	**2-5**
North West	mm	222	353		804		1023		1253	
	%	285	177	50-80	117	5-10	106	2-5	104	2-5
Northumbrian	mm	137	219		538		729		878	
	%	232	153	10-20	117	5-10	110	2-5	103	2-5
Severn Trent	mm	109	172		425		599		818	
	%	202	139	5-10	106	2-5	104	2-5	108	2-5
Yorkshire	mm	120	178		476		650		828	
	%	207	130	5-10	108	2-5	103	2-5	101	2-5
Anglian	mm	55	99		336		516		707	
	%	148	114	2-5	112	2-5	113	2-5	119	5-10
Thames	mm	85	155		402		564		779	
	%	188	142	5-10	110	2-5	107	2-5	113	2-5
Southern	mm	94	178		466		615		836	
	%	174	133	5-10	104	2-5	101	2-5	107	2-5
Wessex	mm	112	204		461		631		858	
	%	173	134	5-10	96	2-5	96	2-5	102	2-5
South West	mm	164	316		660		844		1118	
	%	162	132	5-10	93	2-5	90	2-5	95	2-5
Welsh	mm	218	378		856		1113		1425	
	%	225	158	15-25	109	2-5	107	2-5	108	2-5
Scotland	**mm**	**231**	**442**		**979**		**1267**		**1450**	
		227	**175**	**>200**	**115**	**5-10**	**110**	**2-5**	**101**	**2-5**
Highland	mm	284	545		1241		1573		1791	
	%	224	173	110-150	114	5-10	111	5-10	102	2-5
North East	mm	117	225		615		844		1010	
	%	180	137	5-15	114	2-5	110	2-5	104	2-5
Tay	mm	207	421		853		1111		1289	
	%	218	176	50-80	117	5-10	114	5-10	105	2-5
Forth	mm	183	342		698		945		1108	
	%	232	174	60-90	108	2-5	107	2-5	100	< 2
Tweed	mm	168	298		620		849		1009	
	%	250	178	60-90	116	5-10	111	2-5	104	2-5
Solway	mm	250	453		941		1208		1420	
	%	247	176	70-100	111	2-5	106	2-5	100	< 2
Clyde	mm	288	540		1137		1507		1714	
	%	244	176	110-150	109	2-5	110	2-5	101	2-5
Northern Ireland	**mm**	**162**	**286**		**588**		**811**		**1000**	
	%	**207**	**151**	**10-20**	**97**	**2-5**	**97**	**2-5**	**94**	**2-5**

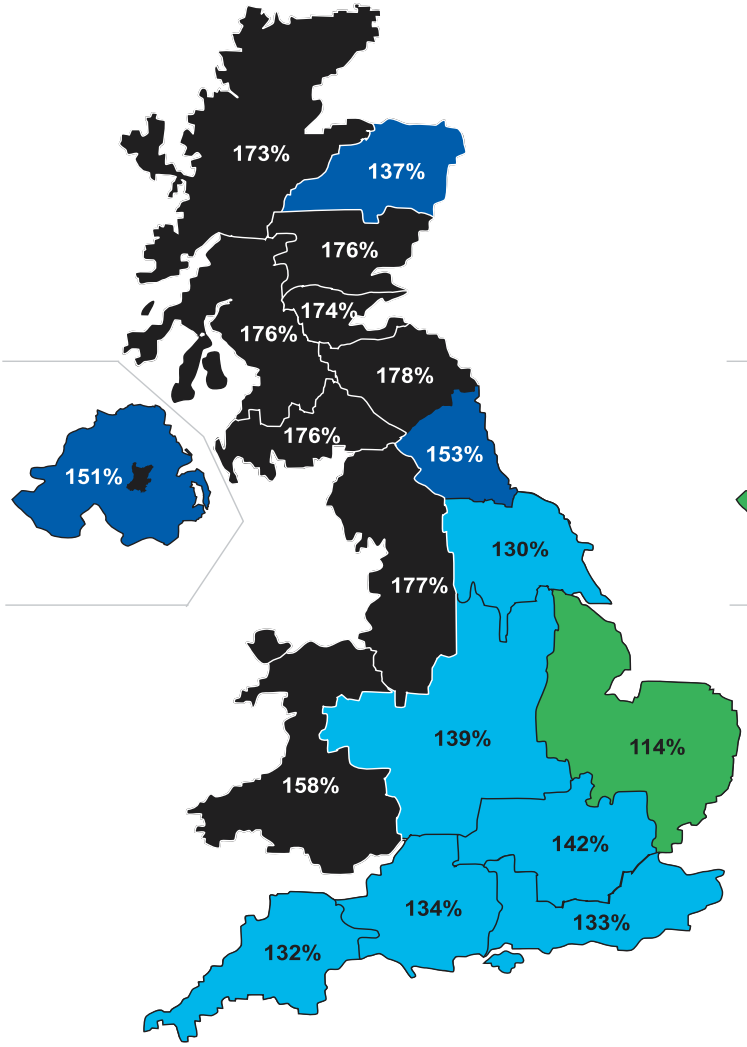
RP = Return period

 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.

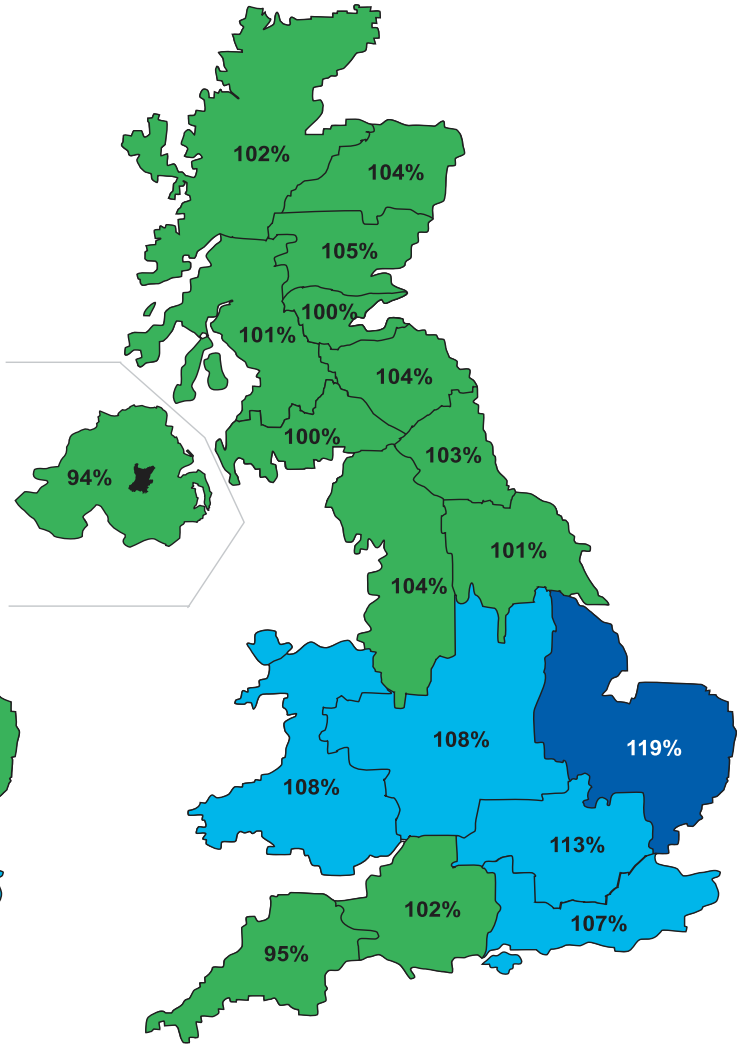
Rainfall . . . Rainfall . . . Rainfall

Key

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



January 2002 - February 2002

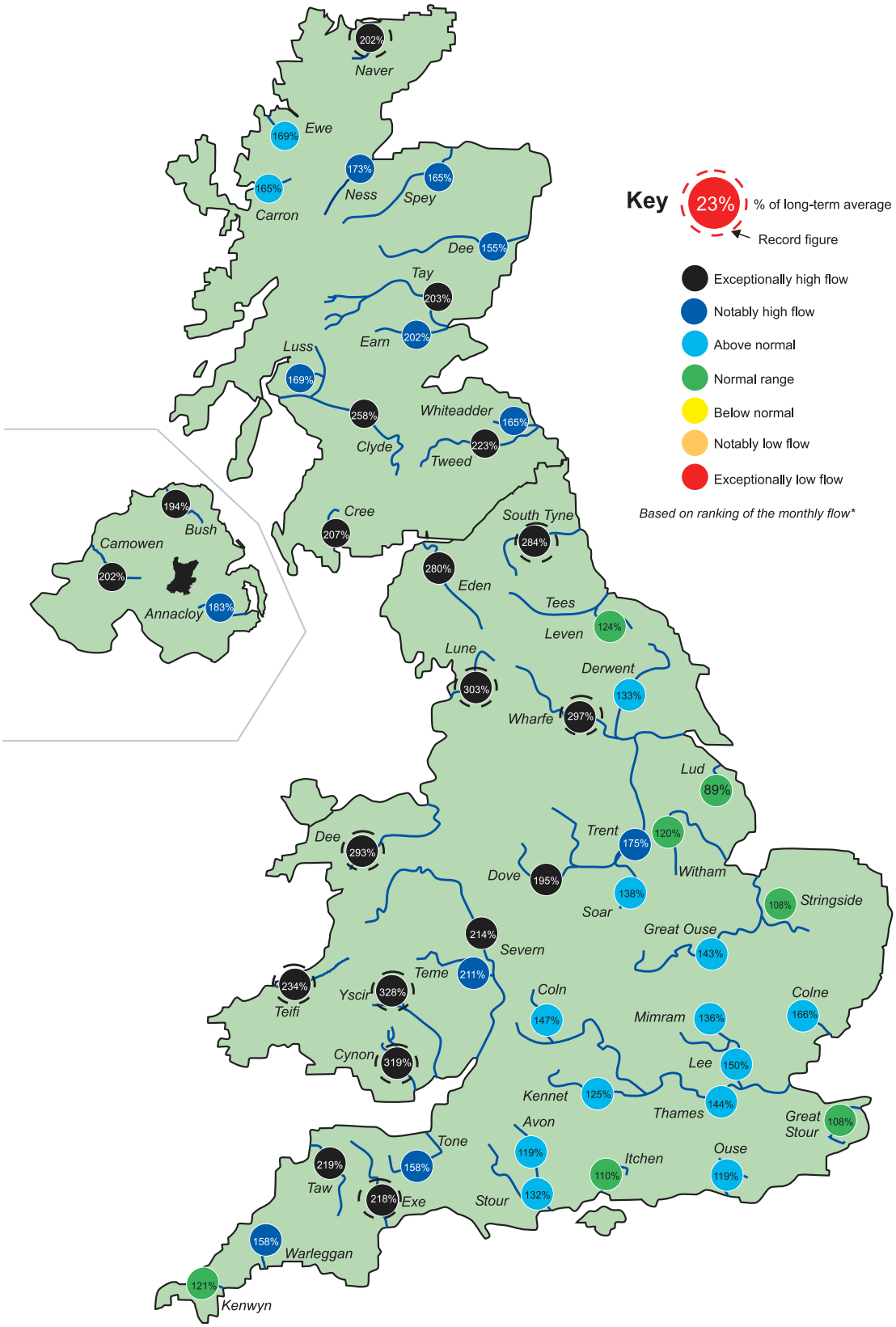


March 2001 - February 2002

Rainfall accumulation maps

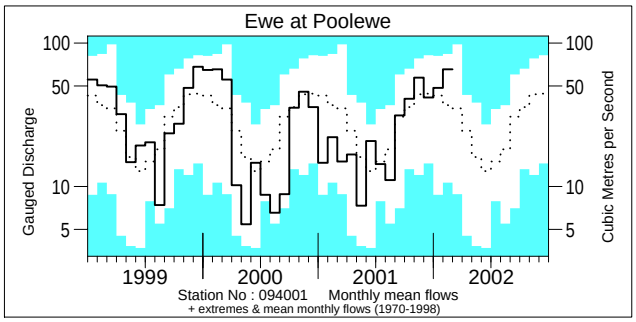
The combined January and February rainfall totals were high in all regions but an accentuation in the normal NW/SE rainfall gradient may also be recognised - a reflection of the prevailing synoptic conditions. Provisional figures suggest that the two-month rainfall totals rank as the third highest - in that specific timespan - for Scotland (in a series from 1869) and fifth highest for Northern Ireland (from 1900). Over the last 12-months regional rainfall has been well within the normal range in all regions.

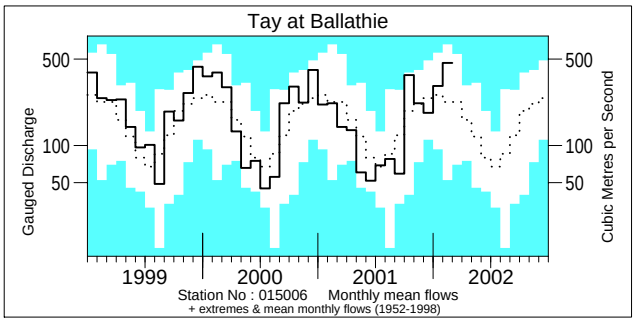
River flow . . . River flow . . .

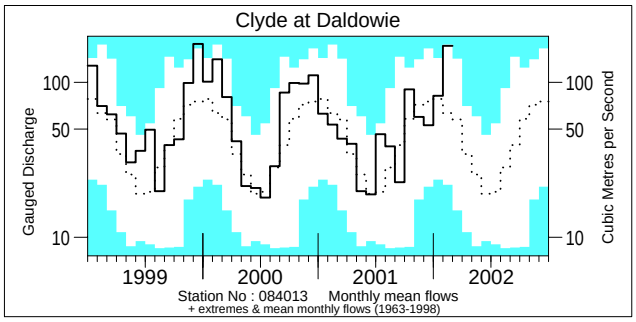


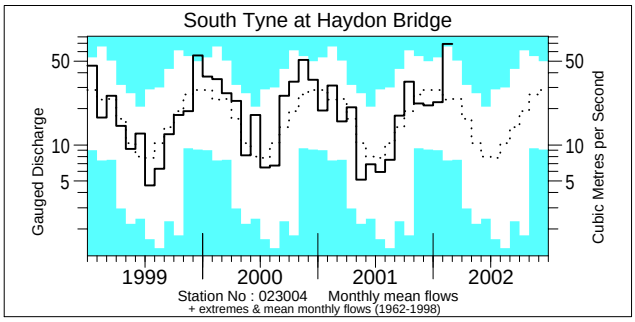
River flows - February 2002

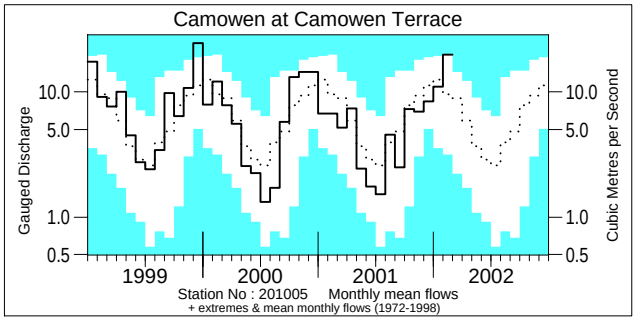
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

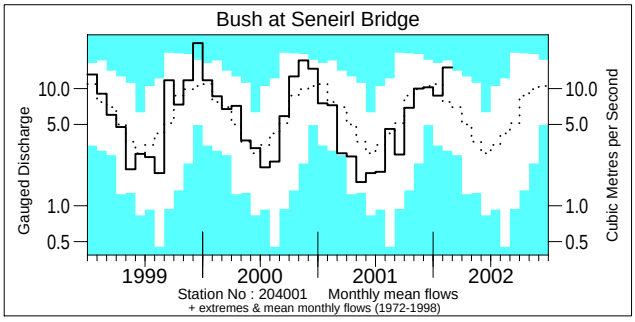


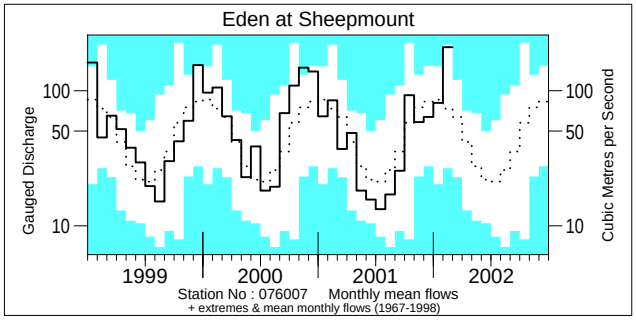


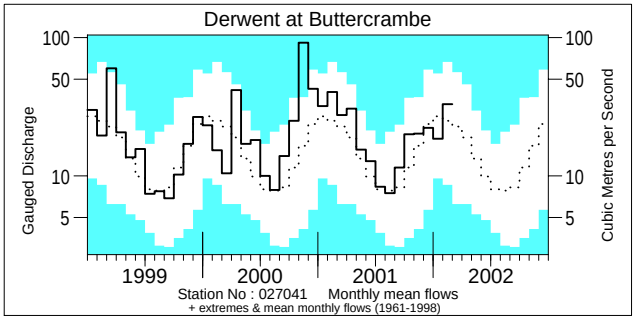


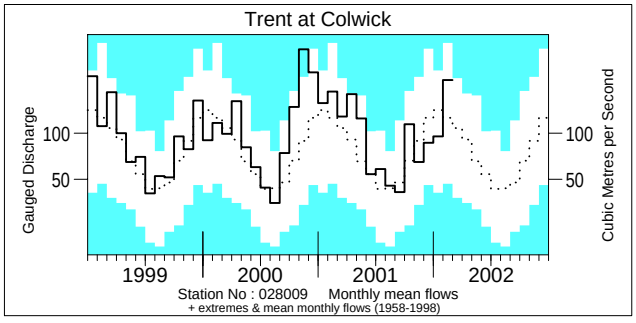


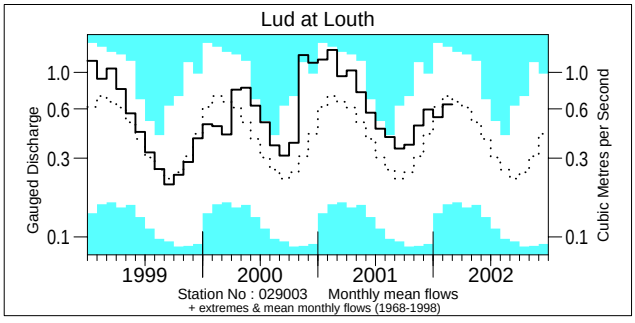








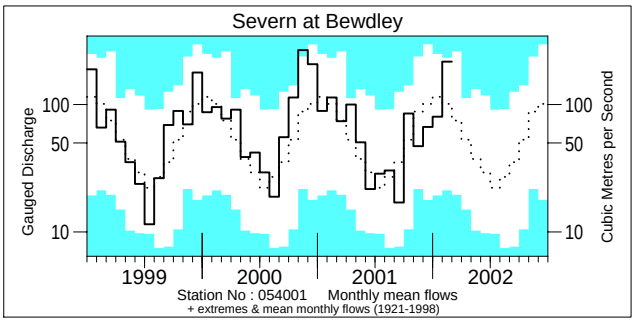


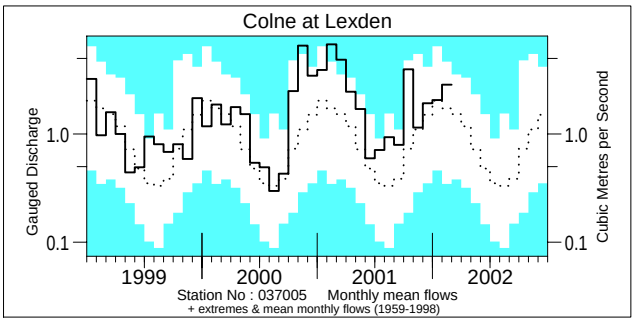


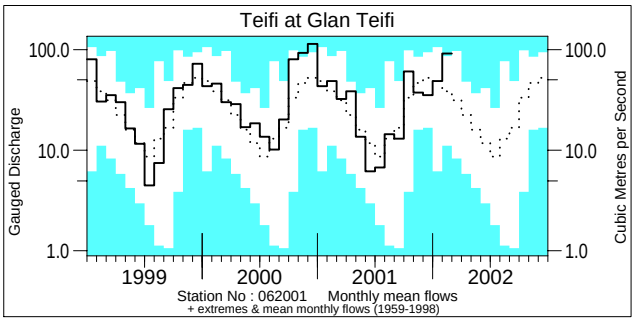
Monthly river flow hydrographs

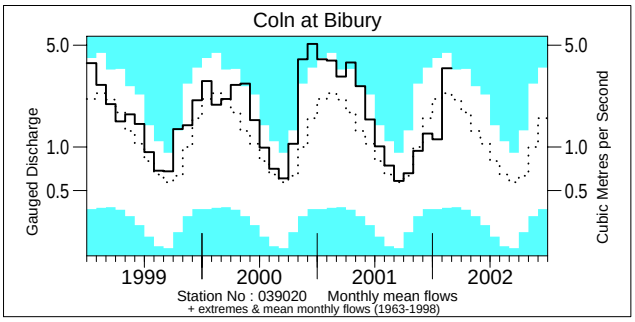
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 1999 (shown by the shaded areas). Monthly flows falling outside the maximum/ minimum range are indicated where the bold trace enters the shaded areas.

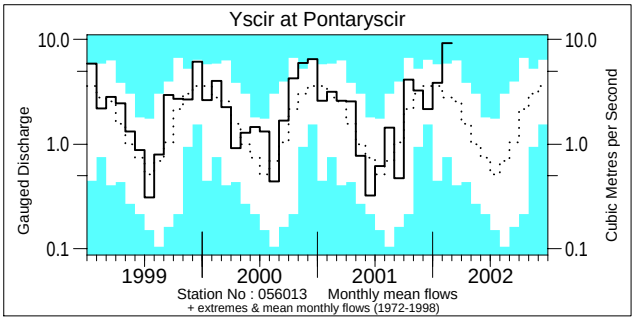
River flow . . . River flow . . .

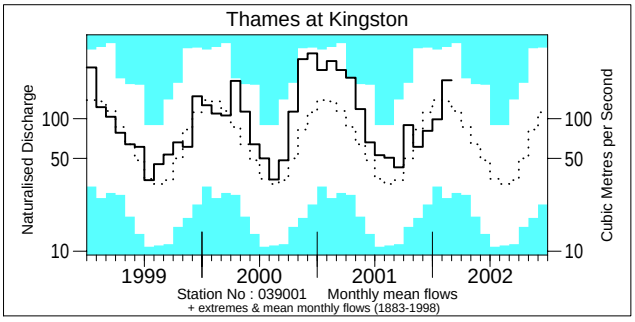


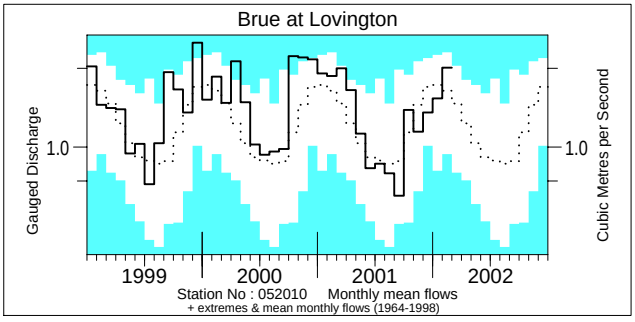


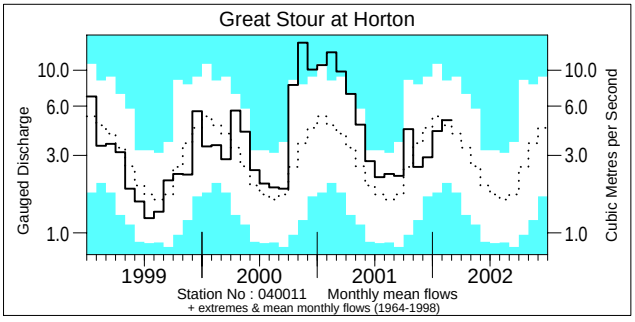


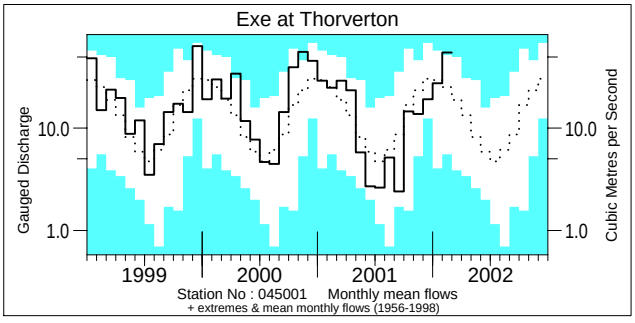


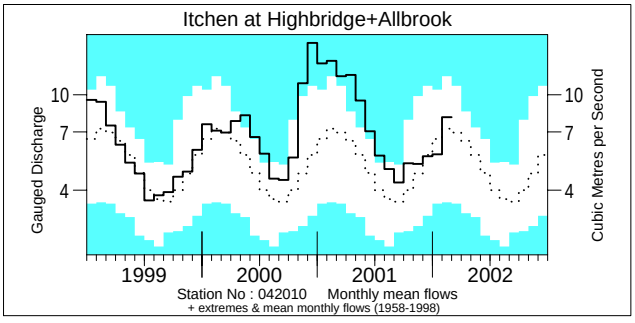












Notable runoff accumulations (a) December 2001 - February 2002, (b)March 2001 - February 2002

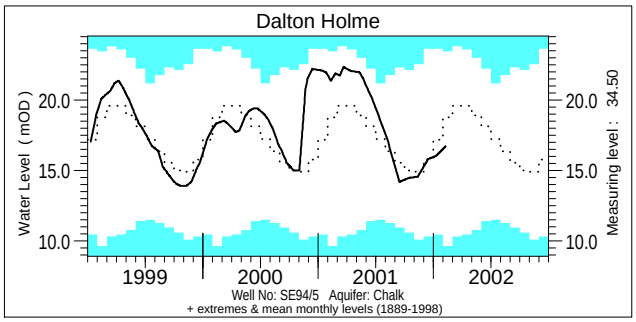
	River	%lta	Rank
(a)	S Tyne	131	36/40
	Yscir	141	27/29
	Cynon	142	40/44
	Dee	133	60/65
	Lune	137	37/40
	Naver	140	23/25
	Bush	112	25/30

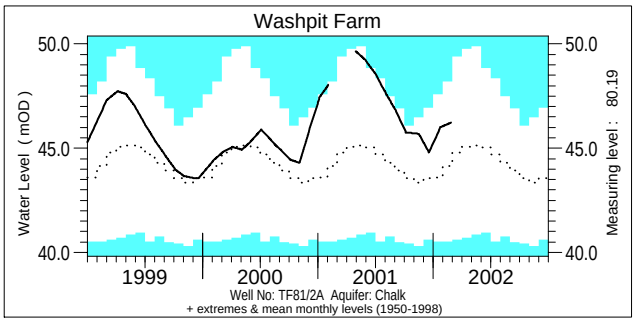
	River	%lta	Rank
(b)	Witham	162	41/42
	Stringside	163	33/34
	Colne	189	39/41
	Lee	193	113/115
	Mimram	201	48/48
	Blackwater	150	48/49
	Kennet	127	37/40

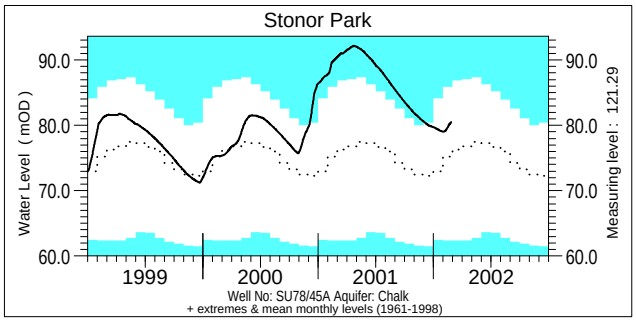
River	%lta	Rank
Lambourn	136	38/39
G Stour	129	31/35
Test	126	38/42
Itchen	132	42/43
Avon (Hants)	122	33/37
Yscir	127	26/29
Annacloy	84	4/22

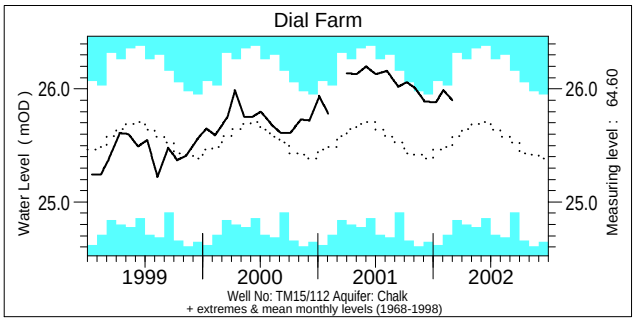
lta = long term average
Rank 1 = lowest on record

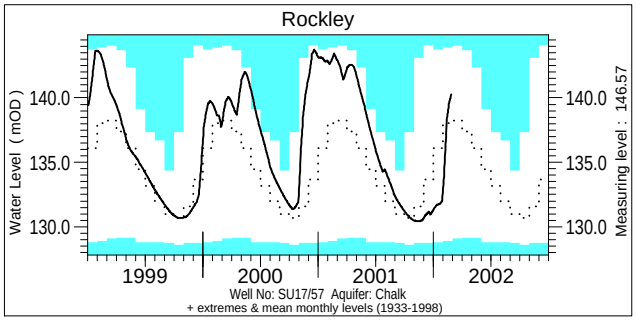
Groundwater…Groundwater

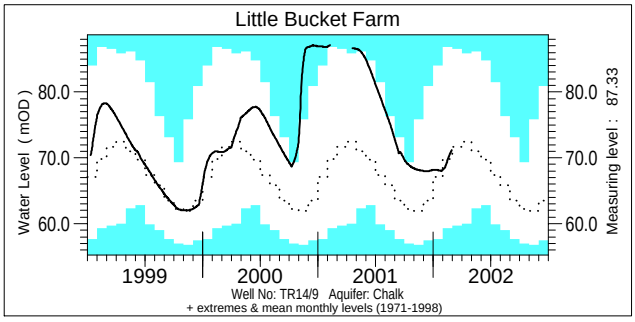


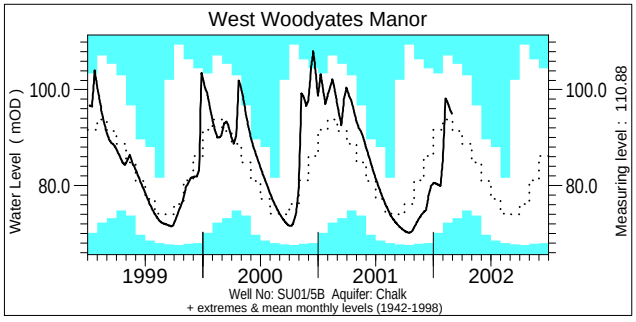


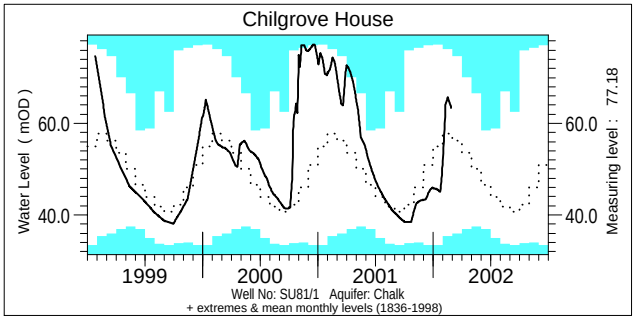


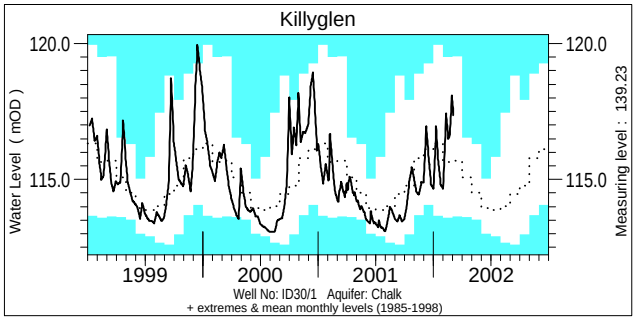


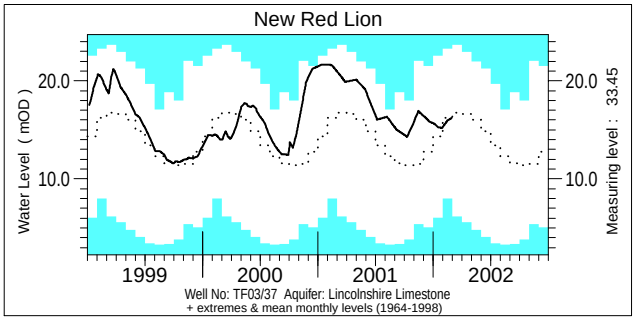








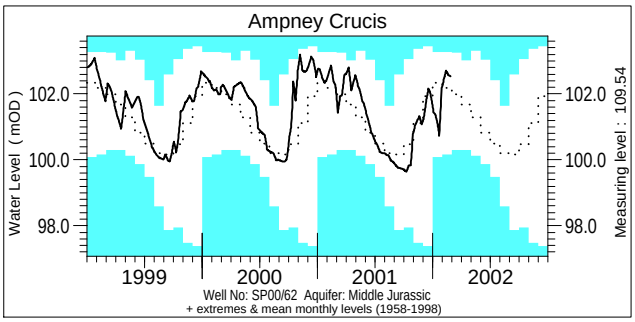


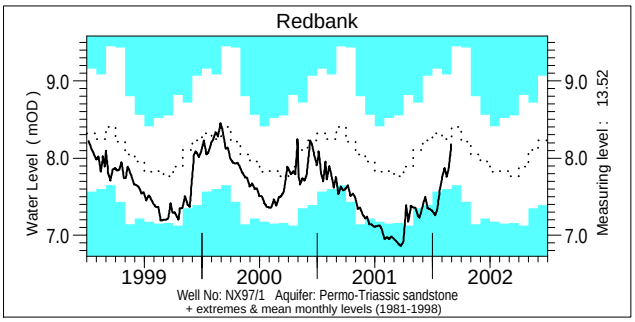


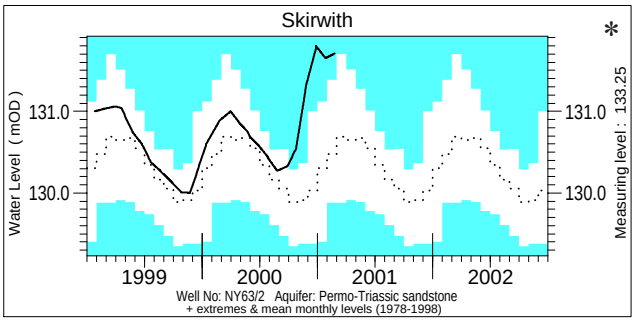
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

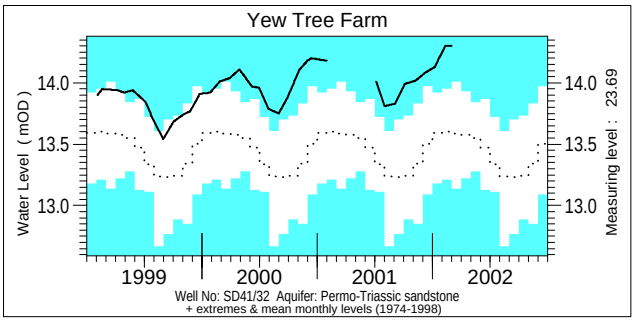
* No March 2001 -March 2002 groundwater levels available.

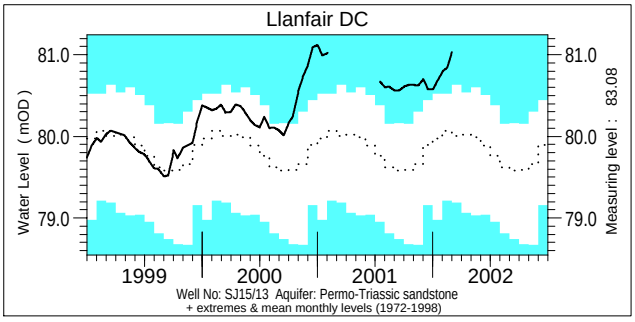
Groundwater . . . Groundwater

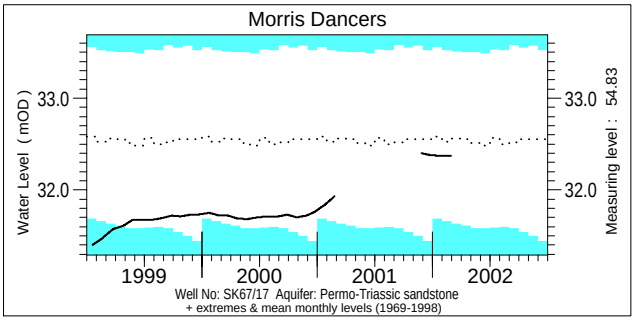


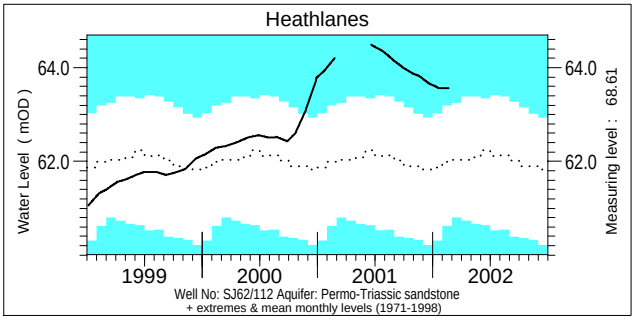


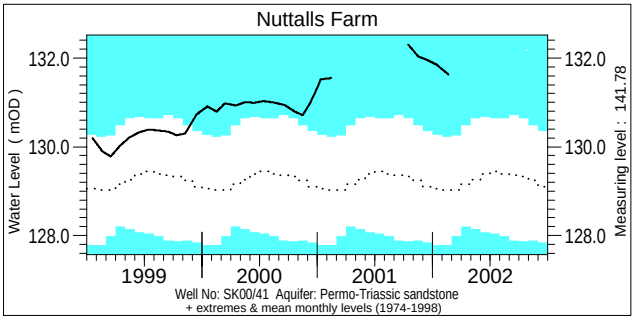


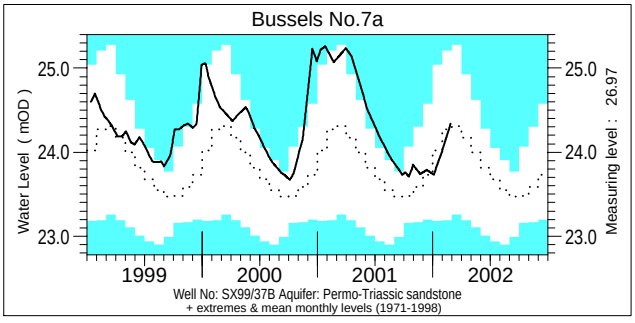


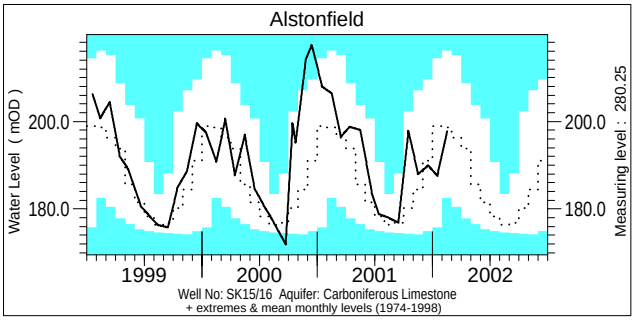












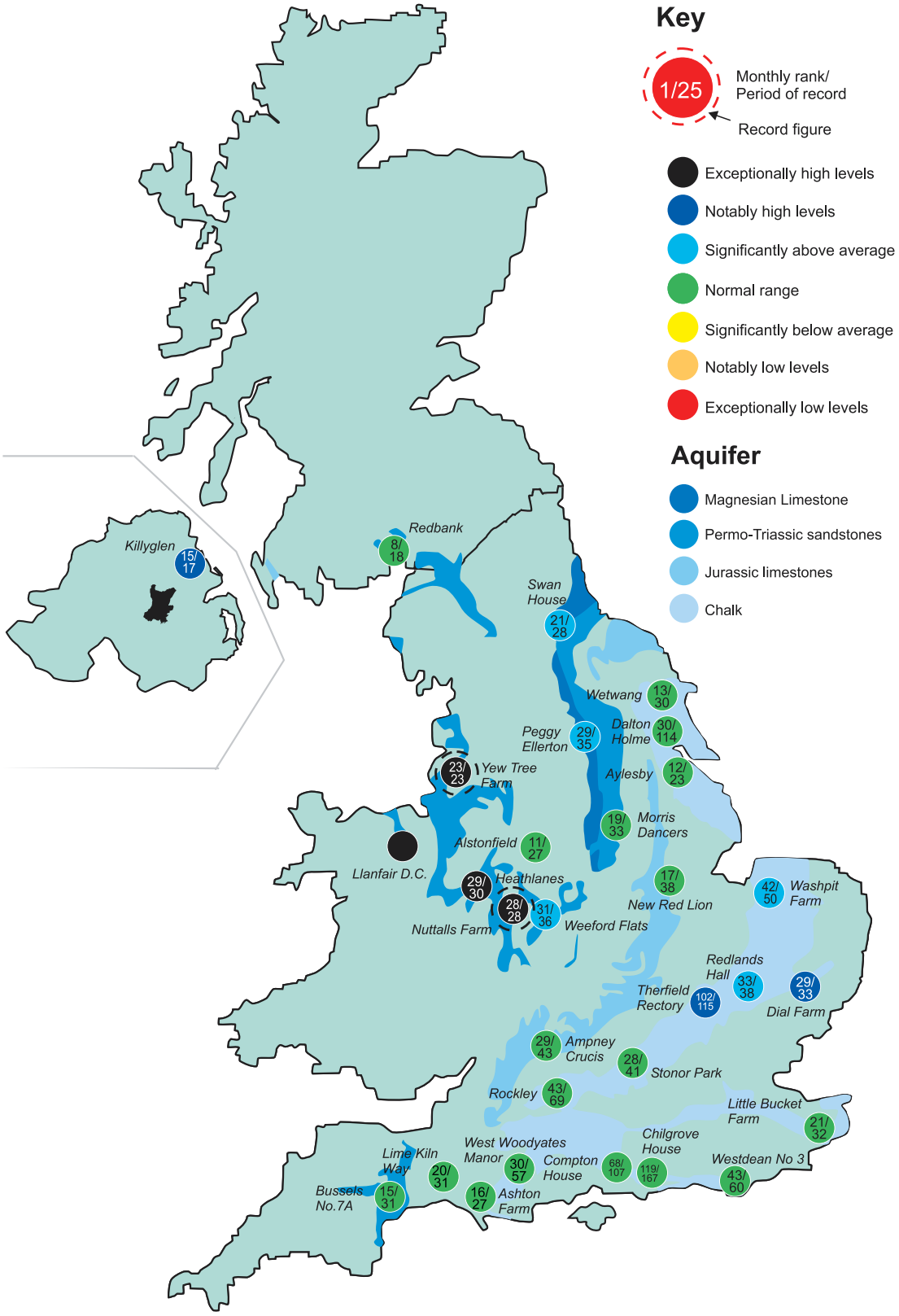
Groundwater levels February 2002 / March 2002

Borehole	Level	Date	Feb. av.	Borehole	Level	Date	Feb. av.	Borehole	Level	Date	Feb. av.
Dalton Holme	16.73	08/02	18.73	Chilgrove House	63.34	26/02	57.56	Morris Dancers	32.37	28/02	32.39
Washpit Farm	46.23	25/02	44.29	Killyglen	117.37	04/03	115.67	Heathlanes	63.57	20/02	61.97
Stonor Park	80.50	25/02	75.65	New Red Lion	16.21	27/02	16.25	Nuttalls Farm	131.63	19/02	129.33
Dial Farm	25.90	01/03	25.49	Ampney Crucis	102.54	25/02	102.22	Bussels No.7a	24.34	25/02	24.33
Rockley	140.25	25/02	138.27	Redbank	8.18	28/02	8.33	Alstonfield	197.81	15/02	198.65
Little Bucket Farm	71.21	28/02	70.15	Yew Tree Farm	14.30	01/03	13.63				
West Woodyates	94.92	28/02	93.16	Llanfair DC	81.03	01/03	80.00				

Skirwith data missing due to access restrictions.

Levels in metres above Ordnance Datum

Groundwater . . . Groundwater



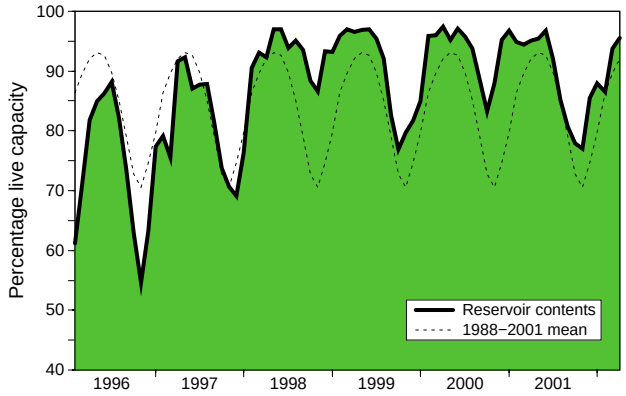
Groundwater levels - February 2002

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.

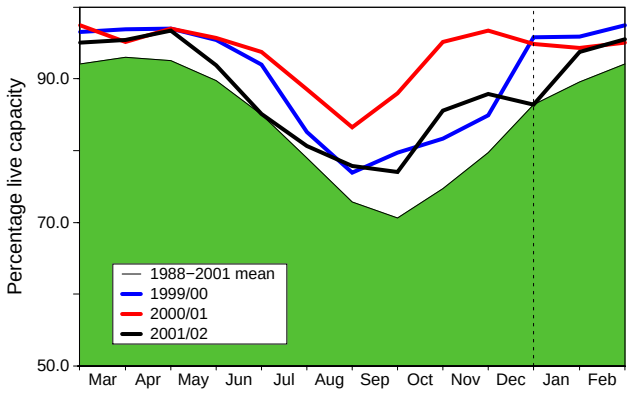
(Note: Redbank is affected by groundwater abstraction)

Reservoirs . . . Reservoirs . .

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.

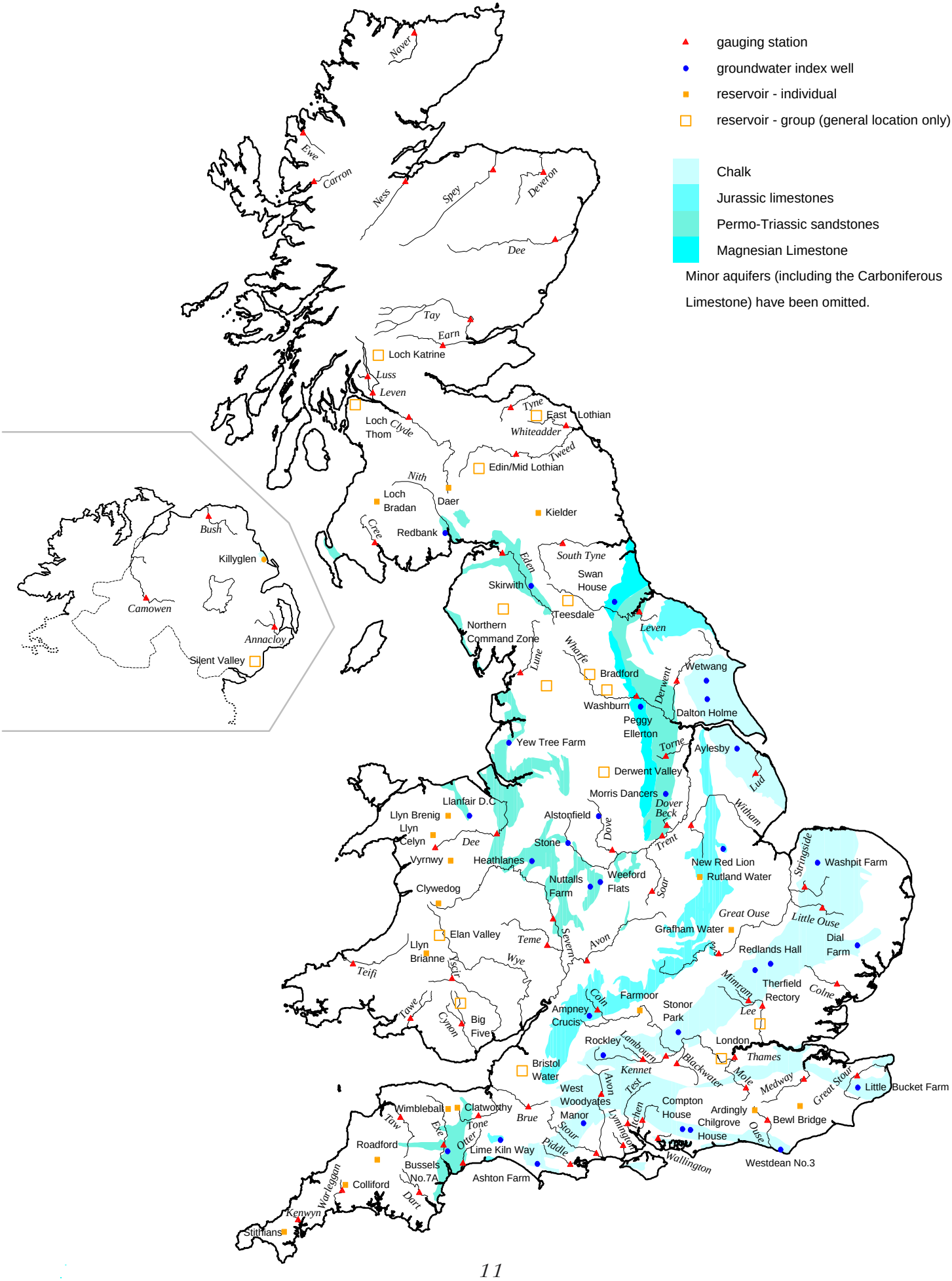
Percentage live capacity of selected reservoirs at start of month

Area	Reservoir	Capacity (Ml)	2001 Oct	Nov	Dec	2002 Jan	Feb	Mar	Min. Mar	Year* of min
North West	N Command Zone	• 124929	44	75	84	84	100	100	78	1996
	Vyrnwy	55146	71	86	91	88	100	100	59	1996
Northumbrian	Teesdale	• 87936	63	96	83	84	99	100	72	1996
	Kielder	(199175)	(86)	(80)	(95)	(89)	(100)	(96)	81	1993
Severn Trent	Clywedog	44922	49	73	100	87	96	100	77	1996
	Derwent Valley	• 39525	81	99	86	100	100	100	46	1996
Yorkshire	Washburn	• 22035	69	89	92	91	95	97	53	1996
	Bradford supply	• 41407	64	86	90	90	99	100	53	1996
Anglian	Grafham	(55490)	(95)	(93)	(88)	(88)	(87)	(87)	72	1997
	Rutland	(116580)	(78)	(80)	(81)	(82)	(84)	(89)	71	1992
Thames	London	• 202340	90	90	87	86	87	88	83	1988
	Farmoor	• 13830	94	92	91	77	79	88	64	1991
Southern	Bewl	28170	72	74	74	75	90	97	50	1989
	Ardingly	4685	67	72	73	86	100	100	89	1992
Wessex	Clatworthy	5364	44	67	72	84	97	100	82	1992
	Bristol WW	• (38666)	(60)	(61)	(59)	(61)	(70)	(99)	65	1992
South West	Colliford	28540	62	60	62	64	72	78	57	1997
	Roadford	34500	73	73	73	72	84	94	35	1996
	Wimbleball	21320	50	52	54	58	76	100	72	1996
	Stithians	5205	37	32	29	33	49	78	45	1992
Welsh	Celyn and Brenig	• 131155	92	94	97	94	100	100	69	1996
	Brianne	62140	86	100	100	94	100	98	94	1998
	Big Five	• 69762	77	97	95	93	99	97	85	1988
	Elan Valley	• 99106	93	100	100	99	100	100	88	1993
East of Scotland	Edinburgh/Mid Lothian	• 97639	70	89	90	89	92	100	73	1999
	East Lothian	• 10206	84	97	100	100	100	100	91	1990
West of Scotland	Loch Katrine	• 111363	55	85	93	88	99	100	93	1999
	Daer	22412	48	91	100	97	100	100		
	Loch Thom	• 11840	62	84	93	93	100	100	98	2001
Northern Ireland	Silent Valley	• 20634	47	54	43	39	46	57	57	2002

() figures in parentheses relate to gross storage • denotes reservoir groups * 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 1988-2002 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 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, 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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RG12 2SY
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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
National Water Archive
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.nerc-wallingford.ac.uk/ih/nrfa/index.htm
Navigate via Water Watch

NATURAL ENVIRONMENT RESEARCH COUNCIL

2/02