Hydrological summary
for the United Kingdom

June 2002

General

June was an unsettled month with above average rainfall across most of the UK. Much of Scotland and Northern Ireland was notably wet - with exceptionally high river flows (for the summer); minor incidents of flooding were common and many new June runoff records were established. In contrast, much of the English Lowlands was very dry after the first week, resulting in steep rises in soil moisture deficits - triggering isolated (and temporary) irrigation restrictions in East Anglia. A much more representative picture of the early summer water resources status is provided by current reservoir stocks for England and Wales – the second highest on record for early July (in a series from 1988) with most major impoundments reporting >90% of capacity. Some very modest local aquifer recharge was also reported in the south. June groundwater levels were close to, or above, average throughout almost all major aquifers. The very uneven rainfall distribution over the first half of 2002 makes for significant regional and local variation, but the overall water resources outlook is healthy.

Rainfall

Low pressure continued to dominate synoptic patterns in June – in northern regions especially – producing weather more typical of early autumn than early summer. The June rainfall exhibited large spatial and temporal variability. Some notable intense storms (mostly convective) were reported – e.g. 10 mm in an hour at High Wycombe (5th), 17 mm in 21 minutes on coast of the Moray Firth (20th) and frontal episodes were very common across northern regions. Parts of western Scotland reported only four days without measurable rainfall – very unusual for June. In northern Ireland, sustained wet conditions contributed to a landslide which derailed a train in County Londonderry on the 4th. June rainfall totals exceeded twice the 1961-90 average in some, mostly western, Scottish catchments. In the English lowlands however, a notably wet six-week period terminated following heavy rainfall on the 5/6th (> 40 mm, e.g. in parts of the South-East); the remainder of June produced very modest rainfall totals. The thundery and showery nature of the rainfall made for limited spatial coherence but June rainfall totals fell below 70% in much of the Midlands, Yorkshire and East Anglia; a few localities reported <50%. Provisional data suggest that Scotland had its wettest June since 1980 and in Northern Ireland rainfall was above average for sixth successive month – the previous January-June maximum rainfall (in a record from 1900) has been eclipsed by a significant margin. Atlantic frontal systems have been much less frequent to the south and east, resulting in modest rainfall deficiencies over the 8-month timeframe in parts of central and eastern England.

River flow

Many rivers exhibited a notably wide range of flows in June – particularly in Scotland and Northern Ireland where seasonally very high flows were recorded in mid-month. The Camowen established a new maximum June flow on the 14th, and the Clyde registered its highest June flow since 1966 on the 15th. Thunderstorms also produced local, mostly urban, flooding (e.g. in Belfast on the 22nd). Significant summer spates were common in southern and eastern England on the 6th but recessions became re-established thereafter. June runoff totals were outstanding in much of northern Britain and parts of Northern Ireland. The Camowen, Nith, Clyde, Tay and Earn (the latter pair with flow records of 50 or more years) were among many rivers establishing new maximum June runoff totals. A few southern rivers shared this distinction (e.g. the Mole) but runoff in a zone from Cleveland to the East Midlands was relatively depressed – in some catchments mean flows were only a little over half of the long term average (e.g. on the Torne). The early July flow recoveries were particularly welcome in these areas - modest runoff deficiencies having built up since the late autumn of 2001. Generally however, runoff accumulations across a range of timespans are within the normal range – but new January-June maxima have been established in a number of western and northern rivers (e.g. the Dart, Lune and Cree).

Groundwater

Parts of the southern Chalk aside, the June rainfall was below average across most major aquifer outcrop areas - but local variations were considerable. Soil moisture deficits were above average in many low-lying eastern areas (e.g. Cambridgeshire) - providing minimal opportunities for late-season recharge. To the south (and across most western and northern areas) however soils remained relatively moist and isolated recharge was reported (e.g. late in the second week in the North Downs), but its overall impact was minimal. Groundwater levels declined through June in almost all index wells and boreholes. In the Chalk, levels are well within the normal early summer range across almost the entire aquifer – but with a tendency for above average levels in the more easterly outcrops. Levels are also close the seasonal average in most limestone outcrop areas. The Permo-Triassic sandstones present a less spatially coherent picture with average levels in the South-West but, generally, very high levels in the Midlands and northern England – levels at the Yew Tree Farm well (Lancs.) remain appreciably above pre-2000 maxima.

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Rainfall . . . Rainfall . . .

Rainfall accumulations and return period estimates

Area	Rainfall	Jun 2002	Apr 02-Jun 02	RP	Jan 02-Jun 02	RP	Nov 01-Jun 02	RP	Jul 01-Jun 02	RP
England & Wales	**mm**	**57**	**183**		**435**		**542**		**917**	
	%	**88**	**96**	**2-5**	**103**	**2-5**	**89**	**2-5**	**100**	**<2**
North West	mm	100	305		718		881		1333	
	%	123	134	5-15	138	30-40	115	5-10	111	2-5
Northumbrian	mm	79	185		457		581		904	
	%	131	104	2-5	117	5-10	104	2-5	106	2-5
Severn Trent	mm	42	160		367		449		760	
	%	71	92	2-5	102	2-5	89	2-5	101	2-5
Yorkshire	mm	46	150		371		465		793	
	%	77	84	2-5	96	2-5	85	5-10	97	2-5
Anglian	mm	33	122		256		330		637	
	%	64	84	2-5	92	2-5	84	5-10	107	2-5
Thames	mm	51	175		373		440		752	
	%	93	109	2-5	114	2-5	95	2-5	109	2-5
Southern	mm	54	180		404		472		820	
	%	99	112	2-5	113	2-5	90	2-5	105	2-5
Wessex	mm	43	195		452		533		851	
	%	75	114	2-5	115	2-5	94	2-5	102	2-5
South West	mm	54	257		649		798		1137	
	%	78	122	2-5	118	5-10	98	2-5	97	2-5
Welsh	mm	69	303		746		940		1437	
	%	87	126	5-10	127	5-15	107	2-5	109	2-5
Scotland	**mm**	**131**	**326**		**892**		**1128**		**1635**	
	%	**152**	**131**	**10-20**	**142**	**>200**	**122**	**10-20**	**114**	**5-15**
Highland	mm	135	337		1047		1382		1967	
	%	137	120	5-10	138	70-100	119	10-20	112	5-10
North East	mm	74	192		478		636		1043	
	%	113	99	2-5	109	2-5	101	2-5	107	2-5
Tay	mm	129	329		864		1012		1488	
	%	177	151	30-40	153	150-250	124	10-20	121	10-20
Forth	mm	130	306		745		882		1279	
	%	189	151	30-45	151	>200	123	10-20	115	5-15
Tweed	mm	92	229		592		715		1069	
	%	142	119	2-5	135	25-40	114	5-10	110	2-5
Solway	mm	153	413		956		1144		1634	
	%	182	168	120-170	154	>200	125	10-20	115	5-10
Clyde	mm	178	429		1127		1389		1988	
	%	191	160	80-120	156	>200	128	30-40	117	10-20
Northern Ireland	**mm**	**113**	**347**		**699**		**844**		**1159**	
	%	**159**	**168**	**60-90**	**145**	**50-80**	**122**	**5-15**	**109**	**2-5**

RP = Return period

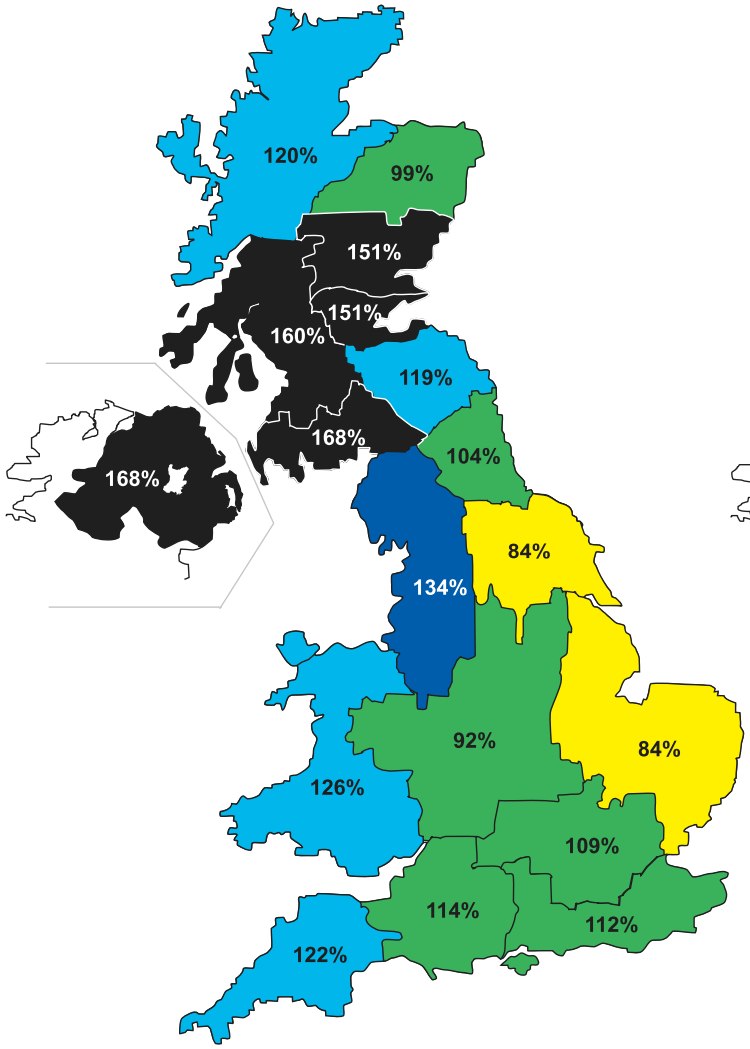
 All monthly totals since December 1998 are provisional (see page 12). The figures for England & Wales are derived by the Hadley Centre and are updates of the homogenised series developed by the Climate Research Unit; the other national figures are derived from different raingauge networks to those used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

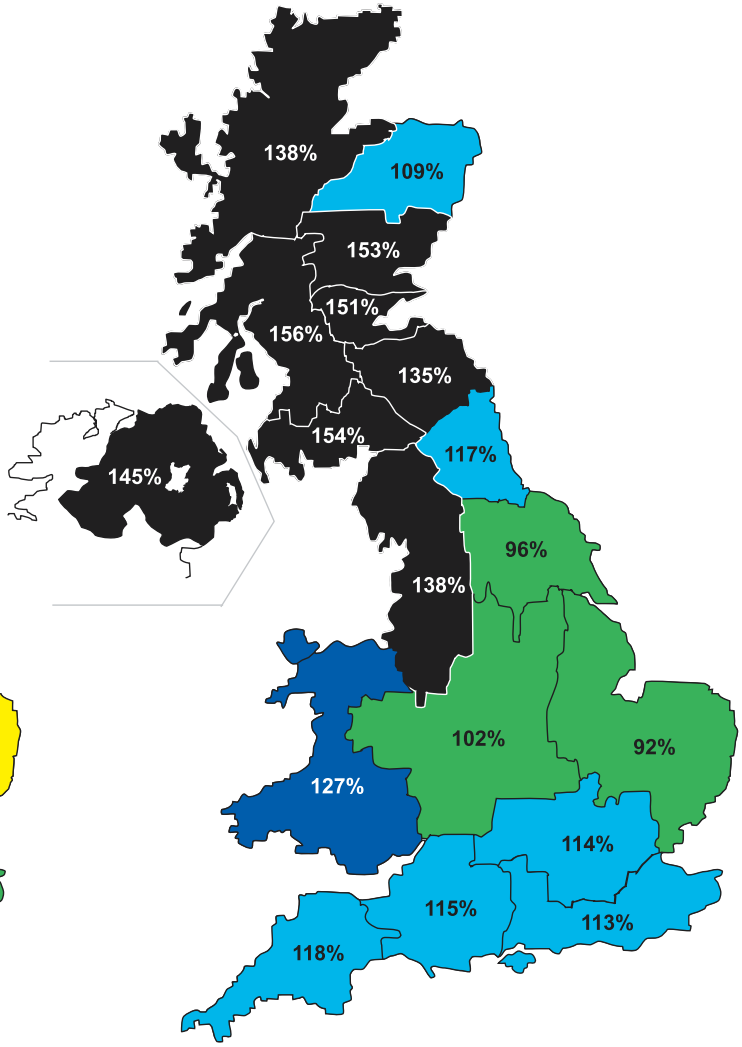
Rainfall . . . Rainfall . . .

Key

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



April 2002 - June 2002

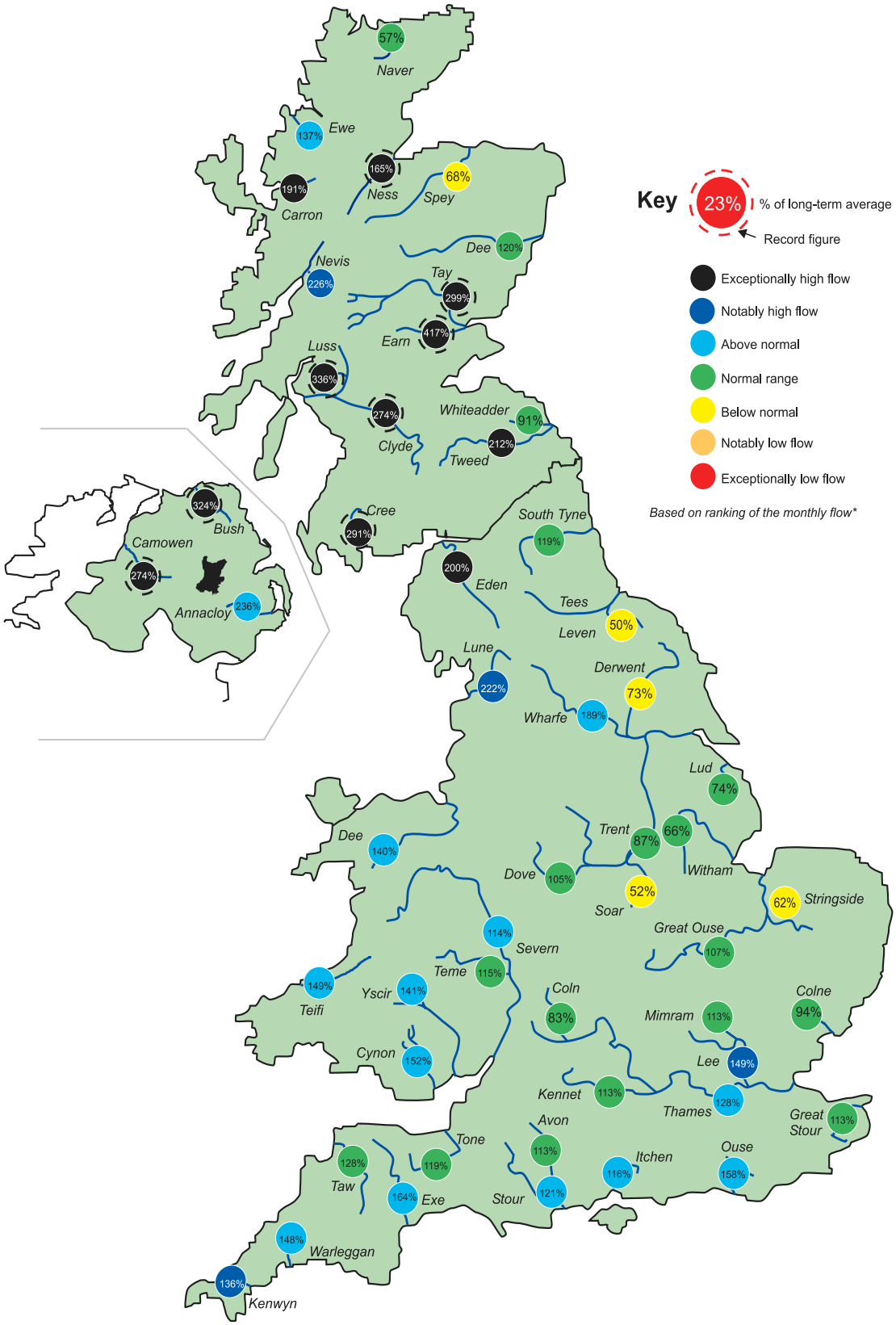


January 2002 - June 2002

Rainfall accumulation maps

Weather conditions over the first six months of 2002 have been heavily influenced by the frequency of Atlantic frontal systems. Their preferred track has been across Northern Britain and Northern Ireland resulting in exceptional high rainfall, in south western Scotland, where many catchments have registered record, or near record rainfall totals over the three and six month timespans. In these timespans, below average regional rainfall is restricted to the sheltered English Lowlands.

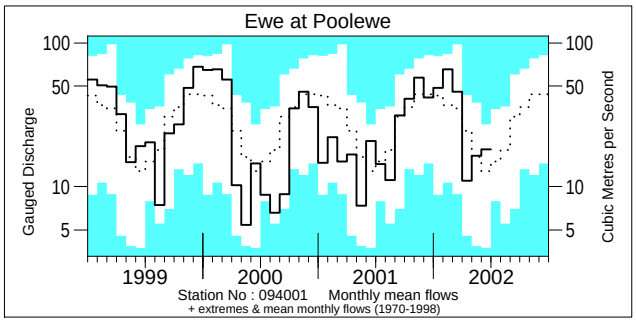
River flow . . . River flow . . .

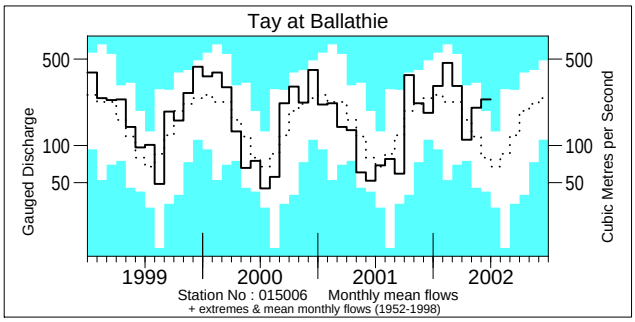


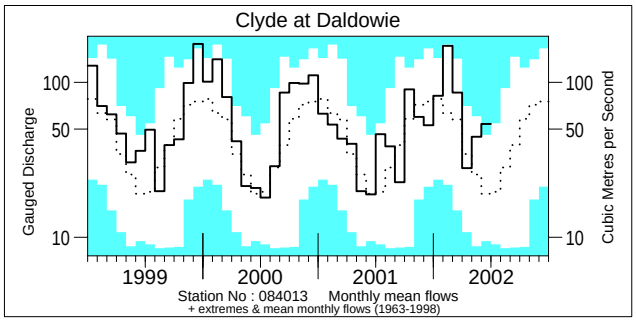
River flows - June 2002

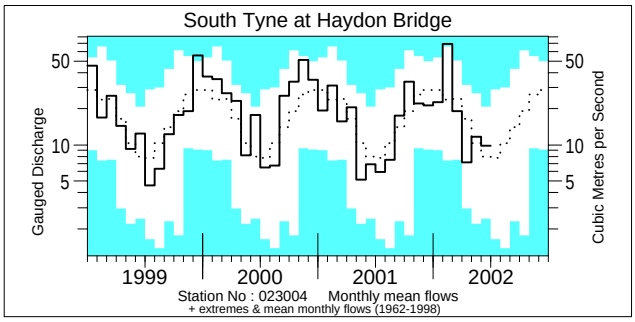
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

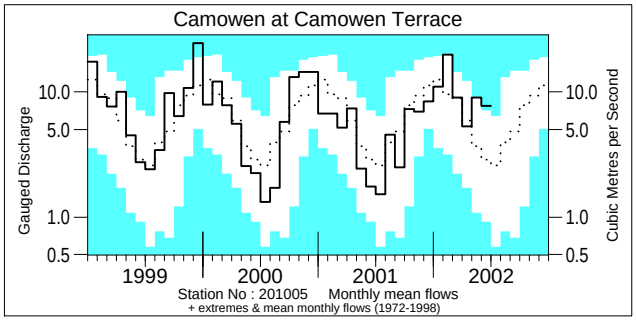
River flow . . . River flow . . .

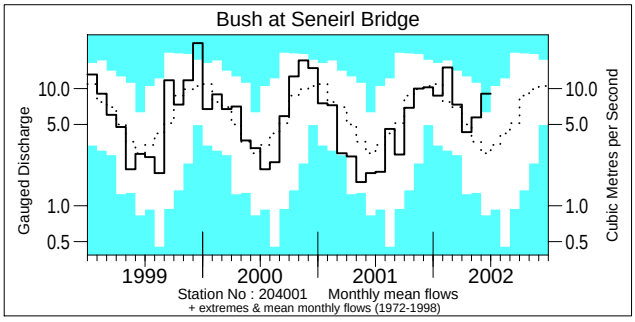


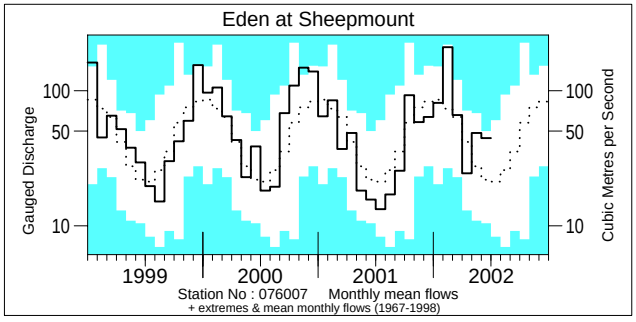


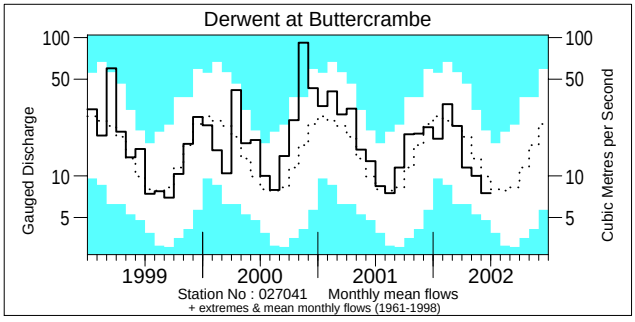


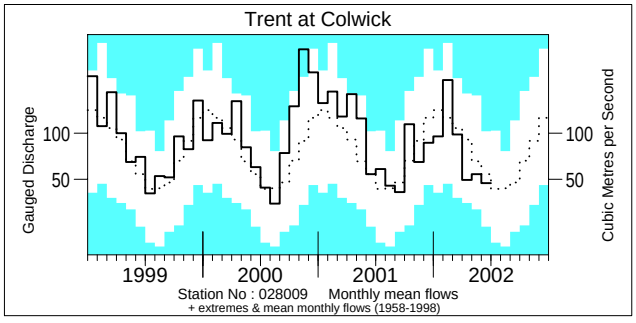


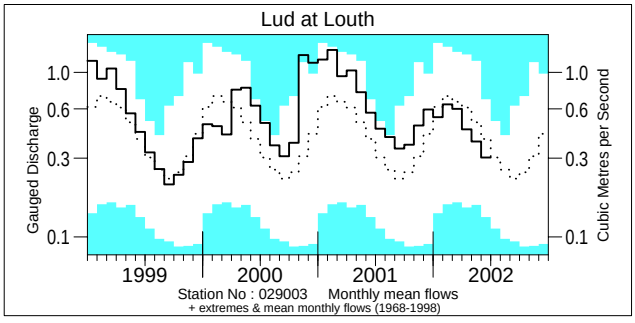








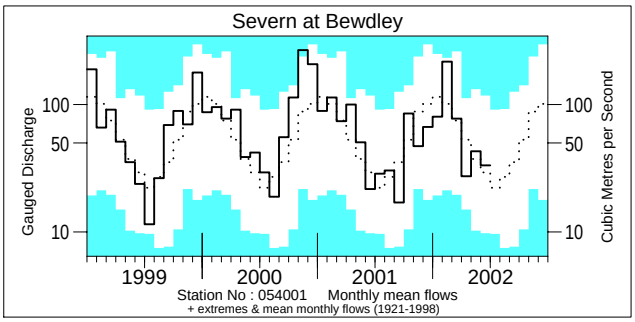


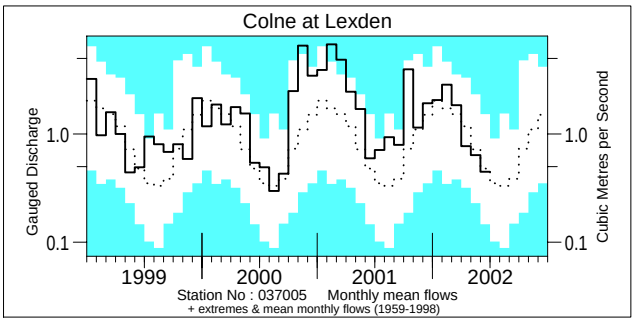


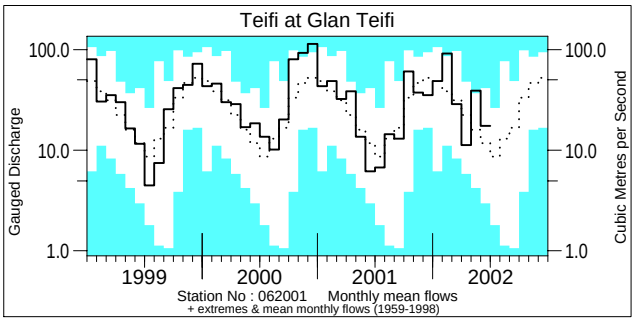
Monthly river flow hydrographs

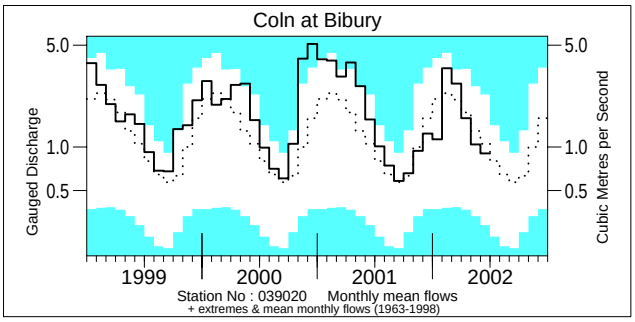
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 1999 (shown by the shaded areas). Monthly flows falling outside the maximum/ minimum range are indicated where the bold trace enters the shaded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

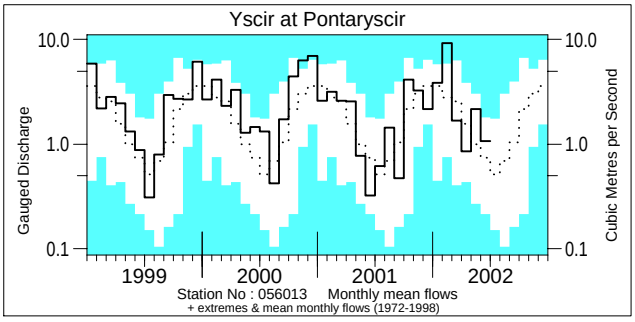
River flow . . . River flow . . .

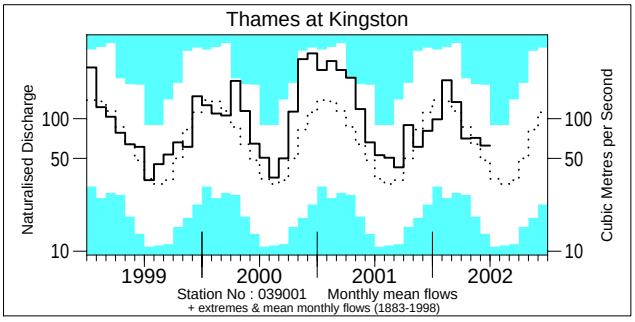


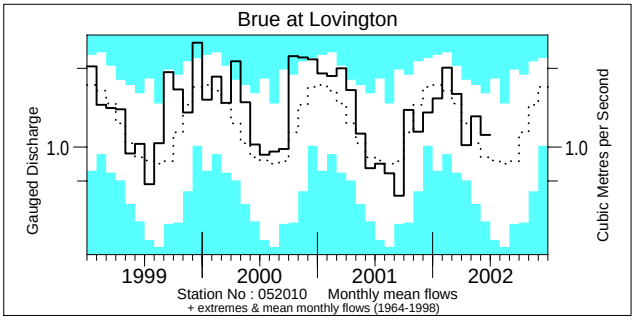


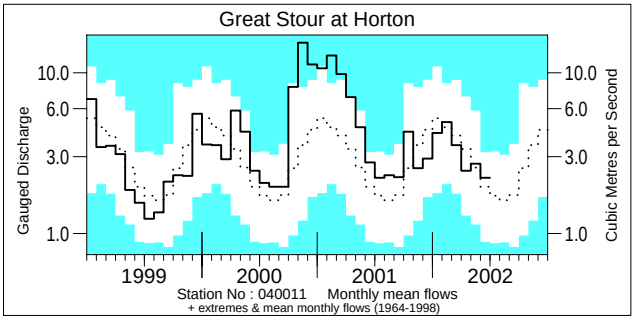


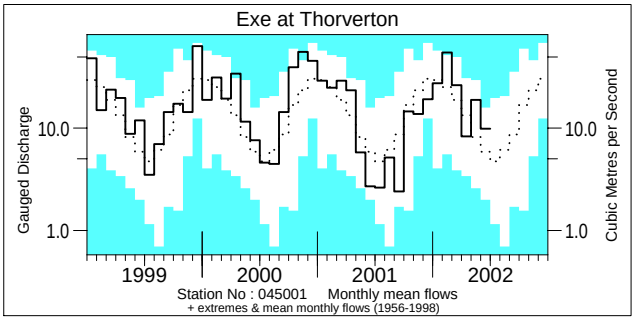


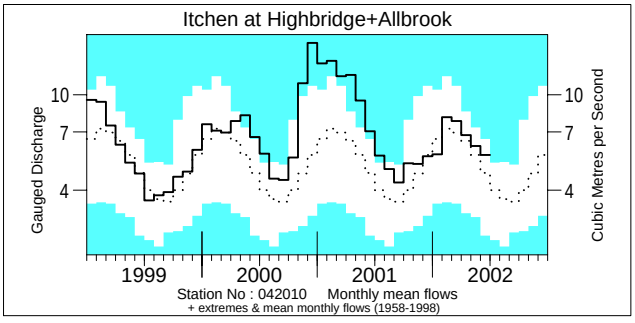












Notable runoff accumulations (a) April 2002 – June 2002, (b) January 2002 – June 2002

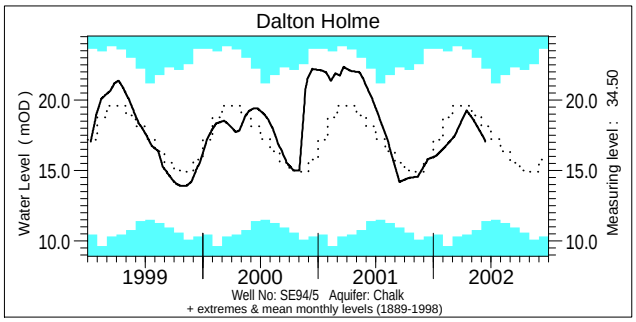
	River	%lta	Rank
a)	Deveron	52	5/41
	Tay	153	49/50
	Earn	195	55/55
	Leven (Yorks.)	35	2/42
	Clyde	155	37/39
	Leven (Glasgow)	180	39/39
	Naver	62	3/25
	Camowen	173	28/29

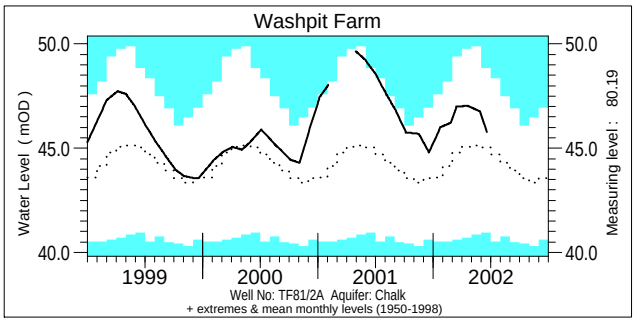
	River	%lta	Rank
b)	Tweed	138	41/42
	Mole	141	27/28
	Exe	139	45/46
	Dart	145	44/44
	Yscir	146	30/30
	Cynon	162	44/44
	Teifi	135	43/43

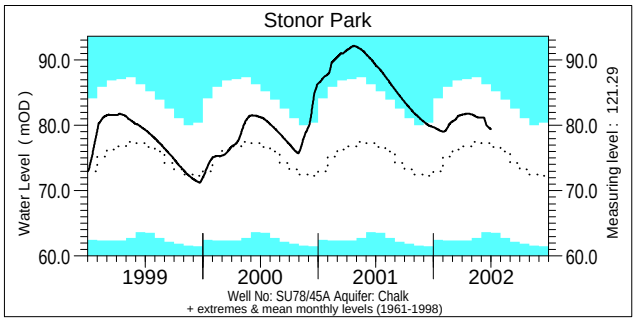
River	%lta	Rank
Welsh Dee	137	64/65
Lune	152	42/42
Eden	144	35/35
Nith	146	44/45
Cree	143	39/39
Luss	139	24/24
Naver	131	22/25

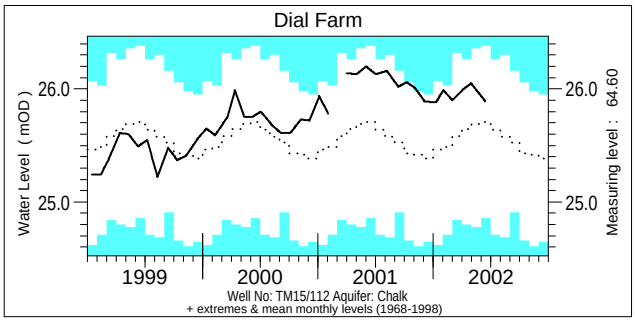
lta = long term average
Rank 1 = lowest on record

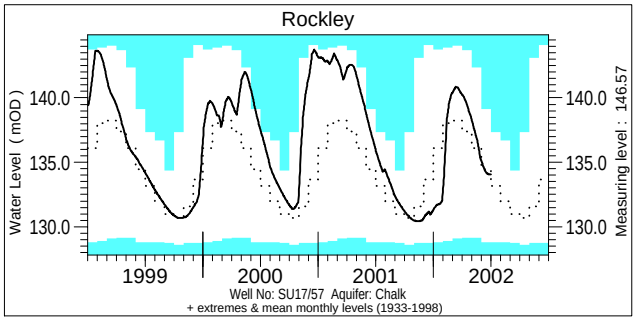
Groundwater . . . Groundwater

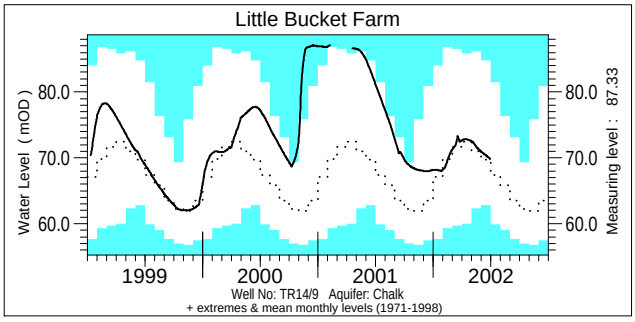


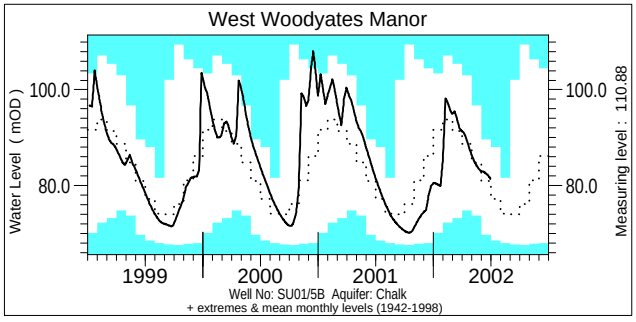


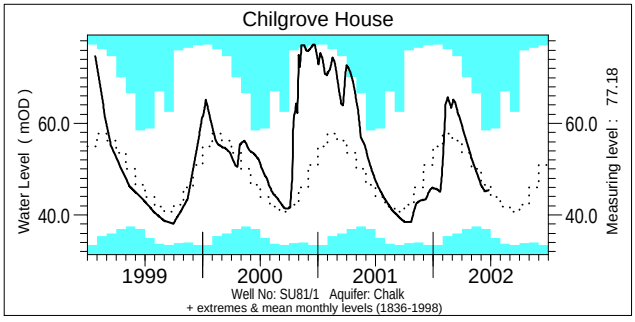


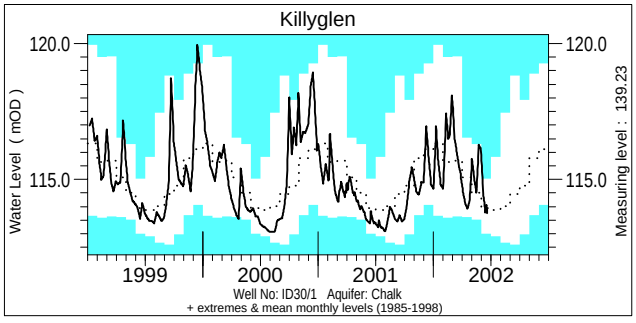


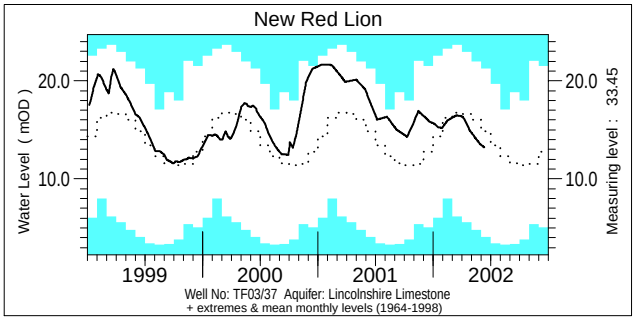






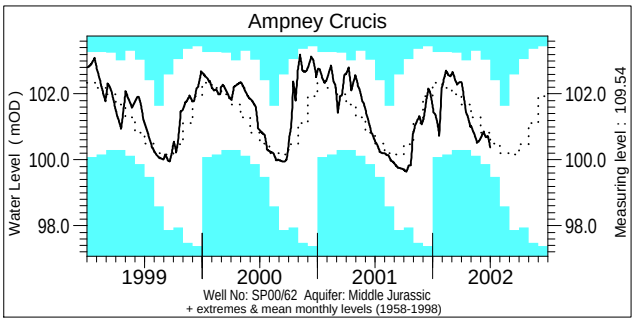


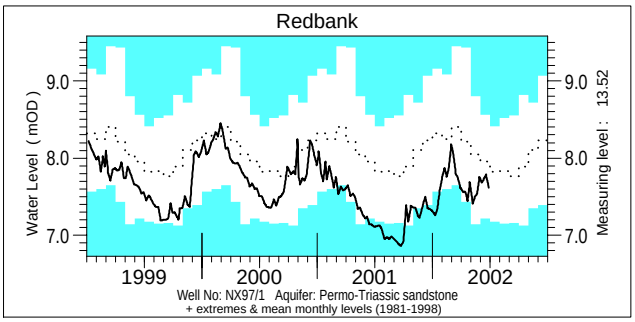


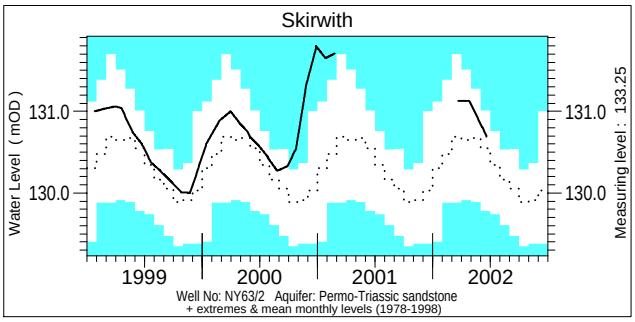


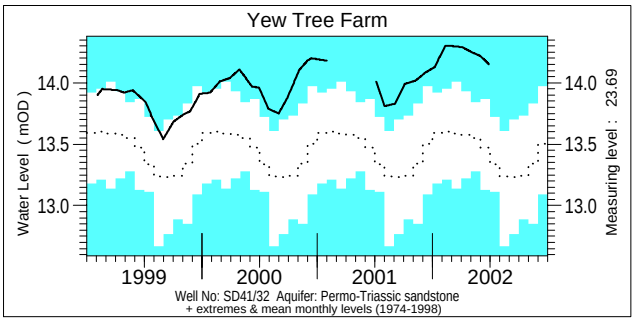
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

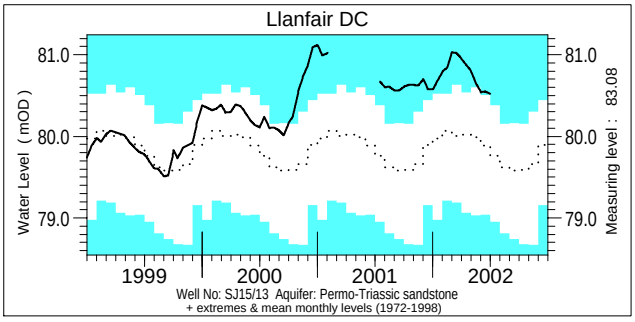
Groundwater . . . Groundwater

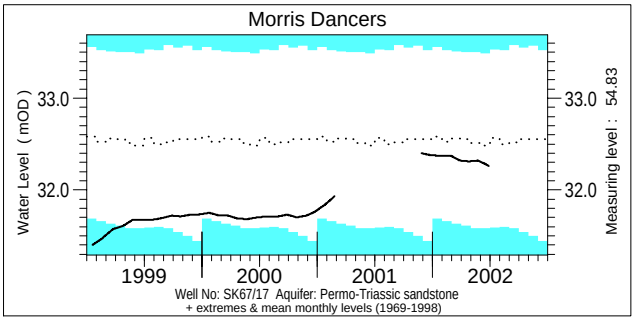


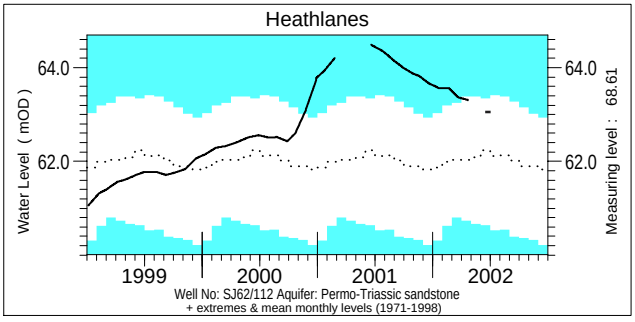


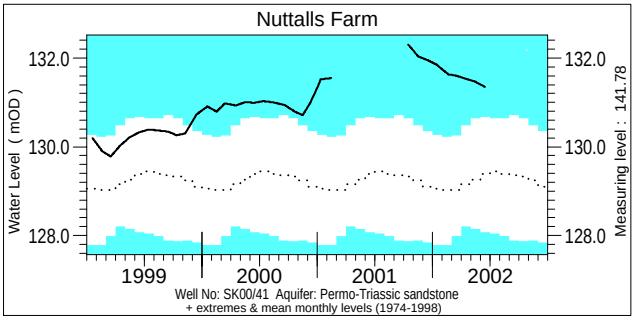


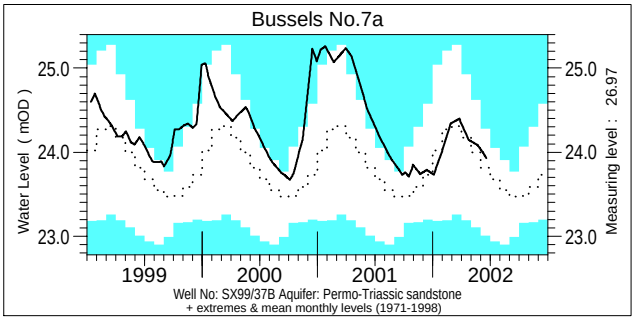


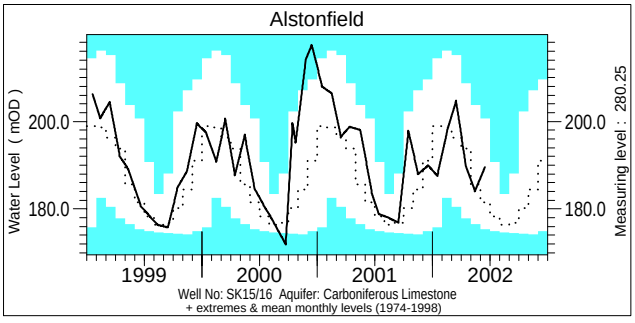








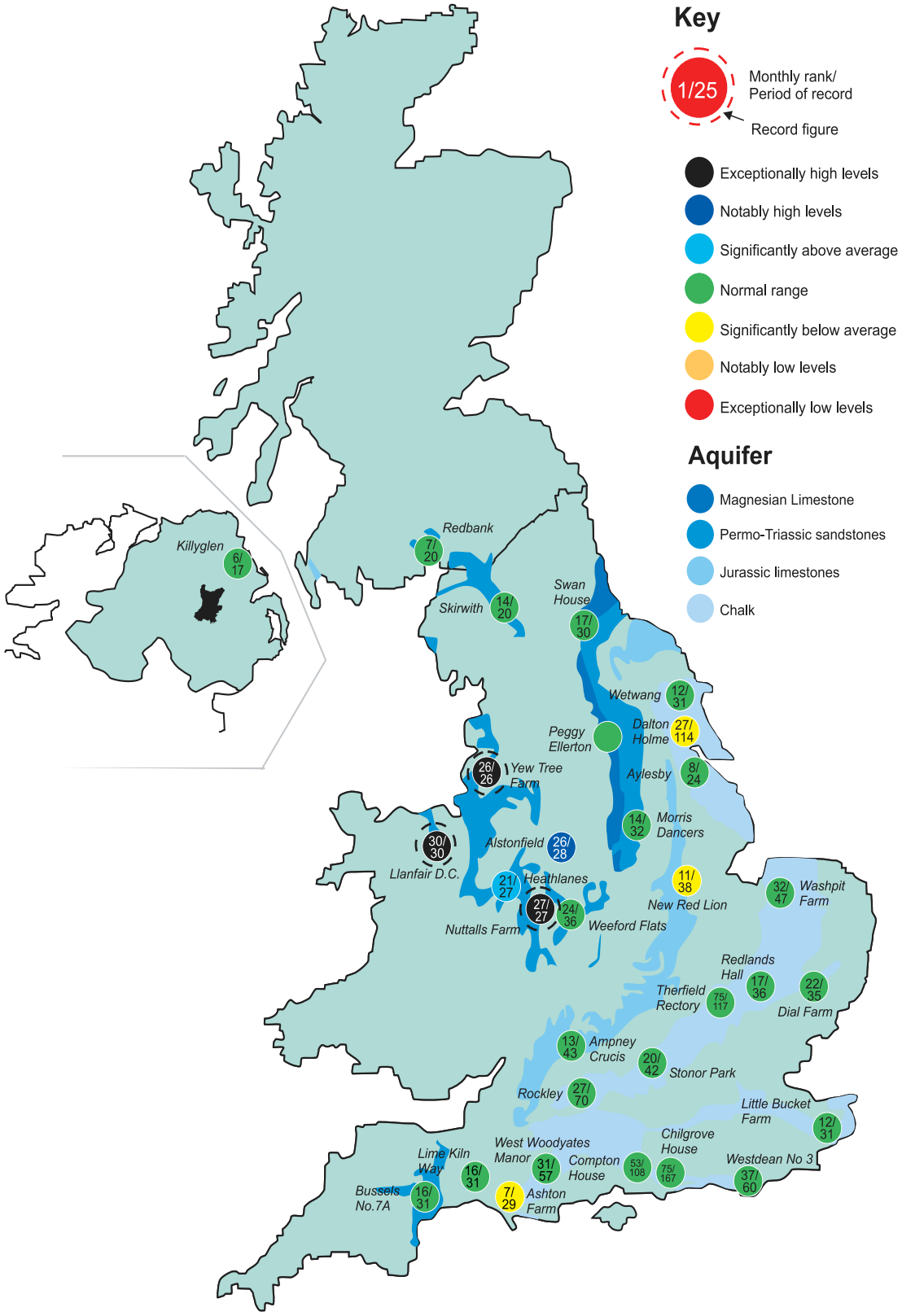




Groundwater levels June 2002 / July 2002

Borehole	Level	Date	Jun. av.	Borehole	Level	Date	Jun. av.	Borehole	Level	Date	Jun. av.
Dalton Holme	17.05	14/06	18.15	Chilgrove House	45.41	25/06	46.04	Llanfair DC	80.52	01/07	79.80
Washpit Farm	45.77	18/06	45.14	Killyglen	113.75	20/06	113.91	Morris Dancers	32.26	27/06	32.37
Stonor Park	79.39	01/07	78.14	New Red Lion	13.20	10/06	14.76	Heathlanes	63.06	25/06	62.25
Dial Farm	25.89	13/06	25.71	Ampney Crucis	100.37	01/07	100.86	Nuttalls Farm	131.35	14/06	129.51
Rockley	134.07	01/07	134.60	Redbank	7.62	27/06	7.91	Bussels No.7a	23.93	19/06	23.88
Little Bucket Farm	69.84	30/06	71.57	Skirwith	130.69	20/06	130.53	Alstonfield	189.61	14/06	181.19
West Woodyates	81.40	30/06	80.95	Yew Tree Farm	14.15	28/06	13.54				

Levels in metres above Ordnance Datum



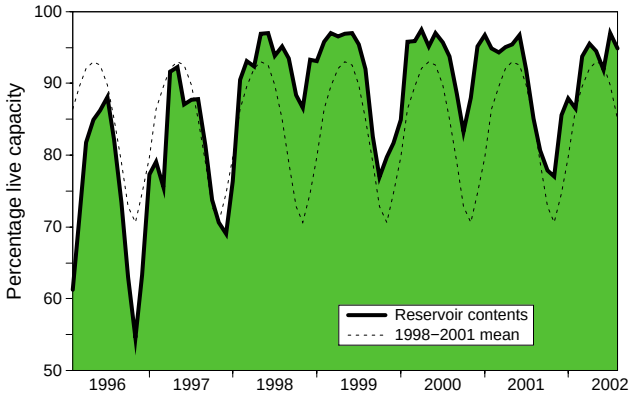
Groundwater levels - June 2002

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.

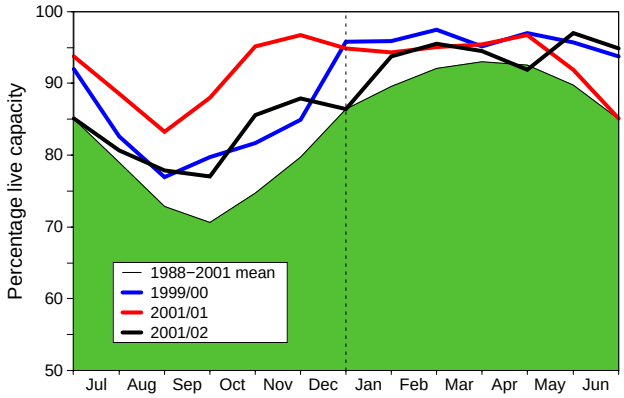
(Note: Redbank is affected by groundwater abstraction)

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.

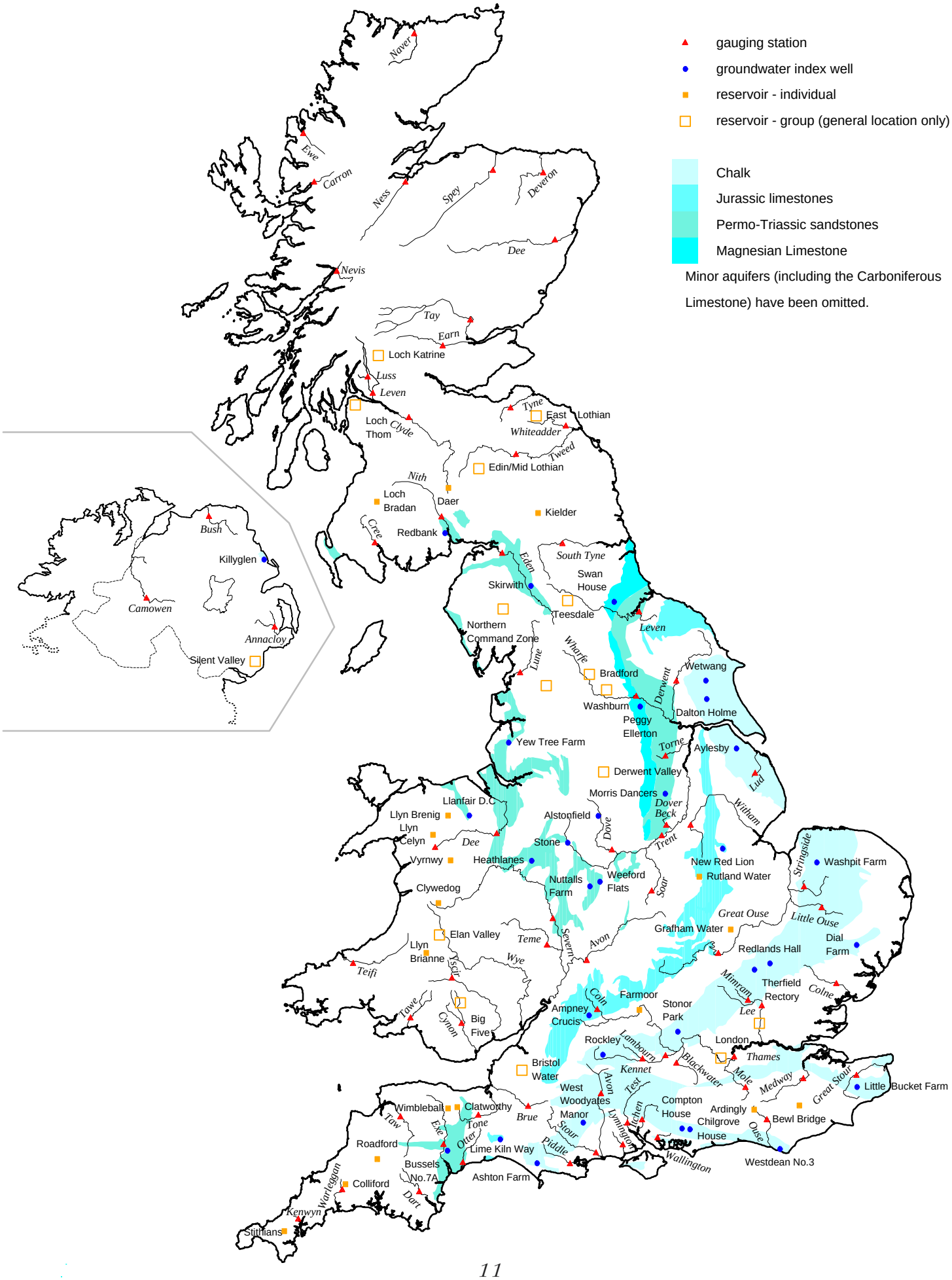
Percentage live capacity of selected reservoirs at start of month

Area	Reservoir	Capacity (Ml)	2002 Feb	Mar	Apr	May	Jun	Jul	Min. Jul	Year* of min
North West	N Command Zone	• 124929	100	100	97	89	100	97	58	1995
	Vyrnwy	55146	100	100	100	94	99	95	65	1990
Northumbrian	Teesdale	• 87936	99	100	97	89	98	95	58	1989
	Kielder	(199175)	(100)	(96)	(92)	(91)	(98)	(94)	71	1989
Severn Trent	Clywedog	44922	96	100	94	98	99	98	72	1989
	Derwent Valley	• 39525	100	100	98	88	85	81	53	1996
Yorkshire	Washburn	• 22035	95	97	91	85	91	89	63	1995
	Bradford supply	• 41407	99	100	96	84	95	95	54	1995
Anglian	Grafham	(55490)	(87)	(87)	(89)	(91)	(94)	(96)	70	1997
	Rutland	(116580)	(84)	(89)	(92)	(94)	(95)	(92)	75	1997
Thames	London	• 202340	87	88	92	93	97	97	85	1990
	Farmoor	• 13830	79	88	87	95	90	96	94	1995
Southern	Bewl	28170	90	97	98	95	95	93	52	1990
	Ardingly	4685	100	100	100	100	100	99	86	1996
Wessex	Clatworthy	5364	97	100	100	89	100	97	61	1995
	Bristol WW	• (38666)	(70)	(99)	(98)	(93)	(95)	(93)	64	1990
South West	Colliford	28540	72	78	82	81	84	84	51	1997
	Roadford	34500	84	94	94	91	94	93	49	1996
	Wimbleball	21320	76	100	100	97	100	97	63	1992
	Stithians	5205	49	78	88	85	86	83	53	1990
Welsh	Celyn and Brenig	• 131155	100	100	98	99	100	99	77	1996
	Brianne	62140	100	98	97	89	100	99	76	1995
	Big Five	• 69762	99	97	94	90	98	94	61	1989
	Elan Valley	• 99106	100	100	97	93	100	95	75	1989
East of Scotland	Edinburgh/Mid Lothian	• 97639	92	100	98	94	99	100	54	1998
	East Lothian	• 10206	100	100	100	100	96	98	81	1992
West of Scotland	Loch Katrine	• 111363	99	100	99	95	100	99	61	2001
	Daer	22412	100	100	100	99	100	99	62	1994
	Loch Thom	• 11840	100	100	98	95	100	100	69	2000
Northern Ireland	Silent Valley	• 20634	46	57	59	65	81	90	54	1995

() 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
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
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

6/02