Hydrological summary for the United Kingdom

June 2000

General

Apart from a short-lived heatwave in mid-month, June was an unsettled month with a damp and cloudy complexion to the weather in most areas. Significant storm events were, however, uncommon and regional rainfall totals were mostly well below average. Overall, June was the driest month in the UK since July last year. Reservoir stocks fell steadily through the month but still remain very healthy for England and Wales as a whole; stocks are below average in some major impoundments in Scotland and Northern Ireland. Groundwater levels remain above average throughout most major aquifers – providing substantial baseflow support to many lowland rivers. This is reflected in unprecedented June runoff totals for some southern rivers draining permeable catchments.

Rainfall

Record June temperatures and exceptional evaporative demands over the 16-19th were atypical of June generally, but the heatwave conditions did culminate a notably dry spell over much of the English lowlands. Some localities (e.g. Oxford) reporting rainfall of <2 mm over the first 18 days; soil moisture deficits and water demand both increased significantly over this period. Most frontal systems were relatively weak but severe gales were experienced in northern Scotland (e.g. on the 12-13th) and a slow-moving front resulted in storm totals up to 75 mm in northern England over the 3rd-5th (with >50mm in 12 hours in some localities). June rainfall exceeded the average only in a small proportion of the country – most extensively in the Pennines and the Lake District. In the English lowlands, the great majority of catchments received <25 mm – corresponding to <40% of the June average; some sheltered localities (e.g. in Kent) registering < 20%. Rainfall in parts of western Scotland was below average for the fourth successive month, more notably Northern Ireland was relatively dry with County Down again failing to reach the 1961-90 average. England and Wales recorded its driest June since 1996, and provisional figures suggest that across the English lowlands it was the third driest June since 1976. Notwithstanding the modest early summer rainfall, three-month totals are well above average for most of eastern and southern Britain (including most of Wales) but appreciably below average in some north-western catchments. For the year thus far, rainfall is well within the normal range in almost all regions and most accumulated rainfall totals are appreciably above average in the 9- and 12-month timeframes.

River flows

The normal seasonal flow pattern has been little in evidence throughout the first half of the year but seasonal recessions became well established in most UK rivers during June. Runoff in many southern rivers declined from the exceptionally high late-spring flows to typical summer discharge rates (prior to a brisk upturn in early July). In northern England the early June recessions were interrupted by very notable spates around the 4th. Sustained heavy rainfall over the Pennines, latterly on saturated catchments, triggered significant flooding which was particularly severe in Bishop Auckland (on the River Gaunless) and Todmorden (on the Calder). Red Flood Alerts were called on many Pennine rivers and the peak flow on the River Wear (at Sunderland Bridge) was the highest since 1967. June runoff totals were above average for most catchments – notably so in southern baseflow-dominated rivers which benefited from the unusually abundant spring recharge. Despite June catchment rainfalls of below 65%, the rivers Test, Itchen and Avon each established new June maximum mean flows in records exceeding 35 years. Exceptionally high runoff also characterised many rivers in northern England. Six and 12-month runoff accumulations are generally above average in most western and northern areas but below average in the east (including eastern catchments in Northern Ireland).

Groundwater

Modest rainfall and above average early summer evaporative losses over the first 20 days of June caused soil moisture deficits to increase smartly, but were moderated around month end and by early July were mostly below the seasonal average. As is usual for June, no significant infiltration occurred in most major aquifer outcrop areas. In the more responsive Chalk outcrops groundwater levels declined through the month but they are still rising in the deeper, less fissured units. The much delayed onset of the recessions has left overall resources in the Chalk at their highest for mid-summer for at least a decade. Brisk declines were reported for almost all the Limestone index wells in June but the water-table is currently close to, or a little above, the mid-summer average. Many index wells and boreholes in Permo-Triassic sandstones are influenced – to a greater or lesser degree - by local or regional pumping; this together with differing aquifer properties can make for widely differing groundwater hydrograph behaviour. Typically, June levels in the more westerly outcrops were substantially above average (Redbank in south-west Scotland is an exception) whilst sluggish recoveries from very depressed levels characterise a few eastern boreholes.

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Rainfall . . . Rainfall . . . Rainfall. . .

Rainfall accumulations and return period estimates

Area	Rainfall	Jun 2000	Apr 00-Jun 00	RP	Jan 00-Jun 00	RP	Oct 99-Jun 00	RP	Jul 99-Jun 00	RP
England & Wales	**mm**	**44**	**253**		**429**		**717**		**960**	
	%	**68**	**134**	**5-15**	**104**	**2-5**	**105**	**2-5**	**100**	**<2**
North West	mm	97	283		579		989		1255	
	%	120	125	5-10	111	2-5	110	2-5	98	2-5
Northumbrian	mm	71	264		444		699		898	
	%	118	148	20-30	114	2-5	110	2-5	98	2-5
Severn Trent	mm	38	241		373		617		840	
	%	64	139	10-15	104	2-5	108	2-5	103	2-5
Yorkshire	mm	68	282		416		646		830	
	%	113	158	30-45	108	2-5	104	2-5	94	2-5
Anglian	mm	19	203		294		458		651	
	%	37	140	10-15	105	2-5	103	2-5	101	2-5
Thames	mm	22	244		357		552		774	
	%	41	151	10-20	109	2-5	106	2-5	104	2-5
Southern	mm	20	259		386		630		861	
	%	37	161	30-45	108	2-5	104	2-5	103	2-5
Wessex	mm	26	262		421		707		954	
	%	45	153	15-25	107	2-5	109	2-5	107	2-5
South West	mm	34	272		496		894		1151	
	%	49	130	5-10	90	2-5	96	2-5	93	2-5
Welsh	mm	68	310		633		1116		1471	
	%	85	129	5-10	108	2-5	109	2-5	106	2-5
Scotland	**mm**	**72**	**235**		**731**		**1292**		**1618**	
	%	**84**	**95**	**2-5**	**117**	**5-10**	**119**	**10-20**	**106**	**2-5**
Highland	mm	86	267		989		1748		2088	
	%	88	95	2-5	130	30-40	129	40-60	112	5-10
North East	mm	43	263		499		864		1078	
	%	65	135	10-20	114	5-10	119	10-15	104	2-5
Tay	mm	65	232		637		1112		1405	
	%	89	106	2-5	112	2-5	118	5-10	108	2-5
Forth	mm	67	224		577		999		1234	
	%	97	111	2-5	117	5-10	120	10-20	105	2-5
Tweed	mm	58	235		472		788		995	
	%	89	122	5-10	108	2-5	109	2-5	96	2-5
Solway	mm	78	241		667		1175		1508	
	%	93	98	2-5	108	2-5	110	2-5	100	<2
Clyde	mm	84	222		816		1517		1884	
	%	91	83	2-5	113	2-5	119	10-15	105	2-5
Northern Ireland	**mm**	**56**	**213**		**437**		**830**		**1152**	
	%	**79**	**103**	**2-5**	**90**	**2-5**	**103**	**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 any unauthorised person or organisation. **All monthly totals since July 1998 are provisional (see page 12).** Recent monthly rainfall figures for the Scottish regions have been compiled using data provided by the Scottish Environment Protection Agency. 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 England & Wales and Scotland rainfall series 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

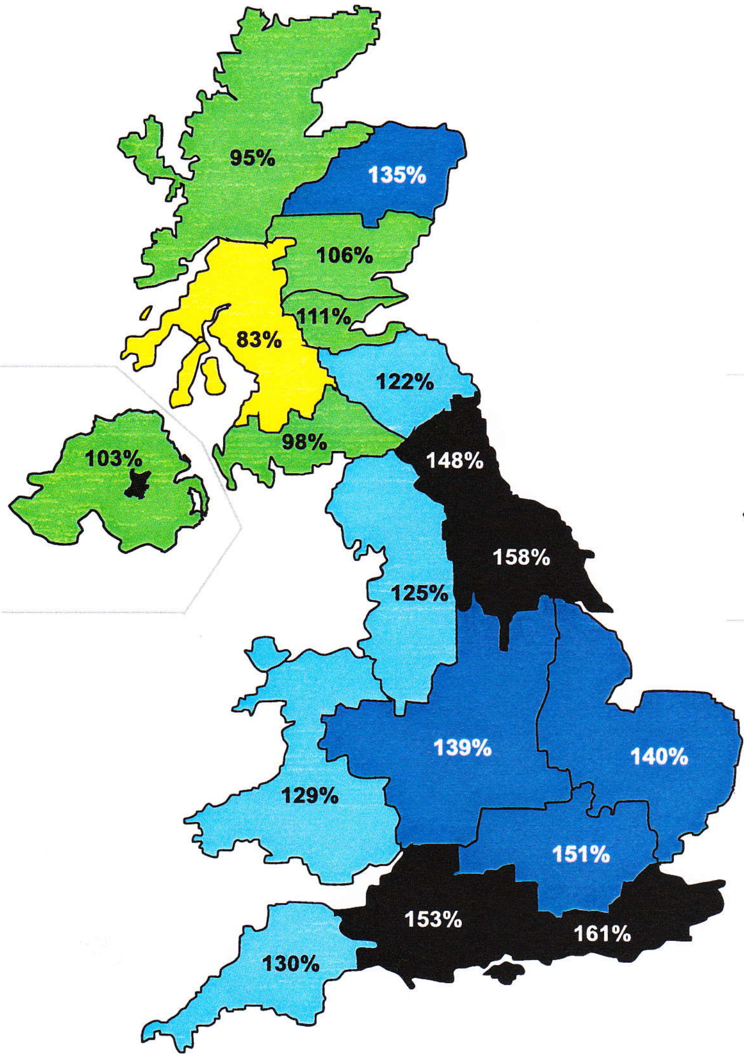
Above average

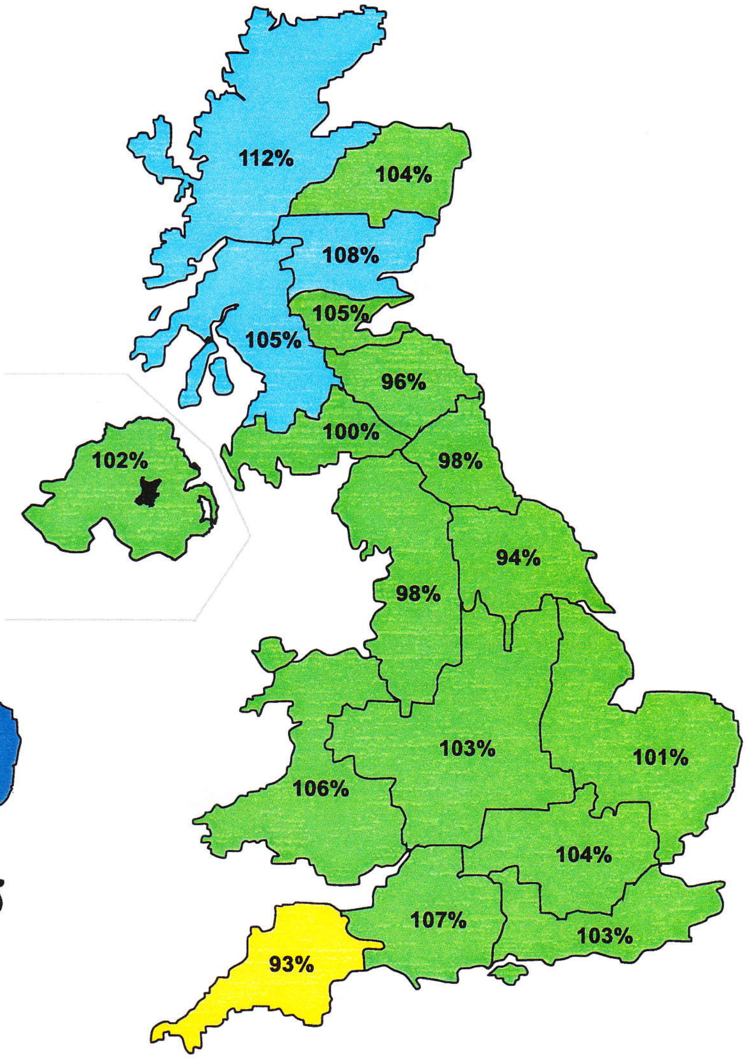
Normal range

Below average

Substantially below average

Exceptionally low rainfall



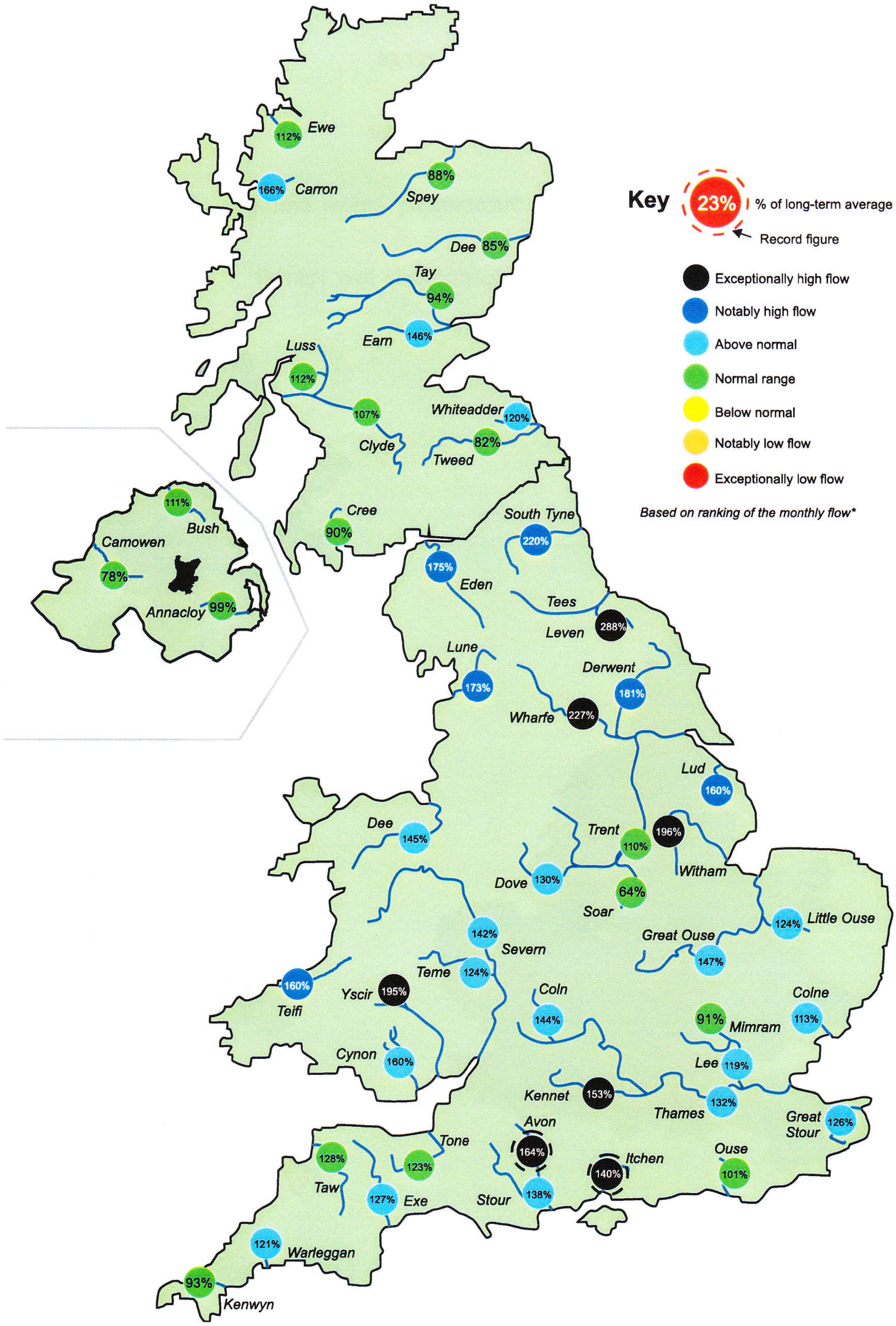


April 2000 - June 2000 **July 1999 - June 2000**

Rainfall accumulation maps

In the April-June timeframe, UK rainfall was well above average for the fourth successive year; the south was especially wet with some catchments reporting their highest accumulated rainfall for over 30 years. The July-June rainfall for the UK as a whole was significantly lower than than for the preceding 12 months but, 1998/99 aside, still the second highest total in the last 15 years.

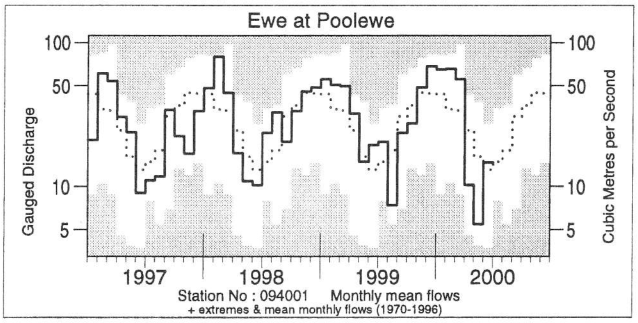
River flow . . . River flow . . .

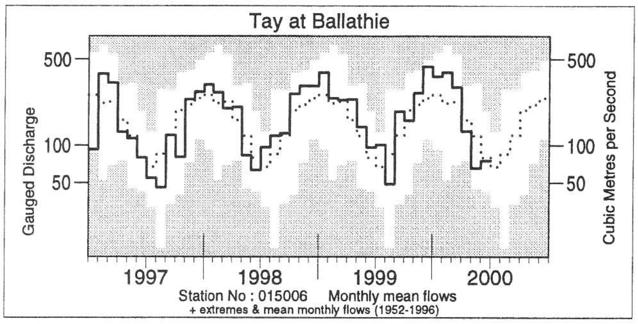


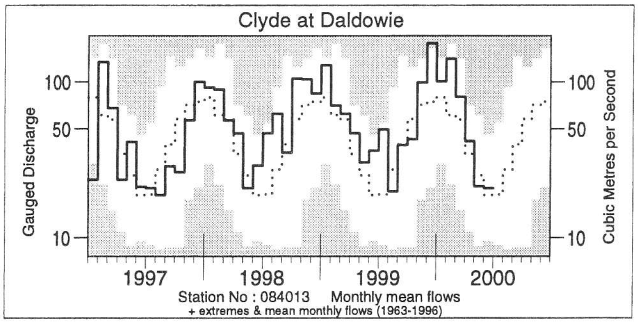
River flows - June 2000

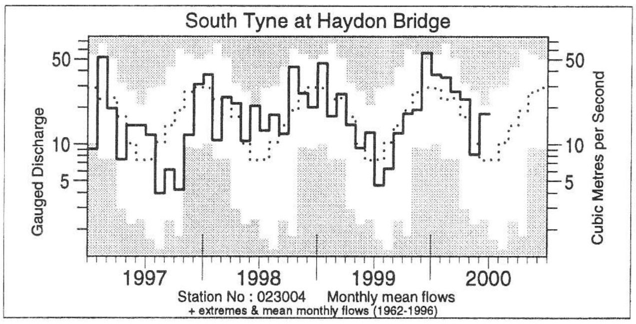
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

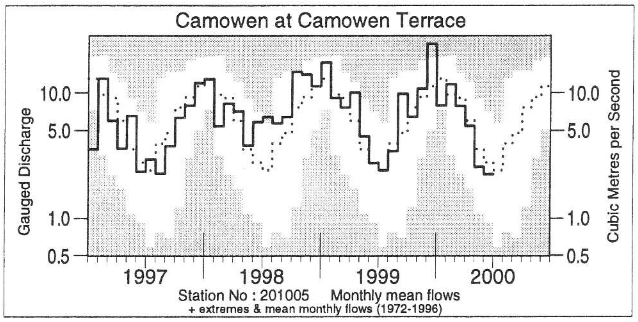
River flow . . . River flow . . .

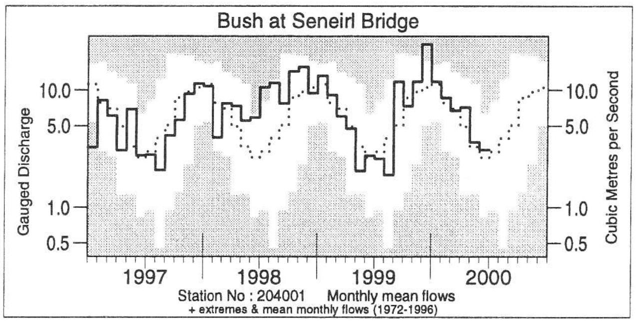


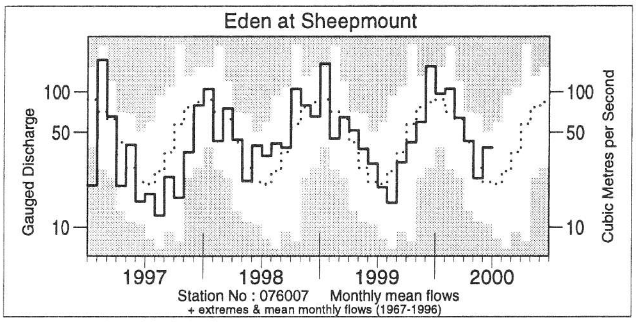


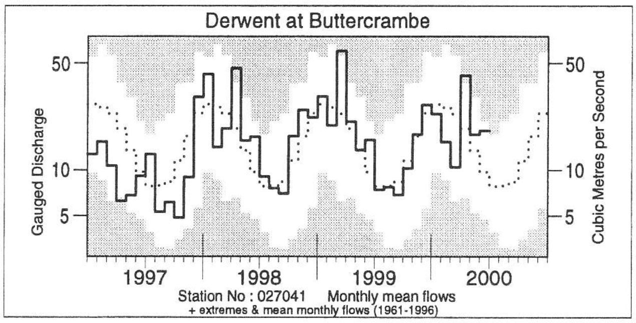


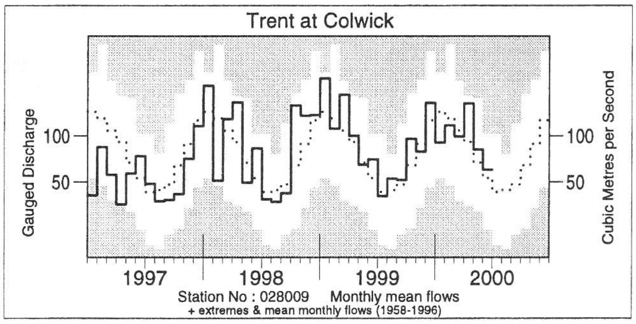


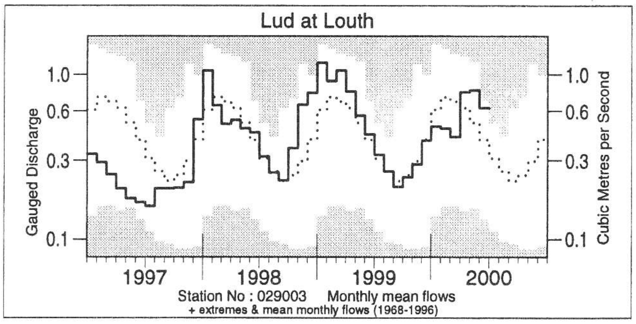








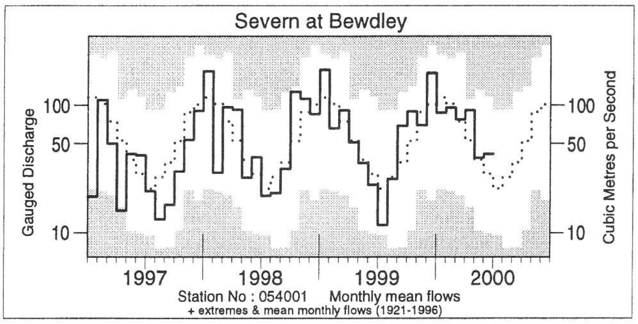




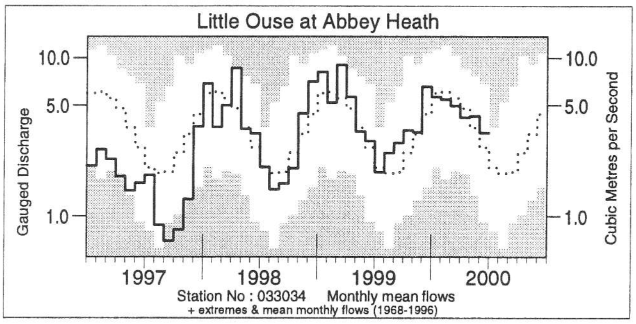
Monthly river flow hydrographs

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 1997 (shown by the shaded areas). Monthly flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

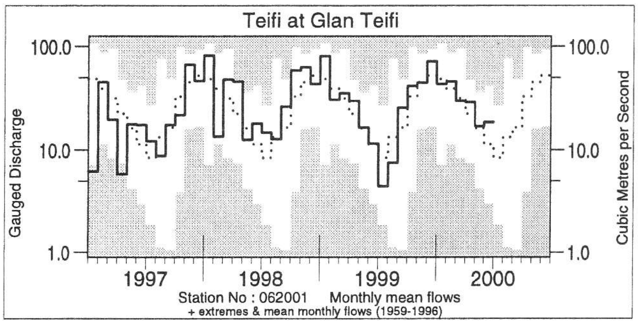
River flow . . . River flow . . .



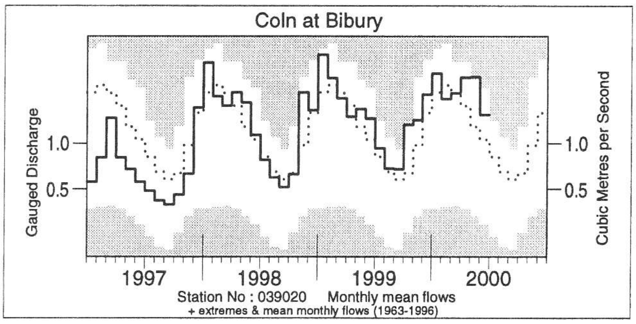
Severn at Bewdley
Station No : 054001 Monthly mean flows
+ extremes & mean monthly flows (1921-1996)



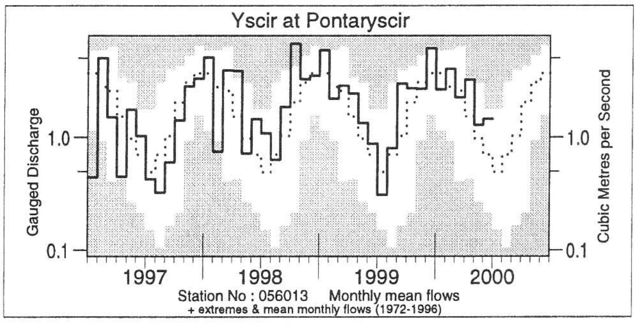
Little Ouse at Abbey Heath
Station No : 033034 Monthly mean flows
+ extremes & mean monthly flows (1968-1996)



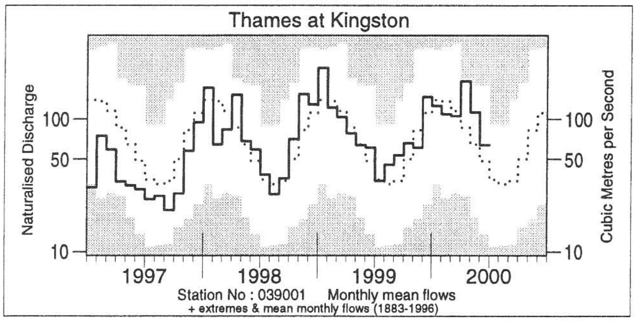
Teifi at Glan Teifi
Station No : 062001 Monthly mean flows
+ extremes & mean monthly flows (1959-1996)



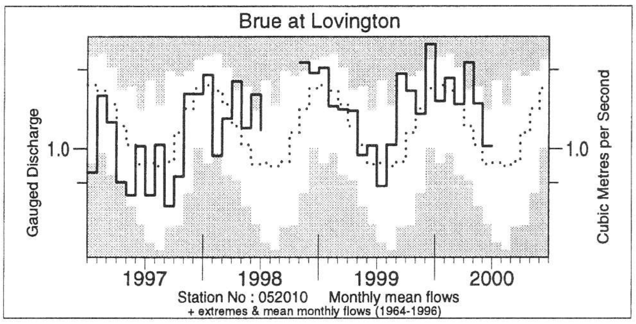
Coln at Bibury
Station No : 039020 Monthly mean flows
+ extremes & mean monthly flows (1963-1996)



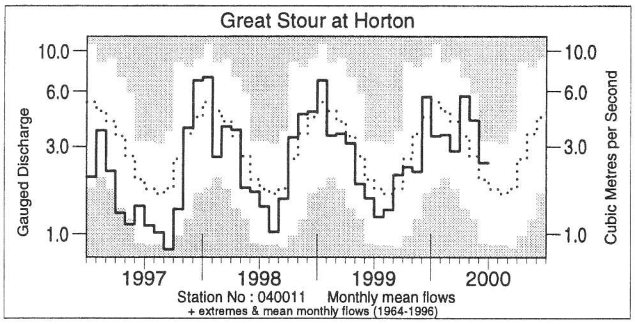
Yscir at Pontaryscir
Station No : 056013 Monthly mean flows
+ extremes & mean monthly flows (1972-1996)



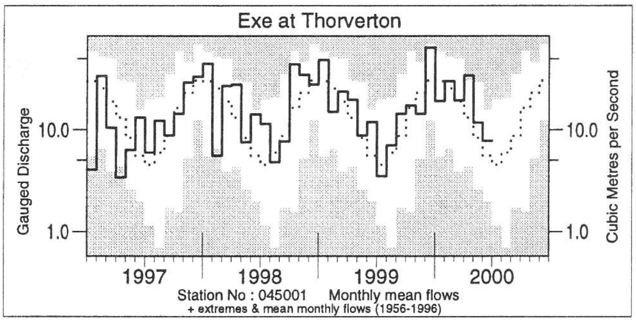
Thames at Kingston
Station No : 039001 Monthly mean flows
+ extremes & mean monthly flows (1883-1996)



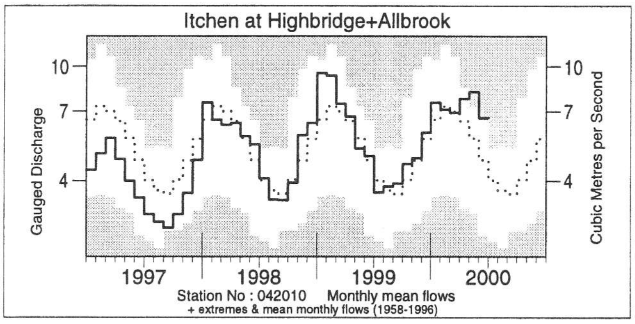
Brue at Lovington
Station No : 052010 Monthly mean flows
+ extremes & mean monthly flows (1964-1996)



Great Stour at Horton
Station No : 040011 Monthly mean flows
+ extremes & mean monthly flows (1964-1996)



Exe at Thorverton
Station No : 045001 Monthly mean flows
+ extremes & mean monthly flows (1956-1996)



Itchen at Highbridge+Allbrook
Station No : 042010 Monthly mean flows
+ extremes & mean monthly flows (1958-1996)

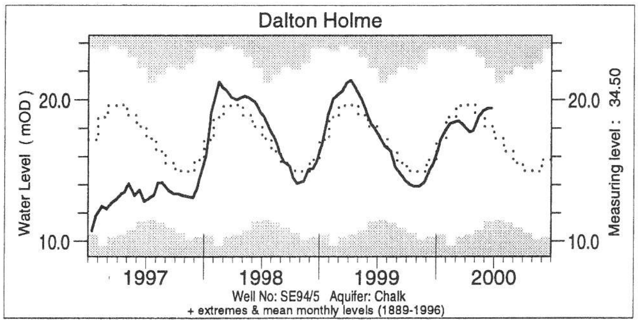
Notable runoff accumulations April - June 2000 (a); July 1999 - June 2000 (b)

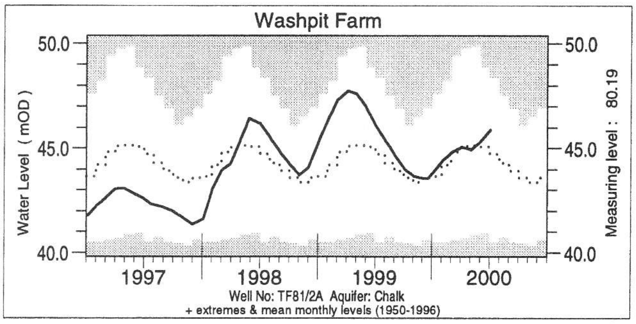
(a) River	%lta	Rank	River	%lta	Rank
Leven	283	40/40	Test	142	42/42
Blackwater	196	48/48	Itchen	134	42/42
Kennet	169	39/39	Avon	171	36/36
Lymington	233	40/40	Exe	187	44/44

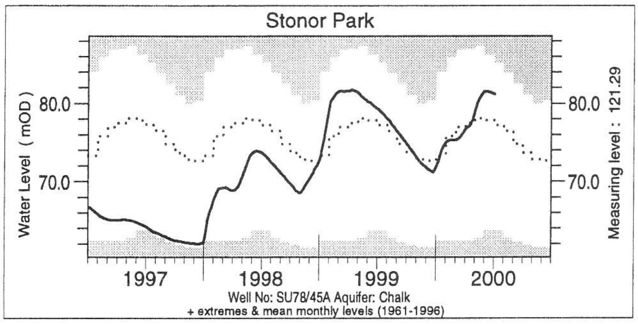
(b) River	%lta	Rank
Brue	171	34/34
Yscir	127	26/27
Clyde	143	36/36
Naver	125	21/22

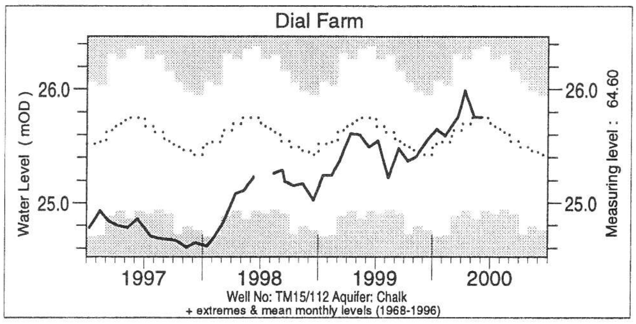
lta = long term average
Rank 1 = lowest on record

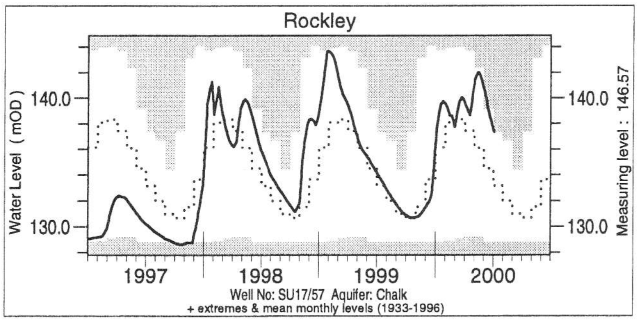
Groundwater . . . Groundwater

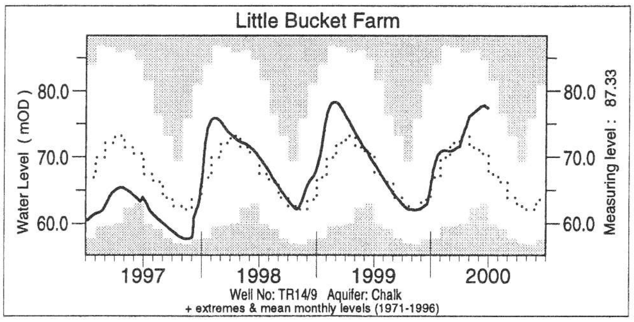


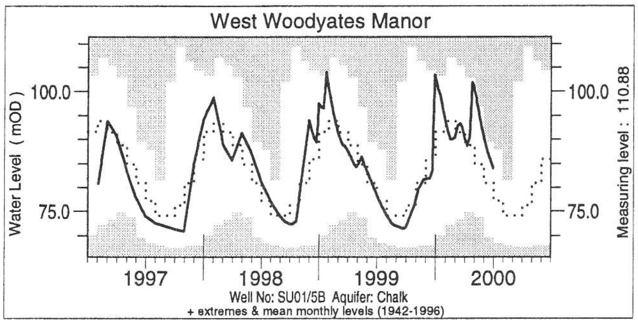


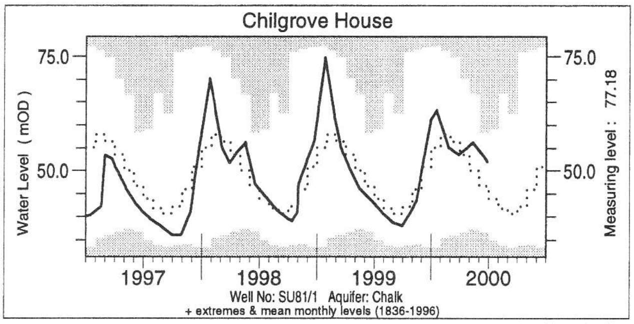


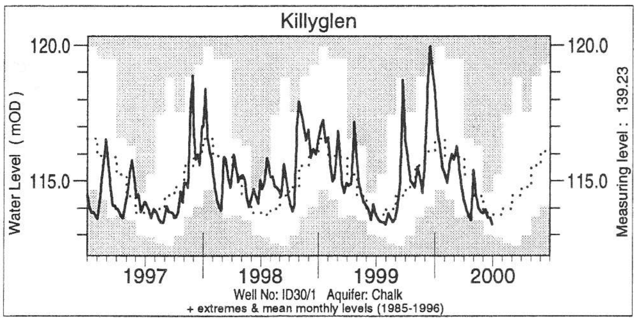


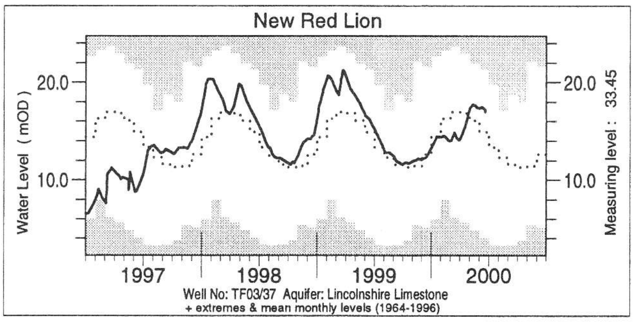








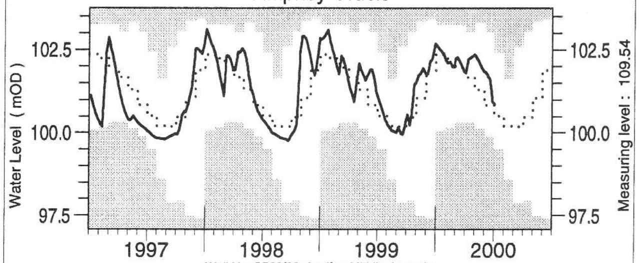




Note. Due to the impact of abstraction on groundwater levels at the Holt, it has been replaced as an index site by the Stonor Park well. Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low 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.

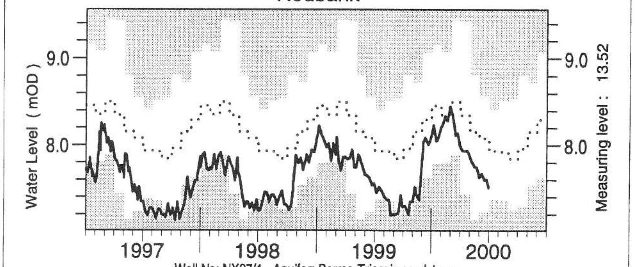
Groundwater . . . Groundwater

Ampney Crucis



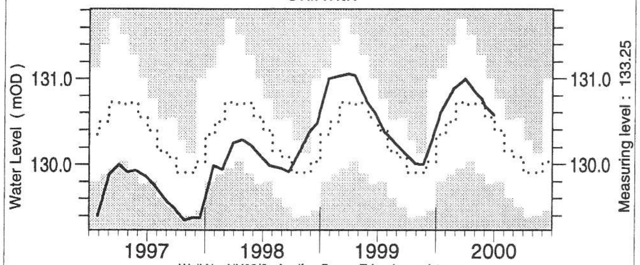
Well No: SP00/62 Aquifer: Middle Jurassic
+ extremes & mean monthly levels (1958-1996)

Redbank



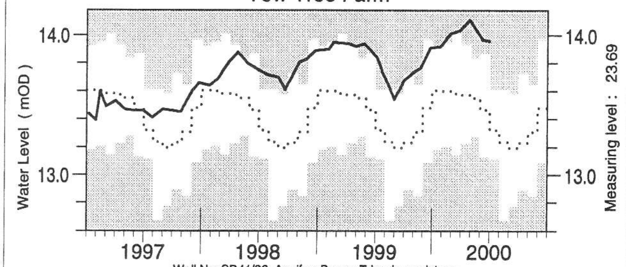
Well No: NX97/1 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1981-1996)

Skirwith



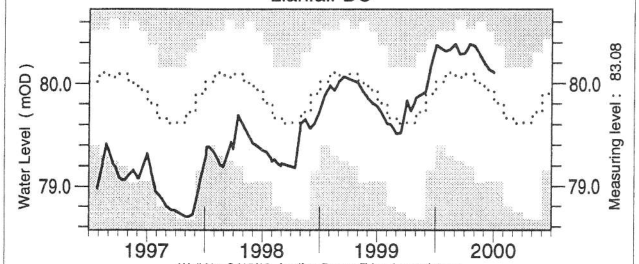
Well No: NY63/2 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1978-1996)

Yew Tree Farm



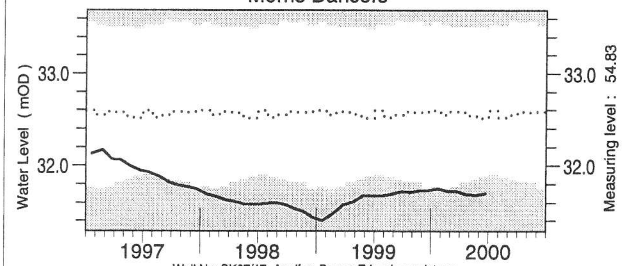
Well No: SD41/32 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1974-1996)

Llanfair DC



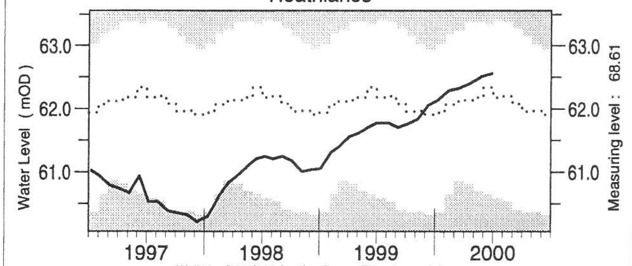
Well No: SJ15/13 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1972-1996)

Morris Dancers



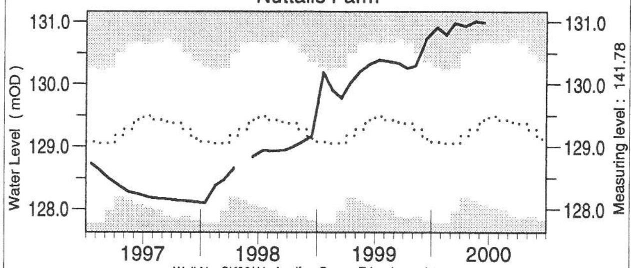
Well No: SK67/17 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1969-1996)

Heathlanes



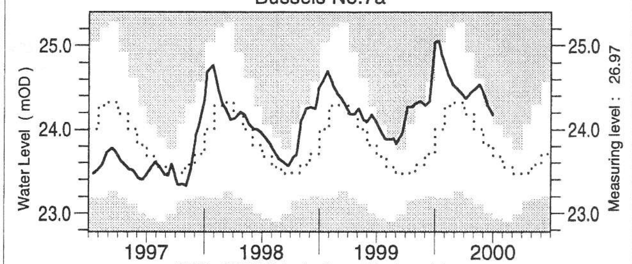
Well No: SJ62/112 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1971-1996)

Nuttalls Farm



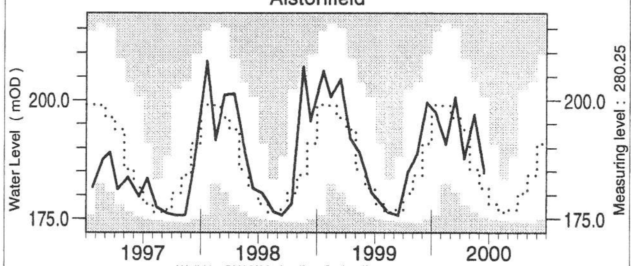
Well No: SK00/41 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1974-1996)

Bussels No.7a



Well No: SX99/37B Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1971-1996)

Alstonfield

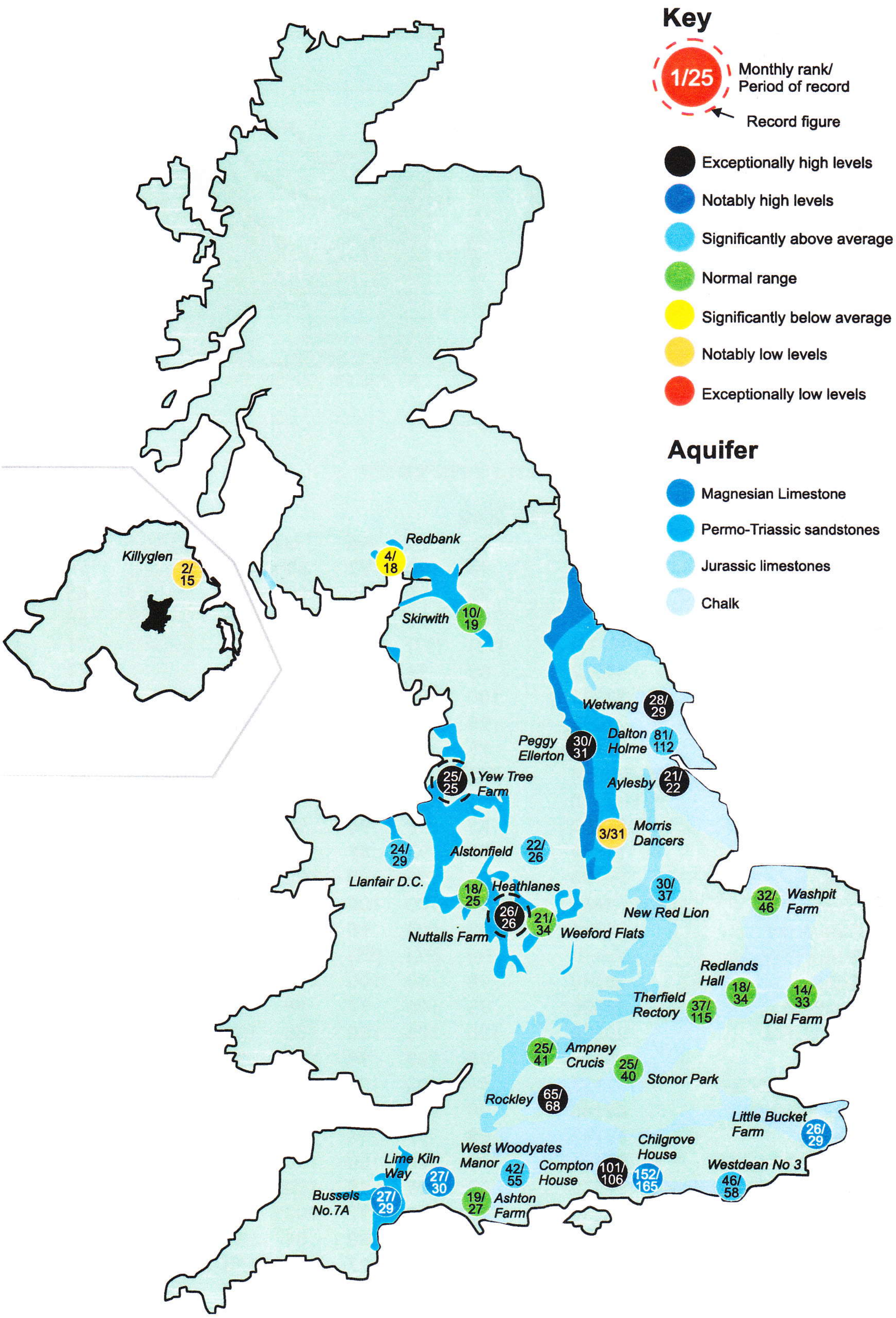


Well No: SK15/16 Aquifer: Carboniferous Limestone
+ extremes & mean monthly levels (1974-1996)

Groundwater levels June/July 2000

Borehole	Level	Date	Jun av.	Borehole	Level	Date	Jun av.	Borehole	Level	Date	Jun av.
Dalton Holme	19.39	23/06	18.12	Chilgrove	52.05	27/06	45.99	Llanfair D.C.	80.11	01/07	79.79
Washpit Farm	45.90	04/07	45.09	Killyglen	113.37	30/06	113.97	Morris Dancers	31.70	23/06	32.41
Redlands Hall	44.03	20/06	43.49	New Red Lion	16.93	20/06	14.64	Heathlanes	62.56	28/06	62.17
Dial Farm	25.75	05/06	25.69	Ampney Crucis	100.87	03/07	100.81	Nuttalls Farm	130.99	14/06	129.42
Rockley	137.32	03/07	134.48	Redbank	7.51	30/06	8.00	Bussels No. 7A	24.18	30/06	23.83
Little Bucket	77.38	29/06	70.97	Skirwith	130.57	30/06	130.52	Alstonfield	184.74	15/06	180.97
West Woodyates	83.99	30/06	80.81	Yew Tree Farm	13.96	30/06	13.52				

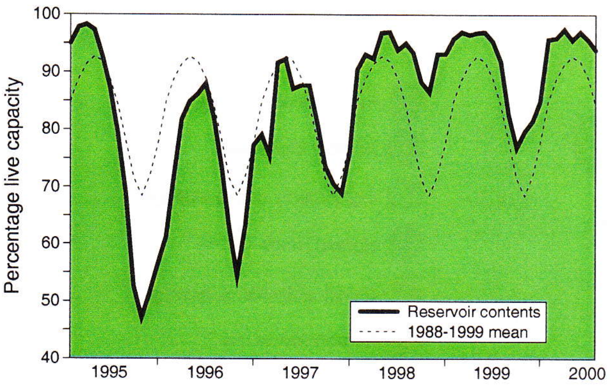
Levels in metres above Ordnance Datum



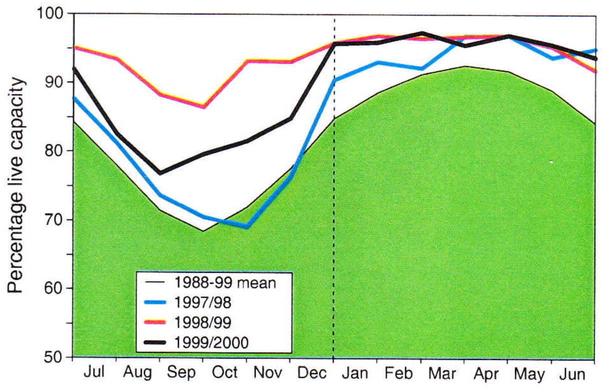
Groundwater levels - June 2000

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.

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

Area	Reservoir	Capacity (Ml)	2000 Feb	Mar	Apr	May	Jun	Jul	Min. Jul	Year* of min
North West	N Command Zone	• 133375	98	100	92	88	79	77	58	1995
	Vyrnwy	55146	96	96	95	99	95	98	65	1990
Northumbrian	Teesdale	• 87936	97	100	94	100	100	93	58	1989
	Kielder	(199175)	(93)	(97)	(90)	(94)	(95)	(92)	71	1989
Severn Trent	Clywedog	44922	88	94	93	99	99	99	72	1989
	Derwent Valley	• 39525	100	100	100	100	100	92	53	1996
Yorkshire	Washburn	• 22035	98	100	94	100	99	90	63	1995
	Bradford supply	• 41407	99	99	93	99	92	90	54	1995
Anglian	Grafham	** (55490)	(94)	(90)	(94)	(96)	(91)	(92)	70	1997
	Rutland	**(116580)	(91)	(94)	(95)	(97)	(96)	(94)	75	1997
Thames	London	• 206399	95	95	96	97	96	96	85	1990
	Farmoor	• 13843	95	93	88	81	97	95	94	1995
Southern	Bewl	28170	95	98	98	100	100	100	52	1990
	Ardingly	4685	100	100	100	100	100	99	86	1996
Wessex	Clatworthy	5364	98	100	98	100	98	93	61	1995
	Bristol WW	• (38666)	(94)	(96)	(95)	(98)	(99)	(92)	64	1990
South West	Colliford	28540	98	100	100	100	100	98	51	1997
	Roadford	34500	95	100	97	99	97	96	49	1996
	Wimbleball	21320	100	100	100	100	100	96	63	1992
	Stithians	5205	98	100	98	98	92	84	53	1990
Welsh	Celyn and Brenig	• 131155	99	100	100	100	100	100	77	1996
	Brianne	62140	98	100	97	100	100	99	76	1995
	Big Five	• 69762	98	97	96	98	98	96	61	1989
	Elan Valley	• 99106	100	100	100	100	99	97	75	1989
East of Scotland	Edinburgh/Mid Lothian	• 97639	98	99	99	100	95	90	54	1998
	East Lothian	• 10206	97	100	97	100	99	96	81	1992
West of Scotland	Loch Katrine	• 111363	85	95	88	84	69	65	65	2000
	Daer	22412	100	100	97	97	90	80	62	1994
	Loch Thom	• 11840	100	100	97	92	79	69	69	2000
Northern Ireland	Silent Valley	• 20634	62	63	57	58	56	57	54	1995

() 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. Since the discontinuation of The Met. Office's CARP system in July 1998, rainfall figures have been provided by differing methods. Initial rainfall estimates for Scotland and the Scottish regions were derived by IH in collaboration with SEPA. In England and Wales, between July 1998 and May 1999, provisional rainfall figures derive from MORECS*. Beginning with the June 1999 report, provisional rainfall figures for England and Wales, the EA regions and Northern Ireland (from September 1999) 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 SEPA; over the coming months further monthly raingauge totals will be included for selected EA regions. Until the access to these additional data has stabilised the regional figures (and the return periods associated with them) should be regarded as a guide only.

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

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The cooperation of all data suppliers is gratefully acknowledged.

Subscription

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

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