Hydrological summary

for Great Britain

January 1999

General

January was very unsettled and, in most regions, remarkably mild. Several reservoirs were drawndown to provide greater scope for flood mitigation and poor water quality restricted the replenishment of a few pumped storage reservoirs. Nonetheless, overall stocks remain exceptionally healthy - most reservoirs are very close to capacity. Weather conditions were also ideal for groundwater recharge and, by month-end, the overall resources outlook was very encouraging (moderated only by the precedent of 1995 when prospects deteriorated rapidly through an extremely dry spring).

Rainfall

Weather patterns in January were dominated by a succession of westerly frontal systems; gales were common especially in northern Britain which experienced both blizzards and a significantly increased avalanche risk. On the 5/6th, 24-hour rainfall totals in excess of 100 mm were reported from Windermere and Dolydd (Wales). A complex low pressure system produced significant rainfall totals over a much wider area on the 15th -Brooksby in Leicestershire recorded 26 mm in four hours, Portland Bill (Dorset) 43 mm in 24 hours and Dolydd 69 mm in 15 hours. Generally however, January was notable for the frequency of storm events - with a very high number of 'wet' days in the South-East - rather than the magnitude of rainfall totals. Although a few raingauges in north-eastern Scotland registered only around half the January average, most regional totals were in the 120-150% range - adding to a cluster of recent wet Januarys; for Britain as a whole, seven of the fourteen wettest in a record from 1869 have occurred in the last fifteen years. Rainfall accumulations over a range of timespans are also generally above average; those for September-January being particularly important in water resources terms especially in parts of the English Lowlands where it was the wettest such period for over twenty years. A particularly wet phase can be traced back to November 1997 - for Britain, the last 15 months ranks, provisionally, alongside 1993/95 as the second wettest such sequence this century.

River Flow

The well above average rainfall and saturated condition of most catchments resulted in spate conditions throughout January in most areas. Tidal flooding occurred early in the month (e.g. at Selsey) followed by significant fluvial flooding in northern Britain around the 6th - which was particularly severe in Cumbria; the peak flow on the Lune was (provisionally) the second highest in at least 20 years. The passage of a very active frontal system on the 15th triggered floodplain inundations over an exceptionally wide area. Steep impermeable western catchments responded initially, along with some lowland clay catchments (e.g. in Berkshire) - in a few localities, for example Cranleigh near Guildford, local flooding was exacerbated by partially blocked storm drains. In the third week, flood alerts applied to many rivers and further flooding occurred in the South-West (e.g. around the 20th at Bedminster, Chew Magna and near Taunton) following up to 40 mm of rainfall over 24 hours. Generally however the speed of the frontal systems limited the duration of storms - and the corresponding rainfall amounts - helping to prevent major flooding; the return period of most peak flows was around the 3-5 year mark. Nonetheless, monthly runoff totals were amongst the highest on record in many catchments and rivers registering unprecedented January totals show a wide distribution - including the Soar (in a 28-year record), the Lune (39 years) and the Kennet for which the (provisional) runoff was the highest for any month in a record from 1961. Runoff totals are also outstanding in the 12-month timeframe especially in northern Britain where the Clyde established a new February-January maximum.

Groundwater

With soils saturated and significant pulses of rainfall throughout the month, groundwater replenishment in January was heavy in almost all major aquifer units; in some eastern areas infiltration in January exceeded twice the monthly average. As importantly in resources terms, infiltration has continued, albeit unevenly, since mid-autumn and generally groundwater levels have been rising briskly since the early winter. Levels in the deeper wells to the north of London - which, in early January 1998 were the lowest on record (e.g. at The Holt and Redlands) - are rising steeply. January levels at Rockley and Chilgrove peaked close to long term maxima, the latter was close to becoming artesian late in the month - the third exceptionally high level in the last six years. Similarly late-January levels were very high in the Limestone aquifers. The position in the Permo-Triassic sandstones is less spatially coherent. Levels at Skirwith, Llanfair and Yew Tree Farm are the highest for almost four years but the benefit of the abundant infiltration over the winter is still awaited at a few very slow responding index sites.

Institute of Hydrology

British Geological Survey

Rainfall . . . Rainfall . . . Rainfall. .

Rainfall accumulations and return period estimates

Area	Rainfall	Jan 1999	Nov 98-Jan 99	RP	Sep 98-Jan 99	RP	Feb 98-Jan 99	RP	Nov 97-Jan 99	RP
England & Wales	**mm**	**120**	**285**		**517**		**1027**		**1371**	
	%	**136**	**105**	**2-5**	**119**	**5-10**	**115**	**5-10**	**117**	**10-20**
North West	mm	178	402		710		1409		1809	
	%	147	109	2-5	116	2-5	117	5-15	115	5-15
Northumbrian	mm	110	267		463		1085		1407	
	%	131	106	2-5	116	2-5	127	30-45	127	40-60
Severn Trent	mm	118	249		472		908		1172	
	%	169	114	2-5	137	10-20	120	10-15	121	10-20
Yorkshire	mm	96	233		434		941		1233	
	%	122	96	2-5	113	2-5	115	5-10	116	5-15
Anglian	mm	68	192		358		720		926	
	%	137	118	2-5	136	10-20	121	10-20	122	15-25
Thames	mm	93	226		454		836		1077	
	%	145	113	2-5	142	20-30	121	5-15	121	10-20
Southern	mm	101	257		511		878		1248	
	%	126	104	2-5	129	5-15	113	2-5	122	10-20
Wessex	mm	121	285		541		1003		1384	
	%	139	108	2-5	131	5-15	120	5-15	126	20-35
South West	mm	145	418		738		1363		1897	
	%	105	104	2-5	121	5-10	116	5-10	120	10-20
Welsh	mm	212	471		850		1587		2126	
	%	148	108	2-5	123	5-10	121	10-20	121	20-30
Scotland	**mm**	**219**	**557**		**888**		**1772**		**2258**	
	%	**145**	**123**	**5-10**	**118**	**5-10**	**123**	**40-60**	**119**	**30-50**
Highland	mm	277	686		1038		2117		2642	
	%	147	117	2-5	108	2-5	120	20-30	113	5-15
North East	mm	85	279		518		1146		1523	
	%	86	96	2-5	109	2-5	118	10-20	120	25-40
Tay	mm	210	519		849		1565		2060	
	%	146	132	5-15	133	10-20	127	30-50	127	50-80
Forth	mm	154	440		777		1506		1888	
	%	131	129	5-10	138	30-45	136	>200	130	150-200
Tweed	mm	150	358		588		1189		1552	
	%	150	125	5-10	125	5-15	123	20-30	124	30-50
Solway	mm	236	588		968		1830		2363	
	%	151	131	5-15	129	10-20	129	50-80	126	50-80
Clyde	mm	263	666		1041		2037		2590	
	%	139	122	5-10	113	2-5	120	15-25	115	10-20

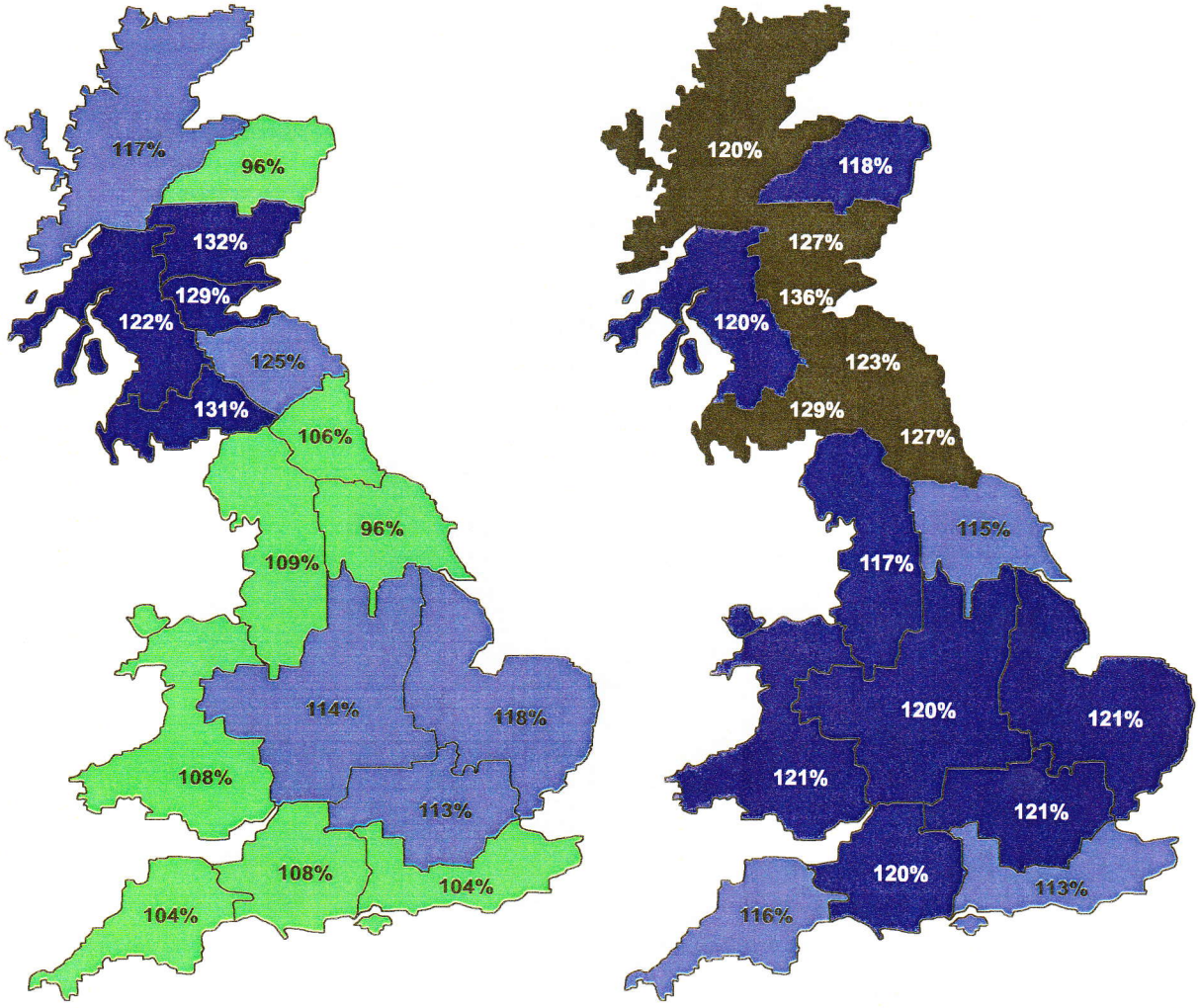
RP = Return period

 Recent monthly rainfall figures for the Scottish regions have ben 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). 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		Normal range
	Very wet		Below average
	Substantially above average		Substantially below average
	Above average		Exceptionally low rainfall

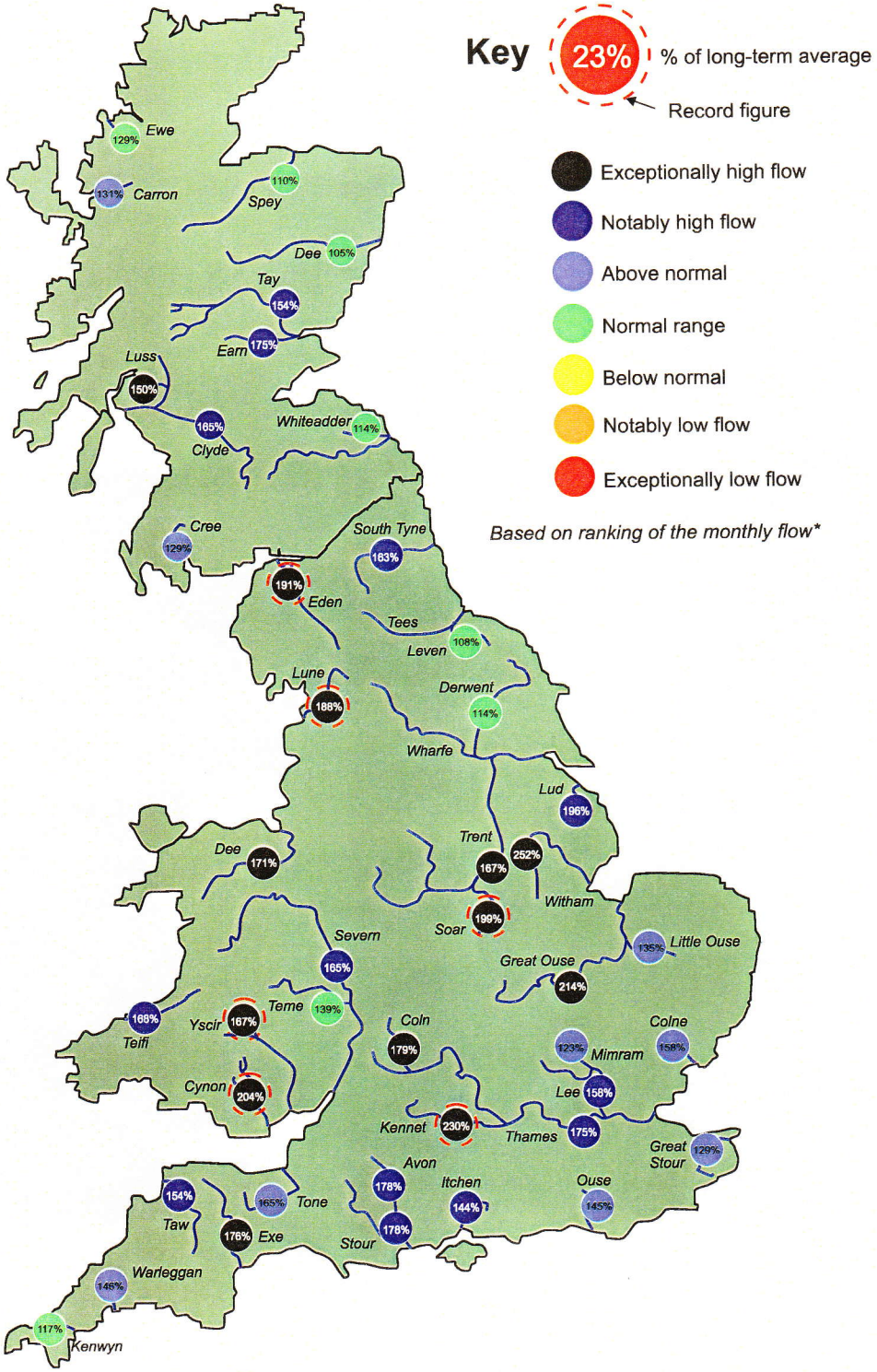


November 1998 - January 1999 **February 1998 - January 1999**

Rainfall accumulation maps

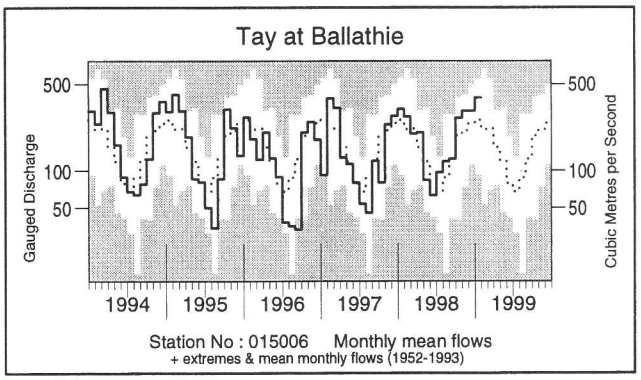
Below average regional rainfall totals over the November-January period have been confined to north-eastern Britain. Accumulated totals in the 12-month timeframe are especially notable: February-January totals are well above average in all regions and, for Britain as whole, provisional rainfall figures suggest that only 1992/93 has been wetter since 1927/28 (but 1994/95 was comparably as wet also).

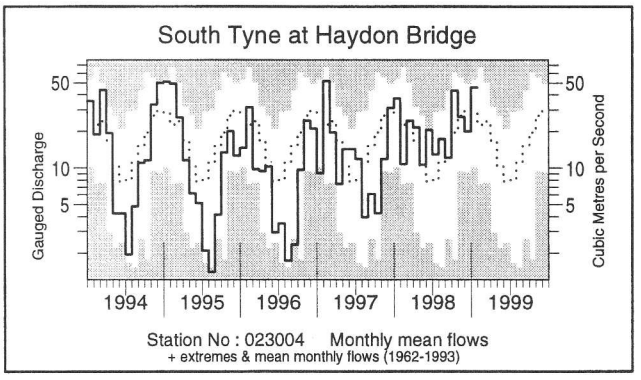
River flow . . . River flow . . .

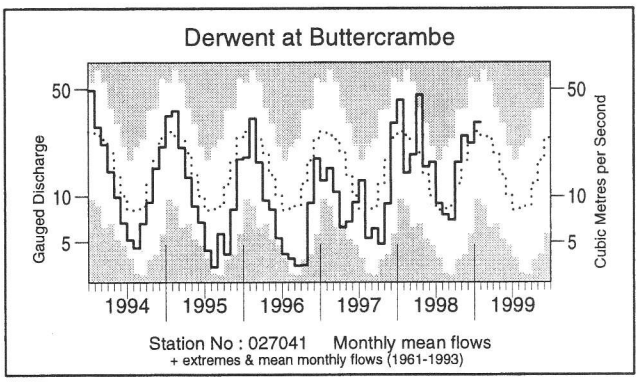


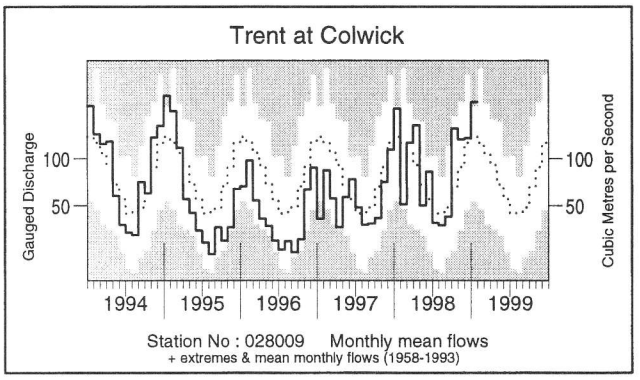
River flows - January 1999

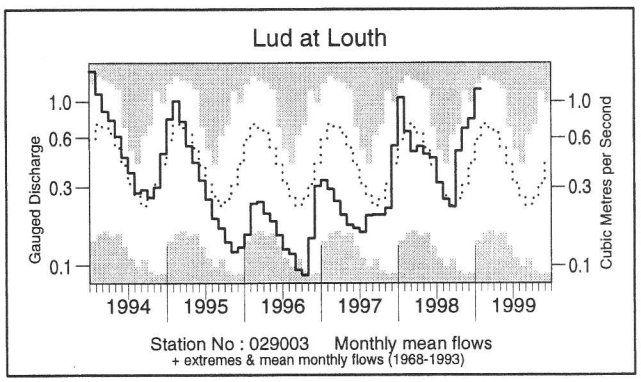
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much greater.

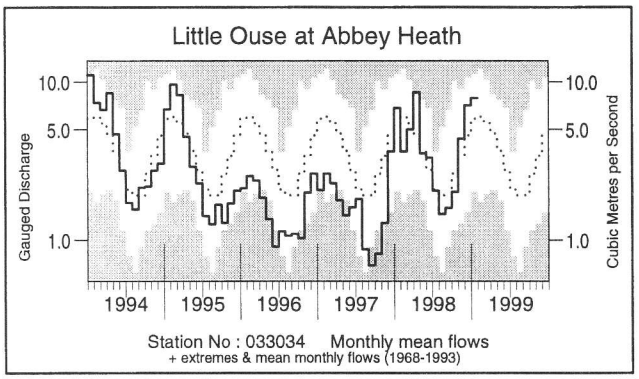


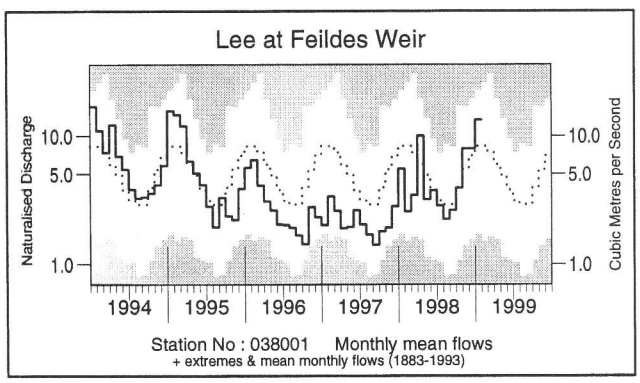


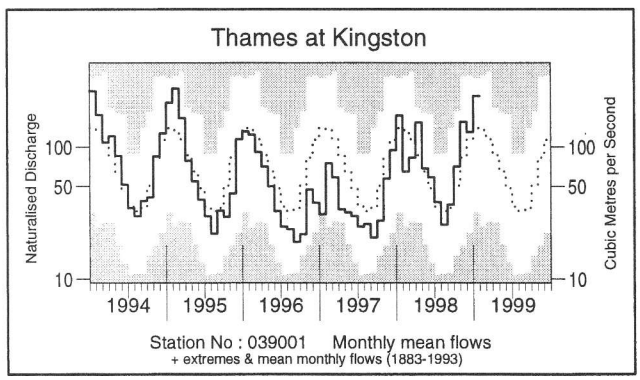








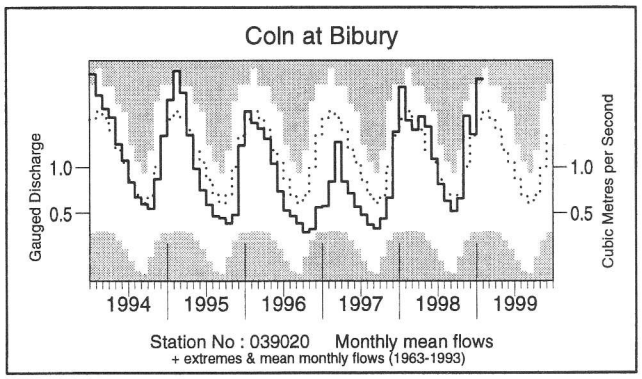


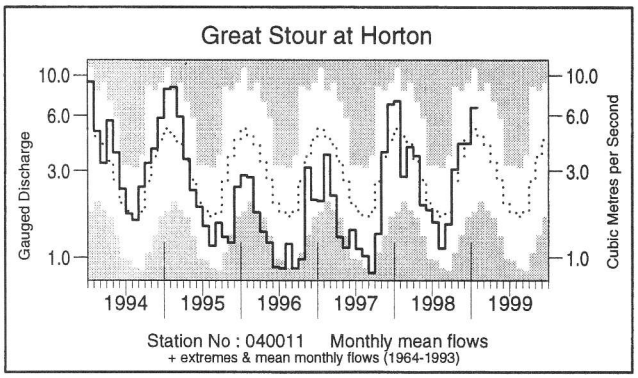


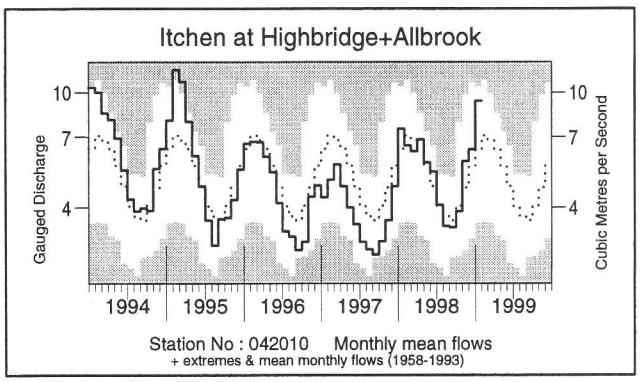
Monthly river flow hydrographs

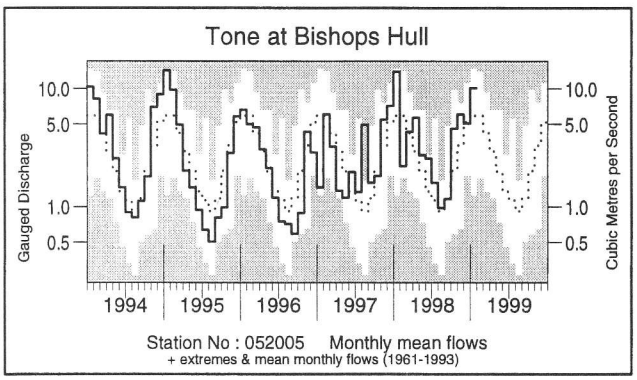
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 1993 (shown by the shaded areas). Monthly flows falling outside the maximum/ minimum range are indicated where the bold trace enters the shaded areas.

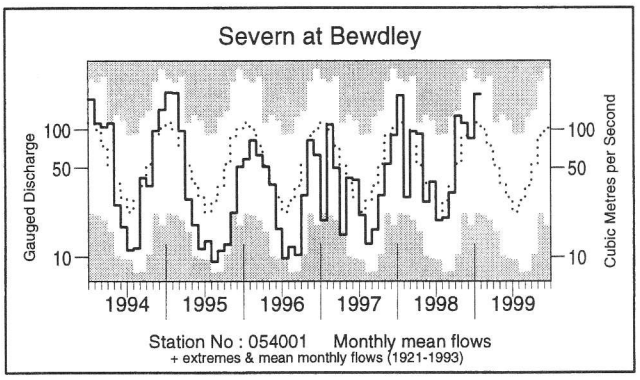
River flow . . . River flow . . .

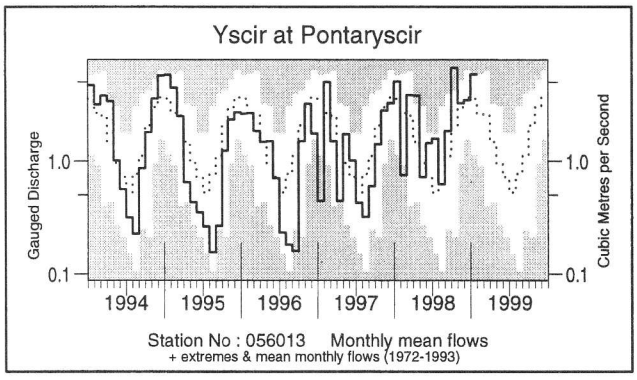


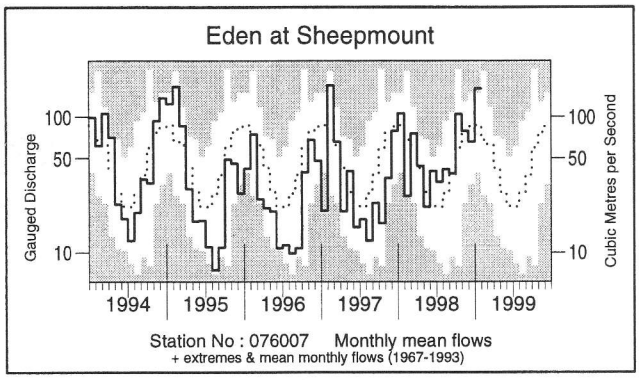


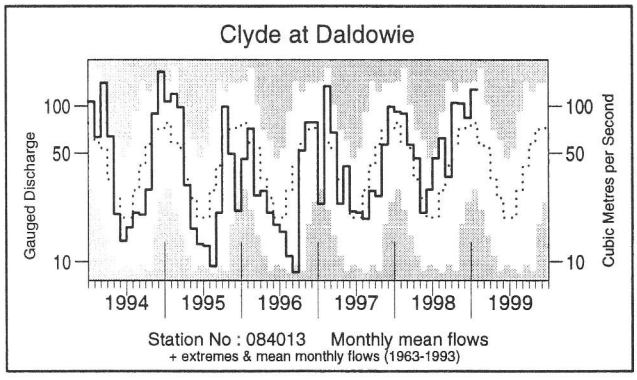










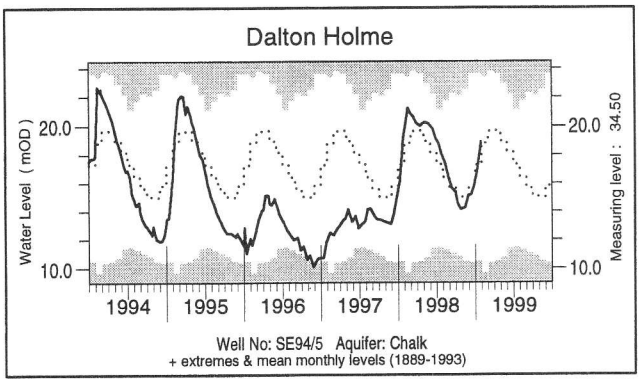


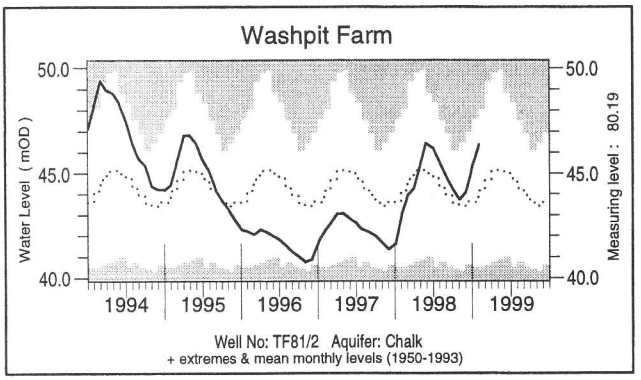
Notable runoff accumulations September 1998 - January 1999 (a); February 1998 - January 1999 (b)

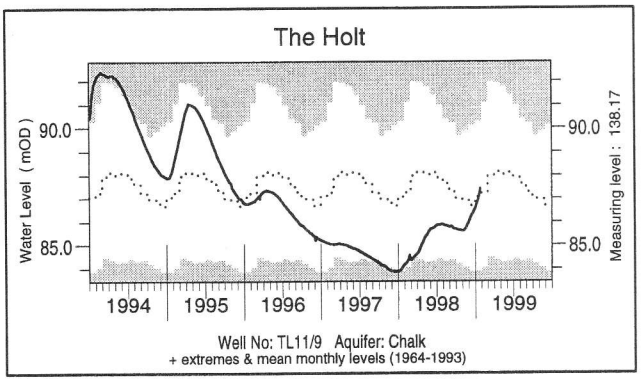
(a) River	%lta	Rank	(b) River	%lta	Rank	River	%lta	Rank
Whiteadder	164	29/30	Tyne	145	33/33	Taw	133	38/40
Lud	183	29/31	Tweed	130	38/38	Yscir	145	26/26
Dart	151	39/40	Whiteadder	151	29/29	Cynon	144	39/39
Yscir	154	26/26	Witham	155	37/39	Dee	129	36/37
Cynon	156	39/39	Ouse	171	65/66	Clyde	141	35/35
Eden	135	30/31	Exe	138	40/42	Naver	125	21/21

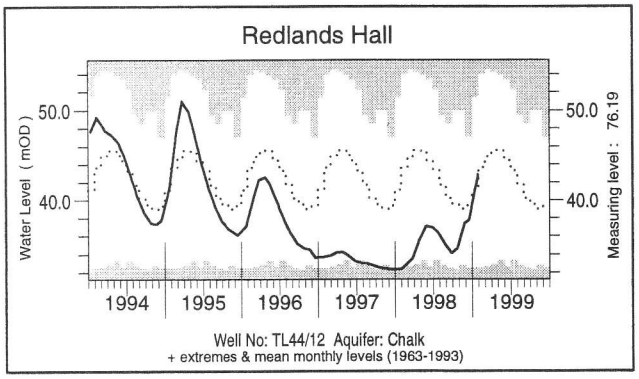
lta = long term average
Rank 1 = lowest on record

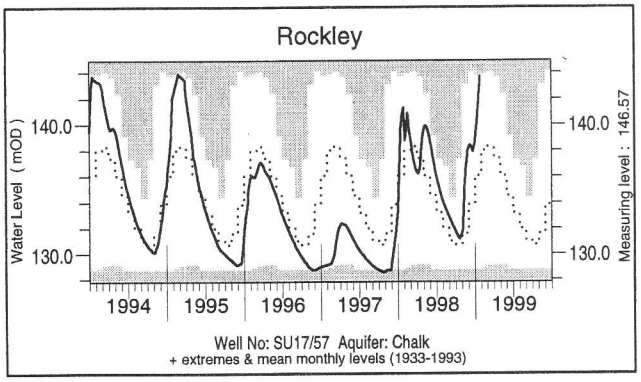
Groundwater . . . Groundwater

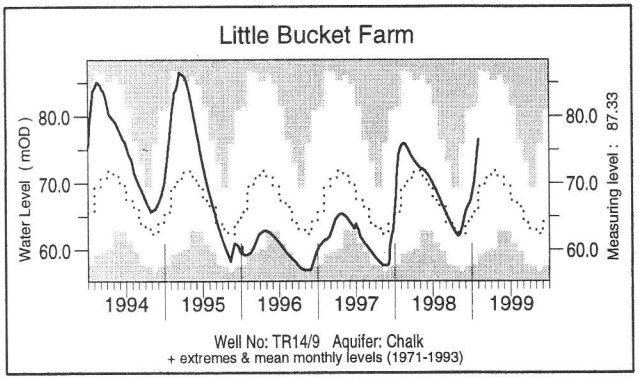


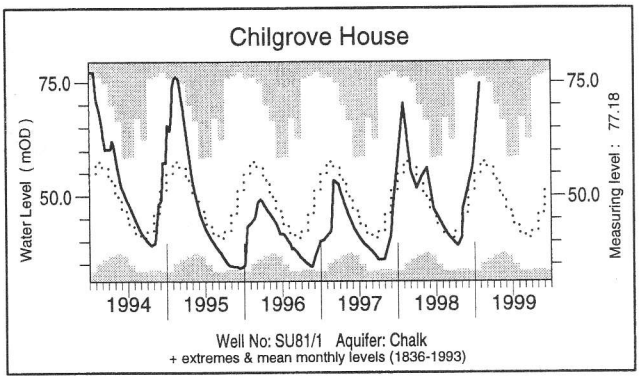


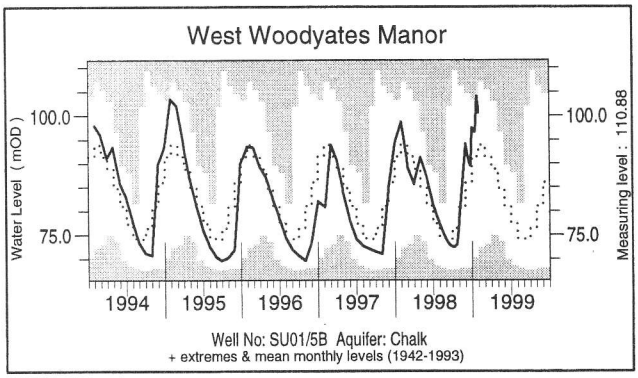








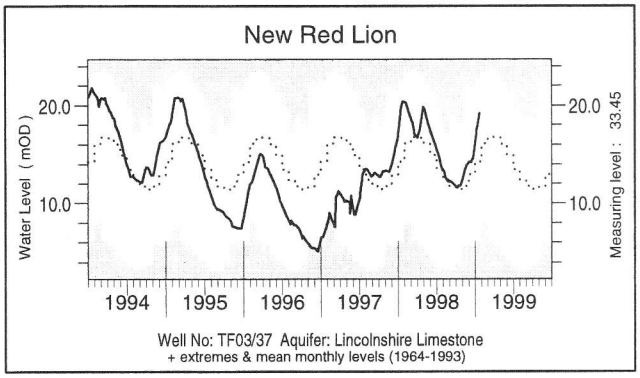


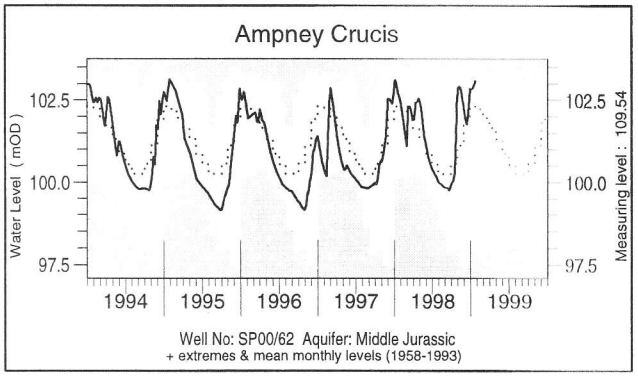


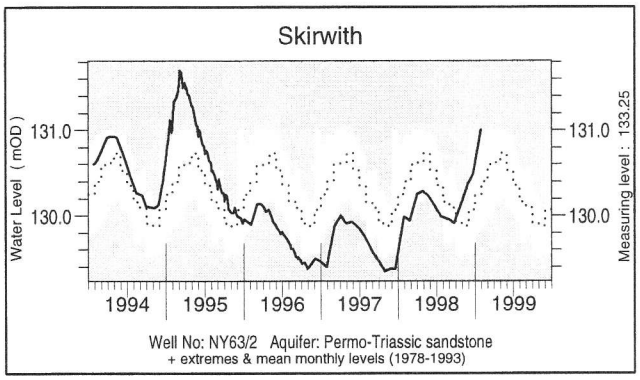
What is groundwater?

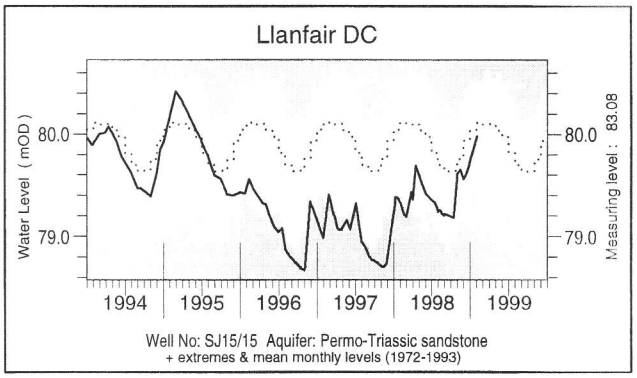
Groundwater is stored in the natural water bearing rock strata (or aquifers) which are found mostly in southern and eastern England (see page 11) where groundwater is the major water supply source. Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment 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.

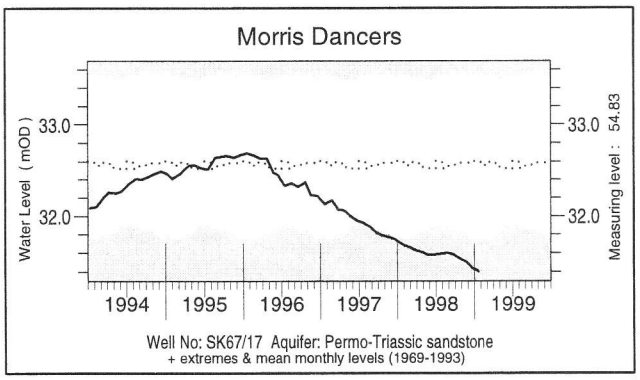
Groundwater . . . Groundwater

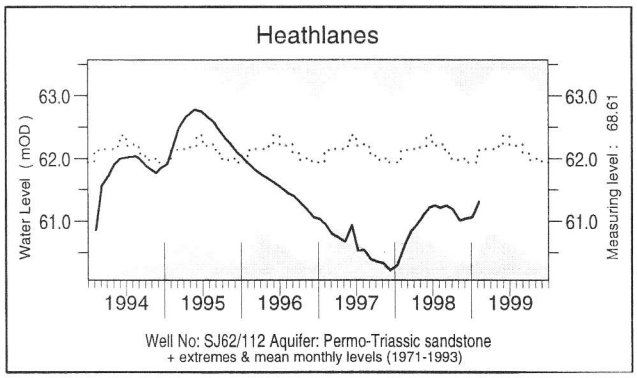


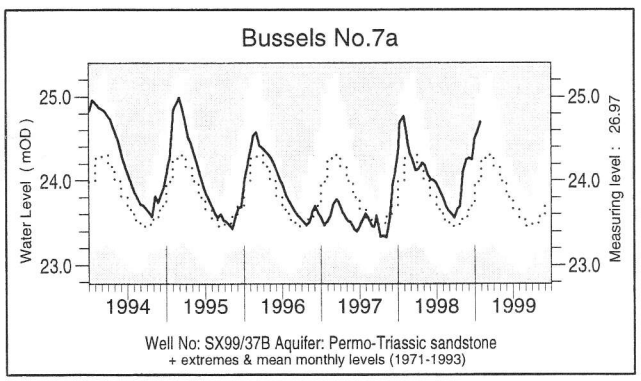


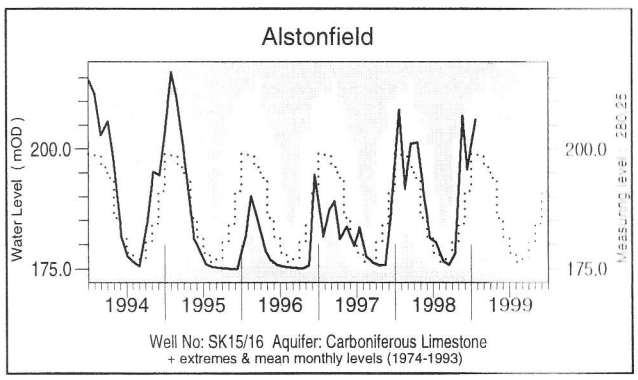










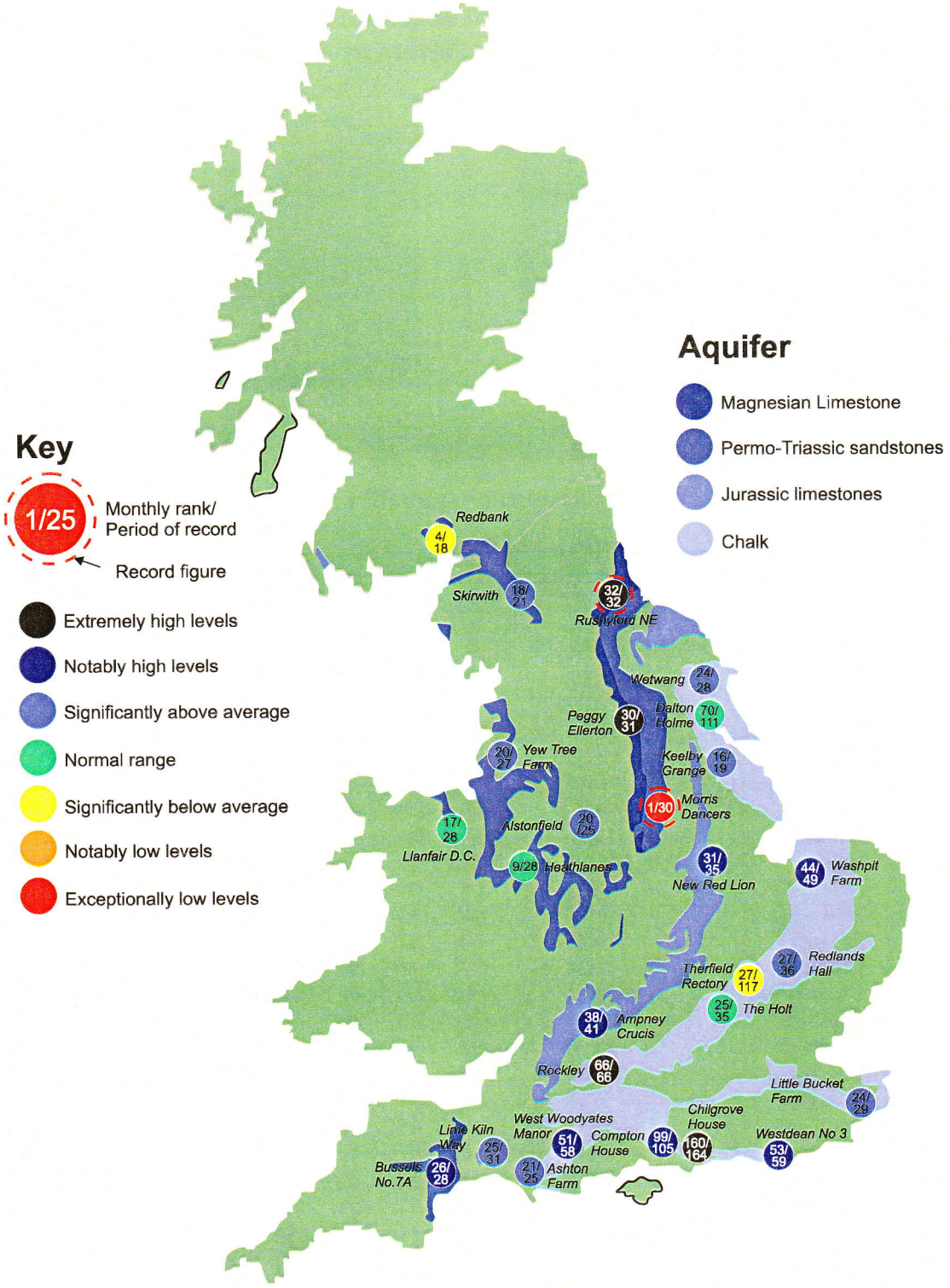


Groundwater levels January/February 1999

Borehole	Level	Date	Jan av.
Dalton Holme	18.87	27/01	17.14
Washpit Farm	46.37	02/02	43.60
The Holt	87.41	25/01	87.04
Redlands Hall	42.85	28/01	40.48
Ashton Farm	71.17	31/01	68.95
Little Bucket	76.50	01/02	66.96
Chilgrove	74.72	26/01	55.85
W Woodyates	100.6	31/01	91.02
New Red Lion	19.24	20/01	14.20
Ampney Crucis	103.09	25/01	102.30
Skirwith	131.00	26/01	130.33
Llanfair DC	79.98	01/02	79.87
Morris Dancers	31.40	19/01	32.50
Heathlanes	61.89	06/02	61.80
Bussels	24.70	26/01	24.02
Alstonfield	206.17	20/01	198.73

Levels in metres above Ordnance Datum

Groundwater . . . Groundwater

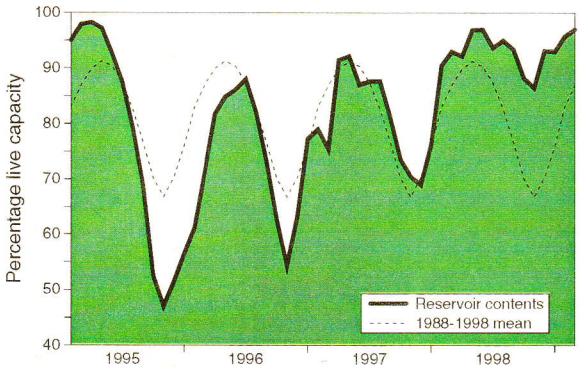


Groundwater levels - January 1999

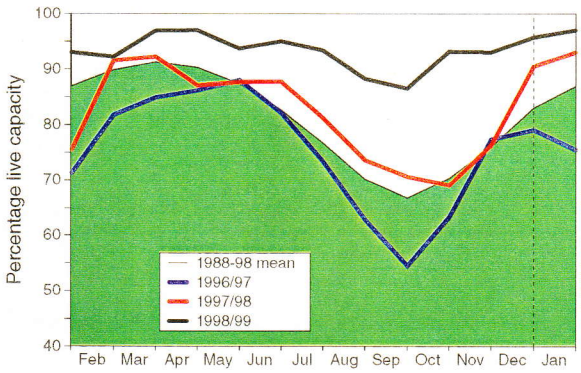
The rankings are based on a comparison of current levels (usually a single reading in a month) with the average level in each corresponding month on record. They need to be interpreted with caution especially when groundwater levels are changing rapidly or when comparing wells with very different periods of record.

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

Area	Reservoir	Capacity (Ml)	1998 Sep	Oct	Nov	Dec	1999 Jan	**Feb**	Min. Feb	Year* of min
NorthWest	N Command Zone	• 133375	80	75	90	93	98	96	63	1996
	Vyrnwy	55146	81	83	100	93	100	99	45	1996
Northumbrian	Teesdale	• 87936	92	87	99	98	98	99	51	1996
	Kielder	(199175)	(94)	(88)	(96)	(93)	(94)	(97)	(85)	1989
SevernTrent	Clywedog	44922	93	88	100	81	85	91	62	1996
	DerwentValley	• 39525	96	90	100	99	100	100	15	1996
Yorkshire	Washburn	• 22035	85	82	96	96	99	99	34	1996
	Bradford supply	• 41407	92	92	99	99	98	98	33	1996
Anglian	Grafham	** (55490)	(87)	(84)	(92)	(87)	(90)	(91)	(67)	1998
	Rutland	**(116580)	(88)	(86)	(87)	(88)	(91)	(95)	(68)	1997
Thames	London	• 206399	85	82	83	92	94	94	70	1997
	Farmoor	• 13843	97	98	96	93	90	85	82	1991
Southern	Bewl	28170	76	70	77	87	92	99	47	1990
	Ardingly	4685	74	67	80	100	100	100	68	1997
Wessex	Clatworthy	5364	77	70	92	100	100	100	62	1989
	BristolWW	• (38666)	(79)	(72)	(84)	(95)	(98)	(97)	(58)	1992
SouthWest	Colliford	28540	76	76	82	89	98	100	52	1997
	Roadford	34500	98	96	100	98	100	98	30	1996
	Wimbleball	21320	92	87	100	100	100	100	59	1997
	Stithians	5205	80	71	80	100	100	100	38	1992
Welsh	Celyn and Brenig	• 131155	84	95	100	96	98	100	61	1996
	Brianne	62140	100	97	100	94	100	99	84	1997
	Big Five	• 69762	88	94	92	86	94	99	67	1997
	Elan Valley	• 99106	96	97	100	100	100	100	73	1996
East of	Edinburgh/Mid Lothian	• 97639	45	43	50	56	60	72	72	**1999**
Scotland	East Lothian	• 10206	99	100	100	100	99	100	68	1990
West of	Loch Katrine	• 111363	89	85	92	89	90	90	85	1997
Scotland	Daer	22412	87	81	99	100	100	99	91	1997
	LochThom	• 11840	98	97	100	100	100	100	93	1998

() figures in parentheses relate to gross storage

last occurence

• denotes reservoir groups

** 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 area; this can be particularly important during droughts.

The minimum storage figures relate to the 1988-1998 period only. In some gravity-fed reservoirs (eg. Clywedog) stocks are kept below capacity during the winter to provide scope for flood attenuation purposes.

Location map . . . Location map

Where the information comes from

The National Hydrological Monitoring Programme was instigated in 1988 and is undertaken jointly by 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) and the Office of Water Services (OFWAT).

River flow and groundwater levels

The National River Flow Archive (maintained by IH) and the National Groundwater Level Archive (maintained by BGS) provide the historical perspective within which to examine contemporary hydrological conditions.

River flow and groundwater level data are provided by the regional divisions of the EA (England and Wales) and SEPA (Scotland). In all cases the data are subject to revision following validation (flood and drought data in particular may be subject to significant revision).

Reservoirs

Reservoir level information is provided by the Water Service Companies, the EA and, in Scotland, the West of Scotland and East of Scotland Water Authorities.

Rainfall

Most rainfall data are provided by the Met Office. To allow better spatial differentiation the rainfall data are presented for the regional divisions of the precursor organisations of the EA and SEPA. The recent rainfall estimates for the Scottish regions are derived by IH in collaboration with the SEPA regions. In England and Wales the recent rainfall figures derive from MORECS. MORECS is the generic name for the Meteorological Office services involving the routine calculation of evaporation and soil moisture throughout Great Britain. The discontinuation of the CARP system used by the Met. Office to provide more definitive regional rainfall assessments means that the recent MORECS figures have not been updated. Negotiations are continuing with the Met. Office to provide more accurate areal figures. Until the negotiations are concluded the regional rainfall figures (and the return periods associated with them) should be regarded as a guide only.

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