Hydrological summary
for Great Britain

February 1999

General

February was a mild and sunny month in most of the country but more boisterous conditions characterised northern Scotland. Such areas aside, February was a relatively dry month. Generally river flows declined briskly but overall reservoir stocks remain very healthy - all index reservoirs (in E&W) exceed 90% of capacity. Groundwater recharge was modest but levels in most outcrop areas are above average. The water resources outlook remains very encouraging but the timing of the onset of the spring drawdown in reservoir levels (and the start of the seasonal recession in groundwater levels) is always an important factor - this will depend on the magnitude and distribution of rainfall over the next three months.

Rainfall

Nationwide, February was another mild month with (northern Scotland excepted) temperatures well above the monthly average, but weather patterns were much less unsettled than earlier in the winter. Anticyclonic conditions dominated initially but from the 4th vigorous westerlies brought gales and blizzards to northern Scotland. In the English lowlands however conditions generally remained dry - in some eastern areas precipitation was largely restricted to fog-drip until mid-month. Thereafter, the weather took on a damper complexion but daily rainfall totals remained modest. Regional rainfall totals for February exceeded the average in the Scottish Highlands (where the substantial snowfall limits the precision of the regional rainfall assessment) but were generally in the 55%-90% range in England. England & Wales had its driest month since last May with totals of only 10 mm characterising parts of Essex and many lowland districts reporting less than 40% of the February mean. Nothwithstanding this dry conclusion to the winter, Dec.-Feb. rainfall totals were above average, albeit modestly, in most of southern Britain, and notably high in parts of Scotland - in the Highlands particularly, adding to a cluster of very wet recent winters. A better guide to the overall improvement in water resources is provided by the six-month rainfall accumulations - which are appreciably above average in all regions. Rainfall totals are relatively high also in the March-February timeframe; 10-25% above average being typical with some exceptional 12-month totals for parts of north-east Britain; for Britain as a whole, the provisional March-February total is the fourth highest this century.

River Flow

Persistent spate conditions in January gave way to sustained recessions in many catchments during February although flows in baseflow-fed rivers held up over the first couple of weeks. The flood risk remained high in many catchments but the limited rainfall, and its relatively even temporal distribution, resulted in very few notable peak flows. Runoff totals for February were above average in northern and western Scotland but mostly well below elsewhere. The influence of catchment geology was particularly evident in the lowlands - for example, flows in the Kennet, a chalk river, remained above average whereas flows in responsive lowland clay catchments were well below average. February runoff patterns testified to an exaggeration in the north-west/south-east runoff gradient across Britain - a common feature of the last few years. Winter (Dec.-Feb.) runoff totals are generally well within the normal range albeit appreciably below average in many impermeable eastern catchments. Over longer timespans, runoff totals are mostly very healthy - almost all index catchments having Sept.-Feb. totals ranking in the highest quartile; for the Clyde and Yscir, the 6-month totals were unprecedented. In the 12-month timeframe (Mar.-Feb.) rather more records have been established (e.g. on the Naver, Whiteadder, Gt Ouse and Cynon).

Groundwater

Nothwithstanding the near-saturated soil conditions throughout much of February, the limited February rainfall - less than 50% over many eastern outcrop areas - contributed only modest groundwater replenishment. However, heavy infiltration over the Oct.-Jan. period (in most areas) has helped to ensure above average infiltration for the 1998/99 recharge season as a whole (again in most areas). Chalk levels in the more responsive fissured units declined in February but still remain generally above average. Below average levels characterise a zone from London to Cambridgeshire but some further recovery may be anticipated. February levels in most limestone wells exceeded the average, notably so in the Lincolnshire Limestone. Current levels are also relatively healthy in most western Permo-Triassic sandstones outcrops. By contrast, levels remain depressed in a few eastern units and still below pre-1999 minima at Morris Dancers in the Sherwood Sandstones (Notts.) - a very slow responding aquifer in a dry (and forested) area where modest soil moisture deficits in late February served to emphasise that opportunities for significant recharge have been restricted in each of the last three winters.

Institute of Hydrology

British Geological Survey

Rainfall . . . Rainfall . . . Rainfall. .

Rainfall accumulations and return period estimates

Area	Rainfall	Feb 1999	Dec 98-Feb 99	RP	Sep 98-Feb 99	RP	Mar 98-Feb 99	RP	Mar 97-Feb 99	RP
England & Wales	**mm**	**47**	**250**		**564**		**1051**		**1923**	
	%	**74**	**102**	**2-5**	**113**	**2-5**	**117**	**5-15**	**107**	**2-5**
North West	mm	73	353		782		1415		2502	
	%	93	109	2-5	114	2-5	118	5-15	104	2-5
Northumbrian	mm	41	208		504		1105		1923	
	%	69	93	2-5	110	2-5	130	35-50	113	5-15
Severn Trent	mm	45	233		518		937		1698	
	%	84	116	2-5	129	10-20	124	15-25	113	5-15
Yorkshire	mm	39	195		473		960		1741	
	%	67	89	2-5	107	2-5	117	5-10	106	2-5
Anglian	mm	30	168		388		743		1336	
	%	81	118	2-5	129	10-20	125	15-25	112	5-10
Thames	mm	28	189		482		855		1483	
	%	63	106	2-5	132	10-20	124	10-20	108	2-5
Southern	mm	31	224		542		900		1693	
	%	57	104	2-5	120	5-10	116	5-10	109	2-5
Wessex	mm	42	257		582		1030		1921	
	%	64	105	2-5	122	5-10	123	10-20	115	5-15
South West	mm	79	370		817		1420		2626	
	%	78	98	2-5	115	2-5	121	10-15	112	5-10
Welsh	mm	97	442		947		1643		2927	
	%	100	112	2-5	120	5-10	125	20-35	111	5-10
Scotland	**mm**	**140**	**525**		**1030**		**1714**		**3179**	
	%	**137**	**130**	**10-15**	**121**	**10-15**	**119**	**20-35**	**111**	**10-15**
Highland	mm	222	717		1260		2006		3820	
	%	175	140	20-30	116	5-10	114	5-10	109	5-10
North East	mm	81	246		599		1175		2208	
	%	125	96	2-5	111	2-5	121	15-25	113	10-20
Tay	mm	92	474		964		1564		2807	
	%	97	130	5-10	132	15-25	127	30-50	114	10-20
Forth	mm	81	364		858		1466		2576	
	%	103	119	2-5	133	25-40	132	110-150	116	20-35
Tweed	mm	48	280		636		1189		2147	
	%	72	108	2-5	118	5-10	123	20-30	111	5-10
Solway	mm	91	484		1054		1799		3191	
	%	90	120	2-5	124	10-15	127	35-50	112	10-15
Clyde	mm	150	604		1191		1935		3592	
	%	127	124	5-10	115	5-10	114	5-10	106	2-5

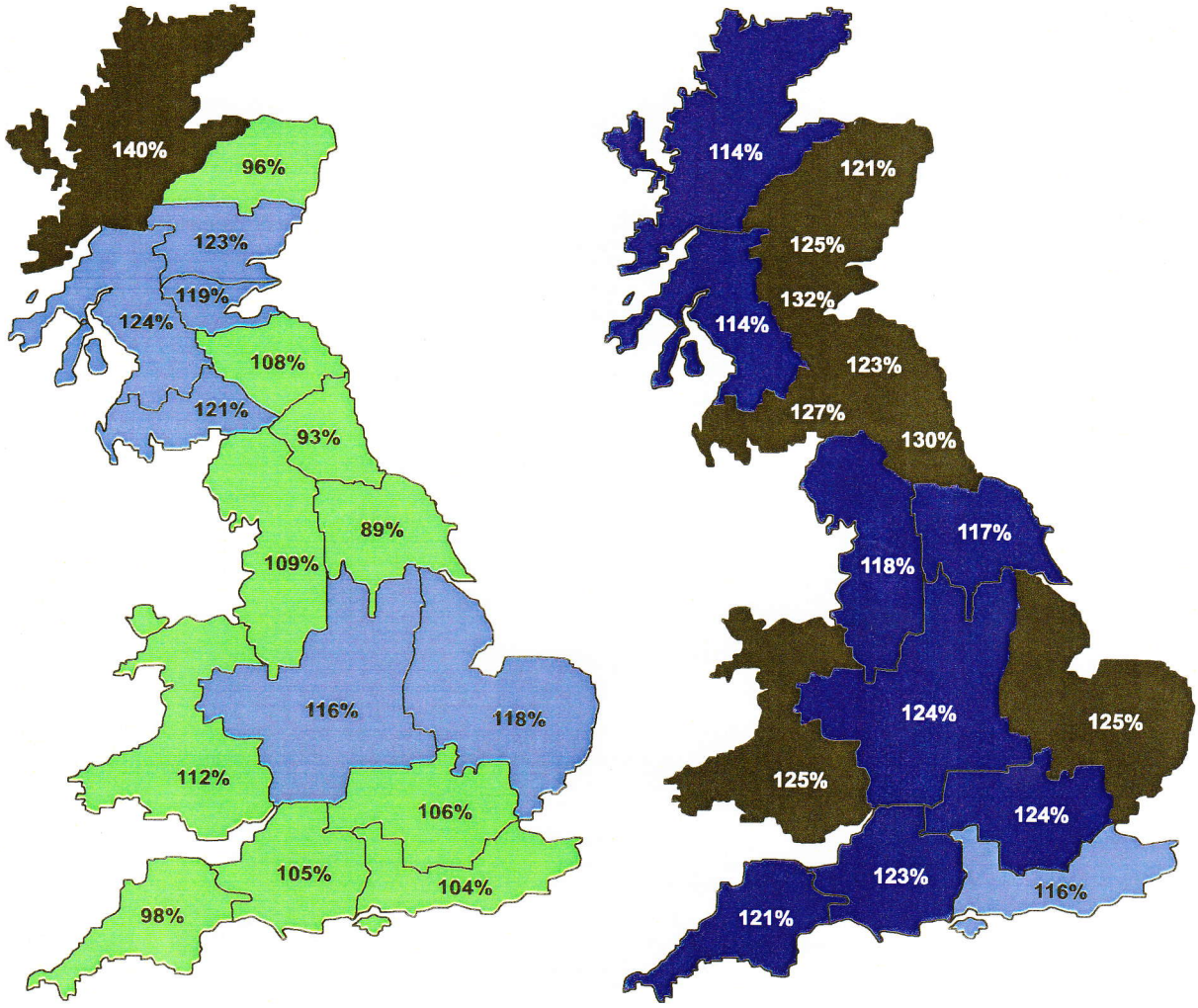
RP = Return period

 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

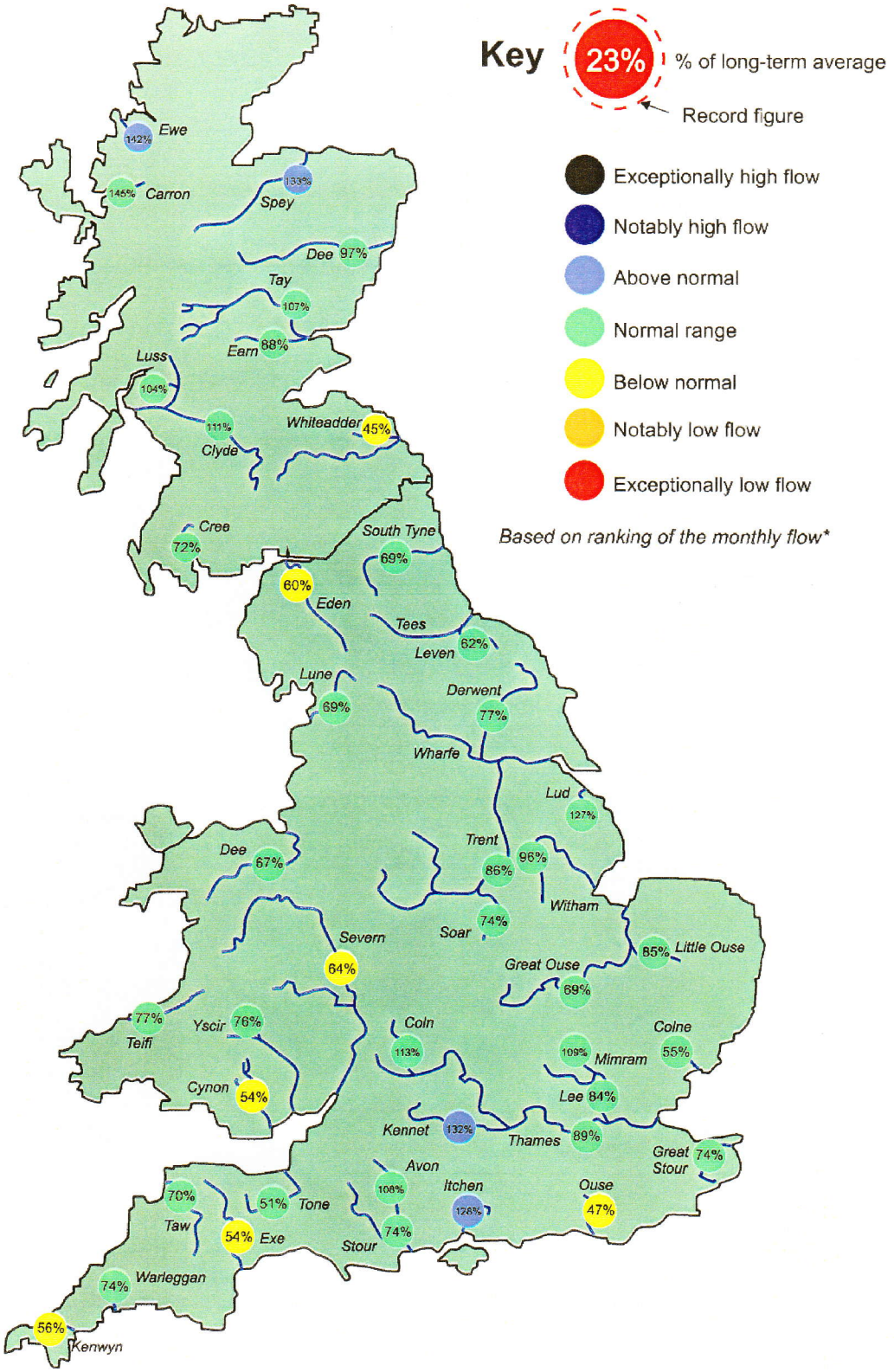


December 1998 - February 1999 **March 1997 - February 1999**

Rainfall accumulation maps

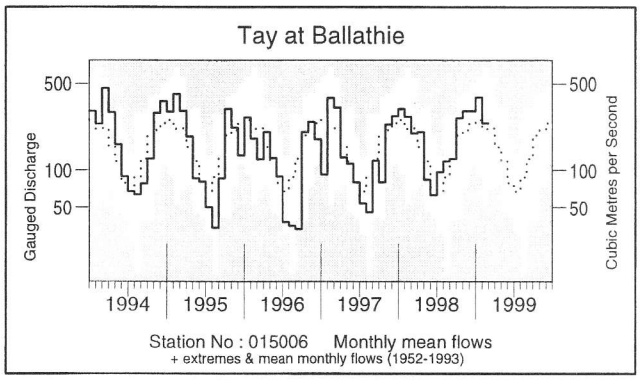
The sustained rainfall deficiencies which characterised most regions over the 1995-97 period have been succeeded by notably wet conditions. In 1998/99 (and on the basis of provisional rainfall figures) England and Wales has experienced its third wettest March-February period since 1966 (1994/95 and 1993/94 were both wetter). Rainfall for Scotland has been even more notable - the third highest March-February accumulation in a series from 1869 (but some caution is needed since the national rainfall series is not a homogeneous one).

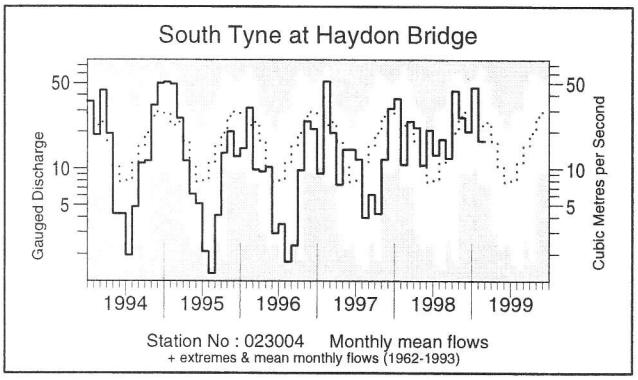
River flow . . . River flow . . .

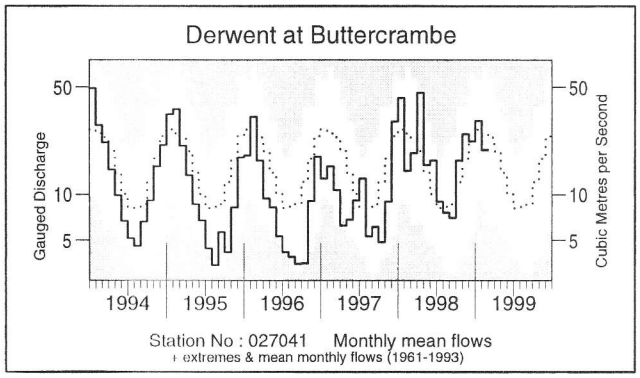


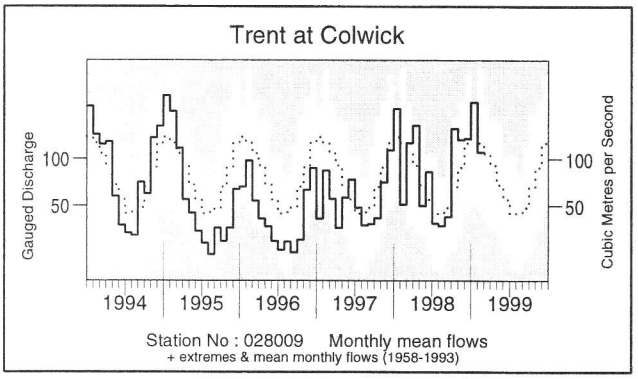
River flows - February 1999

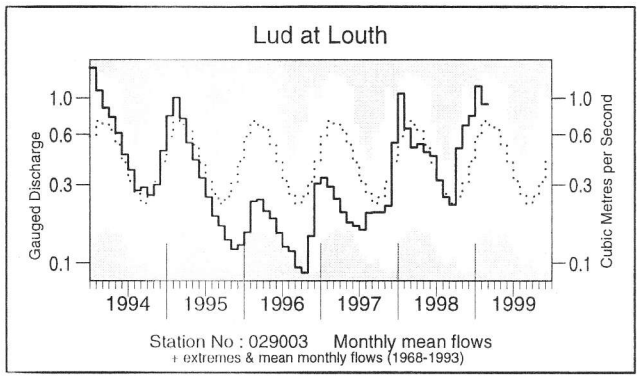
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

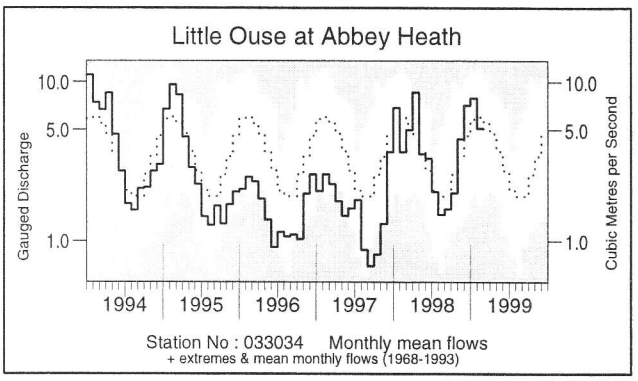


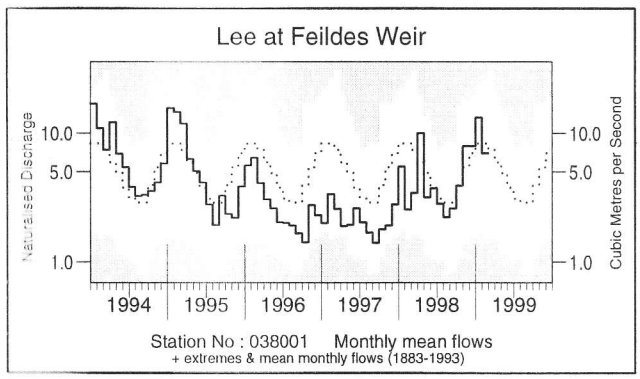


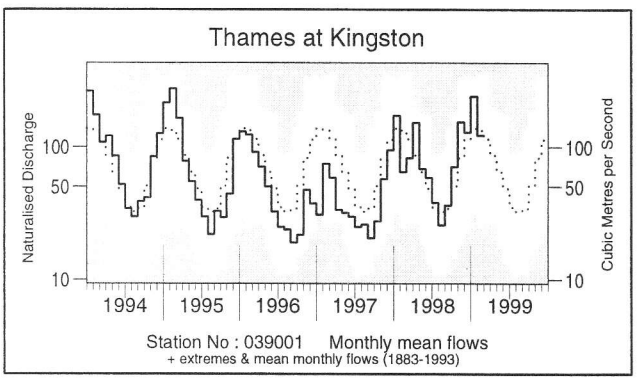








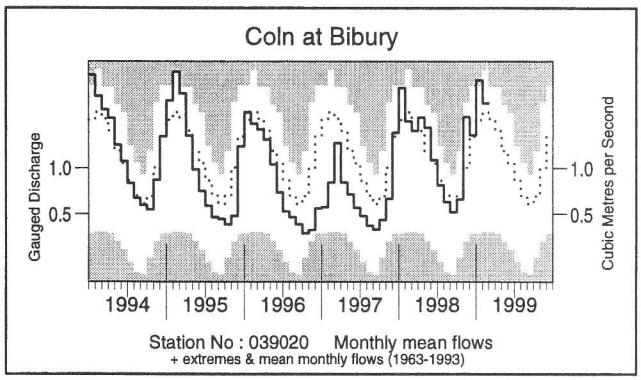


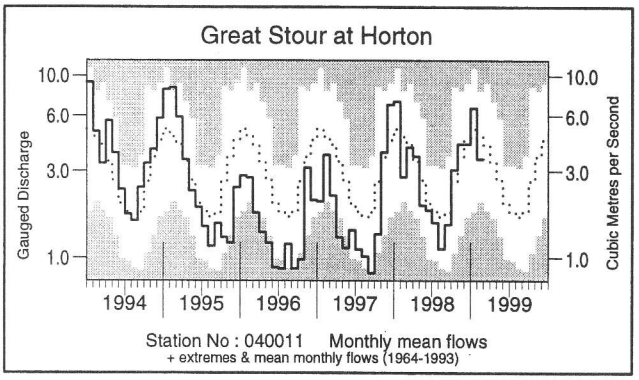


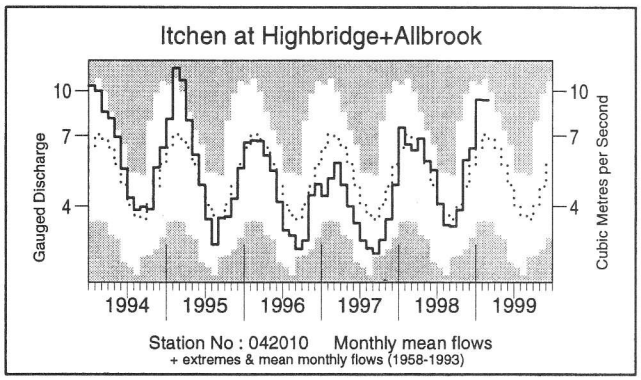
Monthly river flow hydrographs

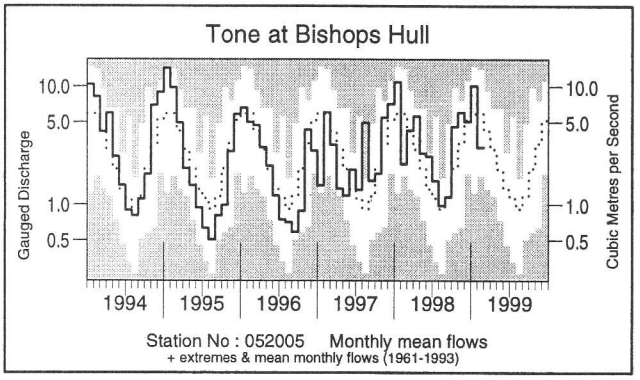
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 1993 (shown by the shaded areas). Monthly flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded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

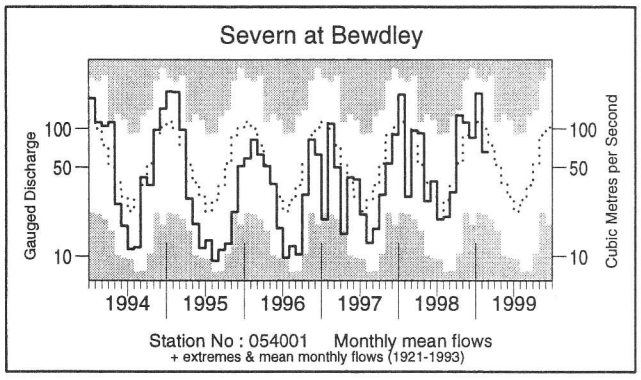
River flow . . . River flow . . .

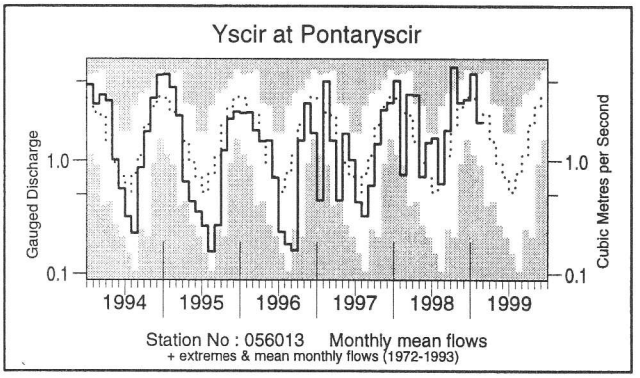


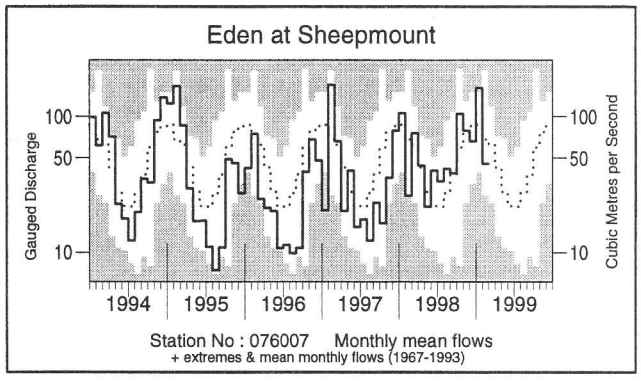


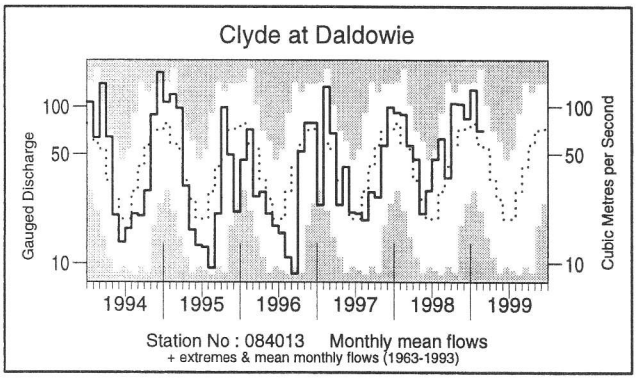










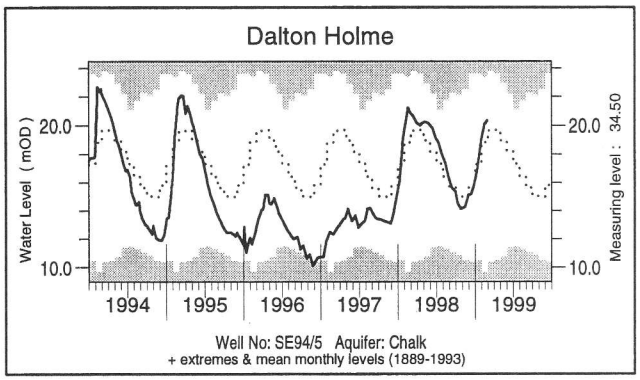


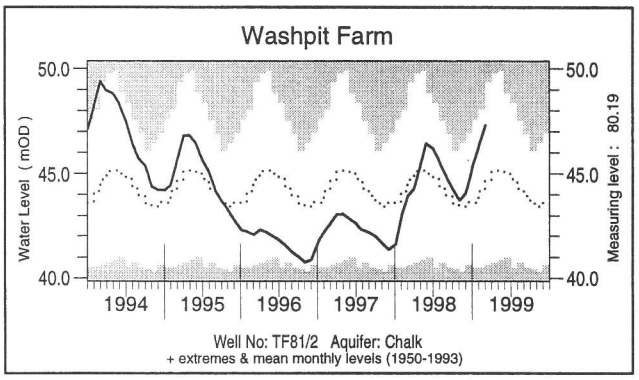
Notable runoff accumulations September 1998 - February 1999 (a); March 1998 - February 1999 (b)

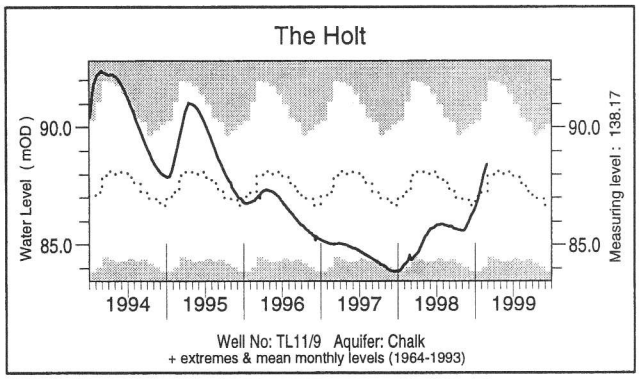
(a) River	%lta	Rank	(b) River	%lta	Rank	River	%lta	Rank
Earn	133	49/51	Spey	121	42/46	Yscir	151	26/26
Lud	168	29/31	Tyne	146	33/33	Cynon	147	39/39
Ouse	172	60/66	Whiteadder	151	29/29	Dee	128	58/61
Exe	131	40/43	Ouse	177	66/66	Lune	127	34/37
Yscir	142	26/26	Mimram	76	09/45	Cree	124	34/35
Clyde	136	35/35	Exe	140	40/42	Naver	125	21/21

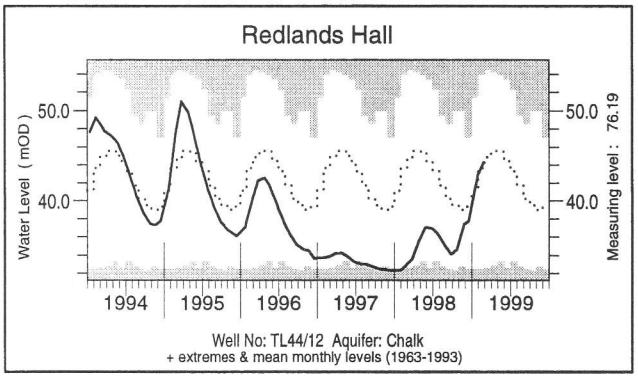
lta = long term average
Rank 1 = lowest on record

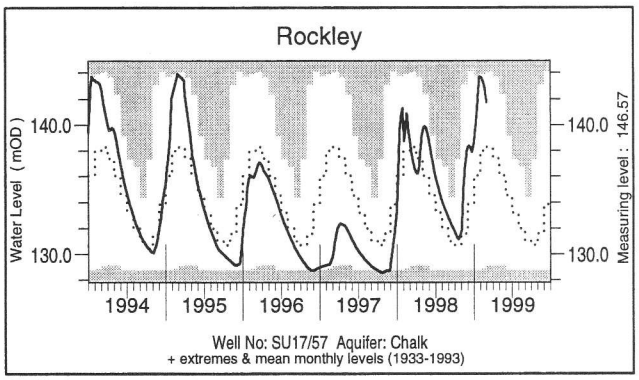
Groundwater . . . Groundwater

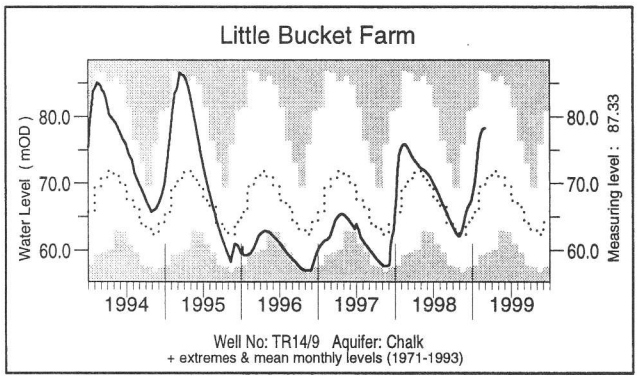


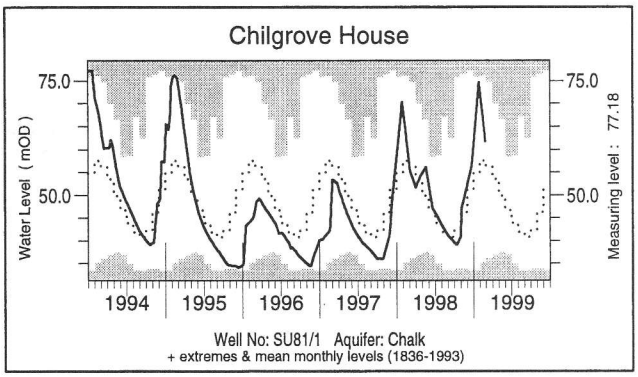


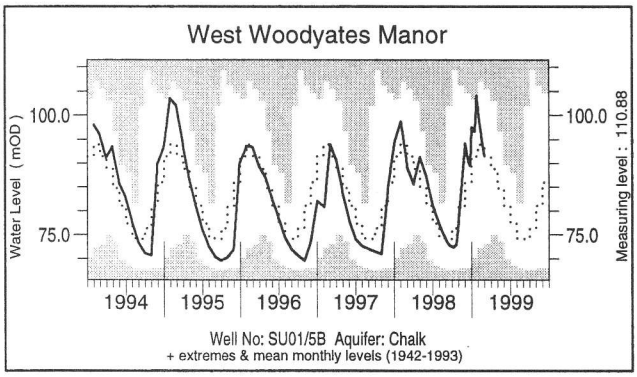








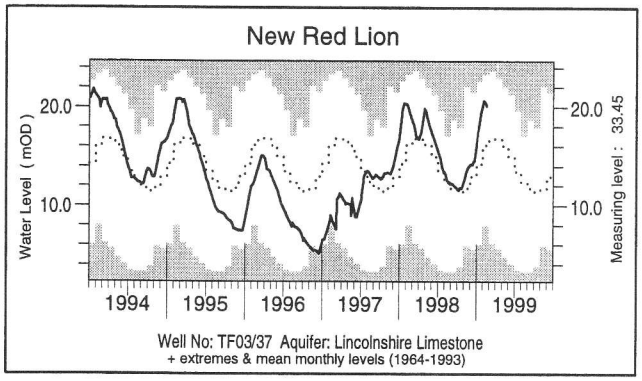


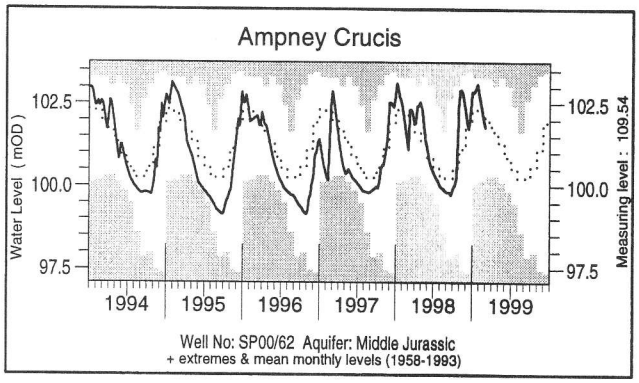


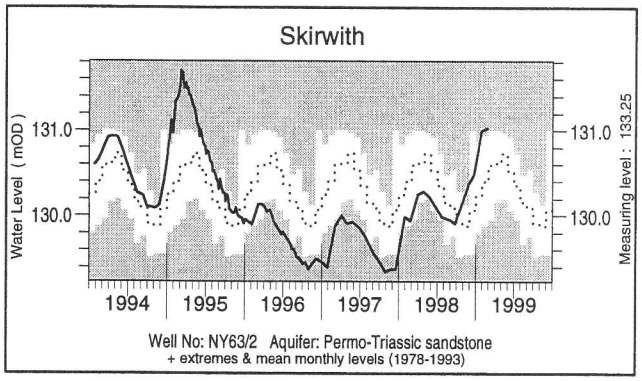
What is groundwater?

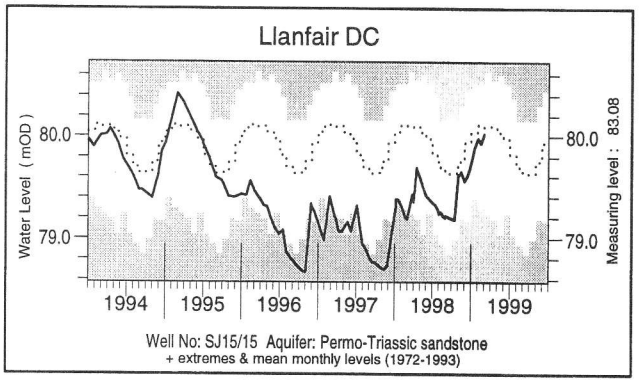
Groundwater is stored in the natural water bearing rock strata (or aquifers) which are found mostly in southern and eastern England (see page 11) where groundwater is the major water supply source. Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment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

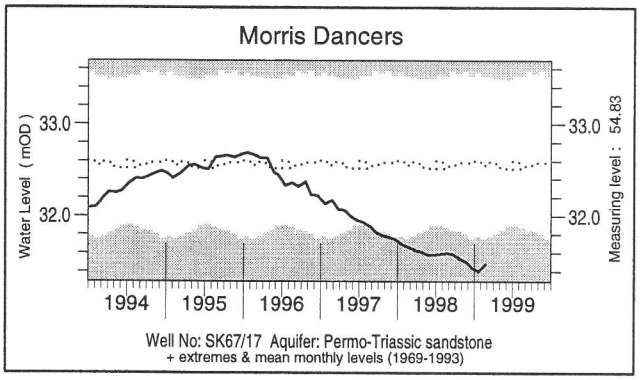
Groundwater . . . Groundwater

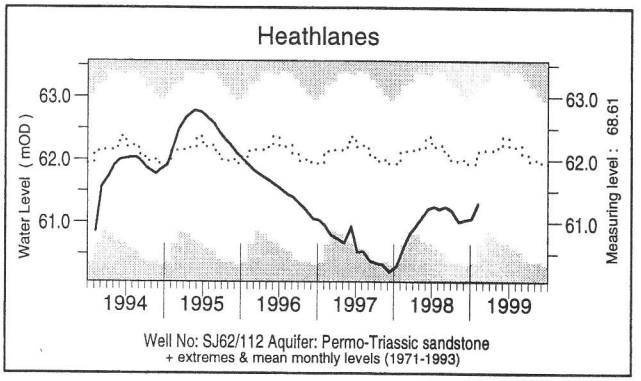


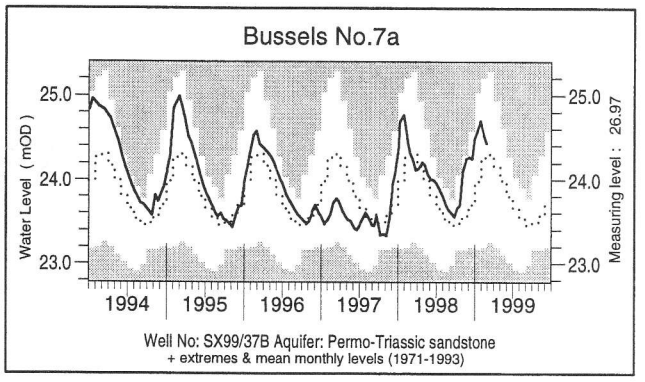


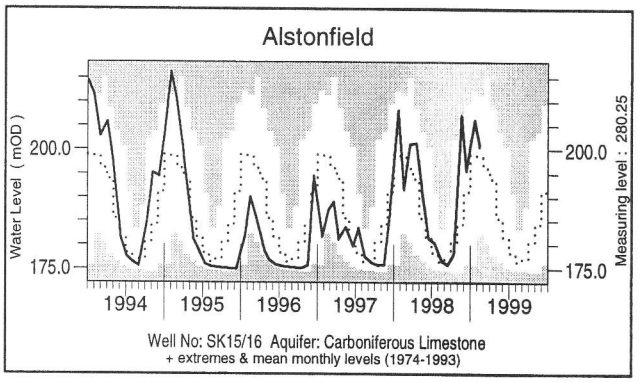










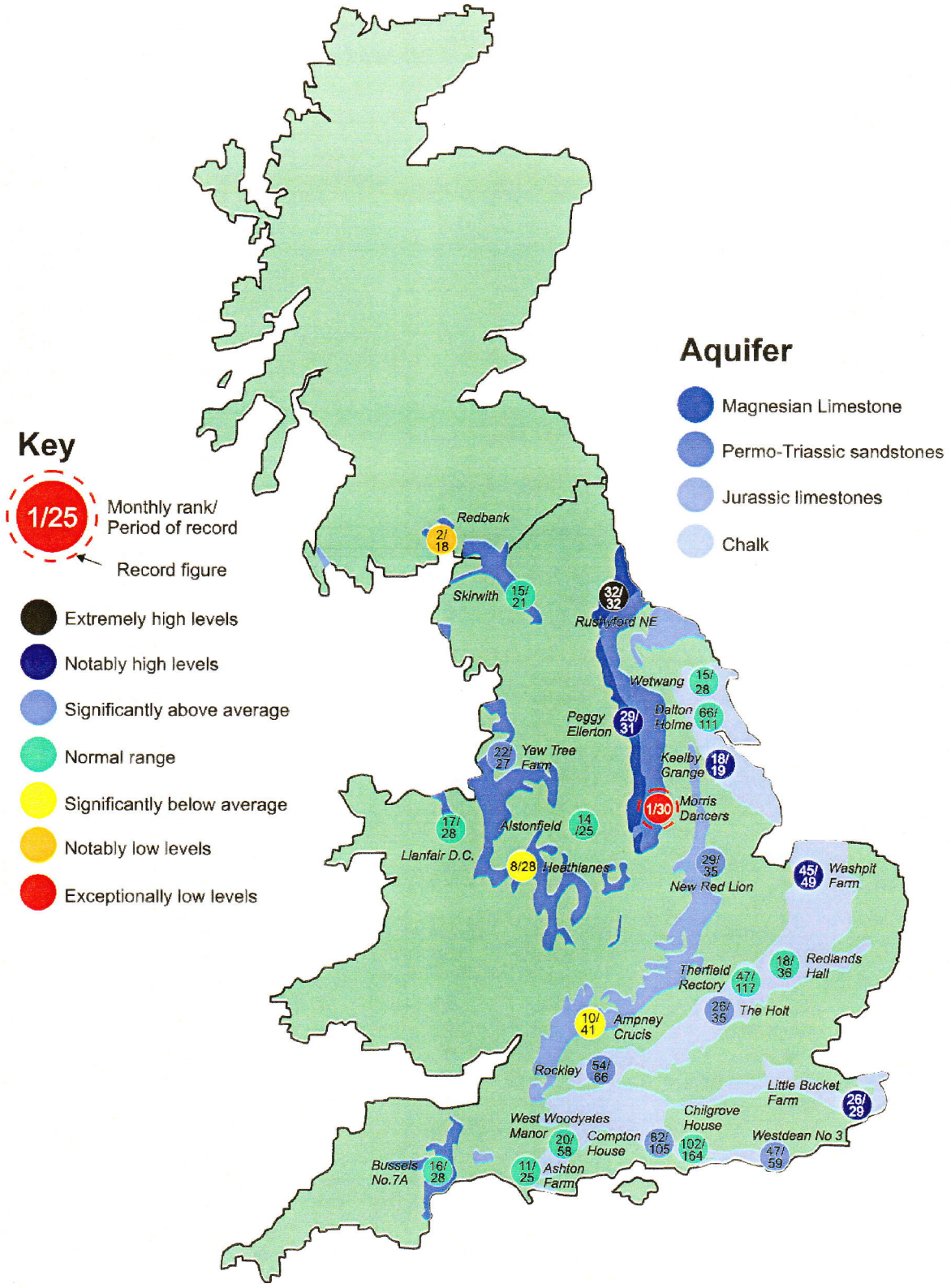


Groundwater levels February/March 1999

Borehole	Level	Date	Feb av.	Borehole	Level	Date	Feb av.	Borehole	Level	Date	Feb av.
Dalton Holme	20.32	25/02	18.67	Chilgrove	61.75	25/02	57.41	Llanfair DC	80.02	01/03	79.98
Washpit Farm	47.30	24/02	44.18	W Woodyates	91.67	28/02	93.05	Morris Dancers	31.48	22/02	32.49
The Holt	88.42	25/02	87.32	New Red Lion	20.13	17/02	15.92	Heathlanes	61.31	06/02	61.95
Redlands Hall	44.27	24/02	43.05	Ampney Crucis	101.78	01/03	102.23	Bussels	24.43	25/02	24.28
Ashton Farm	70.16	28/02	69.64	Skirwith	131.03	24/02	130.53	Alstonfield	200.65	12/02	198.89
Little Bucket	78.30	01/03	69.01								

Levels in metres above Ordnance Datum

Groundwater . . . Groundwater

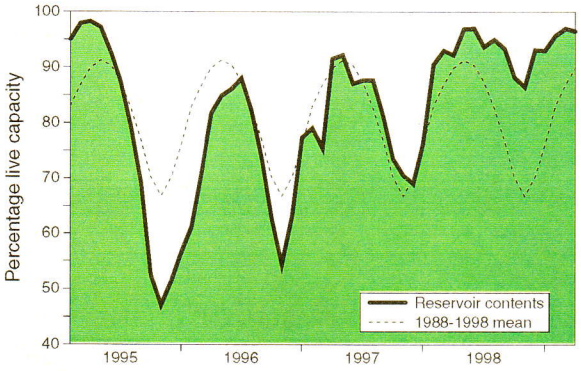


Groundwater levels - February 1999

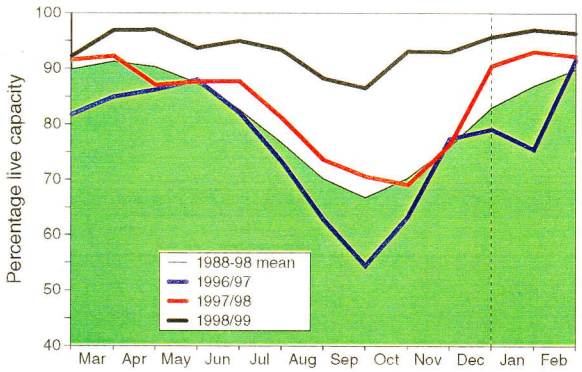
The rankings are based on a comparison of current levels (usually a single reading in a month) with the average level in each corresponding month on record. They need to be interpreted with caution especially when groundwater levels are changing rapidly or when comparing wells with very different periods 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 Oct	Nov	Dec	1999 Jan	Feb	**Mar**	Min. Mar	Year* of min
NorthWest	N Command Zone	• 133375	75	90	93	98	96	93	78	1996
	Vyrnwy	55146	83	100	93	100	99	100	59	1996
Northumbrian	Teesdale	• 87936	87	99	98	98	99	97	72	1996
	Kielder	(199175)	(88)	(96)	(93)	(94)	(97)	(95)	(81)	1993
Severn Trent	Clywedog	44922	88	100	81	85	91	93	77	1996
	DerwentValley	• 39525	90	100	99	100	100	100	46	1996
Yorkshire	Washburn	• 22035	82	96	96	99	99	98	53	1996
	Bradford supply	• 41407	92	99	99	98	98	96	53	1996
Anglian	Grafham	** (55490)	(84)	(92)	(87)	(90)	(91)	(93)	(72)	1997
	Rutland	**(116580)	(86)	(87)	(88)	(91)	(95)	(95)	(71)	1992
Thames	London	• 206399	82	83	92	94	94	94	83	1988
	Farmoor	• 13843	98	96	93	90	85	98	64	1991
Southern	Bewl	28170	70	77	87	92	99	100	50	1989
	Ardingly	4685	67	80	100	100	100	100	89	1992
Wessex	Clatworthy	5364	70	92	100	100	100	97	82	1992
	BristolWW	• (38666)	(72)	(84)	(95)	(98)	(97)	(98)	(65)	1992
SouthWest	Colliford	28540	76	82	89	98	100	100	57	1997
	Roadford	34500	96	100	98	100	98	94	35	1996
	Wimbleball	21320	87	100	100	100	100	100	72	1996
	Stithians	5205	71	80	100	100	100	99	45	1992
Welsh	Celyn and Brenig	• 131155	95	100	96	98	100	100	69	1996
	Brianne	62140	97	100	94	100	99	99	94	1998
	Big Five	• 69762	94	92	86	94	99	99	85	1988
	Elan Valley	99106	97	100	100	100	100	100	88	1993
East of	Edinburgh/Mid Lothian	• 97639	43	50	56	60	72	73	73	**1999**
Scotland	East Lothian	• 10206	100	100	100	99	100	99	91	1990
West of	Loch Katrine	• 111363	85	92	89	90	90	93	93	**1999**
Scotland	Daer	22412	81	99	100	100	99	100	100	**1999**
	LochThom	• 11840	97	100	100	100	100	100	98	1996

() 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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