Hydrological summary

for Great Britain

June 1998

General

June, as in 1997, was a cool and notably wet month - provisionally ranking equal second wettest (with 1997) for Britain since 1912. Seasonally high replenishment and the absence of any surge in summer demand resulted in exceptionally high overall reservoir stocks for England and Wales (around 95% of capacity). River flows in June were also very healthy in most regions and the groundwater resources outlook has improved greatly over the last four months, but levels remain well below average in some areas.

Rainfall

The notably episodic rainfall patterns which have characterised 1998 thus far, continued in June - a very unsettled month when dry interludes were rare; in some central areas of England only 5 or 6 dry days were reported. Frontal systems produced regular pulses of rainfall with some notable daily totals (e.g. 95 mm at Dolydd in the Welsh Uplands on the 26th). Locally, thunderstorms produced some very intense downpours - on the 13th daily totals for a few localities approached the monthly average (e.g. 47.5 mm in Reading - at the University around 25 mm fell in less than 20 minutes - overwhelming the urban drainage system). Thundery outbreaks made for large local variations in monthly rainfall totals but regional figures for England and Wales showed much greater spatial coherence - most approaching twice the 1961-90 June average. Below average rainfall totals were recorded in some northernmost parts of Britain but the June rainfall for Scotland exceeded the average by an appreciable margin. The provisional England and Wales rainfall total was marginally lower than last year but still ranks as the third wettest June in the last 120 years. Notwithstanding the relatively dry May, the April-June period was the wettest since 1879 for England and Wales; rainfall totals were especially outstanding in a zone extending north from the Humber. The healthy water resources position is reflected in the regional rainfall totals - for the last 6 and 12 month periods totals are above average for almost all regions .

River Flow

Seasonal flow recessions in June were much shallower than is normal in the early summer. In the Thames for instance, flows remained relatively stable throughout the month. Some spate conditions were reported, mostly in the South-West, Wales and Cumbria where flows exceeded bankfull in some rivers (e.g. the Ehen) - an uncommon occurrence in summer. Contrary to the usual seasonal patterns June runoff totals in many areas were above those for May and, in much of Britain, were similar to those for February. Below average June flows were mostly confined to a few Scottish catchments and some rivers in the English lowlands - especially those sustained principally from spring sources. Away from the South-East, however flows were generally very healthy with notable monthly runoff totals registered over wide areas. The Rivers Tweed, Leven and Brue each established new June maximum runoff totals and many others approached their highest on record. By contrast, flows in a few, mostly Chalk, streams (e.g. the Mimram) were only a little above 50% of the long term average for June. Generally runoff totals for the year thus far are 10-50% above average, and notably high for the April-June period in many impermeable catchments. In most regions, early summer flows have been substantially greater than have typified much of the last decade - correspondingly, the seasonal shrinkage in the stream network has been much less extensive.

Groundwater

The rapid increase in soil moisture deficits during May faltered in June when surface horizons were wet. However, smds remain close to the seasonal average around month-end in large parts of the English lowlands and significant June recharge was generally confined to isolated localities where intense storms - and thin soil cover above fissured aquifers - promoted rapid groundwater replenishment. June groundwater levels in the Chalk were very close to the seasonal average over most of the outcrop. A continuing recovery in some deeper wells and boreholes in parts of eastern England (e.g. in Hertfordshire and Cambridgeshire) testifies to the lagged response to rainfall over the last 6-8 months. Nonetheless, summer recessions in these areas will begin at levels well below the seasonal average (although generally significantly above the corresponding levels in 1997). Differing response times are also reflected in the wide spatial variations in levels in the Permo-Triassic sandstones, but levels in most index boreholes remain considerably below average. June saw the end of sustained recessions in some very slow responding aquifer units (e.g. at Morris Dances where levels had been falling since early 1996 and have remained below previous minima throughout 1998). By contrast, levels in the much more responsive limestone aquifers are mostly close to, or above, average.

Institute of Hydrology

British Geological Survey

Rainfall . . . Rainfall . . . Rainfall. .

Rainfall accumulations and return period estimates

Area	Rainfall	Jun 1998	Apr 98-Jun 98	RP	Jan 98-Jun 98	RP	Jul 97-Jun 98	RP	Jul 96-Jun 98	RP
England & Wales	**mm**	**125**	**283**		**517**		**986**		**1807**	
	%	**193**	**150**	**30-40**	**126**	**10-15**	**110**	**2-5**	**101**	**2-5**
North West	mm	156	307		641		1215		2328	
	%	192	135	5-15	123	5-10	101	2-5	97	2-5
Northumbrian	mm	113	336		549		942		1801	
	%	188	189	>200	140	35-50	110	2-5	106	2-5
Severn Trent	mm	117	249		449		828		1527	
	%	198	144	10-20	125	5-15	110	2-5	101	2-5
Yorkshire	mm	125	295		512		904		1695	
	%	209	165	40-60	133	15-25	110	2-5	103	2-5
Anglian	mm	99	234		359		668		1248	
	%	195	161	35-50	129	10-15	112	5-10	105	2-5
Thames	mm	98	242		394		746		1316	
	%	179	150	10-20	121	5-10	108	2-5	95	2-5
Southern	mm	97	214		399		864		1557	
	%	180	133	5-10	111	2-5	111	2-5	100	<2
Wessex	mm	109	266		488		1012		1772	
	%	192	156	20-30	124	5-10	121	5-15	106	2-5
South West	mm	125	323		646		1358		2405	
	%	181	154	20-35	118	5-10	116	5-10	102	2-5
Welsh	mm	176	366		766		1475		2651	
	%	223	152	25-40	130	10-20	112	5-10	101	2-5
Scotland	**mm**	**108**	**286**		**771**		**1444**		**2923**	
	%	**125**	**115**	**2-5**	**123**	**10-20**	**100**	**<2**	**102**	**2-5**
Highland	mm	116	296		995		1736		3574	
	%	118	105	2-5	131	30-45	99	2-5	102	2-5
North East	mm	82	289		515		1019		2050	
	%	124	148	30-50	118	5-10	105	2-5	105	2-5
Tay	mm	88	272		634		1241		2475	
	%	121	125	5-10	112	2-5	101	2-5	101	2-5
Forth	mm	100	272		611		1115		2300	
	%	145	135	10-15	124	10-15	101	2-5	104	2-5
Tweed	mm	103	323		554		1009		2098	
	%	158	167	80-120	126	10-15	104	2-5	108	5-10
Solway	mm	147	324		719		1484		2851	
	%	175	132	5-15	116	5-10	104	2-5	100	<2
Clyde	mm	110	249		816		1623		3256	
	%	118	93	2-5	113	2-5	96	2-5	96	2-5

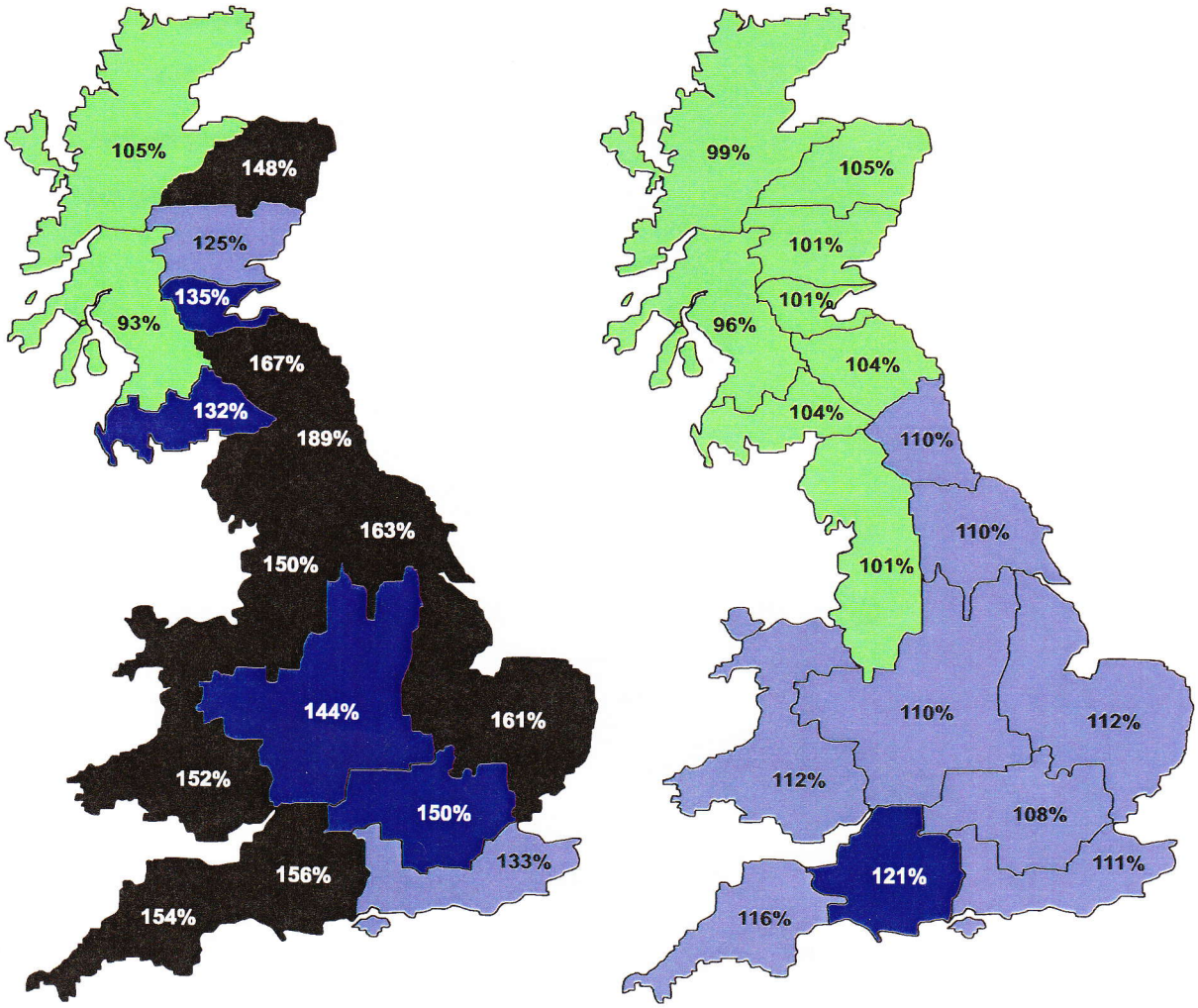
RP = Return period

 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.

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

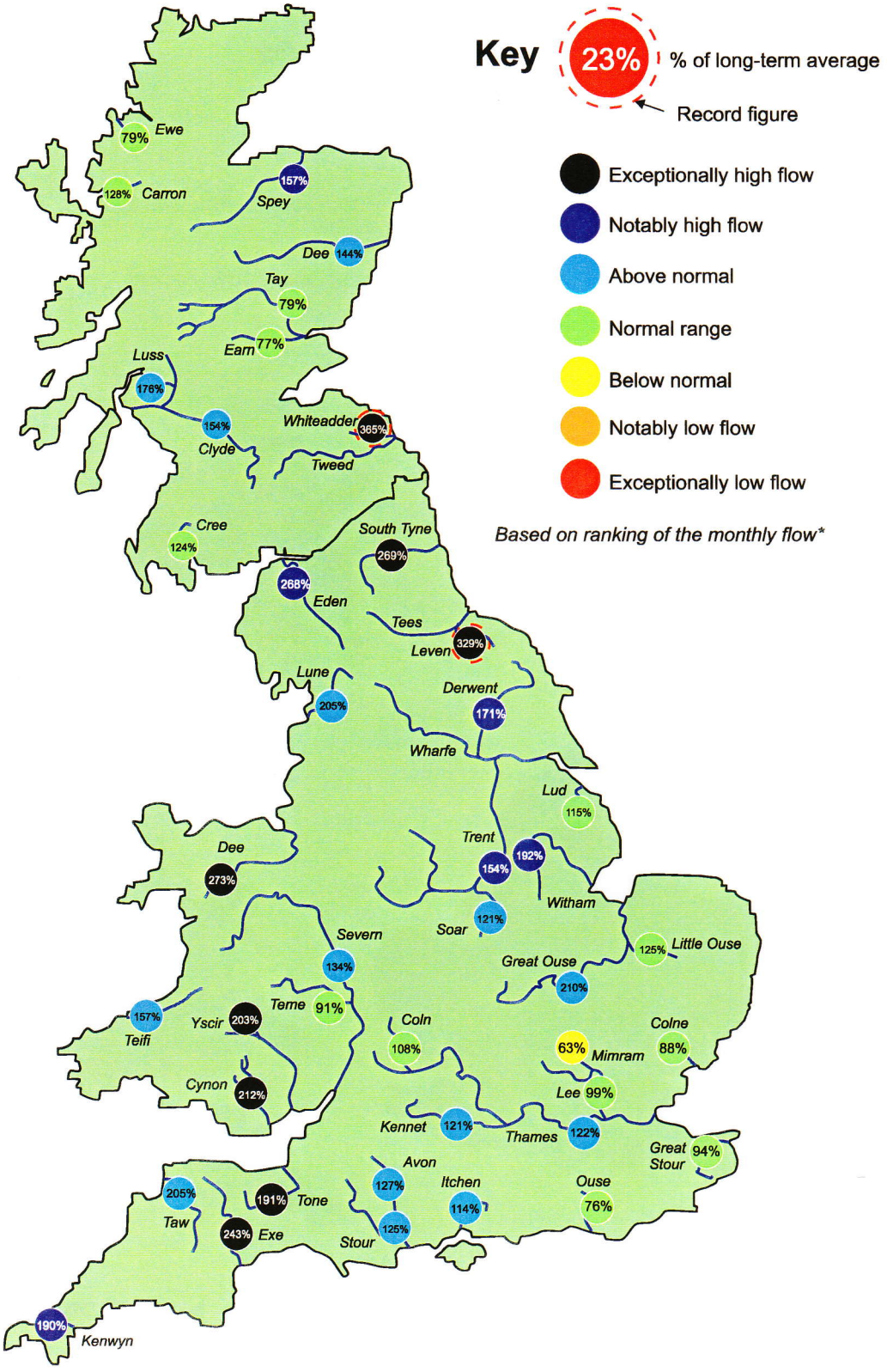


April 1998 - June 1998 **July 1997 - June 1998**

Rainfall accumulation maps

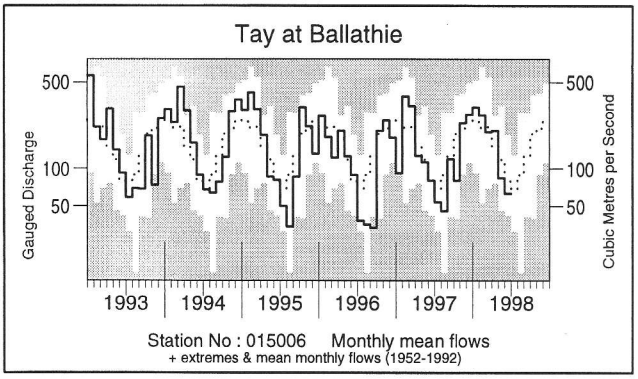
The provisional April-June rainfall total for Great Britain ranks as the second highest since 1931; many catchments in North-East England established new maximum rainfall totals for the three-month period. Very few areas have significant rainfall deficiencies over the last 12 months; modest deficiencies persist over the two-year timespan in the North-West and Thames regions of England.

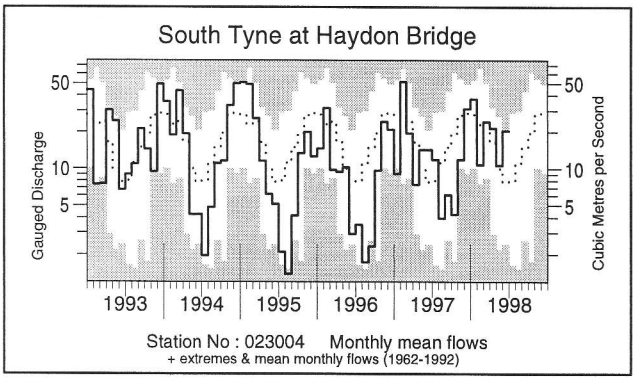
River flow . . . River flow . . .

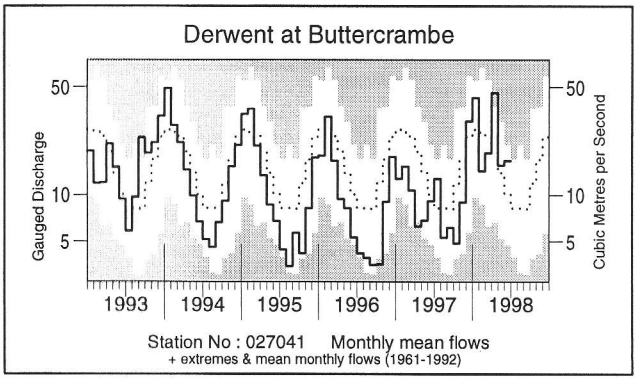


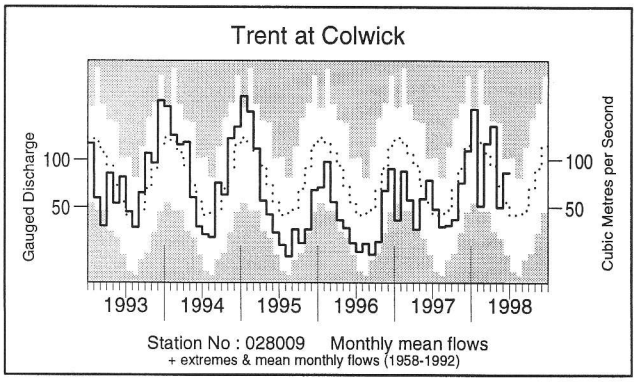
River flows - June 1998

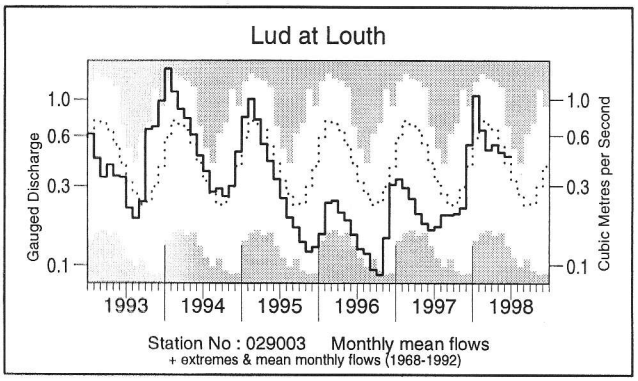
Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

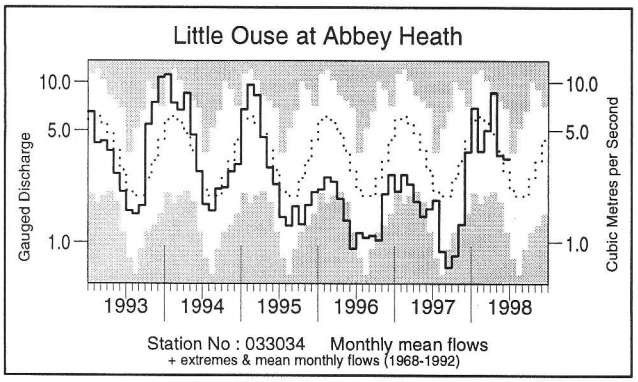


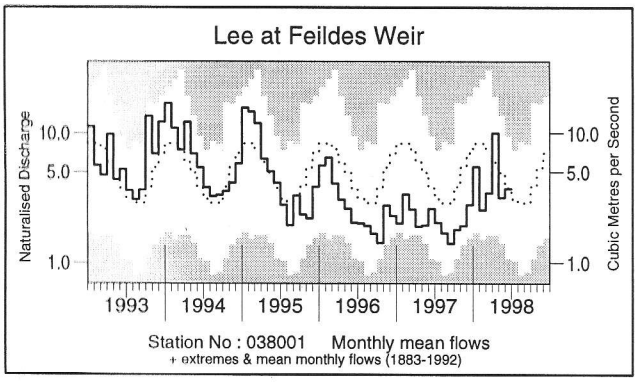


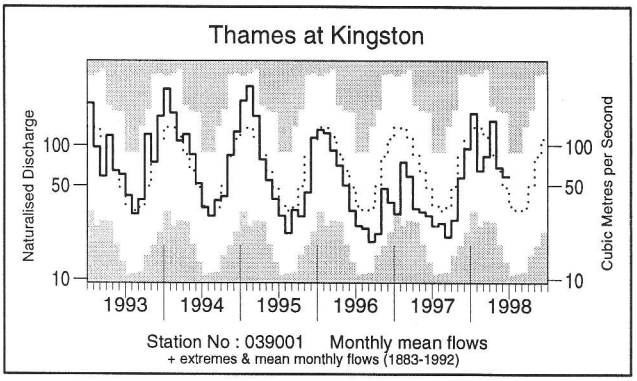








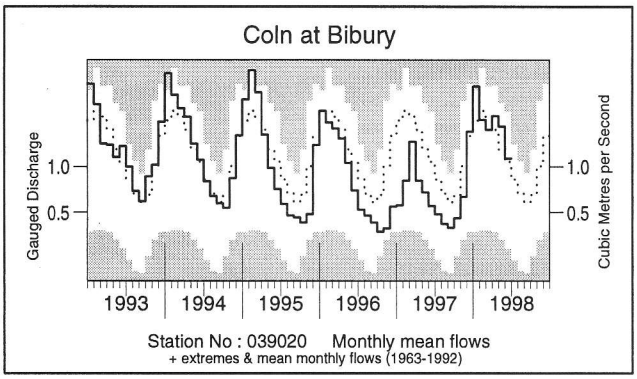


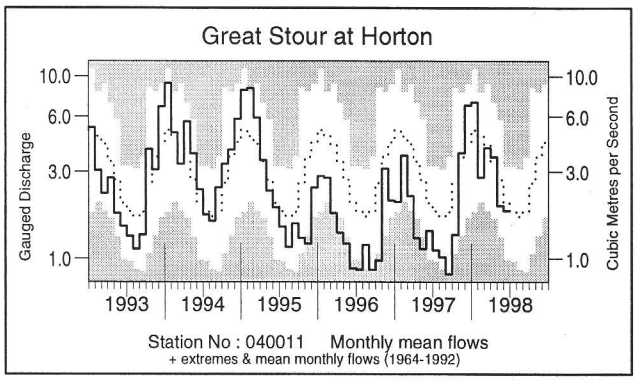


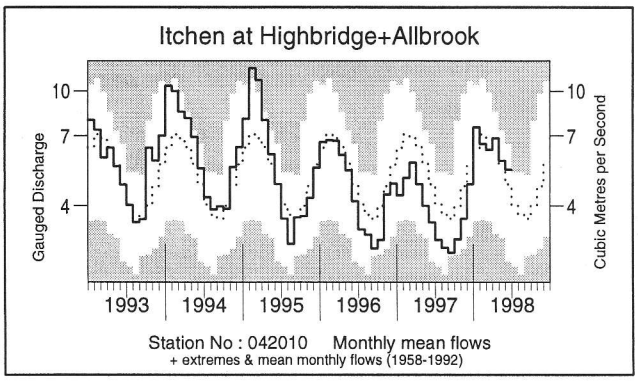
Monthly river flow hydrographs

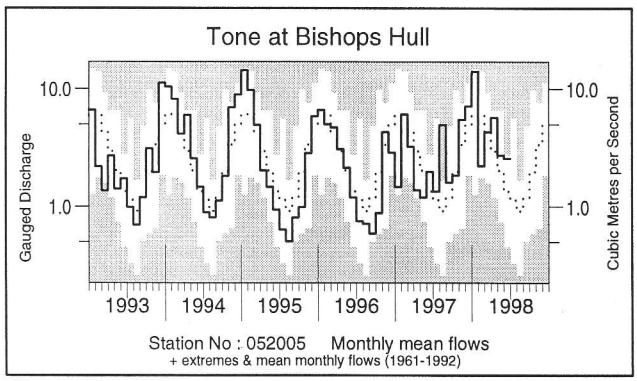
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 1992 (shown by the shaded areas). Monthly flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

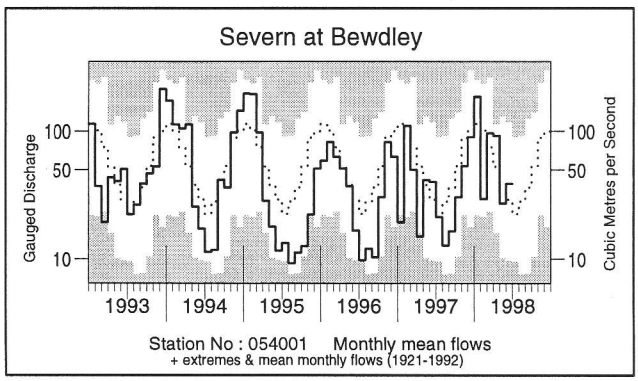
River flow . . . River flow . . .

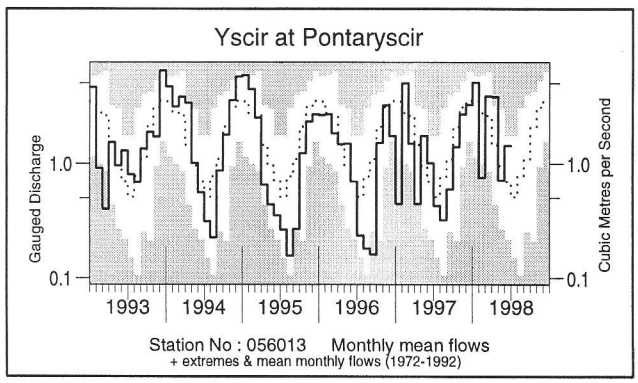


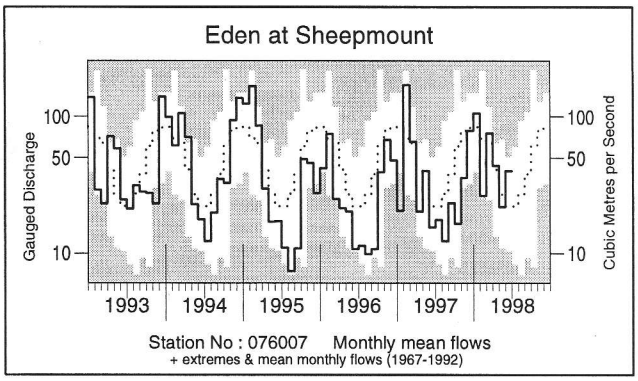


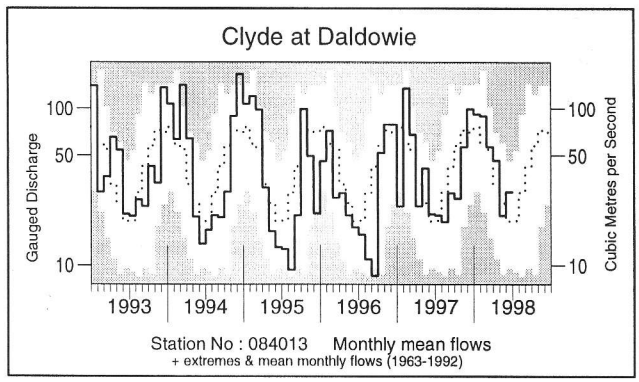












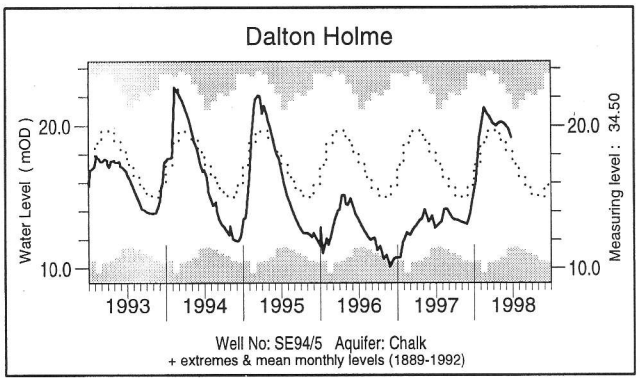
Notable runoff accumulations April 1998 - June 1998 (a); July 1997 - June 1998 (b)

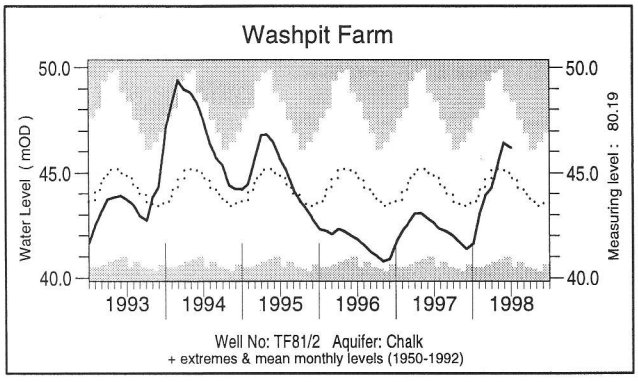
(a) River	%lta	Rank	River	%lta	Rank
Dee (Scot)	150	25/26	Kenwyn	178	30/30
Whiteadder	212	28/29	Brue	234	34/34
Derwent	184	36/37	Yscir	185	26/26
Ouse	282	66/66	Dee (Wales)	153	27/29
Mimram	64	8/46	Eden	169	28/31
Mole	168	23/25			

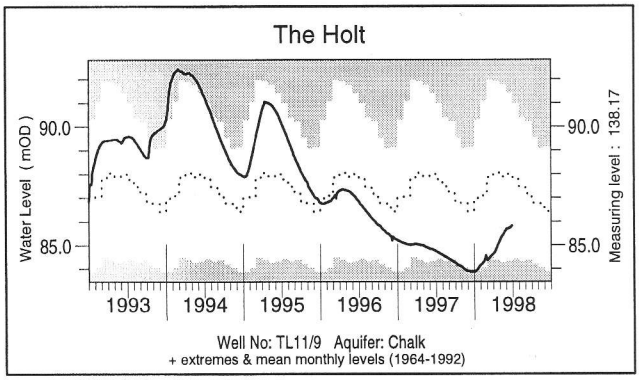
(b)River	%lta	Rank
Dee (Scot)	111	20/25
Mimram	52	4/44
Otter	122	32/35
Tone	147	36/37
Teifi	117	33/37

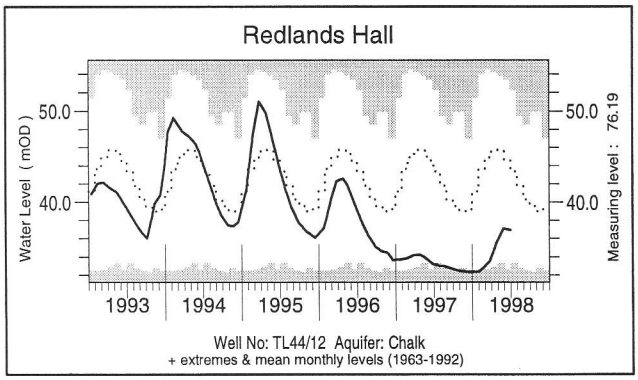
lta = long term average
Rank 1 = lowest on record

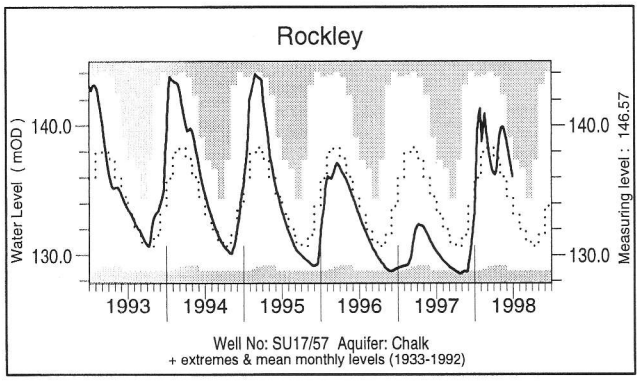
Groundwater . . . Groundwater

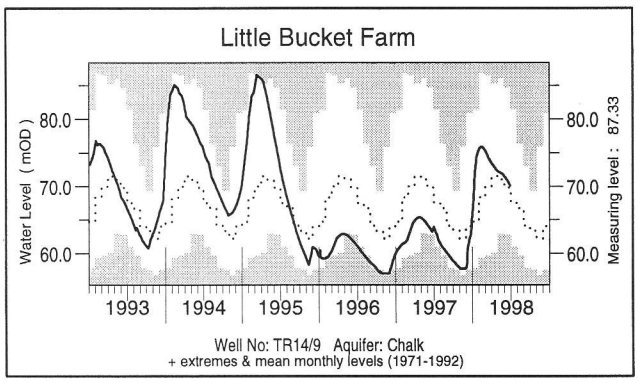


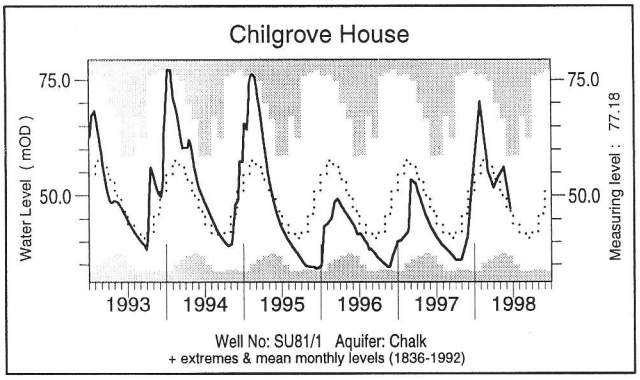


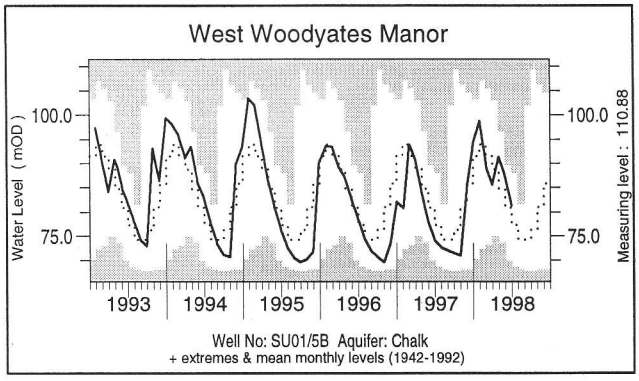








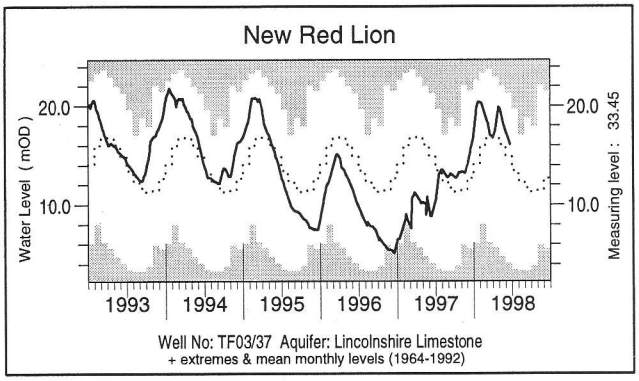


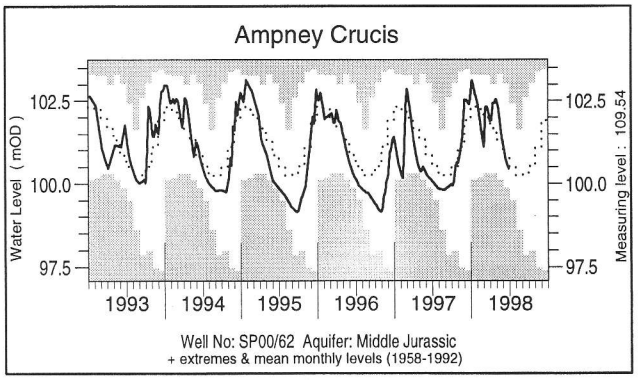


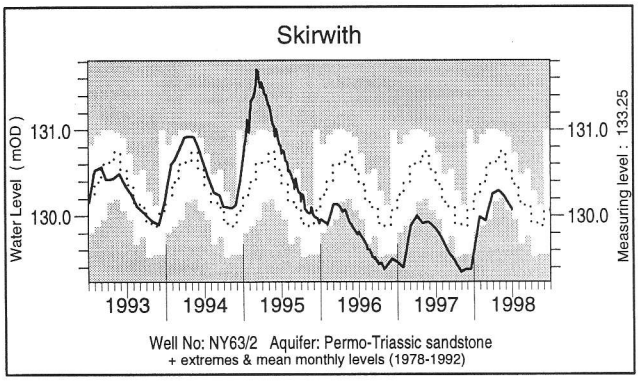
What is groundwater?

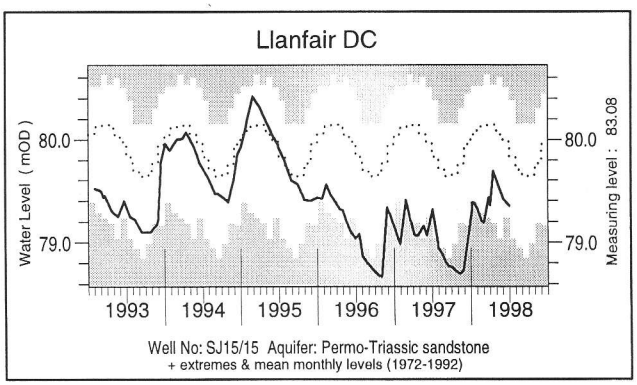
Groundwater is stored in the natural water bearing rock strata (or aquifers) which are found mostly in southern and eastern England (see page 11) where groundwater is the major water supply source. Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment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

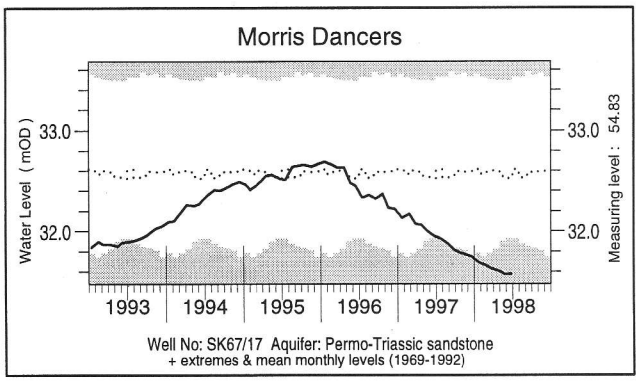
Groundwater . . . Groundwater

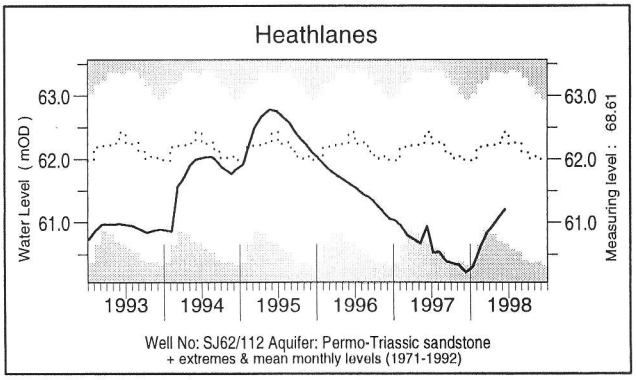


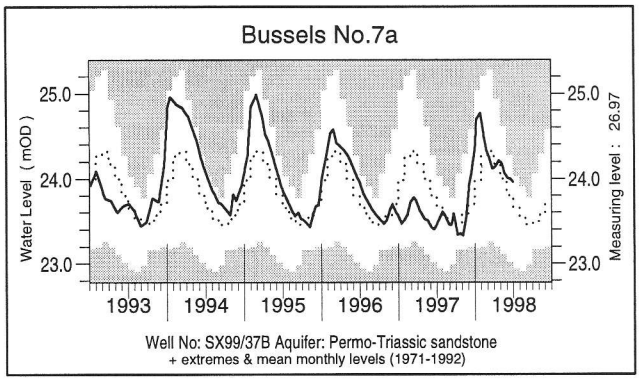


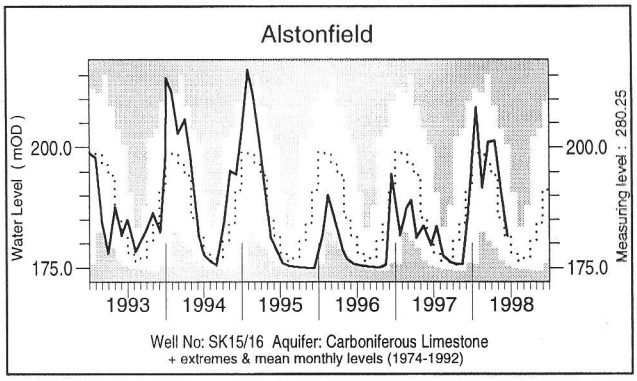










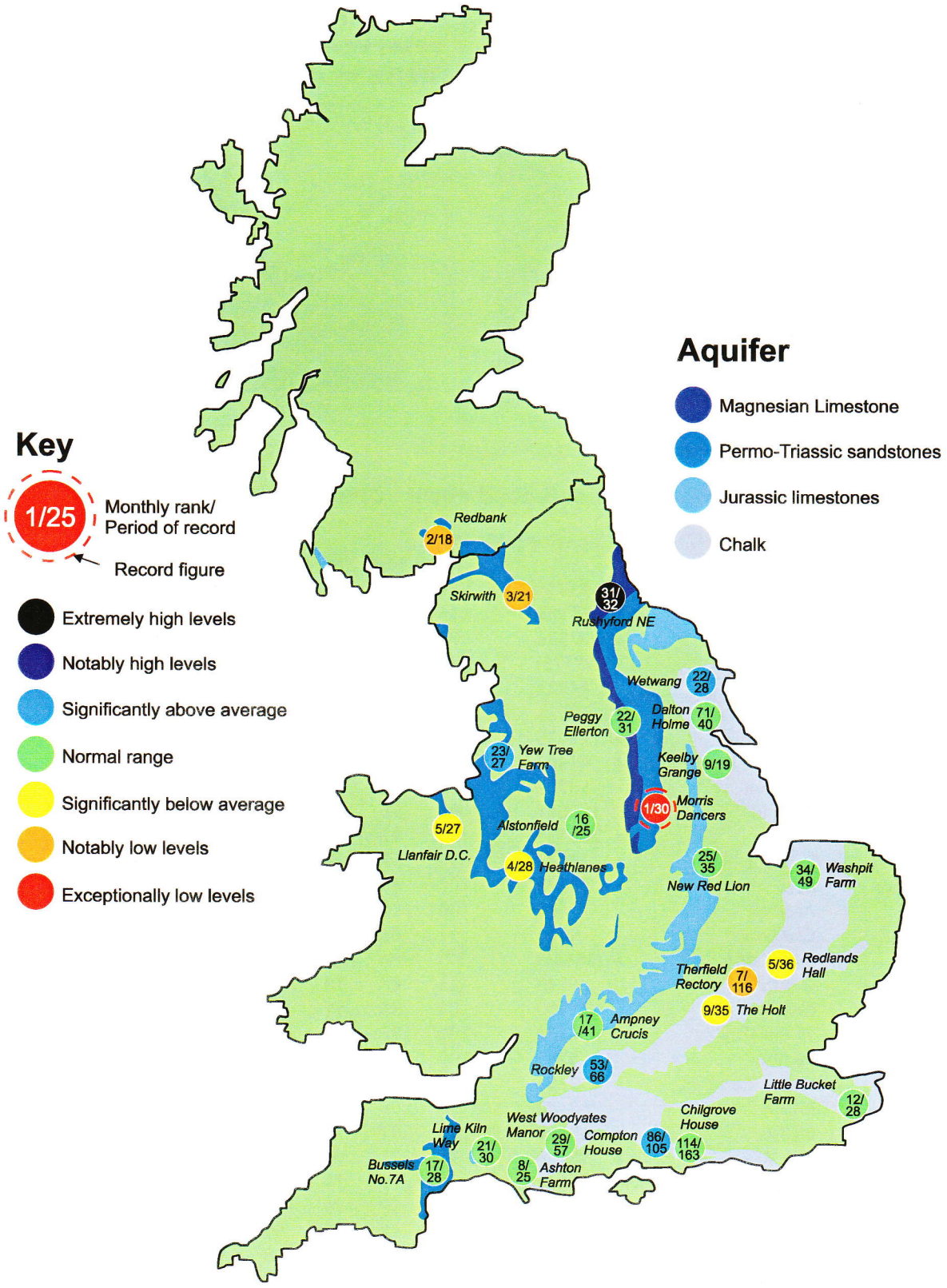


Groundwater levels June/July 1998

Borehole	Level	Date	Jun av.	Borehole	Level	Date	Jun av.	Borehole	Level	Date	Jun av.
Dalton Holme	19.14	26/06	18.11	Chilgrove	47.18	18/06	45.98	Llanfair DC	79.35	02/07	79.80
Washpit Farm	46.18	03/07	45.09	W Woodyates	81.33	30/06	80.80	Morris Dancers	31.58	25/06	32.44
The Holt	85.84	29/06	88.05	New Red Lion	16.06	23/06	14.58	Heathlanes	61.21	13/06	62.22
Redlands Hall	36.96	30/06	43.70	Ampney Crucis	100.44	29/06	100.82	Bussels	23.96	30/06	23.83
Ashton Farm	67.39	30/06	67.66	Skirwith	130.07	01/07	130.52	Alstonfield	181.46	15/06	180.95
Little Bucket	70.07	29/06	70.98								

Levels in metres above Ordnance Datum

Groundwater . . . Groundwater

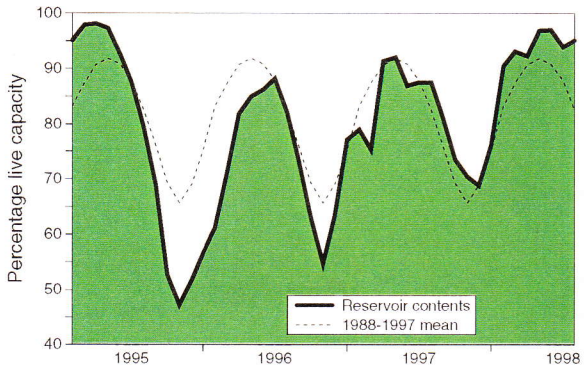


Groundwater levels - June 1998

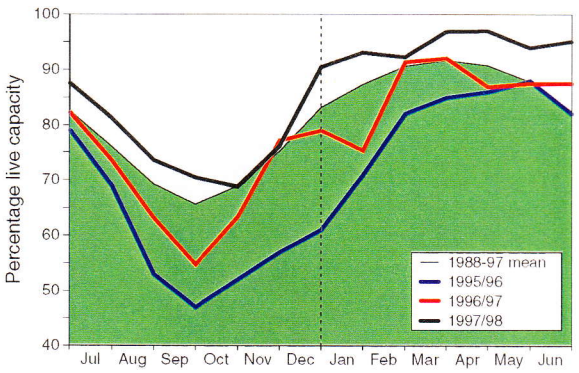
The rankings are based on a comparison of current levels (usually a single reading in a month) with the average level in each corresponding month on record. Caution needs to be exercised when interpreting the ranking, especially during periods of rapid changes in groundwater level. Rankings may be omitted where they are considered misleading.

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 Feb	Mar	Apr	May	Jun	**Jul**	Min. Jul	Year* of min
NorthWest	N Command Zone	• 133375	94	92	94	93	87	85	58	1995
	Vyrnwy	55146	93	87	100	97	95	93	65	1990
Northumbrian	Teesdale	• 87936	97	93	99	97	90	90	58	1989
	Kielder	(199175)	(91)	(91)	(96)	(95)	(92)	(93)	(71)	1989
SevernTrent	Clywedog	44922	89	86	96	99	98	98	72	1989
	DerwentValley	• 39525	100	90	98	99	90	100	53	1996
Yorkshire	Washburn	• 22035	98	95	99	95	91	98	63	1995
	Bradford supply	• 41407	98	96	100	99	93	96	54	1995
Anglian	Grafham	58707	67	75	86	92	99	96	70	1997
	Rutland	130061	96	96	98	98	96	96	75	1997
Thames	London	• 206399	93	97	99	98	99	99	85	1990
	Farmoor	• 13843	94	97	100	97	99	98	94	1995
Southern	Bewl	28170	100	99	100	100	96	92	52	1990
	Ardingly	4685	100	100	100	100	100	100	86	1996
Wessex	Clatworthy	5364	92	86	100	92	88	92	61	1995
	BristolWW	• (38666)	(97)	(94)	(98)	(98)	(91)	(92)	(64)	1990
SouthWest	Colliford	28540	68	68	73	77	76	77	51	1997
	Roadford	34500	84	84	91	98	97	98	49	1996
	Wimbleball	21320	100	97	100	100	99	100	63	1992
	Stithians	5205	100	96	100	100	98	92	53	1990
Welsh	Celyn and Brenig	• 131155	97	98	100	100	98	100	77	1996
	Brianne	62140	94	94	97	100	94	99	76	1995
	Big Five	• 69762	96	91	98	99	91	98	61	1989
	Elan Valley	• 99106	97	93	99	100	93	98	75	1989
East of	Edinburgh/Mid Lothian	• 97639	80	79	71	62	52	54**		
Scotland	East Lothian	• 10206	100	99	100	100	99	100	81	1992
West of	Loch Katrine	• 111363	88	95	97	99	90	81	71	1995
Scotland	Daer	22412	98	100	100	100	90	95	62	1994
	LochThom	• 11840	93	100	100	100	92	90	77	1997

( ) figures in parentheses relate to gross storage
** Megget drawdown for maintainence
• denotes reservoir groups
* last occurrence

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 1988-1997 period only. In some gravity-fed reservoirs (eg. Clywedog) stocks are kept below capacity during the winter to provide scope for flood alleviation.

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 provisional regional rainfall figures are regularly updated using figures derived from a much denser rainguage network. Further details of Met. Office services can be obtained from:

The Meteorological Office
Sutton House
London Road
Bracknell
RG12 2SY.
Tel. 01344 856858; 01344 854024.

The cooperation of all data suppliers is gratefully acknowledged.

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