Hydrological summary

for Great Britain

October 1998

General

A year that began with widespread drought conditions suffered its second major flood episode during late October. Exceptional rainfall over the second half of the month triggered widespread floodplain inundations - particularly serious flooding occurred in South Wales and the Severn Basin. Overall reservoir stocks for England and Wales (for early November) are the highest since the national hydrological monitoring programme began in 1988. Saturated soils in almost all areas offer the prospect of a lengthy 1998/99 aquifer recharge season, but also imply that many catchments will remain vulnerable to further notably wet episodes.

Rainfall

October was a cool, and very unsettled month especially over the latter half when gales were common - a sequence of increasingly vigorous frontal systems produced notable rainfall accumulations over timeframes up to 10 days. In Wales, Capel Curig (N. Wales) registered 90 mm on the 16/17th, and Dolydd (mid-Wales) totalled 246 mm over the 22-29th; Treherbert (head of Rhondda Valley) recorded an October total of around 550 mm - the second highest for any month in the last 30 years. Parts of the Pennines were very wet also. In hydrological terms, the basin-wide extent of the heavy frontal rainfall was particularly significant. Regional rainfall totals for October were generally in the 165-220% range throughout E&W - in the last 30 years only 1987 and 1976 (marginally) have been wetter. More significantly, the autumn rainfall thus far has already exceeded the September-November average in most areas, often by a wide margin. For the Thames basin provisional figures suggest it was the fourth wettest Sept/Oct this century. Notably high rainfall totals extend over the Mar-Oct period also - 1998 vies with 1968 as the wettest for E&W in the last 70 years. In the Nov-Oct timeframe provisional data for 1997/98 indicate that the Scotland total ranks 4th highest in a series from 1869 (but 1989/90,1991/92 and 1994/95 were all wetter) and England and Wales was the wettest since 1966.

River Flows

Seasonal flow recoveries gathered momentum through October and, with most natural catchment storage utilised, sustained spate conditions were common over the second fortnight. Notably high flows occurred in parts of Scotland on the 20/21st and heavy frontal rainfall on the 22/23rd caused severe flooding in South Wales (e.g. in the Rhondda Valley and the Vale of Glamorgan) in places the worst for 20 years; the peak flow on the Cynon was the third highest in a series from 1957. Runoff rates were also very high in rivers draining the Peak District. Though levels fell swiftly in many of the shorter, steeper valleys, flood alerts were then triggered on the larger, slower-responding western catchments - particularly the Wye and Severn basins where successive pulses of rain made for complex and protracted high flow events. Flooding was worst in the middle reaches of the Severn; a return period of around 30 years was provisionally ascribed to the peak at Shrewsbury. Around month end flooding extended to the South-West and to some impervious lowland catchments (e.g. the Thame in Bucks). Index rivers establishing new October maximum flow rates showed a very wide distribution (from the Earn to the Exe) and, some eastern spring-fed rivers excepted, runoff totals were substantially above average in almost all catchments. Several rivers, including the Yscir, Dove and Cree established new monthly maxima flows. Away from the English lowlands, most rivers registered Mar-Oct runoff totals amongst the highest three or four on record; by contrast those for some baseflow dominated eastern rivers (e.g. Mimram and Little Ouse) were well below average - but flows were generally increasing briskly by late October.

Groundwater

Remaining soil water deficits were eliminated in most areas by month end. By early November, significant deficits were largely restricted to areas adjacent to the Wash and in the lower Trent basin. The wetting-up of the soils allowed abundant infiltration from mid-month in most areas - its impact on water-tables is not yet evident in many index hydrographs; some reported in early October and the lag in response to infiltration can extend over several seasons as in parts of the Midland Permo-Triassic sandstones aquifer. Late October/early November groundwater levels confirm a brisk recovery in the more responsive aquifer units, e.g. in the Jurassic and Carboniferous Limestone outcrops. In the Chalk, most seasonal recessions have been arrested and, some deeper eastern boreholes aside, October levels were around the seasonal average. Levels were mostly below average in the Permo-Triassic sandstones but, taking account of recent infiltration, overall groundwater resources are improving rapidly. In almost all regions, the potential recharge season extends over 4-7 months, greatly increasing the likelihood of healthy groundwater stocks by next spring. However, soil moisture deficits have still to be satisfied in a few parts of the eastern Chalk where levels have been depressed over the last year and remain well below average.

Institute of Hydrology

British Geological Survey

Rainfall . . . Rainfall . . . Rainfall. .

Rainfall accumulations and return period estimates

Area	Rainfall	Oct 1998	Aug 98-Oct 98	RP	Mar 98-Oct 98	RP	Nov 97-Oct 98	RP	Nov 96-Oct 98	RP
England & Wales	**mm**	**153**	**287**		**726**		**1093**		**1914**	
	%	**180**	**121**	**2-5**	**129**	**20-35**	**122**	**15-25**	**107**	**2-5**
North West	mm	213	402		941		1407		2464	
	%	167	115	2-5	124	10-20	117	5-10	102	2-5
Northumbrian	mm	127	275		797		1140		1964	
	%	167	119	2-5	147	150-250	134	70-100	115	10-20
Severn Trent	mm	141	270		643		924		1649	
	%	220	138	5-15	133	25-40	122	10-20	109	5-10
Yorkshire	mm	139	244		687		999		1794	
	%	190	113	2-5	132	20-35	122	10-20	109	5-10
Anglian	mm	95	201		520		733		1306	
	%	187	130	5-10	131	20-30	123	10-20	110	5-10
Thames	mm	125	251		593		843		1443	
	%	201	140	5-15	133	20-30	122	10-20	105	2-5
Southern	mm	149	271		599		978		1681	
	%	187	132	5-10	125	5-15	126	10-20	108	2-5
Wessex	mm	154	288		704		1099		1901	
	%	195	133	5-10	138	30-50	131	30-50	113	5-10
South West	mm	202	358		922		1478		2570	
	%	174	122	2-5	137	30-50	126	20-30	109	5-10
Welsh	mm	242	465		1073		1653		2804	
	%	177	132	5-10	138	40-60	126	25-40	107	2-5
Scotland	**mm**	**239**	**454**		**1017**		**1703**		**3095**	
	%	**153**	**109**	**2-5**	**115**	**5-10**	**118**	**20-30**	**108**	**5-10**
Highland	mm	267	483		1102		1960		3705	
	%	135	97	2-5	105	2-5	111	5-10	105	2-5
North East	mm	142	306		813		1242		2201	
	%	146	113	2-5	132	40-60	128	50-80	113	10-20
Tay	mm	226	424		945		1556		2696	
	%	174	125	5-10	127	15-25	127	30-50	110	5-10
Forth	mm	224	458		947		1450		2550	
	%	195	144	20-30	137	70-100	131	80-120	115	15-25
Tweed	mm	155	306		787		1198		2215	
	%	163	113	2-5	128	20-30	124	20-30	114	10-20
Solway	mm	270	517		1123		1773		3068	
	%	172	123	5-10	129	20-35	125	30-45	108	5-10
Clyde	mm	291	550		1119		1924		3462	
	%	151	109	2-5	109	2-5	113	5-10	102	2-5

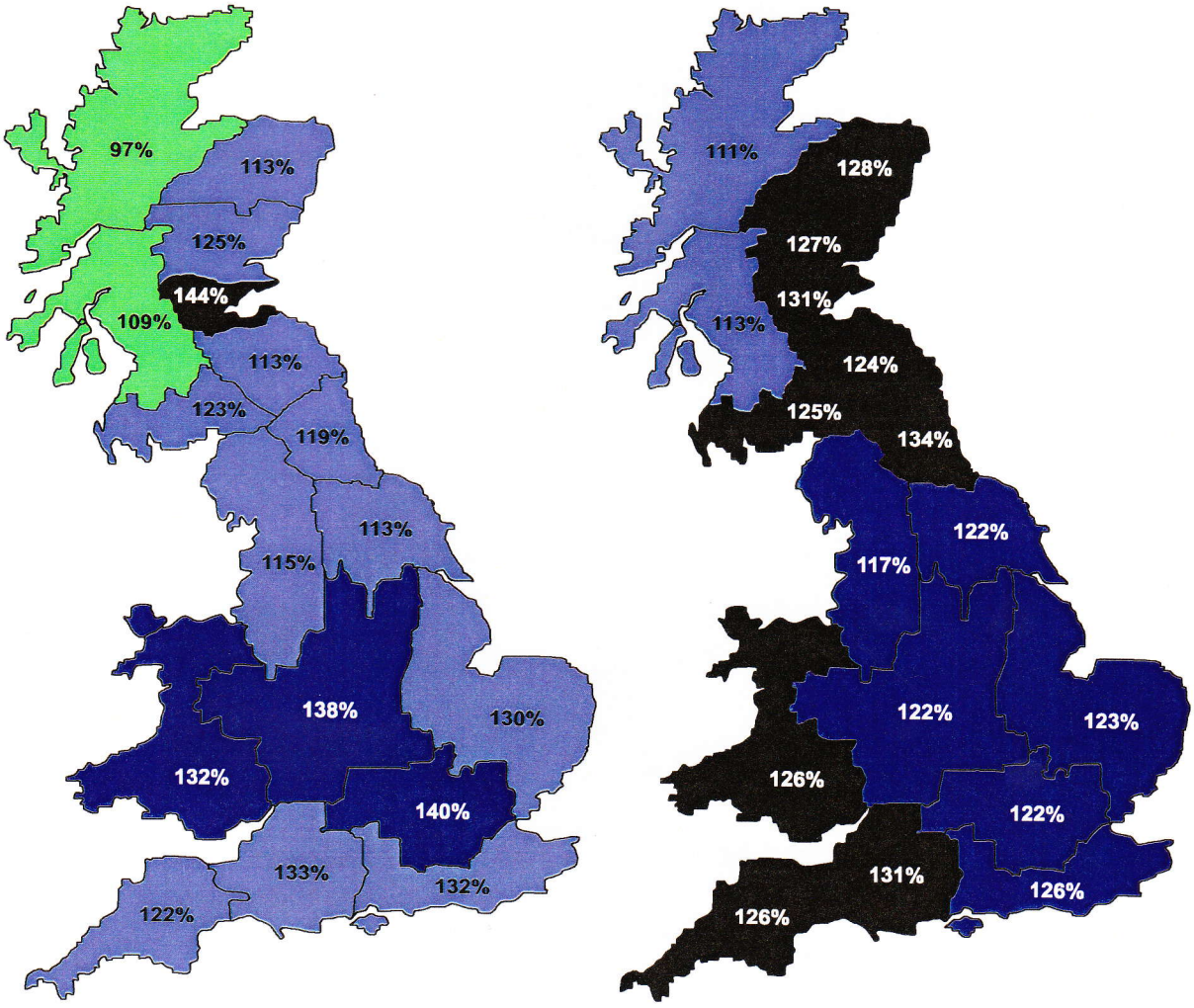
RP = Return period

 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

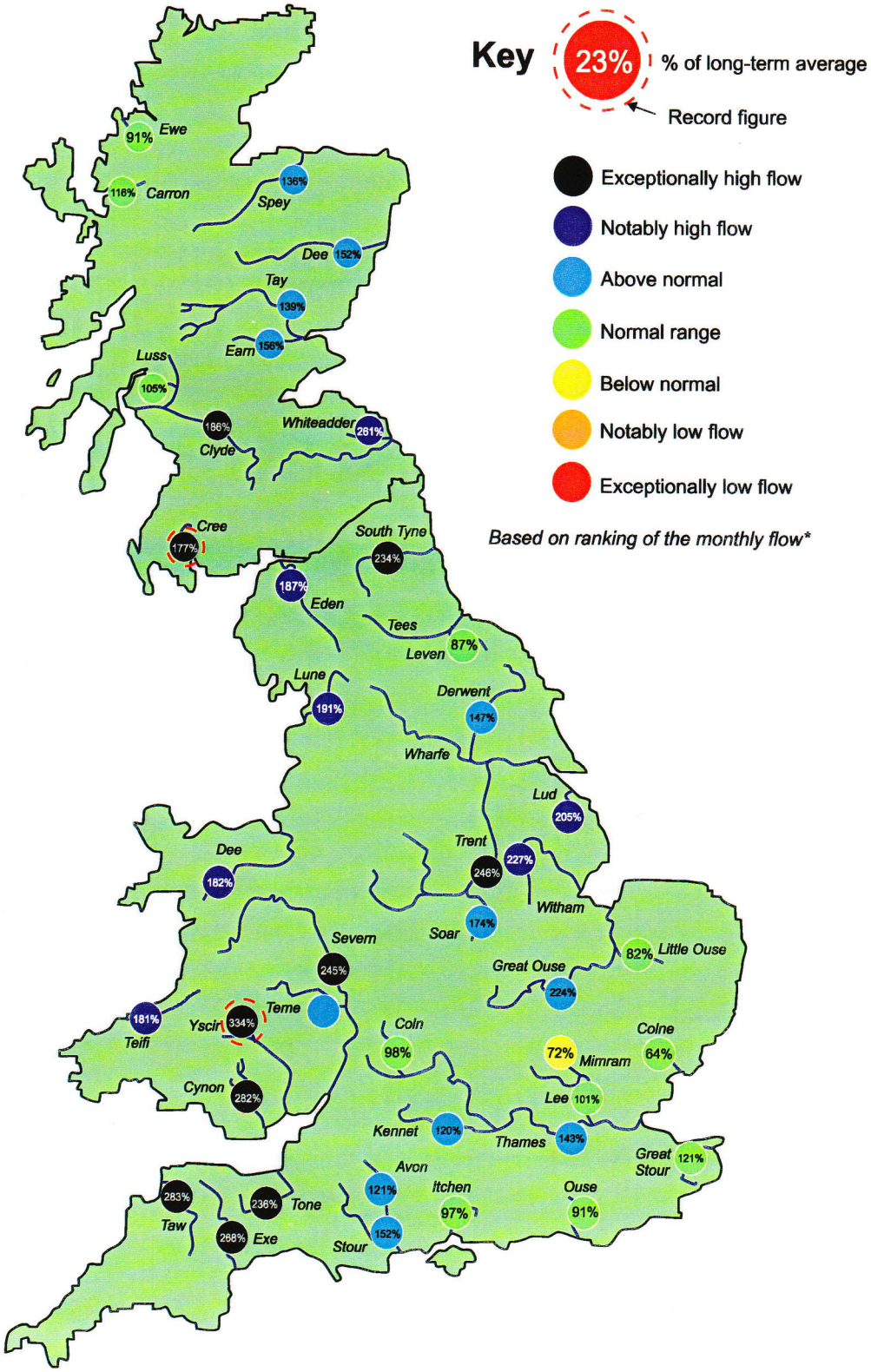


August 1998 - October 1998 **November 1997 - October 1998**

Rainfall accumulation maps

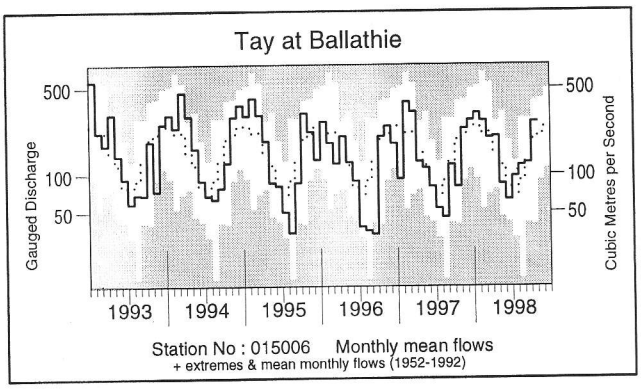
Notwithstanding the relatively dry August, rainfall over the last three months is above average in almost all regions. More notably, rainfall for GB has been well above average in 8 of the last 12 months and the accumulated total for November-October is (provisionally) the equal third highest - with 1959/60 - in the 120-year GB series.

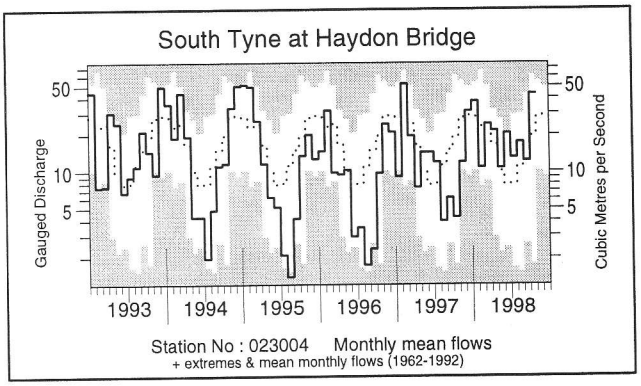
River flow . . . River flow . . .

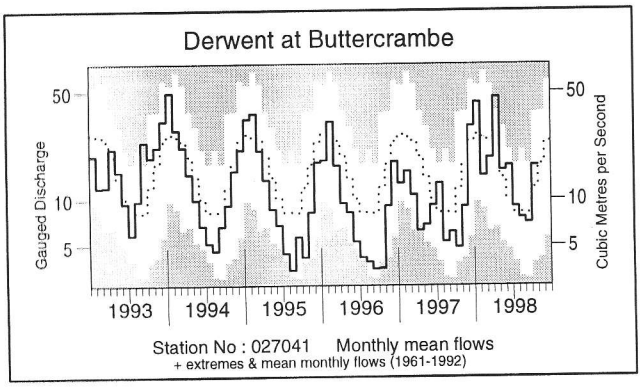


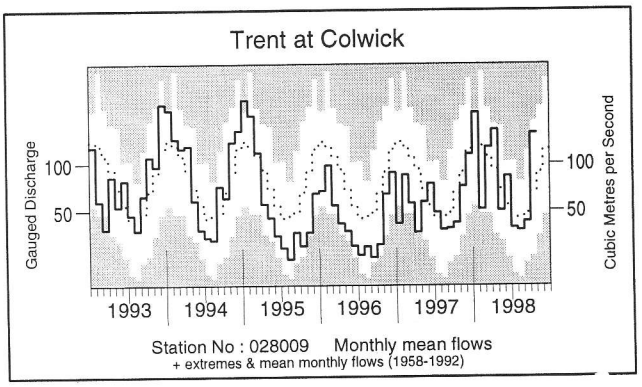
River flows - October 1998

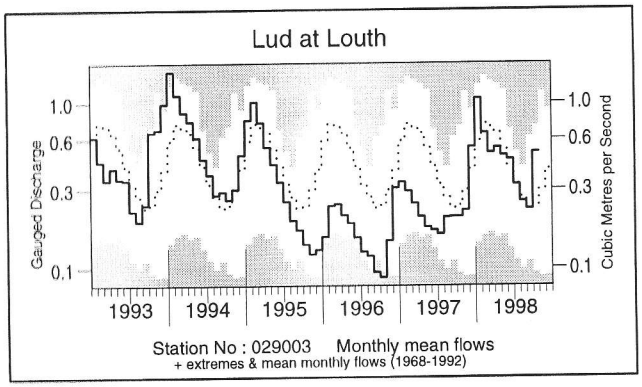
Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

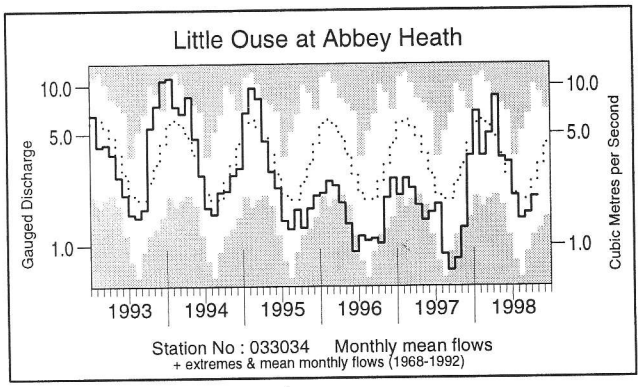


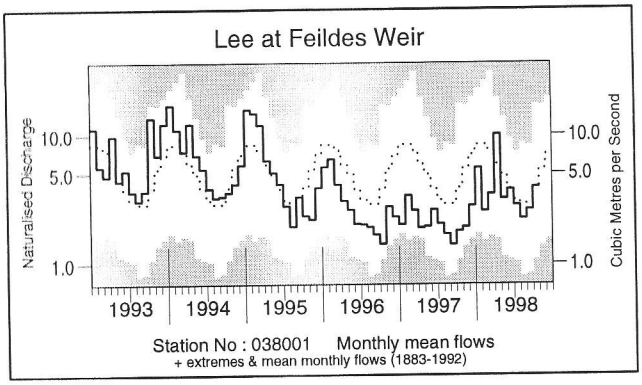


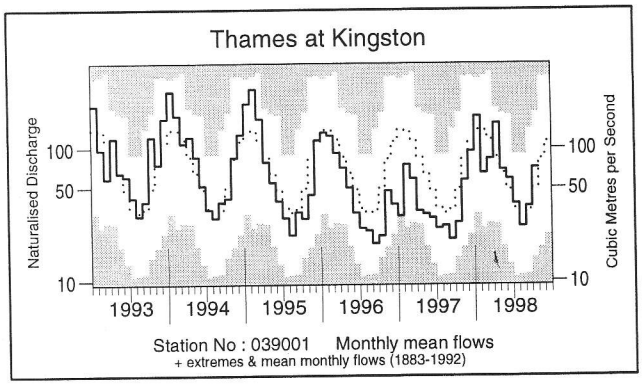








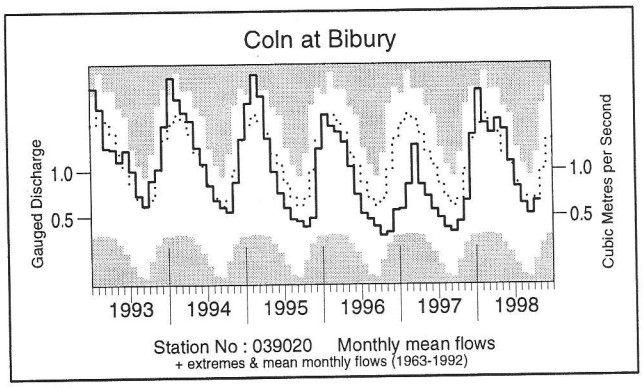


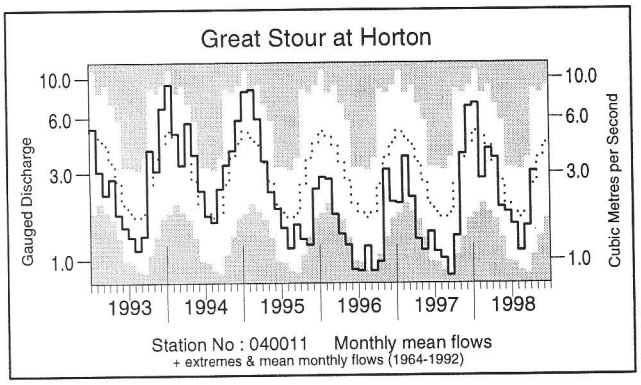


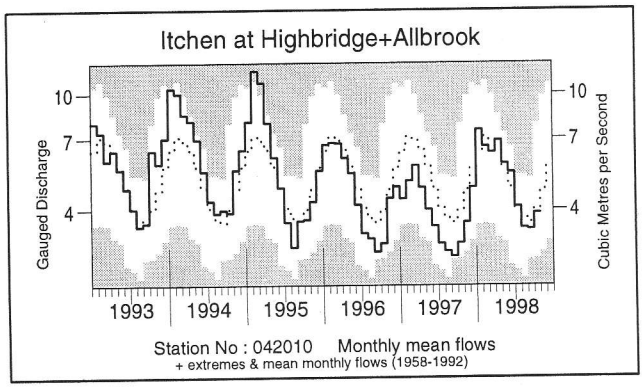
Monthly river flow hydrographs

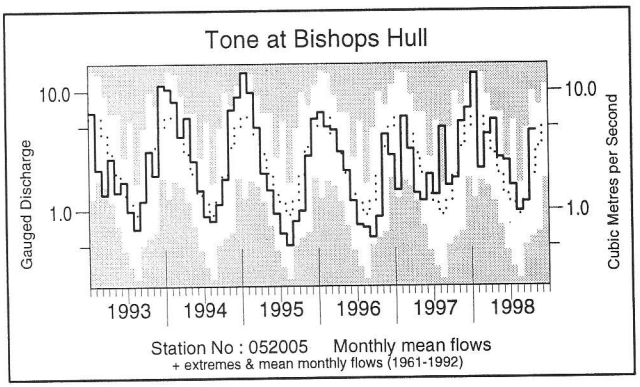
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 1992 (shown by the shaded areas). Monthly flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded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

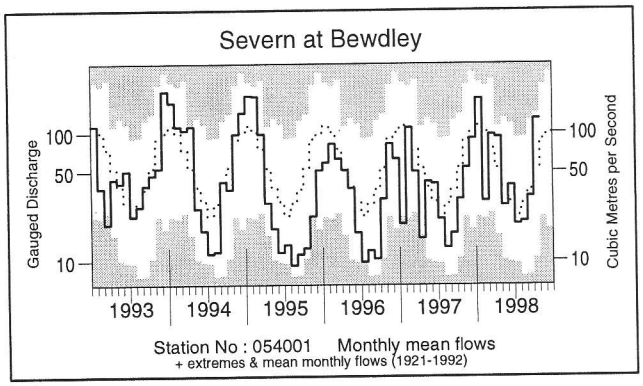
River flow . . . River flow . . .

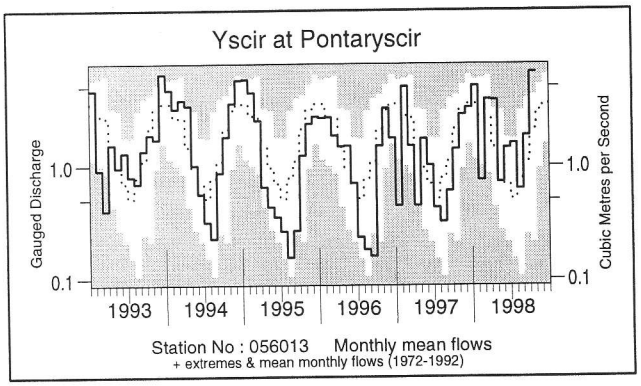


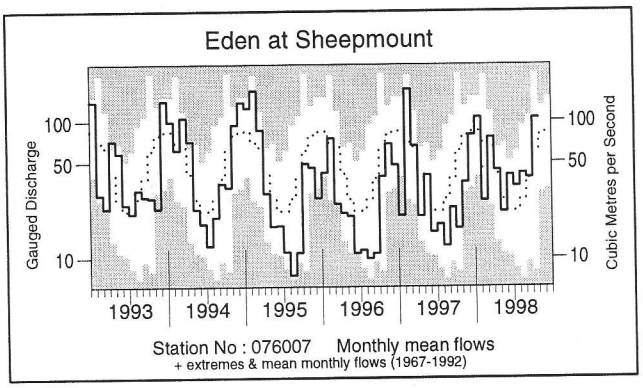


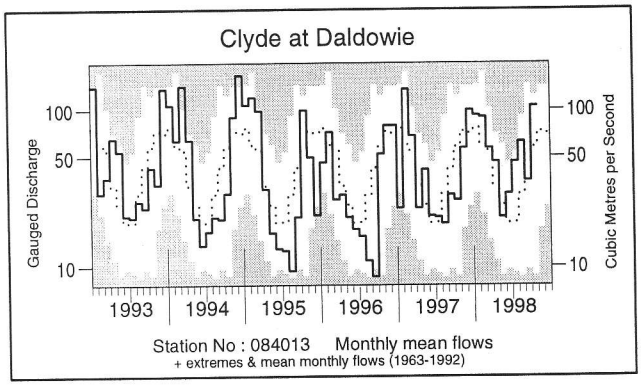












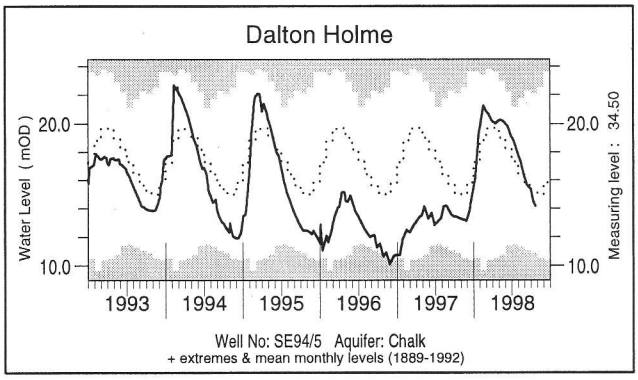
Notable runoff accumulations March 1998 - October 1998 (a); November 1997 - October 1998 (b)

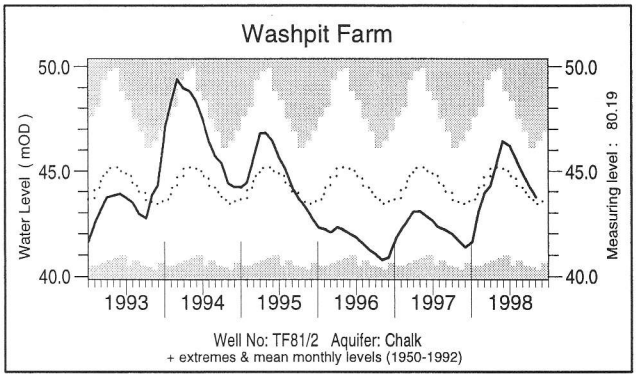
(a) River	%lta	Rank	River	%lta	Rank
Whiteadder	180	29/29	Yscir	199	26/26
Wharfe	144	41/43	Cynon	181	39/39
Ouse	187	63/66	Dee (Wales)	153	29/29
Exe	161	41/42	Clyde	143	34/35
Dart	139	37/40	Naver	133	34/35
Tone	148	37/38	Deveron	158	36/36

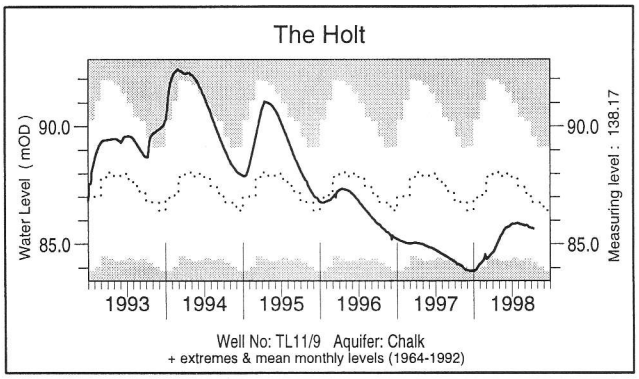
(b) River	%lta	Rank
Dee	127	25/26
Mole	133	22/22
Otter	123	36/36
Tone	143	37/37
Yscir	139	25/25
Cynon	144	39/39

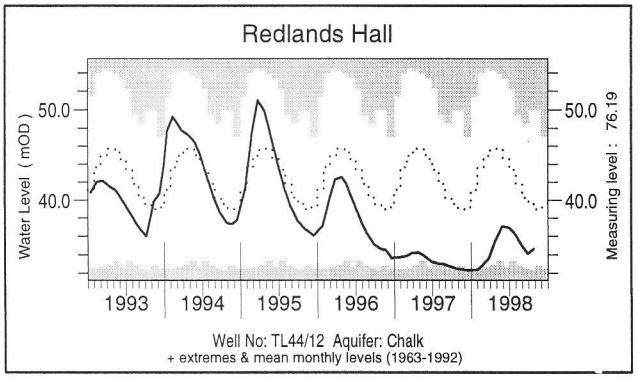
lta = long term average
Rank 1 = lowest on record

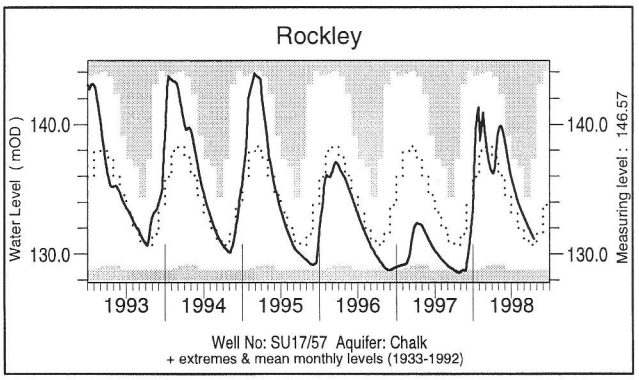
Groundwater . . . Groundwater

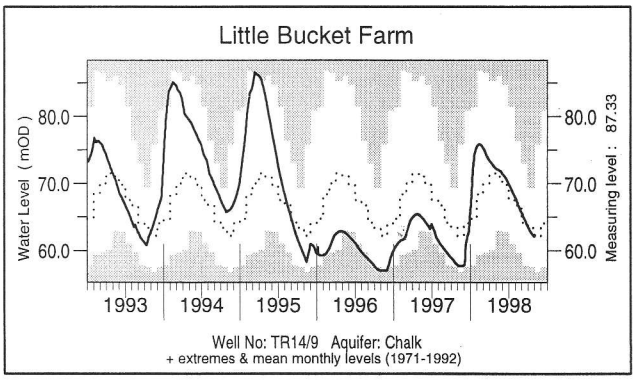


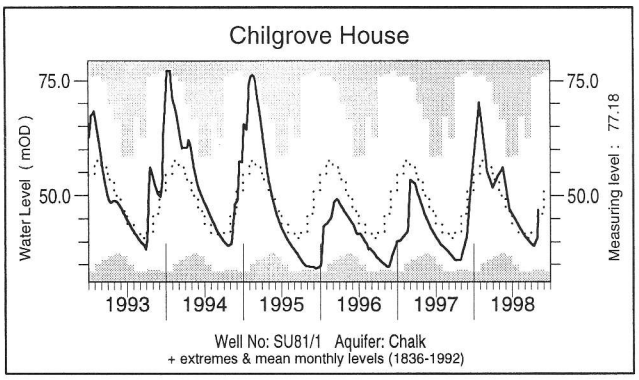


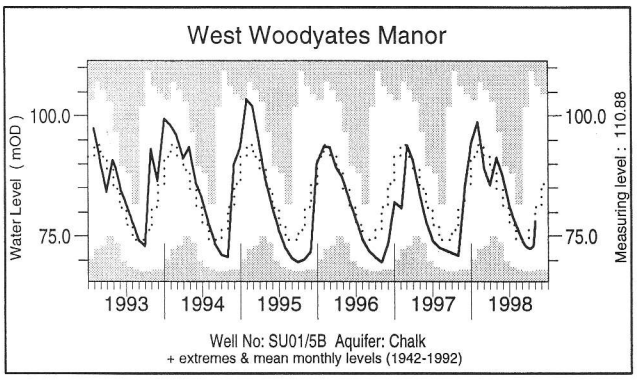








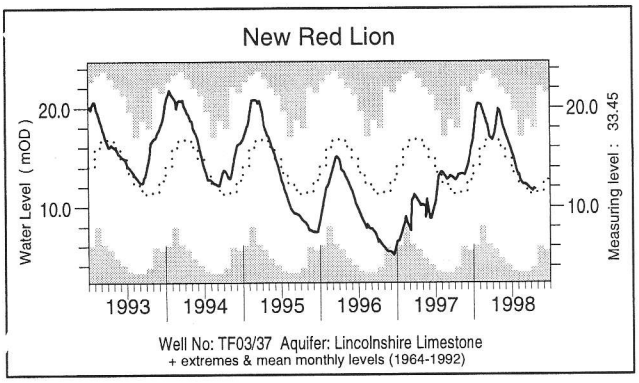


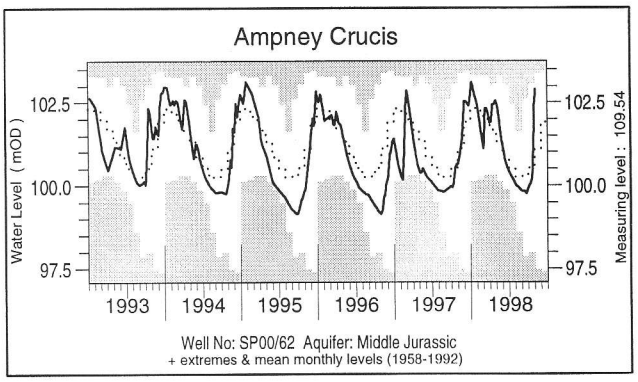


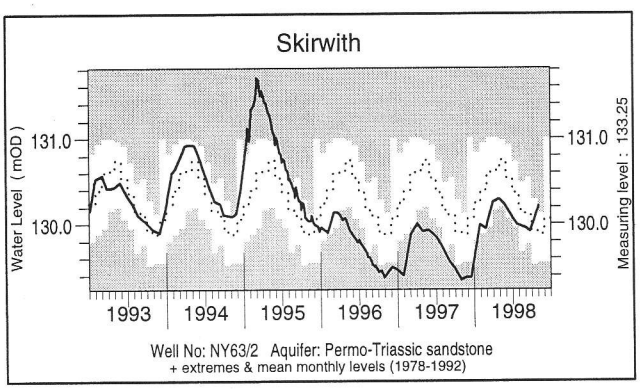
What is groundwater?

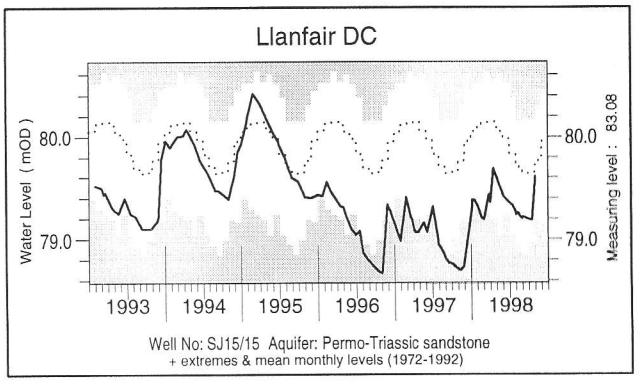
Groundwater is stored in the natural water bearing rock strata (or aquifers) which are found mostly in southern and eastern England (see page 11) where groundwater is the major water supply source. Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment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

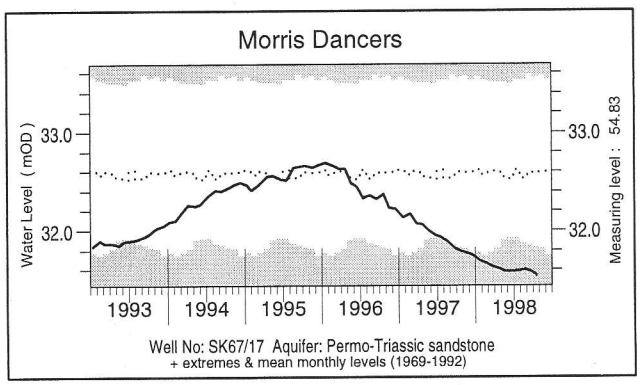
Groundwater . . . Groundwater

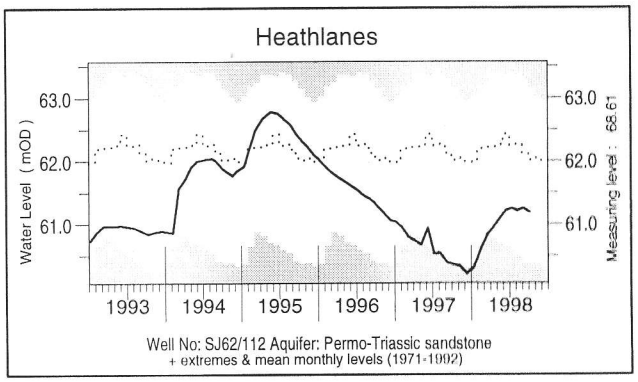


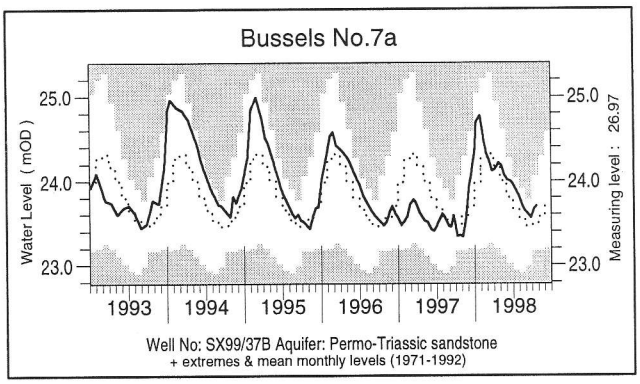


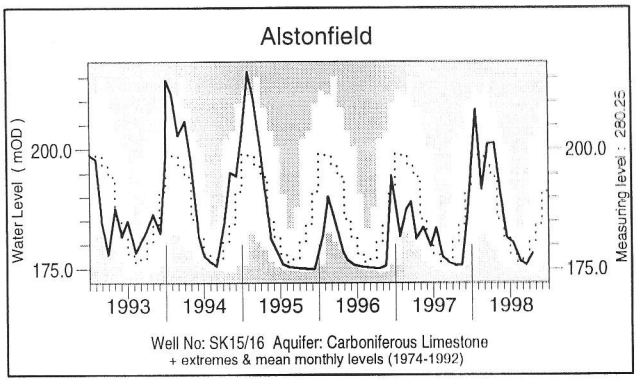












Groundwater levels October/November 1998

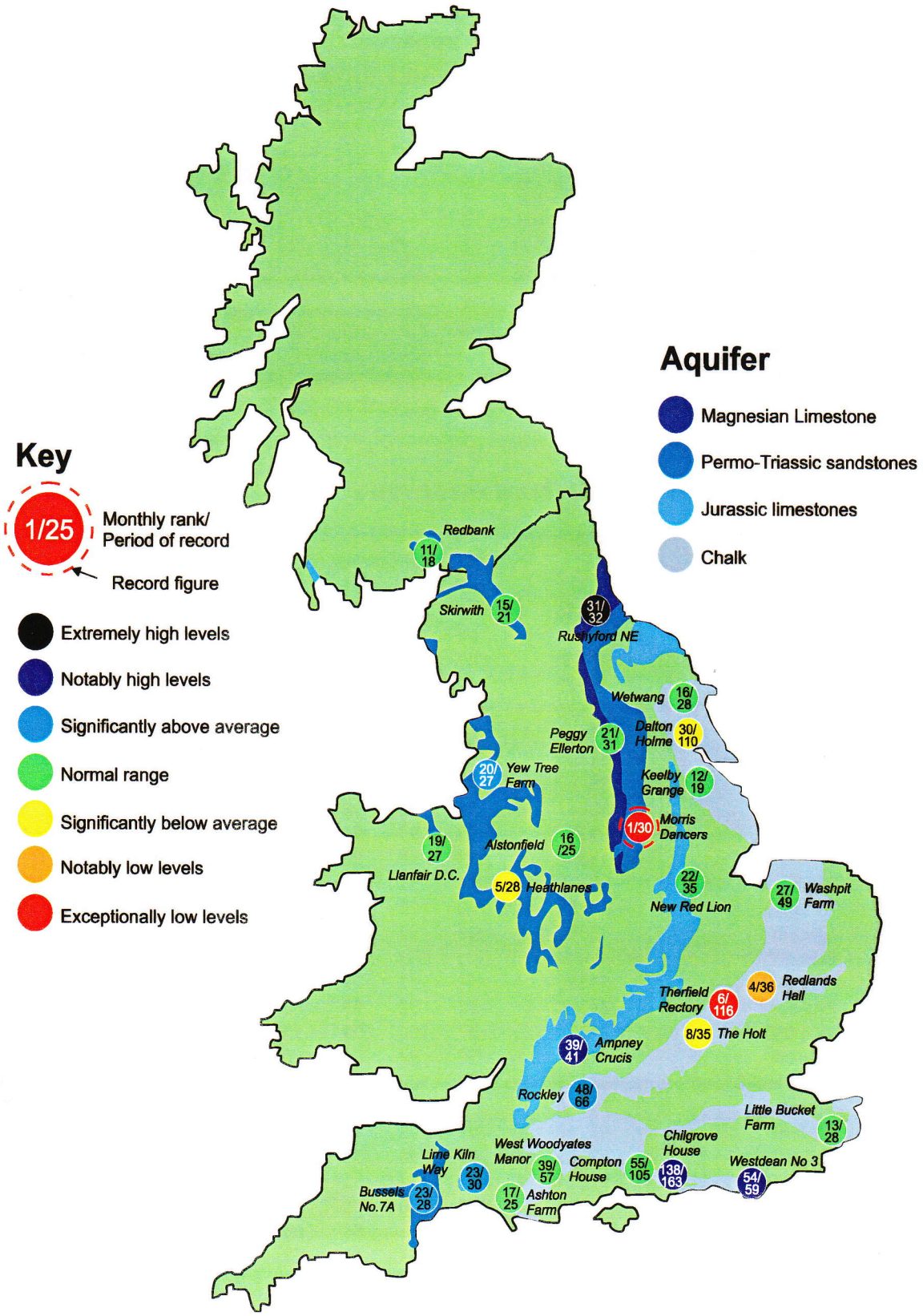
Borehole	Level	Date	Oct av.
Dalton Holme	14.11	23/10	14.91
Washpit Farm	43.73	03/11	43.41
The Holt	85.65	12/10	86.96
Redlands Hall	34.62	23/10	38.71
Ashton Farm	65.27	31/10	65.09
Little Bucket	62.29	4/11	63.18

Borehole	Level	Date	Oct av.
Chilgrove	46.96	3/11	42.43
W Woodyates	77.87	31/10	75.29
New Red Lion	11.74	21/10	11.38
Ampney Crucis	102.89	4/11	100.41
Skirwith	130.21	4/11	129.87

Borehole	Level	Date	Oct av.
Llanfair DC	79.61	01/11	79.46
Morris Dancers	31.54	20/10	32.48
Heathlanes	61.18	06/10	61.89
Bussels	23.70	21/10	23.49
Alstonfield	178.27	15/10	179.95

Levels in metres above Ordnance Datum

Groundwater . . . Groundwater

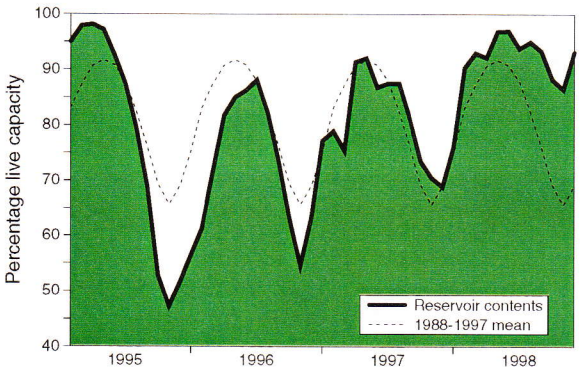


Groundwater levels - October 1998

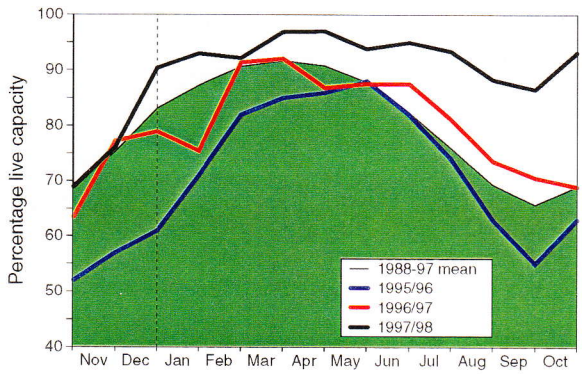
The rankings are based on a comparison of current levels (usually a single reading in a month) with the average level in each corresponding month on record. Caution needs to be exercised when interpreting the ranking, especially during periods of rapid changes in groundwater level. Rankings may be omitted 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 Jun	Jul	Aug	Sep	Oct	**Nov**	Min. Nov	Year* of min
NorthWest	N Command Zone	• 133375	87	85	84	80	75	90	38	1993
	Vyrnwy	55146	95	93	90	81	83	100	25	1995
Northumbrian	Teesdale	• 87936	90	90	90	92	87	99	33	1995
	Kielder	(199175)	(92)	(93)	(92)	(94)	(88)	(96)	(63)	1989
SevernTrent	Clywedog	44922	98	98	97	93	88	100	38	1995
	DerwentValley	• 39525	90	100	93	96	90	100	15	1995
Yorkshire	Washburn	• 22035	91	98	89	85	82	96	15	1995
	Bradford supply	• 41407	93	96	93	92	92	99	16	1995
Anglian	Grafham	58707	99	96	95	87	84	92	44	1997
	Rutland	130061	96	96	93	88	86	87	59	1995
Thames	London	• 206399	99	99	96	85	82	83	46	1996
	Farmoor	• 13843	99	98	96	97	98	96	53	1990
Southern	Bewl	28170	96	92	86	76	70	77	33	1990
	Ardingly	4685	100	100	96	74	67	80	33	1996
Wessex	Clatworthy	5364	88	92	87	77	70	92	19	1989
	BristolWW	• (38666)	(91)	(92)	(88)	(79)	(72)	(84)	(24)	1990
SouthWest	Colliford	28540	76	77	78	76	76	82	42	1996
	Roadford	34500	97	98	99	98	96	100	18	1995
	Wimbleball	21320	99	100	99	92	87	100	26	1995
	Stithians	5205	98	92	88	80	71	80	18	1990
Welsh	Celyn and Brenig	• 131155	98	100	100	84	95	100	48	1989
	Brianne	62140	94	99	100	100	97	100	57	1995
	Big Five	• 69762	91	98	97	88	94	92	41	1995
	Elan Valley	• 99106	93	98	98	96	97	100	37	1995
East of Scotland	Edinburgh/Mid Lothian	• 97639	52	54	51	45	43	50**	62	1997
	East Lothian	• 10206	99	100	100	99	100	100	48	1989
West of Scotland	Loch Katrine	• 111363	90	81	85	89	85	92	76	1997
	Daer	22412	90	95	98	87	81	99	70	1997
	LochThom	• 11840	92	90	100	98	97	100	74	1997

() figures in parentheses relate to gross storage • denotes reservoir groups # last occurence

** Megget filling, work finished 2/10/98

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

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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Selected text and maps are available on the WWW at http://www.nwl.ac.uk/ih

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