Hydrological summary

for Great Britain

July 1998

General

July was a dull, and for most of Britain, a wet month. Rainfall totals were however substantially below average in parts of eastern England (where irrigation demands are concentrated). Fortunately, below average temperatures moderated the seasonal increase in water demand and overall reservoir stocks are exceptional for the late summer. Most major reservoirs remain close to capacity and, very unusually, total stocks exceed those for early March. July runoff totals were high throughout much of northern and western Britain but continue to be modest in some eastern spring-fed rivers. Groundwater levels exhibit significant spatial variations - most are in the normal range but levels remain low in parts of the eastern Chalk and some sandstone aquifer units.

Rainfall

After a relatively dry start to July weather patterns reverted to the unsettled pattern which has typified much of the summer; particularly widespread and intense storms were experienced around month-end. In northern Britain a succession of frontal systems produced appreciable rainfall on most days and July rainfall totals were more than twice the average in many localities, approaching three times in parts of north-east Scotland. By contrast, few active frontal systems crossed the English lowlands. Parts of East Anglia registered <50% of the July average, monthly rainfall totals were also significantly below average throughout most of the English lowlands. The provisional Scottish rainfall total for July ranks as the sixth highest in a series from 1869. More notably, the January-July total is the second highest on record (after 1990). In England and Wales regional and local variability in rainfall was substantial but overall the July rainfall was a little below average. Accumulated totals provide a better guide to the general improvement in the water resources outlook over the last five months; the March-July rainfall total was the fourth highest this century, only 1920 was substantially wetter. Regional rainfall totals throughout Britain are above average for the year thus far, and over the last 12 months.

River flow

July saw a marked exaggeration in the normal runoff gradient across the country. Catchments were close to saturation in Scotland and, mostly minor, spate conditions were common over the latter half of the month. On the 20th, the River Cree reported its third highest August flow in a 35-year record and, following intense rainfall on the 31st, the main rail link to the Central Lowlands was disabled (for two days) at Lockerbie (Dumfries and Galloway). Minor floodplain inundations and local flooding (e.g. in Dundee) were widespread in Scotland. New July maximum runoff totals were established on the River Dee (at Park) and the Spey (at Boat of Garten which has a 47-year record). Notably high July totals were reported from many catchments in western and northern Britain - most index gauging stations recorded July mean flows > 50% above average. By contrast, runoff totals in the English lowlands were generally below average although mostly within the normal range. Notably low July flows were largely confined to spring-fed rivers in eastern England. In such rivers, long term runoff accumulations remain depressed. For example, the runoff total for the Mimram over the last three years is lower than any previous 36-month accumulation (for any start month) in a record from 1952. The very beneficial aquifer recharge over the spring increased flows in groundwater-fed streams to above drought minima but dry soil conditions imply that low flows are likely to persist through most of the autumn. Accumulated runoff totals are generally very healthy in impermeable western and northern catchments.

Groundwater

Soil moisture deficits were close to zero in most of upland Britain during late July but above average in parts of the English lowlands - an unfavourable distribution from a groundwater perspective. As usual in mid-summer no significant recharge was registered to the major aquifer units. July levels in the Chalk remain close to the seasonal average, with the exception of some deeper boreholes in eastern England (Hertfordshire and Cambridgeshire especially) which are still experiencing low levels - a reflection of low winter recharge over the last three years and, where water-tables are deep, the delayed response to infiltration during the spring and early summer. The opportunity for further recovery in these slow responding boreholes is probably past (recessions have resumed at Redlands for example). After erratic behaviour earlier in the year, levels in the limestone aquifers are generally close to the average. The same applies to the Permo-Triassic sandstones of the South West; elsewhere levels are generally low albeit above corresponding levels in 1997. Some signs of recovery have been noted in most Permo-Triassic sandstones boreholes, but the characteristically slow response in many areas (because of the relatively high aquifer storage) means that any recovery during 1998/99 will have to be generated from a very low base.

Institute of Hydrology

British Geological Survey

Rainfall . . . Rainfall . . . Rainfall. .

Rainfall accumulations and return period estimates

Area	Rainfall	Jul 1998	May 98-Jul 98	RP	Jan 98-Jul 98	RP	Aug 97-Jul 98	RP	Aug 96-Jul 98	RP
England & Wales	**mm**	**56**	**215**		**574**		**997**		**1825**	
	%	**91**	**112**	**2-5**	**121**	**5-10**	**111**	**5-10**	**102**	**2-5**
North West	mm	99	301		735		1222		2353	
	%	116	125	5-10	121	5-10	102	2-5	98	2-5
Northumbrian	mm	103	303		657		978		1856	
	%	158	162	40-60	144	70-100	115	5-10	109	5-10
Severn Trent	mm	37	173		485		820		1531	
	%	70	101	2-5	118	5-10	109	2-5	102	2-5
Yorkshire	mm	60	228		569		903		1713	
	%	101	127	5-10	128	10-20	110	2-5	104	2-5
Anglian	mm	30	146		388		656		1238	
	%	61	99	2-5	118	5-10	110	2-5	104	2-5
Thames	mm	33	161		430		748		1315	
	%	68	100	2-5	115	2-5	108	2-5	95	2-5
Southern	mm	36	154		434		881		1564	
	%	74	99	2-5	107	2-5	113	5-10	100	2-5
Wessex	mm	49	199		542		1040		1801	
	%	94	117	2-5	122	5-10	124	10-20	107	2-5
South West	mm	92	258		737		1421		2472	
	%	133	123	2-5	119	5-10	121	10-15	105	2-5
Welsh	mm	78	282		839		1492		2676	
	%	101	119	2-5	126	10-15	114	5-10	102	2-5
Scotland	**mm**	**149**	**313**		**921**		**1501**		**2992**	
	%	**158**	**118**	**5-10**	**128**	**30-50**	**104**	**2-5**	**104**	**2-5**
Highland	mm	153	330		1154		1782		3638	
	%	144	111	2-5	134	50-80	101	2-5	103	2-5
North East	mm	132	258		643		1065		2111	
	%	181	124	5-10	126	15-25	109	2-5	108	5-10
Tay	mm	152	285		786		1334		2581	
	%	197	122	5-10	122	5-10	109	2-5	105	2-5
Forth	mm	120	284		735		1179		2364	
	%	160	130	5-10	129	20-35	106	2-5	107	2-5
Tweed	mm	85	280		637		1034		2129	
	%	116	134	5-15	124	10-15	107	2-5	110	5-10
Solway	mm	174	381		883		1548		2939	
	%	193	147	20-35	124	10-20	109	2-5	103	2-5
Clyde	mm	169	331		991		1693		3327	
	%	155	113	2-5	119	5-10	100	<2	98	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

Very wet

Substantially above average

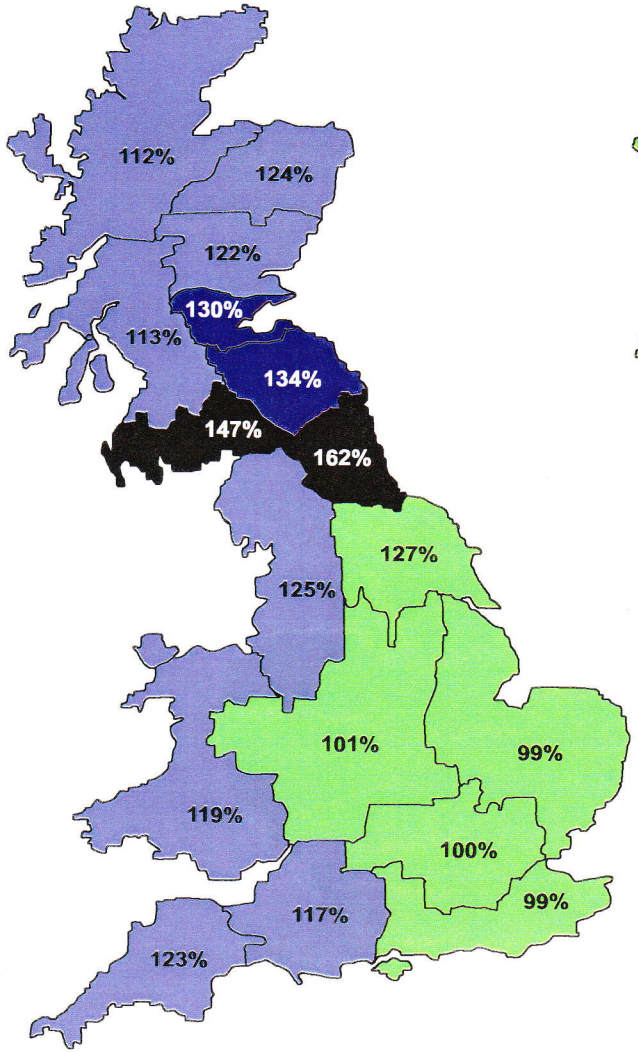
Above average

Normal range

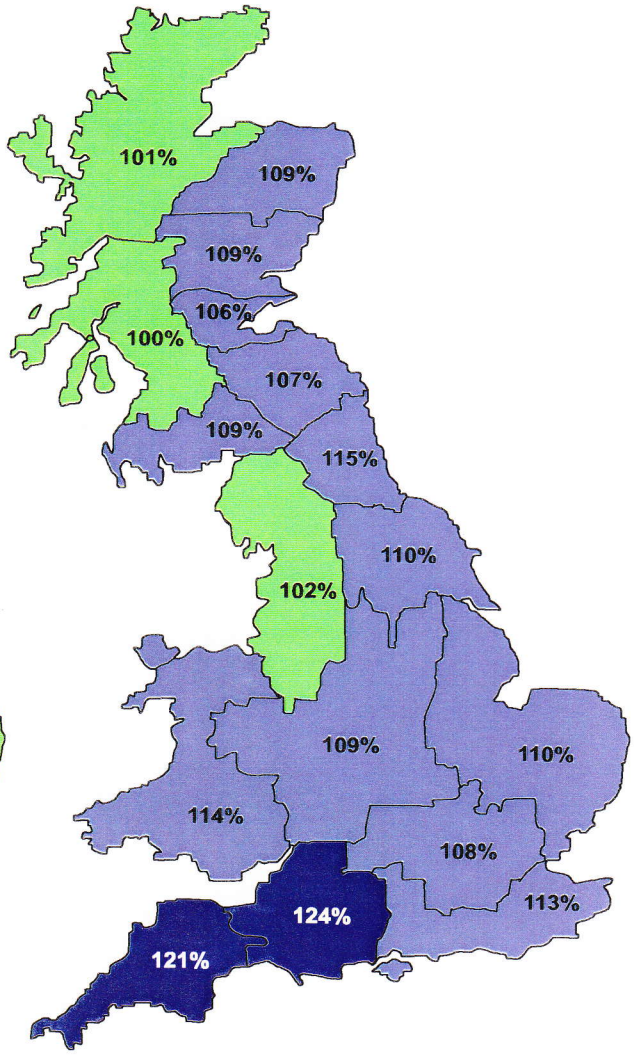
Below average

Substantially below average

Exceptionally low rainfall



May 1998 - July 1998

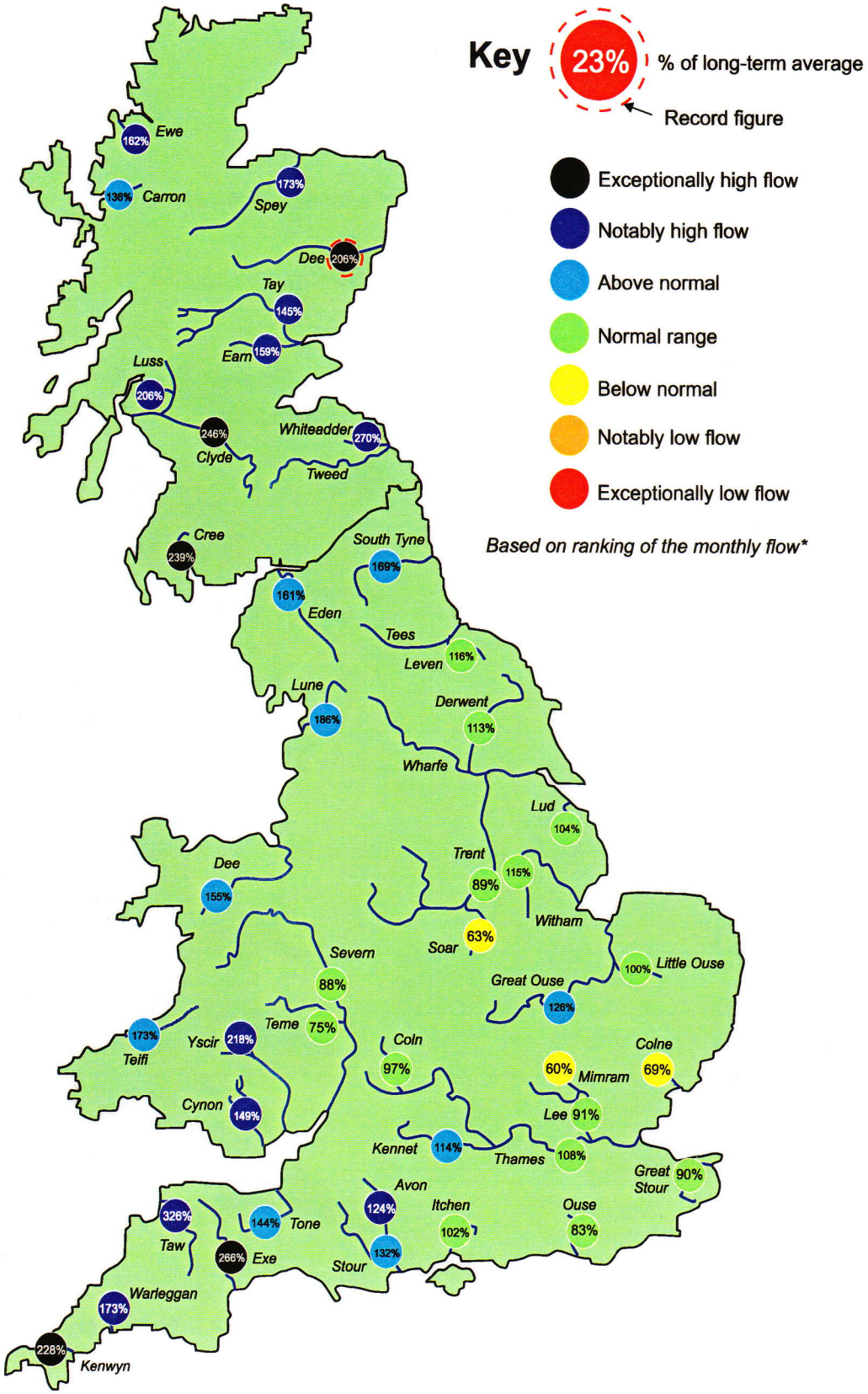


August 1997 - July 1998

Rainfall accumulation maps

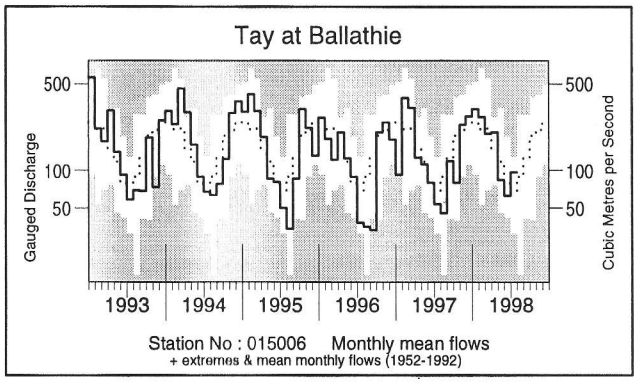
For Britain as a whole the May-July rainfall total has been notably above average in four of the last six years; this year parts of southern Scotland and north-east England have been exceptionally wet. Over the last 12 months regional rainfall totals all exceed the average - by a substantial margin in the South-West.

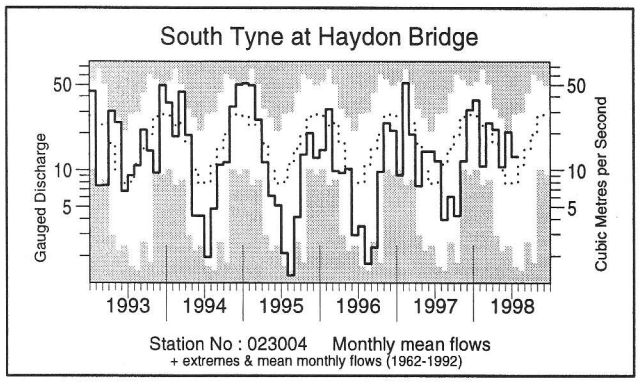
River flow . . . River flow . . .

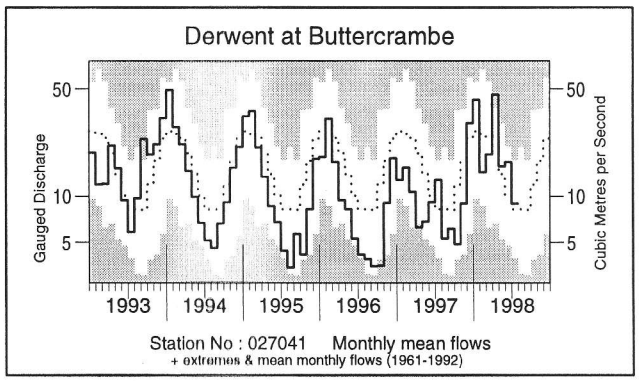


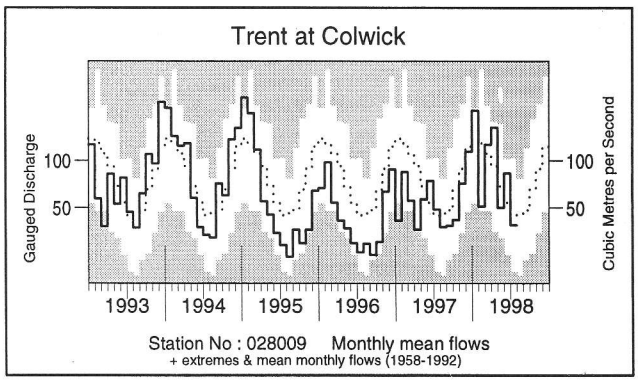
River flows - July 1998

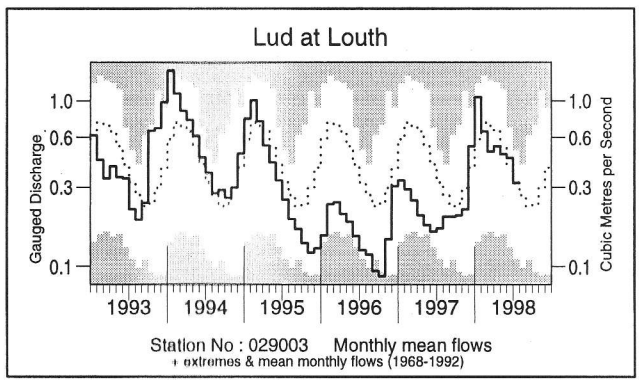
Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

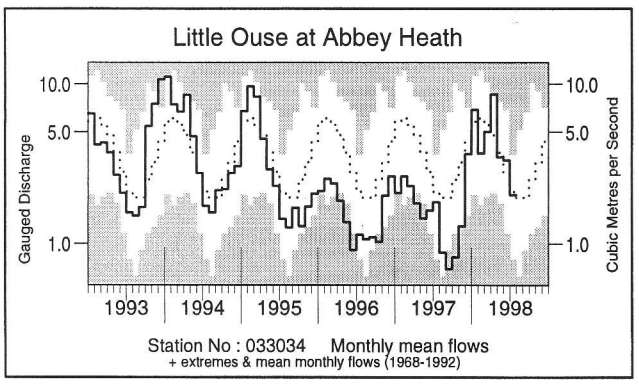


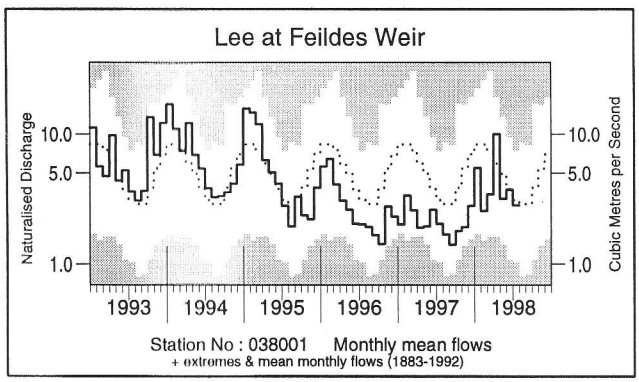


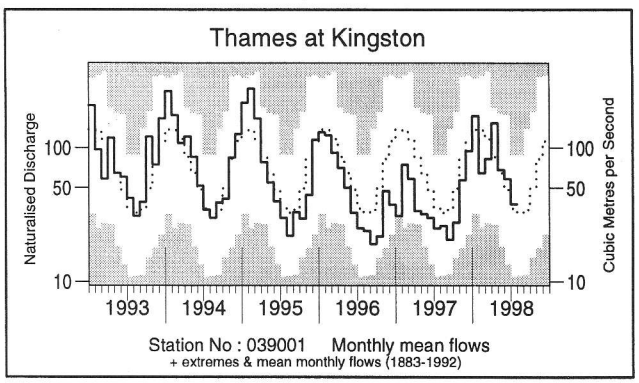








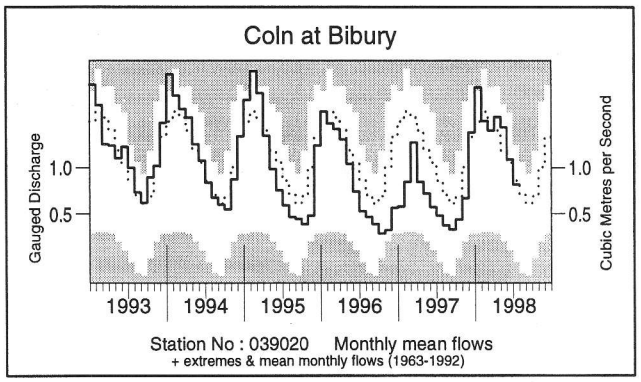


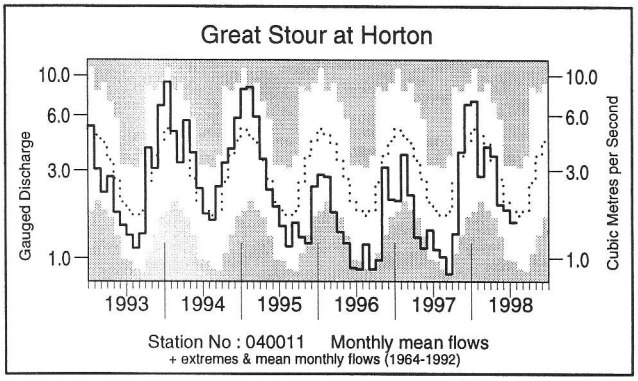


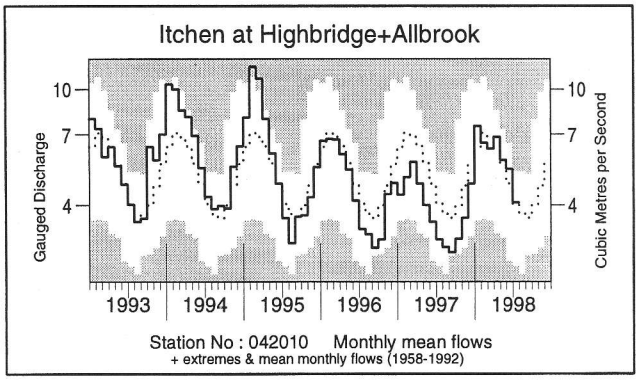
Monthly river flow hydrographs

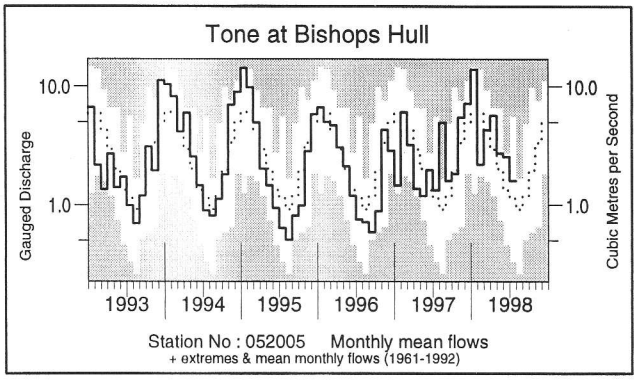
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 1992 (shown by the shaded areas). Monthly flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded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

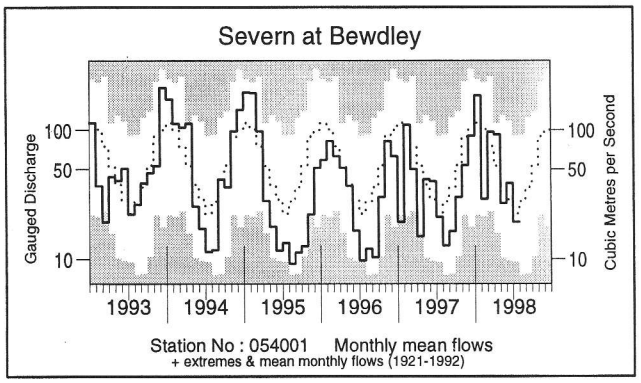
River flow . . . River flow . . .

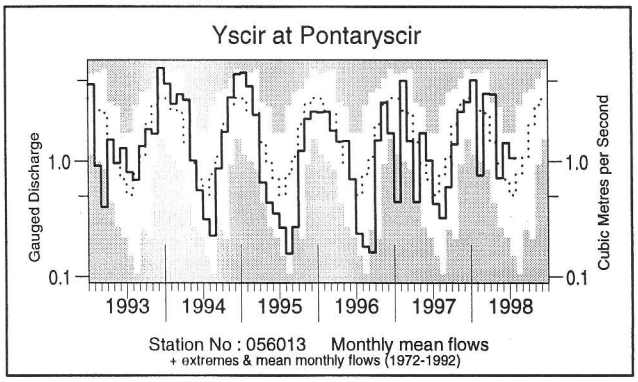


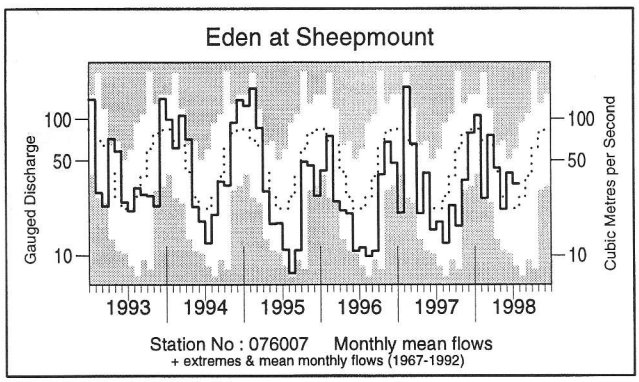


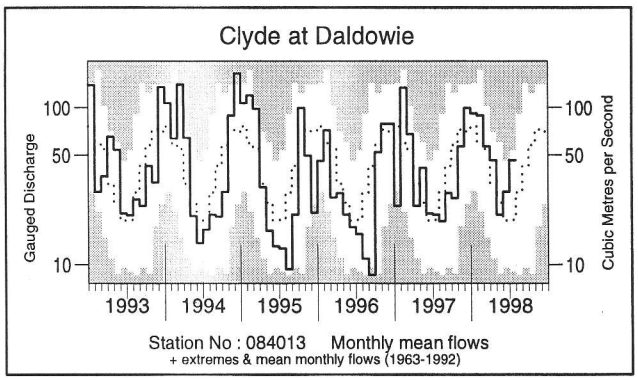










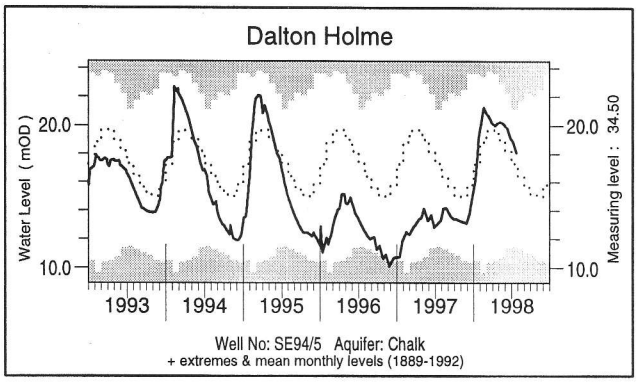


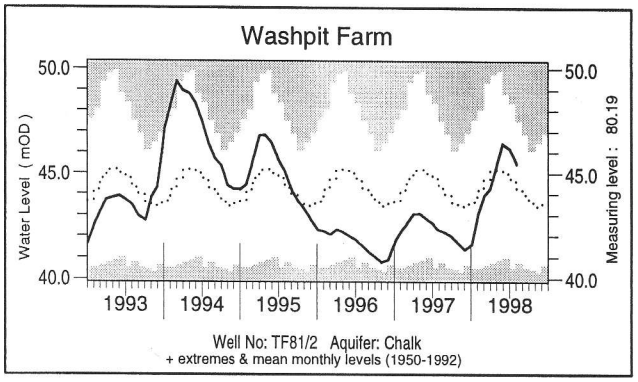
Notable runoff accumulations May 1998 - July 1998 (a); August 1997 - July 1998 (b)

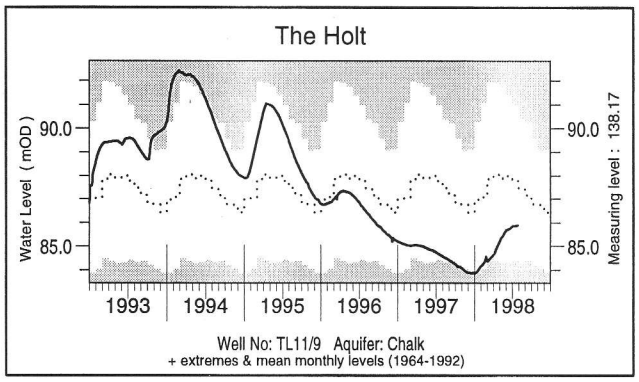
(a) River	%lta	Rank	(b)River	%lta	Rank	River	%lta	Rank
Tweed	166	36/38	Lud	147	34/39	Kenwyn	126	26/29
Whiteadder	221	28/29	Mimram	53	4/44	Tone	148	36/37
S. Tyne	170	35/35	Mole	131	20/23	Cynon	131	38/38
Exe	179	41/43	Otter	123	32/35	Teifi	117	34/39
Kenwyn	202	29/30	Warleggan	116	23/28			
Lune	149	35/38						

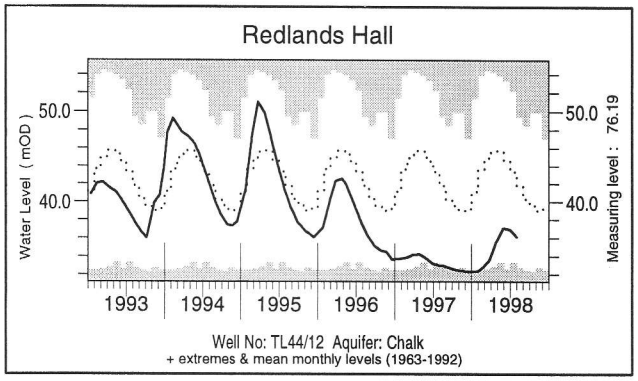
lta = long term average
Rank 1 = lowest on record

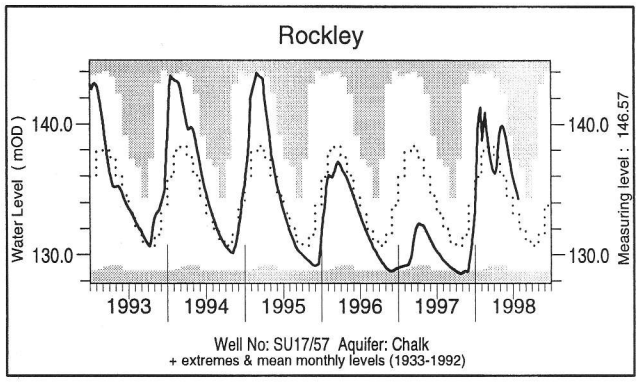
Groundwater . . . Groundwater

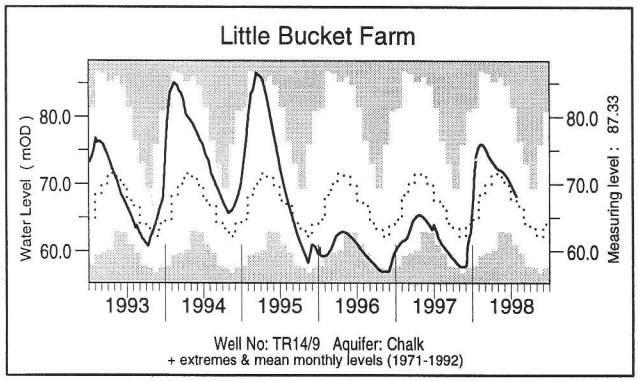


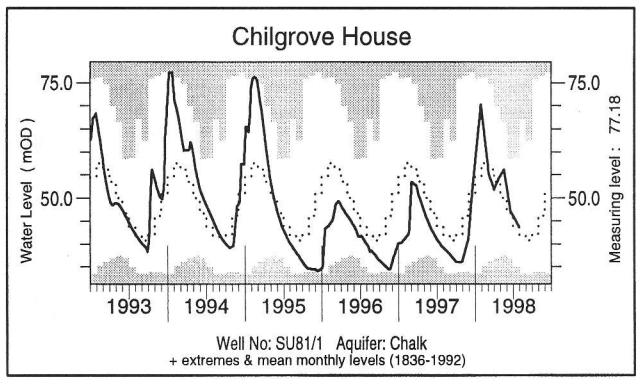


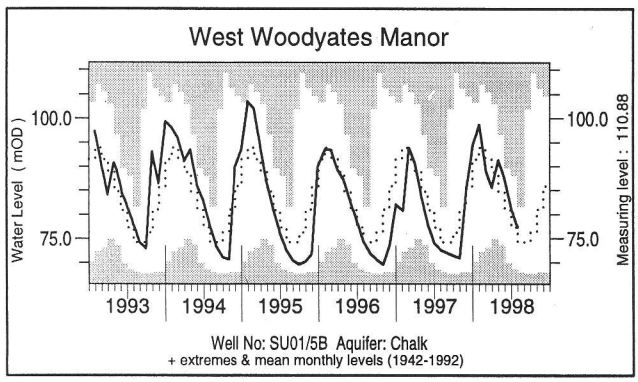








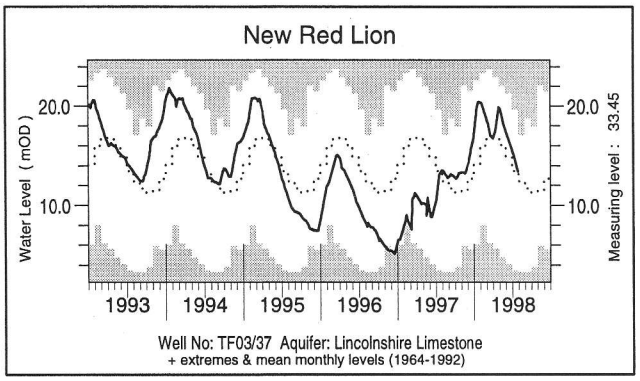


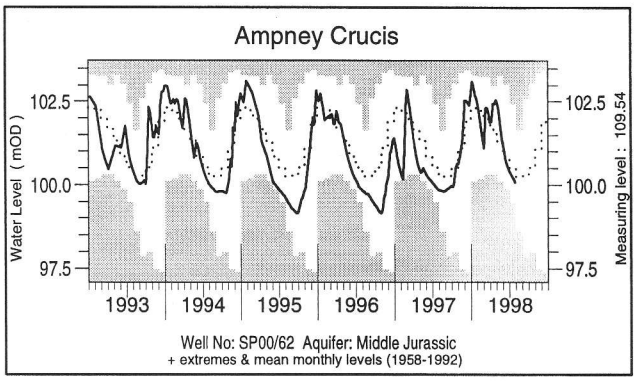


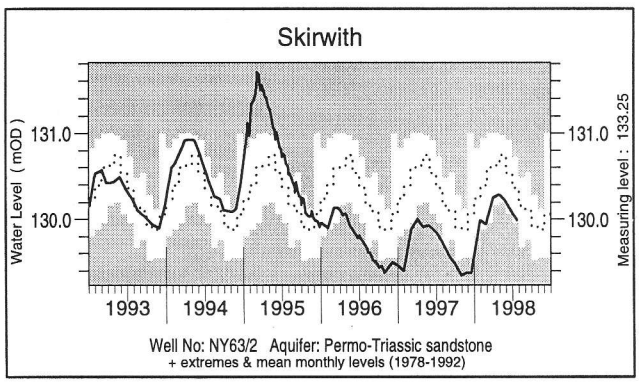
What is groundwater?

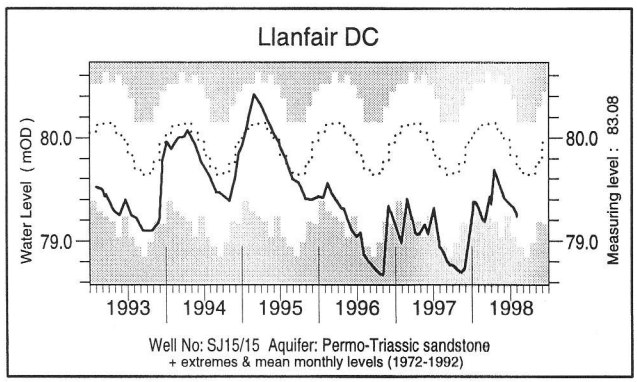
Groundwater is stored in the natural water bearing rock strata (or aquifers) which are found mostly in southern and eastern England (see page 11) where groundwater is the major water supply source. Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment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

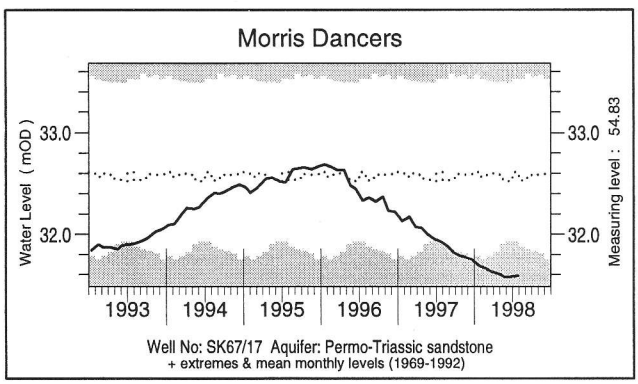
Groundwater . . . Groundwater

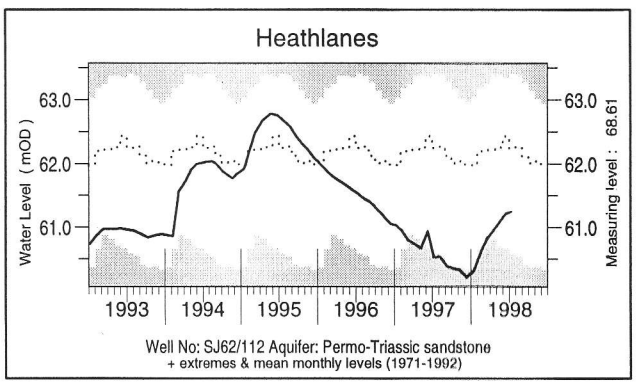


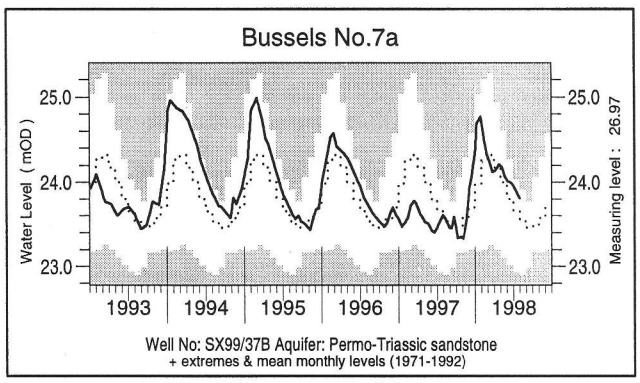


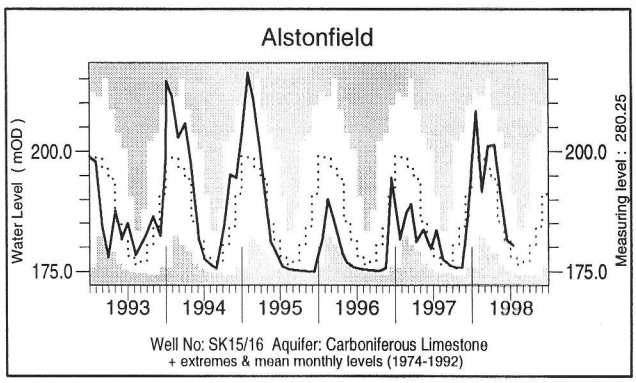












Groundwater levels July/August 1998

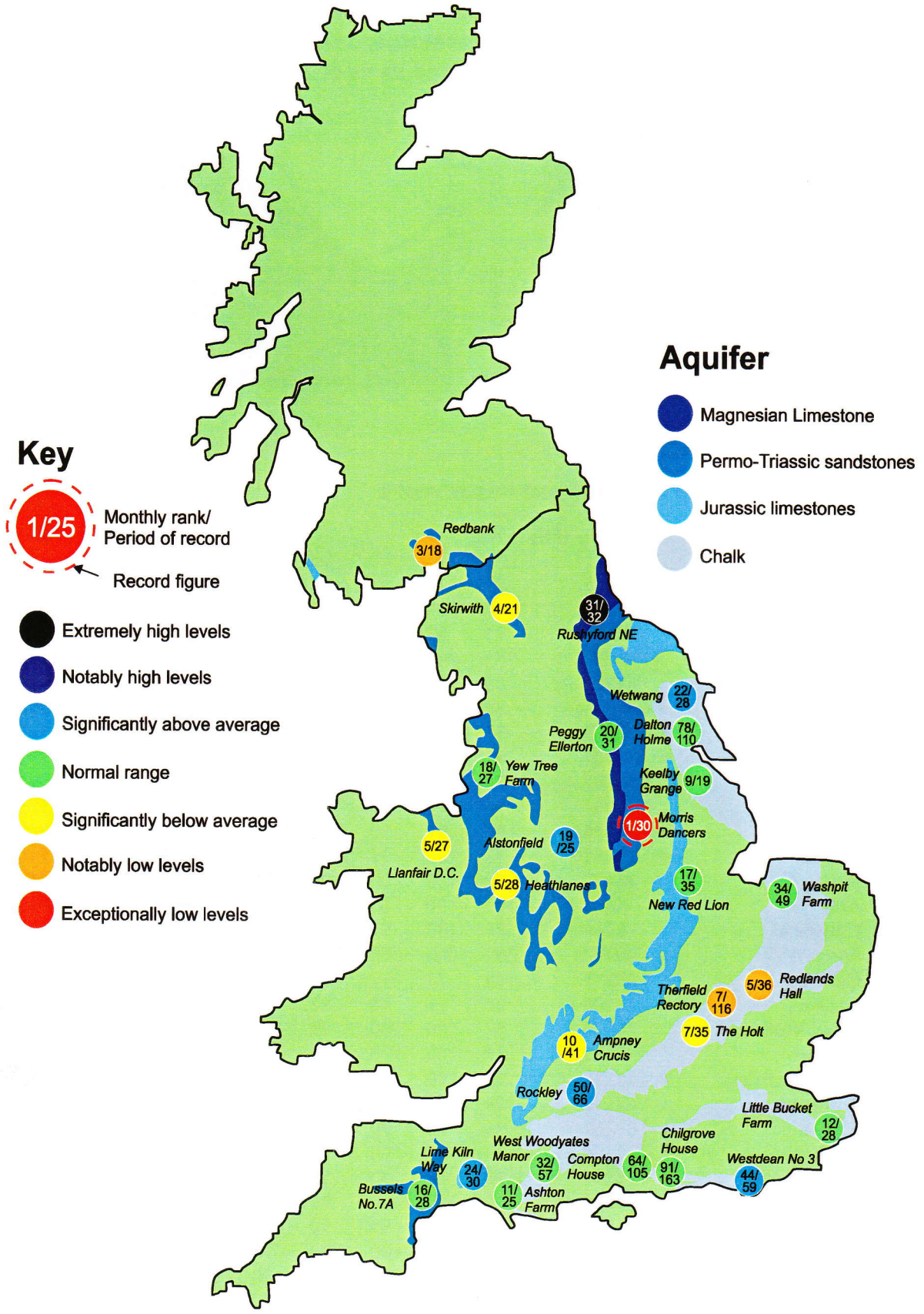
Borehole	Level	Date	Jul av.
Dalton Holme	18.08	24/07	17.17
Washpit Farm	45.47	04/08	44.70
The Holt	85.88	27/07	88.02
Redlands Hall	36.17	30/07	42.41
Ashton Farm	66.35	31/07	66.65
Little Bucket	68.19	27/07	68.19

Borehole	Level	Date	Jul av.
Chilgrove	43.63	30/07	43.68
W Woodyates	77.30	31/07	76.87
New Red Lion	13.37	29/07	13.26
Ampney Crucis	100.08	29/07	100.47
Skirwith	129.99	22/07	130.27

Borehole	Level	Date	Jul av.
Llanfair DC	79.24	01/08	79.67
Morris Dancers	31.59	27/07	32.45
Heathlanes	61.25	11/07	62.12
Bussels	23.81	30/07	23.69
Alstonfield	180.38	15/07	178.81

Levels in metres above Ordnance Datum

Groundwater . . . Groundwater

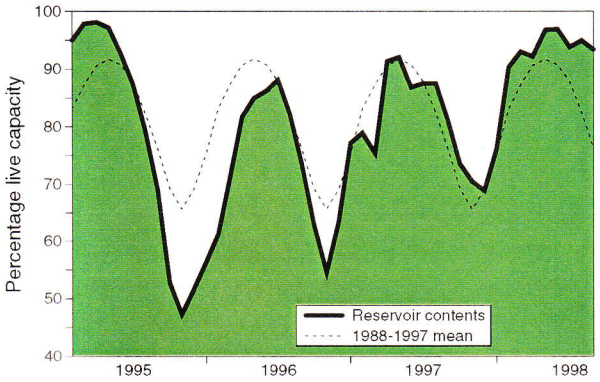


Groundwater levels - July 1998

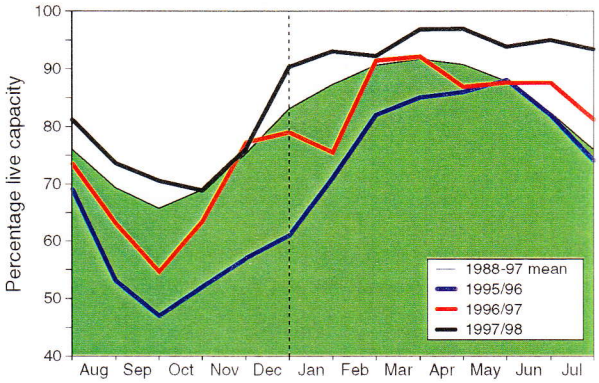
The rankings are based on a comparison of current levels (usually a single reading in a month) with the average level in each corresponding month on record. Caution needs to be exercised when interpreting the ranking, especially during periods of rapid changes in groundwater level. Rankings may be omitted 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 Mar	Apr	May	Jun	Jul	Aug	Min. Aug	Year* of min
North West	N Command Zone	• 133375	92	94	93	87	85	84	38	1989
	Vyrnwy	55146	87	100	97	95	93	90	56	1996
Northumbrian	Teesdale	• 87936	93	99	97	90	90	90	45	1989
	Kielder	(199175)	(91)	(96)	(95)	(92)	(93)	(92)	(66)	1989
Severn Trent	Clywedog	44922	86	96	99	98	98	97	57	1989
	Derwent Valley	• 39525	90	98	99	90	100	93	43	1996
Yorkshire	Washburn	• 22035	95	99	95	91	98	89	50	1995
	Bradford supply	• 41407	96	100	99	93	96	93	38	1995
Anglian	Grafham	58707	75	86	92	99	96	95	66	1997
	Rutland	130061	96	98	98	96	96	93	74	1995
Thames	London	• 206399	97	99	98	99	99	96	73	1990
	Farmoor	• 13843	97	100	97	99	98	96	84	1990
Southern	Bewl	28170	99	100	100	96	92	86	45	1990
	Ardingly	4685	100	100	100	100	100	96	66	1995
Wessex	Clatworthy	5364	86	100	92	88	92	87	43	1992
	Bristol WW	• (38666)	(94)	(98)	(98)	(91)	(92)	(88)	(53)	1990
South West	Colliford	28540	68	73	77	76	77	78	47	1997
	Roadford	34500	84	91	98	97	98	99	46	1996
	Wimbleball	21320	97	100	100	99	100	99	53	1992
	Stithians	5205	96	100	100	98	92	88	39	1990
Welsh	Celyn and Brenig	• 131155	98	100	100	98	100	100	65	1989
	Brianne	62140	94	97	100	94	99	100	67	1995
	Big Five	• 69762	91	98	99	91	98	97	41	1989
	Elan Valley	• 99106	93	99	100	93	98	98	63	1989
East of Scotland	Edinburgh/Mid	• 97639	79	71	62	52	54	51**	62	1989
	East Lothian	• 10206	99	100	100	99	100	100	72	1992
West of Scotland	Loch Katrine	• 111363	95	97	99	90	81	85	68	1997
	Daer	22412	100	100	100	90	95	98	58	1994
	Loch Thom	• 11840	100	100	100	92	90	100	69	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 1988-1998 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 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.

Subscription

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

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

ERRATUM: Hydrological Summary July 1998

The flow for 20 July 1998 for the Cree at Newton Stuart was incorrectly attributed to August in the text It was the second highest July flow on record (after July 1987).

Note:
The Stage Discharge Relationship of the Dee at Park (12002) has changed producing a significant reduction in high flows, as a consequence some rankings associated with the April - July flows will require revision.

National Water Archive

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