Hydrological summary
for Great Britain

November 1997

General

November was a dull, very mild and, in most regions, a wet month. In broad terms the highest percentage rainfalls favoured those areas - southern and eastern England - where the drought is most severe. Overall reservoir stocks, after falling in October, increased briskly in November and now stand a little above average. However stocks in some eastern reservoir are still relatively low - Grafham especially, flows in many spring-fed rivers remain depressed and November groundwater levels were close to seasonal minima over wide areas. Substantial rainfall over the last six weeks has changed the complexion of the drought but above average rainfall is needed through the coming winter to ensure that the reduction in rainfall deficiencies translates into healthy recoveries in groundwater levels.

Rainfall

Weather patterns in November were dominated by low pressure; rain-bearing frontal systems were common and often vigorous in southern Britain, the South-West particularly. On the 26th, a remarkable downpour - 38 mm in 17 minutes - around St Austell (Cornwall) caused very severe local flooding. Generally, however, rainfall was well distributed throughout November. Although parts of the north-east were notably wet, Scotland recorded only a little above the monthly average but for England and Wales it was the third wettest November since 1974, and the wettest month since the drought began in early 1995. Some parts of southern England reported more than twice the monthly average. On average November is the wettest month of the year in the eastern lowlands; with rainfall this year in the 120-150% range, the hydrological benefit was considerable. For the period since May regional rainfall totals in southern Britain are mostly above average and deficiencies are modest in the 12-month timeframe; in rainfall terms, the drought has eased significantly (if erratically). Accumulated deficiencies remain very large for timespans exceeding two years - the E&W rainfall total for the period begining in April 1995 is the lowest for any 32-month accumulation since the 1850s - but only around a third of the deficiency needs to be made up over the winter to greatly improve the resources position.

River Flow

November was a month of contrasts in terms of flow variations through both time and space. Seasonal recoveries gathered momentum in the South-West and, with catchments close to saturation, spates and minor flood alerts were common from mid-month. Heavy rainfall triggered a remarkable transformation in the Dee (Grampian Region) at Park, the lowest November flow for 25 years, on the 2nd, was followed by the second highest November flow on the 18th. Above average runoff characterised most of south-western Britain and the rapid decreases in soil moisture deficits (smds) also sparked recoveries in some impermeable lowland catchments - flows typically increased from around the seasonal minima entering November to above average approaching month-end. By contrast, in slow responding eastern Chalk catchments - where smds remained significant throughout November - recoveries have, as yet, been modest. November runoff totals were the lowest on record for the Little Ouse and second lowest for the Mimram and the Lambourn (Berkshire); late November flows were still close to drought minima over substantial parts of the English lowlands. Such catchments aside, a wet December would see the focus of hydrological concern switch to the risk of flooding, in the west particularly.

Groundwater

Significant infiltration characterised most regions in November but rainfall was insufficient to overcome smds in most of East Anglia, much of the Lee basin and in some north-eastern areas. Strong recoveries are underway in some fissured limestone aquifers; early winter levels are well within the normal range in the Jurassic and Lincolnshire Limestones. This is true of the northern and western extremities of the Chalk and modest upturns have occured in parts of the south and east (eg in Sussex and Kent). However, levels for the Redlands and Holt boreholes in the Chalk are the lowest on record, for November, and Therfield is still dry (as is the old Rockley Well). Levels are also exceptionally low in some minor aquifers in East Anglia (eg the Suffolk Crag and Essex Gravels). Recoveries are underway in the Permo-Triassic sandstones of the South-West but generally levels are still very depressed in the Midlands and the north where most index boreholes registered November levels close to the seasonal minimum. The groundwater outlook has improved substantially over last six weeks but a wet winter is still needed to generate a strong and sustained recovery from an exceptionally low base. Groundwater prospects for the summer of 1998 depend on both the magnitude of the winter recharge and the length of the 1997/98 recharge season.

Institute of Hydrology

British Geological Survey

Rainfall . . . Rainfall . . . Rainfall. .

Rainfall accumulations and return period estimates

Area	Rainfall	Nov 1997	Sep 97-Nov 97	RP	Jun 97-Nov 97	RP	Dec 96-Nov 97	RP	Apr 95-Nov 97	RP
England & Wales	**mm**	**130**	**232**		**498**		**818**		**2006**	
	%	**145**	**92**	**2-5**	**110**	**2-5**	**91**	**2-5**	**85**	**30-45**
NorthWest	mm	118	272		515		1027		2450	
	%	96	74	5-10	81	5-10	85	5-10	77	>200
Northumbrian	mm	83	152		424		792		1953	
	%	96	65	10-15	96	2-5	93	2-5	86	15-25
SevernTrent	mm	89	176		434		715		1687	
	%	125	88	2-5	115	2-5	95	2-5	84	20-35
Yorkshire	mm	91	165		433		767		1758	
	%	113	74	5-10	104	2-5	93	2-5	81	60-90
Anglian	mm	64	130		363		542		1302	
	%	110	82	2-5	116	2-5	91	2-5	81	40-60
Thames	mm	81	158		377		571		1499	
	%	124	85	2-5	108	2-5	83	5-10	82	30-50
Southern	mm	135	233		469		688		1730	
	%	158	99	<2	19	5-10	88	2-5	84	15-25
Wessex	mm	126	215		497		779		2108	
	%	151	92	2-5	121	5-10	93	2-5	96	2-5
SouthWest	mm	198	347		685		1083		2847	
	%	159	104	2-5	123	5-10	92	2-5	94	2-5
Welsh	mm	182	348		674		1150		2950	
	%	128	88	2-5	104	2-5	88	5-10	86	15-25
Scotland	**mm**	**145**	**335**		**594**		**1340**		**3431**	
	%	**96**	**75**	**5-15**	**80**	**10-15**	**93**	**2-5**	**91**	**10-15**
Highland	mm	136	367		650		1624		4014	
	%	67	64	15-25	72	20-35	92	2-5	87	25-40
North East	mm	168	251		525		1013		2672	
	%	170	89	2-5	103	2-5	104	2-5	103	2-5
Tay	mm	188	327		561		1174		3066	
	%	155	90	2-5	92	2-5	96	2-5	95	2-5
Forth	mm	92	241		473		1042		2645	
	%	82	72	5-10	82	5-10	94	2-5	90	5-15
Tweed	mm	96	202		465		978		2386	
	%	103	73	5-10	92	2-5	101	2-5	93	5-10
Solway	mm	142	356		611		1267		3329	
	%	99	80	2-5	83	5-10	89	2-5	89	10-15
Clyde	mm	149	414		646		1462		3876	
	%	83	75	5-10	73	5-25	86	5-10	87	20-35

%= % of 1961-90

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

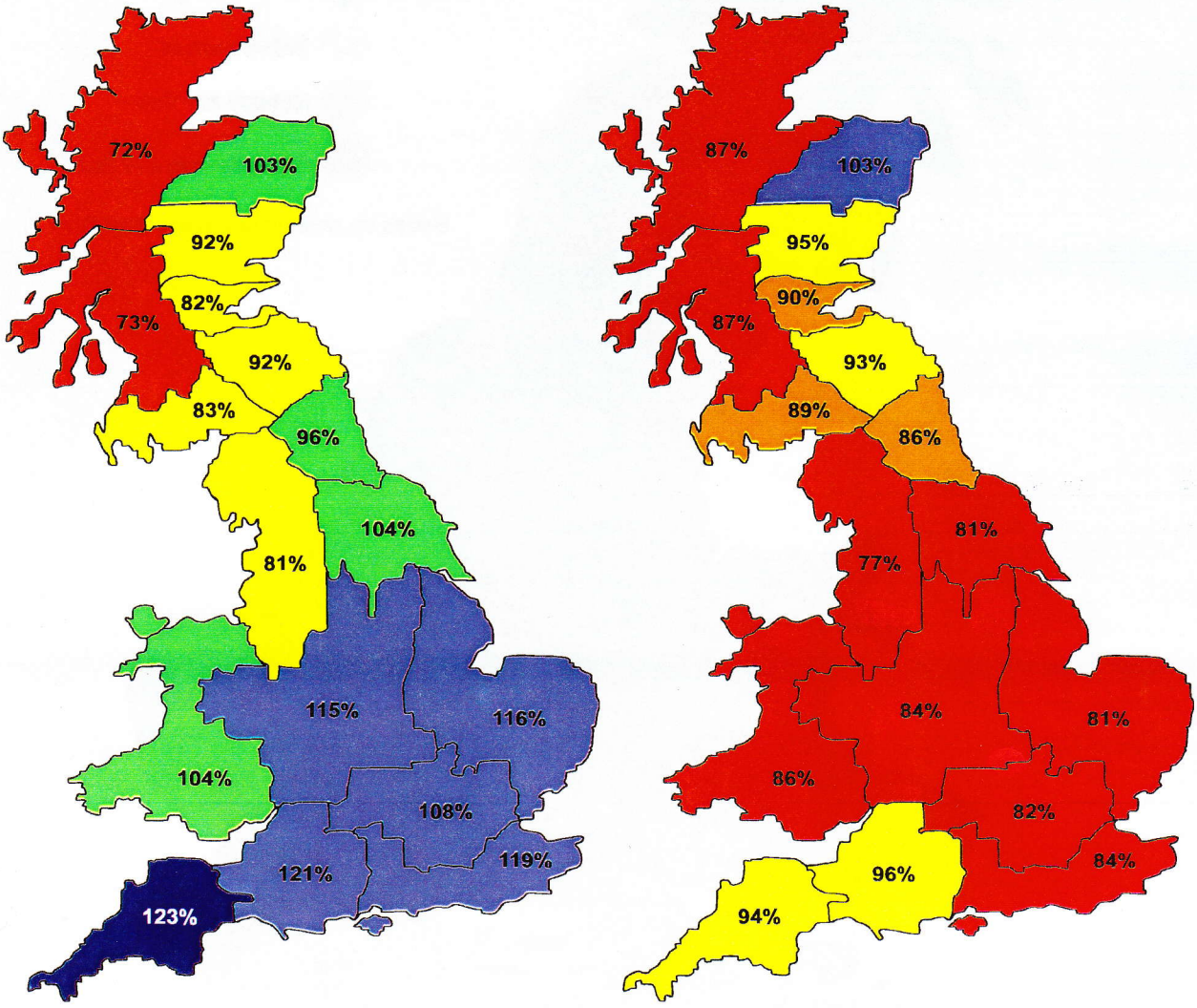
Above average

Normal range

Below average

Substantially below average

Exceptionally low rainfall



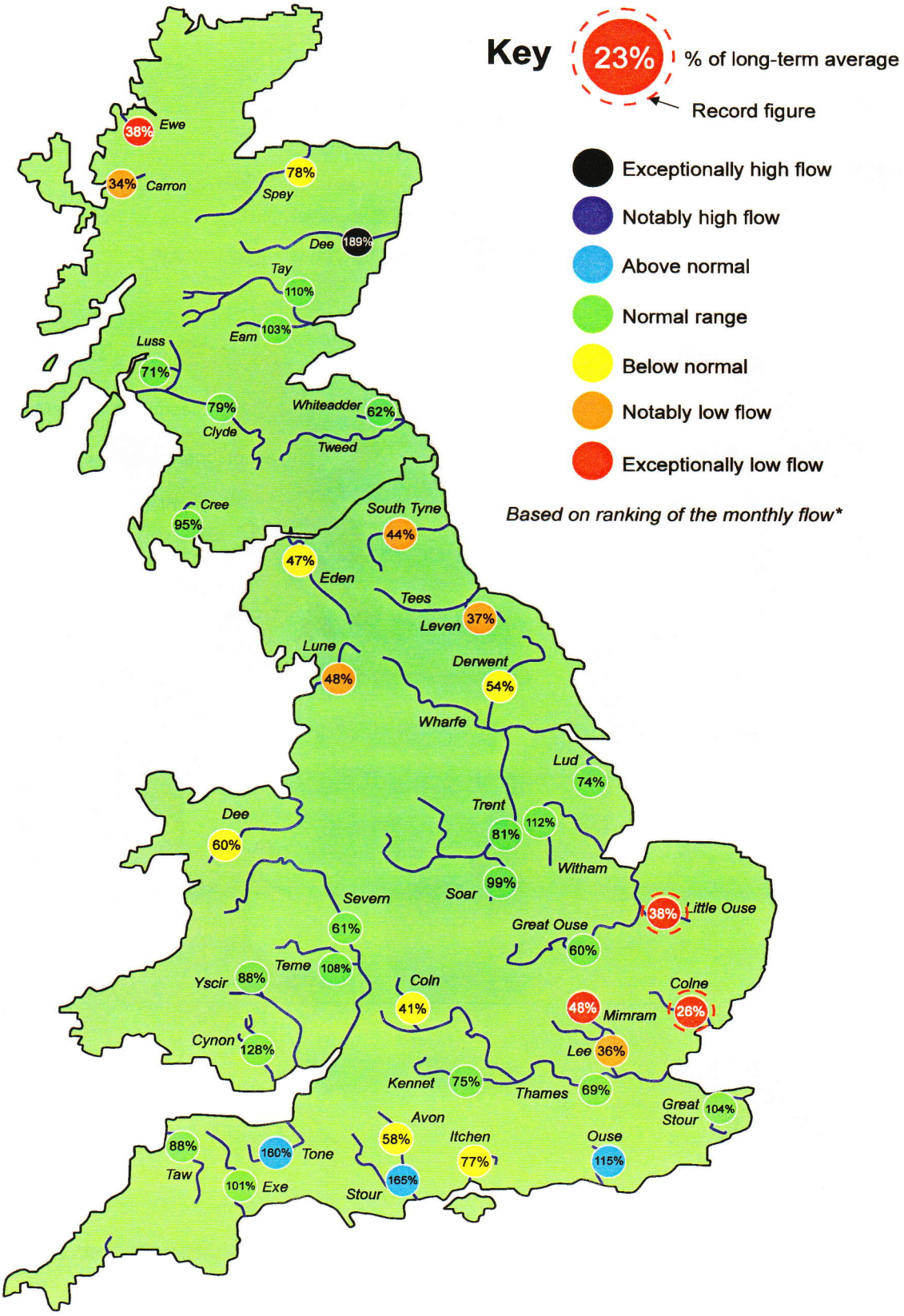
June 1997 - November 1997

April 1995 - November 1997

Rainfall accumulation maps

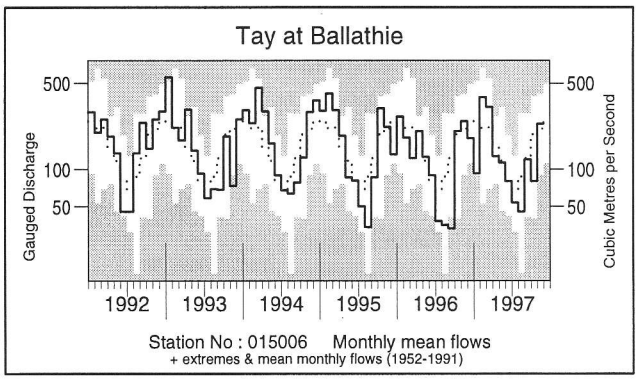
Although the autumn (Sept-Nov) was relatively dry, especially in northen and western Scotland, rainfall over the June-November period has reduced long term deficiencies in most of the drought affected regions.

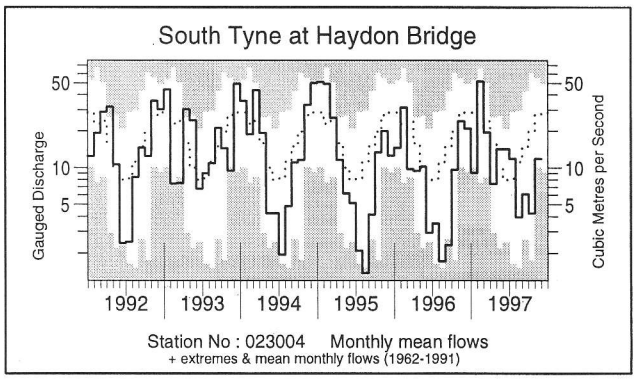
River flow . . . River flow . . .

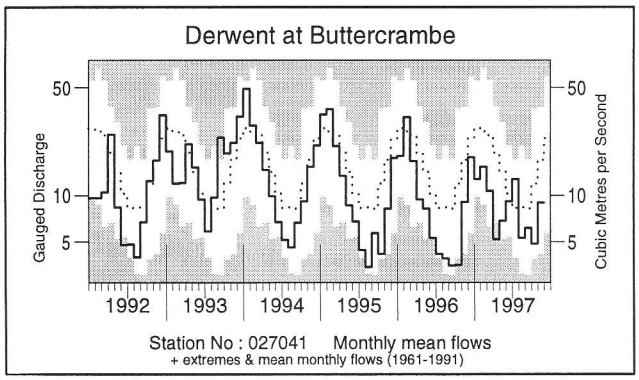


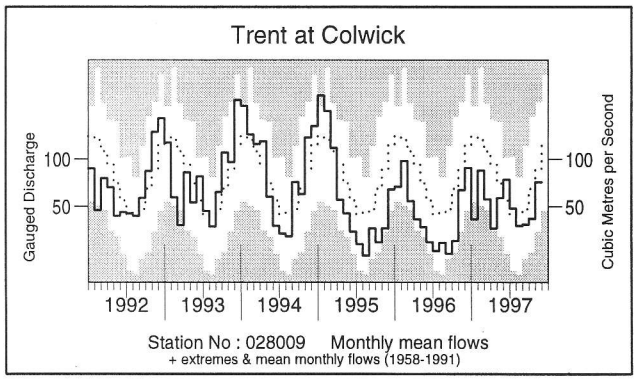
River flows - November 1997

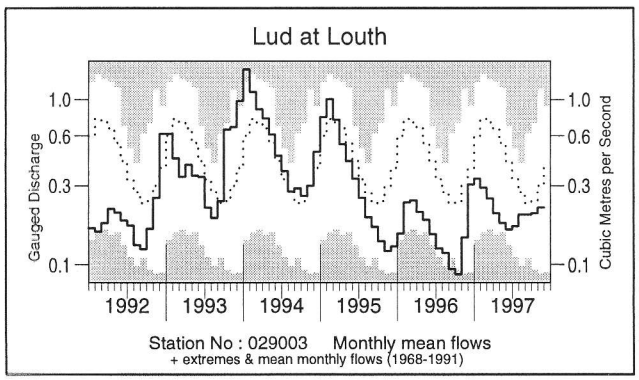
Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

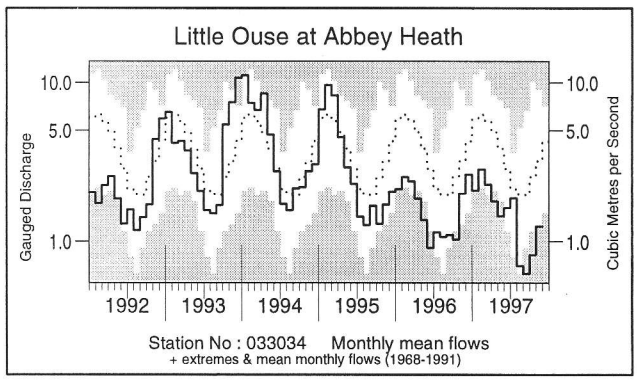


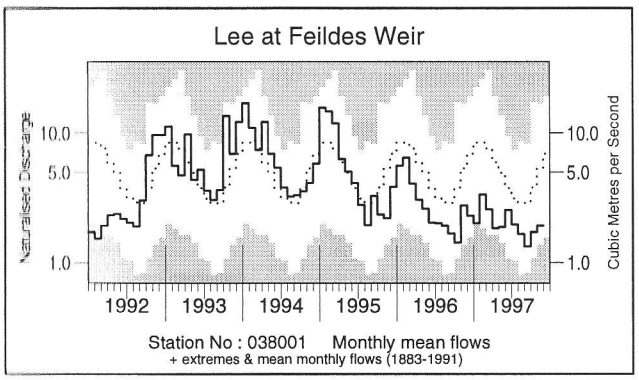


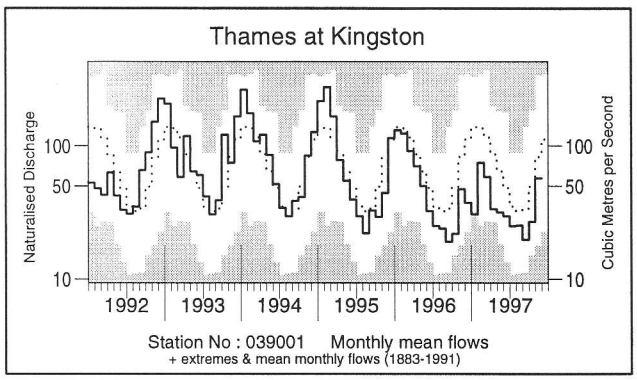








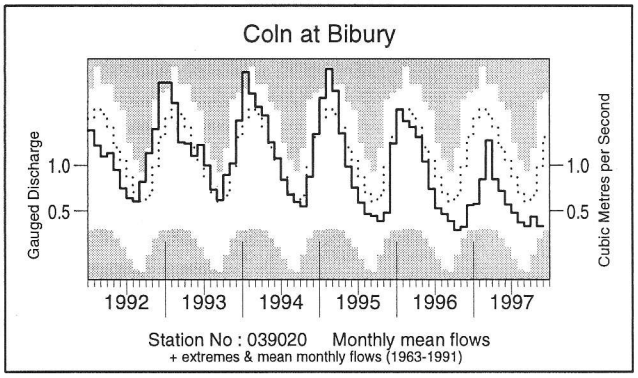


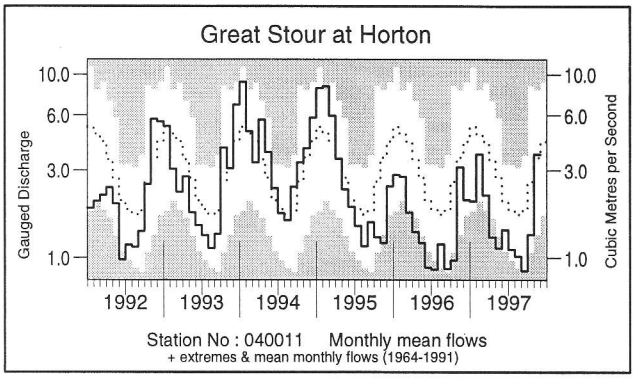


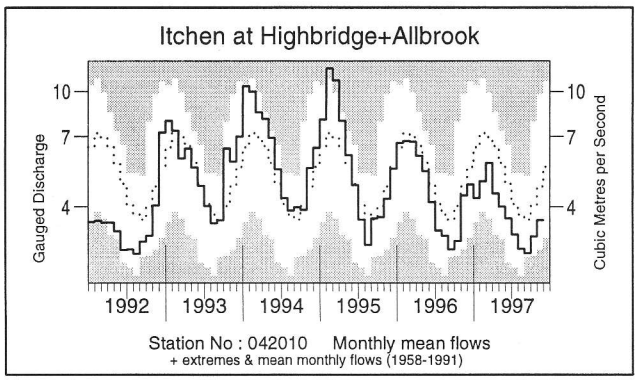
Monthly river flow hydrographs

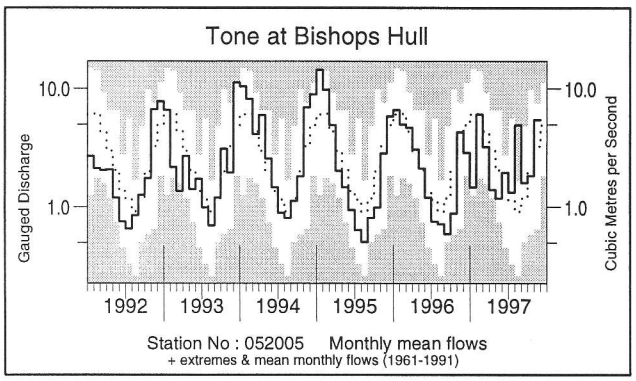
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 1992 (shown by the shaded areas). Monthly flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded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

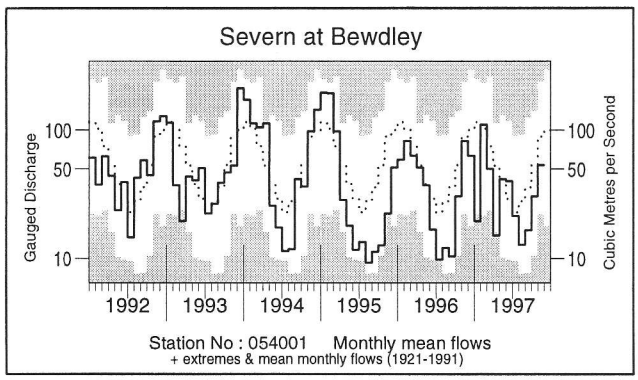
River flow . . . River flow . . .

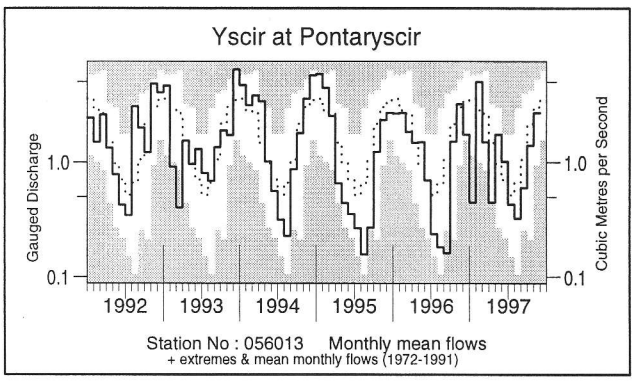


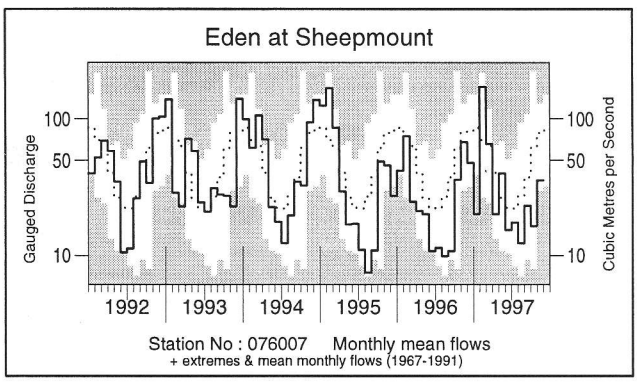


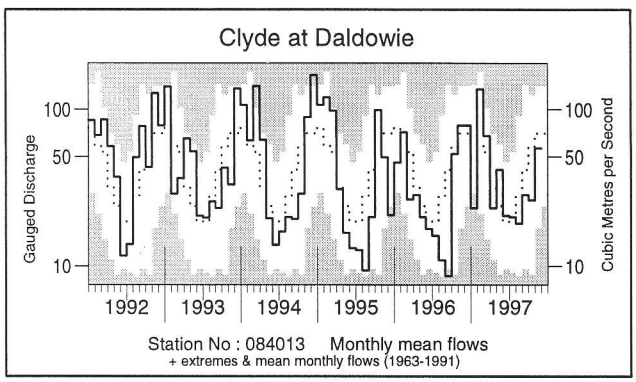










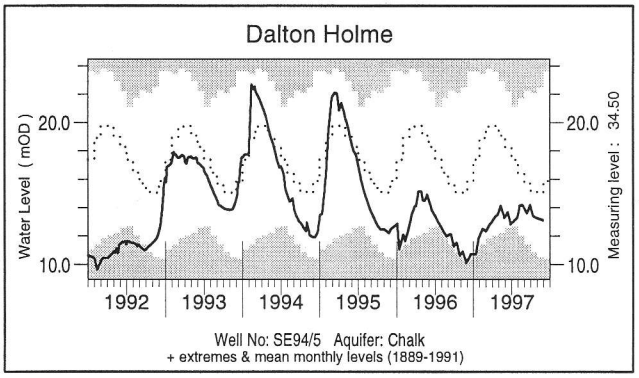


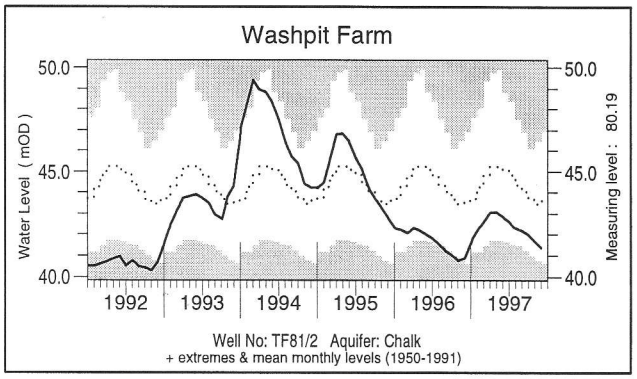
Notable runoff accumulations September - November 1997 (a); May 1995 - November 1997 (b)

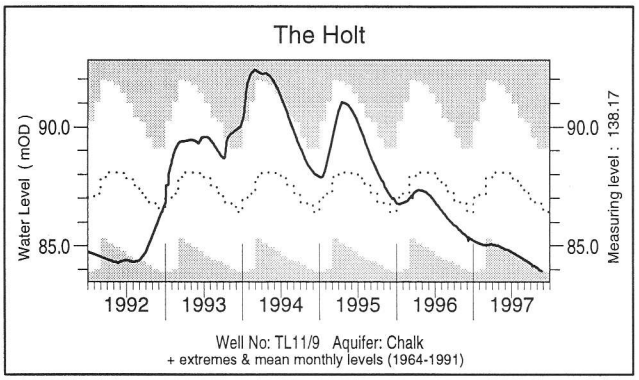
(a) River	%lta	Rank	(b) River	%lta	Rank	River	%lta	Rank
S.Tyne	37	1/34	Wharfe	58	1/40	Medway	53	1/29
L.Ouse	36	1/30	Trent	61	1/37	Taw	70	1/37
Colne	28	1/38	Dove	57	1/34	Brue	72	1/31
Mimram	49	2/45	Soar	53	1/24	Severn	60	1/75
Kennet	62	2/36	L.Ouse	50	1/28	Dee (Welsh)	68	1/58
Spey	57	2/45	Colne	47	1/34	Lune	63	1/33

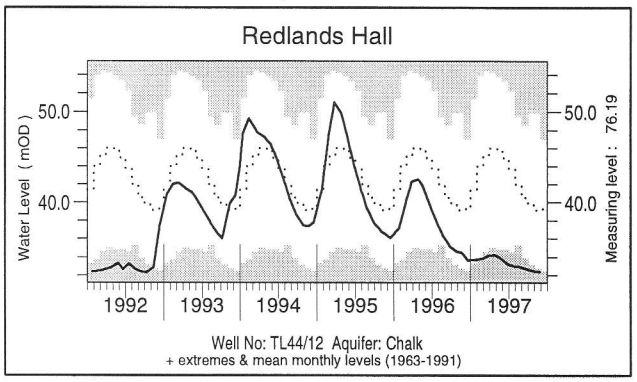
lta = long term average
Rank 1 = lowest on record

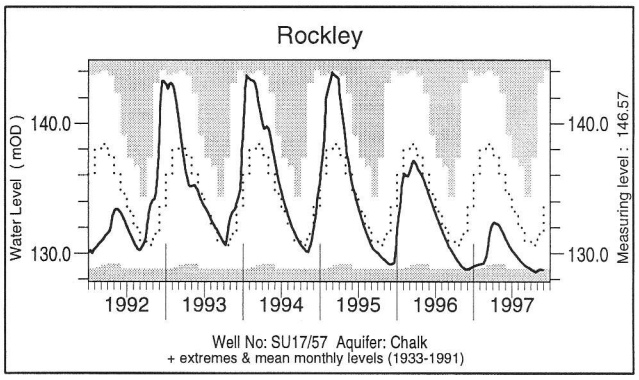
Groundwater . . . Groundwater

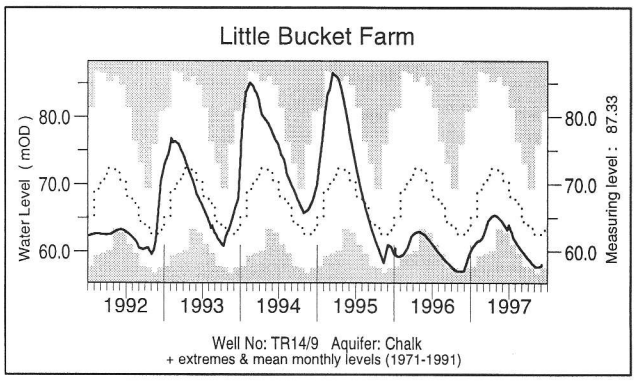


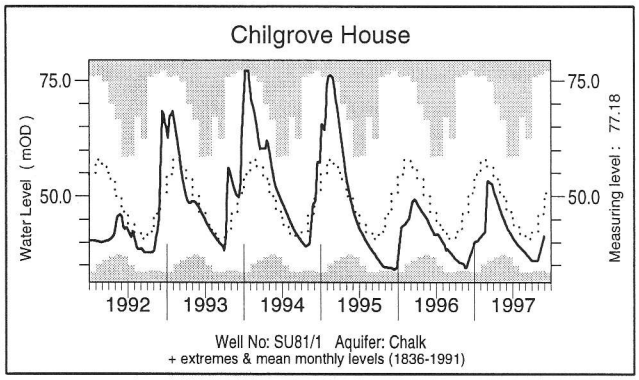


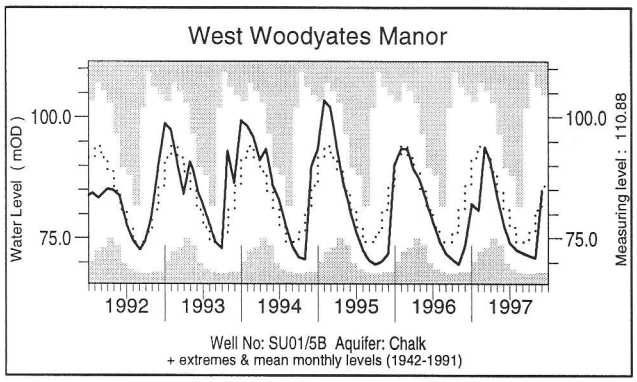








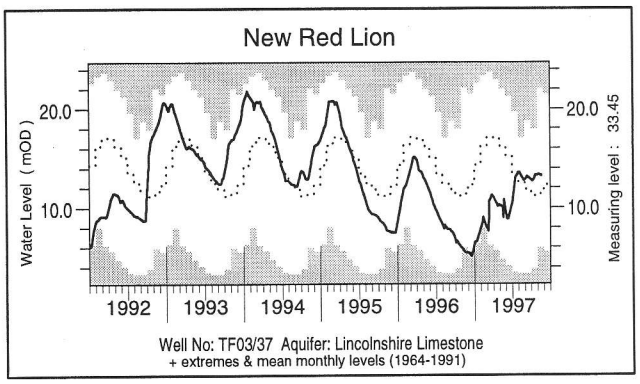


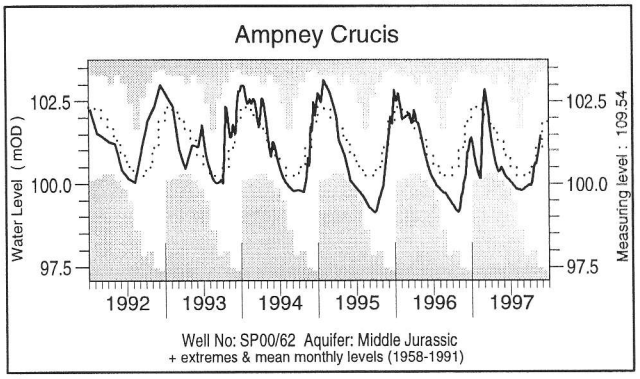


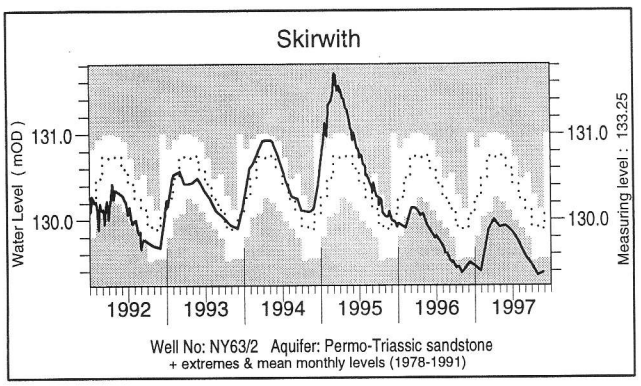
What is groundwater?

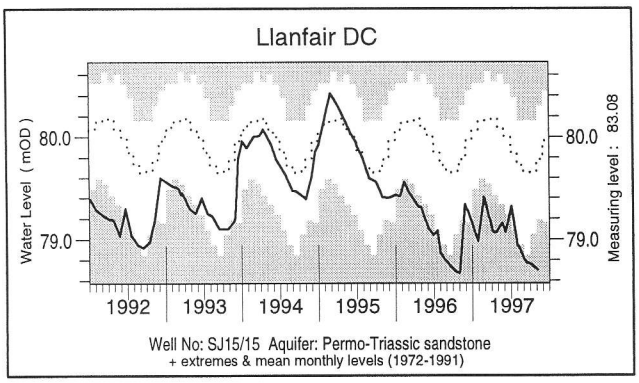
Groundwater is stored in the natural water bearing rock strata (or aquifers) which are found mostly in southern and eastern England (see page 11) where groundwater is the major water supply source. Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment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

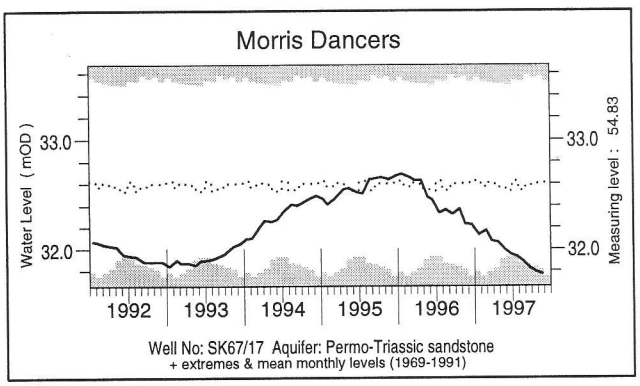
Groundwater . . . Groundwater

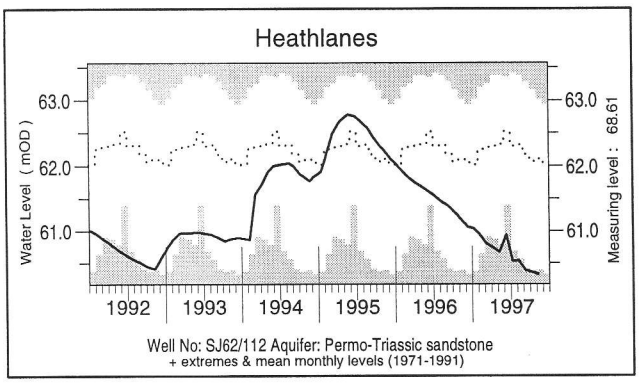


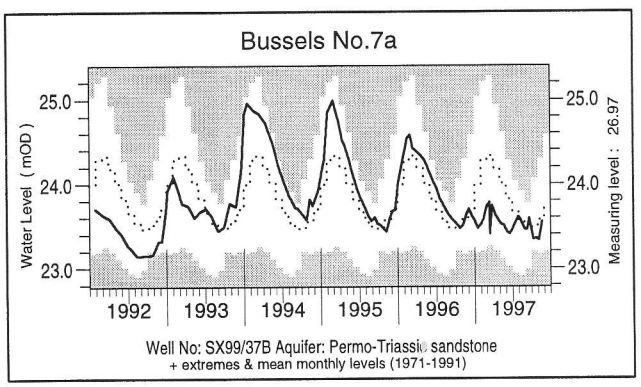


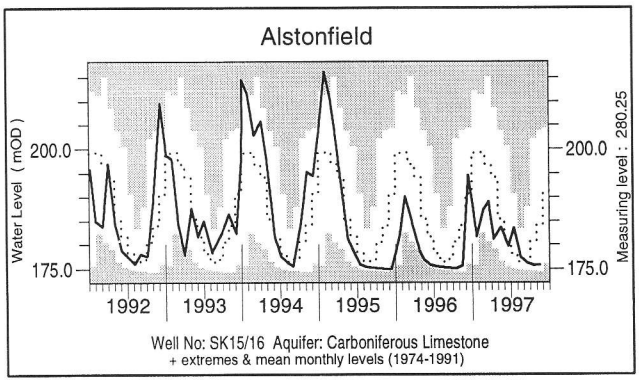












Groundwater levels November/December 1997

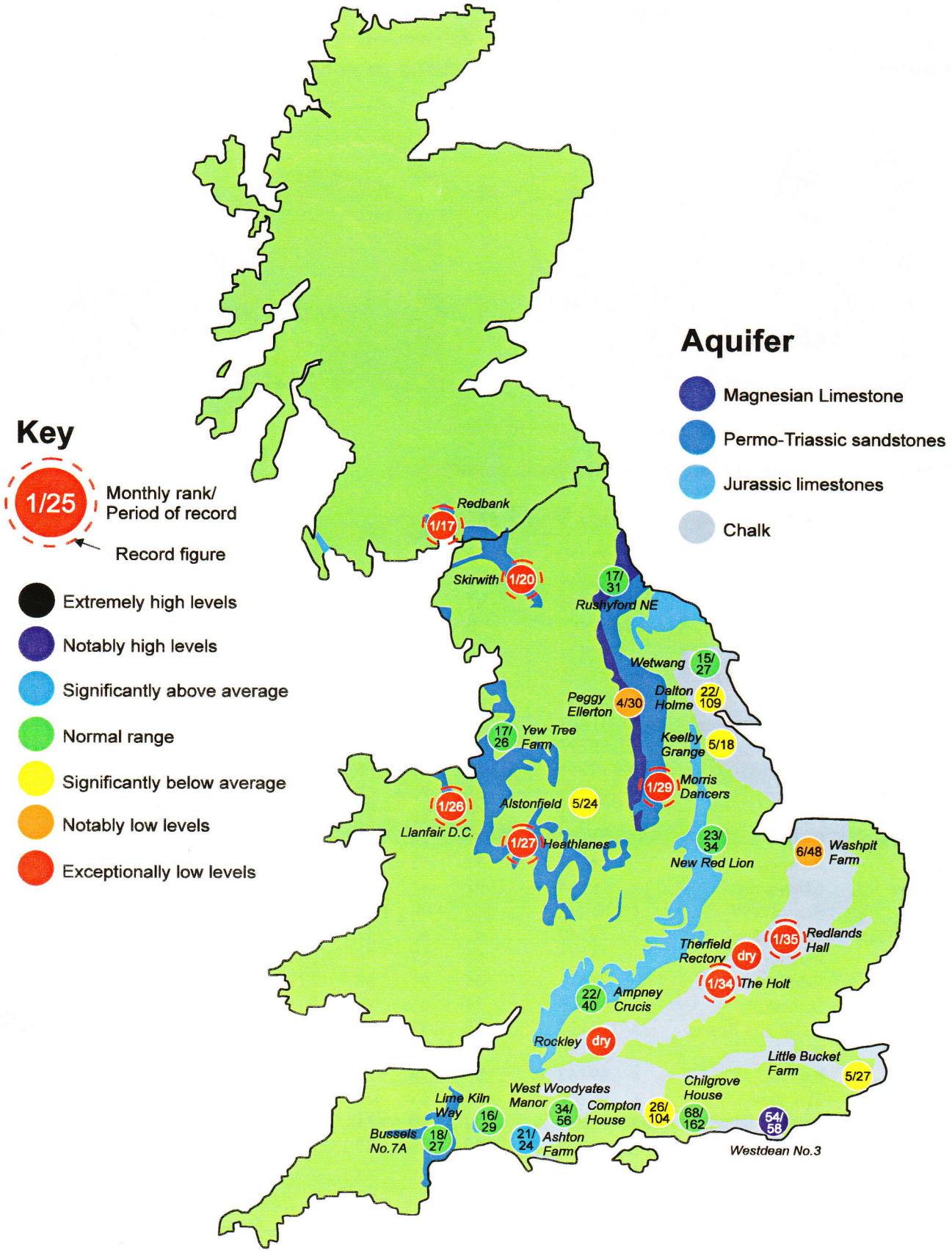
Borehole	Level	Date	Nov av.
Dalton Holme	13.10	27/11	14.79
Washpit Farm	41.36	01/12	43.17
The Holt	83.92	24/11	86.87
Redlands Hall	32.37	25/11	38.22
Ashton Farm	69.98	30/11	66.20
Little Bucket	58.05	04/12	62.32

Borehole	Level	Date	Nov av.
Chilgrove	41.37	28/11	41.37
W Woodyates	84.82	30/11	84.82
New Red Lion	13.23	18/11	11.66
Ampney Crucis	101.1	21/11	101.5
Skirwith	129.4	24/11	130.1

Borehole	Level	Date	Nov av.
Llanfair DC	78.70	03/11	79.55
Morris Dancers	31.77	21/11	32.48
Heathlanes	60.33	07/11	61.84
Bussels	23.55	20/11	23.57
Alstonfield	175.8	14/11	184.1

Levels in metres above Ordnance Datum

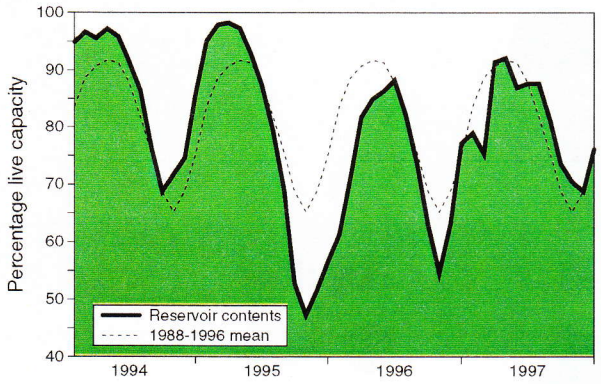
Groundwater . . . Groundwater



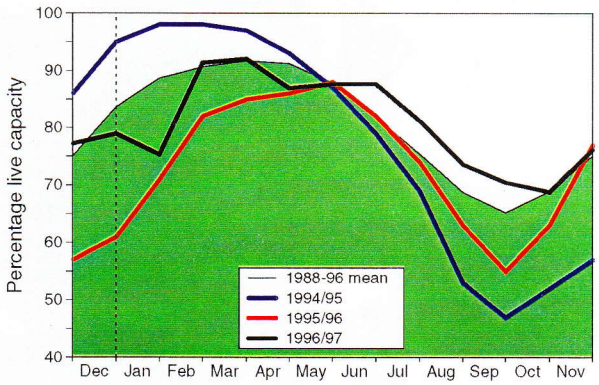
Groundwater levels - November 1997

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)	1997 Jul	Aug	Sep	Oct	Nov	**Dec**	Min. Dec	Year* of min
NorthWest	N Command Zone	• 133375	78	66	53	60	53	64	44	1993
	Vyrnwy	55146	90	75	65	61	59	67	33	1995
Northumbrian	Teesdale	• 87936	87	84	74	73	65	73	39	1995
	Kielder	(199175)	(94)	(94)	(85)	(82)	(82)	(75)	(65)	1989
SevernTrent	Clywedog	44922	98	91	80	82	81	86	43	1995
	DerwentValley	• 39525	100	90	80	72	73	79	9	1995
Yorkshire	Washburn	• 22035	99	87	77	72	60	73	16	1995
	Bradford supply	• 41407	96	87	76	76	72	85	20	1995
Anglian	Grafham	58707	70	66	59	46	44	47	47	**1997**
	Rutland	130061	75	78	76	72	71	75	57	1995
Thames	London	• 206399	88	77	67	53	51	68	52	1990
	Farmoor	• 13843	100	98	99	96	97	92	52	1990
Southern	Bewl	28170	79	74	65	58	56	76	34	1990
	Ardingly	4685	92	93	86	68	68	100	44	1989
Wessex	Clatworthy	5364	97	91	91	85	85	100	37	1989
	BristolWW	• (38666)	(85)	(74)	(72)	(67)	(62)	(71)	(27)	1990
SouthWest	Colliford	28540	51	47	43	43	44	53	42	1995
	Roadford	34500	58	57	56	56	56	65	8	1989
	Wimbleball	21320	84	81	84	79	80	91	34	1995
	Stithians	5205	76	66	70	70	68	84	29	1990
Welsh	Celyn and Brenig	• 131155	98	93	83	83	82	86	50	1995
	Brianne	62140	99	93	92	94	97	100	72	1995
	Big Five	• 69762	88	74	71	68	69	87	49	1990
	Elan Valley	• 99106	99	89	84	87	92	100	47	1995
East of	Edinburgh/Mid Lothian	• 97639	92	90	71	66	62	67	67	**1997**
Scotland	East Lothian	• 10206	100	94	80	71	62	63	43	1989
West of	Loch Katrine	•								

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.

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

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