Hydrological summary

for the United Kingdom

General

February was another exceptionally mild month but, in contrast to January, most regions reported well above average rainfall with river flows and recharge rates generally picking up smartly towards month end. Overall reservoir stocks for England and Wales are very healthy with most reservoirs at, or close to, capacity; in Northern Ireland current stocks are, however, significantly below the early spring average in the Silent Valley group. Generalising broadly, February river flows were well above average in most western catchments but significantly below in low-lying eastern catchments. Following above average winter rainfall, groundwater levels are well within the normal range in most aquifers. The resources outlook is very healthy with the exception of some eastern areas where, as usual, the balance of rainfall and evaporation over the late spring will be particularly influential.

Rainfall

February was a hitherto rare combination of warm, sunny and wet weather. Most of the rainfall fell early or, more notably, late in month (the 24th was especially wet) but, a few catchments excepted, dry interludes extending over more than two days were rare. A sequence of frontal systems, mostly on a westerly airflow, produced exceptional precipitation totals in the Scottish Highlands; some localities registered > 300% of the 1961-90 average and the provisional February total for Scotland is the seventh highest on record. Much of Snowdonia and the Lake District were also very wet (a few raingauges recording > 200%). Rainfall was much less abundant in the eastern lowlands; some coastal districts in north-east Britain reporting less than 80%, but Yorkshire was the only region to fall below the February average. Despite the relatively dry January in many areas, winter (December-February) rainfall exceeded the average by a wide margin in the west and north. The provisional winter rainfall total for Scotland ranks second wettest (after 1994/95) in a series from 1869; seven of the nine wettest now cluster in the last 12 years. Northern Ireland had its seventh wettest winter this century whilst rainfall over England and Wales was much less outstanding – some, mostly eastern, lowland districts falling just short of the long term mean. Regional rainfall totals for the last 12 months exceed the average throughout the UK, albeit very modestly in the South-East.

River flows

In most rivers sustained January recessions were arrested early in February and spate conditions were common throughout the month especially in western and northern rivers. Most frontal systems crossed the UK rapidly – storms were very frequent but tended to be relatively short-lived, thereby helping moderate the risk of flooding. In the lowlands runoff rates picked up briskly in the fourth week and minor flood alerts were common around month-end; near-bankfull flows continued into early March. February runoff totals generally reflected the rainfall patterns. Monthly mean flows were exceptionally high in western Scotland (where the Clyde eclipsed its previous February runoff maximum) but considerably below average in some rivers draining the eastern lowlands e.g. the Leven and Dover Beck (lower Trent basin) which both registered around half the monthly mean. In broad terms, this pattern is repeated for the winter (December-February) as a whole. New winter maximum runoff totals were established for some rivers draining the Scottish Highlands (e.g. the Tay and Spey) but below average flows characterised most eastern catchments; winter runoff was still well above drought minima. This runoff pattern has been a recurring feature of the recent past.

Groundwater

Evaporation rates were almost twice the February average (although still modest in absolute terms) and the rainfall pattern was unfavourable in groundwater terms - the lowest totals tending to coincide with major outcrop areas. In the east modest soil moisture deficits began to build in mid-month but most were rapidly eliminated over the final week and infiltration exceeded the average in most areas. As is common in the early spring, groundwater levels are falling in the more responsive aquifers (following high December peaks) but still rising in the slower responding units. Despite episodic recharge through the winter groundwater levels throughout the Chalk are very close to the average – but appreciably below the seasonal mean in parts of the eastern outcrop. Near-average levels typify most limestone outcrops also, although levels remain very high in the Magnesian Limestone (Peggy Ellerton). The geographical spread of the outcrops and the large variations in responsiveness to recharge, make for a much less coherent picture in the Permo-Triassic sandstones. Generally, levels are above average in the more westerly outcrops, have recovered strongly over the winter in the Midlands but are still depressed in parts of the east. In the latter areas, recharge over the next 8-10 weeks will be of particular importance.

February 2000

Institute of Hydrology

British Geological Survey

Rainfall . . . Rainfall . . . Rainfall.

Rainfall accumulations and return period estimates

Area	Rainfall	Feb 2000	Dec 99-Feb 00	RP	Sep 99-Feb 00	RP	Jun 99-Feb 00	RP	Mar 99-Feb 00	RP
England & Wales	**mm**	**91**	**285**		**547**		**752**		**949**	
	%	**145**	**116**	**2-5**	**110**	**2-5**	**107**	**2-5**	**106**	**2-5**
North West	mm	123	446		790		1014		1277	
	%	158	138	10-15	115	2-5	105	2-5	106	2-5
Northumbrian	mm	68	269		484		678		919	
	%	116	120	2-5	105	2-5	102	2-5	108	2-5
Severn Trent	mm	76	219		458		645		845	
	%	140	109	2-5	114	2-5	111	2-5	112	2-5
Yorkshire	mm	52	215		422		605		846	
	%	90	98	2-5	96	2-5	95	2-5	103	2-5
Anglian	mm	54	140		317		506		645	
	%	145	98	2-5	106	2-5	111	2-5	108	2-5
Thames	mm	74	195		398		591		735	
	%	164	109	2-5	109	2-5	112	2-5	107	2-5
Southern	mm	76	238		469		645		784	
	%	140	110	2-5	104	2-5	106	2-5	101	2-5
Wessex	mm	95	283		531		728		916	
	%	146	115	2-5	111	2-5	111	2-5	109	2-5
South West	mm	136	431		702		929		1182	
	%	135	114	2-5	99	2-5	99	2-5	101	2-5
Welsh	mm	168	498		927		1182		1469	
	%	173	127	5-10	118	5-10	113	2-5	112	5-10
Scotland	**mm**	**188**	**647**		**1113**		**1373**		**1714**	
	%	**184**	**160**	**>200**	**130**	**35-50**	**119**	**10-20**	**119**	**20-35**
Highland	mm	266	883		1477		1780		2194	
	%	209	172	>200	136	60-90	126	30-45	125	35-50
North East	mm	77	341		668		850		1058	
	%	118	133	10-15	124	10-15	111	2-5	109	2-5
Tay	mm	146	558		976		1169		1473	
	%	154	152	30-45	134	20-35	120	5-15	120	10-20
Forth	mm	145	483		812		1033		1283	
	%	184	157	50-80	126	10-20	117	5-10	116	5-15
Tweed	mm	93	343		602		797		1027	
	%	139	132	5-10	112	2-5	104	2-5	106	2-5
Solway	mm	174	597		1001		1280		1637	
	%	172	147	25-40	118	5-10	112	2-5	115	5-10
Clyde	mm	236	810		1340		1645		2017	
	%	200	167	>200	129	20-30	120	10-15	119	10-20
Northern Ireland	**mm**	**108**	**389**		**736**		**942**		**1164**	
	%	**138**	**133**	**5-10**	**121**	**5-10**	**113**	**2-5**	**110**	**2-5**

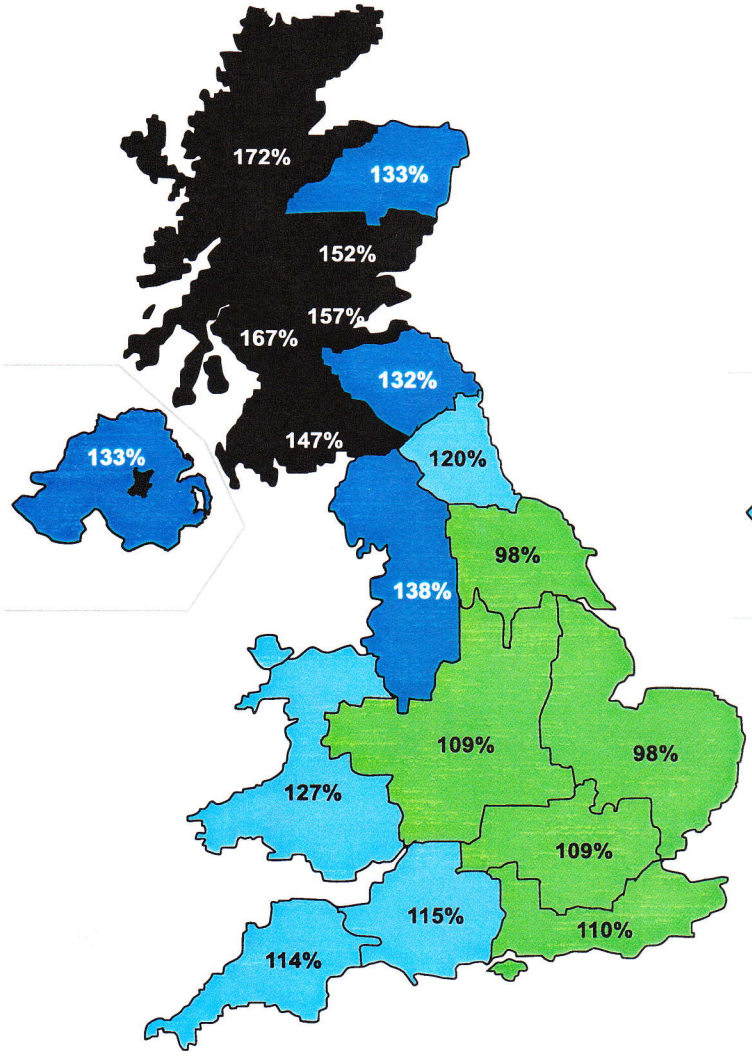
RP = Return period

 All monthly totals since July 1998 are provisional (see page 12). Recent monthly rainfall figures for the Scottish regions have been 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); RP estimates for Northern Ireland are based on the tables for north-west England. The tables reflect rainfall over the period 1911-70 and assume a stable climate. Artifacts in the England & Wales and Scotland rainfall series can exaggerate the relative wetness of the recent past. *See page 12.

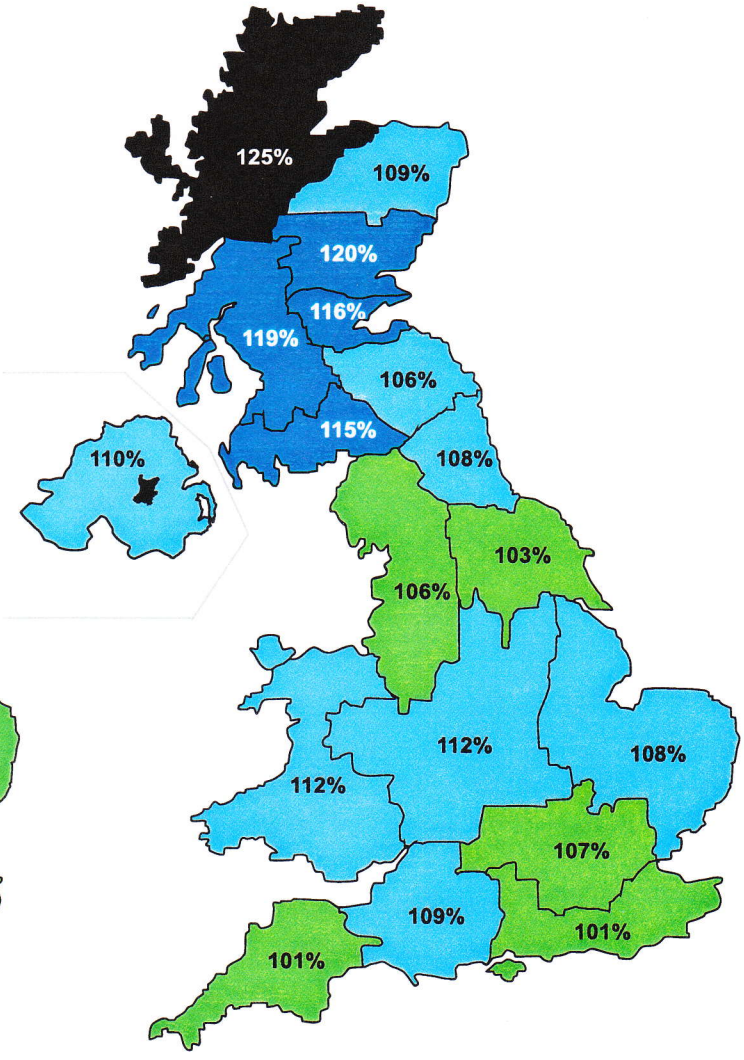
Rainfall . . . Rainfall . . . Rainfall

Key

00%	Percentage of 1961-90 average		Normal range
	Very wet		Below average
	Substantially above average		Substantially below average
	Above average		Exceptionally low rainfall



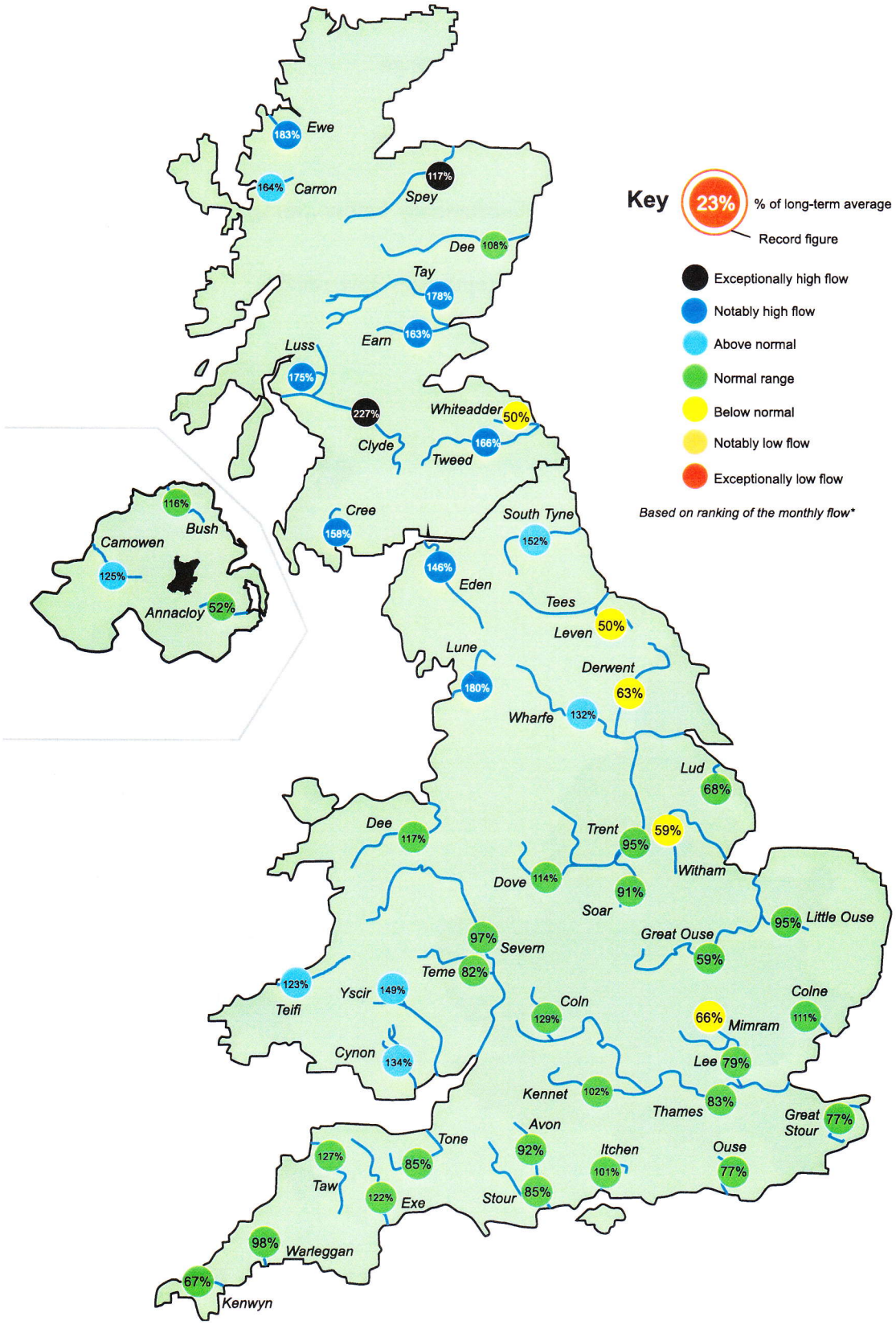
December 1999 - February 2000



March 1999 - February 2000

Rainfall accumulation maps

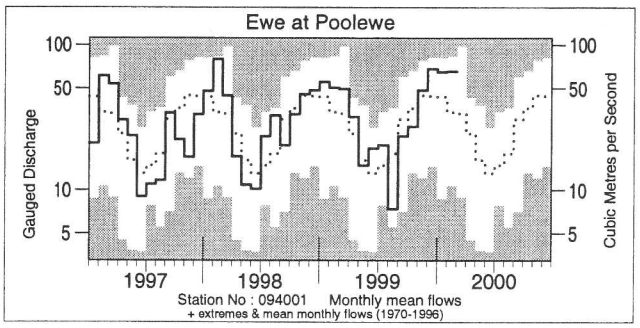
Provisional data suggest that over the three-month and twelve-month timeframes, the UK rainfall totals rank 6th and 11th highest this century. 1998 was wet also and long-term rainfall accumulations are notably high at the countrywide scale. As notably, the accentuation in the north-west south-east rainfall gradient has been a recurring feature of the last dozen years particularly.

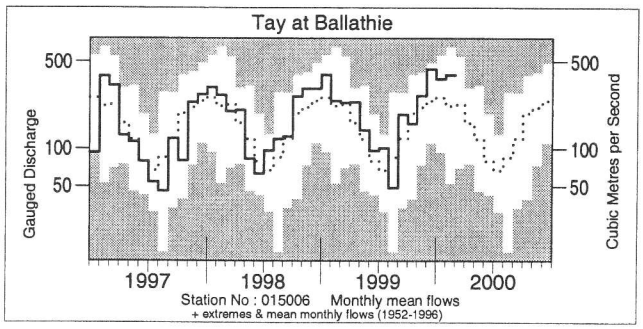


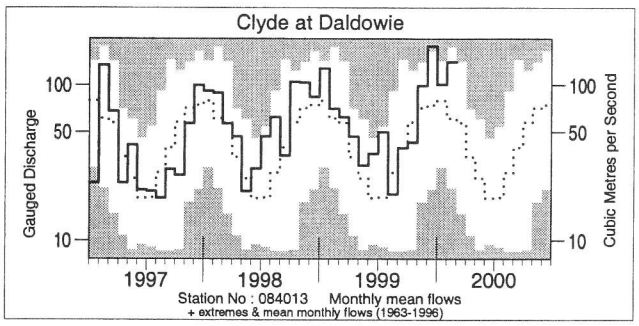
River flows - February 2000

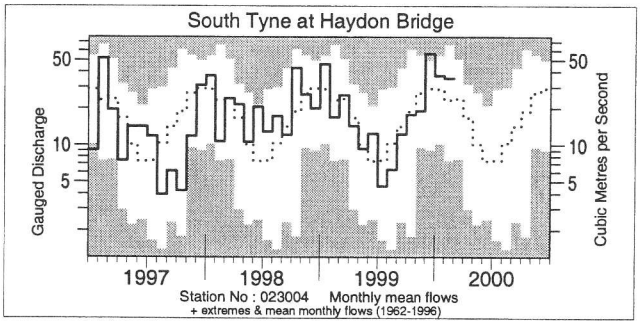
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much greater. Note: the period of record on which these percentages are based varies from station to station.

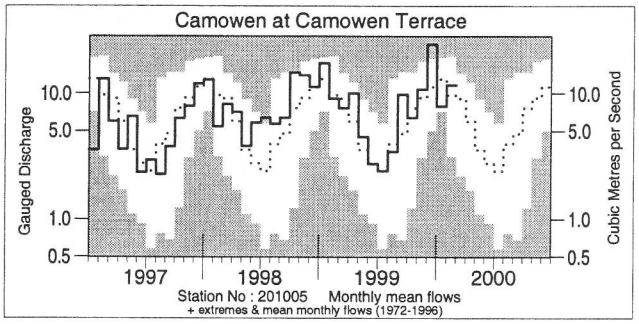
River flow . . . River flow . . .

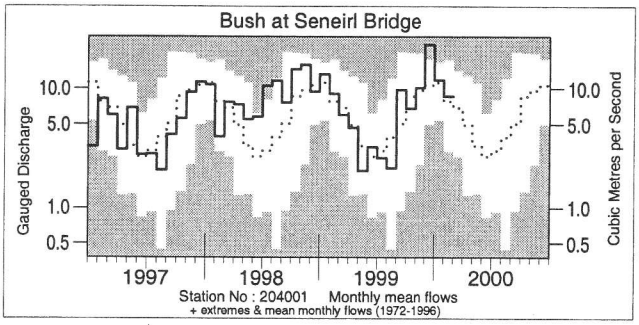


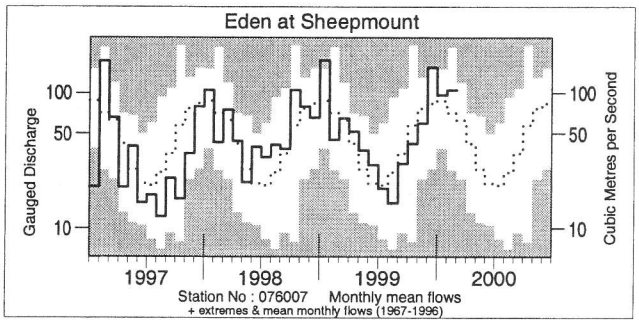


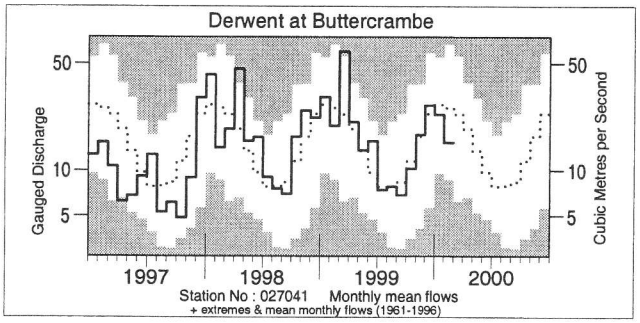


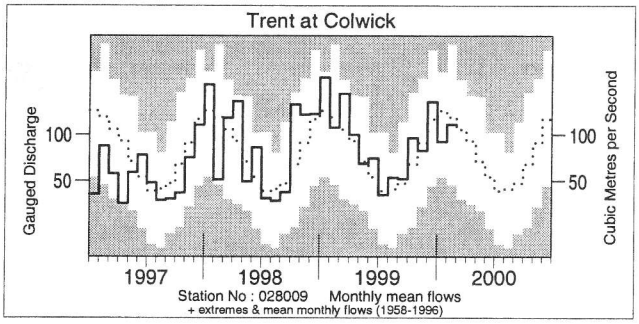


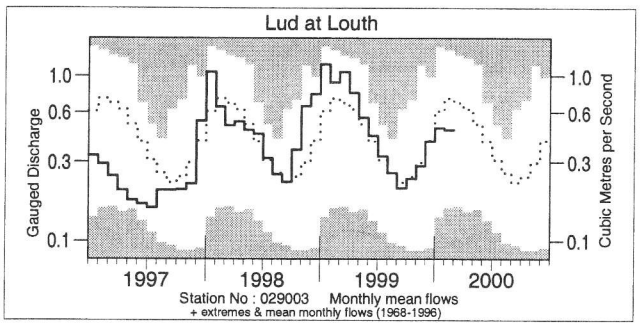








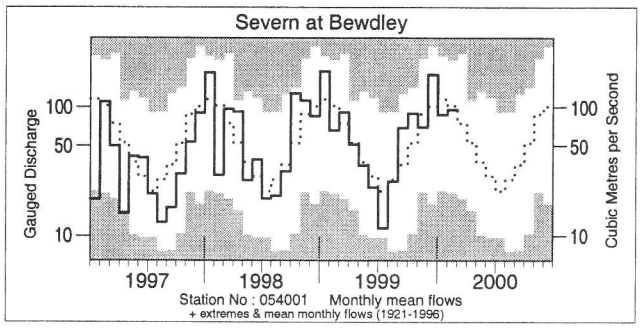


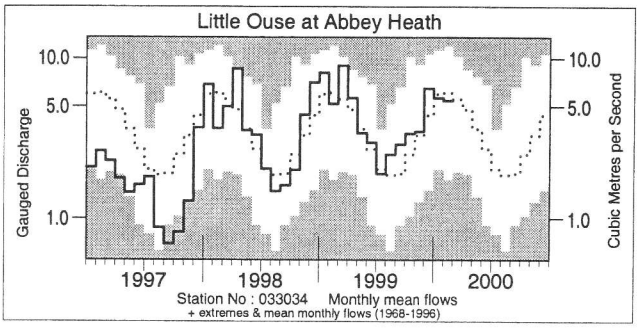


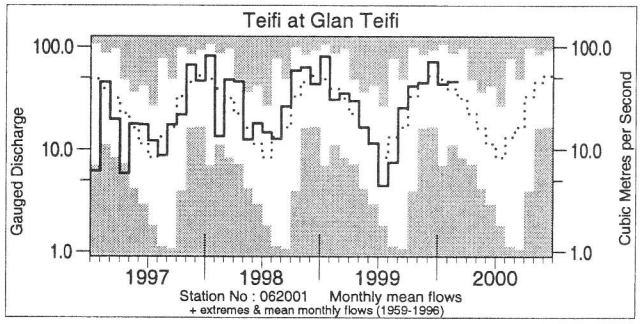
Monthly river flow hydrographs

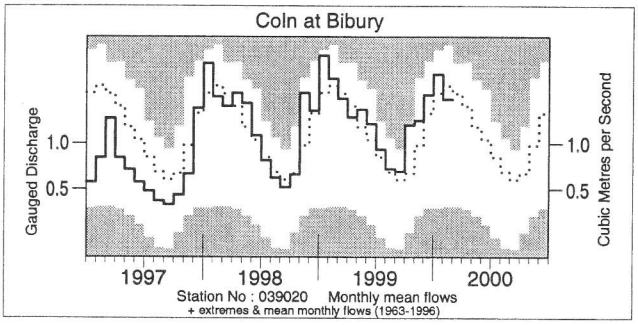
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 1997 (shown by the shaded areas). Monthly flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

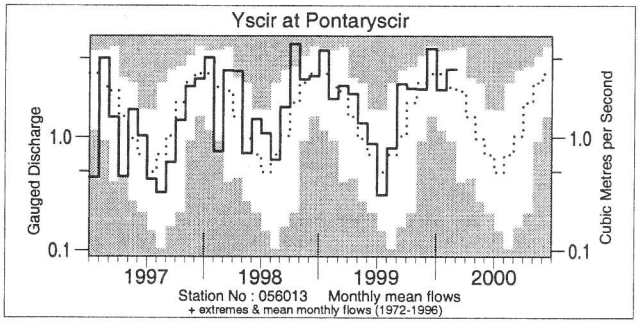
River flow . . . River flow . . .

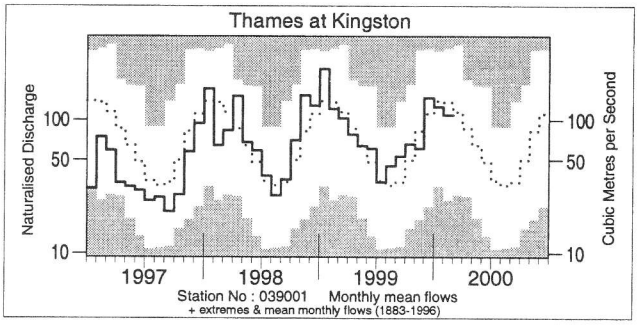


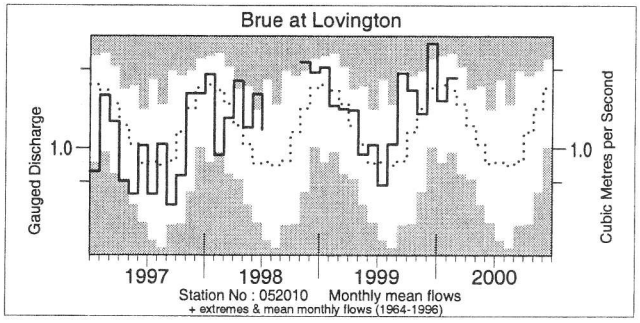


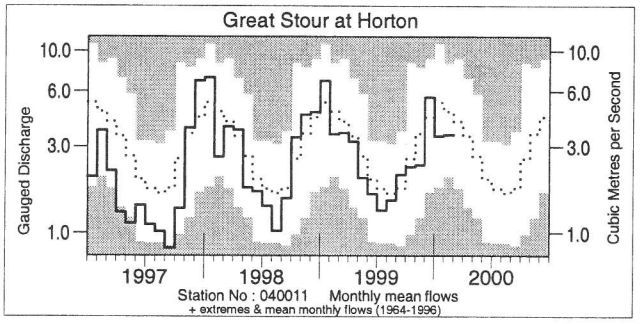


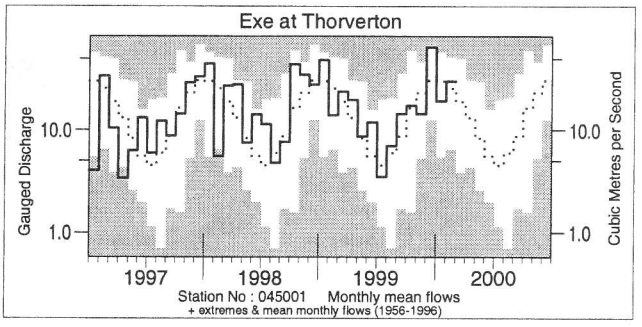


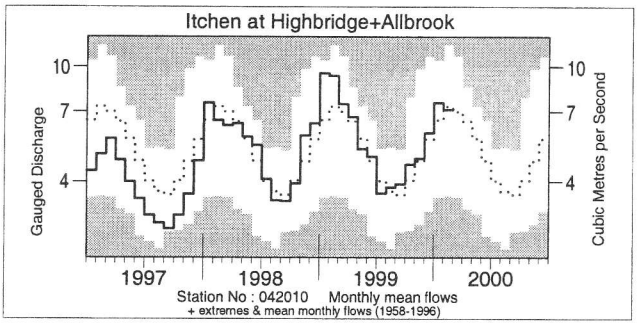












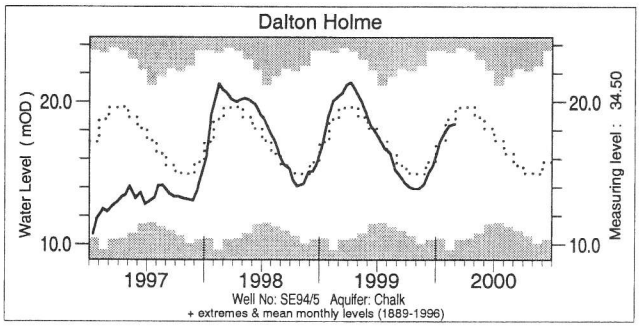
Notable runoff accumulations December 1999 - February 2000 (a); March 1999 - February 2000 (b)

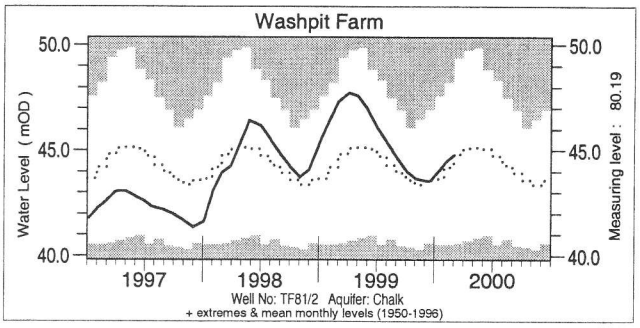
(a) River	%lta	Rank	River	%lta	Rank
Dover Beck	57	5/25	Earn	161	52/52
Lune	162	37/38	Clyde	187	37/37
Spey	167	48/48	Naver	156	23/23
Tay	162	48/48	Bush	148	28/28

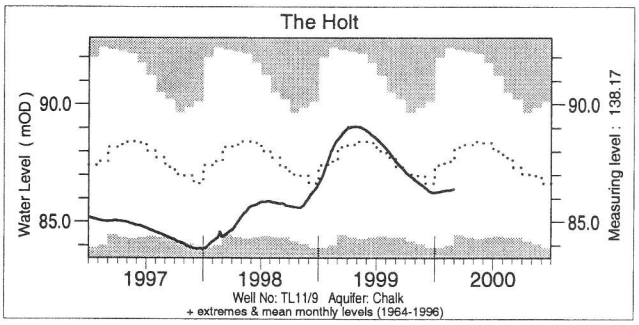
(b) River	%lta	Rank
Brue	149	34/34
Clyde	145	36/36
Naver	125	22/22
Annacloy	85	4/20

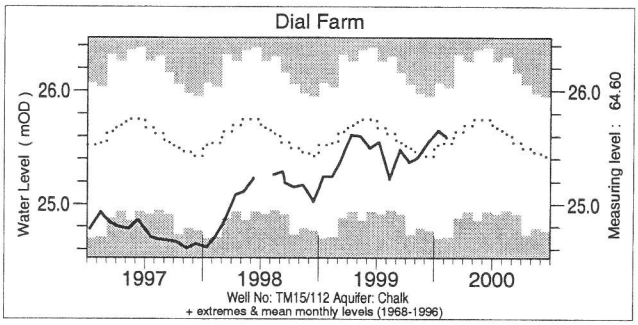
lta = long term average
Rank 1 = lowest on record

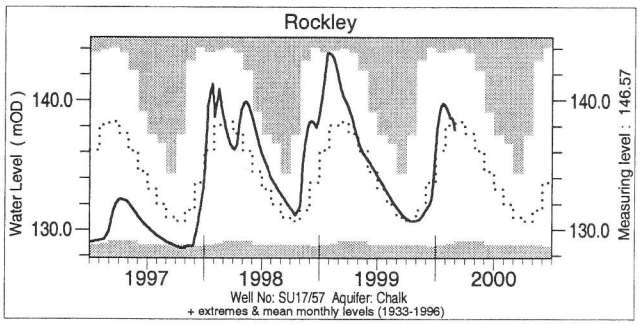
Groundwater . . . Groundwater

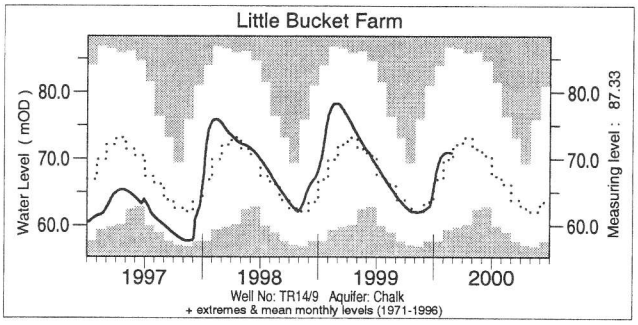


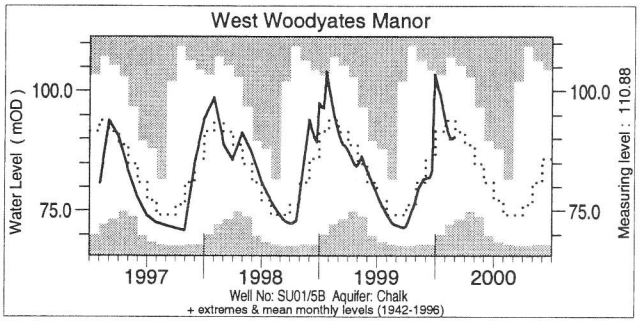


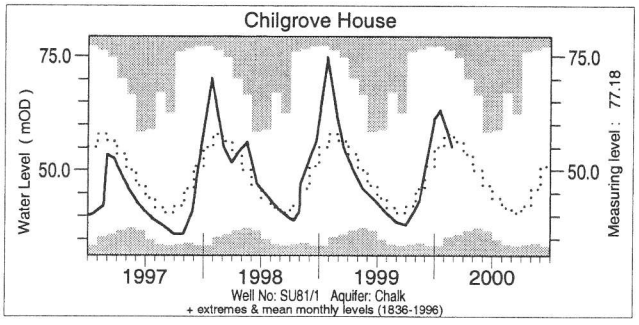


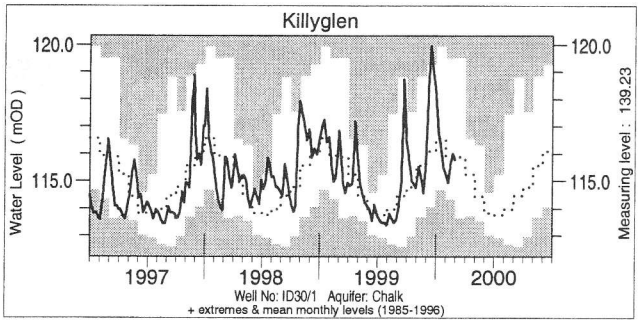


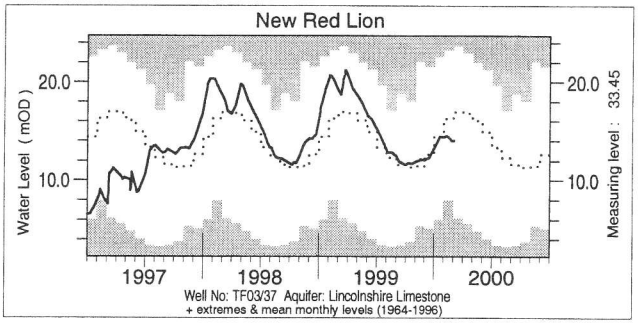








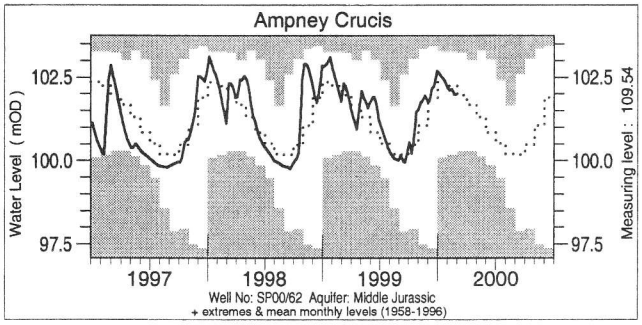


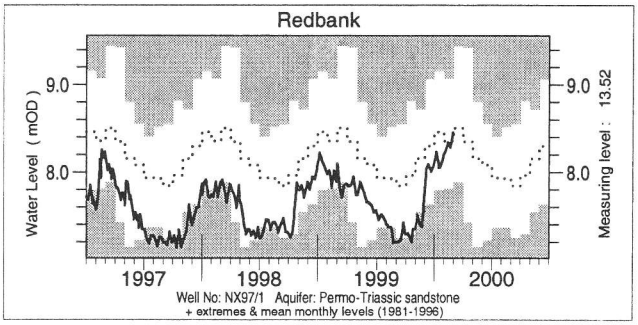


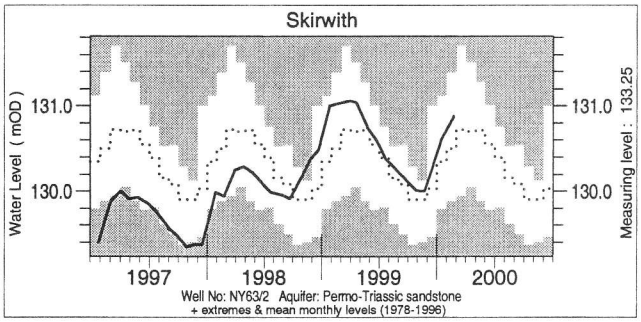
What is groundwater?

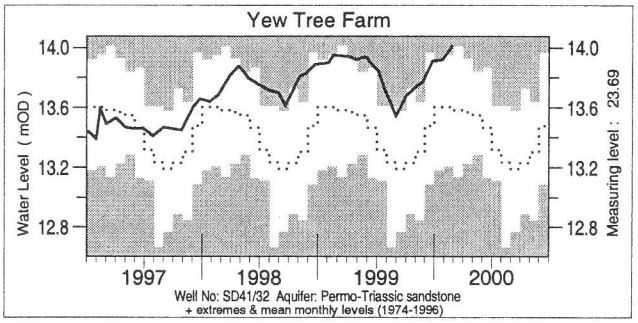
Groundwater is stored in the natural water bearing rock strata (or aquifers) which are found mostly in southern and eastern England (see page 11) where groundwater is the major water supply source. Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined below overlying impermeable strata. The monthly max., min. and mean levels are displayed in a similar style to the river flow hydrographs, note that most groundwater levels are not measured continuously — the latest recorded levels are listed overleaf.

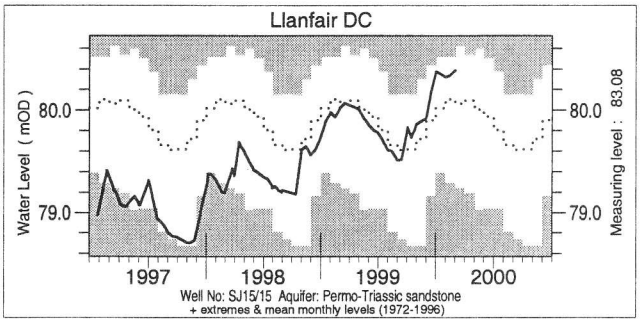
Groundwater . . . Groundwater

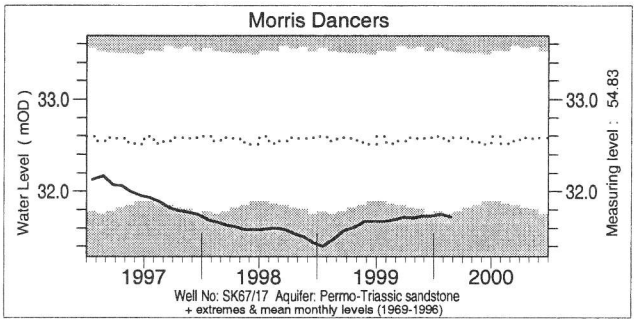


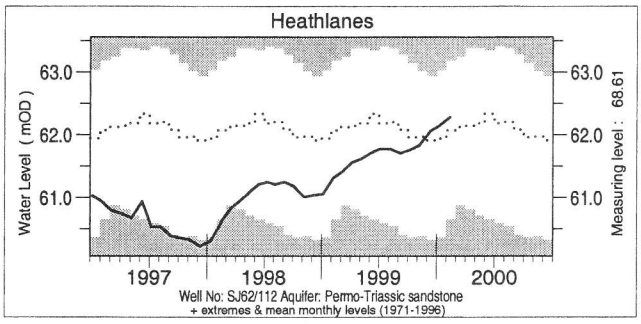


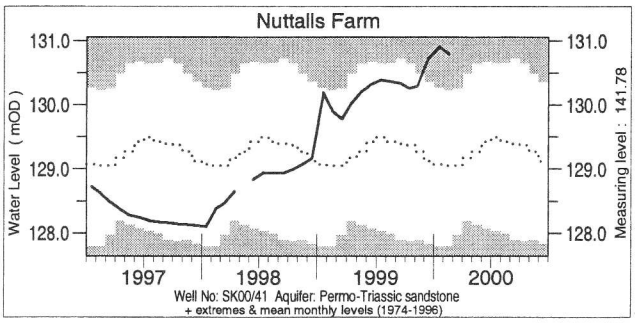


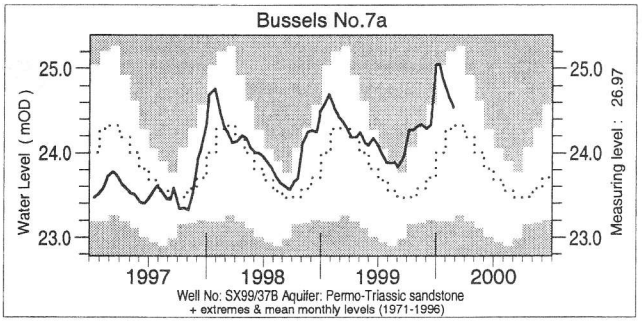


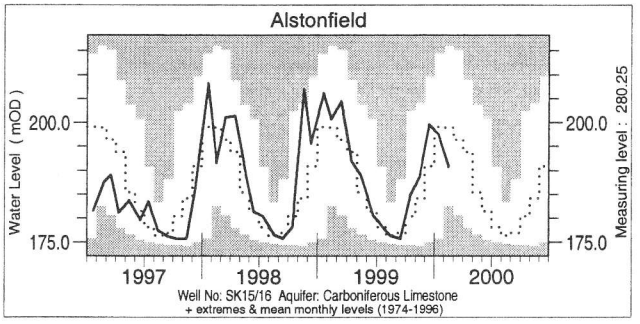








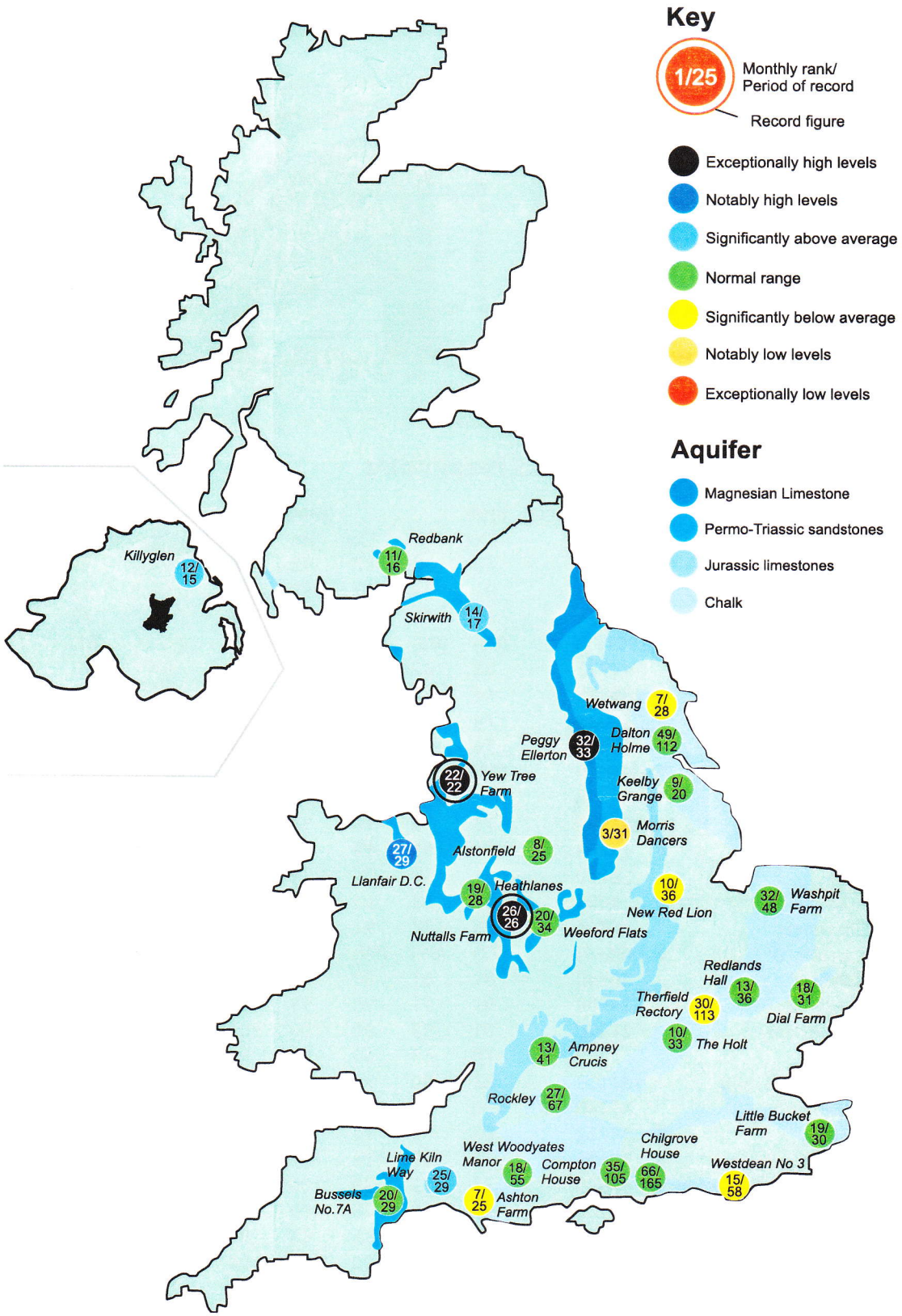




Groundwater levels February/March 2000

Borehole	Level	Date	Feb av.	Borehole	Level	Date	Feb av.	Borehole	Level	Date	Feb av.
Dalton Holme	18.46	28/02	18.67	Chilgrove	55.21	24/02	57.41	Llanfair D.C.	80.39	01/03	79.98
Washpit Farm	44.80	03/03	44.18	Killyglen	115.79	29/02	115.83	Morris Dancers	31.72	24/02	32.49
The Holt	86.39	28/02	87.32	New Red Lion	14.04	04/03	15.92	Heathlanes	62.29	12/02	61.95
Dial Farm	25.59	09/02	25.51	Ampney Crucis	101.99	28/02	102.23	Nuttalls Farm	130.79	16/02	129.19
Rockley	137.76	28/02	138.09	Redbank	8.45	28/02	8.44	Bussels No. 7A	24.54	25/02	24.28
Little Bucket	70.88	27/02	69.01	Skirwith	130.88	23/02	130.53	Alstonfield	190.74	15/02	198.89
West Woodyates	90.42	29.02	93.05	Yew Tree Farm	14.01	25/02	13.59				

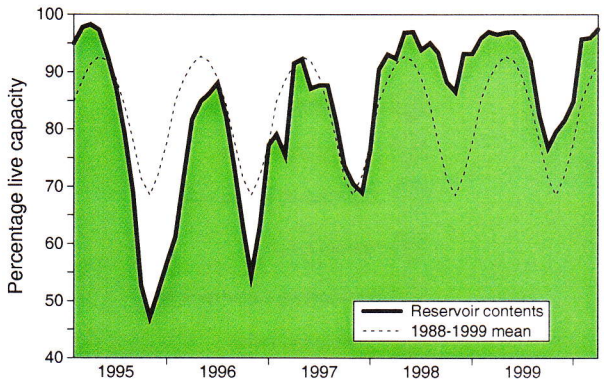
Levels in metres above Ordnance Datum



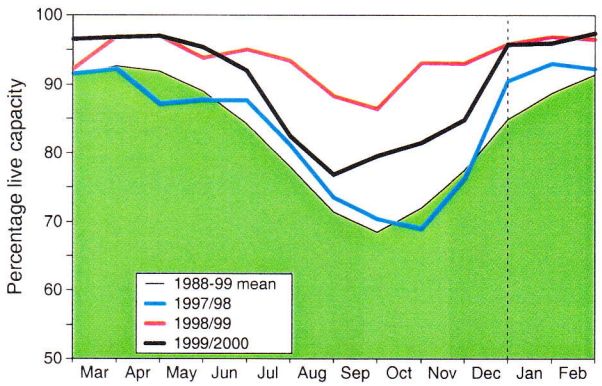
Groundwater levels - February 2000

The rankings are normally based on a comparison of current levels (usually a single reading in a month) with the average level in each corresponding month on record. They need to be interpreted with caution especially when groundwater levels are changing rapidly or when comparing wells with very different periods of record. Rankings may be omitted where they are considered misleading.

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.

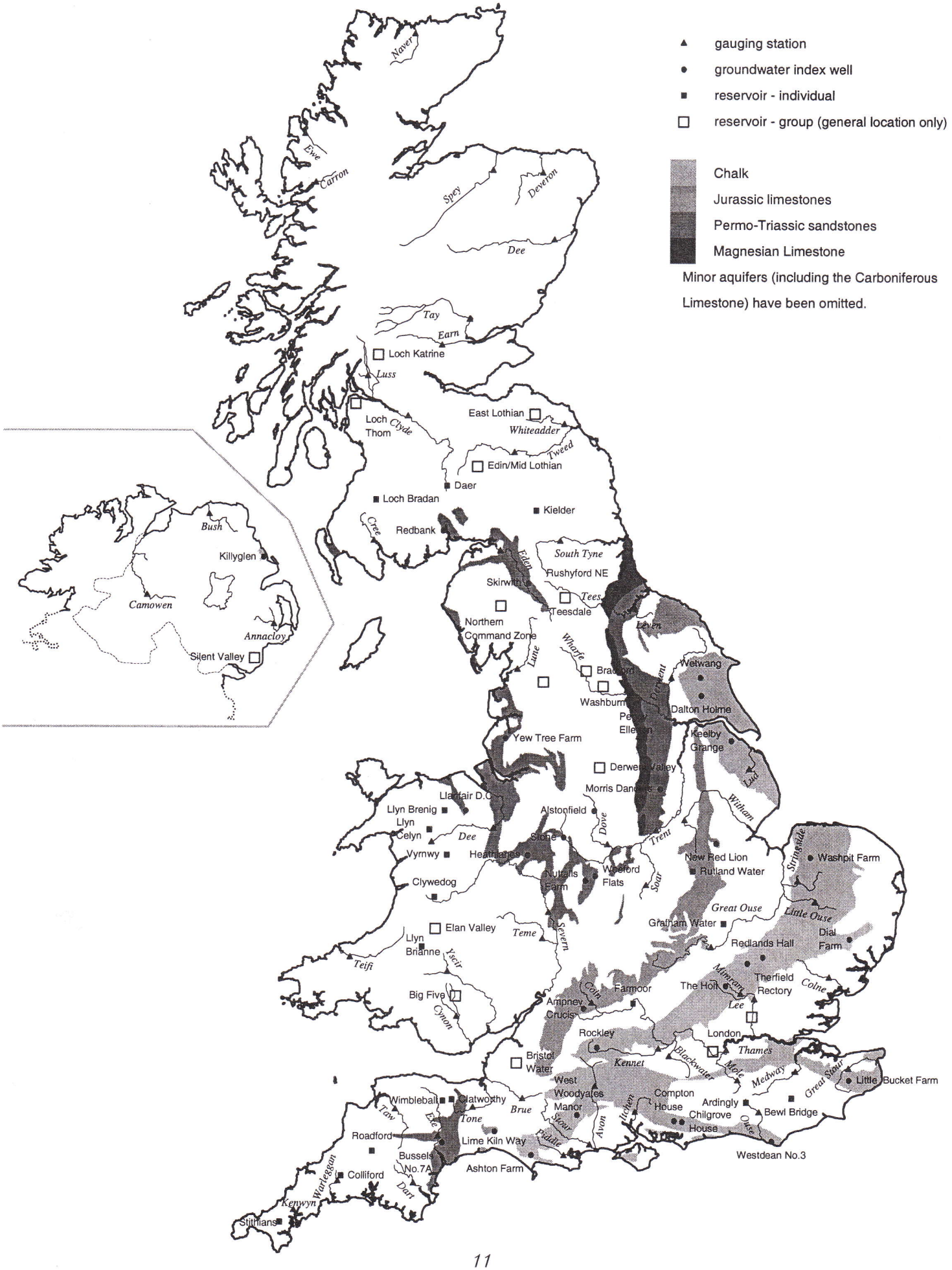
Percentage live capacity of selected reservoirs

Area	Reservoir	Capacity (Ml)	1999 Oct	Nov	Dec	2000 Jan	Feb	**Mar**	Min. Mar	Year* of min
North West	N Command Zone	• 133375	60	57	67	93	98	100	78	1996
	Vyrnwy	55146	81	76	82	99	96	96	59	1996
Northumbrian	Teesdale	• 87936	66	68	69	99	97	100	72	1996
	Kielder	(199175)	(88)	(86)	(87)	(100)	(93)	(97)	(81)	1993
Severn Trent	Clywedog	44922	88	82	84	91	88	94	77	1996
	Derwent Valley	• 39525	64	85	84	100	100	100	46	1996
Yorkshire	Washburn	• 22035	74	72	71	99	98	100	53	1996
	Bradford supply	• 41407	76	77	78	99	99	99	53	1996
Anglian	Grafham	** (55490)	(89)	(92)	(96)	(95)	(94)	(90)	(72)	1997
	Rutland	**(116580)	(79)	(81)	(83)	(88)	(91)	(94)	(71)	1992
Thames	London	• 206399	79	79	90	94	95	95	83	1988
	Farmoor	• 13843	95	93	98	77	95	93	64	1991
Southern	Bewl	28170	61	58	54	74	95	98	50	1989
	Ardingly	4685	57	63	65	100	100	100	89	1992
Wessex	Clatworthy	5364	75	87	91	100	98	100	82	1992
	Bristol WW	• (38666)	(77)	(89)	(89)	(93)	(94)	(96)	(65)	1992
South West	Colliford	28540	81	81	82	96	98	100	57	1997
	Roadford	34500	91	91	90	99	95	100	35	1996
	Wimbleball	21320	81	83	88	100	100	100	72	1996
	Stithians	5205	70	63	60	94	98	100	45	1992
Welsh	Celyn and Brenig	• 131155	86	88	89	99	99	100	69	1996
	Brianne	62140	100	98	96	100	98	100	94	1998
	Big Five	• 69762	87	90	92	94	98	97	85	1988
	Elan Valley	• 99106	77	99	100	100	100	100	88	1993
East of Scotland	Edinburgh/Mid Lothian	• 97639	71	73	80	100	98	99	73	1999
	East Lothian	• 10206	86	90	98	99	97	100	91	1990
West of Scotland	Loch Katrine	• 111363	92	92	95	88	85	95	93	1999
	Daer	22412	80	93	100	100	100	100		
	Loch Thom	• 11840	82	73	84	100	100	100	98	1996
Northern Ireland	Silent Valley	• 20634	71	69	58	61	62	63	63	2000

()figures in parentheses relate to gross storage • denotes reservoir groups *last occurrence **updated gross capacity

Details of the individual reservoirs in each of the groupings listed above are available on request. The featured reservoirs may not be representative of the storage conditions across each region; this can be particularly important during droughts. The minimum storage figures relate to the 1988-2000 period only (except for West of Scotland where data commence in 1994). In some gravity-fed reservoirs (e.g. Clywedog) stocks are kept below capacity during the winter to provide scope for flood attenuation purposes.

Location map . . . Location map



National Hydrological Monitoring Programme

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), the Rivers Agency (RA) in Northern Ireland, and the Office of Water Services (OFWAT).

Data Sources

River flow and groundwater level data are provided by the regional divisions of the EA (England and Wales) and SEPA (Scotland), data for Northern Ireland are provided by the Rivers Agency and the Department of the Environment (NI). In all cases the data are subject to revision following validation (flood and drought data in particular may be subject to significant revision).

Reservoir level information is provided by the Water Service Companies, the EA, the West of Scotland and East of Scotland Water Authorities, and the Northern Ireland Water Service.

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.

Rainfall

Most rainfall data are provided by The Met. Office (address opposite). To allow better spatial differentiation the rainfall data for Britain are presented for the regional divisions of the precursor organisations of the EA and SEPA. Since the discontinuation of The Met. Office's CARP system in July 1998, rainfall figures have been provided by differing methods. Initial rainfall estimates for Scotland and the Scottish regions were derived by IH in collaboration with SEPA. In England and Wales, between July 1998 and May 1999, provisional rainfall figures derive from MORECS*. Beginning with the June 1999 report, provisional rainfall figures for England and Wales, the EA regions and Northern Ireland (from September 1999) have been produced by The Met. Office, National Climate Information Centre (NCIC), using a technique similar to CARP. An initiative is underway with The Met. Office to provide more accurate areal figures and, since October 1999, to include more raingauges in the analysis. A significant number of additional monthly rainfall totals are currently being provided by SEPA; over the coming months further monthly raingauge totals will be included for selected EA regions. Until the access to these additional data has stabilised the regional figures (and the return periods associated with them) should be regarded as a guide only.

*MORECS is the generic name for the Meteorological Office services involving the routine calculation of evaporation and soil moisture throughout Great Britain.

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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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02/00