Hydrological Summary
for the United Kingdom

November 2004

General

November was a mostly mild and generally dry month – reflecting the low frequency of frontal systems crossing the UK. Large parts of the country recorded less than half the average rainfall and it was, provisionally, the driest November since 1993. Unusually for November, stocks fell in a number of major reservoirs leaving some (e.g. in southern England) considerably below average for the end of autumn. Nonetheless, despite the limited November replenishment, overall stocks for England and Wales remained appreciably above average. River flows were in recession throughout much of the month and, in most aquifer outcrop areas, infiltration rates were well below average – causing the seasonal recovery in groundwater levels to stall, but leaving most November levels well within the normal range for the late autumn. The very modest rainfall during what is, on average, the wettest part of the year has led to an appreciable deterioration in water resources outlook relative to the position six weeks ago. Substantial December rainfall would be particularly welcome in parts of eastern and southern England where groundwater levels are still in recession.

Rainfall

Despite a cold snap in mid-month, November was generally mild and cloudy. The damp complexion to the weather (fog and drizzle were common) provided a misleading perception; significant storm events were rare, being largely confined to mid-month in many regions. On the 18th, a 33mm rainfall total was registered at Grimsbury (Oxon) and significant snowfall was reported as far south as East Anglia. Three days later an active frontal system produced 2-day totals of >50mm in parts of the Western Highlands. Thereafter, precipitation was largely limited to fog-drip in many areas. Rainfall totals of only around 5 mm were recorded in parts of central southern Britain over the 21 days from 21st November. November rainfall totals modestly exceeded the average in parts of western Scotland and in a few parts of central England (e.g. Woburn, Beds.) but most index raingauges registered only 40-80% of average; the lowest totals clustered in north-east England and in a zone from Cornwall to Sussex. The provisional UK total of 75mm ranks as the 4th lowest since 1958. Nationally, monthly rainfall totals have alternated between below and above average for the last nine months but in some regions there has been less counterbalancing; autumn (Sept-Nov) rainfall totals were particularly low in Southern Region. All regional rainfall accumulations are above average in the June-Nov timeframe and for the Jan-Nov period only Southern Region and Northern Ireland have below average totals.

River Flows

Contrary to the normal seasonal pattern, flows in most rivers declined substantially through November. Most recessions were interrupted in mid month as spates triggered a few Flood Warnings (e.g. on the Great Ouse) but, thereafter, they continued well into December. Index gauging stations reporting above average monthly runoff totals were mainly confined to the East Midlands and East Anglia. Elsewhere, runoff was below normal, notably so in a number of impermeable catchments – mostly in the West. The Tawe reported its lowest November flow since 1970 and, in Northern Ireland, the Faughan registered its second lowest in the last 22 years. In many spring-fed rivers and streams, November flows were similar to those in late August and a sustained seasonal recovery is still awaited. Autumn runoff totals, boosted by healthy October flows were well above average in most western and northern catchments – the Ness reported its second highest on record but moderately depressed in parts of southern England (e.g. the Mole). For the year thus far, runoff totals show wide spatial variability - mostly above average but runoff deficiencies exceed 20% for a number of, mostly southern, catchments including the Otter and Wallington.

Groundwater

November rainfall totals exceeded the average across a modest proportion of the central Chalk outcrop but elsewhere many aquifer units received less than half the 1961-90 average. Correspondingly, some areas registered little or no infiltration (e.g. parts of the North Downs). The patchiness of recent recharge patterns also reflects the large spatial variations in late autumn soil moisture deficits across the English Lowlands where, at the end of November, significant deficits remained in the east. November groundwater levels in many aquifer outcrops showed little change from those in October (the late autumn is normally a time of brisk recoveries). Levels in the Chalk are generally well within the normal range but a distinction can be drawn between those (e.g. in the south-western and north-eastern extremities) where recoveries are underway and those slower responding units where the summer decline has yet to be arrested (see, for instance Stonor). The heavy October recharge ensured that levels in most index wells in the limestone aquifers are above average entering winter. Early winter levels in the Permo-Triassic sandstones reflect the wide distribution of the outcrop areas and the substantial variations in response rates – nonetheless all are within the normal range. Sustained early winter rainfall is needed to initiate recoveries in the eastern Chalk.

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Rainfall . . . Rainfall . . .

Rainfall accumulations and return period estimates

Area	Rainfall	Nov 2004	Sep 04-Nov 04	RP	Jun 04-Nov 04	RP	Jan 04-Nov 04	RP	Feb 03-Nov 04	RP
England & Wales	**mm**	**49**	**253**		**544**		**906**		**1576**	
	%	**52**	**98**	**2-5**	**118**	**5-10**	**111**	**2-5**	**96**	**2-5**
North West	mm	**76**	372		794		1244		2148	
	%	**61**	100	<2	122	5-10	114	5-10	98	2-5
Northumbrian	mm	**32**	231		581		924		1503	
	%	**37**	97	2-5	129	10-20	118	5-15	96	2-5
Severn Trent	mm	**45**	217		468		776		1332	
	%	**63**	107	2-5	121	5-10	113	2-5	96	2-5
Yorkshire	mm	**37**	211		528		875		1466	
	%	**45**	93	2-5	124	5-10	116	5-10	97	2-5
Anglian	mm	**43**	167		425		685		1129	
	%	**74**	104	2-5	134	15-25	125	15-25	103	2-5
Thames	mm	**42**	188		395		682		1167	
	%	**63**	99	2-5	112	2-5	108	2-5	92	2-5
Southern	mm	**34**	196		379		691		1271	
	%	**40**	83	2-5	96	2-5	98	2-5	90	2-5
Wessex	mm	**39**	232		438		777		1405	
	%	**46**	97	2-5	105	2-5	102	2-5	92	2-5
South West	mm	**60**	314		616		1077		1910	
	%	**47**	93	2-5	109	2-5	102	2-5	91	2-5
Welsh	mm	**94**	453		759		1291		2270	
	%	**65**	113	2-5	114	2-5	109	2-5	95	2-5
Scotland	**mm**	**119**	**495**		**889**		**1488**		**2525**	
	%	**76**	**108**	**2-5**	**117**	**5-10**	**113**	**5-10**	**96**	**2-5**
Highland	mm	**181**	647		1049		1812		3049	
	%	**92**	116	2-5	117	5-10	117	10-20	98	2-5
North East	mm	**73**	319		658		1078		1736	
	%	**71**	107	2-5	123	5-15	116	5-15	93	2-5
Tay	mm	**68**	415		838		1311		2161	
	%	**53**	108	2-5	130	10-20	113	5-10	94	2-5
Forth	mm	**57**	362		737		1157		1937	
	%	**49**	104	2-5	124	5-15	112	5-10	94	2-5
Tweed	mm	**39**	300		675		1069		1744	
	%	**41**	104	2-5	130	10-20	118	5-15	96	2-5
Solway	mm	**86**	459		860		1421		2469	
	%	**59**	103	2-5	115	5-10	111	2-5	96	2-5
Clyde	mm	**132**	564		1034		1727		3007	
	%	**71**	100	<2	113	2-5	110	2-5	96	2-5
Northern Ireland	**mm**	**60**	**300**		**580**		**978**		**1807**	
	%	**56**	**93**	**2-5**	**103**	**2-5**	**99**	**2-5**	**92**	**2-5**

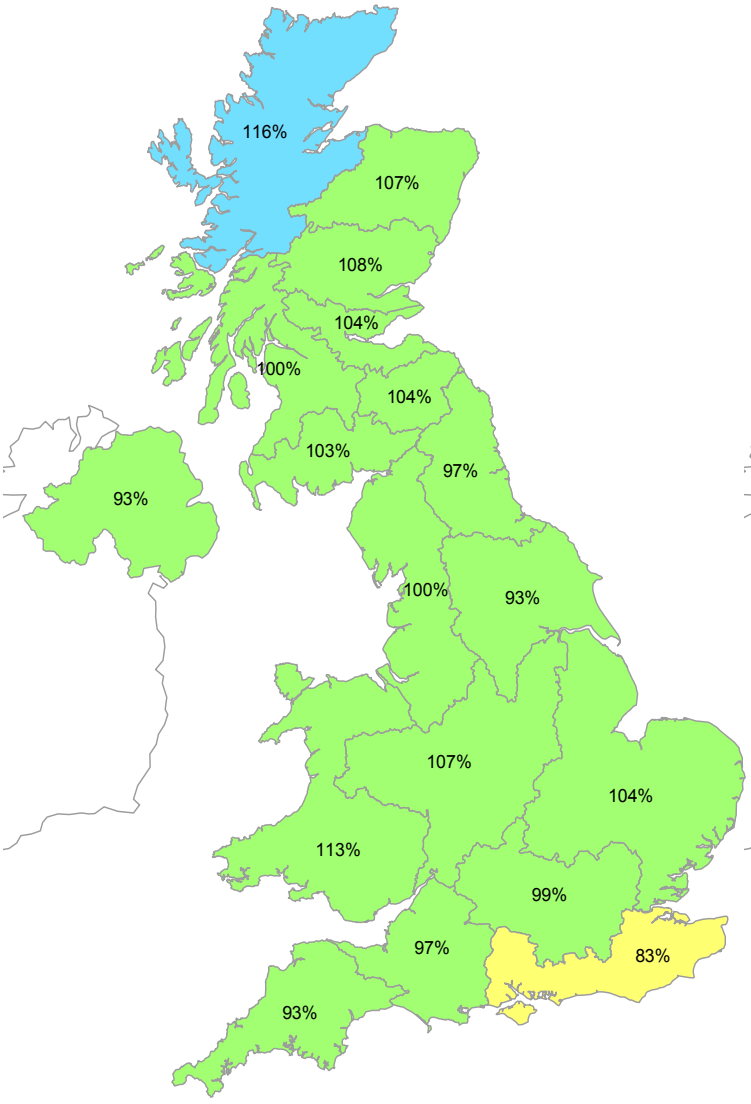
% = percentage of 1961-90 average *RP = Return period*

 All monthly totals since July 2004 are provisional (see page 12). Revised Met Office totals for 1961-2003 have been recently incorporated. The figures for England & Wales are derived by the Hadley Centre and are updates of the homogenised series developed by the Climate Research Unit; the other national figures are derived from different raingauge networks to those used to derive the CRU data series. The return period estimates are based on tables provided by the Met 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 Scottish rainfall series in particular, can exaggerate the relative wetness of the recent past. *See page 12.

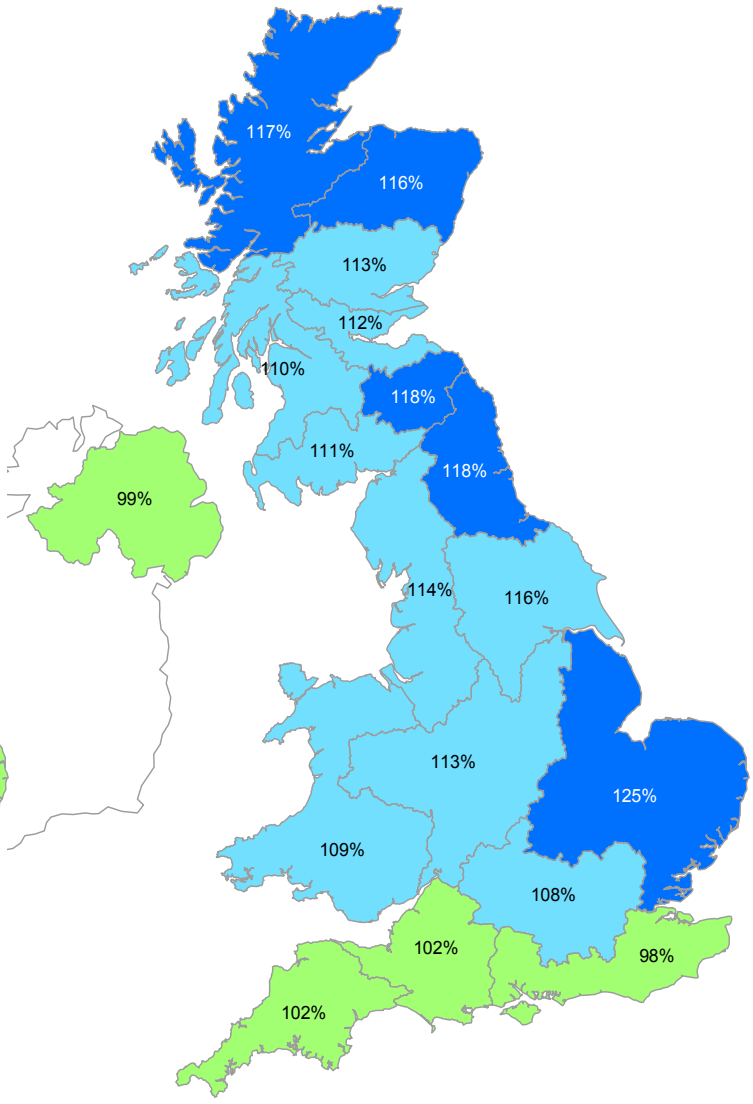
Rainfall . . . Rainfall . .

Key

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



September 2004 - November 2004

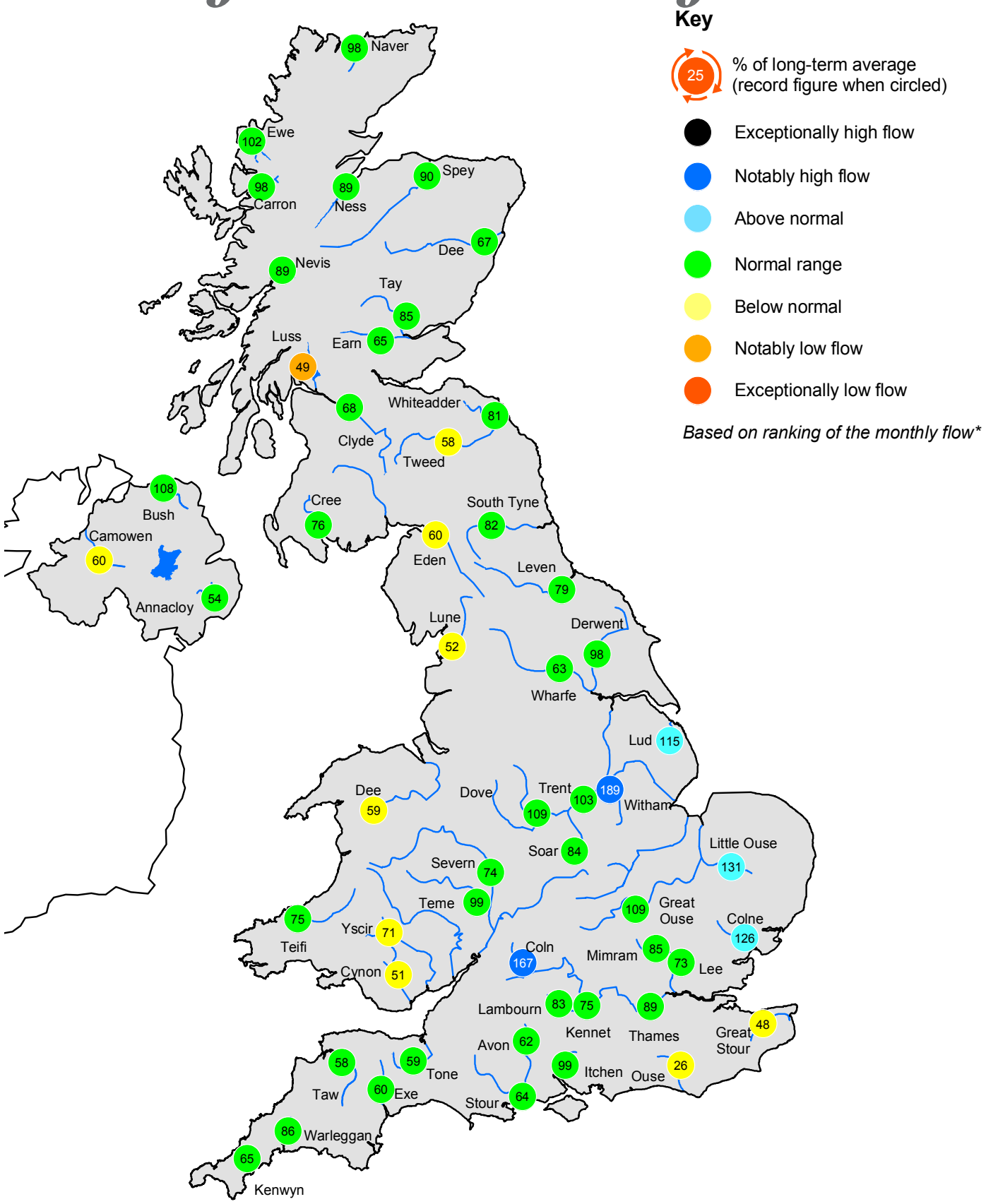


January 2004 - November 2004

Rainfall accumulation maps

Autumn 2004 rainfall totals showed considerable regional coherence and the UK total added to a recent cluster of realtively wet Sept-Nov periods; six of the last seven have exceeded the average. Regional rainfall anomalies are much more notable over the Jan-Nov period. Most are appreciably above average - contributing to a UK rainfall total which, provisionally, ranks in the top ten in a series from 1900; but 1998, 2000 and 2002 were considerably wetter.

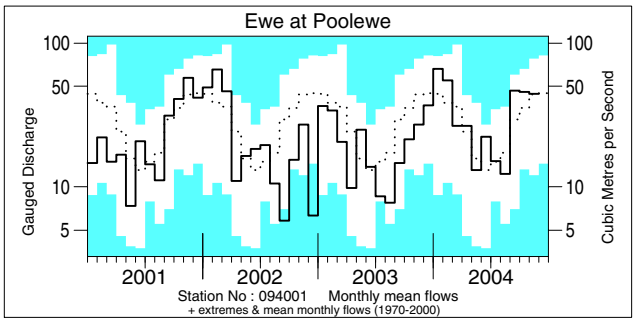
River flow . . . River flow . . .

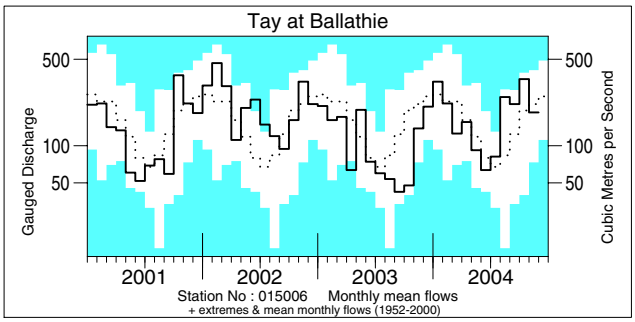


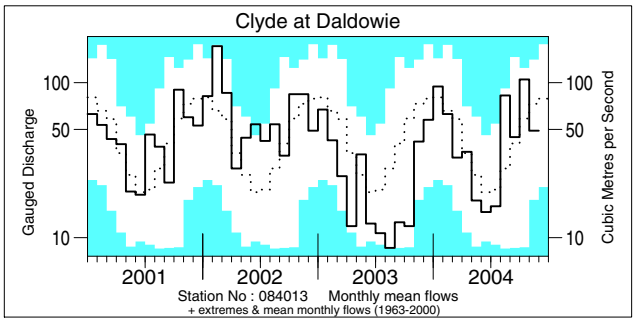
River flows - November 2004

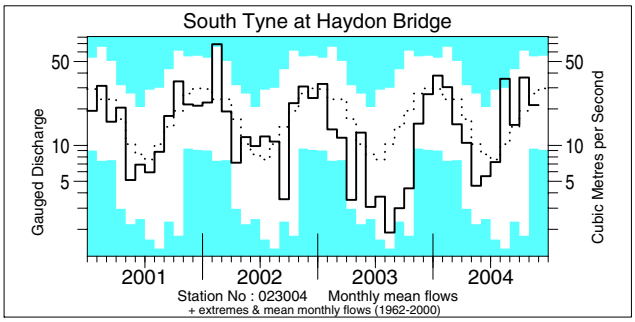
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

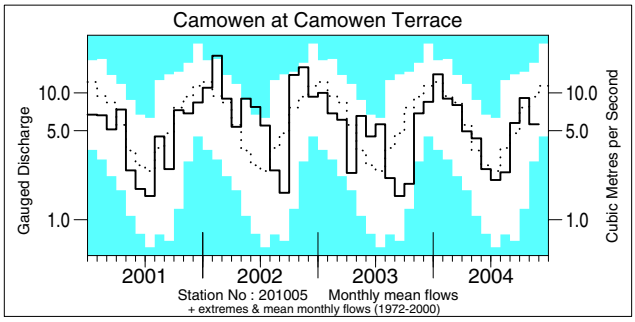
River flow . . . River flow . . .

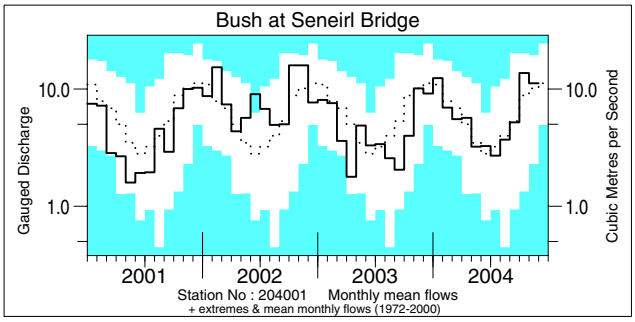


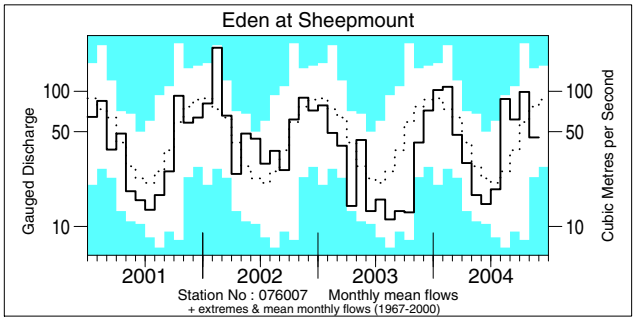


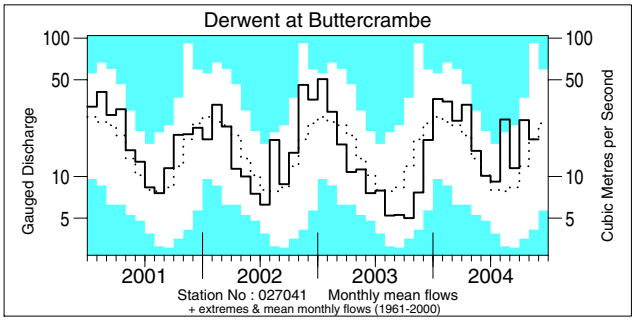


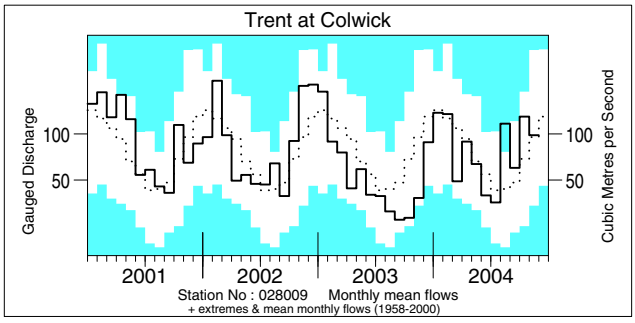


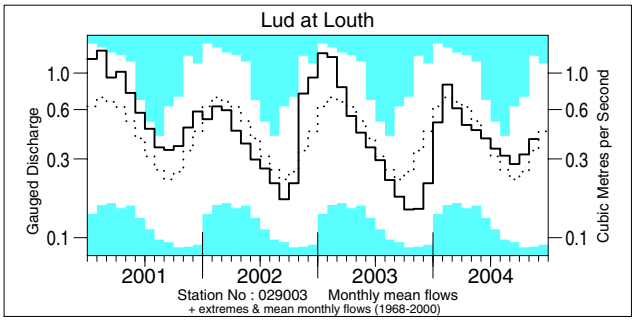








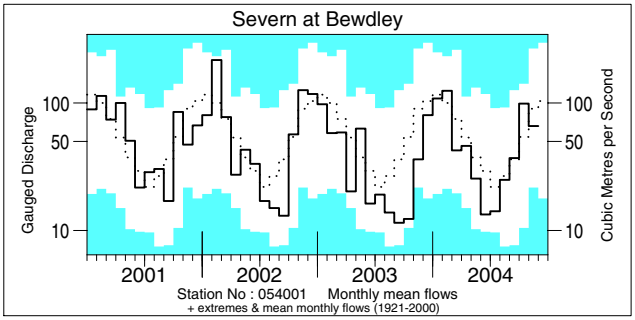


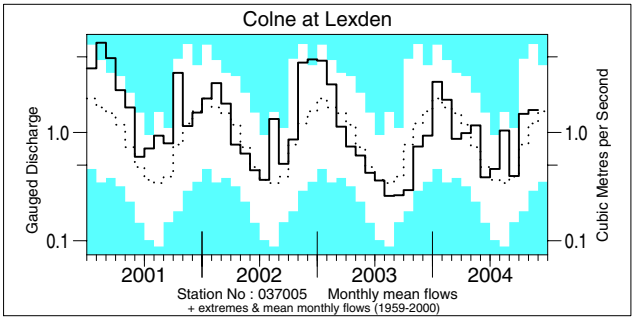


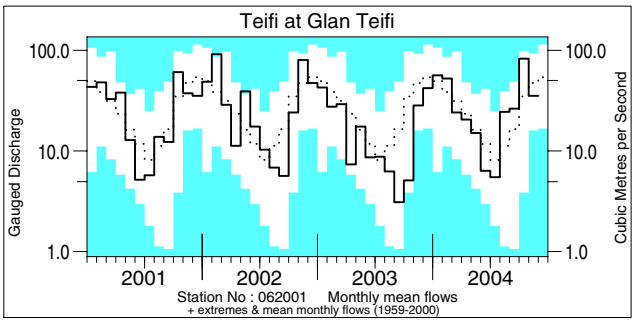
Monthly river flow hydrographs

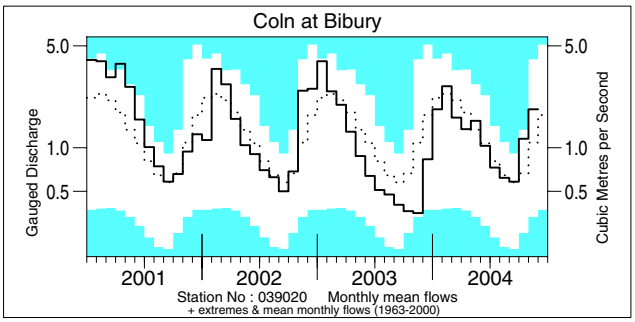
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 2001 (shown by the shaded areas). Monthly flows falling outside the maximum/ minimum range are indicated where the bold trace enters the shaded areas.

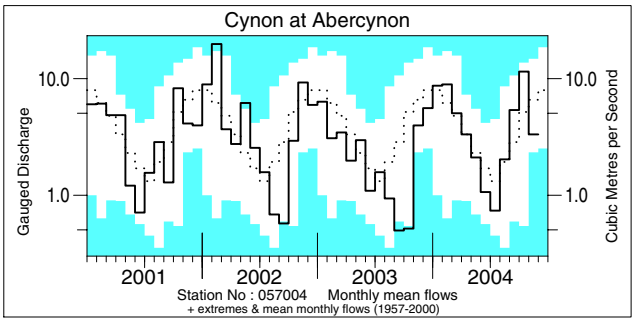
River flow . . . River flow . . .

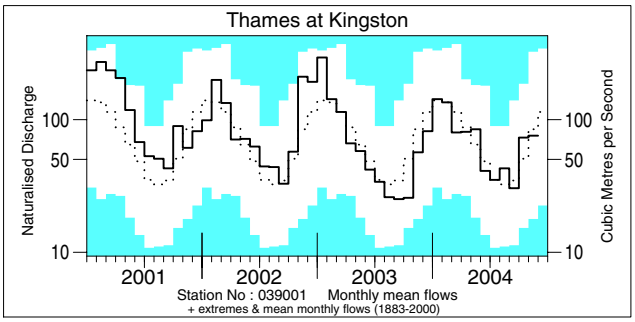


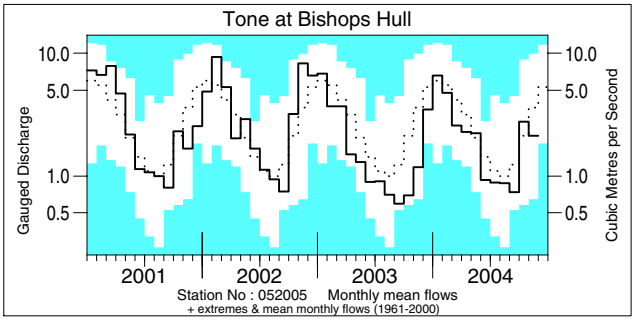


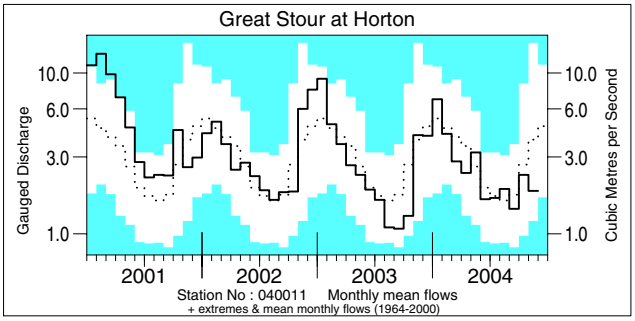


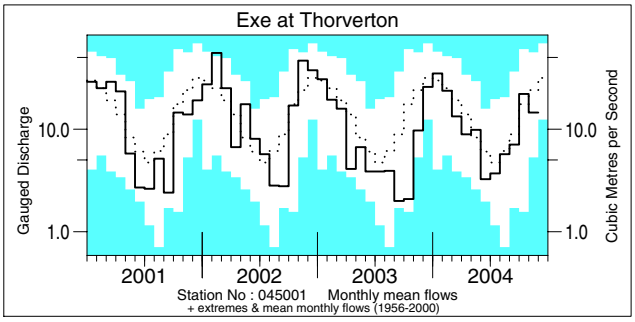


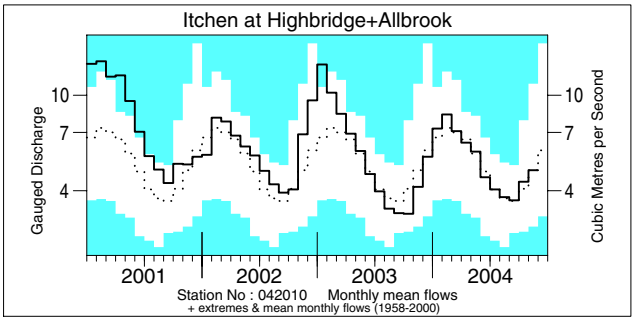












Notable runoff accumulations **(a) September 2004 - November 2004, (b) January 2004 - November 2004**

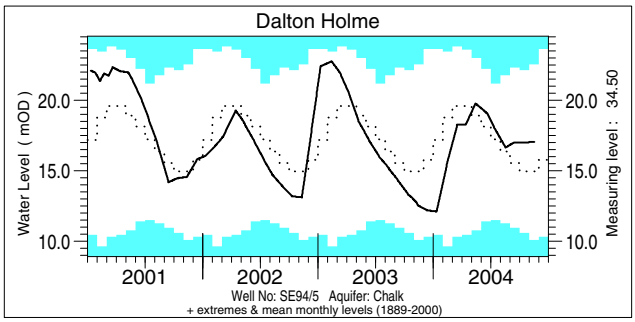
	River	%lta	Rank
a)	Ness	135	31/32
	Tay	139	49/52
	Whiteadder	157	32/36
	Dover Beck	156	27/29
	Stringside	234	34/38
	Mole	58	10/30
	Medway	39	14/43
	Yscir	135	28/32
	Faughan	81	8/29

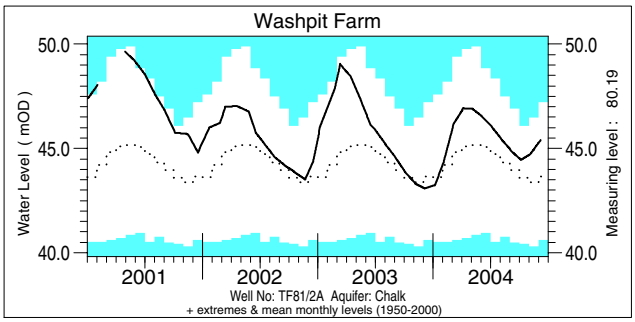
	River	%lta	Rank
b)	Spey (Boat o'Brig)	122	49/52
	Deveron	142	43/44
	Tweed (Norham)	120	40/45
	Leven (Leven B)	145	41/44
	Derwent (Yorks)	140	39/43
	Witham	148	42/45
	Thames (Gauged)	80	36/122

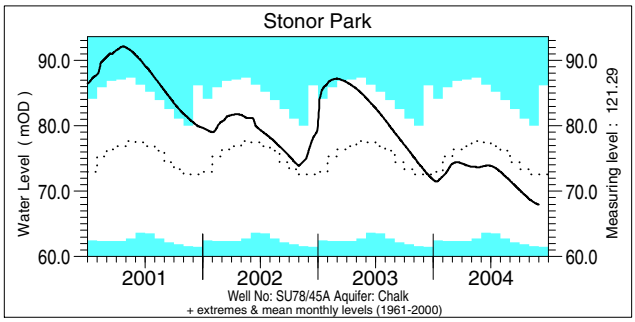
River	%lta	Rank
Lambourn	79	8/42
Medway	60	4/41
Ouse (Sussex)	72	9/39
Wallington	71	10/49
Avon (Wilts)	79	7/39
Otter	80	8/42
Naver	124	24/27

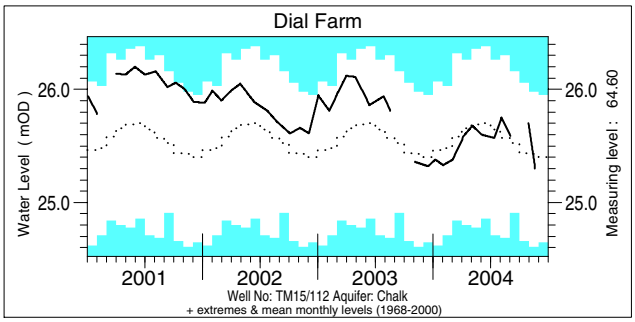
lta = long term average
Rank 1 = lowest on record

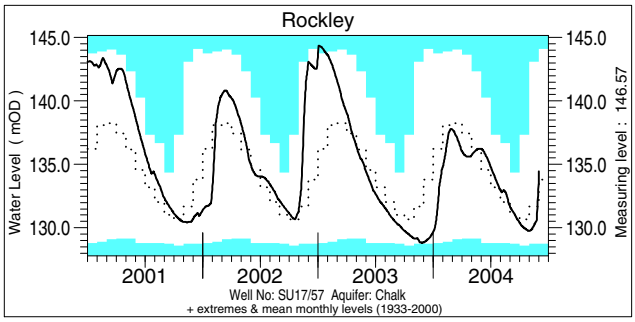
Groundwater . . . Groundwater

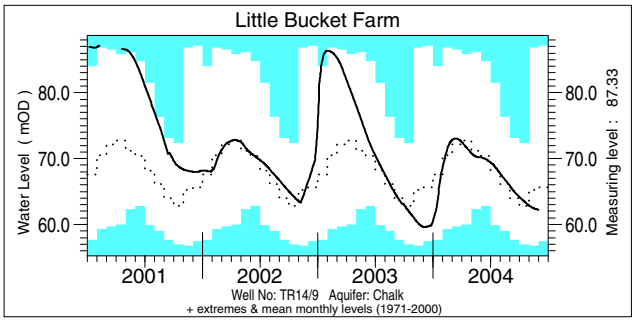


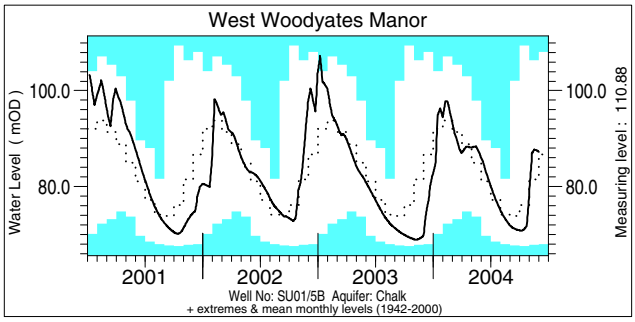


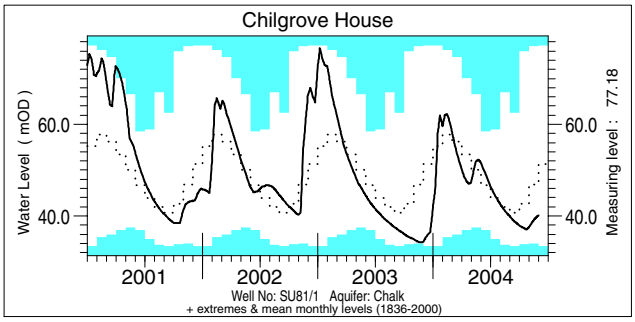


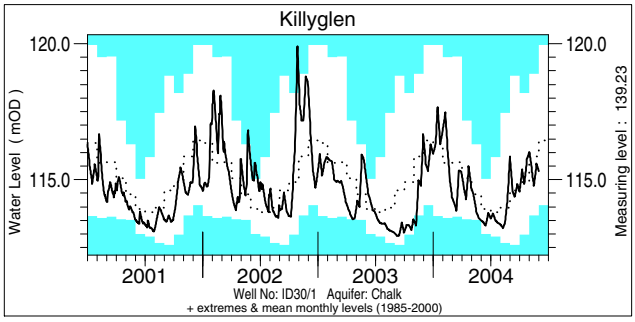


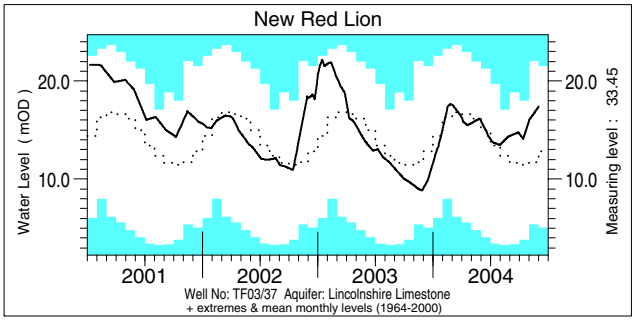






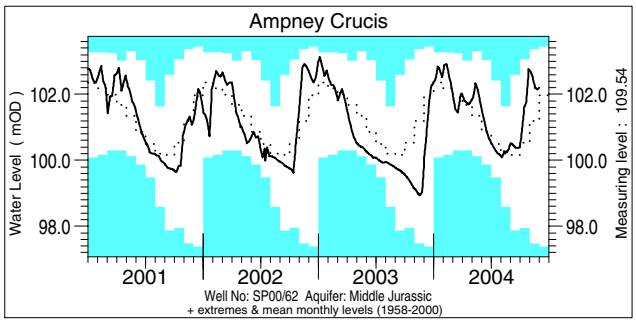


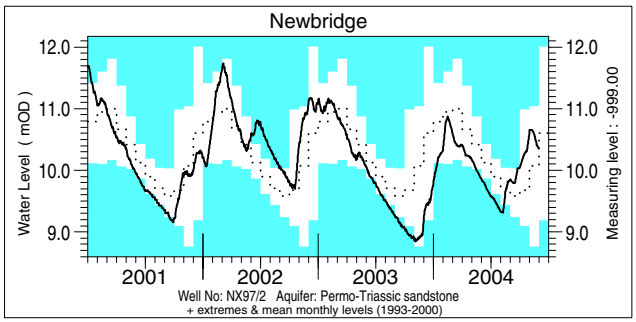


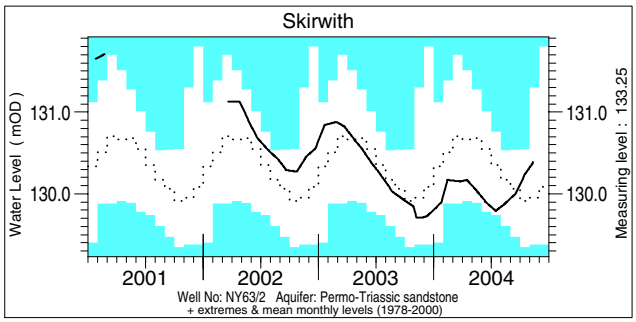


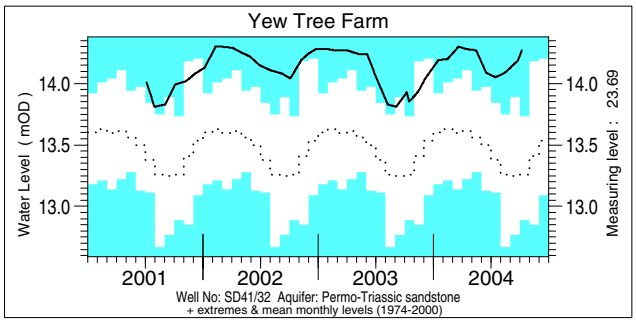
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined 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.

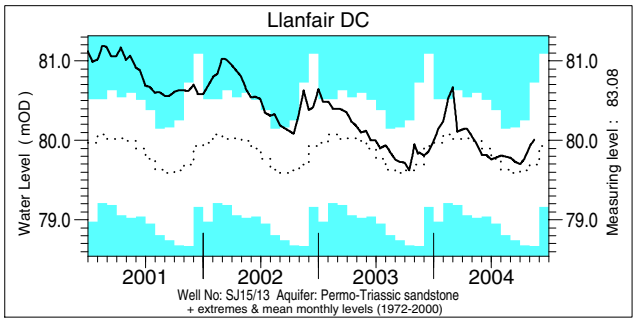
Groundwater . . . Groundwater

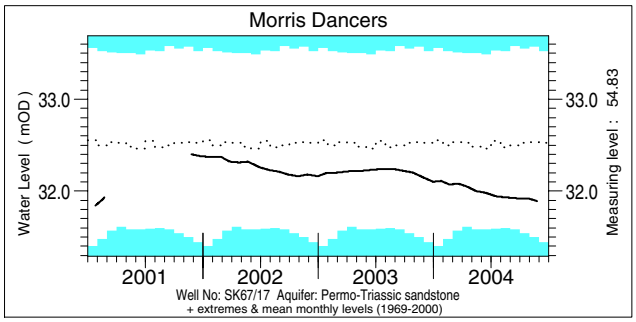


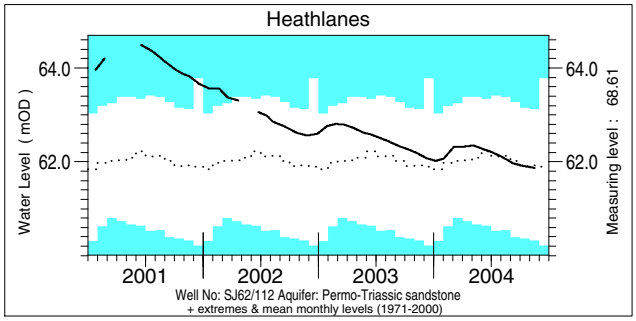


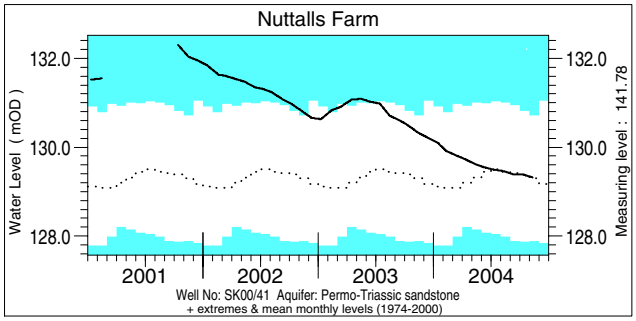


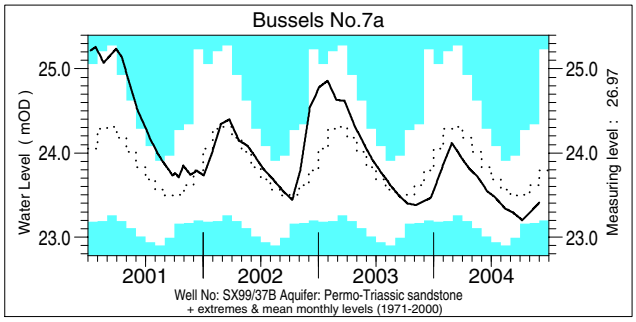


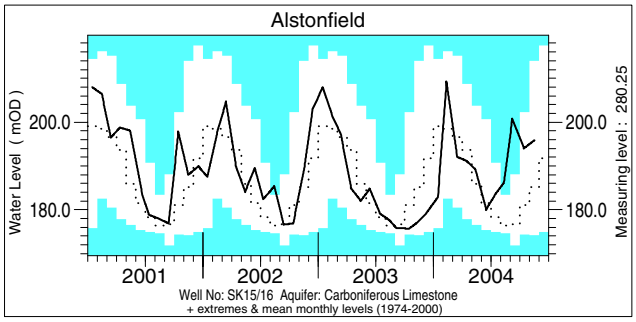










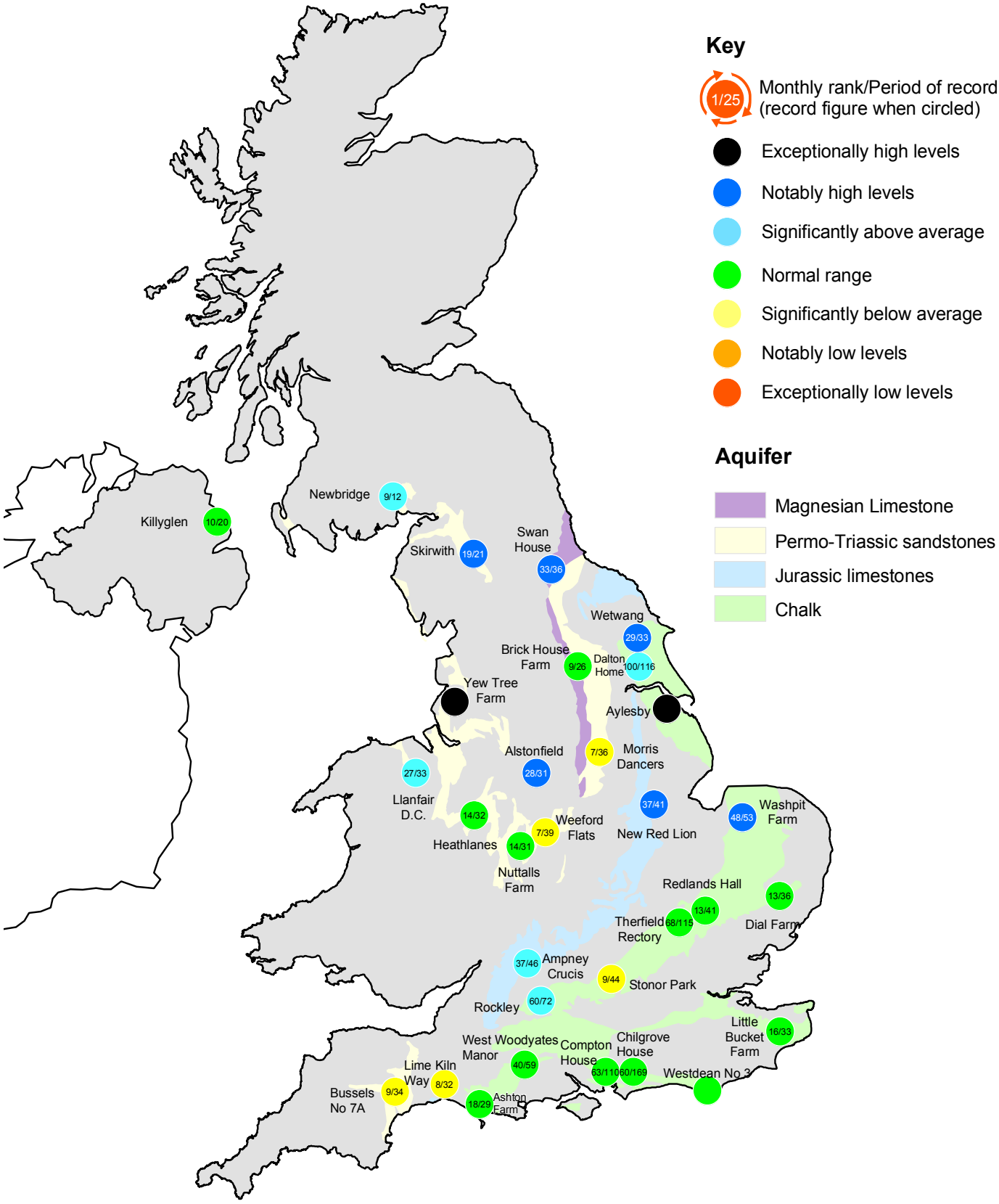


Groundwater levels November / December 2004

Borehole	Level	Date	Nov. av.	Borehole	Level	Date	Nov. av.	Borehole	Level	Date	Nov. av.
Dalton Holme	17.06	16/11	14.79	Chilgrove House	40.12	30/11	46.63	Llanfair DC	80.01	15/11	79.67
Washpit Farm	45.42	07/12	43.27	Killyglen	115.31	30/11	116.02	Morris Dancers	31.89	24/11	32.39
Stonor Park	67.92	01/12	72.70	New Red Lion	17.38	30/11	12.14	Heathlanes	61.87	16/11	61.96
Dial Farm	25.30	18/11	25.45	Ampney Crucis	102.21	01/12	101.17	Nuttalls Farm	129.32	09/11	129.58
Rockley	134.48	01/12	131.63	Newbridge	10.35	29/11	10.02	Bussels No.7a	23.41	30/11	23.63
Little Bucket Farm	62.24	30/11	63.21	Skirwith	130.39	11/11	129.97	Alstonfield	195.91	15/11	186.16
West Woodyates	87.21	30/11	80.90	Yew Tree Farm	14.27	06/10	13.56				

Levels in metres above Ordnance Datum

Groundwater . . . Groundwater



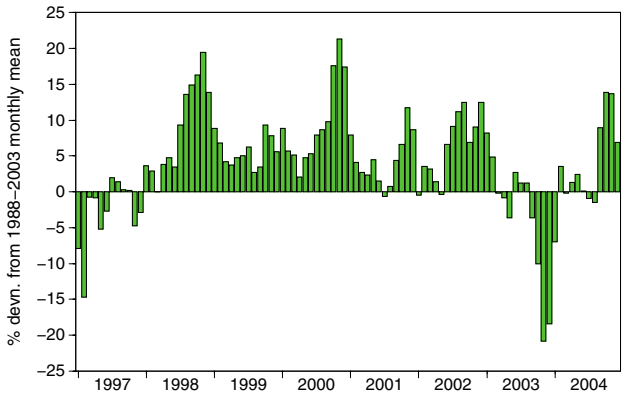
Groundwater levels - November 2004

The rankings are based on a comparison between the average level in the featured month (but often only single readings are available) and 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.

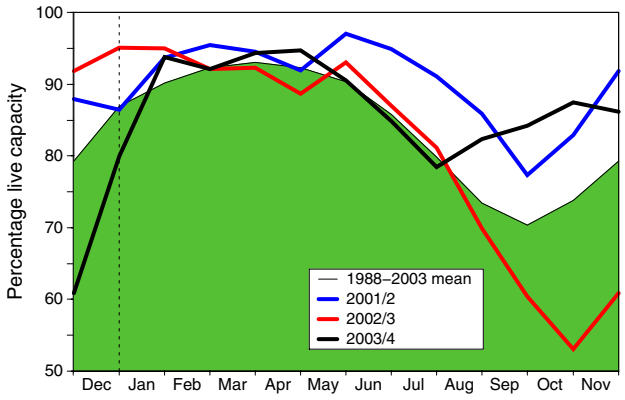
Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.
ii. Yew Tree Farm levels are now received quarterly.

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.

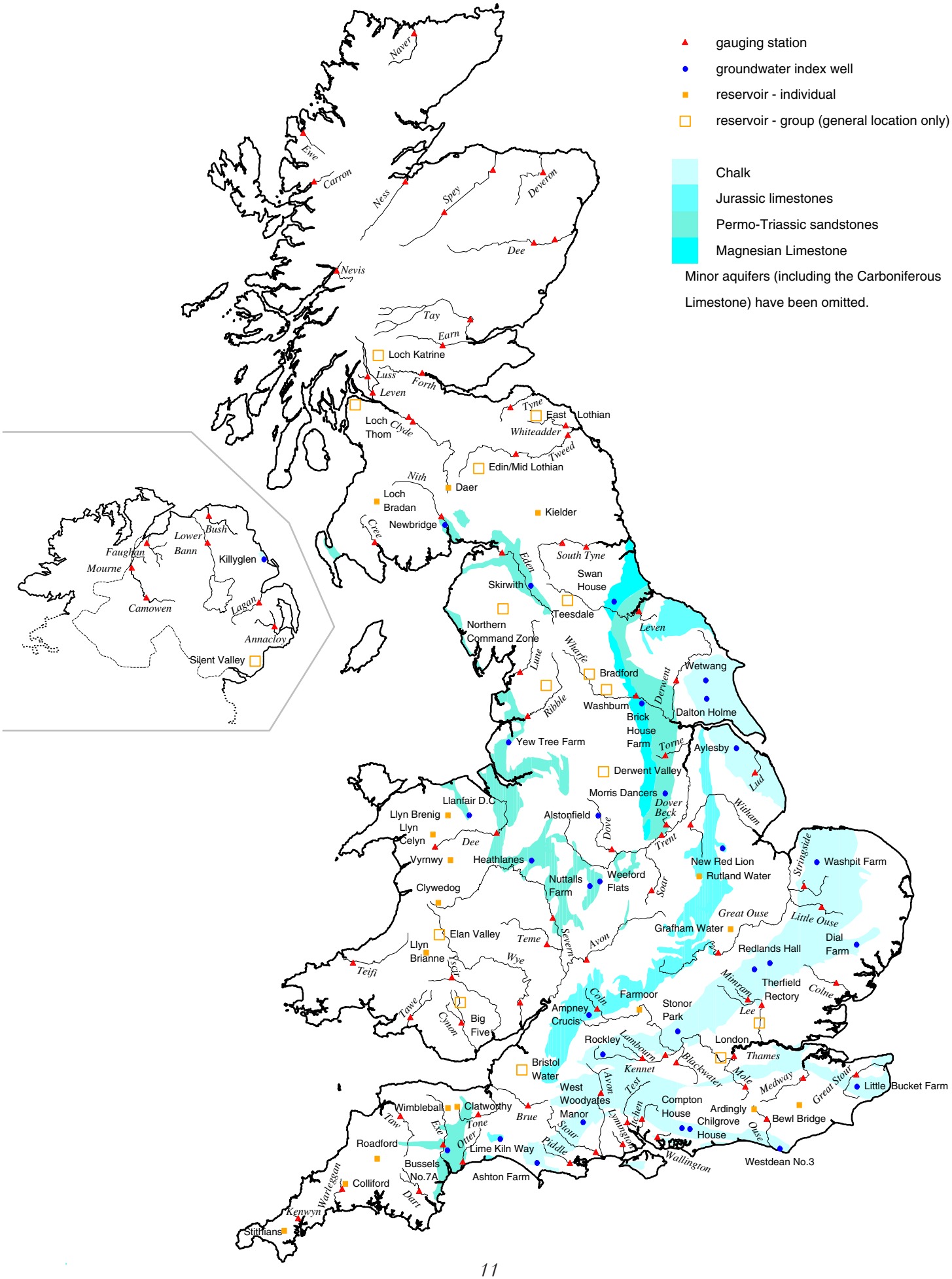
Percentage live capacity of selected reservoirs at start of month

Area	Reservoir	Capacity (Ml)	2004 Aug	Sep	Oct	Nov	Dec	Avg. Dec	Min. Dec	Year* of min.
North West	N Command Zone	• 124929	55	73	86	91	**85**	72	44	1993
	Vyrnwy	55146	68	67	78	94	**85**	78	33	1995
Northumbrian	Teesdale	• 87936	68	97	97	98	**94**	74	39	1995
	Kielder	(199175)	(89)	(94)	(93)	(96)	**(86)**	(85)	(64)	2003
Severn Trent	Clywedog	44922	94	92	80	82	**78**	79	43	1995
	Derwent Valley	• 39525	83	98	93	95	**100**	74	9	1995
Yorkshire	Washburn	• 22035	79	95	85	89	**89**	68	16	1995
	Bradford supply	• 41407	67	90	91	100	**98**	77	20	1995
Anglian	Grafham	(55490)	(84)	(76)	(74)	(78)	**(86)**	(80)	(47)	1997
	Rutland	(116580)	(90)	(87)	(81)	(78)	**(86)**	(79)	(57)	1995
Thames	London	• 202340	84	84	76	81	**83**	79	52	1990
	Farmoor	• 13830	99	98	99	96	**92**	90	52	1990
Southern	Bewl	28170	87	81	74	68	**63**	66	34	1990
	Ardingly	4685	82	71	60	60	**60**	76	23	2003
Wessex	Clatworthy	5364	77	64	56	65	**89**	75	16	2003
	Bristol WW	• (38666)	(75)	(66)	(57)	(56)	**(58)**	(65)	(27)	1990
South West	Colliford	28540	60	55	50	60	**62**	73	42	1995
	Roadford	34500	56	51	55	57	**58**	73	19	1995
	Wimbleball	21320	79	69	63	73	**76**	72	34	1995
	Stithians	5205	68	57	50	60	**61**	64	29	2001
Welsh	Celyn and Brenig	• 131155	83	82	92	97	**95**	84	50	1995
	Brianne	62140	81	85	100	99	**93**	95	72	1995
	Big Five	• 69762	68	71	82	87	**92**	78	49	1990
	Elan Valley	• 99106	79	81	100	100	**99**	92	47	1995
Scotland(E)	Edinburgh/Mid Lothian	• 97639	69	80	94	87	**88**	82	45	2003
	East Lothian	• 10206	97	100	100	100	**100**	84	38	2003
Scotland(W)	Loch Katrine	• 111363	66	74	94	97	**94**	90	66	2003
	Daer	22412	65	90	100	100	**100**	95	73	2003
	Loch Thom	• 11840	93	100	100	100	**100**	92	72	2003
Northern Ireland	Total+	•	62	72	73	85	**88**	81	59	2003
	Silent Valley	• 20634	48	58	64	73	**72**	72	43	2001

() figures in parentheses relate to gross storage • denotes reservoir groups +excludes Lough Neagh *last occurrence - see footnote

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 storage figures relate to the 1988-2004 period only (except for West of Scotland and Northern Ireland where data commence in the mid-1990's). 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 (NHMP) was instigated in 1988 and is undertaken jointly by the Centre for Ecology and Hydrology Wallingford (formerly 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 for Environment, Food and Rural Affairs (Defra), 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 Environment Agency, the Environment Agency Wales, the Scottish Environment Protection Agency and, for Northern Ireland, 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, Scottish Water and the Northern Ireland Water Service.

The National River Flow Archive (maintained by CEH Wallingford) 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 (see 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. Following the discontinuation of the Met Office's CARP system in July 1998, the areal rainfall figures have been derived using several procedures, including initial estimates based on MORECS*. Recent figures have been produced by the Met Office, National Climate Information Centre (NCIC), using a technique similar to CARP. A significant number of additional monthly raingauge totals are provided by the EA and SEPA to help derive the contemporary regional rainfalls. Revised monthly national ans regional rainfall totals for the post-1960 period (together with revised 1961-90 averages) were made available in 2004; these have been adopted by the NHMP. As with all regional figures based on limited raingauge networks the monthly tables and accumulations (and the return periods associated with them) should be regarded as a guide only.

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

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The National Hydrological Monitoring Programme depends on the active cooperation of many data suppliers. This cooperation 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.nerc-wallingford.ac.uk/ih/nrfa/index.htm
Navigate via Water Watch

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