Hydrological Summary
for the United Kingdom

February 2007

General
February was another predominantly mild and wet month – contributing to exceptionally high regional rainfall totals over the last five months. Provisionally, the Oct-Feb period was the wettest on record for the UK (in a series from 1914). Correspondingly, reservoir stocks are close to capacity across almost the entire country. Notwithstanding some further flood alleviation drawdown, overall stocks for England and Wales were the 3rd highest for early March, in a 20-year record; only Colliford (Cornwall) remained appreciably below the early spring average. After seasonally low flows in the first week, many rivers were in spate – across southern Britain especially – with widespread, but mostly modest, floodplain inundations and Flood Watches were common around month-end. Winter (Dec-Feb) catchment runoff totals were notably high over wide areas and the frequent pulses of frontal rainfall generated abundant winter recharge. This fuelled brisk and sustained increases in groundwater levels across most outcrop areas of the major aquifers. The overall water resources outlook, supported by an encouraging Met Office forecast for the spring, is very healthy and in clear contrast with those of the late winter in 2005 and 2006. Nonetheless, the temporal distribution of the spring rainfall will be important, particularly in relation to the onset of the seasonal declines in runoff and recharge.

Rainfall
After a quiet start, synoptic patterns in February were dominated by the passage of vigorous frontal systems, mostly on a south-westerly airflow but several incursions of Arctic air brought significant snowfall – which extended well into southern England on the 9th. The rapid passage of many low pressure systems was reflected in the absence of extreme storm rainfall totals but daily totals of 10-20 mm were very common. Apart from a few, mostly upland, areas February rainfall totals exceeded the monthly average, by a wide margin in southern England where many localities reported >200%. Much of the South East registered its 2nd wettest February in 33 years; rainfall totals were also exceptional in much of eastern Scotland. For the UK as a whole the winter (Dec-Feb) rainfall was the 4th highest in a 93-yr series and all regions substantially exceeded the average. The persistence of a moist, westerly airflow is most evident in the exceptional rainfall accumulations for Scotland: the provisional Oct-Feb total is the highest for *any* 5-month sequence on record. In this timeframe, much of the Highland Region and many western catchments were remarkably wet. For Glasgow, the rainfall total over the Nov-Feb period approached its long-term annual mean. The wet winter ensured that 12-month rainfall accumulations exceed the average in all regions of the UK.

River flows
The continuation of a dry interlude in late January resulted in some notably low river flows in the first week of February (e.g. in the Forth and Wye) but runoff rates increased sharply thereafter. Spate conditions were widespread around the 10th and 14th – when the Mole reported its highest flow for four years. Flood Watches were common around month-end, heralding appreciable floodplain inundation in early March. February runoff totals were within, or above, the normal range for all index rivers across the UK; a relatively rare circumstance. Generally however, the runoff accumulations over 3-6 months are of much greater water resources significance. Winter (Dec-Feb) runoff totals were exceptionally high across northern Britain and much of Wales. For the River Earn, runoff since October exceeds that for *any* 4-month sequence in a 59-yr record and many northern rivers established new Nov-Feb runoff maxima. In this timeframe, outflows from Scotland were, provisionally, the highest in a series from 1961. Winter flow regimes were characterised by sustained high flows but, given the exceptional rainfall and saturated state of most catchments, major flood events were rare. For spring-fed rivers in southern Britain, the brisk post-drought extension in the stream network is continuing but with a significant delay in many eastern catchments. In Dorset and the South Downs many headwater springs are now flowing and, in the Chilterns, the Misbourne was flowing at Gt Missenden for the first time in four years. By contrast, February runoff for the Mimram was still below average (as it was in 41 of the previous 42 months), but late February flows confirm that a recovery is now firmly established.

Groundwater
February rainfall favoured the outcrop areas of the major aquifers, particularly the southern Chalk where many areas reported >170%. With soils remaining close to saturation and only modest evaporative demands, the rainfall translated into February infiltration totals reaching more than three times the monthly average in some localities (e.g. to the south of London); but spatial variability in recharge amounts was substantial. Heavy recharge since last October has sustained strong recoveries in groundwater levels for the great majority of index wells and boreholes; levels in most monitoring sites now exceed the average (commonly for the first time since mid-2003). In the Chalk, February levels at Compton (in the South Downs) were close to the highest in a 114-year record and only in the deepest, slow-responding wells (e.g. Therfield and Stonor), where substantial early 2007 infiltration remains in the unsaturated zone, are levels still below average. February levels in most limestone aquifers were close to, or above, average; a situation replicated in many eastern minor aquifers (e.g. the Essex Gravels and Norfolk Drift). Notable water level rises were reported in the more responsive Permo-Triassic outcrops (e.g. Bussels) but the high storage capacity of many of the outcrops in the Midlands has made for a characteristically sluggish recovery. The groundwater resources outlook provides a stark contrast with the late winter of 2005/06 and, with minimal soil moisture deficits, the prospects for further spring recharge are good.

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

British Geological Survey
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Rainfall . . . Rainfall . . .

Rainfall accumulations and return period estimates

Area	Rainfall	Feb 2007	Dec 06-Feb 07	RP	Oct 06-Feb 07	RP	Aug 06-Feb07	RP	Mar 06-Feb07	RP
England & Wales	**mm**	**101**	**336**		**565**		**730**		**1047**	
	%	**156**	**134**	**5-15**	**132**	**10-20**	**125**	**10-20**	**116**	**5-15**
North West	mm	**83**	468		783		1013		1453	
	%	**105**	145	10-20	136	15-25	126	10-20	119	10-20
Northumbrian	mm	**81**	317		507		685		969	
	%	**136**	141	10-20	130	10-20	125	10-20	112	5-10
Severn Trent	mm	**86**	275		450		607		893	
	%	**156**	134	5-15	132	10-20	128	10-20	116	5-10
Yorkshire	mm	**79**	302		480		682		1005	
	%	**135**	137	5-15	128	5-15	131	10-20	120	10-20
Anglian	mm	**63**	179		311		471		685	
	%	**167**	124	5-10	122	5-10	131	10-20	113	5-10
Thames	mm	**91**	258		456		599		849	
	%	**197**	140	5-15	146	25-40	138	25-40	121	5-15
Southern	mm	**112**	301		529		661		908	
	%	**206**	138	5-15	138	10-20	129	10-20	116	5-10
Wessex	mm	**111**	325		572		690		988	
	%	**168**	129	5-10	137	10-20	124	5-10	116	5-10
South West	mm	**188**	434		747		868		1237	
	%	**185**	114	2-5	119	5-10	107	2-5	104	2-5
Welsh	mm	**150**	560		924		1105		1574	
	%	**149**	140	10-20	135	10-20	122	5-10	117	5-15
Scotland	**mm**	**129**	**633**		**1070**		**1316**		**1823**	
	%	**122**	**152**	**30-60**	**146**	**>100**	**132**	**>100**	**124**	**>100**
Highland	mm	**142**	829		1382		1641		2254	
	%	**112**	165	30-60	155	>100	138	>100	130	>100
North East	mm	**106**	319		610		778		1105	
	%	**153**	118	2-5	128	10-20	118	5-10	107	2-5
Tay	mm	**149**	585		951		1181		1610	
	%	**151**	154	30-50	148	60-90	137	30-50	125	30-40
Forth	mm	**106**	472		744		965		1363	
	%	**130**	150	30-50	135	25-40	127	15-25	119	10-20
Tweed	mm	**86**	367		609		827		1147	
	%	**123**	137	10-20	132	10-20	128	15-25	114	5-10
Solway	mm	**122**	558		994		1254		1776	
	%	**120**	138	10-20	141	30-50	129	20-30	124	25-40
Clyde	mm	**139**	758		1284		1612		2215	
	%	**113**	152	40-60	146	>100	134	40-60	126	50-80
Northern Ireland	**mm**	**192**	**365**		**622**		**850**		**1283**	
	%	**114**	**119**	**2-5**	**118**	**5-10**	**117**	**5-10**	**117**	**5-15**

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

Important note: Figures in the above table may be quoted provided that their source is acknowledged. See page 12. Where appropriate, specific reference must be made to the uncertainties associated with the return period estimates. Generally, the return period estimates are based on tables provided by the Met Office* but those for Northern Ireland are based on the estimates for north-west England. The estimates relate to the specified region and span of months only (RPs may be an order of magnitude less if n-month periods beginning in any month are considered), they reflect rainfall variability over the period 1911-70 only, and assume a stable climate. (For further details see Tabony, R. C., 1977, *The variability of long duration rainfall over Great Britain*, Scientific Paper No. 37). The timespans featured do not purport to represent the critical periods for any particular water resource management zone and, normally, for hydrological or water resources assessments of drought severity, river flows and groundwater levels provide a better guide than return periods based on rainfall totals. *In some cases ranking positions of accumulated rainfalls are considered.

All monthly rainfall totals since October 2006 are provisional.

Rainfall . . . Rainfall . . .

Key

00% Percentage of 1961-90 average

Very wet

Substantially above average

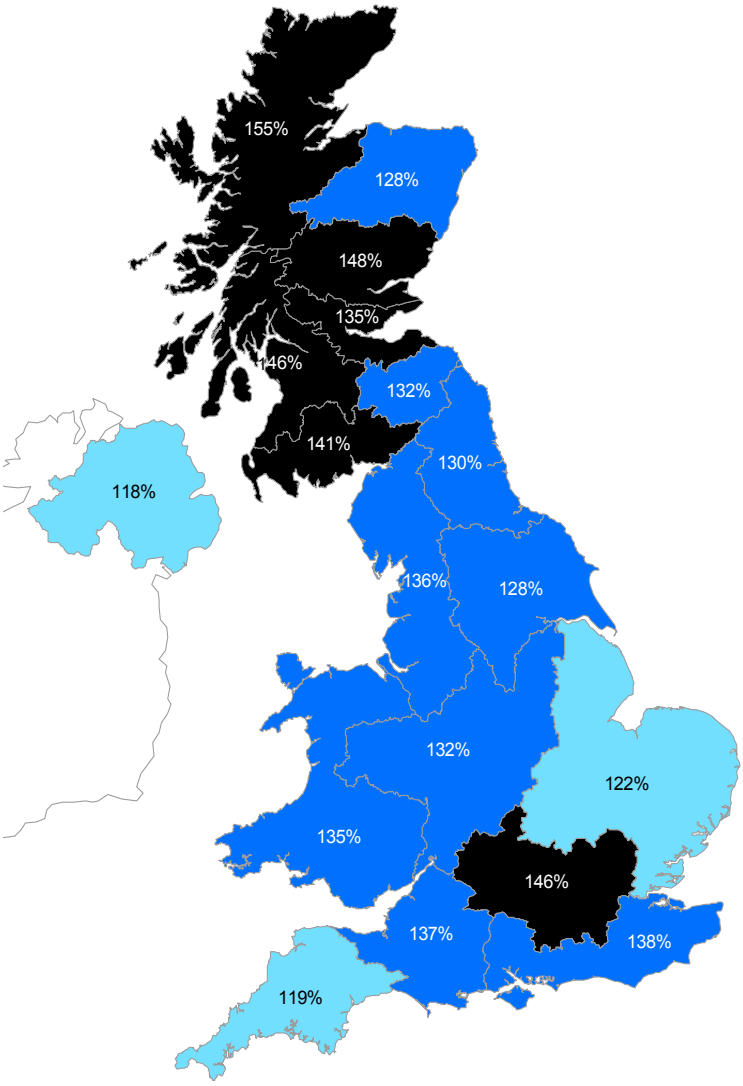
Above average

Normal range

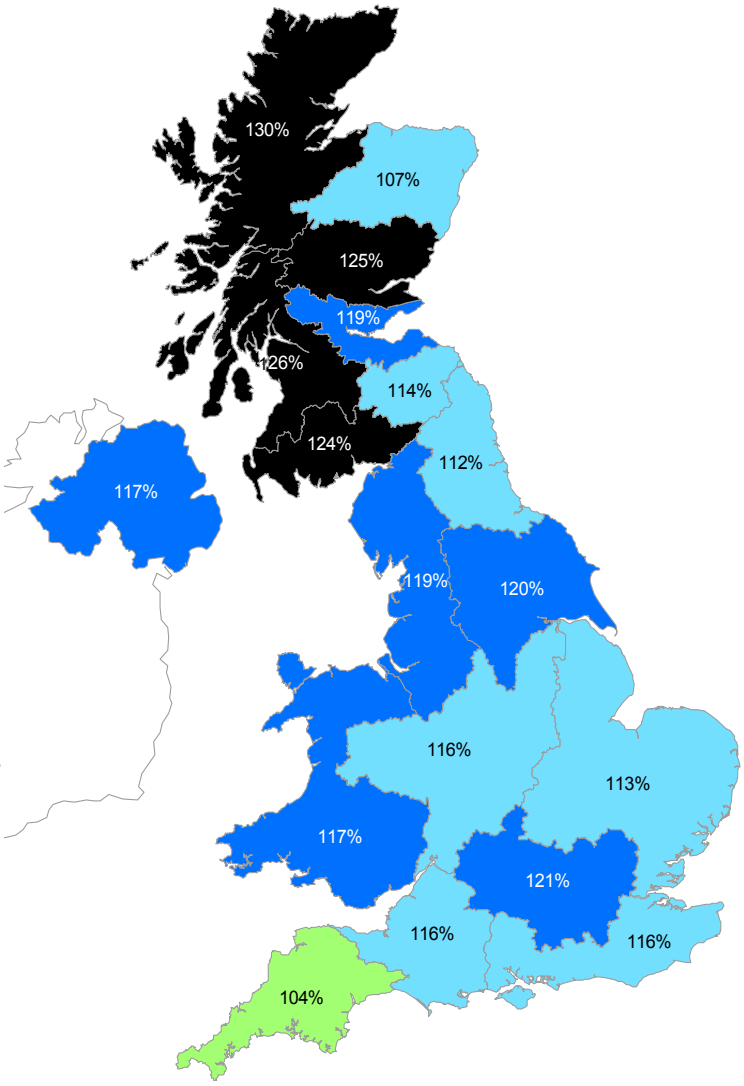
Below average

Substantially below average

Exceptionally low rainfall



October 2006 - February 2007

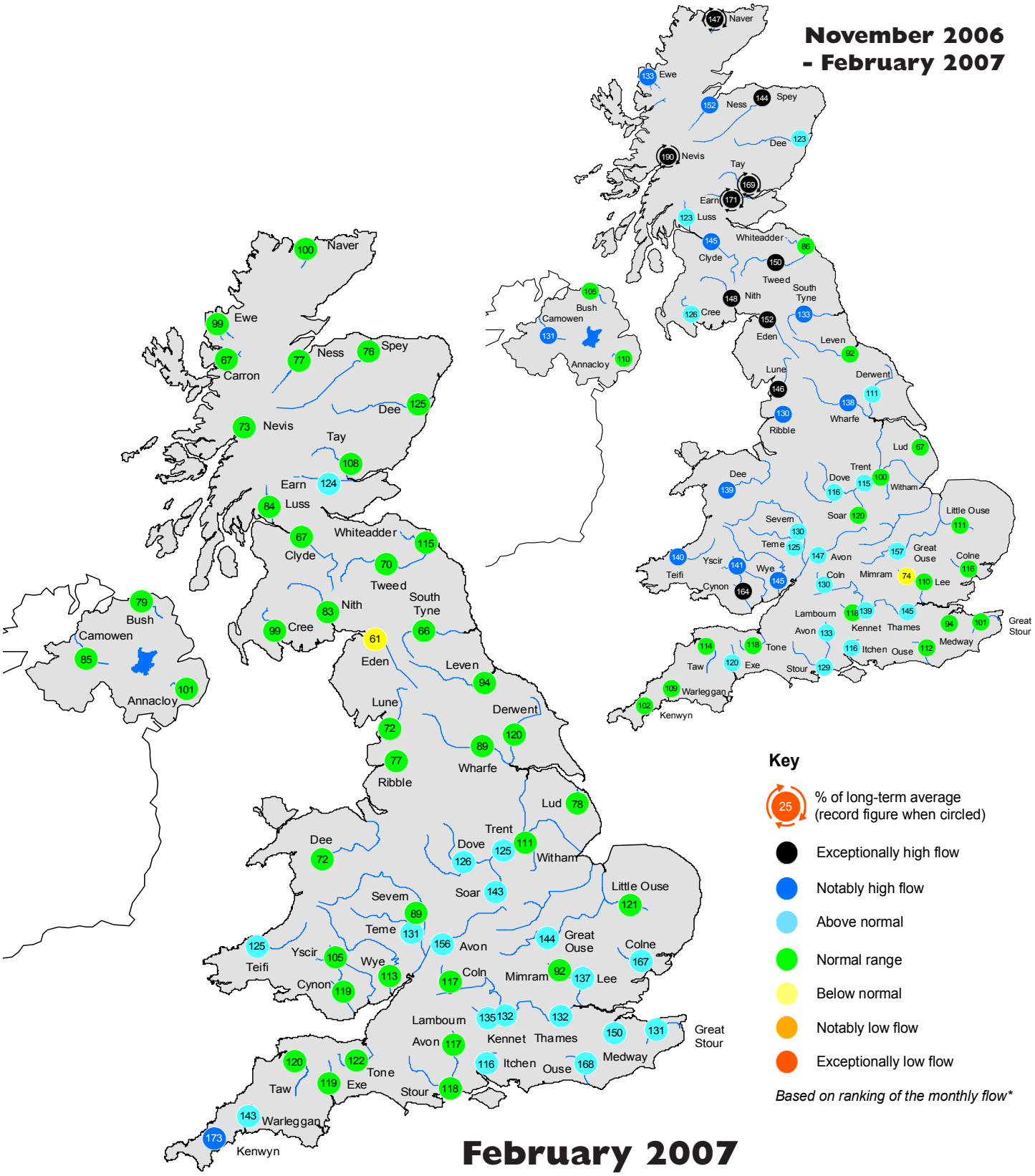


March 2006 - February 2007

Rainfall accumulation map

Accumulated rainfall totals since September 2006 are well above average for all regions of the UK. For the Highland Region the Oct-Feb precipitation is without recorded precedent and the Thames region ranks 5th wettest in the last 70 years. Rainfall totals over the 12-month timespan include (for southern Britain) the final phase of the 2004-06 drought; nonetheless all regional totals exceed the average and the UK reported its highest Mar-Feb rainfall since 1928.

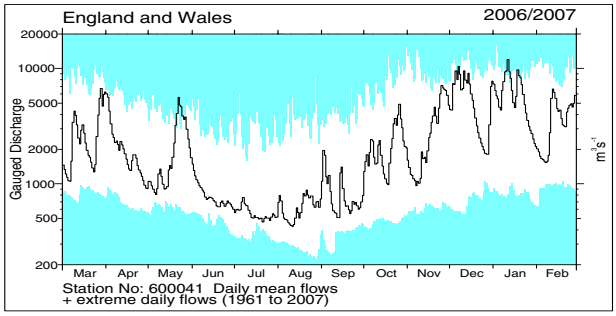
River flow . . . River flow . . .

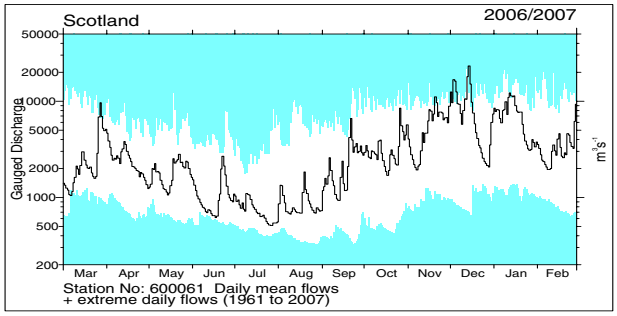


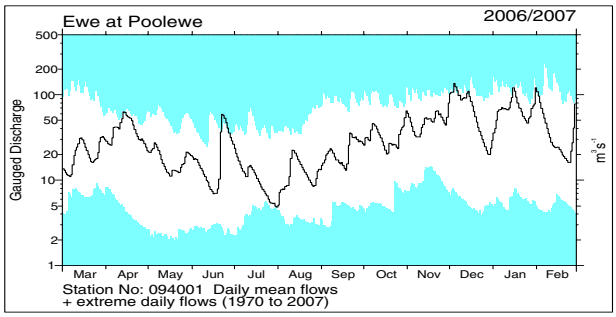
River flows

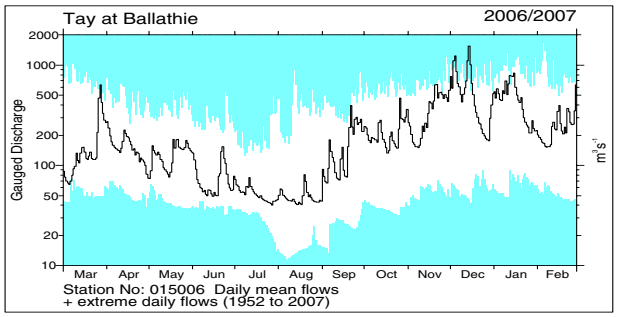
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

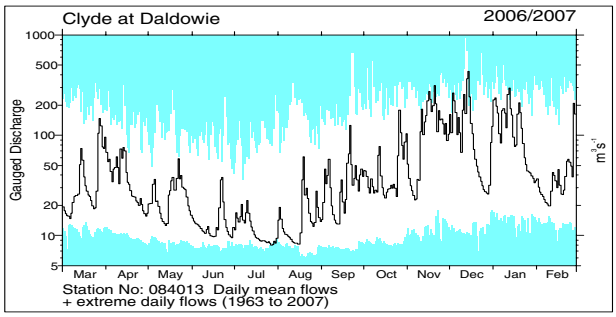
River flow . . . River flow . . .

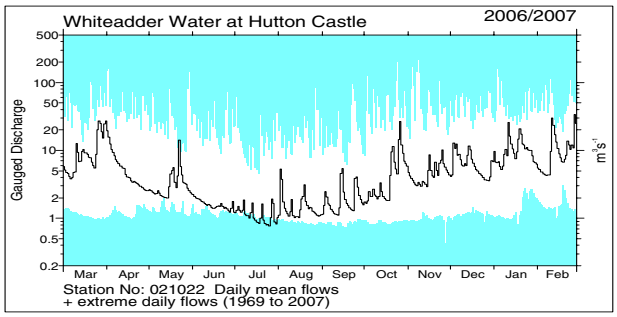


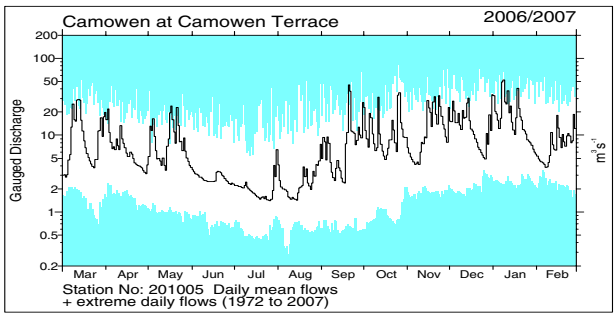


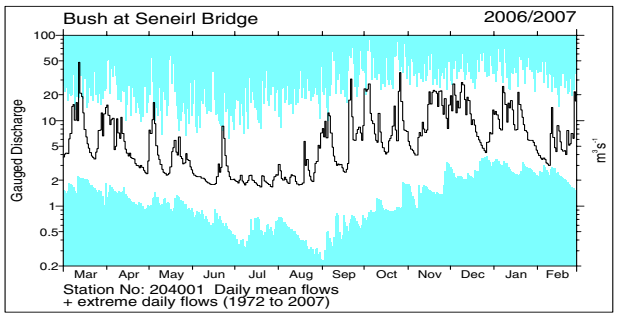


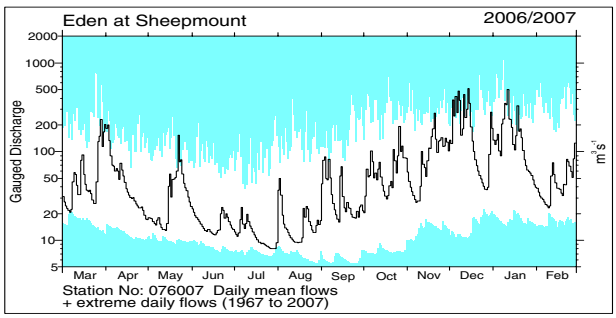


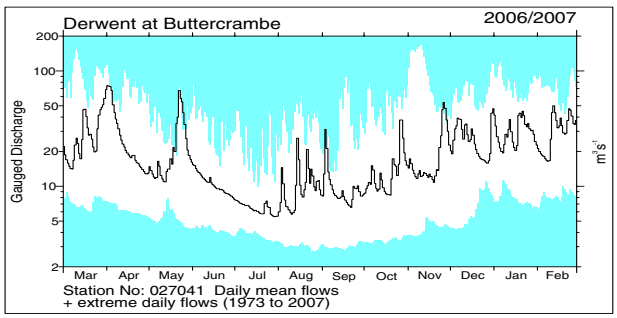








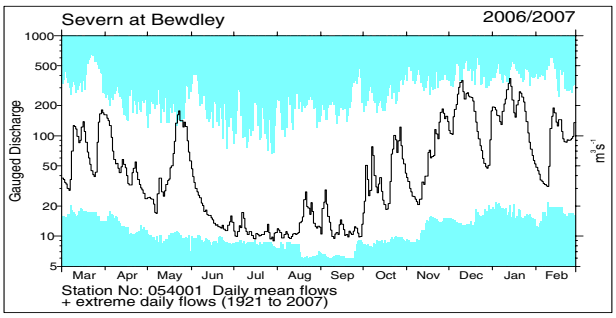


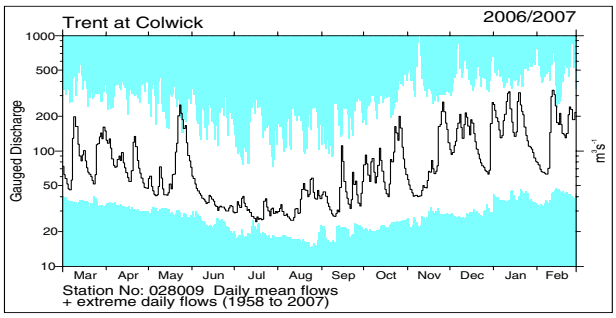


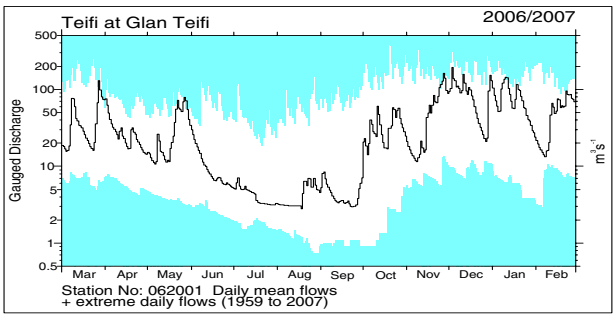
River flow hydrographs

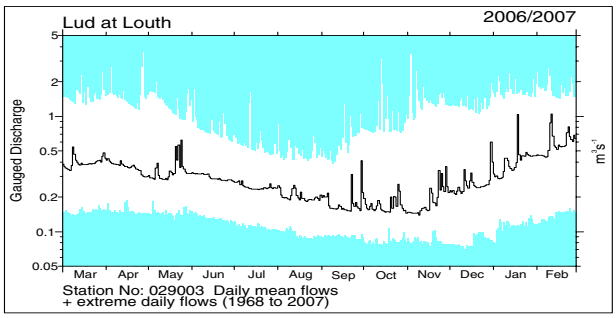
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to March 2006 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

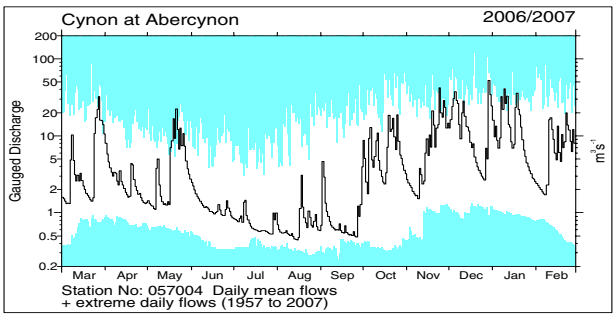
River flow . . . River flow . . .

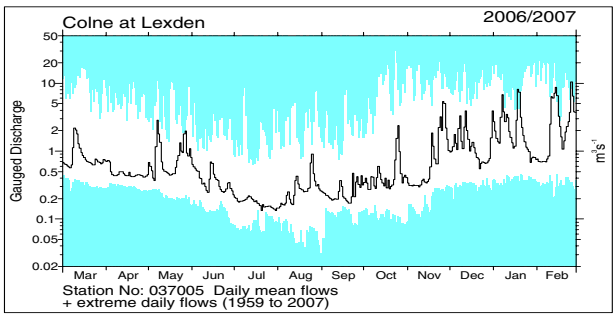


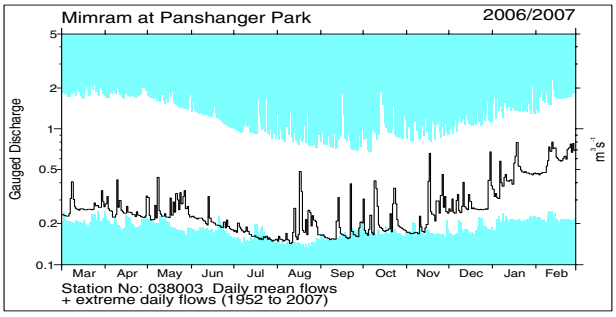


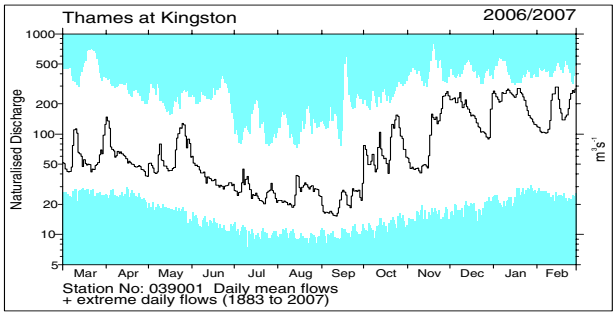


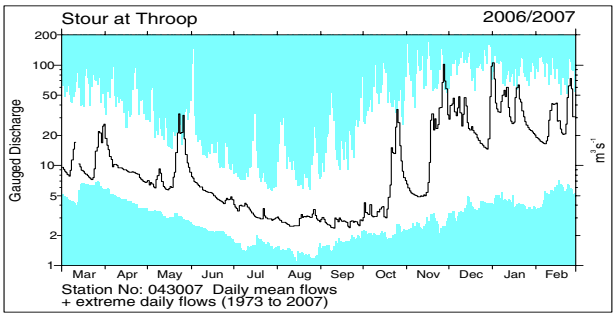


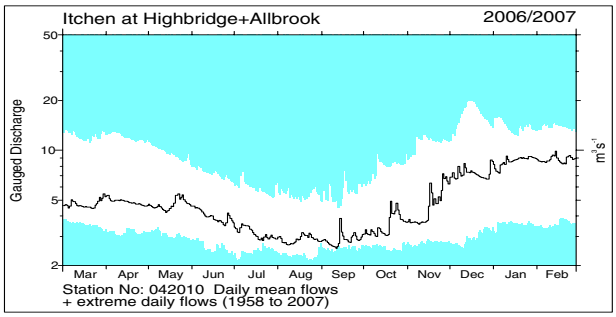










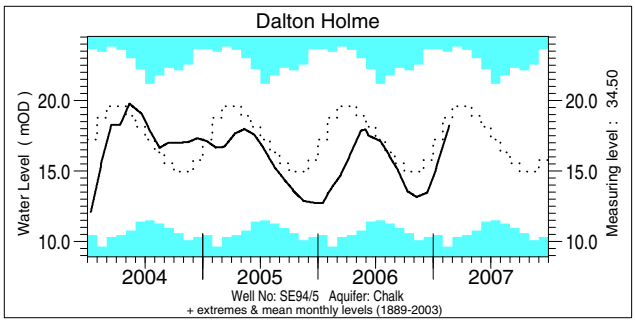


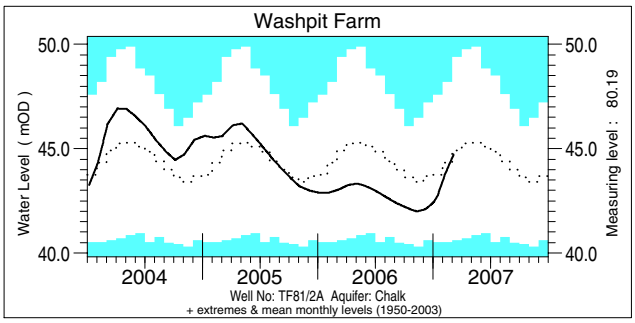
Notable runoff accumulations (a) November 2006 - February 2007, (b) March 2006 - February 2007

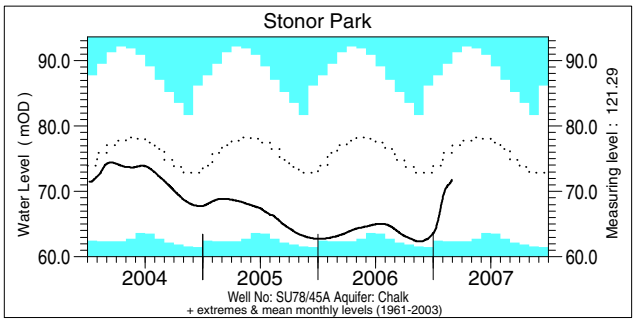
	River	%lta	Rank	River	%lta	Rank		River	%lta	Rank
a)	Ness	152	33/34	Tawe	152	47/48	b)	Mimram	53	5/53
	Spey (Boat o'Brig)	144	54/55	Lune	146	44/45		Lambourn	75	7/44
	Tay	169	55/55	Eden	152	39/40		Yscir	125	30/34
	Earn	171	59/59	Nith	148	49/50		Dee(Manley Hall)	133	66/69
	Forth	147	25/26	Nevis	190	25/25		Leven (Linnbrane)	132	42/42
	Tweed (Boleside)	150	45/46	Naver	147	30/30		Camowen	136	33/33
	Dart	144	48/49	Mourne	122	23/25				
	Cynon	164	48/49							

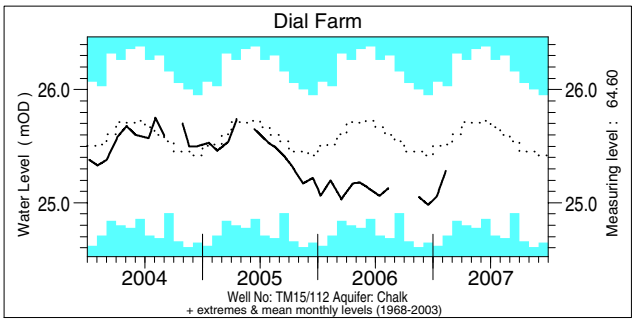
lta = long term average
Rank 1 = lowest on record

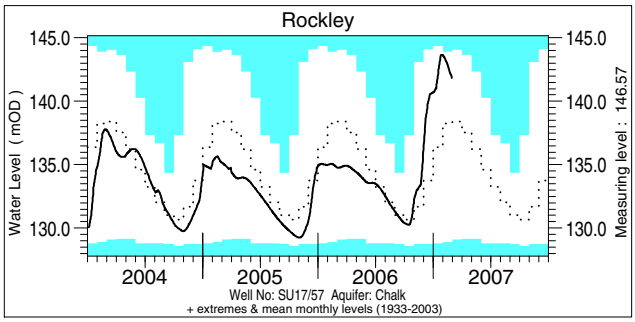
Groundwater . . . Groundwater

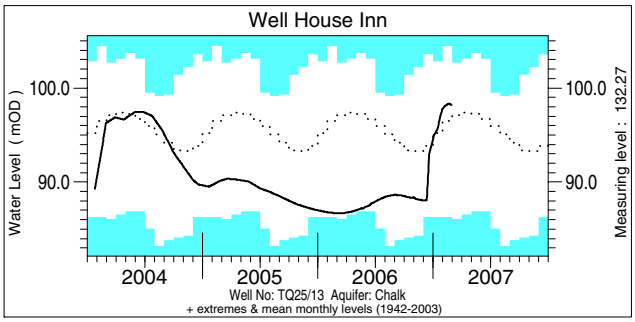


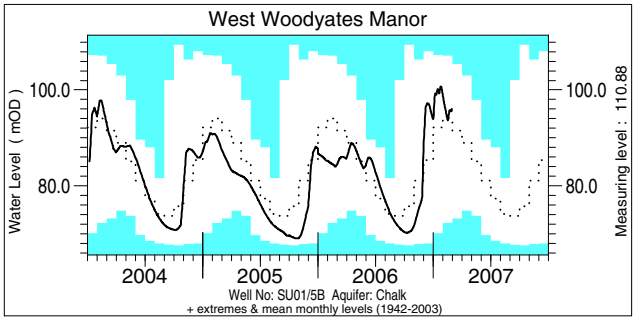


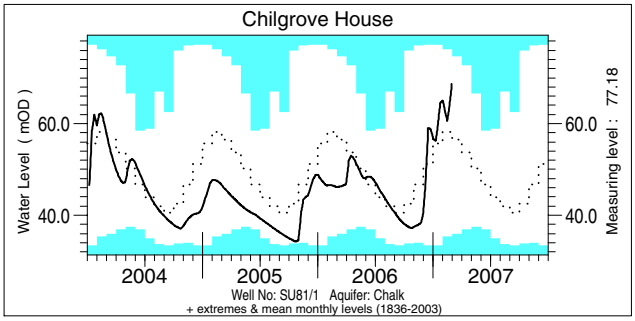


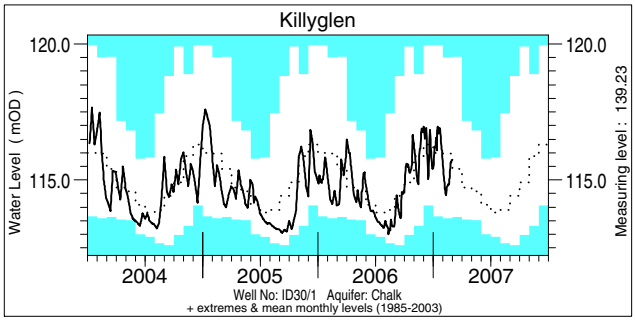


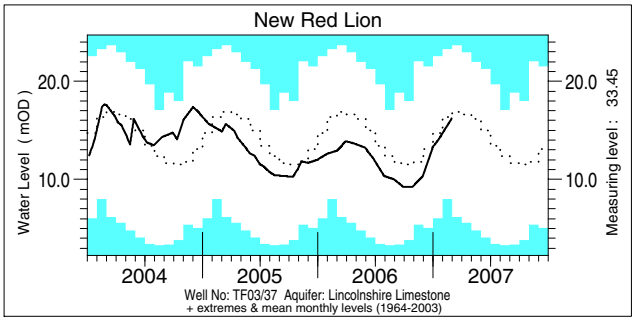






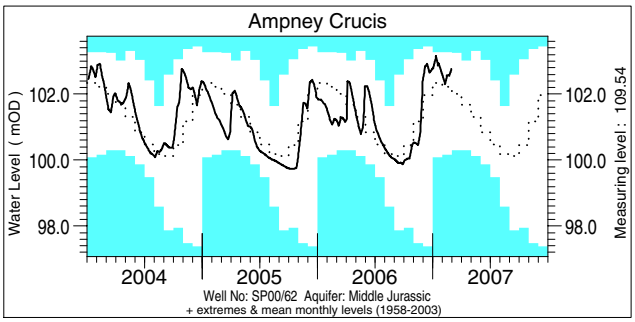


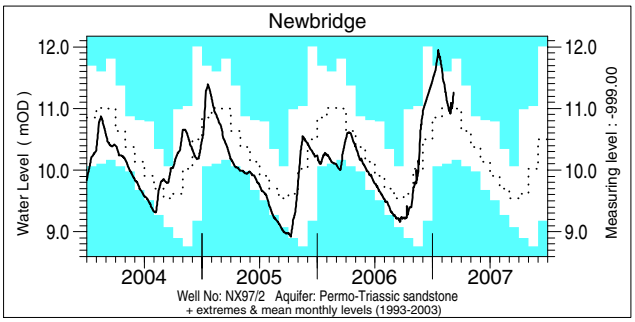


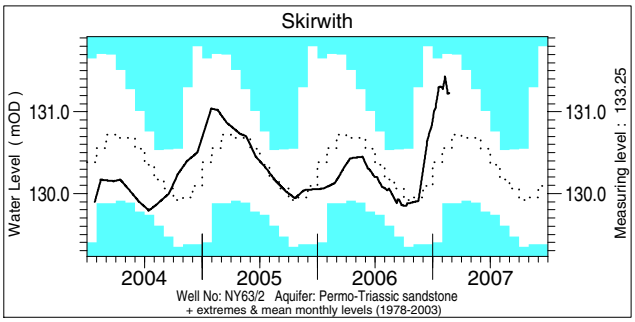


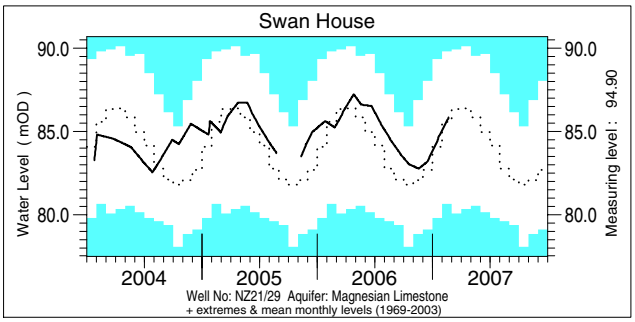
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined below overlying impermeable strata. The monthly mean and the highest and lowest levels recorded for each month 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.

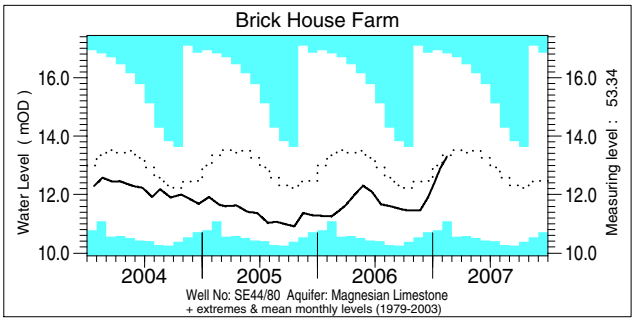
Groundwater . . . Groundwater

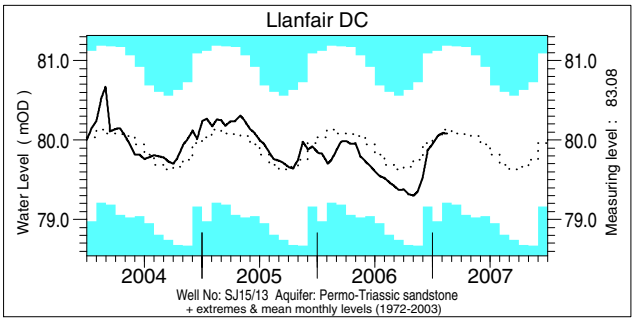


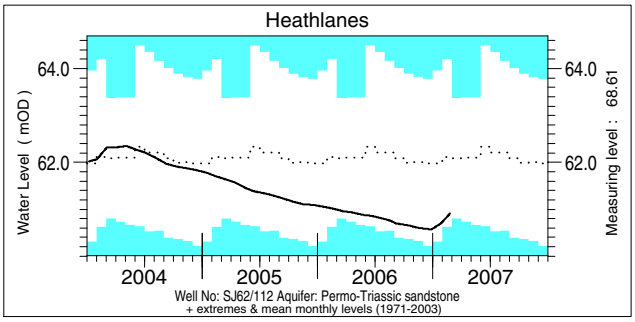


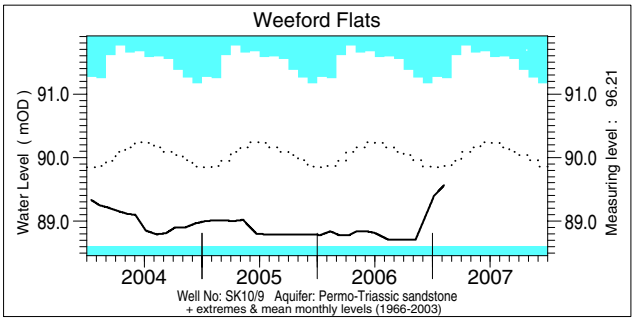


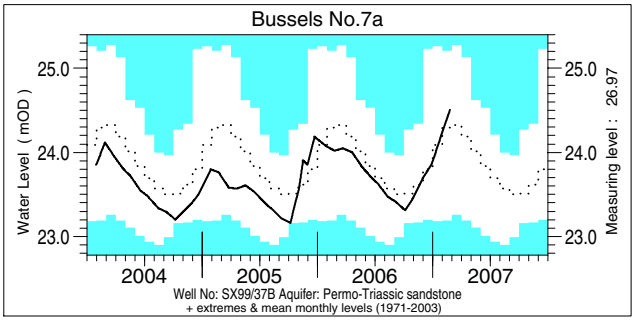


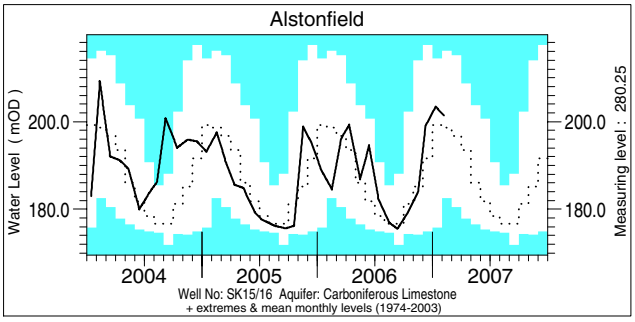










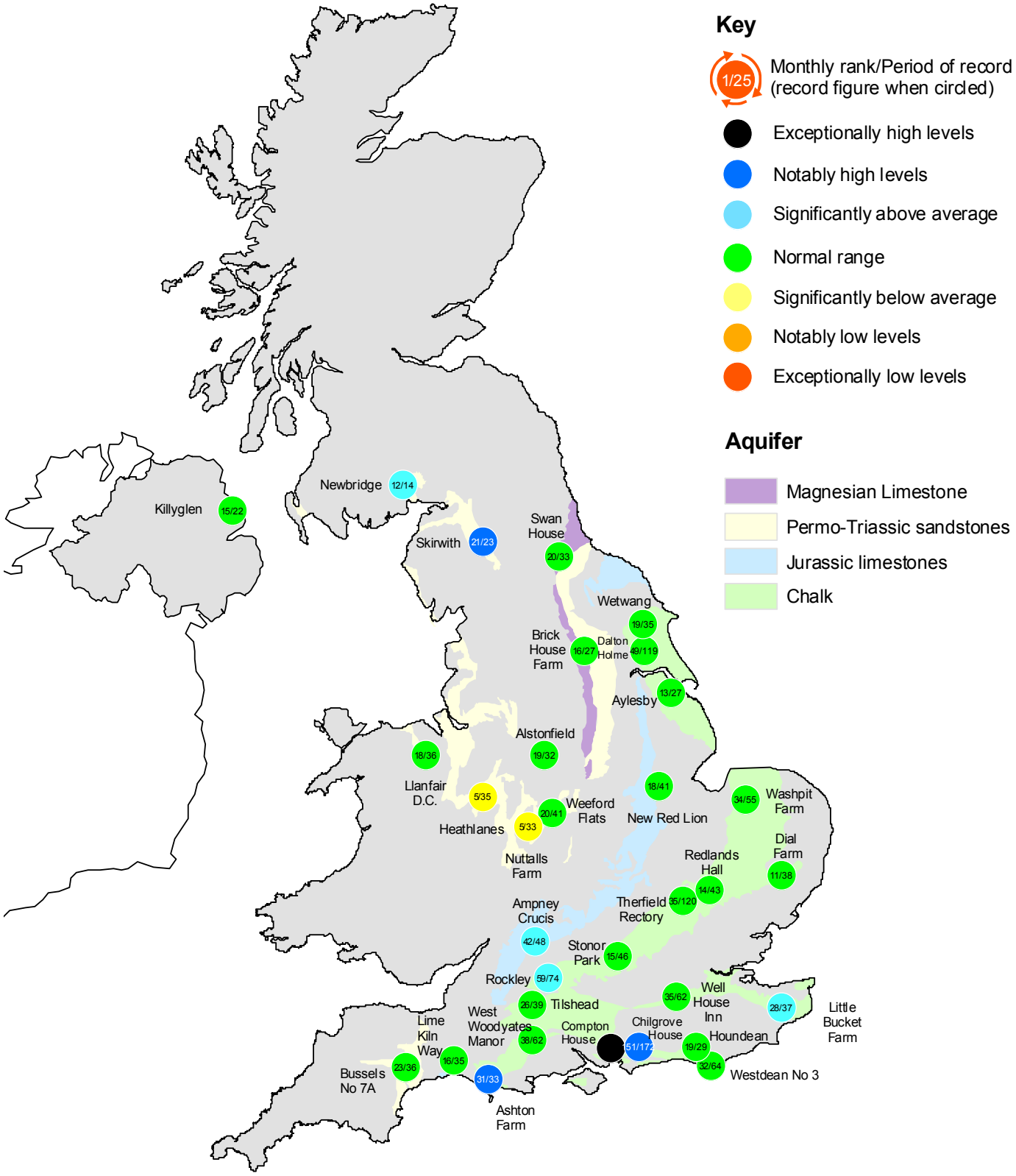


Groundwater levels February / March 2007

Borehole	Level	Date	Feb. av.	Borehole	Level	Date	Feb. av.	Borehole	Level	Date	Feb. av.
Dalton Holme	18.21	19/02	18.66	Chilgrove House	68.63	28/02	57.52	Brick House Farm	13.31	14/02	13.17
Washpit Farm	44.72	06/03	44.39	Killyglen	115.74	27/02	115.64	Llanfair DC	80.08	15/02	80.05
Stonor Park	71.75	28/02	75.51	New Red Lion	16.25	28/02	16.41	Heathlanes	60.91	23/02	62.01
Dial Farm	25.28	09/02	25.50	Ampney Crucis	102.77	28/02	102.20	Weeford Flats	89.56	05/02	89.67
Rockley	141.86	28/02	138.23	Newbridge	11.26	08/03	10.92	Bussels No.7a	24.51	23/02	24.30
Well House Inn	98.18	28/02	96.22	Skirwith	131.23	22/02	130.60	Alstonfield	201.33	05/02	198.56
West Woodyates	96.09	28/02	93.10	Swan House	85.85	20/02	85.45				

Levels in metres above Ordnance Datum

Groundwater . . .Groundwater



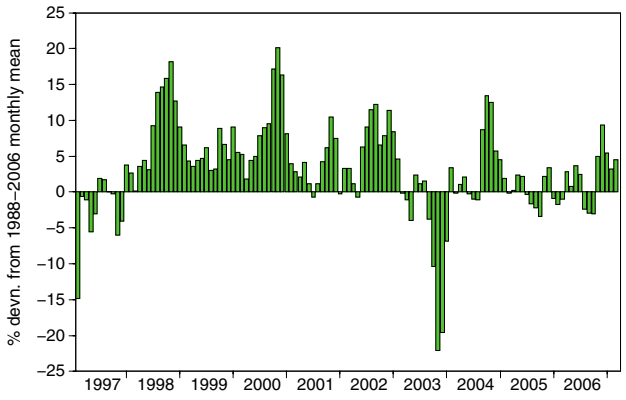
Groundwater levels - February 2007

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.

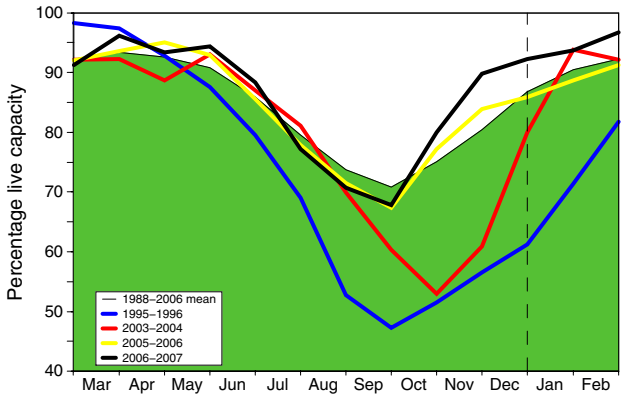
Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.
ii. Yew Tree Farm levels are now received quarterly.
iii. Data for Nuttalls Farm are currently under review.

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.

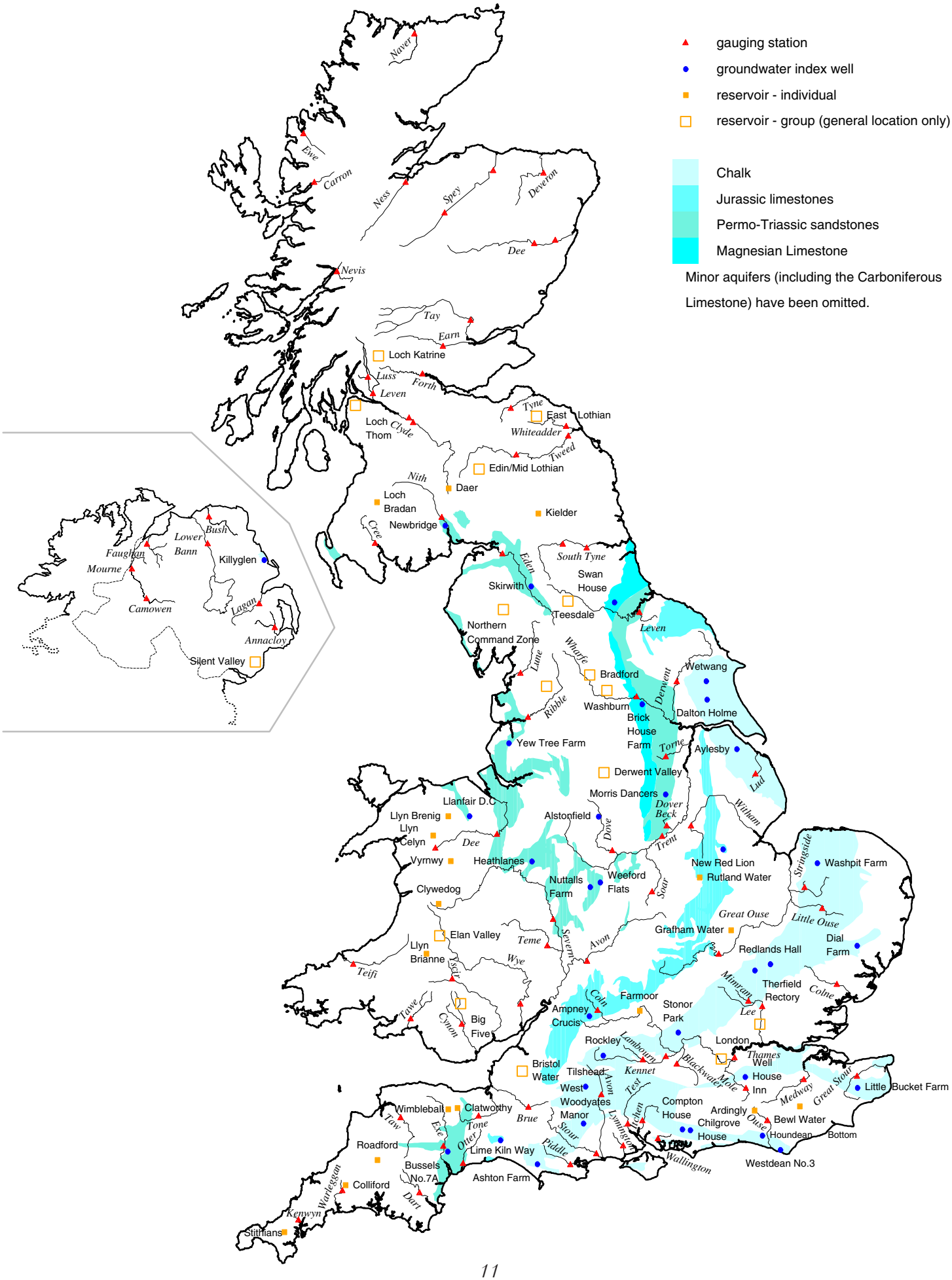
Percentage live capacity of selected reservoirs at start of month

Area	Reservoir	Capacity (Ml)	2007 Jan	Feb	Mar	Mar Anom.	Min. Mar	Year* of min.	2006 **Mar**	Diff **07-06**
North West	N Command Zone	• 124929	99	96	**98**	5	78	1996	90	8
	Vyrnwy	55146	99	93	**100**	6	59	1996	90	10
Northumbrian	Teesdale	• 87936	89	86	**97**	6	72	1996	100	-3
	Kielder	(199175)	(92)	(91)	**(94)**	1	(81)	1993	(92)	2
Severn Trent	Clywedog	44922	83	90	**96**	6	77	1996	88	8
	Derwent Valley	• 39525	87	100	**100**	5	46	1996	98	2
Yorkshire	Washburn	• 22035	96	96	**98**	6	53	1996	89	9
	Bradford supply	• 41407	100	98	**100**	6	53	1996	83	17
Anglian	Grafham	(55490)	(93)	(93)	**(95)**	8	(72)	1997	(89)	6
	Rutland	(116580)	(88)	(94)	**(96)**	8	(71)	1992	(83)	13
Thames	London	• 202406	92	95	**96**	4	83	1988	98	-2
	Farmoor	• 13822	100	95	**97**	4	64	1991	99	-2
Southern	Bewl	28170	83	100	**100**	16	50	2006	50	50
	Ardingly	4685	100	100	**100**	3	77	2006	77	23
Wessex	Clatworthy	5364	100	100	**100**	3	82	1992	100	0
	Bristol WW	• (38666)	(87)	(97)	**(98)**	7	(65)	1992	(81)	17
South West	Colliford	28540	53	61	**75**	-9	57	1997	62	13
	Roadford	34500	70	78	**88**	6	35	1996	71	17
	Wimbleball	21320	84	100	**100**	6	72	1996	95	5
	Stithians	5205	67	85	**100**	8	45	1992	88	12
Welsh	Celyn and Brenig	• 131155	98	98	**100**	3	69	1996	98	2
	Brianne	62140	100	97	**97**	-1	92	2004	95	2
	Big Five	• 69762	96	97	**99**	4	85	1988	97	2
	Elan Valley	• 99106	100	97	**100**	2	88	1993	98	2
Scotland(E)	Edinburgh/Mid Lothian	• 97639	100	100	**100**	6	73	1999	94	6
	East Lothian	• 10206	93	100	**100**	1	91	1990	99	1
Scotland(W)	Loch Katrine	• 111363	100	94	**100**	5	86	2005	95	5
	Daer	22412	98	98	**98**	-1	94	2004	99	-1
	Loch Thom	• 11840	97	94	**98**	-1	90	2004	100	-2
Northern Ireland	Total+	• 67270	90	89	**90**	2	81	2004	88	2
	Silent Valley	• 20634	93	91	**97**	15	57	2002	90	7

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

Details of the individual reservoirs in each of the groupings listed above are available on request. The percentages given in the Average and Minimum storage columns relate to the 1988-2006 period 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 and regional rainfall totals for the post-1960 period (together with revised 1961-90 averages) were made available by the Met Office 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.

NATURAL ENVIRONMENT RESEARCH COUNCIL

The monthly rainfall figures are provided by the Met Office (National Climate Information Centre) and are Crown Copyright and may not be passed on to, or published by, any unauthorised person or organisation.

*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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03/07