Hydrological Summary
for the United Kingdom

June 2004

General

June was a month of contrasting weather patterns: a very warm and dry spell brought an arid complexion to the landscape and generated some local concern for the water resources outlook (e.g. in parts of Northern Ireland); subsequently, much more unsettled weather conditions predominated with some significant and damaging storms; these autumnal conditions extended into July. Nationally, the June rainfall total was near-average but spatial variations were large; parts of the English Lowlands were again relatively dry. Reservoir stocks declined briskly through early June and a few impoundments were seasonally low at month end (e.g. Roadford and Silent Valley), but overall stocks for England and Wales were within 1% of the long term average entering July. River flows exhibited a substantial range – with some notably high and notably low summer flows reported - but June runoff totals were mostly typical of the early summer, albeit generally below average. Groundwater level recessions are generally tracking below the seasonal average but – with a few local exceptions - well above drought minima. Medium and longer term rainfall deficiencies remain significant but the water resources outlook for the summer is generally good.

Rainfall

The unsettled weather of late May continued into June with significant rainfall in northern Britain (Tain Range - Highland region- reported 38mm on the 11th) but rainfall amounts were very modest in the South and, with high pressure dominating, some localities (e.g. in south Oxfordshire) reported < 1mm of rainfall up to the 19th. The resulting stress for farmers, growers and gardeners was relieved locally by thunderstorms (e.g. Leconfield reported 23 mm on the 8th) and, more generally, on the 22/23rd when an unusually vigorous summer depression generated rainfall of 15-25mm across much of the UK – triggering local flooding and landslides (e.g. in Cornwall); Lough Fea (NI) reported 45mm and Buxton 46mm on the following day. The showery nature of much of the rainfall makes for imprecise areal assessments but a notable north-south contrast in June totals is clearly evident. A few localities near the Moray coast reached 300% of average and above average rainfall was particularly welcome in Northern Ireland. Much of the English Lowlands, however, reported <50% with several coastal pockets being extremely dry (e.g. Portsmouth, Southend). In some regions this arid interlude appreciably increased medium term rainfall deficiencies. The February-June period was the 2nd driest in the last 20 years in parts of the South-West, and, for a few southern catchments (e.g. in the Thames basin), above average rainfall has been registered in only 3 or 4 of the last 17 months.

River Flow

Exceptionally dry soil conditions greatly limited the effectiveness of the early June rainfall and flows in most rivers exhibited steep recessions – a new minimum June flow was recorded for the Ribble (on the 15th) and a number of flow augmentation schemes were activated (e.g. in south Wessex). By contrast, some localised - mostly urban - flooding was reported and more notable flow recoveries characterised the final week of the month. The River Whiteadder eclipsed its previous maximum June flow on the 24th having closely approached its minimum in the second week. South of the Moray Firth, a 48-hr rainfall total of 80.4mm (at Torwinny) triggered serious flooding in Elgin and Rothes on the 23/24th - precautionary evacuations were organised and the main Inverness-Aberdeen railway was closed. The Isla at Grange reported its 3rd highest level in a 44-yr record. Grampian Region suffered flash flooding as 14mm of rain fell in 30 minutes at Kinloss (a 1-hr total of 16mm was recorded three days later). June runoff totals showed very wide regional and more local variations. In northern Scotland, the River Naver registered its highest June runoff in a 27-yr record whilst notably low runoff characterised much of south-western Britain; in South Wales, the River Tawe reported its lowest June runoff since 1975. In the English Lowlands, geological control on flows rates was very evident; flows in many Chalk catchments were near-average whilst neighbouring streams draining impermeable catchments reported <35% of the June average. Most June runoff totals were in the 50-85% range, but generally well above drought minima.

Groundwater

Soil moisture deficits increased rapidly in the first half of June and, notwithstanding the unsettled final week, end-of-month values remained considerably above average in southern Britain. Consequently, little or no infiltration occurred in the major aquifer outcrop areas. After modest late spring infiltration moderated the seasonal decline in the more responsive aquifers, groundwater level recessions re-established themselves in June. By month-end levels were in decline in all but the slowest-responding aquifer units. June levels in the Chalk show significant regional differences but, Killyglen apart, most index well levels remain within the normal early summer range. A similar generalisation applies to the major limestone and Permo-Triassic sandstones outcrops, but levels in the latter are relatively depressed in the Midlands (e.g. at Weeford Flats) and in the most northerly outcrops. Levels remain a little above average in the minor aquifers of eastern England. In the absence of an exceptionally dry late summer and early autumn (as occurred last year), a normal recession pattern is expected to continue.

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Rainfall . . . Rainfall . . .

Rainfall accumulations and return period estimates

Area	Rainfall	Jun 2004	May 04-Jun 04	RP	Feb 04-Jun 04	RP	Aug 03-Jun 04	RP	Feb 03-Jun 04	RP
England & Wales	**mm**	**57**	**105**		**294**		**760**		**1089**	
	%	**88**	**80**	**2-5**	**89**	**2-5**	**89**	**2-5**	**88**	**5-10**
North West	mm	92	138		363		964		1436	
	%	113	88	2-5	90	2-5	85	5-10	89	5-10
Northumbrian	mm	88	118		301		707		1008	
	%	142	94	2-5	96	2-5	88	2-5	85	5-15
Severn Trent	mm	51	93		265		608		916	
	%	86	78	2-5	91	2-5	85	5-10	86	5-10
Yorkshire	mm	73	106		302		683		1011	
	%	118	87	2-5	98	2-5	88	2-5	88	5-10
Anglian	mm	45	87		222		510		748	
	%	86	87	2-5	96	2-5	92	2-5	90	5-10
Thames	mm	35	87		241		585		814	
	%	64	78	2-5	91	2-5	90	2-5	84	5-15
Southern	mm	32	82		225		675		915	
	%	58	76	2-5	81	2-5	92	2-5	86	5-10
Wessex	mm	42	82		260		691		1005	
	%	73	69	2-5	84	2-5	86	2-5	86	5-10
South West	mm	65	109		332		895		1342	
	%	93	76	2-5	80	5-10	80	5-15	83	5-15
Welsh	mm	66	130		401		1046		1564	
	%	81	79	2-5	88	2-5	83	5-10	87	5-10
Scotland	**mm**	**128**	**190**		**515**		**1261**		**1760**	
	%	**149**	**110**	**2-5**	**106**	**2-5**	**92**	**5-10**	**90**	**5-10**
Highland	mm	154	230		656		1579		2157	
	%	155	119	2-5	115	5-10	97	2-5	93	2-5
North East	mm	119	159		401		882		1187	
	%	172	112	2-5	111	2-5	93	2-5	85	10-20
Tay	mm	117	185		442		982		1437	
	%	153	114	2-5	100	<2	81	5-15	83	10-20
Forth	mm	119	173		401		907		1318	
	%	165	117	2-5	103	2-5	85	5-10	86	5-15
Tweed	mm	105	145		365		827		1172	
	%	155	103	2-5	103	2-5	89	2-5	86	5-15
Solway	mm	101	141		461		1167		1699	
	%	119	82	2-5	98	2-5	87	5-10	89	5-10
Clyde	mm	140	213		554		1490		2106	
	%	144	110	2-5	99	2-5	91	2-5	91	5-10
Northern Ireland	**mm**	**105**	**153**		**361**		**846**		**1322**	
	%	**144**	**105**	**2-5**	**94**	**2-5**	**82**	**5-15**	**89**	**5-10**

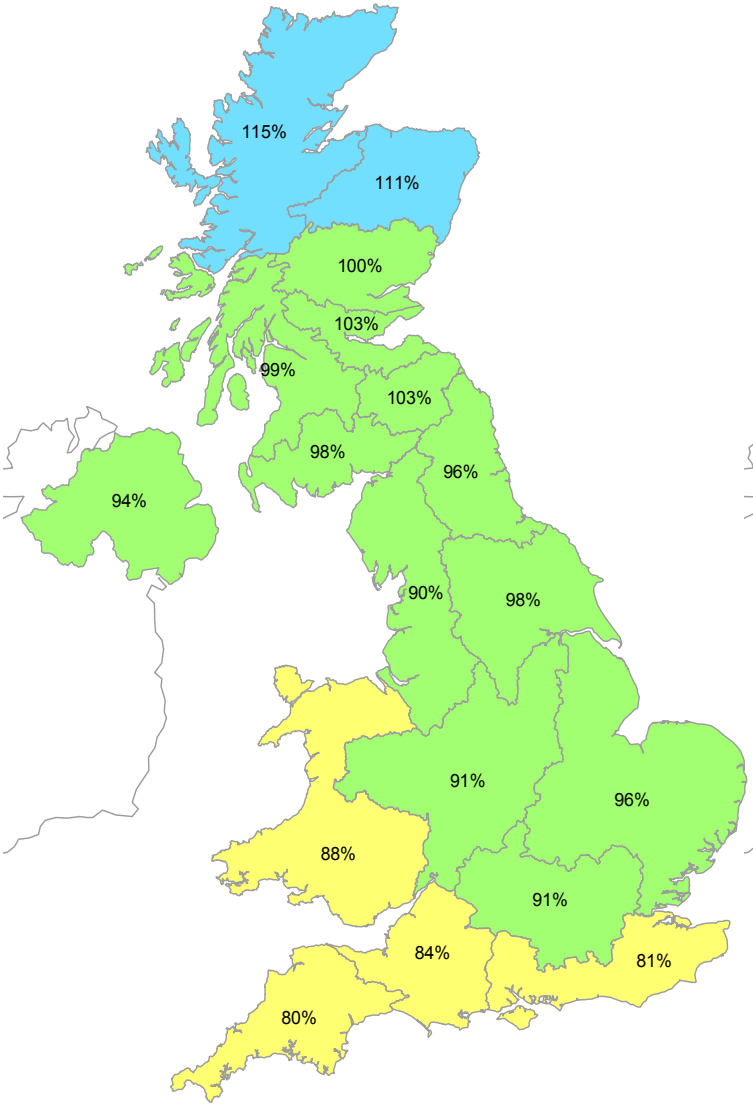
RP = Return period

The monthly rainfall figures* are copyright of The Met Office and may not be passed on to, or published by, any unauthorised person or organisation. **All monthly totals since January 2004 are provisional (see page 12).** Revised Met Office totals for 1961-2003 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.

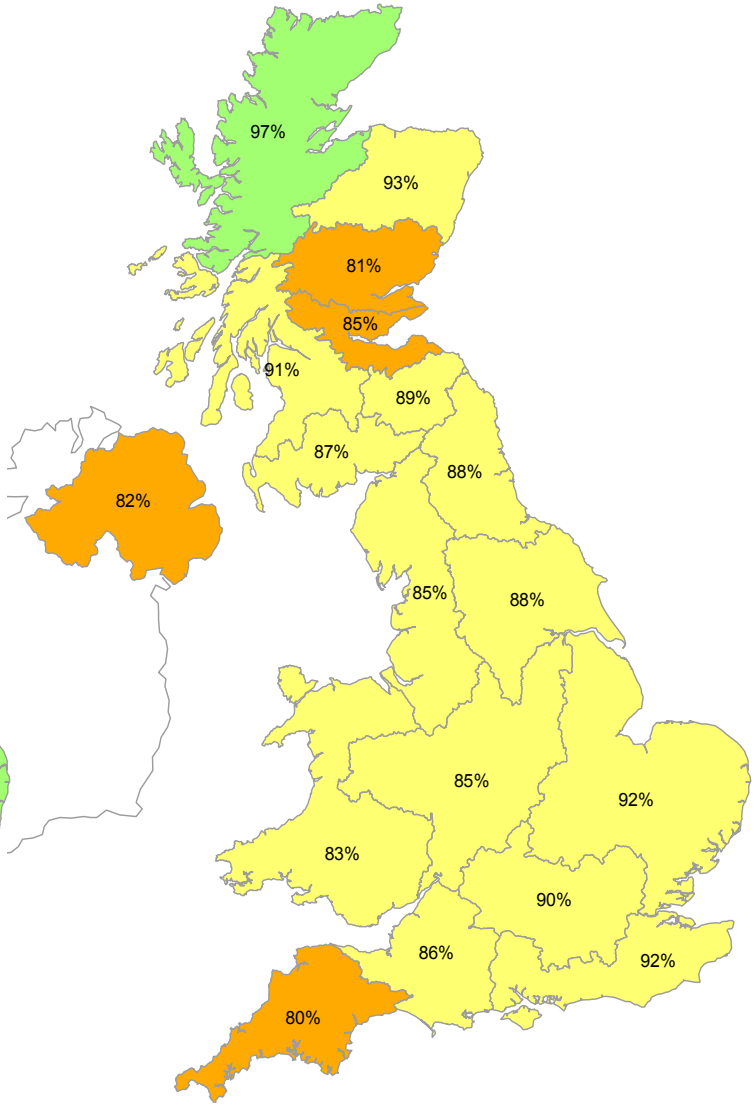
Rainfall . . . Rainfall . .

Key

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



February 2004 - June 2004

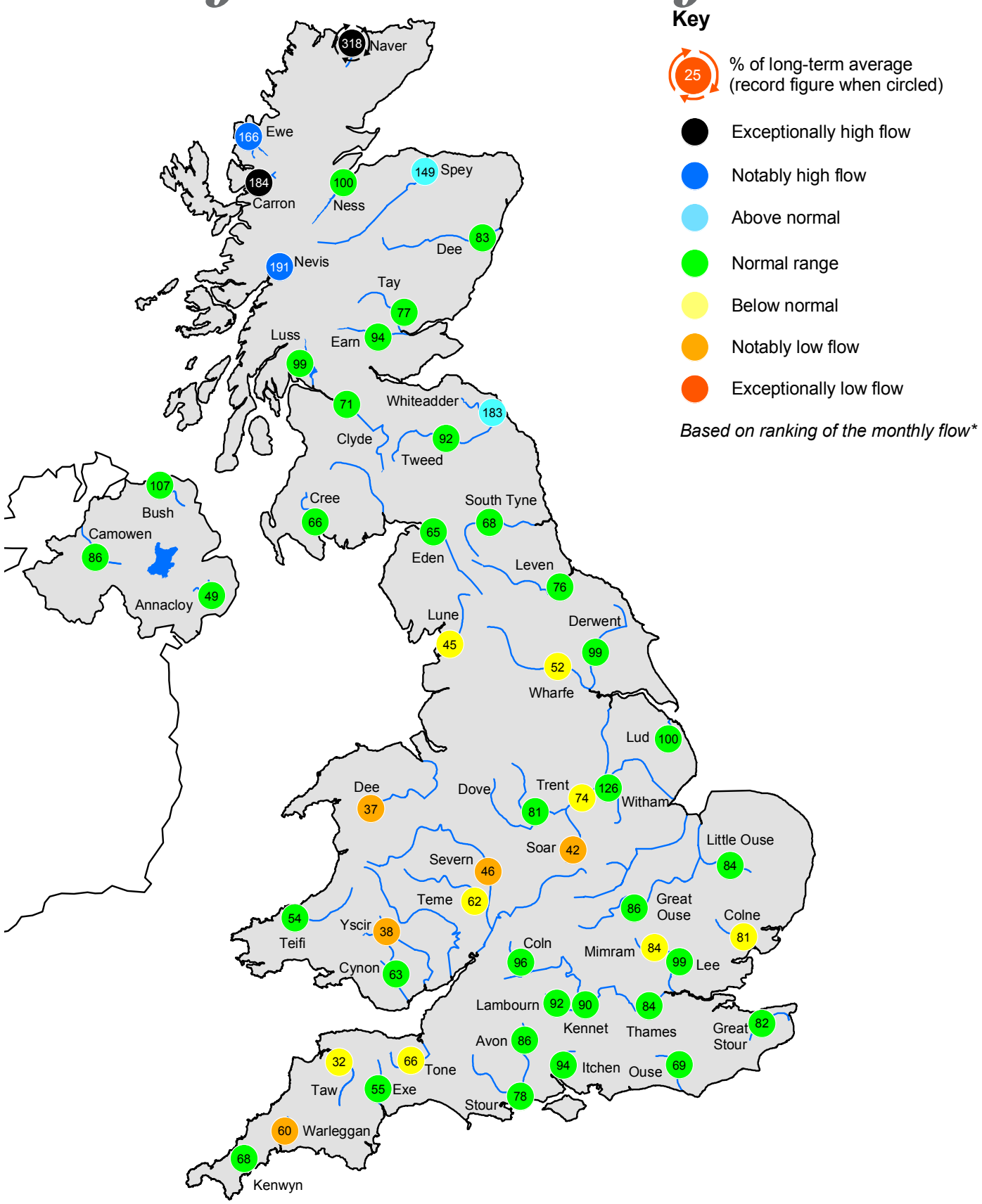


August 2003 - June 2004

Rainfall accumulation maps

Echoes of the 2003 drought are still evident in the longer term regional rainfall accumulations for most regions. The August 2003 - June 2004 rainfall is the second lowest (after 1996) since 1975/76 for the UK as a whole with the most notable deficiencies in parts of eastern Scotland, Northern Ireland, and the South-West. The latter region also has the highest percentage rainfall deficiency over the last five months.

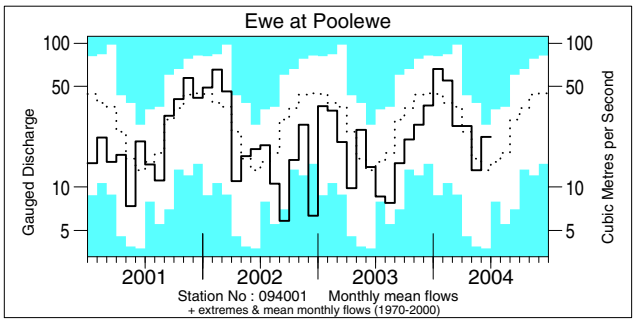
River flow . . . River flow . . .

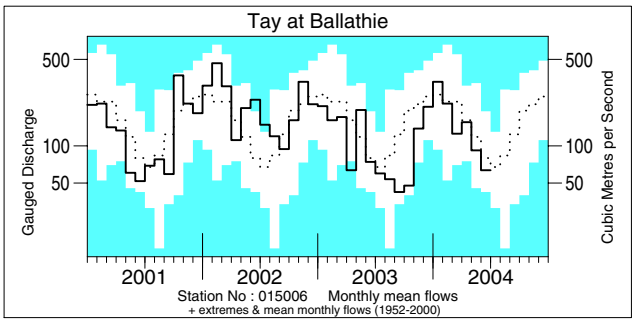


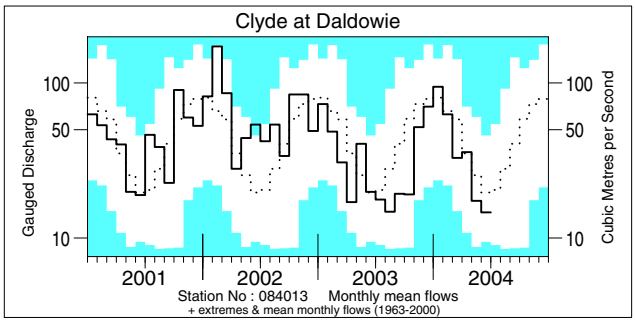
River flows - June 2004

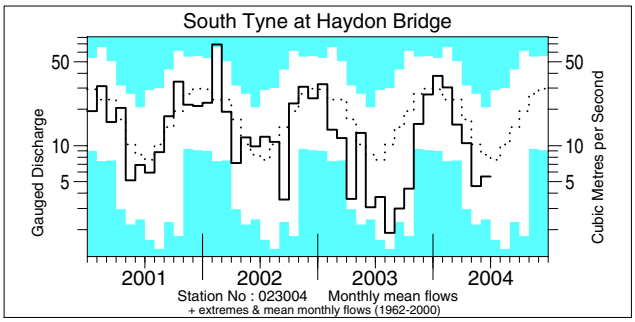
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

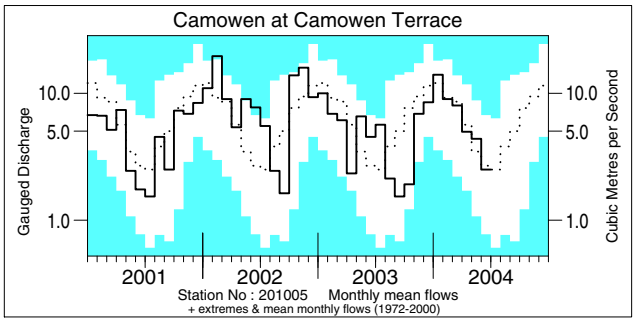
River flow . . . River flow . . .

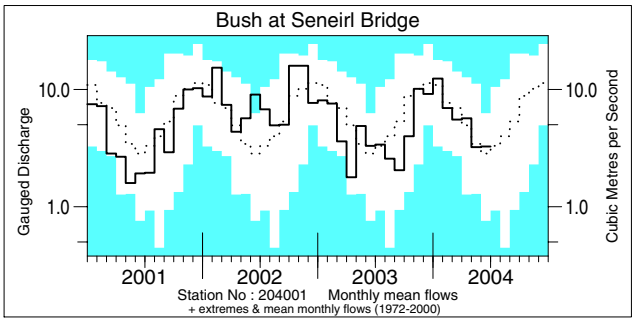


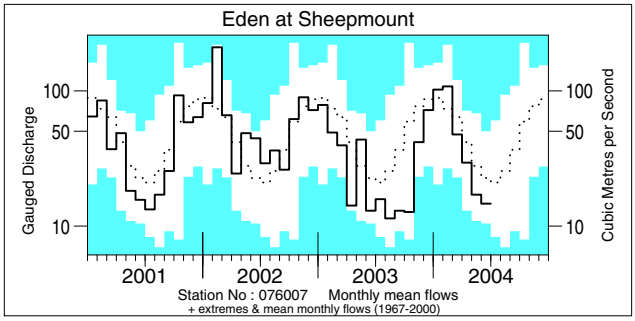


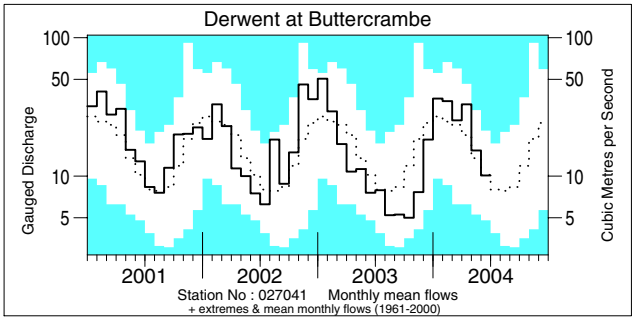


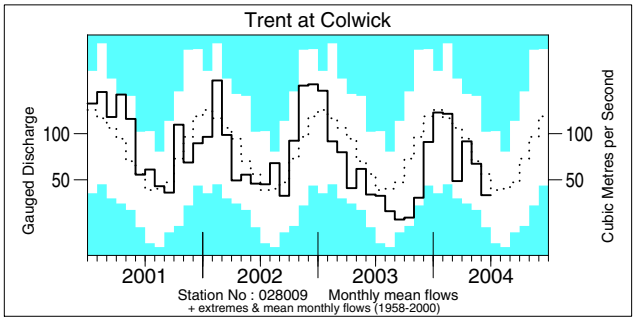


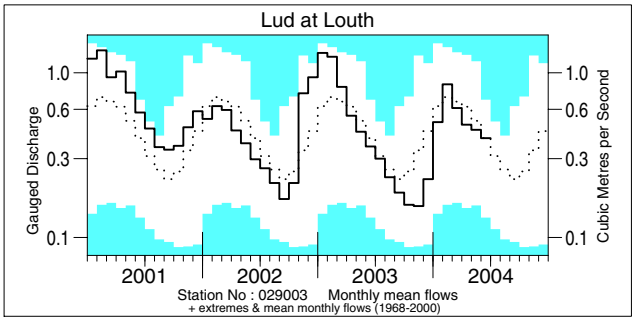








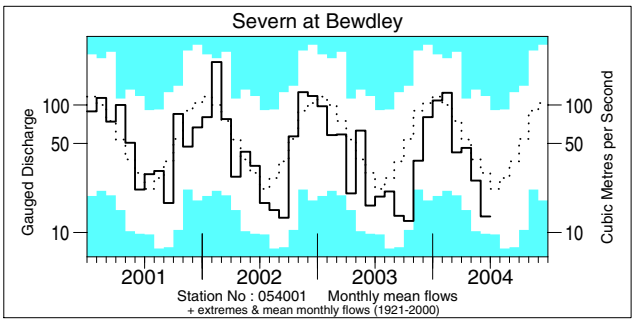


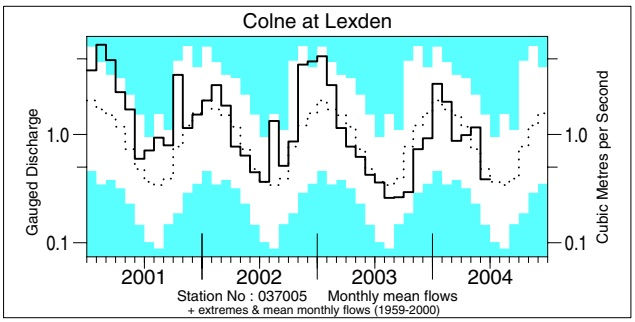


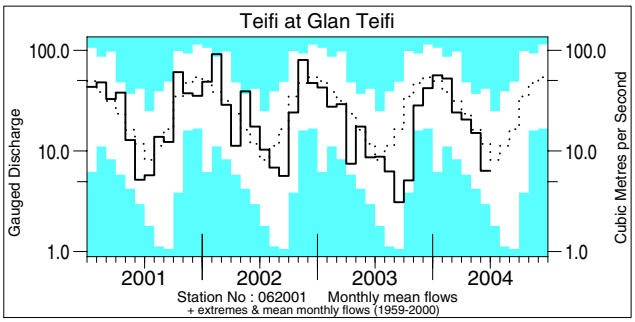
Monthly river flow hydrographs

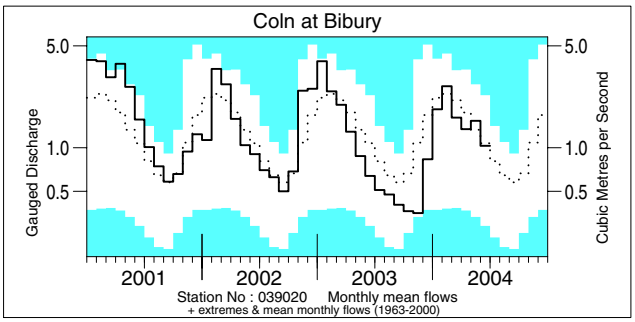
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 2001 (shown by the shaded areas). Monthly flows falling outside the maximum/ minimum range are indicated where the bold trace enters the shaded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

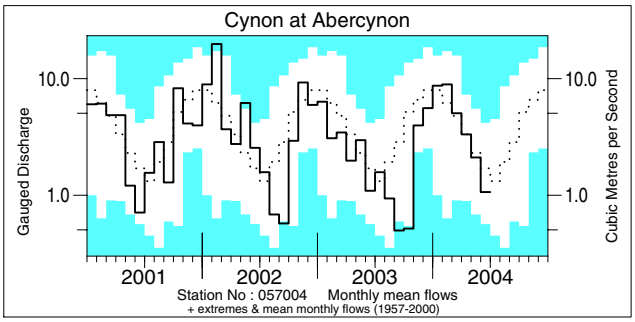
River flow . . . River flow . . .

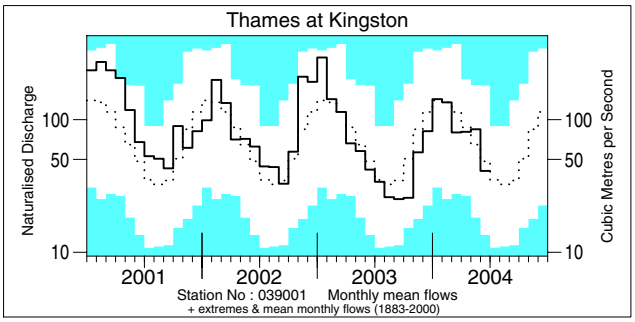


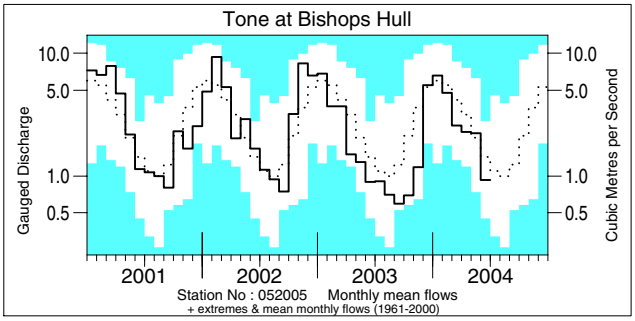


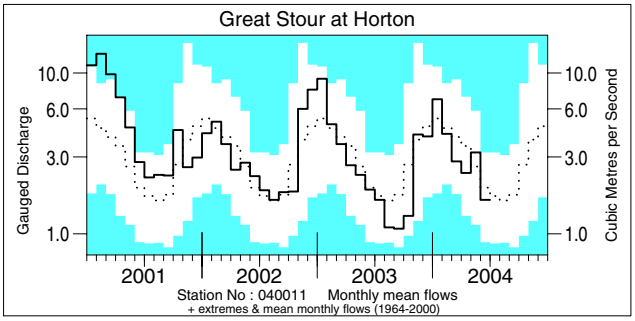


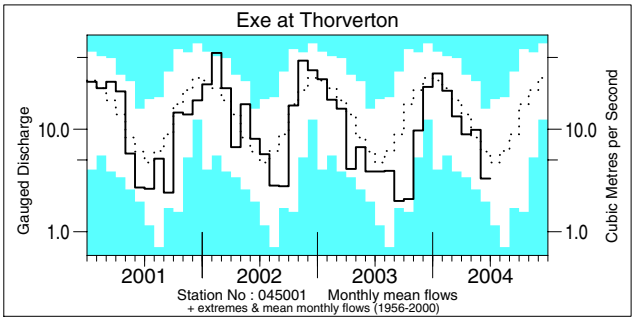


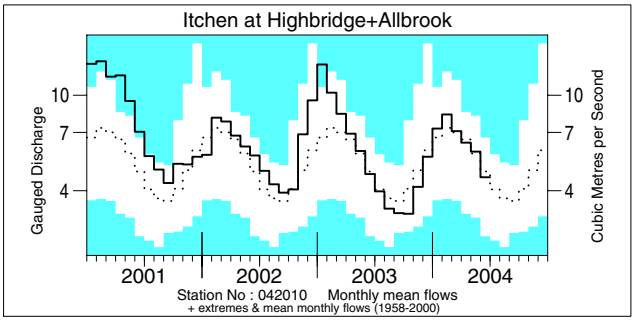












Notable runoff accumulations **(a) May 2004 - June 2004, (b) February 2003 - June 2004**

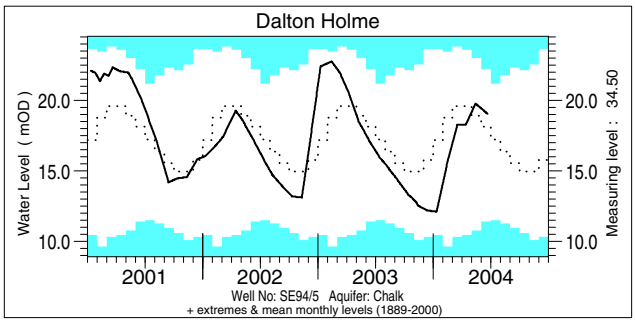
	River	%lta	Rank
a)	S Tyne	55	6/42
	Otter	67	6/42
	Dee (New Inn)	47	6/35
	Ribble	41	2/45
	Carron	125	21/26
	Naver	168	25/27
	L Bann	41	2/24
	Annacloy	39	5/25

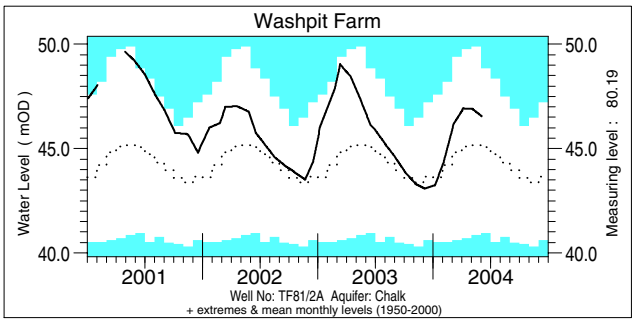
	River	%lta	Rank
b)	Ness	77	2/31
	Dee (Woodend)	74	1/74
	Earn	74	4/56
	Tweed (Norham)	70	4/44
	Wharfe	74	4/48
	Soar	58	3/32
	Medway	56	2/39

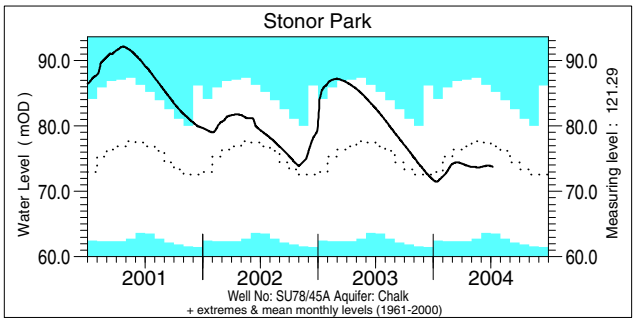
River	%lta	Rank
Exe	72	2/47
Dart	78	3/45
Taw	62	2/45
Yscir	76	2/31
Cree	80	3/40
Luss	73	1/24
Faughan	69	1/27

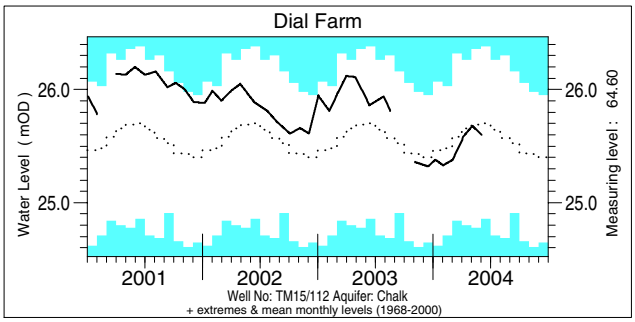
lta = long term average
Rank 1 = lowest on record

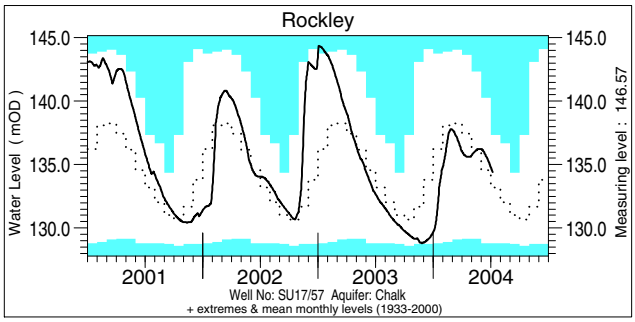
Groundwater . . . Groundwater

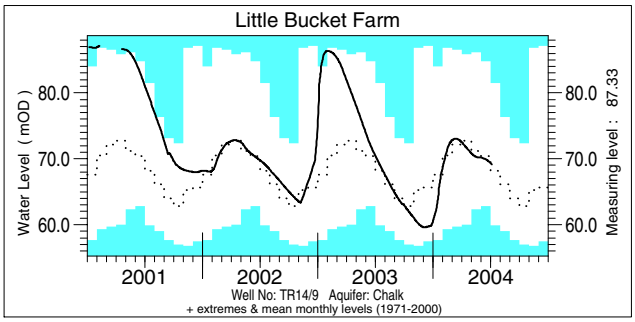


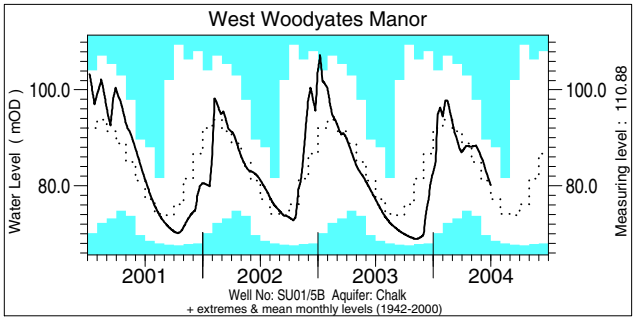


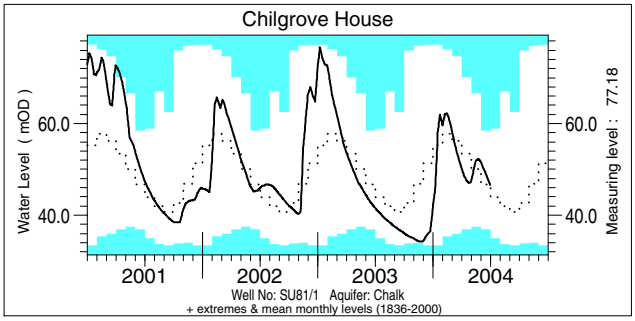


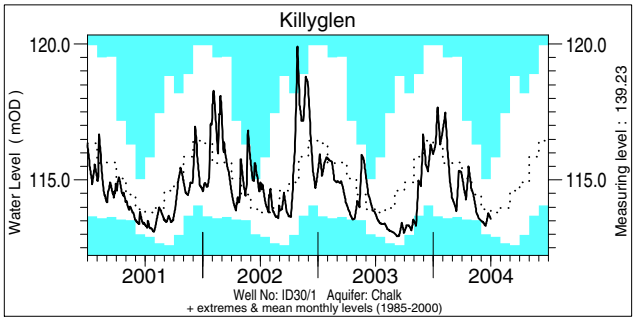


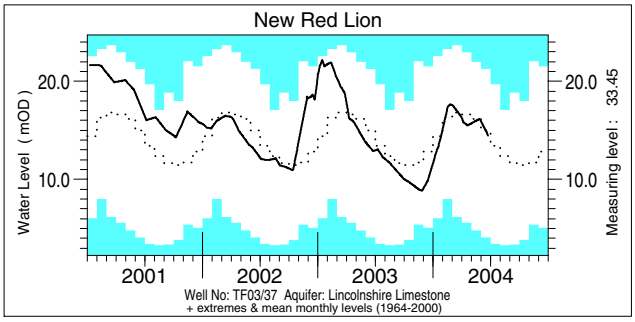






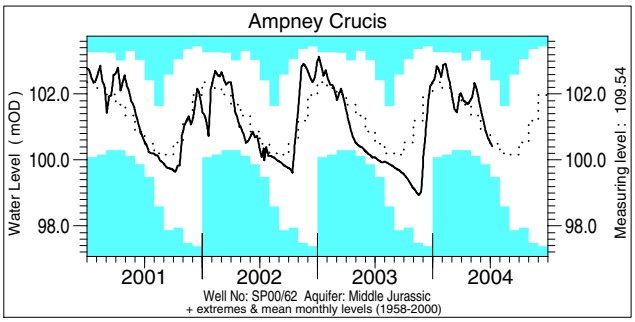


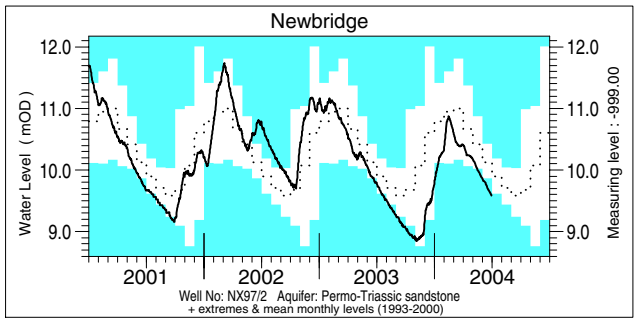


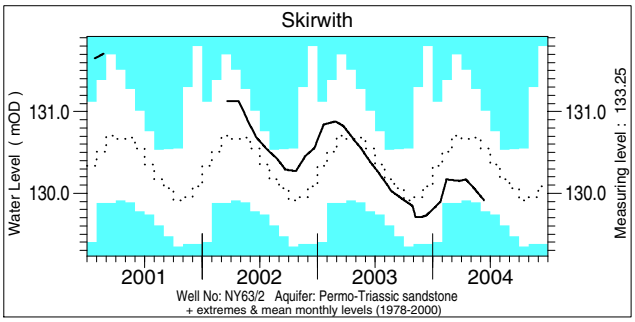


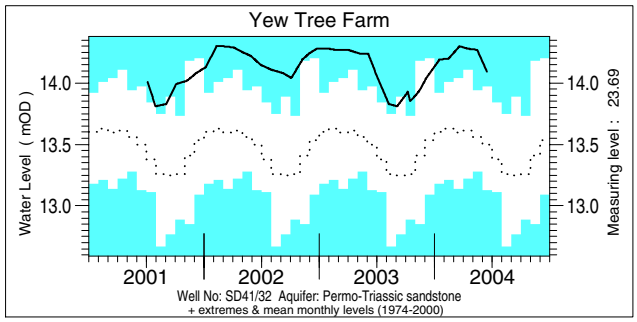
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

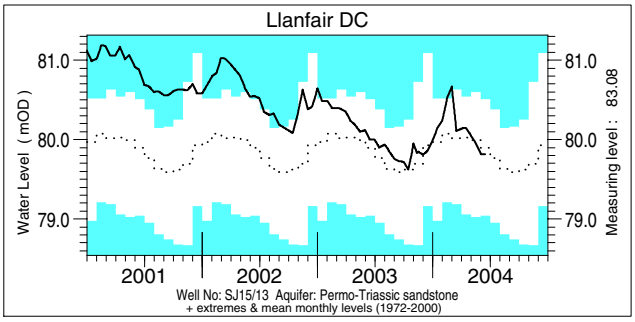
Groundwater . . . Groundwater

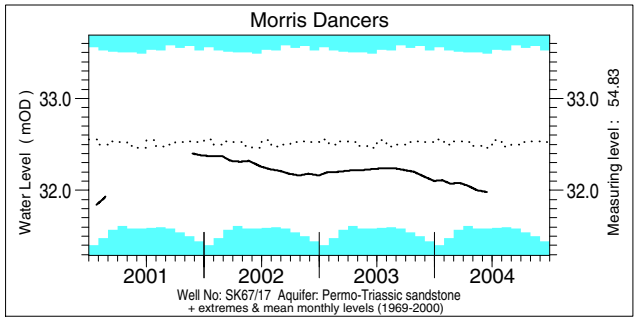


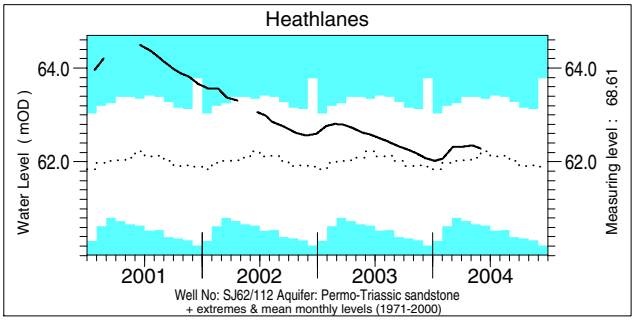


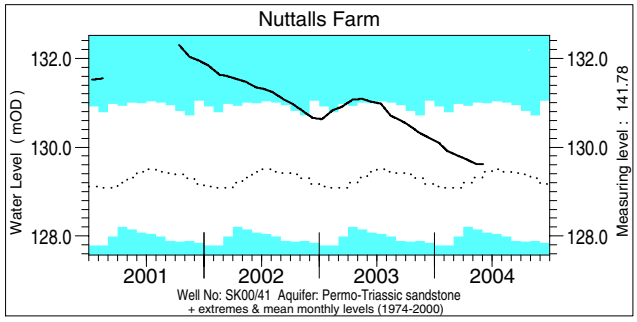


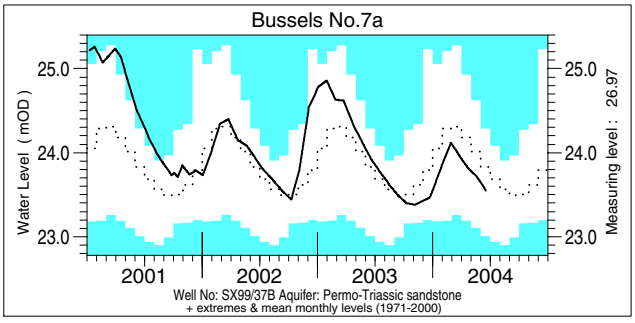


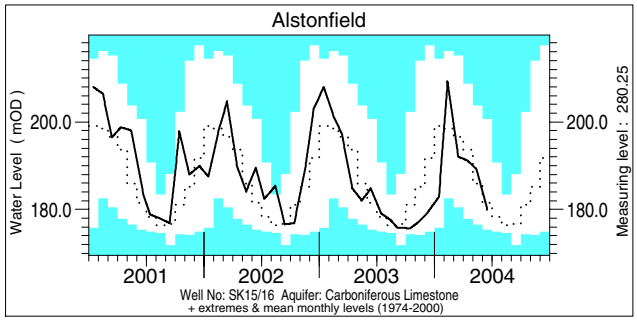










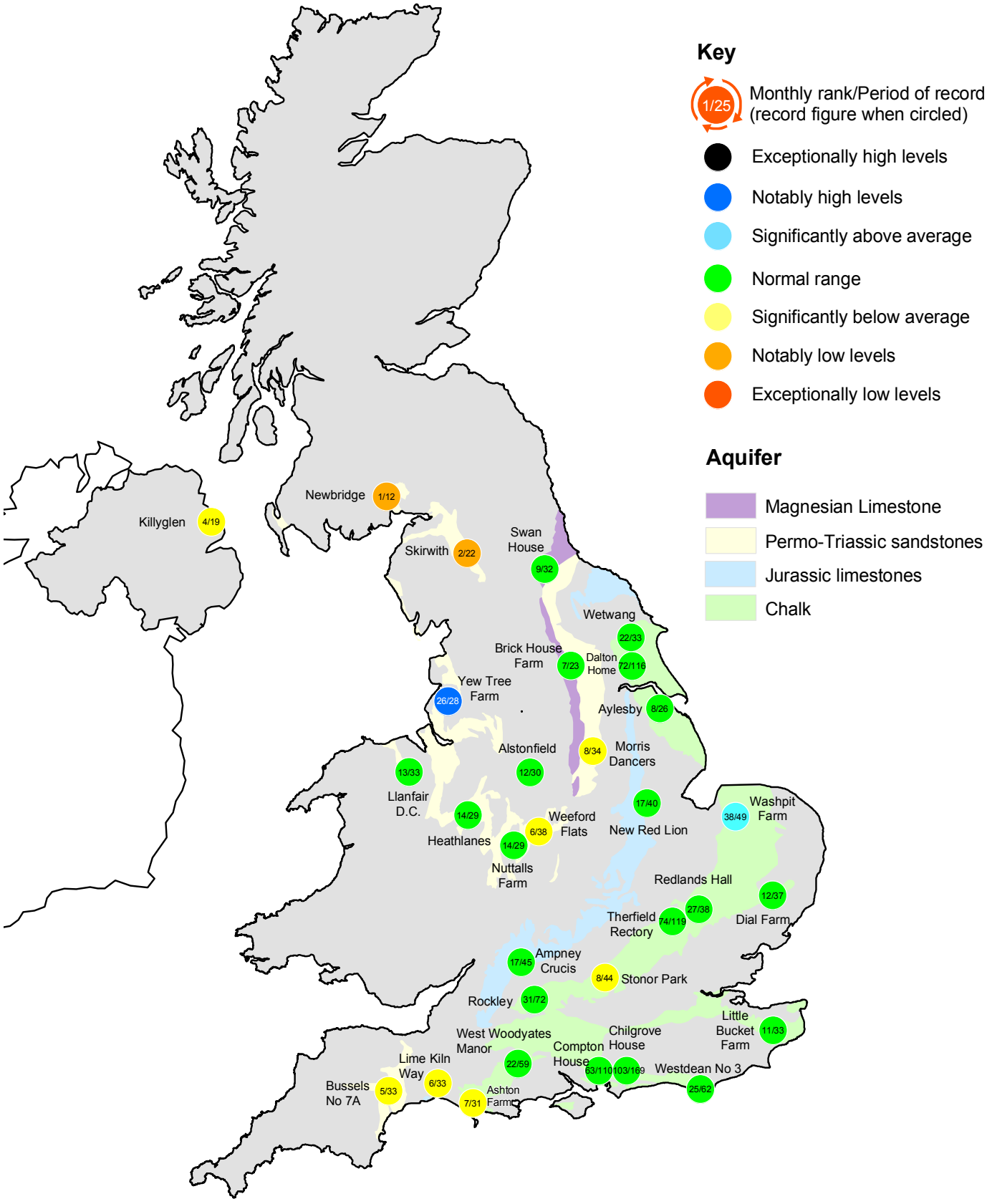


Groundwater levels June / July 2004

Borehole	Level	Date	Jun. av.	Borehole	Level	Date	Jun. av.	Borehole	Level	Date	Jun. av.
Dalton Holme	19.03	21/06	18.13	Chilgrove House	46.58	30/06	46.02	Llanfair DC	79.82	15/06	79.87
Washpit Farm	46.54	03/06	45.17	Killyglen	113.56	01/07	114.00	Morris Dancers	31.98	14/06	32.36
Stonor Park	73.77	07/07	78.33	New Red Lion	14.46	23/06	14.67	Heathlanes	62.28	01/06	62.29
Dial Farm	25.60	02/06	25.71	Ampney Crucis	100.42	07/07	100.84	Nuttalls Farm	129.62	03/06	129.63
Rockley	134.41	07/07	134.59	Newbridge	9.58	30/06	10.13	Bussels No.7a	23.55	17/06	23.88
Little Bucket Farm	69.13	05/07	71.54	Skirwith	129.91	11/06	130.53	Alstonfield	179.98	15/06	181.61
West Woodyates	80.24	30/06	80.94	Yew Tree Farm	14.09	14/06	13.59				

Levels in metres above Ordnance Datum

Groundwater . . . Groundwater

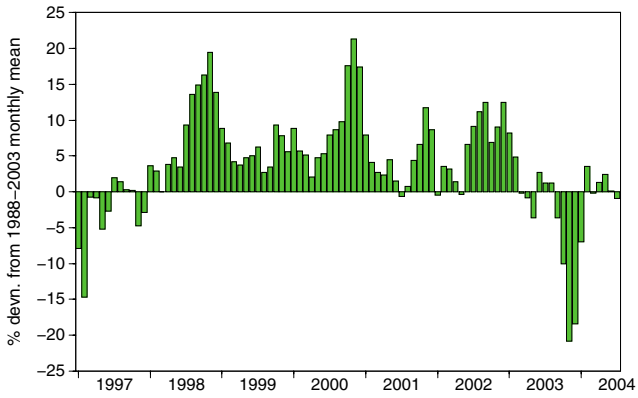


Groundwater levels - June 2004

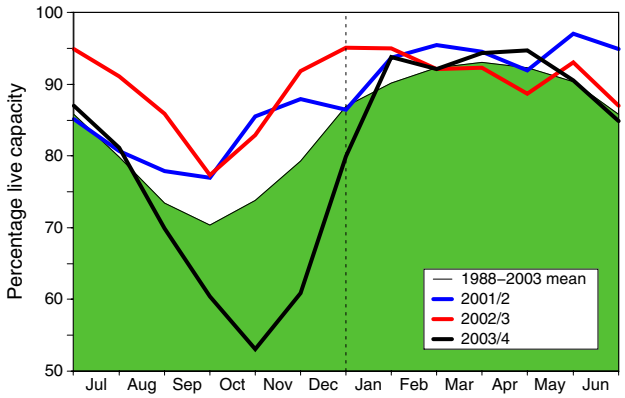
The rankings are based on a comparison between the average level in the featured month (but often only single readings are available) and the average level in each corresponding month on record. They need to be interpreted with caution especially when groundwater levels are changing rapidly or when comparing 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. The Newbridge borehole supercedes Redbank (which was affected by groundwater abstraction). Yew Tree Farm levels are now received quarterly.

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.

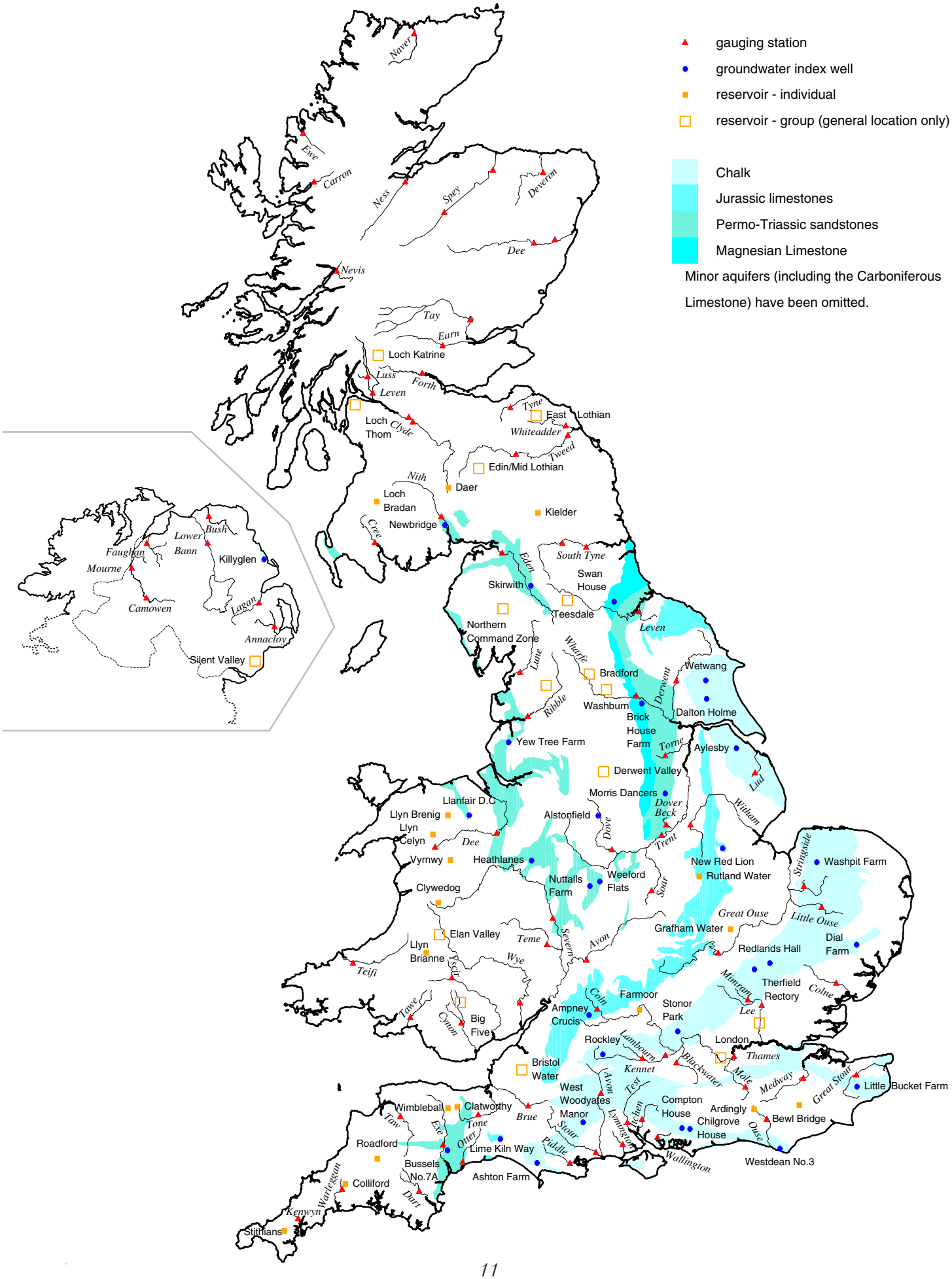
Percentage live capacity of selected reservoirs at start of month

Area	Reservoir	Capacity (Ml)	2004 Mar	Apr	May	Jun	Jul	Avg. Jul	Min. Jul	Year* of min.
North West	N Command Zone	• 124929	90	88	89	76	**63**	72	58	1995
	Vyrnwy	55146	92	99	95	88	**73**	83	65	1990
Northumbrian	Teesdale	• 87936	88	96	95	83	**79**	77	58	1989
	Kielder	(199175)	(90)	(91)	(92)	(91)	**(94)**	89	(71)	1989
Severn Trent	Clywedog	44922	90	99	100	100	**97**	92	72	1989
	Derwent Valley	• 39525	98	96	100	92	**91**	78	53	1996
Yorkshire	Washburn	• 22035	94	92	95	89	**84**	80	63	1995
	Bradford supply	• 41407	90	92	93	85	**75**	77	54	1995
Anglian	Grafham	(55490)	(88)	(95)	(98)	(95)	**(95)**	92	(70)	1997
	Rutland	(116580)	(91)	(94)	(97)	(95)	**(91)**	88	(75)	1997
Thames	London	• 202340	97	97	97	94	**89**	91	85	1990
	Farmoor	• 13830	92	96	100	99	**97**	98	94	1995
Southern	Bewl	28170	98	100	100	99	**92**	82	52	1990
	Ardingly	4685	100	100	100	100	**89**	96	86	1996
Wessex	Clatworthy	5364	100	95	100	96	**86**	81	61	1995
	Bristol WW	• (38666)	(91)	(92)	(92)	(89)	**(81)**	81	(64)	1990
South West	Colliford	28540	72	75	75	73	**67**	83	51	1997
	Roadford	34500	68	68	68	67	**62**	83	49	1996
	Wimbleball	21320	99	100	100	97	**87**	84	63	1992
	Stithians	5205	93	97	94	88	**78**	79	53	1990
Welsh	Celyn and Brenig	• 131155	99	100	99	97	**88**	94	77	1996
	Brianne	62140	92	98	99	96	**88**	92	76	1995
	Big Five	• 69762	96	98	99	93	**82**	84	61	1989
	Elan Valley	• 99106	94	99	95	93	**87**	89	75	1989
Scotland(E)	Edinburgh/Mid Lothian	• 97639	79	80	81	78	**74**	85	54	1998
	East Lothian	• 10206	100	100	100	98	**100**	92	81	1992
Scotland(W)	Loch Katrine	• 111363	88	91	93	84	**74**	82	61	2001
	Daer	22412	94	100	97	89	**75**	82	62	1994
	Loch Thom	• 11840	90	94	97	92	**88**	83	69	2000
Northern Ireland	Total+	•	81	85	84	74	**72**	85	65	1995
	Silent Valley	• 20634	64	66	64	58	**56**	78	54	1995

() 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 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. 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 the Environment Agencies. 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.

The Met Office
FitzRoy Road
Exeter
Devon
EX1 3PB

Tel.: 0870 900 0100
Fax: 0870 900 5050
E-mail: enquiries@metoffice.com

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:

Hydrological Summaries
National Water Archive
CEH Wallingford
Maclean Building
Crowmarsh Gifford
Wallingford
Oxfordshire
OX10 8BB
Tel.: 01491 838800
Fax: 01491 692424
E-mail: nwamail@ceh.ac.uk

Selected text and maps are available on the WWW at
http://www.nerc-wallingford.ac.uk/ih/nrfa/index.htm
Navigate via Water Watch

Some of the features displayed in the maps contained in this report are based on the Ordnance Survey BaseData GB and 1:50,000 digital data (Licence no. GD03012G/01/97) and are included with the permission of Her Majesty's Stationery Office. © Crown copyright. Unauthorised reproduction infringes Crown copyright and may lead to prosecution.

© This document is copyright and may not be reproduced without the prior permission of the Natural Environment Research Council.

NATURAL ENVIRONMENT RESEARCH COUNCIL

07/04