Hydrological Summary
for the United Kingdom

May 2004

General
After an unsettled start, May was generally a warm and dry month punctuated by a few intense local downpours. Rainfall was well below average in most regions and accelerating evaporative demands caused soil moisture deficits to climb rapidly – signalling an end to the aquifer recharge season. Generally, river flows declined steeply through the month and, after increasing modestly early in May, reservoir contents fell relatively briskly in most areas. Nonetheless, overall stocks for England and Wales were marginally above average entering June. Stocks in most major reservoirs were well within 10% of the early summer mean but seasonally low in the South West and, particularly, in Northern Ireland. Groundwater levels are in recession but remain close to the long term early summer average across most major and minor aquifer outcrops. Despite substantial long term rainfall deficiencies – the 16-month period ending in May was the driest for the UK since 1975/76 – the water resources outlook is generally good but a dry summer would signal notably low river flows and some resources stress in areas where the balance between available resources and demand is narrow (e.g. in parts of the South East).

Rainfall
The sequence of low pressure systems which brought plentiful rain in late April continued into May with many areas reporting only one dry day in the first week; the 3rd was especially wet. Thereafter, anticyclonic conditions dominated synoptic patterns, producing notable sequences of dry days, in the west particularly; a number of localities from North Wales to Cornwall registered 22 consecutive dry days. Elsewhere, intense local thunderstorms – on the 19th and 20th especially – contributed to above average May rainfall totals in South-East England (and a few other areas). Generally, however regional rainfall totals were in the 45-90% range with a few areas registering only about a third of average (e.g in parts of the Vale of York and north-east Scotland). The modest UK total added to a cluster of dry Mays in the last 15 years – six being substantially below average. From a resources viewpoint, medium and longer term deficiencies are of more significance. Some catchments (e.g. in the South West) have reported below average rainfall in 9 of the last 10 months and, over wide areas, rainfall deficiencies are particularly significant over timespans of 4, 10 and 16 months; Northern Ireland and the Tay basin both registered their lowest Aug-May rainfall since 1973; the South West was almost as deficient.

River flow
Contrary to the normal late spring trend, flows increased in late April in many regions, and the recovery continued into May. Thereafter, steep recessions became established in most index rivers draining impermeable catchments (which make for a rapid response to a lack of rainfall). By month-end, long term daily minima (for May) were being closely approached in many western and northern rivers, including the Ness, Nith and, in Northern Ireland, the Mourne. In parts of the English Lowlands, localised flooding was reported in response to thunderstorms (e.g. at Haywards Heath on the 19th) but the general pattern was epitomised more effectively by the Thames where flows declined from well above, to appreciably below, the long term daily average through the month. May runoff totals were above average in a few responsive eastern catchments and a larger proportion of spring-fed rivers in the English Lowlands. Elsewhere, runoff totals were mostly well below average – typically in the 50-90% range – and the Lower Bann (which flows from Lough Neagh) registered its second lowest May runoff since 1984. Many rivers – in northern parts of the UK especially – have registered only a couple of months with above average flows since January 2003 and long term runoff accumulations are notably low; the Rivers Dee, Luss Water, Naver, Faughan and Annacloy are amongst those establishing new 16-month minimum runoff totals (for sequences ending in May).

Groundwater
The first week of May saw some modest, but very useful, infiltration before aquifer recharge was curtailed as soil moisture deficits increased rapidly over the rest of the month. By early June, smds were appreciably above average across much of the UK. Nonetheless, the early May rainfall succeeded in postponing the full onset of the summer recession in groundwater levels across most major aquifers (see the Chilgrove hydrograph for example). As a consequence, May groundwater levels remained above the monthly average in almost half the index wells and boreholes. Notwithstanding the erratic recharge patterns through the spring, groundwater levels across much the greater part of the Chalk outcrop are well within the normal range – exceptions include Northern Ireland where the very responsive Killyglen borehole registered its lowest May level in a 20-year record. Levels are also relatively depressed in the Permo-Triassic sandstones of the North West (see Skirwith) but near-average levels characterise most of the outcrop; in the west Midlands, levels have fallen close the average for the first time in five years. Levels in the limestone and minor aquifers are also generally around the normal level entering the summer. Groundwater levels are expected to follow a normal summer recession but autumn rainfall patterns will largely determine minimum levels for 2004 and the starting date of the 2004/05 recharge season (an important one for the 2005 resources outlook).

Centre for Ecology & Hydrology
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British Geological Survey
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Rainfall . . . Rainfall . . .

Rainfall accumulations and return period estimates

Area	Rainfall	May 2004	Apr 04-May 04	RP	Feb 04-May 04	RP	Aug 03-May 04	RP	Feb 03-May 04	RP
England & Wales	**mm**	**47**	**137**		**237**		**702**		**1032**	
	%	**73**	**109**	**2-5**	**89**	**2-5**	**89**	**2-5**	**88**	**5-10**
North West	mm	46	120		270		872		1344	
	%	60	81	2-5	84	2-5	83	5-10	87	5-10
Northumbrian	mm	30	97		214		619		920	
	%	47	80	2-5	85	2-5	84	5-10	82	10-20
Severn Trent	mm	42	136		214		557		865	
	%	70	118	2-5	92	2-5	85	5-10	86	5-10
Yorkshire	mm	33	135		229		610		938	
	%	55	113	2-5	93	2-5	86	5-10	87	10-20
Anglian	mm	42	113		177		465		703	
	%	87	118	2-5	99	2-5	93	2-5	90	2-5
Thames	mm	52	134		206		550		779	
	%	92	125	2-5	98	2-5	92	2-5	86	5-10
Southern	mm	51	126		194		643		884	
	%	94	118	2-5	86	2-5	94	2-5	88	5-10
Wessex	mm	40	118		218		649		963	
	%	65	102	2-5	87	2-5	87	5-10	87	5-10
South West	mm	44	116		267		830		1277	
	%	60	81	2-5	77	5-10	79	5-15	83	5-15
Welsh	mm	65	149		336		931		1498	
	%	77	89	2-5	89	2-5	83	5-10	87	5-10
Scotland	**mm**	**62**	**183**		**837**		**1133**		**1632**	
	%	**71**	**109**	**2-5**	**97**	**2-5**	**88**	**5-10**	**87**	**10-20**
Highland	mm	76	215		502		1425		2003	
	%	81	115	2-5	106	2-5	93	2-5	91	5-10
North East	mm	41	153		283		763		1069	
	%	56	108	2-5	96	2-5	86	5-10	81	30-40
Tay	mm	68	181		325		866		1321	
	%	79	117	2-5	89	2-5	77	15-25	80	30-50
Forth	mm	55	148		282		788		1200	
	%	71	107	2-5	89	2-5	79	10-20	82	20-30
Tweed	mm	39	128		259		721		1067	
	%	54	96	2-5	91	2-5	84	5-10	83	10-20
Solway	mm	40	160		360		1066		1598	
	%	46	96	2-5	93	2-5	85	5-10	88	5-10
Clyde	mm	73	204		414		1350		1966	
	%	76	110	2-5	90	2-5	88	5-10	89	5-10
Northern Ireland	**mm**	**48**	**123**		**255**		**741**		**1217**	
	%	**65**	**88**	**2-5**	**82**	**2-5**	**78**	**10-20**	**86**	**5-10**

RP = Return period

 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

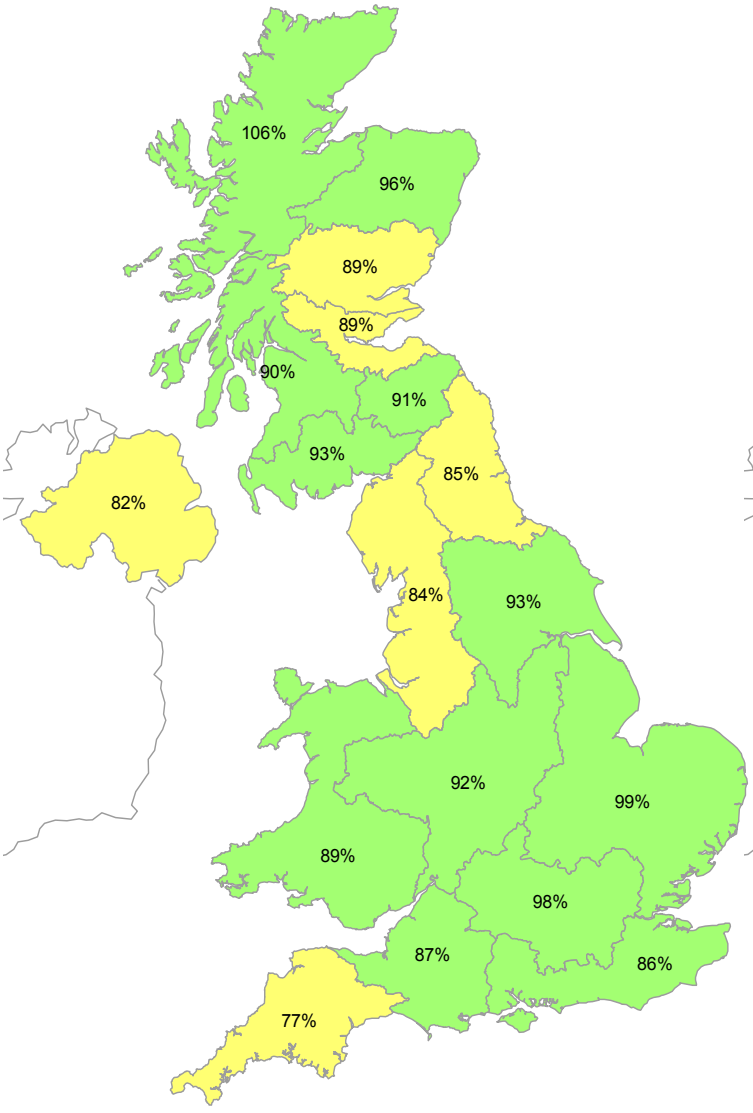
Above average

Normal range

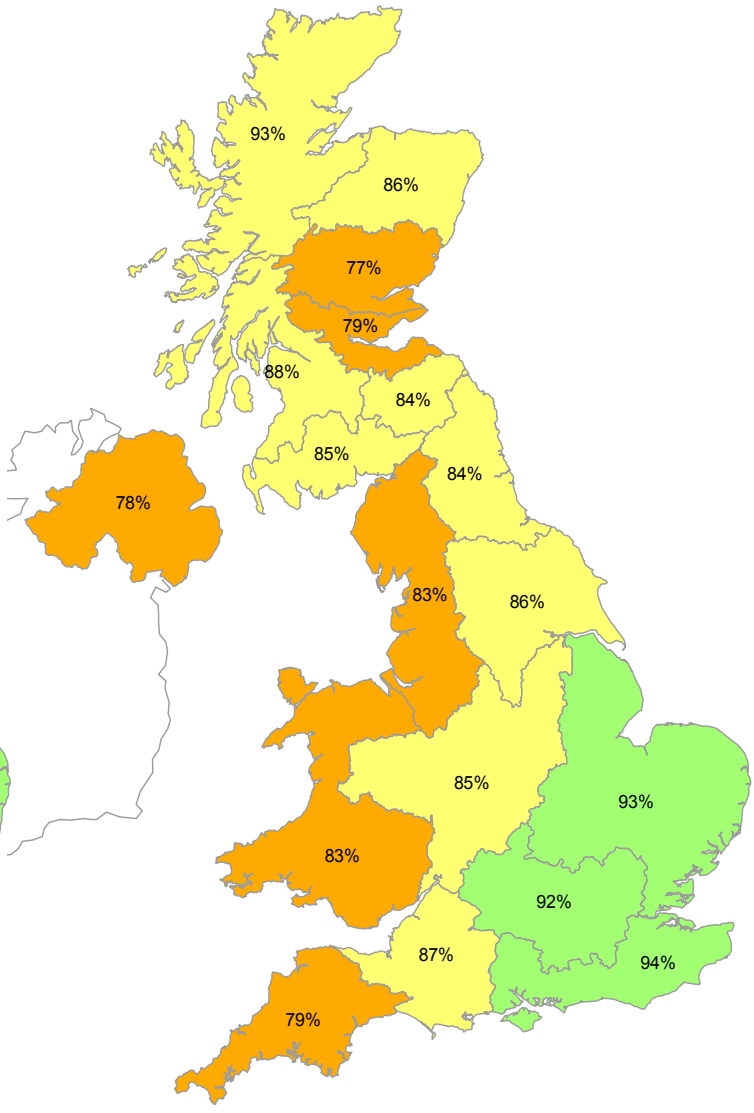
Below average

Substantially below average

Exceptionally low rainfall



February 2004 - May 2004

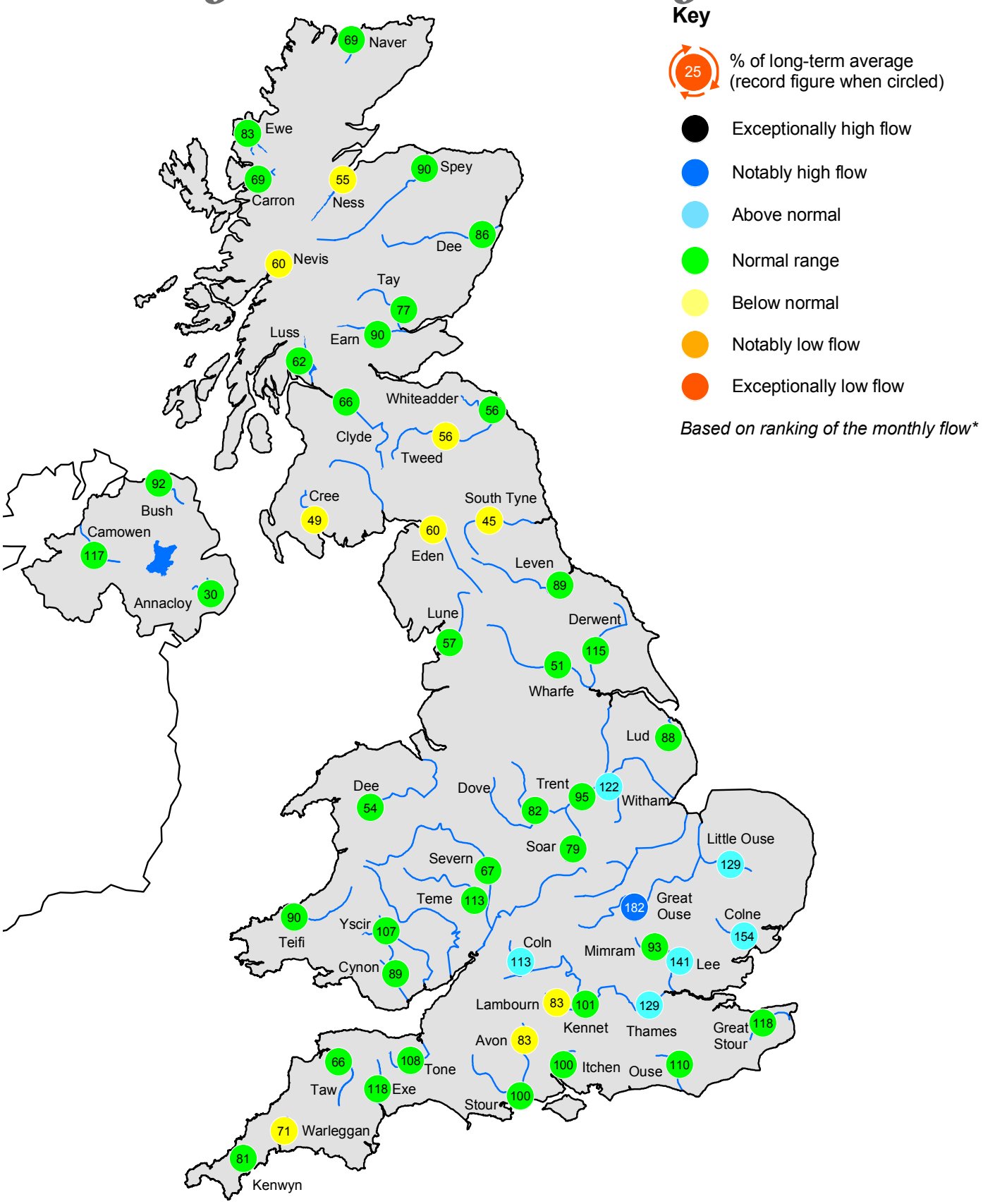


August 2003 - May 2004

Rainfall accumulation maps

Most regions have been relatively dry since January and Feb-May rainfall deficiencies are substantial across large parts of the UK, and notably high in the South West. In the 10-month timeframe, the UK registered it 2nd lowest (after 1996) rainfall total since 1976 with appreciable deficiencies in all regions.

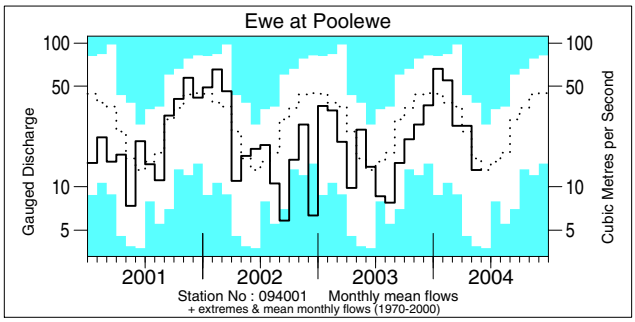
River flow . . . River flow . . .

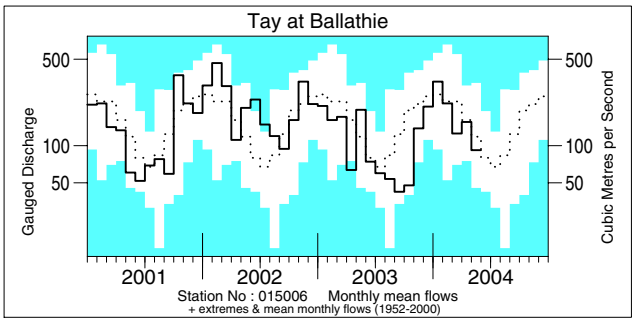


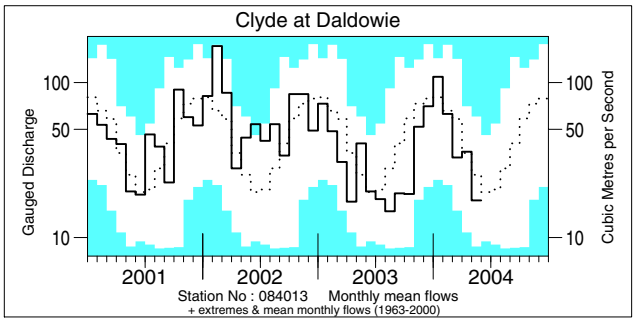
River flows - May 2004

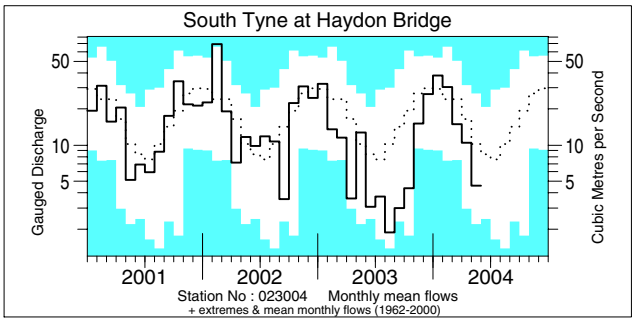
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

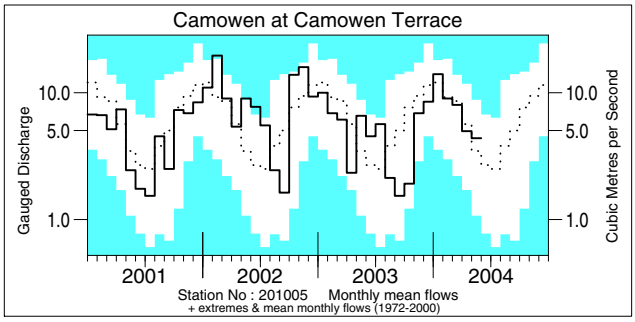
River flow . . . River flow . . .

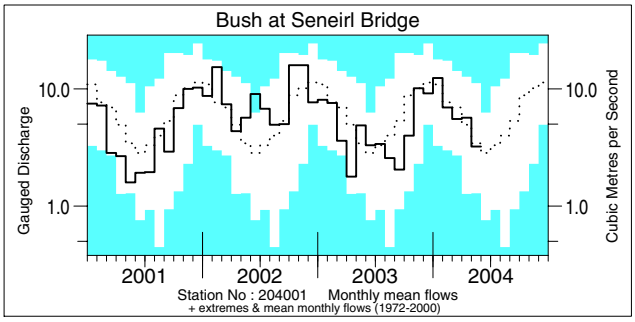


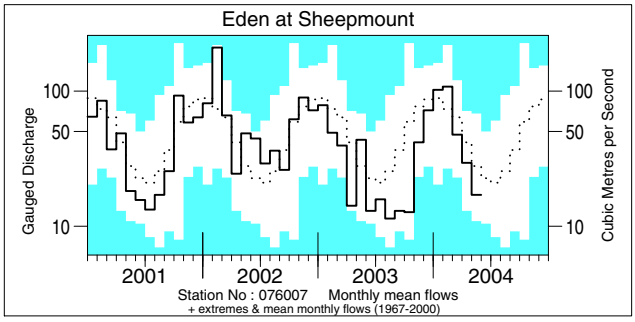


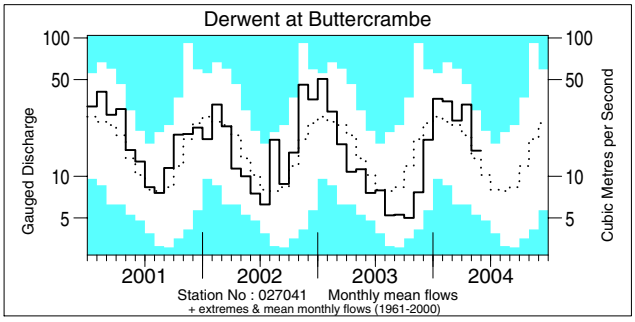


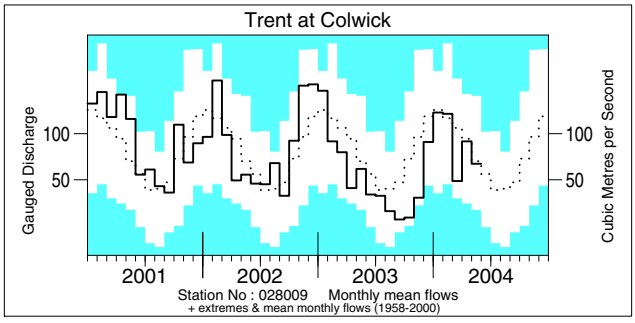


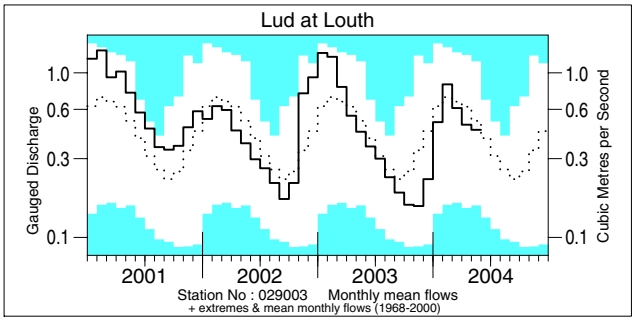








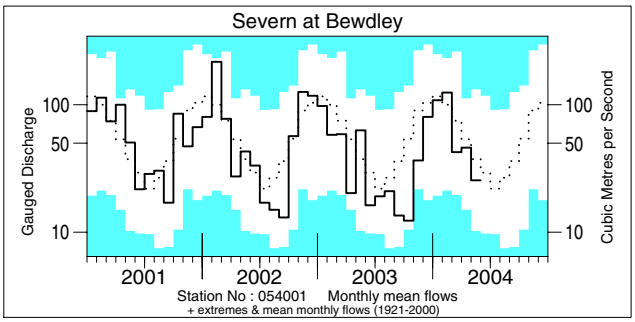


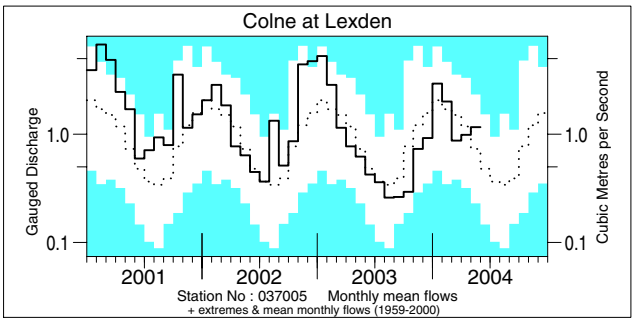


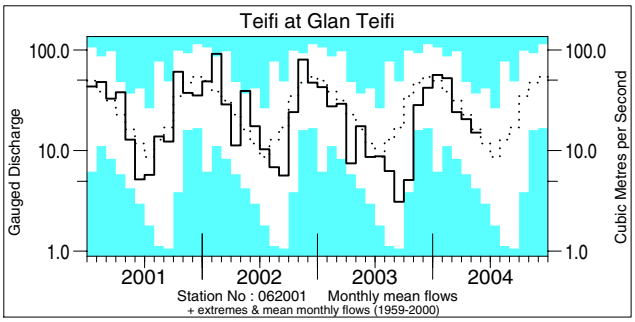
Monthly river flow hydrographs

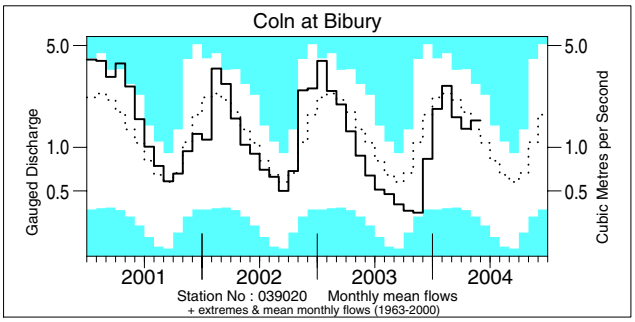
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 2001 (shown by the shaded areas). Monthly flows falling outside the maximum/ minimum range are indicated where the bold trace enters the shaded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

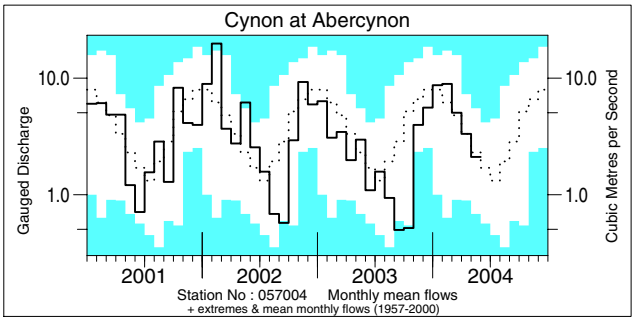
River flow . . . River flow . . .

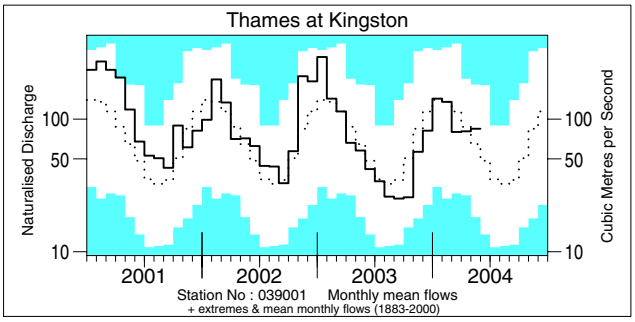


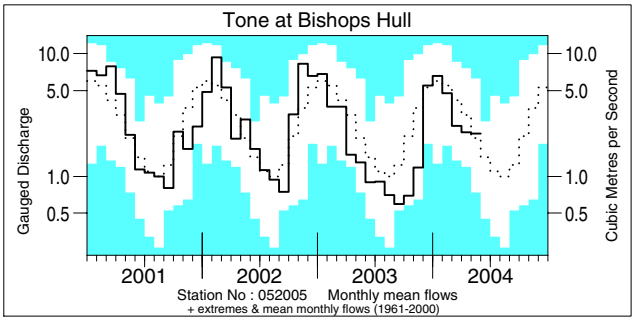


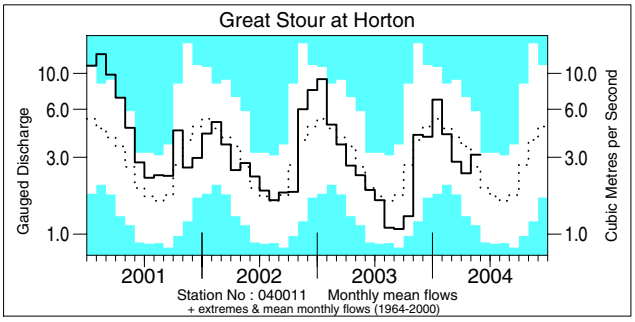


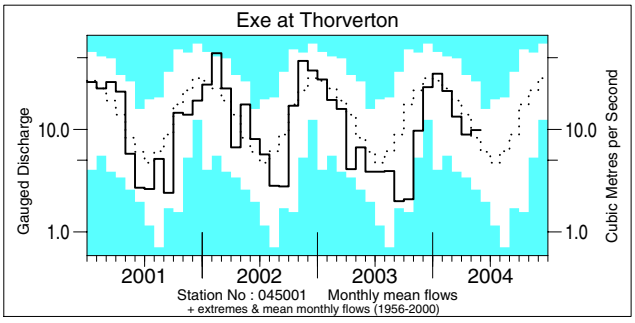


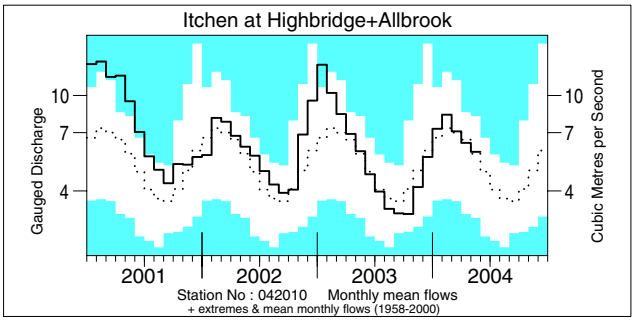












Notable runoff accumulations **(a) February 2004 - May 2004, (b) August 2003 - May 2004, (c) February 2003 - May 2004**

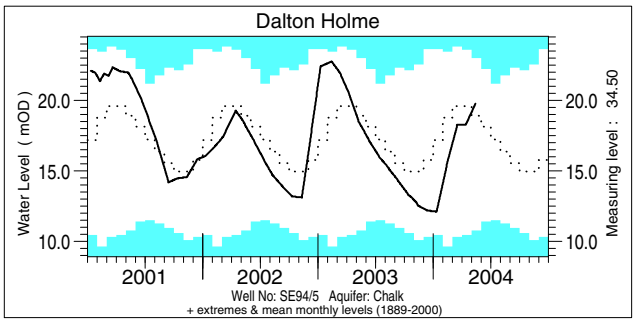
	River	%lta	Rank
a)	Forth	67	3/23
	Soar	64	6/33
	Luss	76	4/27
	Faughan	78	5/28
	L Bann	76	5/24
	Lagan	80	5/31
	Annacloy	69	2/25

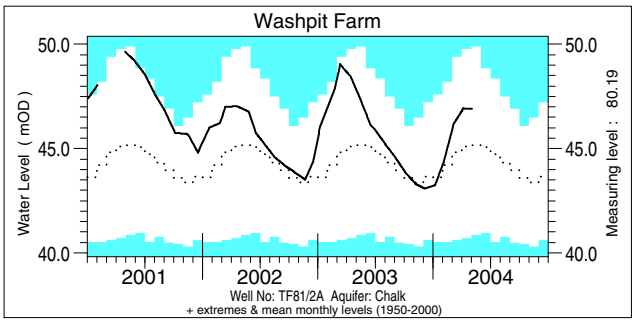
	River	%lta	Rank
b)	Dee (Park)	68	2/31
	Tay	76	3/51
	Tweed (Norham)	72	4/44
	Taw	65	3/45
	Faughan	68	1/27
	L Bann	69	1/24
	Annacloy	57	1/24

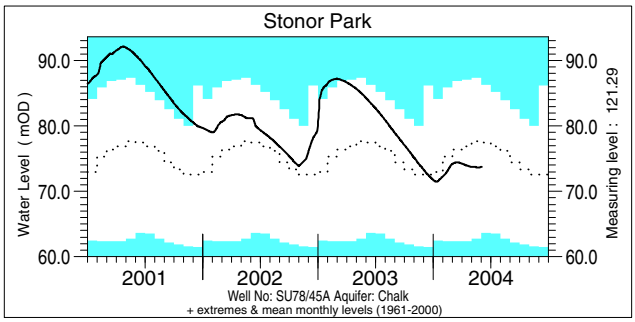
	River	%lta	Rank
c)	Ness	76	2/31
	Dee (Woodend)	73	1/74
	S Tyne	67	2/40
	Medway	56	2/39
	Luss	72	1/25
	Naver	81	1/26
	Lagan	72	2/29

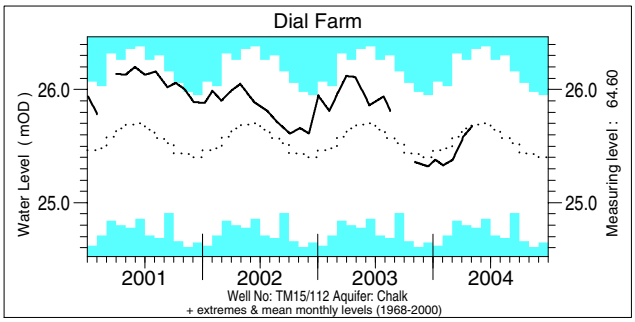
lta = long term average
Rank 1 = lowest on record

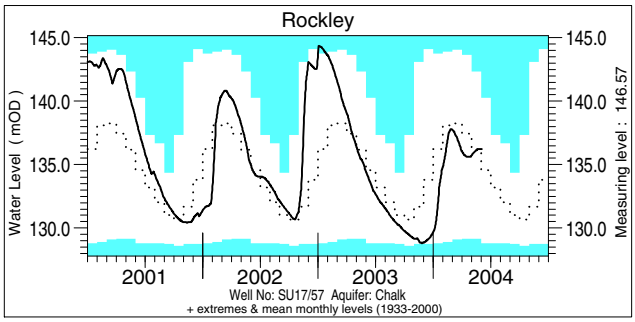
Groundwater . . . Groundwater

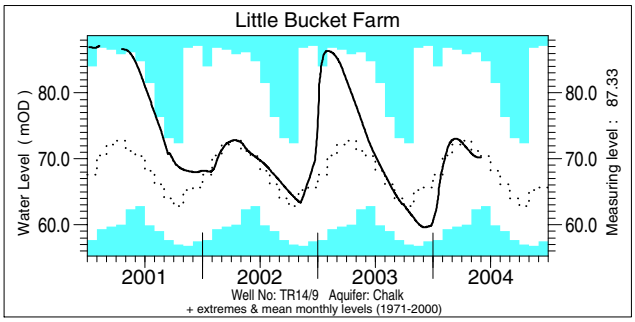


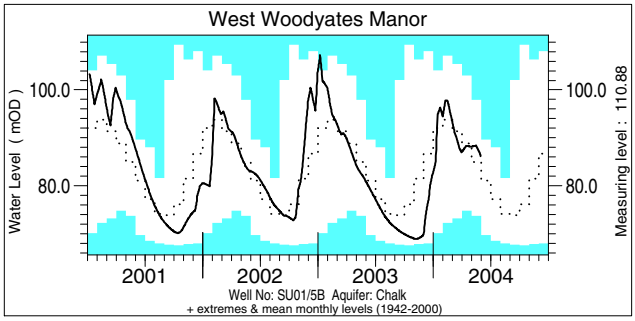


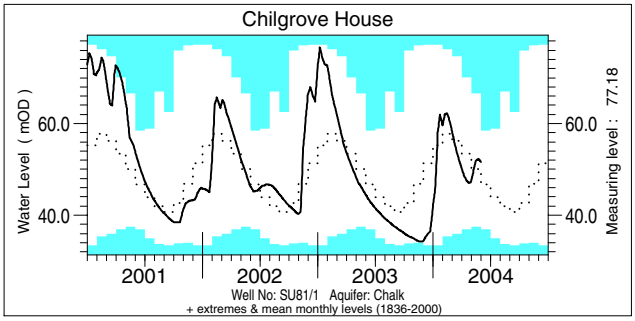


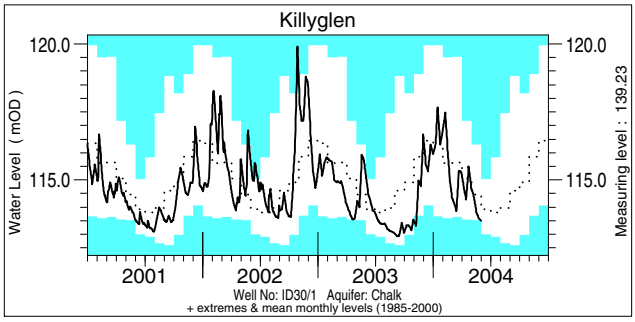


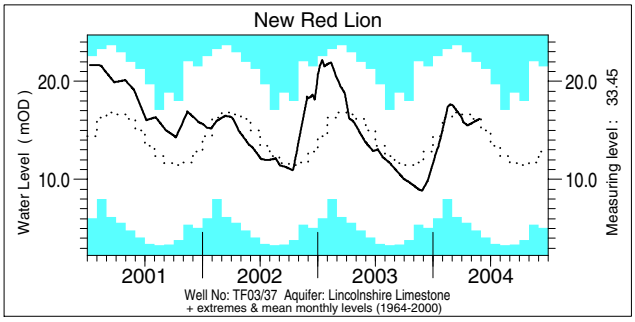






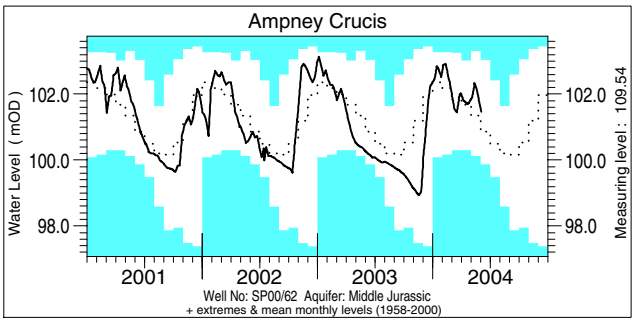


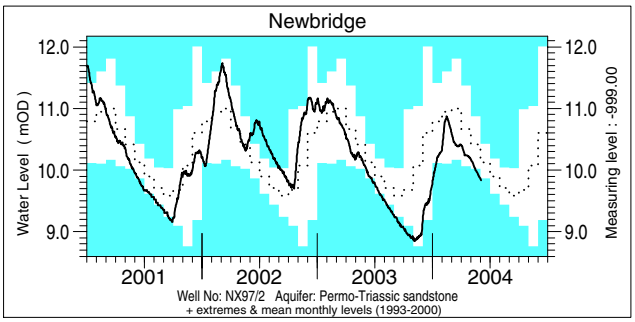


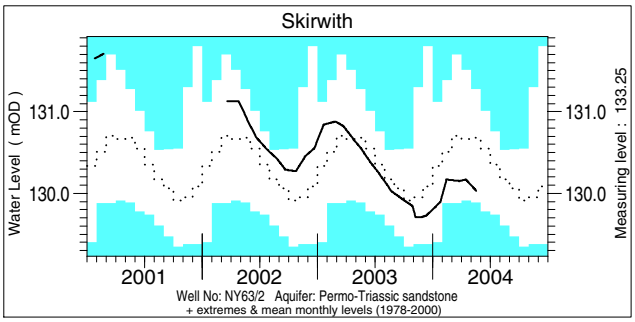


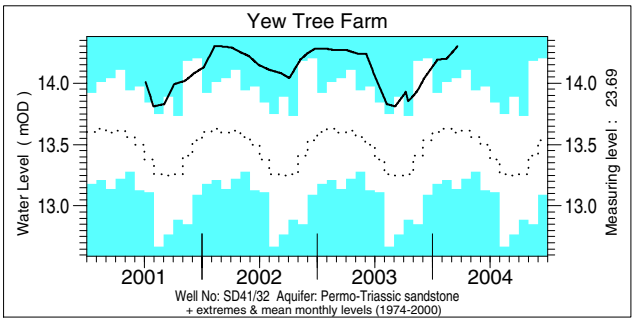
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

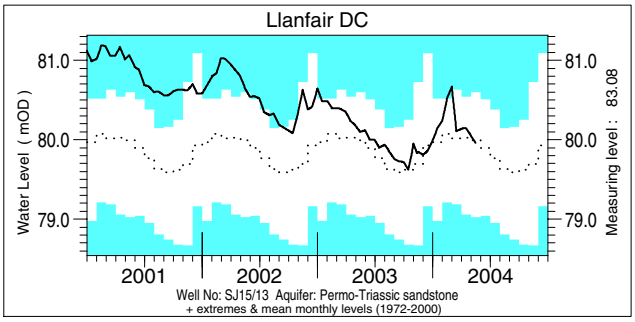
Groundwater . . . Groundwater

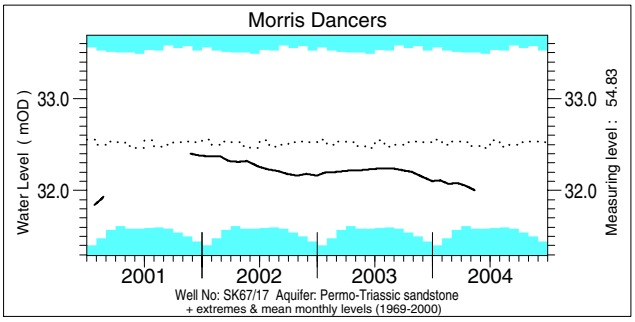


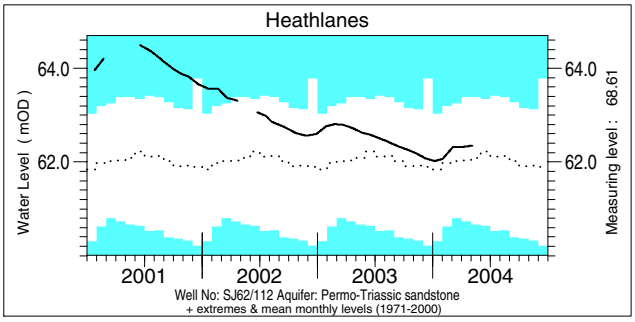


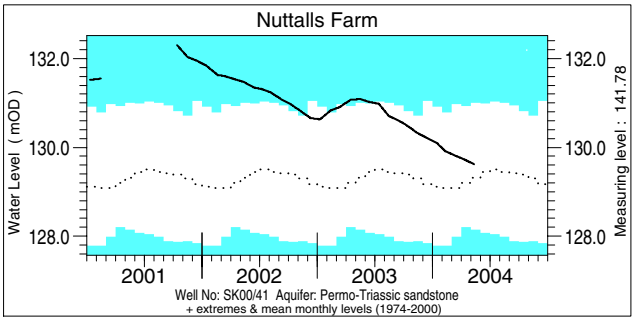


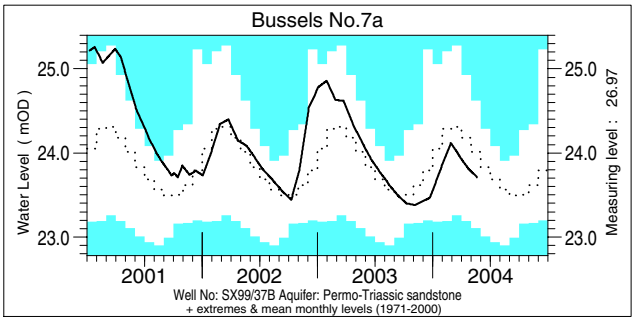


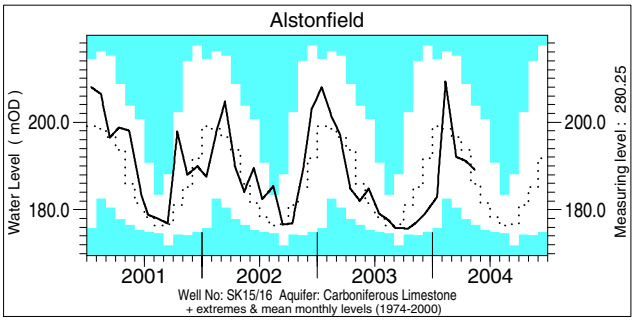












Groundwater levels May / June 2004

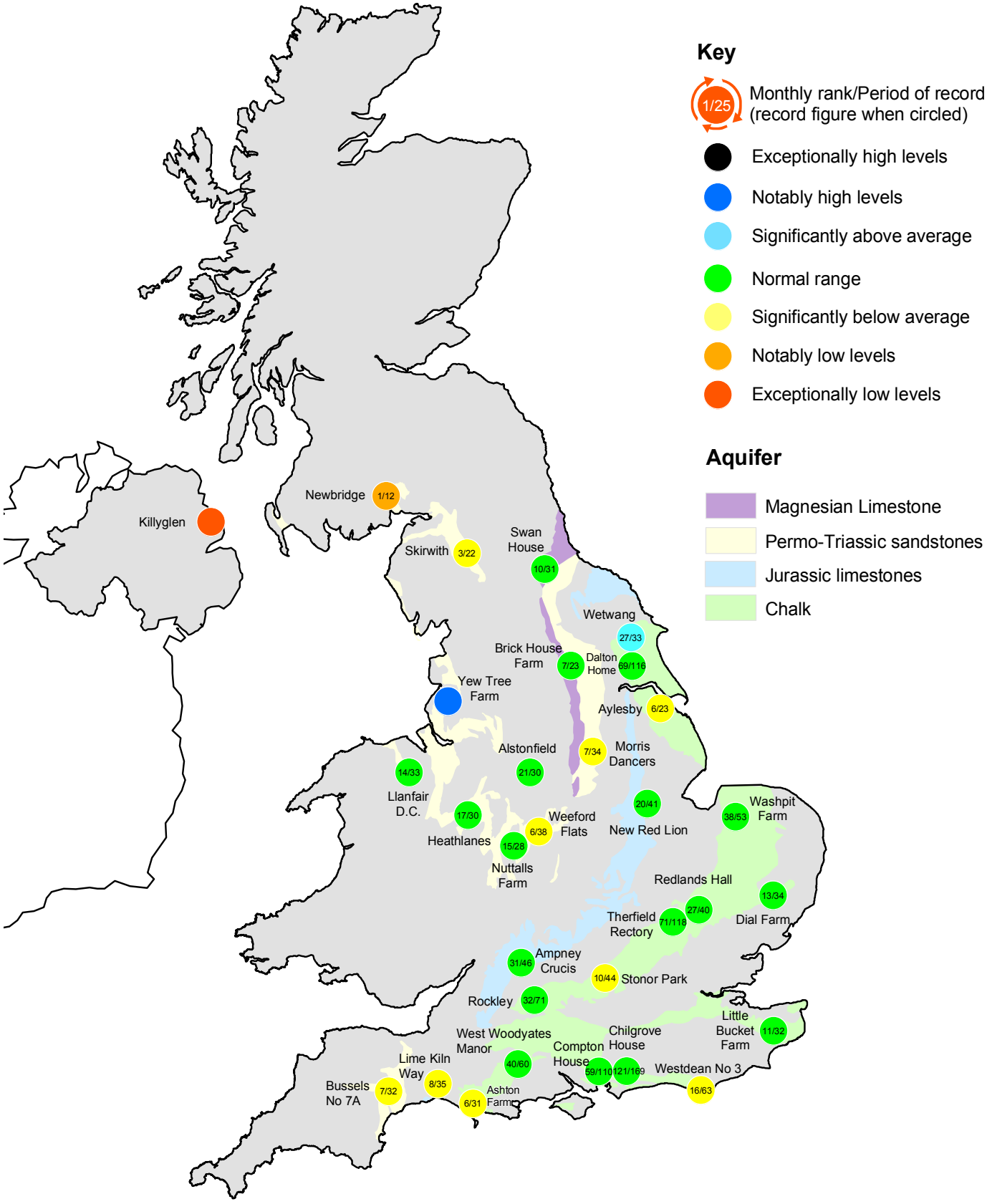
Borehole	Level	Date	May. av.
Dalton Holme	19.78	13/05	18.96
Washpit Farm	46.91	04/05	45.46
Stonor Park	73.75	02/06	78.57
Dial Farm	25.68	04/05	25.71
Rockley	136.21	02/06	136.23
Little Bucket Farm	70.24	31/05	72.60
West Woodyates	86.22	30/05	84.63

Borehole	Level	Date	May. av.
Chilgrove House	51.64	31/05	48.99
Killyglen	113.50	31/05	114.56
New Red Lion	16.19	27/05	15.99
Ampney Crucis	101.46	02/06	101.26
Newbridge	9.83	02/06	10.37
Skirwith	130.03	17/05	130.60
Yew Tree Farm	14.30	19/03	13.64

Borehole	Level	Date	May. av.
Llanfair DC	79.96	15/05	79.96
Morris Dancers	32.00	13/05	32.37
Heathlanes	62.35	06/05	62.10
Nuttalls Farm	129.62	11/05	129.63
Bussels No.7a	23.71	20/05	24.02
Alstonfield	189.14	13/05	186.76

Levels in metres above Ordnance Datum

Groundwater . . . Groundwater

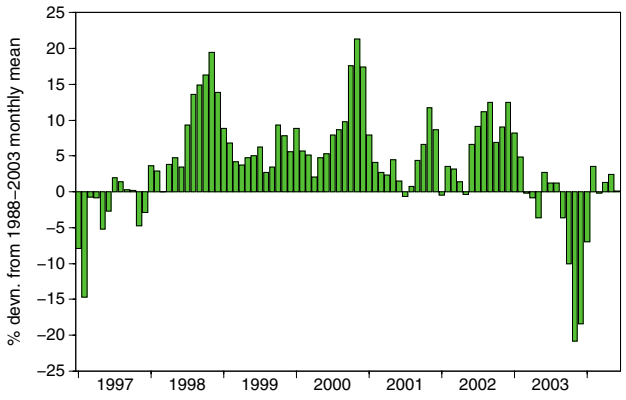


Groundwater levels - May 2004

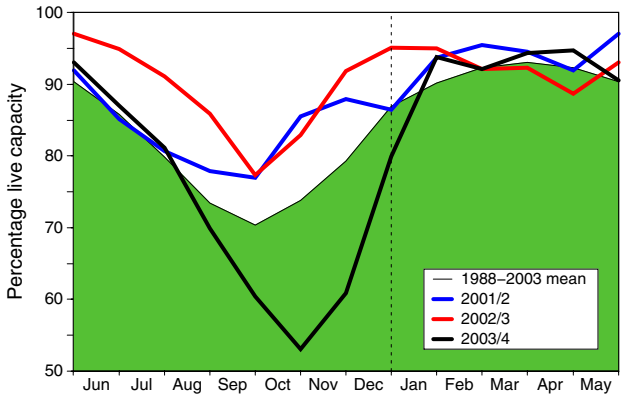
The rankings are based on a comparison between the average level in the featured month (but often only single readings are available) and the average level in each corresponding month on record. They need to be interpreted with caution especially when groundwater levels are changing rapidly or when comparing 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.

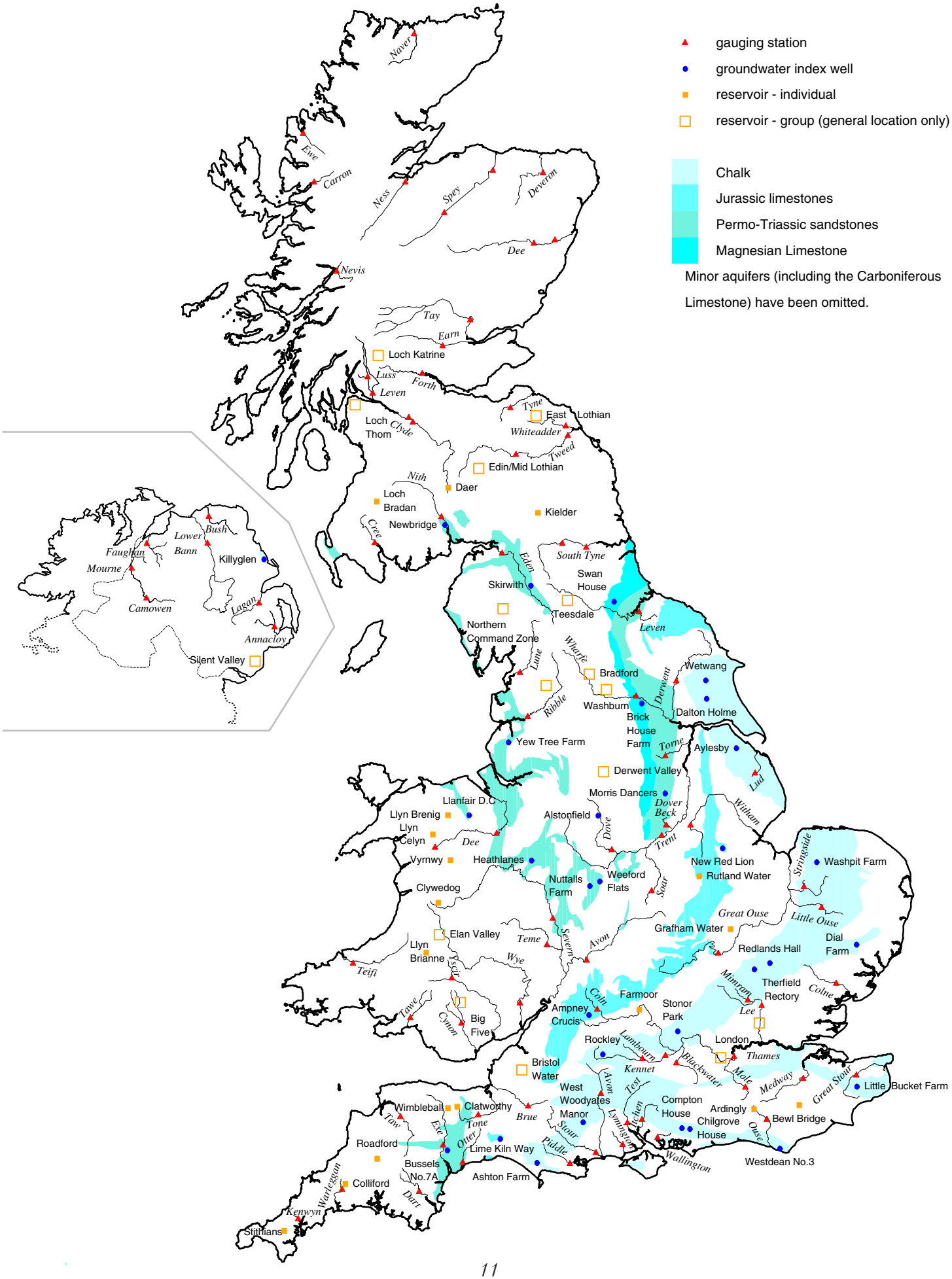
Percentage live capacity of selected reservoirs at start of month

Area	Reservoir	Capacity (Ml)	2004 Feb	Mar	Apr	May	Jun	Avg. Jun	Min. Jun	Year* of min.
North West	N Command Zone	• 124929	99	90	88	89	**76**	83	72	1991
	Vyrnwy	55146	99	92	99	95	**88**	89	72	1990
Northumbrian	Teesdale	• 87936	92	88	96	95	**83**	85	64	1991
	Kielder	(199175)	(96)	(90)	(91)	(92)	**(91)**	92	(85)	1989
Severn Trent	Clywedog	44922	96	90	99	100	**100**	96	83	1989
	Derwent Valley	• 39525	100	98	96	100	**92**	88	56	1996
Yorkshire	Washburn	• 22035	97	94	92	95	**89**	88	72	1990
	Bradford supply	• 41407	89	90	92	93	**85**	85	70	1996
Anglian	Grafham	(55490)	(82)	(88)	(95)	(98)	**(95)**	93	(72)	1997
	Rutland	(116580)	(81)	(91)	(94)	(97)	**(95)**	90	(75)	1997
Thames	London	• 202340	97	97	97	97	**94**	93	83	1990
	Farmoor	• 13830	96	92	96	100	**99**	97	90	2002
Southern	Bewl	28170	96	98	100	100	**99**	86	57	1990
	Ardingly	4685	95	100	100	100	**100**	99	96	1990
Wessex	Clatworthy	5364	100	100	95	100	**96**	86	67	1990
	Bristol WW	• (38666)	(83)	(91)	(92)	(92)	**(89)**	88	(70)	1990
South West	Colliford	28540	71	72	75	75	**73**	86	52	1997
	Roadford	34500	65	68	68	68	**67**	85	48	1996
	Wimbleball	21320	95	99	100	100	**97**	90	76	1992
	Stithians	5205	81	93	97	94	**88**	85	66	1990
Welsh	Celyn and Brenig	• 131155	100	99	100	99	**97**	97	82	1996
	Brianne	62140	100	92	98	99	**96**	96	85	1995
	Big Five	• 69762	97	96	98	99	**93**	89	70	1990
	Elan Valley	• 99106	100	94	99	95	**93**	95	85	1990
Scotland(E)	Edinburgh/Mid Lothian	• 97639	77	79	80	81	**78**	89	52	1998
	East Lothian	• 10206	100	100	100	100	**98**	96	84	1990
Scotland(W)	Loch Katrine	• 111363	98	88	91	93	**84**	87	66	2001
	Daer	22412	100	94	100	97	**89**	90	70	1994
	Loch Thom	• 11840	90	90	94	97	**92**	89	74	2001
Northern Ireland	Total+	•	78	81	85	84	**74**	88	74	**2004**
	Silent Valley	• 20634	59	64	66	64	**58**	81	56	2000

() 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:

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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

NATURAL ENVIRONMENT RESEARCH COUNCIL

06/04