Hydrological Summary for Great Britain

APRIL 1997

Rainfall

March was a mild, relatively sunny month with weather patterns - northern Scotland excepted - dominated by persistent anticyclonic conditions. A blocking high centred initially over western Europe, and later to the north of Britain, served to largely exclude Atlantic frontal systems from the end of the first week. This produced an exceptionally arid episode, in southern Britain especially, which lasted until around the 25th April. In the South-East precipitation over this period was largely restricted to light showers and fog drip with lengthy sequences of rainless days. The Institute of Hydrology registered its driest 50-day sequence in a record from 1963 and many localities reported less than 3 mm of rainfall over this period. The return of a south-westerly airstream in the last week provided a modest boost to April rainfall totals but England and Wales recorded only 42% of the 1961-90 average and catchment totals in the east were mostly less than 35%. Provisional data for E&W indicate that the combined March/April total was the third lowest this century after 1929 and 1938 - in much of the English lowlands only the latter was drier. The December-April accumulated rainfall totals are also notably low: only 1928/29 and 1975/76 being drier in the last 100 years. This reintensification of very protracted drought conditions produced unprecedented national rainfall totals in the 24-26 month timeframes. Rainfall over the last 25 months has eclipsed the E&W minima (established in the 1850s and - based on less reliable data - the 1780s) and is appreciably below the twentieth century minima (registered in 1932-34 and 1990-92). Entering May accumulated rainfall deficiencies exceeded the equivalent of more than six months rainfall over most of England.

River Flow

Limited rainfall together with high evaporation rates (encouraged, on occasions by high winds) produced sustained recessions in April in most catchments. April runoff was within the normal range in parts of NW Scotland but very depressed throughout the rest of Britain. The Dee (at Park) and the Deveron in eastern Scotland registered their lowest April mean flow and in many catchments only 1990 has produced lower flows in the recent past. For England and Wales initial analyses indicate that overall runoff was lower than in the benchmark drought of 1976. New monthly minimum flows for April were established for almost a third of the index rivers - including the Dove, Derwent (Yorks), Little Ouse, Taw and Severn (in a record from 1921). A longer historical perspective is provided by the Thames and Lee which recorded third lowest (after 1976 and 1944) April mean flows this century. In the worst affected catchments runoff was only 15-40% of the mean and, commonly, flows were below those that typify the late summer. In large parts of England runoff in the one and two-year timeframes is also close to, or below, the lowest on record. Accumulated runoff totals of less than half the long term average testify to the drought's exceptional severity. The impact is particularly evident in headwater areas where many higher levels springs have failed and the stream network has contracted substantially - with a consequent impact on aquatic habitats.

Groundwater

Soil moisture deficits increased very rapidly in April in most regions. By the end of the third week soils were exceptionally dry (only 1976 being comparable in the recent past) and, in the lowlands, were the equivalent of around 6-8 weeks average rainfall over wide areas. No significant infiltration can now be expected - to the major aquifer units - before the autumn. Late April groundwater levels confirm that the seasonal recessions have begun or, in the deeper wells, are about to begin. In groundwater terms, the drought is most notable for its spatial extent - water-tables are depressed throughout the country - as much as its intensity. Although winter recharge in some eastern Chalk units has been minimal significant infiltration during February has ensured that the 1997 summer recession has begun, and should remain, above the corresponding levels in 1976 (in some areas 1992 also) in most of the Chalk outcrop areas. In the Permo-Triassic sandstones spring peaks are commonly the lowest on record - a number of new April minimum levels were established - and the spatial extent of the drought implies that overall groundwater stocks by the late summer may well approach the lowest this century.

General

The arid start to the spring, coming on the back of an outstanding long term rainfall deficiency, has produced widespread and severe drought conditions. River flows and groundwater levels are exceptionally depressed and the very parched soils are producing difficulties for the farming community. The current limited restrictions on spray irrigation and isolated hosepipe bans are likely to be extended if the summer is dry. But overall reservoir contents remain healthier than at the same time last year and the 1990s have provided valuable experience in balancing the needs of water abstractors and the aquatic environment - the summer outlook for which is fragile. The scale of the water supply difficulties encountered will reflect both summer rainfall patterns and the associated demand patterns.

Institute of Hydrology

British Geological Survey

This report was compiled jointly by the Institute of Hydrology (a component of the Centre for Ecology and Hydrology) and the British Geological Survey - both organisations form part of the Natural Environment Research Council (NERC).

Data for this report have been provided principally by the regional divisions of the newly formed Environment Agency (England and Wales) and the Scottish Environment Protection Agency. For reasons of consistency and to provide greater spatial discrimination, the original regional divisions of the precursor organisations have been retained for use in the Hydrological Summaries. The majority of the areal rainfall figures have been provided by the Meteorological Office. The most recent areal rainfall figures are derived from a restricted network of raingauges and a proportion of the river flow data is of a provisional nature. Figure 3 is based on weather data collected by the Institute of Hydrology at Wallingford, Balquhidder (Central Region, Scotland) and Plynlimon. Reservoir contents information has been supplied by the Water Services Companies, the Environment Agency and, in Scotland, West of Scotland Water Authority and East of Scotland Water. A map (Figure 4) is provided to assist in the location of the principal monitoring sites.

Financial support towards the production of the Hydrological Summaries is given by the Department of the Environment, the Environment Agency, the Scottish Environment Protection Agency and the Office of Water Services (OFWAT).

The Hydrological Summaries are available on annual subscription at a current cost of £48 per year - enquiries should be directed to the National Water Archive Office at the address below. No charge is made to those organisations providing data for the Summaries. The text of the monthly report, together with details of other National Water Archive facilities, is available on the World Wide Web: http://www.nwl.ac.uk:80/~nrfadata/nwa.html

MORECS

Most of the recent monthly regional rainfall data featured in the Hydrological Summaries are MORECS assessments. MORECS is the generic name for The Meteorological Office services involving the calculation of evaporation and soil moisture routinely for Great Britain. Products include a weekly issue of maps and tables of potential and actual evaporation, soil moisture deficits, effective rainfall and the hydrometeorological variables used to calculate them. The data are used to provide values for 40 km squares - or larger areas - and various sets of maps and tables are available according to user requirements. Options include a day-by-day retrospective calculation of soil moisture at any of 4000 raingauge sites.

Further information about MORECS services may be obtained from: The Meteorological Office, Sutton House, London Road, Bracknell, RG12 2SY

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13 May 1997

TABLE 1 1996/97 RAINFALL AS A PERCENTAGE OF THE 1961-90 AVERAGE

Note: The monthly rainfall figures are the copyright of The Meteorological Office.
These data may not be published or passed on to any unauthorised person or organisation.

		Apr 1996	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan 1997	Feb	Mar	Apr
England and Wales	mm	51	57	30	41	80	34	89	126	52	15	119	24	25
	%	85	89	46	66	105	44	105	140	55	17	189	34	42
North West	mm	77	62	49	65	88	61	149	133	64	14	213	66	39
	%	108	83	60	76	82	53	116	108	52	12	273	69	55
Northumbrian	mm	63	53	22	53	67	31	68	108	84	19	127	37	20
	%	113	85	37	82	83	42	89	126	104	23	215	53	36
Severn Trent	mm	50	48	30	33	68	20	71	95	53	13	85	24	29
	%	91	81	51	62	101	31	111	134	69	19	157	39	53
Yorkshire	mm	41	52	35	41	74	31	57	112	93	13	105	25	22
	%	69	87	58	69	100	46	78	140	112	16	181	36	37
Anglian	mm	15	23	18	40	76	16	46	91	42	14	44	13	18
	%	33	48	35	82	138	33	90	157	76	28	119	27	39
Thames	mm	36	35	16	39	61	20	47	106	24	13	77	13	15
	%	72	63	29	80	105	34	76	163	34	20	171	22	30
Southern	mm	23	51	16	34	80	33	57	147	31	19	94	19	11
	%	43	94	30	71	140	48	71	173	38	24	174	30	21
Wessex	mm	58	60	29	27	86	33	83	145	31	14	116	31	23
	%	109	98	51	52	130	46	105	175	33	16	178	44	43
South West	mm	79	100	34	31	98	50	134	201	52	25	162	37	32
	%	114	139	49	45	117	54	116	161	37	18	160	37	46
Welsh	mm	87	106	47	47	103	58	173	171	52	12	211	69	42
	%	109	129	59	61	102	50	126	120	34	8	218	65	52
Scotland	mm	108	78	65	78	67	64	229	188	95	58	267	191	60
	%	142	91	76	83	57	45	147	125	63	38	262	153	78
Highland	mm	111	84	79	91	73	85	266	250	106	93	339	314	93
	%	122	91	81	86	57	50	134	123	54	49	267	194	102
North East	mm	63	67	33	66	64	32	139	110	86	27	126	76	35
	%	105	97	50	90	74	37	143	111	92	27	194	97	58
Tay	mm	103	67	44	53	64	52	195	142	70	39	247	124	27
	%	166	81	60	69	68	46	150	117	55	27	260	114	44
Forth	mm	86	68	44	55	61	47	186	139	81	40	227	107	33
	%	146	92	64	73	65	43	162	124	74	34	287	114	56
Tweed	mm	79	63	30	53	63	29	134	139	118	24	189	67	21
	%	139	89	46	73	72	33	141	149	127	24	282	85	37
Solway	mm	133	80	78	69	66	58	265	155	99	32	252	123	44
	%	173	94	93	77	55	41	169	108	67	21	250	105	57
Clyde	mm	142	90	88	99	66	78	282	215	93	64	308	218	72
	%	169	99	95	91	49	44	146	119	52	34	261	148	86

Note: The monthly regional rainfall figures for England and Wales for March & April 1997 correspond to the MORECS areal assessments derived by the Meteorological Office. In northern England these initial assessments may have a particularly wide error band associated with them, especially when snow is a significant component in the precipitation total. The figures for the Scottish regions (and also for Scotland) for March & April 1997 were derived by IH in collaboration with the SEPA regions.
The provisional figures for England and Wales and for Scotland are derived using a different raingauge network. Regional areal rainfall figures are regularly updated (normally one or two months in arrears) using figures derived from a far denser raingauge network.
The provisional February rainfall figure for England & Wales has been signficantly increased.

TABLE 2 RAINFALL ACCUMULATIONS AND RETURN PERIOD ESTIMATES

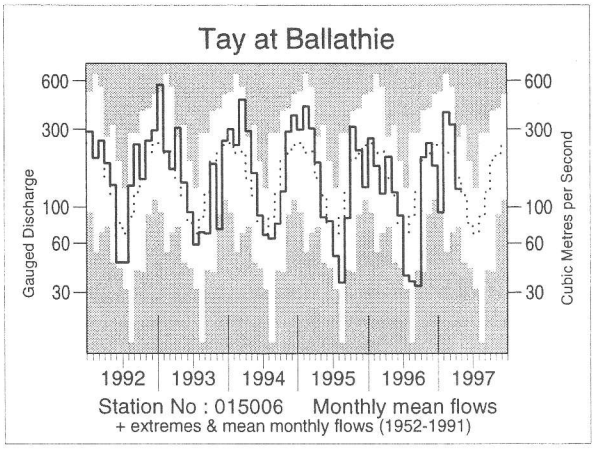
		Feb 97-Apr 97		Dec 96-Apr 97		May 96-Apr 97		Apr 95-Apr 97	
			Est Return Period, years		Est Return Period, years		Est Return Period, years		Est Return Period, years
England and Wales	mm	168		235		692		1419	
	% LTA	86	2-5	62	30-50	77	20-35	77	>200
North West	mm	318		396		1003		1809	
	% LTA	130	5-10	81	5-10	83	5-15	73	>>200
Northumbria	mm	184		287		689		1445	
	% LTA	99	2-5	82	5-10	81	10-20	82	30-40
Severn Trent	mm	138		204		569		1176	
	% LTA	81	2-5	64	15-25	76	20-30	75	110-150
Yorkshire	mm	151		257		659		1247	
	% LTA	82	2-5	74	5-15	80	10-15	73	>200
Anglian	mm	75		131		441		890	
	% LTA	57	15-25	56	50-80	74	30-40	72	>>200
Thames	mm	104		141		465		1067	
	% LTA	69	5-10	50	60-90	68	50-80	75	80-120
Southern	mm	124		174		592		1220	
	% LTA	73	5-10	52	40-60	76	10-20	76	60-90
Wessex	mm	169		214		677		1542	
	% LTA	90	2-5	58	25-40	81	5-15	89	5-10
South West	mm	231		308		956		2069	
	% LTA	86	2-5	56	35-50	81	5-15	86	10-15
Welsh	mm	322		386		1091		2180	
	% LTA	113	2-5	67	15-25	83	5-15	81	35-50
Scotland	mm	518		671		1440		2759	
	% LTA	171	>>200	111	2-5	100	<2	94	5-10
Highland	mm	746		945		1873		3333	
	% LTA	196	>>200	124	5-15	106	2-5	92	5-10
North East	mm	237		350		861		2009	
	% LTA	117	2-5	89	2-5	88	5-10	100	<2
Tay	mm	398		507		1124		2395	
	% LTA	150	25-40	94	2-5	91	2-5	95	2-5
Forth	mm	367		488		1088		2092	
	% LTA	158	60-90	106	2-5	98	2-5	92	5-10
Tweed	mm	277		419		930		1830	
	% LTA	136	10-15	106	2-5	96	2-5	92	5-10
Solway	mm	419		550		1321		2609	
	% LTA	142	15-25	92	2-5	93	2-5	89	5-10
Clyde	mm	598		755		1673		3162	
	% LTA	171	>200	105	2-5	99	2-5	91	5-10

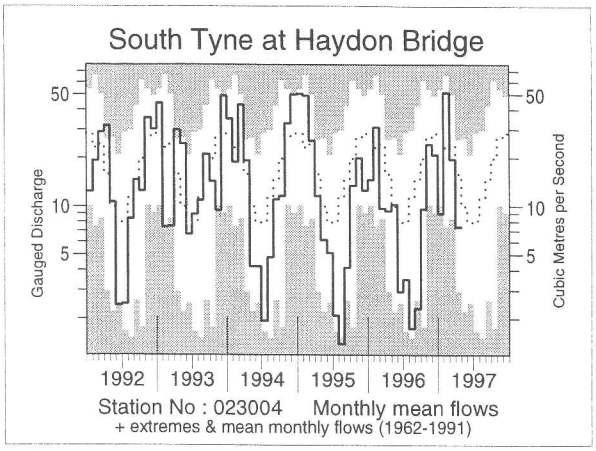
LTA refers to the period 1961-90.

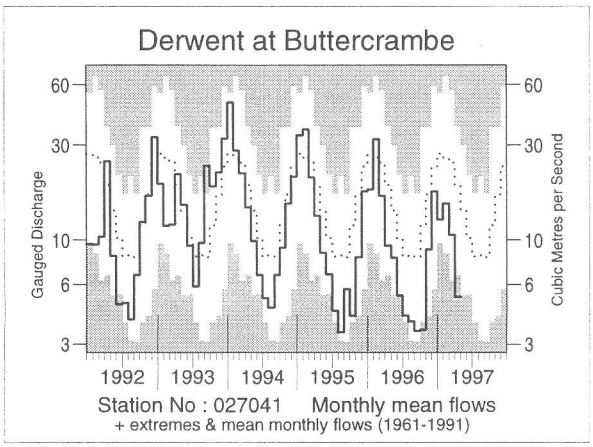
Return period assessments are based on tables provided by the Meteorological Office*. The tables reflect rainfall totals over the period 1911-70 only and the estimate assumes a sensibly stable climate. They assume a start in a specified month; return periods for a start in any month may be expected to be an order of magnitude less - for the longest durations the return period estimates converge. "Wet" return periods underlined. The ranking of accumulated rainfall totals for England & Wales and for Scotland can be affected by artifacts in the historical series - on balance these tend to exaggerate the relative wetness of the recent past.

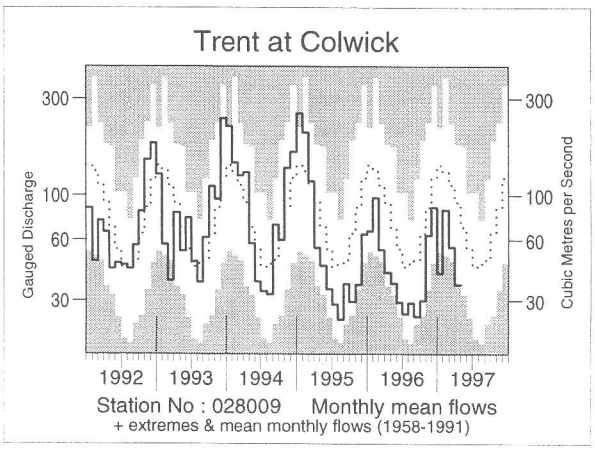
* Tabony, R.C., 1977, The Variability of long duration rainfall over Great Britain, Scientific Paper No. 37, Meteorological Office.

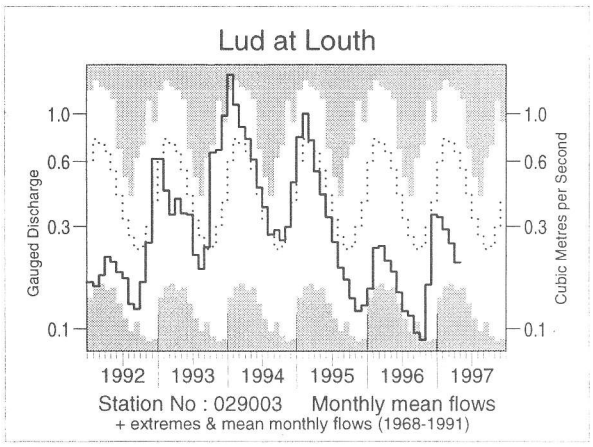
FIGURE 1 MONTHLY RIVER FLOW HYDROGRAPHS

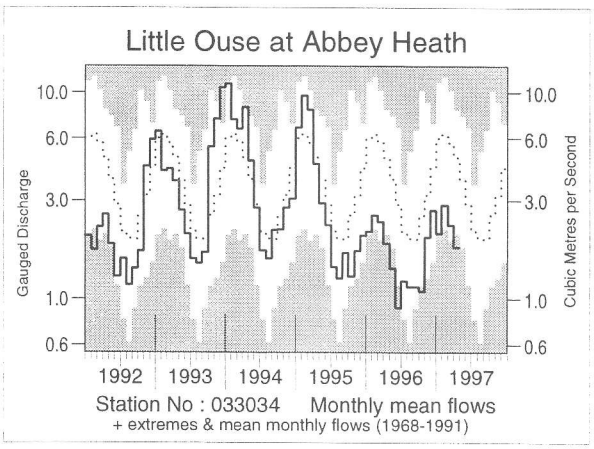


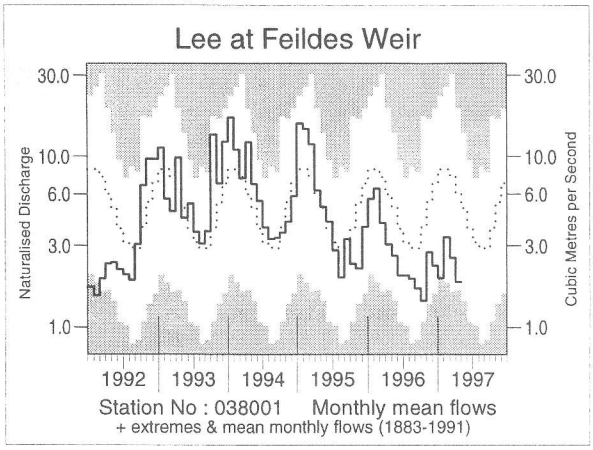


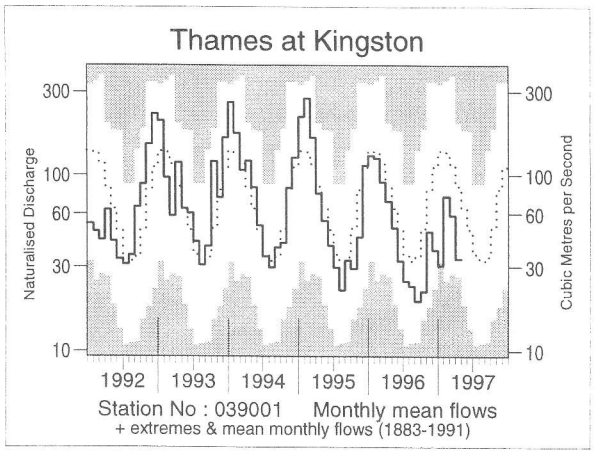


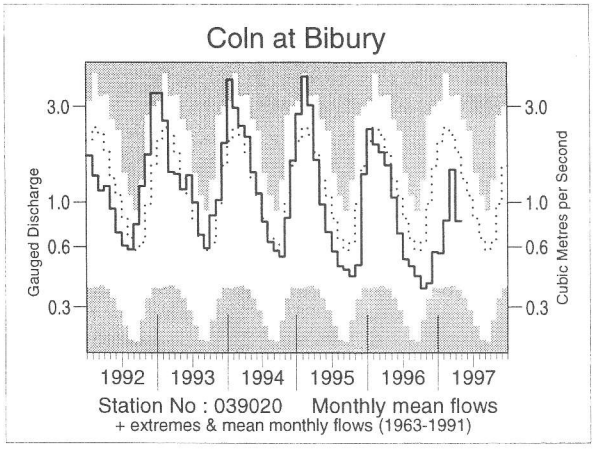


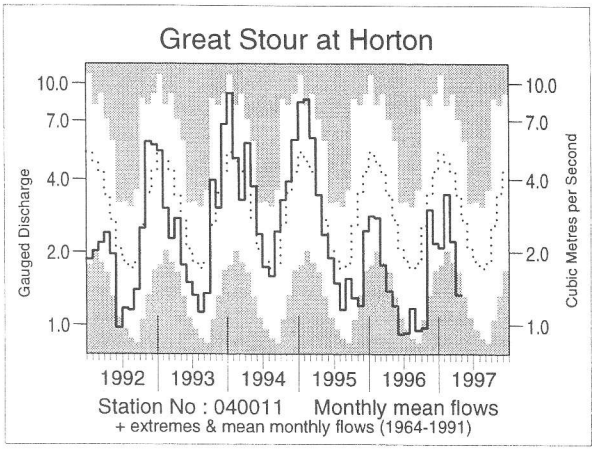


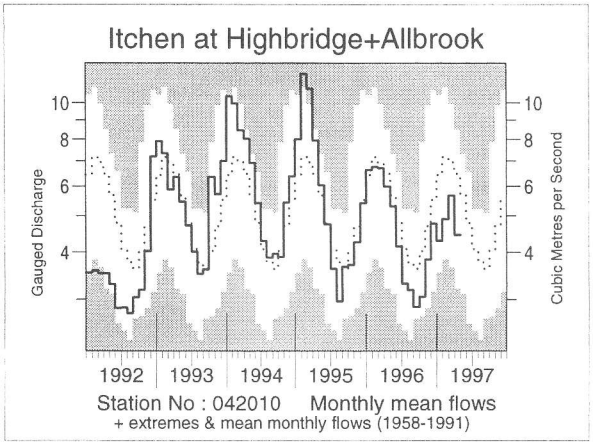


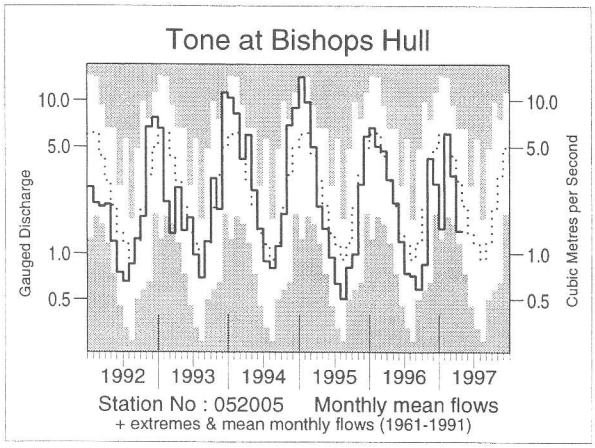


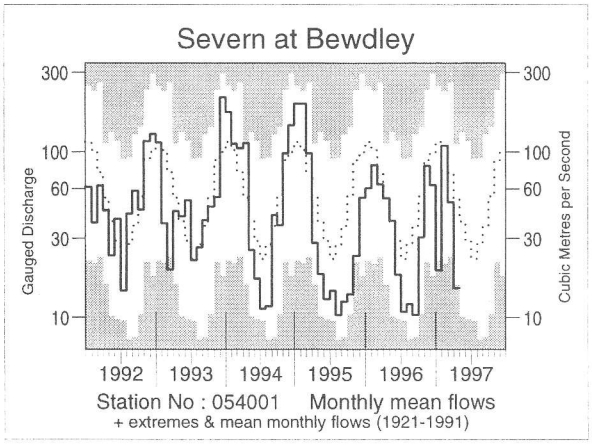


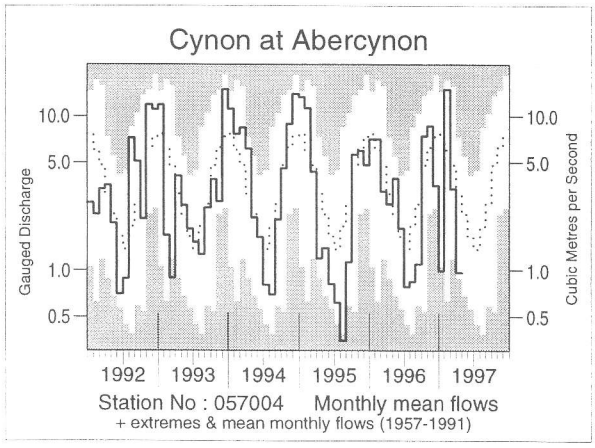

Coln at Bibury
Gauged Discharge
3.0
1.0
0.6
0.3
Cubic Metres per Second
1992 1993 1994 1995 1996 1997
Station No : 039020 Monthly mean flows
+ extremes & mean monthly flows (1963-1991)

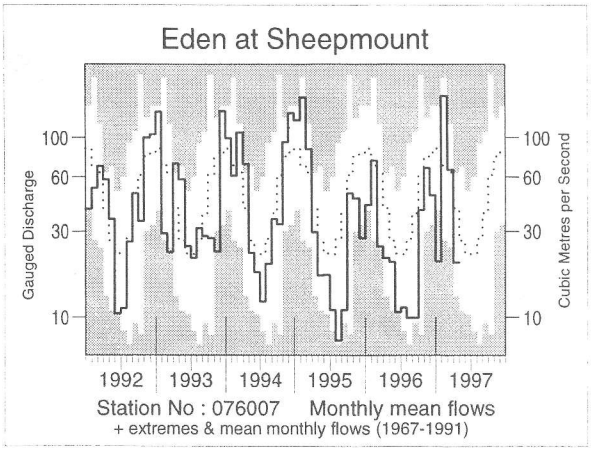

Great Stour at Horton
Gauged Discharge
10.0
7.0
4.0
2.0
1.0
Cubic Metres per Second
1992 1993 1994 1995 1996 1997
Station No : 040011 Monthly mean flows
+ extremes & mean monthly flows (1964-1991)


Itchen at Highbridge+Allbrook
Gauged Discharge
10
8
6
4
Cubic Metres per Second
1992 1993 1994 1995 1996 1997
Station No : 042010 Monthly mean flows
+ extremes & mean monthly flows (1958-1991)


Tone at Bishops Hull
Gauged Discharge
10.0
5.0
1.0
0.5
Cubic Metres per Second
1992 1993 1994 1995 1996 1997
Station No : 052005 Monthly mean flows
+ extremes & mean monthly flows (1961-1991)


Severn at Bewdley
Gauged Discharge
300
100
60
30
10
Cubic Metres per Second
1992 1993 1994 1995 1996 1997
Station No : 054001 Monthly mean flows
+ extremes & mean monthly flows (1921-1991)


Cynon at Abercynon
Gauged Discharge
10.0
5.0
1.0
0.5
Cubic Metres per Second
1992 1993 1994 1995 1996 1997
Station No : 057004 Monthly mean flows
+ extremes & mean monthly flows (1957-1991)


Eden at Sheepmount
Gauged Discharge
100
60
30
10
Cubic Metres per Second
1992 1993 1994 1995 1996 1997
Station No : 076007 Monthly mean flows
+ extremes & mean monthly flows (1967-1991)

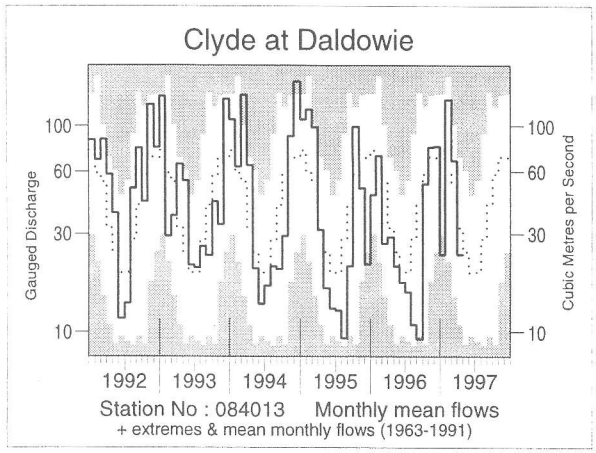

Clyde at Daldowie
Gauged Discharge
100
60
30
10
Cubic Metres per Second
1992 1993 1994 1995 1996 1997
Station No : 084013 Monthly mean flows
+ extremes & mean monthly flows (1963-1991)

TABLE 3 RUNOFF AS MM. AND AS A PERCENTAGE OF THE PERIOD OF RECORD AVERAGE WITH SELECTED PERIODS RANKED IN THE RECORD

River/ Station name	Dec 1996	Jan 1997	Feb	Mar	Apr 1997		1/97 to 4/97		11/96 to 4/97		5/96 to 4/97		5/95 to 4/97	
	mm %LT	mm %LT	mm %LT	mm %LT	mm %LT	rank /yrs	mm %LT	rank/ yrs	mm %LT	rank /yrs	mm %LT	rank /yrs	mm %LT	rank /yrs
Dee at Park	77 91	39 42	97 132	90 94	32 41	1 /25	258 75	4 /25	399 79	3 /25	578 73	2 /24	1556 98	9 /23
Tay at Ballathie	105 74	54 36	202 172	187 142	73 81	14 /45	515 105	29 /45	758 101	21 /45	1059 93	15 /44	2078 91	13 /43
Tweed at Boleside	126 127	42 39	183 233	88 107	24 44	3 /37	337 104	24 /37	566 111	26 /36	740 97	13 /36	1339 88	8 /35
Whiteadder Water at Hutton Castle	102 217	47 78	48 101	27 57	11 30	3 /28	133 70	5 /28	264 96	13 /28	333 86	11 /27	650 84	9 /26
South Tyne at Haydon Bridge	75 72	32 31	166 219	70 80	26 44	5 /35	294 91	10 /35	453 87	10 /35	560 73	3 /33	1013 65	1 /31
Wharfe at Flint Mill Weir	77 79	28 27	138 181	54 70	21 39	7 /42	241 80	12 /42	398 83	8 /42	531 75	4 /41	783 55	1 /40
Derwent at Buttercrambe	30 74	21 47	23 60	18 45	8 27	1 /36	71 47	2 /36	115 53	3 /36	163 51	2 /35	386 60	1 /34
Trent at Colwick	31 69	15 29	27 64	20 51	12 39	2 /39	74 46	2 /39	128 54	3 /39	190 55	2 /38	386 55	1 /37
Lud at Louth	17 83	16 53	13 83	12 36	10 32	2 /29	50 41	6 /29	74 48	6 /29	111 46	3 /28	234 48	2 /27
Witham at Claypole Mill	9 43	9 34	11 40	11 43	6 29	2 /38	36 38	4 /38	51 40	3 /38	75 41	3 /38	177 48	1 /37
Little Ouse at Abbey Heath	10 61	8 34	10 45	9 40	7 37	1 /30	33 41	3 /29	51 46	5 /29	77 47	2 /29	166 50	2 /28
Colne at Lexden	7 40	5 22	5 27	6 34	3 27	1 /38	20 28	2 /38	34 34	4 /37	51 38	1 /36	127 48	3 /34
Lee at Feildes Weir (natr.)	6 33	5 23	8 39	7 34	5 30	2 /111	24 32	4 /111	37 34	4 /111	67 41	4 /110	180 56	9 /108
Thames at Kingston (natr.)	10 33	8 22	18 55	16 51	9 38	4 /115	51 41	5 /115	73 42	6 /114	119 49	6 /114	326 66	10 /113
Coln at Bibury	14 35	14 26	18 33	36 68	20 46	3 /34	88 44	2 /34	112 42	2 /34	201 52	2 /33	523 66	2 /32
Great Stour at Horton	17 49	16 39	24 73	17 53	10 38	1 /32	68 52	4 /32	107 56	3 /31	155 54	1 /31	324 56	1 /29
Itchen at Highbridge+Allbrook	36 85	32 66	33 67	42 81	32 69	4 /39	139 71	5 /39	202 75	6 /39	363 79	3 /38	805 87	6 /37
Stour at Throop Mill	30 52	18 27	49 80	40 79	16 46	3 /25	122 59	4 /25	185 61	3 /24	249 63	3 /24	612 77	2 /23
Exe at Thorverton	71 52	18 13	135 129	46 55	15 26	1 /41	214 57	4 /41	418 69	3 /41	575 70	3 /41	1172 71	1 /40
Taw at Umberleigh	62 52	14 12	118 137	40 59	9 21	1 /39	182 58	4 /39	378 72	4 /39	465 67	5 /38	908 65	1 /37
Tone at Bishops Hull	38 54	19 23	73 99	43 76	18 46	2 /37	153 61	5 /36	245 67	6 /36	327 69	5 /36	762 80	6 /35
Severn at Bewdley	39 62	12 17	61 106	31 66	9 28	1 /77	113 55	4 /76	201 63	4 /76	275 62	5 /76	530 59	1 /75
Teme at Knightsford Bridge	28 50	11 16	48 92	29 62	10 29	1 /28	97 50	3 /27	148 52	3 /27	197 55	3 /27	477 66	3 /26
Cynon at Abercynon	90 46	25 13	340 246	85 71	23 30	2 /39	473 89	13 /39	774 88	11 /39	1175 93	14 /37	2185 86	7 /35
Dee at New Inn	94 37	25 10	364 217	141 78	38 35	5 /28	567 82	9 /28	943 80	5 /28	1489 84	6 /27	2447 69	1 /26
Eden at Sheepmount	56 56	24 23	181 238	77 102	23 47	5 /30	305 101	18 /30	437 90	11 /30	556 80	6 /29	955 68	1 /28
Clyde at Daldowie	112 107	33 29	171 220	95 116	32 68	11 /34	332 104	23 /34	551 106	20 /34	727 92	12 /33	1301 82	5 /32
Carron at New Kelso	162 49	164 50	373 167	286 97	182 120	11 /19	1005 104	12 /19	1529 97	8 /18	2337 93	7 /18	3744 74	1 /17
Ewe at Poolewe	167 61	127 46	335 173	325 156	178 122	18 /27	966 119	19 /27	1447 108	17 /27	2140 100	14 /26	3529 82	4 /25

Notes:
(i) Values based on gauged flow data unless flagged (natr.), when naturalised data have been used.
(ii) Values are ranked so that lowest runoff is rank 1.
(iii) %LT means percentage of long term average from the start of the record to 1995. For the long periods (at the right of this table), the end date for the long term is 1997.

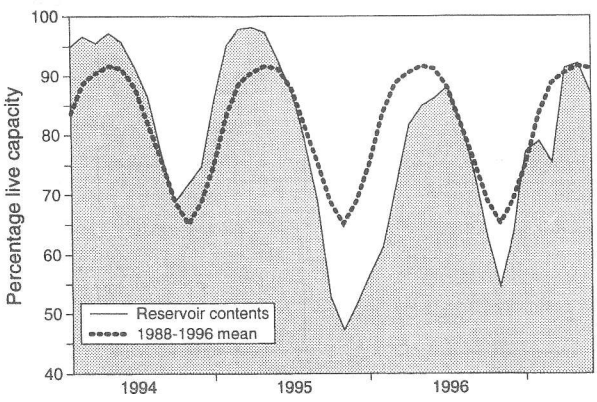
TABLE 4 START-MONTH RESERVOIR STORAGES UP TO MAY 1997

Area	Reservoir (R)/ Group (G)		Capacity● (Ml)	1996 Dec	1997 Jan	Feb	Mar	Apr	May	*1996 May*
North West	N.Command Zone[1]	(G)	133375	84	77	66	100	97	87	*80*
	Vyrnwy	(R)	55146	86	81	71	100	95	86	*70*
Northumbria	Teesdale[2]	(G)	87936	61	78	80	95	97	89	*81*
	Kielder	(R)	199175*	93	88	89	100	93	90	*93*
Severn-Trent	Clywedog	(R)	44922	80	81	76	93	97	98	*93*
	Derwent Valley[3]	(G)	39525	93	98	94	100	100	95	*54*
Yorkshire	Washburn[4]	(G)	22035	86	97	86	98	93	86	*76*
	Bradford supply[5]	(G)	41407	84	90	88	100	98	90	*60*
Anglian	Grafham	(R)	58707	68	69	68	72	77	73	*95*
	Rutland	(R)	130061	70	71	68	73	76	72	*94*
Thames	London[6]	(G)	206399	59	70	70	85	94	93	*95*
	Farmoor [7]	(G)	13843	100	99	93	96	98	98	*97*
Southern	Bewl	(R)	28170	59	60	65	85	98	91	*94*
	Ardingly	(R)	4685	55	64	68	100	100	100	*100*
Wessex	Clatworthy	(R)	5364	88	96	81	100	99	89	*94*
	Bristol W [8]	(G)	38666*	77	80	74	96	95	92	*97*
South West	Colliford	(R)	28540	50	53	52	57	58	56	*66*
	Roadford[9]	(R)	34500	51	54	52	61	62	60	*41*
	Wimbleball[10]	(R)	21320	60	64	59	81	91	84	*81*
	Stithians	(R)	5205	71	88	90	96	97	89	*97*
Welsh	Celyn + Brenig	(G)	131155	75	82	78	97	98	94	*75*
	Brianne	(R)	62140	100	93	84	99	97	86	*100*
	Big Five[11]	(G)	69762	77	75	67	96	95	85	*94*
	Elan Valley[12]	(G)	99106	99	92	85	100	99	91	*99*
East of Scotland	Edin./Mid Lothian[13]	(G)	97639	89	93	91	100	100	94	*98*
	East Lothian[14]	(G)	10206	79	100	100	100	99	98	*98*
West of Scotland	Loch Katrine	(G)	111363	97	89	85	100	100	96	*100*
	Daer	(R)	22412	100	98	91	100	98	94	*100*
	Loch Thom	(G)	11840	100	99	96	100	100	94	*97*

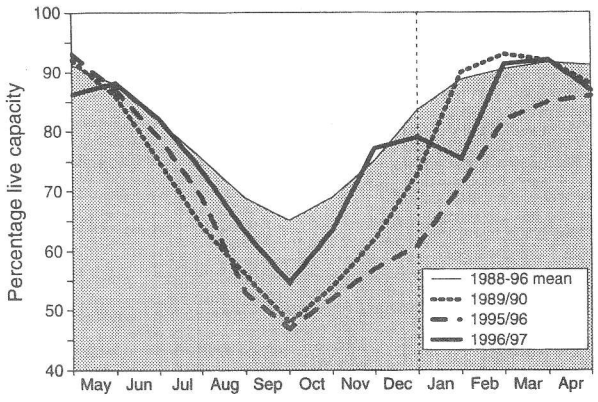
● Live or usable capacity (unless indicated otherwise) * Gross storage/percentage of gross storage

1. Includes Haweswater, Thirlmere, Stocks and Barnacre.
2. Cow Green, Selset, Grassholme, Balderhead, Blackton and Hury.
3. Howden, Derwent and Ladybower.
4. Swinsty, Fewston, Thruscross and Eccup.
5. The Nidd/Barden group (Scar House, Angram, Upper Barden,Lower Barden and Chelker) plus Grimwith.
6. Lower Thames (includes Queen Mother, Wraysbury, Queen Mary, King George VI and Queen Elizabeth II) and Lee Valley (includes King George and William Girling) groups -pumped storages.
7. Farmoor 1 and 2 - pumped storages.
8. Blagdon, Chew Valley and others.
9. Roadford began filling in November 1989.
10. Shared between South West (river regulation for abstraction) and Wessex (direct supply).
11. Usk, Talybont, Llandegfedd (pumped stroage), Taf Fechan, Taf Fawr.
12. Claerwen, Caban Coch, Pen-y-garreg and Craig Goch.
13. Megget, Talla, Fruid, Gladhouse, Torduff, Clubbiedean, Glencorse,Loganlea and Morton (upper and lower).
14. Thorters, Donolly, Stobshiel, Lammerloch, Hopes and Whiteadder

A GUIDE TO THE VARIATION IN OVERALL RESERVOIR STOCKS FOR ENGLAND AND WALES



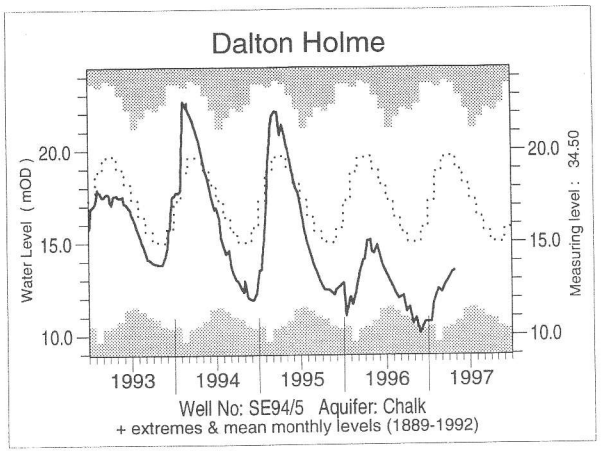
A COMPARISON BETWEEN OVERALL RESERVOIR STOCKS FOR ENGLAND AND WALES IN RECENT YEARS

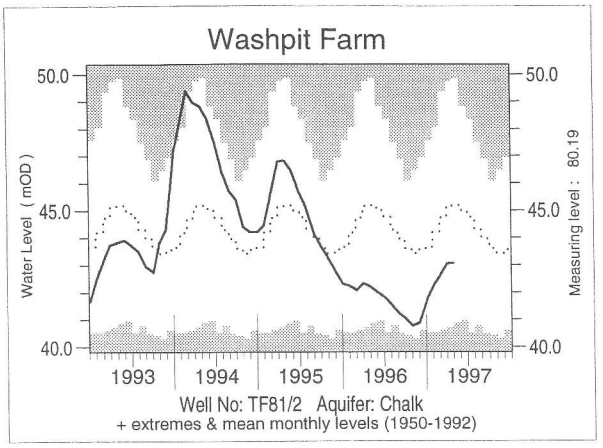


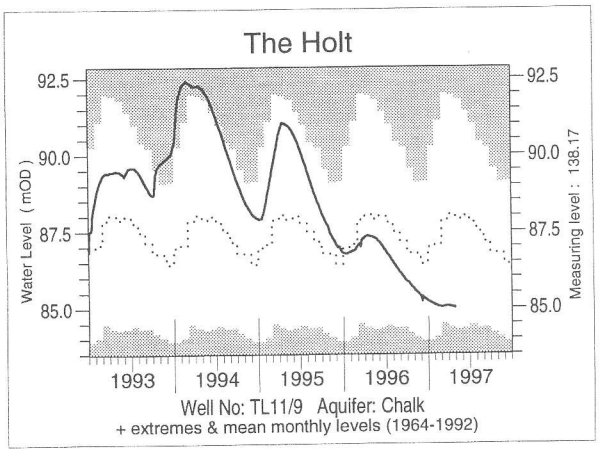
These plots are based on the reservoirs featured in Table 4 only

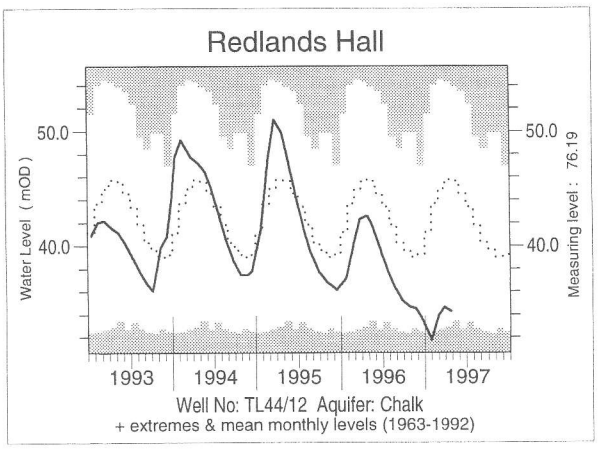
Note: Variations in storage depend on the balance between inputs (from catchment rainfall and any pumping) and outputs (to supply, compensation flow, HEP, amenity). There will be additional losses due to evaporation, especially in the summer months. Operational strategies for making the most efficient use of water stocks will further affect reservoir storages. Table 4 is intended to provide a link between the hydrological conditions described elsewhere in the report and the water resources situation. The reservoirs featured may not be representative of storage conditions across the individual regions; this can be particularly important during drought conditions (eg, in the Severn-Trent region during 1995/96).

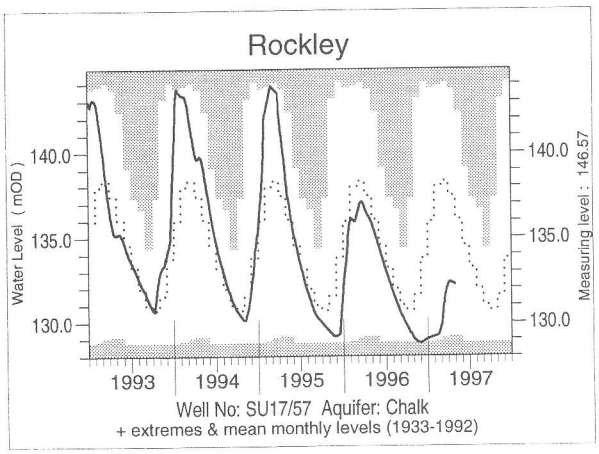
FIGURE 2 GROUNDWATER LEVEL HYDROGRAPHS

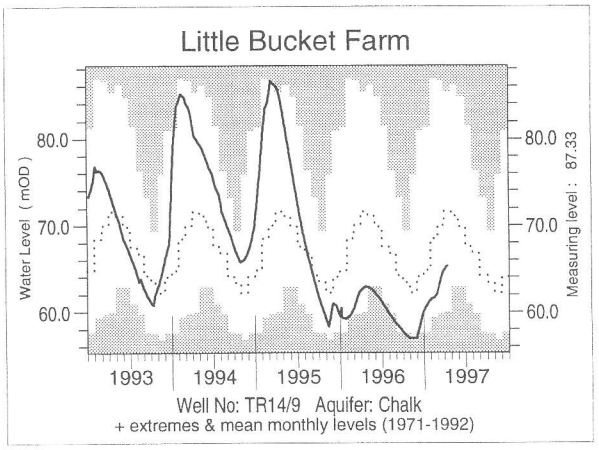


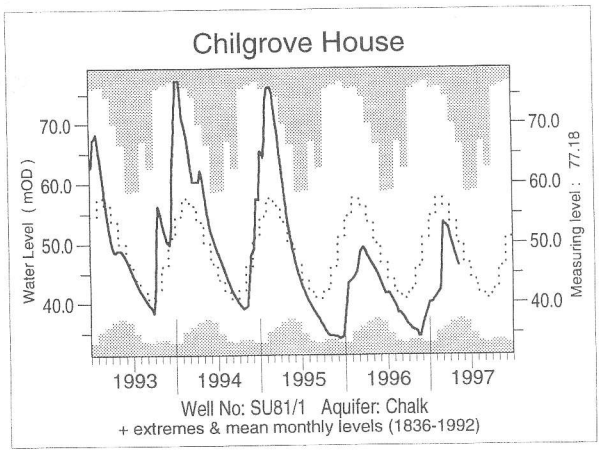


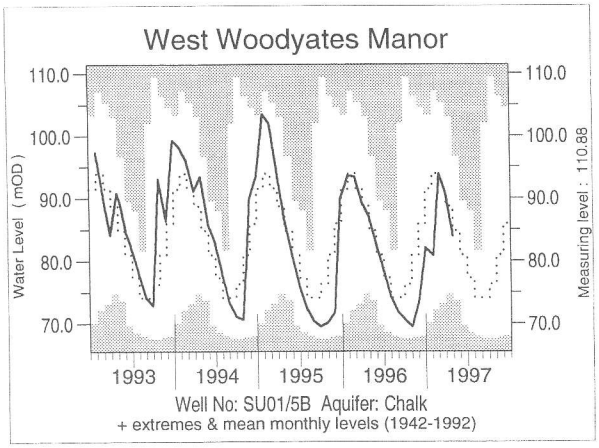


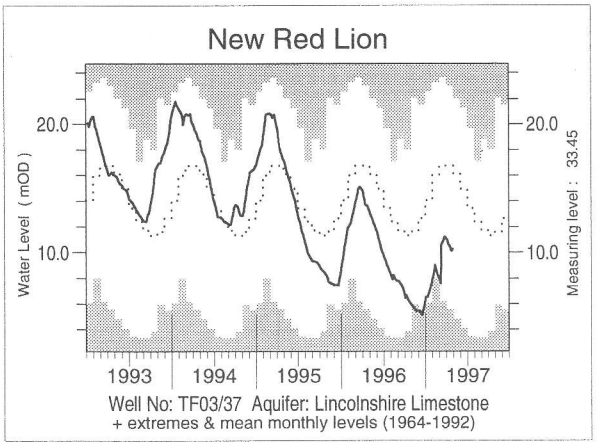


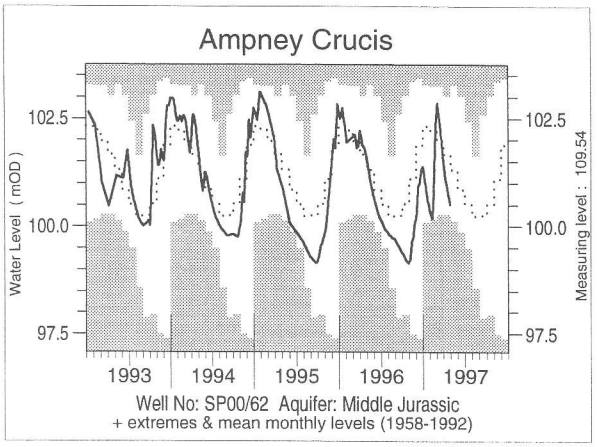


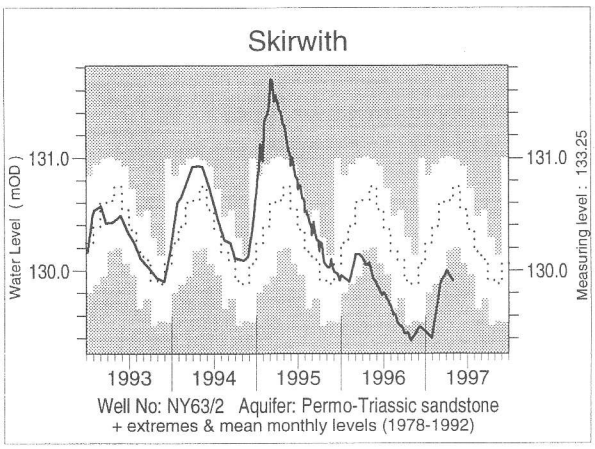


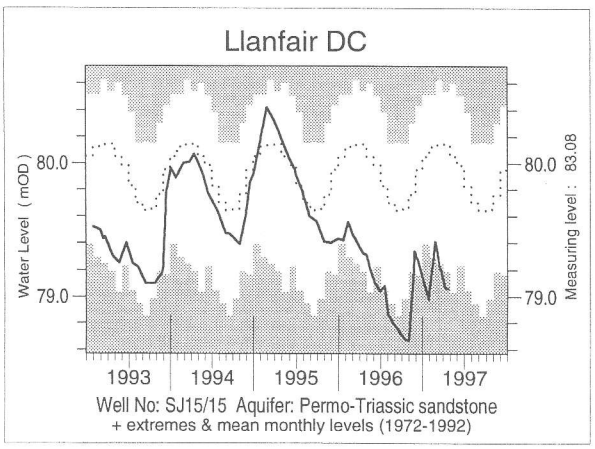


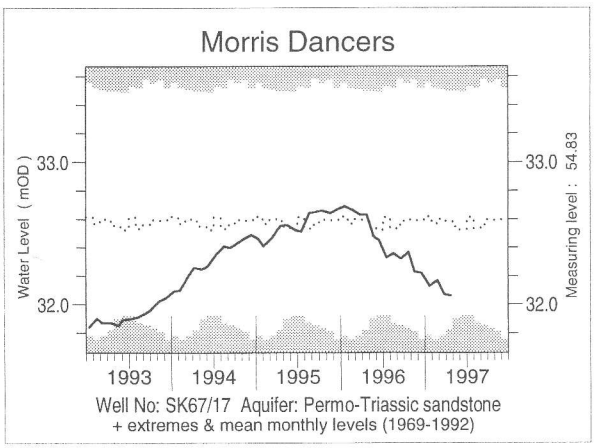


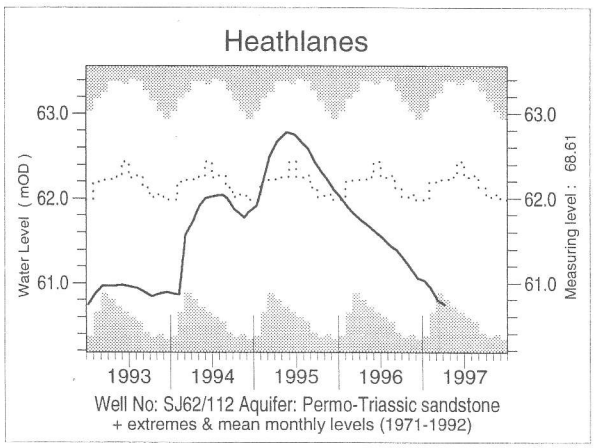

New Red Lion
Water Level (mOD)
20.0
10.0
Measuring level : 33.45
1993
1994
1995
1996
1997
Well No: TF03/37 Aquifer: Lincolnshire Limestone
+ extremes & mean monthly levels (1964-1992)

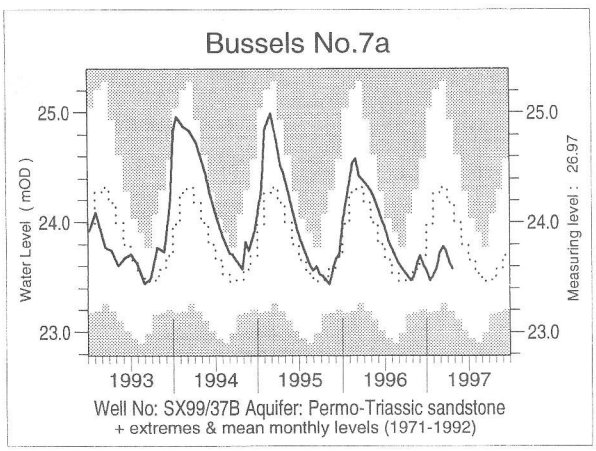

Ampney Crucis
Water Level (mOD)
102.5
100.0
97.5
Measuring level : 109.54
1993
1994
1995
1996
1997
Well No: SP00/62 Aquifer: Middle Jurassic
+ extremes & mean monthly levels (1958-1992)


Skirwith
Water Level (mOD)
131.0
130.0
Measuring level : 133.25
1993
1994
1995
1996
1997
Well No: NY63/2 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1978-1992)


Llanfair DC
Water Level (mOD)
80.0
79.0
Measuring level : 83.08
1993
1994
1995
1996
1997
Well No: SJ15/15 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1972-1992)


Morris Dancers
Water Level (mOD)
33.0
32.0
Measuring level : 54.83
1993
1994
1995
1996
1997
Well No: SK67/17 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1969-1992)


Heathlanes
Water Level (mOD)
63.0
62.0
61.0
Measuring level : 68.61
1993
1994
1995
1996
1997
Well No: SJ62/112 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1971-1992)


Bussels No.7a
Water Level (mOD)
25.0
24.0
23.0
Measuring level : 26.97
1993
1994
1995
1996
1997
Well No: SX99/37B Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1971-1992)

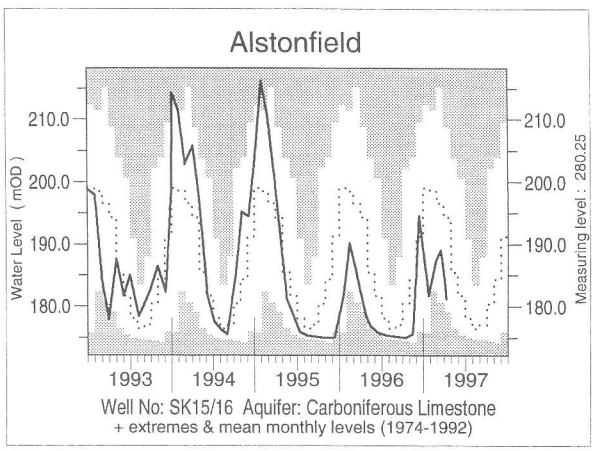

Alstonfield
Water Level (mOD)
210.0
200.0
190.0
180.0
Measuring level : 280.25
1993
1994
1995
1996
1997
Well No: SK15/16 Aquifer: Carboniferous Limestone
+ extremes & mean monthly levels (1974-1992)

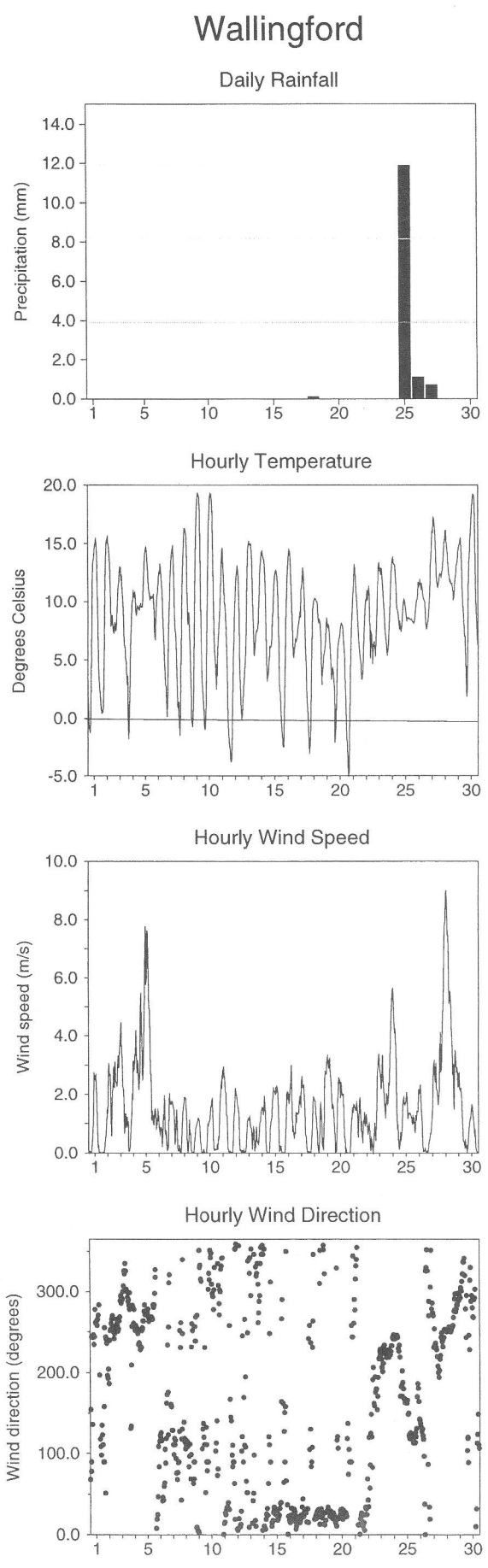
TABLE 5 APRIL GROUNDWATER LEVELS 1997

Site	Aquifer	Records Commence	Minimum Apr <1997	Average Apr <1997	Maximum Apr <1997	No of years Apr/May level < 1997	Apr/May 1997 day	Apr/May 1997 level
Dalton Holme	Ck	1889	10.46	19.50	23.60	5	25/04	13.47
Wetwang	Ck	1971	18.42	23.70	30.17	3	25/04	20.48
Keelby Grange	Ck	1980	3.86	12.08	18.36	1	21/04	5.73
Washpit Farm	Ck	1950	40.71	45.17	49.77	8	01/05	43.08
The Holt	Ck	1964	84.35	88.16	92.26	1	28/04	85.00
Therfield Rectory	Ck	1883	70.72	80.50	97.51	6	21/04	71.94
Redlands Hall	Ck	1963	32.85	44.87	54.32	1	25/04	34.24
Rockley	Ck	1933	129.16	137.45	143.68	5	28/04	132.22
Little Bucket Farm	Ck	1971	60.02	71.68	85.91	5	14/04	65.30
Compton House	Ck	1894	29.50	44.09	57.10	>10	08/05	37.88
Chilgrove House	Ck	1836	36.88	52.21	70.09	>10	08/05	46.26
Westdean No.3	Ck	1940	1.28	2.07	3.68	0	02/05	1.34
Lime Kiln Way	Ck	1969	124.00	125.50	126.23	9	16/04	125.42
Ashton Farm	Ck	1974	65.01	69.41	71.20	7	30/04	68.55
West Woodyates	Ck	1942	74.86	88.22	103.00	>10	30/04	83.91
Killyglen (NI)	Ck	1985	113.74	115.11	116.53	1	06/04	113.98
New Red Lion	LLst	1964	5.61	16.45	22.97	1	28/04	10.27
Ampney Crucis	MidJ	1958	100.29	101.71	103.01	3	28/04	100.51
Redbank	PTS	1981	7.43	8.34	9.43	1	30/04	7.71
Yew Tree Farm	PTS	1972	12.52	13.56	13.93	6	02/05	13.47
Skirwith	PTS	1978	129.91	130.60	131.51	0	29/04	129.91
Llanfair D.C	PTS	1972	79.06	79.97	80.54	0	22/04	79.06
Morris Dancers	PTS	1969	31.82	32.48	33.50	4	23/04	32.06
Heathlanes	PTS	1971	60.74	62.08	63.38	0	07/04	60.74
Bussels No.7A	PTS	1971	23.19	24.15	24.93	2	22/04	23.58
Rusheyford NE	MgLst	1967	65.40	73.04	76.84	>10	21/04	76.12
Peggy Ellerton	MgLst	1968	31.46	34.37	37.39	1	22/04	31.96
Alstonfield	CLst	1974	177.83	193.47	208.75	2	11/04	181.18

groundwater levels are in metres above Ordnance Datum

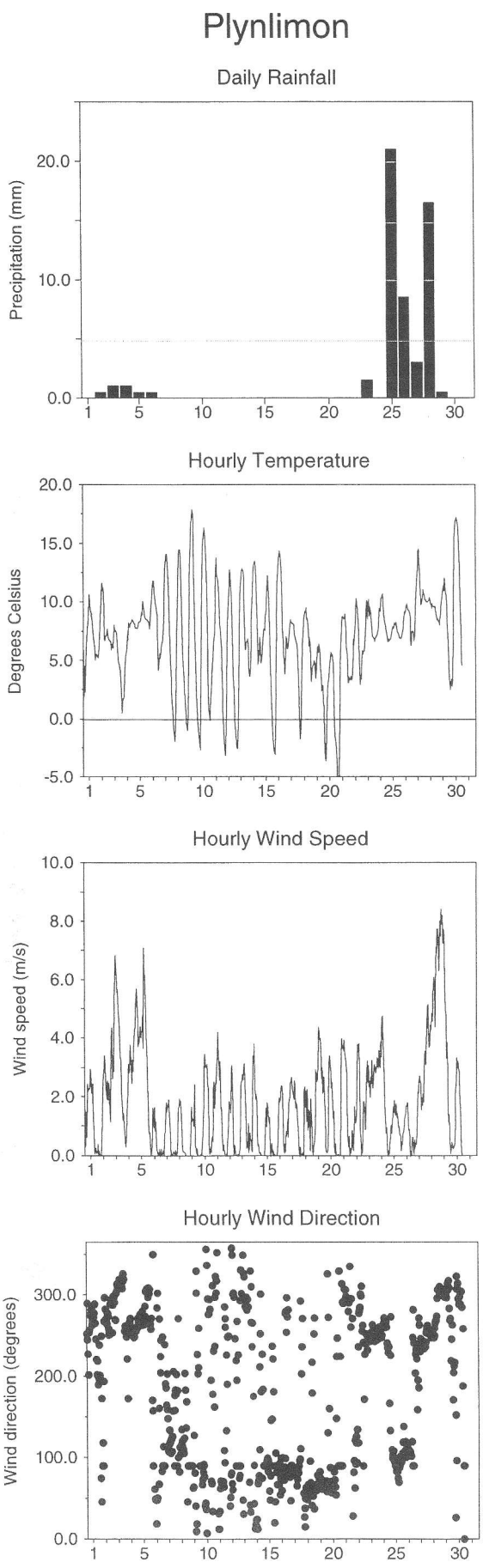
Ck	Chalk	MidJ	Middle Jurassic Limestones
LLst	Linconshire Limestone	MgLst	Magnesian Limestone
PTS	Permo-Triassic sandstones	Clst	Carboniferous Limestones

FIGURE 3 METEOROLOGICAL SUMMARY - APRIL 1997



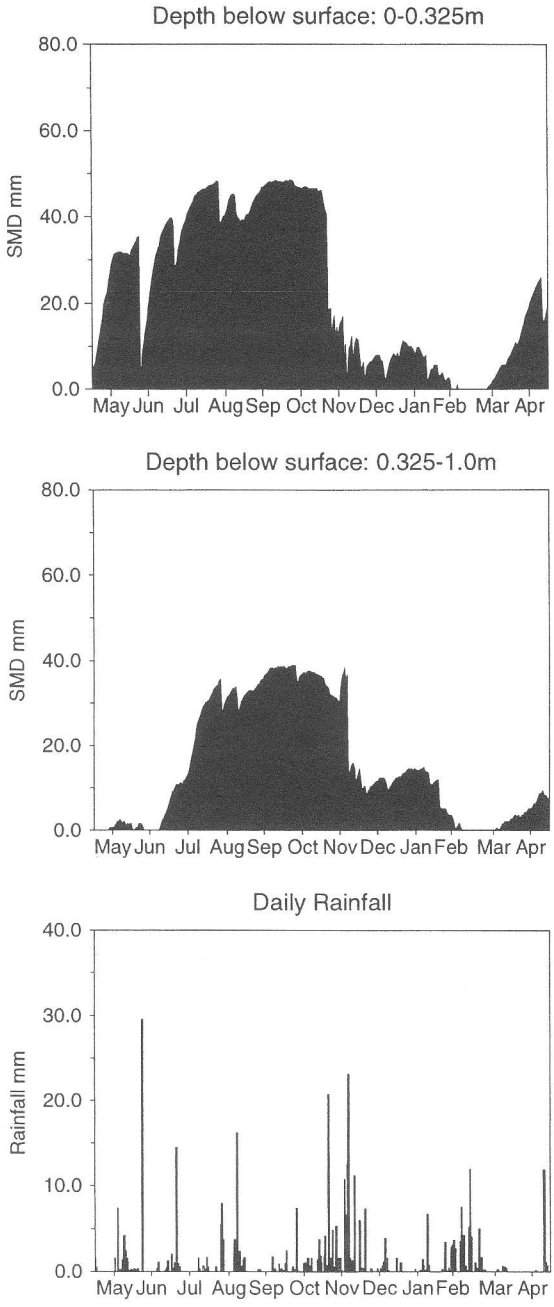
The Institute of Hydrology Meteorological Station occupies a relatively open site on the Thames floodplain about 5km NW of the Chilterns escarpment. Station elevation is 48m

FIGURE 3 (continued)



The Dolydd automatic weather station at Plynlimon is sited in an exposed field with a forested area to the south. Surrounding land reaches a peak height of around 400m. Station elevation is 300m aOD and average annual rainfall exceeds 2300mm.

FIGURE 3a. WALLINGFORD SMD DATA 1996/7.



Note

Soil moisture deficit is defined as the amount by which the water stored in the soil is below the quantity held at field capacity. Two automatic soil water stations (ASWSs) deployed at Wallingford, which use capacitance soil water sensors installed at depths of 5,15 and 50 cm, are the sources of the data. Figure 3a shows deficits calculated from one of the stations for the depth ranges 0-0.325m (15cm probe) and 0.325-1.0m (50cm probe) at 0100 GMT on each day. At the end of January 1996, field capacity was re-estimated using recent data and the soil moisture deficit values for the previous months were recalculated accordingly.

Daily rainfall from the Wallingford met station from May 1996 is presented.

FIGURE 4 LOCATION MAP OF GAUGING STATIONS AND GROUNDWATER INDEX WELLS