

Hydrological Summary for Great Britain

MARCH 1997

Rainfall

March was another exceptionally mild month but rainfall continued in an episodic vein - monthly totals providing a dramatic contrast with the very wet February. Unsettled conditions continued in Scotland but, from around the 5th, active frontal systems were rare in southern Britain; in some catchments <5 mm of rainfall was reported over the ensuing four weeks and some localities in the South-East had registered notable absolute droughts (>30 days) by early April. Rainfall totals for March testified to an exaggeration in the NW/SE rainfall gradient across the country. Following a very wet start (110 mm at Balquhider on the 1st) some parts of Scotland recorded well above average March precipitation whilst regional totals were greatly below average throughout England and Wales - which experienced its fourth driest March in over 50 years. Rainfall was especially meagre in some central, eastern and southern catchments. The Dec-Mar rainfall total for E&W is the lowest since 1964 and has served to reintensify what is now a protracted, widespread and very severe rainfall deficiency. Rainfall over the last two years is the lowest - for *any* 24-month accumulation - in the entire E&W series which begins in 1767. The April-March periods for both 1995/96 and 1996/97 rank amongst the four driest in the last 150 years and the overall deficiency - in percentage terms - is the equivalent of around 5-6 months average rainfall over much of E&W. However, local variations in intensity are important and the focus of the drought - initially in northern England - now encompasses much of the Midlands and eastern England.

River Flow

Normal early spring flow patterns characterised some catchments in northern Britain but, to the south, sustained recessions were much more typical with notably low flows reported over wide areas in early April - causing stress to the aquatic environment and, locally, some navigation problems. March runoff totals in Scotland were close to the normal range for most rivers but significantly above average in some areas. Almost all catchments were saturated by late February and most Scottish rivers were in spate early in March. On the 1st, the peak on the Tay exceeded 1350 cumecs, causing significant flooding and adding to a notable cluster of recent exceptional floods in rivers draining from the Highlands. Above average runoff totals in England were largely confined to the North-West, elsewhere totals in the 25-70% range were typical with the most depressed runoff rates in eastern England and the Midlands - the Soar especially. Prior to the 1990s similar March runoff totals were relatively uncommon but broadly comparable runoff was reported in 1992, 1993 and, in some catchments, last year. For the winter half-year (Oct.-Mar.) runoff is less than 40% of average in the worst affected areas and for 24-month runoff accumulations

ending in March new minimum runoff totals have been established in around half the index catchments in E&W. For some rivers (eg the Trent and Medway) the sequence of below average monthly mean flows is unprecedented and the mean flow since the spring of 1995 has, typically, been only around half the long term average - considerably less in some eastern Chalk streams. With baseflows modest and now declining, the steep March recessions may be expected to herald a general seasonal decline which, in the absence of above average rainfall, will result in notably low late summer flows, particularly for spring-fed streams (with a corresponding contraction in the stream network).

Groundwater

With significant infiltration in February in most outcrop areas and moist soils at month-end, average rainfall would have triggered a limited but important recovery in groundwater levels. In the event, rainfall was below 30% of average over most aquifer units and soil moisture deficits rose steeply - effectively curtailing the 1996/97 recharge season in much of the English lowlands. In March groundwater level downturns were reported from some responsive boreholes (eg Woodyates) and, by early April, recessions were well established in some eastern outcrops. Evidence of winter recharge appears as a mere inflection in the hydrographs for some boreholes (eg The Holt) and after two winters with recharge below 40% of average in much of the Chalk, groundwater levels are close to the seasonal minimum in much of the South-East (Yorkshire also). Levels in the northern and Midland Permo-Triassic sandstones are also depressed especially in the Redbank and Heathlanes boreholes. Provisional analyses suggest that overall groundwater resources were lower in the early spring of 1992 (and in 1976 also) - but the ensuing summer was relatively wet; below average late spring rainfall this year could result in a number of minimum groundwater levels being eclipsed by the late summer.

General

The notable dry spell has triggered an early start to the seasonal recession in river flows and groundwater levels and signalled a deterioration in the water resources outlook. However, helped by substantial replenishment to lowland pumped storage reservoirs, overall stocks increased marginally in March to stand very close to the seasonal average. By contrast, the protracted drought has severely reduced groundwater resources. The likelihood of exceptionally low summer flows and imposition of some restrictions (eg on hosepipes or spray irrigation) has increased. The scale of the difficulties encountered will still be determined by rainfall - and demand - patterns through the summer.



Institute of
Hydrology

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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, Balquhiddy (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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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.

		Mar 1996	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan 1997	Feb	Mar
England and Wales	mm	43	51	57	30	41	80	32	89	126	52	15	100*	24
	%	60	85	89	46	66	105	42	105	140	55	17	159	34
North West	mm	36	77	62	49	65	88	52	149	133	64	14	203	66
	%	38	108	83	60	76	82	45	116	108	52	12	260	69
Northumbrian	mm	31	63	53	22	53	67	30	68	108	84	19	109	37
	%	44	113	85	37	82	83	41	89	126	104	23	184	53
Severn Trent	mm	41	50	48	30	33	68	20	71	95	53	13	80	24
	%	67	91	81	51	62	101	31	111	134	69	19	148	39
Yorkshire	mm	31	41	52	35	41	74	31	57	112	93	13	97	25
	%	46	69	87	58	69	100	46	78	140	112	16	167	36
Anglian	mm	20	15	23	18	40	76	16	46	91	42	14	43	13
	%	43	33	48	35	82	138	33	90	157	76	28	116	27
Thames	mm	35	36	35	16	39	61	20	47	106	24	13	70	13
	%	63	72	63	29	80	105	34	76	163	34	20	155	22
Southern	mm	40	23	51	16	34	80	33	57	147	31	19	88	19
	%	63	43	94	30	71	140	48	71	173	38	24	164	30
Wessex	mm	68	58	60	29	27	86	31	83	145	31	14	107	31
	%	97	109	98	51	52	130	43	105	175	33	16	165	44
South West	mm	72	79	100	34	31	98	49	134	201	52	25	137	37
	%	73	114	139	49	45	117	53	116	161	37	18	135	37
Welsh	mm	73	87	106	47	47	103	58	173	171	52	12	179	69
	%	68	109	129	59	61	102	50	126	120	34	8	185	65
Scotland	mm	60	108	78	65	78	67	62	229	188	95	58	251	191
	%	48	142	91	76	83	57	44	147	125	63	38	246	153
Highland	mm	55	111	84	79	91	73	80	266	250	106	93	303	314
	%	34	122	91	81	86	57	47	134	123	54	49	239	194
North East	mm	59	63	67	33	66	64	32	139	110	86	27	116	76
	%	76	105	97	50	90	74	37	143	111	92	27	178	97
Tay	mm	76	103	67	44	53	64	50	195	142	70	39	242	124
	%	70	166	81	60	69	68	44	150	117	55	27	255	114
Forth	mm	53	86	68	44	55	61	46	186	139	81	40	213	107
	%	56	146	92	64	73	65	42	162	124	74	34	270	114
Tweed	mm	30	79	63	30	53	63	29	134	139	118	24	172	67
	%	38	139	89	46	73	72	33	141	149	127	24	257	85
Solway	mm	74	133	80	78	69	66	56	265	155	99	32	288	123
	%	63	173	94	93	77	55	39	169	108	67	21	285	105
Clyde	mm	62	142	90	88	99	66	79	282	215	93	64	292	218
	%	42	169	99	95	91	49	44	146	119	52	34	247	148

Note: The monthly regional rainfall figures for England and Wales for February & March 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 February & March 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 areal rainfall for England & Wales for February 1997 was estimated from the regional rainfall figures.

TABLE 2 RAINFALL ACCUMULATIONS AND RETURN PERIOD ESTIMATES

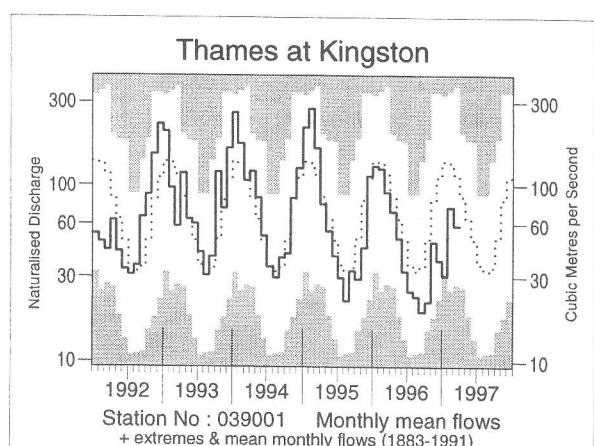
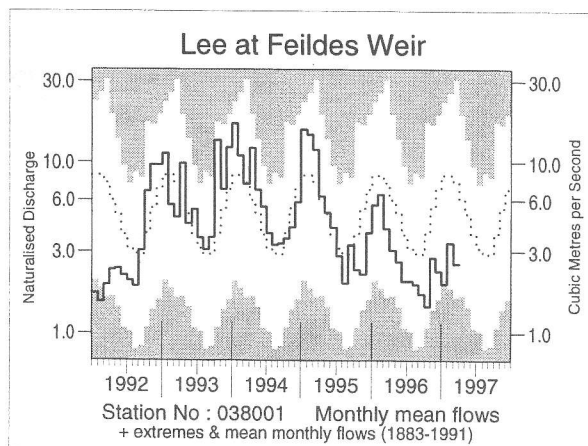
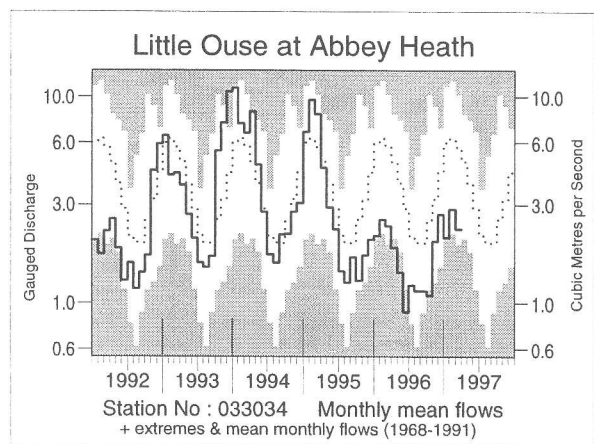
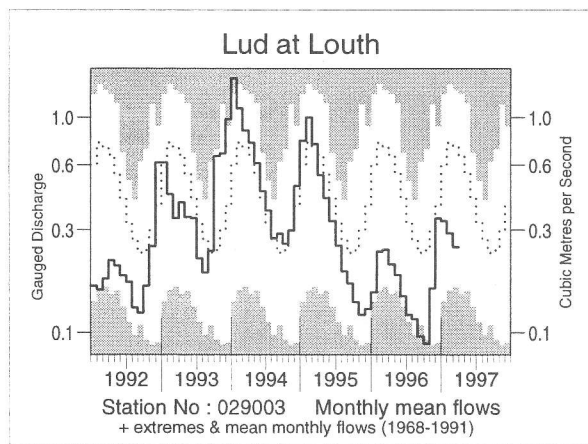
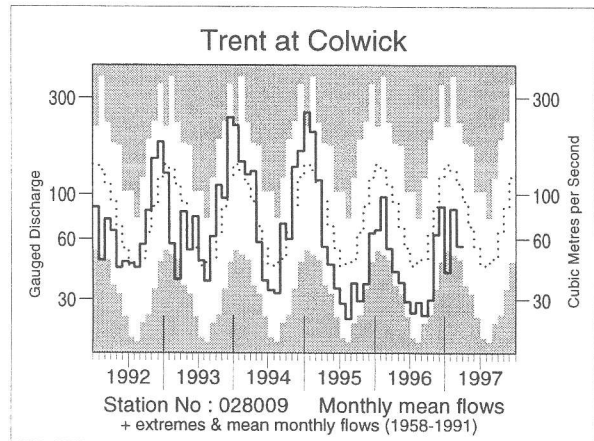
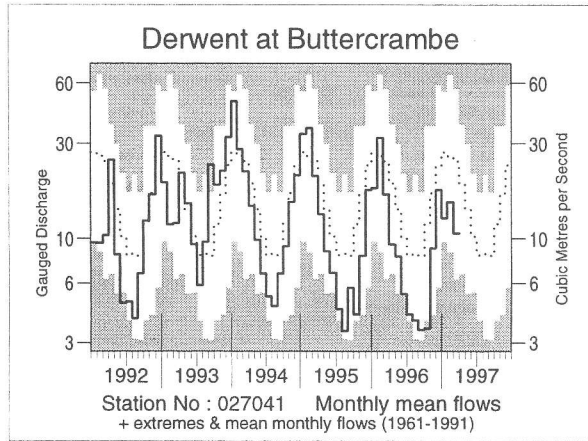
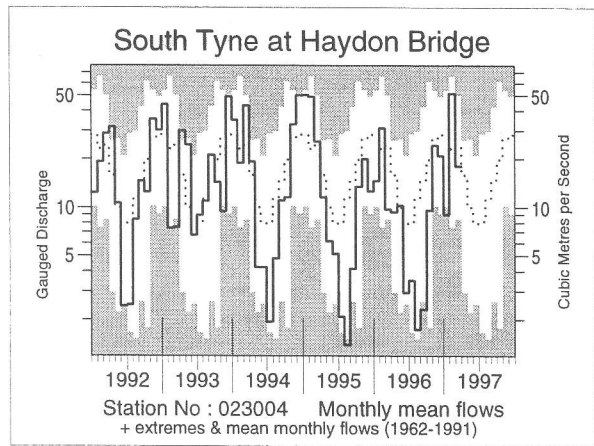
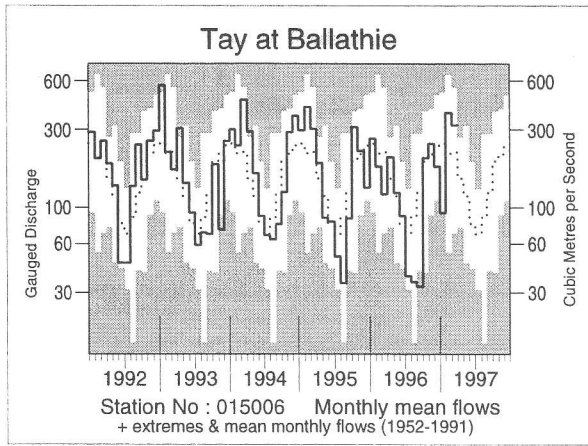
		Dec 96-Mar 97		Oct 96-Mar 97		Apr 96-Mar 97		Apr 95-Mar 97	
		Est Return Period, years		Est Return Period, years		Est Return Period, years		Est Return Period, years	
England and Wales	mm % LTA	191 60	30-40	406 83	5-10	697 78	20-30	1373 77	120-170
North West	mm % LTA	346 83	2-5	628 94	2-5	1021 85	5-10	1750 73	> >200
Northumbria	mm % LTA	248 84	2-5	424 93	2-5	712 84	5-15	1405 82	25-40
Severn Trent	mm % LTA	170 65	10-20	336 85	2-5	585 78	10-20	1142 76	80-120
Yorkshire	mm % LTA	227 79	5-10	396 90	2-5	670 82	5-15	1217 74	>200
Anglian	mm % LTA	112 59	20-35	249 83	2-5	437 73	30-50	871 73	>200
Thames	mm % LTA	119 51	35-50	272 75	5-10	479 70	35-50	1045 76	50-80
Southern	mm % LTA	157 56	20-35	361 81	5-10	598 77	10-20	1203 77	40-60
Wessex	mm % LTA	183 58	15-25	411 86	2-5	702 84	5-10	1509 90	5-10
South West	mm % LTA	251 53	35-50	586 82	5-10	977 83	5-10	2011 86	10-15
Welsh	mm % LTA	312 62	15-25	656 84	2-5	1104 84	5-10	2106 80	35-50
Scotland	mm % LTA	595 112	<u>2-5</u>	1012 121	<u>10-15</u>	1470 102	<u>2-5</u>	2681 93	5-10
Highland	mm % LTA	816 121	<u>5-10</u>	1332 124	<u>10-20</u>	1850 105	<u>2-5</u>	3199 91	5-10
North East	mm % LTA	305 91	2-5	554 104	<u>2-5</u>	879 90	2-5	1964 101	<u>2-5</u>
Tay	mm % LTA	475 100	<2	812 112	<u>2-5</u>	1193 97	2-5	2361 96	2-5
Forth	mm % LTA	441 110	<u>2-5</u>	766 122	<u>5-15</u>	1126 102	<u>2-5</u>	2044 92	5-10
Tweed	mm % LTA	381 112	<u>2-5</u>	654 124	<u>5-15</u>	971 100	<u><2</u>	1792 92	2-5
Solway	mm % LTA	542 104	<u>2-5</u>	962 117	<u>5-10</u>	1444 102	<u>2-5</u>	2599 91	5-10
Clyde	mm % LTA	667 105	<u>2-5</u>	1164 116	<u>5-10</u>	1728 102	<u>2-5</u>	3075 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



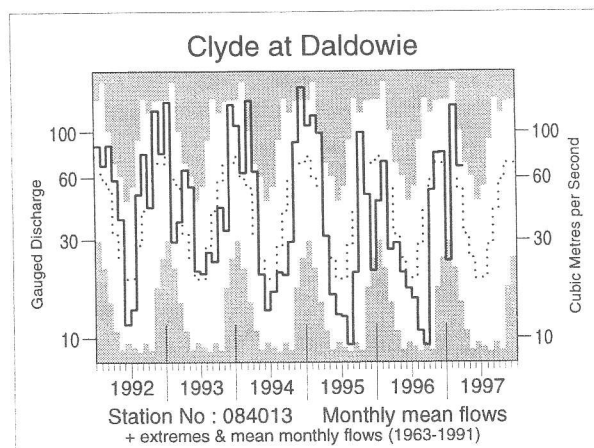
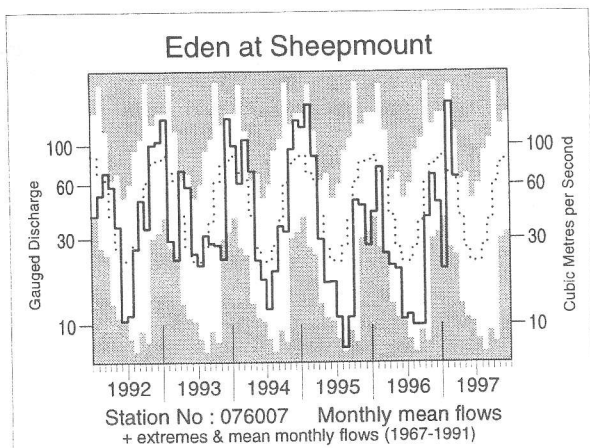
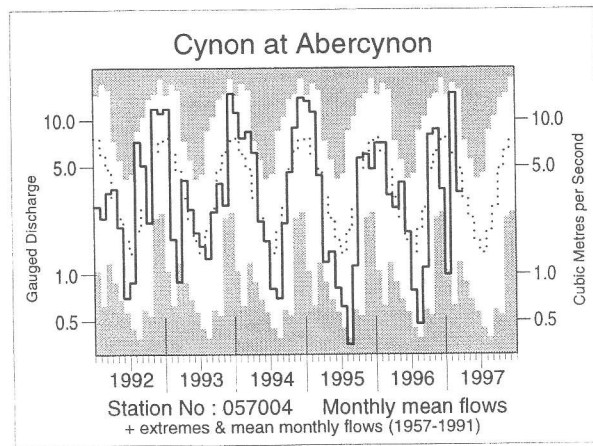
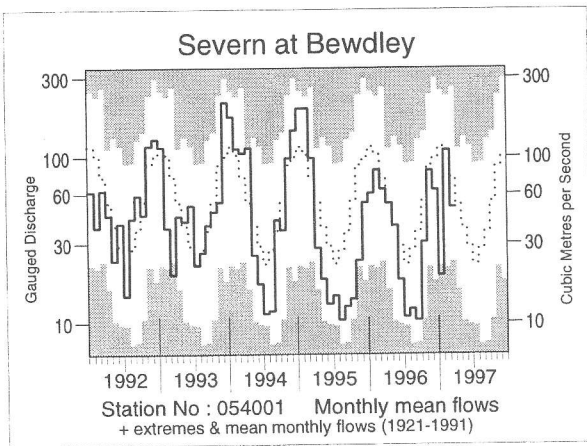
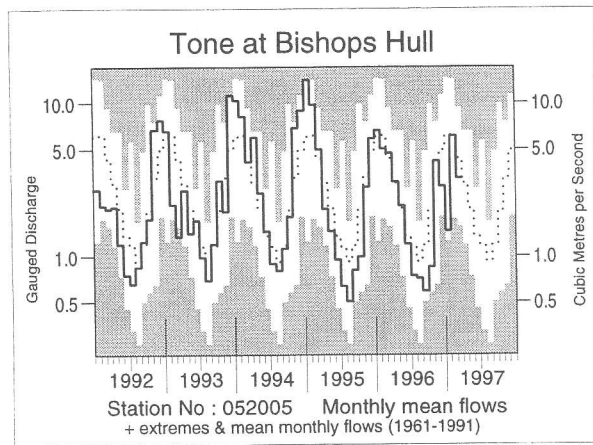
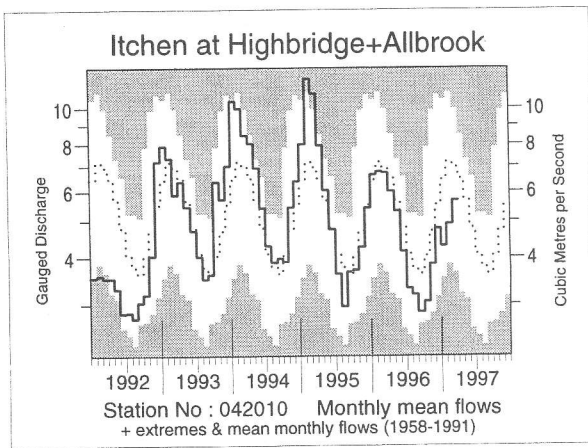
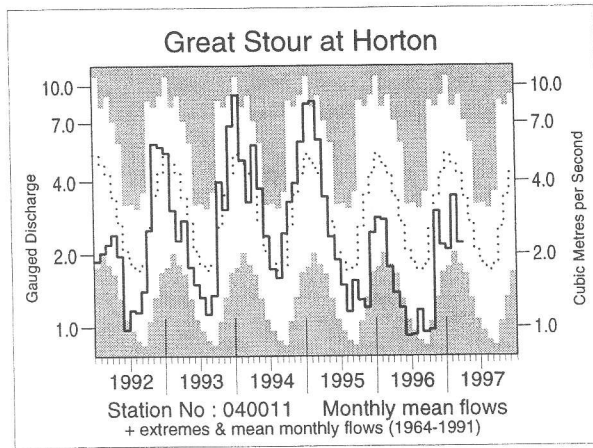
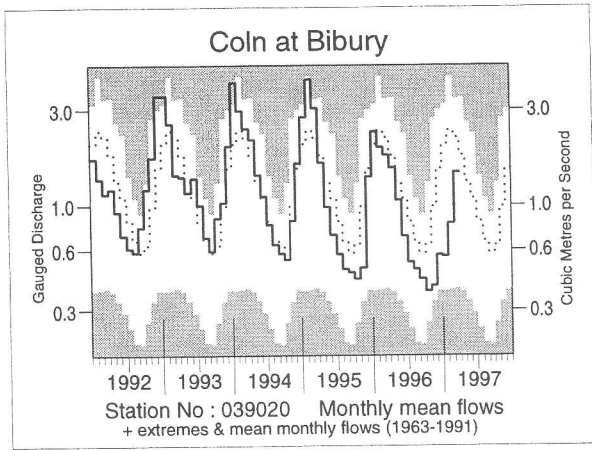


TABLE 3 RUNOFF AS MM. AND AS A PERCENTAGE OF THE PERIOD OF RECORD AVERAGE WITH SELECTED PERIODS RANKED IN THE RECORD

River/ Station name	Nov 1996	Dec	Jan 1997	Feb	Mar 1997	12/96 to 3/97	10/96 to 3/97	4/96 to 3/97	4/95 to 3/97					
	mm %LT	mm %LT	mm %LT	mm %LT	mm %LT	rank /yrs	mm %LT	rank /yrs	mm %LT	rank /yrs	mm %LT	rank /yrs		
Dee at Park	63 82	77 91	39 42	97 132	90 94	12 /25	303 87	7 /25	424 82	4 /24	660 83	5 /24	1591 100	10 /23
Tay at Ballathie	139 115	105 74	54 36	202 172	187 142	40 /45	547 102	27 /45	804 104	25 /45	1102 97	20 /44	2112 92	14 /43
Tweed at Boleside	103 118	126 127	42 39	183 233	88 107	22 /37	439 119	31 /36	608 115	30 /36	756 99	16 /36	1351 89	10 /35
Whiteadder Water at Hutton Castle	29 79	102 217	47 78	48 101	27 57	6 /28	224 111	18 /28	260 98	13 /28	341 89	11 /27	658 85	9 /26
South Tyne at Haydon Bridge	84 91	75 72	32 31	166 219	65 74	11 /35	337 91	13 /35	456 86	9 /35	562 73	3 /33	1022 66	1 /31
Wharfe at Flint Mill Weir	79 102	77 79	28 27	138 181	54 70	13 /42	297 85	13 /42	415 85	10 /42	530 75	5 /41	788 55	1 /40
Derwent at Buttercrambe	15 54	30 74	21 47	23 60	18 45	4 /36	92 57	5 /36	113 54	4 /36	170 54	3 /35	399 62	1 /34
Trent at Colwick	22 71	31 69	15 29	27 64	20 51	5 /39	93 53	2 /39	126 55	3 /39	192 55	1 /38	392 56	1 /37
Lud at Louth	8 53	17 83	16 53	13 38	12 36	5 /29	57 51	6 /29	69 50	6 /29	111 46	2 /28	250 51	3 /27
Witham at Claypole Mill	6 47	9 43	9 34	11 40	11 43	5 /38	39 41	4 /38	49 41	4 /38	80 44	1 /37	186 51	1 /36
Little Ouse at Abbey Heath	7 60	10 61	8 34	10 45	9 40	3 /29	37 46	5 /29	48 47	5 /29	77 47	2 /29	176 53	2 /28
Colne at Lexden	7 58	7 40	5 22	5 27	6 34	3 /38	23 32	3 /37	33 35	4 /37	53 40	1 /36	133 50	3 /34
Lee at Feildes Weir (natr.)	7 51	6 33	5 23	8 39	7 34	6 /111	25 32	4 /111	36 35	5 /111	70 43	6 /109	192 59	9 /107
Thames at Kingston (natr.)	12 57	10 33	8 22	18 55	16 51	17 /115	52 40	7 /114	71 43	9 /114	129 53	7 /114	338 69	10 /113
Coln at Bibury	10 40	14 35	14 26	18 33	36 68	9 /34	83 42	2 /34	102 43	2 /34	218 56	2 /33	543 69	3 /32
Great Stour at Horton	23 85	17 49	16 39	24 73	17 53	5 /33	75 54	4 /32	105 57	5 /32	155 54	1 /30	340 59	1 /28
Itchen at Highbridge + Allbrook	28 81	36 85	32 66	33 67	42 81	8 /39	143 75	7 /39	193 76	6 /39	374 81	4 /38	831 90	8 /37
Stour at Throop Mill	33 98	30 52	18 27	49 80	40 79	9 /25	136 58	4 /24	177 61	4 /24	265 67	5 /24	622 78	2 /23
Exe at Thorverton	133 135	71 52	18 13	135 129	46 55	7 /41	270 60	4 /41	456 73	6 /41	605 73	4 /40	1186 72	1 /39
Taw at Umberleigh	134 146	62 52	14 12	118 137	40 59	8 /39	235 61	5 /39	397 73	8 /39	498 72	5 /38	920 66	1 /37
Tone at Bishops Hull	54 123	38 54	19 23	73 99	43 76	12 /37	173 62	4 /36	238 68	6 /36	348 73	5 /36	770 81	6 /35
Severn at Bewdley	49 93	39 62	12 17	61 106	31 66	23 /76	143 60	6 /76	211 66	9 /76	298 67	5 /76	538 60	2 /75
Teme at Knightsford Bridge	23 68	28 50	11 16	48 92	29 62	7 /27	116 53	4 /27	142 52	3 /27	223 62	3 /27	482 66	3 /26
Cynon at Abercynon	211 135	90 46	25 13	340 246	85 71	17 /39	540 83	11 /39	954 103	23 /39	1222 96	17 /37	2197 87	7 /35
Dee at New Inn	282 121	94 37	25 10	364 217	141 78	12 /28	623 75	6 /28	1160 92	12 /28	1526 86	7 /27	2457 69	1 /26
Eden at Sheepmount	77 88	56 56	24 23	181 238	77 102	18 /30	338 96	12 /30	461 91	11 /30	557 80	6 /29	965 69	1 /28
Clyde at Daldowie	107 111	112 107	33 29	171 220	95 116	23 /34	411 109	21 /34	592 107	19 /34	734 93	12 /33	1312 83	6 /32
Carron at New Kelso	362 130	162 49	164 50	373 167	286 97	10 /19	985 86	6 /18	1718 102	9 /18	2264 90	4 /18	3759 74	1 /17
Ewe at Poolewe	314 121	167 61	127 46	335 173	325 156	23 /27	955 102	15 /27	1542 108	15 /26	2033 96	11 /26	3572 83	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 the 1995. For the long periods (at the right of this table), the end date for the long term is 1997.

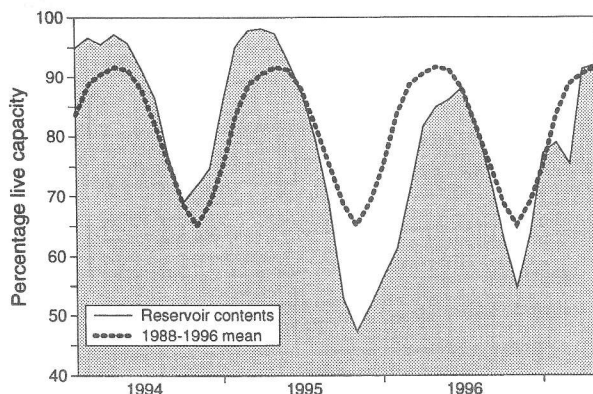
TABLE 4 START-MONTH RESERVOIR STORAGES UP TO APRIL 1997

Area	Reservoir (R)/ Group (G)	Capacity● (Ml)	1996 Nov	Dec	1997 Jan	Feb	Mar	Apr	1996 Apr
North West	N.Command Zone ¹	(G) 133375	69	84	77	66	100	97	78
	Vyrnwy	(R) 55146	65	86	81	71	100	95	64
Northumbria	Teesdale ²	(G) 87936	35	61	78	80	95	97	77
	Kielder	(R) 199175*	86	93	88	89	100	93	96
Severn-Trent	Clywedog	(R) 44922	66	80	81	76	93	97	86
	Derwent Valley ³	(G) 39525	30	93	98	94	100	100	54
Yorkshire	Washburn ⁴	(G) 22035	64	86	97	86	98	93	70
	Bradford supply ⁵	(G) 41407	59	84	90	88	100	98	59
Anglian	Grafham	(R) 58707	67	68	69	68	72	77	94
	Rutland	(R) 130061	70	70	71	68	73	76	92
Thames	London ⁶	(G) 206399	46	59	70	70	85	94	94
	Farmoor ⁷	(G) 13843	92	100	99	93	96	98	99
Southern	Bewl	(R) 28170	52	59	60	65	85	98	99
	Ardingly	(R) 4685	33	55	64	68	100	100	100
Wessex	Clatworthy	(R) 5364	44	88	96	81	100	99	100
	Bristol W ⁸	(G) 38666*	59	77	80	74	96	95	95
South West	Colliford	(R) 28540	42	50	53	52	57	58	63
	Roadford ⁹	(R) 34500	40	51	54	52	61	62	37
	Wimbleball ¹⁰	(R) 21320	42	60	64	59	81	91	78
	Stithians	(R) 5205	50	71	88	90	96	97	99
	Celyn + Brenig	(G) 131155	63	75	82	78	97	98	72
Welsh	Brienne	(R) 62140	87	100	93	84	99	97	100
	Big Five ¹¹	(G) 69762	64	77	75	67	96	95	94
	Elan Valley ¹²	(G) 99106	82	99	92	85	100	99	98
East of Scotland	Edin./Mid Lothian ¹³	(G) 97639	74	89	93	91	100	100	96
	East Lothian ¹⁴	(G) 10206	63	79	100	100	100	99	99
West of Scotland	Loch Katrine	(G) 111363	90	97	89	85	100	100	94
	Daer	(R) 22412	89	100	98	91	100	98	96
	Loch Thom	(G) 11840	88	100	99	96	100	100	98

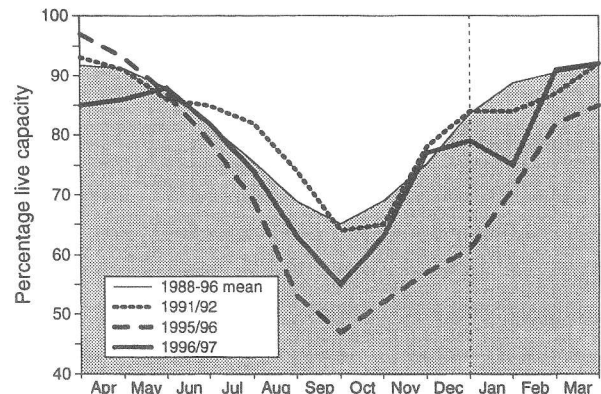
● Live or usable capacity (unless indicated otherwise) * Gross storage/percentage of gross storage

- Includes Haweswater, Thirlmere, Stocks and Barnacre.
- Cow Green, Selset, Grassholme, Balderhead, Blackton and Hury.
- Howden, Derwent and Ladybower.
- Swinsty, Fewston, Thruscross and Eccup.
- The Nidd/Barden group (Scar House, Angram, Upper Barden, Lower Barden and Chelker) plus Grimwith.
- 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.
- Farmoor 1 and 2 - pumped storages.
- Blagdon, Chew Valley and others.
- Roadford began filling in November 1989.
- Shared between South West (river regulation for abstraction) and Wessex (direct supply).
- Usk, Talybont, Llandegfedd (pumped storage), Taf Fechan, Taf Fawr.
- Claerwen, Caban Coch, Pen-y-garreg and Craig Goch.
- Megget, Talla, Fruid, Gladhouse, Torduff, Clubbiedean, Glencorse, Loganlea and Morton (upper and lower).
- Thorters, Donolly, Stobshiel, Lammerloch, Hopes and Whiteadder

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



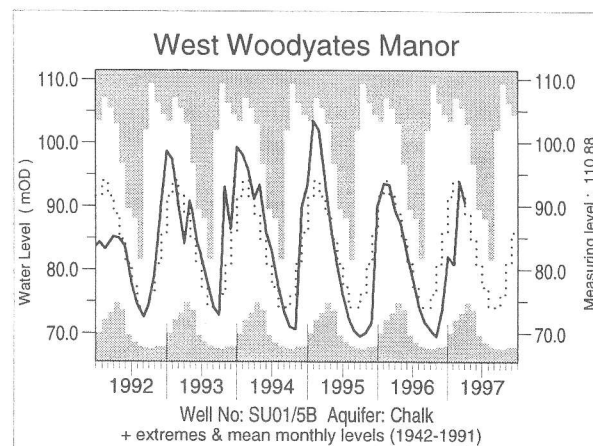
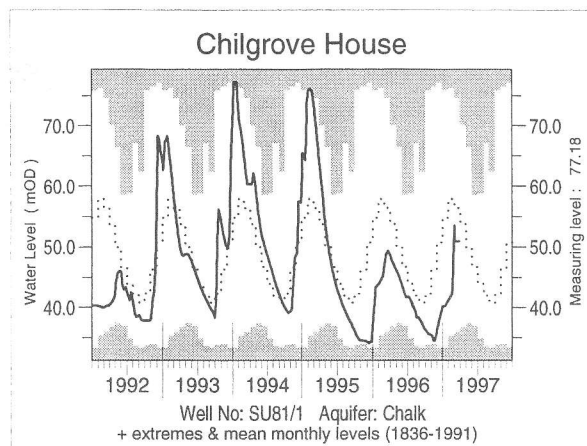
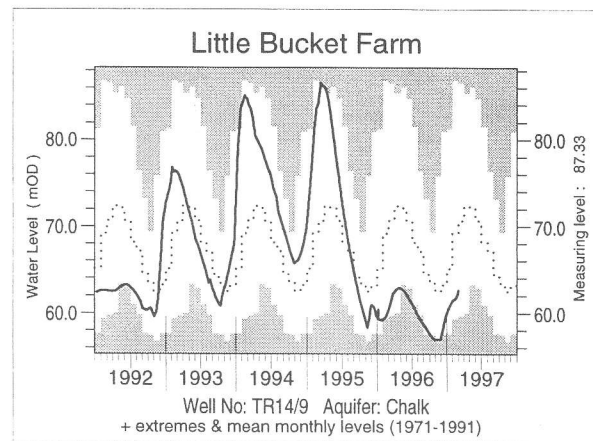
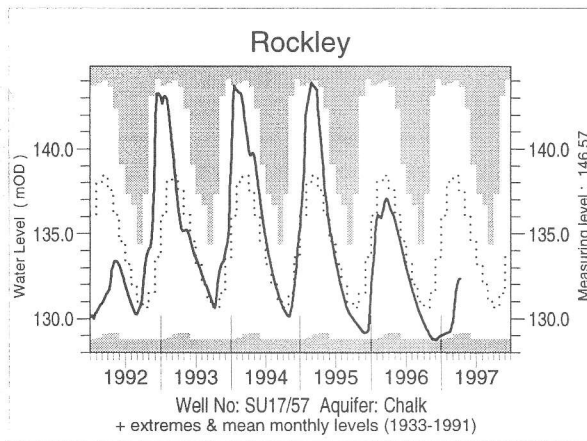
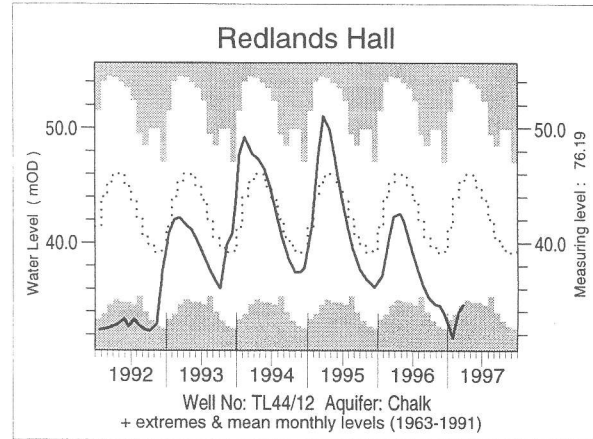
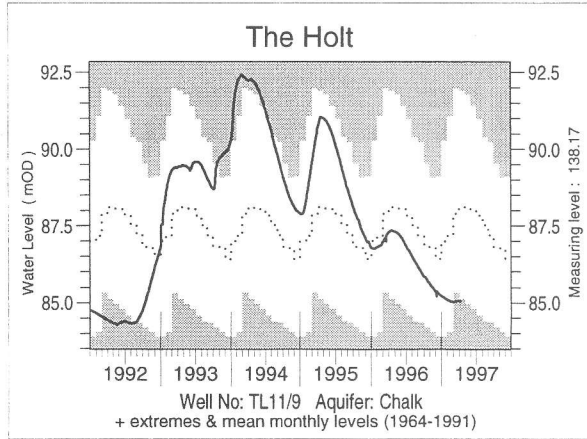
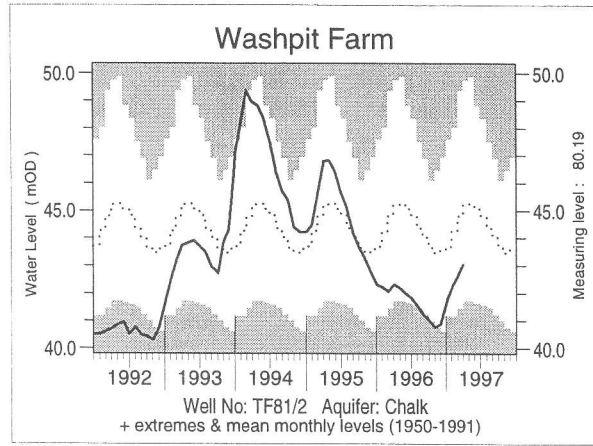
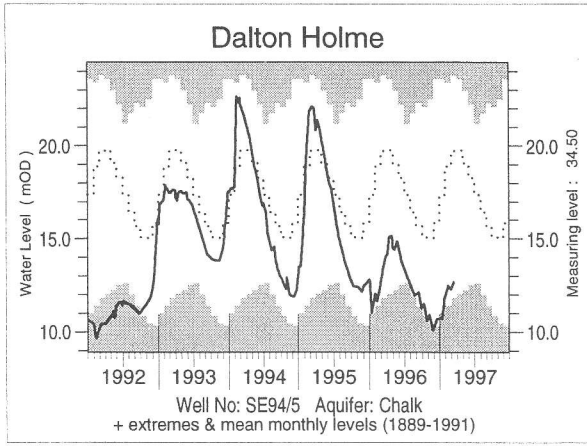
A COMPARISON BETWEEN OVERALL RESERVOIR STOCKS FOR ENGLAND AND WALES IN RECENT YEARS



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



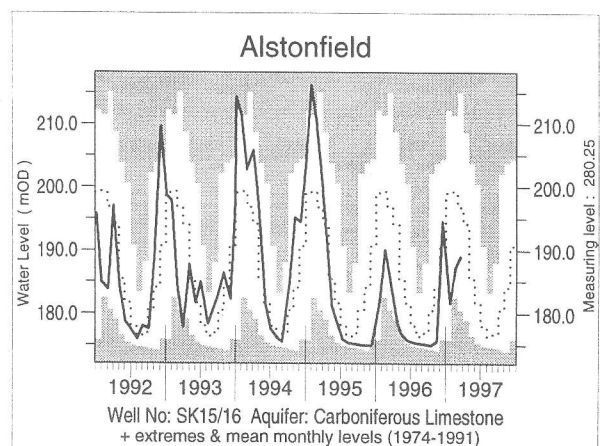
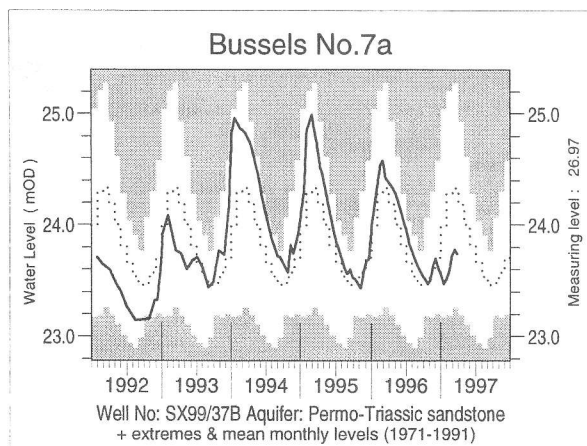
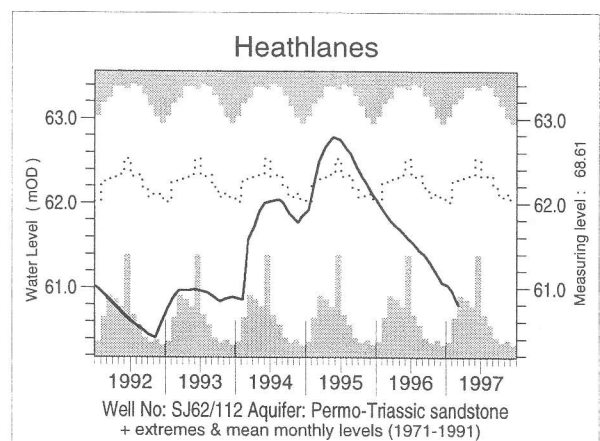
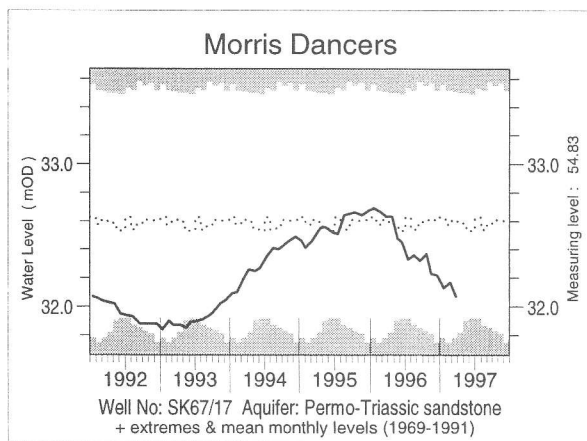
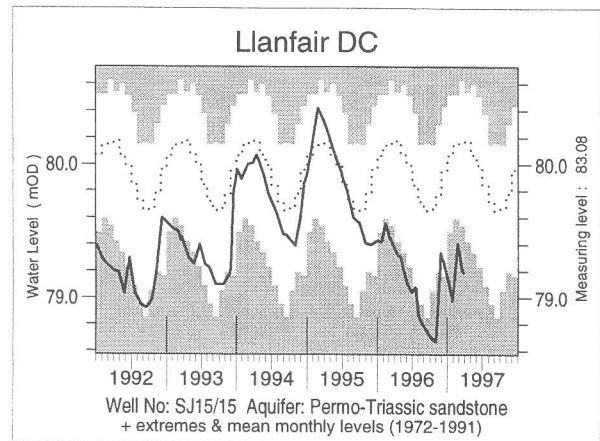
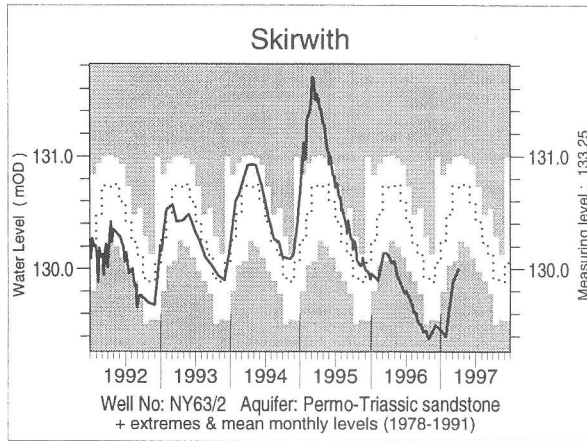
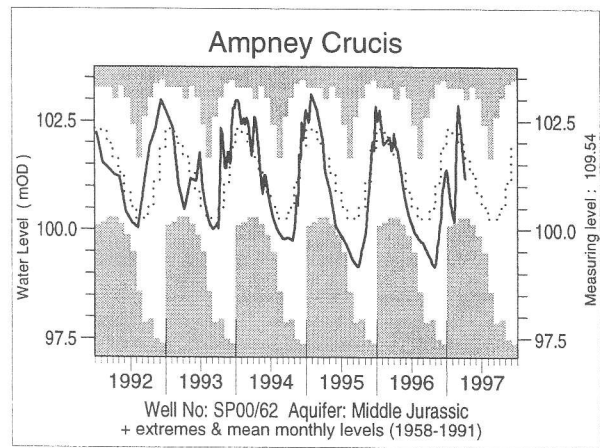
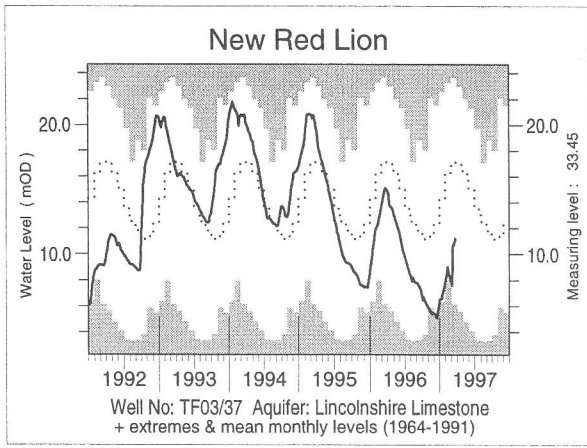


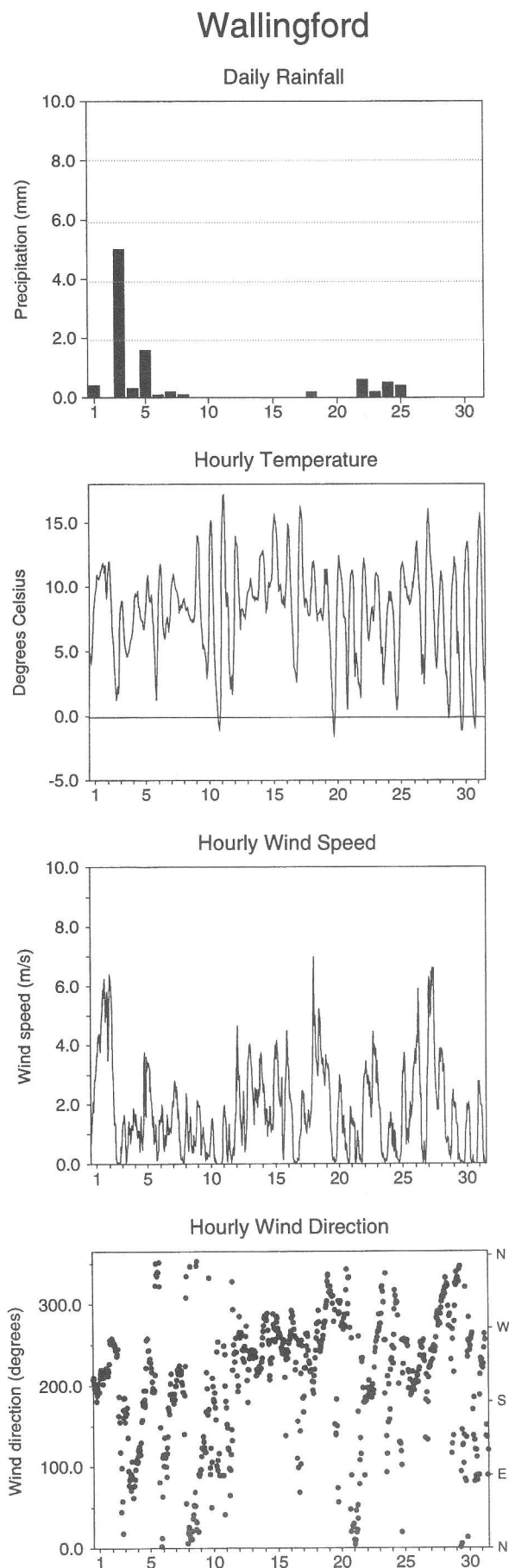
TABLE 5 MARCH GROUNDWATER LEVELS 1997

Site	Aquifer	Records Commence	Minimum Mar <1997	Average Mar <1997	Maximum Mar <1997	No of years Mar/Apr level < 1997	Mar/Apr 1997 day	level
Dalton Holme	Ck	1889	10.34	19.49	23.82	4	14/03	12.70
Wetwang	Ck	1971	17.16	25.06	35.15	3	14/03	21.00
Keelby Grange	Ck	1980	3.74	12.43	18.73	2	25/03	5.75
Washpit Farm	Ck	1950	40.61	44.83	49.39	>10	01/04	43.05
The Holt	Ck	1964	84.47	87.77	92.34	2	07/04	85.04
Therfield Rectory	Ck	1883	70.72	79.18	96.83	8	07/04	72.06
Redlands Hall	Ck	1963	32.62	44.05	54.50	2	25/03	34.60
Rockley	Ck	1933	129.10	138.33	144.06	6	07/04	132.37
Little Bucket Farm	Ck	1971	59.67	71.49	86.58	3	04/03	62.66
Compton House	Ck	1894	29.40	46.74	65.00	>10	26/03	41.45
Chilgrove House	Ck	1836	35.97	55.47	74.68	>10	26/03	53.45
Westdean No.3	Ck	1940	1.31	2.18	4.14	5	21/03	1.48
Lime Kiln Way	Ck	1969	124.07	125.50	126.48	10	24/03	125.41
Ashton Farm	Ck	1974	64.67	69.58	71.10	>10	01/04	70.42
West Woodyates	Ck	1942	73.18	90.70	105.44	>10	01/04	90.57
Killyglen (NI)	Ck	1985	113.63	115.85	119.52	1	21/03	114.10
New Red Lion	LLst	1964	6.14	16.50	23.69	5	24/03	11.24
Ampney Crucis	MidJ	1958	100.29	102.03	103.26	4	07/04	101.17
Redbank	PTS	1981	7.88	8.49	9.45	0	01/04	7.92
Yew Tree Farm	PTS	1972	12.75	13.57	14.01	7	04/04	13.53
Skirwith	PTS	1978	129.88	130.64	131.70	1	03/04	130.00
Llanfair D.C	PTS	1972	79.19	79.97	80.63	0	25/03	79.19
Morris Dancers	PTS	1969	31.78	32.49	33.51	4	25/03	32.07
Heathlanes	PTS	1971	60.80	62.03	63.25	0	06/03	60.80
Bussels No.7A	PTS	1971	23.26	24.30	25.28	2	25/03	23.74
Rusheyford NE	MgLst	1967	65.59	72.92	76.97	>10	20/03	76.14
Peggy Ellerton	MgLst	1968	31.64	34.43	36.93	3	21/03	32.15
Alstonfield	CLst	1974	180.54	195.44	215.15	5	18/03	189.04

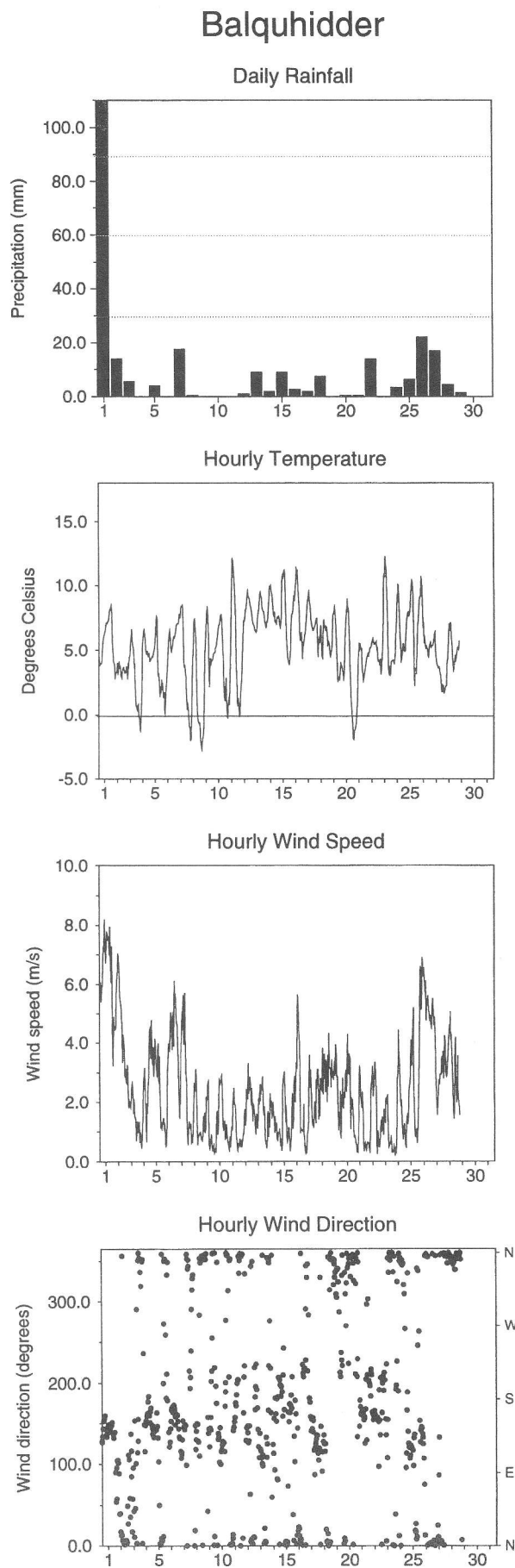
groundwater levels are in metres above Ordnance Datum

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

FIGURE 3 METEOROLOGICAL SUMMARY - MARCH 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

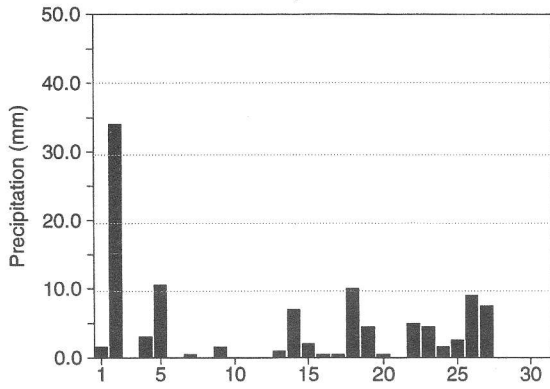


The Lower Kirkton automatic weather station (Balquhiddy) occupies a relatively sheltered position at the mouth of the SSE trending Kirkton Glen. Station elevation is 270m aOD and average annual rainfall exceeds 2000mm; snow cover is expected for 10-30 days a year.

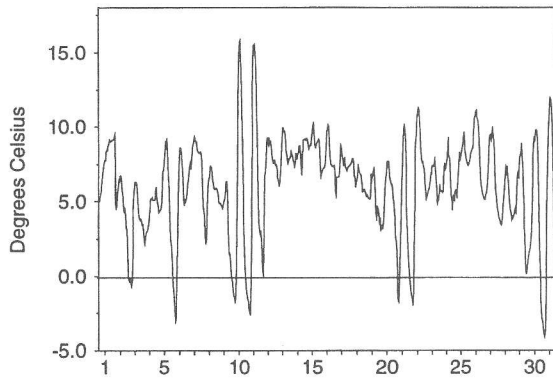
FIGURE 3 (continued)

Plynlimon

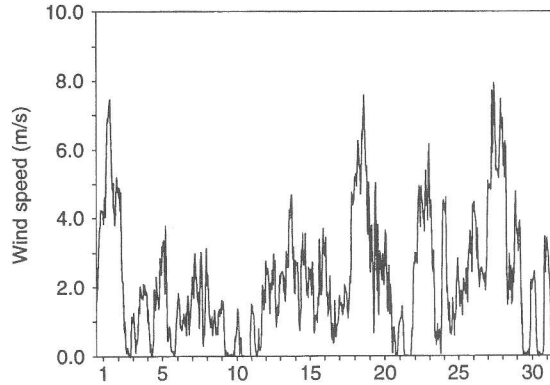
Daily Rainfall



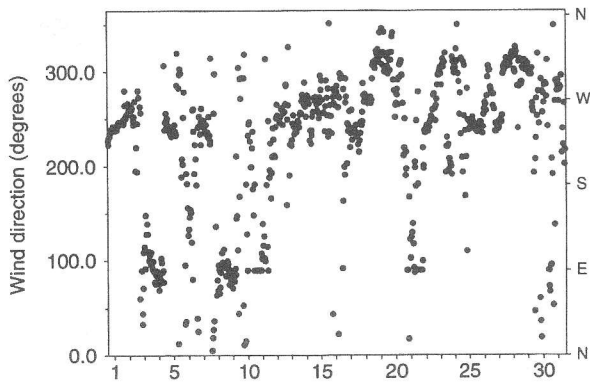
Hourly Temperature



Hourly Wind Speed



Hourly Wind Direction



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 4 LOCATION MAP OF GAUGING STATIONS AND GROUNDWATER INDEX WELLS

