Hydrological Summary for Great Britain

JUNE 1996

Rainfall

June was a very sunny and, in most regions, a warm month but rainfall totals were, once again, low. The month began in unsettled vein and on the 7th a humid southerly airflow triggered a number of damaging hailstorms (e.g. in Norwich, Aylesbury and in Dorset) and, at Yattenden (Oxon), an exceptional 15-minute precipitation total of 30 mm was recorded; in parts of central and eastern England this single storm accounted for over 80% of the June rainfall (see Fig. 3). Further significant, but very localised, thunderstorms occurred along the south coast on the 20th but most regions experienced lengthy sequences of dry days in the predominantly anticyclonic conditions. Regional rainfall totals for June were mostly in the 30-70% range with only western Scotland and Yorkshire approaching the monthly average. Much of the English lowlands registered less than 35% of average with many districts in the London area recording 10 mm or less. For England and Wales as a whole only two months in the last 15 have produced above average rainfall and accumulated rainfall deficiencies are exceptional. Lower 15-month rainfall totals (for any start month) than the provisional April 95-June 96 total are restricted to the droughts of 1784/85, 1854/55 and 1975/76 (which included appreciably drier 15-month sequences). The most significant regional deficiencies occur in East Anglia, where the drought has intensified substantially since the early spring, and parts of northern England. A number of Pennine raingauges have recorded only a little over half their average rainfall since March 1995 - this constitutes an extreme deficiency. Notable rainfall deficiencies also extend across the Midlands and into North Wales.

River Flow

Above average June runoff totals were reported for a few catchments in western Britain - in the western Highlands this upturn follows a period of sustained and notable runoff deficiencies (e.g. on the Rivers Ness and Ewe). Mean flows for June were within the normal range - albeit considerably below average - in a zone from central Wales to the South Downs. More generally, however, the seasonal recessions gathered momentum in June and flows throughout most of the English lowlands were notably depressed, 30-60% of the June average in many catchments. Unprecedented June runoff totals were recorded on the Rivers Eden, Torne, Little Ouse and Great Stour; on others (e.g. the Trent, Soar, Dove and Lud) only June 1976 produced lower runoff totals. A number of eastern catchments have registered 12 or more successive months with below average flows and the eclipsing of the 1976 June minimum in parts of East Anglia is a measure of the drought's recent intensification. Accumulated runoff totals in the 3-, 9- and 12-month timeframes are especially low. For example, runoff since June 1995 has been less than half the long term average on the Lune, Dove, Stringside and Wharfe - the deficiency on the latter has no close modern parallel. New July-June minimum runoffs show a wide distribution - from the Kent Stour to the Carron in the western Highlands. The protracted decline in baseflows in eastern and southern England will continue and, in the absence of well above average rainfall, late summer flows may be expected to be very depressed over wide areas.

Groundwater

Evaporation losses for June were generally above average and month-end soil moisture deficits were outstandingly high in parts of eastern Britain. As usual at this time of year infiltration was minimal. Groundwater level recessions were relatively steep through June but the residual benefits of abundant recharge over the winters of 93/94 and 94/95 can still be identified in parts of the Chalk and Permo-Triassic sandstones aquifers, and throughout most of the South-West groundwater levels remain within the normal range. To the east and north groundwater resources generally deteriorate. At Little Bucket in Kent groundwater levels are the lowest on record for the early summer, at Washpit Farm (Norfolk) they are approaching the pre-92 minimum and water-tables are also depressed in Yorkshire. New minimum June levels characterised many of the more northerly Permo-Triassic outcrops (e.g. at Llanfair D.C. and Skirwith) and, at Alstonfield (in the Carb. Limestone), the long term minimum has been closely approached. Overall groundwater stocks are substantially lower than at the same time in 1995 - but higher than in the summers of 1992 and 1976.

General

Severe drought conditions extend across large parts of Britain. Fortunately the unsettled conditions and lower temperatures in late June/early July moderated water demand. Improved stocks in some pumped storage reservoirs boosted *overall* stocks to close to the seasonal average. However, current resources are causing concern in a number of northern reservoir systems (and a few others) and the water resources outlook for 1997 is very fragile.

Institute of Hydrology

British Geological Survey

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. 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.

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.

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 1995/96 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.

		Jun 1995	Jul	Aug	Sep	Oct	Nov	Dec	Jan 1996	Feb	Mar	Apr	May	Jun
England and Wales	mm	23	40	10	113	58	83	82	65	82	44	49	57	30
	%	35	65	13	147	68	92	87	74	130	61	82	89	46
North West	mm	39	65	18	97	105	76	37	55	105	36	71	66	48
	%	48	76	17	84	82	62	30	45	135	38	100	88	60
Northumbrian	mm	30	29	12	111	57	118	78	46	89	33	63	51	33
	%	50	45	15	152	75	137	96	55	151	47	113	82	54
Severn Trent	mm	13	35	9	94	39	65	79	45	66	42	49	48	30
	%	22	66	13	147	61	92	103	64	122	69	89	81	51
Yorkshire	mm	23	29	9	96	29	65	69	48	78	31	41	53	49
	%	38	49	12	141	40	81	83	61	134	46	69	88	82
Anglian	mm	25	25	8	101	15	42	66	34	49	20	15	25	19
	%	49	51	15	206	29	72	120	68	132	43	33	51	37
Thames	mm	16	31	4	117	34	64	92	52	63	35	35	32	18
	%	29	63	7	198	55	98	131	81	140	63	70	57	32
Southern	mm	20	31	5	140	33	65	94	69	70	42	23	48	18
	%	37	65	9	203	41	76	115	86	130	67	43	88	33
Wessex	mm	14	26	10	144	68	124	103	77	84	68	57	59	25
	%	25	50	15	200	86	149	111	89	129	97	108	96	44
South West	mm	19	47	16	136	104	134	127	157	118	73	78	101	34
	%	28	68	19	146	90	107	91	114	117	74	113	140	49
Welsh	mm	27	69	14	125	115	133	101	102	121	72	85	99	41
	%	34	90	14	109	84	94	66	71	125	67	106	121	51
Scotland	mm	43	86	34	198	228	126	53	90	140	59	107	71	58
	%	50	91	29	139	146	83	35	60	137	47	141	83	67
Highland	mm	47	101	45	251	246	160	46	61	149	55	110	72	65
	%	48	95	35	147	124	79	23	32	117	34	121	78	66
North East	mm	53	45	27	297	103	100	67	75	114	57	62	61	27
	%	80	62	31	341	106	101	72	76	175	73	103	88	41
Tay	mm	32	67	20	178	220	120	61	132	117	79	106	59	41
	%	44	87	21	156	169	99	48	92	123	72	171	71	56
Forth	mm	31	70	21	136	199	90	54	73	82	52	86	66	40
	%	45	93	22	124	173	80	49	62	104	55	146	89	58
Tweed	mm	35	43	23	123	134	97	63	72	104	30	78	59	29
	%	54	59	26	138	141	104	68	72	155	38	137	83	45
Solway	mm	44	79	23	102	249	113	51	134	157	73	133	83	82
	%	52	88	19	71	159	78	34	86	155	62	173	98	98
Clyde	mm	44	125	40	138	324	119	48	117	181	62	138	85	82
	%	47	115	30	77	168	66	27	62	153	42	164	93	88

Note: The monthly regional rainfall figures for England and Wales for May & June 1996 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 May & June 1996 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.

TABLE 2 RAINFALL RETURN PERIOD ESTIMATES

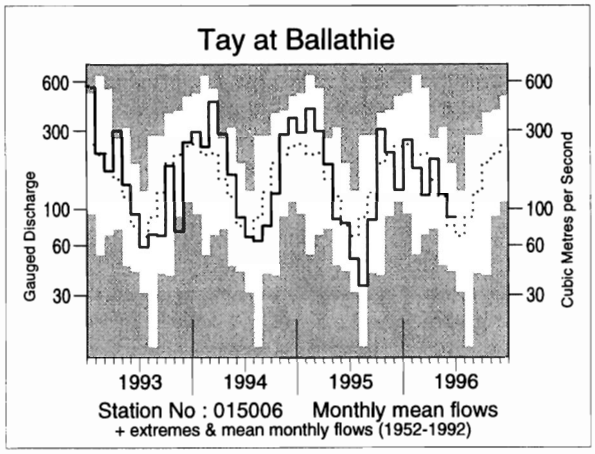
		Mar 96-Jun 96		Jan 96-Jun 96		Oct 95-Jun 96		Apr 95-Jun 96	
		Est Return Period, years		Est Return Period, years		Est Return Period, years		Est Return Period, years	
England and Wales	mm	180		327		550		812	
	% LTA	69	10-20	79	5-10	81	5-15	75	50-80
North West	mm	221		381		599		911	
	% LTA	69	10-15	73	10-20	67	50-80	64	>>200
Northumbria	mm	180		315		568		841	
	% LTA	72	5-15	80	5-10	90	2-5	82	10-20
Severn Trent	mm	169		280		463		683	
	% LTA	72	5-10	78	5-10	81	5-10	74	40-60
Yorkshire	mm	174		300		463		691	
	% LTA	70	5-15	78	5-10	75	15-25	69	120-170
Anglian	mm	79		162		285		490	
	% LTA	41	>200	58	60-90	64	70-100	66	>200
Thames	mm	120		235		425		648	
	% LTA	55	25-40	72	5-15	81	5-10	76	20-30
Southern	mm	130		269		461		698	
	% LTA	58	15-25	75	5-15	76	10-15	74	30-45
Wessex	mm	209		370		665		947	
	% LTA	87	2-5	94	2-5	103	2-5	94	2-5
South West	mm	286		561		926		1249	
	% LTA	93	2-5	102	2-5	100	<2	90	2-5
Welsh	mm	296		519		868		1217	
	% LTA	85	2-5	88	2-5	85	5-10	78	25-40
Scotland	mm	295		525		932		1444	
	% LTA	79	5-15	84	5-10	86	5-10	86	10-20
Highland	mm	302		512		964		1594	
	% LTA	68	20-30	68	40-60	71	60-90	78	50-80
North East	mm	207		396		666		1236	
	% LTA	76	5-15	91	2-5	92	2-5	106	2-5
Tay	mm	285		534		935		1367	
	% LTA	87	2-5	94	2-5	99	2-5	94	2-5
Forth	mm	244		399		742		1106	
	% LTA	82	2-5	81	5-10	89	2-5	84	10-15
Tweed	mm	196		372		666		991	
	% LTA	72	5-15	85	5-10	93	2-5	85	5-15
Solway	mm	371		662		1075		1447	
	% LTA	102	2-5	107	2-5	101	2-5	87	5-10
Clyde	mm	367		665		1156		1652	
	% LTA	88	2-5	92	2-5	91	2-5	84	10-20

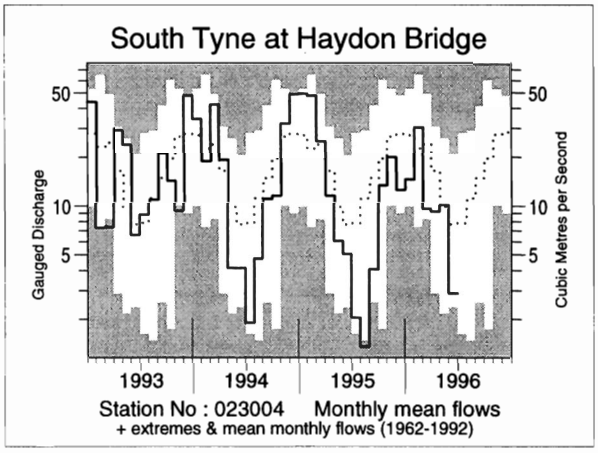
LTA refers to the period 1961-90.

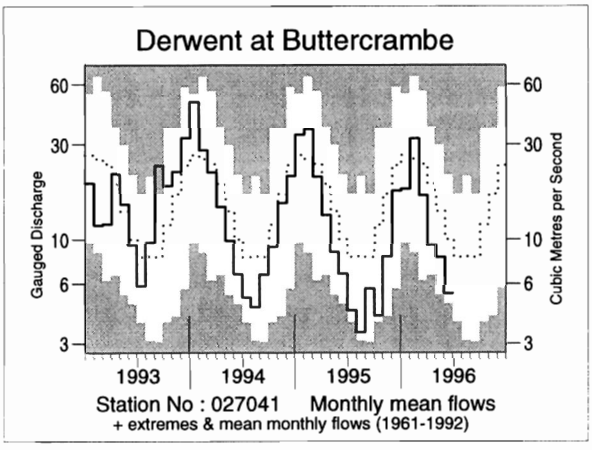
Return period assessments are based on tables provided by the Meteorological Office*. The tables reflect rainfall totals over the period 1911-70 only and the estimate assumes a sensibly stable climate. They assume a start in a specified month; return periods for a start in any month may be expected to 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.

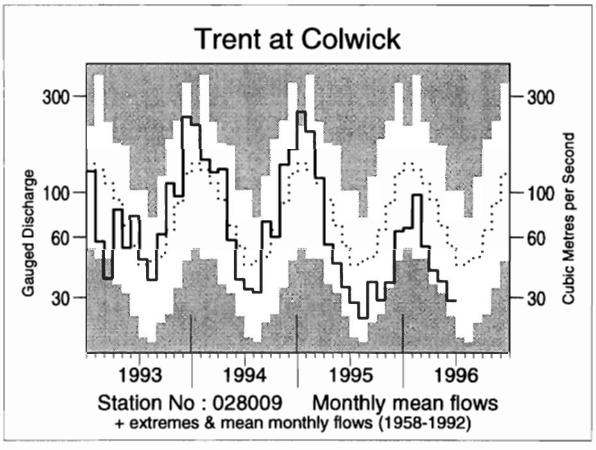
* Tabony, R.C., 1977, The Variability of long duration rainfall over Great Britain, Scientific Paper No. 37, Meteorological Office.

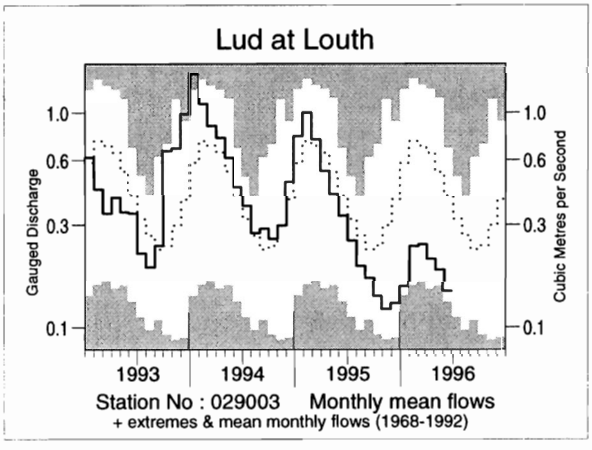
FIGURE 1 MONTHLY RIVER FLOW HYDROGRAPHS

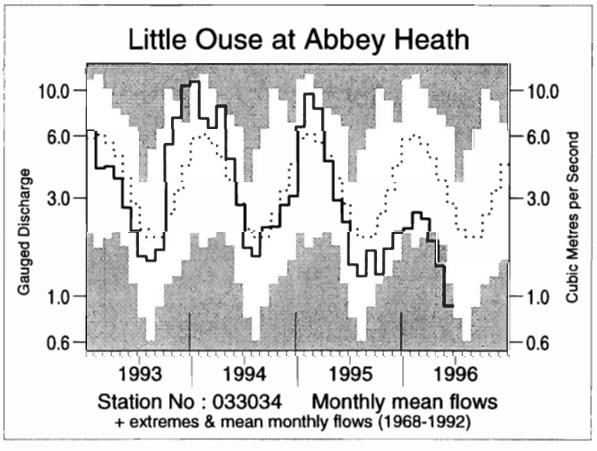


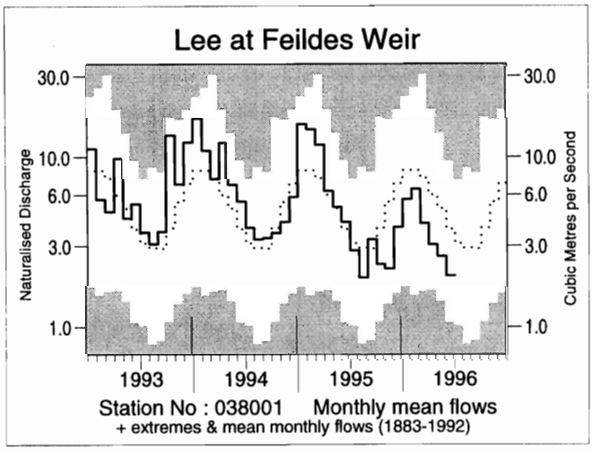


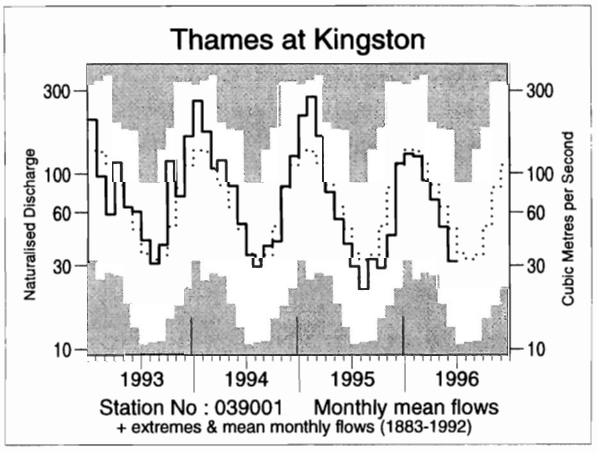


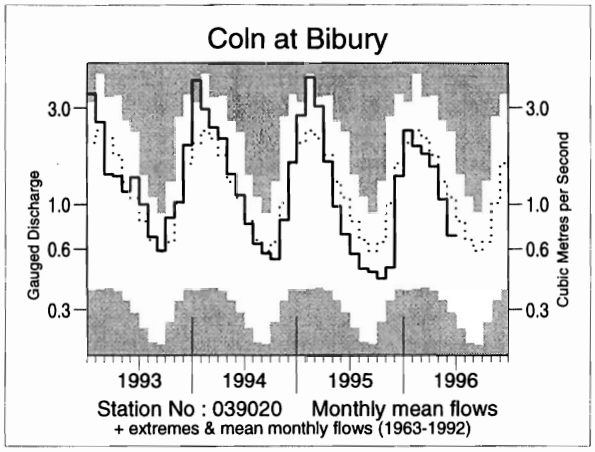


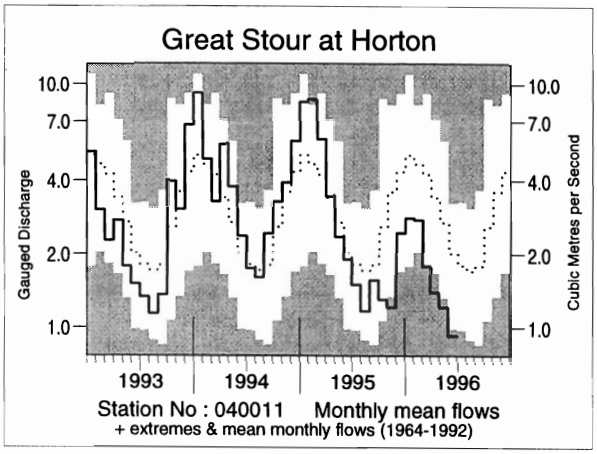


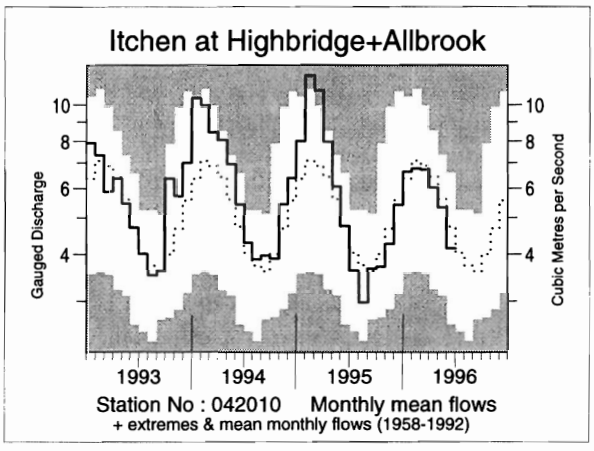


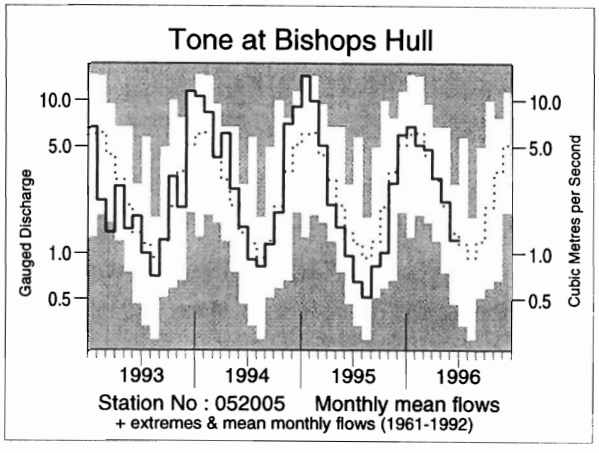


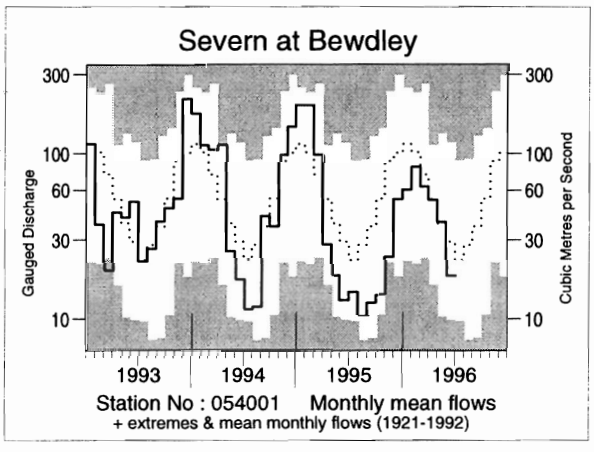


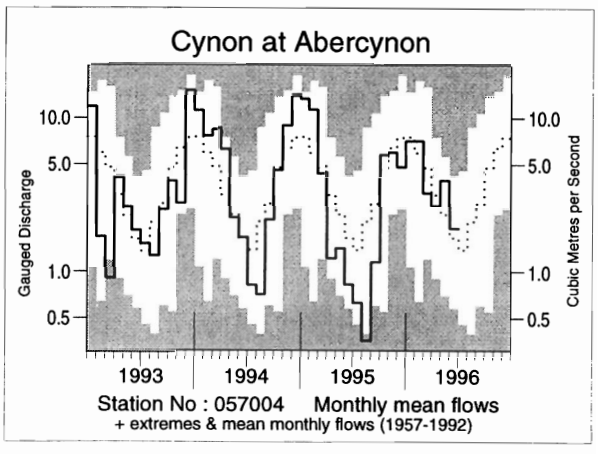

Coln at Bibury
Gauged Discharge
Cubic Metres per Second
3.0
1.0
0.6
0.3
1993
1994
1995
1996
Station No : 039020 Monthly mean flows
+ extremes & mean monthly flows (1963-1992)

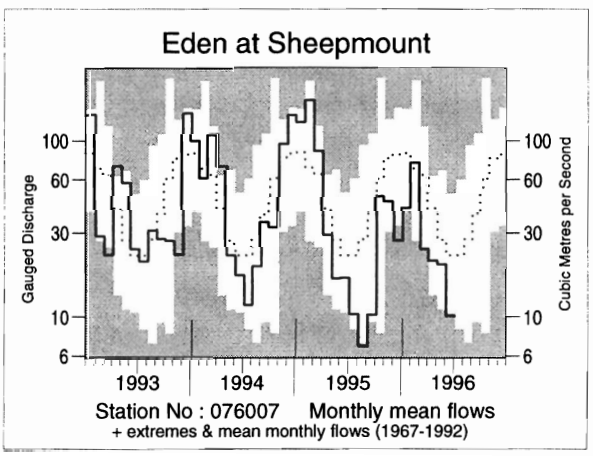

Great Stour at Horton
Gauged Discharge
Cubic Metres per Second
10.0
7.0
4.0
2.0
1.0
1993
1994
1995
1996
Station No : 040011 Monthly mean flows
+ extremes & mean monthly flows (1964-1992)


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


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


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


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


Eden at Sheepmount
Gauged Discharge
Cubic Metres per Second
100
60
30
10
6
1993
1994
1995
1996
Station No : 076007 Monthly mean flows
+ extremes & mean monthly flows (1967-1992)

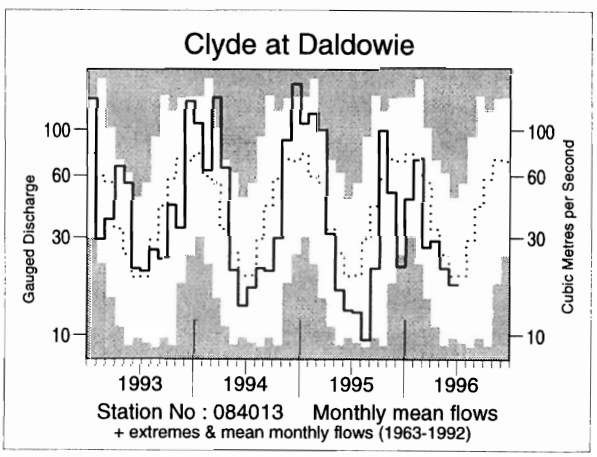

Clyde at Daldowie
Gauged Discharge
Cubic Metres per Second
100
60
30
10
1993
1994
1995
1996
Station No : 084013 Monthly mean flows
+ extremes & mean monthly flows (1963-1992)

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	Feb 1996	Mar	Apr	May	Jun 1996		4/96 to 6/96		10/95 to 6/96		7/95 to 6/96		7/94 to 6/96	
	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	99	71	114	49	28	10	191	14	794	19	954	20	1656	13
Park	135	74	143	78	78	/24	107	/24	113	/23	119	/23	104	/22
Tay at	98	71	115	72	50	30	237	33	947	17	1045	13	2385	29
Ballathie	84	54	128	104	111	/44	116	/44	97	/44	91	/43	104	/42
Tweed at	113	42	40	42	26	21	108	15	577	8	624	6	1511	13
Boleside	144	51	73	98	97	/36	87	/36	88	/35	82	/35	99	/34
Whiteadder Water at	64	37	20	31	10	10	61	15	310	9	333	8	589	6
Hutton Castle	135	77	53	116	63	/27	77	/27	90	/27	86	/26	76	/25
South Tyne at	104	35	32	37	10	5	79	7	432	3	459	1	1367	6
Haydon Bridge	137	40	56	101	39	/34	66	/34	67	/34	59	/32	87	/30
Wharfe at	68	23	20	30	10	6	61	8	242	1	270	1	1086	1
Flint Mill Weir	90	30	37	83	43	/41	54	/41	40	/41	38	/40	75	/39
Derwent at	51	28	15	14	9	3	38	2	197	7	220	6	516	8
Buttercrambe	130	71	50	60	54	/35	55	/35	70	/35	68	/34	80	/33
Trent at	32	19	14	13	10	2	38	2	159	2	191	2	613	10
Colwick	77	49	45	54	55	/38	51	/38	52	/38	54	/37	86	/36
Lud at	11	12	10	9	7	2	26	2	74	3	104	4	378	8
Louth	32	35	32	35	36	/28	35	/28	35	/28	42	/27	77	/26
Witham at	17	16	10	8	4	5	22	4	88	5	99	5	350	15
Claypole Mill	65	63	52	51	43	/38	50	/37	54	/37	54	/37	94	/36
Little Ouse at	9	9	7	5	3	1	16	1	61	2	78	2	256	5
Abbey Heath	42	42	38	38	33	/29	38	/29	42	/28	46	/28	76	/27
Mimram at	10	10	9	8	6	6	22	7	77	7	105	9	278	27
Panshanger Park	82	77	69	64	55	/44	63	/44	77	/43	84	/43	110	/42
Lee at	16	11	8	7	5	8	19	12	82	22	102	23	308	46
Feildes Weir (natr.)	79	54	50	53	53	/111	52	/110	58	/110	63	/109	95	/107
Thames at	31	25	18	13	8	28	40	39	181	38	204	38	513	60
Kingston (natr.)	94	80	82	77	65	/114	76	/114	83	/113	83	/113	104	/112
Coln at	46	45	37	27	17	7	81	9	286	9	324	9	771	14
Bibury	83	83	87	83	65	/33	81	/33	84	/33	82	/32	97	/31
Great Stour at	20	14	10	9	7	1	27	1	121	1	153	1	528	9
Horton	60	42	40	45	46	/31	44	/30	49	/29	53	/29	90	/27
Itchen at	47	50	43	39	30	8	112	10	357	14	433	12	995	25
Highbridge+Allbrook	95	96	93	94	87	/38	92	/38	94	/38	94	/37	108	/36
Stour at	64	49	33	21	12	12	66	11	350	10	370	10	925	18
Throop Mill	106	97	93	91	82	/24	90	/24	95	/23	93	/23	115	/22
Exe at	89	62	45	53	21	20	118	20	608	8	638	5	1722	23
Thorverton	86	73	79	144	86	/41	100	/40	81	/40	77	/40	103	/39
Taw at	67	44	41	32	13	19	86	19	457	7	470	4	1378	18
Umberleigh	78	65	92	114	76	/38	96	/38	72	/38	67	/37	98	/36
Tone at	62	63	39	28	15	19	83	21	422	16	448	13	1146	30
Bishops Hull	85	112	101	106	89	/36	100	/36	97	/35	94	/35	119	/34
Severn at	48	39	31	24	11	23	66	36	246	5	269	4	806	22
Bewdley	84	84	99	103	62	/76	91	/76	62	/75	60	/75	89	/74
Teme at	57	48	36	24	10	11	70	17	289	6	300	5	777	13
Knightsford Bridge	110	102	110	126	77	/27	107	/27	85	/26	82	/26	106	/25
Cynon at	167	82	65	99	46	26	210	25	1048	15	1100	9	2663	19
Abercynon	121	69	84	171	116	/38	119	/38	95	/38	87	/36	105	/34
Dee at	173	68	74	112	42	12	228	13	912	1	1028	1	3108	4
New Inn	103	37	68	166	72	/27	97	/27	61	/27	58	/27	87	/26
Eden at	82	28	23	23	11	1	58	4	356	1	388	1	1268	9
Sheepmount	108	37	48	71	46	/29	55	/29	58	/29	55	/28	90	/27
Clyde at	95	38	39	29	24	18	92	11	527	6	587	4	1589	14
Daldowie	122	46	83	82	92	/33	85	/33	80	/33	74	/32	100	/31
Carron at	151	70	108	55	85	12	248	5	1094	1	1404	1	4007	1
New Kelso	68	24	72	59	105	/18	77	/18	55	/17	56	/17	78	/16
Ewe at	104	106	71	65	110	22	246	8	1154	1	1395	2	3830	5
Poolewe	54	51	49	66	147	/26	78	/26	66	/25	65	/25	89	/24

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 1996.

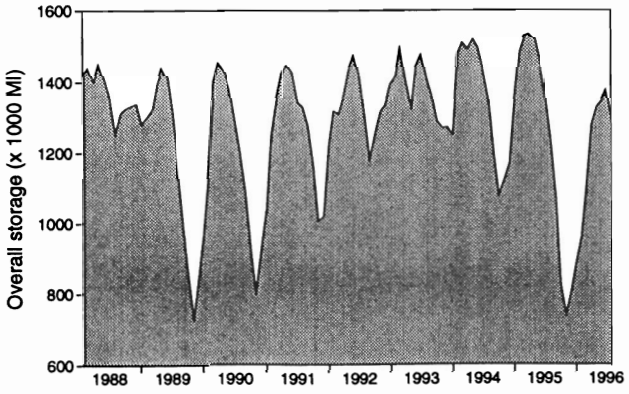
TABLE 4 START-MONTH RESERVOIR STORAGES UP TO JULY 1996

Area	Reservoir (R)/ Group (G)		Capacity● (Ml)	1996 Feb	Mar	Apr	May	Jun	Jul	1995 Jul
North West	N.Command Zone[1]	(G)	133375	63	78	78	80	80	75	58
	Vyrnwy	(R)	55146	45	59	64	70	74	66	69
Northumbria	Teesdale[2]	(G)	87936	51	72	77	81	81	68	70
	Kielder	(R)	199175*	93	95	96	93	96	91	91
Severn-Trent	Clywedog	(R)	44922	62	77	86	93	100	97	86
	Derwent Valley[3]	(G)	39525	15	46	54	54	56	53	72
Yorkshire	Washburn[4]	(G)	22035	34	53	70	76	87	82	63
	Bradford supply[5]	(G)	41407	33	53	59	60	70	63	54
Anglian	Grafham	(R)	58707	92	94	94	95	95	89	94
	Rutland	(R)	130061	72	82	92	94	93	88	80
Thames	London[6]	(G)	206399	89	94	94	95	95	88	93
	Farmoor [7]	(G)	13843	99	96	99	97	99	98	94
Southern	Bewl	(R)	28170	82	96	99	94	88	80	88
	Ardingly	(R)	4685	84	100	100	100	100	86	97
Wessex	Clatworthy	(R)	5364	91	100	100	94	97	89	61
	Bristol W [8]	(G)	38666*	73	86	95	97	95	87	79
South West	Colliford	(R)	28540	55	61	63	66	69	67	80
	Roadford[9]	(R)	34500	30	35	37	41	48	49	76
	Wimbleball[10]	(R)	21320	60	72	78	81	86	81	74
	Stithians	(R)	5205	100	100	99	97	98	93	61
Welsh	Celyn + Brenig	(G)	131155	61	69	72	75	82	77	87
	Brianne	(R)	62140	97	100	100	100	100	95	76
	Big Five[11]	(G)	69762	84	94	94	94	97	90	65
	Elan Valley[12]	(G)	99106	73	95	98	99	97	90	80
East of Scotland	Edin./Mid Lothian[13]	(G)	97639	96	100	96	98	98	95	88
	East Lothian[14]	(G)	10206	99	100	99	98	99	95	91
West of Scotland	Loch Katrine	(G)	111363	91	96	94	100	99	91	71
	Daer	(R)	22412	97	100	96	100	96	93	73
	Loch Thom	(G)	11840	100	98	98	97	94	90	77

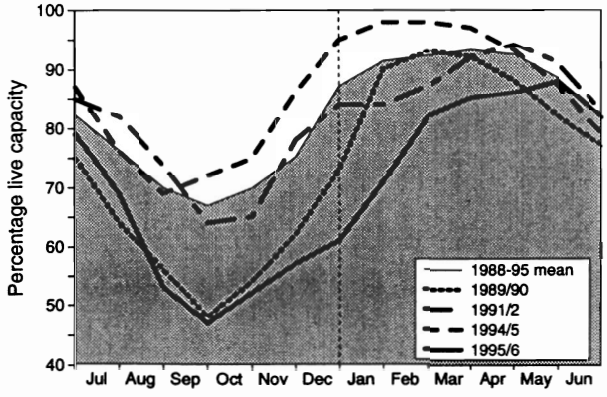
● Live or usable capacity (unless indicated otherwise) * Gross storage/percentage of gross storage

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



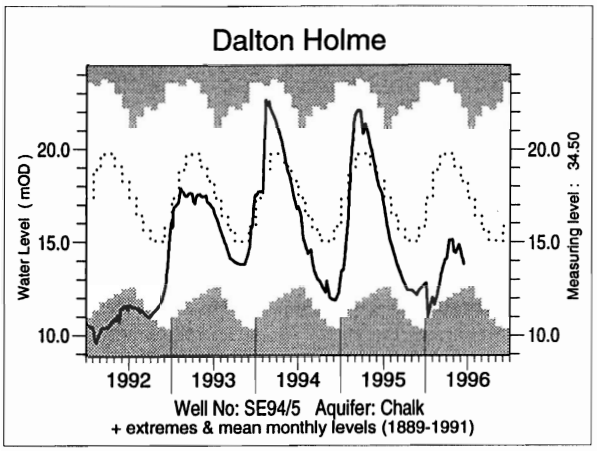
A COMPARISON BETWEEN OVERALL RESERVOIR STOCKS FOR ENGLAND AND WALES IN RECENT YEARS

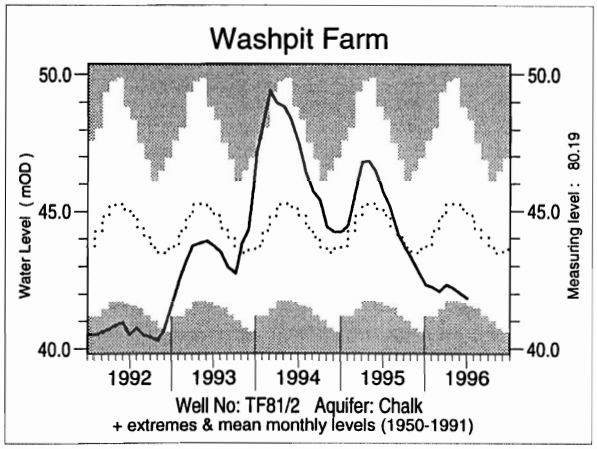


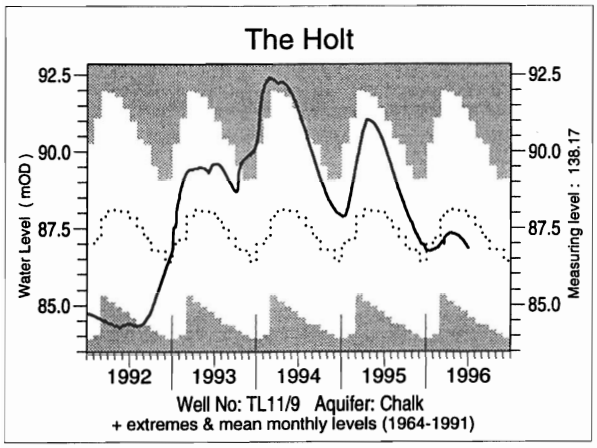
These plots are based on the reservoirs featured in Table 4 only

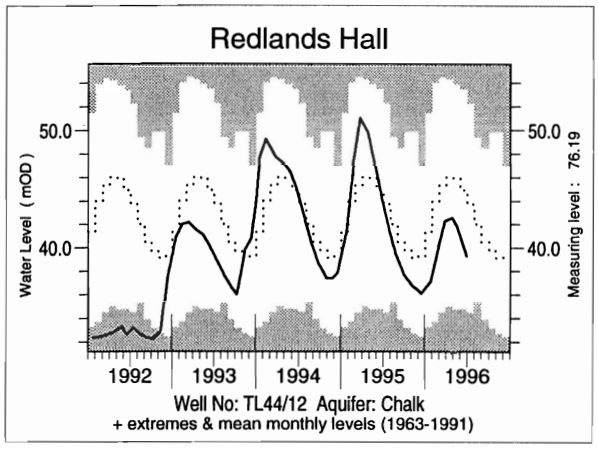
Note: Variations in storage depend on the balance between inputs (from catchment rainfall and any pumping) and outputs (to supply, compensation flow, HEP, amenity). There will be additional losses due to evaporation, especially in the summer months. Operational strategies for making the most efficient 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).

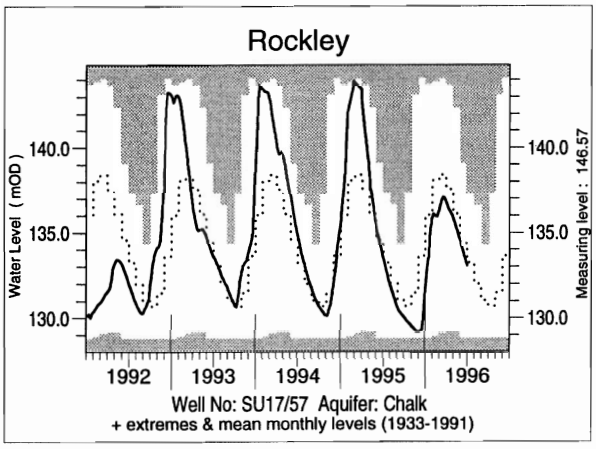
FIGURE 2 GROUNDWATER LEVEL HYDROGRAPHS

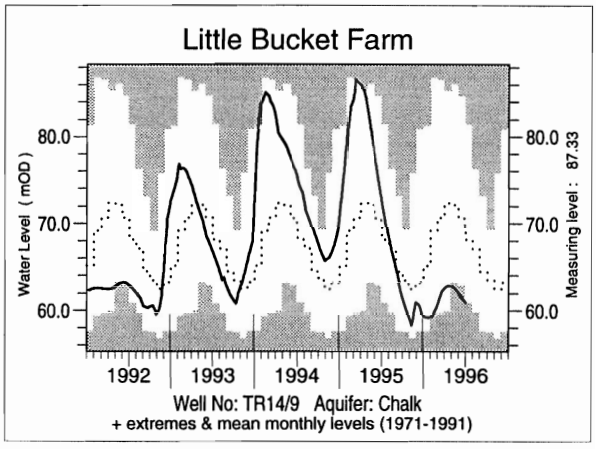


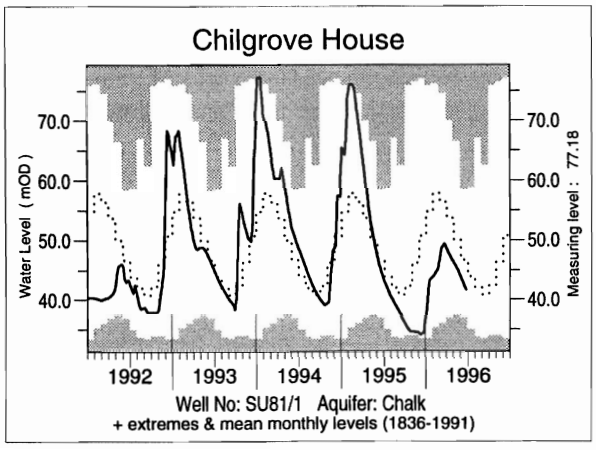


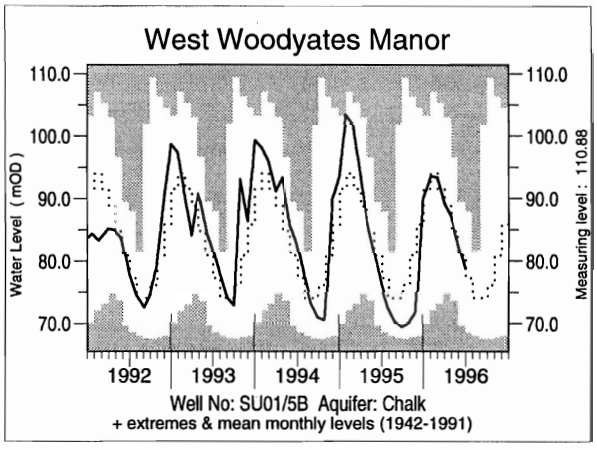


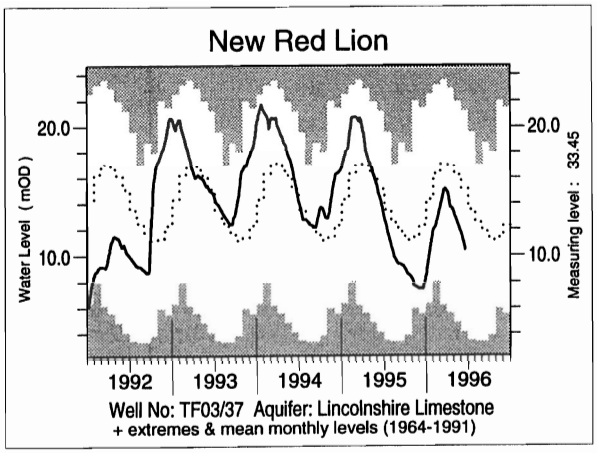


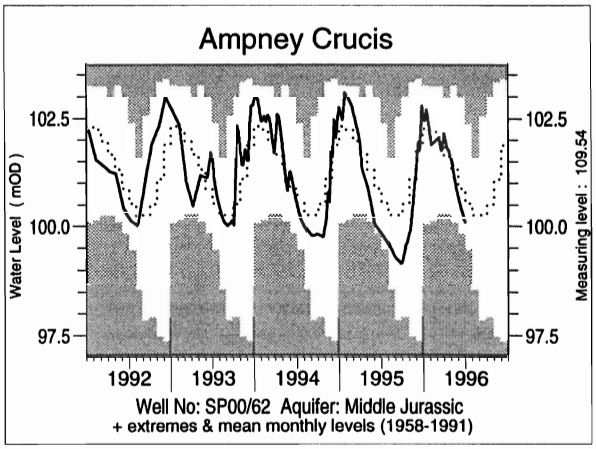


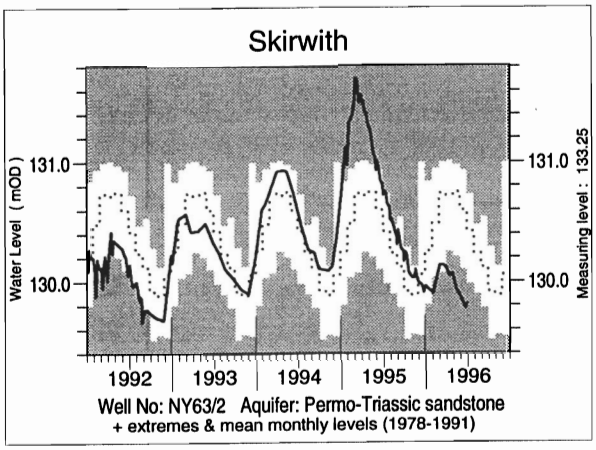


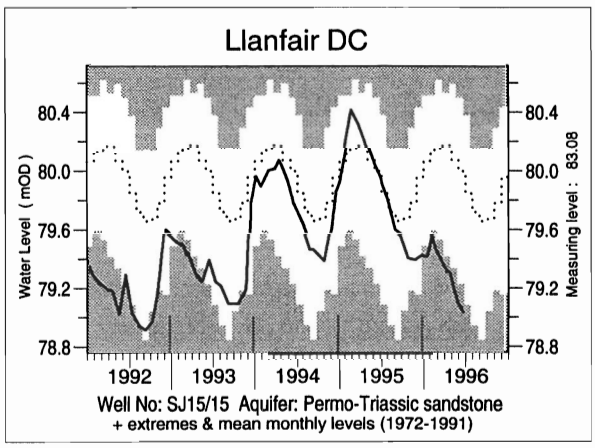


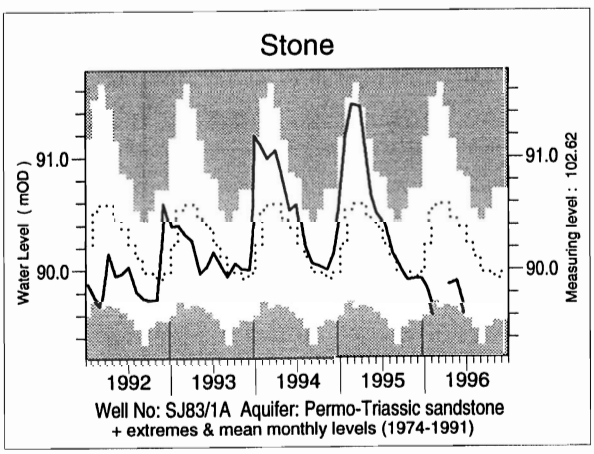


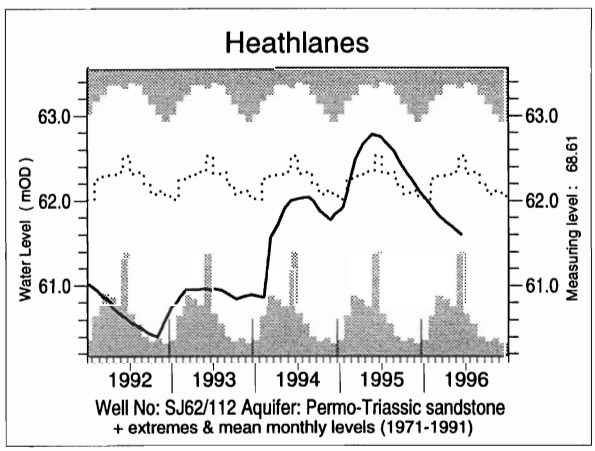

New Red Lion
Water Level (mOD)
20.0
10.0
Measuring level : 33.45
1992
1993
1994
1995
1996
Well No: TF03/37 Aquifer: Lincolnshire Limestone
+ extremes & mean monthly levels (1964-1991)

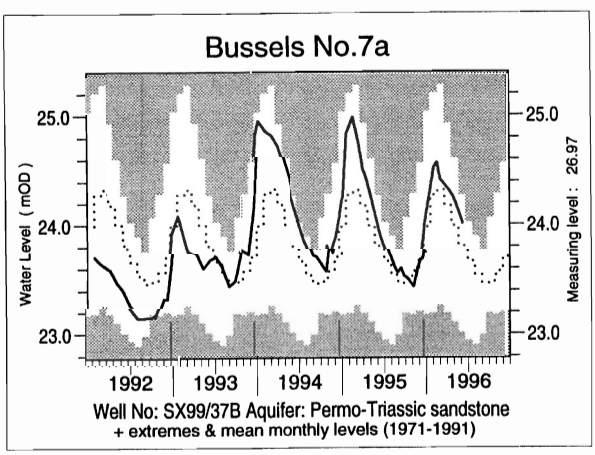

Ampney Crucis
Water Level (mOD)
102.5
100.0
97.5
Measuring level : 109.54
1992
1993
1994
1995
1996
Well No: SP00/62 Aquifer: Middle Jurassic
+ extremes & mean monthly levels (1958-1991)


Skirwith
Water Level (mOD)
131.0
130.0
Measuring level : 133.25
1992
1993
1994
1995
1996
Well No: NY63/2 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1978-1991)


Llanfair DC
Water Level (mOD)
80.4
80.0
79.6
79.2
78.8
Measuring level : 83.08
1992
1993
1994
1995
1996
Well No: SJ15/15 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1972-1991)


Stone
Water Level (mOD)
91.0
90.0
Measuring level : 102.62
1992
1993
1994
1995
1996
Well No: SJ83/1A Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1974-1991)


Heathlanes
Water Level (mOD)
63.0
62.0
61.0
Measuring level : 68.61
1992
1993
1994
1995
1996
Well No: SJ62/112 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1971-1991)


Bussels No.7a
Water Level (mOD)
25.0
24.0
23.0
Measuring level : 26.97
1992
1993
1994
1995
1996
Well No: SX99/37B Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1971-1991)

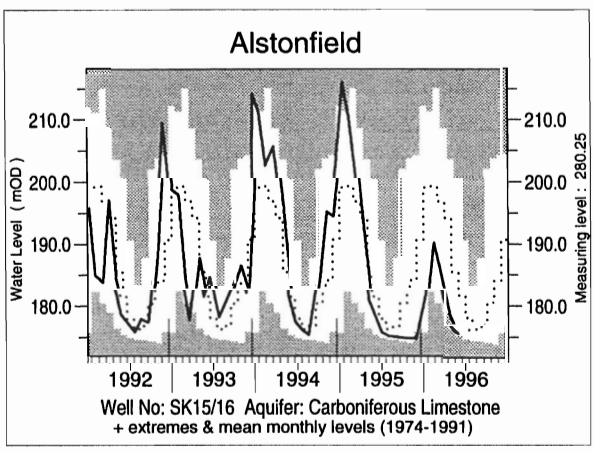

Alstonfield
Water Level (mOD)
210.0
200.0
190.0
180.0
Measuring level : 280.25
1992
1993
1994
1995
1996
Well No: SK15/16 Aquifer: Carboniferous Limestone
+ extremes & mean monthly levels (1974-1991)

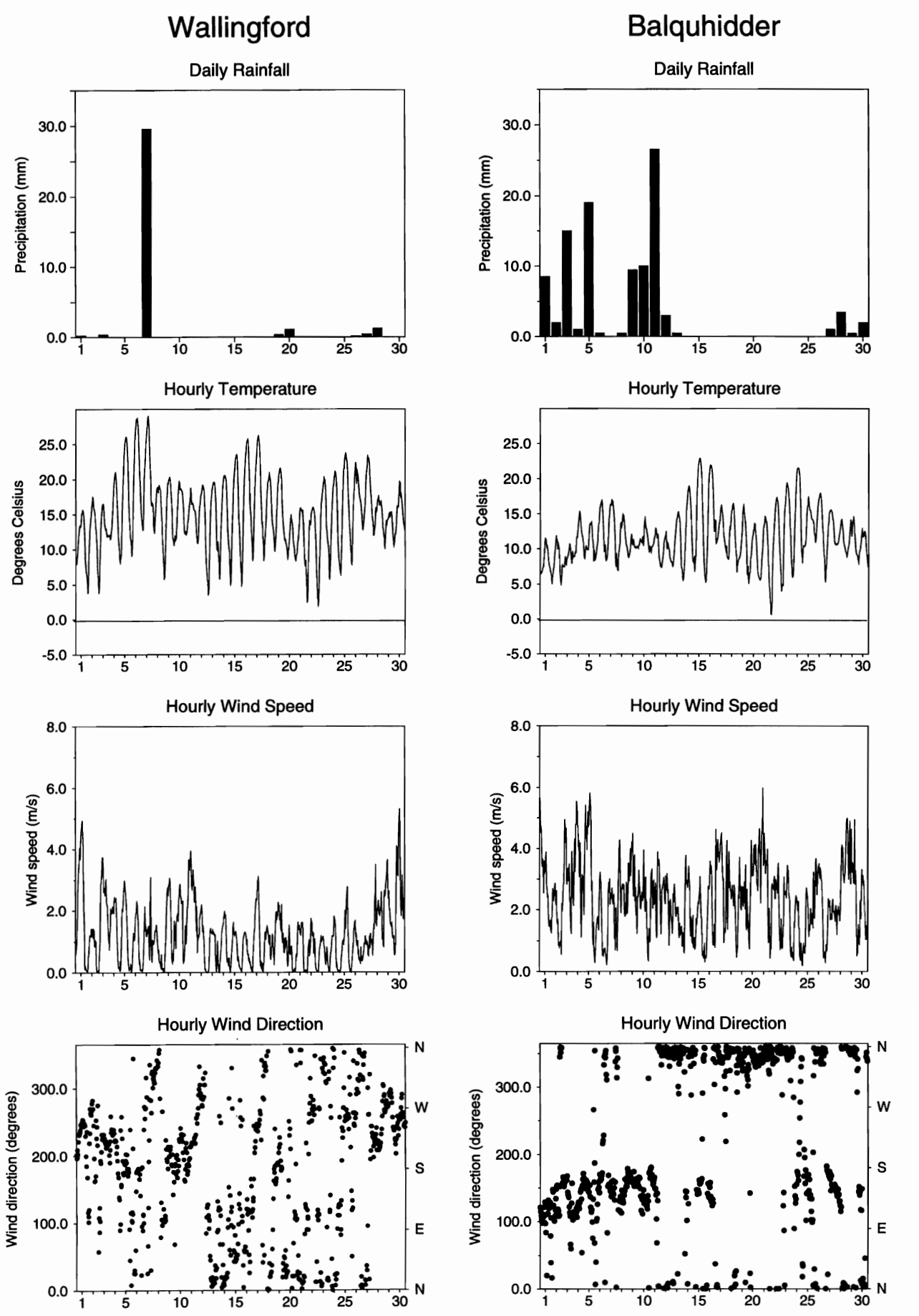
TABLE 5 JUNE GROUNDWATER LEVELS 1996

Site	Aquifer	Records commence	Minimum June <1996	Average June <1996	Maximum June <1996	No. of years June/July level<1996	June/July 1996 day	June/July 1996 level
Dalton Holme	C & UGS	1889	11 .40	18.28	22.23	7	14/06	13.82
Wetwang	C & UGS	1971	18.97	21.73	27.95	4	14/06	19.82
Keelby Grange	C & UGS	1980	3.78	12.36	17.69	1	17/06	5.72
Washpit Farm	C & UGS	1950	40.96	45.14	48.84	3	03/07	41.82
The Holt	C & UGS	1964	84.33	88.20	91.80	5	01/07	86.84
Therfield Rectory	C&UGS	1883	dry <71.60	82.00	98.77	>10	01/07	78.13
Redlands Hall	C & UGS	1964	32.64	44.21	53.46	5	27/06	39.34
Rockley	C & UGS	1933	dry<128.44	134.55	139.11	>10	01/07	133.04
Little Bucket Farm	C & UGS	1971	62.83	71.27	84.75	0	05/07	60.95
Compton House	C & UGS	1894	29.06	38.28	48.28	>10	21/06	34.46
Chilgrove House	C & UGS	1836	36.91	46.29	58.52	>10	21/06	41.64
Westdean No.3	C & UGS	1940	1.11	1.66	2.38	>10	28/06	1.38
Lime Kiln Way	C & UGS	1969	123.97	125.34	126.04	>10	13/06	125.90
Ashton Farm	C & UGS	1974	64.78	67.75	69.79	7	28/06	67.49
West Woodyates Manor	C & UGS	1942	69.78	80.97	89.58	>10	28/06	78.81
Killyglen (NI)	C & UGS	1985	113.00	113.88	114.58	7	20/06	113.82
New Red Lion	LLst	1964	4.11	14.87	21.28	3	18/06	10.42
Ampney Crucis	Mid Jur	1958	99.87	100.84	103.03	7	01/07	100 .14
Redbank	PTS	1981	7.22	8.10	8.56	5	01/07	7.88
Yew Tree Farm	PTS	1973	13.01	13.52	13.87	3	24/06	13.24
Skirwith	PTS	1978	130.06	130.56	131.01	0	01/07	129.81
Llanfair D.C	PTS	1972	79.23	79.86	80.51	0	28/06	79.04
Morris Dancers	PTS	1969	31.89	32.46	33.49	>10	14/06	32.45
Stone	PTS	1974	89.63	90.35	90.87	0	27/06	89.62
Heathlanes	PTS	1971	60.66	62.31	63.35	5	10/06	61.60
Bussels No.7A	PTS	1972	23.01	23.83	24.28	>10	18/06	24.02
Rushyford NE	MgLst	1967	65.22	72.86	76.62	>10	20/06	76.22
Peggy Ellerton	MgLst	1968	31.38	34.28	36.78	8	20/06	33.41
Alstonfield	CLst	1974	175.45	181.25	200.66	2	13/06	175.83

groundwater levels are in metres above Ordnance Datum

C & UGS	Chalk and Upper Greensand	Mid Jur	Middle Jurassic limestones
LLst	Lincolnshire Limestone	MgLst	Magnesian Limestone
PTS	Permo-Triassic sandstones	CLst	Carboniferous Limestone

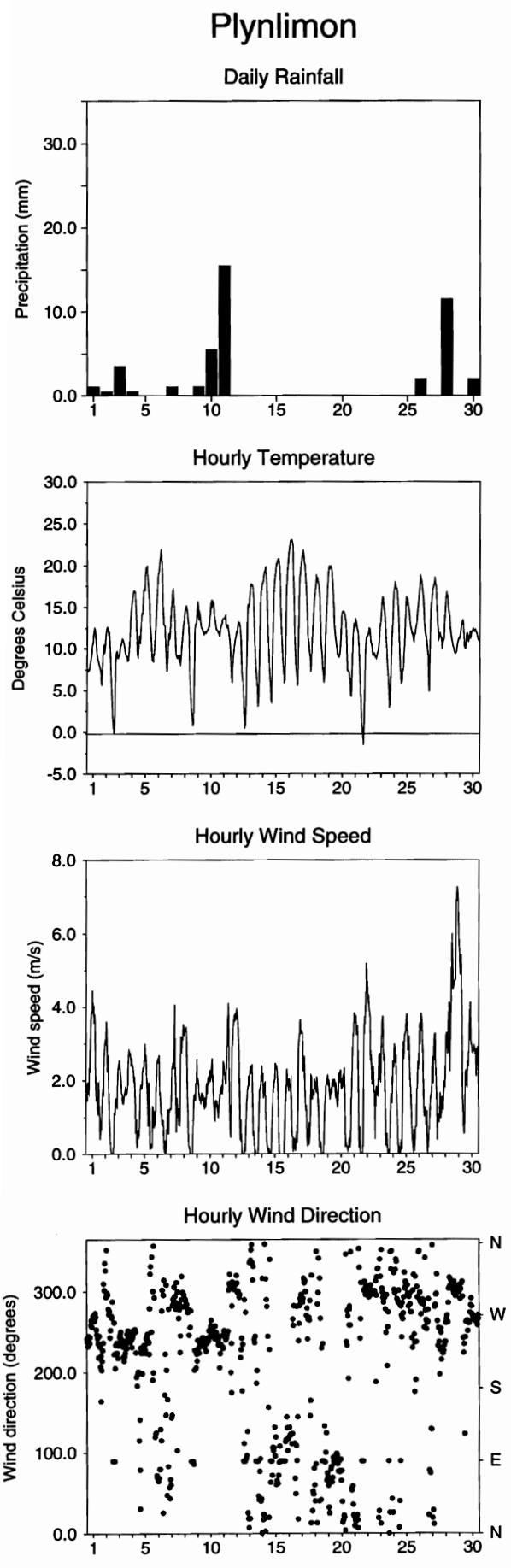
FIGURE 3 METEOROLOGICAL SUMMARY - JUNE 1996



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

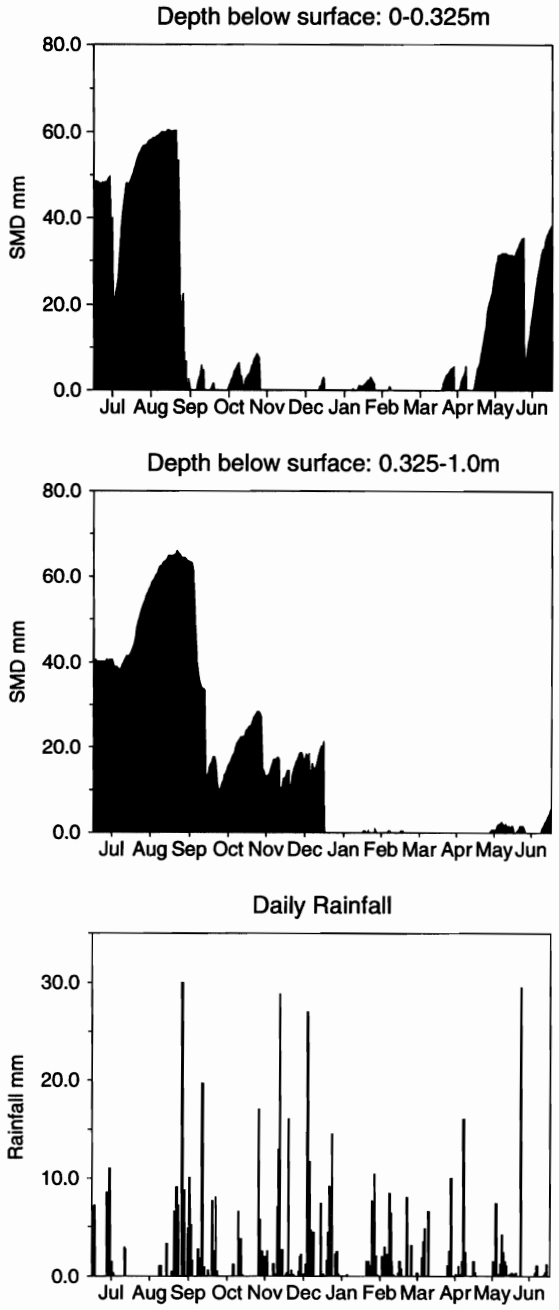
The Lower Kirkton automatic weather station (Balquhidder) occupies a relatively sheltered position at the mouth of the SSE trending Kirkton Glen. Station elevation is 270m aOD and average annual rainfall exceeds 2000mm; snow cover is expected for 10-30 days a year.

FIGURE 3 (continued)



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 270m aOD and average annual rainfall exceeds 2300mm.

FIGURE 3a. WALLINGFORD SMD DATA 1995/6.



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 meteorological station from July 1995 is presented.

FIGURE 4 LOCATION MAP OF GAUGING STATIONS AND GROUNDWATER INDEX WELLS