Hydrological Summary for Great Britain

SEPTEMBER 1996

Rainfall

September was another relatively dry and generally warm month with above average sunshine totals in most areas. The synoptic pattern was predominantly anticyclonic, very few Atlantic frontal systems crossing the British Isles until near month-end (a marked contrast to September 1995). Many central areas registered little or no appreciable rainfall over the first three weeks of the month and monthly totals would have been remarkably low but for significant rainfall on the 28/29th; 24-hr rainfall totals exceeding 100 mm were reported from north Wales and the Lake District. Even so, large areas in central England recorded September totals of less than 10 mm. The provisional regional rainfall totals for September all fell in the 30-55% range extending what is now a very protracted drought. Scotland recorded its third driest June-Sept. in a series from 1869 and Britain its lowest Mar.-Sept. rainfall in more than 120 years. But the drought achieves its most extreme expression in the period from March 1995. Over the ensuing 18 months only three have registered above average rainfall for England and Wales - with a few districts in northern England reporting one only. The April 1995-September 1996 period has, marginally, eclipsed 1975/76 as the driest in the 230-year E&W series and only during the 1853/55 and 1975/76 droughts have drier 18-month sequences been recorded. Exceptional rainfall deficiencies now extend across most of Britain with the most extreme drought conditions in northern Scotland and in a zone extending from northern England through the Midlands to East Anglia.

River Flow

This September saw a continuation of the summer recessions in most catchments - although minor and short-lived high flows were reported at month-end; the Lune recorded its highest September flow in a decade. Generally the spates served only to bolster depressed monthly runoff totals. This contrasts with the September spates which interrupted the drought last year. Aside from spring-fed rivers in parts of southern England, most rivers recorded September runoff totals below half of the preceding average, in extreme cases flows were below 25%. Flows were particularly depressed in north-eastern Britain where many new September minimum runoff totals were established (e.g. on the Tay and South Tyne). Further south a few rivers, including the Dove and Gt. Stour (Kent), registered their lowest flow for *any* month. The Thames recorded its second lowest September flow in almost 50 years but, in common with many lowland rivers, runoff was not greatly different from the September minima during the 1988-92 drought. In most regions, flows were also appreciably above those recorded in September 1959. The severity and spatial extent of the current drought is most evident from the longer term runoff accumulations. Water-year (Oct.-Sept.) runoff totals were below *any* previous 12-month sequence for the South Tyne, Dove and Gt. Stour, and in the 18-month timeframe, are exceptionally low from north Wales to north-west Scotland - a remarkable contrast with the abundant runoff that characterised most of the previous 15 years. Long term runoff totals are healthier in the south but the continuing decline in baseflows has caused a significant contraction in the river network and an associated, albeit temporary, loss of aquatic habitat.

Groundwater

In most aquifer outcrop areas soils remained parched throughout September and groundwater level recessions continued. The recent decline of water-tables in the South-West and the deepest Chalk wells, leaves vitually all index wells below average - most very substantially so. As in August, new minimum levels were established in the Permo-Triassic sandstones boreholes at Llanfair DC (north Wales) and Skirwith (Eden Valley) - both are now significantly below pre-1996 minima. In the northern Chalk, levels at Dalton Holme closely approached the September minimum in a record from 1889. Levels at Washpit Farm (Norfolk) and Little Bucket (Kent) confirm the depressed state of water-tables close to the eastern seaboard. Levels in the Chalk are mostly well above drought minima to the west but with soil moisture deficits the equivalent of around 8-12 weeks average rainfall over wide areas, recessions are set to continue and the window of opportunity for aquifer replenishment over the coming winter could be significantly restricted.

General

Most reservoir stocks declined by more than the seasonal average in September but overall stocks - although well below average - are above the corresponding figure for 1995 (1989 and 1990 also). Protracted and severe drought conditions are now widespread but the degree of water resources stress in 1997 will be heavily dependant on rainfall over the coming winter and spring.

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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 11 October 1996

TABLE 1 1995/96 RAINFALL AS A PERCENTAGE OF THE 1961-90 AVERAGE

		Sep 1995	Oct	Nov	Dec	Jan 1996	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
England and Wales	mm	113	58	83	84	63	83	44	49	57	29	40	84	34
	%	147	68	92	89	72	132	61	82	89	45	65	111	44
North West	mm	97	105	76	42	53	105	36	71	56	45	58	84	62
	%	84	82	62	34	44	135	38	100	75	56	68	78	54
Northumbrian	mm	111	57	118	79	46	89	33	63	53	22	52	67	35
	%	152	75	137	98	55	151	47	113	85	37	80	83	48
Severn Trent	mm	94	39	65	81	44	67	42	49	48	30	33	61	22
	%	147	61	92	105	63	124	69	89	81	51	62	92	34
Yorkshire	mm	96	29	65	70	46	78	31	41	52	35	41	80	31
	%	141	40	81	84	58	134	46	69	87	58	69	107	45
Anglian	mm	101	15	42	69	33	50	20	15	23	18	41	76	17
	%	206	29	72	125	66	135	43	33	48	35	84	137	34
Thames	mm	117	34	64	96	50	64	35	35	34	15	38	66	22
	%	198	55	98	137	78	142	63	70	61	27	78	113	37
Southern	mm	140	33	65	95	67	68	42	23	51	16	31	82	31
	%	203	41	76	116	84	126	67	43	94	30	65	145	45
Wessex	mm	144	68	124	104	76	85	68	57	59	30	27	72	33
	%	200	86	149	112	87	131	97	108	97	53	52	109	45
South West	mm	136	104	134	126	156	119	73	78	99	35	31	84	49
	%	146	90	107	91	113	118	74	113	138	51	45	100	53
Welsh	mm	125	115	133	103	102	127	72	85	104	47	46	97	55
	%	109	84	94	67	71	131	67	106	127	59	60	96	48
Scotland	mm	198	228	126	55	89	141	59	107	77	65	77	53	63
	%	139	146	83	36	59	138	47	141	90	76	82	46	45
Highland	mm	251	246	160	48	58	152	55	110	83	83	91	57	86
	%	147	124	79	24	31	120	34	121	90	85	86	45	50
North East	mm	297	103	100	70	69	114	57	62	66	32	66	43	31
	%	341	106	101	75	70	175	73	103	96	48	90	49	36
Tay	mm	178	220	120	68	136	116	79	106	64	41	52	53	50
	%	156	169	99	54	94	122	72	171	77	56	68	56	44
Forth	mm	136	199	90	54	72	86	52	86	70	43	55	52	48
	%	124	173	80	49	61	109	55	146	95	62	73	55	44
Tweed	mm	123	134	97	64	68	103	30	78	63	31	53	47	30
	%	138	141	104	69	68	154	38	137	89	48	73	53	34
Solway	mm	102	249	113	52	135	160	73	133	80	75	70	63	62
	%	71	159	78	35	87	158	62	173	94	89	78	53	43
Clyde	mm	138	324	119	47	119	180	62	138	90	88	97	53	75
	%	77	168	66	26	63	153	42	164	99	95	89	40	42

Note: The monthly regional rainfall figures for England and Wales for August & September 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 August & September 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

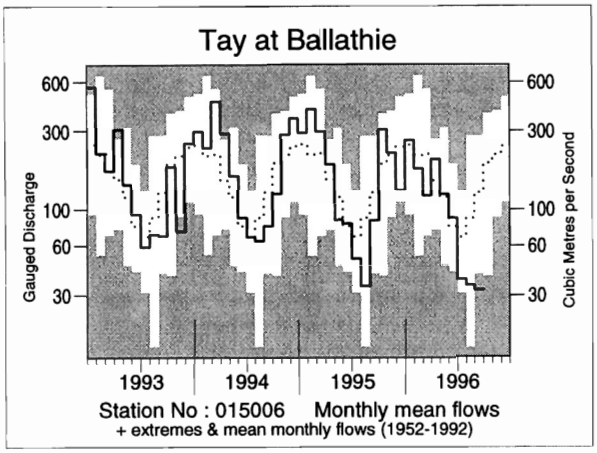
		Jun 96-Sep 96		Mar 96-Sep 96		Oct 95-Sep 96		Apr 95-Sep 96	
		Est Return Period, years		Est Return Period, years		Est Return Period, years		Est Return Period, years	
England and Wales	mm	187		337		708		970	
	% LTA	67	10-20	71	20-35	79	15-25	75	110-150
North West	mm	249		412		793		1105	
	% LTA	64	15-25	66	40-60	66	>200	64	>>200
Northumbria	mm	177		326		715		988	
	% LTA	63	15-25	70	20-35	84	5-15	79	30-50
Severn Trent	mm	146		285		581		801	
	% LTA	60	20-30	68	20-35	77	15-25	72	110-150
Yorkshire	mm	186		310		598		826	
	% LTA	71	5-15	69	20-35	73	35-50	69	>200
Anglian	mm	152		210		419		624	
	% LTA	74	5-10	61	60-90	70	50-80	70	>200
Thames	mm	140		244		552		775	
	% LTA	64	10-20	64	30-40	80	5-15	76	30-45
Southern	mm	161		277		605		842	
	% LTA	70	5-10	70	10-20	78	10-20	76	30-50
Wessex	mm	162		346		803		1085	
	% LTA	65	5-15	80	5-10	96	2-5	90	2-5
South West	mm	199		449		1088		1411	
	% LTA	63	10-20	81	5-10	93	2-5	87	5-10
Welsh	mm	245		506		1086		1435	
	% LTA	66	10-20	79	5-10	83	5-15	78	35-50
Scotland	mm	259		502		1141		1653	
	% LTA	59	80-120	69	70-100	79	30-50	81	50-80
Highland	mm	317		565		1229		1859	
	% LTA	63	35-50	67	70-100	70	>200	76	>200
North East	mm	172		357		813		1383	
	% LTA	55	80-120	69	40-60	84	10-15	98	2-5
Tay	mm	196		445		1105		1537	
	% LTA	55	40-60	73	15-25	90	2-5	89	5-10
Forth	mm	198		406		907		1271	
	% LTA	57	50-80	71	30-45	82	10-20	80	35-50
Tweed	mm	161		332		798		1123	
	% LTA	51	80-120	64	60-90	82	10-15	79	35-50
Solway	mm	270		556		1265		1637	
	% LTA	62	25-40	78	10-15	89	5-10	81	25-40
Clyde	mm	313		603		1392		1888	
	% LTA	61	35-50	72	30-40	82	10-20	79	50-80

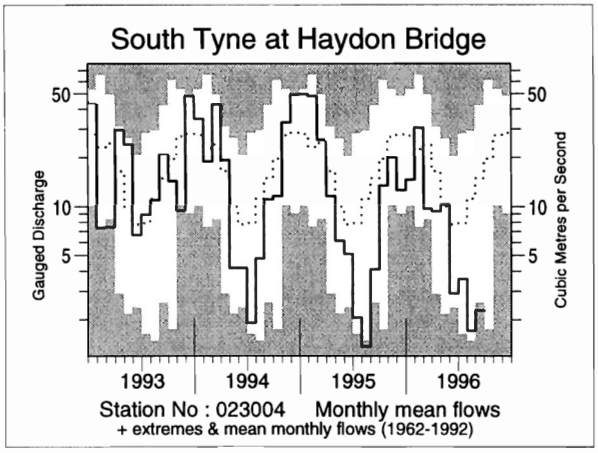
LTA refers to the period 1961-90.

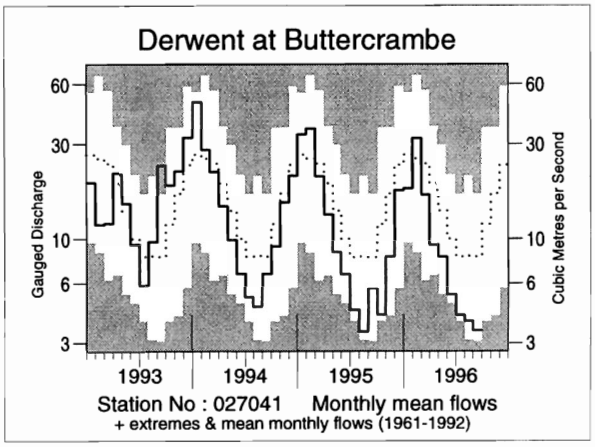
Return period assessments are based on tables provided by the Meteorological Office*. The tables reflect rainfall totals over the period 1911-70 only and the estimate assumes a sensibly stable climate. They assume a start in a specified month; return periods for a start in any month may be expected to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

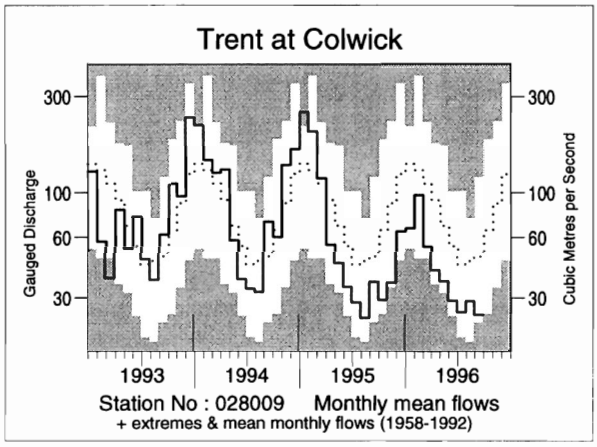
* Tabony, R.C., 1977, The Variability of long duration rainfall over Great Britain, Scientific Paper No. 37, Meteorological Office.

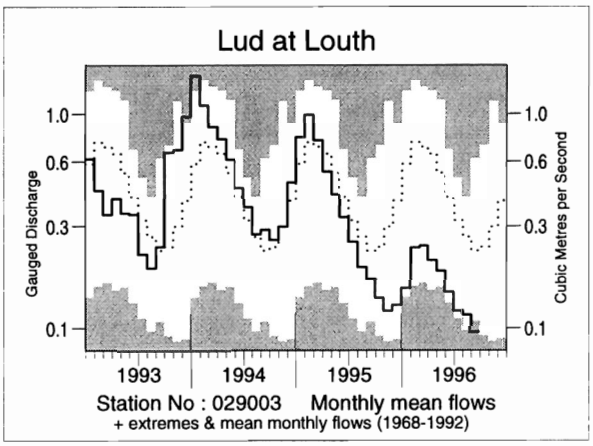
FIGURE 1 MONTHLY RIVER FLOW HYDROGRAPHS

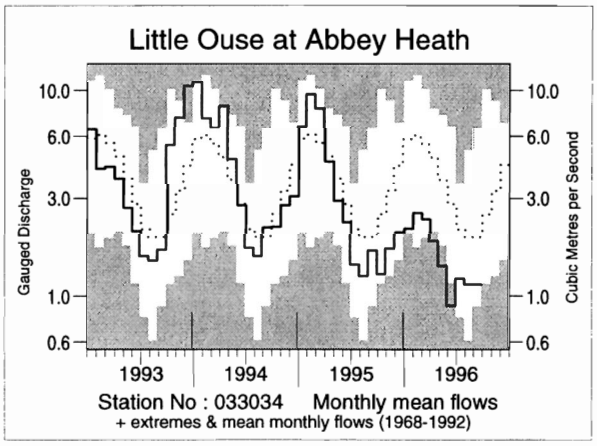


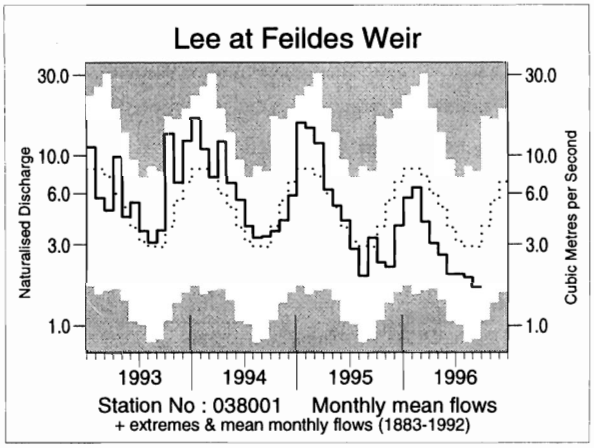


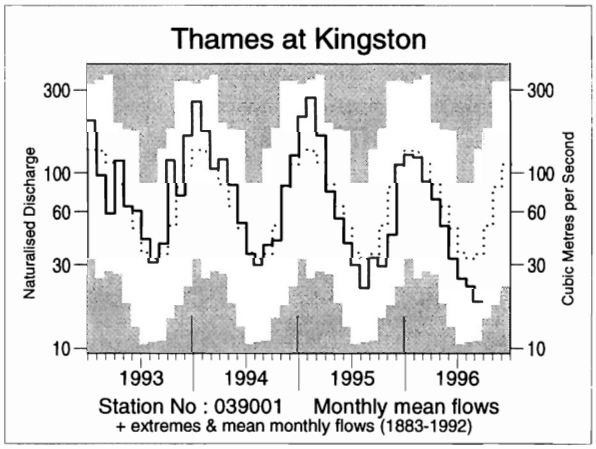


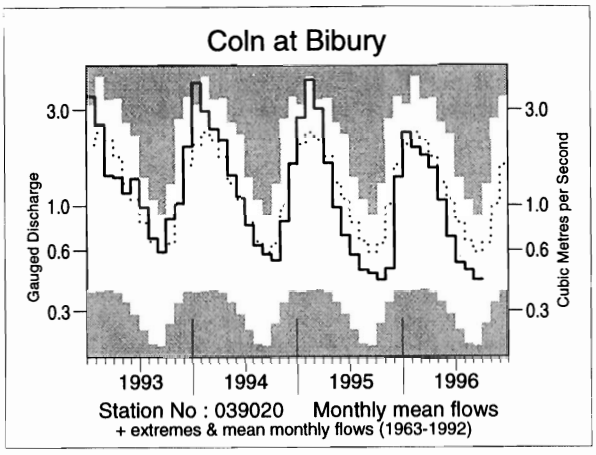


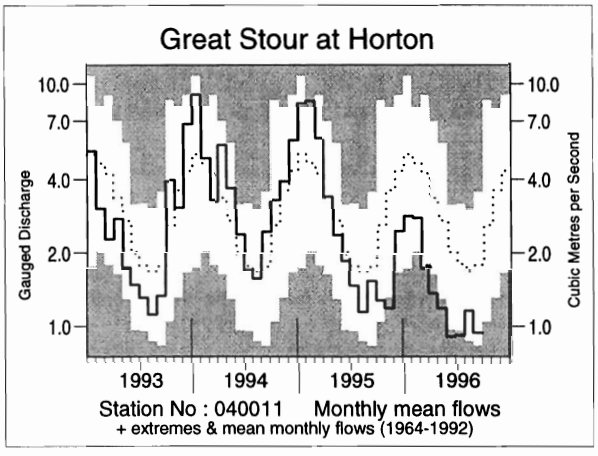


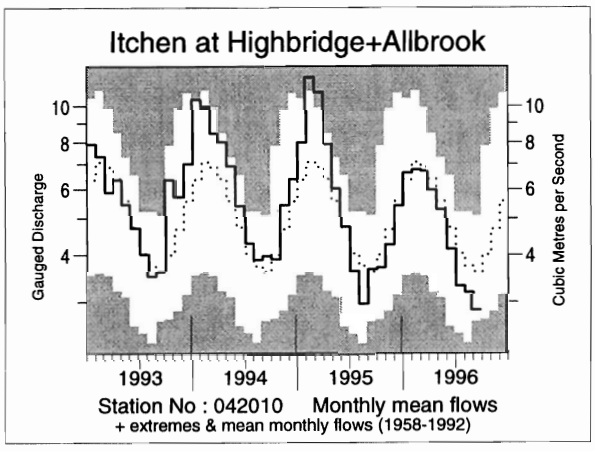


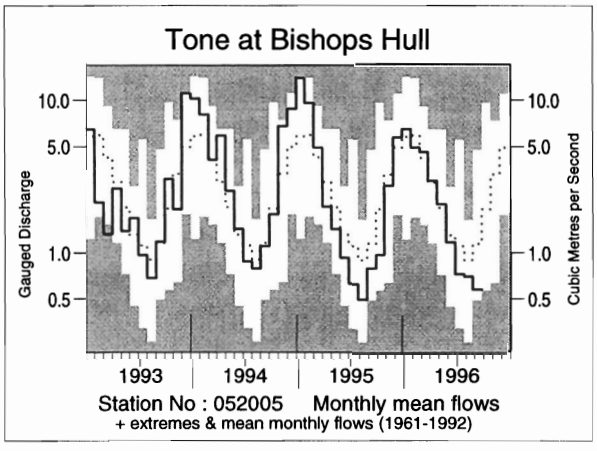


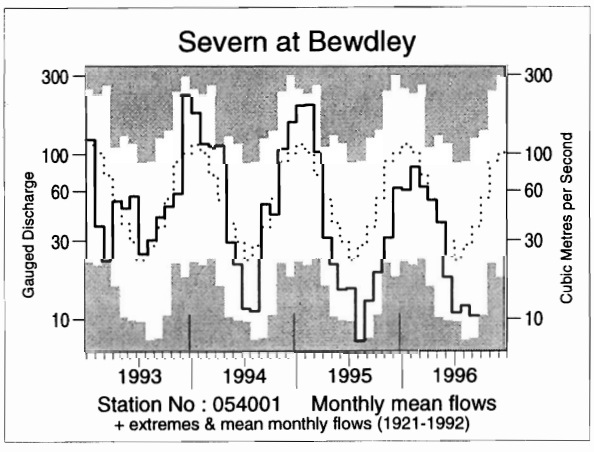


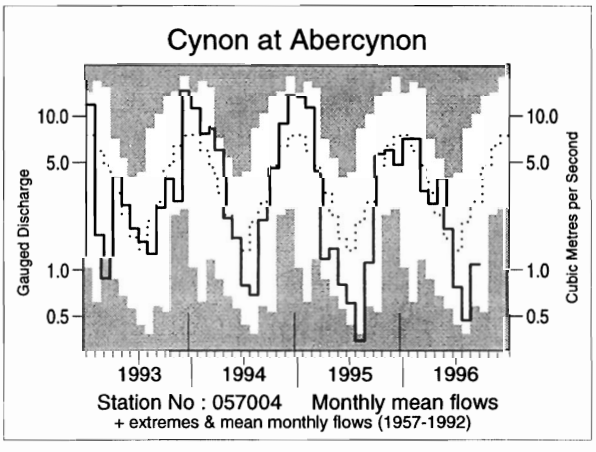

Coln at Bibury
Gauged Discharge
Cubic Metres per Second
3.0
1.0
0.6
0.3
1993
1994
1995
1996
Station No : 039020 Monthly mean flows
+ extremes & mean monthly flows (1963-1992)

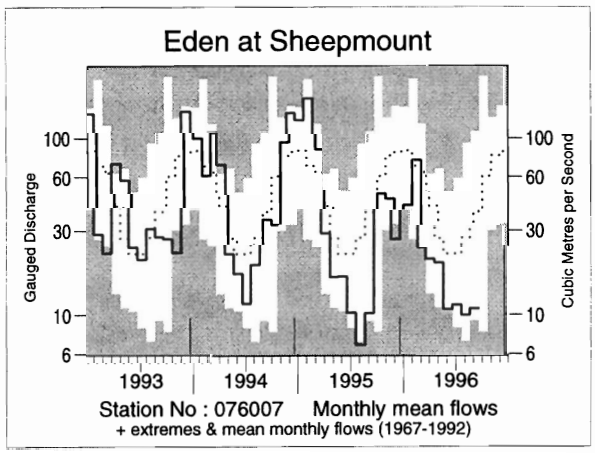

Great Stour at Horton
Gauged Discharge
Cubic Metres per Second
10.0
7.0
4.0
2.0
1.0
1993
1994
1995
1996
Station No : 040011 Monthly mean flows
+ extremes & mean monthly flows (1964-1992)


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)

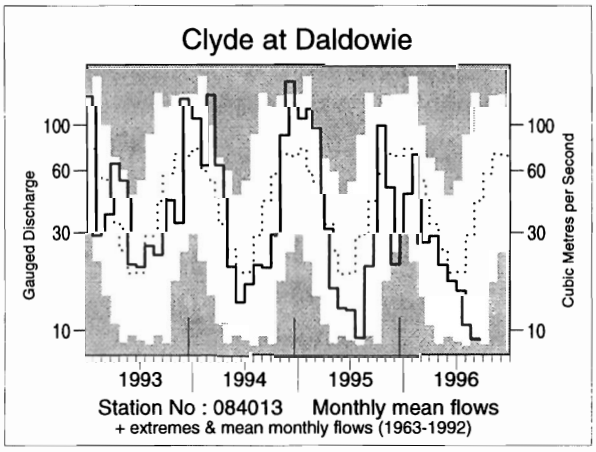

Clyde at Daldowie
Gauged Discharge
Cubic Metres per Second
100
60
30
10
1993
1994
1995
1996
Station No : 084013 Monthly mean flows
+ extremes & mean monthly flows (1963-1992)

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	May 1996	Jun	Jul	Aug	Sep 1996		4/96 to 9/96		1/96 to 9/96		10/95 to 9/96		4/95 to 9/96	
	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 Park	49 78	28 78	19 71	13 44	12 27	1 /24	235 85	7 /24	562 104	12 /24	838 105	15 /23	1167 108	16 /23
Tay at Ballathie	72 104	50 111	22 56	20 41	19 27	1 /44	299 82	8 /44	623 82	8 /44	1008 89	11 /44	1309 87	6 /43
Tweed at Boleside	42 98	26 97	16 62	13 35	11 23	2 /36	148 63	5 /36	393 78	5 /36	617 81	4 /35	743 75	4 /35
Whiteadder Water at Hutton Castle	31 116	10 63	8 64	7 47	6 38	2 /28	81 68	9 /27	236 86	8 /27	330 85	8 /27	398 78	8 /26
South Tyne at Haydon Bridge	37 101	10 39	13 47	6 16	8 16	1 /33	106 46	1 /33	297 60	1 /33	459 60	1 /33	566 56	1 /31
Wharfe at Flint Mill Weir	30 83	10 43	13 53	22 58	19 43	8 /41	115 52	5 /41	240 51	1 /41	296 42	1 /41	373 40	1 /40
Derwent at Buttercrambe	14 60	9 54	7 53	7 49	6 41	4 /35	57 52	2 /35	166 71	7 /35	216 67	7 /35	286 66	4 /34
Trent at Colwick	13 54	10 55	9 59	10 66	9 51	2 /38	66 54	2 /38	142 56	2 /38	188 53	2 /38	266 56	2 /37
Lud at Louth	9 35	7 36	6 38	6 44	5 42	1 /29	42 38	2 /28	72 35	3 /28	90 36	3 /28	181 51	3 /27
Witham at Claypole Mill	8 51	4 43	3 46	3 49	3 39	3 /38	31 48	2 /37	77 54	3 /37	97 53	3 /37	137 54	3 /36
Little Ouse at Abbey Heath	5 38	3 33	5 59	4 61	4 60	3 /29	29 46	2 /29	55 43	1 /28	74 44	1 /28	127 55	3 /28
Colne at Lexden	4 50	3 50	2 53	3 77	2 56	4 /37	20 51	2 /37	55 56	7 /37	72 53	7 /36	100 57	6 /35
Lee at Feildes Weir (natr.)	7 53	5 53	5 64	5 66	4 58	18 /111	34 56	10 /110	74 61	17 /110	96 59	19 /110	156 70	22 /108
Thames at Kingston (natr.)	14 78	8 67	7 71	6 69	5 54	15 /114	58 73	30 /114	149 82	38 /114	199 81	35 /113	267 82	35 /113
Coln at Bibury	27 83	17 65	13 64	12 73	10 74	5 /33	116 77	7 /33	265 85	9 /33	322 82	9 /33	441 81	8 /32
Great Stour at Horton	9 45	7 46	7 52	9 71	7 53	2 /32	50 50	1 /30	106 51	1 /30	144 50	1 /29	235 60	1 /28
Itchen at Highbridge+Allbrook	39 94	30 87	25 82	24 86	21 79	4 /38	181 88	8 /38	328 92	10 /38	426 92	10 /38	638 96	13 /37
Stour at Throop Mill	21 91	12 82	9 79	8 78	6 54	5 /24	88 84	7 /24	268 96	11 /24	373 93	10 /23	445 88	8 /23
Exe at Thorverton	53 144	21 86	9 46	12 46	9 24	3 /41	149 74	11 /40	409 78	5 /40	639 77	6 /40	730 71	2 /39
Taw at Umberleigh	32 114	13 76	4 30	6 31	4 18	2 /38	100 69	9 /38	303 73	6 /38	472 68	4 /38	523 62	2 /37
Tone at Bishops Hull	28 106	15 89	10 67	9 79	8 50	3 /36	110 89	14 /36	322 96	14 /35	449 94	12 /35	532 89	11 /35
Severn at Bewdley	24 102	11 61	7 48	7 44	6 29	5 /76	86 69	13 /76	211 70	7 /75	280 62	5 /75	342 59	3 /75
Teme at Knightsford Bridge	24 126	10 77	5 62	4 43	2 25	1 /27	81 90	11 /27	243 95	9 /26	300 82	5 /26	340 75	5 /26
Yscir at Pontaryscir	64 158	29 100	10 47	8 25	7 15	1 /25	179 80	7 /24	478 80	3 /24	743 76	3 /23	832 69	2 /23
Dee at New Inn	112 166	42 72	29 44	41 46	69 55	8 /28	367 71	7 /27	744 67	1 /27	1051 59	1 /27	1300 56	1 /26
Eden at Sheepmount	23 71	12 49	13 54	12 38	12 29	3 /29	96 48	1 /29	255 56	1 /29	394 56	1 /29	496 55	1 /28
Clyde at Daldowie	29 82	24 92	22 82	15 39	13 23	1 /33	142 62	2 /33	340 68	3 /33	577 74	4 /33	720 71	1 /32
Carron at New Kelso	55 59	85 105	102 87	83 53	112 45	2 /18	546 66	1 /18	814 50	1 /18	1392 56	1 /17	2041 61	1 /17
Ewe at Poolewe	65 66	110 147	124 141	61 56	59 32	3 /26	491 71	2 /26	755 56	1 /26	1399 66	1 /25	2031 72	1 /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 1996.

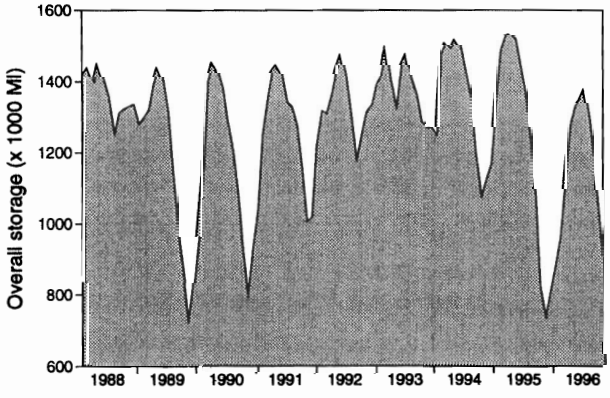
TABLE 4 START-MONTH RESERVOIR STORAGES UP TO OCTOBER 1996

Area	Reservoir (R)/ Group (G)		Capacity● (Ml)	1996 May	Jun	Jul	Aug	Sep	Oct	*1995 Oct*
North West	N.Command Zone[1]	(G)	133375	80	80	75	64	45	36	*13*
	Vyrnwy	(R)	55146	70	74	66	56	43	35	*26*
Northumbria	Teesdale[2]	(G)	87936	81	81	68	62	42	34	*31*
	Kielder	(R)	199175*	93	96	91	89	83	81	*82*
Severn-Trent	Clywedog	(R)	44922	93	100	97	81	67	46	*36*
	Derwent Valley[3]	(G)	39525	54	56	53	43	36	27	*25*
Yorkshire	Washburn[4]	(G)	22035	76	87	82	75	69	62	*24*
	Bradford supply[5]	(G)	41407	60	70	63	56	55	48	*15*
Anglian	Grafham	(R)	58707	95	95	89	83	78	71	*72*
	Rutland	(R)	130061	94	93	88	83	78	72	*61*
Thames	London[6]	(G)	206399	95	95	88	77	67	54	*66*
	Farmoor [7]	(G)	13843	97	99	98	95	97	91	*76*
Southern	Bewl	(R)	28170	94	88	80	72	65	58	*69*
	Ardingly	(R)	4685	100	100	86	68	47	37	*46*
Wessex	Clatworthy	(R)	5364	94	97	89	70	62	48	*30*
	Bristol W [8]	(G)	38666*	97	95	87	76	66	57	*44*
South West	Colliford	(R)	28540	66	69	67	59	52	43	*47*
	Roadford[9]	(R)	34500	41	48	49	46	42	38	*26*
	Wimbleball[10]	(R)	21320	81	86	81	64	53	43	*30*
	Stithians	(R)	5205	97	98	93	79	68	57	*27*
Welsh	Celyn + Brenig	(G)	131155	75	82	77	66	55	48	*48*
	Brianne	(R)	62140	100	100	95	85	77	63	*48*
	Big Five[11]	(G)	69762	94	97	90	73	54	46	*19*
	Elan Valley[12]	(G)	99106	99	97	90	81	67	57	*34*
East of Scotland	Edin./Mid Lothian[13]	(G)	97639	98	98	95	89	77	68	*64*
	East Lothian[14]	(G)	10206	98	99	95	86	76	67	*72*
West of Scotland	Loch Katrine	(G)	111363	100	99	91	76	62	56	*43*
	Daer	(R)	22412	100	96	93	85	66	53	*32*
	Loch Thom	(G)	11840	97	94	90	82	70	59	*56*

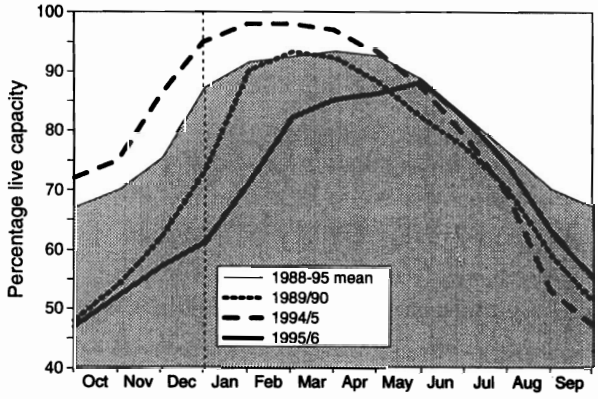
● Live or usable capacity (unless indicated otherwise) * Gross storage/percentage of gross storage

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



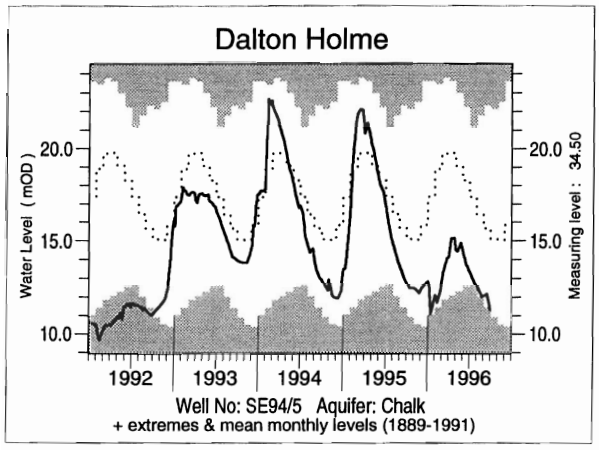
A COMPARISON BETWEEN OVERALL RESERVOIR STOCKS FOR ENGLAND AND WALES IN RECENT YEARS

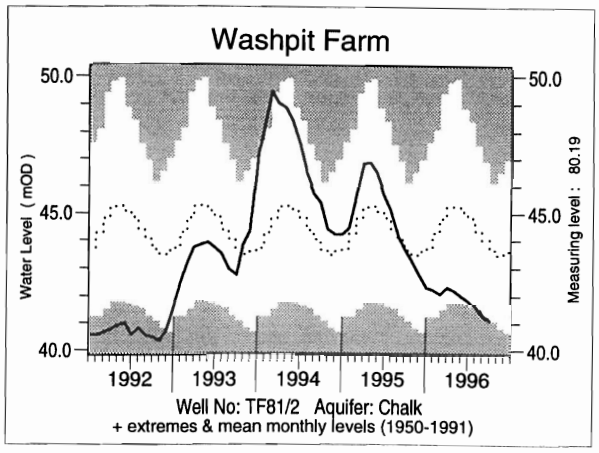


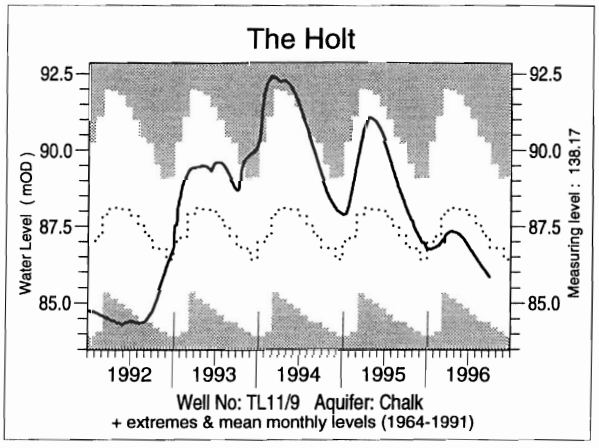
These plots are based on the reservoirs featured in Table 4 only

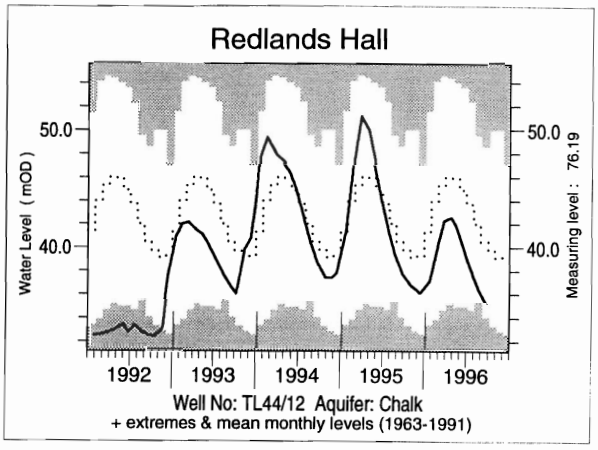
Note: Variations in storage depend on the balance between inputs (from catchment rainfall and any pumping) and outputs (to supply, compensation flow, HEP, amenity). There will be additional losses due to evaporation, especially in the summer months. Operational strategies for making the most efficient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

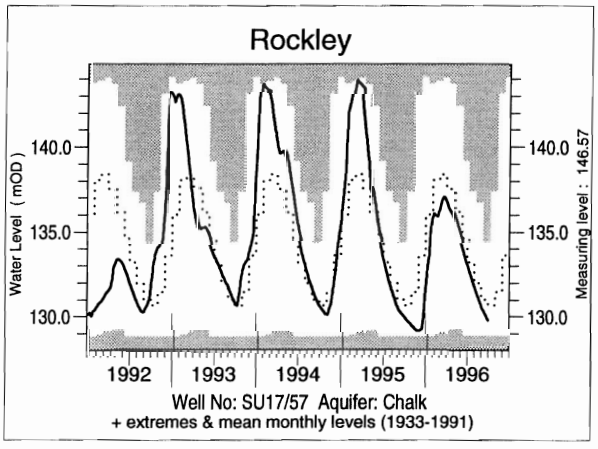
FIGURE 2 GROUNDWATER LEVEL HYDROGRAPHS

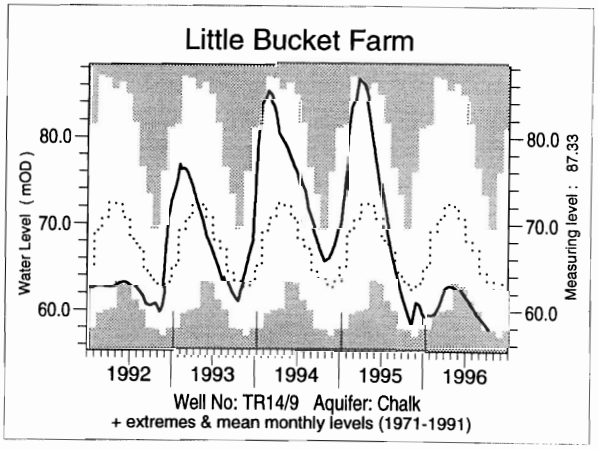


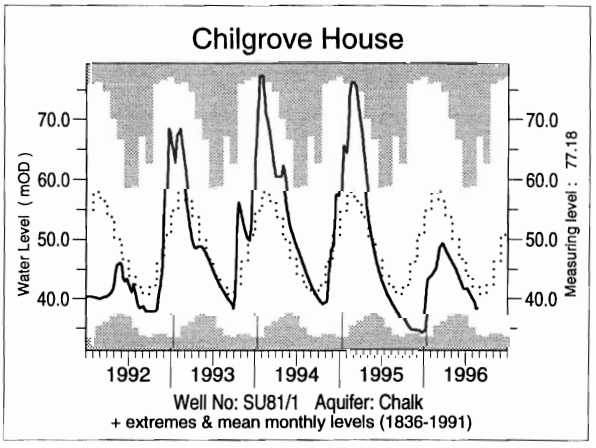


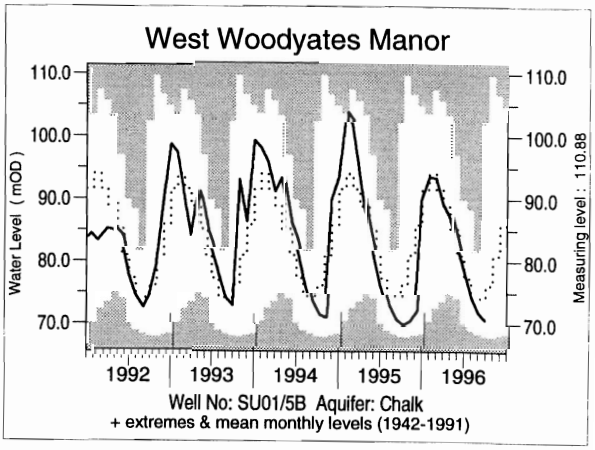


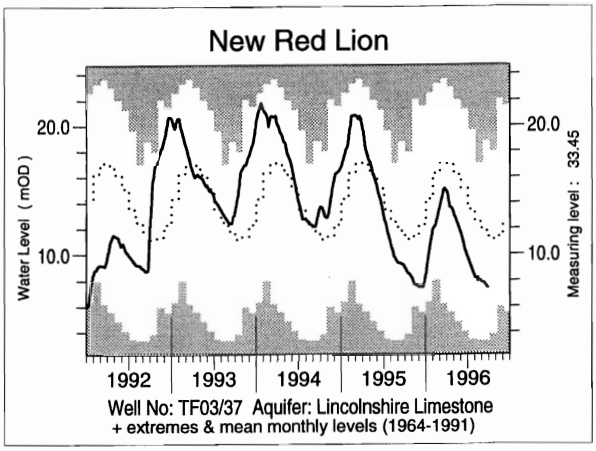


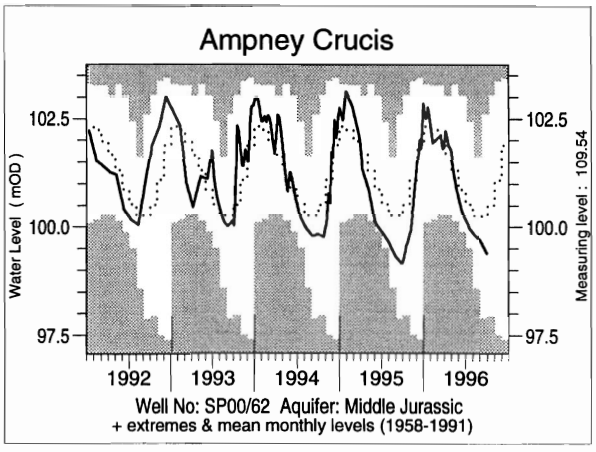


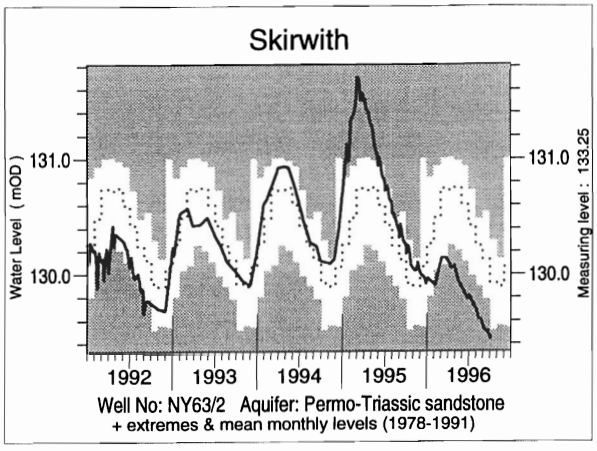


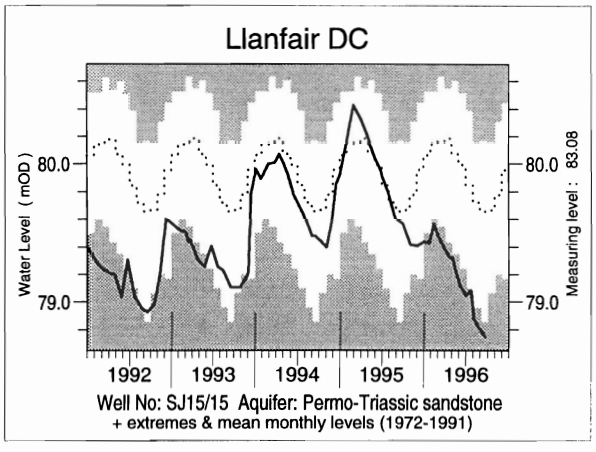


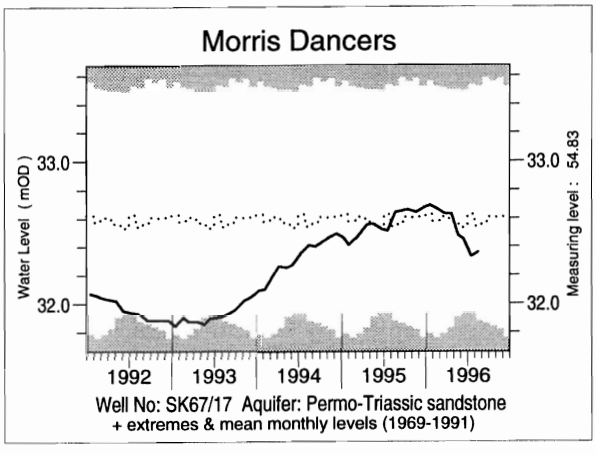


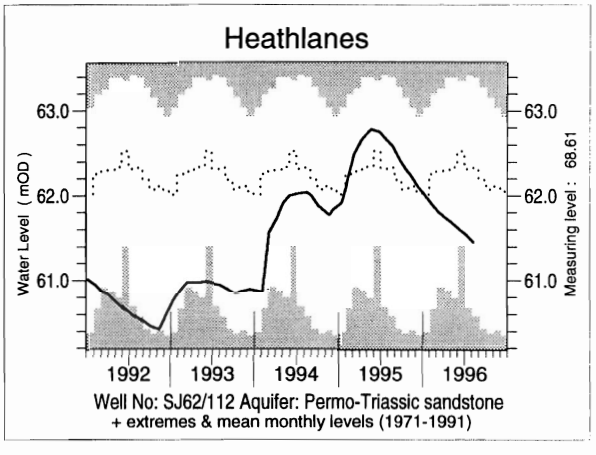

New Red Lion
Water Level (mOD)
20.0
10.0
Measuring level : 33.45
1992
1993
1994
1995
1996
Well No: TF03/37 Aquifer: Lincolnshire Limestone
+ extremes & mean monthly levels (1964-1991)

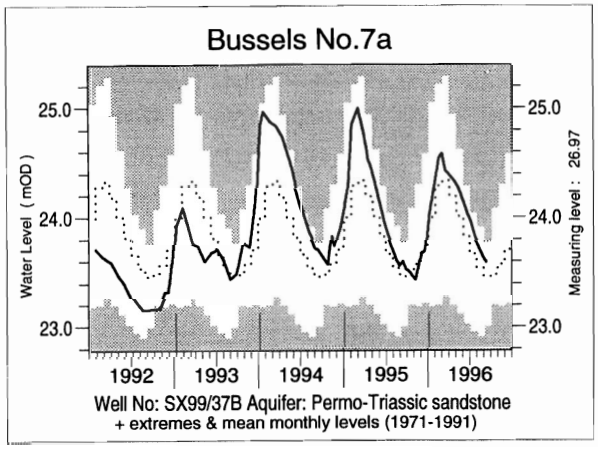

Ampney Crucis
Water Level (mOD)
102.5
100.0
97.5
Measuring level : 109.54
1992
1993
1994
1995
1996
Well No: SP00/62 Aquifer: Middle Jurassic
+ extremes & mean monthly levels (1958-1991)


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)
80.0
79.0
Measuring level : 83.08
1992
1993
1994
1995
1996
Well No: SJ15/15 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1972-1991)


Morris Dancers
Water Level (mOD)
33.0
32.0
Measuring level : 54.83
1992
1993
1994
1995
1996
Well No: SK67/17 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1969-1991)


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)

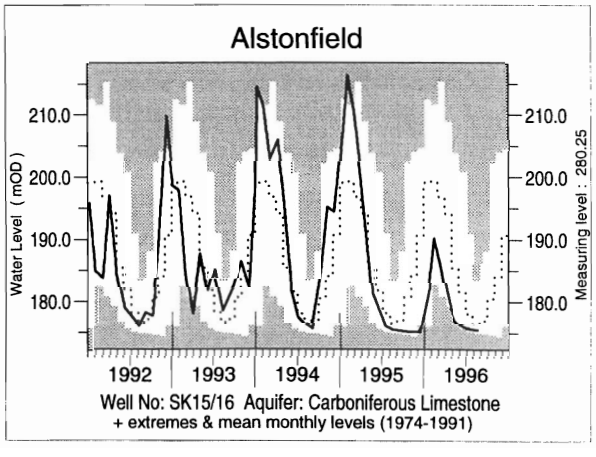

Alstonfield
Water Level (mOD)
210.0
200.0
190.0
180.0
Measuring level : 280.25
1992
1993
1994
1995
1996
Well No: SK15/16 Aquifer: Carboniferous Limestone
+ extremes & mean monthly levels (1974-1991)

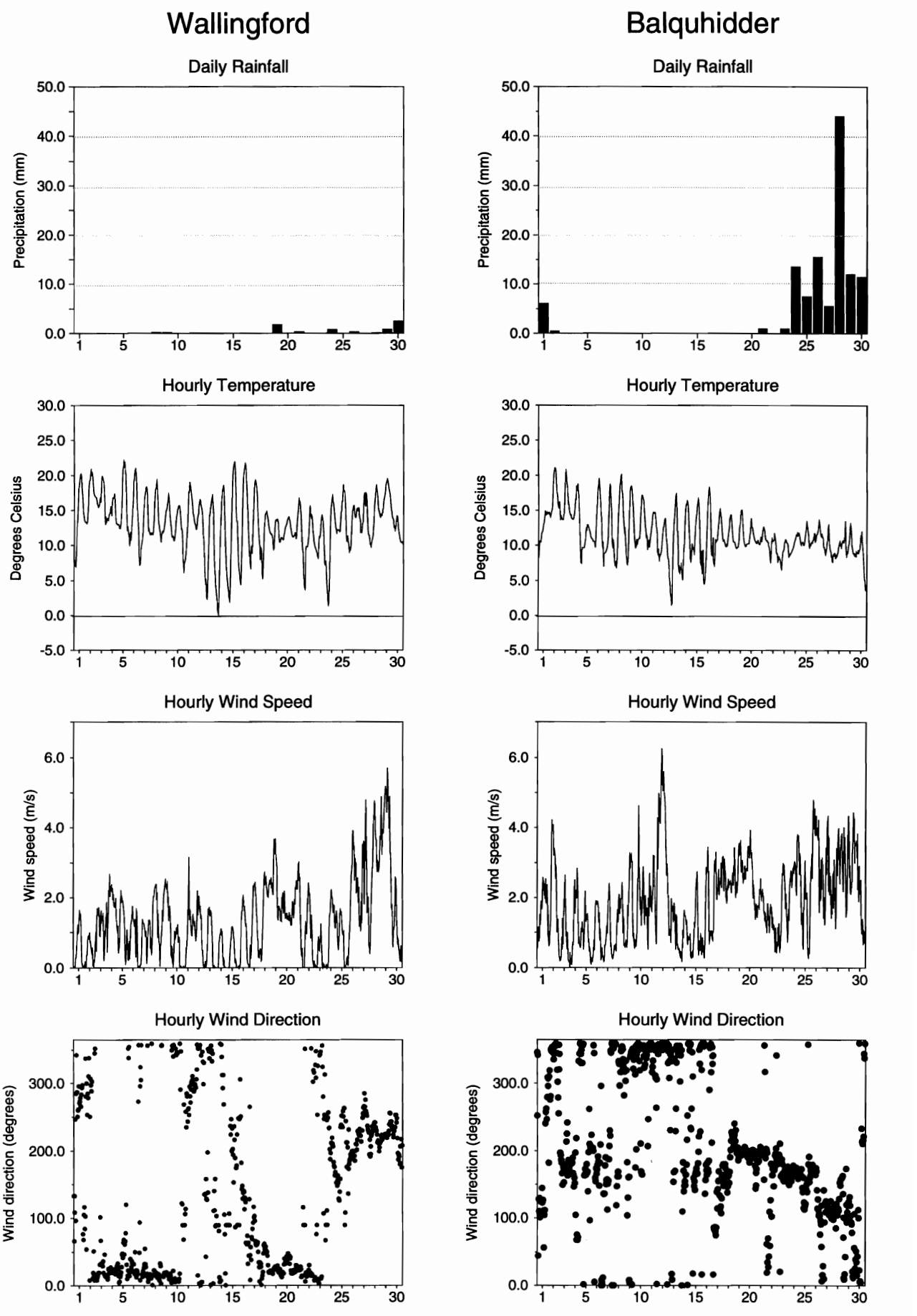
TABLE 5 SEPTEMBER GROUNDWATER LEVELS 1996

Site	Aquifer	Records commence	Minimum Sept	Average Sept	Maximum Sept	No. of years Sept/Oct	Sept/Oct 1996	
			<1996	<1996	<1996	level<1996	day	level
Dalton Holme	C & UGS	1889	10 .98	15.60	22.30	1	26/09	11 .27
Wetwang	C & UGS	1971	17.61	19.31	20.73	3	26/09	18.06
Keelby Grange	C & UGS	1980	3.50	10.14	13.60	1	23/09	4.57
Washpit Farm	C & UGS	1950	40.49	43.95	46.90	2	02/10	41.03
The Holt	C & UGS	1964	84.34	87.48	90.22	5	30/09	85.85
Therfield Rectory	C&UGS	1883	dry <71.60	80.11	98.51	>10	30/09	75.62
Redlands Hall	C & UGS	1964	32.40	39.90	48.49	2	23/09	35.19
Rockley	C & UGS	1933	dry<128.44	131.01	134.38	9	30/09	129.77
Little Bucket Farm	C & UGS	1971	57.64	64.92	73.12	1	01/10	57.66
Compton House	C & UGS	1894	27.72	32.88	44.90	6	23/09	30.37
Chilgrove House	C & UGS	1836	33.48	40.80	62.48	6	23/09	36.68
Westdean No.3	C & UGS	1940	1.10	1.46	1.90	>10	27/09	1.30
Lime Kiln Way	C & UGS	1969	123.85	125.02	125.65	>10	05/09	125.60
Ashton Farm	C & UGS	1974	63.23	65.19	67.07	6	30/09	64.68
West Woodyates Manor	C & UGS	1942	67.67	73.19	102.09	>10	30/09	70.60
Killyglen (NI)	C & UGS	1985	112.60	114.52	118.82	1	05/09	112.97
New Red Lion	LLst	1964	3.37	11.59	18.84	2	20/09	7.36
Ampney Crucis	Mid Jur	1958	97.87	100.17	102.60	3	30/09	99.39
Redbank	PTS	1981	7.25	7.90	8.55	5	30/09	7.68
Yew Tree Farm	PTS	1973	11.08	13.22	13.75	4	24/09	13.04
Skirwith	PTS	1978	129.75	130.13	130.54	0	02/10	129.44
Llanfair D.C	PTS	1972	78.85	79.52	80.16	0	18/09	78.74
Morris Dancers	PTS	1969	31.85	32.49	33.58	>10	16/08	32.36
Heathlanes	PTS	1971	60.41	62.08	63.28	5	08/08	61.45
Bussels No.7A	PTS	1972	22.99	23.47	23.77	>10	11/09	23.59
Rushyford NE	MgLst	1967	64.89	72.62	76.40	>10	21/09	75.90
Peggy Ellerton	MgLst	1968	31.10	33.97	36.73	6	20/09	32.76
Alstonfield	CLst	1974	174.70	176.88	183.39	6	16/08	175.29

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

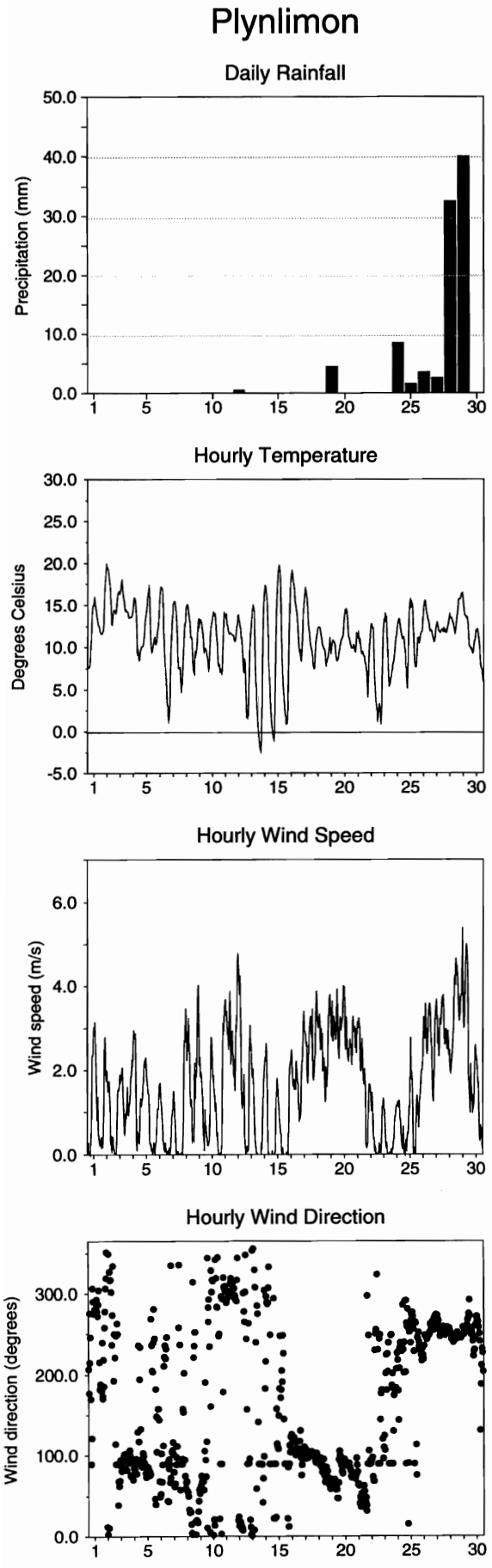
FIGURE 3 METEOROLOGICAL SUMMARY - SEPTEMBER 1996



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

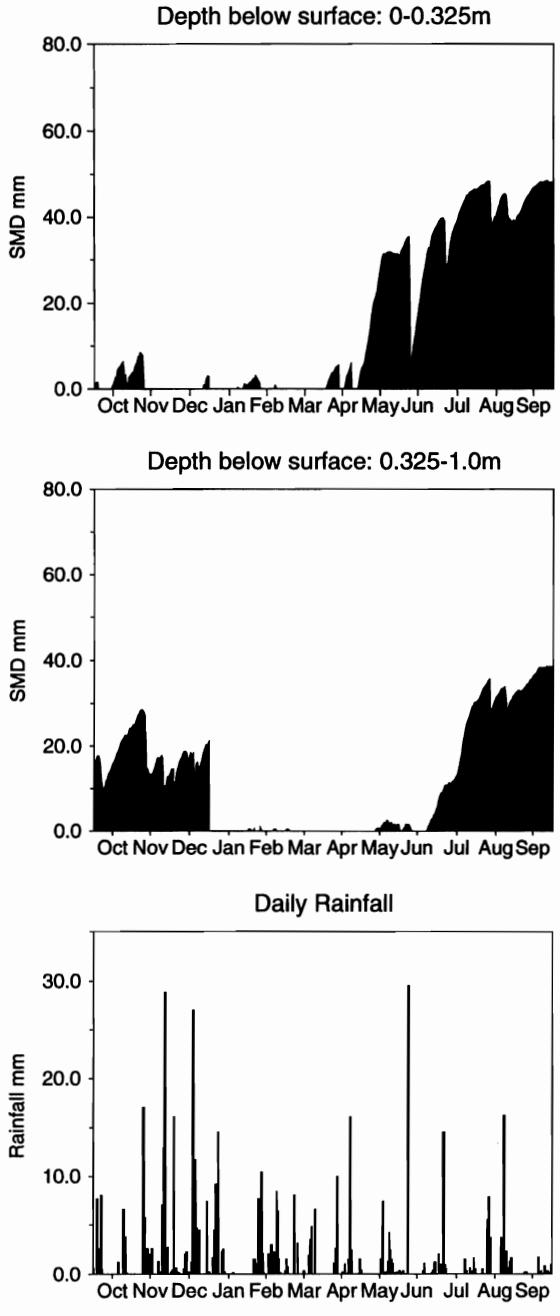
The Lower Kirkton automatic weather station (Balquhidder) occupies a relatively sheltered position at the mouth of the SSE trending Kirkton Glen. Station elevation is 270m aOD and average annual rainfall exceeds 2000mm; snow cover is expected for 10-30 days a year.

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 300m 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 October 1995 is presented.

FIGURE 4 LOCATION MAP OF GAUGING STATIONS AND GROUNDWATER INDEX WELLS