Hydrological Summary for Great Britain

APRIL 1996

Rainfall

April was a month of large spatial and temporal contrasts in weather conditions. Initially high pressure dominated, extending lengthy sequences of rainless days up to three weeks in eastern areas. A complex synoptic pattern then allowed frontal systems to penetrate around mid-month. A number of these were slow-moving and produced sustained precipitation which was very important in relation to reservoir replenishment. Showers, some thundery were common over the latter half of the month but regional rainfall totals were modest, in the eastern lowlands particularly. The April rainfall total for Britain was near-average but regional variations were large. Parts of western Scotland reported almost twice the April mean whereas much of the English lowlands were dry, some parts of East Anglia recorded less than 30% of average (at an important time agriculturally). Notwithstanding the significant April rainfall in some northern and western gathering grounds, accumulated totals since September 1995 remain substantially below average throughout much of northern England - the southern Pennines especially; rainfall deficiencies are notable in parts of the Midlands and East Anglia also. The drought's intensity and extent is most evident from the 13-month rainfall accumulations. For England and Wales as a whole, the provisional April '95-April '96 rainfall total is the fifth lowest (75/76 and 33/34 were drier) in the 228-year national series; more significantly only five drought episodes in last 200 years include drier 13-month sequences (the driest on record occurred in 1975/76). Over the April '95-April '96 period most regions have recorded only 3 or 4 months with above average rainfall; a few districts in northern England have reported none and the rainfall deficiency (>50%) is indicative of an extremely intense drought.

River Flow

Although river flows picked-up in many catchments in mid-April, the seasonal recession was generally well established by early May and notably low spring flows were registered in a number of catchments. The interplay of rainfall, soil moisture conditions and baseflow contributions made for limited spatial coherence in monthly runoff totals. Generalising: April totals were above average in a number of rivers draining from the Scottish Highlands - where snowmelt was an important contributory factor - and in a few catchments in southern England where the residual baseflow benefit of the very high 1994/95 groundwater recharge could still be recognised. Elsewhere, flows were typically in the lowest quartile for the month and below half the monthly average across large parts of England. Steep spring recessions resulted in new April minimum runoff totals on the Little Ouse and the Kent Stour (in records of around 30 years), but the drought's extent and geographical range, is clearer from the longer term runoff totals. In a broad zone from North Wales and the north Midlands to north-west Scotland, many Oct.-April catchment runoff totals are unprecedented and, in the 12-month timeframe, the area registering new minima is slightly more extensive (and embraces a few south-eastern catchments, e.g. the Kent Stour). The focus of the longer term drought is underlined by the runoff accumulations for the Wharfe: the average flow over the last 12 months is substantially below the previous 12-month minima established during the 1959 drought.

Groundwater

With soil moisture deficits increasing steadily in early May - and now exceeding 50 millimetres throughout much of the English lowlands - little or no further recharge may be expected to most aquifers. Figure 2 confirms the paucity of 1995/96 aquifer replenishment throughout the eastern Chalk with, in some cases (e.g. Washpit Farm) only a modest inflection interrupting the protracted fall in levels from the spring of 1995. Although the fall in level relative to last year's peaks have been exceptional, levels mostly remain well above drought minima (e.g. those for 1992 and 1976). Exceptions can be found in the Chalk of Kent and levels are also very depressed in the more northerly outcrop areas (Lincolnshire especially). The tendency for groundwater resources to deteriorate in a northerly direction is also evident in other aquifers. Levels in the Permo-Triassic sandstones are typically within the normal range in the South-West but close to the April minima in parts of North Wales, Cumbria and Dumfries and Galloway. The spring minimum has also been closely approached at Alstonfield in the Carboniferous Limestone.

General

Although overall reservoir contents increased marginally (but very usefully) in April, they remain below comparable stocks in other recent drought years. The drought's severity is uneven but the resource outlook remains very fragile in the drought affected areas, particularly since groundwater levels are generally much lower than in the spring of 1995. One consequence is that the seasonal contraction in lowland headwaters is likely to be substantial through the summer.

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.

		Apr 1995	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan 1996	Feb	Mar	Apr
England and Wales	mm	27	49	23	40	10	113	54	80	82	65	82	50	49
	%	45	77	35	65	13	147	64	89	87	74	130	69	81
North West	mm	28	65	39	65	18	97	86	65	37	55	105	45	77
	%	39	87	48	76	17	84	67	53	30	45	135	48	109
Northumbrian	mm	38	53	30	29	12	111	56	112	78	46	89	32	59
	%	68	85	50	45	15	152	74	130	96	55	151	46	104
Severn Trent	mm	20	49	13	35	9	94	38	64	79	45	66	38	48
	%	36	83	22	66	13	147	59	90	103	64	122	63	88
Yorkshire	mm	27	44	23	29	9	96	29	61	69	48	78	47	48
	%	46	73	38	49	12	141	40	76	83	61	134	69	82
Anglian	mm	16	30	25	25	8	101	16	42	66	34	49	22	17
	%	35	63	49	51	15	206	31	72	120	68	132	46	38
Thames	mm	18	37	16	31	4	117	35	64	92	52	63	34	36
	%	36	66	29	63	7	198	56	98	131	81	140	60	71
Southern	mm	18	23	20	31	5	140	34	63	94	69	70	42	24
	%	34	43	37	65	9	203	43	74	115	86	130	67	46
Wessex	mm	35	53	14	26	10	144	69	123	103	77	84	61	50
	%	66	87	25	50	15	200	87	148	111	89	129	86	93
South West	mm	50	55	19	47	16	136	104	132	127	157	118	79	72
	%	72	76	28	68	19	146	90	106	91	114	117	79	104
Welsh	mm	37	77	27	69	14	125	110	129	101	102	121	77	90
	%	46	94	34	90	14	109	80	91	66	71	125	72	113
Scotland	mm	67	84	43	86	34	198	228	125	53	90	140	96	89
	%	88	98	50	91	29	139	146	83	35	60	137	77	116
Highland	mm	97	89	47	101	45	251	249	161	46	61	149	118	85
	%	107	97	48	95	35	147	126	79	23	32	117	73	93
North East	mm	68	80	53	45	27	297	104	99	67	75	114	75	61
	%	113	116	80	62	31	341	107	100	72	76	175	96	102
Tay	mm	39	96	32	67	20	178	217	116	61	132	117	113	87
	%	63	116	44	87	21	156	167	96	48	92	123	104	140
Forth	mm	35	71	31	70	21	136	197	90	54	73	82	63	74
	%	59	96	45	93	22	124	171	80	49	62	104	67	125
Tweed	mm	36	65	35	43	23	123	134	97	63	72	104	40	74
	%	63	92	54	59	26	138	141	104	68	72	155	51	130
Solway	mm	40	84	44	79	23	102	251	111	51	134	157	99	116
	%	52	99	52	88	19	71	160	77	34	86	155	85	151
Clyde	mm	66	83	44	125	40	138	319	118	48	117	181	92	112
	%	79	91	47	115	30	77	165	66	27	62	153	63	133

Note: The monthly regional rainfall figures for England and Wales for March & April 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 March & April 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

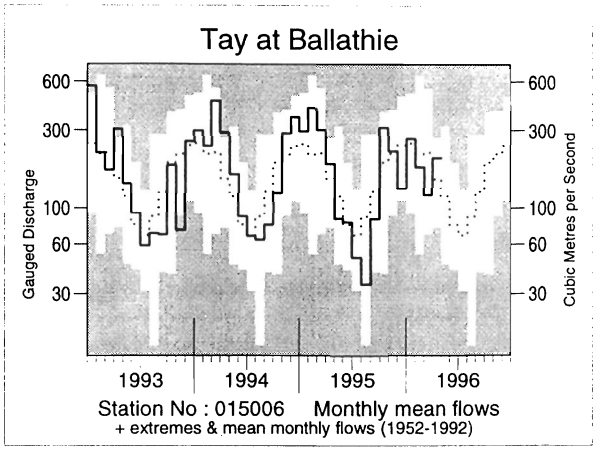
		Jan 96-Apr 96		Oct 95-Apr 96		Apr 95-Apr 96		Sep 94-Apr 96	
			Est Return Period, years		Est Return Period, years		Est Return Period, years		Est Return Period, years
England and Wales	mm	245		461		723		1497	
	% LTA	87	30-50	84	5-10	76	35-50	98	2-5
North West	mm	283		471		783		1842	
	% LTA	77	5-10	64	50-80	61	>>200	89	5-10
Northumbria	mm	226		472		745		1402	
	% LTA	84	5	92	2-5	82	10-15	97	2-5
Severn Trent	mm	197		378		598		1252	
	% LTA	82	5	84	5-10	74	30-50	99	2-5
Yorkshire	mm	221		380		608		1292	
	% LTA	84	5	76	10-15	69	80-120	93	2-5
Anglian	mm	122		246		451		912	
	% LTA	68	10-15	72	10-20	70	60-90	92	2-5
Thames	mm	184		375		598		1173	
	% LTA	86	5	91	2-5	81	5-15	101	2-5
Southern	mm	205		396		633		1364	
	% LTA	82	5	80	5-10	76	15-25	101	2-5
Wessex	mm	271		566		848		1649	
	% LTA	99	2-5	107	2-5	95	2-5	115	5-10
South West	mm	426		789		1112		2215	
	% LTA	105	2-5	100	<2	89	2-5	108	2-5
Welsh	mm	390		730		1079		2249	
	% LTA	91	2-5	85	2-5	77	20-30	98	2-5
Scotland	mm	415		821		1333		2522	
	% LTA	91	2-5	90	2-5	88	5-10	101	2-5
Highland	mm	413		869		1499		2988	
	% LTA	73	10-20	75	20-30	81	20-30	96	2-5
North East	mm	325		595		1165		1814	
	% LTA	108	2-5	101	2-5	113	5-10	110	5-10
Tay	mm	449		843		1275		2275	
	% LTA	110	2-5	107	2-5	99	2-5	107	2-5
Forth	mm	292		633		997		1904	
	% LTA	83	5	92	2-5	85	5-10	100	<2
Tweed	mm	290		584		909		1650	
	% LTA	96	2-5	100	<2	89	5-10	100	<2
Solway	mm	506		919		1291		2454	
	% LTA	112	5	102	2-5	86	5-10	100	<2
Clyde	mm	502		987		1483		2924	
	% LTA	93	2-5	91	2-5	83	10-20	99	2-5

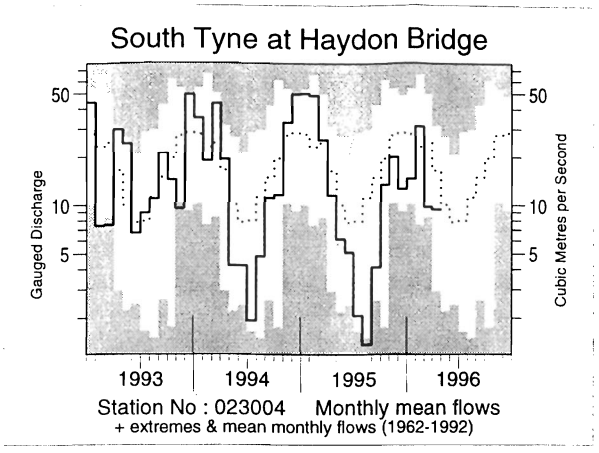
LTA refers to the period 1961-90.

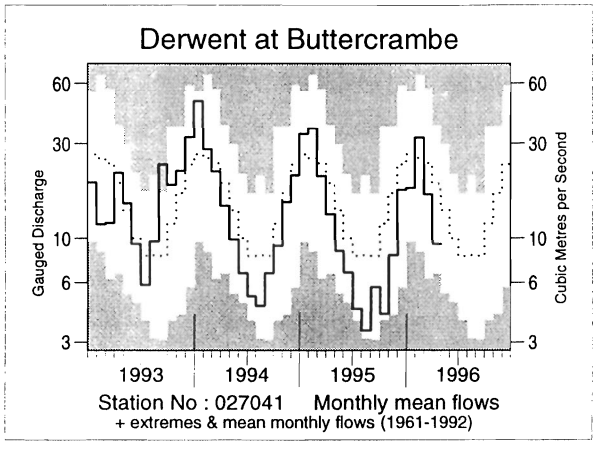
Return period assessments are based on tables provided by the Meteorological Office*. The tables reflect rainfall totals over the period 1911-70 only and the estimate assumes a sensibly stable climate. They assume a start in a specified month; return periods for a start in any month may be expected to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

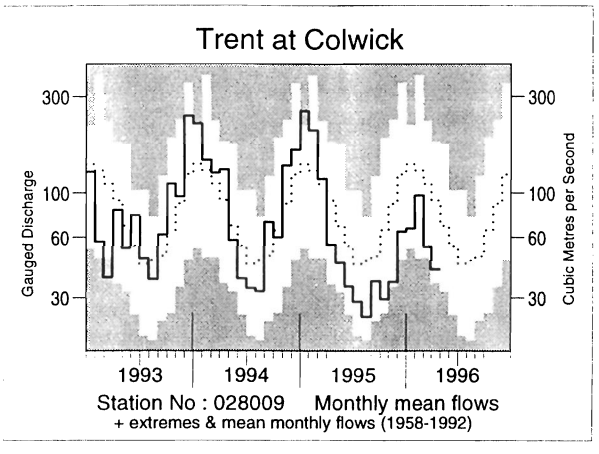
* Tabony, R.C., 1977, The Variability of long duration rainfall over Great Britain, Scientific Paper No. 37, Meteorological Office.

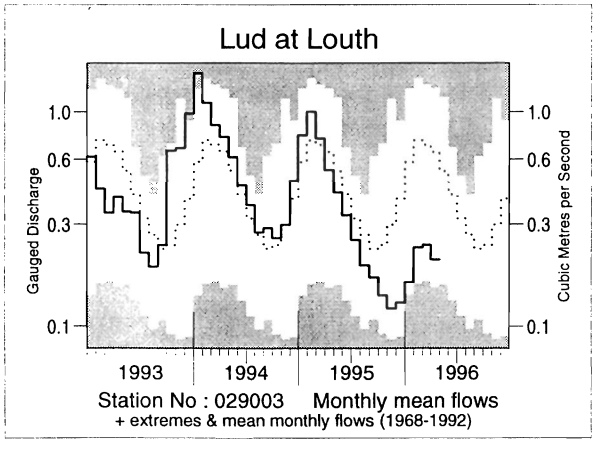
FIGURE 1 MONTHLY RIVER FLOW HYDROGRAPHS

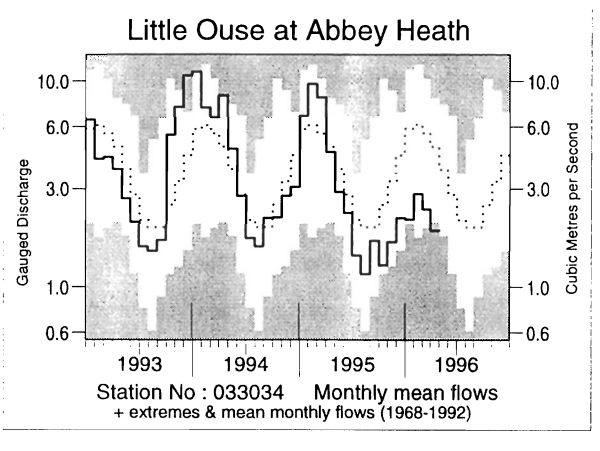


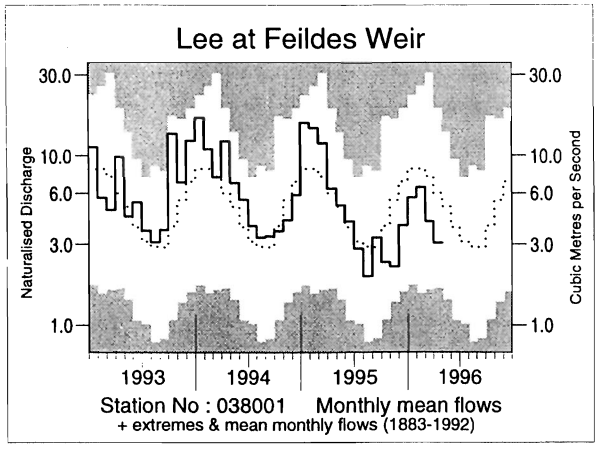


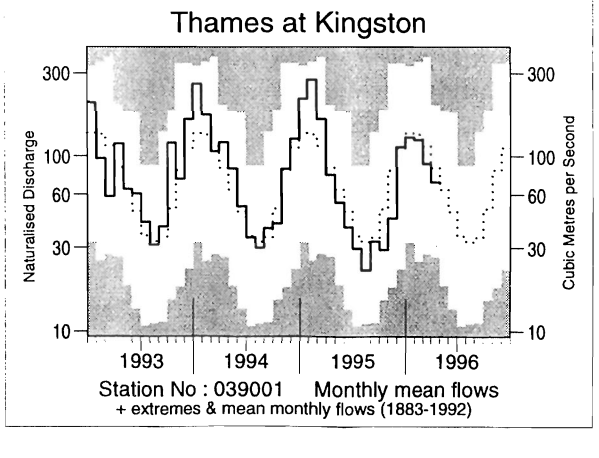


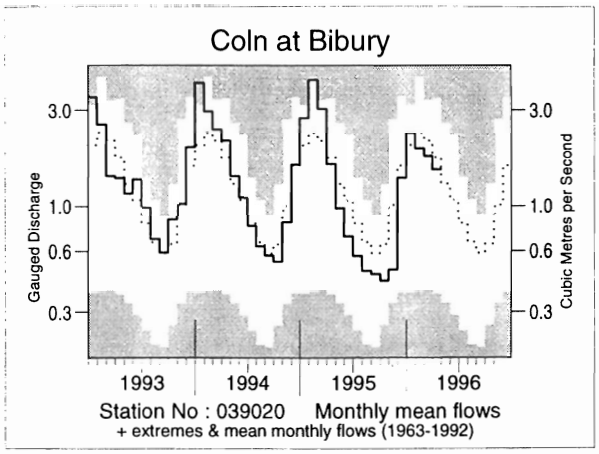


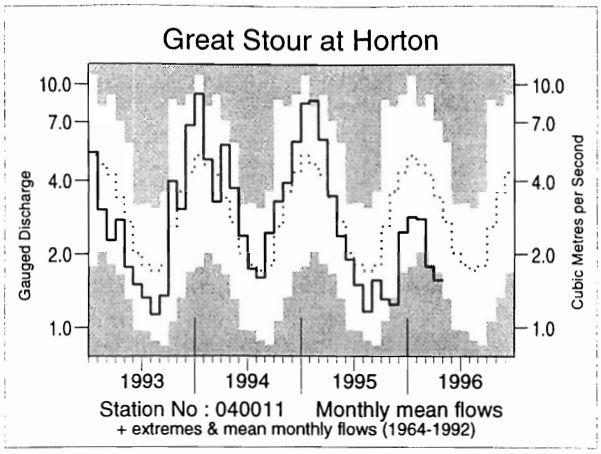


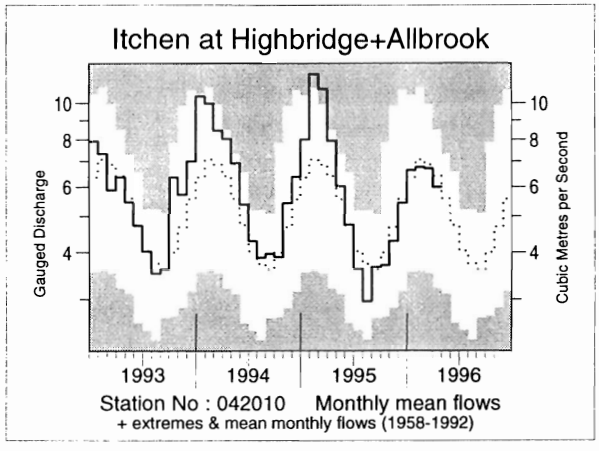


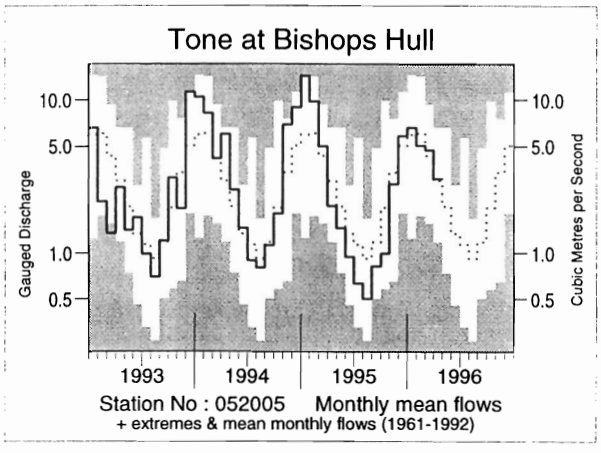


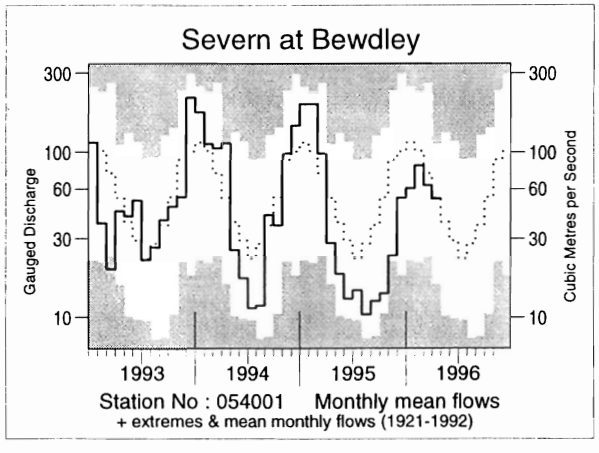


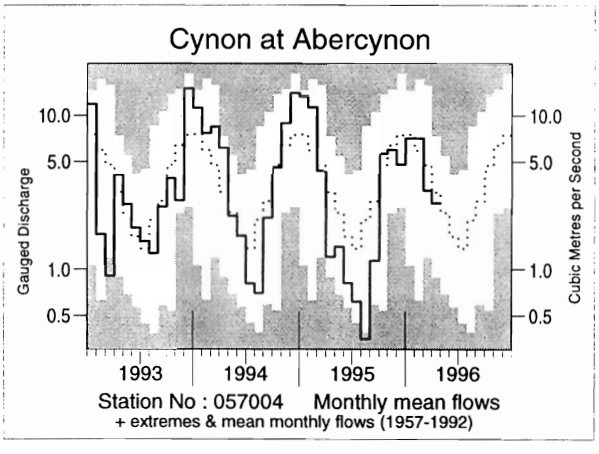

Coln at Bibury
Gauged Discharge
Cubic Metres per Second
3.0
1.0
0.6
0.3
1993
1994
1995
1996
Station No : 039020 Monthly mean flows
+ extremes & mean monthly flows (1963-1992)

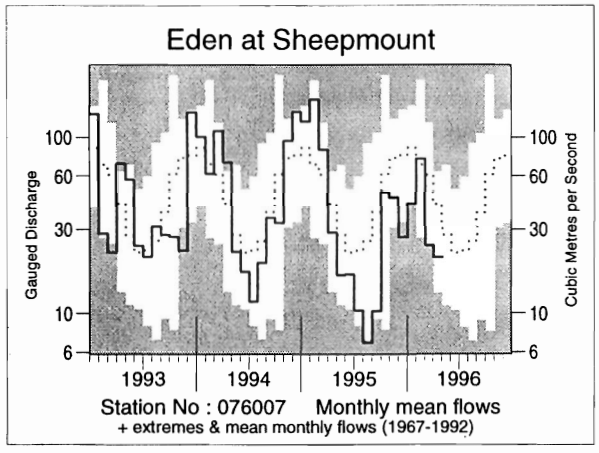

Great Stour at Horton
Gauged Discharge
Cubic Metres per Second
10.0
7.0
4.0
2.0
1.0
1993
1994
1995
1996
Station No : 040011 Monthly mean flows
+ extremes & mean monthly flows (1964-1992)


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)

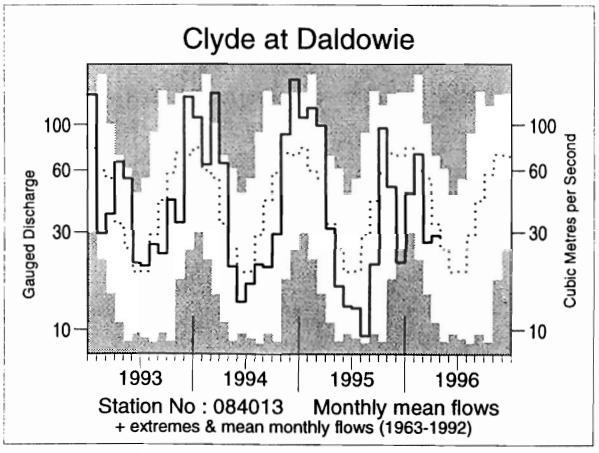

Clyde at Daldowie
Gauged Discharge
Cubic Metres per Second
100
60
30
10
1993
1994
1995
1996
Station No : 084013 Monthly mean flows
+ extremes & mean monthly flows (1963-1992)

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	Dec 1995	Jan 1996	Feb	Mar	Apr 1996		1/96 to 4/96		10/95 to 4/96		5/95 to 4/96		5/94 to 4/96	
	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	73	156	99	71	114	22	441	23	717	20	978	21	1669	13
Park	85	167	138	74	142	/24	128	/24	119	/23	122	/23	104	/22
Tay at	77	155	98	71	115	38	440	19	825	16	1019	12	2407	28
Ballathie	54	104	86	54	129	/44	90	/44	96	/44	89	/43	105	/42
Tweed at	36	90	113	42	40	12	285	13	510	7	599	5	1495	10
Boleside	36	84	148	51	72	/36	88	/36	88	/35	79	/35	98	/34
Whiteadder Water at	46	54	64	37	20	6	175	10	269	11	318	9	571	6
Hutton Castle	98	89	135	75	52	/27	91	/27	89	/27	82	/26	73	/25
South Tyne at	45	52	104	35	32	9	223	4	386	3	452	1	1349	4
Haydon Bridge	42	51	142	40	55	/34	69	/34	66	/34	58	/32	86	/30
Wharfe at	17	34	68	23	20	6	145	1	201	1	253	1	1078	1
Flint Mill Weir	17	34	92	30	37	/41	48	/41	37	/41	35	/40	75	/39
Derwent at	30	30	51	28	15	3	124	12	174	8	223	6	521	8
Buttercrambe	73	66	131	71	49	/35	81	/35	72	/35	69	/34	80	/33
Trent at	23	24	32	19	14	2	90	2	136	2	195	2	623	12
Colwick	50	47	78	49	45	/38	55	/38	52	/38	55	/37	88	/36
Lud at	6	8	11	12	10	2	40	4	58	3	124	3	413	10
Louth	31	26	32	34	32	/28	32	/28	34	/28	50	/27	83	/26
Witham at	7	13	17	16	10	4	56	5	73	5	100	5	359	15
Claypole Mill	35	49	66	63	51	/37	58	/37	53	/37	54	/37	96	/36
Little Ouse at	8	8	10	9	7	1	34	3	54	4	89	3	277	6
Abbey Heath	48	35	48	43	39	/29	41	/28	44	/28	53	/28	82	/27
Mimram at	9	10	10	10	9	7	39	11	63	10	122	=21	302	36
Panshanger Park	86	83	83	79	69	/44	78	/44	82	/43	97	/43	120	/42
Lee at	10	14	16	11	8	15	48	22	70	23	114	25	328	52
Feildes Weir (natr.)	55	66	80	54	50	/110	63	/110	59	/110	70	/109	100	/107
Thames at	31	35	31	25	19	49	110	42	160	38	207	36	527	64
Kingston (natr.)	101	94	95	80	83	/114	88	/114	85	/113	84	/113	107	/112
Coln at	35	58	46	45	37	12	186	10	243	9	322	8	790	14
Bibury	86	109	85	84	87	/33	91	/33	85	/33	82	/32	99	/31
Great Stour at	19	22	20	14	12	1	67	3	106	1	171	1	560	12
Horton	55	54	62	43	45	/31	51	/31	50	/30	59	/30	96	/28
Itchen at	40	49	47	50	43	10	190	14	289	16	443	14	1017	29
Highbridge+Allbrook	97	102	97	98	93	/38	97	/38	95	/38	96	/37	110	/36
Stour at	56	67	64	49	33	9	213	12	317	10	363	10	935	19
Throop Mill	96	107	112	99	92	/24	101	/24	96	/23	91	/23	116	/22
Exe at	124	109	89	63	45	17	306	8	537	7	599	3	1705	21
Thorverton	90	83	87	75	78	/40	81	/40	78	/40	72	/40	102	/39
Taw at	99	91	67	44	41	21	244	7	412	5	442	3	1369	16
Umberleigh	82	78	79	65	91	/38	77	/38	70	/38	64	/37	98	/36
Tone at	77	87	62	63	39	24	251	19	377	16	434	13	1154	30
Bishops Hull	108	108	87	112	100	/36	100	/35	96	/35	91	/35	120	/34
Severn at	33	37	48	39	31	43	156	13	212	4	254	3	798	20
Bewdley	51	52	85	85	98	/76	75	/75	59	/75	57	/75	88	/74
Teme at	40	57	57	48	36	18	198	13	255	6	280	5	766	13
Knightsford Bridge	69	86	113	103	107	/27	99	/26	83	/26	77	/26	104	/25
Cynon at	121	178	167	82	65	19	493	15	904	14	1011	6	2613	21
Abercynon	61	91	124	69	82	/38	92	/38	90	/38	80	/36	103	/34
Dee at	82	136	173	68	74	10	451	1	758	1	961	1	3074	4
New Inn	31	57	106	37	66	/27	65	/27	55	/27	54	/26	85	/25
Eden at	31	49	82	28	23	5	182	2	322	1	391	1	1265	6
Sheepmount	32	47	114	40	47	/26	61	/26	59	/25	57	/24	92	/22
Clyde at	30	65	95	38	39	14	237	8	469	6	569	2	1578	14
Daldowie	28	58	126	47	83	/33	75	/33	78	/33	72	/32	99	/31
Carron at	27	47	151	70	108	8	377	1	931	1	1322	1	4029	1
New Kelso	8	15	72	24	73	/18	39	/18	51	/17	52	/17	78	/16
Ewe at	86	54	104	106	71	4	335	1	971	1	1381	2	3877	6
Poolewe	31	20	56	51	50	/26	42	/26	62	/25	65	/25	90	/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 1994. For the long periods (at the right of this table), the end date for the long term is 1996.

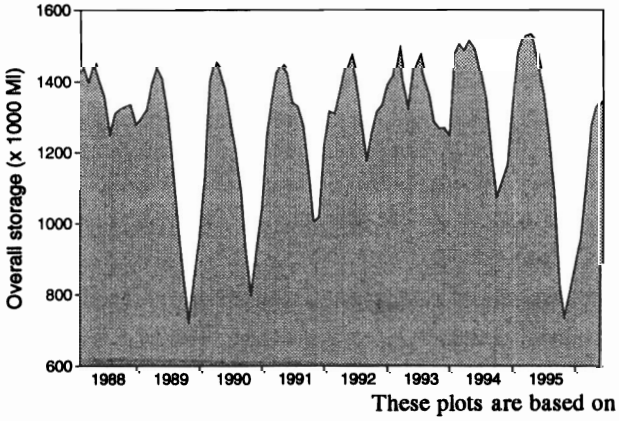
TABLE 4 START-MONTH RESERVOIR STORAGES UP TO MAY 1996

Area	Reservoir (R)/ Group (G)		Capacity ● (Ml)	1995 Dec	1996 Jan	Feb	Mar	Apr	May	1995 May
North West	N.Command Zone[1]	(G)	133375	57	51	63	78	78	80	86
	Vyrnwy	(R)	55146	33	35	45	59	64	70	89
Northumbria	Teesdale[2]	(G)	87936	39	41	51	72	77	81	95
	Kielder	(R)	199175*	91*	89*	93*	95*	96*	93*	89*
Severn-Trent	Clywedog	(R)	44922	43	54	62	77	86	93	96
	Derwent Valley[3]	(G)	39525	9	10	15	46	54	54	97
Yorkshire	Washburn[4]	(G)	22035	16	23	34	53	70	76	88
	Bradford supply[5]	(G)	41407	20	22	33	53	59	60	89
Anglian	Grafham	(R)	58707	72	83	92	94	94	95	96
	Rutland	(R)	130061	57	61	72	82	92	94	87
Thames	London[6]	(G)	206399	71	82	89	94	94	95	95
	Farmoor [7]	(G)	13843	98	89	99	96	99	97	97
Southern	Bewl	(R)	28170	60	65	82	96	99	94	97
	Ardingly	(R)	4685	45	67	84	100	100	100	100
Wessex	Clatworthy	(R)	5364	63	92	91	100	100	94	85
	Bristol W [8]	(G)	38666*	43*	60*	73*	86*	95*	97*	94*
South West	Colliford	(R)	28540	42	46	55	61	63	66	93
	Roadford[9]	(R)	34500	19	23	30	35	37	41	92
	Wimbleball[10]	(R)	21320	34	46	60	72	78	81	95
	Stithians	(R)	5205	31	54	100	100	99	97	86
Welsh	Celyn + Brenig	(G)	131155	50	54	61	69	72	75	100
	Brianne	(R)	62140	72	76	97	100	100	100	97
	Big Five[11]	(G)	69762	56	67	84	94	94	94	86
	Elan Valley[12]	(G)	99106	47	56	73	95	98	99	99
East of Scotland	Edin./Mid Lothian[13]	(G)	97639	91	91	96	100	96	98	98
	East Lothian[14]	(G)	10206	95	99	99	100	99	98	100
West of Scotland	Loch Katrine	(G)	111363	95	80	91	96	94	100	92
	Daer	(R)	22412	93	83	97	100	96	100	91
	Loch Thom	(G)	11840	97	93	100	98	98	97	92

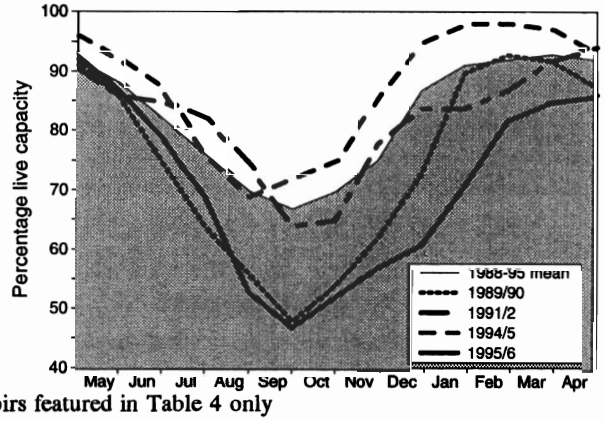
● Live or usable capacity (unless indicated otherwise) * Gross storage/percentage of gross storage

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 storage), 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 Whitcadder

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



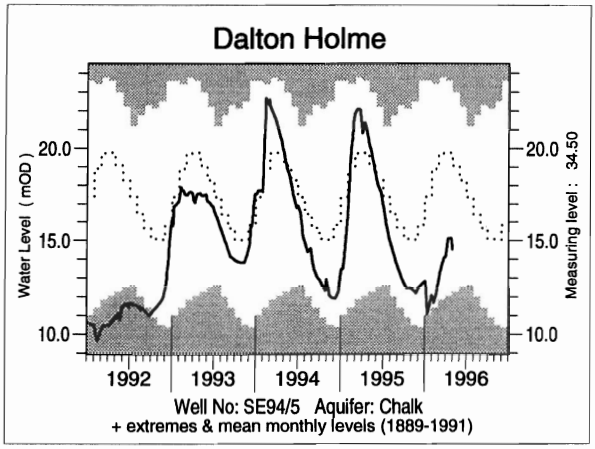
A COMPARISON BETWEEN OVERALL RESERVOIR STOCKS FOR ENGLAND AND WALES IN RECENT YEARS

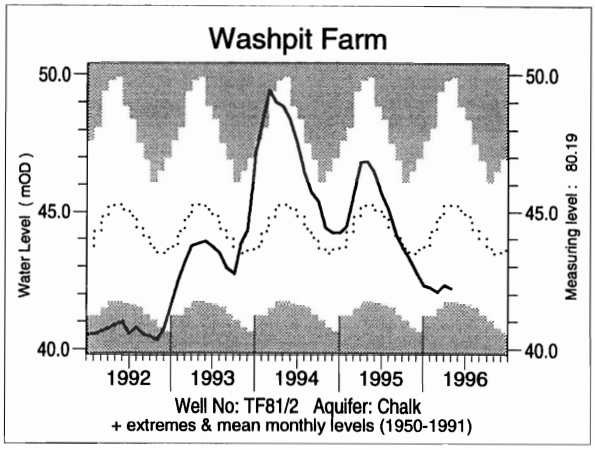


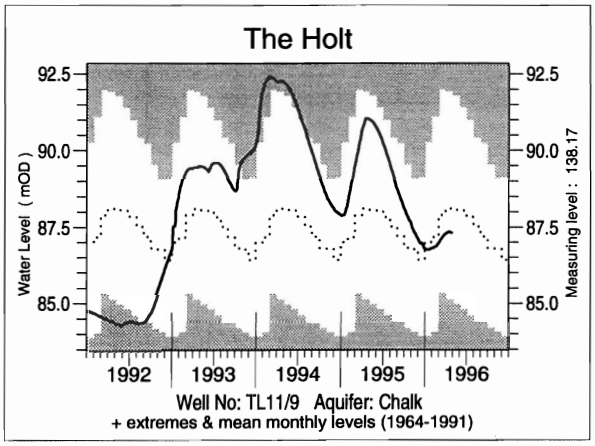
These plots are based on the reservoirs featured in Table 4 only

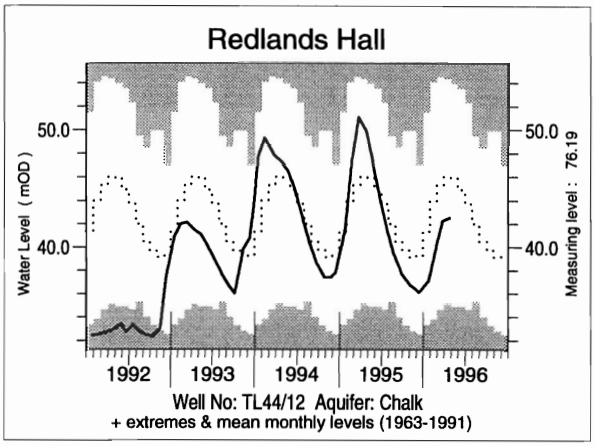
Note: Variations in storage depend on the balance between inputs (from catchment rainfall and any pumping) and outputs (to supply, compensation flow, HEP, amenity). There will be additional losses due to evaporation, especially in the summer months. Operational strategies for making the most efficient use of water stocks will further affect reservoir storages. Table 4 provides a link between the hydrological conditions described elsewhere in the report and the water resources situation.

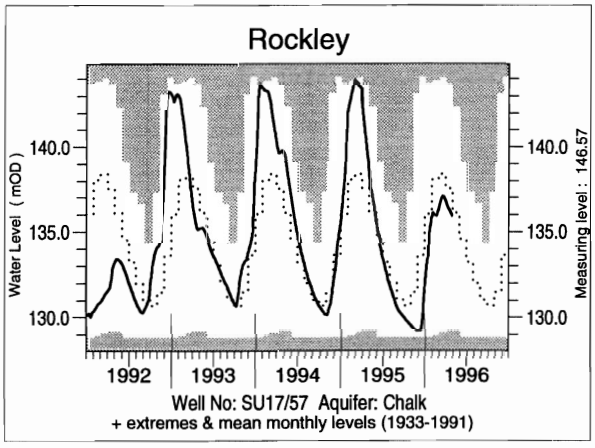
FIGURE 2 GROUNDWATER LEVEL HYDROGRAPHS

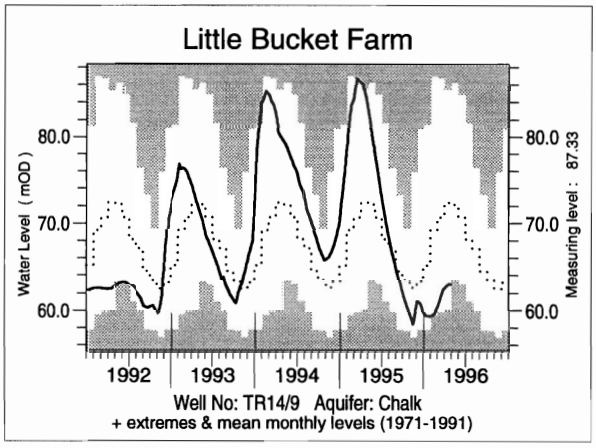


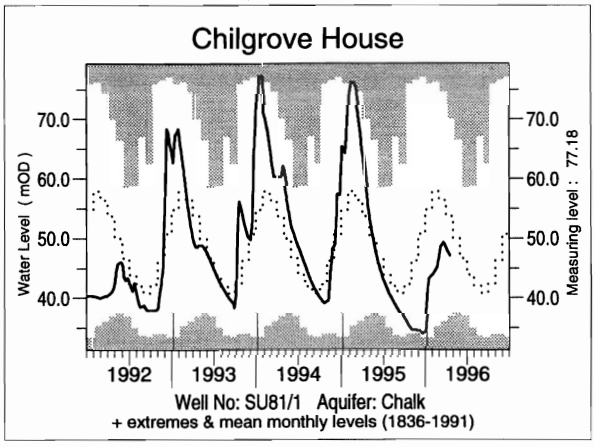


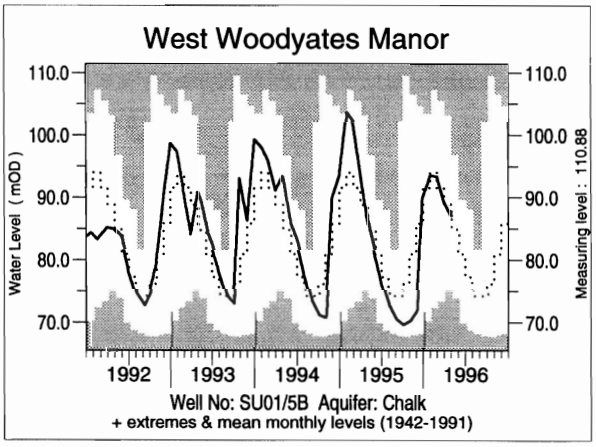


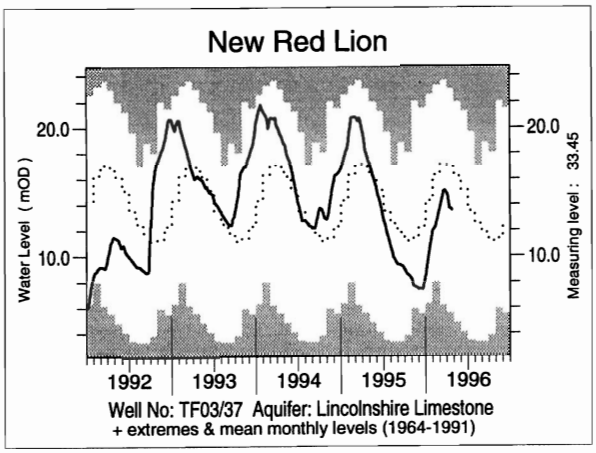


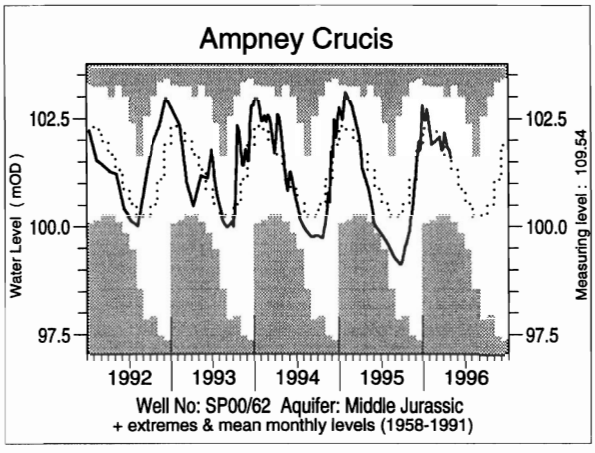


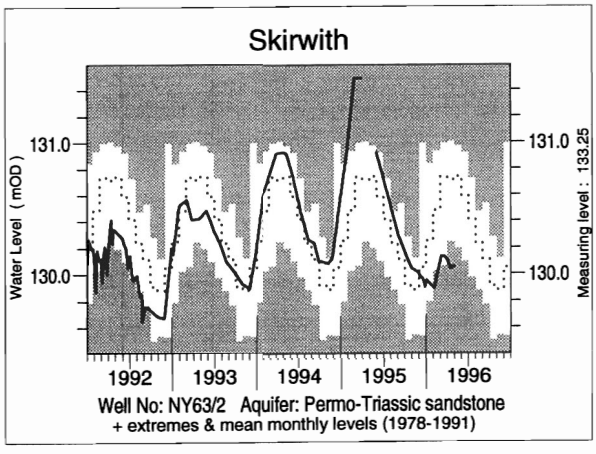


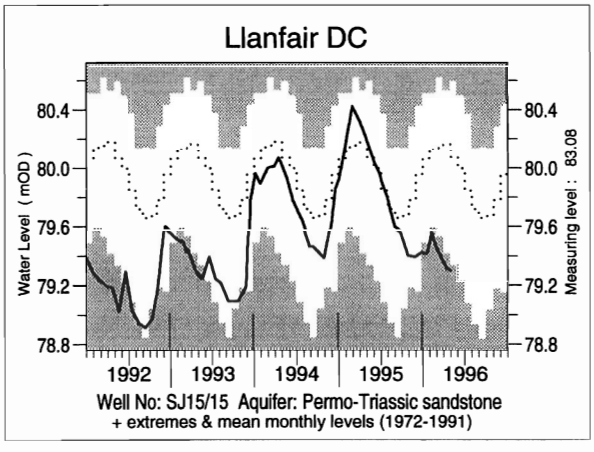


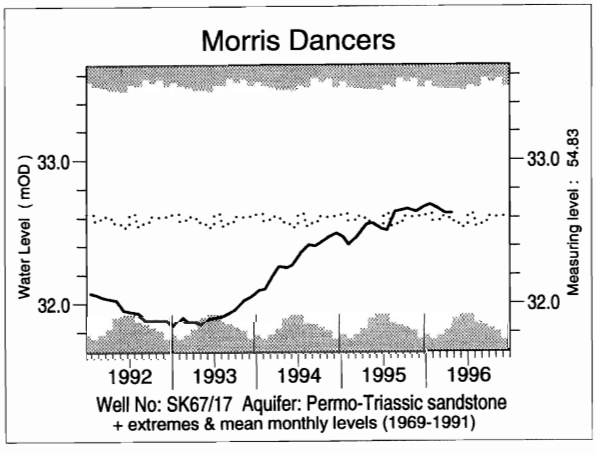


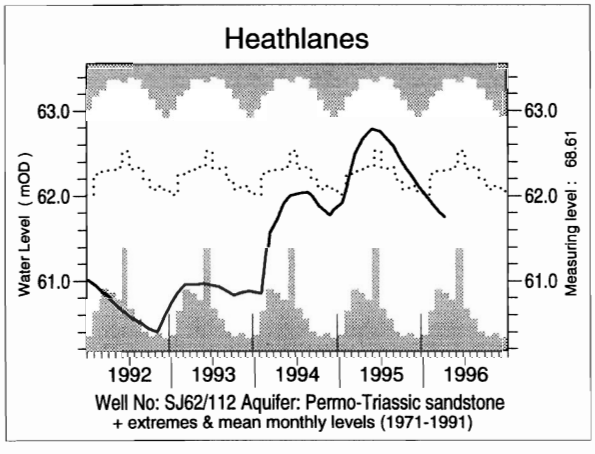

New Red Lion
Water Level (mOD)
20.0
10.0
Measuring level : 33.45
1992
1993
1994
1995
1996
Well No: TF03/37 Aquifer: Lincolnshire Limestone
+ extremes & mean monthly levels (1964-1991)

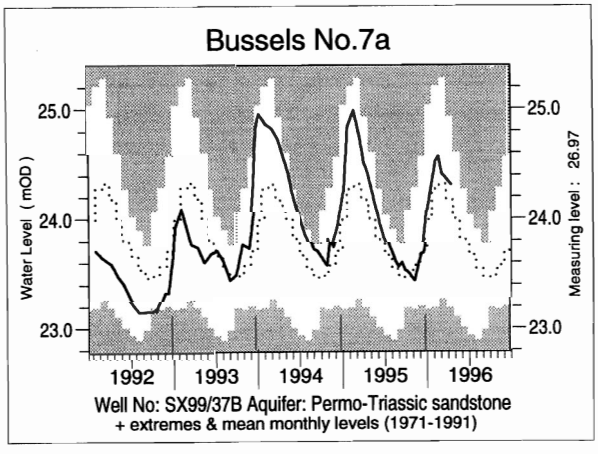

Ampney Crucis
Water Level (mOD)
102.5
100.0
97.5
Measuring level : 109.54
1992
1993
1994
1995
1996
Well No: SP00/62 Aquifer: Middle Jurassic
+ extremes & mean monthly levels (1958-1991)


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)


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)

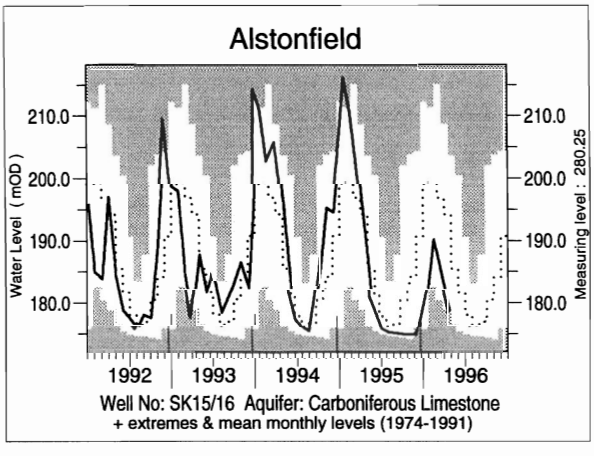

Alstonfield
Water Level (mOD)
210.0
200.0
190.0
180.0
Measuring level : 280.25
1992
1993
1994
1995
1996
Well No: SK15/16 Aquifer: Carboniferous Limestone
+ extremes & mean monthly levels (1974-1991)

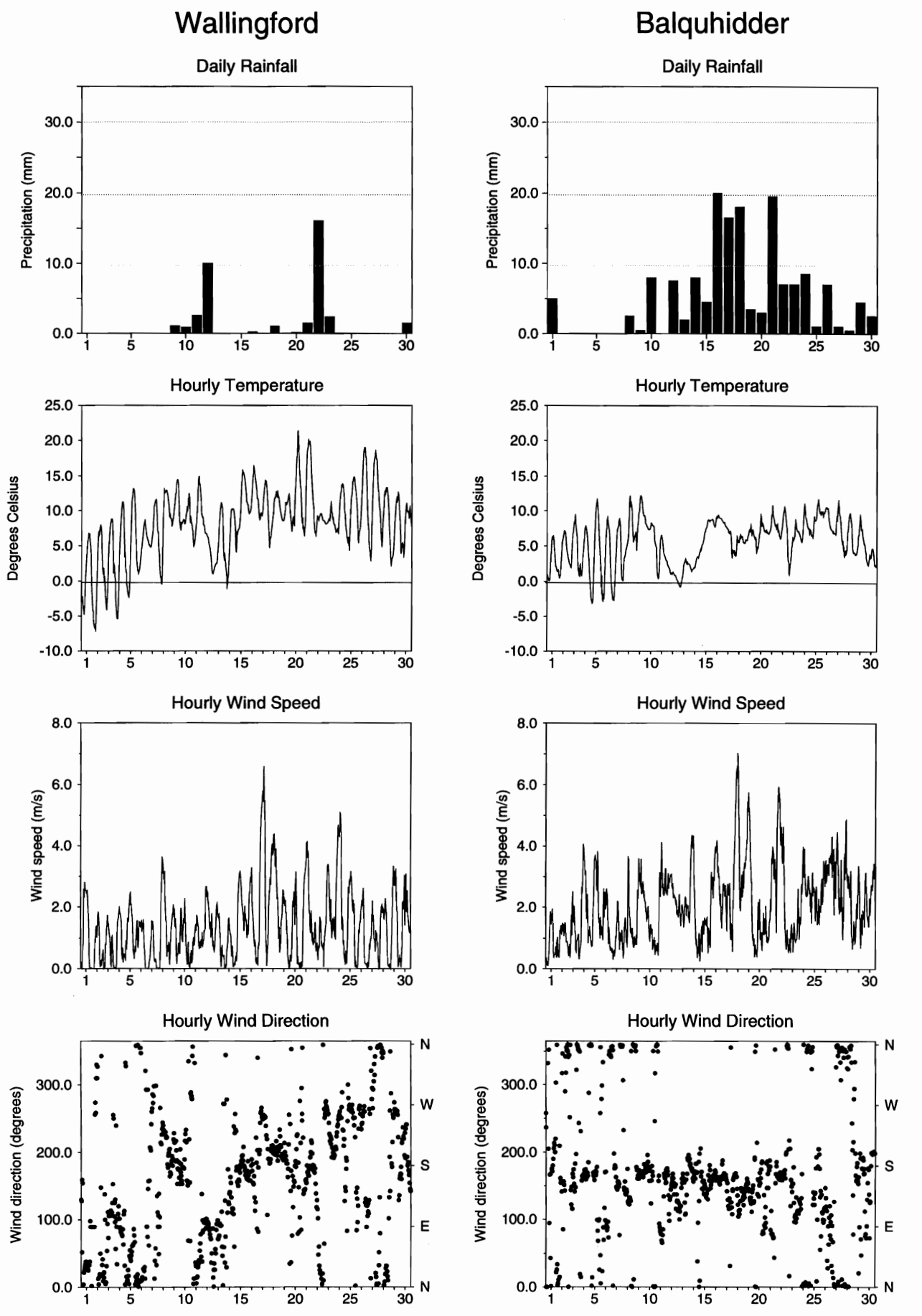
TABLE 5 APRIL GROUNDWATER LEVELS 1996

Site	Aquifer	Records commence	Minimum Apr <1996	Average Apr <1996	Maximum Apr <1996	No. of years Apr/May level <1996	Apr/May 1996 day	Apr/May 1996 level
Dalton Holme	C & UGS	1889	10 .46	19.71	23.60	8	01/05	14.52
Wetwang	C & UGS	1971	18.42	23.90	30.17	6	01/05	21.10
Keelby Grange	C & UGS	1980	3.86	12.89	18.36	1	24/04	6.10
Washpit Farm	C & UGS	1950	40.71	45.28	49.77	4	02/05	42.20
The Holt	C & UGS	1964	84.35	88.30	92.26	9	29/04	87.32
Therfield Rectory	C&UGS	1883	dry <71.60	80.48	97.51	>10	7/05	78.09
Redlands Hall	C & UGS	1964	32.85	45.29	54.32	8	26/04	42.56
Rockley	C & UGS	1933	129.16	137.55	143.68	>10	29/04	135.93
Little Bucket Farm	C & UGS	1971	60.02	72.32	85.91	2	29/04	62.88
Compton House	C & UGS	1984	29.50	44.18	57.10	>10	04/04	39.39
Chilgrove House	C & UGS	1836	36.88	52.68	70.09	>10	18/04	47.06
Westdean No.3	C & UGS	1940	1.34	2.10	3.68	5	28/04	1.50
Lime Kiln Way	C & UGS	1969	124.00	125.48	126.23	>10	17/04	126.20
Ashton Farm	C & UGS	1974	65.01	69.39	71.20	>10	30/04	69.84
West Woodyates Manor	C & UGS	1942	74.86	88.26	103.00	>10	30/04	86.96
New Red Lion	LLst	1964	5.61	16.71	22.97	6	24/04	13.57
Ampney Crucis	Mid Jur	1958	100.29	101.72	103.01	>10	29/04	101 .59
Redbank	PTS	1981	7.43	8.42	9.43	1	01/05	8.16
Yew Tree Farm	PTS	1973	12.52	13.57	13.90	5	08/05	13.47
Skirwith	PTS	1978	130.17	130.69	131.49	0	29/04	130.07
Llanfair D.C	PTS	1972	79.19	86.03	80.54	2	02/05	79.31
Morris Dancers	PTS	1969	31.82	32.49	33.50	>10	22/04	32.63
Heathlanes	PTS	1971	60.81	62.16	63.38	8	04/04	61.75
Bussels No.7A	PTS	1972	23.19	24.17	24.93	>10	22/04	24.32
Rushyford NE	MgLst	1967	65.40	72.81	76.84	>10	19/04	76.40
Peggy Ellerton	MgLst	1968	31.46	34.98	37.39	9	22/04	33.98
Alstonfield	CLst	1974	177.83	194.82	208.75	1	23/04	178.71

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

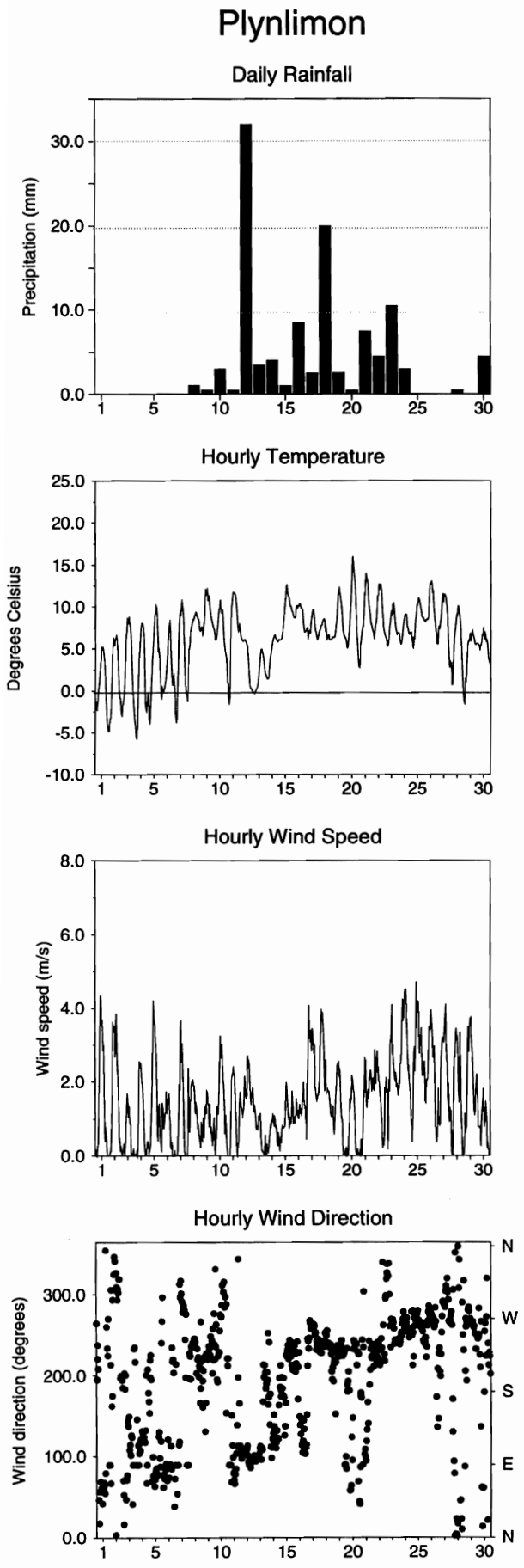
FIGURE 3 METEOROLOGICAL SUMMARY - APRIL 1996



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

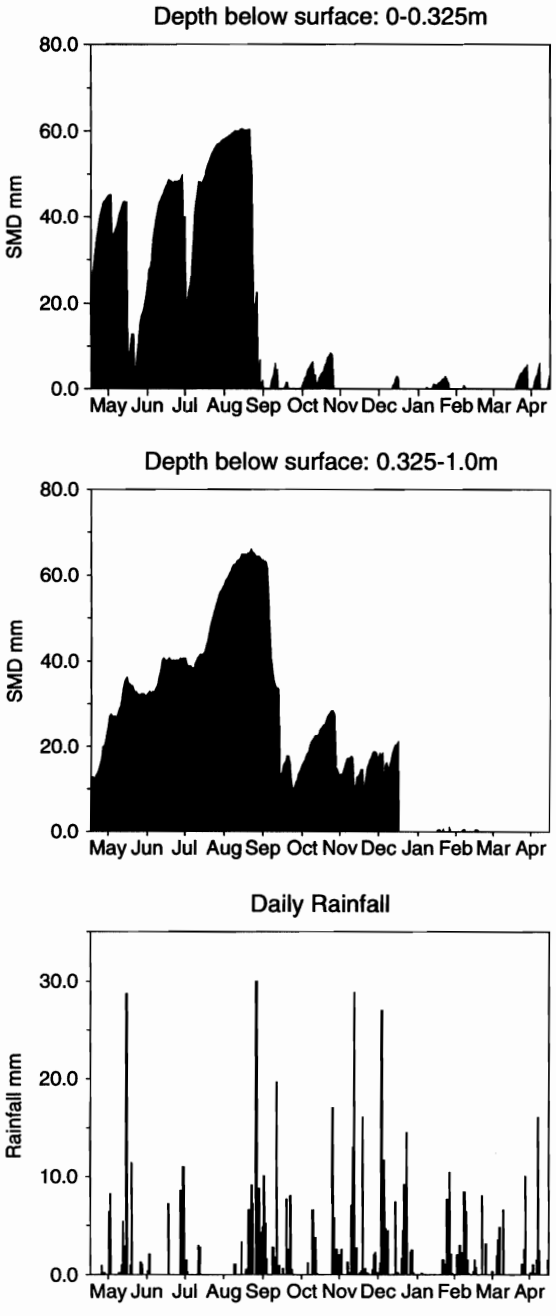
The Lower Kirkton automatic weather station (Balquhidder) occupies a relatively sheltered position at the mouth of the SSE trending Kirkton Glen. Station elevation is 270m aOD and average annual rainfall exceeds 2000mm; snow cover is expected for 10-30 days a year.

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 May 1995 is presented.

FIGURE 4 LOCATION MAP OF GAUGING STATIONS AND GROUNDWATER INDEX WELLS