Hydrological Summary for Great Britain

JULY 1995

Rainfall

July was an exceptionally warm and notably dry month in most areas; rain-bearing Atlantic frontal systems were again conspicuous by their absence, in southern and eastern Britain especially. With high pressure dominant a heatwave over much of the latter half of the month resulted in very high evaporative demands and a return to the torrid conditions which characterised late June. Preliminary data suggest that last month was the second warmest July this century. The patchy nature of the July rainfall - thunderstorms were responsible for a high proportion of the lowland precipitation - implies that the provisional areal totals need to be treated with caution. Most regions registered between 45% and 70% of average but many districts recorded monthly totals below 10 mm to continue a particularly arid spell which now extends over eleven weeks. The abrupt decline in the frequency of westerly rain-bearing systems since the early spring has made for a very unusual partitioning of rainfall over the last 12 months. Since 1870, only in 1921 and 1976 have the April-July periods been drier for England and Wales as a whole. As notably, only five drier four-month sequences (beginning in any month and non-overlapping) have been recorded this century. Substantial rainfall deficiencies have developed in much of eastern and southern Britain since mid-March and moderate to severe short-term drought conditions now extend from parts of eastern Scotland to southern England. Importantly, the large spatial variability in the post-March rainfall has produced pockets of intense drought (e.g. in West Yorkshire).

River Flow

The seasonal decline in river flows continued throughout July interrupted, in most catchments, only by short-lived increases in runoff resulting from convectional rainfall. Some of these storms were especially intense (e.g. on the 11th), localised urban flooding and pollution incidents in oxygen-depleted streams were common. Despite such events, monthly runoff totals were below average in almost all index catchments apart from a few Chalk rivers which continue to benefit from the heavy groundwater recharge of last winter. Spring and summer recessions have been much steeper in impermeable catchments and flow rates are currently depressed over wide areas. The Rivers Soar, Yorkshire Derwent and Teme (the low flows for which have recently been revised) are amongst those reporting their lowest July flow since 1976. Generally July runoff, though well below average, was significantly above historical drought minima and unremarkable in the context of the low summer flows recorded over the 1989-92 period. However, the hot and virtually rainless spell since mid-July has accelerated the rate of recession in many catchments. By early August new absolute minimum daily mean flows were reported from the lower Tweed basin and many springs and burns had dried up. An index of the hydrological stress in parts of Yorkshire is provided by the May to July runoff total for the River Wharfe: the lowest in a 40-year series.

Groundwater

By late July, soil moisture deficits had achieved their maximum value throughout most of eastern and southern Britain (normally this occurs in late August). Aquifer replenishment was minimal and the steep decline in groundwater levels from the notable late-winter peaks continued. As a result of the exceptionally healthy state of groundwater resources early in the year - and the fact that the major aquifers are not vulnerable to short-term summer drought conditions - water-tables in the Chalk are, with a few exceptions, still well within the normal summer range; groundwater resources, as during the 1984 drought, are providing a valuable buffer to mitigate the effects of the very limited recent rainfall. However, away from eastern and southern England, the decline in groundwater levels has been particularly brisk and levels in, for example, parts of the Cotswolds and the northern Permo-Triassic outcrops are depressed. There is concern (e.g. in parts of eastern Scotland) for the immediate resources outlook in a few minor aquifers.

General

Four successive months with well below average rainfall, notably high evaporative losses and, latterly, unprecedented water demand have exposed weaknesses in the distribution networks and triggered the introduction of publicity campaigns, hose-pipe bans, pressure reductions and other measures to moderate peak demands. Exceptional declines in reservoir contents have occurred in some areas (e.g. smaller impoundments in Yorkshire and Cornwall) but overall stocks for England and Wales are still only a little below 70% of capacity, comparable with the same time in 1990 and significantly greater than in 1989. Problems associated with the difficulty of meeting demand surges will continue through the summer but as the growing season comes to an end the focus of concern will shift to the longer term resources prospects. Parched soils will delay the recovery of river flow and runoff rates until late in the year. A dry winter would make for a very fragile water resources outlook for 1996.

Institute of Hydrology

British Geological Survey

Data for this report have been provided principally by the regional divisions of the National Rivers Authority* in England and Wales, the River Purification Boards in Scotland and by the Meteorological Office. Figure 3 is based on weather data collected by the Institute of Hydrology at Wallingford and Balquhidder (Central Region, Scotland). Reservoir contents information has been supplied by the Water Services Companies, the NRA or, in Scotland, the Lothian and Strathclyde Regional Councils. 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 and the National Rivers Authority.

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.

* For reasons of consistency and to provide greater spatial discrimination, the original ten regional divisions of the NRA have been retained for use in the Hydrological Summaries.

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 rain-gauge 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 August 1995

TABLE 1 1994/95 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.

		Jul 1994	Aug	Sep	Oct	Nov	Dec	Jan 1995	Feb	Mar	Apr	May	Jun	Jul
England and Wales	mm	47	72	106	97	86	142	157	111	64	27	48	26	38
	%	76	95	138	114	96	151	178	176	89	45	75	40	62
NRA REGIONS														
North West	mm	70	103	113	123	36	207	210	148	88	28	62	38	74
	%	82	96	98	96	111	167	174	190	93	39	83	47	87
Northumbrian	mm	41	81	77	71	97	124	123	107	60	38	53	39	34
	%	63	100	105	93	113	153	146	181	86	68	85	65	52
Severn Trent	mm	44	56	127	68	73	115	128	88	52	20	49	14	30
	%	83	84	198	106	103	149	183	163	85	36	83	24	57
Yorkshire	mm	53	58	101	73	89	123	125	100	65	26	44	27	29
	%	90	78	149	100	111	148	158	172	96	44	73	45	49
Anglian	mm	41	57	89	70	32	59	98	62	51	16	31	25	25
	%	84	104	182	137	55	107	196	168	109	35	65	49	52
Thames	mm	21	50	74	85	53	93	136	83	50	18	37	18	29
	%	43	86	125	137	82	133	213	184	89	36	66	32	59
Southern	mm	29	68	90	118	66	123	163	112	58	18	25	22	29
	%	60	119	130	148	78	150	204	207	92	34	46	40	61
Wessex	mm	34	68	99	115	96	139	179	111	57	34	53	19	24
	%	65	103	138	146	116	149	206	171	81	64	87	34	47
South West	mm	49	103	131	140	127	214	230	163	92	50	55	23	49
	%	71	123	141	121	102	154	167	161	93	72	76	33	70
Welsh	mm	68	94	134	139	134	255	235	181	84	36	72	25	61
	%	88	93	117	101	94	167	164	187	79	45	88	32	79
Scotland	mm	67	101	103	110	156	245	225	205	147	67	85	39	63
	%	71	86	73	71	103	162	149	201	118	88	99	46	67
RIVER PURIFICATION BOARDS														
Highland	mm	62	112	153	116	169	304	293	271	185	99	90	40	74
	%	58	88	89	59	83	154	156	213	114	109	98	41	70
North East	mm	40	47	89	87	89	93	136	83	72	65	79	48	39
	%	55	54	102	90	90	100	137	128	92	108	114	73	53
Tay	mm	47	81	56	115	154	196	184	188	125	38	99	25	51
	%	61	86	49	88	127	154	128	198	115	61	119	34	66
Forth	mm	59	80	56	90	134	210	150	167	91	33	69	29	61
	%	79	85	51	78	120	191	127	211	97	56	93	42	81
Tweed	mm	46	71	57	75	123	173	127	109	75	37	66	39	36
	%	63	81	64	79	132	186	127	163	95	65	93	60	49
Solway	mm	106	121	76	117	184	246	219	175	146	41	85	49	61
	%	118	102	53	75	128	166	140	173	125	53	100	58	68
Clyde	mm	97	142	98	128	189	322	258	248	192	65	81	39	83
	%	89	106	55	66	105	180	137	210	131	77	89	42	76

Note: The monthly rainfall figures for the NRA regions for June & July 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. The figures for the RPB regions for June & July 1995 were derived by IH in collaboration with the RPBs. 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

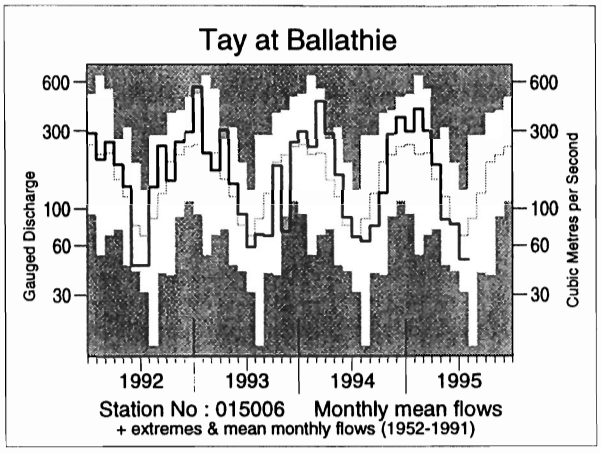
		Apr 95-Jul 95		Jan 95-Jul 95		Aug 94-Jul 95		Apr 93-Jul 95	
		Est Return Period, years		Est Return Period, years		Est Return Period, years		Est Return Period, years	
England and Wales	mm	139		471		974		2322	
	% LTA	55	40-60	99	2-5	109	2-5	114	10-20
NRA REGIONS									
North West	mm	202		648		1330		2954	
	% LTA	65	10-20	107	2-5	111	2-5	109	5-10
Northumbria	mm	163		453		903		2150	
	% LTA	67	10-20	99	2-5	106	2-5	110	5-10
Severn Trent	mm	113		381		820		1969	
	% LTA	50	50-80	93	2-5	109	2-5	114	10-15
Yorkshire	mm	126		416		860		2073	
	% LTA	53	40-60	94	2-5	105	2-5	110	5-10
Anglian	mm	98		309		616		1592	
	% LTA	50	50-80	94	2-5	103	2-5	115	10-20
Thames	mm	102		371		726		1770	
	% LTA	48	40-60	99	2-5	105	2-5	111	5-10
Southern	mm	94		427		892		2146	
	% LTA	45	60-90	105	2-5	115	5-10	121	35-50
Wessex	mm	130		477		994		2308	
	% LTA	58	15-25	107	2-5	119	5-10	122	35-50
South West	mm	176		661		1376		3295	
	% LTA	63	10-20	107	2-5	117	5-10	125	120-170
Welsh	mm	194		694		1450		3374	
	% LTA	61	20-30	104	2-5	110	2-5	115	10-20
Scotland	mm	255		832		1547		3440	
	% LTA	74	10-15	116	5-10	108	2-5	107	5-10
RIVER PURIFICATION BOARDS									
Highland	mm	303		1052		1906		4023	
	% LTA	78	5-10	122	10-15	108	2-5	103	2-5
North East	mm	231		522		927		2266	
	% LTA	86	2-5	102	2-5	95	2-5	102	2-5
Tay	mm	213		710		1312		3058	
	% LTA	72	5-10	110	2-5	107	2-5	111	5-10
Forth	mm	192		600		1170		2751	
	% LTA	69	10-20	106	2-5	106	2-5	110	5-10
Tweed	mm	178		489		988		2414	
	% LTA	67	10-20	96	2-5	102	2-5	109	5-10
Solway	mm	236		776		1520		3445	
	% LTA	70	10-15	109	2-5	107	2-5	108	5-10
Clyde	mm	268		966		1845		4094	
	% LTA	71	10-15	116	5-10	109	2-5	109	5-10

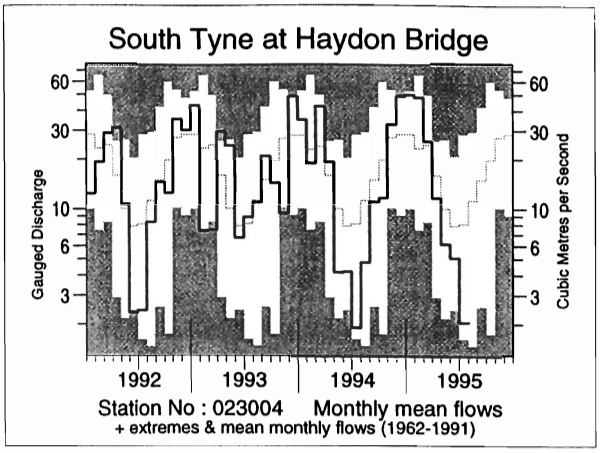
LTA refers to the period 1961-90.

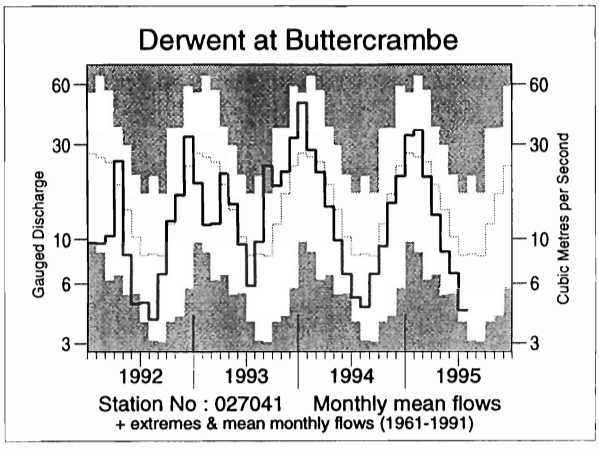
Return period assessments are based on tables provided by the Meteorological Office*. The tables reflect rainfall totals over the period 1911-70 only and the estimate assumes a sensibly stable climate. They assume a start in a specified month; return periods for a start in any month may be expected to be an order of magnitude less - for the longest durations the return period estimates converge. "Wet" return periods underlined.

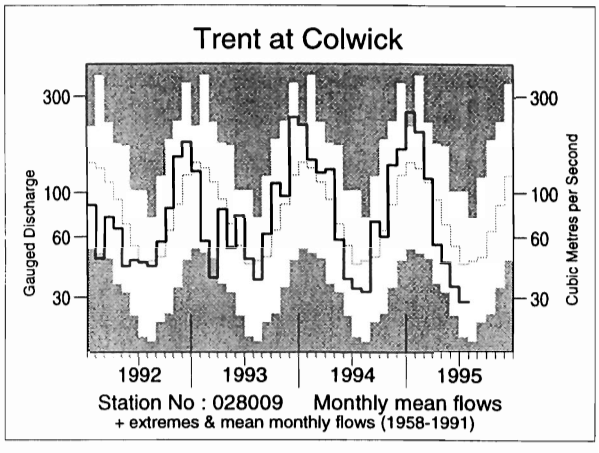
* Tabony, R.C., 1977, The Variability of long duration rainfall over Great Britain, Scientific Paper No. 37, Meteorological Office.

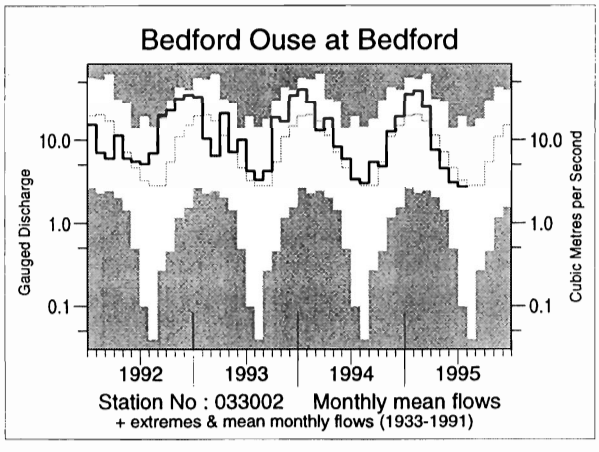
FIGURE 1 MONTHLY RIVER FLOW HYDROGRAPHS

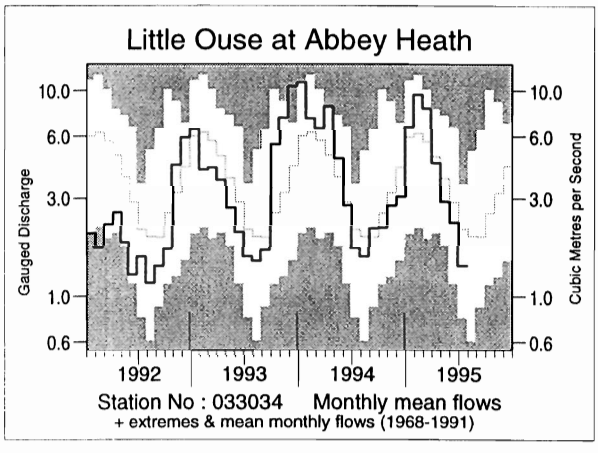


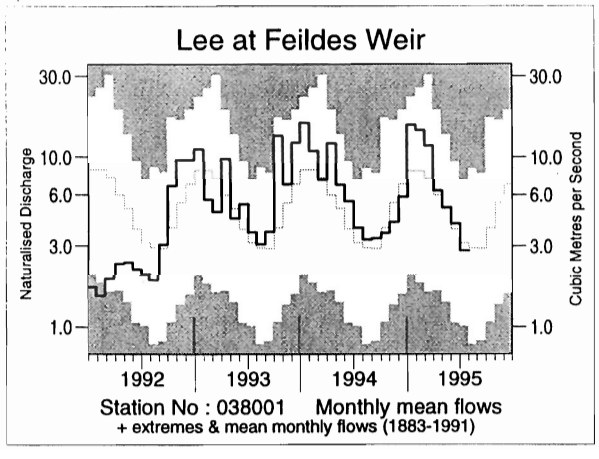


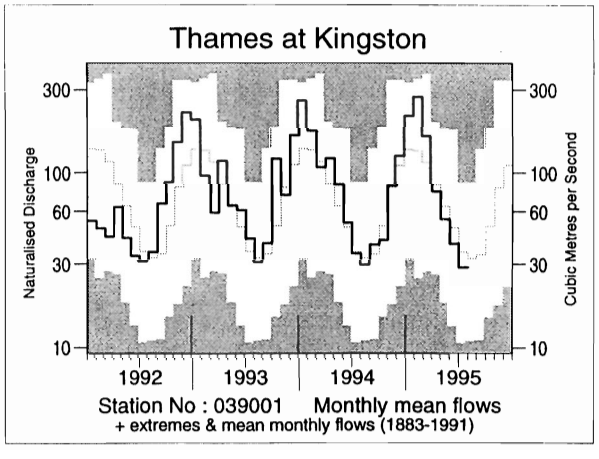


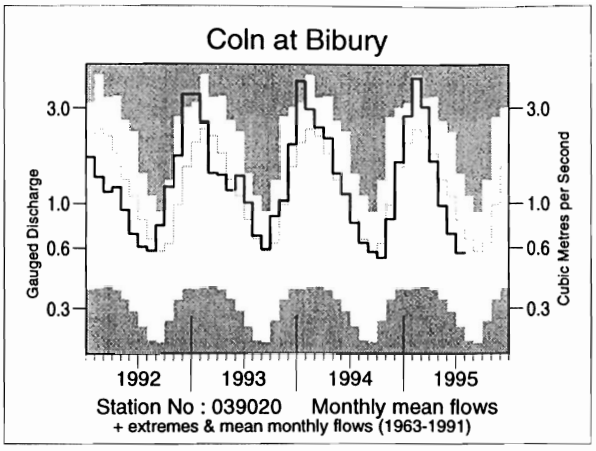


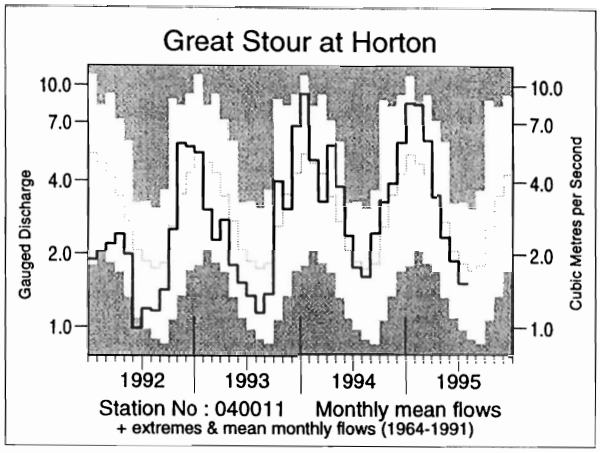


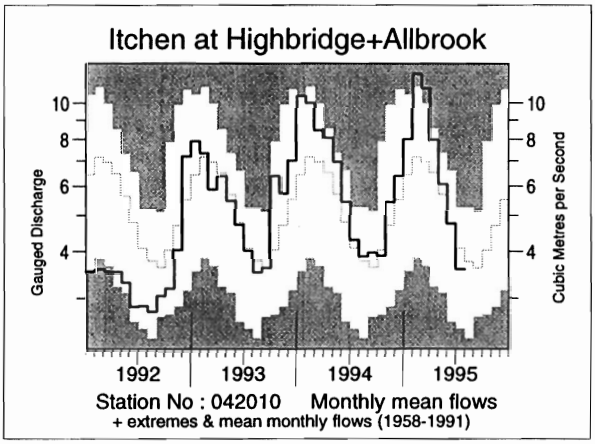


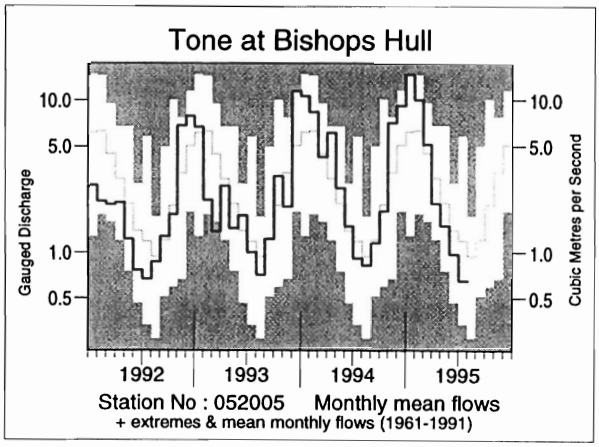


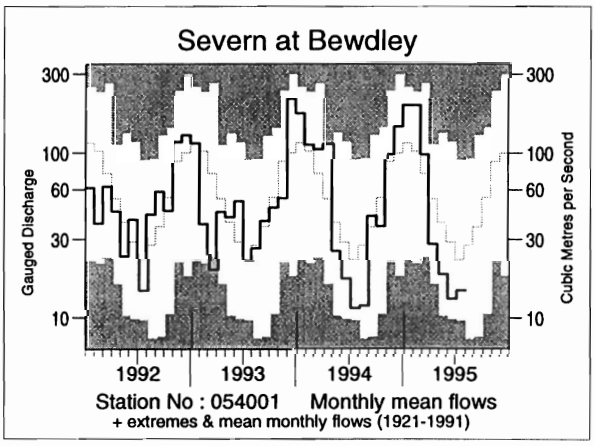


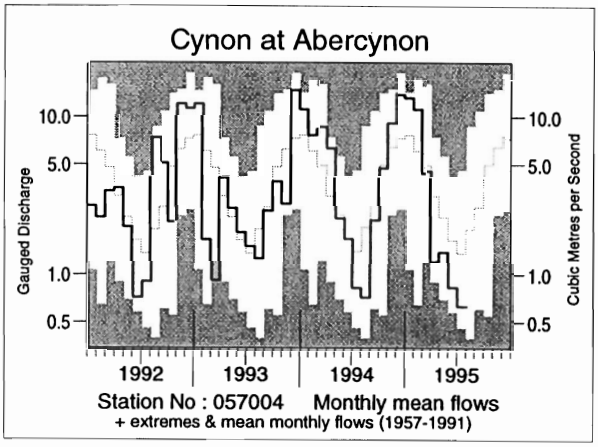

Coln at Bibury
Gauged Discharge
Cubic Metres per Second
3.0
1.0
0.6
0.3
1992
1993
1994
1995
Station No : 039020 Monthly mean flows
+ extremes & mean monthly flows (1963-1991)

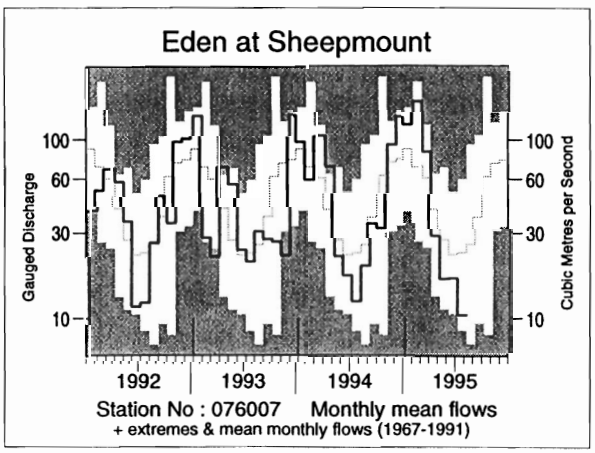

Great Stour at Horton
Gauged Discharge
Cubic Metres per Second
10.0
7.0
4.0
2.0
1.0
1992
1993
1994
1995
Station No : 040011 Monthly mean flows
+ extremes & mean monthly flows (1964-1991)


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


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


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


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


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

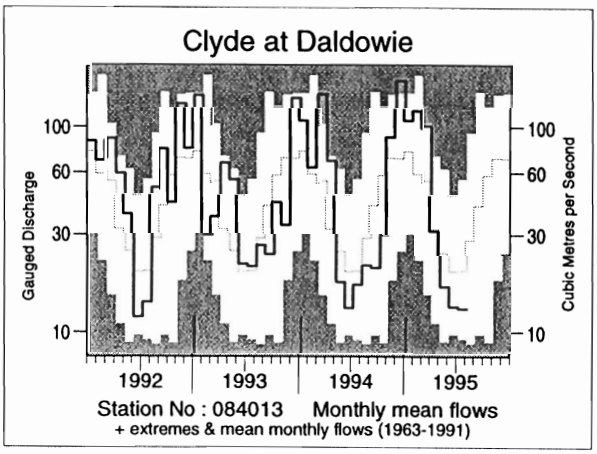

Clyde at Daldowie
Gauged Discharge
Cubic Metres per Second
100
60
30
10
1992
1993
1994
1995
Station No : 084013 Monthly mean flows
+ extremes & mean monthly flows (1963-1991)

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

River/ Station name	Mar 1995	Apr	May	June	July 1995		5/95 to 7/95		1/95 to 7/95		8/94 to 7/95		9/93 to 7/95	
	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	84	67	55	46	16	6	117	12	453	9	700	4	1662	15
Park	88	84	88	126	59	/23	93	/23	97	/23	88	/22	106	/21
Tay at	176	105	50	46	29	10	125	13	797	37	1327	37	2583	34
Ballathie	134	118	72	102	73	/43	81	/43	124	/43	116	/42	115	/41
Tweed at	133	36	24	19	14	4	56	5	548	34	942	32	1812	33
Boleside	163	66	55	72	52	/35	59	/35	131	/35	123	/34	121	/33
Whiteadder Water at	24	19	13	13	7	4	33	8	166	5	255	5	733	10
Hutton Castle	49	50	48	79	59	/26	61	/26	67	/26	65	/25	95	/25
South Tyne at	92	40	22	18	7	5	47	3	519	29	908	24	1687	22
Haydon Bridge	105	69	60	67	27	/32	53	/32	125	/32	115	/30	109	/28
Wharfe at	91	26	13	11	10	6	34	1	465	32	825	30	1584	33
Flint Mill Weir	119	47	35	44	39	/40	39	/40	118	/40	114	/39	112	/38
Derwent at	35	22	15	11	7	2	33	6	201	16	295	13	678	21
Buttercrambe	88	70	63	68	55	/34	63	/34	97	/34	91	/33	106	/32
Trent at	42	19	16	12	10	4	38	5	256	28	420	28	860	34
Colwick	108	60	66	63	65	/37	66	/37	115	/37	118	/36	123	/35
Bedford Ouse at	46	13	8	6	5	35	19	24	210	53	292	44	637	59
Bedford	150	66	64	65	81	/63	69	/63	140	/63	132	/62	145	/61
Little Ouse at	32	17	11	8	5	5	25	8	133	17	177	15	433	23
Abbey Heath	150	91	77	82	68	/27	77	/27	113	/27	106	/26	134	/25
Mimram at	24	19	17	13	11	29	41	34	117	39	171	38	378	41
Panshanger Park	178	148	136	125	112	/43	125	/43	141	/43	135	/42	155	/41
Lee at	31	16	13	10	7	50	31	62	152	95	203	82	453	99
Feildes Weir (natr.)	157	105	102	108	90	/110	101	/110	142	/109	124	/108	143	/106
Thames at	44	20	15	10	8	39	33	46	222	98	307	88	632	100
Kingston (natr.)	143	91	84	81	82	/113	83	/113	136	/113	125	/112	131	/111
Coln at	77	39	24	17	14	6	56	8	338	26	442	19	916	26
Bibury	145	93	75	66	69	/32	71	/32	119	/32	111	/31	117	/30
Great Stour at	46	26	18	14	12	11	44	11	239	26	371	24	722	23
Horton	144	100	87	94	83	/31	88	/30	130	/29	126	/28	126	/26
Itchen at	81	57	45	34	27	8	106	17	384	35	557	32	1111	34
Highbridge+Allbrook	159	123	107	100	89	/37	100	/37	127	/37	121	/36	124	/35
Stour at	70	26	16	10	6	3	32	4	370	21	551	20	1145	21
Throop Mill	142	73	70	64	57	/23	67	/23	143	/23	137	/22	145	/21
Piddle at	77	44	26	19	14	6	59	7	377	28	537	25	1133	27
Baggs Mill	137	105	82	82	78	/31	81	/31	132	/31	131	/29	140	/27
Exe at	101	29	20	12	8	5	41	6	581	38	1080	36	2206	38
Thorverton	120	50	54	51	41	/40	51	/40	126	/39	129	/39	134	/38
Taw at	85	21	11	6	4	5	21	3	481	35	906	33	1904	35
Umberleigh	126	47	39	34	27	/37	35	/37	127	/37	129	/36	138	/35
Tone at	66	26	19	12	8	3	40	5	438	33	694	33	1358	33
Bishops Hull	118	67	72	70	56	/35	68	/35	141	/34	145	/34	144	/33
Severn at	61	17	11	8	9	21	28	7	336	69	539	57	1091	69
Bewdley	131	53	49	44	65	/75	52	/75	128	/74	119	/74	123	/73
Teme at	56	14	9	5	4	2	18	3	292	21	457	24	887	23
Knightsford Bridge	120	42	47	37	48	/26	45	/26	122	/25	124	/25	123	/24
Cynon at	111	29	35	20	15	4	70	5	802	30	1557	31	3099	33
Abercynon	92	37	60	50	46	/37	54	/37	120	/37	122	/35	125	/33
Dee at	144	38	45	31	69	18	145	9	1009	18	2009	22	3850	21
New Inn	79	35	67	52	107	/27	76	/26	113	/26	112	/26	110	/25
Eden at	99	32	19	19	12	4	50	4	496	24	857	20	1543	18
Sheepmount	139	65	58	76	47	/25	61	/25	129	/25	123	/23	115	/21
Clyde at	139	43	23	18	18	7	59	6	544	30	997	29	1915	29
Daldowie	174	90	64	69	66	/32	67	/32	133	/32	126	/31	124	/30
Carron at	289	188	61	49	89	5	199	2	1504	13	2609	10	4720	5
New Kelso	98	127	64	61	75	/17	69	/17	117	/17	101	/16	94	/15
Ewe at	274	222	92	78	63	7	232	9	1476	24	2432	18	4200	12
Poolewe	133	155	93	104	71	/25	89	/25	/136	/25	112	/24	100	/23

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 1992. For the long periods (at the right of this table), the end date for the long term is 1995.

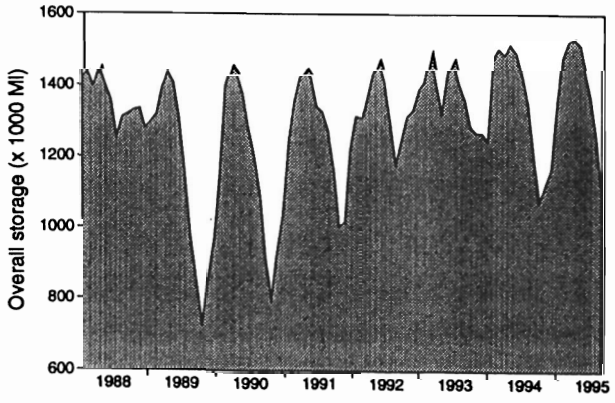
TABLE 4 START-MONTH RESERVOIR STORAGES UP TO AUGUST 1995

Area	Reservoir (R)/ Group (G)		Capacity • (Ml)	1995 Mar	Apr	May	Jun	Jul	Aug	1994 Aug
North West	N.Command Zone[1]	(G)	133375	100	99	86	73	58	44	59
	Vyrnwy	(R)	55146	100	97	89	81	69	59	66
Northumbria	Teesdale[2]	(G)	87936	100	99	95	89	70	59	54
	Kielder	(R)	199175*	100*	97*	89*	90*	91*	87*	89*
Severn-Trent	Clywedog	(R)	44922	94	97	96	96	86	73	77
	Derwent Valley[3]	(G)	39525	100	100	97	86	72	59	60
Yorkshire	Washburn[4]	(G)	22035	100	98	88	78	63	50	53
	Bradford supply[5]	(G)	41407	99	98	89	70	54	38	49
Anglian	Grafham	(R)	58707	93	95	96	95	94	88	88
	Rutland	(R)	130061	95	91	87	83	80	74	89
Thames	London[6]	(G)	206399	95	97	95	96	93	82	83
	Farmoor [7]	(G)	13843	96	97	97	97	94	86	98
Southern	Bewl	(R)	28170	99	99	97	94	88	81	92
	Ardingly	(R)	4685	100	100	100	99	97	66	100
Wessex	Clatworthy	(R)	5364	100	100	85	69	61	44	68
	Bristol W [8]	(G)	38666*	99*	99*	94*	86*	79*	67*	71*
South West	Colliford	(R)	28540	96	97	93	88	80	70	78
	Roadford[9]	(R)	34500	97	96	92	85	76	60	79
	Wimbleball[10]	(R)	21320	100	100	95	89	74	59	77
	Stithians	(R)	5205	100	96	86	77	61	45	69
Welsh	Celyn + Brenig	(G)	131155	100	100	100	96	87	79	78
	Brianne	(R)	62140	100	100	97	85	76	67	81
	Big Five[11]	(G)	69762	100	99	86	79	65	49	70
	Elan Valley[12]	(G)	99106	100	95	99	90	80	65	77
Lothian	Edin./Mid Lothian[13]	(G)	97639	100	99	98	90	88	79	79
	East Lothian[14]	(G)	10206	100	100	100	96	91	84	76
Strathclyde	Loch Katrine	(G)	111363	99	100	92	85	71	69	81
	Daer	(R)	22412	100	96	91	85	73	62	58
	Loch Thom	(G)	11840	100	100	92	84	77	72	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

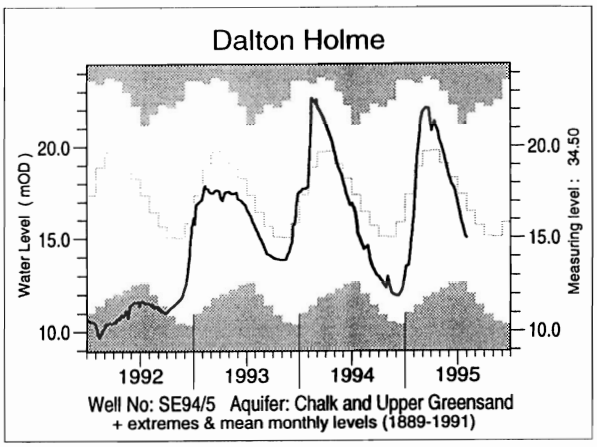
A GUIDE TO THE VARIATION IN OVERALL RESERVOIR STOCKS FOR ENGLAND AND WALES

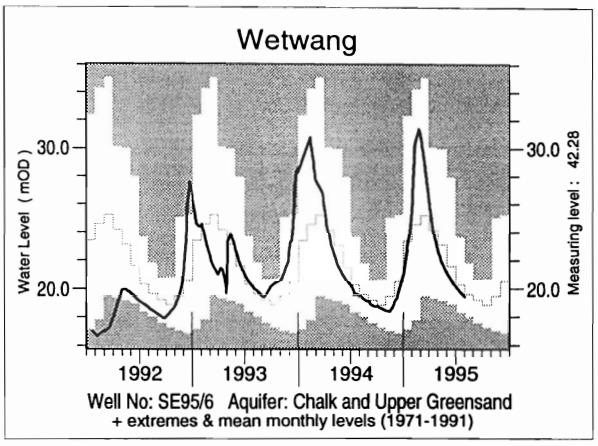


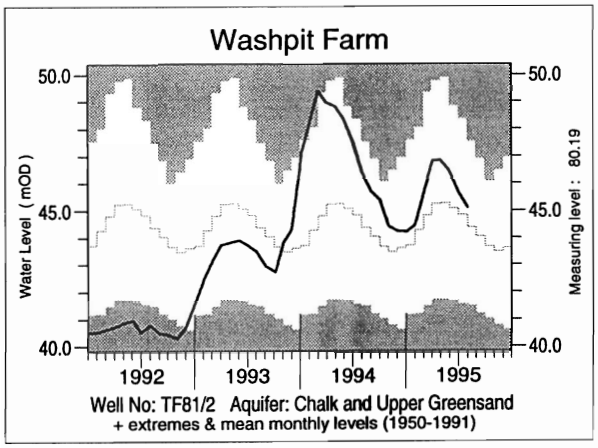
This plot is based on the reservoirs featured in Table 4 only.

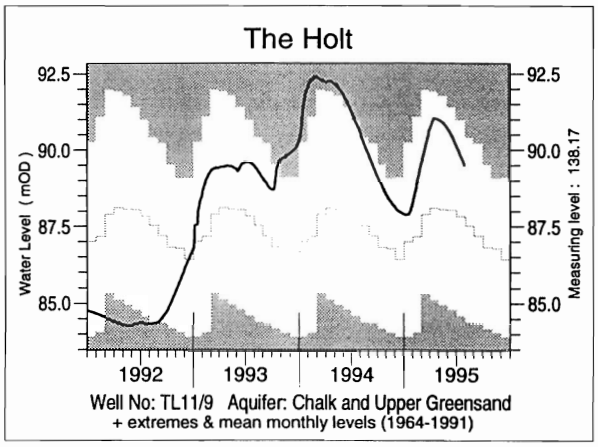
Note: Variations in storage depend on the balance between inputs (from catchment rainfall and any pumping) and outputs (to supply, compensation flow, HEP, amenity). There will be additional losses due to evaporation, especially in the summer months. Operational strategies for making the most efficient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

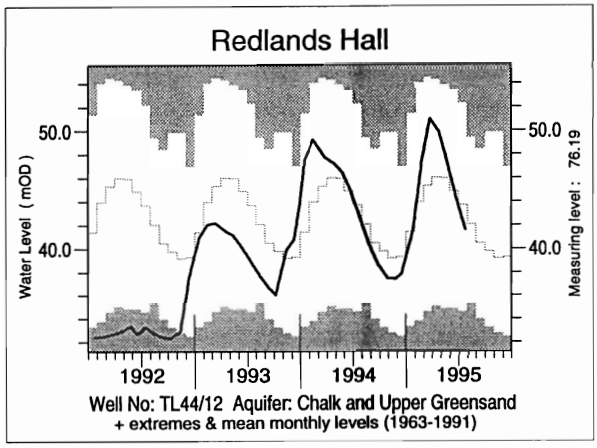
FIGURE 2 GROUNDWATER LEVEL HYDROGRAPHS

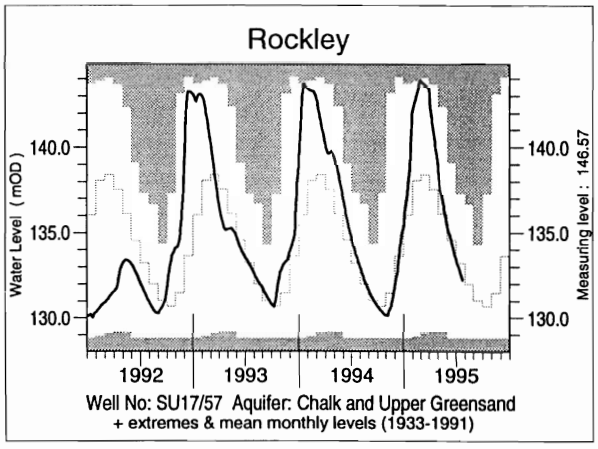


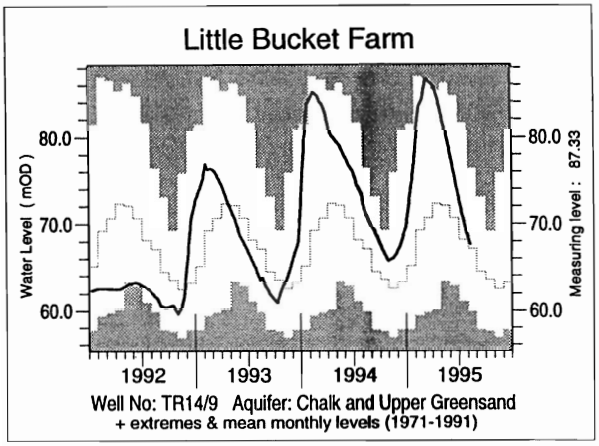


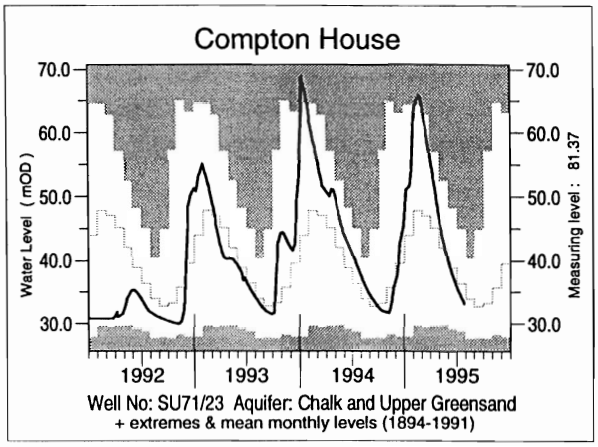


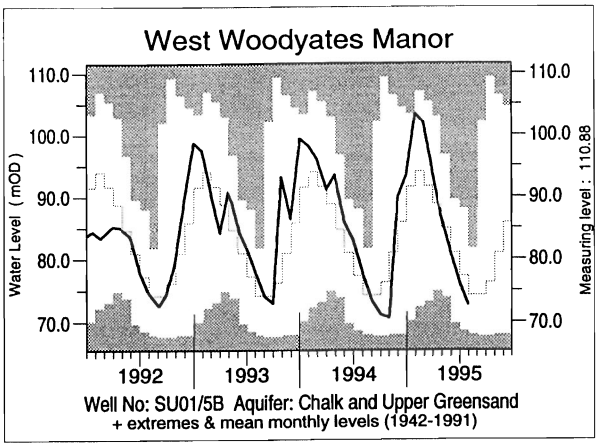


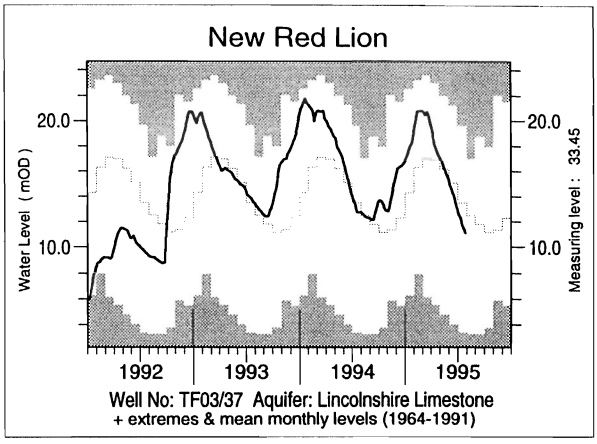


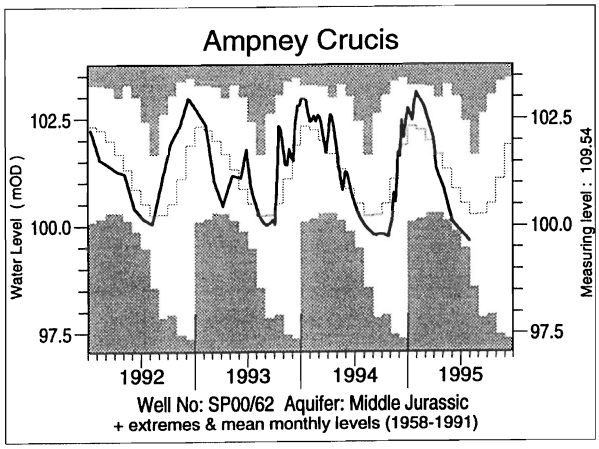


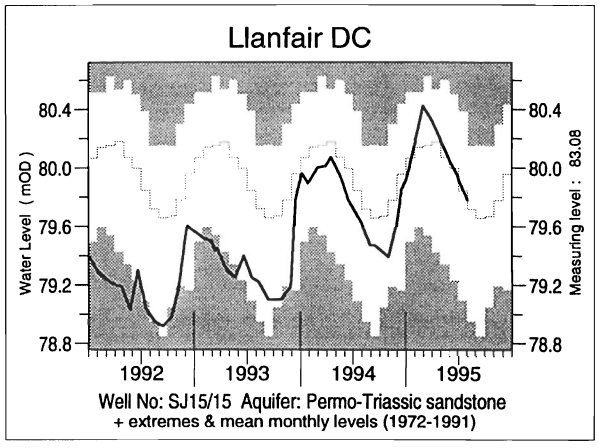


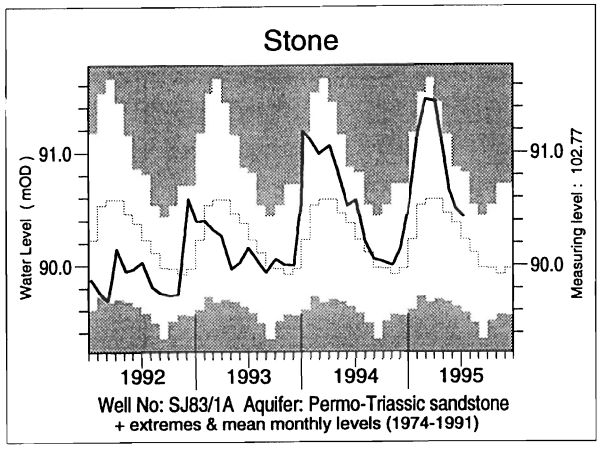


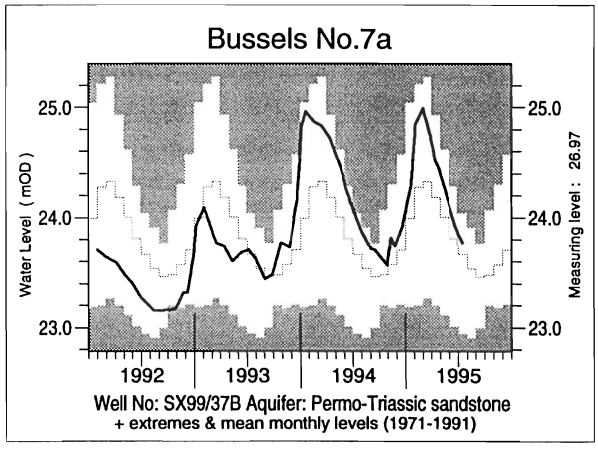

West Woodyates Manor
Water Level (mOD)
110.0
100.0
90.0
80.0
70.0
Measuring level : 110.88
1992
1993
1994
1995
Well No: SU01/5B Aquifer: Chalk and Upper Greensand
+ extremes & mean monthly levels (1942-1991)

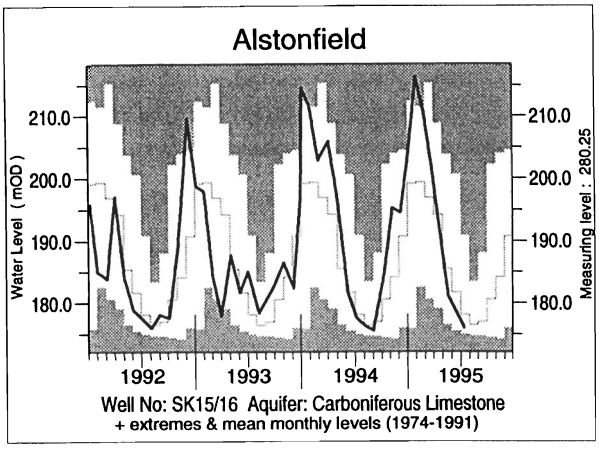

New Red Lion
Water Level (mOD)
20.0
10.0
Measuring level : 33.45
1992
1993
1994
1995
Well No: TF03/37 Aquifer: Lincolnshire Limestone
+ extremes & mean monthly levels (1964-1991)


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


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


Stone
Water Level (mOD)
91.0
90.0
Measuring level : 102.77
1992
1993
1994
1995
Well No: SJ83/1A Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1974-1991)


Bussels No.7a
Water Level (mOD)
25.0
24.0
23.0
Measuring level : 26.97
1992
1993
1994
1995
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
Well No: SK15/16 Aquifer: Carboniferous Limestone
+ extremes & mean monthly levels (1974-1991)

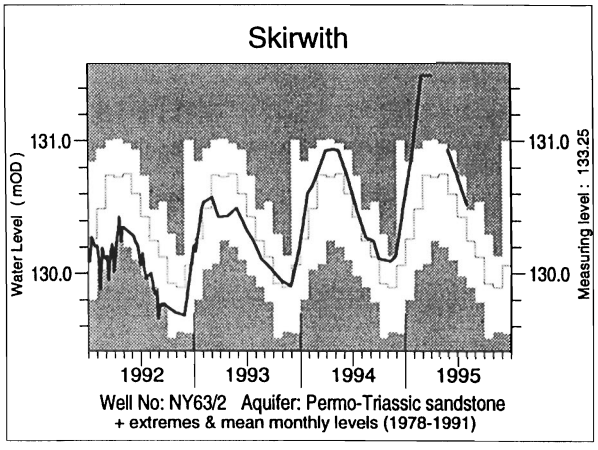

Skirwith
Water Level (mOD)
131.0
130.0
Measuring level : 133.25
1992
1993
1994
1995
Well No: NY63/2 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1978-1991)

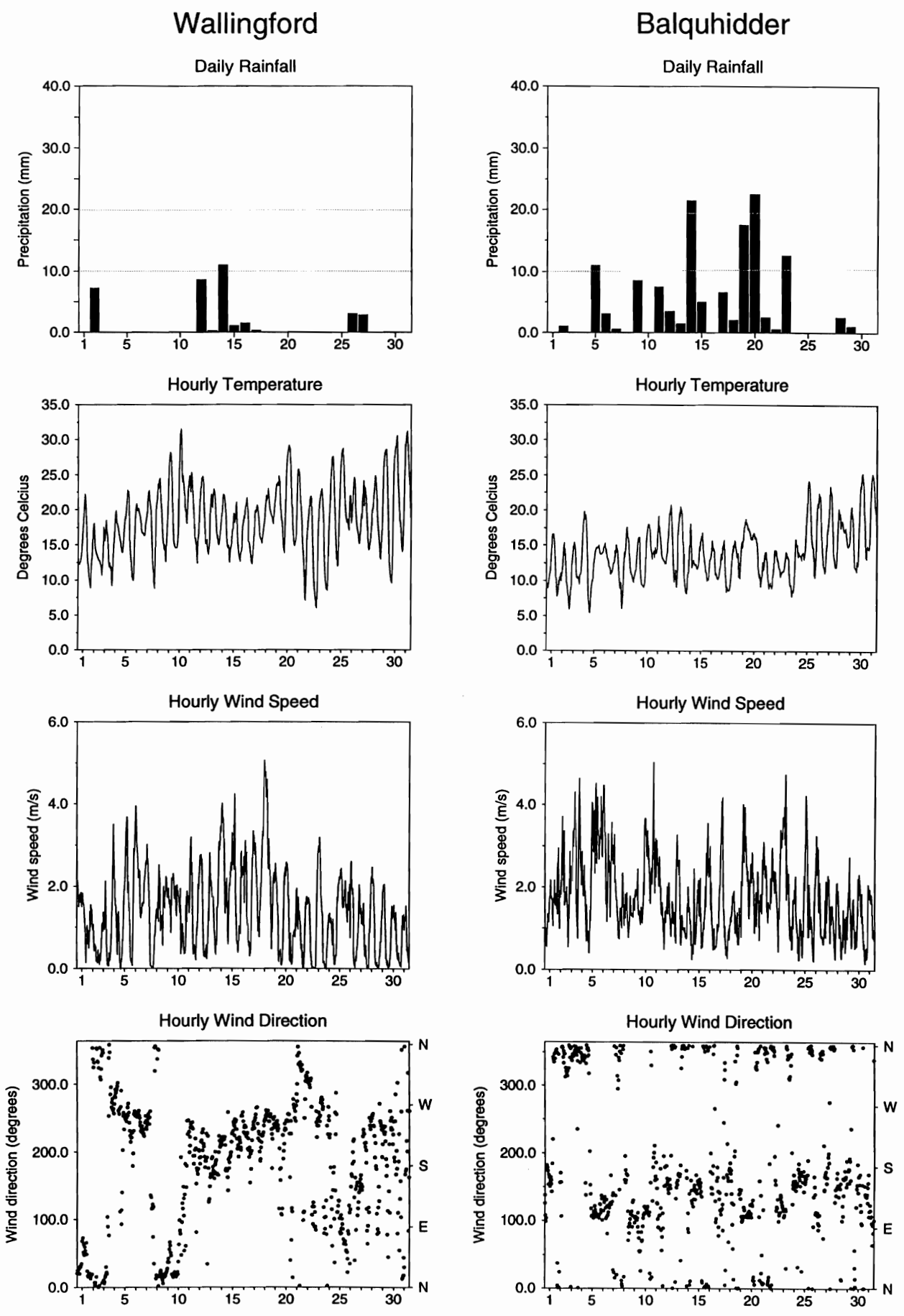
TABLE 5 JULY GROUNDWATER LEVELS

Site	Aquifer	Records commence	Minimum July <1995	Average July <1995	Maximum July <1995	No. of years July/Aug level <1995	July/Aug 1995 day	July/Aug 1995 level
Dalton Holme	C & UGS	1889	11.51	17.35	21.17	>10	01/08	14.99
Wetwang	C & UGS	1971	18.39	20.63	23.71	7	01/08	19.47
Washpit Farm	C & UGS	1950	40.51	44.82	48.37	>10	01/08	45.10
The Holt	C & UGS	1964	84.40	88.15	91.25	>10	31/07	89.51
Therfield Rectory	C & UGS	1883	dry <71.6	81.67	99.05	>10	10/07	85.46
Redlands Hall	C & UGS	1964	32.25	42.96	52.30	10	26/07	41.53
Rockley	C & UGS	1933	dry <128.44	133.21	137.34	>10	24/07	132.33
Little Bucket Farm	C & UGS	1971	60.97	68.72	81.50	>10	08/08	67.61
Compton House	C & UGS	1984	28.75	35.73	45.10	>10	27/07	33.11
Chilgrove House	C & UGS	1836	34.95	43.69	58.38	>10	26/07	40.73
Westdean No.3	C & UGS	1940	1.06	1.50	2.02	>10	28/07	1.38
Lime Kiln Way	C & UGS	1969	123.91	125.20	125.90	>10	13/07	125.87
Ashton Farm	C & UGS	1974	64.21	66.81	69.77	1	31/07	65.12
West Woodyates Manor	C & UGS	1942	68.56	77.09	88.07	>10	31/07	72.59
Killyglen (NI)	C & UGS	1985	113.17	113.82	115.25	0	12/07	112.97
New Red Lion	LLst	1964	3.42	13.47	19.69	8	28/07	11.12
Ampney Crucis	Mid Jur	1958	99.48	100.52	102.42	1	31/07	99.64
Yew Tree Farm	PTS	1973	8.43	13.03	13.87	2	09/08	13.02
Llanfair D.C	PTS	1972	79.04	79.71	80.38	>10	01/08	79.78
Morris Dancers	PTS	1969	31.90	32.47	33.53	>10	19/07	32.31
Stone	PTS	1974	89.57	90.22	90.82	>10	10/07	90.43
Skirwith	PTS	1978	129.96	130.31	130.73	>10	02/08	130.52
Redbank	PTS	1981	7.55	8.03	8.41	0	27/07	7.39
Bussels No.7A	PTS	1972	22.94	23.68	24.05	>10	20/07	23.77
Rushyford NE	MgLst	1967	65.19	72.70	76.55	>10	21/07	76.28
Peggy Ellerton	MgLst	1968	31.30	34.17	36.96	>10	21/07	34.47
Alstonfield	CLst	1974	174.90	178.88	190.77	8	14/07	175.94

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

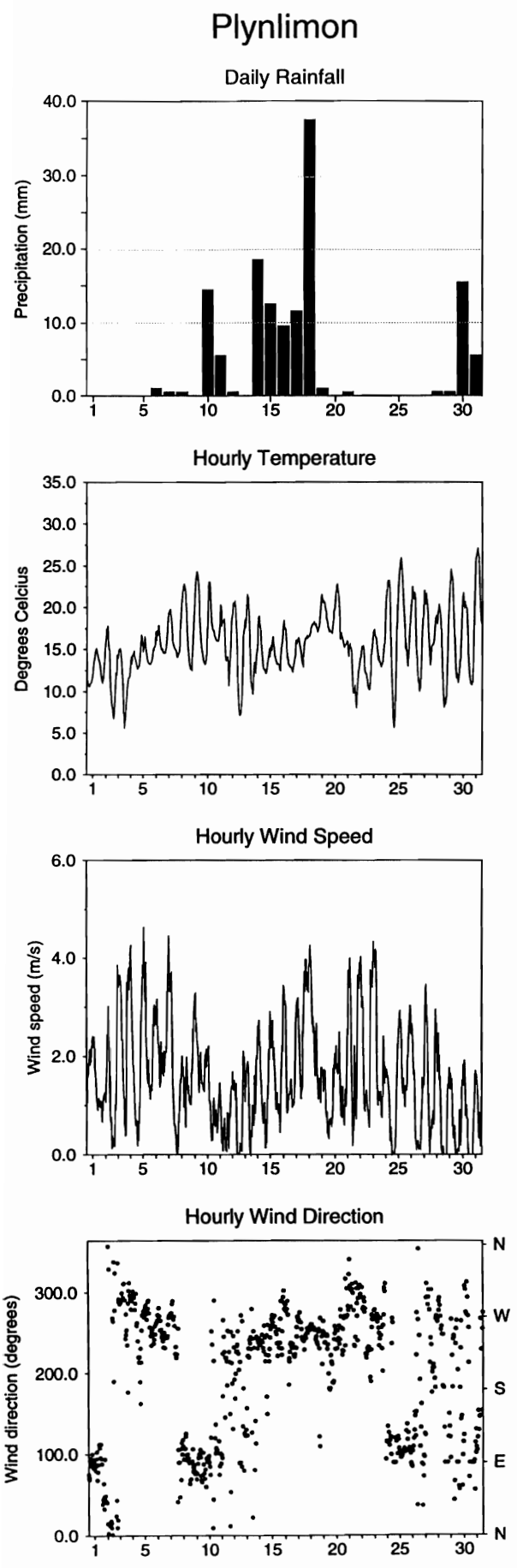
FIGURE 3 METEOROLOGICAL SUMMARY - JULY 1995



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

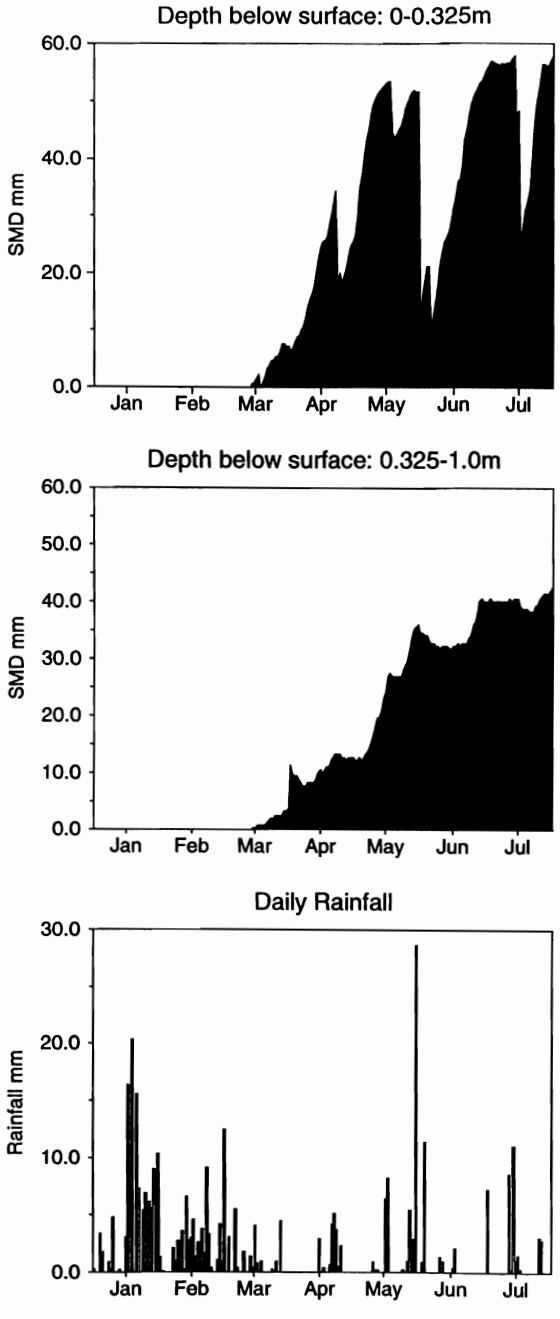
The Lower Kirkton automatic weather station (Balquhidder) occupies a relatively sheltered position at the mouth of the SSE trending Kirkton Glen. Station elevation is 270m aOD and average annual rainfall exceeds 2000mm; snow cover is expected for 10-30 days a year.

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



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. The data presented here are calculated from readings taken at the two automatic soil water stations (ASWSs) at Wallingford. They employ capacitance soil water sensors installed at depths of 5, 15 and 50 cm. 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; slight discontinuities in the SMD trace can occur when switching between the ASWSs. The data presented give a good representative picture of soil moisture variations - avoiding the short term changes that can be dominant close to the surface.

Daily rainfall from the Wallingford meteorological station from the start of 1995 is presented.

FIGURE 4 LOCATION MAP OF GAUGING STATIONS AND GROUNDWATER INDEX WELLS