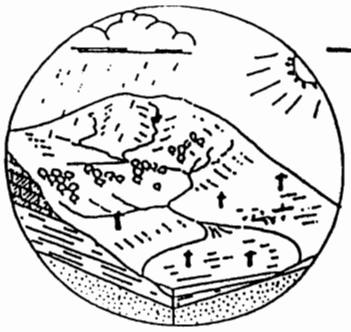
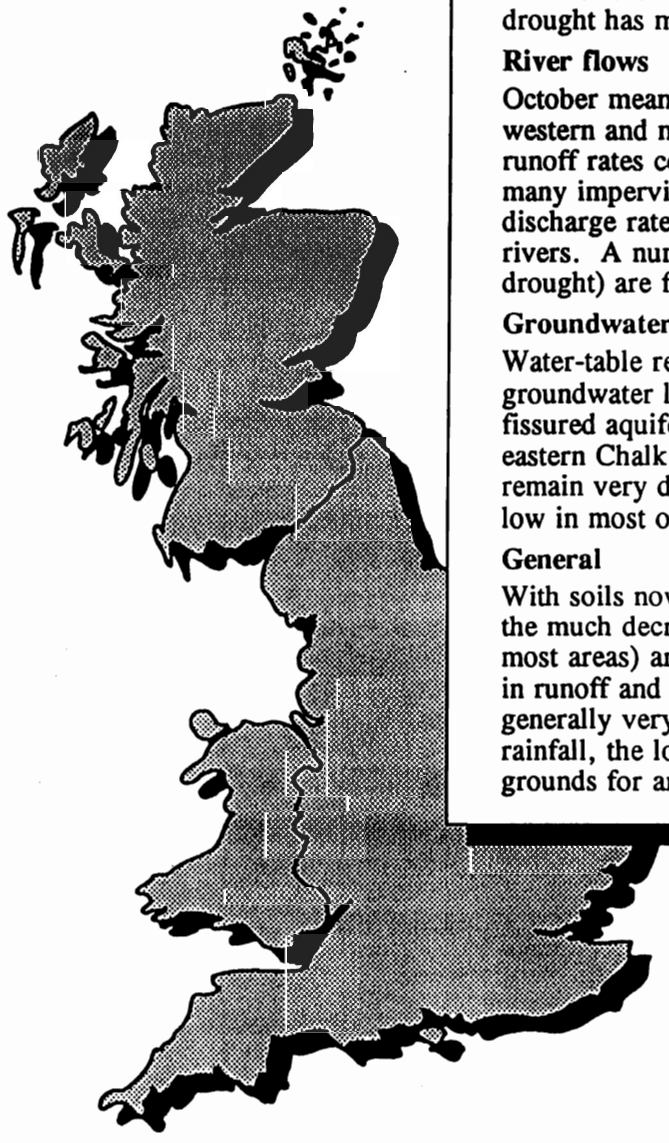
Hydrological Summary for Great Britain





OCTOBER 1992

Rainfall

GB rainfall was above average for the fourth successive month and, importantly, again favoured eastern regions. The period beginning with July has been notably wet in much of the English lowlands and in rainfall terms, the drought has moderated greatly since the early spring.

River flows

October mean flows were below average in much of western and northern Britain but the recent recovery in runoff rates continued in the English lowlands - flows in many impervious catchments were relatively high and discharge rates are also increasing steadily in most Chalk rivers. A number of springs (which failed during the drought) are flowing once more.

Groundwater

Water-table recoveries are underway in most areas. Steep groundwater level increases have been reported from fissured aquifers. But levels in the deeper wells in the eastern Chalk have yet to respond to recent rainfall and remain very depressed. Water-tables are also still very low in most of the Permo-Triassic sandstone outcrops.

General

With soils now wet and evaporation rates in rapid decline the much decreased rainfall deficiencies (since February in most areas) are now translating into a sustained recovery in runoff and recharge rates. Reservoir stocks are generally very health and, given above average winter rainfall, the long recharge season in prospect provides real grounds for an optimistic water resources outlook.

Institute of Hydrology

British Geological Survey

Institute of Hydrology / British Geological Survey
Maclean Building
Crowmarsh Gifford
Wallingford
Oxfordshire
OX10 8BB

HYDROLOGICAL SUMMARY FOR GREAT BRITAIN - October 1992

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. Reservoir contents information has been supplied by the Water Services Companies, the NRA or, in Scotland, the Lothians Regional Council. The most recent areal rainfall figures are derived from a restricted network of raingauges (particularly in Scotland) 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.

Rainfall

October was a cold month characterised by winds from the northern sector. High pressure over the North Atlantic dominated weather patterns until westerly incursions produced more typical conditions towards month end. A relatively dry spell beginning around the 4th of the month lasted, in most areas, until the 20th when a slow-moving depression brought sustained rainfall to southern Britain and heralded a period of very unsettled weather which extended into November.

Relative to the average, October rainfall totals displayed considerable spatial variability. For England and Wales as a whole rainfall was above average, albeit marginally, for the fourth successive month. More importantly the rainfall once again favoured the English lowlands - a recurring pattern since June - and was particularly abundant in some of the areas where the 1988-92 drought achieved its greatest intensity. Rainfall was more than 50% above average in central parts of East Anglia (the Cheshire Plain also). By contrast much of south-western Britain and western Scotland was relatively dry.

The period since the early spring has witnessed a transformation in the meteorological drought throughout much of eastern England. Over the Thames Valley, rainfall has been above average for seven of the last eight months and the provisional July-October rainfall total is the third highest in the last 65 years. Similarly, areal rainfall estimates for the Bedford Ouse catchment suggest that the four-month period is the second wettest such sequence in a record from 1934.

The impact of the wet end to the summer and the unsettled autumn is evident in Table 2 which, on a regional basis, testifies to a large reduction in drought severity since February 1992; in the English lowlands the estimated return periods (RPs) associated with the long term deficiencies have decreased by around an order of magnitude. Notable regional deficiencies in the 32-month timeframe are now confined to Wessex - substantial within-region variations may, however, still be recognised in the east especially. Notwithstanding the relatively dry October in western Scotland, accumulated rainfall totals in the longest timeframes (two to five years) remain remarkably high (but the limited precision of areal rainfall estimates in mountainous areas needs to be considered when assessing the credibility of the return periods quoted in Table 2).

As with a number of very extended droughts, a termination is in prospect well before the long term rainfall deficiencies are fully satisfied. The shortfall since the summer of 1988 is still the equivalent of more than nine months rainfall in parts of eastern England, but the sustained recovery in runoff rates and the early upturn in groundwater levels, which helped to trigger the removal of almost all remaining restrictions on water use, signal also that the drought may be entering its final phase.

Evaporation and Soil Moisture Deficits (SMDs)

Last month was the coldest October since 1974 with average temperatures more than two degrees below average over wide areas - nationwide, the monthly anomaly was estimated to be the greatest for five years. Southern Britain was also generally cloudy but sunshine amounts were significantly above average in northern and western areas. Potential evaporation (PE) losses for October were mostly below average but remain somewhat above the MORECS average for the year thus far. Whilst 1992 PE totals are very modest compared with 1989 and 1990, actual evaporation losses (for grass) in the lowlands have been substantially higher - a reflection of the relatively moist soils throughout 1992; in some areas (e.g. the Lower Trent Valley) the January to October AE losses are the highest in the MORECS series.

October saw the region with soils at, or very close to, field capacity extend across the whole of Great Britain with the exception of a few low-lying areas close to the eastern seaboard. In central parts of East Anglia, end-of-October deficits were 50-70 mm below average and up to 100 mm below mid-autumn SMDs for the previous three years. The wet soils greatly increase the likelihood that groundwater recharge will extend across most of the coming winter; a notable contrast to recent years.

Runoff

Relatively wet soils, declining evaporation rates and above average rainfall throughout most of the drought affected catchments has enabled the declining rainfall deficiencies to translate into substantial recoveries in river flow, especially over the last eight weeks.

October runoff totals declined appreciably relative to September in much of western Britain but remained well within the normal range except in western Scotland where the Luss Water registered its lowest October mean flow (in a 15-year record). In eastern England the improvement in runoff rates in early autumn was consolidated in October especially over the second half of the month. Entering November, flows remained depressed only in rivers sustained largely from groundwater. Even in such catchments a modest increase in baseflows - away from the headwaters - produced October runoff totals well above historical minima. The recent brisk decline in drought severity was clearly demonstrated on the Lee where the October mean flow was more than double that for September and the runoff was the highest for any month since February 1990. Flows were above average throughout the London area and an appreciable discharge was recorded for the Stanstead Springs (at Mountfitchet, Hertfordshire) which dried-up at the end of 1991, for the first time in a 23-year record. In the Cotswolds, the Coln recorded its second highest October runoff in a 31-year record and several flood alerts were called in the Midlands. The Bedford Ouse remained near to spate conditions for much of October and the combined September/October runoff total - around five times the average - is the highest, by a considerable margin, in a flow series from 1933.

Accumulated runoff deficiencies have been substantially reduced in most lowland catchments since July but the relative dryness of some catchments on the periphery of the severe drought zone (in Wessex for example) has resulted in a more subdued seasonal recovery. Generally, the hydrological drought is abating rapidly but annual runoff totals in the lowlands are typically below average and long term accumulations remain remarkably low.

Flood drawdown releases influenced net replenishment in a some western reservoirs (e.g. Clywedog) during October and only modest inflows were registered in parts of south-western England. As in September, valuable replenishment occurred to many lowland reservoirs and, overall, stocks are healthy in all regions. In the Anglian and Thames regions the major impoundments are at 95 per cent of capacity or better, a dramatic improvement compared to the same time in 1991.

Groundwater

Summer evaporation losses and dry soils have caused the recovery in water-tables to lag well behind the initial return of persistently unsettled weather conditions (in the spring). The very uneven pattern of autumn groundwater levels shown on Figure 3 demonstrates that we have entered an important transitional phase for groundwater resources; the full impact of the recent infiltration has yet to be reflected in some areas (and particularly in the deeper Chalk wells). Unusually for the autumn, the recovery in some lowland aquifers (e.g the fissured Lincolnshire Limestone, see below) is outstripping that in some western aquifers.

Groundwater levels are now rising in most aquifers but in eastern Lincolnshire and to the east of a line from the Wash to the Thames Estuary, October levels still showed gentle declines although upturns in some shallow wells have been reported. Despite the onset of infiltration, water-tables in eastern Britain from Northumbria to the Lower Thames Valley and eastern Kent remain very depressed. At the Washpit Farm and Redlands sites, the lowest levels in a 42-year and a 28-year record respectively, have again been achieved. In the Midland Permo-Triassic sandstone belt, the Weeford Flats well remains dry, levels in the Stone borehole are close to the seasonal minimum and even more depressed at the Llanfair DC site. Along the South Coast, water-tables are generally near or rather below the seasonal mean, but in the South-West near minimum. In general therefore, the recovery still has a long way to go before mean levels are achieved over most of Britain.

The Jurassic Limestones, and other fissured aquifers, are notable in that they normally react rapidly to rainfall and subsequent infiltration. The New Red Lion site, in the Lincolnshire Limestone, has shown a large rise in water level to a point approaching the seasonal maximum by 21 October. The Ampney Crucis site, in the Great Oolite of the upper Thames Valley, had shown an almost equally steep rise by 9 October, and may currently be approaching maximum recorded values. Thus it may be assumed that substantial recharge should be taking place to the aquifers that react less rapidly although the effects may not yet be apparent.

At the present time, there is no agreed definition of the end of a groundwater drought. It is suggested that a suitable definition might be for water-tables to reach or surpass seasonal monthly mean levels for two consecutive months. On this basis, the 1988-92 drought is far from at an end but a continuation of recharge through until the late spring of 1993 should, given average rainfall, ensure healthier groundwater resources in most of the drought affected regions than for much the greater part of the last four years.

Institute of Hydrology/British Geological Survey
12 November 1992

TABLE 1 1991/92 RAINFALL AS A PERCENTAGE OF THE 1941-70 AVERAGE

		Oct	Nov	Dec 1991	Jan 1992	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct
England and Wales	mm	77	95	49	48	47	85	75	49	45	87	126	103	90
	%	93	98	54	56	72	144	129	73	74	119	140	124	108
NRA REGIONS														
North West	mm	125	169	119	57	100	142	89	62	31	72	137	114	128
	%	106	140	99	51	123	197	116	76	37	70	110	93	109
Northumbria	mm	75	109	78	33	45	107	103	31	19	61	104	108	84
	%	100	116	104	41	68	206	187	48	31	79	103	137	112
Severn-Trent	mm	55	68	39	59	31	67	50	59	55	87	117	72	73
	%	85	86	56	86	58	129	96	92	98	134	144	107	113
Yorkshire	mm	63	94	62	47	42	96	66	34	33	81	94	98	80
	%	91	106	84	61	66	170	118	56	57	116	104	136	115
Anglian	mm	26	54	24	45	17	63	43	48	34	89	82	92	72
	%	50	87	45	87	40	158	108	102	69	156	128	176	138
Thames	mm	36	66	16	28	25	52	65	60	39	77	107	89	76
	%	56	90	24	45	53	113	141	107	75	128	153	144	118
Southern	mm	51	81	23	18	33	59	84	30	26	75	105	73	81
	%	65	86	28	24	58	113	175	55	52	127	144	102	103
Wessex	mm	83	72	30	36	39	57	81	24	49	64	127	94	50
	%	101	74	33	43	66	98	150	35	91	103	155	119	61
South West	mm	123	112	52	44	69	75	100	31	23	83	171	100	96
	%	109	84	39	34	77	89	141	37	35	99	169	96	85
Welsh	mm	154	142	65	76	80	129	91	80	48	93	212	112	100
	%	119	99	45	56	83	148	107	88	59	98	178	89	77
Scotland	mm	165	227	141	139	167	208	123	80	52	103	217	187	148
	%	111	160	90	101	161	226	137	88	57	92	168	136	99
RIVER PURIFICATION BOARDS														
Highland	mm	193	305	166	197	229	248	138	105	46	97	250	77	144
	%	104	180	85	120	172	218	121	102	42	76	169	112	
North-East	mm	120	133	53	67	52	113	68	57	50	48	128	113	107
	%	124	129	52	74	70	182	111	74	71	52	120	130	110
Tay	mm	155	154	97	117	111	172	90	57	30	78	197	152	92
	%	127	129	72	99	121	210	120	60	36	76	167	132	76
Forth	mm	111	124	108	110	111	164	76	45	25	67	174	156	80
	%	105	115	99	111	144	238	112	54	33	68	150	144	75
Tweed	mm	101	127	92	63	70	138	98	52	27	60	151	126	80
	%	115	122	102	68	101	238	161	68	40	67	132	135	91
Solway	mm	172	203	162	91	140	206	144	66	30	99	214	166	114
	%	119	140	107	65	151	226	164	72	33	90	165	110	79
Clyde	mm	193	274	208	170	231	267	144	93	41	123	270	195	135
	%	105	164	112	106	204	254	140	96	40	95	190	111	74

Note: The most recent monthly rainfall figures correspond to the MORECS areal assessments derived by the Meteorological Office. The regional areal rainfall figures are regularly updated (normally one or two months in arrears) using figures derived from a far denser raingauge network.

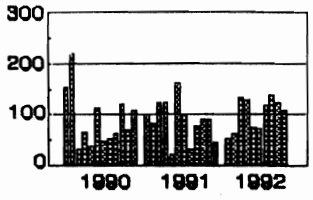
TABLE 2 RAINFALL RETURN PERIOD ESTIMATES

		Jan - Oct92		Mar - Oct92		Mar90-Oct92		Aug88-Oct92	
		Est Return Period, years		Est Return Period, years		Est Return Period, years		Est Return Period, years	
England and Wales	mm	753		658		2106		3528	
	% LTA	104	<5	115	<5	88	10-20	90	10-20
NRA REGIONS									
North West	mm	932		775		2909		4935	
	% LTA	96	<5	99	<5	90	5	94	<5
Northumbria	mm	696		618		2120		3336	
	% LTA	98	<5	110	<5	91	5-10	88	20-30
Severn Trent	mm	670		580		1787		2976	
	% LTA	107	<5	116	<5	87	10-20	90	10-20
Yorkshire	mm	664		575		1885		3111	
	% LTA	99	<5	109	<5	86	10-20	87	20-30
Anglian	mm	584		522		1399		2256	
	% LTA	118	5-10	130	15-20	86	10-20	87	20-30
Thames	mm	618		565		1567		2627	
	% LTA	109	<5	124	5-10	84	15-25	87	20-30
Southern	mm	583		532		1728		2879	
	% LTA	94	<5	109	<5	83	20-30	85	30-40
Wessex	mm	621		546		1847		3224	
	% LTA	91	<5	101	<5	81	30-40	87	15-25
South West	mm	793		680		2627		4632	
	% LTA	86	5-10	96	<5	85	15-25	91	5-10
Welsh	mm	1020		864		3085		5342	
	% LTA	98	<5	106	<5	89	10	94	5
Scotland	mm	1424		1118		4267		7047	
	% LTA	126	50-100	125	15-20	114	40-80	115	>200
RIVER PURIFICATION BOARDS									
Highland	mm	1631		1205		5214		8750	
	% LTA	120	15-20	114	5-10	116	50-100	119	>>200
North-East	mm	803		684		2536		3987	
	% LTA	98	<5	105	<5	94	<5	91	10-20
Tay	mm	1096		868		3363		5727	
	% LTA	109	<5	110	<5	102	<5	107	5-10
Forth	mm	1007		786		3082		5119	
	% LTA	112	5-10	109	5-10	104	5-10	107	5-10
Tweed	mm	865		723		2612		4133	
	% LTA	107	<5	113	5-10	98	<5	96	<5
Solway	mm	1278		1039		3843		6422	
	% LTA	113	5-10	116	5-10	103	<5	105	<5
Clyde	mm	1669		1268		5132		8502	
	% LTA	127	30-50	122	10-20	117	50-100	119	>>200

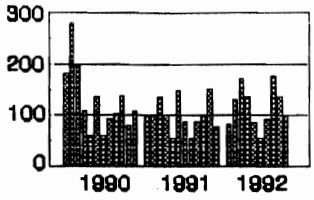
Return period assessments are based on tables provided by the Meteorological Office*. These assume a start in a specified month; return periods for a start in any month may be expected to be an order of magnitude less - for the longest durations the return period estimates converge. "Wet" return periods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

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

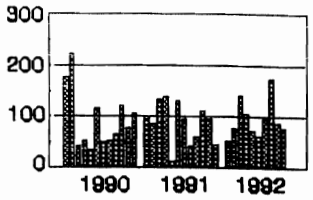
FIGURE 1. MONTHLY RAINFALL FOR 1990-1992 AS A PERCENTAGE OF THE 1941-1970 AVERAGE



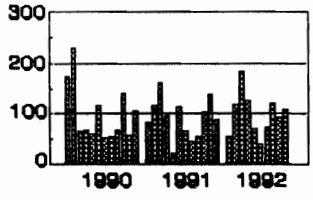
England and Wales



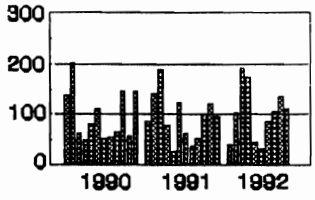
Scotland



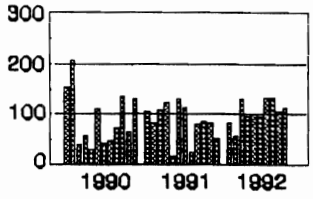
Welsh Region



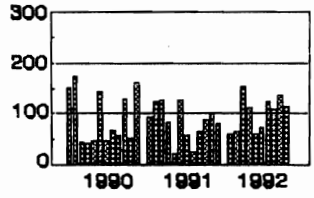
North West Region



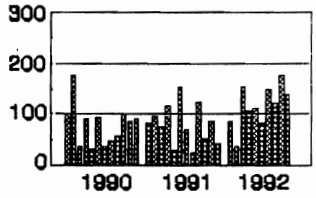
Northumbria Region



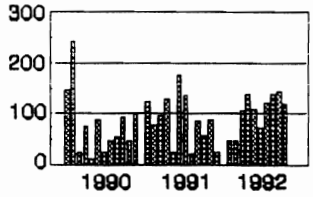
Severn-Trent Region



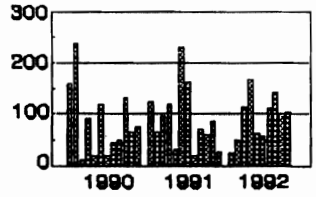
Yorkshire Region



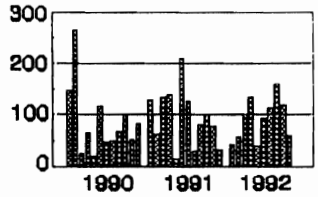
Anglian Region



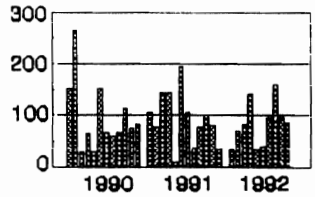
Thames Region



Southern Region

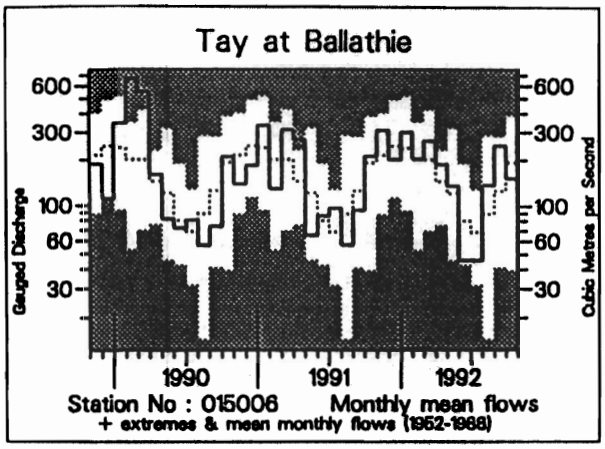


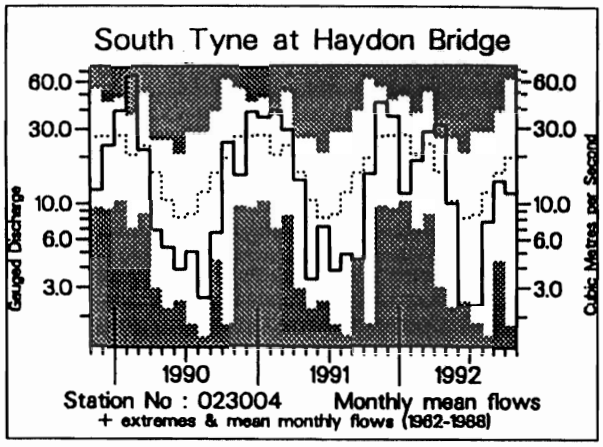
Wessex Region

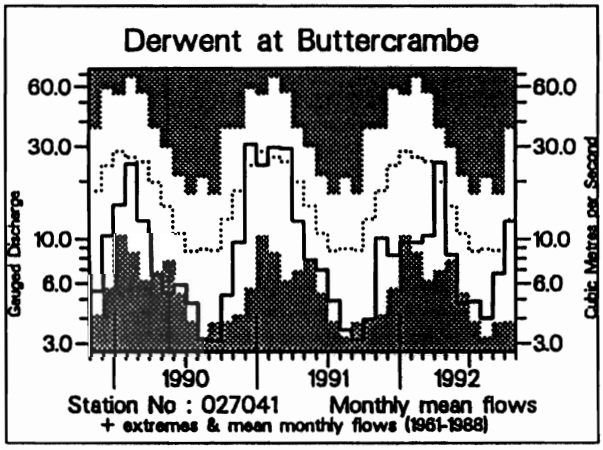


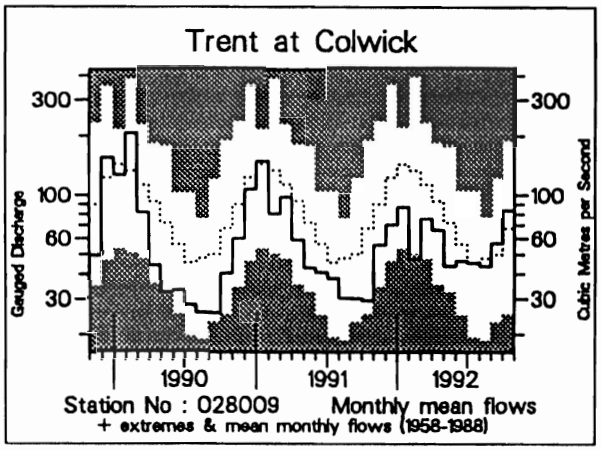
South West Region

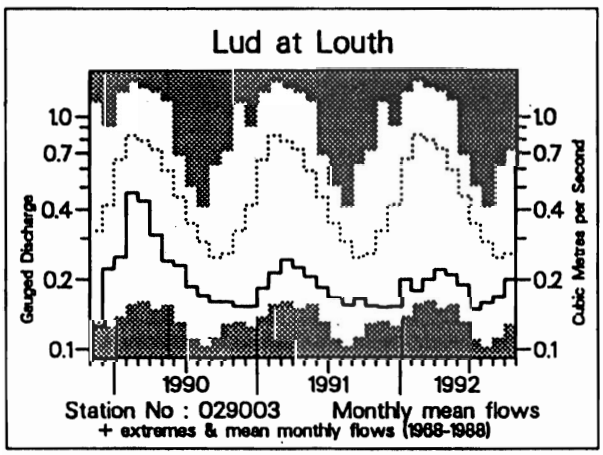
FIGURE 2 MONTHLY RIVER FLOW HYDROGRAPHS

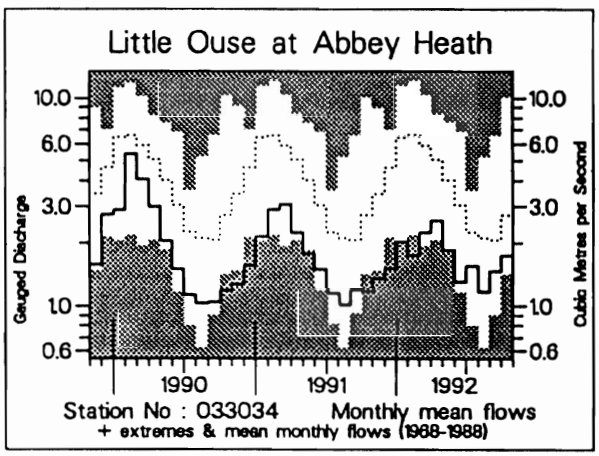


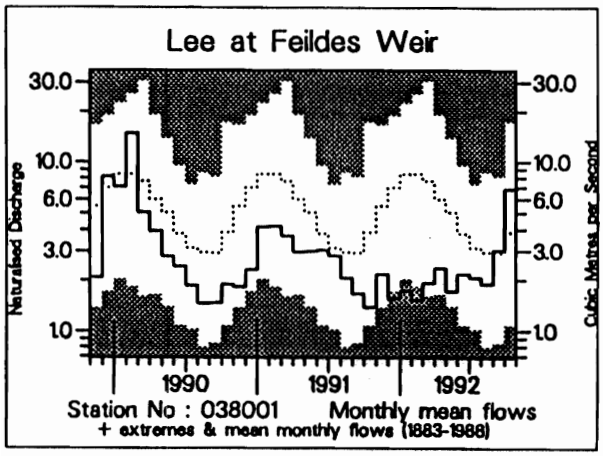


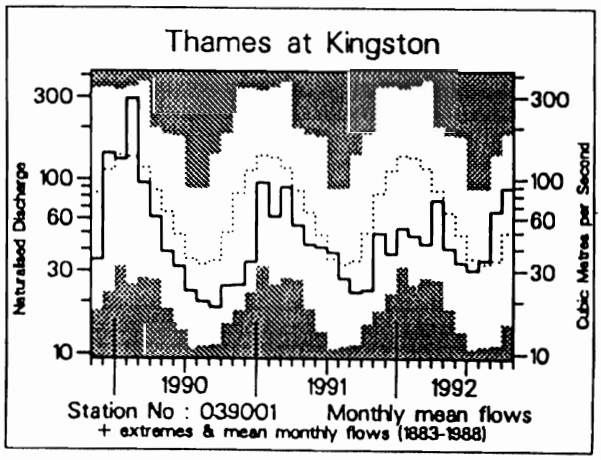


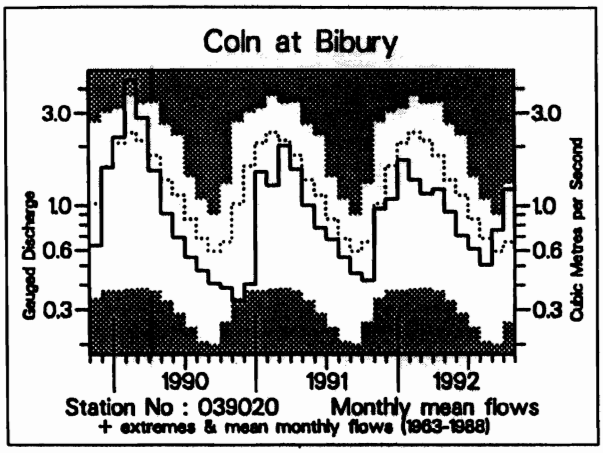








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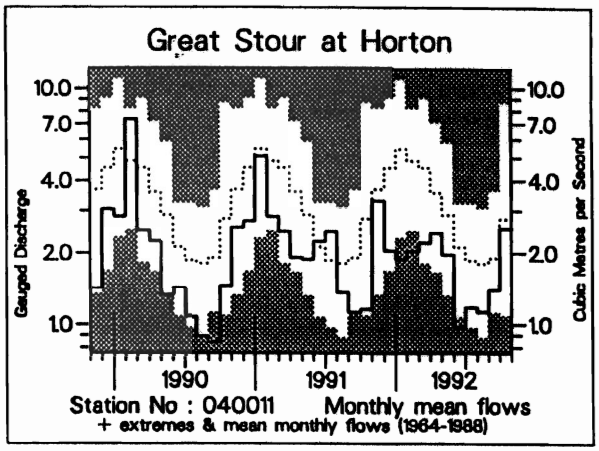
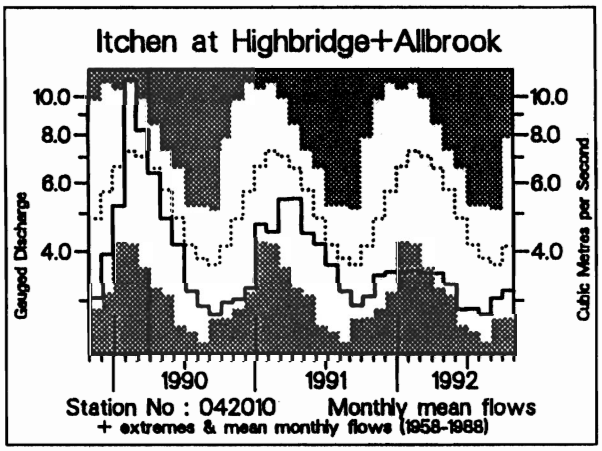
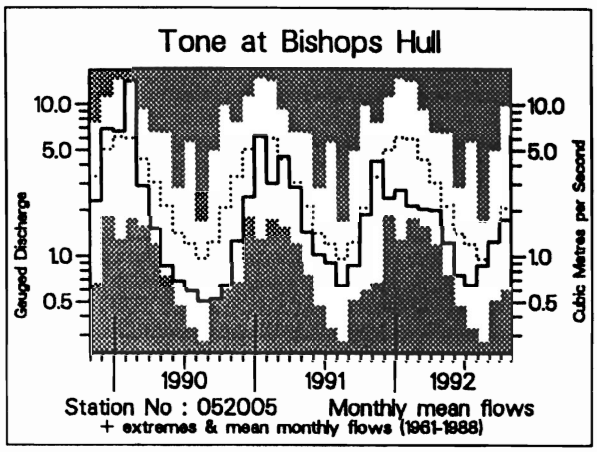
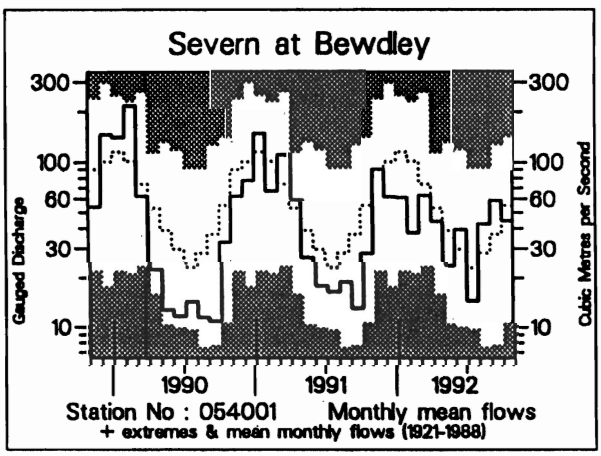
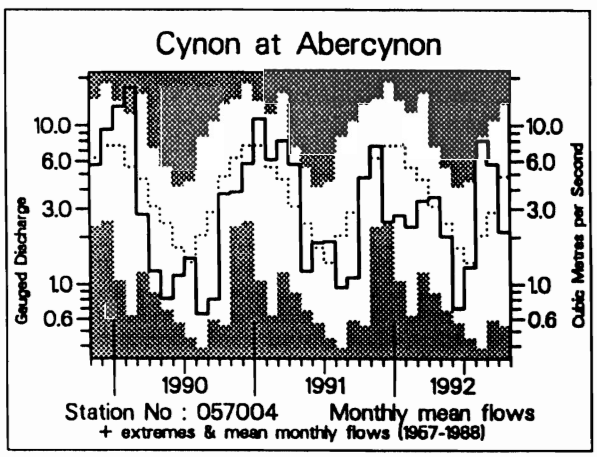
3.0
1.0
0.6
0.3
Gauged Discharge
Cubic Metres per Second
1990
1991
1992
Station No : 039020 Monthly mean flows
+ extremes & mean monthly flows (1963-1988)

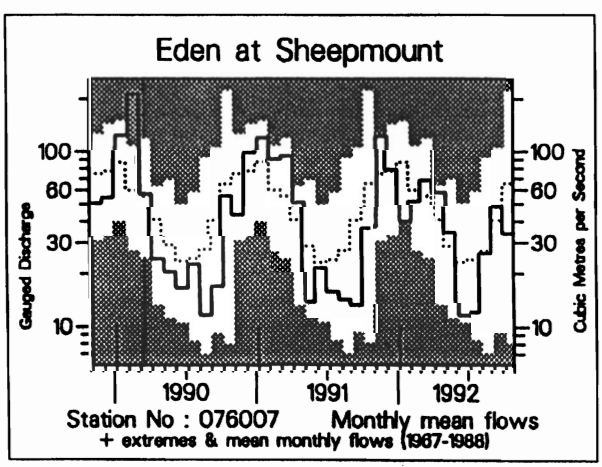

Great Stour at Horton
10.0
7.0
4.0
2.0
1.0
Gauged Discharge
Cubic Metres per Second
1990
1991
1992
Station No : 040011 Monthly mean flows
+ extremes & mean monthly flows (1964-1988)


Itchen at Highbridge+Allbrook
10.0
8.0
6.0
4.0
Gauged Discharge
Cubic Metres per Second
1990
1991
1992
Station No : 042010 Monthly mean flows
+ extremes & mean monthly flows (1958-1988)


Tone at Bishops Hull
10.0
5.0
1.0
0.5
Gauged Discharge
Cubic Metres per Second
1990
1991
1992
Station No : 052005 Monthly mean flows
+ extremes & mean monthly flows (1961-1988)


Severn at Bewdley
300
100
60
30
10
Gauged Discharge
Cubic Metres per Second
1990
1991
1992
Station No : 054001 Monthly mean flows
+ extremes & mean monthly flows (1921-1988)


Cynon at Abercynon
10.0
6.0
3.0
1.0
0.6
Gauged Discharge
Cubic Metres per Second
1990
1991
1992
Station No : 057004 Monthly mean flows
+ extremes & mean monthly flows (1957-1988)


Eden at Sheepmount
100
60
30
10
Gauged Discharge
Cubic Metres per Second
1990
1991
1992
Station No : 076007 Monthly mean flows
+ extremes & mean monthly flows (1967-1988)

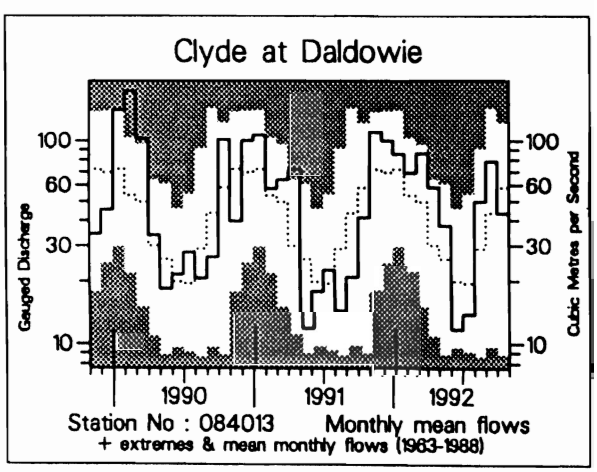

Clyde at Daldowie
100
60
30
10
Gauged Discharge
Cubic Metres per Second
1990
1991
1992
Station No : 084013 Monthly mean flows
+ extremes & mean monthly flows (1963-1988)

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	Jun 1992	Jul 1992	Aug 1992	Sep 1992	Oct 1992		8/92 to 10/92		1/92 to 10/92		5/90 to 10/92		11/88 to 10/92	
	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
Earn at Kinkell Bridge	14 35	16 42	95 173	193 249	110 94	21 /45	397 157	38 /44	1076 124	37 /43	2769 104	25 /39	5204 116	30 /36
Whiteadder Water at Hutton Castle	9 53	8 63	12 78	19 123	32 118	17 /24	63 107	14 /23	276 89	7 /23	840 93	8 /21	1185 75	4 /20
South Tyne at Haydon Bridge	8 30	8 28	28 72	48 95	41 59	7 /31	117 73	8 /29	477 85	8 /29	1655 92	8 /25	2766 90	5 /23
Derwent at Buttercrambe	8 48	8 57	7 49	11 82	21 105	20 /32	39 82	12 /31	158 62	3 /31	508 67	3 /29	811 61	1 /28
Trent at Colwick	16 85	16 101	16 97	20 121	30 130	26 /35	65 117	26 /34	209 75	3 /34	586 71	2 /32	1081 76	2 /31
Lud at Louth	9 45	7 44	8 60	8 72	10 84	12 /25	25 71	7 /25	90 41	2 /24	264 45	1 /22	500 49	1 /21
V ım at Claypole Mill	6 62	7 100	5 73	11 179	23 274	31 /34	38 176	30 /34	108 71	9 /33	264 63	4 /32	492 67	2 /30
Little Ouse at Abbey Heath	5 47	6 73	4 53	5 69	7 72	9 /25	17 68	6 /25	66 48	2 /24	185 47	1 /23	397 59	1 /21
Lee at Feildes Weir (natr.)	5 53	5 62	5 66	8 111	18 182	95 /108	30 122	82 /107	64 49	8 /106	187 49	5 /103	419 65	6 /100
Thames at Kingston (natr.)	9 71	8 84	9 103	17 191	24 180	94 /110	50 162	96 /110	136 70	24 /110	347 62	5 /108	710 72	5 /106
Coln at Bibury	17 64	15 72	13 78	18 128	30 189	29 /30	61 130	25 /29	249 76	5 /29	651 71	2 /27	1222 77	2 /26
Great Stour at Horton	7 45	9 63	9 67	11 81	20 99	20 /29	39 83	10 /28	135 59	1 /26	439 64	1 /23	749 64	1 /19
Itchen at Highbridge+Allbrook	20 58	21 69	20 71	22 84	24 80	8 /35	66 79	4 /34	235 62	1 /34	787 71	1 /32	1388 75	1 /31
Piddle at Baggs Mill	17 73	15 84	14 90	17 113	17 83	15 /30	48 94	17 /29	207 63	3 /28	667 72	1 /25	1231 76	1 /22
Exe at Thorverton	13 55	15 71	47 169	61 161	63 85	19 /37	170 121	26 /37	440 74	4 /36	1503 80	4 /35	2688 81	1 /33
T tt Uniberleigh	8 51	7 46	30 164	38 162	49 79	21 /35	116 113	23 /34	318 67	3 /34	1206 78	4 /32	2273 83	2 /31
Tone at Bishops Hull	10 57	8 52	11 90	16 106	23 87	20 /32	50 94	19 /32	200 56	2 /31	687 65	1 /30	1433 75	1 /28
Severn at Bewdley	24 138	9 64	26 152	35 163	28 84	36 /72	89 123	53 /72	261 78	13 /71	802 78	8 /70	1501 83	7 /68
Wye at Cefn Brwyn	41 48	44 40	214 149	204 125	179 86	16 /40	596 119	29 /38	1517 100	17 /35	4675 95	10 /26	7814 /95	5 /20
Cynon at Abercynon	17 42	32 93	199 408	140 213	55 45	10 /35	393 162	29 /33	790 88	9 /33	2546 89	8 /29	4746 95	12 /27
Dee at New Inn	40 68	29 43	160 178	156 120	123 62	5 /24	439 105	12 /24	1167 89	8 /23	3626 85	2 /21	6393 88	1 /20
Eden at Sheepmount	13 51	14 52	31 104	55 132	40 55	5 /23	125 92	13 /22	440 86	6 /22	1533 97	8 /18	2713 100	8 /15
Clyde at Daldowie	16 61	19 69	70 176	107 189	61 74	11 /30	237 132	24 /29	736 128	27 /29	2109 116	25 /27	3574 117	24 /26

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 as rank 1.
(iii) %LT means percentage of long term average from the start of the record to 1991. For the long periods (at the right of this table), the end date for the long term is 1991.

TABLE 4 START-MONTH RESERVOIR STORAGES UP TO NOVEMBER 1992

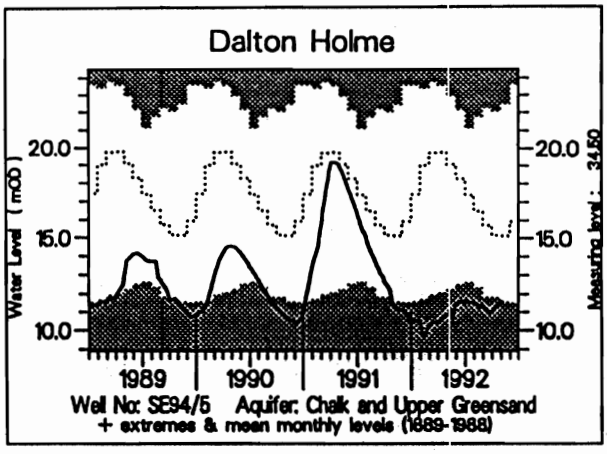
Area	Reservoir (R)/ Group (G)		Capacity● (Ml)	1992 Jun	Jul	Aug	Sep	Oct	Nov	1991 Nov
North West	Northern Command Zone[1]	(G)	133375	86	66	55	60	66	64	59
	Vyrnwy	(R)	55146	94	89	80	96	93	81	48
Northumbria	Teesdale[2]	(G)	87936	89	71	58	63	68	79	68
	Kielder	(R)	199175*	90*	86*	77*	84*	89*	87*	70*
Severn-Trent	Clywedog	(R)	44922	97	93	85	87	92	86	67
	Derwent Valley[3]	(G)	39525	91	79	73	66	62	79	43
Yorkshire	Washburn[4]	(G)	22035	95	85	72	64	64	70	38
	Bradford supply[5]	(G)	41407	91	76	58	56	65	65	52
Anglian	Grafham	(R)	58707	96	95	95	94	94	95	59
	Rutland	(R)	130061	82	81	81	86	93	95	61
Thames	London[6]	(G)	206232	93	86	85	89	94	96	52
	Farmoor [7]	(G)	13843	98	98	97	99	99	99	53
Southern	Bewl	(R)	28170	73	71	64	60	68	69	40
	Ardingly	(R)	4730	100	100	88	71	79	81	55
Wessex	Clatworthy	(R)	5364*	77*	65*	43*	35*	40*	49*	41
	Bristol WW [8]	(G)	38666*	80*	71*	61*	58*	65*	61*	39*
South West	Colliford	(R)	28540	80	71	66	63	65	67	70
	Roadford	(R)	34500	91	83	75	70	72	76	55
	Wimbleball[9]	(R)	21320	76	63	53	48	50	55	33
	Stithians	(R)	5205	69	61	54	53	63	69	18
Welsh	Celyn + Brenig	(G)	131155	100	99	87	89	93	96	64
	Brianne	(R)	62140	97	88	77	90	99	100	80
	Big Five[10]	(G)	69762	92	77	66	83	86	87	41
	Elan Valley[11]	(G)	99106	96	91	87	100	100	100	71
Lothian	Edinburgh/Mid Lothian	(G)	97639	98	87	79	86	92	90	77
	West Lothian	(G)	5613	76	60	49	60	82	84	53
	East Lothian	(G)	10206	91	81	72	68	78	82	67

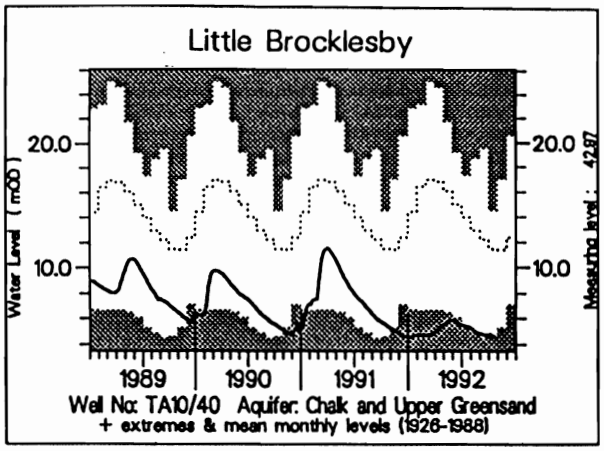
● Live or usable capacity (unless indicated otherwise)
* Gross storage/percentage of gross storage

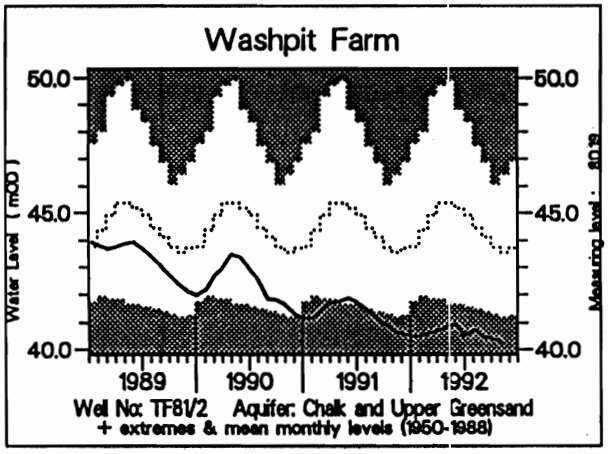
1. Includes Haweswater, Thirlmere, Stocks and Barnacre.
2. Cow Green, Selset, Grassholme, Balderhead, Blackton and Hury.
3. Howden, Derwent and Ladybower.
4. Swinsty, Fewston, Thruscross and Eccup.
5. The Nidd/Barden group (Scar House, Angram, Upper Barden, Lower Barden and Chelker) plus Grimwith.
6. 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. Shared between South West (river regulation for abstraction) and Wessex (direct supply).
10. Usk, Talybont, Llandegfedd (pumped storage), Taf Fechan, Taf Fawr.
11. Claerwen, Caban Coch, Pen y Garreg and Craig Goch.

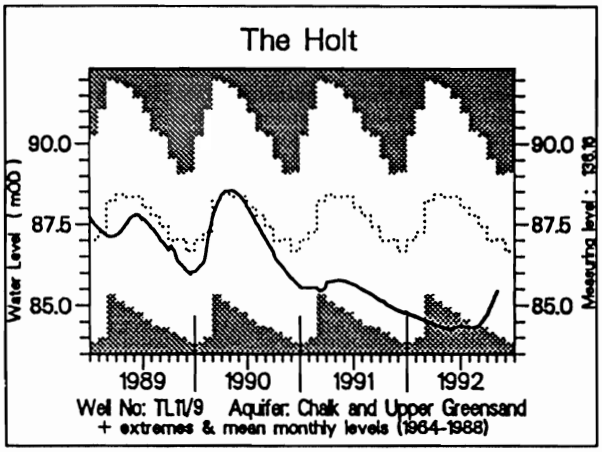
Note: Variations in storage depend on the balance between inputs (from catchment rainfall and any pumping) and outputs (to supply, compensation flow, HEP, amenity). There will be additional losses due to evaporation, especially in the summer months. Operational strategies for making the most efficient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

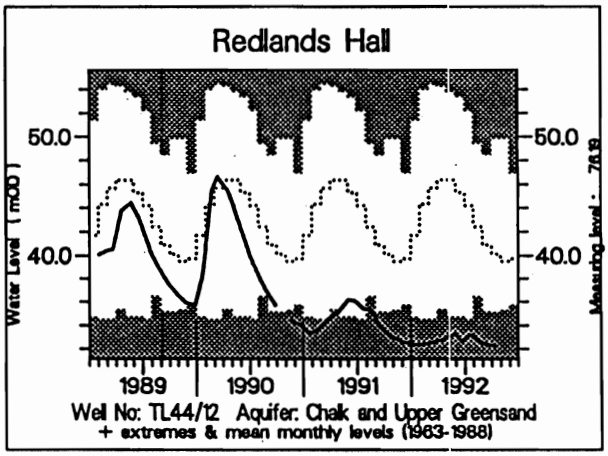
FIGURE 3 GROUNDWATER LEVEL HYDROGRAPHS

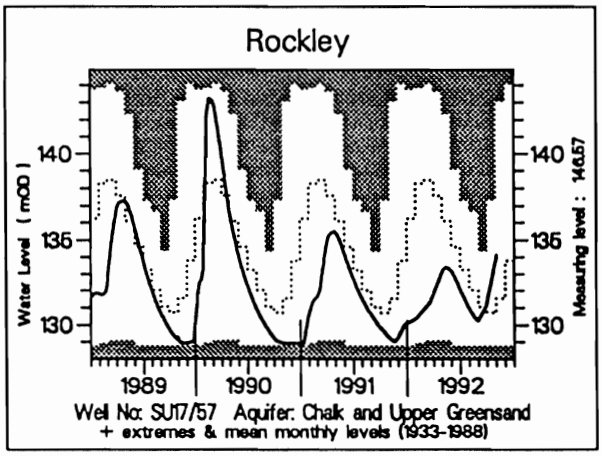


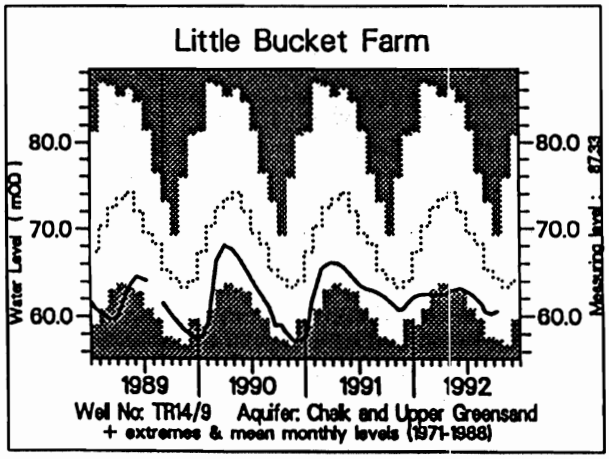


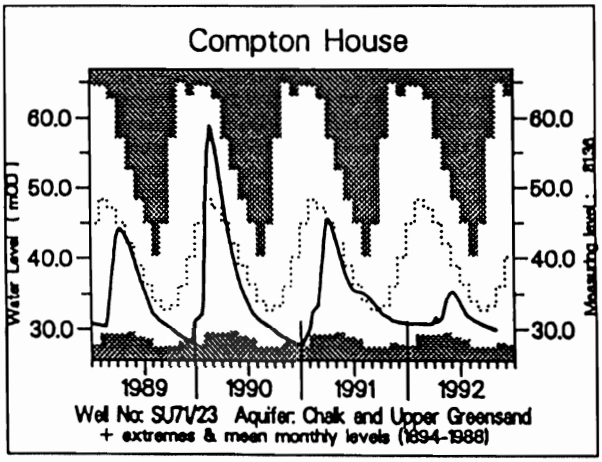


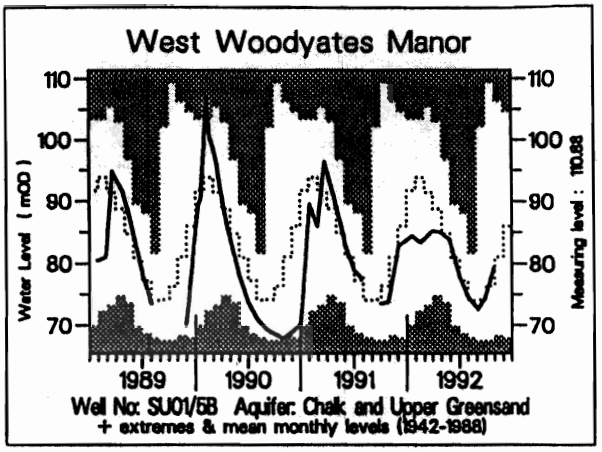


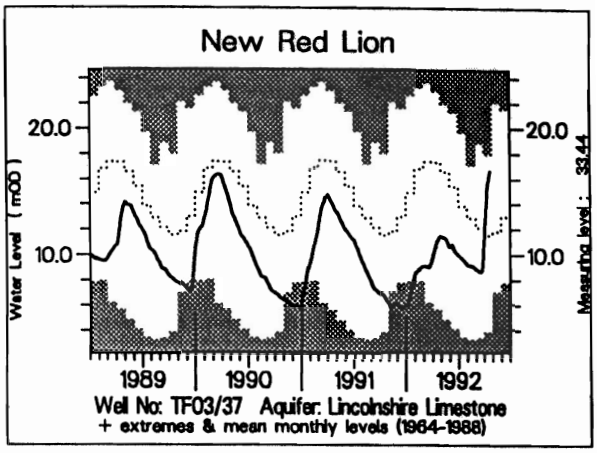


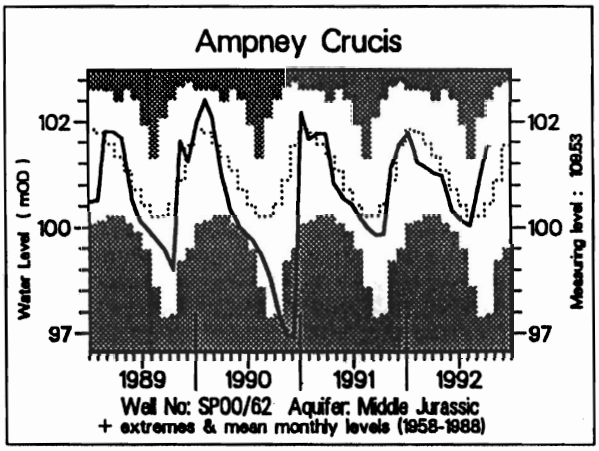


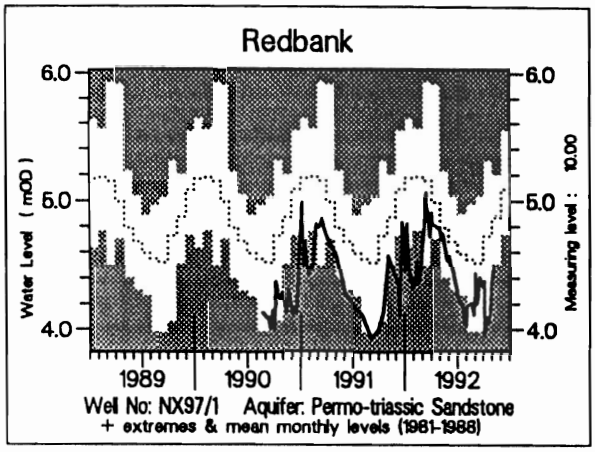


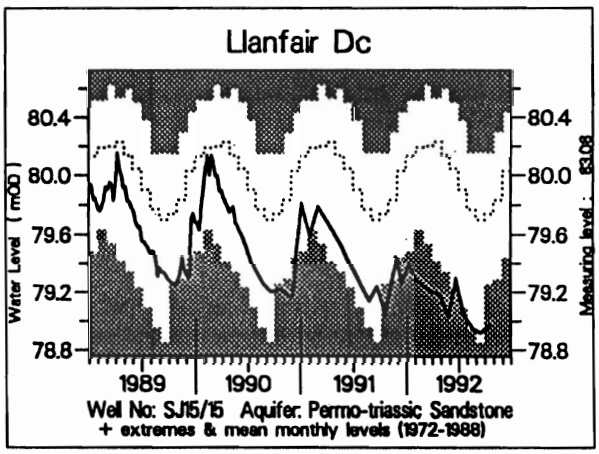


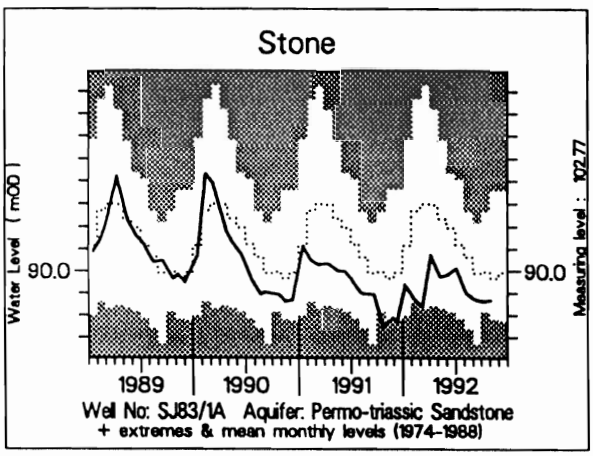

West Woodyates Manor
Water Level (mOD)
Measuring level : 110.68
110
100
90
80
70
1989
1990
1991
1992
Well No: SU01/5B Aquifer: Chalk and Upper Greensand
+ extremes & mean monthly levels (1942-1988)

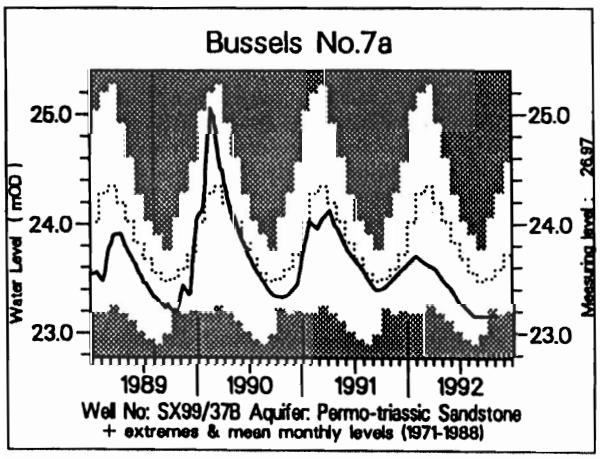

New Red Lion
Water Level (mOD)
Measuring level : 33.44
20.0
10.0
1989
1990
1991
1992
Well No: TF03/37 Aquifer: Lincolnshire Limestone
+ extremes & mean monthly levels (1964-1988)


Ampney Crucis
Water Level (mOD)
Measuring level : 109.53
102
100
97
1989
1990
1991
1992
Well No: SP00/62 Aquifer: Middle Jurassic
+ extremes & mean monthly levels (1958-1988)


Redbank
Water Level (mOD)
Measuring level : 10.00
6.0
5.0
4.0
1989
1990
1991
1992
Well No: NX97/1 Aquifer: Permo-triassic Sandstone
+ extremes & mean monthly levels (1981-1988)


Llanfair Dc
Water Level (mOD)
Measuring level : 63.08
80.4
80.0
79.6
79.2
78.8
1989
1990
1991
1992
Well No: SJ15/15 Aquifer: Permo-triassic Sandstone
+ extremes & mean monthly levels (1972-1988)


Stone
Water Level (mOD)
Measuring level : 102.77
90.0
1989
1990
1991
1992
Well No: SJ83/1A Aquifer: Permo-triassic Sandstone
+ extremes & mean monthly levels (1974-1988)


Bussels No.7a
Water Level (mOD)
Measuring level : 26.97
25.0
24.0
23.0
1989
1990
1991
1992
Well No: SX99/37B Aquifer: Permo-triassic Sandstone
+ extremes & mean monthly levels (1971-1988)

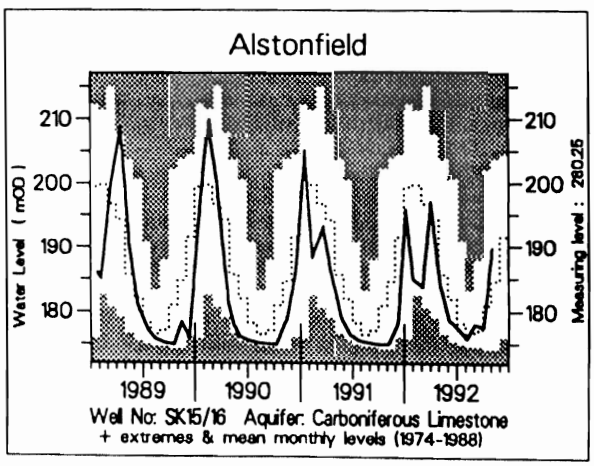

Alstonfield
Water Level (mOD)
Measuring level : 280.25
210
200
190
180
1989
1990
1991
1992
Well No: SK15/16 Aquifer: Carboniferous Limestone
+ extremes & mean monthly levels (1974-1988)

TABLE 5 A COMPARISON OF OCTOBER GROUNDWATER LEVELS : 1992, 1991 AND 1976

Site	Aquifer	Records commence	Average October Level	October 1976		October 1991		October November 1992		No of years Oct/level <1992	Lowest pre-1992 level (any month)
				Day	Level	Day	Level	Day	Level		
Wetwang	C & UGS	1971	19.57	01/10	18.16	30/10	17.49	02/11	18.79	7	16.84
Dalton Holme	C & UGS	1889	15.12	30/10	12.62	28/10	11.58	04/11	11.56	1	10.34
Little Brocklesby	C & UGS	1926	11.04	01/10	4.58	30/10	5.26	20/10	4.59	1	4.54
Washpit Farm	C & UGS	1950	43.54	01/10	41.50	01/10	41.01	02/11	40.30	0	40.61
The Holt	C & UGS	1964	87.18	27/10	84.22	27/10	85.00	02/11	85.44	5	83.90
Therfield Rectory	C & UGS	1883	78.96	25/10	72.92	27/10	72.67	01/11	dry	-	dry (below 71.60)
..lands Farm	C & UGS	1964	39.86	01/10	35.40	18/10	33.18	09/10	32.29	0	32.46
Rockley	C & UGS	1933	130.72	31/10	dry	27/10	129.34	31/10	134.12	>10	dry (below 128.94)
Little Bucket Farm	C & UGS	1971	63.74	no	levels	31/10	61.20	14/10	60.59	4	56.77
Compton House	C & UGS	1894	33.47	28/10	29.17	29/10	31.68	28/10	30.01	8	27.64
Chilgrove House	C & UGS	1836	41.99	30/10	38.64	31/10	40.04	28/10	37.92	>10	33.46
West Dean No 3	C & UGS	1940	1.58	22/10	1.70	25/10	1.44	30/10	1.63	>10	1.01
Lime Kiln Way	C & UGS	1969	124.95	15/10	124.14	09/10	124.38	08/10	123.75	0	124.09
Ashton Farm	C & UGS	1974	65.21	19/10	64.79	28/10	65.70	28/10	64.66	6	63.10
West Woodyates	C & UGS	1942	75.81	19/10	75.33	28/10	73.74	28/10	79.37	>10	67.62
New Red Lion	LLst	1964	11.58	29/10	5.79	31/10	6.13	21/10	16.63	>10	3.29
Ampney Crucis	Mid Jur	1958	100.59	31/10	101.57	14/10	99.84	09/10	101.90	>10	97.38
Dunmurry (NI)	PTS	1985	28.24	no	levels	31/10	27.79	23/10	27.91	4	27.47
..bank	PTS	1981	4.78	no	levels	18/10	4.14	31/10	4.45	4	3.93
Skirwith	PTS	1978	129.98	no	levels	31/10	129.88	30/10	129.70	2	129.44
Llanfair DC	PTS	1972	79.64	01/10	79.28	14/10	79.05	16/10	78.98	0	78.85
Morris Dancers	PTS	1969	32.57	19/10	31.83	15/10	32.03	12/10	31.88	1	30.87
Stone	PTS	1974	90.04	22/10	89.67	23/10	89.50	03/11	89.74	4	89.34
Bussels 7A	PTS	1972	23.51	26/10	24.07	09/10	23.41	27/10	23.16	0	22.90
Rushyford NE	MgLst	1967	75.87	26/10	67.27	15/10	75.11	13/10	74.51	>10	64.77
Peggy Ellerton	MgLst	1968	34.18	25/10	32.48	07/10	33.03	08/10	31.46	0	31.10
Alstonfield	CLst	1974	181.72	21/10	185.26	15/10	175.00	04/11	189.61	>10	174.22

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 4 LOCATION MAP OF GAUGING STATIONS AND GROUNDWATER INDEX WELLS