HYDROLOGICAL SUMMARY FOR GREAT BRITAIN
FEBRUARY 1990

Data for this review 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. The recent areal rainfall figures are derived from a restricted network of raingauges and a significant proportion of the river flow data is of a provisional nature.

Flood warning and alleviation duties were priority activities in February; consequently, data for some rivers are incomplete and the monthly runoff figures may require revision in the event of station re-calibration following the recent high flows. For a fuller appreciation of the water resources impact of the drought, this hydrological review should be considered alongside assessments of the current reservoir storage and water demand situations in each region.

SUMMARY

In all but a few isolated localities along the eastern seaboard of northern Britain the transformation in hydrological conditions which began around the second week of December reached a climax in February. Rainfall in the first half of the month was extremely heavy resulting in remarkable rates of river runoff and aquifer recharge. Although a number of droughts - notably those of 1959, 1976 and 1984 - have been followed by notably wet spells there are very few modern parallels to the dramatic improvement in water resources over the last three months; by the end of February, the outlook was reassuring in all but a few very restricted areas.

The elimination of soil moisture deficits in late December and early January left many catchments vulnerable to significant precipitation and the abundant February rainfall caused very widespread flooding up to mid-month. Although recessions subsequently became well established, mean river flows exceeded previous February maxima in many catchments; a substantial proportion registered their highest mean flow for any month. Infiltration rates were also unprecedented in some areas and generally the groundwater situation is much improved. Exceptional recoveries in groundwater levels were reported in parts of the South and healthy upturns were also recorded throughout most parts of those eastern aquifers which had registered extremely depressed levels through much of the autumn and early winter.

Provisional rainfall figures suggest that the 1989/90 winter (December-February) rainfall total for Great Britain is the third highest in a record extending back to 1869. This follows a notable drought which afflicted much of eastern and southern Britain; for England and Wales the 13-month sequence beginning in November 1988 was the third driest such period this century. The change in hydrological conditions and the associated improvement in water resources fully reflect the extraordinary contrast in weather patterns between the last 12 weeks and the preceding 12 months or so. Where, as in parts of Kent and Yorkshire, recoveries in runoff rates and groundwater levels have been generated from an extremely low base, the recent brisk increases have still left flows and water tables significantly below the end-of-winter average.

RAINFALL

In most regions, dry interludes during February were rare as a sequence of very active frontal systems brought boisterous - occasionally violent - weather across the British Isles. Rainfall totals for February were above average in all regions, often greatly so. Great Britain registered its highest February rainfall total in a record extending back to 1869. For England and Wales, it was the second wettest February in the last 40 years, behind 1977, with a number of southern and western areas registering over three times the monthly mean. In some central and southern districts, rainfall over the 12 weeks ending on the 28th February exceeded 50 per cent of the mean **annual** figure for 1941-70. In Scotland, rain-shadow effects were less influential than earlier in the winter but, nonetheless, a few very restricted localities along the eastern seaboard registered just below average rainfall totals. A minority of these localities have recorded below average rainfalls in all but one or two months since October 1988. Such districts stand out as rather bizarre anomalies when set against precipitation throughout the rest of Scotland. For Scotland as a whole the February rainfall total easily eclipsed the record established last year. The relatively dry December, however, caused the three-month winter total to rank second behind 1988/89 in the record from 1876.

Winter rainfall totals were noteworthy throughout the UK - only the exceptionally wet winter of 1914/15 recorded a higher Great Britain precipitation total this century. England and Wales recorded its third wettest winter in a rainfall series which begins in 1767. All of the National Rivers Authority regions registered winter totals well above the long-term mean. In the context of the runoff data presented in this report perhaps the most significant of a plethora of statistics testifying to the exceptional nature of the climatic conditions experienced in recent months relates to the combined January and February rainfall total for Scotland. Provisional figures indicate that it was the second highest two-month rainfall total (after November/December 1986) ever recorded. Return periods relating to the December-February period are given in Table 2.

Whilst in many eastern areas there was no realistic prospect of the long term rainfall deficiencies being fully satisfied before the spring, the rainfall over the winter period was of sufficient magnitude to reduce almost all the regional drought assessments to moderate at worst; the return period for the 16-month rainfall total for Northumbria is of the order of 20 years. On a more local level, some accumulated deficiencies - especially those extending beyond 12 months - remain significant. Rainfall in the North East River Purification Board area since October 1988, for instance, has been only 75% of the average (corresponding to a return period in excess of 100 years). By comparison, the corresponding figure for the Highland River Purification Board areas around 120% - testimony the very persistent variations in rainfall. The effect of the long-running exaggeration in the normal west to east rainfall gradient, especially in northern Britain, needs to be appreciated when considering the regional rainfall figures presented in Table 2.

SOIL MOISTURE DEFICITS

Soil moisture deficits displayed a similar pattern to that established in January. Soils throughout Great Britain - with the exception only of the eastern coastal fringe - stood at field capacity throughout February; zero deficits obtained even in those parts of southern and eastern England where modest SMDs normally persist late into the winter. Minor deficits developed over the last week of February in some eastern districts. Mostly these were unremarkable but the MORECS square embracing St Abbs Head continued its lengthy sequence of notable SMDs (>50 mm at month-end).

RIVER FLOWS

The general absence of soil moisture deficits, limited evaporative losses and the mild temperatures ensured that almost all the February precipitation contributed to runoff rather than accumulating in snow packs. Combined with heavy rainfall, these conditions produced February runoff totals of historically significant magnitude. The particular hydrological effectiveness of the of the February rainfall may be judged by comparison with December. Rainfall totals in southern Britain were marginally higher in the latter month but runoff totals in England were, often, below half of those for February.

Relatively few extreme floods were reported but exceptionally high discharge rates were maintained over periods of a fortnight or more during which extensive floodplain inundation was common.

With the exception of a few small eastward draining rivers in Scotland and some high baseflow rivers in Yorkshire and East Anglia, February mean flows greatly exceeded the average throughout Great Britain. Many rivers registered their highest February runoff on record, often by wide margins, and new maximum monthly mean flows were established over very wide areas; the Midlands being an exception. The February mean for the River Tay - Britain's largest river in discharge terms - was 670 m^3s^{-1} at the Ballathie gauging station. This exceeds all the monthly mean flows held on the national Surface Water Archive and forms a suitable complement to the unprecedented daily mean flow (on the 5th February) reported in the January Hydrological Summary. The Clyde (at Blairston) also comfortably eclipsed its previous maximum monthly flow.

Flows in southern England were almost as extreme. The River Thames (at Kingston) registered seventeen successive days above a threshold of 300 m^3s^{-1} for the first time since the flood of March 1947. The recent dramatic change in runoff conditions is, perhaps, best exemplified by the River Itchen (Hampshire). This chalk stream normally has a very stable flow regime. In 1989 flows declined throughout most of the year and by the second week of December the naturalised flow rate reached an absolute minimum in a 32-year record. By early February, bankfull discharge rates persisted through most of the month and the mean flow for the month is without parallel for any month (note: gauged flows are illustrated in Figure 2).

The latter half of February witnessed a decline in discharge rates especially in lowland England where sustained recessions resulted in early March flows falling to comparatively close to the monthly mean.

Notwithstanding the very limited runoff in early December, accumulated runoff totals for the winter period (December-February) are above average for all western and northern regions. The depressed nature of runoff conditions in late-1989 still finds an echo in the accumulated runoff figures for the winter half-year and for the longer term accumulations. Runoff deficiencies remain significant in a number of eastern and southern catchments - see Table 3. This is particularly true of rivers sustained principally from baseflow. The Yorkshire Derwent, for instance, has a combined runoff total over the last 16 months which ranks as the lowest in a 17-year record; the accumulated runoff being only a fraction above 50% of the long term mean. As the impact of the winter rainfall, in terms of increased baseflow, is sustained into the spring, these deficiencies may be expected to decrease over the next few months.

Nationwide assessments of monthly runoff can have only a limited precision when based upon skeletal monitoring networks. The need to review stage-discharge relations in the light of the recent flood discharges will also influence the accuracy of computed outflows. Even with these caveats, it is clear from preliminary analysis that the freshwater outflow from Great Britain - and especially Scotland - in February was of a truly exceptional magnitude; further analysis may well confirm the February 1990 outflow as unsurpassed, for any month, in at least 30 years.

Most reservoirs in western areas were spilling (or filling fast, in the case of Roadford in Devon), early in the month and, as a consequence of the exceptional runoff, by month-end very healthy increases in stocks were also reported throughout lowland England. Some eastern impoundments remain below capacity but generally the outlook for the summer of 1990 is reassuring and contrasts sharply with the situation at the end of winter in 1989.

GROUNDWATER

Groundwater levels at the beginning of the 1989-90 winter were inordinately low, particularly in some eastern and southern aquifers. A belated seasonal upturn generally began over the latter part of December. However, apart from some western areas, groundwater levels were still below average at the end of the year. During January, further heavy rainfall led to continued infiltration and consequent rises in groundwater level in the south-west and south of England, but the effects appear to have been much less marked in the extreme south-east, the north Midlands and the north-east. During February a very marked increase in infiltration led to substantial rises in groundwater level as shown in the well hydrographs in Figure 3. (Locations are shown in Figure 4). By the beginning of March 1990, the winter recharge had generally exceeded the mean values (Table 4), while groundwater levels stood at, or above, the seasonal means.

Among the indicator well hydrographs shown, there are three exceptions. At the little Bucket Farm site, located in the Chalk of Kent, the groundwater level is still below the seasonal mean and the estimated recharge is only (as of late February) some 75% of the annual mean; however, an examination of the hydrograph over the period of record suggests that there is a considerable lag between the times of peak rainfall and peak groundwater level. The depressed groundwater level may have been expected to lengthen the delay between initial infiltration and water-table response to over four weeks and the full effect of the heavy February rainfall is yet to appear in the groundwater level trace. At the Washpit Farm site in the Chalk of East Anglia, there have been problems in measuring the groundwater levels. The latest available reading is for the 7th February 1990; since, particularly at times of low groundwater level, the groundwater levels may lag some time behind the rainfall, the level at this date may reflect little more than the early part of the January rainfall. At the Dalton Holme site in the Chalk of eastern Yorkshire, the groundwater level still stands only a little distance above the seasonal minimum. Again, there may be some lag in reaction to rainfall at the unprecedentedly low groundwater levels of midwinter, but this will have been exacerbated by the regional rainfall pattern, with the greater part of the precipitation being intercepted by the higher ground of western Yorkshire.

At many sites, the well hydrographs show a down-turn following the peak due to the late February rainfall. The cessation in recharge is likely to be temporary unless the March rainfall is very much below average.

The groundwater resource situation appears to be healthy with the possible exception of the Chalk of eastern Yorkshire. In view of the lack of recent data from the Washpit Farm site, there is some doubt about the true situation in northern East Anglia. It is expected generally that groundwater resources will be near to, or above average, by the end of the 1989/90 recharge period.

One exceptional feature remains to be considered. At the Chilgrove House site, which is not normally used as an indicator well, groundwater levels through January and February 1990 rose by about 40 metres in only seven weeks, including an extraordinary single week increase of 20 metres in mid-February. This scale of rise has few, if any, precedents in the 156 years of record for this site. By way of contrast, the rise of Compton House, which is nearby, was just over 31 metres. Whereas at Chilgrove, the groundwater level at the end of February was close to the all-time seasonal high - having been within half a metre of the period-of-record minimum in early December - that at Compton was still substantially beneath such a level. This difference may in part reflect the variable distribution of rainfall even in adjacent subcatchments.

IH/BGS
14 March 1990

TABLE 1 1989/90 RAINFALL AS A PERCENTAGE OF THE 1941-70 AVERAGE

		Jan	Feb	Mar 1989	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan 1990	Feb
England and	mm	44	78	84	85	22	63	41	60	40	95	62	135	116	132
Wales	%	51	120	142	147	33	103	56	66	48	114	64	150	135	203
NRA REGIONS															
North West	mm	68	123	113	92	33	102	34	118	28	136	75	103	178	171
	%	61	152	157	119	40	123	33	94	22	115	62	86	159	212
Northumbrian	mm	32	70	55	49	25	65	19	87	21	85	36	61	110	116
	%	40	106	106	89	39	107	25	86	26	113	38	81	138	176
Severn Trent	mm	35	65	69	87	23	53	37	40	37	83	51	126	113	109
	%	51	123	133	167	36	95	57	49	54	128	65	181	164	206
Yorkshire	mm	24	64	63	79	24	84	38	47	19	83	46	93	106	104
	%	31	100	119	141	39	145	54	52	27	120	52	126	138	162
Anglia	mm	31	34	48	74	14	62	44	37	29	43	37	95	52	77
	%	60	81	120	185	30	127	77	57	56	83	60	180	100	182
Thames	mm	31	60	65	77	14	46	38	40	32	66	37	134	86	110
	%	50	128	141	167	25	88	63	57	51	103	51	203	139	234
Southern	mm	29	62	75	81	11	50	32	28	29	80	44	137	110	132
	%	38	109	144	169	20	100	54	39	41	102	47	169	145	232
Wessex	mm	44	89	87	74	25	33	47	45	52	103	60	174	124	155
	%	52	151	150	137	37	61	76	55	66	126	62	193	147	263
South West	mm	65	135	115	92	18	38	36	63	99	141	97	192	181	215
	%	50	150	137	130	21	58	43	62	96	125	72	142	140	239
Welsh	mm	80	140	151	89	23	65	49	78	57	164	100	189	211	201
	%	59	146	174	103	25	79	52	66	46	127	70	130	155	209
Scotland	mm	172	239	188	71	58	84	60	181	89	173	62	100	218	268
	%	126	230	204	79	64	91	54	140	65	116	44	64	159	258
RIVER PURIFICATION BOARDS															
Highland	mm	319	355	233	60	68	90	66	222	118	252	83	107	290	430
	%	195	267	204	53	66	82	52	150	75	135	49	55	177	323
North-East	mm	52	113	83	54	59	57	25	84	57	87	30	61	100	130
	%	57	153	134	89	77	81	27	78	66	90	29	60	110	176
Tay	mm	156	197	173	45	42	58	31	140	84	135	53	87	230	220
	%	132	214	211	60	44	70	30	119	73	111	45	65	195	239
Forth	mm	133	158	151	44	36	64	27	142	69	112	38	78	210	200
	%	134	205	219	65	43	85	28	122	64	106	35	72	212	260
Tweed	mm	71	105	105	48	43	51	23	114	47	67	30	72	158	170
	%	76	152	181	79	57	75	27	100	51	76	29	80	170	246
Solway	mm	139	157	195	87	35	71	43	177	78	146	58	117	270	290
	%	99	169	214	99	38	79	39	136	52	101	40	77	193	312
Clyde	mm	232	262	229	82	46	90	64	249	120	240	74	107	320	345
	%	144	232	218	80	47	87	49	175	69	131	44	58	199	305

Note: January to December rainfalls are based upon MORECS figures supplied by the Meterological Office.
Scottish RPB data for Feb. 1990 are estimated from the isohyetal map of February rainfall in the MORECS bulletin.

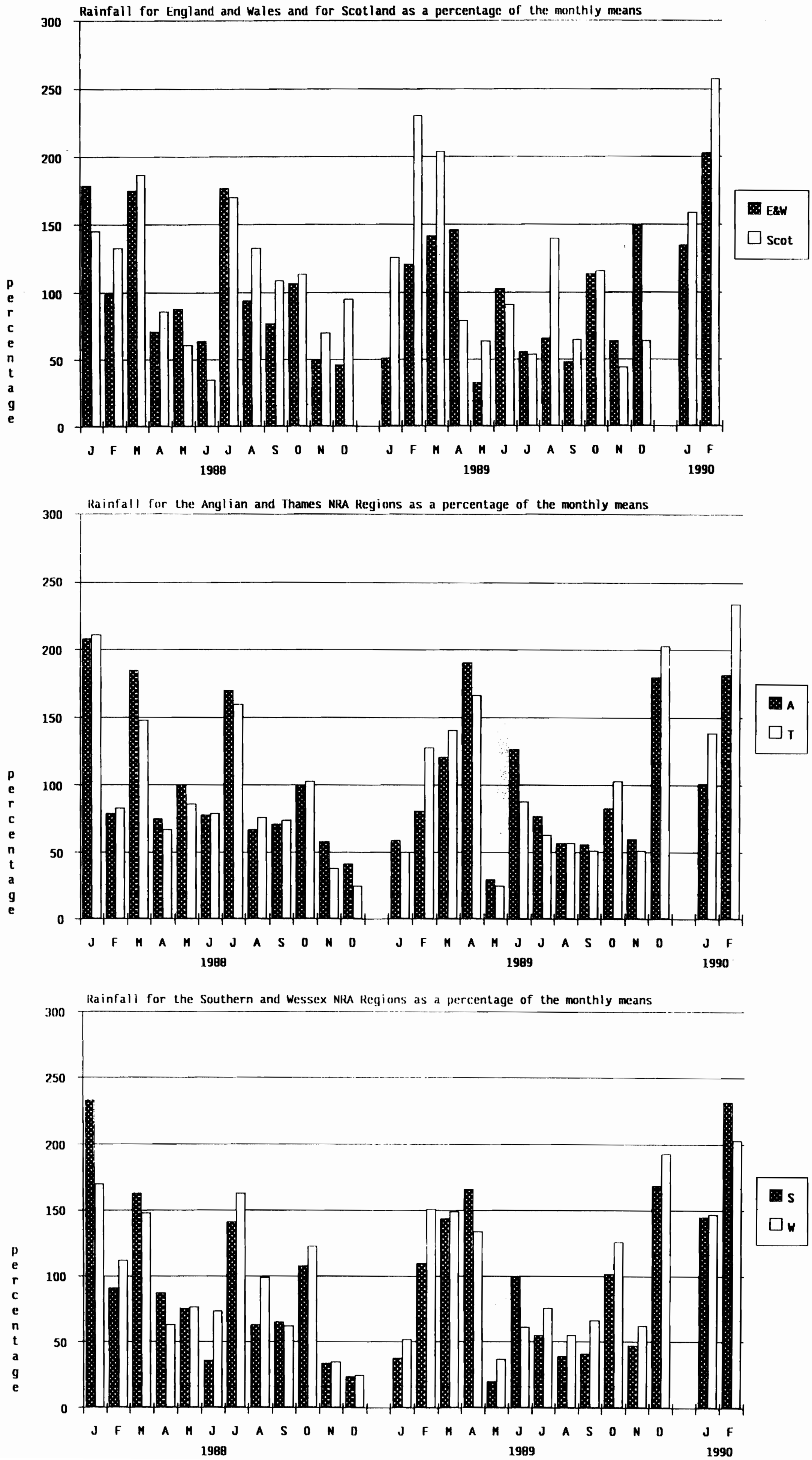
TABLE 2 RAINFALL RETURN PERIOD ESTIMATES

		FEB 90	Est Return Period, years	JAN 90 - FEB 90	Est Return Period, years	DEC 89 - FEB 90	Est Return Period, years
England and	mm	142		275		409	
Wales	% LTA	219	100-200	182	100-200	170	100-200
NRA REGIONS							
North West	mm	187		383		483	
	% LTA	231	100-200	198	>200	154	20-50
Northumbrian	mm	133		244		319	
	% LTA	202	20-50	167	20-50	144	10-20
Severn Trent	mm	110		217		352	
	% LTA	208	20-50	178	50-100	183	200-300
Yorkshire	mm	112		230		328	
	% LTA	175	10-20	163	20-50	183	20-50
Anglia	mm	74		127		225	
	% LTA	177	10-20	135	10	153	20-50
Thames	mm	114		205		346	
	% LTA	242	100-200	188	50-100	197	200-300
Southern	mm	135		256		398	
	% LTA	238	100	193	50-100	186	200
Wessex	mm	157		280		445	
	% LTA	265	200-300	196	200-500	191	200-500
South West	mm	238		433		629	
	% LTA	264	200-300	198	100-200	178	100-200
Welsh	mm	214		454		653	
	% LTA	223	100	196	200	173	100-200
Scotland	mm	291		541		637	
	% LTA	280	>>200	224	>>200	160	>200
RIVER PURIFICATION BOARDS							
Highland	mm	364		658		767	
	% LTA	274	>500	221	>>500	155	100
North-East	mm	145		247		302	
	% LTA	195	50-100	150	20	113	2-5
Tay	mm	249		484		570	
	% LTA	270	>500	231	>500	166	100
Forth	mm	221		440		579	
	% LTA	287	>500	250	>>500	182	>500
Tweed	mm	180		346		424	
	% LTA	260	>500	214	>>500	168	100-200
Solway	mm	282		532		651	
	% LTA	303	>>500	228	>>500	170	200-300
Clyde	mm	343		659		766	
	% LTA	304	>>500	241	>>500	167	200-500

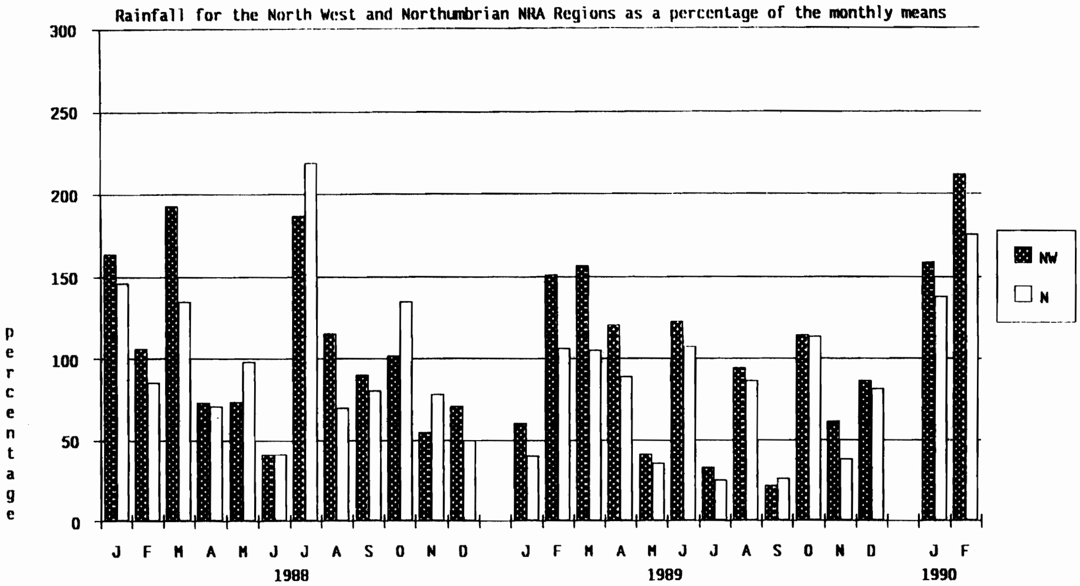
Return period assessments are based on tables provided by the Meteorological Office*. These assume a start in a specified month; return periods for a start in any month may be expected to be an order of magnitude less.
The tables reflect rainfall totals over the period 1911-70 only and the estimate assumes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

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

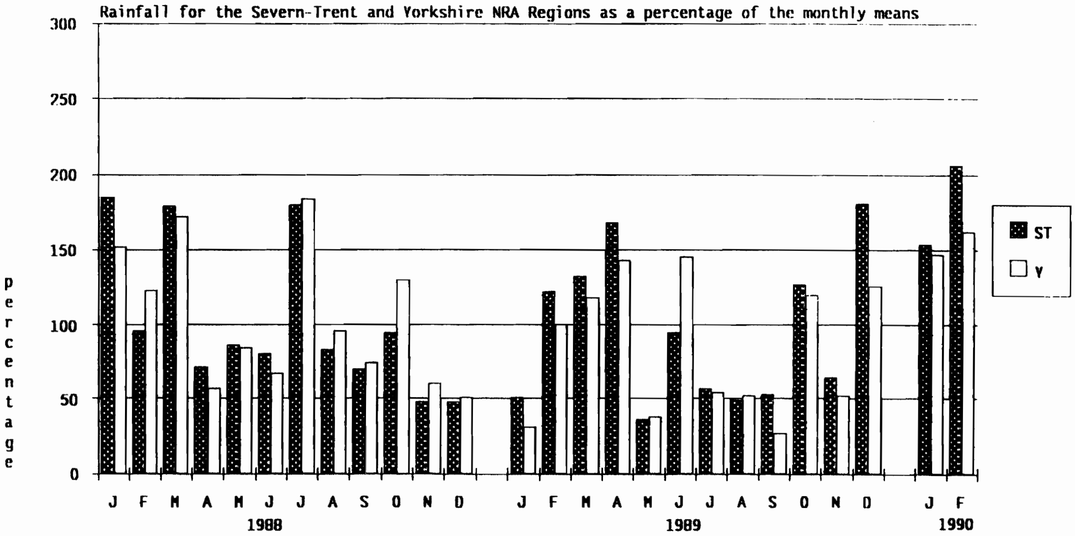
FIGURE 1 HISTOGRAMS OF RAINFALL AS A PERCENTAGE OF THE MONTHLY MEAN



Rainfall for the North West and Northumbrian NRA Regions as a percentage of the monthly means



Rainfall for the Severn-Trent and Yorkshire NRA Regions as a percentage of the monthly means



Rainfall for the South West and Welsh NRA Regions as a percentage of the monthly means

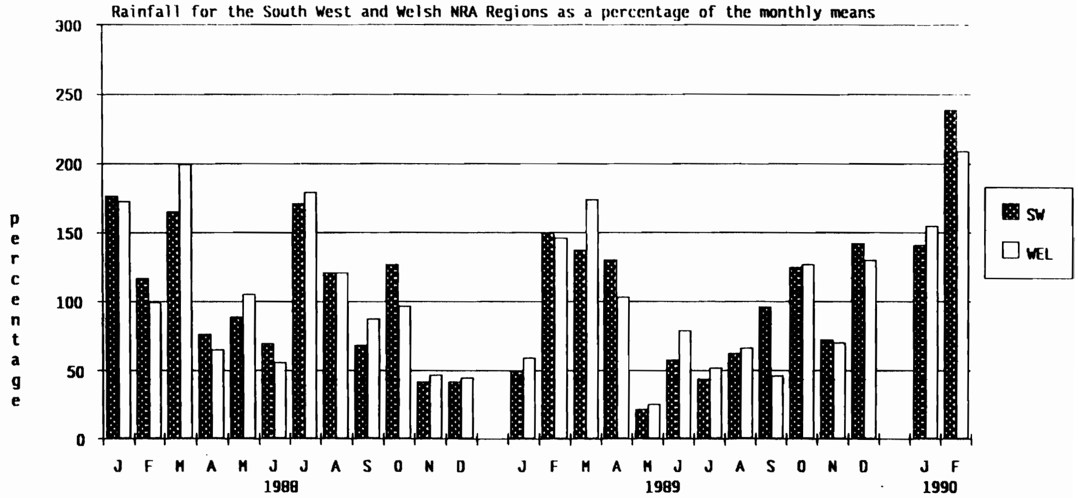
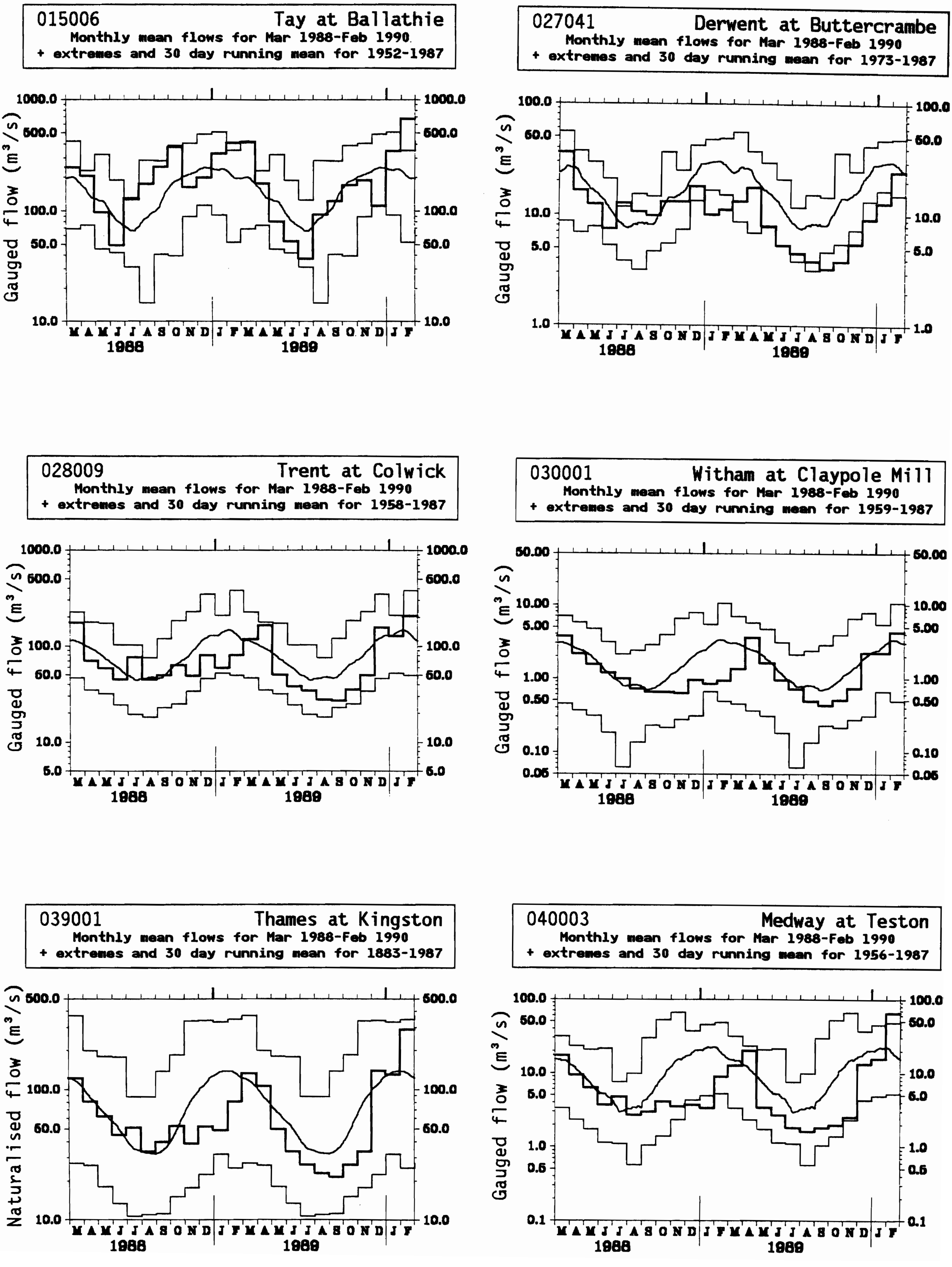
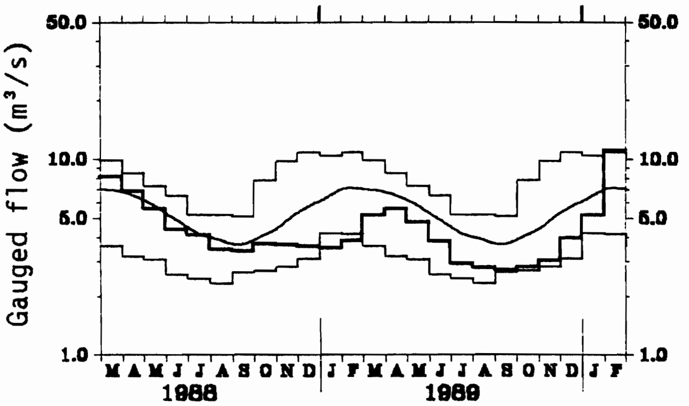


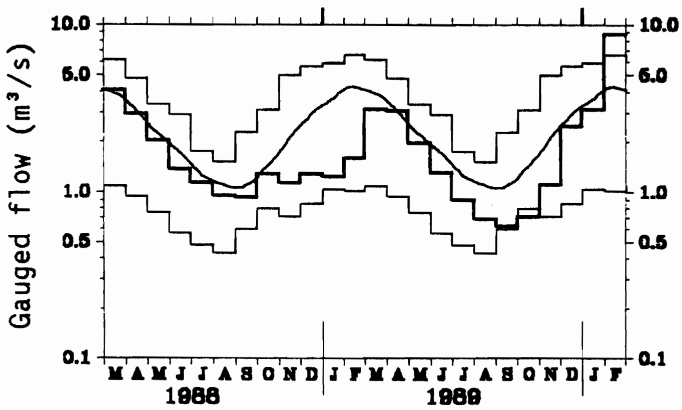
FIGURE 2 MONTHLY RIVER FLOW HYDROGRAPHS



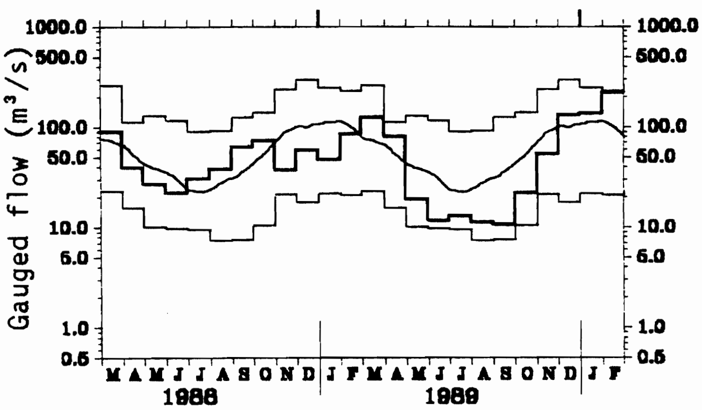
042010 Itchen at Highbridge+Allbrook
Monthly mean flows for Mar 1988-Feb 1990
+ extremes and 30 day running mean for 1958-1987



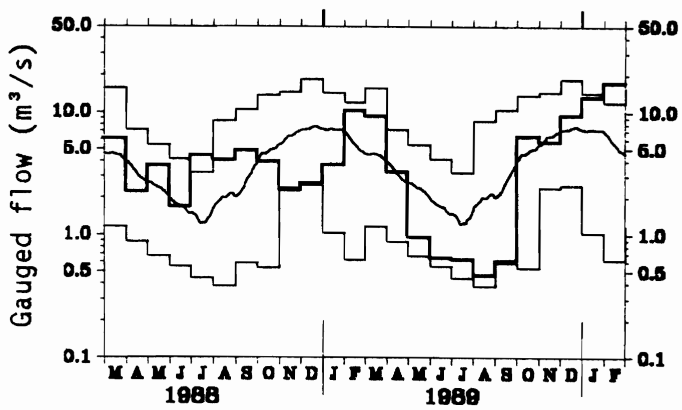
044002 Piddle at Baggs Mill
Monthly mean flows for Mar 1988-Feb 1990
+ extremes and 30 day running mean for 1963-1987



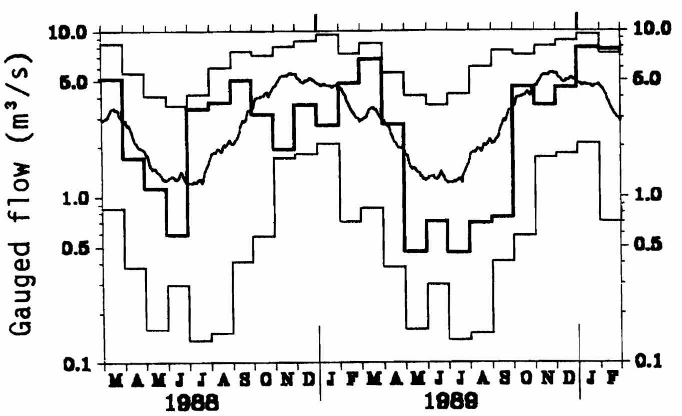
054001 Severn at Bewdley
Monthly mean flows for Mar 1988-Feb 1990
+ extremes and 30 day running mean for 1921-1987



057004 Cynon at Abercynon
Monthly mean flows for Mar 1988-Feb 1990
+ extremes and 30 day running mean for 1957-1987



067018 Dee at New Inn
Monthly mean flows for Mar 1988-Feb 1990
+ extremes and 30 day running mean for 1969-1987



076007 Eden at Sheepmount
Monthly mean flows for Mar 1988-Feb 1990
+ extremes and 30 day running mean for 1967-1987

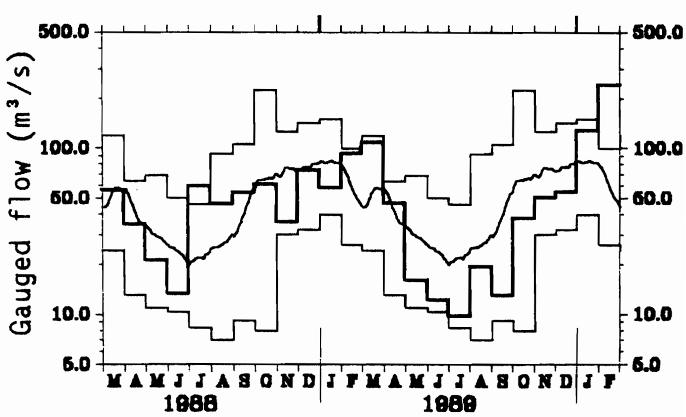


TABLE 3 RUNOFF AS MM. AND AS A PERCENTAGE OF THE PERIOD OF RECORD AVERAGE WITH SELECTED PERIODS RANKED IN THE RECORD

River/ Station name	May 1990 mm %LT	Jun mm %LT	Jul mm %LT	Aug mm %LT	Sep mm %LT	Oct mm %LT	Nov mm %LT	Dec mm %LT	Jan mm %LT	Feb 1990 mm %LT	Feb WET rank /yrs	10/89 to 2/90 mm %LT	DRY rank /yrs	5/89 to 2/90 mm %LT	DRY rank /yrs	11/88 to 2/90 mm %LT	DRY rank /yrs	10/88 to 2/90 mm %LT	DRY rank /yrs
Dee at	48	23	11	17	29	34	37	43	79	165	1	193	2	322	1	729	1	846	1
Park	72	60	38	50	67	41	48	47	85	236	/18	57	/17	59	/17	70	/17	74	/16
Tay at	47	30	22	54	69	99	106	65	201	353	1	471	15	692	9	1645	28	1863	31
Ballathie	66	66	55	104	97	89	88	45	144	331	/38	91	/38	87	/37	108	/37	114	/37
Tweed at	25	16	11	27	29	32	35	60	175	245	1	301	7	409	4	913	7	992	8
Boleside	57	56	40	68	55	44	40	64	177	345	/29	86	/29	76	/28	90	/28	91	/28
Wharfe at	15	13	10	14	10	39	29	44	126	142	3	238	4	300	1	713	1	790	2
Flint Mill Weir	38	51	37	33	21	60	36	45	128	192	/35	71	/35	58	/34	72	/34	75	/34
Derwent at	13	9	8	6	5	6	9	15	22	37	9	52	1	94	1	230	1	252	1
Buttercrambe	50	51	58	42	37	25	35	36	43	86	/17	39	/17	43	/16	50	/16	52	/16
Trent at	18	13	12	10	9	13	17	56	45	66	4	131	12	193	7	385	5	407	6
Colwick	70	67	74	59	52	54	55	127	88	152	/32	88	/32	80	/31	75	/31	80	/31
Dove at	24	17	17	12	10	16	29	59	68	78	5	173	7	253	4	544	3	585	3
Marston on Dove	66	63	73	50	40	47	60	91	98	142	/29	81	/29	73	/27	80	/27	81	/27
Lud at	15	12	10	9	8	9	8	12	12	21	19	41	4	96	2	187	3	201	3
Louth	52	56	59	64	69	72	53	59	38	57	/22	53	/22	59	/21	56	/21	58	/21
Witham at	14	8	6	4	4	5	6	20	20	34	9	51	13	88	14	160	7	166	7
Claypole Mill	87	80	84	56	63	57	49	105	76	126	/31	77	/31	78	/31	65	/30	65	/30
Colne at	6	4	5	3	5	3	5	14	11	35	2	34	6	57	6	145	6	153	7
Lexden	67	73	119	73	115	34	39	82	46	193	/31	55	/31	64	/30	75	/30	76	/30
Mimram at	11	9	9	7	6	6	6	10	11	15	6	32	10	74	6	135	9	146	9
Panshanger Park	88	82	92	77	73	71	68	98	94	127	/38	83	/37	83	/37	86	/36	88	/36
Thames at	13	9	7	6	6	7	9	38	33	70	3	86	44	127	36	247	22	261	23
Kingston (natr.)	74	71	74	68	67	52	41	126	88	212	/108	84	/107	79	/107	74	/106	75	/106
Coln at	30	18	15	13	10	10	15	39	56	100	1	120	11	205	8	364	3	378	3
Bibury	89	66	70	76	69	61	60	98	107	184	/27	91	/27	84	/26	71	/26	72	/26
Mole at	16	19	12	11	11	15	16	81	64	153	1	176	5	244	5	492	1	518	1
Kinnersley Manor	57	106	93	71	61	38	36	123	85	317	/16	79	/15	79	/15	76	/13	75	/13
Medway at	7	6	4	3	4	4	5	28	33	125	1	70	7	94	4	201	1	209	1
Teston	47	60	62	41	40	21	16	69	66	336	/32	51	/29	50	/26	51	/25	51	/25
Itchen at	36	27	22	21	20	21	22	29	39	74	1	111	3	236	2	420	1	448	1
Highbridge+Allbrook	84	77	71	73	75	68	63	68	79	150	/32	71	/32	74	/31	71	/31	72	/31
Stour at	15	11	8	6	6	8	15	74	66	154	1	164	10	211	6	388	1	413	1
Throop Mill	62	68	70	55	49	35	46	134	106	271	/18	96	/17	86	/17	71	/16	73	/16
Tone at	19	11	10	7	9	13	29	91	88	170	1	221	15	277	12	521	5	565	6
Bishops Hull	67	61	63	55	57	47	68	136	108	233	/30	102	/29	90	/29	78	/28	81	/28
Brue at	15	7	6	5	5	6	16	98	77	125	1	198	11	236	4	484	2	560	5
Lovington	62	45	35	31	32	20	37	144	108	213	/26	93	/25	79	/25	78	/25	86	/24
Severn at	12	7	8	7	6	14	32	81	84	123	2	333	53	373	37	634	21	679	24
Bewdley	50	39	56	40	27	41	59	130	118	215	/69	119	/69	100	/69	91	/68	93	/68
Teme at	12	5	3	2	2	4	17	101	93	118	1	210	29	250	16	511	13	556	15
Knightsford Bridge	55	34	35	22	23	19	50	190	138	221	/20	95	/69	79	/69	80	/68	82	/68
Yscir at	18	10	11	8	11	90	125	209	225	228	1	214	16	239	10	419	2	448	3
Pontaryscir	40	32	49	25	22	97	101	140	152	225	/18	122	/20	101	/20	80	/19	82	/19
Cynon at	24	16	16	12	15	160	139	238	331	393	1	649	16	707	9	1288	5	1379	5
Abercynon	39	38	46	23	21	132	90	126	175	308	/32	122	/17	101	/17	91	/16	91	/16
Dee at	23	34	23	34	36	226	169	224	388	344	1	867	28	950	18	1711	14	1811	11
New Inn	32	57	33	35	25	113	68	90	161	217	/21	132	/32	102	/30	96	/30	95	/30
Lune at	20	14	12	44	13	121	81	84	266	298	1	1007	14	1156	5	2237	5	2393	5
Caton	39	34	23	61	14	99	60	54	182	332	/28	108	/21	84	/20	87	/20	87	/20
Eden at	19	14	11	24	15	44	45	52	149	253	1	552	13	655	3	1430	7	1559	6
Sheepmount	56	53	39	75	33	57	53	58	147	392	/20	98	/26	75	/26	91	/24	92	/24
Clyde at	19	13	9	36	31	55	47	64	200	227	1	291	7	374	4	847	5	917	5
Blairston	52	50	36	91	54	68	48	62	196	319	/32	84	/19	74	/18	89	/17	89	/17

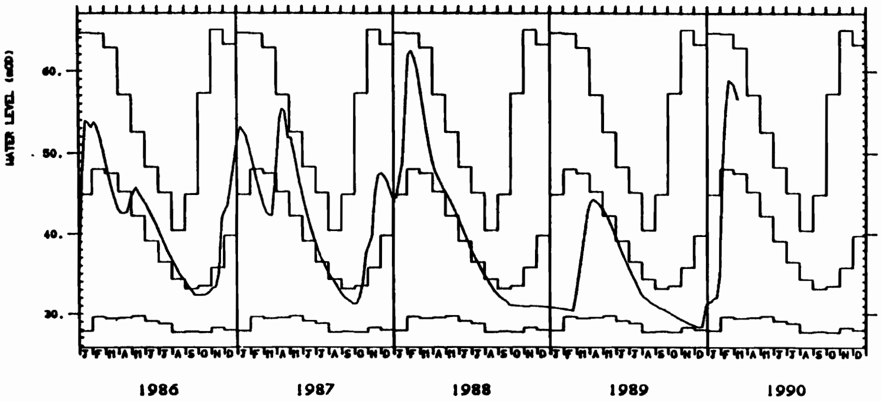
Notes
(i) Values based on gauged flow data unless flagged (natr.), when naturalised data have been used.
(ii) Values are ranked in the multi-month periods with lowest runoff as rank1; February is ranked with the highest runoff as rank 1.
(iii) %LT means percentage of the long term average from the start of the record to 1988. For the long periods (at the right of this table) the end date for the long term is 1989.

FIGURE 3 GROUNDWATER HYDROGRAPHS

Site name: COMPTON HOUSE

National grid reference: SU 7755 1490 | Well number: SU71/23

Aquifer: CHALK AND UPPER GREENSAND | Measuring level: 81.37

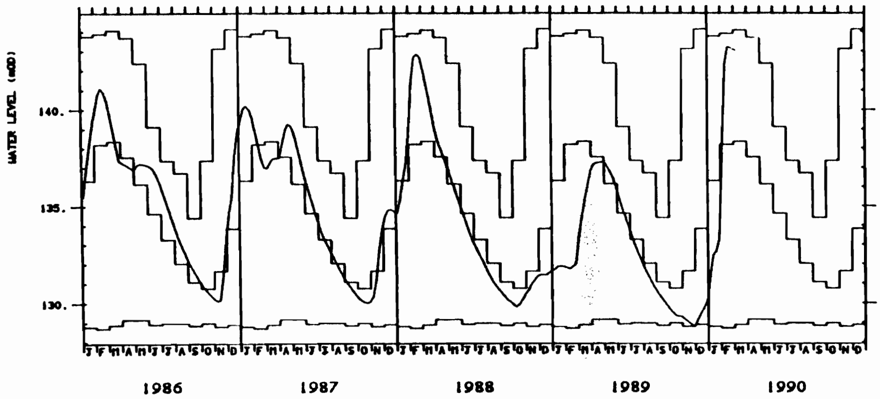


Max, Min and Mean values calculated from years 1894 TO 1989

Site name: ROCKLEY

National grid reference: SU 1655 7174 | Well number: SU17/57

Aquifer: CHALK AND UPPER GREENSAND | Measuring level: 146.39

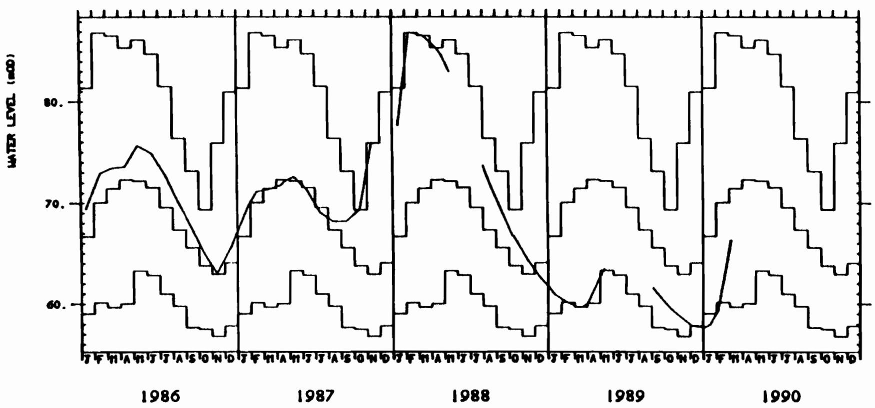


Max, Min and Mean values calculated from years 1933 TO 1989

Site name: LITTLE BUCKET FARM,WALTHAM

National grid reference: TR 1225 4690 | Well number: TR14/9

Aquifer: CHALK AND UPPER GREENSAND | Measuring level: 87.33



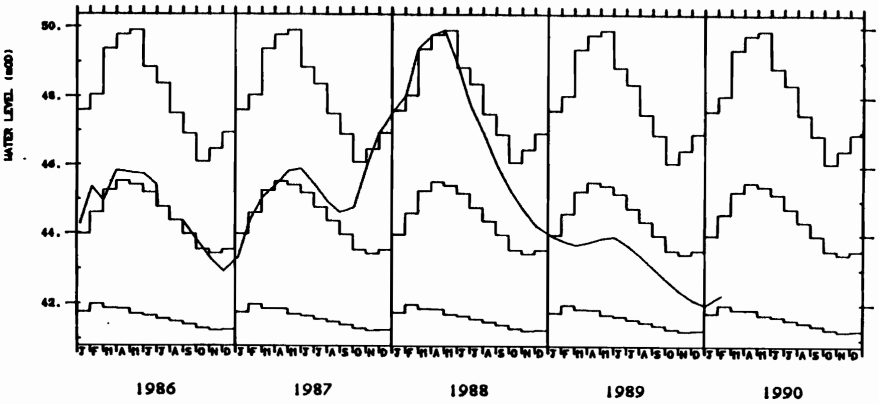
Max, Min and Mean values calculated from years 1971 TO 1989

A break in the data line indicates a recording interval of greater than 8 weeks

Site name: WASHPIT FARM

National grid reference: TF 8138 1960 Well number: TF81/2

Aquifer: CHALK AND UPPER GREENSAND Measuring level: 80.20

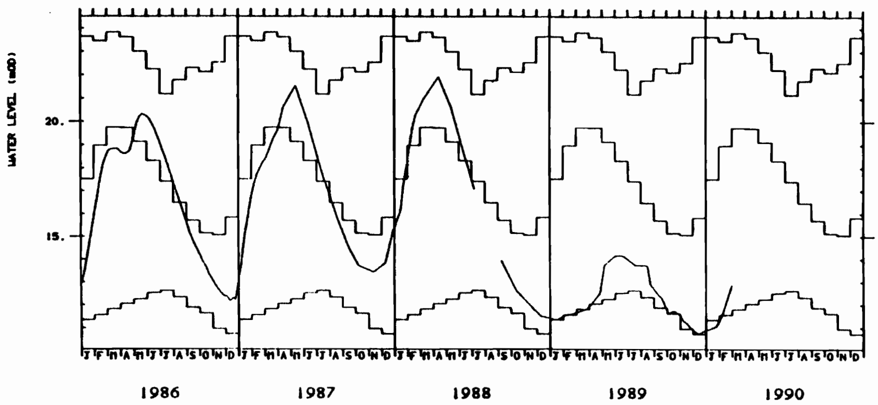


Max, Min and Mean values calculated from years 1950 TO 1989

Site name: DALTON HOLME

National grid reference: SE 9651 4530 Well number: SE94/5

Aquifer: CHALK AND UPPER GREENSAND Measuring level: 33.50



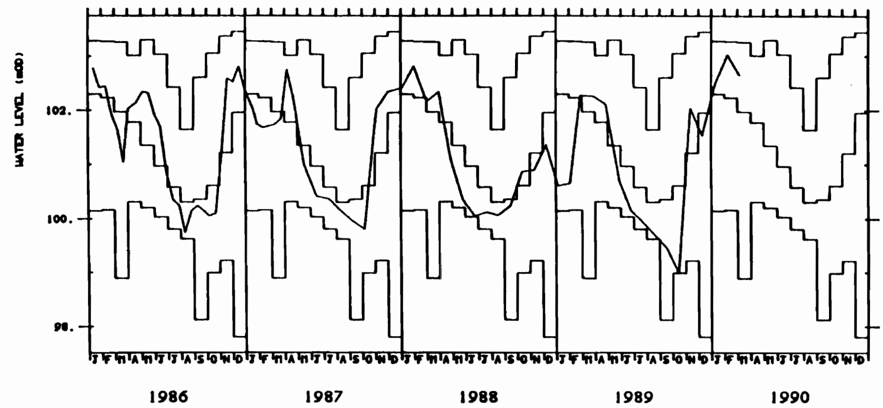
Max, Min and Mean values calculated from years 1889 TO 1989

A break in the data line indicates a recording interval of greater than 8 weeks

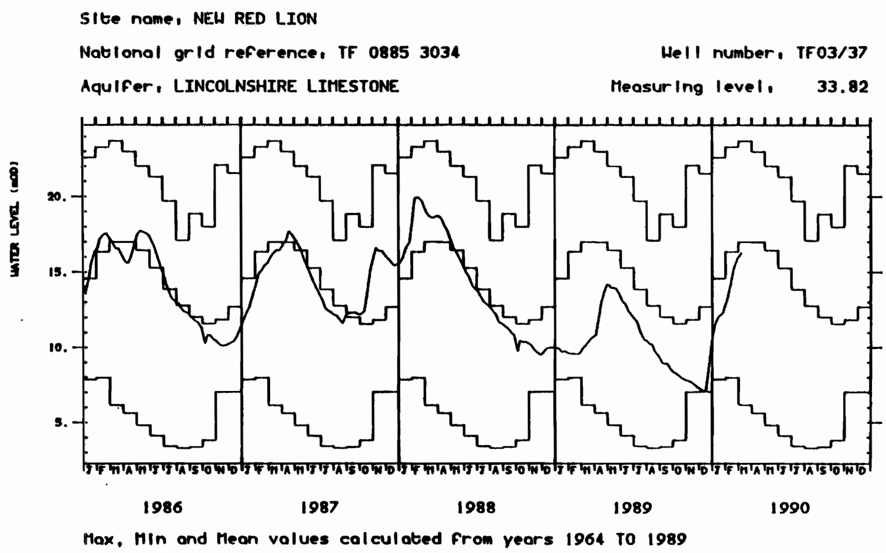
Site name: AMPNEY CRUCIS

National grid reference: SP 0595 0190 Well number: SP00/62

Aquifer: MIDDLE JURASSIC Measuring level: 109.70



Max, Min and Mean values calculated from years 1958 TO 1989



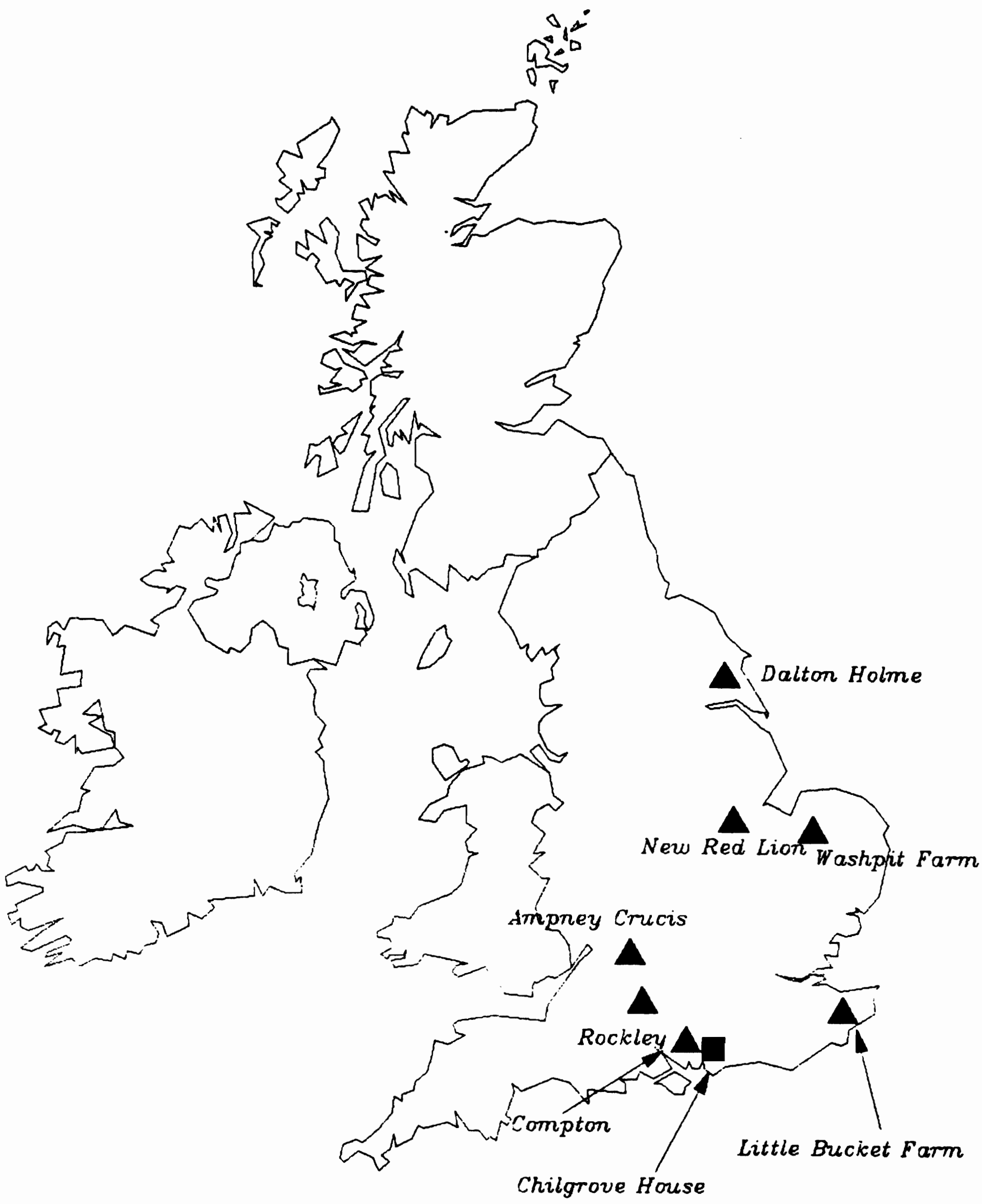


FIGURE 4 LOCATION MAP OF GROUNDWATER INDEX WELLS

TABLE 4 RISE IN GROUNDWATER LEVELS AT CERTAIN INDICATOR WELL SITES FOR THE WINTER OF 1989-90, AND THE CALCULATED PERCENTAGE OF MEAN ANNUAL RECHARGE SO FAR RECEIVED.

Site	Latest date of measurement	Approximate rise in groundwater levels (metres)	Mean annual range (metres)	Percentage of mean annual recharge
Compton House	06 03 90	31.8	21.8	146
Rockley	04 03 90	14.6	10.9	134
Little Bucket Farm	05 03 90	8.6	11.4	75
Washpit Farm	07 02 90	0.3	2.9	10
Dalton Holme	01 03 90	2.1	7.1	30
Ampney Crucis	05 03 90	4.1	3.1	132
New Red Lion	06 03 90	9.3	9.2	101