ENVIRONMENT AGENCY

Report on the By Brook low flow investigations

October 2001

Volume II

(Figures, Maps and Appendices)

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ENVIRONMENT AGENCY

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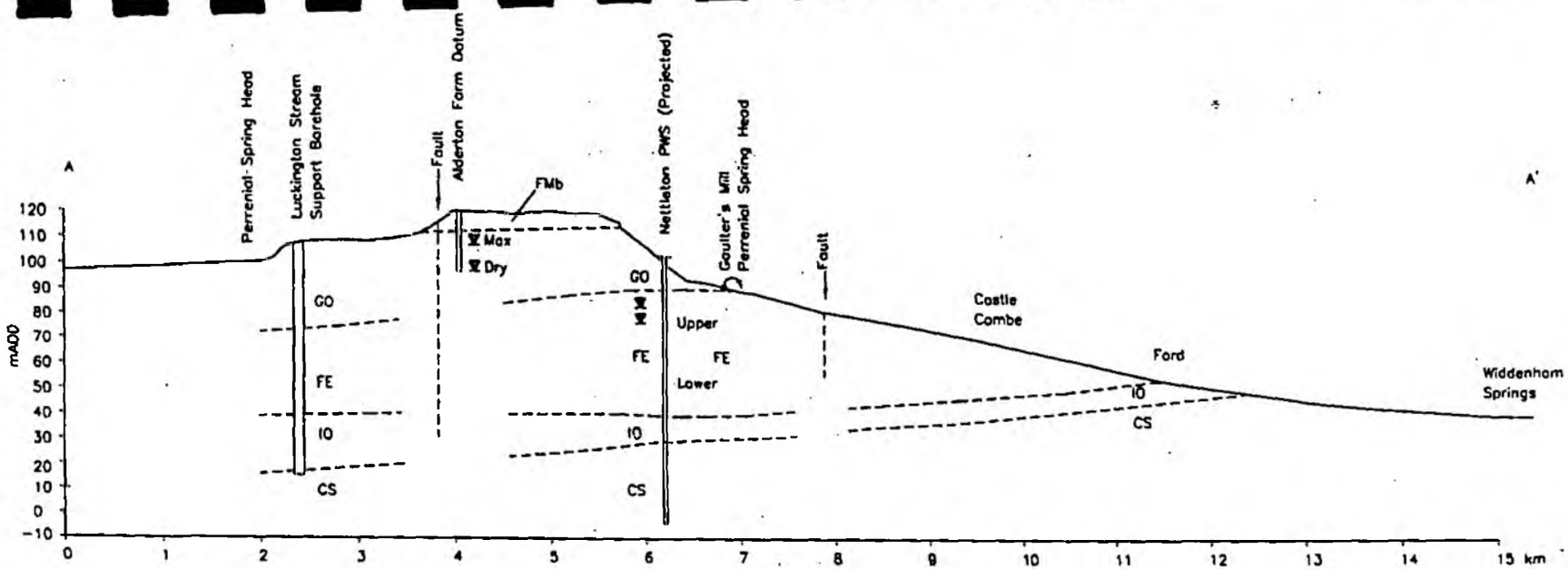
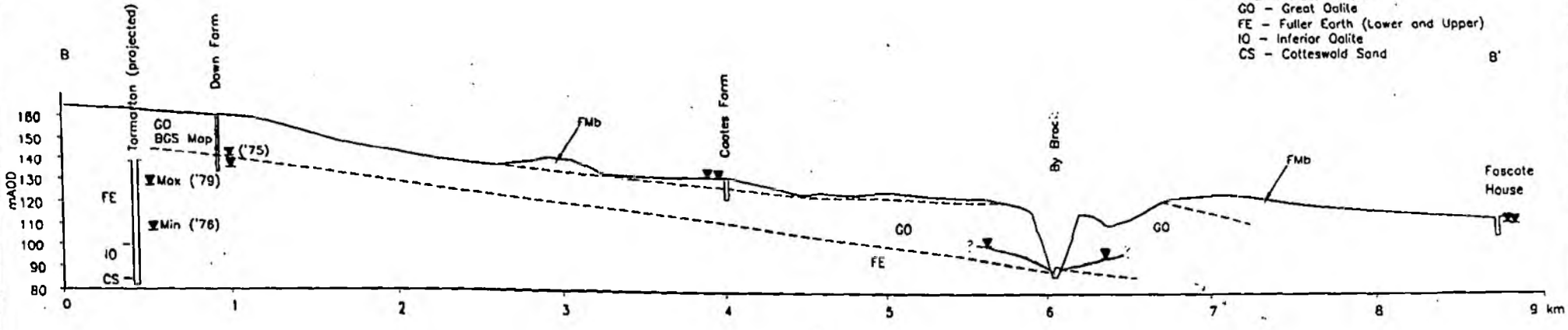
Figure 1 Geological cross-sections

North – South (A – A^{1})

WNW – ESE (B – B^{1})

The cross-sections are annotated on Map 2





Key
FMb – Forest Marble
GO – Great Oolite
FE – Fuller Earth (Lower and Upper)
IO – Inferior Oolite
CS – Cotteswold Sand

Marcus Hodges Environment Limited Consulting Hydrogeologists and Environmental Engineers	Drawn: IC	Drafted: RB	Title: By Brook Cross Sections A–A' and B–B'
	Checked: DK	Date: 10/07/01	
	Scale: v = 1:2000 h = 1:20,000	Ref.: 51593/mhe2	

Figure 2 -Annual catchment rainfall 1981-2000

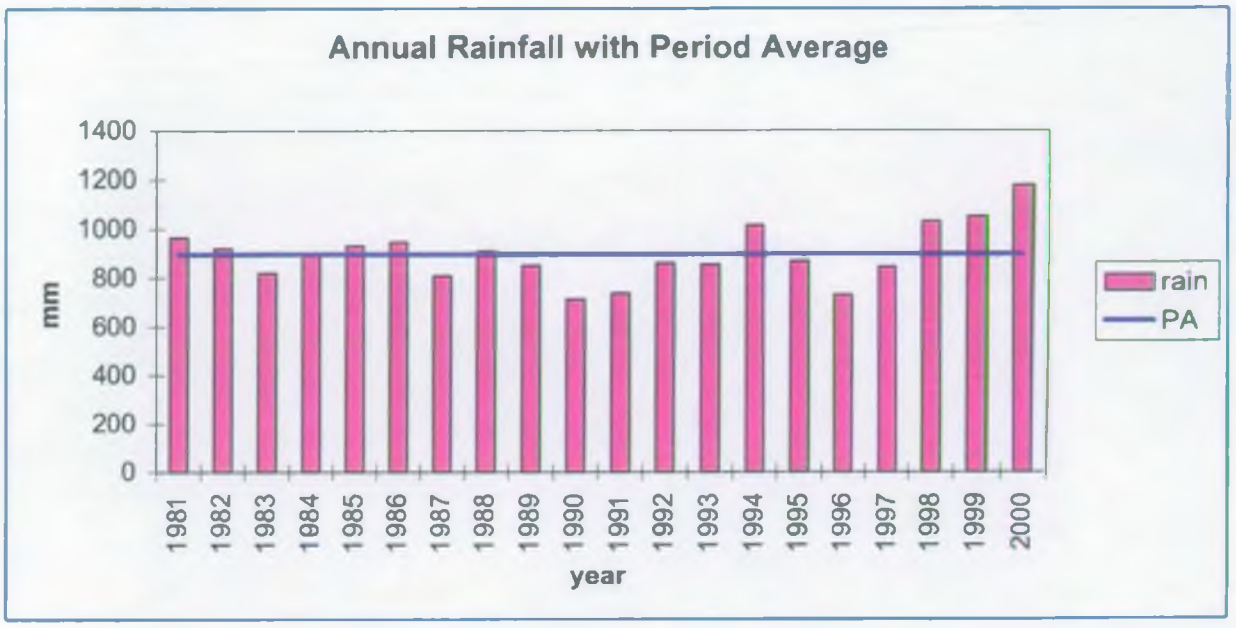
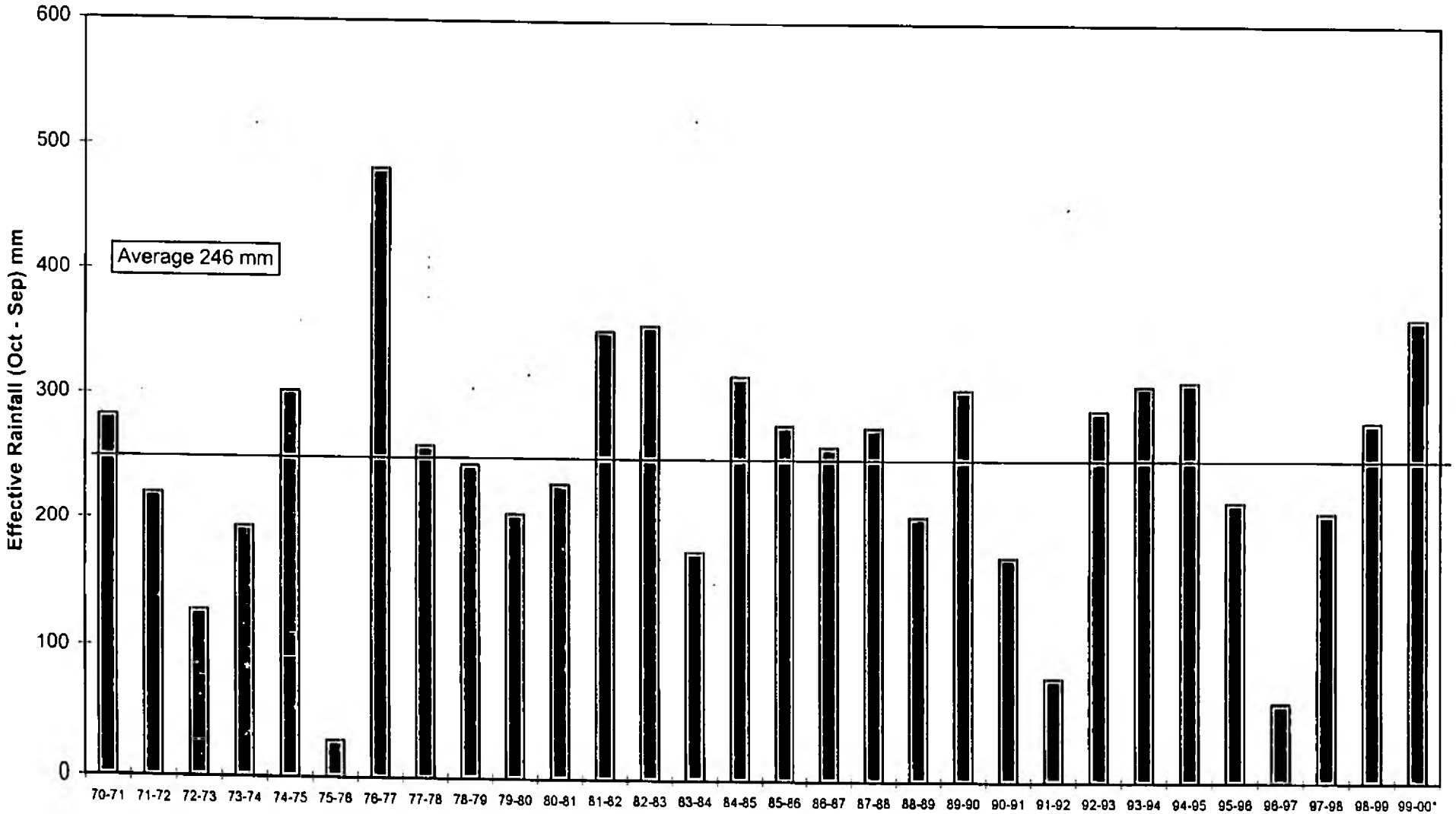


Figure 3: By Brook - Effective Rainfall



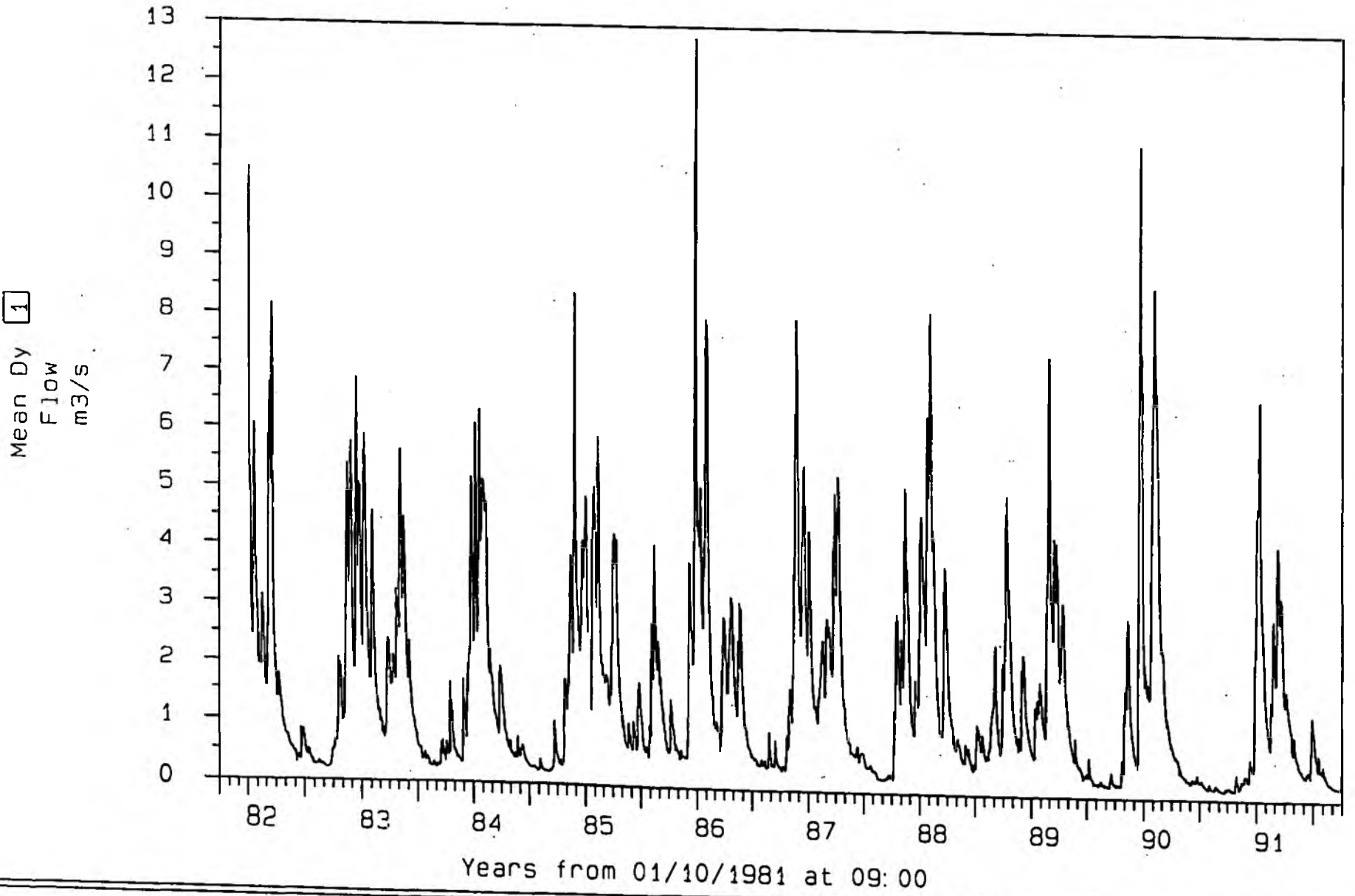
*Incomplete year, no data available for March 2000

Figure 4 Middlehill flow record

ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX

HYDROLOG Archive Report

Auth.: 530450	Name: Middlehill	Locat.: By Brook



ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX

HYDROLOG Archive Report

Auth.: 530450	Name: Middlehill	Locat.: By Brook

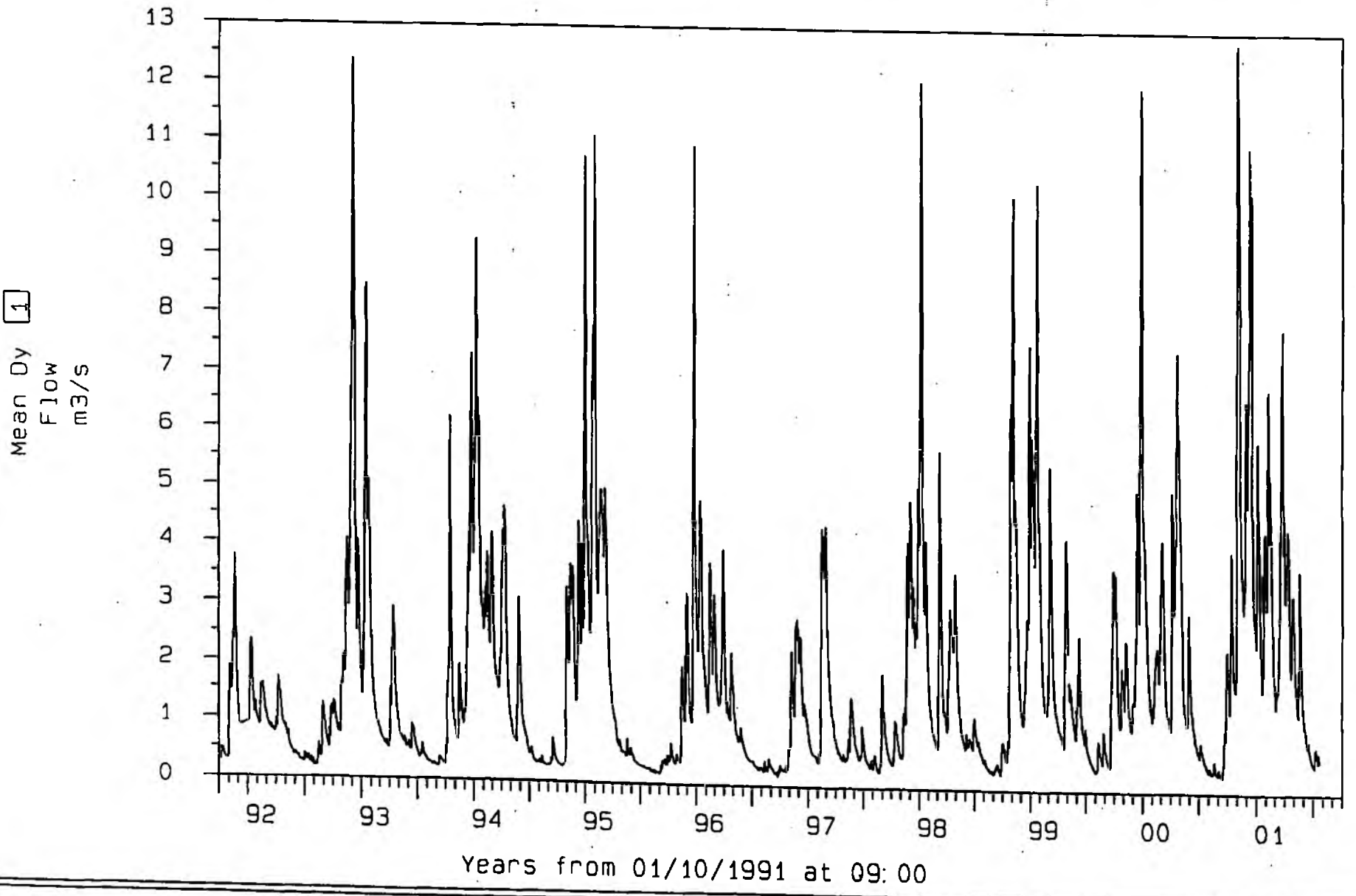


Figure 5 - By Brook (Middlehill) - Base Flow Separation

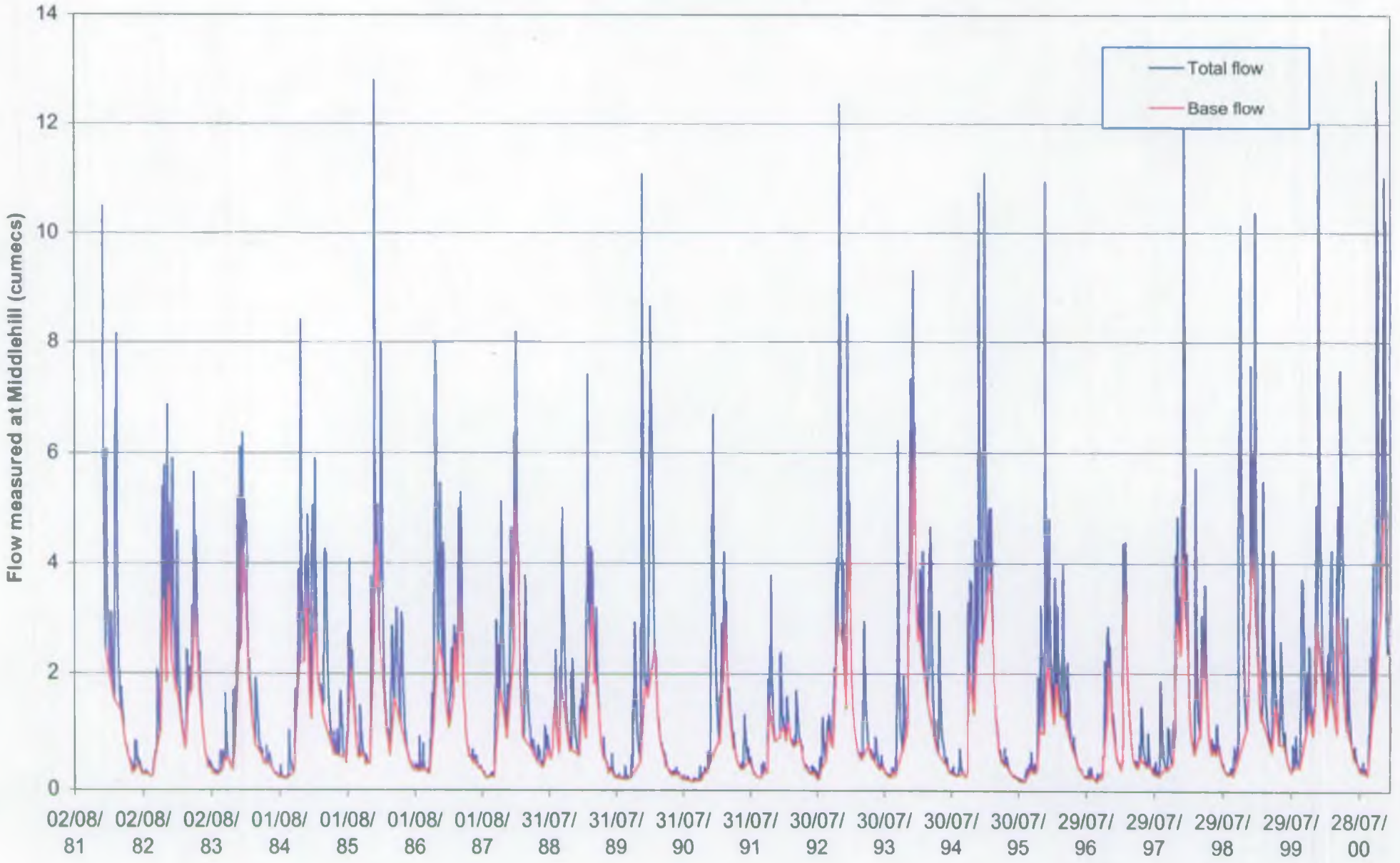
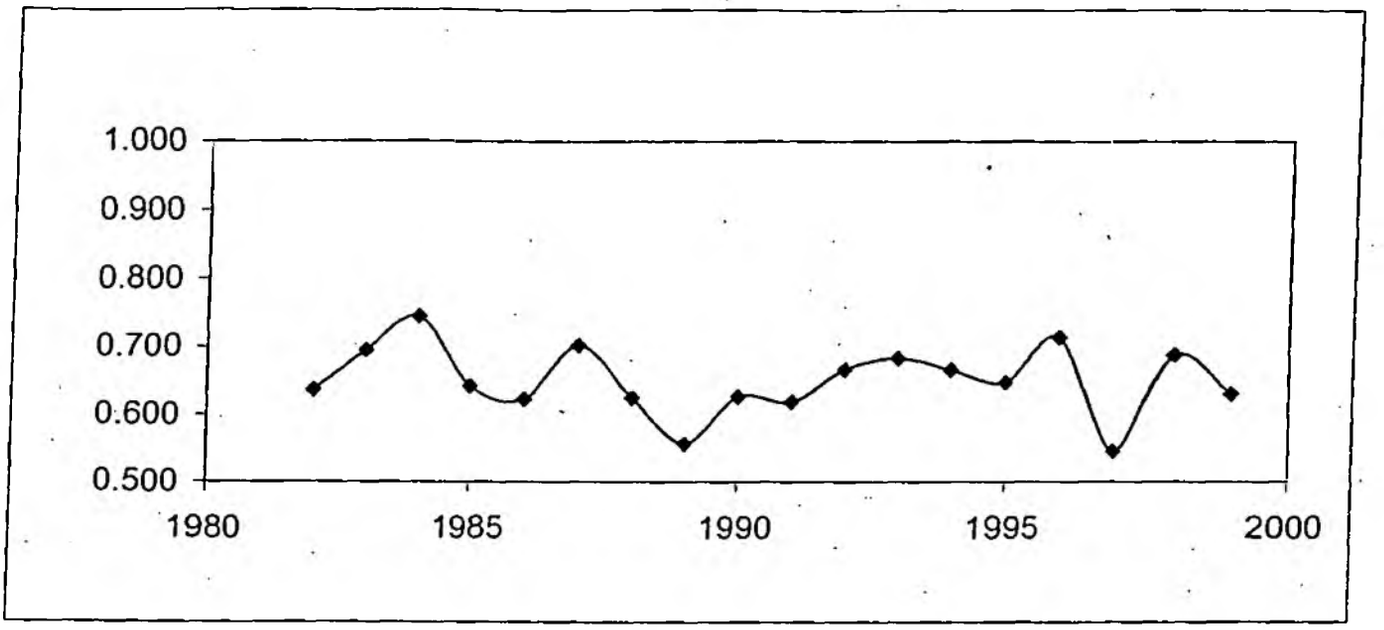


Figure 6 -Annual Base Flow Index values: trend



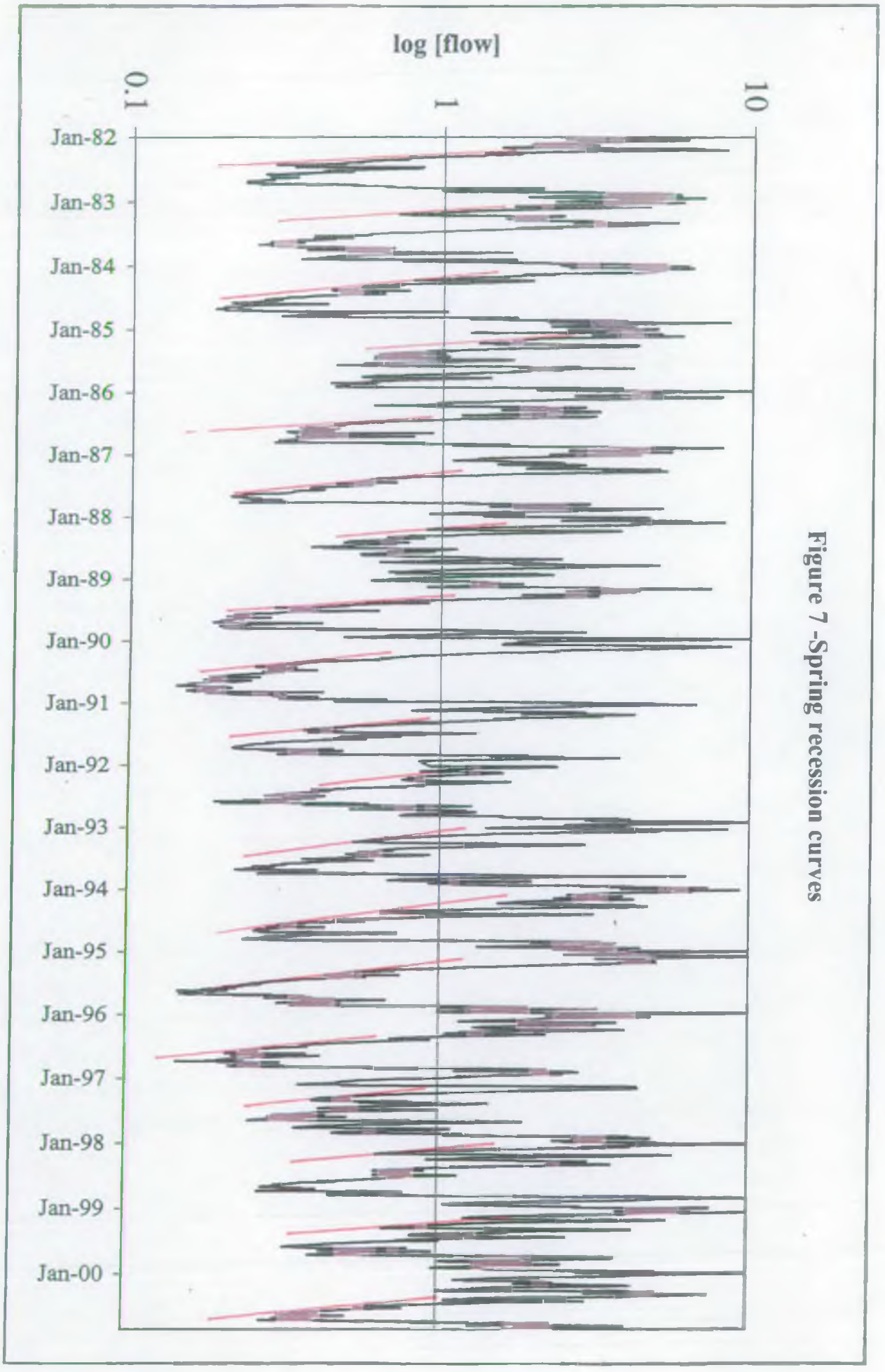


Figure 7 -Spring recession curves

Figure 8 -Annual spring recession values: trend

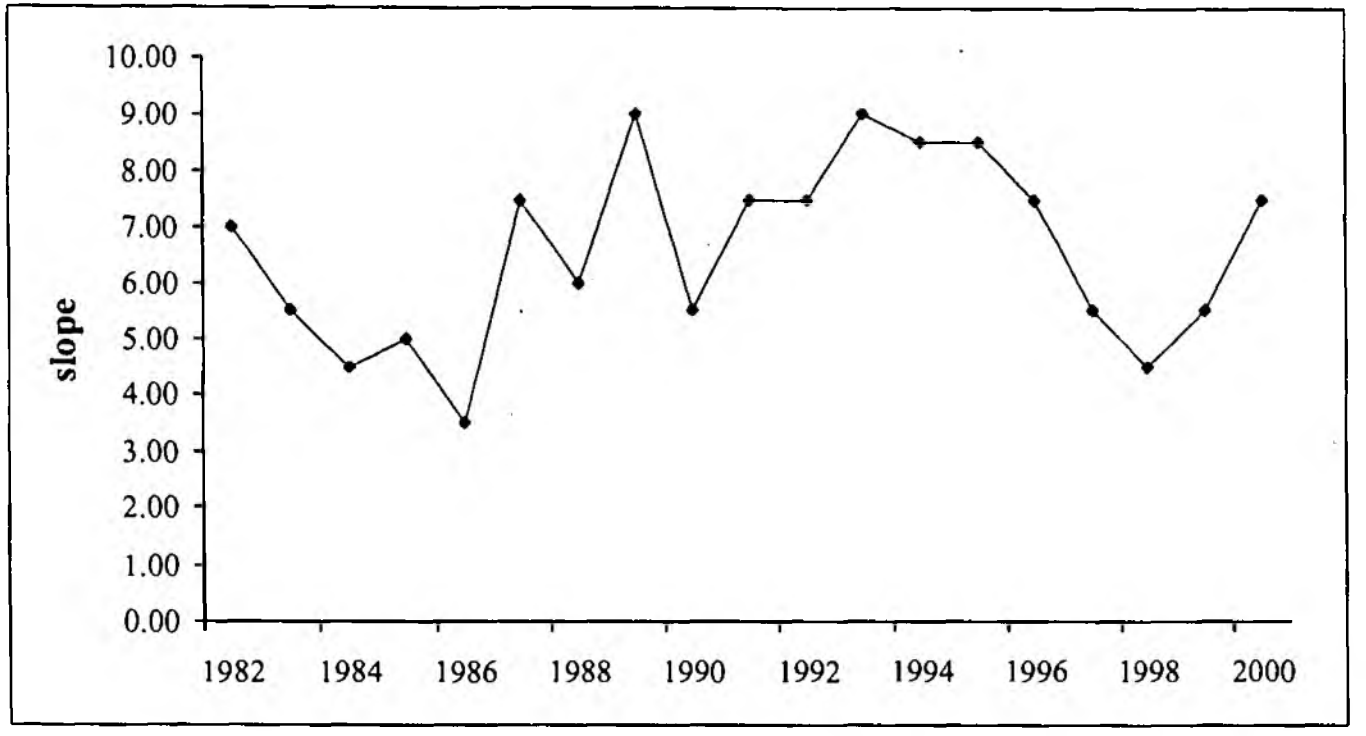


Figure 9 -Monthly rainfall and runoff

Figure 10 Flow accretion profiles

Location indications:

0 km	West Kington
3.05 km	Broadmead Brook, Golf Course
3.45 km	By Brook, Golf Course
8.45 km	By Brook, Ford
9.6 km	By Brook downstream of Doncombe Brook
18.25 km	By Brook downstream of Lid Brook
21.65 km	By Brook, Middlehill

Figure 10 - By Brook Flow Accretion Profiles

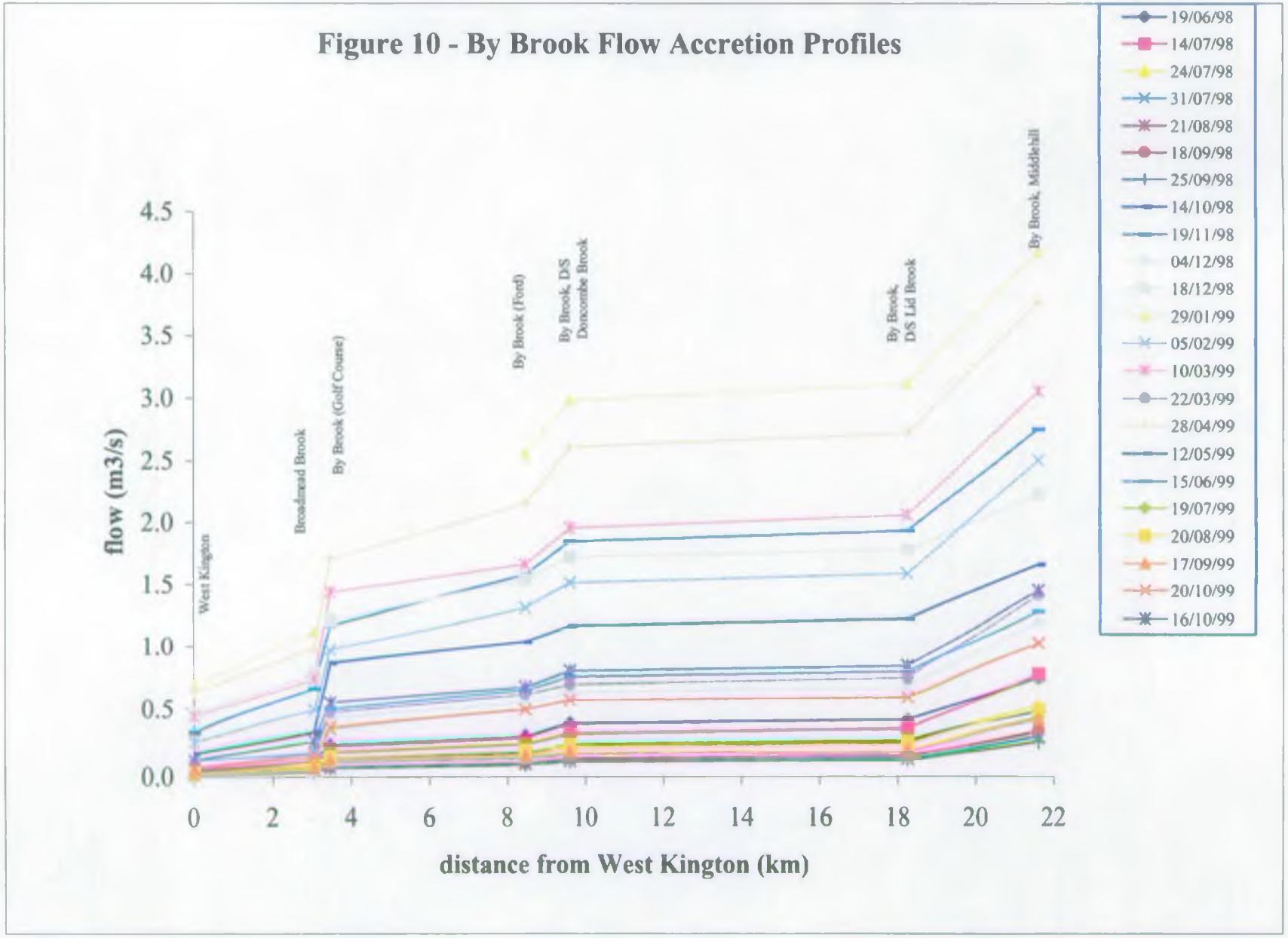


Figure 11 Middlehill flows: influence of sluice operation

ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX HYDROLOG Archive Report

Auth.: 530450	Name: Middlehill	Locat.: By Brook

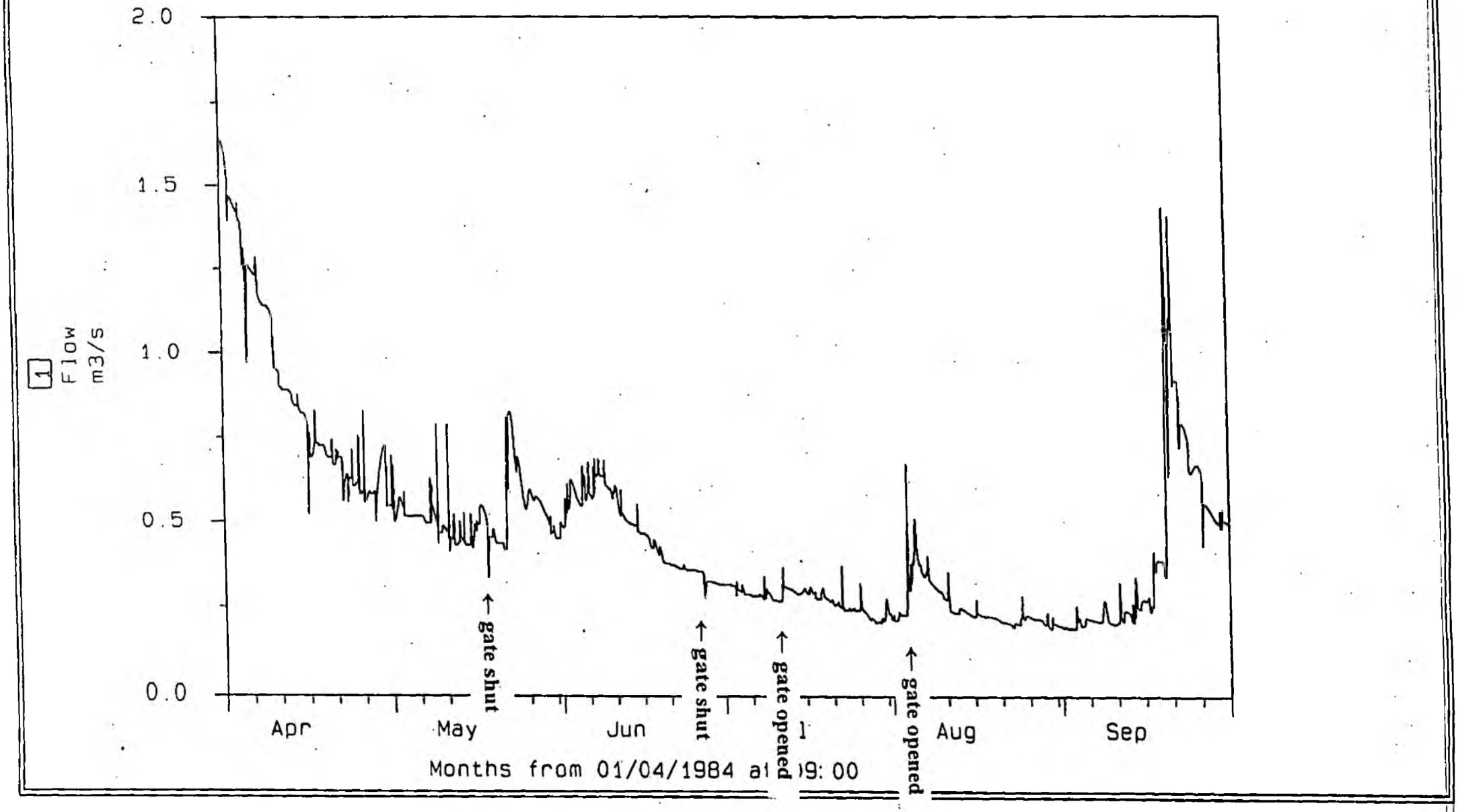


Figure 12 -Water quality time series

Figure 12.1: Mean monthly concentration of TIN (all sites)

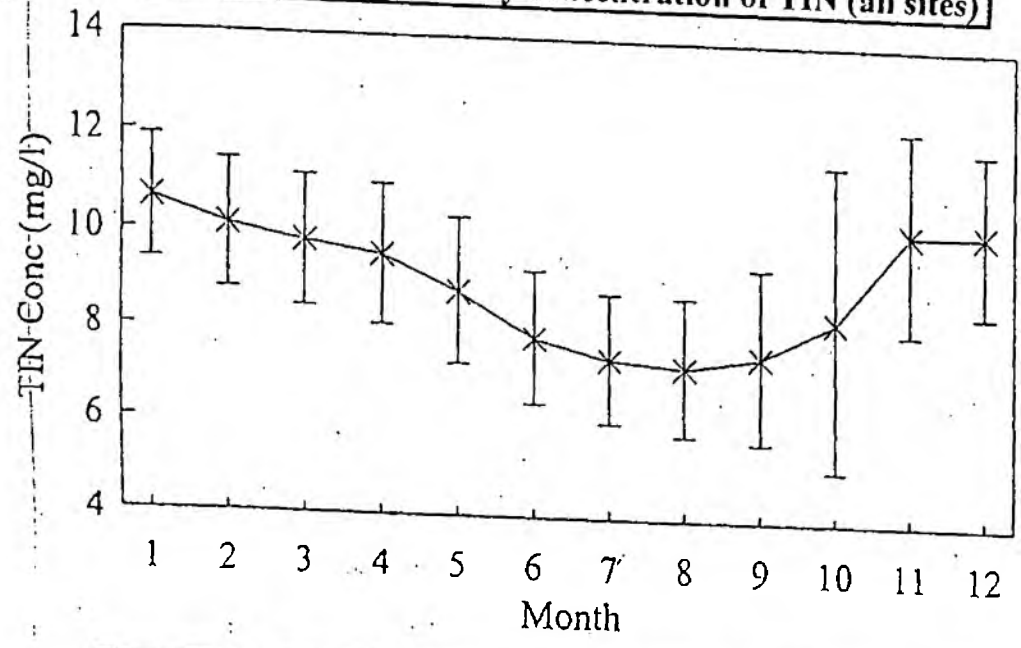


Figure 12.3: Annual mean concentration of TIN (all sites)

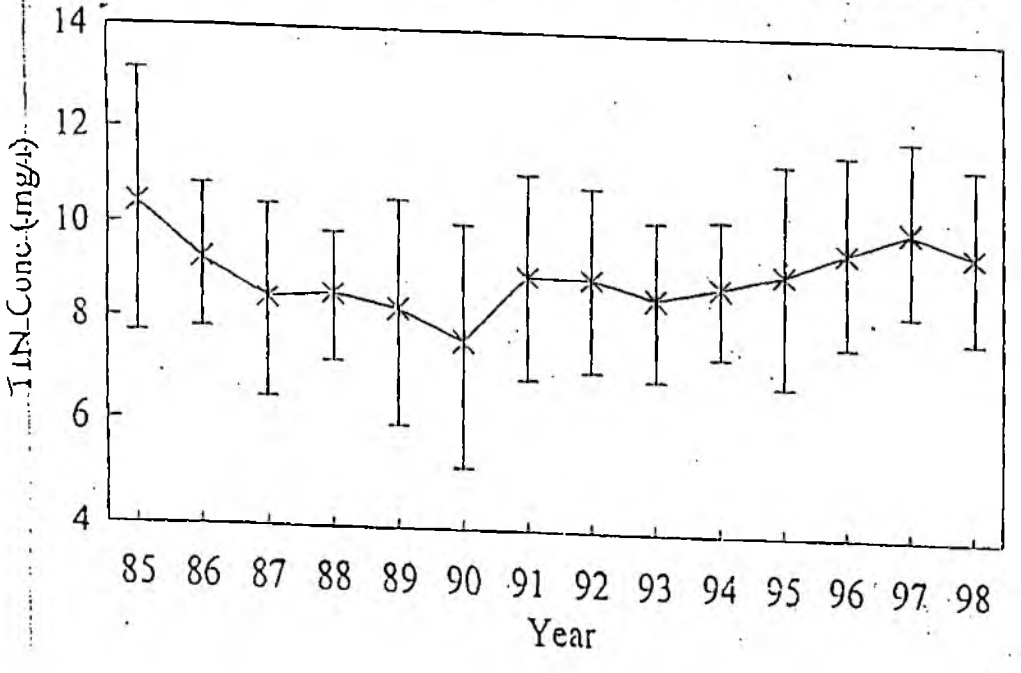


Figure 12.2: Mean monthly concentration of PO4 (all sites)

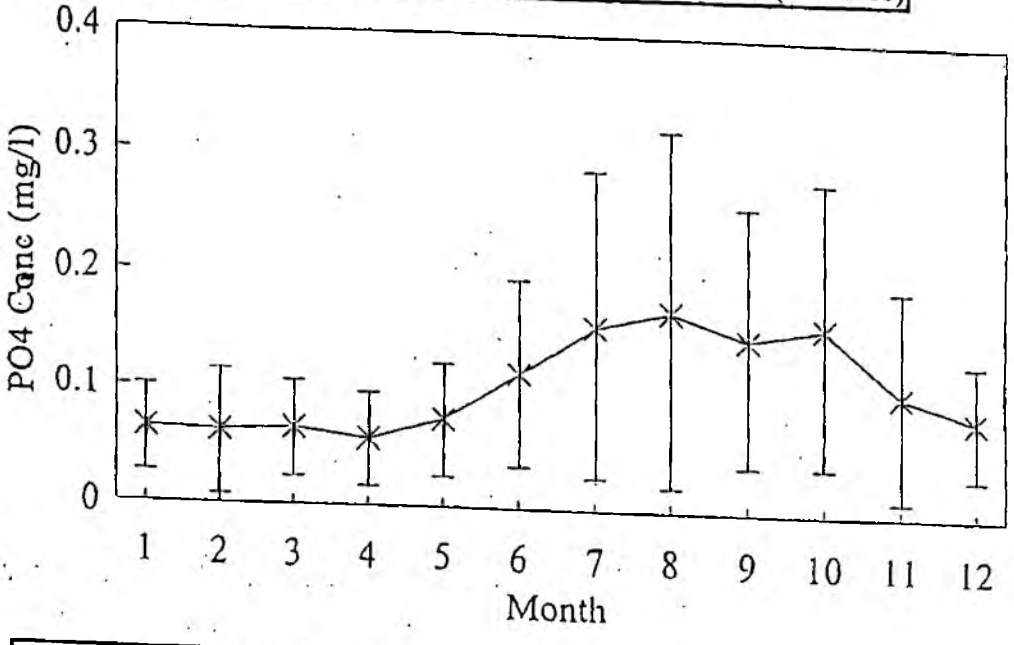


Figure 12.4: Annual mean concentration of PO4 (all sites)

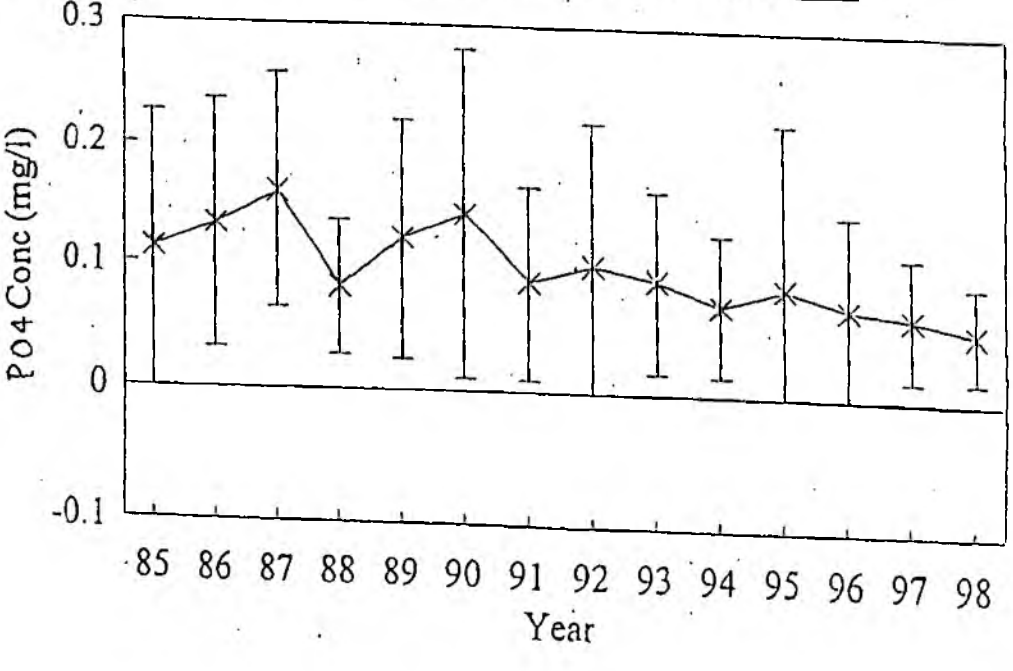


Figure 12.5: Mean concentration of TIN by site

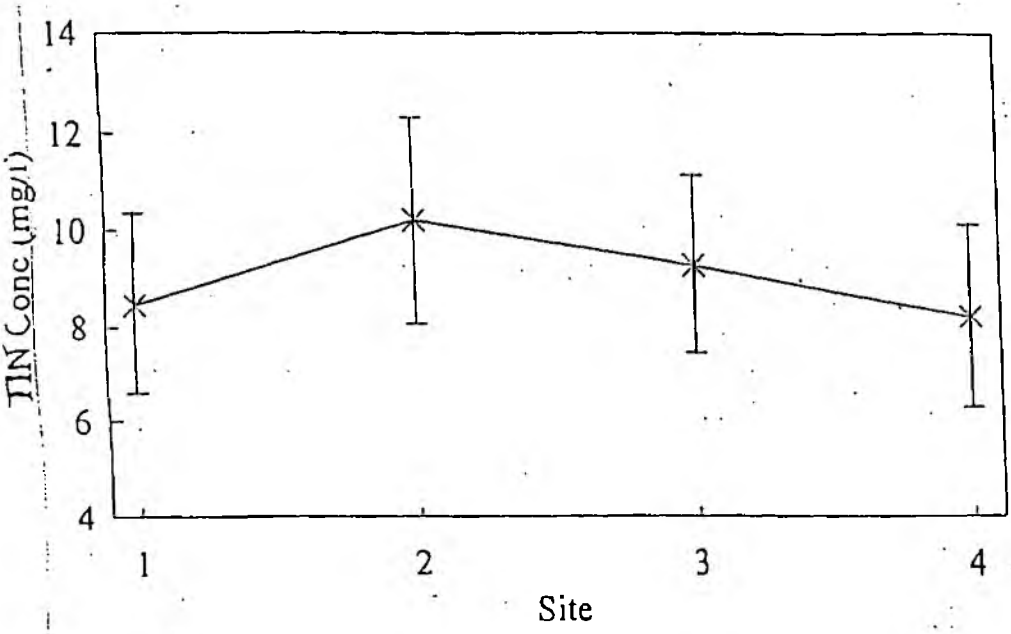


Figure 12.6: Mean concentration of PO4 by site

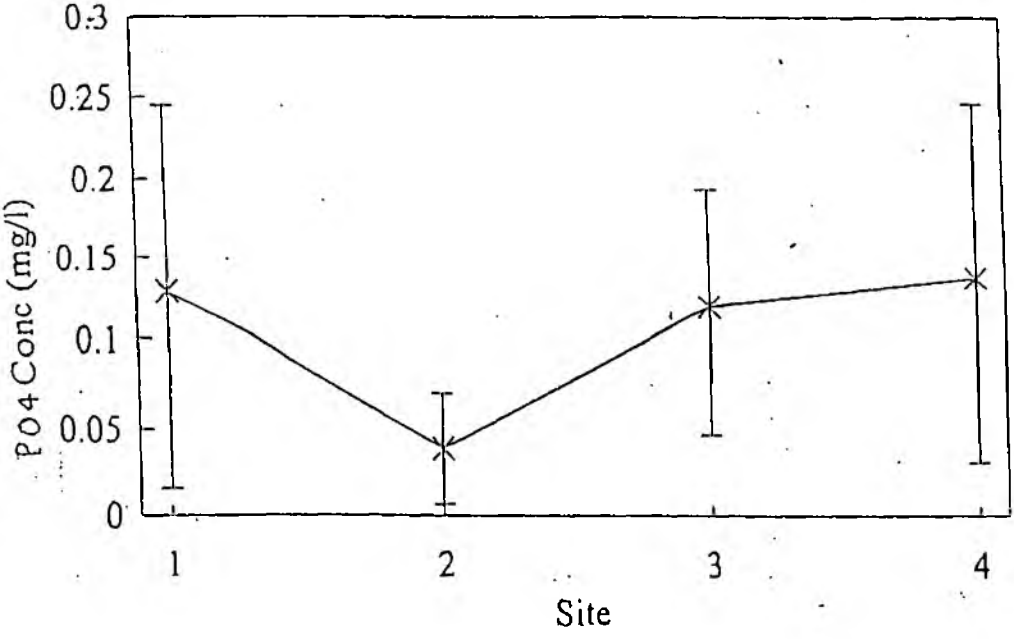
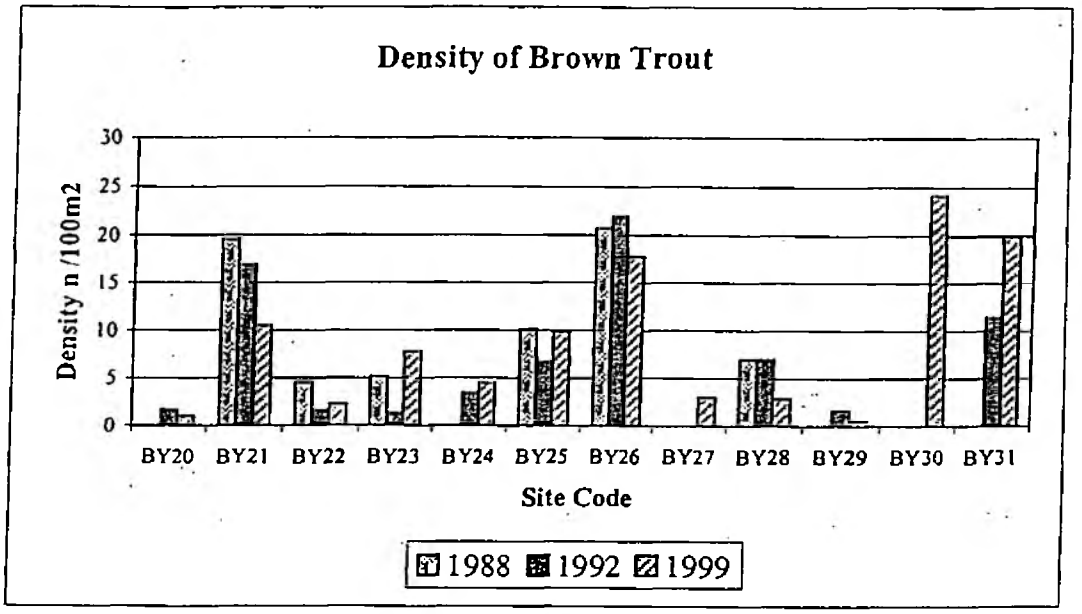


Figure 13 -Density of fish – time series



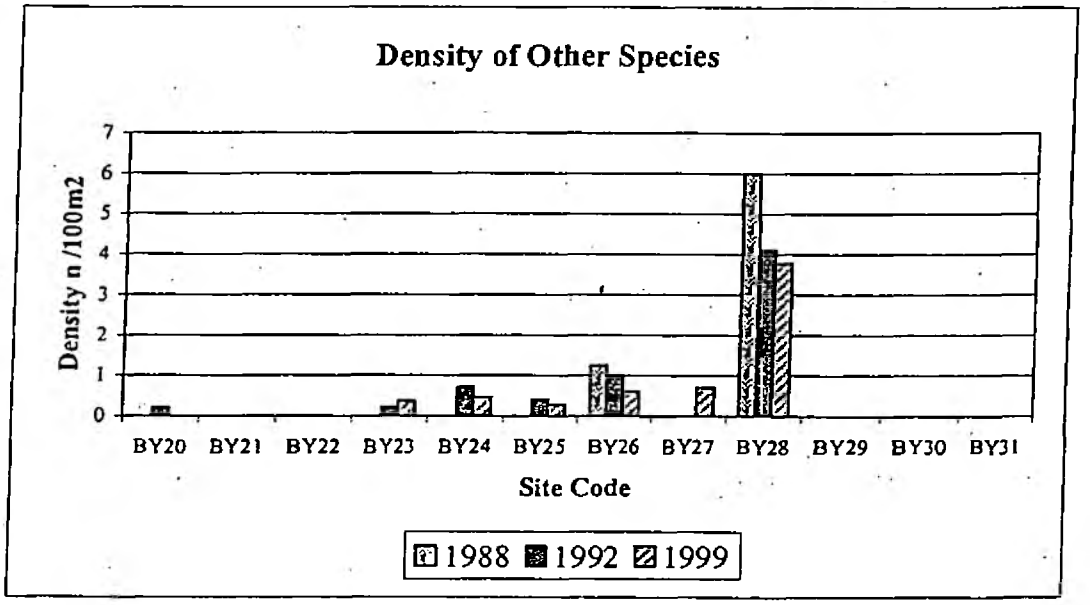
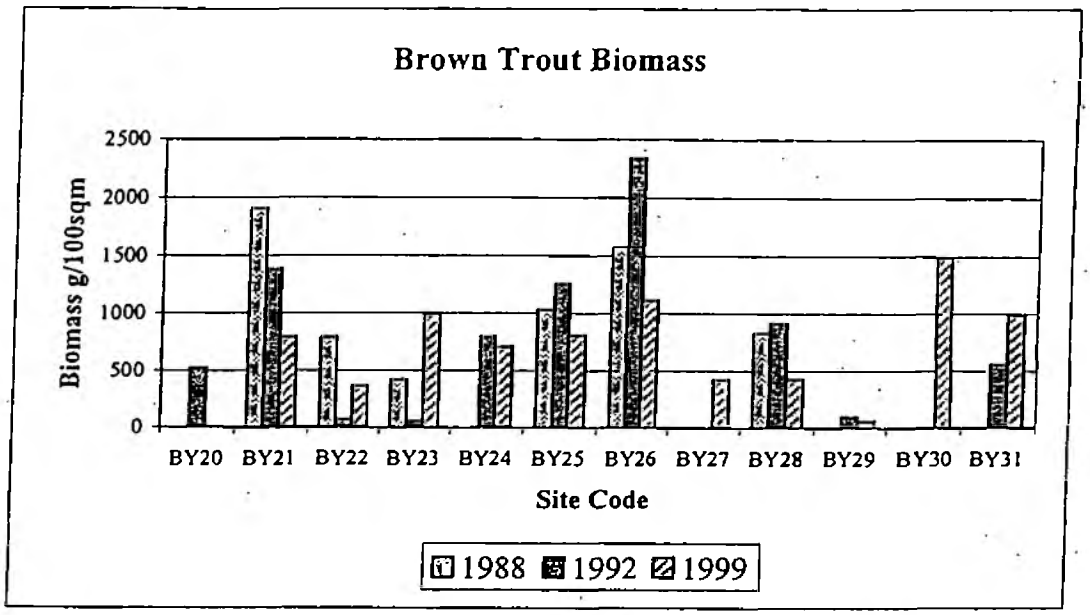


Figure 14-Fish biomass – time series



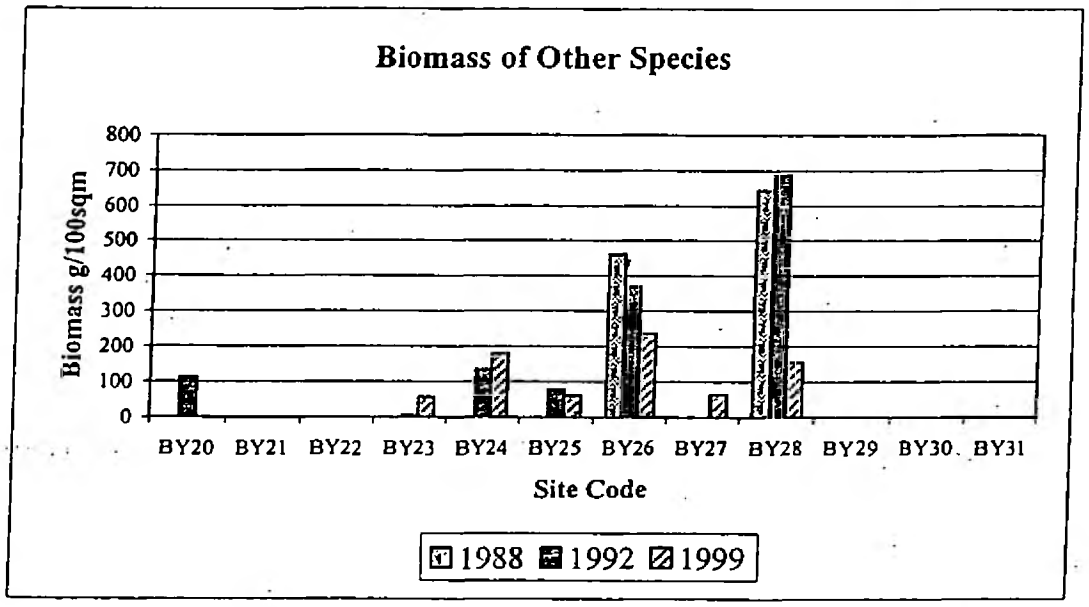
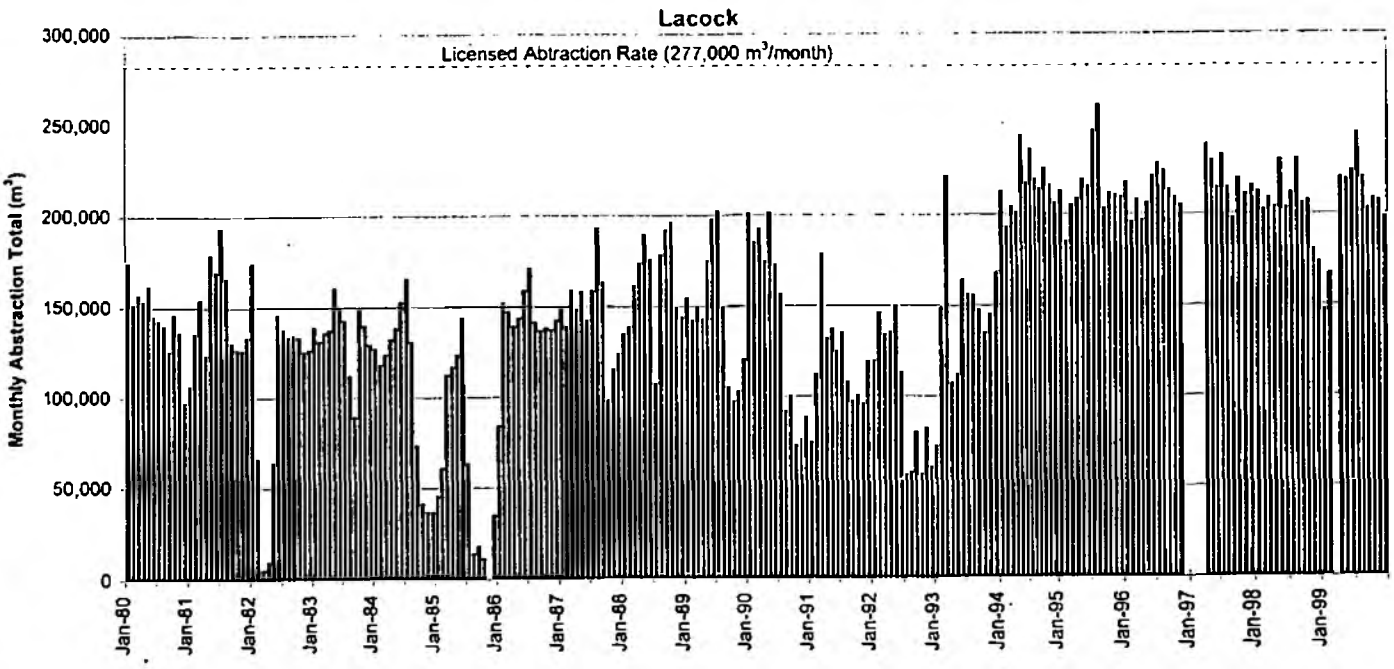
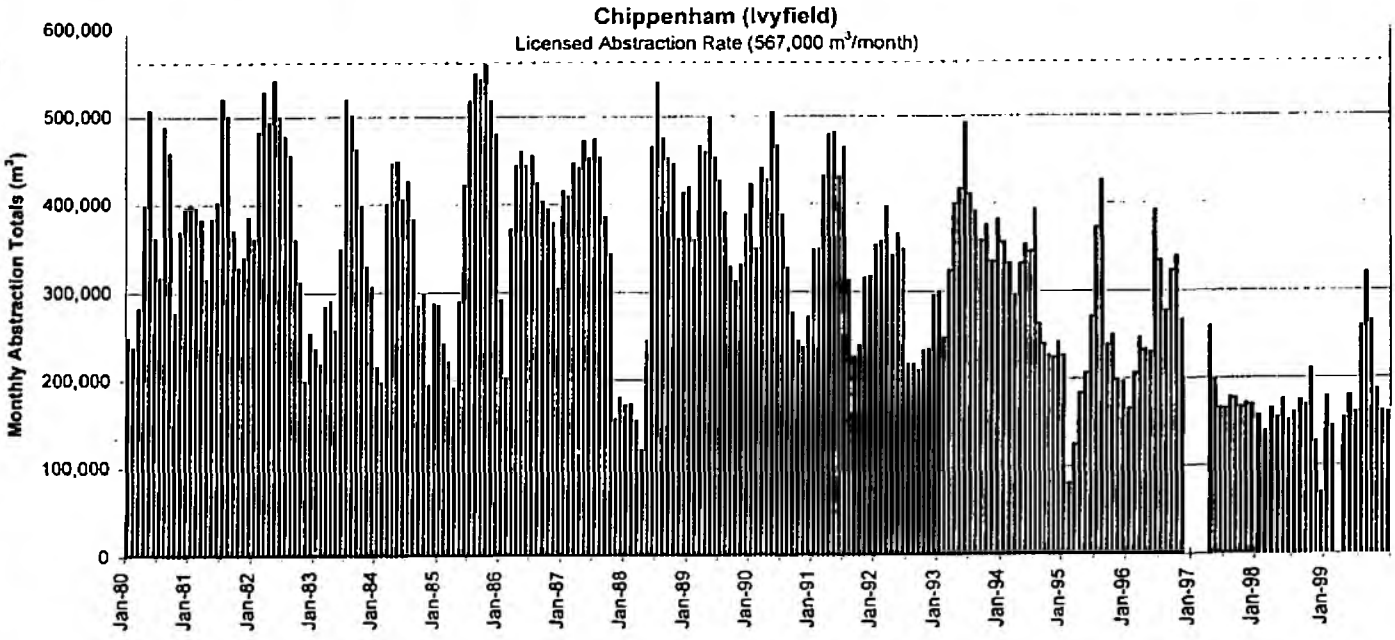


Figure 15

– Monthly Public Supply Abstraction Returns – Lacock & Ivyfield

Note: The gaps shown for Dec1996- March 1997 in this figure are due to missing data, and do not represent the absense of abstraction in these months.


Lacock
Licensed Abtraction Rate (277,000 m³/month)
Monthly Abstraction Total (m³)
300,000
250,000
200,000
150,000
100,000
50,000
0
Jan-80
Jan-81
Jan-82
Jan-83
Jan-84
Jan-85
Jan-86
Jan-87
Jan-88
Jan-89
Jan-90
Jan-91
Jan-92
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99


Chippenham (Ivyfield)
Licensed Abstraction Rate (567,000 m³/month)
Monthly Abstraction Totals (m³)
600,000
500,000
400,000
300,000
200,000
100,000
0
Jan-80
Jan-81
Jan-82
Jan-83
Jan-84
Jan-85
Jan-86
Jan-87
Jan-88
Jan-89
Jan-90
Jan-91
Jan-92
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99

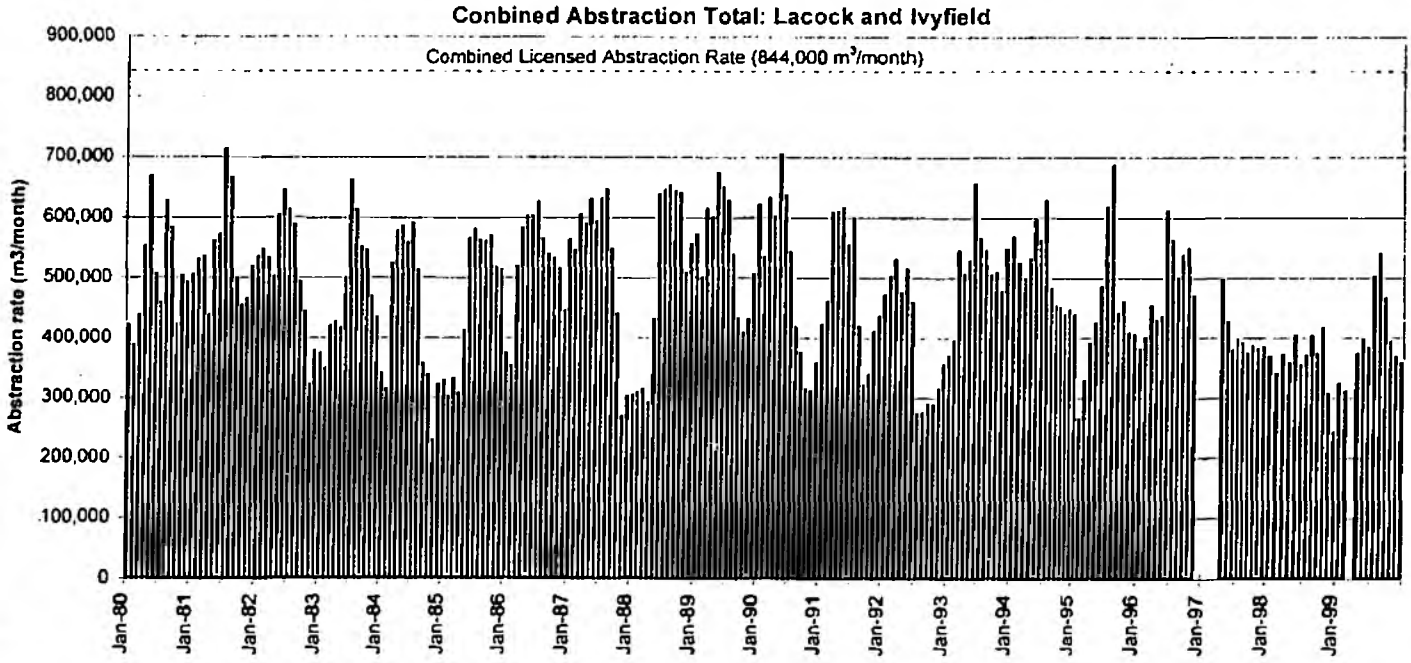

Conbined Abstraction Total: Lacock and Ivyfield
Combined Licensed Abstraction Rate (844,000 m³/month)
Abstraction rate (m3/month)
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
Jan-80
Jan-81
Jan-82
Jan-83
Jan-84
Jan-85
Jan-86
Jan-87
Jan-88
Jan-89
Jan-90
Jan-91
Jan-92
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99

Figure 16 - Monthly Stream Support Abstraction Returns

Cumulative monthly totals for all three sources

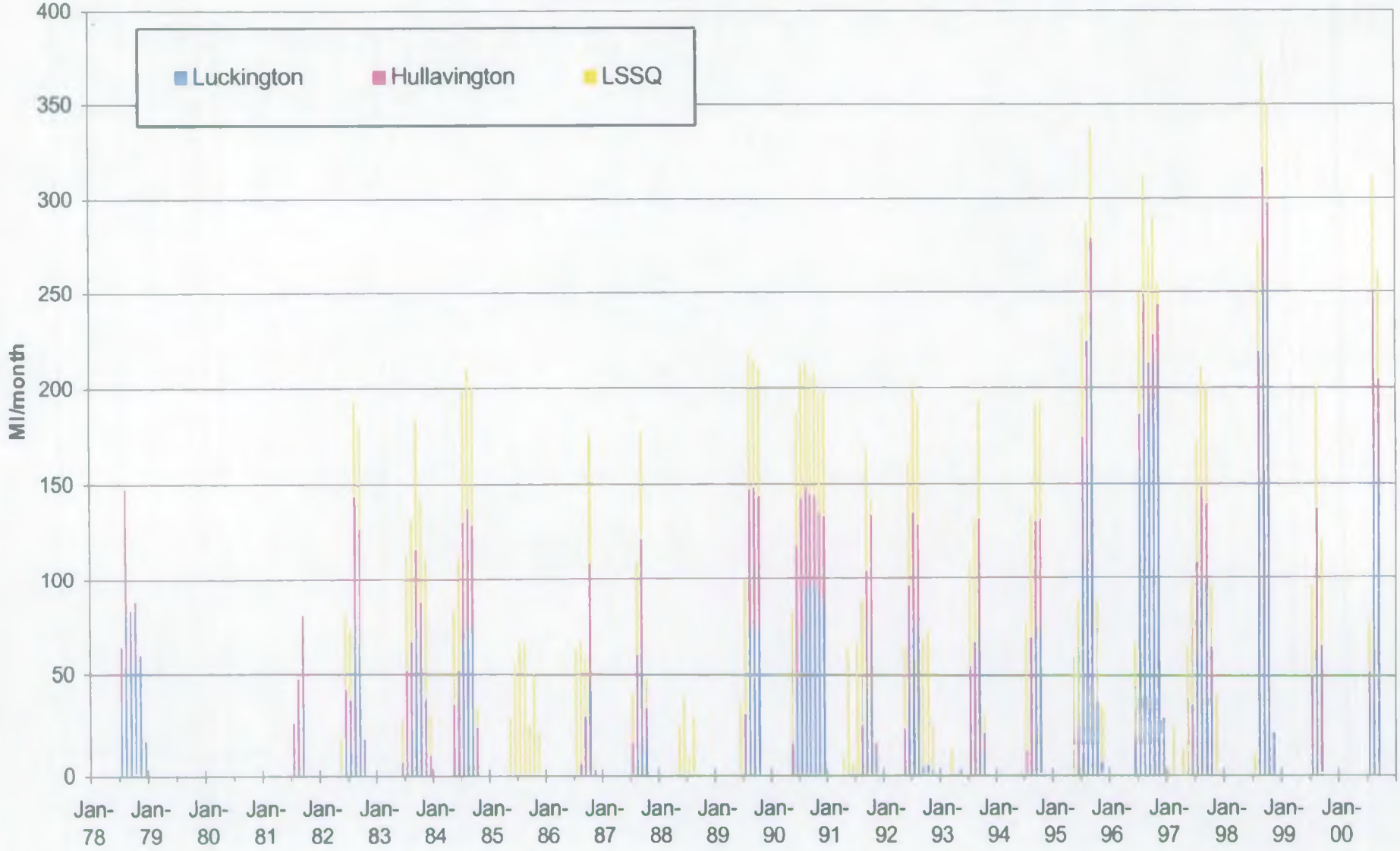
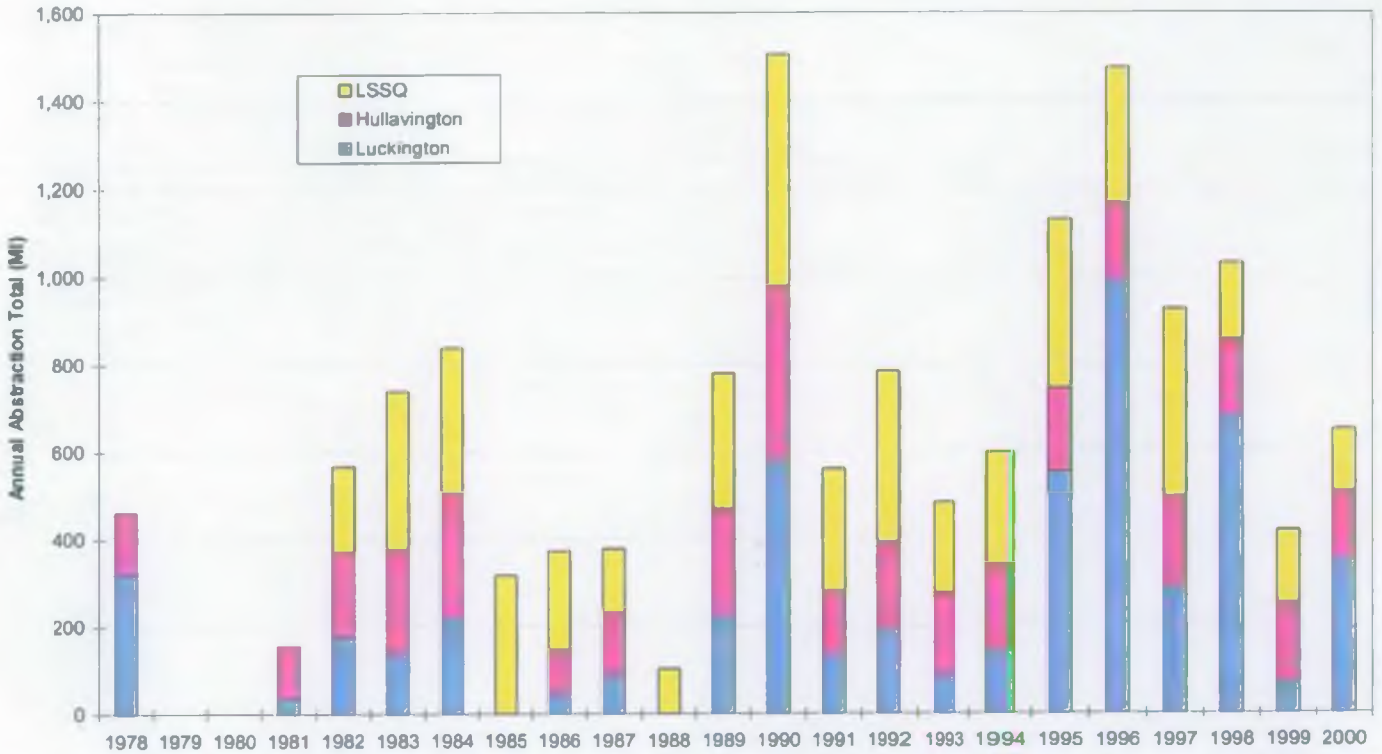


Figure 17 – Annual Stream Support Abstraction Returns



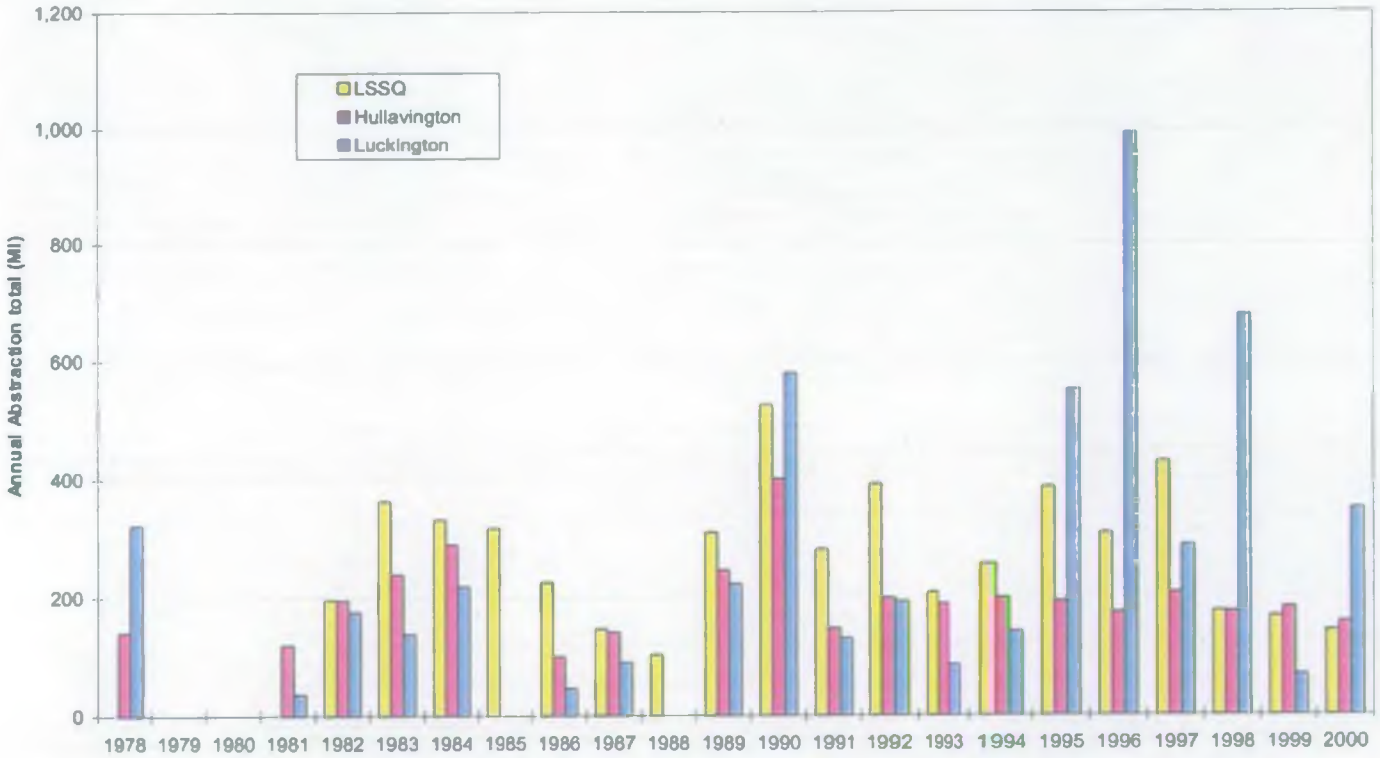


Figure 18 - Flow at Ford: Contribution from tributaries and main valley

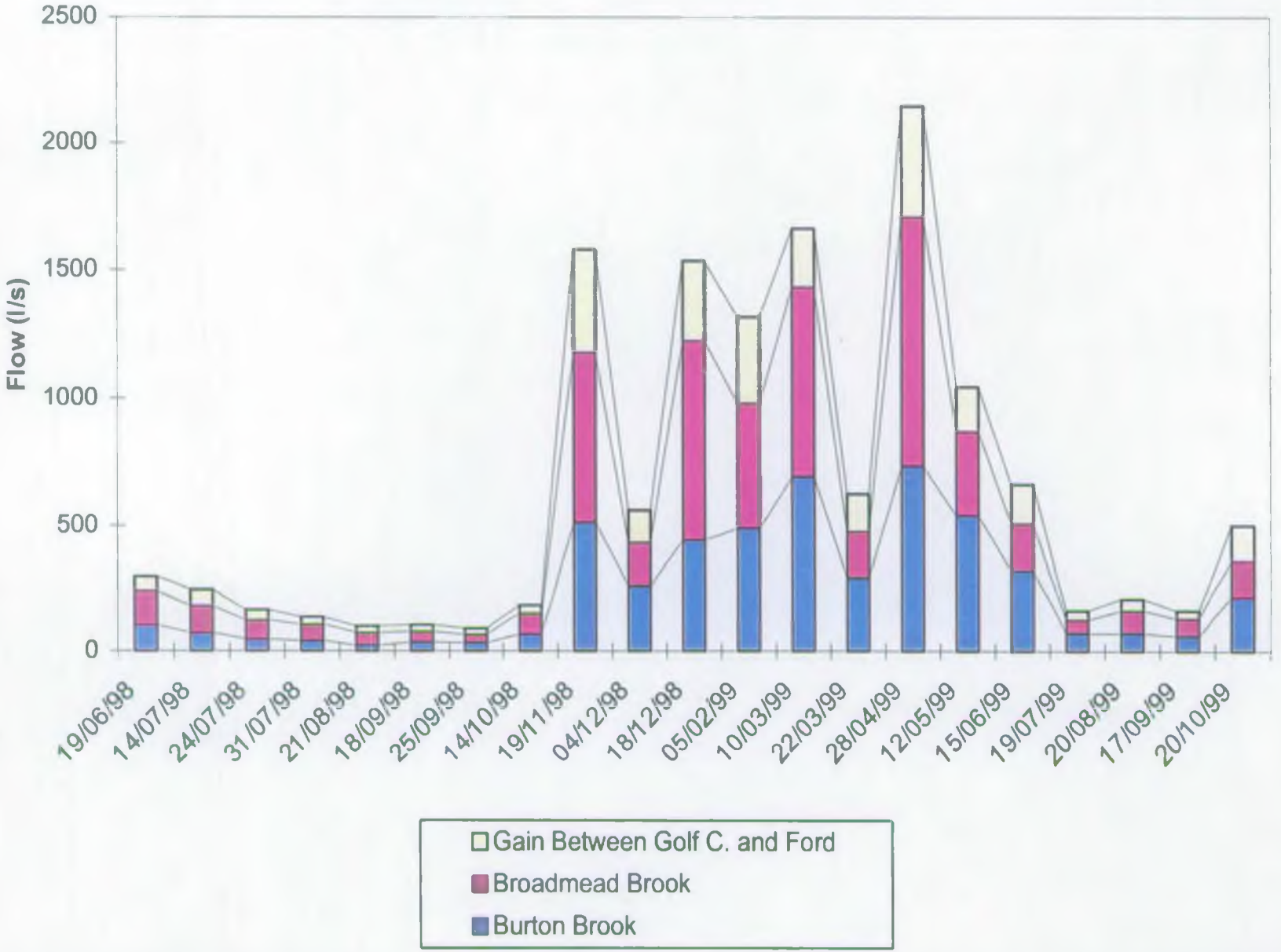


Figure 19 - By Brook effective rainfall against groundwater levels in the Great Oolite

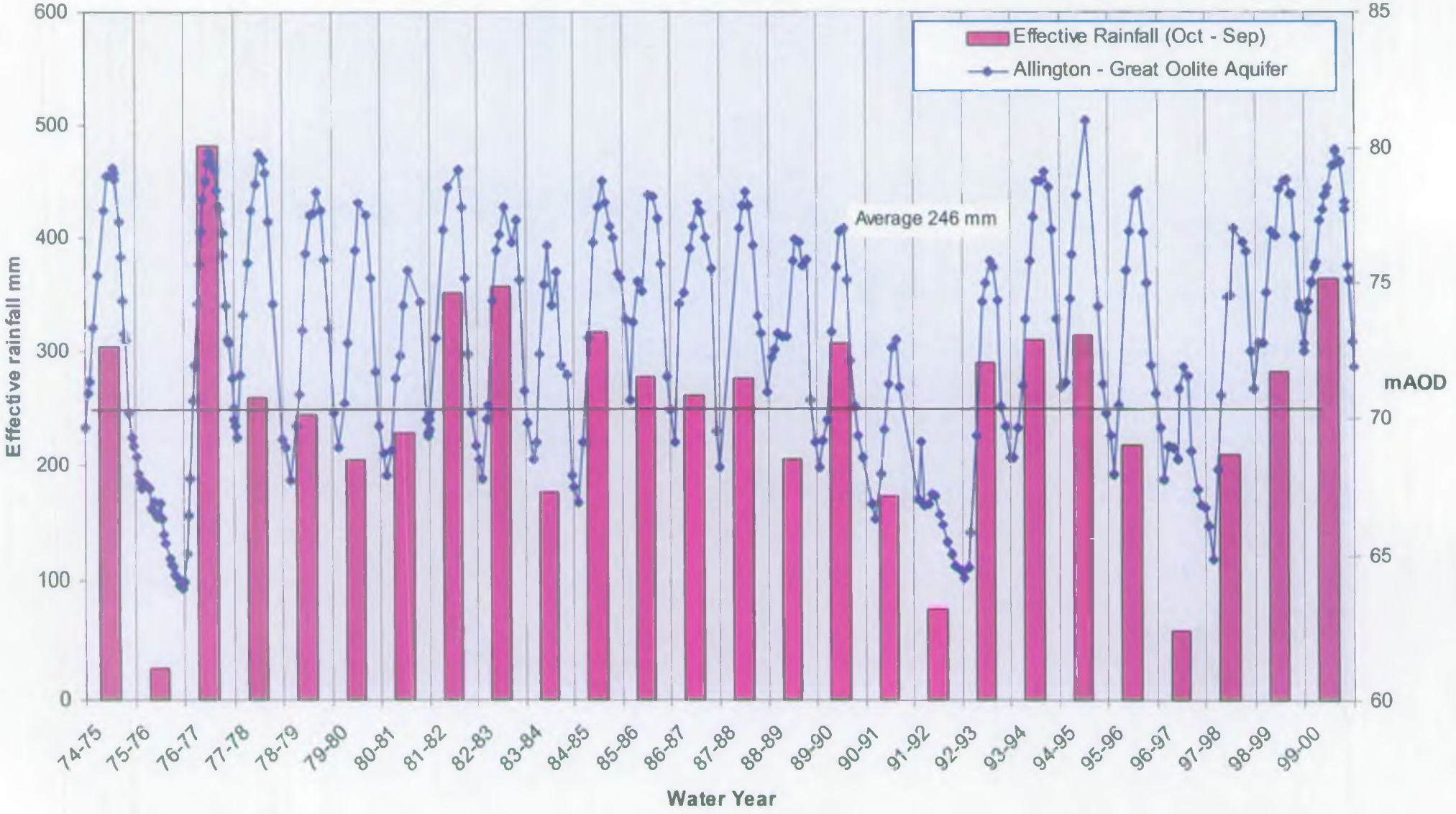
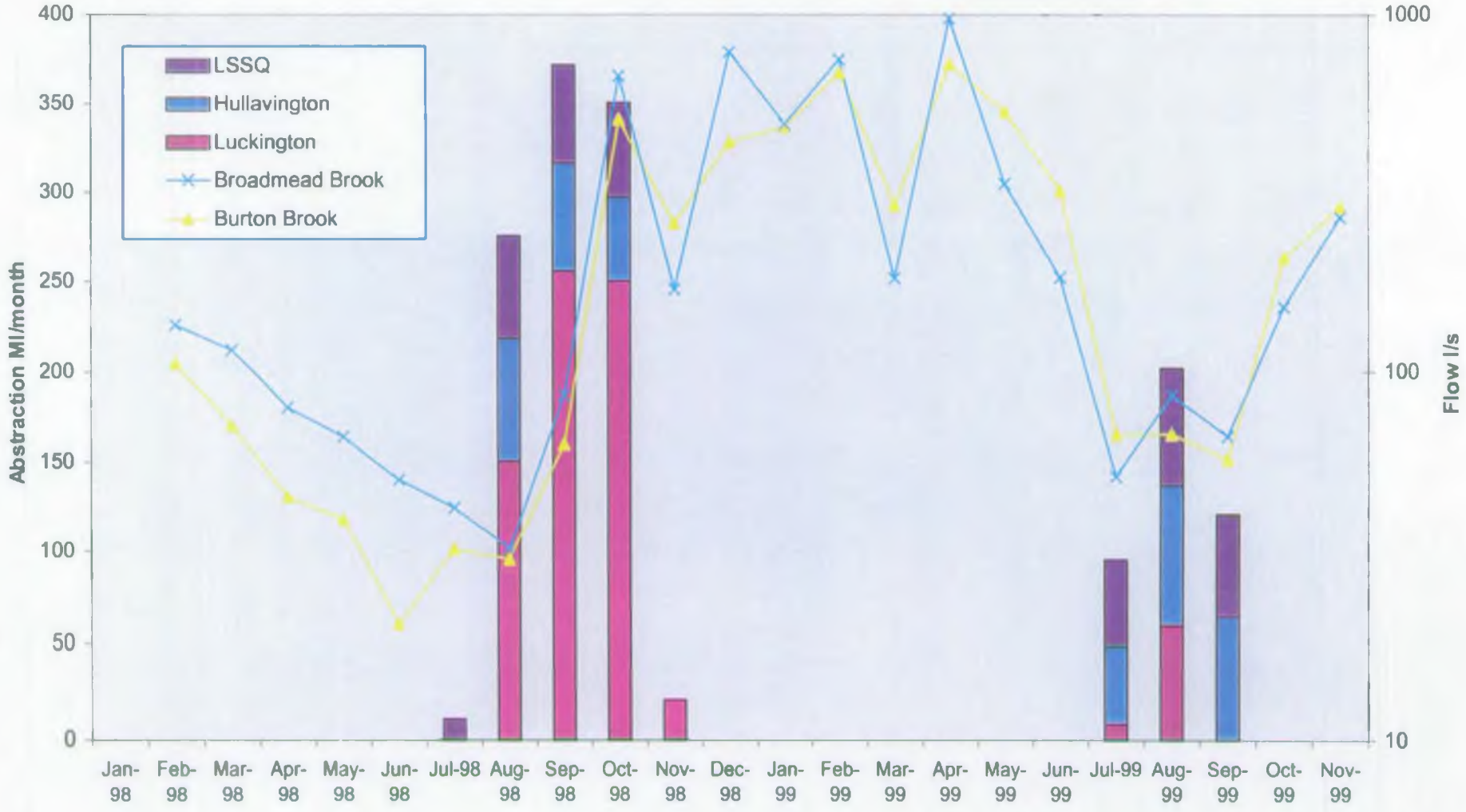


Figure 20 - Monthly stream support abstractions and flow in the Burton & Broadmead Brooks



Map 1 -By Brook catchment with water resources observation sites

Raingauges

number	location	start date	weight	1981-2000 Period Average
5301049OB	Bathford	01/01/1973	0.22	863 mm
5304010OB	Castle Combe	01/01/1981	0.36	875mm
5304040OB	Marshfield	01/01/1975	0.42	934mm

Groundwater observation sites

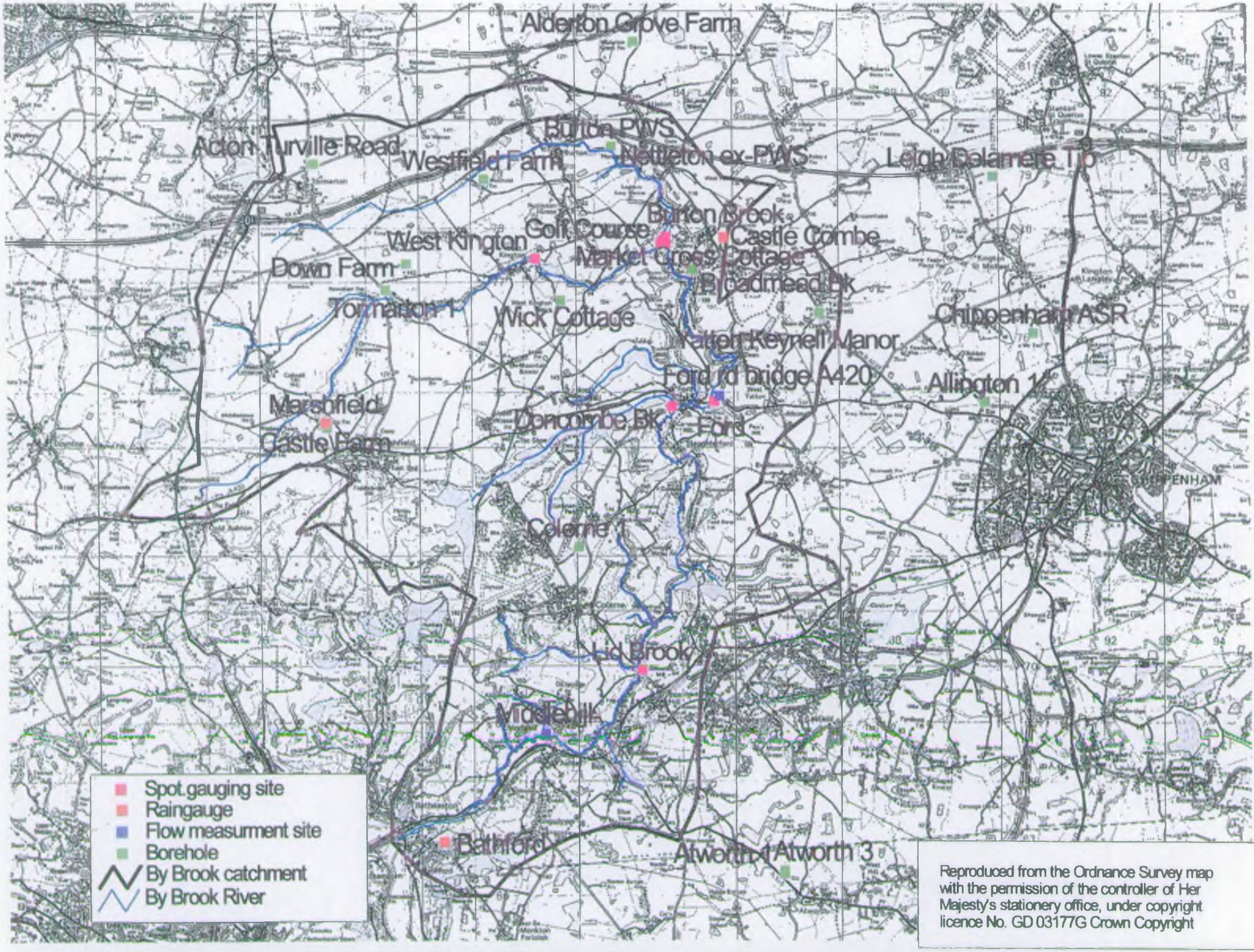
site number	Name	NGR	Type	period of observation
90886332	Atworth 1	ST 8589 6635	borehole	1973-1989 and 1998-present
90887301	Nettleton ex-PWS	ST 8267 7947	borehole	new site
90897401	Chippenham ASR (Ivyfield)	ST 9060 7605	borehole	new site
908773412	Tormarton 1	ST 7834 7682	borehole	1973-1986 and 1998-present
91477333	Acton Turville Road	ST 7701 7915	well	1960-1970 and 1999-present
914773348	Down Farm	ST 7874 7730	well	1960-1978 and 1998-present
91477408	Castle Farm	ST 7722 7433	well	1964-1974 and 1999-present
91486334	Atworth 3	ST 8590 6640	borehole	1972-present
91487134A	Coleme 1	ST 8201 7213	borehole	1973-present
91487201	*Burton PWS**	*ST 8267 7947*	*well*	*new site –no longer in use**
91487202	Westfield Farm	ST 8023 7887	well	new site
91487247	Market Cross Cottage	ST 8420 7720	well	1998-present
91487301	Wick Cottage	ST 8168 7663	well	new site
914873377	Yatton Keynell Manor	ST 8660 7640	well	1975-1979 and 1998-present
914873407	Leigh Delamere Tip 1	ST 8988 7893	borehole	1978-1986 and 1998-present
914873415	Leigh Delamere Tip 2	ST 8988 7893	borehole	1978-1986 and 1998-present
91487433	Allington 1	ST 8970 7479	borehole	1974-present
914881337	Alderton Grove Farm	ST 8310 8140	borehole	1966-1986 and 1998-present

*Burton PWS has been taken out of use as it represents residual well head and is not related to groundwater levels (see Appendix 3)

Note: The first three digits of the borehole numbering system reflect the (dominant) aquifer: 908 = Inferior Oolite and 914 = Great Oolite. However, a borehole or well may capture more than one aquifer.

Flow measurement sites

site	NGR	type
Middlehill FMS	ST814688	permanent
Lid Brook	ST832699	spot
Doncombe Brook	ST838747	spot
Ford FMS	ST846748	permanent
Golf Course	ST837777	spot
Broadmead Brook	ST836777	spot
Burton Brook	ST837778	spot
West Kington	ST812774	spot



Map 2 -Geological Map of the By Brook Catchment

INDEX, EXPLANATION AND KEY TO GEOLOGICAL COLOURS

DRIFT

Not drawn to scale

PLEISTOCENE AND RECENT

- Alluvium
- Alluvial Cone
- First Terrace (Loam)
- First Terrace (Gravel)
- Second Terrace (Gravel)
- First and Second Terraces (Gravel) Undifferentiated
- Third Terrace (Gravel)
- Head

SOLID

GENERALIZED VERTICAL SECTION

Scale: 1 inch to 200 feet

CRETACEOUS

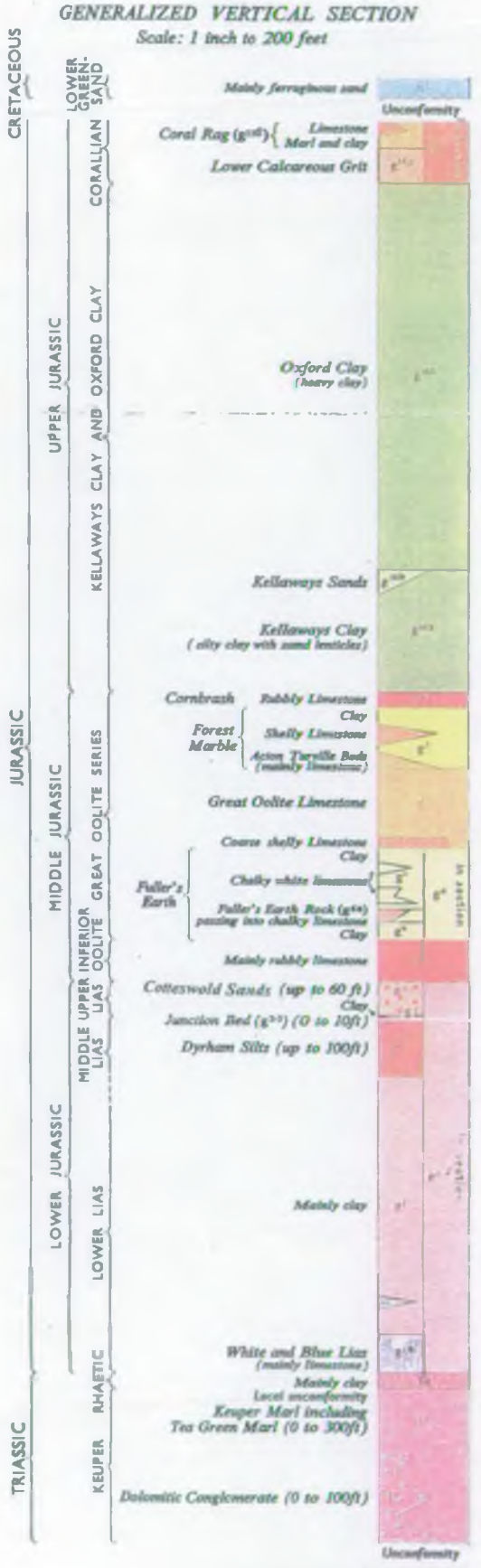
LOWER GREEN-SAND

- Mainly ferruginous sand

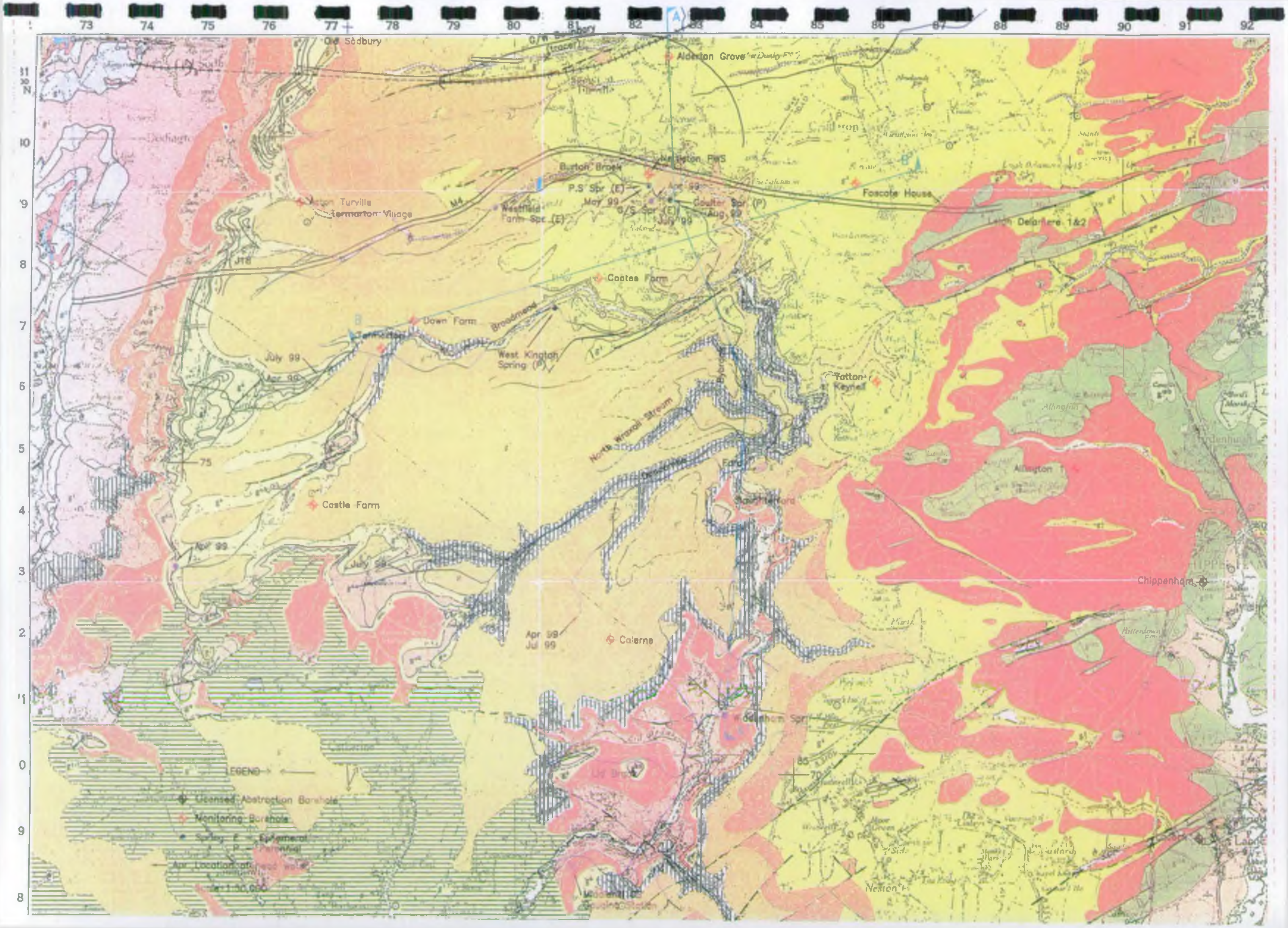
Unconformity

CORALLIAN

- Coral Rag (g^{1st}) — Limestone / Marl and clay
- Lower Calcareous Grit

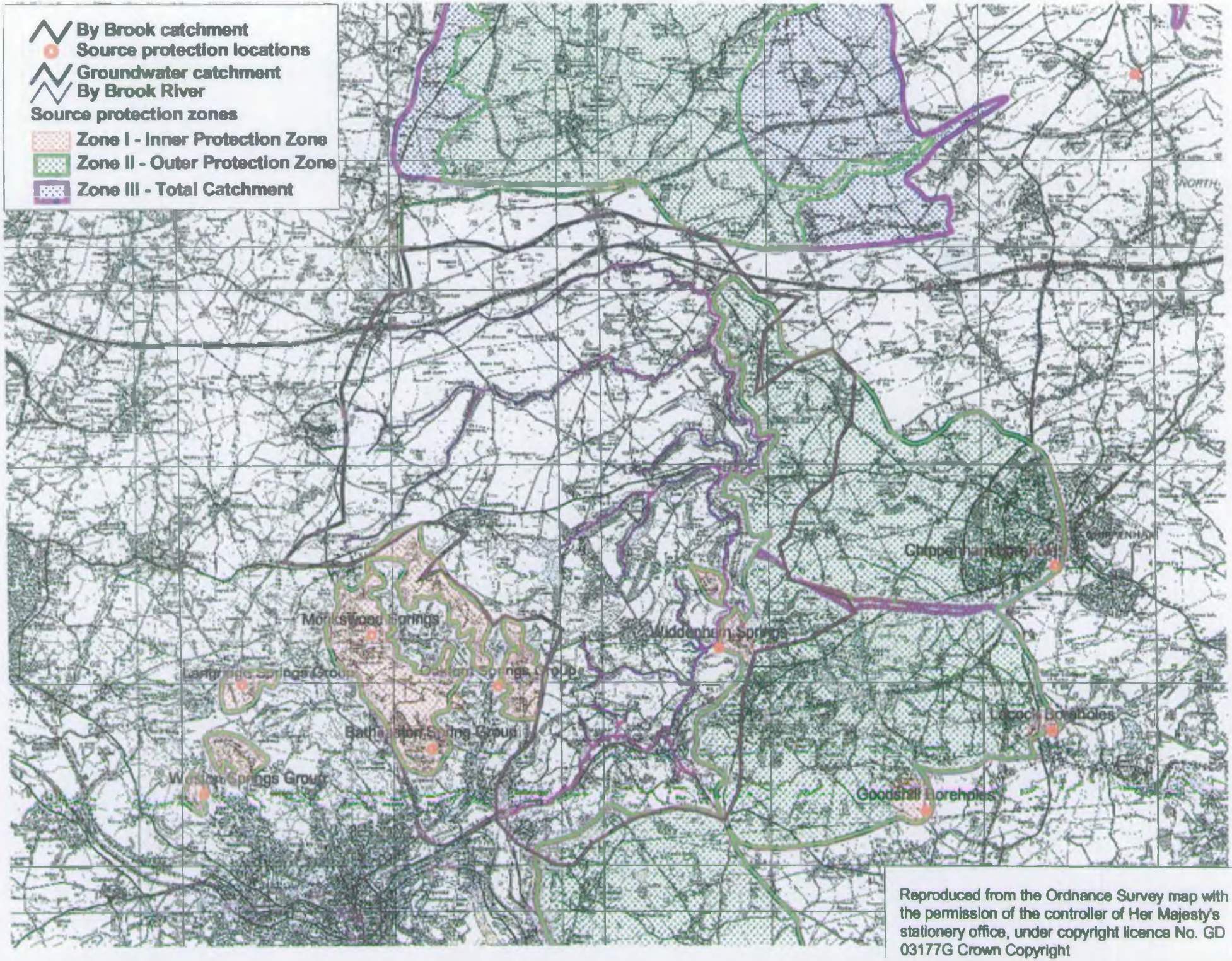


- Lower and Middle Jurassic undivided, in foundered areas
- Carboniferous Limestone Series, undivided



73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
Old Sodbury
G/W Sodbury (tracer)
Alderton Grove
Burton Brook
P.S Spr (E)
May 99
Apr 99
G/S Spr (E)
July 99
Coulter Spr (P)
Aug 99
Foscote House
Leigh Delamere 1&2
Acton Turville
Tormarton Village
M4
Westfield Farm Spr (E)
J18
Cootes Farm
Down Farm
Broadmead
West Kington Spring (P)
July 99
Apr 99
North Wraxall Stream
75
Castle Farm
Apr 99
July 99
Apr 99
Jul 99
Colerne
Allington
Chippenham
Neston
LEGEND
Licensed Abstraction Borehole
Monitoring Borehole
Spring E = Ephemeral
P = Perennial
Apr Location of head water

Map 3 -Catchment boundaries and source protection zones



Map 4 -Major abstraction licenses and discharge consents

Main abstraction licences in the catchment with licensed quantity (Ml)

Licence No	Licence Holder	Daily Quantity	Annual Quantity	source
175304G003	M J CHURCH PLANT HIRE	0.003	1	ground
175304S008	PORTALS (BATHFORD) LTD	1.364	409.15	surface
175304S025	WESSEX WATER PLC (WIDDENHAM)	2.7	800	surface
175304G048	WEST KINGTON NURSERIES	0.23	38.2	ground
175304S054	MANOR HOUSE GOLF CLUB	0.72	50	surface

Note: Licensed quantities are maximum volumes per day or per year. 1 Ml = 1000 m^3

Major abstraction licences outside the By Brook catchment

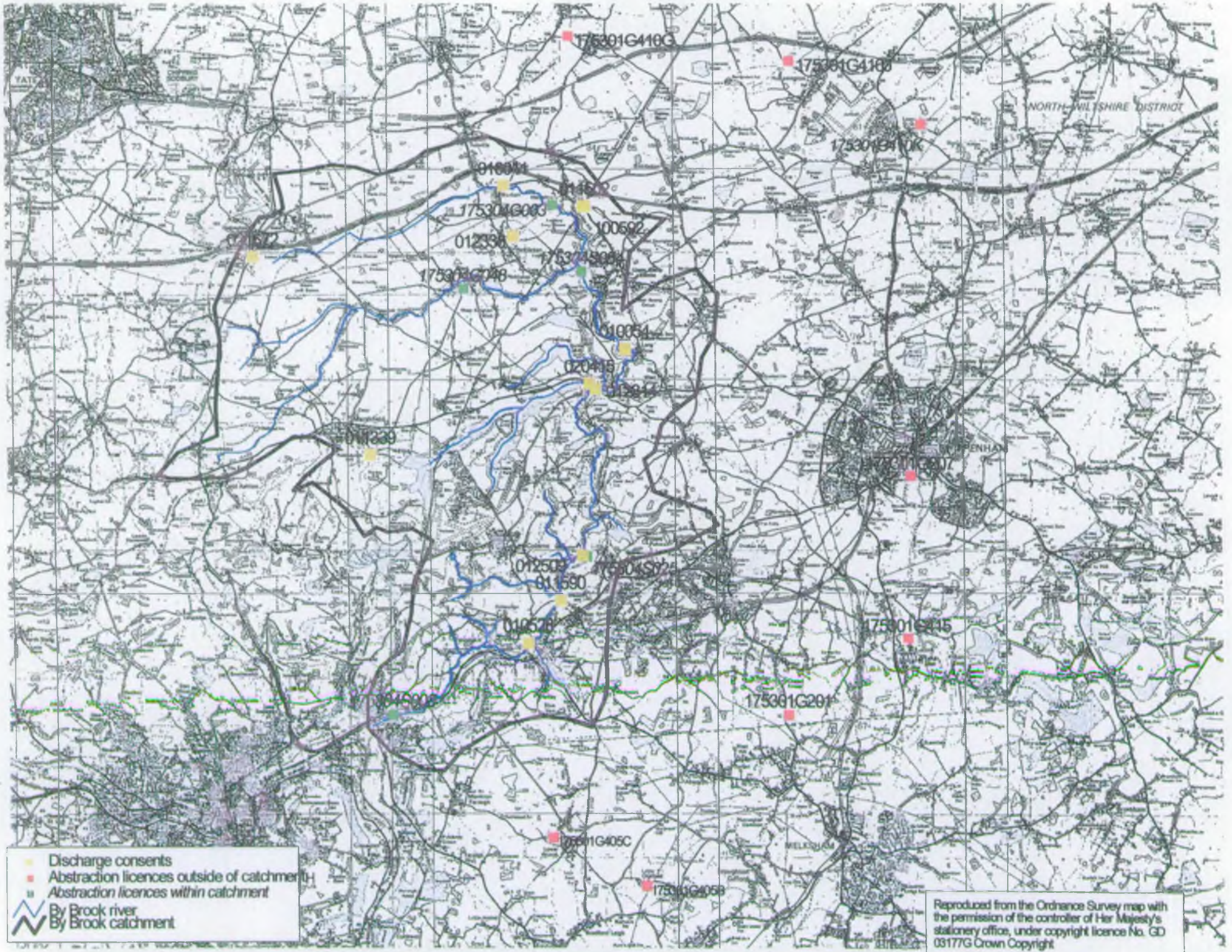
Licence No	Licence Holder	Annual Licensed Quantity
175301G201	WESSEX WATER PLC – GOODSHILL	500
175301G207	WESSEX WATER PLC – IVYFIELDS	6820
175301G405B	WESSEX WATER PLC – LITTLE CHALFIELD	401.5
175301G405C	WESSEX WATER PLC – SOUTH WRAXALL	730
175301G410G	WESSEX WATER PLC – LUCKINGTON (G)	900
175301G410J	WESSEX WATER PLC – HULLAVINGTON (J)	900
175301G410K	WESSEX WATER PLC - L.S.S.Q. (K)	900
175301G415	WESSEX WATER PLC – LACOCK	3320

Consented discharges

Number	location	dry weather flow (m^3/d)	maximum flow (m^3/d)
	Sewage Treatment Works (public)		
010011	Burton STW (Wessex Water)	32	190
010054	Long Dean STW (Wessex Water)	210	
010528	Box STW (Wessex Water)	580	1728
011339	Marshfield STW (Wessex Water)	272	907
011590	Colerne STW (Wessex Water)	527	n.a.
101513	Ford Deane (North Wilts) [1]		6.5
101512	Nettleton STW (North Wilts) [1]		6.5
	Consented discharges (private)		
011502	The Salutation Inn		5
012814	White Hart PH		9
012509	RAF Rudloe Manor		60
021672	Tormarton rest area		6
100592	*Slaughterford Housing Devt.* [2]		*10*

[1] *consents relating to the new sewage treatment units due to be installed in early 2002*

[2] *consent no. 100592 is currently under review by the Secretary of State*



Map 5 -River Quality Objectives and water quality monitoring points

River Quality Objectives (RQO) stretches

(including the corresponding biological GQA sampling reference[1])

Water Quality Site Ref.	Leap Ref. No.*	Equivalent Biological GQA sampling site Ref.	Public Stretch	RQO
Z4170201	57	NR09.6001	Burton Brook from Burton to confluence with Broadmead Brook	2
Z4170207	58	NR09.6003	By Brook confluence (Broadmead and Burton Brooks) to Rack Hill	1
Z4170214	59	NR09.6004	Rack Hill to confluence with Doncombe Brook	1
Z4170107	60		Confluence with Doncombe Brook to d/s confluence with Lid Brook	1
Z4170101	61	NR09.6007	d/s confluence with Lid Brook to Box Bridge	1
Z4170102	62	NR09.6008	Box Bridge to confluence with Avon	1
Z4180108	63	NR09.6011	Doncombe Brook: Fuddlebrook to u/s Marshfield STW	2
Z4180118	64	NR09.6010	Doncombe Brook: u/s Marshfield STW to d/s Marshfield STW	2
Z4180101	65	NR09.6005	Doncombe Brook: d/s Marshfield STW to confluence By Brook	1
Z4170202	66	NR09.6002	Broadmead Brook: West Kington to confluence with By Brook	1

* Ref. number used in the Local Environment Agency Plan (LEAP)

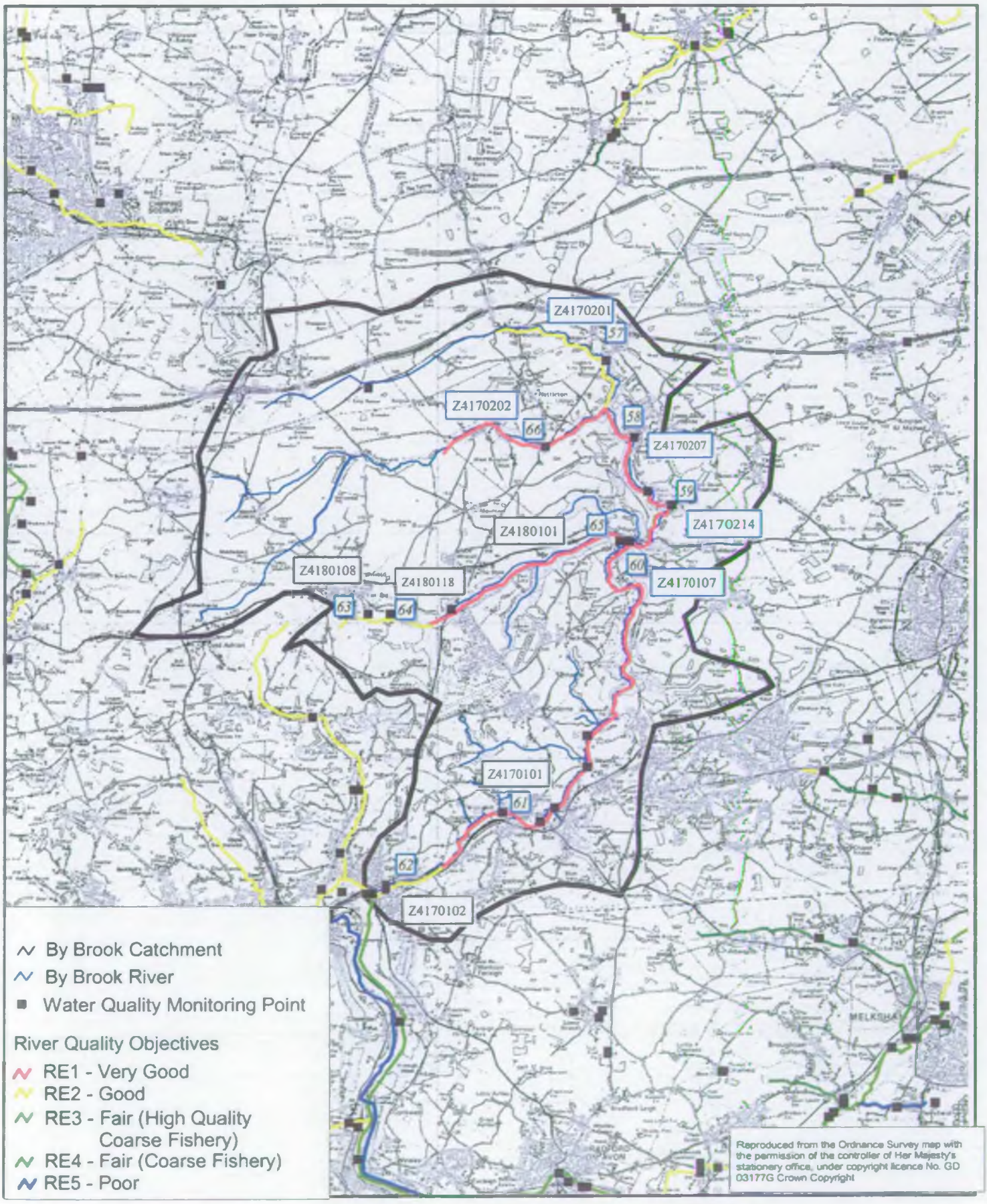
Water quality monitoring sites

(including the corresponding biological GQA sampling reference[1])

Water Quality Site Ref.	Equivalent Biological GQA sampling site Ref.[1]	Site location	Purpose
Z4170201	NR09.6001	By Brook @ Fosse Way	GQA
Z4170207	NR09.6003	By Brook @ Castle Combe	GQA
Z4170214	NR09.6004	By Brook @ Long Dean Mill	GQA, FF
Z4170107	N/A	By Brook @ Drewett's Mill	GQA,
Z4170101	NR09.6007	By Brook @ Middlehill	GQA, FF
Z4170102	NR09.6008	By Brook @ Bathford	GQA
Z4180108	NR09.6011	Doncombe Brook u/s STW	GQA
Z4180118	NR09.6010	Doncombe Brook d/s STW	GQA
Z4180101	NR09.6005	Doncombe Brook @ Ford	GQA, FF
Z4170202	NR09.6002	Broadmead Brook	GQA, FF

Note: GQA = general quality assessment
FF = freshwater fisheries monitoring

[1] Water Quality (chemical) and biological GQA samples are not taken from exactly the same location due to the different requirements of sampling techniques, however they are very close to each other and are taken to relate to the same 'site'.


Z4170201
57
Z4170202
66
58
Z4170207
59
Z4180101
65
Z4170214
60
Z4180108
Z4180118
63
64
Z4170107
Z4170101
61
62
Z4170102
By Brook Catchment
By Brook River
Water Quality Monitoring Point
River Quality Objectives
RE1 - Very Good
RE2 - Good
RE3 - Fair (High Quality Coarse Fishery)
RE4 - Fair (Coarse Fishery)
RE5 - Poor
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Map 6 -Macrophyte sampling sites & chemistry sampling points

Locations of river macrophyte surveys.

River	Location	from (NGR)	to (NGR)
Broadmead Brook	West Kington	ST 8178 7706	ST 8186 7703
Burton Brook	Gatcombe	ST 8350 7893	ST 8356 7887
By Brook	Lower Long Dean	ST 8495 7545	ST 8490 7545
By Brook	Ford	ST 8358 7424	ST 8358 7414
By Brook	Widdenham Mill	ST 8375 7114	ST 8375 7104
By Brook	Middlehill	ST 8155 6876	ST 8142 6880

Details of water chemistry sampling sites.

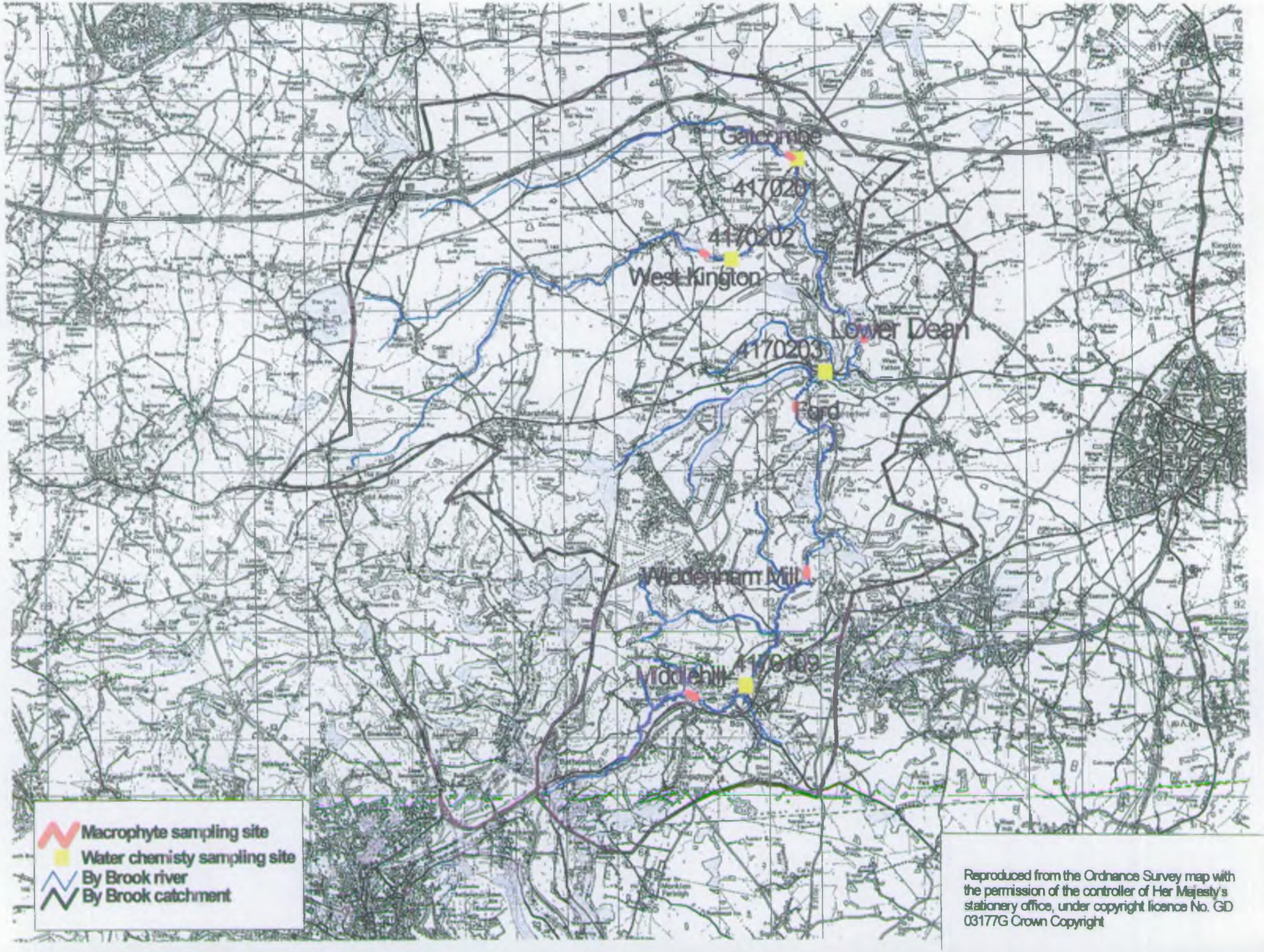
Site	River	Location	Archive Ref.*	Water Quality Site Ref.	NGR
1	By Brook	Fosse Way	04170201	Z4170201	ST 836 788
2	Broadmead Brook	Fosse Way	04170202	Z4170202	ST 823 769
3	By Brook	Ford	04170203	Z4170214	ST 841 748
4	By Brook	Box	04170109	Z4170101	ST 825 689

* Old Ref. Numbering system used

WWT Water Crowfoot Survey locations

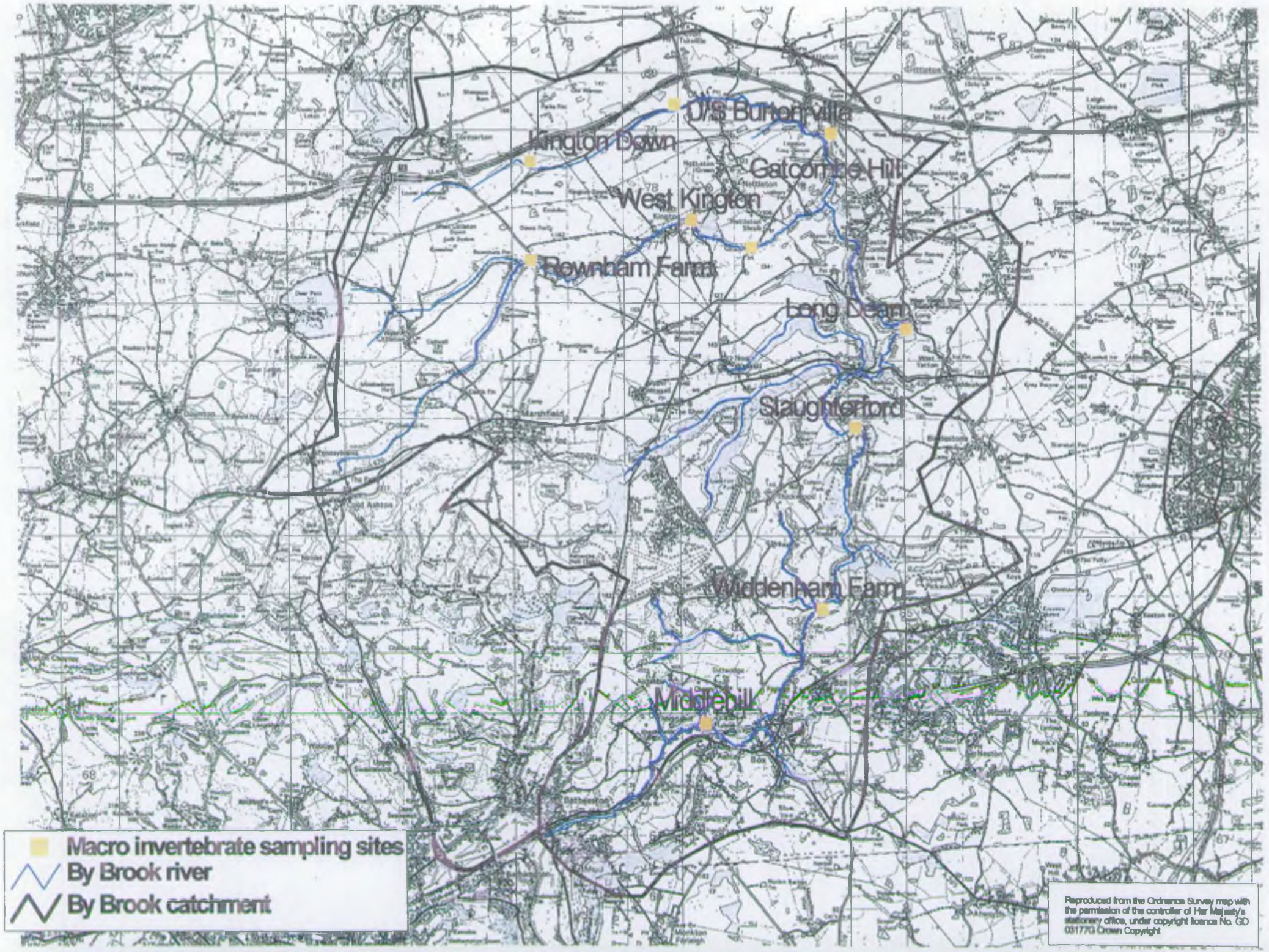
(not marked on this map)

stretch	location of start point	NGR
1	eastern edge Golf Course boundary	ST 838 783
2	stepping stones across By Brook on Golf Course	ST 836 777
3	opposite last pylon southern end Honeybrook Farm	ST 840 724
4	where railway line crosses the By Brook	ST 823 688
5	Middlehill road bridge	ST 814 687



Map 7 –1999 Macro-invertebrate Survey - sampling sites

Watercourse	Site	NGR
Burton Brook	Kington Down	ST 7830 7840
Burton Brook	U/S Burton village	ST 8090 7940
Broadmead Brook	Rownham Farm	ST 7830 7670
Broadmead Brook	West Kington	ST 8120 7740
Broadmead Brook	Nettleton Shrub	ST 8227 7693
By Brook	Gatcombe Hill	ST 8370 7890
By Brook	Long Dean	ST 8500 7550
By Brook	Slaughterford	ST 8410 7380
By Brook	Widdenham Farm	ST 8350 7070
By Brook	Middlehill	ST 8140 6880


D/s Burtonville
Kington Down
Gatcombe Hill
West Kington
Rowntham Farm
Long Beam
Slaughterford
Widdenham Farm
Middlehill
Macro invertebrate sampling sites
By Brook river
By Brook catchment
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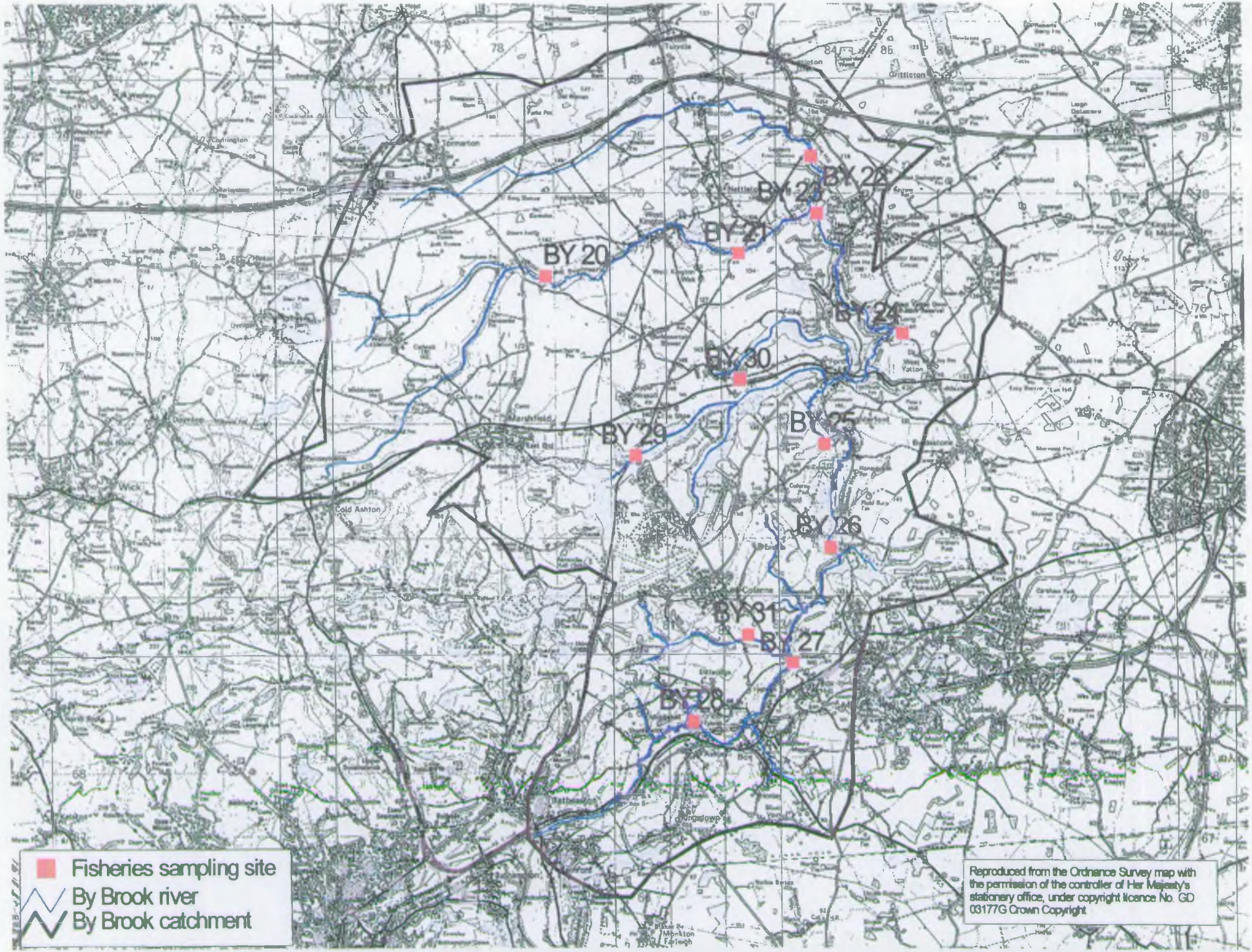
Map 8 -Fisheries sampling sites

Fisheries sampling sites

site code	site name	NGR
BY 20	Broadmead Brook, Lower Shirehill Fm	ST 788765
BY 21	Broadmead Brook, Fosseway	ST 823769
BY 22	Gatcombe Mill	ST 836786
BY 23	Castle Combe Golf Course	ST 837776
BY 24	Long Dean	ST 852755
BY 25	Slaughterford	ST 838736
BY 26	Weavern	ST 839718
BY 27	Drewetts Mill	ST 832698
BY 28	Middlehill	ST 814688
BY 29	Doncombe Brook, Fosseway	ST 804734
BY 30	Doncombe Brook, North Wraxall	ST 823747
BY 31	Lid Brook, Colerne	ST 824703


BY 20
BY 21
BY 22
BY 23
BY 24
BY 25
BY 26
BY 27
BY 28
BY 29
BY 30
BY 31
Fisheries sampling site
By Brook river
By Brook catchment
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Appendix 1 1998 recommendations & proposed actions (Halcrow)

This Appendix presents the recommendations of the Halcrow report and the Agency's proposals for action as agreed with the FOTBV in spring 1998, as well as the update on these actions in October 2000 (in italics).

1. GENERAL

The report recommended the preparation of a strategic plan for the By Brook which should involve all interested parties. The report also envisaged the development of a Forum of interested parties to allow for long-term sustainable management of the catchment.

Environment Agency (EA) PROPOSAL: The actions identified below are intended to form the basis of a three year strategy for the catchment. At the end of that period the additional information gathered and actions implemented will be reported back to the Friends of The By Brook Valley (FOTBV) in spring 2001. Existing communications between the EA and FOTBV and other interested parties will be maintained. Interim reports on progress with studies will be provided annually.

Progress: Strategic plan was agreed with the FOTBV. Reports on progress were regularly presented to the FOTBV meetings (6 monthly or annually). The present report represents our reporting to the FOTBV.

2. SPECIFIC

2.1 EA to produce a "popular leaflet"

PROPOSAL: EA to produce leaflet for publication in 1998.

Progress: A general leaflet 'Living on the edge: a guide to the rights and responsibilities of a riverside owner' was made available. A leaflet 'Wildlife along the By Brook' was produced with the Wiltshire Wildlife Trust in 1997; this presents detailed advice on practical conservation measures. The production of new leaflet has been delayed until results of the investigation are known and agreed. Action deferred.

2.2 Improve the hydrological data set for the catchment, spanning the summer months but concentrating on low flow periods. Report emphasises the need for more detailed information on the timing and rates of all abstractions and effluent returns within the catchment.

PROPOSALS:

1. EA to establish one or two temporary flow measuring sites in middle and upper reaches of catchment. Aim to establish one site at Castle Combe.

Progress: station established at Ford (no suitable site at Castle Combe). Action completed.

2. EA to undertake spot flow gaugings to provide accretion profiles for the catchment for June to October 1998. Frequency of spot gaugings not more than once per month. Sites to cover Burton Brook, Broadmead Brook, Doncombe Brook, Lid Brook.

Progress: Spot flow measurement programme extended from June 1998 to October 1999. Results presented in this report. Action completed.

3. Abstractions. EA to conduct in-house review of abstraction return information.

Progress: Results presented in this report. Action completed.

4. For groundwater abstractions, focus effort on examining potential for environmental impact of the West Kington abstraction (Licensed for 0.23 Ml/d).

Progress: Results presented in this report. Action completed.

5. For surface water abstraction, the major licence is the Wessex Water abstraction at Widdenham farm (licensed for 2.7 Ml/d). EA to explore opportunities with Wessex Water to minimise the abstraction during summer months.

Progress: Results presented in this report. Action completed.

6. Discharges. There are 5 Wessex Water sewage treatment works in the catchment with consented dry weather flows (DWF) ranging from 0.023 to 0.580 Ml/d. EA to obtain improved data set for DWFs.

Progress: Results presented in this report. Action completed.

2.3 Further analysis of flow record to determine if the catchment has become more flashy.
PROPOSAL: EA to undertake in-house recession curve analysis of flow record. Analysis to be completed in 1998.
Progress: Results of recession curve and BFI analysis presented in this report. Action completed.

2.4 Develop a better Effective Precipitation data set for the catchment in order to support a more thorough evaluation of the catchment water balance.
MORECS data was used for the study (being the only data available) but was reported by Halcrows as being too crude, each MORECS square covering 1600 km^2. By Brook catchment is about 100 km^2.
PROPOSAL: No proposal to set up additional field data gathering for this item which would require regular measurements of climate data at an appropriate site. EA to undertake in-house hydrological analysis of available data in order to attempt to explain the discrepancy between MORECS effective precipitation and gauged flows for the By Brook.
Progress: Current & historical gaps in rainfall network do not permit further analysis. No local climatic observations available. MORECS data notoriously coarse & calculation method of effective precipitation based on too many assumptions to permit use on this scale. Flows at Middlehill, and further upstream, are healthy as assessed by ecological analysis methods. Further action therefore not necessary (and not possible for lack of data).

2.5 More detailed information on groundwater levels and their fluctuation is required throughout the catchment. (No historical records were available to the study).
The report also identified the possibility of some influence from major groundwater abstractions outside the catchment.
PROPOSAL: Invite FOTBV to identify wells or disused boreholes for groundwater monitoring purposes. Agency to include suitable sites in future groundwater monitoring programme. EA discussions with Wessex Water and action required, to further evaluate potential impact on the By Brook of Wessex Water abstractions to the north and east of the catchment.
Progress: groundwater observation network re-established as described in this report. Historical records found and analysed in this report. Analysis of tracer tests commissioned. No impact of abstractions found. Results presented in this report. Action completed.

2.6 A standard river macrophyte survey that can be directly compared with the 1987 Ecological Survey should be undertaken.
PROPOSAL: Following a review of the 1987 survey by Agency ecology and biology staff, it is the Agency's view that a repeat of the 1987 survey would be scientifically undesirable. The survey method used in 1987 was developed to record key habitats and species with the aim of protecting or reinstating them during and after channel maintenance work. There was a lack of quantification in the method; this was not necessary to meet the objectives at that time, but this limits the value of the survey to the current exercise. EA proposal is to establish a baseline survey on key reaches of river. Use will be made of the 1987 survey where appropriate. The baseline survey would be conducted in 1998 if possible. However, as at May 1998 resources for doing this work this year are not secured.
Progress: Macrophyte study has been done in 1998 and repeated in 1999. Results presented in this report. Action completed.

2.7 Conduct fisheries survey in 1999 to be comparable with 1992 survey.
PROPOSAL: Fisheries survey programmed for 1999 as part of North Wessex Area rolling programme.
Progress: Results presented in this report. Action completed.

2.8 Dependent on results of 2.6 and 2.7 above, other ecological surveys may be appropriate.
PROPOSAL: No additional survey proposed. River water quality will be reported in 2001 following a 5 yearly review in 2000. This will be part of a national "General Quality Assessment" of river quality. Assessment will be based on both chemical and biological parameters.
Progress: Additional survey of macro-invertebrates done in 1999. Results presented in this report. Action completed.

2.9 Further study of potential long-term changes in land use. To include specialist interpretation of aerial photographs.
PROPOSAL: No action proposed at this time. Expenditure would not be expected to yield tangible benefits.
Progress: no action necessary.

2.10 Agency to be more pro-active in promoting the broader aspects of river management in the catchment. To include provision of advice to FOTBV and others in relation to hatch/mill operation; ecological enhancement opportunities etc.
PROPOSAL: A "river walk" was organised on 19 June 1998 with key Agency specialists and FOTBV representatives attending. FOTBV invited to choose the reaches of river to walk, and to facilitate the day by making arrangements for landowner liaison. The objectives for this day are to identify:

- what, if anything, should be done "on the ground" to improve the river habitat;
- who would need to accept responsibility for it happening;
- how such action might be achieved.

The results from this day will be used to inform and develop the strategy for the catchment.
Progress: The only concrete suggestion to arise was the installation of a fence to prevent cattle trampling the river edge. This is the landowner's responsibility, and no further action was undertaken on this. Extra effort has been made by Environmental Protection staff, who have visited all farms in the upper catchment to inspect potential polluting practices, and to advise on how to prevent these.

Appendix 2

- Monthly rainfall for Castle Combe, Marshfield and Bathford
- 1981-2000 monthly average rainfall calculation
- Monthly Catchment Rainfall showing Percentage Period Average

ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX

GAUGE REFERENCE : 53040480B
O. REFERENCE : 415725
UGE TYPE : Storage
AIN DAY START : 09:00 GMT

STATION NAME : MARSHFIELD CASTLE FM
LOCATION :
GRID REF : ST772744
ALTITUDE : 175.0 m

cade Summary : 1971 to 1980

Record Type : Archive file

nthly Rainfall totals recorded in mm

	LTA	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	
Jan	88.0					117.0	28.0	84.9	123.1	77.8	72.6	Jan
Feb	65.0					39.4	41.0	149.9 E	79.4	68.5	81.2 E	Feb
Mar	75.0					93.6	62.3	88.5 E	90.4 E	147.6	127.3 E	Mar
Apr	57.0					63.7	11.0	42.0	52.2 E	40.6 E	20.4	Apr
May	68.0					29.5	40.1	51.3 E	38.1 E	152.8 E	41.2	May
Jun	65.0					3.4	35.8	99.7 E	58.5 E	39.8 E	102.7	Jun
Jul	63.0					57.3 E	18.0	16.7 E	121.1 E	27.2 E	53.4 E	Jul
Aug	73.0					77.6	37.7	166.4	36.2 E	124.2	81.8 E	Aug
Sep	81.0					141.9	203.1 E	28.5	24.3	29.9 E	66.2 E	Sep
Oct	79.0					17.7	123.3 E	79.5 E	5.7 E	45.8 E	125.0 E	Oct
Nov	84.0					60.0	77.0 E	108.5 E	46.9 E	70.0 E	66.7 E	Nov
Dec	99.0					39.9	127.7 E	98.2 E	148.0 E	152.0	61.4 E	Dec
tal (mm):	897.0					741.0 E	805.0 E	1014.1 E	823.9 E	976.2 E	899.9 E	
t (%LTA):						83 E	90 E	113 E	92 E	109 E	100 E	
Mnth(mm):						3.4	11.0	16.7 E	5.7 E	27.2 E	20.4	
Mnth(mm):						141.9	203.1 E	166.4	148.0 E	152.8 E	127.3 E	

uality : E=Edited S=Snow ?=Suspect M=Incomplete T=Trace A=Accumulation
() = Logger/check gauge inconsistency

[redacted]out from RAINARK data logging & processing system, (c)1989-01 Hydro-Logic Ltd
[redacted]TION RAINFALL REPORT Printed on 03/08/2001 at 15:09 hrs.

ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX

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[redacted]. REFERENCE : 415725
[redacted]GE TYPE : Storage
[redacted]IN DAY START : 09:00 GMT

STATION NAME : MARSHFIELD CASTLE FM
LOCATION :
GRID REF : ST772744
ALTITUDE : 175.0 m

[redacted]ade Summary : 1971 to 1980

Record Type : Archive file

[redacted]thly Rainfall expressed as % of Long Term Average(1961-1990)

	LTA	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	
Jan	88.0					133	32	96	140	88	82	Jan
[redacted]eb	65.0					61	63	231 E	122	105	125 E	Feb
Mar	75.0					125	83	118 E	121 E	197	170 E	Mar
[redacted]pr	57.0					112	19	74	92 E	71 E	36	Apr
[redacted]ay	68.0					43	59	75 E	56 E	225 E	61	May
Jun	65.0					5	55	153 E	90 E	61 E	158	Jun
[redacted]ul	63.0					91 E	29	27 E	192 E	43 E	85 E	Jul
Aug	73.0					106	52	228	50 E	170	112 E	Aug
[redacted]ep	81.0					175	251 E	35	30	37 E	82 E	Sep
[redacted]ct	79.0					22	156 E	101 E	7 E	58 E	158 E	Oct
Nov	84.0					71	92 E	129 E	56 E	83 E	79 E	Nov
[redacted]ec	99.0					40	129 E	99 E	149 E	154	62 E	Dec
[redacted]a[redacted] (mm):	897.0					741.0 E	805.0 E	1014.1 E	823.9 E	976.2 E	899.9 E	
[redacted]e[redacted]LTA):						83 E	90 E	113 E	92 E	109 E	100 E	
[redacted]. (%LTA):						5	19	27 E	7 E	37 E	36	
[redacted]: (%LTA):						175	251 E	231 E	192 E	225 E	170 E	

[redacted]ality : E=Edited S=Snow ?=Suspect M=Incomplete T=Trace A=Accumulation
() = Logger/check gauge inconsistency

[redacted]put from RAINARK data logging & processing system, (c)1989-01 Hydro-Logic Ltd
[redacted]TION RAINFALL REPORT Printed on 03/08/2001 at 15:08 hrs.

ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX

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[redacted]. REFERENCE : 415725
[redacted]GE TYPE : Storage
[redacted]AIN DAY START : 09:00 GMT

STATION NAME : MARSHFIELD CASTLE FM
LOCATION :
GRID REF : ST772744
ALTITUDE : 175.0 m

[redacted]ade Summary : 1981 to 1990

Record Type : Archive file

[redacted]thly Rainfall totals recorded in mm

	LTA	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
Jan	88.0	42.0 E	68.1 E	117.6	165.3 E	77.4 E	146.7 E	20.1	154.7	56.4	122.3	Jan
Feb	65.0	58.8	55.1 E	16.9 E	50.8 E	63.3	6.9	75.3	72.6	106.9	132.1	Feb
Mar	75.0	190.8 E	146.1 E	63.6 E	50.2 E	72.3 E	72.4 E	93.5 E	93.2 E	95.8	20.6 E	Mar
Apr	57.0	30.0	30.8	108.4 E	2.9	61.7 E	83.7 E	72.7 E	42.0	73.5	41.1 E	Apr
May	68.0	102.4 E	23.0 E	130.0 E	87.1 E	70.1 E	101.5	41.4 E	65.4	40.4	4.8	May
Jun	65.0	38.9 E	113.3 E	30.7 E	23.7 E	117.7 E	21.1 E	112.6 E	49.1 E	41.7	84.2 E	Jun
Jul	63.0	61.6 E	34.2	40.9	34.7	90.2	55.6 E	71.7 E	122.8 E	31.2	52.3 E	Jul
Aug	73.0	21.6 E	71.6 E	33.5	66.2 E	144.9 E	98.8 E	17.4 E	98.9 E	38.9	40.1 E	Aug
Sep	81.0	171.9 E	77.5 E	108.3 E	135.6	30.2 E	38.6 E	52.9	83.3 E	53.5 E	41.5	Sep
Oct	79.0	146.0 E	96.7 E	83.8 E	83.8 E	49.9 E	90.3 E	172.6 E	107.2 E	106.2	73.4	Oct
Nov	84.0	64.5 E	140.3 E	42.4 E	144.3 E	41.3 E	142.7 E	78.9 E	41.6 E	58.8 E	45.5 E	Nov
Dec	99.0	137.1 E	115.3 E	98.0 E	96.2 E	171.5 E	124.5 E	61.1 E	22.4 E	161.9 E	82.9 E	Dec
[redacted] (mm):	897.0	1065.6 E	972.0 E	874.1 E	940.8 E	990.5 E	982.8 E	870.2 E	953.2 E	865.2 E	740.8 E	
[redacted] (%LTA):		119 E	108 E	97 E	105 E	110 E	110 E	97 E	106 E	96 E	83 E	
.Mnth(mm):		21.6 E	23.0 E	16.9 E	2.9	30.2 E	6.9	17.4 E	22.4 E	31.2	4.8	
.Mnth(mm):		190.8 E	146.1 E	130.0 E	165.3 E	171.5 E	146.7 E	172.6 E	154.7	161.9 E	132.1	

uality : E=Edited S=Snow ?=Suspect M=Incomplete T=Trace A=Accumulation
() = Logger/check gauge inconsistency

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TION RAINFALL REPORT Printed on 03/08/2001 at 15:08 hrs.

ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX

AUGE REFERENCE : 5304048OB
. REFERENCE : 415725
UGE TYPE : Storage
AIN DAY START : 09:00 GMT

STATION NAME : MARSHFIELD CASTLE FM
LOCATION :
GRID REF : ST772744
ALTITUDE : 175.0 m

ade Summary : 1981 to 1990

Record Type : Archive file

thly Rainfall expressed as % of Long Term Average(1961-1990)

	LTA	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
Jan	88.0	48 E	77 E	134	188 E	88 E	167 E	23	176	64	139	Jan
Feb	65.0	90	85 E	26 E	78 E	97	11	116	112	164	203	Feb
Mar	75.0	254 E	195 E	85 E	67 E	96 E	97 E	125 E	124 E	128	27 E	Mar
Apr	57.0	53	54	190 E	5	108 E	147 E	128 E	74	129	72 E	Apr
May	68.0	151 E	34 E	191 E	128 E	103 E	149	61 E	96	59	7	May
Jun	65.0	60 E	174 E	47 E	36 E	181 E	32 E	173 E	76 E	64	130 E	Jun
Jul	63.0	98 E	54	65	55	143	88 E	114 E	195 E	50	83 E	Jul
Aug	73.0	30 E	98 E	46	91 E	198 E	135 E	24 E	135 E	53	55 E	Aug
Sep	81.0	212 E	96 E	134 E	167	37 E	48 E	65	103 E	66 E	51	Sep
Oct	79.0	185 E	122 E	106 E	106 E	63 E	114 E	218 E	136 E	134	93	Oct
Nov	84.0	77 E	167 E	50 E	172 E	49 E	170 E	94 E	50 E	70 E	54 E	Nov
ec	99.0	138 E	116 E	99 E	97 E	173 E	126 E	62 E	23 E	164 E	84 E	Dec
a (mm) :	897.0	1065.6 E	972.0 E	874.1 E	940.8 E	990.5 E	982.8 E	870.2 E	953.2 E	865.2 E	740.8 E	
a %LTA) :		119 E	108 E	97 E	105 E	110 E	110 E	97 E	106 E	96 E	83 E	
. (%LTA) :		30 E	34 E	26 E	5	37 E	11	23	23 E	50	7	
. (%LTA) :		254 E	195 E	191 E	188 E	198 E	170 E	218 E	195 E	164	203	

ality : E=Edited S=Snow ?=Suspect M=Incomplete T=Trace A=Accumulation
() = Logger/check gauge inconsistency

[redacted]put from RAINARK data logging & processing system, (c)1989-01 Hydro-Logic Ltd
[redacted]TION RAINFALL REPORT Printed on 03/08/2001 at 14:15 hrs.

ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX

[redacted]AUGE REFERENCE : 53040480B
[redacted]. REFERENCE : 415725
[redacted]GE TYPE : Storage
[redacted]AIN DAY START : 09:00 GMT

STATION NAME : MARSHFIELD CASTLE FM
LOCATION :
GRID REF : ST772744
ALTITUDE : 175.0 m

[redacted]ade Summary : 1991 to 2000

Record Type : Archive file

[redacted]thly Rainfall totals recorded in mm

	LTA	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	
Jan	88.0	111.1 E	45.4 E	134.3 E	129.2	160.7	71.2 E	9.7	118.0 E	167.5	29.8	Jan
Feb	65.0	40.2 E	37.4	6.1 E	88.6	94.8 E	75.8 E	113.6 E	14.8 E	49.3	100.3	Feb
Mar	75.0	73.1	47.6 E	28.9	84.2	70.4	73.5 E	22.4	102.5	57.3	27.6	Mar
Apr	57.0	60.7	67.3	77.4	62.9	26.3 E	57.2	24.7	120.0	94.1	190.9	Apr
May	68.0	8.1 E	23.7 E	60.3	95.9	66.5	63.0	102.2	20.4	68.3	107.8	May
Jun	65.0	117.6	58.9	71.1	27.4	18.3	16.8 E	101.0	155.5	87.2	34.7	Jun
Jul	63.0	87.1	67.3 E	75.2	33.9	13.0	31.3	33.7	50.4	8.6	49.4	Jul
Aug	73.0	11.8	147.0 E	32.2	69.3	5.7	92.1 E	146.3	35.7	124.2	77.7	Aug
Sep	81.0	58.3	69.5 E	96.5 E	81.0 E	129.0 E	40.2	18.2	104.0	133.5	140.5	Sep
Oct	79.0	70.0 E	54.0	100.6	112.5	63.9	81.3	69.1	166.9	70.1	179.5	Oct
Nov	84.0	93.3	179.9 E	55.8	84.5	96.5 E	125.7	111.6	75.2	61.0	142.9	Nov
Dec	99.0	29.4 E	84.0	147.0	170.6	112.8	32.0 E	111.5	104.8	167.7	142.6 S	Dec
[redacted] (mm):	897.0	760.7 E	882.0 E	885.4 E	1040.0 E	857.9 E	760.1 E	864.0 E	1068.2 E	1088.8	1223.7 S	
[redacted] %LTA):		85 E	98 E	99 E	116 E	96 E	85 E	96 E	119 E	121	136 S	
.Mnth(mm):		8.1 E	23.7 E	6.1 E	27.4	5.7	16.8 E	9.7	14.8 E	8.6	27.6	
.Mnth(mm):		117.6	179.9 E	147.0	170.6	160.7	125.7	146.3	166.9	167.7	190.9	

[redacted]uality : E=Edited S=Snow ?=Suspect M=Incomplete T=Trace A=Accumulation
() = Logger/check gauge inconsistency

Output from RAINARK data logging & processing system, (c)1989-01 Hydro-Logic Ltd
STATION RAINFALL REPORT Printed on 03/08/2001 at 14:15 hrs.

ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX

GAUGE REFERENCE : 5304048OB
I.D. REFERENCE : 415725
GAUGE TYPE : Storage
RAIN DAY START : 09:00 GMT

STATION NAME : MARSHFIELD CASTLE FM
LOCATION :
GRID REF : ST772744
ALTITUDE : 175.0 m

Decade Summary : 1991 to 2000 Record Type : Archive file

Monthly Rainfall expressed as % of Long Term Average(1961-1990)

	LTA	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	
Jan	88.0	126 E	52 E	153 E	147	183	81 E	11	134 E	190	34	Jan
Feb	65.0	62 E	58	9 E	136	146 E	117 E	175 E	23 E	76	154	Feb
Mar	75.0	97	63 E	39	112	94	98 E	30	137	76	37	Mar
Apr	57.0	106	118	136	110	46 E	100	43	211	165	335	Apr
May	68.0	12 E	35 E	89	141	98	93	150	30	100	159	May
Jun	65.0	181	91	109	42	28	26 E	155	239	134	53	Jun
Jul	63.0	138	107 E	119	54	21	50	53	80	14	78	Jul
Aug	73.0	16	201 E	44	95	8	126 E	200	49	170	106	Aug
Sep	81.0	72	86 E	119 E	100 E	159 E	50	22	128	165	173	Sep
Oct	79.0	89 E	68	127	142	81	103	87	211	89	227	Oct
Nov	84.0	111	214 E	66	101	115 E	150	133	90	73	170	Nov
Dec	99.0	30 E	85	148	172	114	32 E	113	106	169	144 S	Dec
total (mm):	897.0	760.7 E	882.0 E	885.4 E	1040.0 E	857.9 E	760.1 E	864.0 E	1068.2 E	1088.8	1223.7 S	
cent (%LTA):		85 E	98 E	99 E	116 E	96 E	85 E	96 E	119 E	121	136 S	
min. (%LTA):		12 E	35 E	9 E	42	8	26 E	11	23 E	14	34	
max. (%LTA):		181	214 E	153 E	172	183	150	200	239	190	335	

Quality : E=Edited S=Snow ?=Suspect M=Incomplete T=Trace A=Accumulation
() = Logger/check gauge inconsistency

tput from RAINARK data logging & processing system, (c)1989-01 Hydro-Logic Ltd
TION RAINFALL REPORT Printed on 03/08/2001 at 15:09 hrs.

ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX

AUGE REFERENCE : 53040100B
. REFERENCE : 411067
GE TYPE : Storage
AIN DAY START : 09:00 GMT

STATION NAME : CASTLE COMBE
LOCATION :
GRID REF : ST848778
ALTITUDE : 114.0 m

ade Summary : 1981 to 1990

Record Type : Archive file

thly Rainfall totals recorded in mm

	LTA	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
Jan	82.0	33.3	76.6 E	99.9	148.3	73.3	153.0	10.7	143.2	50.6	118.7 E	Jan
Feb	60.0	39.9	49.2	14.7	47.6	53.7	7.1	64.1	66.9	101.6	126.3	Feb
Mar	70.0	158.1 E	131.7 E	60.4 E	50.8 E	78.9 E	66.1 E	79.1 E	88.0 E	84.4 E	17.8 E	Mar
Apr	53.0	32.9 E	26.4 E	101.9 E	2.5	51.2 E	71.6 E	71.1 E	36.9 E	67.7 E	34.3 E	Apr
May	65.0	91.5 E	21.9 E	130.8 E	83.9 E	61.3 E	91.5 E	38.9 E	66.8 E	34.0 E	5.6 E	May
Jun	60.0	33.5 E	116.2 E	17.5 E	20.0 E	126.1 E	16.6 E	102.8 E	59.7 E	42.9 E	92.9 E	Jun
Jul	55.0	60.0 E	29.9 E	25.0	18.9 E	79.2 E	44.5 E	42.3 E	113.9 E	29.8 E	39.0 E	Jul
Aug	67.0	24.9 E	43.5 E	29.8	47.1 E	134.7 E	102.1 E	14.1 E	89.1 E	36.8 E	33.1 E	Aug
Sep	75.0	148.9 E	69.9 E	89.5 E	134.0 E	27.2 E	41.4 E	47.7 E	73.6 E	84.0 E	35.8	Sep
Oct	73.0	107.3 E	90.8 E	69.8 E	81.7 E	44.7 E	87.2 E	170.0 E	96.9 E	105.2 E	74.0 E	Oct
Nov	78.0	59.9 E	117.9 E	42.5 E	147.9 E	38.6 E	144.8 E	71.4 E	36.6 E	56.7 E	36.7 E	Nov
Dec	91.0	116.6 E	96.0 E	83.5 E	87.1 E	146.5 E	108.5 E	54.2 E	21.2 E	165.3 E	77.5 E	Dec
(mm):	829.0	906.8 E	870.0 E	765.3 E	869.8 E	915.4 E	934.4 E	766.4 E	892.8 E	859.0 E	691.7 E	
%LTA):		109 E	105 E	92 E	105 E	110 E	113 E	92 E	108 E	104 E	83 E	
Mnth(mm):		24.9 E	21.9 E	14.7	2.5	27.2 E	7.1	10.7	21.2 E	29.8 E	5.6 E	
Mnth(mm):		158.1 E	131.7 E	130.8 E	148.3	146.5 E	153.0	170.0 E	143.2	165.3 E	126.3	

ality : E=Edited S=Snow ?=Suspect M=Incomplete T=Trace A=Accumulation
() = Logger/check gauge inconsistency

tput from RAINARK data logging & processing system, (c)1989-01 Hydro-Logic Ltd
ATION RAINFALL REPORT Printed on 03/08/2001 at 15:09 hrs.

ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX

AUGE REFERENCE : 53040100B
D. REFERENCE : 411067
UGE TYPE : Storage
AIN DAY START : 09:00 GMT

STATION NAME : CASTLE COMBE
LOCATION :
GRID REF : ST848778
ALTITUDE : 114.0 m

cade Summary : 1981 to 1990

Record Type : Archive file

nthly Rainfall expressed as % of Long Term Average(1961-1990)

	LTA	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
Jan	82.0	41	93 E	122	181	89	187	13	175	62	145 E	Jan
Feb	60.0	66	82	24	79	89	12	107	112	169	210	Feb
Mar	70.0	226 E	188 E	86 E	73 E	113 E	94 E	113 E	126 E	121 E	25 E	Mar
Apr	53.0	62 E	50 E	192 E	5	97 E	135 E	134 E	70 E	128 E	65 E	Apr
May	65.0	141 E	34 E	201 E	129 E	94 E	141 E	60 E	103 E	52 E	9 E	May
Jun	60.0	56 E	194 E	29 E	33 E	210 E	28 E	171 E	99 E	71 E	155 E	Jun
Jul	55.0	109 E	54 E	45	34 E	144 E	81 E	77 E	207 E	54 E	71 E	Jul
Aug	67.0	37 E	65 E	44	70 E	201 E	152 E	21 E	133 E	55 E	49 E	Aug
Sep	75.0	199 E	93 E	119 E	179 E	36 E	55 E	64 E	98 E	112 E	48	Sep
Oct	73.0	147 E	124 E	96 E	112 E	61 E	119 E	233 E	133 E	144 E	101 E	Oct
Nov	78.0	77 E	151 E	54 E	190 E	49 E	186 E	92 E	47 E	73 E	47 E	Nov
Dec	91.0	128 E	105 E	92 E	96 E	161 E	119 E	60 E	23 E	182 E	85 E	Dec
t (mm):	829.0	906.8 E	870.0 E	765.3 E	869.8 E	915.4 E	934.4 E	766.4 E	892.8 E	859.0 E	691.7 E	
t (%LTA):		109 E	105 E	92 E	105 E	110 E	113 E	92 E	108 E	104 E	83 E	
n. (%LTA):		37 E	34 E	24	5	36 E	12	13	23 E	52 E	9 E	
x (%LTA):		226 E	194 E	201 E	190 E	210 E	187	233 E	207 E	182 E	210	

uality : E=Edited S=Snow ?=Suspect M=Incomplete T=Trace A=Accumulation
() = Logger/check gauge inconsistency

tput from RAINARK data logging & processing system, (c)1989-01 Hydro-Logic Ltd
ATION RAINFALL REPORT Printed on 03/08/2001 at 15:10 hrs.

ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX

AUGE REFERENCE : 53040100B
D. REFERENCE : 411067
UGE TYPE : Storage
AIN DAY START : 09:00 GMT

STATION NAME : CASTLE COMBE
LOCATION :
GRID REF : ST848778
ALTITUDE : 114.0 m

ecade Summary : 1991 to 2000

Record Type : Archive file

onthly Rainfall totals recorded in mm

	LTA	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	
Jan	82.0	105.5 E	46.6	119.8	126.7	165.9	68.7	8.8	107.1	151.1	30.3	Jan
Feb	60.0	39.1 E	29.5	6.3	87.4	95.8	70.0	110.5	11.6	43.3	92.5	Feb
Mar	70.0	74.0	49.3	30.4	72.2	57.6	59.8 E	20.2 E	87.7 E	51.5 E	31.3	Mar
Apr	53.0	71.0	64.9	83.0	51.8 E	27.2	57.4	24.8	106.2	88.3	177.3	Apr
May	65.0	5.9	30.2 E	70.9	137.4	63.0	54.0	100.4 E	21.7	83.8	88.3	May
Jun	60.0	116.6	49.3	46.8	23.5 E	15.0	16.7	102.2	138.0	80.6	34.5	Jun
Jul	55.0	75.3	61.9	68.5 E	28.4 E	38.7 E	34.4	26.2	37.2	3.6	37.4	Jul
Aug	67.0	11.4	148.5 E	31.2	65.6	2.7	76.4 E	145.1	27.5	146.2	61.8	Aug
Sep	75.0	51.4	62.6 E	87.3	87.7	141.8	37.2	18.9	108.1	120.2	107.8	Sep
Oct	73.0	64.6	64.8	116.9	82.5	68.5	76.6	64.0	156.2	68.1	167.8	Oct
Nov	78.0	98.5	171.7	54.1	77.1	101.9 E	114.6	110.6	74.8 ?	45.3	164.1	Nov
Dec	91.0	27.1	80.2 E	137.9	157.4	111.0	34.1	107.4	99.1 E	155.5	142.3	Dec
ot (mm) :	829.0	740.4 E	859.5 E	853.1 E	997.7 E	887.1 E	699.9 E	839.1 E	975.2 ?	1037.5 E	1135.4	
ot (%LTA) :		89 E	104 E	103 E	120 E	107 E	84 E	101 E	118 ?	125 E	137	
.Mnth(mm) :		5.9	29.5	6.3	23.5 E	2.7	16.7	8.8	11.6	3.6	30.3	
.Mnth(mm) :		116.6	171.7	137.9	157.4	165.9	114.6	145.1	156.2	155.5	177.3	

uality : E=Edited S=Snow ?=Suspect M=Incomplete T=Trace A=Accumulation
() = Logger/check gauge inconsistency

[redacted]put from RAINARK data logging & processing system, (c)1989-01 Hydro-Logic Ltd
[redacted]TION RAINFALL REPORT Printed on 03/08/2001 at 15:10 hrs.

ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX

[redacted]AUGE REFERENCE : 53040100B
[redacted]. REFERENCE : 411067
[redacted]GE TYPE : Storage
[redacted]AIN DAY START : 09:00 GMT

STATION NAME : CASTLE COMBE
LOCATION :
GRID REF : ST848778
ALTITUDE : 114.0 m

[redacted]ade Summary : 1991 to 2000

Record Type : Archive file

[redacted]thly Rainfall expressed as % of Long Term Average(1961-1990)

	LTA	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	
Jan	82.0	129 E	57	146	155	202	84	11	131	184	37	Jan
Feb	60.0	65 E	49	10	146	160	117	184	19	72	154	Feb
Mar	70.0	106	70	43	103	82	85 E	29 E	125 E	74 E	45	Mar
Apr	53.0	134	122	157	98 E	51	108	47	200	167	335	Apr
May	65.0	9	46 E	109	211	97	83	154 E	33	129	136	May
Jun	60.0	194	82	78	39 E	25	28	170	230	134	58	Jun
Jul	55.0	137	113	125 E	52 E	70 E	63	48	68	7	68	Jul
Aug	67.0	17	222 E	47	98	4	114 E	217	41	218	92	Aug
Sep	75.0	69	83 E	116	117	189	50	25	144	160	144	Sep
Oct	73.0	88	89	160	113	91	105	88	214	93	230	Oct
Nov	78.0	126	220	69	99	131 E	147	142	96 ?	58	210	Nov
Dec	91.0	30	88 E	152	173	122	37	118	109 E	171	156	Dec
[redacted] (mm):	829.0	740.4 E	859.5 E	853.1 E	997.7 E	887.1 E	699.9 E	839.1 E	975.2 ?	1037.5 E	1135.4	
[redacted] (%LTA):		89 E	104 E	103 E	120 E	107 E	84 E	101 E	118 ?	125 E	137	
[redacted]. (%LTA):		9	46 E	10	39 E	4	28	11	19	7	37	
[redacted] (%LTA):		194	222 E	160	211	202	147	217	230	218	335	

[redacted]ality : E=Edited S=Snow ?=Suspect M=Incomplete T=Trace A=Accumulation
() = Logger/check gauge inconsistency

[redacted]tput from RAINARK data logging & processing system, (c)1989-01 Hydro-Logic Ltd
[redacted]TION RAINFALL REPORT Printed on 03/08/2001 at 15:11 hrs.

ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX

[redacted]AUGE REFERENCE : 53010490B
[redacted]D. REFERENCE : 416056
[redacted]GE TYPE : Storage
[redacted]AIN DAY START : 09:00 GMT

STATION NAME : BATHFORD
LOCATION :
GRID REF : ST794669
ALTITUDE : 63.0 m

[redacted]ade Summary : 1971 to 1980

Record Type : Archive file

[redacted]thly Rainfall totals recorded in mm

	LTA	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	
Jan	77.0			34.5	112.8	104.4	24.1	78.3	108.7 E	63.4 E	52.8 E	Jan
Feb	59.0			28.9	150.2	27.1	39.6	134.8	70.1 E	60.5	72.4 E	Feb
Mar	67.0			15.0	31.9	86.5	57.1 E	60.4 E	85.6 E	145.9 E	109.2 E	Mar
Apr	52.0			56.0	18.5	53.8	7.6	35.1 E	46.0 E	42.0 E	17.7 E	Apr
May	61.0			71.4	33.9	23.3	35.4 E	48.6 E	33.3 E	134.0 E	35.5 E	May
Jun	61.0			86.1	73.0	8.0	32.9 E	92.7	35.0	32.3 E	101.5	Jun
Jul	59.0			76.6	44.1	53.1	38.4 E	22.1 E	115.3	29.2	56.8	Jul
Aug	66.0			51.0	77.4	65.8	35.1 E	165.6	43.4 E	114.4 E	60.2 E	Aug
Sep	76.0			64.1	199.6	120.0	208.7 E	23.3 E	28.5	26.7 E	61.2 E	Sep
Oct	71.0			32.7	46.0	21.1	122.6 E	68.9 E	5.2 E	38.4 E	135.6 E	Oct
Nov	76.0			49.9	97.1	56.8 E	80.3 E	92.6	33.8 E	60.7 E	54.4 E	Nov
Dec	89.0			59.0	69.1	38.1	120.0	105.8 E	141.7 E	151.0 E	46.2 E	Dec
[redacted]t (mm):	814.0			625.2	953.6	658.0 E	801.8 E	928.2 E	746.6 E	898.5 E	803.5 E	
[redacted]t (%LTA):				77	117	81 E	99 E	114 E	92 E	110 E	99 E	
.Mnth(mm):				15.0	18.5	8.0	7.6	22.1 E	5.2 E	26.7 E	17.7 E	
.Mnth(mm):				86.1	199.6	120.0	208.7 E	165.6	141.7 E	151.0 E	135.6 E	

[redacted]uality : E=Edited S=Snow ?=Suspect M=Incomplete T=Trace A=Accumulation
() = Logger/check gauge inconsistency

tput from RAINARK data logging & processing system, (c)1989-01 Hydro-Logic Ltd
ATION RAINFALL REPORT Printed on 03/08/2001 at 15:11 hrs.

ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX

AUGE REFERENCE : 5301049OB
O. REFERENCE : 416056
UGE TYPE : Storage
AIN DAY START : 09:00 GMT

STATION NAME : BATHFORD
LOCATION :
GRID REF : ST794669
ALTITUDE : 63.0 m

ade Summary : 1971 to 1980

Record Type : Archive file

thly Rainfall expressed as % of Long Term Average(1961-1990)

	LTA	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	
Jan	77.0			45	146	136	31	102	141 E	82 E	69 E	Jan
Feb	59.0			49	255	46	67	228	119 E	103	123 E	Feb
Mar	67.0			22	48	129	85 E	90 E	128 E	218 E	163 E	Mar
Apr	52.0			108	36	103	15	67 E	88 E	81 E	34 E	Apr
May	61.0			117	56	38	58 E	80 E	55 E	220 E	58 E	May
Jun	61.0			141	120	13	54 E	152	57	53 E	166	Jun
Jul	59.0			130	75	90	65 E	37 E	195	49	96	Jul
Aug	66.0			77	117	100	53 E	251	66 E	173 E	91 E	Aug
Sep	76.0			84	263	158	275 E	31 E	38	35 E	81 E	Sep
Oct	71.0			46	65	30	173 E	97 E	7 E	54 E	191 E	Oct
Nov	76.0			66	128	75 E	106 E	122	44 E	80 E	72 E	Nov
Dec	89.0			66	78	43	135	119 E	159 E	170 E	52 E	Dec
(mm):	814.0			625.2	953.6	658.0 E	801.8 E	928.2 E	746.6 E	898.5 E	803.5 E	
(%LTA):				77	117	81 E	99 E	114 E	92 E	110 E	99 E	
(%LTA):				22	36	13	15	31 E	7 E	35 E	34 E	
(%LTA):				141	263	158	275 E	251	195	220 E	191 E	

ality : E=Edited S=Snow ?=Suspect M=Incomplete T=Trace A=Accumulation
() = Logger/check gauge inconsistency

Output from RAINARK data logging & processing system, (c)1989-01 Hydro-Logic Ltd
STATION RAINFALL REPORT Printed on 03/08/2001 at 15:11 hrs.

ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX

GAUGE REFERENCE	: 53010490B	STATION NAME	: BATHFORD
NRA REFERENCE	: 416056	LOCATION	:
GAUGE TYPE	: Storage	GRID REF	: ST794669
MAIN DAY START	: 09:00 GMT	ALTITUDE	: 63.0 m
Decade Summary	: 1981 to 1990	Record Type	: Archive file

Monthly Rainfall totals recorded in mm

	LTA	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
Jan	77.0	36.3 E	60.1 E	92.8 E	141.2	58.4 E	129.2	19.0 E	136.6 E	44.3 E	104.0	Jan
Feb	59.0	34.7 E	45.4 E	16.1 E	44.4	51.3	4.8	68.7	72.4	89.9 E	129.1	Feb
Mar	67.0	150.7 E	112.6 E	63.9 E	53.9 E	55.3 E	68.3 E	78.8 E	83.5 E	84.6 E	16.3 E	Mar
Apr	52.0	34.9 E	27.9	102.4 E	2.0	54.2 E	80.5 E	71.4 E	40.6 E	67.7 E	38.2 E	Apr
May	61.0	76.7 E	30.7	129.0 E	76.4 E	55.3 E	96.3 E	34.3 E	48.8 E	42.9 E	3.9 E	May
Jun	61.0	35.3 E	162.9 E	20.2 E	22.4 E	91.9 E	19.9 E	111.6	63.0 E	32.9 E	65.8 E	Jun
Jul	59.0	55.7 E	38.6 E	45.5 E	28.2 E	64.9 E	45.2 E	46.9	114.7 E	57.9	40.1 E	Jul
Aug	66.0	15.8 E	58.3 E	26.3	48.1 E	139.5 E	103.5 E	19.5	88.1 E	37.6 E	49.5 E	Aug
Sep	76.0	139.7 E	66.8 E	112.8 E	127.2 E	23.7 E	37.5 E	54.6 E	53.9 E	58.7 E	45.6 E	Sep
Oct	71.0	126.2 E	84.5	77.0 E	77.5 E	52.4 E	74.2 E	142.9 E	101.6 E	104.2 E	75.3 E	Oct
Nov	76.0	45.3 E	123.7 E	34.7	136.0	36.3 E	125.4 E	73.2 E	33.5	53.0 E	41.5 E	Nov
Dec	89.0	121.0 E	95.3 E	84.5 E	98.2 E	161.1 E	115.5 E	41.7 E	19.7	139.5 E	87.6 E	Dec
Total (mm):	814.0	872.3 E	906.8 E	805.2 E	855.5 E	844.3 E	900.3 E	762.6 E	856.4 E	813.2 E	696.9 E	
Total (%LTA):		107 E	111 E	99 E	105 E	104 E	111 E	94 E	105 E	100 E	86 E	
Min Mnth(mm):		15.8 E	27.9	16.1 E	2.0	23.7 E	4.8	19.0 E	19.7	32.9 E	3.9 E	
Max Mnth(mm):		150.7 E	162.9 E	129.0 E	141.2	161.1 E	129.2	142.9 E	136.6 E	139.5 E	129.1	

Quality : E=Edited S=Snow ?=Suspect M=Incomplete T=Trace A=Accumulation
() = Logger/check gauge inconsistency

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ATION RAINFALL REPORT Printed on 03/08/2001 at 15:11 hrs.

ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX

AUGE REFERENCE : 53010490B
O. REFERENCE : 416056
UGE TYPE : Storage
AIN DAY START : 09:00 GMT

STATION NAME : BATHFORD
LOCATION :
GRID REF : ST794669
ALTITUDE : 63.0 m

cade Summary : 1981 to 1990

Record Type : Archive file

nthly Rainfall expressed as % of Long Term Average(1961-1990)

	LTA	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
Jan	77.0	47 E	78 E	121 E	183	76 E	168	25 E	177 E	58 E	135	Jan
Feb	59.0	59 E	77 E	27 E	75	87	8	116	123	152 E	219	Feb
Mar	67.0	225 E	168 E	95 E	80 E	83 E	102 E	118 E	125 E	126 E	24 E	Mar
Apr	52.0	67 E	54	197 E	4	104 E	155 E	137 E	78 E	130 E	73 E	Apr
May	61.0	126 E	50	211 E	125 E	91 E	158 E	56 E	80 E	70 E	6 E	May
Jun	61.0	58 E	267 E	33 E	37 E	151 E	33 E	183	103 E	54 E	108 E	Jun
Jul	59.0	94 E	65 E	77 E	48 E	110 E	77 E	79	194 E	98	68 E	Jul
Aug	66.0	24 E	88 E	40	73 E	211 E	157 E	30	133 E	57 E	75 E	Aug
Sep	76.0	184 E	88 E	148 E	167 E	31 E	49 E	72 E	71 E	77 E	60 E	Sep
Oct	71.0	178 E	119	108 E	109 E	74 E	105 E	201 E	143 E	147 E	106 E	Oct
Nov	76.0	60 E	163 E	46	179	48 E	165 E	96 E	44	70 E	55 E	Nov
Dec	89.0	136 E	107 E	95 E	110 E	181 E	130 E	47 E	22	157 E	98 E	Dec
tal (mm):	814.0	872.3 E	906.8 E	805.2 E	855.5 E	844.3 E	900.3 E	762.6 E	856.4 E	813.2 E	696.9 E	
t (%LTA):		107 E	111 E	99 E	105 E	104 E	111 E	94 E	105 E	100 E	86 E	
n (%LTA):		24 E	50	27 E	4	31 E	8	25 E	22	54 E	6 E	
x. (%LTA):		225 E	267 E	211 E	183	211 E	168	201 E	194 E	157 E	219	

uality : E=Edited S=Snow ?=Suspect M=Incomplete T=Trace A=Accumulation
() = Logger/check gauge inconsistency

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STATION RAINFALL REPORT Printed on 03/08/2001 at 15:11 hrs.

ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX

GAUGE REFERENCE : 53010490B
NO. REFERENCE : 416056
GAUGE TYPE : Storage
RAIN DAY START : 09:00 GMT

STATION NAME : BATHFORD
LOCATION :
GRID REF : ST794669
ALTITUDE : 63.0 m

Decade Summary : 1991 to 2000

Record Type : Archive file

Monthly Rainfall totals recorded in mm

	LTA	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	
Jan	77.0	112.6 E	37.2 E	108.1	130.6	168.4 E	70.0 E	8.1	121.3	143.1 E	25.2	Jan
Feb	59.0	28.8 E	35.2	4.1	78.8 E	101.1	73.3 E	113.2	18.3 ?	54.0	94.6	Feb
Mar	67.0	69.8 E	48.7 E	34.3	77.5	52.7	60.1	20.3	74.6 ?	55.2 E	23.3	Mar
Apr	52.0	69.9	65.9	78.9	54.3	31.0	67.0	23.0	134.3	92.4 E	189.6	Apr
May	61.0	4.4	25.2	56.4	89.4	61.2	50.5 E	99.5	26.5	69.9	80.0	May
Jun	61.0	84.6	28.8	48.1	22.8	18.0	22.5	88.6 E	154.0 E	77.0	21.7	Jun
Jul	59.0	69.6	62.8 E	59.4	37.2	10.1	45.2	47.7	41.6	9.6	73.4	Jul
Aug	66.0	14.5	147.3	26.3	79.4 E	2.8	81.5	146.6	42.4	115.5	91.0	Aug
Sep	76.0	49.3	85.5	87.8 E	75.7 E	145.6 E	35.0	11.3	118.0 ?	117.2	123.8	Sep
Oct	71.0	70.0	43.1	111.9	96.9	66.5	76.8	54.7	168.1	65.8	163.7	Oct
Nov	76.0	89.4 E	160.2 E	46.2	79.8 E	103.9	113.8	111.9 E	73.2	55.7	132.0	Nov
Dec	89.0	32.5	86.6	138.8	173.9 E	97.7 E	28.6 E	94.4 E	82.8	148.3	142.9 S	Dec
Total (mm):	814.0	695.4 E	826.5 E	800.3 E	996.3 E	859.0 E	724.3 E	819.3 E	1055.1 ?	1003.7 E	1161.2 S	
Total (%LTA):		85 E	102 E	98 E	122 E	106 E	89 E	101 E	130 ?	123 E	143 S	
Min Mnth (mm):		4.4	25.2	4.1	22.8	2.8	22.5	8.1	18.3 ?	9.6	21.7	
Max Mnth (mm):		112.6 E	160.2 E	138.8	173.9 E	168.4 E	113.8	146.6	168.1	148.3	189.6	

Quality : E=Edited S=Snow ?=Suspect M=Incomplete T=Trace A=Accumulation
() = Logger/check gauge inconsistency

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STATION RAINFALL REPORT Printed on 03/08/2001 at 15:11 hrs.

ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX

GAUGE REFERENCE : 53010490B
I.H.O. REFERENCE : 416056
GAUGE TYPE : Storage
RAIN DAY START : 09:00 GMT

STATION NAME : BATHFORD
LOCATION :
GRID REF : ST794669
ALTITUDE : 63.0 m

Decade Summary : 1991 to 2000

Record Type : Archive file

Monthly Rainfall expressed as % of Long Term Average(1961-1990)

	LTA	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	
Jan	77.0	146 E	48 E	140	170	219 E	91 E	11	158	186 E	33	Jan
Feb	59.0	49 E	60	7	134 E	171	124 E	192	31 ?	92	160	Feb
Mar	67.0	104 E	73 E	51	116	79	90	30	111 ?	82 E	35	Mar
Apr	52.0	134	127	152	104	60	129	44	258	178 E	365	Apr
May	61.0	7	41	92	147	100	83 E	163	43	115	131	May
Jun	61.0	139	47	79	37	30	37	145 E	252 E	126	36	Jun
Jul	59.0	118	106 E	101	63	17	77	81	71	16	124	Jul
Aug	66.0	22	223	40	120 E	4	123	222	64	175	138	Aug
Sep	76.0	65	113	116 E	100 E	192 E	46	15	155 ?	154	163	Sep
Oct	71.0	99	61	158	136	94	108	77	237	93	231	Oct
Nov	76.0	118 E	211 E	61	105 E	137	150	147 E	96	73	174	Nov
Dec	89.0	37	97	156	195 E	110 E	32 E	106 E	93	167	161 S	Dec
Total (mm):	814.0	695.4 E	826.5 E	800.3 E	996.3 E	859.0 E	724.3 E	819.3 E	1055.1 ?	1003.7 E	1161.2 S	
Total (%LTA):		85 E	102 E	98 E	122 E	106 E	89 E	101 E	130 ?	123 E	143 S	
Min. (%LTA):		7	41	7	37	4	32 E	11	31 ?	16	33	
Max. (%LTA):		146 E	223	158	195 E	219 E	150	222	258	186 E	365	

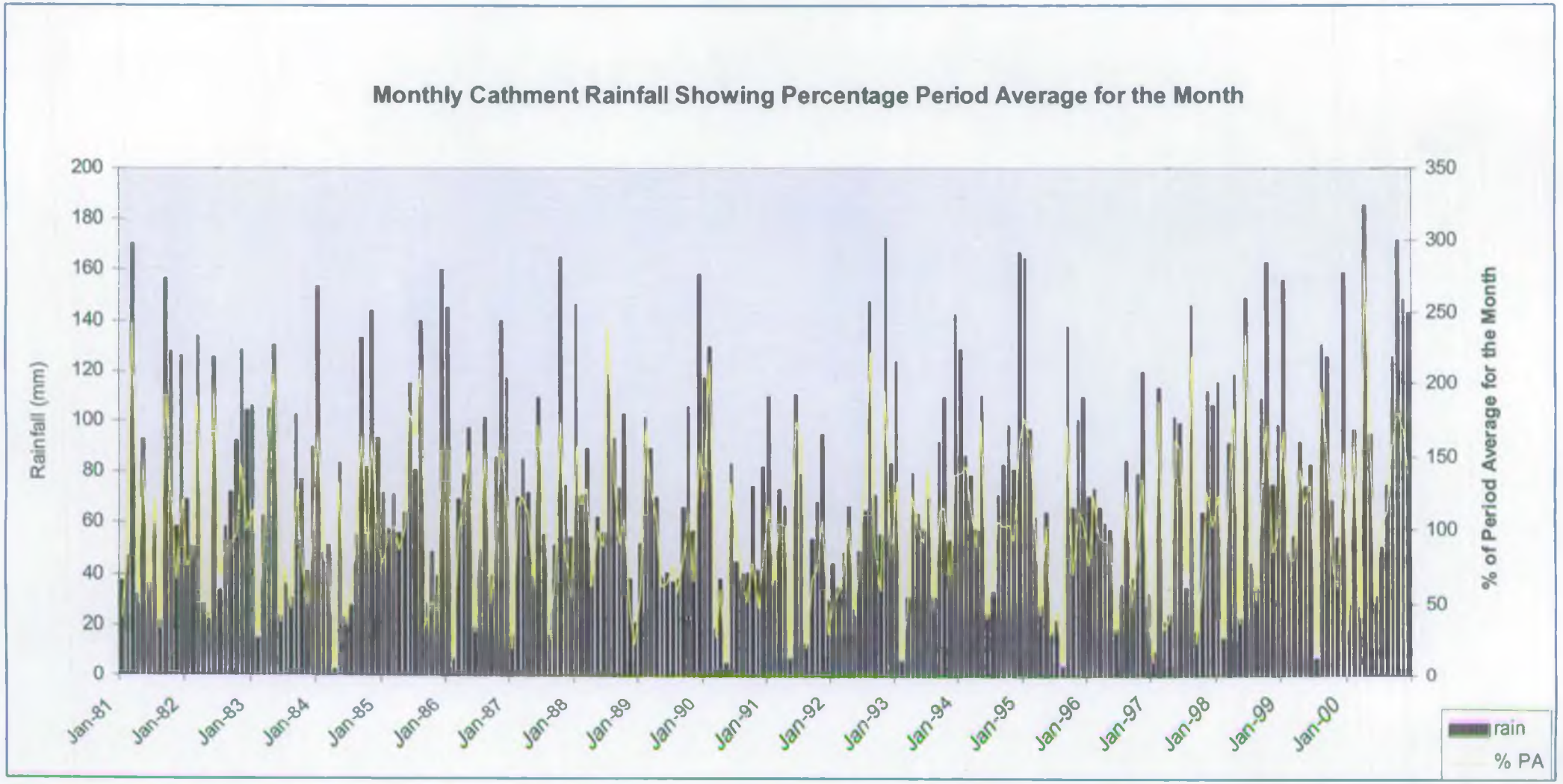
Quality : E=Edited S=Snow ?=Suspect M=Incomplete T=Trace A=Accumulation
() = Logger/check gauge inconsistency

1981-2000 monthly average rainfall calculation

Month	Bathford	Castle C.	Marshfield	Catchment Average*
1	87	92	97	93
2	58	58	63	60
3	64	67	74	70
4	66	62	66	65
5	58	64	64	63
6	60	63	66	63
7	50	45	52	49
8	67	64	69	66
9	78	79	83	81
10	92	93	99	95
11	83	88	91	88
12	100	100	109	104
Annual Period Average	**863**	**875**	**934**	**897**

* Catchment average calculated using the Thiessen polygon method.
Formula used: Catchment rain = 0.22 * Bathford + 0.36 * Castle Combe + 0.42 * Marshfield

Appendix 2


Monthly Cathment Rainfall Showing Percentage Period Average for the Month
Rainfall (mm)
% of Period Average for the Month
0
20
40
60
80
100
120
140
160
180
200
0
50
100
150
200
250
300
350
Jan-81
Jan-82
Jan-83
Jan-84
Jan-85
Jan-86
Jan-87
Jan-88
Jan-89
Jan-90
Jan-91
Jan-92
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
rain
% PA

Appendix 3 Borehole and well data

Name	NGR	Well *or* Borehole	Depth (m)	Diameter	Aquifer	Start of record / Drill date	Purpose	Comments
Colerne 1	ST8201 7213	Borehole	21.37 (drilled to 22.25m August 1973)		Unconfined GO to 16.6mbgl.	20/11/98 1973	Monitoring	Datum = 160.19mAOD Historical data shows a sudden increase in observed water levels. Reason unknown.
Atworth 1	ST8589 6635	Borehole	52.81 (drilled to 112m)	1 inch cased to 60m	Originally an Inferior Oolite monitoring hole but suspected collapse in FE. Hole is cased and grouted to 60m.	20/11/98 Drilled in 1972	Monitoring	Check depth. Possible borehole collapse at top of FE. Blockage clearance? Change in hydrograph unexplained. Continue to monitor. Borehole suspected by WIS to be close to a fault.
Atworth 3	ST859 6640	Borehole	29.31	1 inch	Great Oolite	19/11/98 (Drilled in 1972?)	Monitoring	Datum 74.990AOD
Yatton Keynell – Manor House	ST8660 7640	Well	33.65m		Great Oolite and pos. confined Inferior Oolite?	20/11/98	Disused domestic	Datum = 119.64mAOD Gamma logging to determine geology. Diam may however be too wide?
Yatton Keynell 2	ST8660 7640	Well	1.55		Unconfined Forest Marble	20/11/98	Disused domestic	
Market Cross Cottage	ST8420 7720	Well	6.46		Alluvium? Unconfined Great Oolite?	30/9/98	Disused domestic	
Leigh Delamere Tip (#2)	ST8988 7893	Well	25.18 -drilled to 62.8m Partially blocked?	200 mm	Confined Great Oolite (c 17m of FM, 21.5m of GO and FE recorded to 44.9m no further info	21/9/98 (drilled 1978)	Disused tip monitoring	Datum = 109.07mAOD
Foscote House	ST8621 7930	Well	6.85? 34m recorded as silted up to 14.6 in 1959		Forest Marble / Forest Marble	16/3/99	Disused domestic	Datum = 111.95mAOD
Chippenham ASR (Ivyfield)	ST9060 7605	Borehole	137m	200m	Inferior Oolite	14/2/00	Monitoring	
Alderton Grove Farm	ST8310 8140	Well	100 ? Depth suspect.		Great Oolite? Confined?	20/11/98	Disused domestic	Datum = 121.41mAOD Depth suspect. RE PLUMB required

Burton PWS (see note)	ST8267 7947	Well	9.26 (16/4/99) Recorded as a well to 10.4m and borehole to 99.7m. Diagram suggests 109m depth.	Well = 2.3m Borehole = 0.5m	Confined GO and IO and Cotteswold Sand. 24m of GO between 21.3 and 46mbgl and 12.3m of IO between 63.5 and 75.8mbgl.	14/01/99 (drilled in 1936)	Disused public supply	This is a well with a borehole. The depth recorded on 16/4/99is therefore believed to be the base of the well. Current RWL is c. 7m higher than previously recorded. No apparent explanation. CCTV to establish casing depth and condition?
Coates Farm	ST8182 7794	Well	9.94 (BGS record 10.3m)		Great Oolite? Unconfined?	16/4/99	Disused domestic	Requires modification to lid handle for safe access. Datum = 132.04mAOD
Acton Turville Road	ST7701 7915	Well	17.2m BGS record = 17.5m		Great Oolite. Into FE?	16/3/99	Disused domestic	Previously recorded as 17.5m deep Datum = 174.6mAOD Leakage evident from a point above the RWL. Gamma log to confirm geology? Hole too wide?
Down Farm	ST7874 7730	Well	27.55m BGS record = 27.6m	1.1m	Great Oolite. Into Inferior Oolite?	30/9/98 1959	Disused domestic Geological survey data logger installed 1959	Datum = 161.78m Aquifer not certain.
Tormarton 1	ST7834 7682	Borehole	27.60 (drilled to 58m)	2" casing to 45m	Confined Inferior Oolite. 39.1m FE, 14.7m IO and into Midford Sands	20/11/98 (drilled Sept. 1973)	Monitoring	Borehole blocked at 27.6m (i.e. within FE) is the blockage allowing water movement, but restricting dipper? Datum = 139.06mAOD
Castle Farm	ST7722 7433	Well	18m	0.9m	Unconfined Great Oolite	1959	Potable domestic supply	Historically recorded as 18m deep. Datum = 181.95mAOD
Allington 1	ST8970 7479	Borehole	59.4 (as drilled)	2 inch steel to 20m	Unconfined Great Oolite	1975		Ground level = 81.46mAOD Base of GO = 33.5mAOD

Note: Burton PWS and Nettleton PWS are actually located at the same site. The record for Burton refers to the water level in the well head, whereas the Nettleton record refers to the groundwater level monitored in the borehole, which was drilled through the base of the well. It would seem that the water in the well head is residual water from the days when pumping was taking place and is not related to groundwater level at all. If this can be proven then the Burton record should be ignored.

Appendix 4 Groundwater hydrographs

Notes

1. The Allington observation borehole is a superb trace for the Great Oolite. It shows the low recharge years of 1976, 1984, 1992 and 1997. As it is positioned between the By Brook and Chippenham, it indicates that the Ivyfields abstraction boreholes in Chippenham have had no deleterious impact on groundwater levels, and hence surface water flows, in the By Brook catchment.

2. Atworth No 3 – high transmissivity and low storage gives this a karstic response. As a 'Great Oolite' hole it may not be confined as the lower part of the Forest Marble is essentially limestone. The rising groundwater level is as yet unexplained. It could be due to a local pump stopping, or the borehole being blocked. However, the borehole has recently been plumbed to the expected depth of 29.3m.

3. Coleme No. 1. Believed to be drilled 3-4 m into the Fuller's Earth, or a shallow mudstone band. Hence a flat line at the bottom.

4. Alderton Grove Farm. Believed to be a Forest Marble, Great Oolite hole. Not confined, but drilled into the Fuller's Earth and bottoming out. The well could be pumped less or have become silted up to explain the shallower lower water levels.

5. Acton Turville Road. Unconfined, drilled into a mudstone so bottoming out.

6. Castle Farm. Unexplained rise. Possibly pumping less?

7. Market Cross Cottage. Could be alluvium. Unconfined.

8. Down Farm. Great Oolite only, probably into Fullers Earth. Dry in summer.

9. Manor House. Forest Marble and Great Oolite. Significant fluctuation and going dry or bottoming out in summer months.

10. Leigh Delamere 1. 19.5m deep and goes dry.

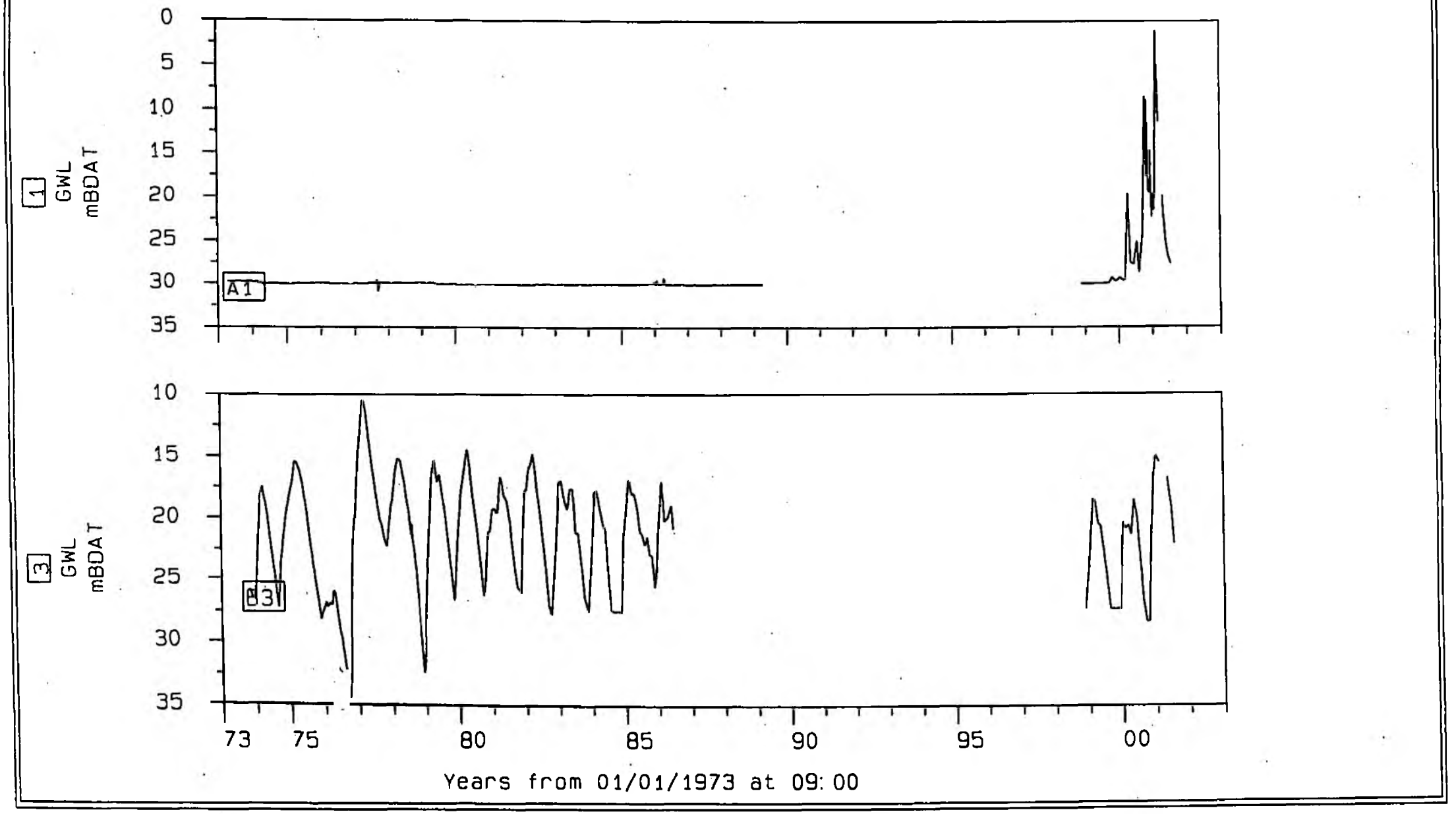
11. Leigh Delamere 2. Forest Marble/Great Oolite appears to drain away. Limited aquifer thickness? These two holes demonstrate the variation with depth of the geology and the corresponding hydrogeology response.

12. Atworth No. 1. Change in hydrograph is unexplained. Atworth No.3 also changed latterly. Was dry, now not? Keep on monitoring.

13. Tormarton No 1. If this well/borehole is 40m deep it is expected to be Great Oolite and the limestones of the upper Fuller's Earth. Possibility that sedimentation builds up from the Fuller's Earth and then gets washed away by high groundwater levels.

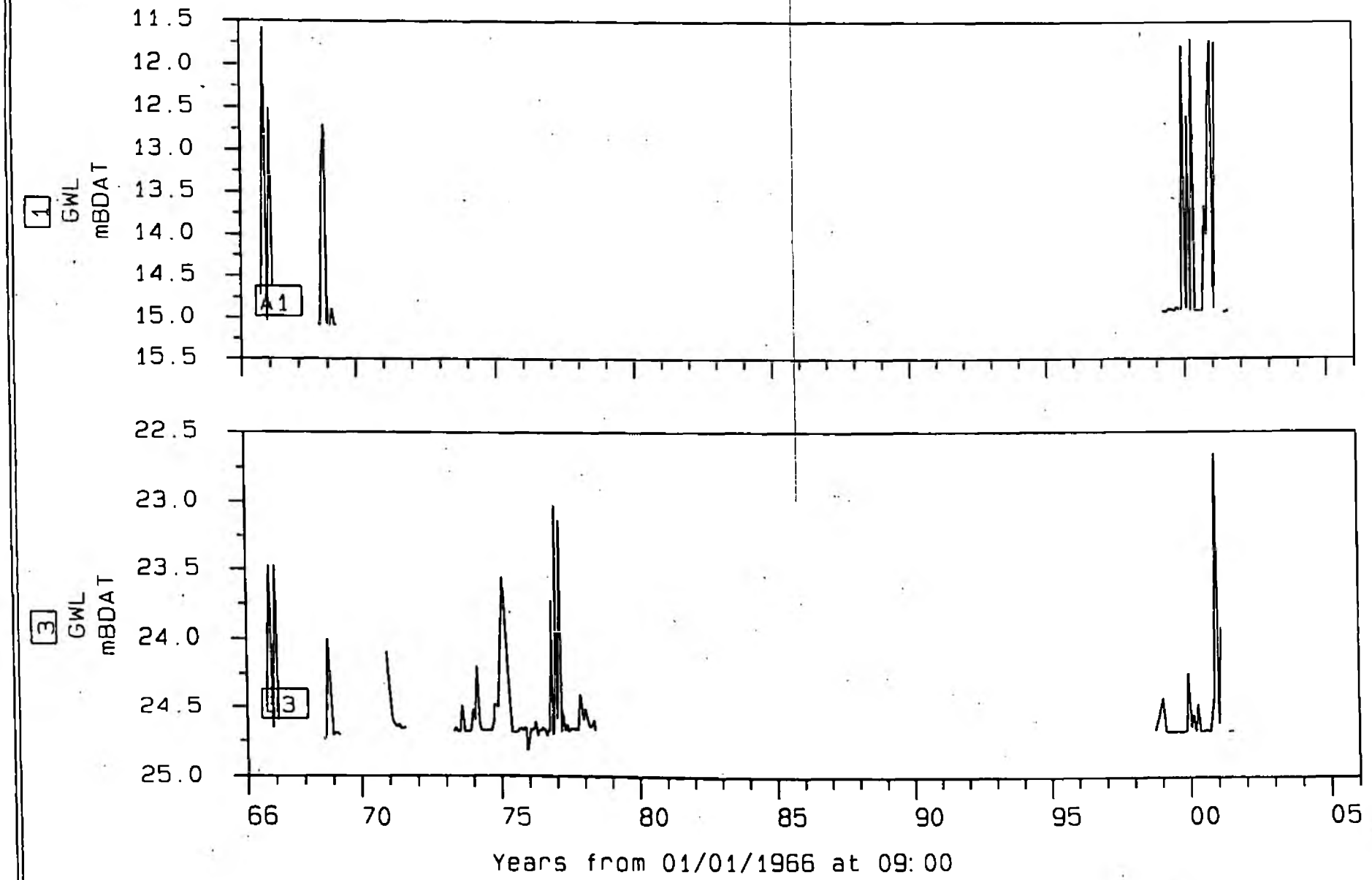
A1 90886332 - ATWORTH NO1

B3 90877341 - TORMARTON NO1



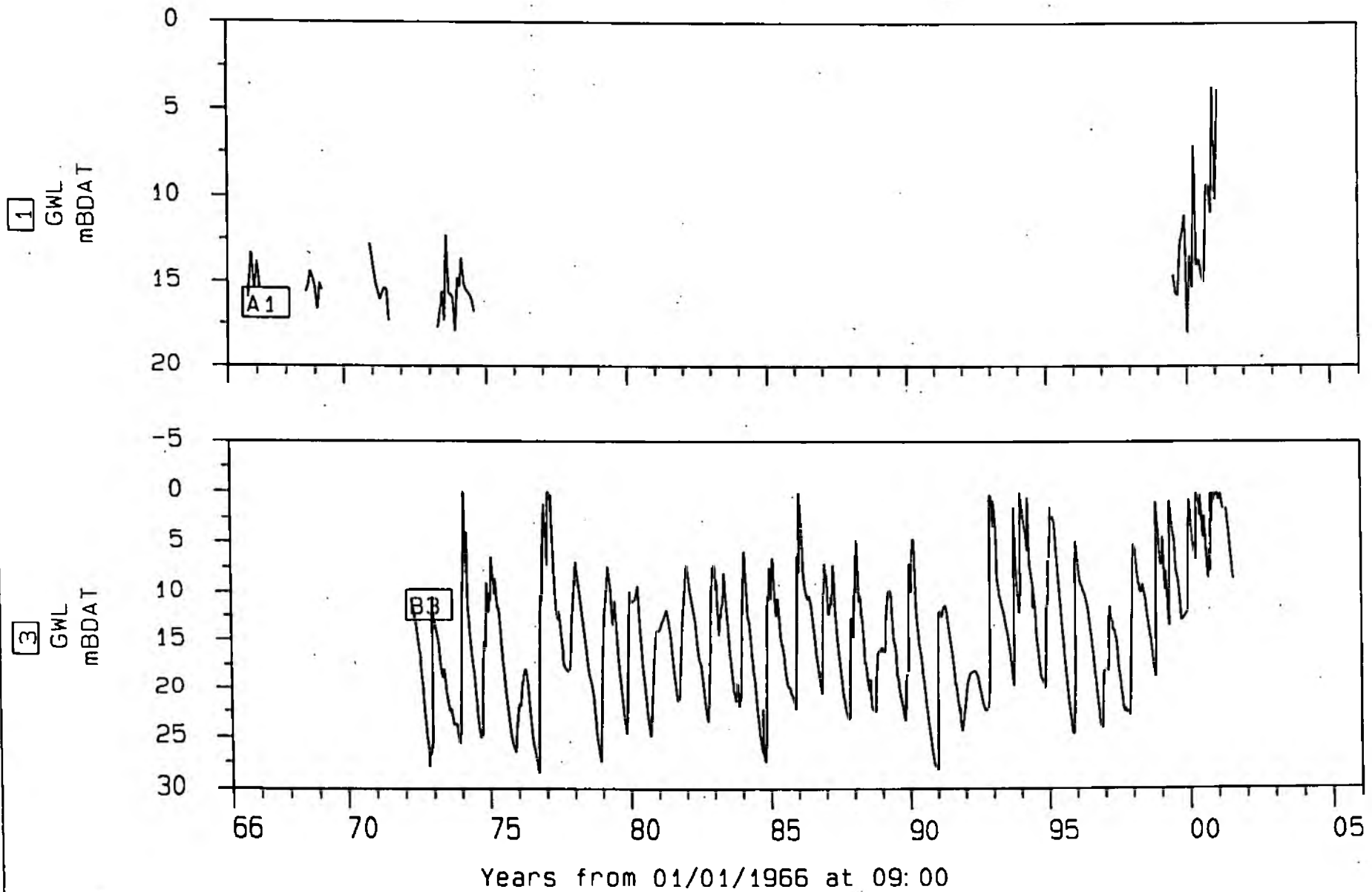
A1 91477333 - ACTON TURVILLE ROAD

B3 91477334 - DOWN FARM -W.KINGTON



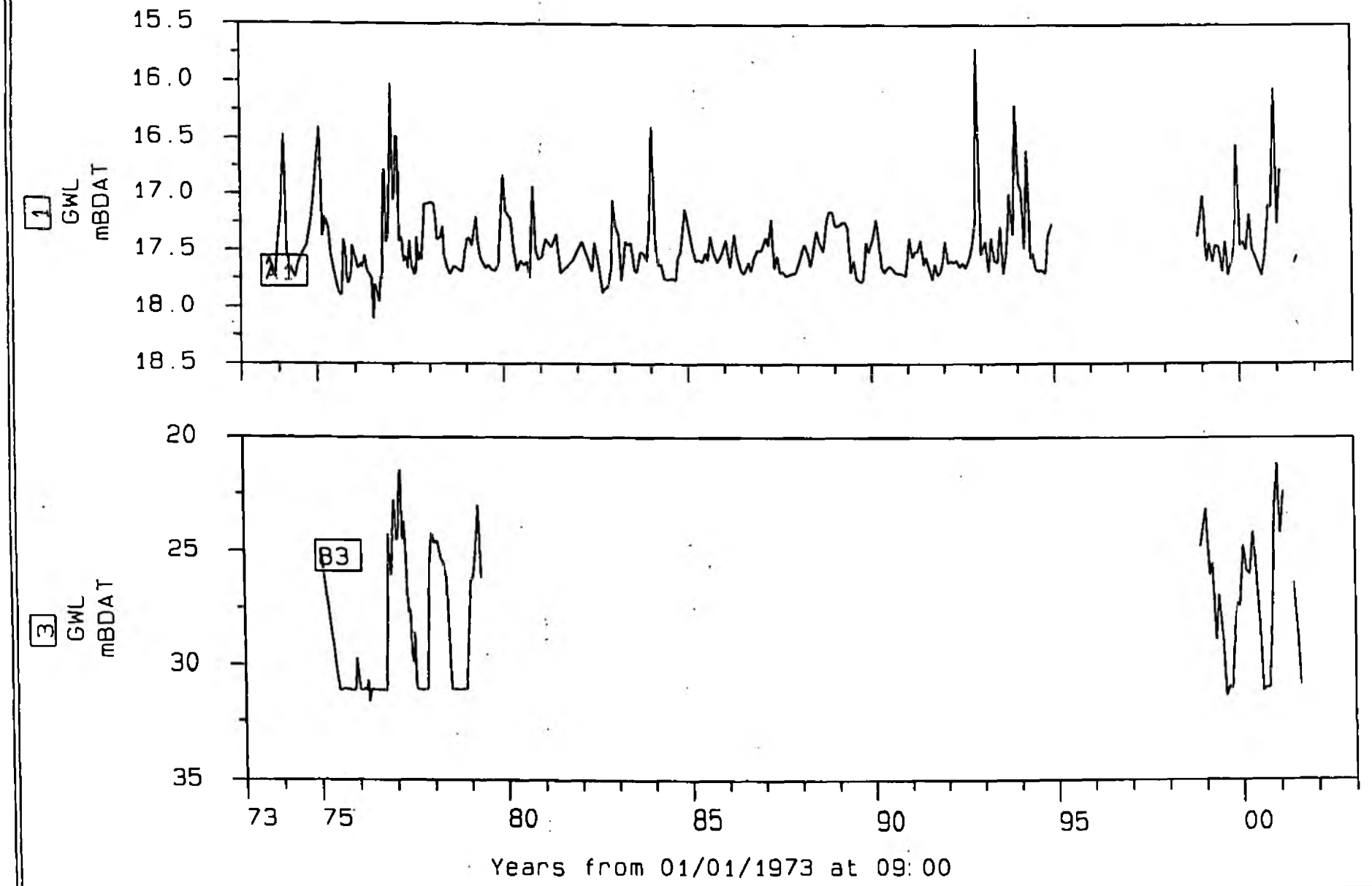
A1 91477408 - CASTLE FARM. M-FIELD

B3 91486334 - ATWORTH NO 3



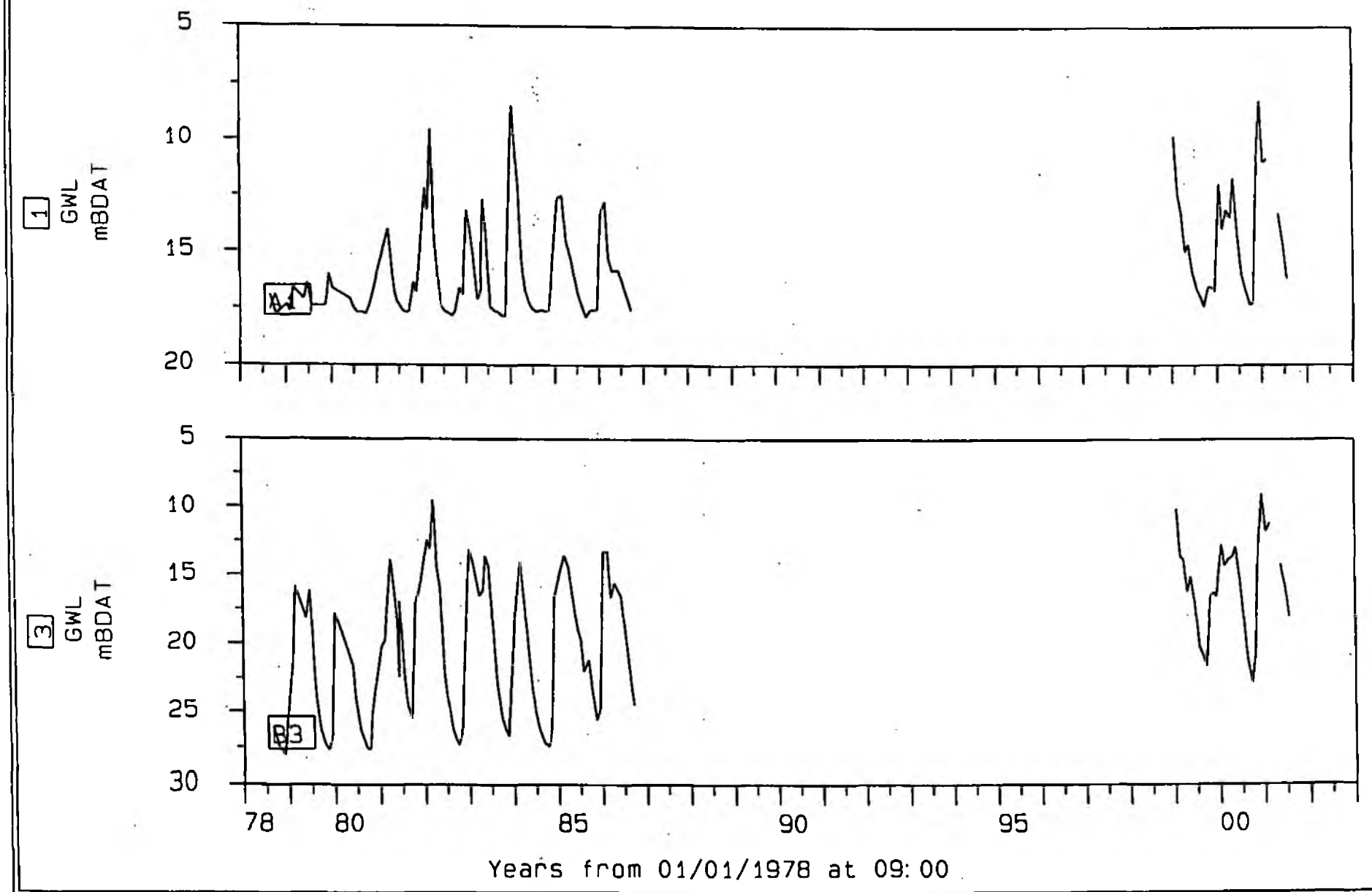
A1 91487134 - COLERNE NO 1

B3 91487337 - MANOR HO. YATTON K



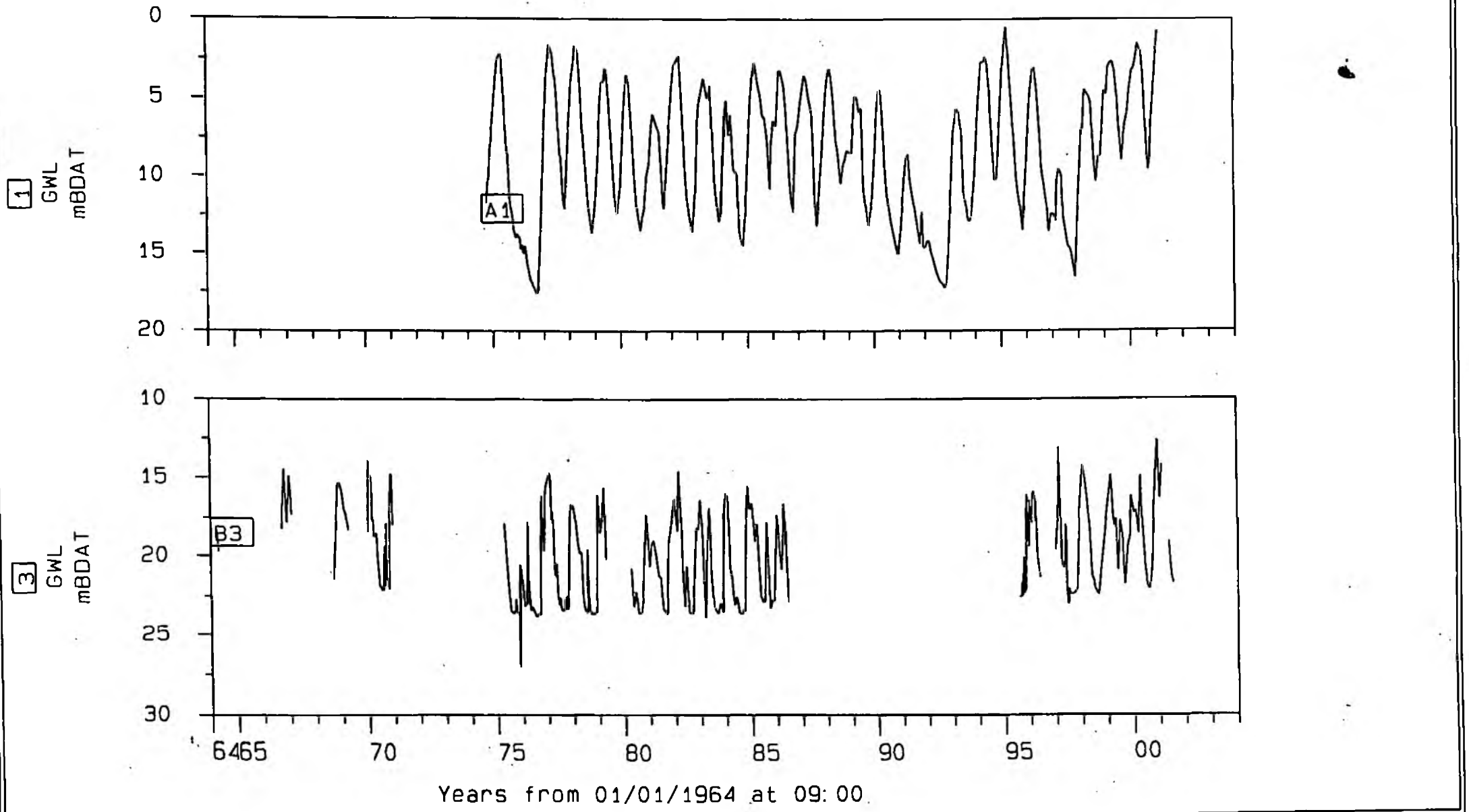
A1 91487340 - LEIGH DELAMERE TIP 1

B3 91487341 - LEIGH DELAMERE TIP 2



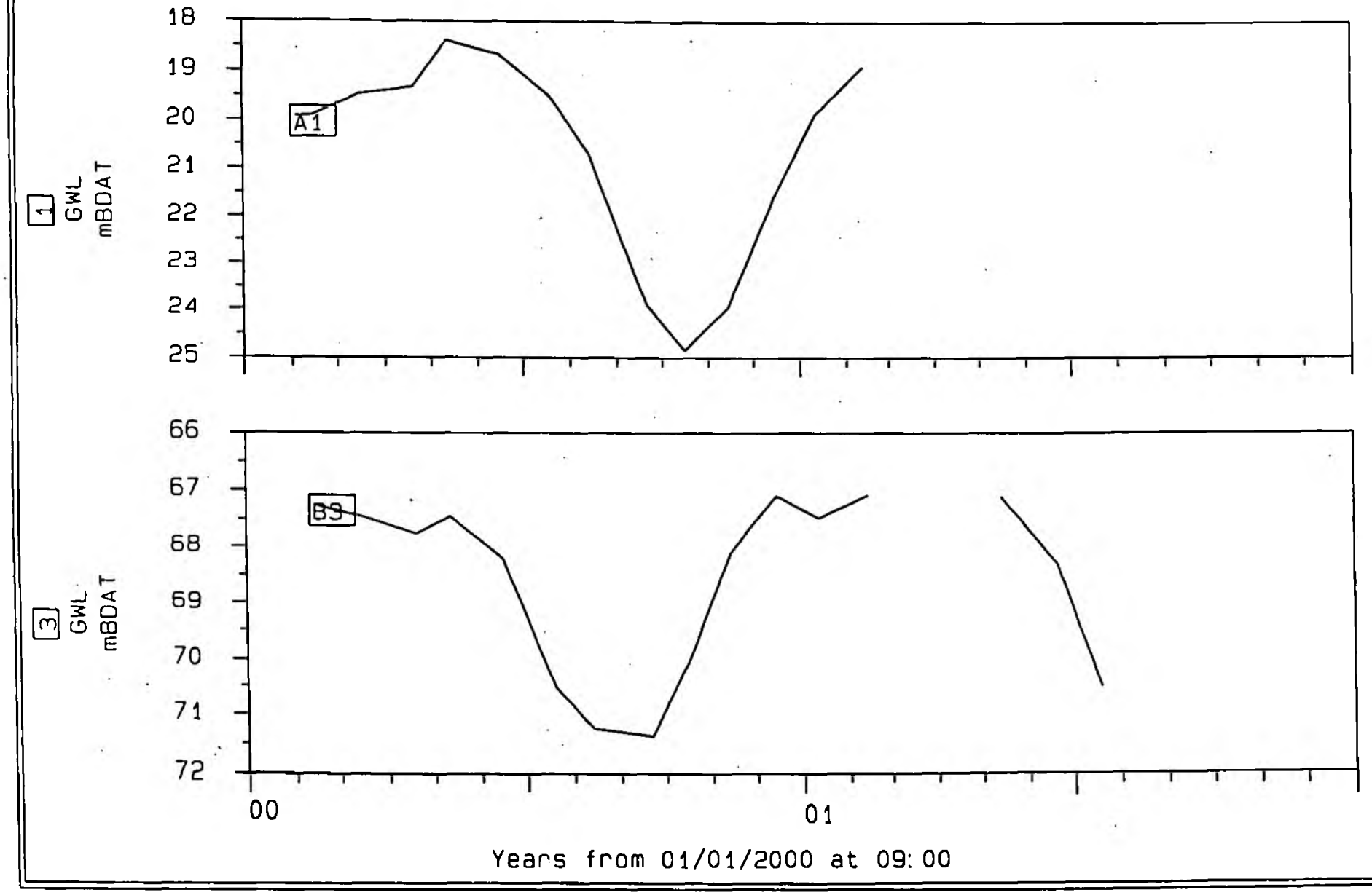
A1 91487433 - ALLINGTON NO1

B3 91488133 - ALDERTON GROVE FARM



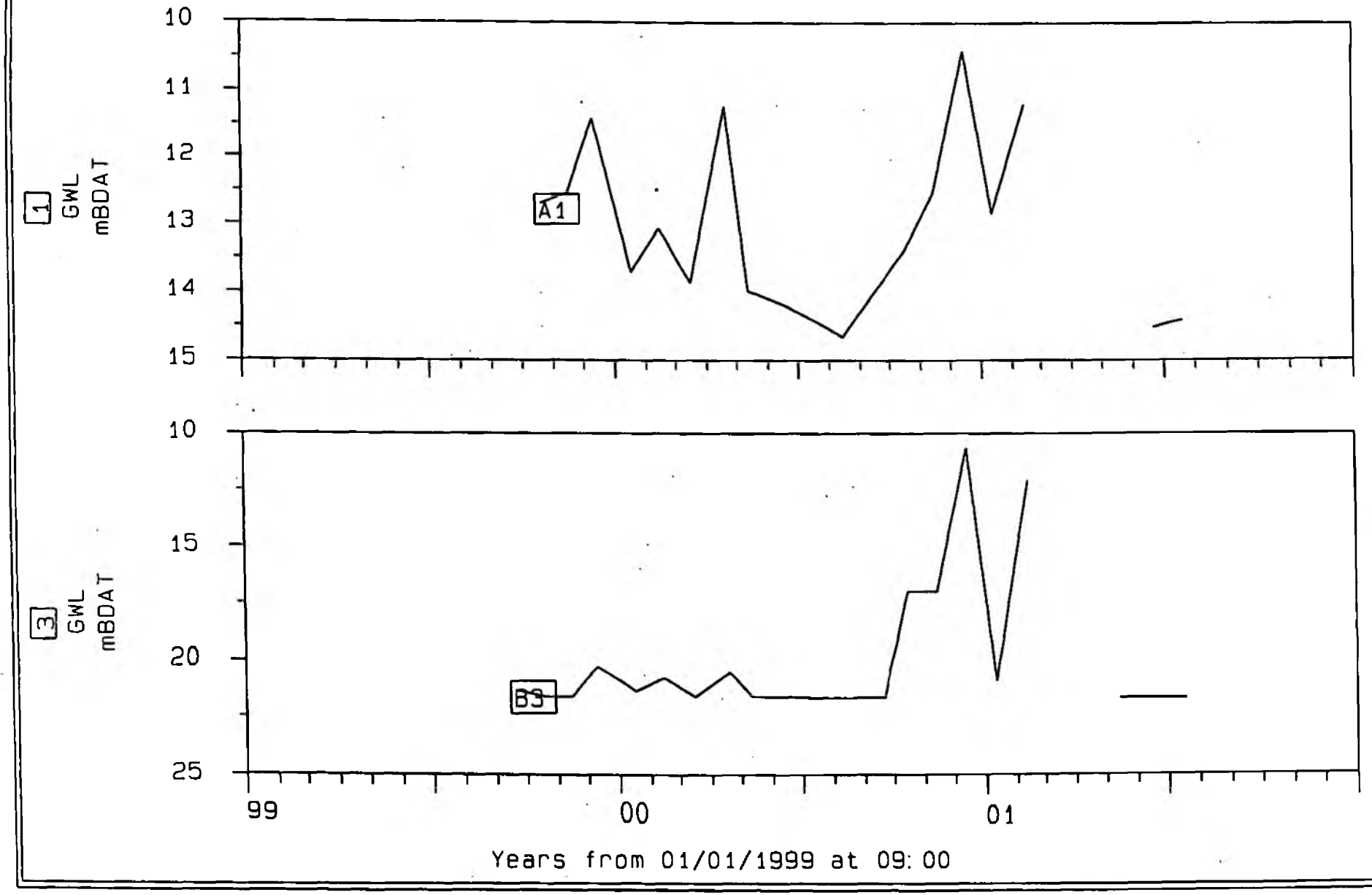
A1 90887301 - NETTLETON PWS

B3 90897401 - CHIPPENHAM ASR

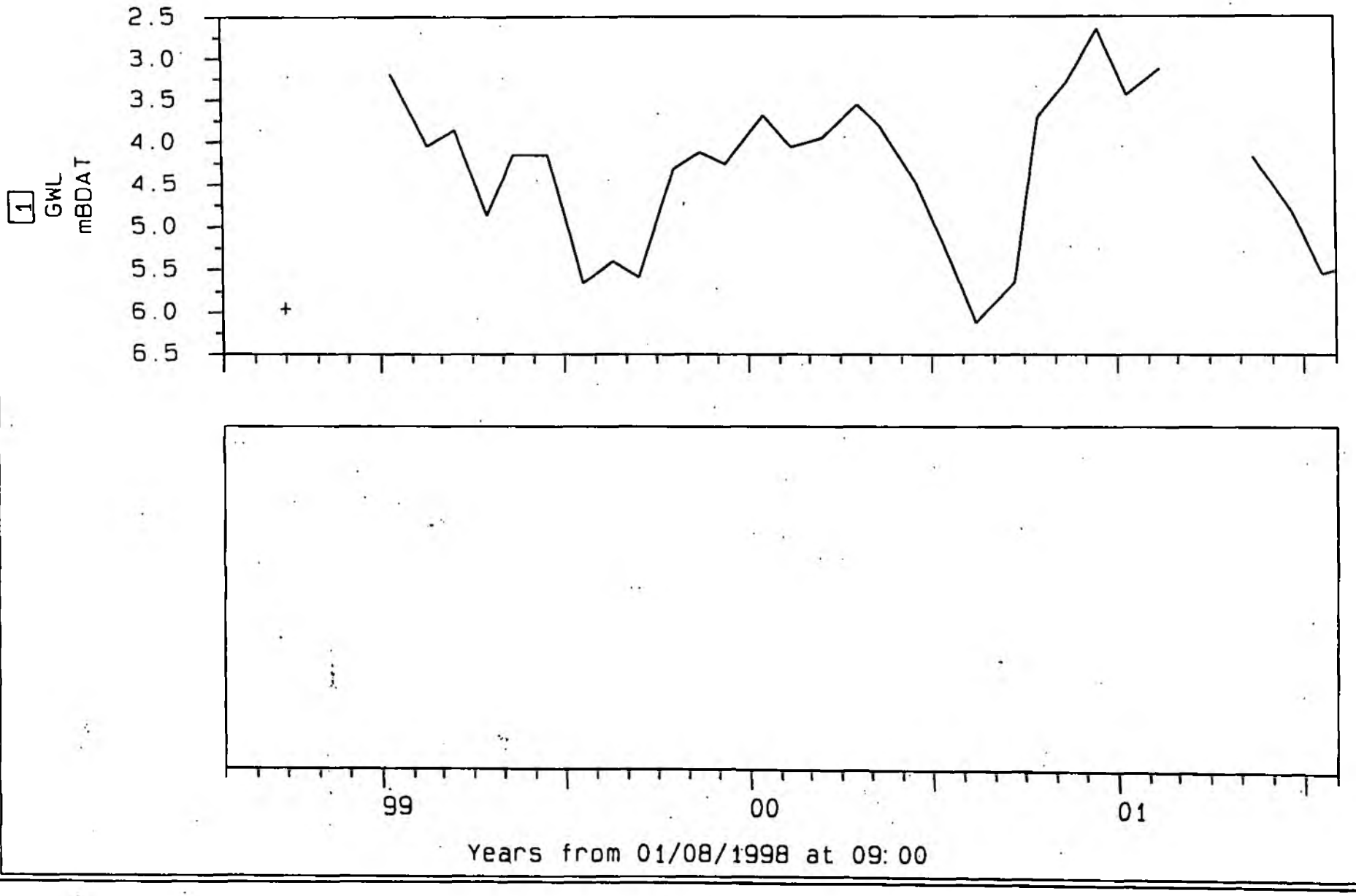


A1 91487202 - WESTFIED FARM WELL

B3 91487301 - WICK COTTAGE WELL



Auth.: 91487247	Name: MARKET CROSS COTTAGE	Locat.: Castle Combe



Appendix 5 Winterbourne signature data

Table 2.1 Burton Brook

Month	NGR	Observation	Elevation (m AOD)	Geology
April 99	ST 8282 7917	Flow starts here	Spring @ 99	Great Oolite limestone
May 99	ST 8268 7942	Flow starts	Overflow from artesian Nettleton pws borehole? @ 99	(Great Oolite &) Inferior Oolite & Cotteswold Sands?
June 99	"	"	"	Great Oolite limestone
July 99	ST 8322 7906	Flow starts	94	Great Oolite limestone
August 99	"	"		Great Oolite limestone

Table 2.2 Broadmead Brook

Month	NGR	Observation	Elevation (m AOD)	Geology
April 99	ST 7587 7590 ST 7575 7572 ST 7494 7314	Flow begins here - fed u/s by drain pipe	158 163 spring @ 189	FE limestone on FE clay FE limestone on FE clay GO limestone on FE clay
May 99	ST 7523 7625 ST 7575 7572 ST 7494 7314	Flow begins -fed u/s by drain pipe	174 163 spring @ 189	FE limestone on FE clay FE limestone on FE clay GO limestone on FE clay
June 99	ST 7523 7625 ST 7575 7572 ST 7494 7314	Standing water Flow begins -fed u/s by drain pipe	 "	FE limestone on FE clay FE limestone on FE clay GO limestone on FE clay
July 99	ST 7726 7638 ST 7739 7650 ST 7494 7314	Start of sodden ground Flow begins -fed u/s by drain pipe	Top of spring outflows @ 145 141 spring @ 189	GO limestone on FE clay GO limestone on FE clay GO limestone on FE clay
August 99	ST 7587 7595 ST 7575 7572 ST 7494 7314	Flow begins here	160 163 spring @ 189	FE limestone on FE clay FE limestone on FE clay GO limestone on FE clay

Table 2.3 Doncombe Brook

Month	NGR	Observation	Elevation (m AOD)	Geology
April 99	ST 7536 7335 ST 7766 7280 ST 8150 7243	Flow begins	175 165 130	FE Rock underlain by FE clay " GO limestone
May 99	ST 7836 7335 ST 7766 7280 ST 8150 7243	Flow begins	175 165 130	FE limestone over FE clay " GO limestone
June 99	As for May	No change from May	"	"
July 99	ST 7836 7335 ST 8145 7239	Flow now received from drain pipe too Flow begins further u/s	175 140	FE Rock over FE clay GO limestone

August 99	ST 7836 7335 ST 7766 7280 ST 8145 7239	From recent drain pipe too Flow influent into ground	175 165 140	FE Rock over FE clay " GO limestone

Table 2.4 Lid Brook

Month	NGR	Observation	Elevation (m AOD)	Geology
April 99	ST 8055 7095 ST 8046 7090 ST 8046 7084 ST 8038 7081 ST 8056 7076 ST 8043 7020	Flow begins at all points	Spring @ 100 100 spring @ 112 spring @ 100 spring @ 125 spring @ 144	GO limestone over FE clay landslip " " " Fuller's Earth GO/Fuller's Earth clay boundary
May 99	Same as for April	Flow begins at all points	"	As above
June 99	As for May	No change from May	"	"
July 99	As for June	Same flow starting points, but from ST 8038 7081, flow becomes influent at ST 8046 7081	"	Flow considered to be influent on permeable Fuller's Earth
August 99	As for June	"	"	"

Appendix 6 Monthly flow data at Middlehill

ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX

Auth. Ref. : 530450
Desc. Desc. : By Brook
Report Type : Monthly Means
Parameter : Flow
Units : m3/s

Station Name : Middlehill
Catchment Ref. : 53
Grid Ref. : ST81356878
Gauge Zero : 76.400 MAOD
Catchment Area : 102.000 Sq Km

Period : 1982 - 2001

Start of Day : 09:00 GMT

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean	Data Code	Year
[illegible]2	4.450	2.209E	4.237E	1.242	0.588	0.519	0.412	0.280	0.288	1.124	3.614	3.978E	1.915	E	1982
1983	3.304E	2.203	1.276	2.208	3.486	1.221	0.480	0.314	0.421	0.771	0.575U	2.400	1.554	E	1983
[illegible]4	4.466	3.082	1.315E	0.894	0.516	0.463	0.265	0.243	0.403	0.728	3.586	3.338	1.603	E	1984
[illegible]5	3.428M	3.290	1.821	2.757	0.793	0.981	0.734	2.258	1.048	0.808	0.497U	4.088	1.844	M	1985
1986	4.415	2.988	1.303	2.361	1.995E	0.845	0.420	0.438	0.413	0.528	3.738	3.540	1.908	E	1986
1987	2.165	1.888	2.938	3.063	0.762	0.576	0.401	0.266	0.248	1.535	2.958	1.406	1.512		1987
[illegible]8	4.069	4.178	1.915	1.173	0.657	0.533	0.799	0.846	1.292	2.873	0.964	1.347	1.715		1988
[illegible]9	1.134	2.482	3.547	2.133	0.757	0.405	0.315	0.223	0.245	0.387	1.589	3.723	1.406		1989
1990	2.530	5.326	1.440	0.638	0.333	0.302	0.236	0.196	0.163	0.201	0.291	0.832	1.013		1990
[illegible]1	3.604	1.518	2.787	1.239	0.582	0.572	0.645	0.339	0.244	0.355	2.089	0.927	1.242		1991
[illegible]2	1.402	1.215	0.858	1.132	0.573	0.336	0.319	0.484	0.845	1.070	3.857	4.967	1.421		1992
1993	4.129	1.337	0.642	1.676	0.684	0.649	0.434	0.282	0.300	2.002	1.113	3.688	1.417		1993
1994	5.010	3.154	2.157	2.886	1.269	0.936	0.390	0.300	0.398	0.504?	2.740?	3.944	1.967	?	1994
[illegible]5	5.310	4.605	2.852	0.818	0.509	0.345	0.232	0.171	0.301E	0.419E	1.236	3.277	1.660	E	1995
1996	2.887	2.318	2.055	1.543	0.884	0.455	0.282	0.276	0.216	0.294	1.875	1.556	1.216		1996
1997	0.539	2.624	1.598	0.517	0.809	0.593	0.402	0.446	0.811	0.662	1.911	3.485	1.191		1997
[illegible]8	4.974	1.000	2.130	2.429	1.287	0.776	0.675E	0.341	0.367	2.050	4.138	2.614	1.906	E	1998
[illegible]9	5.412	1.752	2.394	1.661E	1.448M	1.314	0.481E	0.575E	1.306	1.956	1.539	4.789	2.061	M	1999
2000	2.545U	2.062	2.057U	4.658U	2.016	1.038	0.530	0.359	0.778	2.939	5.718	5.605E	2.522	E	2000
[illegible]1	3.456	3.778	3.563U	3.211U	1.915	0.740	0.521U	0.609U	0.318M	M	M	M	1.999	M	2001
Mean	3.462M	2.650E	2.144E	1.912E	1.093M	0.680	0.449E	0.462E	0.520M	1.116M	2.317M	3.132M	1.649M		
[illegible]. Monthly Mean	0.539M	1.000E	0.642E	0.517E	0.333M	0.302	0.232E	0.171E	0.163M	0.201M	0.291M	0.832M	1.013M		
Year	1997	1998	1993	1997	1990	1990	1995	1995	1990	1990	1990	1990	1990		
[illegible]. Monthly Mean	5.412M	5.326E	4.237E	4.658E	3.486M	1.314	0.799E	2.258E	1.306M	2.939M	5.718M	5.605M	2.522M	E	
Year	1999	1990	1982	2000	1983	1999	1988	1985	1999	2000	2000	2000	2000		
Highest Recorded	12.323M	8.707E	8.919E	7.755E	6.070M	2.732	1.536E	4.353E	4.049M	13.168M	13.101M	12.951M	13.168M	E	
Date	05/01/98	04/02/90	15/03/82	20/04/00	02/05/83	07/06/99	24/07/00	12/08/85	27/09/99	31/10/00	30/11/92	26/12/85	31/10/00		
Lowest Recorded	0.368M	0.320E	0.109E	0.218E	0.243M	0.115	0.111E	0.117E	0.091M	0.094M	0.130M	0.212M	0.091M		
Date	31/01/97	03/02/97	17/03/86	27/04/95	21/05/85	03/06/82	31/07/92	14/08/95	23/09/96	28/10/96	01/11/95	09/12/90	23/09/96		

Data Codes : E - Edited ? - Suspect U - Unchecked M - Incomplete

Appendix 7 Spot gauging results (cumecs)

date	By Brook - Middlehill FMS[2]	Lid Brook	Doncombe Brook	By Brook - Ford	By Brook - Golf Course	Broadmead Brook	Burton Brook[3]	West Kington
NGR	ST814688	ST832699	ST838747	ST846748	ST837777	ST836777	ST837778	ST812774
19-Jun-98	0.757	0.029	0.091	0.296	0.241	0.135	0.106	
14-Jul-98	0.776	0.030	0.070	0.247	0.186	0.115	0.071	0.045
24-Jul-98	0.534	0.025	0.045	0.170	0.125	0.080	0.045	0.029
31-Jul-98	0.415	0.018	0.038	0.138	0.106	0.066	0.039	0.022
21-Aug-98	0.294	0.015	0.024	0.096	0.070	0.050	0.020	0.013
18-Sep-98	0.324	0.022	0.039	0.101	0.075	0.042	0.032	0.012
25-Sep-98	0.260	0.015	0.025	0.086	0.062	0.032	0.030	0.010
14-Oct-98	0.485	0.023	0.058	0.184	0.149	0.086	0.063	0.033
19-Nov-98	2.746	0.084	0.272	1.576	1.178	0.671	0.507	0.332
4-Dec-98	1.199	0.042	0.085	0.556	0.428	0.169	0.259	0.083
18-Dec-98	2.220	0.060	0.187	1.533	1.223	0.785	0.438	0.462
29-Jan-99	4.171	0.130	0.431	2.548		1.130		0.685
5-Feb-99	2.501	0.075	0.196	1.314	0.974	0.491	0.484	0.267
10-Mar-99	3.050	0.102	0.292	1.659	1.433	0.746	0.687	0.438
22-Mar-99	1.412	0.047	0.083	0.620	0.472	0.181	0.291	0.065
28-Apr-99	3.770	0.108	0.460	2.143	1.705	0.977	0.727	0.645
12-May-99	1.660	0.056	0.134	1.040	0.866	0.333	0.533	0.180
15-Jun-99	1.285	0.037	0.106	0.657	0.501	0.182	0.319	0.122
19-Jul-99	0.433	0.014	0.029	0.153	0.118	0.051	0.067	0.017
20-Aug-99	0.499	0.015	0.033	0.200	0.153	0.086	0.067	0.023
17-Sep-99	0.420	0.011	0.029	0.153	0.123	0.066	0.057	0.017
20-Oct-99	1.030	0.026	0.081	0.494	0.358	0.151	0.207	0.064
16-Nov-99	1.449	0.039	0.120	0.684	0.555	0.268	0.287	0.131

Additional spot gaugings used to determine STW % of streamflow in Table 20

Date	Marshfield (u/s STW)
	ST 785 733
12-May-99	0.0095
15-Jun-99	0.0042
19-Jul-99	0.0011
20-Aug-99	0.001
17-Sep-99	0.0008

(no gaugings available prior to May '99 for the year of study Sept'98 – 99)

[2] Daily average flow at the flow measurement station, not a spot gauging result.
[3] Difference between the gaugings at the Golf Course (on the By Brook) and on the Broadmead Brook.

Appendix 8 To impound or not: example from Malmesbury

Clean-up operation brings back river life

TROUT are once again flourishing in the Sherston Avon thanks to a £20,000 partnership between the Environment Agency, an Easton Gray landowner and local anglers.

Environment Agency fisheries officer Martin Frayling said old mill sluice gates downstream from Easton Gray had caused a deep channel which had choked a section of the river with weeds and silt.

The poor condition of the river had deprived native brown trout in the area of the clean, gravel channels, or riffles, and pools in which they needed to spawn.

Two years ago, after a significant drop in the number of young trout in the river, the Environment Agency joined forces with Easton Gray landowner John Tremaine and local fishermen to remove the sluice gates and reinstate the river's natural features.

Gravel riffles and pools were created providing oxygen-rich water for young trout and their developing eggs, and the riverbank was re-shaped using natural willow hurdles to increase the speed of the water and form deeper pools downstream for older fish.

Mr Frayling said: "Recent surveys have found young trout around 10 centimetres long on each riffle. These fish are the result of successful spawning last autumn."

"As it is only two years since the improvement work was done, the presence of these young trout is very encouraging for everyone."

He said the riffles had also made ideal spawning grounds for bullhead fish, and a home for native crayfish which were decimated by pollution several years ago.

He said the aim of the project was to preserve and increase the natural brown trout population.

"Restocking is fine in cases of pollution, but it is important to get a self-sustaining fish population, or as near to that as we can get. We wouldn't want to see our rivers denuded of natural fish."

He said there was a marked difference between wild trout and trout bred in captivity.

He said: "Natural trout tend to be a much nicer looking fish with brighter colours and perfect fins."

"You tend to get a certain degree of fin erosion with bred fish. Wild trout are a perfect-looking little fish, and they're much healthier and stronger. They're also much better fighters."

He said the Environment Agency would continue to monitor the river.

Mr Tremaine, who owns the land on which the former mill was located, said: "I very rarely fish, but conservation is important to me. The river is now a lot cleaner and nicer for the fish, crayfish,

Appendix 9 Widdenham abstraction impact assessment

Monthly average flows Middlehill m^3/s

year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1988	4.069	4.178	1.915	1.173	0.657	0.533	0.799	0.846	1.292	2.873	0.964	1.347
1989	1.134	2.482	3.547	2.133	0.757	0.405	0.315	0.223	0.245	0.387	1.589	3.723
1990	2.53	5.326	1.44	0.638	0.333	0.302	0.236	0.196	0.163	0.201	0.291	0.832
1991	3.604	1.518	2.787	1.239	0.582	0.572	0.645	0.339	0.244	0.355	2.089	0.927
1992	1.402	1.215	0.858	1.132	0.573	0.336	0.319	0.484	0.845	1.07	3.857	4.967
1993	4.129	1.337	0.642	1.676	0.684	0.649	0.434	0.282	0.3	2.002	1.113	3.688
1994	5.01	3.154	2.157	2.886	1.269	0.936	0.39	0.3	0.398	0.504	2.74	3.944
1995	5.31	4.605	2.852	0.818	0.509	0.345	0.232	0.171	0.301	0.419	1.236	3.277
1996	2.887	2.318	2.055	1.543	0.884	0.455	0.282	0.276	0.216	0.294	1.875	1.556
1997	0.539	2.624	1.598	0.517	0.809	0.593	0.402	0.446	0.811	0.662	1.911	3.485
1998	4.974	1	2.13	2.429	1.287	0.776	0.675	0.341	0.367	2.05	4.138	2.614
1999	5.412	1.752	2.394	1.661	1.448	1.314	0.481	0.575	1.306	1.956	1.539	4.789
2000	2.545	2.062	2.057	4.658	2.016	1.038	0.53	0.359	0.778			

Monthly estimated flows Widdenham (from d/s Doncombe Bk) m^3/s

year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1988	2.804	2.883	1.241	0.703	0.298	0.239	0.366	0.388	0.789	1.936	0.444	0.829
1989	0.674	1.652	2.425	1.399	0.346	0.177	0.134	0.090	0.101	0.169	1.004	2.553
1990	1.687	3.716	0.896	0.289	0.143	0.128	0.097	0.077	0.062	0.080	0.123	0.381
1991	2.466	0.953	1.874	0.750	0.262	0.257	0.292	0.146	0.100	0.153	1.367	0.427
1992	0.869	0.733	0.394	0.673	0.258	0.144	0.136	0.215	0.388	0.628	2.650	3.455
1993	2.847	0.822	0.291	1.068	0.311	0.294	0.191	0.119	0.127	1.304	0.659	2.527
1994	3.487	2.140	1.417	1.945	0.772	0.431	0.170	0.127	0.174	0.225	1.840	2.713
1995	3.704	3.193	1.921	0.375	0.227	0.149	0.095	0.066	0.128	0.184	0.748	2.229
1996	1.946	1.533	1.343	0.971	0.406	0.201	0.119	0.116	0.087	0.124	1.212	0.980
1997	0.241	1.755	1.011	0.231	0.370	0.267	0.176	0.197	0.371	0.300	1.238	2.380
1998	3.461	0.577	1.397	1.614	0.785	0.355	0.306	0.147	0.159	1.339	2.854	1.748
1999	3.778	1.123	1.588	1.057	0.902	0.805	0.214	0.259	0.799	1.271	0.968	3.326
2000	1.698	1.348	1.344	3.231	1.314	0.605	0.237	0.155	0.356			

The equation to calculate flows u/s Widdenham from flow at Middlehill is :
Q Widdenham = 0.7256*Q Middlehill - 0.1486 (r^2 0.99). This is applicable to average flows.
For low flows another equation should be used:
Q Widdenham =0.4779* Q Middlehill - 0.0162 (r^2 0.93)
The estimated Q95 for u/s Widdenham = 0.092 m^3/s

Average abstractions Widdenham for the month (m3/s)

year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1988				0.012	0.012	0.010	0.009	0.009	0.012	0.009	0.008	0.013
1989	0.012	0.013	0.012	0.012	0.012	0.009	0.007	0.005	0.004	0.004	0.006	0.012
1990	0.007	0.012	0.011	0.010	0.008	0.007	0.005	0.004	0.004	0.003	0.003	0.004
1991	0.007	0.009	0.010	0.010	0.005	0.006	0.007	0.006	0.005	0.004	0.008	0.010
1992*	0.010	0.009	0.007	0.009	0.008	0.007	0.005	0.006	0.010	0.000	0.000	0.000
1993*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1994*	0.000	0.000	0.000	0.006	0.011	0.010	0.008	0.005	0.005	0.007	0.008	0.011
1995	0.010	0.012	0.019	0.016	0.011	0.010	0.009	0.006	0.004	0.005	0.006	0.004
1996	0.011	0.010	0.010	0.015	0.017	0.009	0.008	0.005	0.000	0.003	0.007	0.011
1997	0.011	0.010	0.010	0.009	0.008	0.010	0.010	0.006	0.011	0.011	0.010	0.011
1998	0.011	0.011	0.011	0.010	0.011	0.011	0.011	0.010	0.008	0.010	0.010	0.012
1999	0.011	0.011	0.000	0.009	0.009	0.010	0.009	0.010	0.010	0.010	0.004	0.007
2000	0.009	0.010	0.010									
average	0.008	0.009	0.008	0.010	0.009	0.008	0.007	0.006	0.005	0.005	0.006	0.007

An average abstraction rate for the month was derived from monthly abstraction returns (in Ml/month) which are then converted into an average flow rate (m^3/s) for the month.

* No abstraction occurred between Oct 1992 and March 1994

Widdenham abstraction as percentage of estimated river flows at Widdenham (%)

year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1988				1.7%	3.9%	4.2%	2.6%	2.3%	1.5%	0.5%	1.8%	1.6%	
1989	1.8%	0.8%	0.5%	0.8%	3.3%	5.4%	4.9%	5.6%	3.7%	2.1%	0.6%	0.5%	
1990	0.4%	0.3%	1.3%	3.3%	5.8%	5.1%	5.7%	5.4%	5.9%	4.0%	2.7%	1.0%	
1991	0.3%	1.0%	0.5%	1.3%	2.0%	2.3%	2.4%	3.8%	4.5%	2.7%	0.6%	2.3%	
1992*	1.1%	1.3%	1.8%	1.3%	3.3%	5.1%	3.8%	2.6%	2.5%	0.0%	0.0%	0.0%	
1993*	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
1994*	0.0%	0.0%	0.0%	0.3%	1.4%	2.3%	4.7%	3.7%	2.8%	3.1%	0.4%	0.4%	
1995	0.3%	0.4%	1.0%	4.4%	4.8%	6.9%	9.0%	9.4%	2.9%	2.8%	0.8%	0.2%	
1996	0.6%	0.6%	0.7%	1.5%	4.2%	4.7%	6.7%	4.4%	0.1%	2.4%	0.5%	1.1%	
1997	4.5%	0.5%	1.0%	4.1%	2.2%	3.8%	5.8%	3.2%	2.9%	3.5%	0.8%	0.5%	
1998	0.3%	1.8%	0.8%	0.7%	1.4%	3.0%	3.5%	7.1%	5.3%	0.8%	0.4%	0.7%	
1999	0.3%	0.9%	0.0%	0.9%	1.0%	1.2%	4.4%	3.9%	1.3%	0.8%	0.4%	0.2%	
2000	0.6%	0.7%	0.7%										
													Average
average	0.8%	0.7%	0.7%	1.7%	2.7%	3.6%	4.6%	4.5%	2.9%	2.0%	0.7%	0.6%	2.1%
max	4.5%	1.8%	1.8%	4.4%	5.8%	6.9%	9.0%	9.4%	5.9%	4.0%	2.7%	2.3%	
min	0	0	0	0	0	0	0	0	0	0	0	0	

* No abstraction occurred between Oct 1992 and March 1999

Widdenham abstraction (returns) as percentage of annual licensed abstraction (%)

	Jan	Feb	Mar	April	May	June	July	August	September	October	November	December	
1988				47%	47%	39%	38%	36%	45%	38%	32%	52%	
1989	49%	46%	49%	45%	46%	37%	26%	20%	15%	14%	25%	46%	
1990	29%	42%	46%	37%	33%	25%	22%	17%	14%	13%	13%	15%	
1991	30%	33%	39%	38%	21%	22%	28%	22%	18%	17%	30%	40%	
1992*	39%	36%	29%	35%	34%	28%	21%	22%	37%	0%	0%	0%	
1993*	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
1994*	0%	0%	0%	25%	42%	38%	32%	19%	19%	28%	29%	46%	
1995	39%	45%	75%	64%	43%	40%	34%	25%	14%	21%	23%	18%	
1996	17%	37%	69%	57%	69%	36%	32%	20%	0%	12%	25%	43%	
1997	44%	35%	40%	37%	33%	40%	41%	25%	42%	42%	40%	44%	
1998	43%	38%	43%	41%	43%	42%	43%	42%	33%	42%	40%	47%	
1999	44%	39%	0%	36%	35%	39%	37%	40%	40%	39%	16%	30%	
2000	38%	36%	38%										Period Average
average	31%	32%	35%	38%	37%	32%	30%	24%	23%	22%	23%	32%	30%
max	49%	46%	75%	64%	69%	42%	43%	42%	45%	42%	40%	52%	

These figures were calculated by dividing the actual monthly abstraction (Ml/month) by 1/12th of the annual licenced abstraction rate (i.e. the monthly equivalent of the annual authorised volume)

* No abstraction occurred between Oct 1992 and March 1994.

Appendix 10 Sewage treatment plants inflows

ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX

Auth. Ref.	: 0410000000	Station Name	: Marshfield STW
Doc. Desc.	: inflow to STW	Catchment Ref.	: 53
Report Type	: Daily Means For Yr.	Grid Ref.	: ST785733
Parameter	: Flow	Gauge Zero	: N/A
Units	: l/s	Catchment Area	: 0.000 Sq Km
Period	: 1998	Start of Day	: 09:00 GMT

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Day
										2.860	7.002	2.694	1
										2.626	8.239	2.705	2
3										2.738	6.203	2.639	3
										3.057	4.587	2.645	4
										2.722	4.696	2.821	5
										2.562	3.573	3.167	6
7										2.562	4.345	2.728	7
										2.490	6.264	2.968	8
										2.599	5.448	2.374	9
10										2.708	4.126	3.268	10
										3.100	4.741	3.454	11
										2.574	5.285	3.973	12
13										3.436	4.004	3.402	13
										2.789	3.621	3.247	14
										2.739	3.710	4.141	15
									0.000M	4.635	3.167	3.281	16
17									2.107	3.520	2.869	3.486	17
									2.341	3.423	2.920	4.963	18
									2.483	2.708	2.805	4.629	19
20									2.784	3.336	2.546	4.393	20
									2.380	3.010	3.003	3.797	21
									2.402	6.094	3.216	3.867	22
23									2.383	5.250	2.805	4.240	23
24									2.404	7.800	3.132	4.041	24
									2.522	6.337	2.778	7.046	25
									5.439	4.920	3.084	7.835	26
27									4.514	8.638	2.831	5.214	27
									3.339	6.380	3.118	4.081	28
									3.464	4.597	3.143	3.594	29
30									3.392	4.032	2.988	3.297	30
31										9.459		3.972	31
Mean									2.797	4.055	4.008	3.805	
Maximum													
Daily Mean									5.439	9.459	8.239	7.835	
Day of Max.									26	31	2	26	
Minimum													
Daily Mean									0.000	2.490	2.546	2.374	
Day of Min.									16	8	20	9	
Total (TCM)										4	11	10	10
Runoff (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Above summary is for Daily Means of Flow

Data Codes : E - Edited ? - Suspect U - Unchecked M - Incomplete

ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX

Auth. Ref.	: 0410000000	Station Name	: Marshfield STW
Loc. Desc.	: inflow to STW	Catchment Ref.	: 53
Report Type	: Daily Means For Yr.	Grid Ref.	: ST785733
Parameter	: Flow	Gauge Zero	: N/A
Units	: l/s	Catchment Area	: 0.000 Sq Km
Period	: 1999	Start of Day	: 09:00 GMT

Dy	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Day
1	5.040	3.209	6.146	2.444	2.931		2.488	3.021	2.716U				1
2	6.296	3.103	9.274	2.651	3.059		2.036	3.220	2.894U				2
3	7.092	3.081	7.492	2.539	3.253		2.495	2.743	2.499U				3
4	5.807	2.793	5.590	2.729	2.824		2.092	3.303	2.469U				4
5	4.438	2.784	4.161	3.063	2.707		0.000	2.765	2.938U				5
6	5.108	2.981	3.862	2.858	2.801		2.708	3.638	2.493U				6
7	5.574	3.388	3.954	2.571	3.104	3.703M	2.740	2.825	2.475U				7
8	4.786	3.449	3.339	2.590	3.366	3.220	2.511	4.991	2.577U				8
9	3.888	2.797	3.060	2.582	3.608	2.883	2.656	5.243	2.500U				9
10	3.875	2.775	2.924	2.634	2.986	2.874	2.666	2.869	2.455U				10
11	3.496	2.835	3.017	4.208	5.369	2.719	3.294	4.129	2.694U				11
12	4.203	2.840	3.516	2.768	4.567	2.836	2.975	2.800	2.994U				12
13	4.279	2.913	3.374	2.772	4.626	2.914	2.898	3.123	2.639U				13
14	3.424	3.346	3.459	3.023	3.746	2.317	2.917	3.175	2.647U				14
15	8.596	2.759	3.225	2.648	3.862	2.266	2.944	2.991	3.201U				15
16	6.700	2.788	2.605	2.569	3.994	2.677	2.986	2.678	3.255U				16
17	5.080	2.700	2.794	2.545	3.638M	2.462	2.870	2.696	2.589U				17
18	5.614	3.435	2.939	3.260		2.480	3.229	2.942	6.153U				18
19	9.311	2.973	2.563	2.708		2.708	3.159	2.875	5.175U				19
20	8.374	2.981	3.244	5.458		2.993	3.152	2.809	4.264U				20
21	5.638	3.718	3.458	5.365		2.423	2.975	2.639	3.739U				21
22	3.968	3.027	2.885	6.138		2.571	3.016	2.922	4.796U				22
23	4.107	3.356	2.826	8.668		2.416	2.936	2.889	5.280U				23
24	4.194	3.033	2.828	5.192		2.437	2.915	4.231	5.033U				24
25	4.118	2.826	3.289	5.817		2.317	3.075	4.862	4.526U				25
26	5.236	3.789	2.699	4.700		2.446	2.853	3.105U	6.564U				26
27	4.136	3.338	2.854	3.753		3.434	2.816	2.514U	5.221U				27
28	3.651	5.849	2.918	3.378		4.512	2.738	2.454U	4.260U				28
29	3.455		3.154	3.211		3.801	2.728	2.581U	0.000M				29
30	3.522		3.160	2.909		2.633	2.728	2.594U					30
31	3.777		2.653				2.698	2.973U					31
Mean	5.058	3.174	3.654	3.592	3.555	2.835	2.719	3.181	3.484				
Maximum													
Daily Mean	9.311	5.849	9.274	8.668	5.369	4.512	3.294	5.243	6.564				
Dy of Max.	19	28	2	23	11	28	11	9	26				
Minimum													
Daily Mean	3.424	2.700	2.563	2.444	2.707	2.266	0.000	2.454	0.000				
Dy of Min.	14	17	19	1	5	15	5	28	29				
Total (TCM)	14	8	10	9	5	6	7	9	9				
Runoff (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Above summary is for Daily Means of Flow

Data Codes : E - Edited ? - Suspect U - Unchecked M - Incomplete

ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX

Auth. Ref.	: 0430000000	Station Name	: Longdean STW
Loc. Desc.	: inflow to STW	Catchment Ref.	: 53
Report Type	: Daily Means For Yr.	Grid Ref.	: ST849756
Parameter	: Flow	Gauge Zero	: N/A
Units	: l/s	Catchment Area	: 0.000 Sq Km
Period	: 1998	Start of Day	: 09:00 GMT

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Day
										2.497	9.943	2.220	1
										2.129	11.328	2.295	2
3										2.237	10.007	2.452	3
4										2.194	9.386	1.540	4
										1.829	9.217	1.648	5
										1.841	8.639	1.676	6
7										1.700	8.494	1.383	7
										1.963	9.460	2.589	8
										1.942	9.358	2.078	9
10										2.029	8.573	3.672	10
										2.018	8.716	2.909	11
										1.784	8.799	4.021	12
13										2.028	8.239	3.333	13
14										1.962	7.806	2.648	14
										1.616	7.196	4.153	15
										4.572	6.401	2.924	16
17										3.755	5.811	2.717	17
										2.606	5.279	4.760	18
										2.107	4.634	4.266	19
20										2.560	4.122	3.539	20
21										1.508	3.957	3.171	21
										0.000	3.763	4.385	22
23										6.516	3.140	7.027	23
24										11.255	3.516	6.349	24
										8.097	2.938	9.947	25
										7.356	2.561	11.110	26
27										10.244	2.406	10.005	27
28										10.091	3.413	9.555	28
										8.971	2.920	9.180	29
30									0.188M	8.434	2.349	8.543	30
31										11.673		8.212	31
Mean									0.188	4.178	6.412	4.655	
Maximum													
Daily Mean									0.188	11.673	11.328	11.110	
Day of Max.									30	31	2	26	
Minimum													
Daily Mean									0.188	0.000	2.349	1.383	
Day of Min.									30	22	30	7	
Total (TCM)									0	11	17	12	
Runoff (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Above summary is for Daily Means of Flow

Data Codes : E - Edited ? - Suspect U - Unchecked M - Incomplete

ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX

Auth. Ref.	: 0430000000	Station Name	: Longdean STW
Loc. Desc.	: inflow to STW	Catchment Ref.	: 53
Report Type	: Daily Means For Yr.	Grid Ref.	: ST849756
Parameter	: Flow	Gauge Zero	: N/A
Units	: l/s	Catchment Area	: 0.000 Sq Km
Period	: 1999	Start of Day	: 09:00 GMT

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Day
1	8.673	6.809	6.066	2.355	3.887	4.815	3.838	2.507	3.575U				1
2	9.348	6.237	10.337	2.543	3.488	4.954	3.303	3.399	3.388U				2
3	9.867	5.108	9.500	2.366	3.054	5.066	3.497	2.834	2.670U				3
4	9.802	4.634	9.280	2.466	2.630	3.876	3.504	4.032	2.979U				4
5	9.265	4.988	8.861	2.579	2.402	7.243	3.195	2.853	2.801U				5
6	9.309	4.911	8.307	2.277	2.570	5.130	3.207	4.034	2.657U				6
7	9.935	4.539	7.512	2.265	3.597	4.531	2.984	3.464	2.506U				7
8	9.753	4.422	6.754	2.042	3.978	3.934	2.888	6.810	2.068U				8
9	9.095	3.730	5.463	2.005	3.301	3.986	2.920	7.001	1.921U				9
10	8.679	3.158	4.704	2.118	2.871	3.838	3.106	4.523	1.844U				10
11	8.231	2.949	4.964	3.415	5.532	3.606	3.108	6.172	2.140U				11
12	8.285	3.247	4.370	2.653	3.446	3.638	2.789	4.328	2.120U				12
13	7.912	3.352	4.027	1.807	3.524	3.801	2.853	2.843	1.778U				13
14	7.003	3.448	3.733	1.825	2.997	3.338	2.688	2.692	1.740U				14
15	9.760	2.958	3.100	1.876	2.935	3.012	2.796	2.486	1.967U				15
16	9.660	2.552	2.931	1.543	2.855	3.008	2.701	2.004	3.273U				16
17	9.154	2.210	2.690	1.618	2.578	2.937	2.846	2.217	2.297U				17
18	9.729	2.530	2.950	1.670	2.594	2.852	2.824	3.010	7.834U				18
19	10.954	2.757	2.455	1.672	2.417	3.095	2.650	2.110	8.812U				19
20	10.626	2.744	2.810	5.462	2.660	3.077	2.645	1.842	8.608U				20
21	9.478	2.898	3.012	5.847	2.452	2.904	2.620	1.944	5.627U				21
22	9.011	2.462	2.562	6.841	2.525	2.818	2.644	1.954	7.245U				22
23	8.943	2.723	2.356	10.172	2.500	2.750	2.595	1.765	7.025U				23
24	8.872	2.974	2.299	6.008	2.228	2.657	2.626	4.681	7.072U				24
25	9.117	2.633	3.068	6.709	2.229	2.636	2.771	7.470	6.923U				25
26	9.529	3.344	2.445	7.513	2.032	2.858	2.527	4.451U	9.187U				26
27	8.984	3.062	2.474	6.415	2.439	3.313	2.665	4.345U	9.949U				27
28	8.416	5.109	2.588	5.813	2.137	4.931	2.462	4.389U	8.557U				28
29	7.977		2.855	5.634	6.446	5.981	2.381	4.198U	0.638M				29
30	7.620		2.886	4.266	3.427	3.715	2.285	4.510U					30
31	7.175		2.499		2.958		2.480	3.748U					31
Mean	9.038	3.660	4.512	3.726	3.054	3.810	2.852	3.697	4.455				
Maximum Daily Mean	10.954	6.809	10.337	10.172	6.446	7.243	3.838	7.470	9.949				
Day of Max.	19	1	2	23	29	5	1	25	27				
Minimum Daily Mean	7.003	2.210	2.299	1.543	2.032	2.636	2.285	1.765	0.638				
Day of Min.	14	17	24	16	26	25	30	23	29				
Total (TCM)	24	9	12	10	8	10	8	10	11				
Runoff (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Above summary is for Daily Means of Flow

Data Codes : E - Edited ? - Suspect U - Unchecked M - Incomplete

ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX

Auth. Ref.	: 0420000000	Station Name	: Colerne STW
Loc. Desc.	: Inflow to STW	Catchment Ref.	: 53
Report Type	: Daily Means For Yr.	Grid Ref.	: ST823706
Parameter	: Flow	Gauge Zero	: N/A
Units	: l/s	Catchment Area	: 0.000 Sq Km
Period	: 1998	Start of Day	: 09:00 GMT

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Day
1										6.857	9.949	5.803	1
2										7.069	12.057	5.806	2
3										6.866	7.916	5.925	3
4										7.557	5.948	5.628	4
5										7.267	7.257	6.438	5
6										6.956	6.610	6.538	6
7										6.479	8.453	6.052	7
8										6.503	10.191	7.041	8
9										6.810	7.235	5.873	9
10										6.600	6.495	6.928	10
11										7.030	7.938	6.129	11
12										6.070	6.722	7.117	12
13										7.518	6.085	7.079	13
14										6.178	6.085	6.168	14
15										6.118	6.763	7.152	15
16									0.000M	6.832	5.518	5.962	16
17									4.914	4.236	5.668	6.946	17
18									6.247	4.165	5.785	8.542	18
19									6.495	3.574	5.872	6.777	19
20									8.884	4.168	5.179	6.947	20
21									6.291	3.716	5.818	5.857	21
22									6.086	7.546	6.534	6.970	22
23									5.805	4.612	5.640	6.797	23
24									6.102	12.278	6.185	6.968	24
25									6.808	6.916	5.508	10.829	25
26									12.014	4.932	5.605	10.596	26
27									9.120	10.435	6.140	8.137	27
28									7.612	6.694	6.414	7.039	28
29									8.122	5.170	6.481	6.473	29
30									7.226	4.956	5.866	6.369	30
31										12.788		7.284	31
Mean									6.782	6.610	6.797	6.909	
Maximum													
Daily Mean									12.014	12.788	12.057	10.829	
Day of Max.									26	31	2	25	
Minimum													
Daily Mean									0.000	3.574	5.179	5.628	
Day of Min.									16	19	20	4	
Total (TCM)										9	18	18	19
Runoff (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Above summary is for Daily Means of Flow

Data Codes : E - Edited ? - Suspect U - Unchecked M - Incomplete

ENVIRONMENT AGENCY SOUTH WEST REGION, NORTH WESSEX

Auth. Ref. : 0420000000
Disc. Desc. : Inflow to STW
Report Type : Daily Means For Yr.
Parameter : Flow
Units : l/s

Station Name : Colerne STW
Catchment Ref.: 53
Grid Ref. : ST823706
Gauge Zero : N/A
Catchment Area: 0.000 Sq Km

Period : 1999

Start of Day : 09:00 GMT

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Day
1	8.698	5.672	6.679	3.992	4.885	8.708	5.732	5.078	7.873U				1
2	9.277	5.630	10.772	4.358	5.058	5.238	7.881	7.990	6.279U				2
3	9.634	5.528	9.176	4.407	6.846	5.989	5.762	6.408	7.865U				3
4	7.946	5.470	6.940	4.428	4.103	5.034	6.338	6.512	8.160U				4
5	7.333	4.983	6.016	5.012	4.093	8.719	7.294	7.287	5.795U				5
6	7.859	5.311	5.954	4.950	4.903	6.454	7.767	5.641	11.729U				6
7	8.110	5.489	6.111	4.101	4.661	6.361	8.833	4.903	4.477U				7
8	6.854	5.484	5.118	4.389	5.171	5.337	5.383	10.378	4.428U				8
9	6.242	4.601	4.902	4.432	5.463	7.838	7.982	7.375	5.172U				9
10	6.958	4.588	4.920	4.404	4.781	5.549	5.424	4.372	4.204U				10
11	6.000	4.745	5.305	6.942	8.055	5.275	5.291	6.547	4.881U				11
12	6.599	4.424	5.274	5.010	4.358	5.662	5.652	4.462	4.804U				12
13	6.850	4.419	5.203	4.919	5.033	8.378	5.505	4.721	3.823U				13
14	5.634	5.571	5.219	5.280	4.156	7.152	4.872	4.626	3.968U				14
15	10.435	4.740	4.462	4.511	4.278	5.657	4.864	4.423	4.971U				15
16	7.424	4.586	4.430	4.425	4.716	5.718	4.980	4.108	4.061U				16
17	7.368	4.584	4.177	4.833	3.775	5.175	10.263	4.946	4.005U				17
18	8.412	5.654	4.182	5.507	3.781	6.693	6.173	4.532	11.178U				18
19	12.085	5.027	4.217	4.716	4.783	5.277	4.962	4.943	7.311U				19
20	8.790	5.055	5.252	8.354	4.447	5.485	4.763	4.869	6.487U				20
21	7.166	6.305	5.639	6.110	4.696	4.686	4.965	4.159	5.821U				21
22	6.182	4.853	4.661	8.007	4.832	4.729	5.064	4.416	7.240U				22
23	6.201	5.232	4.708	8.699	5.189	5.035	6.684	4.667	6.766U				23
24	7.116	4.728	4.539	6.127	4.172	7.288	4.687	6.957	7.191U				24
25	6.512	4.791	6.017	8.511	3.710	7.976	5.125	8.158	5.974U				25
26	8.042	6.245	4.620	6.347	4.159	6.452	5.529	4.342U	8.939U				26
27	5.593	5.089	4.743	5.386	5.972	6.989	6.336	4.594U	6.644U				27
28	5.953	8.067	5.167	5.310	4.034	9.585	8.409	6.093U	5.232U				28
29	5.872		5.285	5.141	8.352	6.570	9.256	4.957U	0.000M				29
30	5.984		5.230	5.478	4.702	5.594	5.190	6.685U					30
31	6.606		4.299		4.827		4.822	4.274U					31
Mean	7.411	5.245	5.459	5.470	4.903	6.353	6.187	5.594	6.044				
Maximum													
Daily Mean	12.085	8.067	10.772	8.699	8.352	9.585	10.263	10.378	11.729				
Day of Max.	19	28	2	23	29	28	17	8	6				
Minimum													
Daily Mean	5.593	4.419	4.177	3.992	3.710	4.686	4.687	4.108	0.000				
Day of Min.	27	13	17	1	25	21	24	16	29				
Total (TCM)	20	13	15	14	13	16	17	15	15				
Runoff (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Above summary is for Daily Means of Flow

Data Codes : E - Edited ? - Suspect U - Unchecked M - Incomplete

Appendix 11 Water quality analyses proformas

Analysis Required Group (ARG) Dictionary Report

GQA1 = same without Cu, Zn, Ca, 2

ARG Code : GQA2 GQA METALS Active ? : Y

Date Last Modified : 11th Aug 1997

Contact Officer : RG01 WALMSLEY Richard

Det.	Desc.	(Units)	Method Code	Method Descriptions Analytical+User (if different)	Active?
61	pH	pH	1	SKALAR PH SYSTEM RIVERS LOW LEVEL	Y
76	TEMP	Celsius	1	IN SITU	Y
81	D.O.%	%	2	IN SITU	Y
82	D.O.MG/L	mg/l	2	CALCULATION	Y
85	BOD ATU	mg/l	1	BOD ATU ROUTINE	Y
111	AMMONIA	mg/l	1	LACHAT NUTRIENTS NUTRIENTS-RIVERS - LOW LEVEL	Y
116	T.O.N	mg/l	1	LACHAT NUTRIENTS NUTRIENTS-RIVERS - LOW LEVEL	Y
117	NITRATE	mg/l	1	CALCULATED - LOW RANGE	Y
[illegible]	NITRITE	mg/l	1	LACHAT NUTRIENTS NUTRIENTS-RIVERS - LOW LEVEL	Y
119	NH3 NON-IO	mg/l	1	CALCULATED	Y
158	HARD TOTAL	mg/l	1	CALCULATION	Y
180	ORTHO-PHOS	mg/l	1	LACHAT NUTRIENTS NUTRIENTS-RIVERS - LOW LEVEL	Y
213	COPPER DIS	mg/l	1	PERKIN ELMER ELAN ROUTINE DISSOLVED	Y
217	MG	mg/l	6	OPTIMA 3000 MAGNESIUM TOTAL/ICP-OES	Y
241	CALCIUM	mg/l	6	OPTIMA 3000 CALCIUM TOTAL/ICP-OES	Y
245	ZINC	mg/l	1	PERKIN ELMER ELAN ROUTINE-RIVERS AND DISCHARGES	Y
183	WEATH PREC	Misc	1	IN SITU	Y
207	FLOW	Misc	1	IN SITU	Y
[illegible]	[illegible]	[illegible]	1	L.R. DISS METALS PREP	Y
[illegible]	[illegible]	[illegible]	1	PREP DISS METALS LOW RANGE METALS PREP	Y
[illegible]	[illegible]	[illegible]	1	CALCULATED	Y
[illegible]	[illegible]	[illegible]	1	OPTIMA 3000 ICP-OES TOTAL PREP	Y

*** END OF REPORT ***

MENSAR V2.0.7
ENVIRONMENT AGENCY LABORATORY EXETER
Analysis Required Group (ARG) Dictionary Report

ARG Code : FF02 FRESHWATER FISH + GQA Active ? : Y
Date Last Modified : 13th Mar 1998
Contact Officer : RG01 WALMSLEY Richard

Det.	Desc.	(Units)	Method Code	Method Descriptions Analytical+User (if different)	Active?
001	pH	pH	1	SKALAR PH SYSTEM RIVERS LOW LEVEL	Y
076	TEMP	Celsius	1	IN SITU	Y
081	D.O.%	%	2	IN SITU	Y
082	D.O.MG/L	mg/l	2	CALCULATION	Y
085	BOD ATU	mg/l	1	BOD ATU ROUTINE	Y
111	AMMONIA	mg/l	1	LACHAT NUTRIENTS NUTRIENTS-RIVERS - LOW LEVEL	Y
116	T.O.N	mg/l	1	LACHAT NUTRIENTS NUTRIENTS-RIVERS - LOW LEVEL	Y
117	NITRATE	mg/l	1	CALCULATED - LOW RANGE	Y
118	NITRITE	mg/l	1	LACHAT NUTRIENTS NUTRIENTS-RIVERS - LOW LEVEL	Y
119	NH3 NON-IO	mg/l	1	CALCULATED	Y
135	SS 105 C	mg/l	1	SUSP SOLIDS (NO MINERAL) LOW	Y
158	HARD TOTAL	mg/l	1	CALCULATION	Y
180	ORTHO-PHOS	mg/l	1	LACHAT NUTRIENTS NUTRIENTS-RIVERS - LOW LEVEL	Y
213	COPPER DIS	mg/l	1	PERKIN ELMER ELAN ROUTINE DISSOLVED	Y
227	MG	mg/l	6	OPTIMA 3000 MAGNESIUM TOTAL/ICP-OES	Y
241	CALCIUM	mg/l	6	OPTIMA 3000 CALCIUM TOTAL/ICP-OES	Y
245	ZINC	mg/l	1	PERKIN ELMER ELAN ROUTINE-RIVERS AND DISCHARGES	Y
163	WEATH PREC	Misc	1	IN SITU	Y
021	MINERALOIL	Misc	1	In Situ IN SITU	Y
023	PHENOL	Misc	1	In Situ IN SITU	Y
247	FLOW	Misc	1	IN SITU	Y
[redacted]			1	L.R. DISS METALS PREP PREP DISS METALS	Y
[redacted]			1	LOW RANGE METALS PREP	Y
[redacted]			1	CALCULATED	Y
[redacted]			1	OPTIMA 3000 ICP-OES TOTAL PREP	Y

*** END OF REPORT ***

Appendix 12 Assessing water quality Fact Sheet

ASSESSING WATER QUALITY - General Quality Assessment (GQA) scheme for Biology

ENVIRONMENT AGENCY

Background

The Environment Agency is responsible for water quality monitoring under the Water Resources Act 1991.

The quality of rivers and canals has been reported for many years. In 1978 a formal classification scheme was developed by the then National Water Council. Stretches of rivers and canals were classified as being of good quality (Classes 1A and 1B), through fair (Class 2), poor (Class 3) to bad (Class 4).

The basis of the scheme was the measurement of dissolved oxygen, biochemical oxygen demand (BOD) and ammonia. Other information - both chemical and biological - was used in various ways by the 10 regional Water Authorities. This led to regional inconsistencies and differences from one survey to another. Different statistical methods were also used.

A further problem was the need for the scheme to reflect uses of the river or canal water. This resulted in the need to incorporate other standards including those of the EC Directive on Surface Water Abstraction (75/440/EEC).

Introduction

To resolve these problems, the National Rivers Authority (NRA), one of the Environment Agency's predecessor bodies introduced a scheme to examine separate stretches of freshwater in terms of their chemical, biological, nutrient and aesthetic qualities. This is called the General Quality Assessment (GQA) scheme.

Assessments using the GQA (Chemical) scheme have been based on measurements taken since 1988. The assessment scheme for biology has taken longer to develop. Rivers were first assessed using this scheme in 1995. However, the methodology has been applied retrospectively to the 1990 biology survey. This fact sheet outlines how this assessment is carried out.

Biological assessment

The biological scheme is based on groups of macroinvertebrates (small animals including mayfly nymphs, snails, shrimps and worms) that are found on the river bed. Macroinvertebrates are used because they:

- do not move far;
- have reasonably long life cycles;
- respond to the physical and chemical characteristics of the river;
- are affected by pollutants which occur infrequently and which are not measured by spot-sampling used in the GQA (Chemical) scheme;
- provide a picture of quality integrated over time.

For biological assessment, macroinvertebrates are grouped into 83 taxa. As different taxa respond differently to pollution, they are given scores of 1 (pollution-tolerant taxa) to 10 (pollution-sensitive taxa). The presence of taxa sensitive to pollution suggests better water quality than for sites where only pollution-tolerant taxa are found.

By comparing taxa found in the sample with those expected if the river were unpolluted, rivers can be classified into one of six grades (Table 1).

Table 1. GQA Scheme for Biology

Grade	Outline Description
a - Very Good	Biology similar to (or better than) that expected for an average and unpolluted river of this size, type and location. High diversity of taxa, usually with several species in each. Rare to find dominance of any one taxon.
b - Good	Biology falls a little short of that expected for an unpolluted river. Small reduction in the number of taxa that are sensitive to pollution. Moderate increase in the number of individuals in the taxa that tolerate pollution.
c - Fairly Good	Biology worse than expected for an unpolluted river. Many sensitive taxa absent, or number of individuals reduced. Marked rise in numbers of individuals in taxa that tolerate pollution.
d - Fair	Sensitive taxa scarce and contain only small numbers of individuals. A range of pollution tolerant taxa present, some with high numbers of individuals.
e - Poor	Biology restricted to pollution tolerant species with some taxa dominant in terms of the numbers of individuals. Sensitive taxa rare or absent.
f - Bad	Biology limited to a small number of very tolerant taxa such as worms, midge larvae, leeches and water hoglouse, present in very high numbers. In the worst case, there may be no life present.

Sampling and analysis

Each stretch of river has representative biological and chemical sampling sites. Two biological samples are taken - 1 in Spring (March-May) and 1 in Autumn (September-November). To take account of seasonal variation, taxa found in the Spring sample are combined with any additional taxa found in the Autumn sample.

Samples are collected using a standard method of three minutes active sampling with a pond net. For deep sites, samples are collected by 3 to 5 trawls with a Medium Naturalist's Dredge or by using an air-lift sampler. Both deep water sampling methods are followed by a 1 minute sweep with a pond net. A 1 minute visual search for animals living on the water surface, or attached to rocks, logs or vegetation is carried out for all samples.

Methods used to wash and sort samples vary, depending on the amount of silt or weed present. In all laboratories, 10 percent of samples are re-inspected to ensure that on average no more than two taxa are missed. A second check, is also carried out, where at least 20 samples from each Agency laboratory and a minimum of 60 samples from each Agency Region are analysed by an independent auditor.

Other recorded information includes width and depth of the stream and the percentage cover on the river bed of boulders, gravel, sand and silt. These items are calculated as annual averages based on Spring, Summer and Autumn measurements. Information derived from maps includes grid reference, the slope of the river, its altitude above sea level and the distance of the site from the source of the river.

Allocating a grade

Two indices are determined for each sample:

- the number of different scoring taxa present;
- the Average Score Per Taxon (ASPT).

The ASPT is calculated by dividing the Biological Monitoring Working Party (BMWP) score by the number of taxa. The BMWP score is calculated by totalling the pollution score for each taxon.

Having calculated these indices, they are compared to those which you would expect to find in an unpolluted river. As there is much natural variation due to geographical location, geology and habitat, a mathematical model - RIVPACS (River Invertebrate Prediction and Classification System) - is used to predict the fauna, using the physical data, measured at the site and from maps, together with alkalinity. From this, the number of taxa and ASPT expected in the absence of pollution can be calculated.

The biological quality of a river is expressed as a ratio of the actual value from sampling compared with the predicted value. This ratio is known as the Ecological Quality Index (EQI) and is calculated for both the number of taxa and the ASPT. A sample with an EQI of 1 or more has a similar number of taxa or ASPT to that expected under conditions of natural water quality. Each EQI is then compared with those set for the biological grades (Table 2) and the site is assigned the lower of the two grades (if these differ for the two indices).

The divisions between grades are based on the need to detect changes in biological quality. The extremes (grades a and f) are set to reflect very good and bad quality with intermediate grades set pragmatically between these extremes.

The grading of waters through sampling is not precise. There is, on average, a risk of 22% that rivers will be graded incorrectly. It is unusual for this error to extend beyond the adjacent grade. There is a tendency for a pessimistic grade to be calculated as taxa are more likely to be missed, than added (due to mis-identification or a recording error), when samples are analysed.

Table 2. GQA (Biological) Grades

	Ecological Quality Index	
Grade	EQI for Taxa	EQI for ASPT
a	0.85	1.00
b	0.70	0.90
c	0.55	0.77
d	0.45	0.65
e	0.30	0.50
f	<0.30	<0.50

Improving water quality

Use of the GQA (Biological) scheme for classification will help the Agency fulfil its duties in describing the state of the environment and planning improvements in river quality.

HO-3/97-20K-D-AYCO

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