

The Faunal Richness of Headwater Streams

Progress Report for the Period
April 1992 - June 1992

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The Faunal Richness of Headwater Streams, Progress Report, April 1992 - June 1992.

1. TECHNICAL PROGRESS

1.1 Objectives

The complete work programme for this study comprises four stages and is scheduled for the total period 1st October 1990 to 31st January 1995. Stage 1 is complete and has been fully documented in previous reports. This report summarises the progress made so far in meeting the objectives of Stage 2.

The overall and specific objectives of each stage are detailed in the Project Investment Appraisal (PIA) which is Schedule 2 of the Memorandum of Agreement for Research Contract (ref:54015000) between the National Rivers Authority (NRA) and the Institute of Freshwater Ecology (IFE).

1.2 Work Programme

Stage 2 has involved a field-based study of the contribution of individual streams to the total faunal richness of a set of selected catchments. The streams sampled have been chosen, as far as possible, to be of good environmental quality. The work programme is as follows:

1.2.1 Macro-invertebrate Data

- Finalise the choice of sampling sites in consultation with the project leader.
- Undertake field sampling and laboratory processing of samples collected from headwater sites in each of three seasons (spring, summer and autumn) of a single year.
- Identify all taxa to the best achievable level (normally species).
- Identify taxa from other appropriate headwater samples, such as those collected during the 1990 NRA River Quality Survey and the DoE-sponsored Countryside Surveys of 1988 and 1990.

1.2.2 Environmental Data

- Derive environmental data required for RIVPACS by field measurement or from cartographic sources. The latter should also be used to derive other topographical, geological, soil type and geographical information relevant to the project.
- In addition other habitat features or management practices which might explain the presence or absence of species should be noted.

1.2.3 Land Use

- Carry out ground surveys of land-use in the 1km squares containing the sample sites.
- Utilize available satellite imagery of the whole study catchment to place the study sites in context.
- Undertake an assessment of current and historical farming/land-use practices from a variety of sources such as maps, parish records, planning records, aerial photography, MAFF Annual Agricultural Censuses and Farm Business Surveys.

1.2.4 Reporting

- Produce progress reports as required.
- Produce a draft main report by 1st February 1993 and a final main report, as an NRA Note, by 31st March 1993.

The following text is sectioned in accordance with Schedule 1 of the research contract and outlines the progress made in meeting the scientific objectives within the prescribed project budget.

1.3 Progress Achieved

1.3.1 Headwater Sites - Biological.

Sampling for aquatic macro-invertebrates has been successfully completed. This includes spring 1992 sampling of the two replacement sites at Caldecote and Down Hall Farm, on the Cam. Complete lists of sampling dates are given in Appendices 1-4.

1.3.2 Headwater Sites - Environmental

Standard, field-measured physical data were collected from each site at the time of biological sampling, including spring 1992 data for Cam replacement sites.

1.3.3 Headwater Sites - Land-use

Land-use ground-truth surveys of headwater sub-catchments were undertaken in summer 1991, as detailed in a previous progress report. No subsequent surveys were undertaken for the two Cam replacement sites.

1.3.4 Lower Catchment Sites - Biological

The full lists of samples received from the NRA regions for each season are given in Appendices 1-4.

Almost all samples from each season have been received. The exceptions are two autumn samples from the Stour at Walford Mill and Syles Farm. Contrary to the statement in the previous progress report, it is now believed that both of these sites will need to be re-sampled in 1992.

1.3.5 Lower Catchment Sites - Environmental

Standard environmental data for lower catchment sites, excluding chemical information, have been received for all samples.

1.3.6 Lower Catchment Sites - Land-use

No further progress has been made in this area beyond that detailed in the previous progress report.

1.3.7 General and administrative

The Project Leader and Manager have liaised, as necessary, throughout the reporting period.

A progress meeting between the Project Leader and Manager was held at the IFE River Laboratory on 16th June 1992.

One of the main items discussed was the sampling programme for Stage 3 of the project, which is concerned with agricultural impacts on headwaters. The Project Leader recognised the need for a greater number of sites per catchment than that upon which the NRA's PIA was based. This accorded with the Project Manager's view, expressed in pre-contract discussions, that the research programme should be based on a more detailed study of no more than two catchments. NRA's decision to base the PIA on four study catchments, each having fewer sites, followed from their need, as a national organisation, to provide a wide geographic coverage.

At the same progress meeting it was agreed that the Project Leader and Manager needed to liaise with Dr. Robin Fuller, of the Natural Environment Research Council, about the acquisition of remotely-sensed land-cover data for the four study catchments. Subsequently a meeting with Dr. Fuller was arranged for Thursday 9th July at Monks' Wood Experimental Station.

2. INTERIM RESULTS

2.1 Biological

2.1.1 Headwaters

Appendices 1-4 show the progress made in sample sorting and identification. All samples collected from headwaters by IFE have now been almost completely identified to the best achievable level (normally species). This includes all Oligochaeta and Chironomidae. Sphaeriidae are the only group still to be identified to a RIVPACS compatible level.

2.1.2 Lower Catchment Sites

For each of the four study catchments, a shortlist of lower catchment sites has been drawn up for sample processing. Appendices 1-4 show the full list of samples provided to IFE and those to be processed during Stage 2 of the project.

Nine sites have been chosen on the Lugg and Stour, ten on the Derwent and twelve on the Cam. A tenth Derwent site has been included following discussions with the Project Leader. Twelve sites have been chosen for the Cam because this is the only catchment for which IFE holds no relevant data on any other lower catchment site.

Sorting of samples from the selected sites is nearing completion. The only remaining samples to be sorted are the autumn samples from the Derwent and Cam and the two outstanding Stour samples. No identification has yet been attempted.

2.1.3 Countryside Survey Sites

All of the 160 samples collected in 1988 and the 361 collected in 1990 have been fully identified to species.

All biological data have been stored on a Micro-Vax II mainframe computer and are in the last stages of validation.

2.2 Environmental

2.2.1 Headwaters

All seasonal sample registers have been compiled and transferred to computer. Validation is in progress.

Further chemical sampling has been attempted at all sites for which fewer than two samples had been previously collected. The determinands sampled for were total alkalinity ($\text{mg l}^{-1} \text{CaCO}_3$) and nitrate ($\text{mg l}^{-1} \text{NO}_3$).

All available results are given in Appendix 5.

Collection and analysis of Lugg and Derwent samples were carried out by NRA staff. IFE collected and analysed samples from the Cam and Stour catchments.

2.2.2 Lower Catchment Sites

Compilation of sample registers is almost complete.

Environmental data files have been compiled on computer and are being validated.

2.2.3 Countryside Survey Sites

Full sample registers have been compiled, as presented in the previous report.

Collation of environmental data-sets is nearing conclusion. No chemical data are available for these sites.

2.3 Land use

2.3.1 Headwaters

The land-use survey dates were given in the previous progress report.

Interpretation of field survey data has begun using the software digitising package "CLIMATE" devised by Michael Jones, of Dart Computing, Devon.

Slight adaptation of the software will be necessary in order to more precisely quantify the the area occupied by the smallest of the fields and land "packages" recorded by the field surveyors.

Dart Computing have been contacted and have agreed to make the necessary software modification. There will be a small, but as yet undetermined cost for this work.

Catchment digitisation can continue whilst the necessary modifications are being made.

The procedures being used were demonstrated to the Project Leader at the June 16th progress meeting.

Analyses of the river corridor survey data have yet to begin.

2.3.2 Lower Catchment Sites

No analysis of land-use in these catchments has yet been attempted.

2.3.3 Countryside Survey Sites

No data collation or analysis has yet been carried out for these sites. Collaboration with the Institute of Hydrology has still not been clarified. If this does not come to fruition then IFE will undertake the work using CLIMATE.

2.3.4 General and Administrative

Lists of landowners requesting feedback of data have been compiled. Some addresses are incomplete and will need further research before information can be supplied to the respective owners.

Results will be fed back as soon as validation has been completed.

3. WORK PROGRAMME FOR THE NEXT REPORTING PERIOD

The period considered here is from 1st July 1992 until 31st October 1992.

3.1 Biological and Environmental Sampling of Headwater Sites

- . Chemical sampling will be considered for any remaining sites with fewer than two chemical samples. This may require NRA co-operation.
- . The Sphaeriidae will be identified.
- . Biological and environmental files will be compiled and validated.
- . Lists of landowners' requests for data feedback will be completed and the results supplied to them when available.
- . Initial attempts at Stage 3 site selection will be made, subject to the availability of land cover data, (see below), as a stratification matrix.

3.2 Lower Catchment Sites

- . Sample registers for the selected sites will be produced.
- . Sample sorting will be completed.
- . Sample identification will begin.

3.3 Countryside Survey Sites

- . Environmental data files will be completed.
- . All biological and environmental data-files will be validated.
- . Initial ordination and classification analyses of headwater sites in this data-set will be carried out. (This item is carried over from the previous reporting period).

3.4 Land-use

- . Analyses of the field surveyed land-use data will continue.
- . The necessary modifications to the CLIMATE package will be made by Dart Computing.
- . Analyses of the river corridor data will begin.
- . Investigation of sources of archived/published land-use data for the study catchments will continue.
- . Landowners' requests for data feedback will be met once results become available.
- . Discussions will be held with Dr. Fuller about the availability of remotely-sensed land-cover data, including cost implications.
- . Subject to agreement, production of the land-cover data will begin and may be completed.

4. COST OF WORK DURING THE REPORTING PERIOD

The total cost of the work undertaken during the reporting period is likely to be in line with the Memorandum of Agreement.

Detailed costings will be made available to the NRA, via the IFE Finance Officer, as soon as possible.

5. ESTIMATE OF TOTAL COST OF WORKS

The estimated inflation-linked costs of the works under most categories of expenditure remain as listed in Section 10 of the PIA and Schedule 8 of the project contract.

The costs of modifying the CLIMATE package are likely to be absorbed within the existing project budget, as are the anticipated costs of providing the remotely-sensed land cover data.

However, the decision to increase the number of Stage 3 sampling sites in each study catchment has two important implications.

Firstly there is no budgetary provision for increasing the number of samples that can be processed in the laboratory. Nonetheless the number of sites may be trebled by reducing the sampling frequency to one season per site. This is feasible since the objectives of Stage 3, unlike the current stage, do not include producing data-bases suitable for inclusion as target communities in RIVPACS. Rather, the principal aim is to provide comparable biological and environmental data for a series of headwaters situated amongst various land-cover types and agricultural intensities and impacts.

Secondly, and more significantly, the increase in the number of sites will lead to a concomitant increase in the number of sub-catchments subject to ground-truth, land use and river corridor surveys. Since these activities have always been costed on the basis of a single visit per site, a trebling of the number of sites will lead to a commensurate threefold increase in costs.

This may amount to approximately £10,000 of extra expenditure.

6. ESTIMATE OF COSTS FOR THE NEXT REPORTING PERIOD

Costs for the next reporting period are expected to be in line with the anticipated cost-base adjusted budget.

7. FACTORS LIKELY TO AFFECT THE SATISFACTORY COMPLETION OF THE WORK

The work is generally on schedule and it is anticipated that all major contract deadlines will be met. However three un-resolved issues may effect the timing and funding of specific tasks.

Firstly, the rate of processing land-use field survey data has yet to be determined with certainty.

Secondly, the possible assistance of the Institute of Hydrology, with automated, digitized catchment-boundary definitions has still not been clarified. If realised, this co-operation may lead to re-allocation of funding and staff time schedules.

Thirdly, the cost implications of the extra land-use and corridor surveying of the additional Stage 3 sites need to be resolved.

APPENDIX 1 River Cam catchment. Sampling locations & dates. (Sites in lower case not to be processed)

<u>HEADWATER SITES (sampled by IFE)</u>		NGR	SPRING	SUMMER	AUTUMN
UN-NAMED WATERCOURSE	BURWELL	(TL 587 660)	06 MAY 1991	05 AUG 1991	29 OCT 1991
CAUNDLE DITCH	TEVERSHAM	(TL 504 573)	07 MAY 1991	05 AUG 1991	29 OCT 1991
NINE WELLS SPRING	NINE WELLS	(TL 460 542)	07 MAY 1991	06 AUG 1991	29 OCT 1991
UN-NAMED WATERCOURSE	LANGLEY WOOD	(TL 615 419)	07 MAY 1991	DRY 6-8-91	DRY 30-10-91
THE SLADE	HADSTOCK COMMON	(TL 547 436)	07 MAY 1991	DRY 6-8-91	DRY 30-10-91
RIVER CAM	PRIOR'S WOOD	(TL 549 306)	08 MAY 1991	06 AUG 1991	30 OCT 1991
Hoffer Brook	Thriplow	(TL 452 470)	09 May 1991	Site abandoned	
Gascote Dean	Caxton	(TL 296 584)	09 May 1991	Site abandoned	
UN-NAMED WATERCOURSE	CALDECOTE	(TL 337 565)	14 APR 1992	07 AUG 1991	31 OCT 1991
UN-NAMED WATERCOURSE	WHADDON GAP	(TL 343 461)	08 MAY 1991	06 AUG 1991	31 OCT 1991
ARRINGTON BROOK	ARRINGTON	(TL 325 505)	09 MAY 1991	DRY 6-8-91	DRY 30-10-91
Un-named watercourse	Wellhead Springs	(TL 328 431)	09 May 1991	Site abandoned	
UN-NAMED WATERCOURSE	DOWN HALL FARM	(TL 308 438)	14 APR 1992	07 AUG 1991	31 OCT 1991
RUDDERY SPRING	ASHWELL	(TL 279 403)	09 MAY 1991	DRY 7-8-91	DRY 30-10-91
<u>LOWER CATCHMENT SITES (sampled by NRA)</u>					
River Rhee	Ashwell	(TL 270 398)	30 Apr 1991	23 Jul 1991	11 Nov 1991
WHADDON BROOK	WHADDON	(TL 539 465)	30 APR 1991	18 JUL 1991	11 NOV 1991
BLACK PEAK SPRING STREAM	MELDRETH	(TL 383 474)	14 MAY 1991	18 JUL 1991	11 NOV 1991
SWAFFAM BULBECK LODGE	COMMERCIAL END	(TL 554 635)	15 MAY 1991	06 JUL 1991	16 OCT 1991
MILL RIVER	WENDY	(TL 321 475)	30 APR 1991	23 JUL 1991	11 NOV 1991
RIVER GRANTA	HILDERSHAM	(TL 545 485)	07 MAY 1991	28 JUN 1991	15 OCT 1991
BOURN BROOK	CANTELUPE FARM	(TL 432 547)	14 MAY 1991	26 JUN 1991	15 OCT 1991
REACH LODGE	UPWARE LOCK	(TL 537 696)	13 MAY 1991	04 JUNE 1991	16 OCT 1991
Bottisham Lode	Lode	(TL 532 630)	13 May 1991	06 June 1991	16 Oct 1991
RIVER RHEE	WIMPOLE LODGE	(TL 334 485)	30 APR 1991	18 JUL 1991	11 NOV 1991
RIVER RHEE	HARSTON	(TL 417 511)	30 APR 1991	22 JUL 1991	11 NOV 1991
RIVER CAM	HAUXTON HILL	(TL 432 527)	07 MAY 1991	23 JUL 1991	13 NOV 1991
RIVER CAM	ANSTEY HALL	(TL 438 549)	14 MAY 1991	26 JUL 1991	15 OCT 1991
RIVER CAM	DIMMOCK'S COTE	(TL 537 723)	13 MAY 1991	06 JUN 1991	16 OCT 1991

APPENDIX 2 R.Derwent catchment. Sampling locations & dates. (Sites in lower case not to be processed)

<u>HEADWATER SITES (sampled by IFE)</u>		NGR	SPRING	SUMMER	AUTUMN
BILLER HOWE NOOK SLACK	TURF RIGG	(NZ 916 007)	14 MAY 1991	13 AUG 1991	23 OCT 1991
MILL BECK	BATHINGWELL WOOD	(SE 822 638)	14 MAY 1991	13 AUG 1991	21 OCT 1991
ROWMIRE SPRING STREAM	ROWMIRE PLANTATION	(SE 828 653)	14 MAR 1991	13 AUG 1991	21 OCT 1991
BISHOP WILTON BECK	BISHOP WILTON	(SE 802 554)	14 MAY 1991	14 AUG 1991	21 OCT 1991
LONG GILL	NEWGATE FOOT	(SE 866 935)	14 MAY 1991	13 AUG 1991	21 OCT 1991
HALLEYKELD SPRING STREAM	HALLEYKELD RIGG	(SE 939 860)	16 MAY 1991	15 AUG 1991	23 OCT 1991
UN-NAMED WATERCOURSE	NAB FARM	(SE 860 951)	14 MAY 1991	13 AUG 1991	21 OCT 1991
MARR'S BECK	RAPE CLOSE LANE	(SE 610 735)	15 MAY 1991	14 AUG 1991	22 OCT 1991
BELLYMAR DIKE	HARTOFT RIGG	(SE 754 955)	16 MAY 1991	15 AUG 1991	21 OCT 1991
GILL DIKE	FROST HALL	(SE 642 987)	16 MAY 1991	14 AUG 1991	23 OCT 1991
COWHOUSE BECK	SNAPER HOUSE	(SE 598 912)	16 MAY 1991	15 AUG 1991	22 OCT 1991
MIREFALLS GILL	REIN'S WOOD	(SE 566 853)	15 MAY 1991	14 AUG 1991	22 OCT 1991
SLEDHILL GILL	YOWLASS WOOD	(SE 531 870)	15 MAY 1991	14 AUG 1991	22 OCT 1991
WHEAT BECK	DALE HEAD	(SE 496 950)	15 MAY 1991	14 AUG 1991	22 OCT 1991
<u>LOWER CATCHMENT SITES (sampled by NRA)</u>					
SCAMPSTON BECK	SCAMPSTON	(SE 868 757)	02 MAY 1991	05 AUG 1991	23 OCT 1991
WHISPERDALES BECK	LOW DALES	(SE 958 922)	02 MAY 1991	05 AUG 1991	23 OCT 1991
HODGE BECK	HOLD CAULDRON	(SE 668 869)	24 MAY 1991	05 AUG 1991	23 OCT 1991
HOLBECK	HOVINGHAM CARRS	(SE 669 773)	02 MAY 1991	15 AUG 1991	23 OCT 1991
SAILS BECK	ALLERTHORPE COMMON	(SE 743 476)	02 MAY 1991	16 AUG 1991	19 NOV 1991
Bielby Beck	Hayton	(SE 820 457)	02 May 1991	19 Aug 1991	19 Nov 1991
PICKERING BECK	LEVISHAM	(SE 816 911)	18 APR 1991	15 AUG 1991	23 OCT 1991
River Seven	Sinnington	(SE 745 853)	24 May 1991	05 Aug 1991	23 Oct 1991
RIVER SEPH	LASKILL	(SE 563 907)	24 APR 1991	05 AUG 1991	23 OCT 1991
MENETHORPE BECK	MENETHORPE	(SE 768 676)	02 MAY 1991	05 AUG 1991	23 OCT 1991
SPITTLE BECK	BRAISTHWAITE BRIDGE	(SE 727 624)	23 APR 1991	05 AUG 1991	23 OCT 1991
River Rye	Helmsley	(SE 615 836)	24 Apr 1991	02 Aug 1991	Dry 23-10-91
RIVER RYE	NUNNINGTON	(SE 664 794)	02 MAY 1991	02 AUG 1991	23 OCT 1991

APPENDIX 3 River Lugg catchment. Sampling locations & dates. (Sites in lower case not to be processed).

<u>HEADWATER SITES (sampled by IFE)</u>		NGR	SPRING	SUMMER	AUTUMN
UN-NAMED WATERCOURSE	GREAT WACTON	(SO 534 433)	20 MAY 1991	19 AUG 1991	05 NOV 1991
UN-NAMED WATERCOURSE	BREDENBURY	(SO 603 558)	20 MAY 1991	19 AUG 1991	05 NOV 1991
UN-NAMED WATERCOURSE	BARNSTONE FARM	(SO 577 532)	20 MAY 1991	DRY 20-8-91	05 NOV 1991
Stretford Brook	Pudleston Court	(SO 561 593)	20 May 1991	Site abandoned	
UN-NAMED WATERCOURSE	DUNHAMPTON FARM	(SO 586 603)	21 MAY 1991	20 AUG 1991	06 NOV 1991
UN-NAMED WATERCOURSE	DINMORE MANOR	(SO 490 503)	21 MAY 1991	20 AUG 1991	06 NOV 1991
NEWBRIDGE BROOK	SHOAL'S BANK	(SO 394 494)	21 MAY 1991	DRY 21-8-91	07 NOV 1991
GLADESTRY BROOK	CEFNHIR	(SO 210 558)	22 MAY 1991	DRY 21-8-91	07 NOV 1991
UN-NAMED WATERCOURSE	GLASHANT	(SO 182 508)	22 MAY 1991	21 AUG 1991	07 NOV 1991
UN-NAMED WATERCOURSE	LOWER LYE	(SO 407 672)	21 MAY 1991	DRY 20-8-91	DRY 6-11-91
UN-NAMED WATERCOURSE	CRINFYNYDD	(SO 176 602)	22 MAY 1991	21 AUG 1991	06 NOV 1991
UN-NAMED WATERCOURSE	HILL HOUSE DINGLE	(SO 303 685)	22 MAY 1991	20 AUG 1991	06 NOV 1991
UN-NAMED WATERCOURSE	PEN-TWYN	(SO 187 729)	22 MAY 1991	20 AUG 1991	06 NOV 1991
<u>LOWER CATCHMENT SITES (sampled by NRA)</u>					
Moreton Brook	Shelwich Green	(SO 532 438)	04 Apr 1991	30 Jul 1991	23 Oct 1991
BACK BROOK	KINGTON	(SO 303 570)	03 APR 1991	29 JUL 1991	22 OCT 1991
CURL BROOK	PEMBRIDGE	(SO 390 585)	03 APR 1991	29 JUL 1991	22 OCT 1991
MAIN DITCH	LEOMINSTER	(SO 501 597)	03 APR 1991	29 JUL 1991	22 OCT 1991
Stretford Brook	Stretford	(SO 441 553)	03 Apr 1991	29 Jul 1991	22 Oct 1991
RIVER LODON	STOKE LACY	(SO 619 494)	04 APR 1991	30 JUL 1991	23 OCT 1991
HACKLEY BROOK	NOAKES BRIDGE	(SO 634 548)	04 APR 1991	30 JUL 1991	23 OCT 1991
TEDSTONE BROOK	BROMYARD	(SO 657 551)	04 APR 1991	30 JUL 1991	23 OCT 1991
HINDWELL BROOK	COMBE	(SO 345 635)	03 APR 1991	29 JUL 1991	22 OCT 1991
River Arrow	Broadward	(SO 498 571)	03 Apr 1991	29 Jul 1991	22 Oct 1991
RIVER FROME	YARKHILL	(SO 614 427)	04 APR 1991	30 JUL 1991	23 OCT 1991
RIVER LUGG	MORDIFORD	(SO 570 375)	19 APR 1991	31 JUL 1991	24 OCT 1991

APPENDIX 4 River Stour catchment. Sampling locations & dates. (Sites in lower case not to be processed).

<u>HEADWATER SITES (sampled by IFE)</u>		NGR	SPRING	SUMMER	AUTUMN
UN-NAMED WATERCOURSE	GASPER	(ST 763 335)	01 MAY 1991	30 JUL 1991	15 OCT 1991
UN-NAMED WATERCOURSE	WOODLANDS MANOR	(ST 816 309)	01 MAY 1991	30 JUL 1991	15 OCT 1991
UN-NAMED WATERCOURSE	COMHERD SHUTE FARM	(ST 858 239)	03 MAY 1991	30 JUL 1991	15 OCT 1991
UN-NAMED WATERCOURSE	WEST WOOD	(ST 694 219)	01 MAY 1991	DRY 30-7-91	DRY 15-10-91
UN-NAMED WATERCOURSE	LYON'S GATE	(ST 656 055)	02 MAY 1991	29 JUL 1991	14 OCT 1991
UN-NAMED WATERCOURSE	ALTON COMMON	(ST 717 047)	01 MAY 1991	29 JUL 1991	14 OCT 1991
UN-NAMED WATERCOURSE	TWYFORD	(ST 862 186)	01 MAY 1991	31 JUL 1991	14 OCT 1991
UN-NAMED WATERCOURSE	FARRINGTON	(ST 846 152)	03 MAY 1991	31 JUL 1991	14 OCT 1991
UN-NAMED WATERCOURSE	WOOLLAND	(ST 782 069)	02 MAY 1991	29 JUL 1991	14 OCT 1991
UN-NAMED WATERCOURSE	OKEFORD FITZPAINE	(ST 801 105)	02 MAY 1991	29 JUL 1991	14 OCT 1991
GUSSAGE	GUSSAGE ST. ANDREW	(ST 973 145)	29 APR 1991	DRY 29-7-91	DRY 15-10-91
UN-NAMED WATERCOURSE	DELPH WOOD	(SZ 013 972)	03 MAY 1991	31 JUL 1991	15 OCT 1991

LOWER CATCHMENT SITES (sampled by NRA)

SHREEN WATER	COLESBROOK	(ST 807 278)	13 MAY 1991	12 AUG 1991	18 NOV 1991
River Lodden	Gillingham	(ST 815 261)	12 May 1991	12 Aug 1991	18 Nov 1991
Caundle Brook	Blackmore Ford	(ST 675 097)	18 Mar 1991	13 Jun 1991	06 Sep 1991
FONTMELL BROOK	FONTMELL PARVA	(ST 825 147)	18 MAR 1991	20 JUN 1991	19 SEP 1991
RIVER ALLEN	WALFORD MILL	(SU 010 006)	06 MAR 1991	27 JUN 1991	
RIVER CALE	SYLES FARM	(ST 759 199)	02 MAY 1991	31 JUL 1991	
RIVER STOUR	TRILL BRIDGE	(ST 790 205)	13 MAY 1991	12 AUG 1991	18 NOV 1991
CAUNDLE BROOK	WARR BRIDGE	(ST 733 143)	27 MAR 1991	17 JUL 1991	07 OCT 1991
River Lydden	Cox's Water	(ST 743 129)	27 Mar 1991	17 Jul 1991	20 Sep 1991
RIVER STOUR	PLECK	(ST 765 176)	05 APR 1991	30 JUL 1991	07 OCT 1991
RIVER LYDDEN	BAGBER BRIDGE	(ST 765 157)	04 APR 1991	04 JUL 1991	17 OCT 1991
RIVER STOUR	SPETISBURY	(ST 919 020)	25 MAR 1991	26 JUN 1991	09 OCT 1991

The autumn sample from the River Allen at Walford Mill and the River Cale at Syles Farm will be collected by IFE in 1992.

APPENDIX 5 Alkalinity (mg l⁻¹ CaCO₃) and nitrate (mg l⁻¹ NO₃) values for headwater sites.

		ALKALINITY			NITRATE		
		SPRING	SUMMER	AUTUMN	SPRING	SUMMER	AUTUMN
<u>RIVER CAM CATCHMENT</u>							
UN-NAMED WATERCOURSE	BURWELL	N.S.	223.5	300.0	N.S.	12.20	7.46
CAUNDLE DITCH	TEVERSHAM	N.S.	210.0	226.5	N.S.	10.85	7.40
NINE WELLS SPRING	NINE WELLS	N.S.	225.5	246.0	N.S.	9.20	7.22
UN-NAMED WATERCOURSE	LANGLEY WOOD	212.0	DRY	DRY	9.80	DRY	DRY
THE SLADE	HADSTOCK COMMON	176.5	DRY	DRY	29.60	DRY	DRY
RIVER CAM	PRIOR'S WOOD	N.S.	260.5	271.0	N.S.	0.32	0.14
UN-NAMED WATERCOURSE	CALDECOTE	N.S.	189.0	194.5	N.S.	28.9	7.63
UN-NAMED WATERCOURSE	WHADDON GAP	N.S.	195.0	108.0	N.S.	4.52	1.78
ARRINGTON BROOK	ARRINGTON	339.5	DRY	DRY	N.D.	DRY	DRY
UN-NAMED WATERCOURSE	DOWN HALL FARM	217.0	183.5	219.0	5.03	1.59	3.51
RUDDERY SPRING	ASHWELL	DRY	DRY	DRY	DRY	DRY	DRY
<u>RIVER DERWENT CATCHMENT</u>							
BILLER HOWE NOOK SLACK	TURF RIGG	N.S.	5.5	1.5	N.S.	N.D.	0.20
MILL BECK	BATHINGWELL WOOD	N.S.	140.5	118.5	N.S.	13.60	15.00
ROWMIRE SPRING STREAM	ROWMIRE PLANTATION	250.0	A.E.	262.0	9.71	A.E.	12.50
BISHOP WILTON BECK	BISHOP WILTON	N.S.	128.5	129.5	N.S.	9.70	12.50
LONG GILL	NEWGATE FOOT	N.S.	92.0	84.0	N.S.	0.78	0.82
MALLEYKELD SPRING STREAM	MALLEYKELD RIGG	N.S.	167.5	173.0	N.S.	1.47	1.50
UN-NAMED WATERCOURSE	NAB FARM	N.S.	8.0	1.5	N.S.	0.20	0.15
MARR'S BECK	RAPE CLOSE LANE	N.S.	134.0	78.0	N.S.	16.20	20.00
BELLYMAR DIKE	HARTOFT RIGG	N.S.	4.5	0.5	N.S.	0.10	2.00
GILL DIKE	FROST HALL	N.S.	17.0	13.5	N.S.	0.09	0.20
COMHOUSE BECK	SNAPER HOUSE	N.S.	182.0	176.5	N.S.	1.46	1.50
MIREFALLS GILL	REIN'S WOOD	N.S.	161.5	162.0	N.S.	10.55	12.50
SLEDHILL GILL	YOWLASS WOOD	N.S.	138.5	151.5	N.S.	7.10	6.60
WHEAT BECK	DALE HEAD	N.S.	76.5	77.0	N.S.	0.37	0.70
<u>RIVER LUGG CATCHMENT</u>							
UN-NAMED WATERCOURSE	GREAT WACTON	N.S.	258.5	196.5	N.S.	3.55	6.71
UN-NAMED WATERCOURSE	BREDENBURY	N.S.	271.0	258.5	N.S.	5.91	5.59
UN-NAMED WATERCOURSE	BARNSTONE FARM	333.0	DRY	273.0	11.65	DRY	2.25
UN-NAMED WATERCOURSE	DUNHAMPTON FARM	N.S.	266.0	267.5	N.S.	5.32	5.19
UN-NAMED WATERCOURSE	DINMORE MANOR	N.S.	204.5	225.0	N.S.	1.08	0.90
NEWBRIDGE BROOK	SHOAL'S BANK	229.0	DRY	162.5	6.62	DRY	2.85
GLADESTRY BROOK	CEFMHIR	64.3	DRY	32.5	0.35	DRY	0.22
UN-NAMED WATERCOURSE	GLASNANT	N.S.	73.5	18.5	N.S.	0.14	0.55
UN-NAMED WATERCOURSE	LOWER LYE	192.3*	TBSN	DRY	3.29	TBSN	DRY
UN-NAMED WATERCOURSE	CRINFYNYDD	N.S.	55.0	29.0	N.S.	0.24	0.90
UN-NAMED WATERCOURSE	HILL HOUSE DINGLE	N.S.	82.5	38.5	N.S.	3.75	4.29
UN-NAMED WATERCOURSE	PEN-TWYN	N.S.	140.5	64.0	N.S.	0.51	0.81
<u>RIVER STOUR CATCHMENT</u>							
UN-NAMED WATERCOURSE	GASPER	N.S.	54.0	46.5	N.S.	1.37	1.46
UN-NAMED WATERCOURSE	WOODLANDS MANOR	N.S.	277.5	229.5	N.S.	0.38	1.85
UN-NAMED WATERCOURSE	COWHERD SHUTE FARM	N.S.	129.5	119.5	N.S.	0.76	0.87
UN-NAMED WATERCOURSE	WEST WOOD	221.5	DRY	DRY	2.09	DRY	DRY
UN-NAMED WATERCOURSE	LYON'S GATE	N.S.	172.5	151.5	N.S.	1.70	1.43
UN-NAMED WATERCOURSE	ALTON COMMON	N.S.	259.5	170.0	N.S.	2.52	3.01
UN-NAMED WATERCOURSE	THYFORD	N.S.	277.5	257.5	N.S.	6.01	5.30
UN-NAMED WATERCOURSE	FARRINGTON	N.S.	222.5	251.0	N.S.	4.74	5.04
UN-NAMED WATERCOURSE	WOOLLAND	N.S.	164.5	183.5	N.S.	1.44	0.34
UN-NAMED WATERCOURSE	OKEFORD FITZPAINE	N.S.	205.5	235.0	N.S.	2.42	3.48
GUSSAGE	GUSSAGE ST. ANDREW	DRY	DRY	DRY	DRY	DRY	DRY
UN-NAMED WATERCOURSE	DELPH WOOD	N.S.	81.0	72.5	N.S.	3.13	2.87

N.S. = Not sampled N.D. = Not detected TBSN = To be supplied by NRA A.E. = Analytical error
 * = Alkalinity estimated from measured total hardness and calcium concentrations.



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