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Baseline Biological Assessment of Mells River Springs 1995

Baseline aquatic macro-invertebrate, botanical, habitat and fish surveys

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BASELINE BIOLOGICAL ASSESSMENT OF MELLS RIVER SPRINGS 1995

Baseline aquatic macro-invertebrate, botanical, habitat and fish surveys

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EXECUTIVE SUMMARY

Aquatic macro-invertebrates

1. Nine streams flowing into the Mells River were sampled for macro-invertebrate fauna on the 18th April 1995 and 27th June 1995. Sites were established on Hurdlestone, Bector Wood, White Hole Farm, Leigh Wood West, Leigh Wood East, Lower Soho Farm, Finger Stream West, Chantry East and Chantry West Springs and in three wet flushes in Bector Wood.

2. The taxa captured included flat worms, molluscs, worms, leeches, water mites, crustacea, may flies, stone flies, bugs, beetles, caddis flies and true flies. The true flies (Diptera) and caddis flies (Trichoptera) comprised the largest groups of taxa.

3. Of special interest were the beetles *Hydreana nigrita* Germar and *Riolus subviolaceus* (Muller); the caddis *Rhyacophila septentrionis* McLachlan, *Tinodes unicolor* (Pictet) and *Tinodes dives* (Pictet) each of which had the national conservation status of "notable"; and the dipteran *Oxycera pardalina* (Meigen) which is classed as "vulnerable".

4. The dataset of headwaters sites at the Institute of Freshwater Ecology (IFE) in Wareham holds additional records for each of these notable and vulnerable species. Their frequency of occurrence in these headwaters indicates that the status of at least some of them should be subject to review.

5. In those longer streams, subject to longitudinal sampling, there was a trend towards greater downstream diversity in the faunal communities. There was also a general decrease in macro-invertebrate diversity from the streams in the west of the study area to those further east, with the exception of the Chantry Springs which are fed from a different groundwater source.

6. The Ecological Quality Indices (EQIs) calculated for the sites still running in summer showed that three of the five sites were Band A (Bector Wood, White Hole Farm and Chantry West Springs), indicating good quality. Bector Wood Spring had the highest ecological quality index for the springs in the study area. Hurdlestone and Chantry East Springs were Band B indicating "fair" quality.

7. The evidence indicates that water quality is not a limiting factor for macro-invertebrates in most of these streams. However, the abundance and variety of animals is likely to be restricted by low and fluctuating water flow.

8. In comparison, an IFE survey of 131 headwater sites in four major British river catchments showed that aproximately 40% of them were of Band A quality and 31% of Band B. A separate IFE survey of 123 English and Welsh headwater sites produced equivalent values of 35% "good" and 33% "fair" quality sites.

9. The first of these surveys suggested that approximately 7% of headwater sites could be regarded as "exceptional" by virtue of the diversity and type of taxa present. None of the Mells River Springs sites had Ecological Quality Index values indicative of "exceptional" quality.

EXECUTIVE SUMMARY

Botanical and habitat

1. Ten stream sections on seven watercourses flowing into the Mells River were studied to determine their relevant ecological or conservation characteristics. These sections were on the streams at Hurdlestone, Bector Wood (two sites), White Hole Farm, Leigh Wood East, Leigh Wood West, Soho Farm, Finger Stream West, Chantry West and the Chantry East tributary of the Whatley Brook.

2. A standard IFE Biomorphic Survey of plants, animals, stream morphology and water chemistry was carried out to give a context to the character of the streams being studied. The newer National Rivers Authority River Habitat Survey was also undertaken.

3. Details were recorded for the flora, fauna (excluding macro-invertebrates), bank, sediment and bed characteristics, watercourse size, adjacent land use, on-site evidence of recreational use, proximity to designated sites of conservation importance, and other potential problem features including long-term morphological changes.

4. The information was used to derive scores indicating the environmental quality of each site. The score was then corrected for the effects of maintenance on the watercourse. The resulting scores indicate a range of environmental quality from very poor at the bottom of the scale (<2) to excellent at the top of the scale (8-10).

5. The biomorphic assessment of the Mells River streams indicates that both sites on the Bector Wood stream are of moderate to good environmental quality. Hurdlestone stream and the Chantry East part of the Whatley Brook watercourse are of moderate quality. The White Hole Farm stream is poor to moderate quality. The streams at Leigh Wood West, Leigh Wood East, Soho Farm, Finger Stream West and Chantry Springs West are all considered to have an overall assessment of poor environmental quality.

EXECUTIVE SUMMARY

Fisheries

1. The Bector Wood Stream, Whitehole Farm Spring, Leigh Wood East Spring, Finger Valley Stream and the Chantry Springs Watercourse were all sampled for fish and crayfish on 27 June 1995. At the time of sampling the Leigh Wood East Spring and the Finger Valley Stream were dry.

2. Brown trout *Salmo trutta* were only found at low densities in the Bector Wood Stream and the Chantry Springs Watercourse. It is suggested that the low densities indicate these streams are marginal habitats for this species.

3. A single adult female white-clawed crayfish *Austropotamobius pallipes* was found in the Chantry Spring Watercourse. This is a protected species under Schedule 5 of the Wildlife and Countryside Act 1981, and there is therefore a requirement not to intentionally damage their habitat or place of shelter. Any augmentation of streams containing this species will need to be with water conforming to the requirements of this species i.e. a calcium content greater than 7.8 mg/l and a pH of between 7 and 9.

1. INTRODUCTION

To make a baseline biological assessment of watercourses near to Whatley Quarry, near Frome, Somerset, nine streams flowing from a southerly direction into the Mells River were studied. These were Hurdlestone, Bector Wood, White Hole Farm, Leigh Wood West, Leigh Wood East, Lower Soho Farm, Finger Stream West, Chantry East and Chantry West Springs. The locations of these streams are shown in Figure 1.

Sites on each of these streams were sampled for aquatic macro-invertebrates in spring 1995 and selected sites were also sampled in summer. Spring samples were taken on 18th April 1995 with the aim of obtaining as broad a sample of aquatic macro-invertebrates as possible and determining any downstream zonation of the organisms. Samples were collected in various locations on each watercourse, using techniques designed to minimise the possible impact of the sampling activities on the stream beds.

One summer sample was obtained from each of the five streams still flowing on 27th June 1995. These samples were taken using a standard procedure that would enable the sites to be compared with other headwater streams already sampled by the Institute of Freshwater Ecology. Environmental information was also recorded for each site in the field, and also by extrapolation from maps, using the methods described by Furse et al (1993).

The types of macro-invertebrate families present during the summer, together with the collated environmental data, enabled the ecological quality of each site to be assessed using prediction techniques devised by IFE (Furse et al 1995). Additionally, identifications were made to species level, wherever practicable, for both spring and summer samples to determine whether these streams supported individual species and faunal assemblages of particular conservation value.

A standard IFE Biomorphic Survey and NRA River Habitat Survey were carried out on 18th April 1995 on ten stream sections of the same watercourses that were studied for aquatic macro-invertebrates. These surveys recorded details of the plants, animals other than macro-invertebrates, stream banks, sediments and bed characteristics, watercourse size, water chemistry, adjacent land use, on-site evidence of recreational use, proximity to designated sites of conservation importance, and other potential problem features. Scores for flora, fauna and maintence effects were derived from the data to make an assessment of the environmental quality of the sites based on their biological, physical and chemical characteristics.

A fish survey was undertaken by electro-fishing on 27th June 1995 to determine the presence, abundance and population structure of fish inhabiting the watercourses flowing into the Mells River from Bector Wood, White Hole Farm, Leigh Wood East, Finger Valley, and Chantry East streams. At the time of the survey, the streams at Leigh Wood East, and Finger Valley were found to be dry. The upstream limit for the distribution of fish was established where fish were found in those watercourses which were still flowing. A hand search was also made for crayfish in the Bector Wood stream and any crayfish observed during electric fishing were captured, recorded and released.

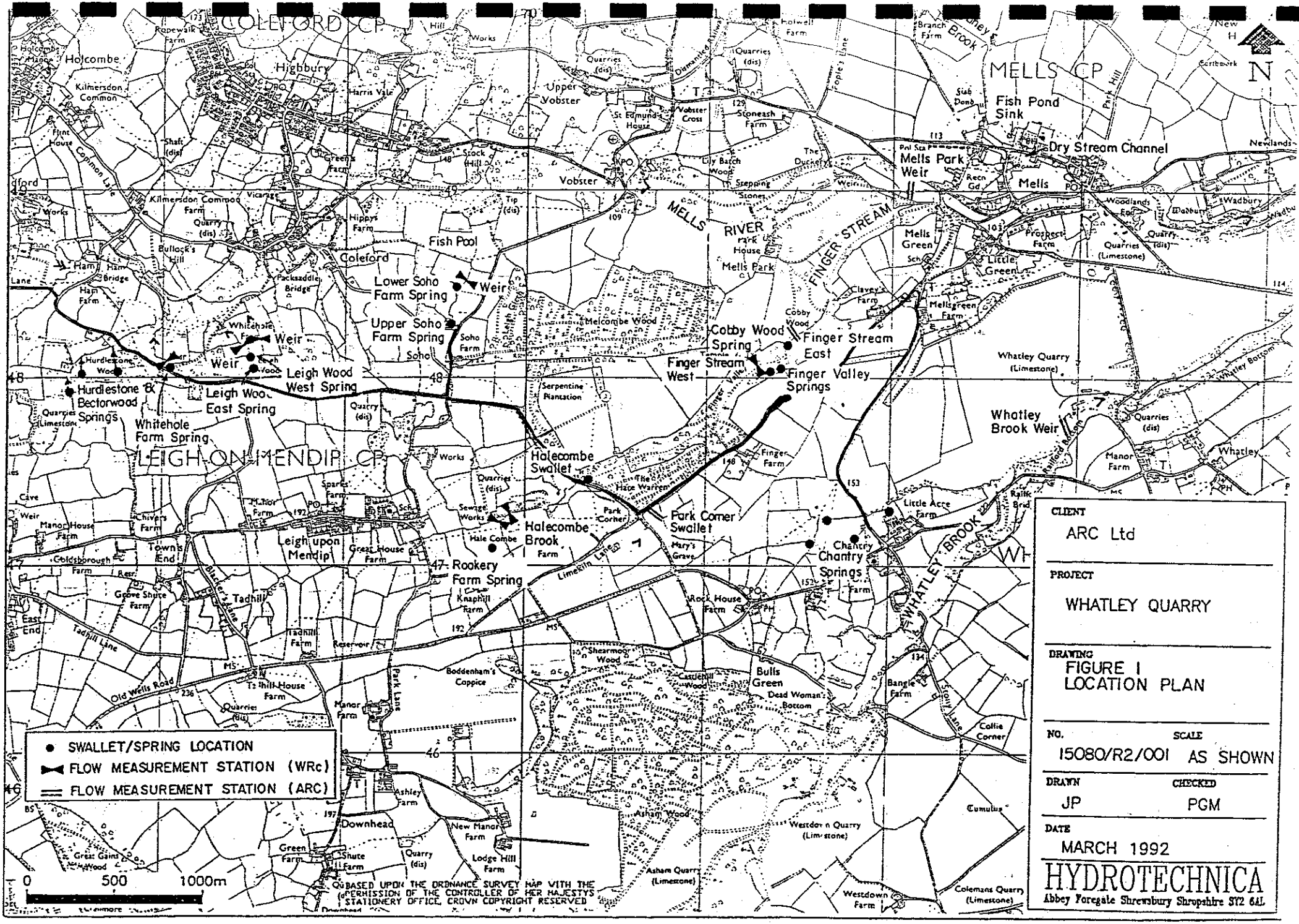

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FIGURE 1 LOCATION OF MELLS RIVER SPRINGS SITES

SECTION 1 - AQUATIC MACRO-INVERTEBRATE SURVEY

2. METHODS - MACRO-INVERTEBRATES

2.1 Location of sampling sites

The stream sampling points were chosen to provide information about any downstream zonation of benthic macro-invertebrates. Depending on the length and character of the stream, samples were taken at approximately 50 metres, 250 metres and 1000 metres downstream from the source. The source itself was sampled on selected streams. Some flushes and small areas of standing water adjacent to, and feeding into, streams were also sampled. The position of the sampling sites is indicated in Figures 2 to 6. In the summer, the most downstream of the sites that were sampled in the spring were chosen for sampling. Of the nine streams visited in April only five were still flowing in June.

2.2 Sampling techniques

In the spring, fifteen one-minute kick samples were taken with a pond net on the main watercourses. Eight non-standard samples of up to fifteen seconds duration were taken in other locations by scooping the surface of the water with the pond net and by collecting by hand from beneath stones and plant debris.

In the summer, three-minute kick samples were taken using the methodology described by Furse et al (1981). This involved disturbing the stream-bed by kicking and collecting the dislodged taxa in a pond-net (230 x 255 mm frame, 900 µm mesh) held downstream of the disturbance. Other taxa were collected by sweeping the pond-net through any aquatic vegetation present. All available habitats (e.g. cobbles, gravel, silt, aquatic plants) were sampled in proportion to their occurrence. The complete sampling strategy is shown in Table 1.

Table 1 **Aquatic macro-invertebrate sampling strategy for Mells River Springs, showing the number of sites sampled by each method and in each season on each watercourse**

WATERCOURSE	SPRING STANDARD 1 minute	SPRING NON-STANDARD 15 seconds	SUMMER STANDARD 3 minutes
Hurdlestone	1	1	1
Bector Wood	3	4	1
White Hole Farm	2	1	1
Leigh Wood West	1	0	1
Leigh Wood East	2	1	1
Lower Soho Farm	1	0	1
Finger Stream West	3	1	1
Chantry East	1	0	1
Chantry West	1	1	1
TOTALS	15	9	9

2.3 Environmental recording

At each site, in each season during which sampling took place, time-variant physical data such as current velocity, the water width in the sample area, and the mean depth calculated from measurements taken at one quarter, one half and three quarters distance across the water width, were collected. An estimate of the percentage cover of the different components of the substratum in the sample area was also made. Substratum types included boulders (> 256 mm) and cobbles (≤ 256 mm), pebbles (< 64 mm) and gravel (< 16 mm), sand (2 mm), and silt and clay (< 2 mm). The particle size categories follow the Wentworth system and substratum estimation is described in Furse et al (1986).

Additional time-invariant data on altitude, slope, distance from source, and National Grid Reference (NGR) were derived from Ordnance Survey maps. Discharge categories were obtained from National Rivers Authority water quality maps. Mean air temperature, air temperature range, latitude and longitude were derived from NGRs using databases and software programs held by IFE. The environmental data relating to the Mells Rivers Springs sites is given in Appendix 1.

2.4 Identification

The samples were preserved in 4% formalin solution on site and taken to the laboratory for processing. Most taxa were identified to species but some juvenile organisms, dipteran larvae and animals for which no suitable taxonomic keys are available were identified to family or genus level (Furse et al 1986). Chironomidae (non-biting midges) and Oligochaeta (worms) were identified to subfamily or tribe level, and Hydracarina (water-mites) and Sphaeriidae (pea-mussels) were not identified further because the identification of these groups is considered to be unduly time-consuming at this stage.

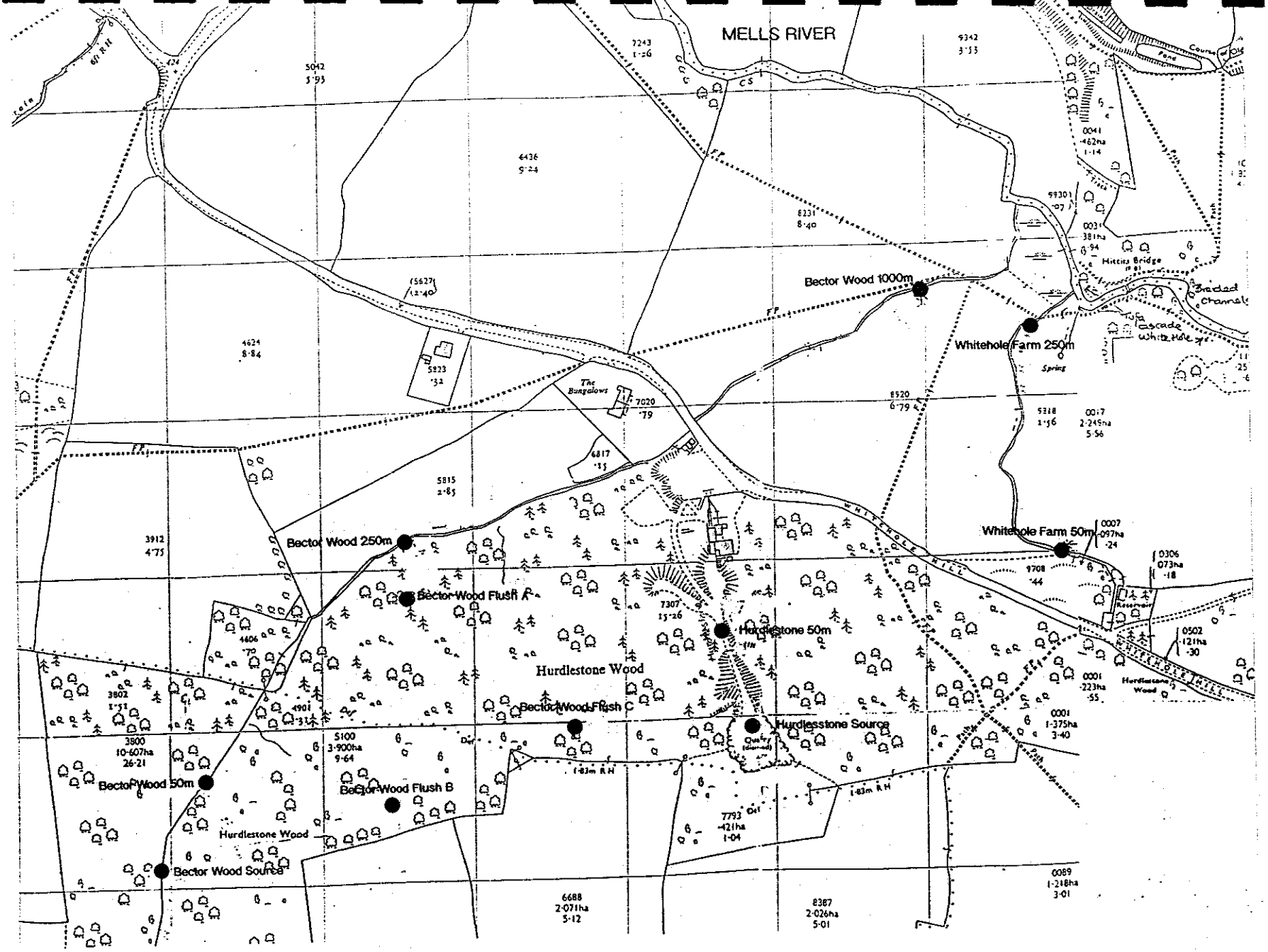

FIGURE 2 Map showing sampling sites for macroinvertebrates at Hurdlestone, Bector Wood and White Hole Farm streams

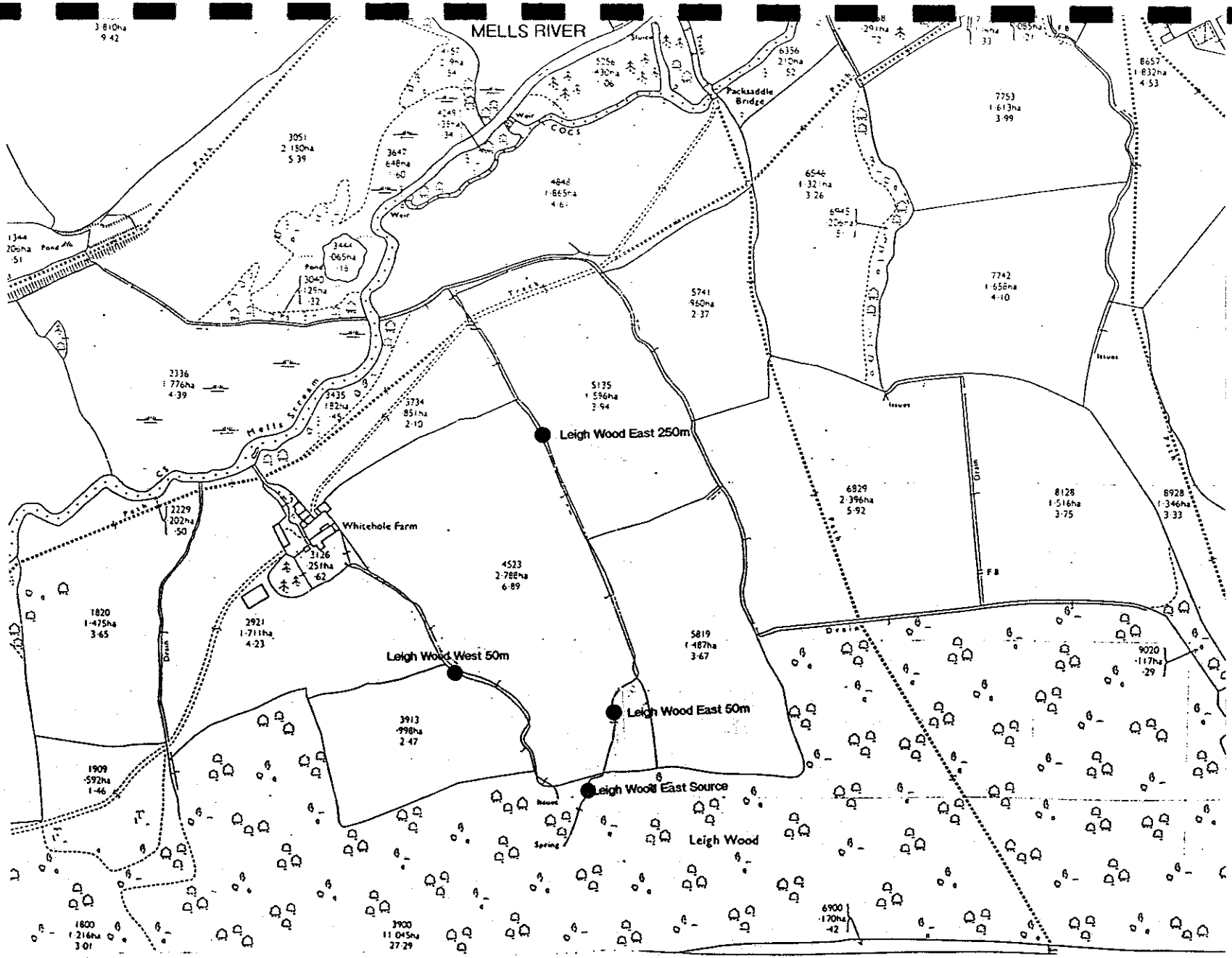

FIGURE 3 Map showing sampling sites at Leigh Wood West and Leigh Wood East streams

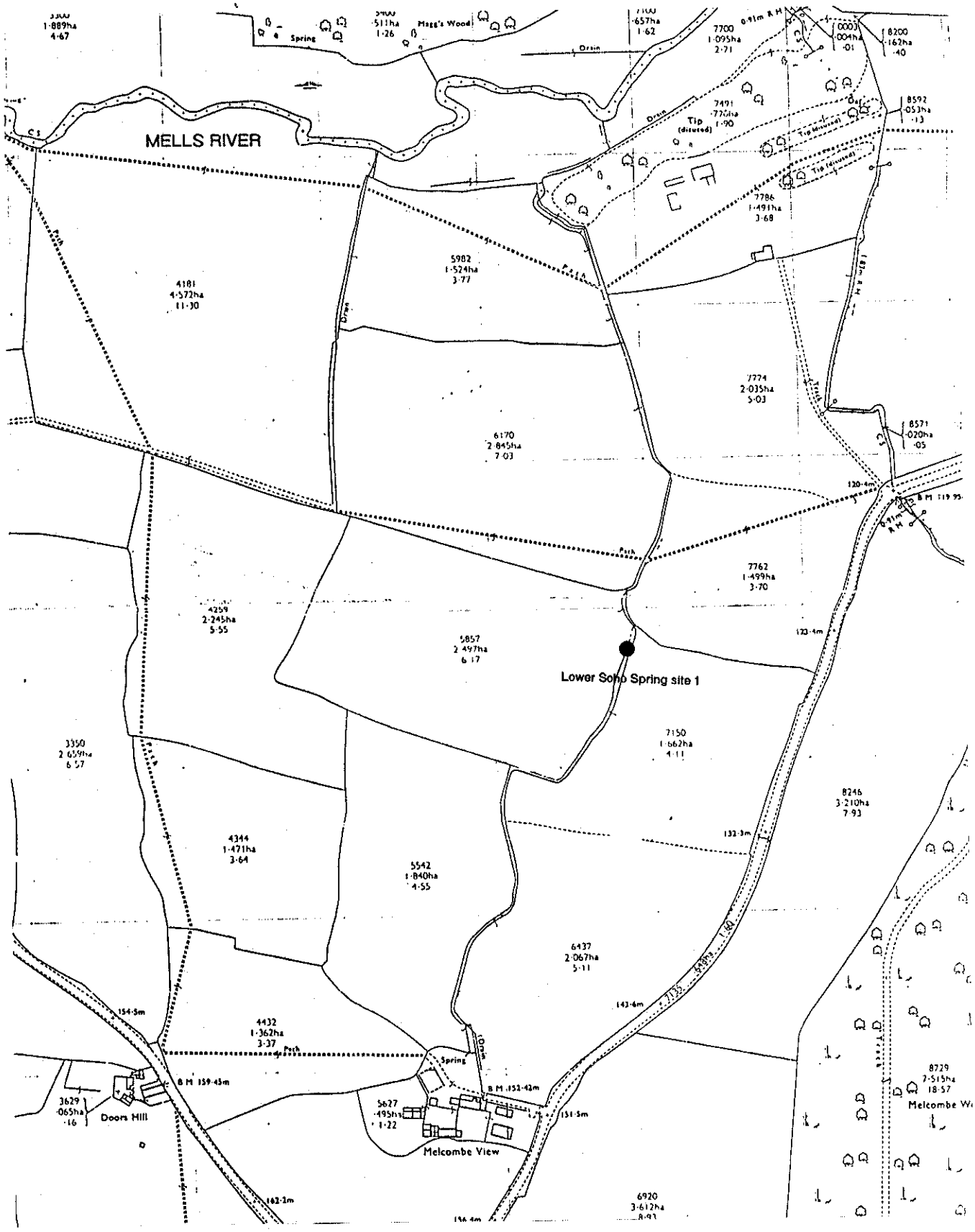

FIGURE 4 Map showing sampling site for macroinvertebrates at Lower Soho Farm stream

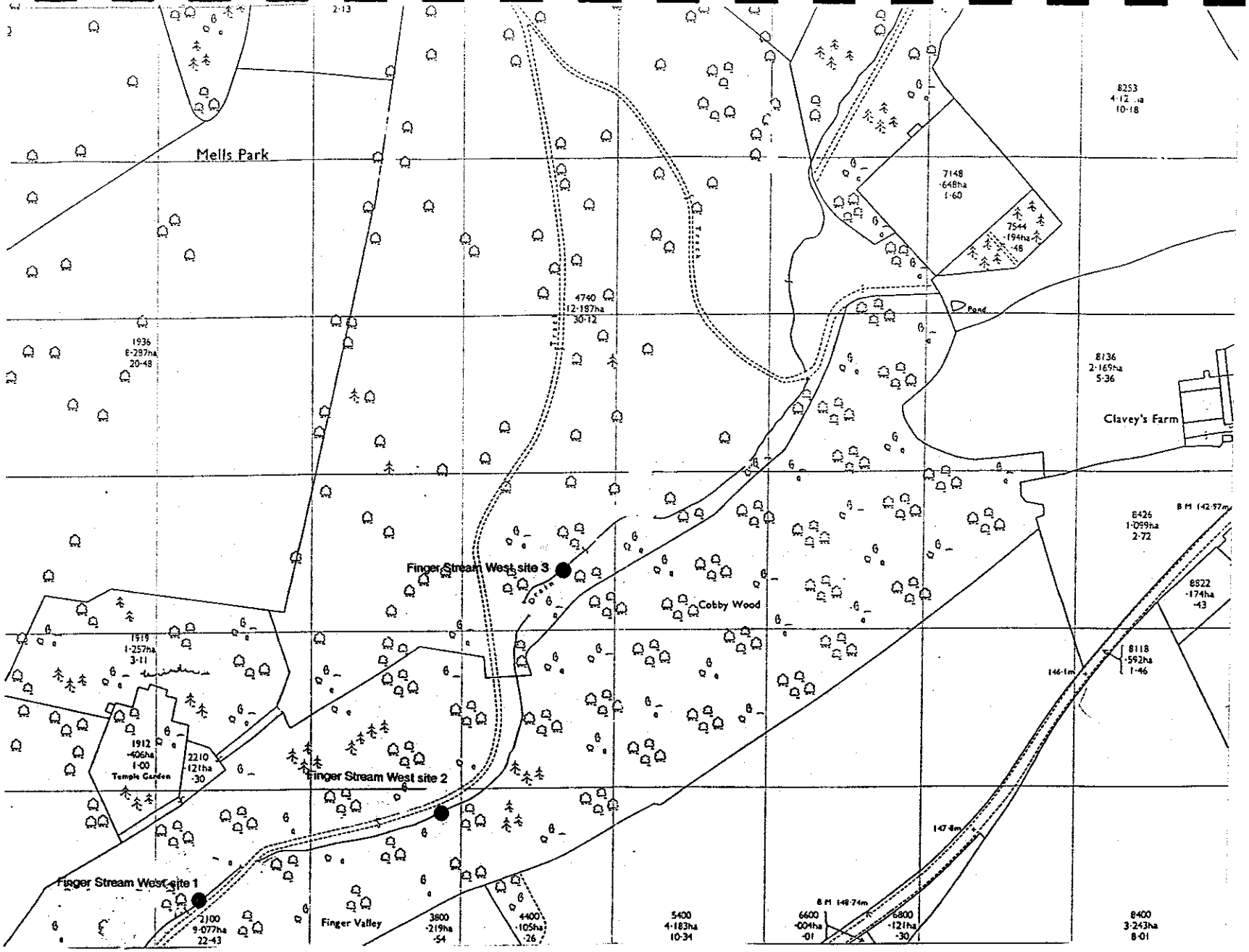

FIGURE 5 Map showing sampling sites for macroinvertebrates at Finger Stream West

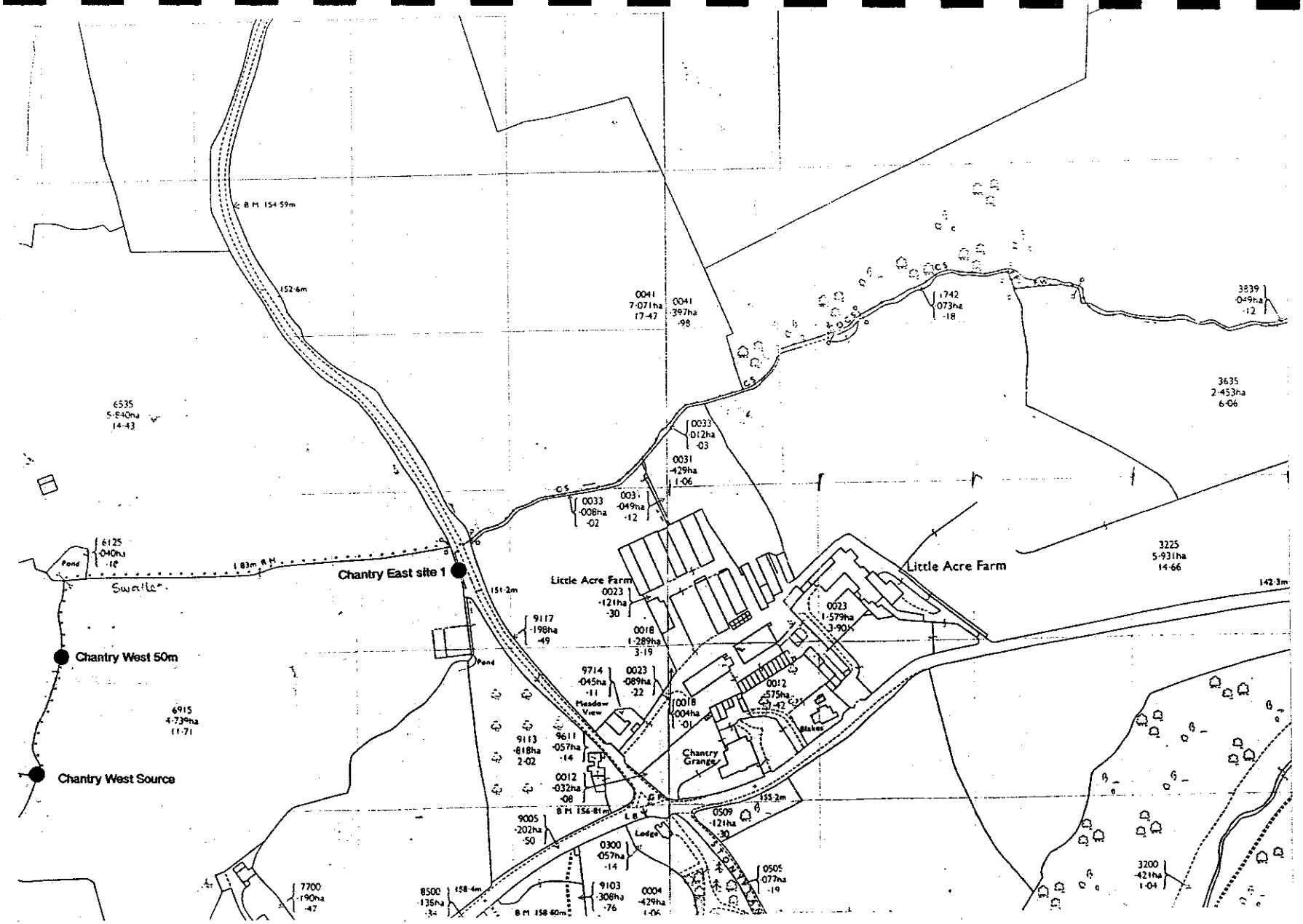

FIGURE 6 Map showing sampling sites for macroinvertebrates at Chantry East and Chantry West streams

throughout their range.

The distribution of the species with special status collected from Mells River stream sites is shown in Table 3.

TABLE 3 DISTRIBUTION OF SPECIES WITH NATIONAL CONSERVATION STATUS FROM MELLS RIVER SPRINGS

	Bector Wood 2 250m	Bector Wood 3 1000m	W. Hole Farm 2 250m	Leigh Wood West 50m	Leigh Wood East 250m
Hydreana nigrita	-	-	-	-	+
Riolus subviolaceus	+	-	-	-	-
Rhyacophila septentrionis	-	-	+	-	-
Tinodes unicolor	+	+	+	-	-
Tinodes dives	-	+	-	-	-
Oxycera pardalina	+	-	+	+	-

+ = species present in sample
- = species absent from sample

3.2.2 Habitat preferences and distribution

Hydraena nigrita Germar
This beetle typically lives amongst the gravel and stones in rivers, often in shaded areas. It has been recorded occasionally from Scotland, Northern England, South-west England, Wales, South-eastern England (including East Anglia) and Ireland (Friday,1988). *Hydraena nigrita* has also been recorded three times during Stages 2 and 3 of the Faunal Richness of Headwaters project from the Rivers Lugg, (Dorset) Stour, and Cam systems (Furse et al 1993 & 1995), that is, at 1.4% of sites.

Riolus subviolaceus (Muller)
The larvae and adults of this beetle live under stones and in moss in base-rich (calcareous) streams and rivers. They have been recorded occasionally in Scotland, Northern England, South-west England and Wales, and South-eastern England including East Anglia. Sixty four headwater sites studied by the IFE (29.9%) on forty-three different rivers have been noted with this beetle. This frequency of occurrence suggests that the species is more common than its notable B status suggests.

Rhyacophila septentrionis McLachlan has been recorded previously from Gloucestershire; north Clwydd; limestone areas of Yorkshire; Crawfordwalls Burn, Carluke, Lanarkshire; and at Longniddry, Aberlady, and Bangower, Lothian. More recently, this caddis-fly has been recorded from six headwater sites by the IFE, one on the Yorkshire Derwent system, and five on the River Lugg system in the Welsh borderlands. This species has been identified at 2.8 of sites used in the Faunal Richness of Headwater study (Furse et al 1995).

Typically this species lives in stony streams with a high calcium carbonate content, usually precipitating to some extent. *Rhyacophila* are likely to be restricted to conditions of high current-speed. The larvae do not spin nets or build fixed galleries but are completely free-living. They appear to be actively foraging predators. Major sources of prey are chironomid larvae and larvae of *Baetis* and *Simulium* but it seems that the larvae sometimes actively feed on the algae and moss on stones.

Tinodes unicolor (Pictet) is a caddis-fly with a restricted distribution in England and Wales in highly calcareous small streams which are depositing travertine (calcium concentration > 60 mg l^{-1}). This type of stream is commonest in limestone country but is also found where stream water is enriched by marl bands in the rock. The IFE has four additional site records for this species on the Rivers Lathkill, Dorset Stour, Lugg and Nene systems.

Tinodes dives (Pictet) has been recorded in headwater streams in Scotland (Perthshire and Lothian), Yorkshire, Derbyshire, Staffordshire, Breconshire, and Cumbria where this caddis-fly it is thought to require calcareous water. Wallace (1991) writes that the scarcity of records could be due to the fact that it is a small, often upland caddis. Six new sites have been noted for this species by the IFE in recent years, mostly in Yorkshire on the Derwent system but also on the River Dove in the Severn-Trent region.

Both *Tinodes unicolor* and *Tinodes dives* belong to the family Psychomyiidae. These gallery-building caddis larvae are particularly characteristic of streams running over easily weathered rocks, and lakes with stony substrata. Psychomyiid galleries are fixed, tunnel-like, structures constructed from fragments of mineral or other materials held together by silk (Edington and Hildrew 1981). In thin water films running over rocks, however, the galleries of *Tinodes dives* and *Tinodes unicolor* consist largely of faecal pellets. They differ from the nets or transportable cases of other caddis larvae.

The larva partially emerges from the front of the gallery and grazes material from the substratum. There is evidence that some psychomyiid species are associated with particular algal communities (Alderson, 1969). *Tinodes unicolor* feeds on the blue-green alga *Phormidium incrustatum*. This alga is to be found embedded in calcite incrustations and is involved in their deposition (Fritsch 1950). The larvae appear to gain access to the algal filaments by using an acid secretion which dissolves the surrounding calcite.

Oxycera pardalina Meigen larvae occur in mossy habitats where thin films of water flowing down inclined rocks or over stones but the flow of water is generally slight (Brindle, 1964). This dipteran is also known to favour limestone waters. This species has been recorded recently from four new headwater sites on the River Lugg system by the IFE. All IFE identifications of this species, including the current survey, have been made from larval material using the best available key (Brindle 1964). However, not all British species are included in the publication and the possibility exists that specimens keyed out to *O. pardalina* may be another species. Those species not included in Brindle (1961) are generally as rare or rarer than *O. pardalina.*

3.3 Biological indices

3.3.1 BMWP Scores

As well as considering the individual macro-invertebrate taxa recorded from a watercourse, it is possible to consider the composition of the faunal community in terms of the information it provides on the biological condition of the watercourse. In Britain the most widely used index of the biological condition of streams and rivers is the Biological Monitoring Working Party (BMWP) score system (Biological Monitoring Working Party 1978, Chesters 1980, Armitage et al 1983). In this system a wide variety of families of aquatic macro-invertebrate families are assigned scores according to their perceived tolerance to organic pollution. The least tolerant taxa, i.e. those likely to be confined to streams with lowest levels of organic pollution were allocated a score of 10. The most tolerant families persist even at badly polluted sites and are assigned low scores (minimum 1). The total BMWP score for a site is the sum of the scores of each family present. Appendix 35 gives the scores for the different families.

3.3.2 ASPT

Since a high BMWP score can result from either a few high scoring families or many low scoring families, another index is derived from the BMWP by dividing the site score by the number of taxa contributing to that score. This gives the average score per taxon (ASPT) which is a better indicator of the types of animals found at the site, and hence the water quality; whereas the BMWP score is more an indication of abundance and diversity.

3.3.3 Biological index values for the Mells River Springs

The numbers of taxa, BMWP scores and ASPT`s for the Mells River stream sites are seen in Table 4.

For the samples collected in the spring, only those resulting from one-minute kick samples can be compared with each other. Of these, Bector Wood 3 (1000 m) had the highest number of taxa (21) and the highest BMWP score (133) of the nine streams studied. White Hole Farm had the second highest values (15 taxa and a BMWP score of 89 respectively). The lowest number of taxa was found at Finger Stream West site 1 which also had the lowest BMWP score (33) of all the one-minute kick sampled sites.

A zonation is apparent from the samples taken in spring, particularly in the Bector Wood stream with 18, 19, and 21 taxa; and BMWP scores of 105, 111, and 133 recorded respectively for the 50 m, 250 m and 1000 m sites - demonstrating an progressive increase in diversity downstream from source. This can also be clearly seen in the Finger Stream West figures and is the normal situation in headwaters (Tapia and Furse in preparation).

TABLE 4 BIOLOGICAL INDICES FOR SPRING AND SUMMER SAMPLES

Site	Spr Taxa	Sum Taxa	Spr BMWP	Sum BMWP	Spr ASPT	Sum ASPT
Hurdlestone Source	12	-	60	-	5.00	-
Hurdlestone 1 (50m)	10	9	50	43	5.00	4.80
Bector Wood Flush A	11	-	56	-	5.09	-
Bector Wood Flush B	13	-	82	-	6.31	-
Bector Wood Flush C	14	-	85	-	6.07	-
Bector Wood Source	9	-	53	-	5.88	-
Bector Wood 1 (50m)	18	-	105	-	5.83	-
Bector Wood 2 (250m)	19	-	111	-	5.84	-
Bector Wood 3 (1000m)	21	20	133	116	6.33	5.80
White Hole Farm 1 (50m)	15	-	89	-	5.93	-
White Hole Farm 2 (250m)	14	17	73	93	5.21	5.50
WHF Standing water adj. 2	5	-	27	-	5.40	-
Leigh Wood West 1 (50m)	10	-	54	-	5.40	-
Leigh Wood East Source	5		26	-	5.20	-
Leigh Wood East 1 (50m)	12	-	58	-	4.83	-
Leigh Wood East 2 (250m)	11	-	53	-	4.82	-
Finger Stream West 1 (U/S)	8	-	33	-	4.13	-
Finger Stream West 2 (mid)	9	-	52	-	5.78	-
Finger Stream West 3 (D/S)	12	-	70	-	5.83	-
Lower Soho Farm 1	9	-	38	-	4.22	-
Chantry East 1	12	11	53	52	4.42	4.70
Chantry West Source	9	-	49	-	5.40	-
Chantry West 1 (50m)	11	12	69	63	6.27	5.30

- = no sample taken

The areas in which non-standardised sampling procedures were used, that is the sources, flushes, and areas of standing water, make a significant contribution to the faunal diversity of the aquatic environment. The area at the source of Hurdlestone stream, for example, yielded 12 taxa (BMWP score 60) compared with Hurdlestone site 1 at 50m from source with its 10 taxa and BMWP score of 50. Similarly, Bector Wood Flush C had 14 taxa and BMWP score of 85 - the same number of taxa as White Hole Farm 2 (250m at the cascade) for which a lower BMWP score of 73 was noted.

The five summer three-minute kick samples similarly showed a range in diversity and quality, although the number of taxa was reduced in some cases compared with spring season levels. Bector Wood 3 again had the highest scores followed by White Hole Farm 2, Chantry West, Chantry East and Hurdlestone streams.

The average score per taxon reflected the same pattern as the other parameters but with lower ASPTs being achieved for the summer samples at Bector Wood, Hurdlestone and Chantry East while a slight increase can be observed for White Hole Farm 2 and Chantry East streams.

3.4 Predictions

3.4.1 Headwaters classification

When interpreting the significance of recorded BMWP scores and ASPT, high values generally reflect better biological conditions in streams than low scores. However, different types of streams on different geology in different parts of Britain have different intrinsic potentials for their index values. An alkaline stream in Somerset can be expected to have a higher BMWP score but lower ASPT than a base-poor stream in the Cairngorms for example. In order to compare index values and the biological condition of the Mells River Springs with similar sized watercourses in different parts of Britain, then the observed index values have to be compared with the separate optimal potential values for the sites. The relationship between these values is the degree to which the biological condition of a site meets its potential and is called the Ecological Quality Index (EQI). Optimal site values for each site are based on the biological classification of sites of good biological condition from all over the country and then developing predictive relationships between the composition of each biological group and the environmental characteristics of the sites in the same groups.

In order to compare the Mells River Springs samples with other samples collected in headwater streams by the Institute of Freshwater Ecology, the biological and environmental data from 214 headwaters samples collected using standardised procedures were used to create a classification system for headwater sites (Furse et al 1993, 1995). These headwaters sites were divided into 19 groups on the basis of their macro-invertebrate fauna. The groups show a gradual shift from group 1 to 19 associated with declining altitude, slope, substratum particle size and latitude. The probability of the Mells sites belonging to each of the 19 groups was calculated. The Mells springs were allocated to groups 11 or 14 which had a wide geographical distribution in England and the Welsh borders and typically had a high average level of calcium (mean 183 mg l^{-1} $CaCo_3$).

3.4.2 Ecological Quality Indices

To determine the biological condition of each site on the Mells River streams, their environmental characteristics were used to calculate the probabilities that they belonged to each of the 19 groups in the headwater classification. These probabilities were then used to calculate the optimal or expected ASPT values for each site. Two types of Ecological Quality Index (EQI) values were calculated, one using the ASPT, and the other the number of taxa. In turn, the expected or predicted ASPT values were compared to those obtained by sampling in order to calculate EQIs. A similar procedure was used to calculate separate EQIs for each site based on the expected and observed numbers of taxa. EQIs were calculated for the single summer samples because only these were based on the same standardised sampling procedures used to create the classification system needed to provide the expected index values.

3.4.3 Quality bands

EQI scores are grouped into 4 bands: A good, B fair, C poor, and D bad. The range of EQI values represented by each band is given in Table 5.

Table 5 Single season band ranges for Ecological Quality Indices (EQI)

ASPT	
A	≥ 0.84
B	0.68 - 0.83
C	0.52 - 0.67
D	≤ 0.51
Number of taxa	
A	≥ 0.67
B	0.34 - 0.66
C	0.01 - 0.33
D	0.00

The biological and environmental data obtained during the single season sampling indicated that all 5 Mells sites belonged to Band A when comparing the observed (actual) ASPT with the predicted ASPT. In comparisons of the observed and expected number of taxa, three of the Mells sites fell into Band A and two into Band B. ASPT is a measure of organic pollution and is likely to be low if the site is polluted. The number of taxa is likely to be low when the site is subjected to other kinds of stress such as inorganic pollution or a uniform substratum such as concrete. Using the two different types of stress indicator covers the eventuality of pollution or a loss of habitat quality. The combined bands from the two types of EQI are normally used, with the lower of the two EQIs being selected. Therefore the quality bands for the Mells River stream sites are the same as the Taxa EQI. The EQIs and bands for each site are given in Table 6.

In order for an EQI value to be considered exceptional, the observed value would have to exceed the predicted figure by more than the five percent confidence level. To belong to Band A the EQI (using ASPT) for a site needs to be equal to or greater than 0.84 but for a site to be thought exceptional, in statistical terms, it would need an EQI of 1.16. On the basis of the EQIs obtained from the number of taxa, the values obtained would need to be 1.33 or more in order to categorise the site as exceptional.

Table 6 Single season EQIs for Mells River Springs sites

SITE	EQI(ASPT)	BAND	EQI(TAXA)	BAND
1. Hurdlestone	0.9048	A	0.5172	B
2. Bector Wood	1.0711	A	1.1364	A
3. White Hole Farm	1.0240	A	0.9659	A
8. Chantry East	0.8811	A	0.6250	B
9. Chantry West	1.0066	A	0.6897	A

3.4.4 Evaluation of the quality banding for Mells River Springs

Using combined quality bands, the Bector Wood, White Hole Farm, and Chantry West streams are included in the top 40% of headwaters sites which are classed as Band A (based on 131 reference headwater sites surveyed by the IFE in 1993). Hurdlestone and Chantry

East belong to a group of 30.5% that were Band B in the same dataset. Fifteen of all the reference sites (11.5%) had a higher ASPT EQI than the Bector Wood Spring. 18 of all the reference sites (13.7%) had higher ASPT EQI than White Hole Farm Spring. 25 of all the reference sites (19.1%) had an equal or greater ASPT EQI than Chantry West.

These EQIs mean that in terms of the kinds of invertebrates (ASPT) found in the watercourses, the water quality is good. However, the values are not exceptional. The Mells site EQIs for ASPT ranged from 0.88 at Chantry East to 1.07 at Bector Wood. Nine of the reference headwater sites (6.9%) surveyed in four major river catchments in 1993 achieved exceptional quality status with the maximum Taxa EQI of 1.44 and ASPT EQI of 1.20. Maximum BMWP score was 158.

The values for Band A sites (EQI based on taxa) ranged from 0.69 at Chantry West to 1.14 at Bector Wood. Only 2.3% of the reference headwater sites were considered exceptional using EQIs based on taxa. 9.9% of the reference headwater sites had a higher Taxa EQI than Bector Wood.

ASPT scores indicate that organic pollution is not a limiting factor for the macro-invertebrate organisms in the Mells River streams. However, the number of taxa suggests that there is a factor limiting the potential variety of animals. Numbers of individual animals recovered in the standard three minute kick samples were small. A probable limiting factor is the small and fluctuating quantity of water flowing in these springs. On 18.4.95 it was observed that the sources of the springs had in several instances moved downstream by distances between 1 and 25m in comparison with the situation on 29.3.95. On 27.6.95 flow was further reduced in Hurdlestone, Bector Wood, White Hole Farm, Chantry East and Chantry West. Leigh Wood West, Leigh Wood East, Lower Soho Farm and Finger West streams were dry right down to their confluences with the Mells River. Additionally, there was low habitat diversity with few aquatic macro-invertebrates and a relatively homogenous substratum.

4. DISCUSSION - MACRO-INVERTEBRATES

One hundred and twelve taxa of macro-invertebrate animals in all were identified from the nine Mells River streams in the spring and summer. These taxa belonged to 44 families. Many of these taxa were typical of small headwaters streams close to their source and none of the taxa present were those exclusive to winterbourne streams which regularly dry up. The animals identified show that the majority of the streams are in good biological condition with no apparent signs of organic pollution. However, Ecological Quality Index values indicate that there is some factor which is influencing the diversity of animals. Absolute numbers of individuals of those taxa present are also low by comparison with many streams sampled by IFE (IFE unpublished).

The springs on the western side of the study area were of a higher quality than those to the east. Hurdlestone, Bector Wood and White Hole Farm watercourses came into this category with Bector Wood stream having the greatest number of taxa and highest ASPT values and White Hole Farm stream coming a close second. Both streams were allocated to Band A for ecological quality on the basis of their summer samples for both number of taxa and ASPT. Hurdlestone stream achieved Band B status overall but on the basis of its ASPT alone its belonged to Band A.

Further eastwards, Leigh Wood East and Leigh Wood West streams proved to be of poorer quality than Hurdlestone, Bector Wood and White Hole streams. Because they dried up in the summer, it was not possible to work out their ecological quality banding. The numbers of taxa and ASPT were lower than for the latter group of streams. However, the single specimen of *Hydraena nigrita* which has notable B status was recorded from Leigh Wood East stream (250 m).

Lower Soho Farm stream showed yet a further decrease in quality although its number of taxa and ASPT were not the lowest recorded for one-minute kick samples. The upstream sample from Finger Stream West site 1 had the lowest scores for this type of sample. Finger Stream West had plenty of water in the spring but, despite this, the number of taxa was low (although the ASPT obtained for the lowermost site beneath the waterfall and after the input from the Cobby Wood stream was comparable with ASPTs obtained for some of the Bector Wood Spring sites - due to a few high scoring families). The fauna of this stream probably reflects the fact that it receives water occasionally from a quarry further upstream, and also that it may dry out completely in summer.

Chantry East and Chantry West streams which are located in the eastern part of the study area are fed from a different groundwater source. Chantry West Spring was accorded Band A status for ecological quality but with the lowest EQI of the sites belonging to that band. The joint EQIs for Chantry East stream placed it in Band B along with Hurdlestone stream which had a higher EQI.

The three Band A streams in the study area place the sites in the top 40% of headwater streams so far recorded by the Institute of Freshwater Ecology. However, none of these Mells River stream sites is exceptional within the banding requirements - although approximately 7% and 10% of the IFE database sites met these requirements for ASPT EQI and Taxa EQI respectively.

The two notable and high scoring psychomyiid caddis *Tinodes unicolor* and *Tinodes dives*, and the relatively low scoring (notable B) beetle *Riolus subviolaceus*, were all recovered from Bector Wood stream, together with the dipteran larva *Oxycera pardalina*. Not all families are used in the BMWP scoring system, and non-scoring families are not regularly identified from routine water-quality monitoring samples (see Appendix 35). Many of the Dipteran families are non-scorers on the BMWP system; these include Psychodidae, Ptychopteridae, Dixidae, Ceratopogonidae, Stratiomyidae, Empididae, Dolichopodidae, Muscidae, Fannidae, Thaumaleidae and Syrphidae. Hydracarina, and Veliidae are also non-scoring families. *Oxycera pardalina* belongs to the non-scoring Stratiomyidae family. *Tinodes unicolor* and *Oxycera pardalina* also occurred at the cascade on White Hole Farm stream with the addition of the rhyacophilid *Rhyacophila septentrionis*. These species have in common their preference for stony or gravelly streams flowing with calcareous water and in some cases the water need only be a thin, slow flowing film.

Regarding the species which have been recorded as having special conservation status, it should be noted that attribution to a threatened status group may be revised when the species has previously been under-recorded, either because of identification difficulties or where the type of habitat the animal occupies has been insufficiently sampled. The IFE headwater sites dataset contains new records for all the insects of special interest identified in this Mells River Springs study. It is likely that these additional records may change the status of some of these species. In particular, *Oxycera pardalina*, if correctly identified, and *Riolus subviolaceus* may each be more widespread than their current conservation status suggests.

Wallace (1991), referring to the conservation status of caddis flies, states:

> Allocation of Notable and, in particular Regionally Notable status has been more difficult. There will be records which I have not yet abstracted and some areas of the country (eg parts of Scotland) have not been well worked. The Caddis Recording Scheme is not at an advanced enough stage for me to be able to analyse the number of records and produce proper Notable A, Notable B or Regionally Notable listings. My gradings take into account my knowledge of many factors and are of a "thought to be" nature.

Thus the Notable category for Trichoptera is fifth in a series of eight status levels for living caddis and attribution to Notable status may be subject to revision. A recent example of such a need for a change in status concerns the caddis *Hydropsyche saxonica* McLachlan. Blackburn and Forrest (1995) write that this insect had been designated as Red Data Book 1, i.e. taxa which are known only as a single population in only one 10 km square, but that it has now been recorded at 34 sites, mostly small first order streams, from 30 separate kilometre squares.

SECTION 2 - BOTANICAL AND HABITAT SURVEY

5. METHODS - BOTANY AND HABITAT SURVEY

5.1 Programme of work

It was agreed that the standard IFE Biomorphic Survey of plants, animals, stream morphology and water chemistry, would be used in order to give a context to the character of the streams being studied. Over 500 standardised surveys have now been undertaken using this method, the relevant sections of which are outlined in the following section. In addition the newer National Rivers Authority River Habitat Survey, that will soon become a national standard for river habitat quality assessment, would also be undertaken

5.2 Biomorphic reconnaissance techniques for assessing the environmental quality of watercourses.

The following elements of the standard Biomorphic Survey techniques, developed by the Institute of Freshwater Ecology, were used in this survey.

5.2.1 Site reconnaissance

Ten stream sections/sites were surveyed on seven different watercourses (Table 7) in order to determine their relevant ecological or conservation characteristics

TABLE 7 The ten biomorphic survey sections

Site number	Stream name	Location name
1	Hurdlestone Stream	Stoke St.Michael
2a	Bector Wood Stream	Stoke St. Michael
2b	Bector Wood Stream	Stoke St. Michael
3	White Hole Spring	Stoke St. Michael
4a	Leigh Wood West Stream	Leigh upon Mendip
4b	Leigh Wood East Stream	Leigh upon Mendip
5	Upper Soho Stream	Leigh upon Mendip
6	Finger Stream West	Mells Park
7a	Chantry West Stream	Whatley
7b	Chantry East trib. of Whatley Brook	Whatley

On-site assessment were made of the following features:

- Flora and fauna
- Bank, sediment and bed characteristics
- Watercourse size
- Adjacent land use
- On-site evidence of recreational use
- Proximity to designated sites of conservation importance
- Other potential problems including reinstatement and long term morphological changes

At several sites water samples were collected and filtered on-site and analyzed in the laboratory on the following day.

Assessments were made of the need or value of undertaking full biomorphic surveys and specific further actions were recommended where appropriate.

In addition, sections thought to be of particular value were noted and a location map, outline data and subjective assessments of the conservation value are reported in the results section.

5.2.2 Aquatic and riparian flora

Flowering plants, major mosses, liverworts and macroscopic algae were recorded within each of the ten sections of watercourse surveyed.

Riparian and terrestrial plants were recorded to a width of typically 100m from each bank. Records were limited to flora readily visible and preferably in flower. Notes were made to assist in the assignment of a value for the relative quality of the defined site.

Separate assessments, on a scale of 0 - 5 (bad to excellent), were made for submerged aquatic plants and also for bank or emergent species. Expected rare species were specifically sought.

These two scores were added together to produce a score from 0 - 10 for flora for each site after correcting for bankside shade.

Scores were based upon the occurrence of species to be expected in natural unmanaged watercourses of the area after considering the water flow and geology of the catchment.

5.2.3 Aquatic fauna

A survey of aquatic macro-invertebrates is normally undertaken as part of the Biomorphic assessment. In this study the macro-invertebrate sampling was undertaken and reported upon separately (see Section 1).

Only records of fish, birds and mammals are noted in the present section.

5.2.4 Bank, sediment and bed characteristics

Bank, sediment and bed characteristics were assessed in two ways:

- the percentage cover of the stream bed in the macro-invertebrate sample area, and
- the relative proportions of various materials in the banks and adjacent areas in the general sample area

Specific searches were made for materials of special relevance eg to construction such as peat, rock as bed rock or outcrops.

5.2.5 Locational data

The following features were recorded during the Biomorphic survey:

- watercourse name and name of the nearest village
- survey date
- numeric National Grid Reference (NGR)
- distance from source of watercourse
- altitude of survey section to *c* 5 m
- latitude and longitude

5.2.6 Physical characteristics

Values of the following features were estimated in the field

- watercourse size as mean width and mean depth of water at time of survey and also at the bankfull condition of the watercourse. *[The mean depth of pools was recorded if appropriate. Additional comments relating to obvious recent events, as seen from debris stranded on the banks or adjacent vegetation, were recorded as the additional height above that at survey. Mean width is the unobstructed width without allowance for dense fringing vegetation, e.g. reedstands, which would be accounted for in bank-full widths]*
- the discharge of the watercourse at the time of survey in cubic metres per second
- the estimated mean surface velocity of the water
- the slope of the channel bed over survey length (estimated to the nearest 1°)
- the type of bed or water flow - waterfall, stepped, long riffle, riffle-pool with sequence distance, glide or run, smooth, static or ponded;
- relative stream power - estimated on scale of 0 to 10 based to cover the range of British rivers

The broad scale for recording relative stream flow is as follows:

0 - 3 indicates bed and bank-stable rivers and streams
4 - 5 indicates rivers or large streams with some bed scour or bank erosion or lateral migration,
6 - 8 indicates active rivers with rock or worked gravels and erosion or migration or both.

Uncertainty about a value eg water depth where the river was to deep to measure without a boat or a statement will be indicated by the use of question mark.

5.2.7 Channel characteristics

The following channel characteristics were recorded:

- channel form in plan - straight, meandering, braided;
- channel sinuosity, current and previous, where the situation may have naturally changed - slight, moderate, extreme, or the channel straightened. The actual and previous amplitude is recorded in metres and this relates to the potential lateral migration over future decades which may expose reinstatement work or construction eg buried pipework, or promote consequential downstream adjustment or erosion;
- channel section - slope, steep, vertical, or trapezoid if managed, dredged or resectioned;
- erosion of stream banks as percentage of stream bank of section - incising, flake or slab, slump or slide, undercut or block fall, or depositions with type of material and position
- substratum, where the proportions of the major particle sizes on the bed of the river are indicated by asterisks (* = *c* 20%).

The following categories of particle size were considered:

bedrock or outcrops
boulders (>256 mm),
cobbles (65 - 255 mm),
pebbles and gravel (2.1-64 mm)
sand (.06-2 mm)
silt & clays (.06-.004 mm)
organic material or peat

Occasionally the soils of stream banks and appropriate adjacent areas were noted if these were considered relevant or particularly different.

- the colour and nature of the water, e.g. presence of particles or other discolouration

5.2.8 Adjacent features

The following categories of riparian and adjacent features were recorded

- land use on watercourse banks together with visual features within 0.5 km;
- upstream features eg large farms, inflows, lakes;
- downstream features, eg as 20;
- maintenance, its frequency or extent;
- fishery interest

Other data may be used or referred to, if it is readily available.

5.3 The Biomorphic Score system

In the current study macro-invertebrate assemblages were not used in calculating the Biomorphic Scores of the survey reaches. The condition of the macro-invertebrate assemblages is reported separately in Section 1.

Environmental data on physical parameters, flora and fauna (not including aquatic macro-invertebrates) is summarised together with a score for environmental quality based on scales of 0-10 for flora.

A correction factor for the extent of stream maintenance is also applied. Maintenance effects will be scored on a -2 to +2 scale broadly based on:

-2	for channel resectioning and realignment
-1	for channel realignment / channel resectioning of both banks
-0.5	for channel realignment / channel resectioning of one bank
0	a neutral score, for possible or historical management
+1	for unmanaged but agricultural banks especially rough grazing etc.
+2	near natural conditions for the area ie considering flow and geology

Combinations of these scores may also be used. In a full Biomorphic Survey, the overall environmental biomorphic score would be calculated by adding the floral (from 0-10) to the macro-invertebrate (from 0-10) scores and dividing by two. This value is then corrected by adding the maintenance score (from the range -2.5 to +2).

Where macro-invertebrate scores were not used, plant scores and maintenance factors were considered in conjunction with the surveyor`s experienced judgement to arrive at a final grading. Five grades of very poor, poor, moderate, good and excellent were used for the overall assessment of each site.

Where scores were not available in this survey through difficulty in sampling or inappropriateness, eg dry ditches, an estimate (in brackets) was made for the overall score.

5.4 Environmental summary

A summary at the bottom of each site data sheet is provided. Comments are made on environmental matters. The overall Biomorphic Score from the reconnaissance survey is presented in this summary.

5.5 Chemical analysis

Chemical analysis was carried out on samples collected from several sites (see the following sections) in order to determine the character of the water and to indicate biotic potential.

Water characterisation at survey sites included:

- pH (Hydrogen ion)
- conductivity

In the laboratory, the following parameters were determined on water samples collected and filtered at the sites:

- anion to cation balance for common ions (in milli-equivalents per litre)
- concentrations of the nutrients nitrate and phosphorus
- alkalinity as bicarbonate
- silicate-silicon
- the cations; calcium, magnesium, sodium and potassium

Anion and cation concentrations are reported in milligrams per litre.

6. RESULTS

6.1 Biomorphic Survey data

Biomorphic Survey data are presented in a series of ten double-paged spreads, one set per survey section, on the pages which follow.

These summary sheets include an overall assessment for each section of stream and its immediate environs. For the convenience of the reader, these assessments are summarised here (Table 8).

Table 8 The overall biomorphic assessments of each of the ten survey sections/sites.

Site number	Stream name	Location name	Biomorphic assessment
1	Hurdlestone Stream	Stoke St.Michael	moderate
2a	Bector Wood Stream	Stoke St. Michael	moderate/good
2b	Bector Wood Stream	Stoke St. Michael	moderate/good
3	White Hole Spring	Stoke St. Michael	poor/moderate
4a	Leigh Wood West Stream	Leigh upon Mendip	poor
4b	Leigh Wood East Stream	Leigh upon Mendip	poor
5	Upper Soho Stream	Leigh upon Mendip	poor
6	Finger Stream West	Mells Park	(poor)
7a	Chantry West Stream	Whatley	poor
7b	Chantry East Stream	Whatley	moderate

6.2 Vegetation

The genera of flora noted during the surveys on springs, streams and wet areas of the survey sections are given in Table 9 which follows the Biomorphic Survey summary sheets.

6.3 General observations

Further explanatory comment must be given especially for the Hurdlestone Wood area for although the area is of interest being of SSSI designation, the watercourses with the exception of the upper part of Bector wood stream are not exceptional as streams. The main interest is the whole complex, the stream being an integral part without which the whole area would be poorer.

The presence of the tufa in the bed of Bector Wood stream and the cascades of White Hole Farm stream is considered of great interest and is referred to in the Biomorphic Survey summary sheets which follow.

6.4.1 Site 1 Hurdlestone Stream

LOCATION

Location name	: Stoke St.Michael
Date	: 18.4.95
NGR	: 3677 1480
Approximate latitude	: 51° 14'
Approximate longitude	: 2° 27' W
Distance from source	: 0 - 0.2 km
Altitude	: 170 m

PHYSICAL CHARACTERISTICS

Width at survey	: 0.3 m
Depth at survey	: (10) cm
Height Board	: none
Water depth	: 20 cm
Bank full width	: no banks
Bank full depth	: -
Discharge at survey	: 0.005 $m^3 s^{-1}$
Velocity at survey	: 0.2 m s^{-1}
Bed slope	: 0 - 10^0
Bed slope type	: N/A
Relative Stream Power	: 1
Channel type	
Plan form	: see opposite
Sinuosity now	: N/A - (2?) m
Previous sinuosity	: see opposite - (2)m
Section	: open, road
Erosion state	: N/A
Erosion type	: access

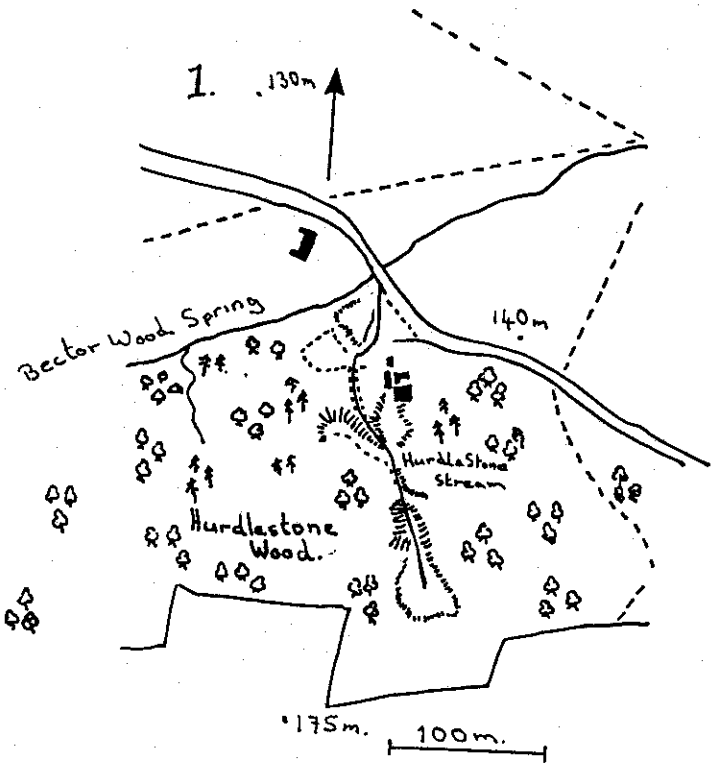

FIGURE 7

SUBSTRATUM COVER

	Bed	Banks	Adjacent
Bed rock	**	**	**
Boulders/cobbles	*	**	**
Pebbles/gravel	**	*	**
Sand	*	*	
Silt/clay/(peat)		*	

Stream bed with light concretions; track

ADJACENT FEATURES

Land use	: SSSI, quarry, access road
Upstream	: Quarry
Downstream	: track, road
Maintenance	: none
Fishery interest	: nil

WATER CHARACTERISTICS

Kept at 3-5°C for analysis on 19.4.95

Colour	: clear
Temperature	: 9°C
Conductivity	: 723µS cm^{-1}
pH	: 7.2 (6.7)
Alkalinity	: 5.52 mmol

Anions, mg l^{-1}		Cations, mg l^{-1}	
Alkalinity	276	Calcium	121
Nitrate N	5.0	Magnesium	4.0
Phosphate	0.035	Sodium	5.9
Silicate Si	2.8	Potassium	1.1
Ion balance	6.70 : 6.66 mmol		

Assessment: nutrient-rich calcareous calcite precipitation probable (.47)

PHYSICAL Maintenance Factor -2

Water springs from the floor of the disused quarry flowing on gravels with rich-organic areas along and down a steep former quarry access with some large boulders and scattered sections of old walling to east, before reaching a wet area near a disused loading platform and probable settlement tank; the water then joins a small stream after passing under a road.

PLANTS

Shade 90% : Cover; algae 1%, moss 1%, aquatic macrophytes 5% 0.5 + (3.5) = Score (4)

A trickle of water flowing from disused quarry with a good variety of typical wet area plants flowing down along a track through good mixed probably-coppiced deciduous woodland of alder, ash, beech, birch, sycamore, hazel, willow and holly with a good understorey including areas with wood anemone, primrose, bluebell, etc or wood rush and numerous smaller & larger mosses eg *Thuidium*, *Aitrichum* & liverworts. Few weedy species present. [Recheck for *Apium inundatum*]

ANIMALS Score

See Section 1 for macro-invertebrate data.

Deer tracks.

ADJACENT FEATURES

Disused worked steep rockface either with a series of rock chip debris piles with steep sides, washed soil heaps, pools, seepages or wet-flushes at its base and with beech-shaded dense understorey varying from large stands of wood rush, rushes, a good variety of shade-tolerant herbaceous plants, several ferns, and moss- and liverwort-covered fallen trunks (20-30 cm). Probable clay strata noted towards west end near hut and extensive area of ransoms. Oak with epiphytic fern and honeysuckle and with a mature understorey of anemone, bluebell but a little bramble.

SUMMARY

Spring and water flow within a high conservation interest area with variety increased by quarrying in past but the water flows on an erratic course along a gravel access road through woodland of reserve status.

OVERALL SCORE (FOR WATERCOURSE) : Moderate

6.4.2 Site 2a Bector Wood Stream

LOCATION

Location name	: Stoke St.Michael
Date	: 18.4.95
NGR	: 3675 1479
Approximate latitude	: 51° 14'
Approximate longitude	: 2° 27' W
Distance from source	: 0.5 - 0.9? km
Altitude	: 170 m

PHYSICAL CHARACTERISTICS

Width at survey	: 0.4 m
Depth at survey	: 10 cm
Height Board	: Downstream
Water depth	: 10 cm
Bank full width	: 1 - 2 m
Bank full depth	: 40cm
Discharge at survey	: 0.01 $m^3 s^{-1}$
Velocity at survey	: 0.15 m s^{-1}
Bed slope	: 2^0
Bed slope type	: gentle
Relative Stream Power	: 1- 2
Channel type	
Plan form	: slightly sinuous braided
Sinuosity now	: 2 m
Previous sinuosity	: see opposite - 2m
Section	: trapezoidal, wetland
Erosion state	: none
Erosion type	: -

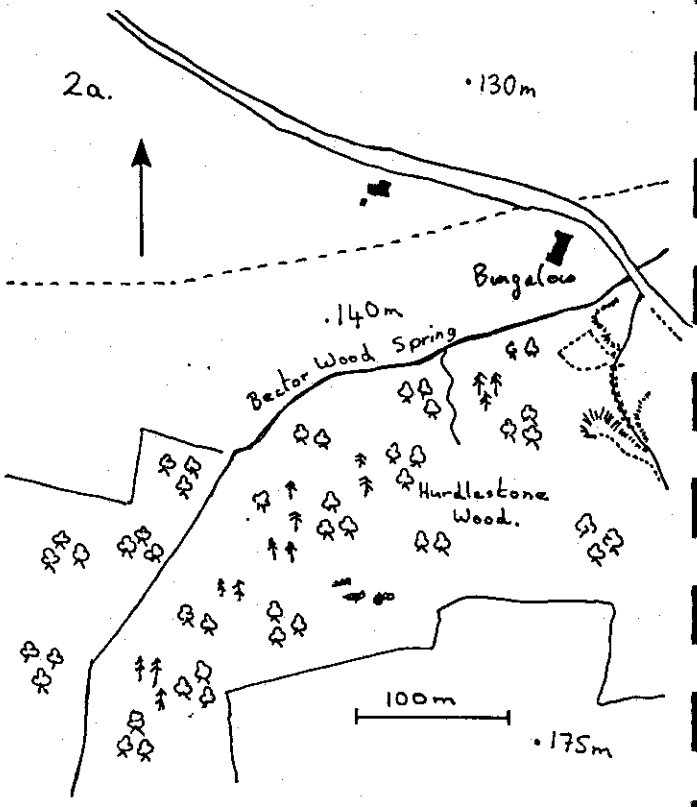

FIGURE 8

SUBSTRATUM COVER

	Bed	Banks	Adjacent
Bed rock		*	
Boulders/cobbles	*	*	*
Pebbles/gravel	**	**	**
Sand		*	
Silt/clay/(peat)	**//*	*//*	//**

All overlain with tufa

ADJACENT FEATURES

Land use	: SSSI, nature reserve, path disused quarry, grazing
Upstream	: path, screen, quarry
Downstream	: house, road, river
Maintenance	: nil upstream, some dredging by bungalow/farm
Fish interest	: nil-low

WATER CHARACTERISTICS

Kept at 3-5°C for analysis on 19.4.95

Colour	: clear
Temperature	: 8°C
Conductivity	: 643µS cm^{-1},
pH	: 8.1 (8.0)
Alkalinity	: 5.18 mmol

Anions, mg l^{-1}		Cations, mg l^{-1}	
Alkalinity	259	Calcium	124
Nitrate N	2.3	Magnesium	7.9
Phosphate	0.012	Sodium	7.8
Silicate Si	2.8	Potassium	0.83
Ion balance	6.75 : 7.19 mmol		

Assessment: calcareous water, calcite precipitation expected (1.3) and much tufa deposited

PHYSICAL Maintenance Factor +2

A small slightly-sinuous, tree-shaded, fine gravel-bed stream with banks varying from stable cobbles and boulders and much woody debris, tree-root, to soft deep semi-stable bed and marginal wet areas upstream. The stream seems to arise beneath a 25m high embanked earth-covered tree-planted artificial barrier, of quarry waste material, traversing the valley and screening from general view an adjacent deep 50 ha stone-extraction quarry partially full with water. Old extraction face of quarry extensive to southwest and south.

Further downstream, narrower slightly steeper valley with less sinuous channel possibly constrained by disused walling, before reaching a lightly dredged section with fenced improved grazing to the north west. In addition, 100 m of glass debris and abandoned pig huts near bridge.

PLANTS

Shade 90%: Cover; algae 0%, moss 1%, macrophytes 0% 2 + 3 = Score 5

A small shaded stream with liverworts on both firmer areas of the stream bed and in mats on silty margins, shaded banks of predominantly beech with sycamore with more stable moss covered banks supported by tree roots. A variety of shade tolerant understorey plants on banks including ransoms, dogs mercury, meadowsweet, celandine and ferns with bluebell to north; nettle occasional. Wet flushes with ferns, mosses and thallose liverworts. Royal fern on the slopes to the southwest & south ie not quarry face.

Further downstream, less dense shade, probably once coppiced hazel with similar good variety of understorey plants bushes including wild rose and bramble were seen on the poached grazed banks and fenced-banks which separated the stream from the coppiced hazel with hawthorn, holly.

ANIMALS Score

See Section 1 for macro-invertebrate data.

Deer tracks, possibly fox, several bird. No fish or fry were seen.

SUMMARY

Stream of high conservation interest within woodland area of high conservation interest with variety increased by quarrying in past and with tufa deposits in the channel through woodland of reserve status.

OVERALL SCORE (FOR WATERCOURSE) : Moderate/good

6.4.3 Site 2b Bector Wood Stream

LOCATION

Location name	: Stoke St.Michael
Date	: 18.4.95
NGR	: 3677 1482
Approximate latitude	: 51° 14'
Approximate longitude	: 2° 27' W
Distance from source	: 0.9 - 1.3? km
Altitude	: 140 m

PHYSICAL CHARACTERISTICS

Width at survey	: 0.4 m
Depth at survey	: 15 cm
Height Board	: Present
Water depth	: 15 cm
Bank full width	: 2 m
Bank full depth	: 50cm
Discharge at survey	: 0.02 $m^3 s^{-1}$
Velocity at survey	: 0.2 m s^{-1}
Bed slope	: 1 - 2^0
Bed slope type	: gentle
Relative Stream Power	: 1- 2
Channel type	
Plan form	: slightly sinuous
Sinuosity now	: 3 m
Previous sinuosity	: realigned
Section	: trapezoidal, wetland
Erosion state	: none
Erosion type	: some poached cattle drinks

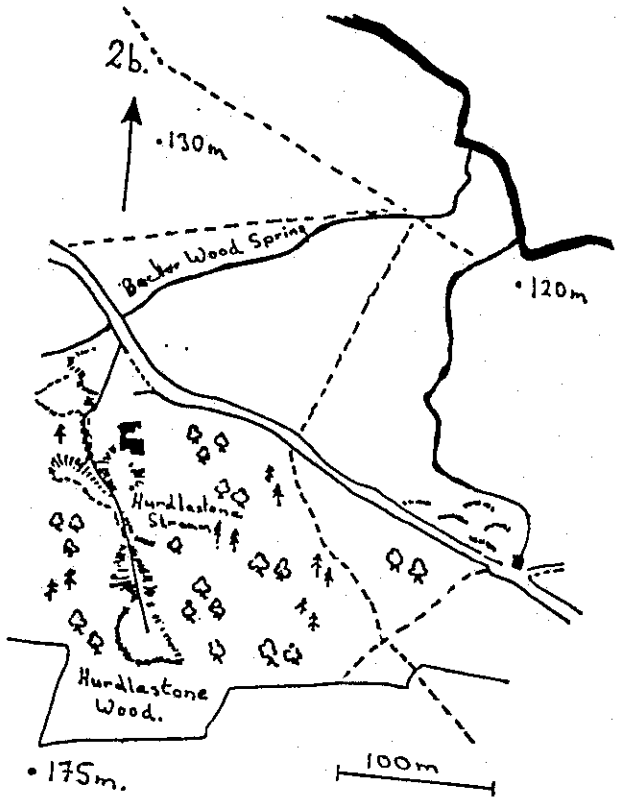

FIGURE 9

SUBSTRATUM COVER

	Bed	Banks	Adjacent
Bed rock		*	
Boulders/cobbles	*	*	*
Pebbles/gravel	**	**	**
Sand	*	*	*
Silt/clay/(peat)	**//*	*//(*)	//(**)

All overlain with tufa

ADJACENT FEATURES

Land use	: improved grazing, marginal wet area
Upstream	: road, nature reserve, quarry
Downstream	: river
Maintenance	: low, occasional dredging
Fish interest	: low, possible spawning area

WATER CHARACTERISTICS

No sample. See site 2a above.

Colour	:
Temperature	:
Conductivity	:
pH	:
Alkalinity	:

Anions, mg l^{-1}	**Cations, mg l^{-1}**
Alkalinity	Calcium
Nitrate N	Magnesium
Phosphate	Sodium
Silicate Si	Potassium
Ion balance	

Assessment: See 2a.

PHYSICAL Maintenance Factor 0

From below road bridge, a small almost straight stream, with a bed of cobbles, sands and some tufa in long riffles with several silty pools all within planted tree-line and barbed-wire fence, downstream to river with small adjacent wetland area. Water level in wetland mainly controlled by level of the river which seems to have been over-deepened in past despite some recovery. Grazed on both sides and poached to east, bridge and field gate midway downstream, water main pipeline marker at 1.1 km?.

PLANTS

Shade 90%: Cover; algae 0%, moss 1%, macrophytes 0% 0.5 + 2.5 = Score 3

A small stream shaded by planted tree-line (25 years?) with beech, hazel, and oak with an understorey bush layer of hawthorn, holly, thorn, rose and large bramble and a sparse herb layer including ransoms, dogs mercury, bluebell, wood anemone and some umbellifers. Broadening treeline and deeper silty downstream in wetland area to south and south east with Rush and other herbs with occasional nettle & bramble and stands of thorn to field side. Several species typical of an alkaline wetland and its surroundings were also present including iris, meadowsweet, dropwort with bushes of willow, alder. Orchid habitat but none were seen; resurvey.

ANIMALS Score

See Section 1 for macro-invertebrate data.

No fish or fry were seen.

MAIN RIVER MELLS

The main river at this point has a mean width of 4 m and depth of 0.6 m , with a water velocity of *c* 0.5 m s^{-1}. The main channel with 1-1.5 m high sandy earth banks, has small debris dams, side bars deposition and overbank deposition of both natural woody but also rubbish eg plastic barrels but shows signs of recent changes in course - 30-50 year old hawthorn on new island but also established anemone and bluebell stands to the north. No fish were seen but there is likely to be a fisheries interest albeit low. The vegetation was bushes of alder, hawthorn, willow but particularly in the wetland corner to the east between this and site 3, cattle had moderately trampled the sedge, spurge and iris in parts of the wet area.

SUMMARY

There is conservation interest only in the downstream area being part of a marginal wetland area of the Mells River linked to the lower end of White Hole spring stream.

OVERALL SCORE (FOR WATERCOURSE) : Moderate/good

6.4.4 Site 3 White Hole Spring

LOCATION

Location name	: Stoke St.Michael
Date	: 18.4.95
NGR	: 3680 1482
Approximate latitude	: 51° 14'
Approximate longitude	: 2° 27' W
Distance from source	: 0 - 1.0 km
Altitude	: 160 m

PHYSICAL CHARACTERISTICS

Width at survey	: 0.6 m
Depth at survey	: 20 cm
Height Board	: none
Water depth	: 10 cm
Bank full width	: 0.4 m
Bank full depth	: 7 cm
Discharge at survey	: 0.01 $m^3 s^{-1}$
Velocity at survey	: 0.2 m s^{-1}
Bed slope	: 20 - 45^0
Bed slope type	: riffle cascade
Relative Stream Power	: 1 - 2
Channel type	
Plan form	: slightly sinuous
Sinuosity now	: 2 - 7 m
Previous sinuosity	: probably not changed
Section	: bowl, trapezoid
Erosion state	: slight
Erosion type	: poached

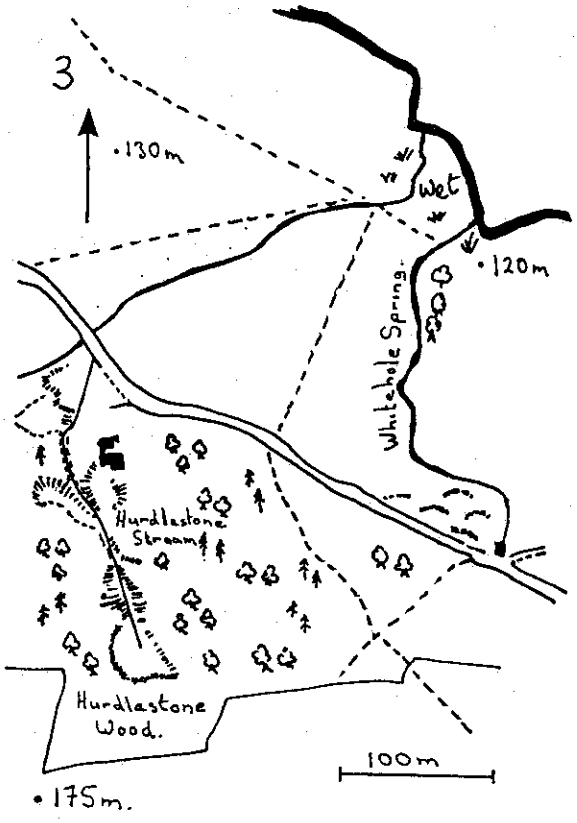

FIGURE 10

SUBSTRATUM COVER

	Bed	Banks	Adjacent
Bed rock	*?	*	*?
Boulders/cobbles	*	**	*
Pebbles/gravel	**	*	**
Sand	*	*	*
Silt/clay/(peat)	*//*	*//*	*//*

Tufa accretions and overfalls

ADJACENT FEATURES

Land use	: grazing
Upstream	: waste & road debris, road, disused quarry
Downstream	: wetland, river
Maintenance	: probably slight
Fish interest	: slight downstream

WATER CHARACTERISTICS

Kept at 3-5°C for analysis on 19.4.95

Colour : clear
Temperature : 9°C
Conductivity : 723µS cm^{-1},
pH : 7.2 (6.7)
Alkalinity : 5.52 mmol

Anions, mg l^{-1}		Cations, mg l^{-1}	
Alkalinity	259	Calcium	124
Nitrate N	2.3	Magnesium	7.9
Phosphate	0.012	Sodium	7.8
Silicate Si	2.8	Potassium	0.83
Ion balance	6.75 : 7.19 mmol		

Assessment: calcareous water, nitrate-rich, calcite precipitation expected (1)

PHYSICAL

Maintenance Factor +1

A very interesting set of tufa cascades flowing from seepage amongst old quarry waste pile under a road overflowing from the tufa-encrusted outlet water storage tank by a road. The steep (8°) upper channel is a poorly-defined partly-braided and poached channel of small cobbles and pebbles and flows to the measuring flume and then over a series of interesting steep cascades within a treeline, before flowing through the flatter more open wet area and entering the main river.

PLANTS

Shade 80%: Cover; algae -%, moss 2%, macrophytes 2% 1 + 3.5 = Score 4.5

In the upper channel section which is initially much trampled, is shaded by hazel etc with a sparse understorey of meadowsweet and other herbs together with many wall bryophytes, the water flows near a field margin of willow, thorn and bramble before entering a section of similar more mature bushes and trees. Although the wetland section is essentially similar to 2b, there is some rush and thistle to the more open west. However native butterbur, *Petasites*, is unusually common in an open area with thick wet organic soil.

ANIMALS

Score

See Section 1 for macro-invertebrate data.

No fish or fry were seen.

SUMMARY

The presence of the tufa cascades and small wetland area make a fairly ordinary field margin stream into a most interesting site.

OVERALL SCORE (FOR WATERCOURSE) : Poor/moderate

6.4.5 Site 4a Leigh Wood West Stream

LOCATION

Location name	: Leigh upon Mendip
Date	: 18.4.95
NGR	: 3684 1482
Approximate latitude	: 51° 14'
Approximate longitude	: 2° 27' W
Distance from source	: 0 - 0.25 km
Altitude	: 150 m

PHYSICAL CHARACTERISTICS

Width at survey	: 0.3 m
Depth at survey	: 10 cm (50 - 1)
Height Board	: none
Water depth	: 30 cm
Bank full width	: 0.7 m
Bank full depth	: 40 cm
Discharge at survey	: 0.01 $m^3 s^{-1}$
Velocity at survey	: 0.1 m s^{-1}
Bed slope	: 4^0
Bed slope type	: run
Relative Stream Power	: 1
Channel type	
Plan form	: slightly sinuous, part ditched
Sinuosity now	: slightly sinuous, straightened
Previous sinuosity	: see opposite
Section	: trapezoid
Erosion state	: 10% poached
Erosion type	: poached

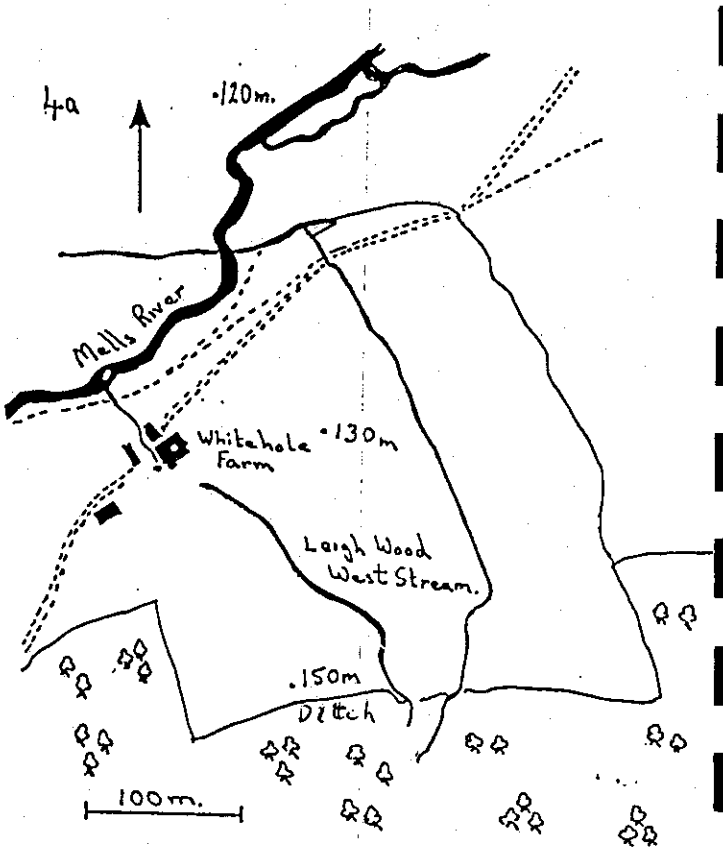

FIGURE 11

SUBSTRATUM COVER

	Bed	Banks	Adjacent
Bed rock			
Boulders/cobbles	*	*	*
Pebbles/gravel	**	**	*
Sand	**	**	**
Silt/clay/(peat)	*/*/*	*/*/	*/*/

ADJACENT FEATURES

Land use	: improved grazing, woodland
Upstream	: SSSI, woodland
Downstream	: farm, tracks, river
Maintenance	: rare
Fish interest	: nil

WATER CHARACTERISTICS

No sample. See site 4b below.

Colour	:
Temperature	:
Conductivity	:
pH	:
Alkalinity	:

Anions, mg l^{-1}	**Cations, mg l^{-1}**
Alkalinity	Calcium
Nitrate N	Magnesium
Phosphate	Sodium
Silicate Si	Potassium
Ion balance	

Assessment: See 4b.

Maintenance Factor 0

PHYSICAL

A very small stream arising near the downhill north edge of steep woodland, joined by small over-wide ditch from west and then flows downhill to the farm (80 m); there was a small weir with only 20 mm of water flowing over it.

PLANTS

Shade 60%: Cover; algae 0%, moss 1 %, macrophytes 0 % 0.5 + 1.5 = Score 2

Arising in beech woodland with some holly and dense understorey of bluebell, ransoms, celandine, wild daffodil (recheck). The ditch on the edge of the woodland contained large quantities of dead leaves and its banks were vegetated by several smaller herbs including wood sorrel, wood anemone, meadow sweet and some tussocks of grass including moor grass, with hawthorn and willow on field edge. The wet corner of this field separated by iron fence, had rush, buttercup but also bluebell, spurge, and kingcup. The stream bank downhill to the farm was an intermittent line of oaks about 15 m apart with a very dense 'impenetrable' thicket of thorn and hawthorn and occasional stands of wild rose particularly at the poached cattle drink (150 m) and also willow. There were more weedy species further downstream alongside the main pasture including daisy, thistle, buttercup, nettle.

Score

ANIMALS

See Section 1 for macro-invertebrate data.

Pheasants and moles.

SUMMARY

A small stream arising in woodland and flowing across moderately used farmland close to farm buildings (unviewed) and then into the Mells River.

OVERALL SCORE (FOR WATERCOURSE) : Poor

6.4.6 Site 4b Leigh Wood East Stream

LOCATION

Location name	: Leigh upon Mendip
Date	: 18.4.95
NGR	: 3685 1483
Approximate latitude	: 51° 14'
Approximate longitude	: 2° 27' W
Distance from source	: 0 - 0.25 km
Altitude	: 150 m

PHYSICAL CHARACTERISTICS

Width at survey	: 0.3 m
Depth at survey	: 10 cm
Height Board	: none
Water depth	: 30 cm
Bank full width	: 0.6 m
Bank full depth	: 30 cm
Discharge at survey	: 0.01 $m^3 s^{-1}$
Velocity at survey	: 0.1 m s^{-1}
Bed slope	: 4°
Bed slope type	: run
Relative Stream Power	: 1
Channel type	
Plan form	: slightly sinuous
Sinuosity now	: slightly sinuous, straightened
Previous sinuosity	: see opposite
Section	: trapezoid
Erosion state	: 10% poached
Erosion type	: poached

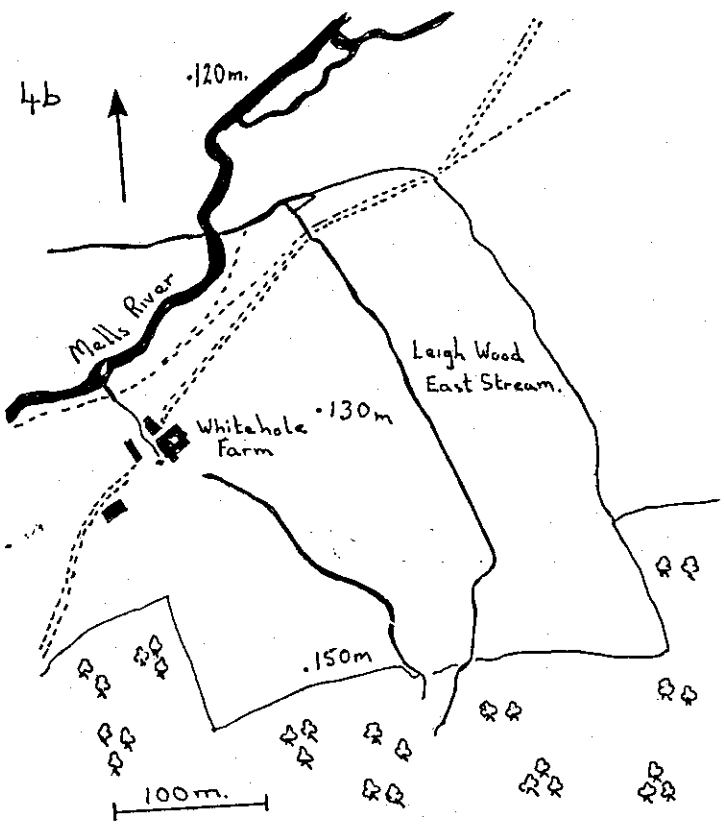

FIGURE 12

SUBSTRATUM COVER

	Bed	Banks	Adjacent
Bed rock			
Boulders/cobbles	*	*	*
Pebbles/gravel	**	**	*
Sand	**	**	**
Silt/clay/(peat)	*/*/*	*/*/*	*/*/*

ADJACENT FEATURES

Land use	: agricultural, improved grassland
Upstream	: SSSI, steep, deciduous woodland
Downstream	: track, main Mells River
Maintenance	: occasional
Fish interest	: nil

WATER CHARACTERISTICS

No sample. See site 4b below.

Colour	:
Temperature	:
Conductivity	:
pH	:
Alkalinity	:

Anions, mg l^{-1}	Cations, mg l^{-1}
Alkalinity	Calcium
Nitrate N	Magnesium
Phosphate	Sodium
Silicate Si	Potassium
Ion balance	

Assessment: nitrate-rich, calcareous water, calcite precipitation expected (0.3) but, surprisingly, tufa not seen.

PHYSICAL Maintenance Factor 0.5

A small stream (similar to 4a) arising on the lower slope of a steep woodland flowing in the upstream part as a distinct banked channel within tree line, but downstream it is crossed by farm track and becomes diffuse, wetter and muddy before entering the River Mells.

PLANTS

Shade 60 %: Cover; algae 1%, moss 1 %, macrophytes 0 % 0.5 + 1.5 = Score 2

The vegetation is similar to the adjacent stream (4a) when arising from the wood. The stream then flows initially as a mature channel with holly for 100 m before changing to include oak, alder, hawthorn with some bramble. Below the road there are signs of enrichment and weedy species are also present including dock and nettle.

ANIMALS Score

See Section 1 for macro-invertebrate data.

SUMMARY

A small stream arising in woodland and flowing across moderately used farmland with an enriched area near the banks of Mells River into which the stream flows.

OVERALL SCORE (FOR WATERCOURSE) : Poor

6.4.7 Site 5 Upper Soho Stream

LOCATION

Location name	: Leigh upon Mendip
Date	: 18.4.95
NGR	: 3696 1485
Approximate latitude	: 51° 14'
Approximate longitude	: 2° 26' W
Distance from source	: 0 - 0.6 km
Altitude	: 130 m

PHYSICAL CHARACTERISTICS

Width at survey	: 0.2 m
Depth at survey	: 1 cm
Height Board	: none
Water depth	: 1 cm
Bank full width	: 0.6 m
Bank full depth	: 20 cm
Discharge at survey	: 0.005 $m^3 s^{-1}$
Velocity at survey	: 0.05 m s^{-1}
Bed slope	: 0.5^0
Bed slope type	: -
Relative Stream Power	: 0 - 1
Channel type	
Plan form	: straightened
Sinuosity now	: -
Previous sinuosity	: not available
Section	: trapezoid
Erosion state	: 5%
Erosion type	: poached

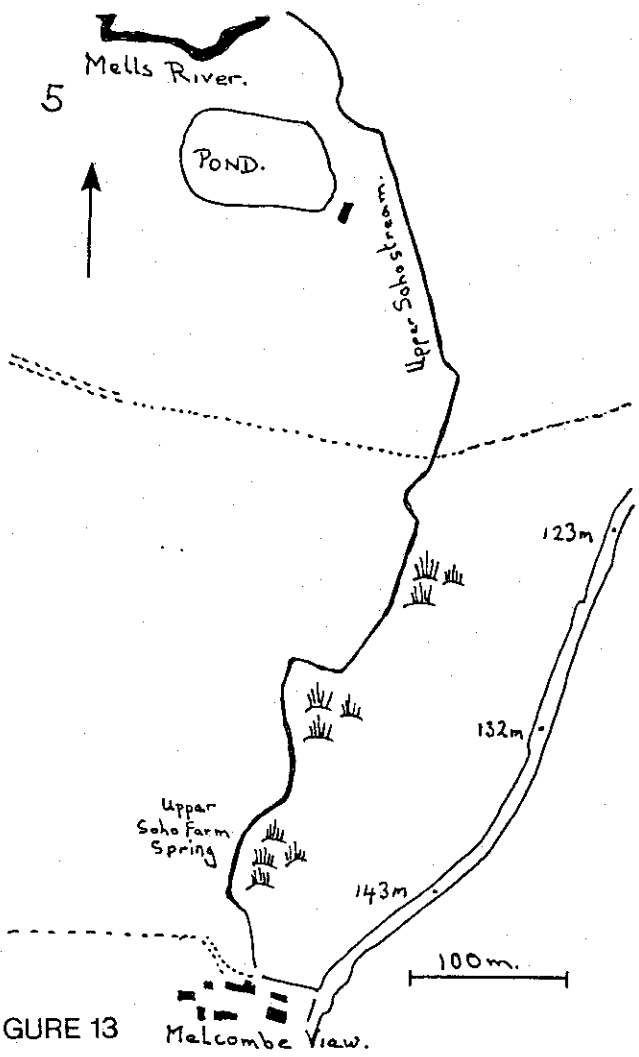

FIGURE 13

SUBSTRATUM COVER

	Bed	Banks	Adjacent
Bed rock			
Boulders/cobbles			
Pebbles/gravel	**	*	*
Sand	**	**	**
Silt/clay/(peat)	*/*/	*/*/	*/*/

ADJACENT FEATURES

Land use	: improved grazing, fishing lake
Upstream	: farm, grazing, roads, extraction
Downstream	: grazing, fishing access, woodland, river
Maintenance	: rare
Fish interest	: nil

WATER CHARACTERISTICS

No sample.

Colour	:
Temperature	:
Conductivity	:
pH	:
Alkalinity	:

Anions, mg l^{-1}	Cations, mg l^{-1}
Alkalinity	Calcium
Nitrate N	Magnesium
Phosphate	Sodium
Silicate Si	Potassium
Ion balance	

Assessment: None

PHYSICAL Maintenance Factor -1

A small pebble and silty farm stream arising in spring by farm flows along the hedge line and is supplemented by drainage, including land drains (eg @ 170 m), of sandy agricultural land and downstream made deeper except for the bends and then passes a fishing lake almost on the bank of the main Mells River . There are small wet areas in pasture, occasional land drains. There is a drinking trough upstream and a small weir at 300 m.

PLANTS

Shade 15 %: Cover; algae -%, moss 2 %, macrophytes 5 % 0.5 + 2 = Score 2.5

Small managed hedges are alongside the stream for most of its length. Upstream a treeline of mature and young alder with ash were seen together with an understorey of hawthorn, thorn, wild rose, honeysuckle, ivy and bramble with rush, cress, wood anemone, and some bank mosses but also weedy species such as nettle, dandelion, buttercup, dock, thistle, behind barbed-wire fences mainly to the west. Downstream areas of cleared woodland stream banks with over-maintained hedges and grassy banks but which still had rose, primrose and bluebell as remnant vegetation.

The turbid water of the lake made it difficult to see if there was any submerged vegetation of significance.

ANIMALS Score

See Section 1 for macro-invertebrate data.

Fishing lake. Score

WET AREAS

The wet area (200-250 m) was small probably only seasonal but it was vegetated with wetland species such as rush and lady's smock, but also thistle and spathulate dock.

SUMMARY

A small stream arising near farm (unviewed) and flowing across moderately used farmland and flowing into the Mells River past a fishing lake.

OVERALL SCORE (FOR WATERCOURSE) : Poor

6.4.8 Site 6 Finger Stream West

LOCATION

Location name	: Mells Park
Date	: 18.4.95
NGR	: 3713 1481
Approximate latitude	: 51° 14'
Approximate longitude	: 2° 24' W
Distance from source	: 2.8 - 3.3 km
Altitude	: 120 m

PHYSICAL CHARACTERISTICS

Width at survey	: 0.7 - 1.5 m
Depth at survey	: 15 cm
Height Board	: Downstream
Water depth	: 15 cm
Bank full width	: 2 m
Bank full depth	: 1 m

Resectioned, realigned natural channel then artificial

Discharge at survey	: 0.01 $m^3 s^{-1}$
Velocity at survey	: 0.5 m s^{-1}
Bed slope	: 2° then 3m cascade
Bed slope type	: artificial
Relative Stream Power	: 1
Channel type	
Plan form	: straightened
Sinuosity now	: straightened
Previous sinuosity	: see opposite
Section	: bowl, trapezoidal, rectangular
Erosion state	: none
Erosion type	: -

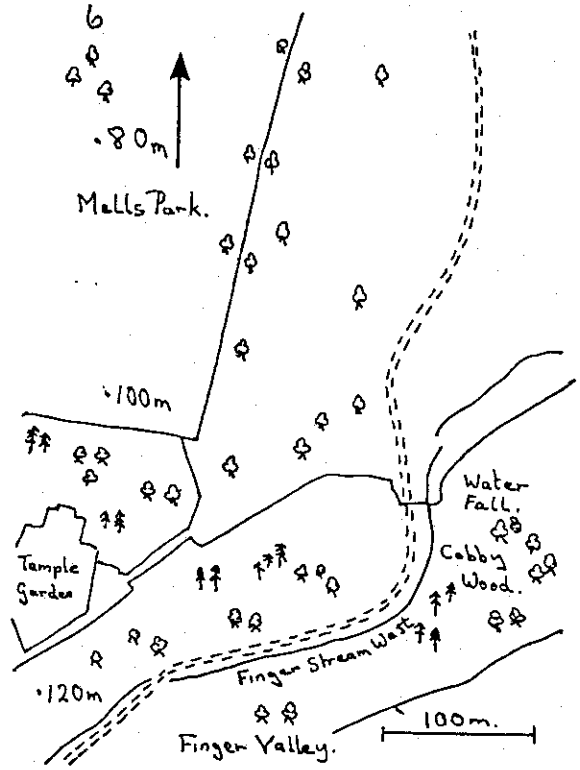

FIGURE 14

SUBSTRATUM COVER

	Bed	Banks
Bed rock		
Boulders/cobbles	**	***
Pebbles/gravel	***	**
Sand	*	*
Silt/clay/(peat)		
Concrete channel liner		

ADJACENT FEATURES

Land use	: road, park, plantation
Upstream	: plantation, road, farm buildings
Downstream	: grazing, parkland, road
Maintenance	: minimal
Fish interest	: low

WATER CHARACTERISTICS

Kept at 3-5°C for analysis on 19.4.95

Colour	: clear
Temperature	: 8°C
Conductivity	: 643µS cm^{-1},
pH	: 8.1 (8.0)
Alkalinity	: 5.18 mmol

Anions, mg l^{-1}		Cations, mg l^{-1}	
Alkalinity	259	Calcium	124
Nitrate N	2.3	Magnesium	7.9
Phosphate	0.012	Sodium	7.8
Silicate Si	2.8	Potassium	0.83
Ion balance	6.75 : 7.19 mmol		

Assessment: nutrient-rich calcareous water, calcite precipitation probable (0.9).

PHYSICAL Maintenance Factor -2.5

A small realigned fine-gravel stream flowing as a long riffle alongside a gravel track as a Victorian ride and then feeds a 0.7 m wide & deep channel ending in a 3-4 m high artificial waterfall and cascade as a Victorian feature before continuing downstream with an adjacent path, to the Mells River.

PLANTS

Shade 15%: Cover; algae 40%, moss 10%, macrophytes 5% 3 + 3 = Score 6

The upstream resectioned channel contained several aquatic and marginal plants including Fools cress, dropwort, meadow sweet, meadow-rue, lichen, some algae (*Cladophora*); the valley sides, banks and the road side were grassy and vegetated with primrose, spurge, etc., under lines of planted beech, and backed with a variety of deciduous trees.

The main artificial channel was dominated by immense stands of the underwater red algae *Lemanea*. [Whether or not this should be considered rare or just interesting, is uncertain and needs further investigation.] Further downstream the banks were a mono-specific stand of ransoms and backed by spruce plantation.

ANIMALS Score

See Section 1 for macro-invertebrate data.

Squirrel

SUMMARY

A modified and artificial section feeding a waterfall but whose conditions have selected for the dominance of unusual or uncommon flora

ADVICE

Establish significance of site before further investigation.

OVERALL SCORE (FOR WATERCOURSE) : (Poor)

6.4.9 Site 7a Chantry Springs

LOCATION

Location name	: Whatley
Date	: 18.4.95
NGR	: 3718 1472
Approximate latitude	: 51° 13'
Approximate longitude	: 2° 24' W
Distance from source	: 0 - 0.2 km
Altitude	: 150 m

PHYSICAL CHARACTERISTICS

Width at survey	: 0.5 m
Depth at survey	: 3 cm
Height Board	: none
Water depth	: 3 cm
Bank full width	: 1.5 m
Bank full depth	: 60 cm
Discharge at survey	: 0.01 $m^3 s^{-1}$
Velocity at survey	: 0.1 m s^{-1}
Bed slope	: 0^0
Bed slope type	: N/A
Relative Stream Power	: 0
Channel type	
Plan form	: straightened
Sinuosity now	: N/A
Previous sinuosity	: N/A
Section	: trapezoid
Erosion state	: 0%
Erosion type	: -

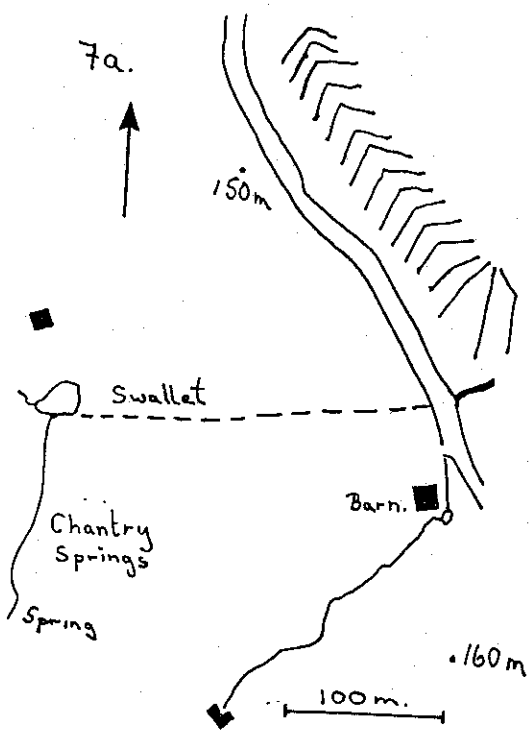

FIGURE 15

SUBSTRATUM COVER

	Bed	Banks	
Bed rock			
Boulders/cobbles	*	*	
Pebbles/gravel	**	**	*
Sand	*	*	**
Silt/clay/(peat)	*/*/	*/*/	*/*/

ADJACENT FEATURES

Land use	: agricultural (crucifers), grazing
Upstream	: tilled land
Downstream	: pond, hedge, improved grazing, farm buildings
Maintenance	: straightened, occasional
Fish interest	: nil

WATER CHARACTERISTICS

No sample.

Colour	:
Temperature	:
Conductivity	:
pH	:
Alkalinity	:

Anions, mg l^{-1}	**Cations, mg l^{-1}**
Alkalinity	Calcium
Nitrate N	Magnesium
Phosphate	Sodium
Silicate Si	Potassium
Ion balance	

Assessment: None

PHYSICAL Maintenance Factor -1

A small source arising inside small well house containing water pipes, cisterns etc., filling a water trough between two fields and then flowing 150 m down a small sandy stream with woody debris alongside a hedge to the west before passing a pond with weir board and then disappearing underground down a 'swallet'.

PLANTS

Shade 30%: Cover; algae 2%, moss - %, macrophytes 5 % 0.5 + 2.5 = Score 3

A partially tree shaded building submerged in vegetation with trees of oak, ash, thorn and under a tangle of weedy species dominated by bramble with also dock, nettle, densely shading the stream bed itself upstream but with burdock, deadnettle, chamomile, hairy willowherb, dogs mercury, bluebell, etc. downstream in less densely shaded areas. Many unknown seedling on wet stream margins.

ANIMALS Score

See Section 1 for macro-invertebrate data.

Grouse

SUMMARY

A spring in agricultural land.

OVERALL SCORE (FOR WATERCOURSE) : Poor

6.4.10 Site 7b Whatley Brook (Chantry East)

LOCATION

Location name	: Whatley
Date	: 18.4.95
NGR	: 3718 1472
Approximate latitude	: 51° 13'
Approximate longitude	: 2° 24' W
Distance from source	: 0 - 0.5 km
Altitude	: 130 m

PHYSICAL CHARACTERISTICS

Width at survey	: 0.5 m
Depth at survey	: 2 cm
Height Board	: none
Water depth	: 2 cm
Bank full width	: 3.0 m
Bank full depth	: 1.5 m
Discharge at survey	: 0.01 $m^3 s^{-1}$
Velocity at survey	: 0.1 m s^{-1}
Bed slope	: 2^0
Bed slope type	: long riffle
Relative Stream Power	: 1 - 2
Channel type	
Plan form	: straightened
Sinuosity now	: slight
Previous sinuosity	: N/A
Section	: trapezoid
Erosion state	: 0%
Erosion type	: -

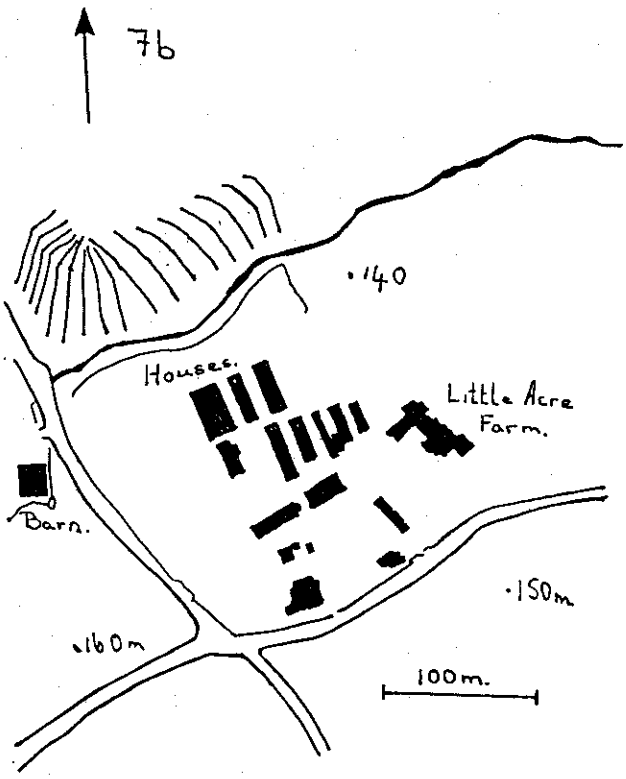

FIGURE 16

SUBSTRATUM COVER

	Bed	Banks	
Bed rock			
Boulders/cobbles	*	*	
Pebbles/gravel	**	**	*
Sand	*	*	**
Silt/clay/(peat)	*/*/	*/*/	*/*/

ADJACENT FEATURES

Land use	: grazing, farm buildings
Upstream	: bridge, embanked road, footpath & gate
Downstream	: gardens
Maintenance	: occasional
Fish interest	: low

WATER CHARACTERISTICS

No sample.

Colour	: brown
Temperature	:
Conductivity	:
pH	:
Alkalinity	:

Anions, mg l^{-1}	**Cations, mg l^{-1}**
Alkalinity	Calcium
Nitrate N	Magnesium
Phosphate	Sodium
Silicate Si	Potassium
Ion balance	

Assessment: None

PHYSICAL Maintenance Factor 1

A small stream arising near agricultural building flowing under road and in a narrow valley between new house gardens and an extensive high earth screening embankment (20 m) planted with whips and surrounded by a large-mesh and barbed wire fence.

PLANT

Shade 30%: Cover; algae 2%, moss - %, macrophytes 5 % 0.5 + 2+ = Score 2.5+

The steep margins of the stream in the sandy valley was vegetated by a line of maturing sycamore with holly, ash, hawthorn and elder with bramble, nettle and buttercup underneath together with primrose, lords & ladies, and surprisingly, growing out of an area in which much domestic debris including a TV had been dumped, a nice colony of **broomrape**. This is uncommon and an unusual bankside plant and is a probably a species *Orobanche hederae* Duby. which is saprophytically associated with ivy which was present at the site and could have been the host.

ANIMALS Score

See Section 1 for macro-invertebrate data

SUMMARY

Small agricultural stream alongside a limestone quarry.

OVERALL SCORE (FOR WATERCOURSE) : Moderate

Table 9. **Genera of flora** noted during surveys on springs, streams and wet areas of the Mells River system.

(key: + = present; number = number of species in genera found; letters = short form of particular species; tr = trace; ? = not seen at vegetation survey but reported at another time by another surveyor; * = introduced alien species)

Site	1	2a	2b	3	4a	4b	5	6	7
TREES/BUSHES									
Acer p/c		+							+
Aesculus		+							
Alnus	+	+	+	+		+	+	+	
Betula	+								
Corylus	+	+	+	+					
Crataegus			+		+	+	+		
Fagus	++	++	+	+				+	
Fraxinus							+	+	+
Ilex	+	+	+		+	+			+
Kerria*									
Larix								+	
Ligustrum									
Prunus			+		+		+		
Quercus	+	+	+		+	+		+	
Rosa			+		+		+		
Salix	c		+	+	+			+	
Sambucus			+					+	+
Sorbus		+							
AQUATIC MACROPHYTES									
None present at time of survey									
FILAMENTOUS ALGAE									
Indeterminate taxon								+	
MARGINALS, BANK & OTHER HABITAT SPECIFIC FLORA									
Allium	+	++	+	+			+		
Agrimonia			+						
Ajuga	+								
Anemone	+	+	+	+	+		+	+	
Apium								+	
Arctium								+	
Arum	+	+	+				+	+	+
Bryophytes (bank)		+	++				+	+	
Caltha		+			+				
Cardamine			+				+		
Carex p/r			+						
Epilobium h/ang			h					h	
Eupatorium					+				
Euphorbia	2		+					+	
Fragaria	+								
Hedera		+	+		+		+	+	+
Hyacinthoides	+	++	+	+		+	+		
Juncus	2		++	+	+		+		
Lonicera	+						+	+	
Luzula	+								

Table 9 (continued)

Site	1	2a	2b	3	4a	4b	5	6	7
MARGINALS, BANK & OTHER HABITAT SPECIFIC FLORA (continued)									
Mentha	+	+							
Mercurialis	+	++	+	+		+		+	
Molinia					+				
Oenanthe cr			+					+	
Orobanche (h)									+
Osmunda	+								
Oxalis	+	+			+				
Nasturtium							+		
Petasites				+					
Potentilla	+								
Primula	+						+	+	+
Pteridophytes	p/d	p						+	
Ranunculus f	f	f	f	f	f				
Scrophularia	+								
Stachys	+								
Teucrium		+							
Ulmeria	+	+	+	+				+	
F. Umbelliferae		+	3						
Veronica a/b	b								
Viola	+								
WIDESPREAD RUDERALS, AGRICULTURAL & WEED SPECIES									
Bellis					+				
Cirsium				+	+		+		
Lepidium	+								
Matricaria								+	
Medicago						+			
Rubus fr/id	f	f	2	f		f	f	f	f
Rumex a/?						+	+	+	
Ranunculus	+		+		+		+		
Solidago									
Urtica			+		+	+	+	+	
Taraxacum							+		
Indeterminate seedlings									+
Vicia			+						

7 CONCLUSIONS - BOTANICAL AND HABITAT

The middle stretch of Bector Wood stream, downstream of the road, and the other streams to the east, i.e. Leigh Wood East and West streams, despite arising in environmentally interesting and relatively undegraded areas, are typical of less intensively utilised agricultural areas. In comparison the lowest part of Bector Wood stream and the lower White Hole Farm stream are judged to be of better quality due to the presence of the small riparian calcareous wetland, i.e. fen. The latter have far more frequently been lost to pasture development or to ploughing than those in more acid water areas.

The Upper Soho watercourse is a typical stream of an agricultural area. It collects runoff in the area of the farm buildings and also drains the pasture and its small wet areas.

Finger Stream West at Mells Park is very artificial with the middle section modified to flow in part along the valley side and not the valley bottom, before returning to a more natural channel.

Chantry West Springs are of interest for although they arise in a modified system and flow alongside an agricultural hedge, they fall down a `swallet' near an artificial pond. Additional water also rises from Chantry Springs East near the farm buildings and soon enlarges the channel as it flows more steeply to form a tributary of the Whatley Brook. The character of the watercourse is influenced by the presence of the screening bank to the north and by the tipping of rubbish from the south.

The vegetation of the streams, in general, strongly reflects the calcareous nature of the rock, although no vascular aquatic plants were found. The steep woodlands of both Hurdlestone, Bector and Leigh Wood are of high environmental interest although in the past they have been degraded by quarrying. Such changes have led, however, to greater habitat variety although this does not seem to have increased the total variety of vegetation present. Of special interest must be the large stands of bluebell, anemone, and ransoms which should be protected.

Between Bector Wood and White Hole Farm stream, the wetland has a good community of butterbur, the significance of which needs to be established at the local, county and regional level. Similar assessments should be made with the less usual stand of broomrape some tens of metres downstream of the bridges on the Chantry East tributary of the Whately Brook system. The filamentous red algae, *Lemanea*, seems to have become dominant at Finger Stream West because of the specific conditions of the artificial section of channel.

River Habitat Surveys were undertaken as an additional item because there is a considerable momentum behind this new methodology which is likely to become a nationally applied technique for providing an appropriate context by which to judge stream and river quality. Although still in development for NRA, 3,000 of the proposed 4,500 reference sites have been surveyed in 1994 and 1995, together with the addition of about 700 sites from special surveys. Although the details of the results are not presented in this report, they were taken into consideration when arriving at the biomorphic scores. The sites surveyed so far near Mells River indicate that the woodland source streams will lie in the upper of five quality band whereas those in agricultural land will be second or third band and will thus retain their own special interest status.

SECTION 3 - FISH SURVEY

8. METHODS - FISH

8.1 Brown trout

Where electric fishing was possible, all streams were fished on 27 June 1995 using an IFE/Deka battery operated electric fisher with a single anode. If fish were present, a length of stream was confined within stop nets, and fished twice. The absolute numbers of fish captured were used to estimate the number and density of brown trout within each section, as no fish were ever caught on the second fishing. The limit of fish distribution in each stream was determined by continuous sampling in an upstream direction until no fish were found for 100 m, or until it became obvious that the stream could no longer support fish i.e. the stream bed was dry.

The fork length (FL) of all fish captured were measured to the nearest mm, and scales were taken for age analysis.

Specifically at each site the following operations were carried out.

8.1.1 Bector Wood

To improve the estimate of density of over the whole stream length three short sections were electric fished. One of these was above the road culvert and two were between the culvert and the confluence with the River Mells. The dimensions of these sections are shown in Table 1.

8.1.2 Whitehole Farm Spring

This stream was electric fished continuously for 150 m above the impassable tufa cascade.

8.1.3 Leigh Wood East Spring

The stream bed was dry, and was not sampled.

8.1.4 Finger Valley Stream

The stream bed was dry, and was not sampled.

8.1.5 Chantry Springs Watercourse

This stream was electric fished continuously for 500 m above its confluence with the Whatley Brook, and then at 50 m intervals, until it passed under the road bridge at Little Acre Farm.

8.2 Crayfish

A hand search over 25 m of stream bed was made for crayfish in the Bector Wood stream. In addition, any crayfish observed during the electric fishing were captured. All crayfish were identified to species on site and released unharmed.

9 RESULTS - FISH

9.1 Brown trout

9.1.1 Bector Wood

Three brown trout were captured in total over the three sections electric fished in this stream. One of those trout was in the 0+ age group and the other two were 1+. The density of trout in the three sections ranged from 0 to 0.06 fish per m^2. A number of other 0+ trout were observed at low densities above the road bridge out side the limits of the stop netted sections. The upstream limit of trout distribution was found to be approximately 200 m above the road bridge and is shown in Figure 17.

Table 10. The dimensions of the three sections electric fished on the Bector Wood Stream together with the density of fish in each section.

	Length (m)	Average Width (m)	Total Area (m^2)	No. of Trout	Density (n/m^2)
Section 1	52	0.61	31.7	2	0.06
Section 2	34	0.49	16.7	0	0
Section 3	45	1.02	45.9	1	0.02

Table 11. Number, length and age of brown trout captured by electric fishing in three sections of the Bector Wood Stream.

	Species	Number	Length (cm)	Age (yr)
Section 1	Brown Trout	2	8.2	1+
			10.6	1+
Section 2	Brown Trout	0	-	-
Section 3	Brown Trout	1	4.9	0+

9.1.2 Whitehole Farm Spring

No fish were found above the impassable tufa cascade.

9.1.3 Chantry Springs Watercourse

No juvenile fish were found in this stream. The only fish found was an adult brown trout 27.9 cm in length (age 4+) in a small plunge pool at the location indicated in Figure 2. This fish appeared to be trapped and movement, up or downstream, did not look possible with the water at its current level. Despite this, its condition was good and it was returned to the same pool.

9.2 Crayfish

No crayfish were found in the Bector Wood stream. One large (10 cm) adult female native white-clawed crayfish was caught during the electric fishing of the Chantry Spring Watercourse. Its location was approximately 100 m above the confluence with the Whatley Brook (Fig 18).

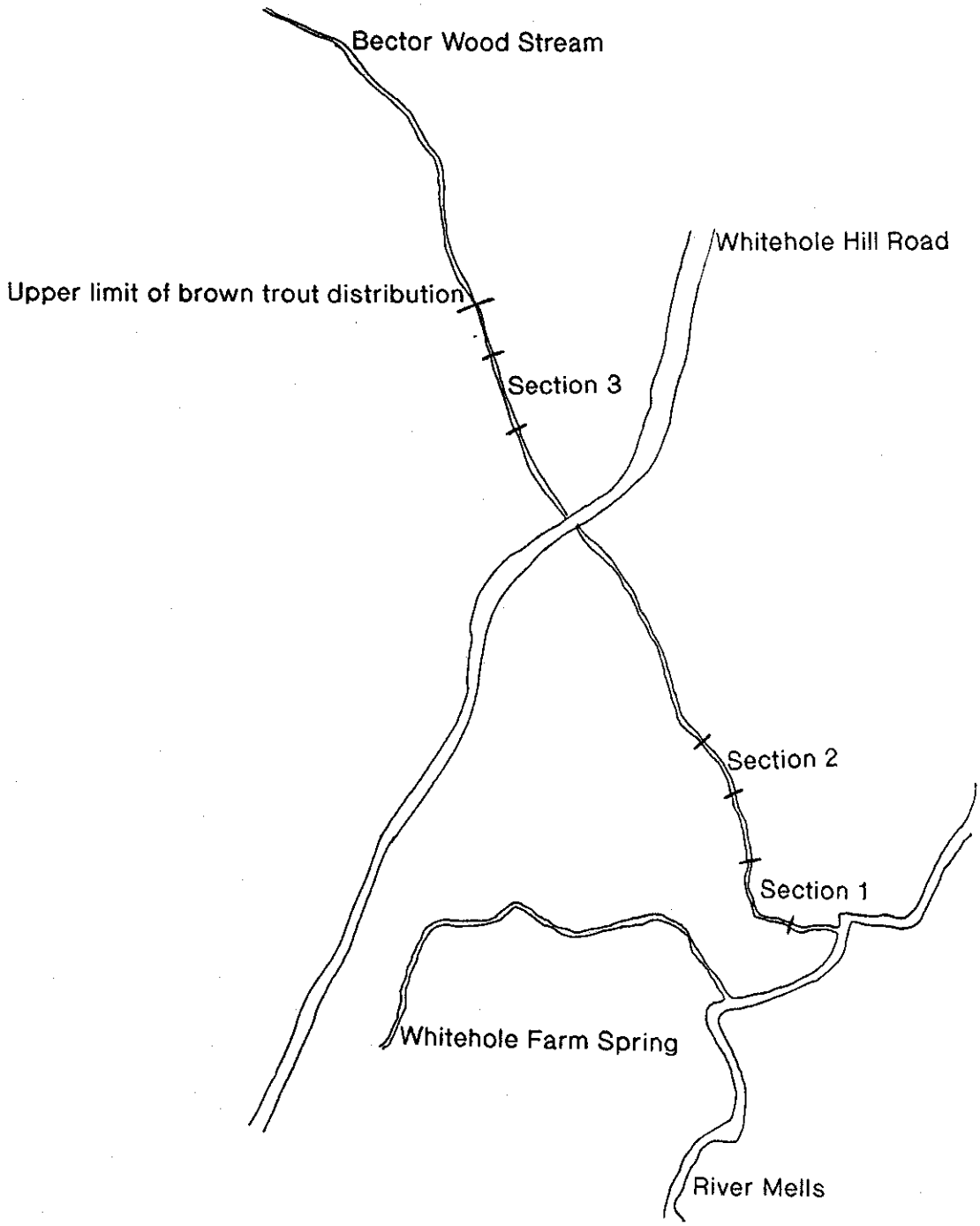

FIGURE 17 Map of the Bector Wood Stream showing the locations of the three sections electric fished and the upstream limit of the brown trout distribution.

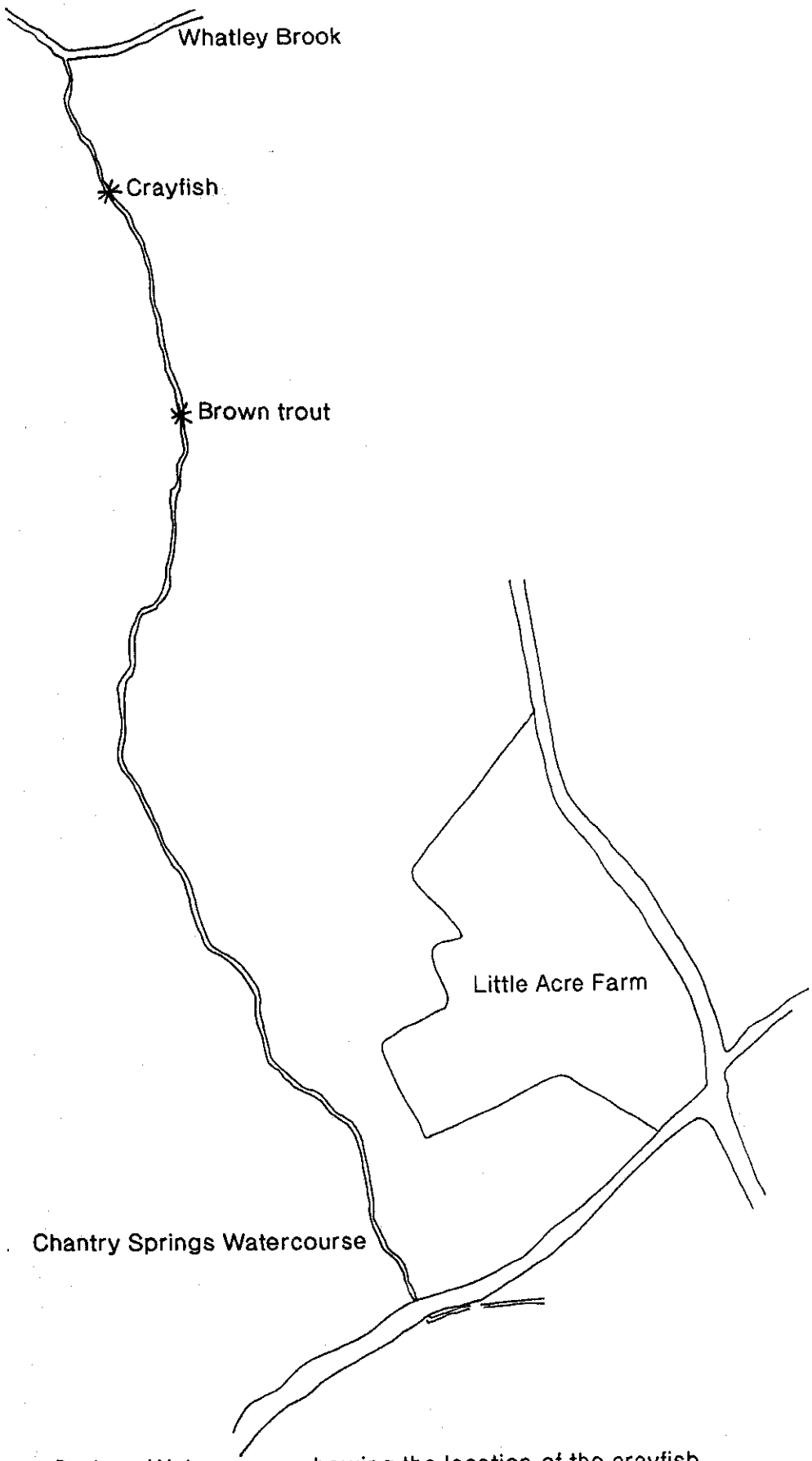

FIGURE 18 Map of the Chantry Springs Watercourse showing the location of the crayfish and brown trout captured.

10 DISCUSSION - FISH

10.1 Brown trout

The low density of brown trout (0 - 0.06 fish/m^2) in the Bector Wood Stream and the Chantry Springs Watercourse suggests that they are marginal habitats for this species. By comparison, average densities of salmonid fish derived from published literature give values of approximately 0.15 fish/m^2 for 10 cm fish and 1.5 fish/m^2 for 4 cm fish (Allen 1969). Both these streams were very small and had limited areas for spawning and juvenile recruitment. Migration in and out by adults appeared to be restricted by the large number of debris dams, as evidenced by the trapped adult in the Chantry Spring Watercourse.

Multiplying the density of juvenile fish found in the three sections of the Bector Wood Stream with the total area of the stream gives an estimate of between 10 and 20 fish for the whole brown trout population of that stream. This may be an underestimate since some of the fish may have already migrated to the main river, but it does give a good impression of the small contribution this stream makes to the main river population.

The two dry streams, Leigh Wood East Spring and Finger Valley Stream, may make some contribution to main river populations through the provision of spawning and incubation habitat. Clearly to do this they must be running from the period of spawning (December/January) to the stage when the eggs have hatched and the alevins have emerged from the gravel (April). By far the most significant of these two is the Finger Valley Stream. Drying out of the river bed after April will cause high mortality of juveniles as they become stranded, but a significant number of juveniles have been shown to migrate from other drying streams (Avon & Dorset River Authority, 1973), and a similar migration may occur here. The fate of these migrants is not known, but it is likely that their mortality will be greater the earlier such migration occurs.

The other dry stream, namely the Leigh Wood East Spring, had a similar channel size to the Bector Wood Stream and was therefore likely to be of similar importance to that stream.

The Whitehole Farm Spring, has no brown trout population above the impassable tufa cascade, and therefore has no importance to local or main river populations.

10.2 Crayfish

The native white-clawed crayfish is a protected species under Schedule 5 of the Wildlife and Countryside Act 1981. This means that it cannot be intentionally killed, injured, taken or sold. It would also contravene this act to intentionally disturb them in, or damage their places of shelter.

The presence of the one white-clawed crayfish in the Chantry Springs Watercourse demonstrates the presence of this species in the River Mells catchment. There is a requirement not to intentionally damage the habitats they are present in. Thus, at the very minimum, flow in the Chantry Springs Watercourse will need to be maintained to imitate natural conditions.

Crayfish have particular requirements for water chemistry, and are only found in waters with a pH of between 7 and 9 (Lowery 1988). Calcium is a pre-requisite for calcification of the exoskeleton and moulting is seriously impeded at calcium concentrations below 5 mg/l (Greenaway 1974), although it is possible that concentrations may need to be as much as 7.8 mg/l (Jay & Holditch, 1981). Growth of crayfish can only occur at temperatures above 10°C (Pratten 1980). Any water used for augmentation of streams containing crayfish will need to conform to these requirements. This should not be a cause for concern, as locally derived water should be of suitable quality.

Permanent populations of crayfish cannot exist in the two dry streams, Leigh Wood East Spring and the Finger Valley Stream. Augmentation of these streams with the correct quality of water may result in colonisation from any main river populations.

11. REFERENCES

Alderson, R. (1969)
Studies on the larval biology of caddis flies of the family Psychomyiidae. Unpublished Ph.D Thesis, University of Wales.

Allen K.R. (1969) Limitations on production in salmonid populations in streams. In: *Symposium on salmon and trout in streams* (Ed. T.G. Northcote) pp. 3-18. Blackwell Scientific Publications.

Armitage, P.D., Moss, D., Wright, J.F. & Furse, M.T. (1983)
The performance of a new biological water quality score system based on macro-invertebrates over a wide range of unpolluted running-water sites, *Water Research* **17**, 333-347.

Avon & Dorset River Authority (1973) Upper Wylye investigation. *Report of the Avon & Dorset River Authority*. pp 120.

Ball, S.G. (1986)
Terrestrial and Freshwater Invertebrates with Red Data Book, Notable or Habitat Indicator Status. Invertebrate Site Register Report No. 66 Peterborough: Nature Conservancy Council.

Biological Monitoring Working Party (1978)
Final report: Assessment and presentation of the biological quality of rivers in Great Britain. December 1978. Unpublished report, Department of the Environment, Water Data Unit, 37 pp.

Blackburn, J.H. and Forrest, M.B. (1995)
New records of *Hydropsyche saxonica* McLachlan (Trichopt., Hydropsychidae) from small streams in Great Britain, Entomologist's Monthly Magazine 20th March, 1995 Vol.131.

Brindle, A. (1964)
Taxonomic notes on the larvae of British Diptera. No. 17 - The Clitellarinae (Stratiomyidae), *The Entomologist*, 97, 134-135

Chesters, R.K. (1980)
Biological Monitoring Working Party. The 1978 national testing exercise. Department of the Environment, Water Data Unit, Technical Memorandum 19, 1-37.

Clarke, R.T., Furse, M.T. and Wright, J.F. (1992)
A comparison of single, paired and 3 season combined macro-invertebrate samples for the biological banding of river quality. A report (R&D Document 243/2/Y) to the National Rivers Authority, R&D Project 243.

Edington, J.M. and Hildrew, A.G. (1981)
A key to the caseless caddis larvae of the British Isles with notes on their ecology. Freshwater Biological Association Scientific Publication No. 43

Friday, L.E. (1989)

A key to the adults of British Water Beetles, Field Studies 7, 1-151.

Fritsch, F.E. (1950)
Phormidium incrustatum (Naeg.) Gom., an important member of the lime encrusted communities of flowing water. *Biol. Jaarb.* 70, 27-39.

Furse, M.T., Symes, K.L., Winder, J.M, Clarke, R.T., Blackburn, J.H., Gunn, R.J.M, Grieve, N.J., and Hurley, M. (1995)
The faunal richness of headwater streams: Stage 3 - Impact of agricultural activity Volume 1 Main Report, Volume 2 Appendices. National Rivers Authority R&D Note 392, NRA: Bristol.

Furse, M.T., Winder, J.M., Symes, K.L., and Clarke, R.T., Gunn, R.J.M, Blackburn, J.H. and Fuller, R.M. (1993)
The faunal richness of headwater streams. Stage 2 - Catchment Studies. Volume 1 Main Report, Volume 2 Appendices. National Rivers Authority R&D Note 221, NRA: Bristol.

Furse, M.T., Winder, J.M., Symes, K.L., and Clarke, R.T. (1991)
The faunal richness of headwater streams. A preliminary report (R&D Document 08Y) to the National Rivers Authority by the Institute of Freshwater Ecology, R&D Project 242. [NRA publication reference P-96]

Furse, M.T., Wright, J.F., Armitage, P.D. and Moss, D. (1981)
An appraisal of pond-net samples for biological monitoring of lotic macro-invertebrates. *Water Research* 15, 679-689.

Furse, M.T., Moss, D., Armitage, P.D. and Gunn, R.J.M. (1986)
A practical manual for the classification and prediction of macro-invertebrate communities in running water in Great Britain, pp147, FBA River Laboratory, East Stoke, Wareham.

Greenaway P. (1974) Calcium balance at the post-moult stage of the freshwater crayfish Austropotamobius pallipes (Lereboullet). *Journal of Experimental Biology*. **61**. 35-45.

Holland, D.G. (1972)
A key to the larvae, pupae and adults of the British species of Elminthidae, Freshwater Biological Association Scientific Publication No. 26.

Jay D. and Holditch D.M. (1981) The distribution of the crayfish, Austropotamobius pallipes, in British waters. *Freshwater Biology*. **11**. 121-129.

Lowery R.S. (1988) Growth, moulting and reproduction. In: *Freshwater crayfish: biology, management and exploitation* (Eds. D.M. Holditch and R.S. Lowery) pp. 83-113. Croom Helm, London.

Pratten D.J. (1980) Growth in the crayfish Austropotamobius pallipes (Crustacea, Astacidae). *Freshwater Biology*. **10**. 401-412.

Tapia, G. and Furse, M.T. (in preparation)

3. RESULTS - MACRO-INVERTEBRATES

3.1 Species lists

The full range of aquatic macro-invertebrate taxa identified in the samples from the nine Mells River streams and flushes for both seasons is listed in Appendix 2. One hundred and twelve separate taxa were recorded. The distribution of the taxa for the 24 spring sampling sites is presented in Appendices 3 and 4, and the distribution of the taxa for the five summer sample sites is shown in Appendix 5. Individual taxon lists for each site in spring can be seen in Appendices 6 - 28, and for each summer sampling site in Appendices 29 - 33. The majority of these species are typically associated with headwater streams within 2.5 km of their source.

3.2 Species of special interest

There are several species of special interest Five notable and one vulnerable (Red Data Book 2) species were identified from the Mells River streams. These are listed below.

Table 2 Species of national conservation status from Mells River Springs

Coleoptera (beetles)	
Hydraena nigrita Germar	Notable b
Riolus subviolaceus (Muller)	Notable b
Trichoptera (caddis-flies)	
Rhyacophila septentrionis McLachlan	Notable
Tinodes unicolor (Pictet)	Notable
Tinodes dives (Pictet)	Notable
Diptera (true flies)	
Oxycera pardalina (Meigen)	Vulnerable

3.2.1 Status levels

The definitions of the different status levels assigned to organisms are given in Appendix 34. The categories are: extinct, endangered (Red Data Book 1), vulnerable (Red Data Book 2), rare (Red Data Book 3), insufficiently known (Red Data Book K), notable, regionally notable (NR), local, and common.

The category "notable" describes taxa which do not fall within Red Data Book categories 1-3 but which are nonetheless scarce in Great Britain and thought to occur in fewer than a hundred 10 km squares of the National Grid. For some well-recorded groups of invertebrates `notable' has been subdivided into 'notable A' (thirty or fewer 10 km squares) and `notable B' (thirty-one to one hundred 10 km squares), but this has not been attempted for Trichoptera.

`Vulnerable' (Red Data Book 2) describes taxa likely to move into the endangered category (present in five or fewer 10 km squares) in the near future if causal factors continue to operate. It includes taxa of which most or all of the populations are decreasing and those with populations which are still abundant but are under threat from serious adverse factors

Longitudinal zonation of macro-invertebrate assemblages in the first kilometre of headwater streams.

Wallace, I.D. (1991)
A Review of the Trichoptera in Great Britain. Research and Survey in Nature Conservation, No. 32. Peterborough: Nature Conservancy Council.

Wells, S.M., Pyle, R.M. and Collins, N.M. (1983)
The IUCN Invertebrate Red Data Book. Gland: International Union for Conservation of Nature and Natural Resources.

APPENDIX 1 ENVIRONMENTAL VARIABLES FOR MELLS RIVER SPRINGS SUMMER SAMPLING SITES

SITE	ALT	SLP	DCH	DST	WID	DEP	BCB	PGR	SND	SCL	MTP	TRG	LAT	LNG
1. HURDLESTONE	150	200	1	0.05	0.37	1	0	15	20	65	10.30	12.40	51.22	2.45
2. BECTORWOOD	125	100	1	0.75	0.55	7	0	20	30	50	10.30	12.40	51.22	2.45
3. WHITE HOLE FARM	125	200	1	0.25	0.74	4	7	7	14	72	10.30	12.40	51.22	2.45
4. LEIGH WOOD WEST	140	100	1	0.05	0.00	0	0	5	5	90	10.30	12.41	51.22	2.45
5. LEIGH WOOD EAST	125	100	1	0.25	0.00	0	15	40	5	40	10.29	12.41	51.23	2.45
6. LOWER SOHO FARM	125	66.6	1	0.10	0.00	0	0	50	0	50	10.28	12.43	51.23	2.43
7. FINGER STREAM WEST	115	25	1	1.50	0.00	0	10	90	0	0	10.27	12.46	51.22	2.40
8. CHANTRY EAST	150	50	1	0.05	0.40	3.7	0	10	0	90	10.27	12.47	51.22	2.40
9. CHANTRY WEST	160	33	1	0.05	0.70	1.7	15	20	30	35	10.27	12.46	51.22	2.40

KEY

ALT altitude
SLP slope (m km-1)
DCH discharge category
WID width water (metres)
DEP depth water (centimetres)
BCB % cover of boulders/cobbles
PGR % cover of pebbles/gravel
SND % cover of sand
SCL % cover of silt/clay
MTP mean air temperature
TRG air temperature range
LAT latitude
LNG longitude

APPENDIX 2 FULL TAXON LIST FOR ALL MELLS RIVER SITES IN SPRING & SUMMER

COMMON NAME	ORDER	FAMILY	SPECIES
Flat worms	Tricladida	Planariidae	Polycelis felina (Dalyell)
			Crenobia alpina (Dana)
Molluscs	Mollusca	Hydrobiidae	Potamopyrgus jenkinsi (Smith)
		Lymnaeidae	Lymnaea truncatula (Muller)
			Lymnaea peregra (Muller)
		Sphaeriidae	Pisidium sp.
Worms	Oligochaeta	Naididae	
		Tubificidae	
		Enchytraeidae	
		Lumbriculidae	
		Lumbricidae	
Leeches	Hirudinea	Glossiphoniidae	Glossiphonia complanata (L.)
Water mites	Hydracarina		Indet sp.
Freshwater shrimps	Malacostraca	Gammaridae	Gammarus pulex (L.)
May flies	Ephemeroptera	Baetidae	Baetis vernus Curtis
			Baetis rhodani (Pictet)
			Baetis muticus (L.)
		Heptageniidae	Rhithrogena semicolorata gp.
			Ecdyonurus sp.
		Leptophlebiidae	Paraleptophlebia submarginata (Stephens)
		Ephemerellidae	Ephemerella ignita (Poda)
Stone flies	Plecoptera	Taeniopterygidae	Brachyptera risi (Morton)
		Nemouridae	Amphinemura standfussi Ris
			Nemurella picteti Klapalek
			Nemoura cinerea (Retzius)
			Nemoura cambrica gp.
			Nemoura erratica Classen
		Leuctridae	Leuctra nigra (Olivier)
			Leuctra fusca (L.)
		Perlodidae	Isoperla grammatica (Poda)
		Chloroperlidae	Chloroperla torrentium (Pictet)
Bugs	Heteroptera	Veliidae	Velia caprai Tamanini
Beetles	Coleoptera	Dytiscidae	Agabus guttatus (Paykull)
		Hydrophilidae	Hydraena nigrita Germar
			Helophorus brevipalpis Bedel
			Helophorus grandis Illiger
			Anacaena globulus (Paykull)
			Cercyon sp.
			Indeterminate species (indet. sp.)
		Helodidae	Elodes sp.
			Cyphon sp.
		Elmidae	Elmis aenea (Muller)
			Riolus subviolaceus (Muller)
Caddis-flies	Trichoptera	Rhyacophilidae	Rhyacophila septentrionis McLachlan
			Agapetus sp.
		Philopotamidae	Wormaldia sp.
		Polycentropodidae	Plectrocnemia conspersa (Curtis)
			Plectrocnemia geniculata McLachlan
		Psychomyiidae	Tinodes unicolor (Pictet)
			Tinodes dives (Pictet)
			Lype sp.
		Hydropsychidae	Hydropsyche instabilis (Curtis)
		Limnephilidae	Drusus annulatus Stephens
			Limnephilus lunatus Curtis
			Potamophylax latipennis (Curtis)/cingulatus (Stephens)
			Potamophylax gp./Halesus sp.
			Halesus sp.
			Micropterna sequax McLachlan
			Chaetopteryx villosa (Fabricius)
		Beraeidae	Beraea maurus (Curtis)
		Lepidostomatidae	Crunoecia irrorata (Curtis)
True flies	Diptera	Tipulidae (crane-flies)	Tipula montium gp.
			Pedicia sp. (not rivosa)
			Dicranota sp.
			Pilaria filata gp.
			Pilaria/Oxydiscus?
			Limnophila (Eleaophila) sp.
			Molophilus sp.
			Indet. sp.
		Psychodidae (moth-winged flies)	Pericoma calcilega Feuerborn

APPENDIX 2 (continued)

COMMON NAME	ORDER	FAMILY	SPECIES
		Psychodidae (moth-winged flies)	Pericoma (cf calcilega Feuerborn)
			Pericoma neglecta Eaton
			Pericoma pulchra Eaton
			Pericoma trifasciata (Meigen)
			Pericoma trivialis gp.
			Pericoma sp. (trivialis gp/canescens)
			Psychoda severini Tonnoir
			Indet. sp.
		Ptychopteridae	Ptychoptera sp.
		Dixidae (meniscus midges)	Dixa maculata complex
			Dixa puberula Loew
		Ceratopogonidae (biting midges)	Indet. sp.
		Chironomidae (non-biting midges)	
		Tanypodinae	Indet. sp.
		Diamesinae	Indet. sp.
		Prodiamesinae	Indet sp.
		Orthocladiinae	Indet sp.
		Chironomini	Indet sp.
		Tanytarsini	Indet sp.
		Simuliidae (black-flies)	Simulium vernum gp.
			Simulium cryophilum gp.
			Simulium costatum Friederichs
			Simulium angustitarse gp.
			Simulium aurem gp.
			Simulium ornatum gp.
			Simulium ornatum gp. (prob. spinosum)
		Stratiomyidae (soldier-flies)	Oxycera formosa Meigen
			Oxycera pardalina Meigen
			Indet. sp.
		Empididae (dance-flies)	Chelifera gp.
			Hemerodromia gp.
			Clinocera gp.
		Dolichopodidae (long-legged flies)	Indet. sp.
		Muscidae	Indet. sp.
		Fannidae	Indet. sp.
		Thaumaleidae	Indet. sp.
		Syrphidae (hover-flies)	Chrysogaster sp.

APPENDIX 3 DISTRIBUTION OF SPRING TAXA FOR HURDLESTONE, BECTOR WOOD & WHITE HOLE FARM STREAMS

	HURDLESTONE SOURCE	HURDLESTONE 50m	BECTOR WOOD FLUSH A	BECTOR WOOD FLUSH B	BECTOR WOOD FLUSH C	BECTOR WOOD SOURCE	BECTOR WOOD 50m	BECTOR WOOD 250m	BECTOR WOOD 1000m	WHITE HOLE FARM 50m	WHITE HOLE FARM 250m	WHITE HOLE ADJ. 250m
Polycelis felina (Dalyell)	-	-	+	+	+	+	+	+	+	+	+	+
Crenobia alpina (Dana)	-	-	+	+	+	+	+	-	-	+	+	+
Potamopyrgus jenkinsi (Smith)	-	-	-	-	+	-	-	+	-	-	-	-
Lymnaea truncatula (Muller)	-	+	-	-	-	-	-	-	-	-	-	-
Pisidium sp.	+	+	+	+	+	-	+	+	+	-	+	-
Tubificidae	-	-	+	-	+	-	-	+	+	-	-	-
Enchytraeidae	+	-	-	-	-	-	-	-	+	-	+	-
Lumbriculidae	+	+	-	-	+	-	+	+	+	-	+	-
Lumbricidae	-	-	-	-	-	-	-	+	+	-	+	-
Indet. Oligochaeta	+	+	+	-	+	-	+	+	+	+	+	-
Gammarus pulex (L.)	+	+	+	+	-	+	+	+	+	+	+	+
Baetis vernus Curtis	-	-	-	-	-	-	-	-	-	+	+	-
Baetis rhodani (Pictet)	+	+	-	-	-	+	+	+	+	+	+	+
Baetis muticus (L.)	-	-	-	-	-	-	-	+	-	+	+	-
Rhithrogena semicolorata gp.	-	-	-	-	-	-	-	-	-	+	-	-
Ecdyonurus sp.	-	-	-	-	-	-	-	+	-	-	-	-
Paraleptophlebia submarginata (Stephens)	-	-	-	-	-	-	-	-	+	-	-	-
Brachyptera risi (Morton)	+	-	-	-	-	+	-	-	+	-	-	-
Amphinemura standfussi Ris	-	-	-	-	-	+	-	-	+	-	-	-
Nemurella picteti Klapalek	-	-	-	+	+	-	-	-	-	-	-	-
Nemoura sp.	+	-	-	-	-	-	-	-	-	-	-	-
Nemoura cinerea (Retzius)	-	-	-	-	-	+	-	-	-	-	-	-
Nemoura cambrica gp.	-	-	-	-	+	-	+	-	+	+	+	+
Nemoura erratica Classen	-	-	-	-	-	-	-	-	+	-	-	-
Leuctra nigra (Olivier)	-	+	+	+	+	-	+	+	+	-	-	-
Isoperla grammatica (Poda)	-	-	-	-	+	-	+	+	+	-	-	-
Chloroperla torrentium (Pictet)	-	-	-	-	-	-	-	-	-	+	-	-
Agabus guttatus (Paykull)	-	+	-	-	+	-	-	-	-	-	-	-
Helophorus grandis Illiger	-	+	-	-	-	-	-	-	-	-	-	-
Anacaena globulus (Paykull)	-	-	-	-	-	+	-	-	-	-	-	-
Elodes sp.	-	-	-	+	+	-	+	+	+	-	+	+
Elmis aenea (Muller)	-	-	-	-	-	-	-	+	+	+	-	-
Riolus subviolaceus (Muller)	-	-	-	-	-	-	-	+	-	-	-	-
Rhyacophila septentrionis McLachlan	-	-	-	-	-	-	-	-	-	-	+	-
Agapetus sp.	-	+	+	+	+	+	+	+	-	+	-	-
Wormaldia sp.	-	-	-	-	-	-	+	+	+	+	+	-
Plectrocnemia sp.	-	-	-	-	-	-	+	-	-	-	-	-
Plectrocnemia conspersa (Curtis)	-	+	+	+	+	-	+	+	+	-	+	-
Plectrocnemia geniculata McLachlan	-	-	-	+	-	-	+	-	-	+	-	-
Tinodes unicolor (Pictet)	-	-	-	-	-	-	-	+	+	-	+	-
Tinodes dives (Pictet)	-	-	-	-	-	-	-	-	+	-	-	-
Lype sp.	-	-	-	+	-	-	-	-	+	-	-	-
Hydropsyche instabilis (Curtis)	-	-	-	-	-	-	-	+	+	-	+	-
Drusus annulatus Stephens	-	-	-	-	-	-	-	+	-	+	-	-
Potamophylax latipennis (Curtis)/cingulatus (Stephens)	-	-	-	-	-	-	-	+	+	-	-	-
Halesus sp.	-	-	-	-	-	-	-	-	+	-	-	-
Micropterna sequax McLachlan	+	+	+	+	-	+	+	+	-	+	-	-
Beraea maurus (Curtis)	-	-	-	-	+	-	-	-	+	-	-	-
Crunoecia irrorata (Curtis)	-	-	-	+	+	-	+	-	-	-	-	-
Pedicia sp. (not rivosa)	-	-	-	-	-	-	-	+	-	-	-	-
Dicranota sp.	-	-	-	-	-	-	-	+	+	+	+	-
Limnophila (Eloeophila) sp.	-	-	+	+	-	-	+	+	+	-	-	-
Molophilus sp.	+	-	-	-	-	-	-	-	-	-	-	-
Indet. Tipulidae	-	-	+	-	-	-	-	-	-	-	-	-
Pericoma (cf calcilega Feuerborn)	-	-	-	-	-	-	-	-	-	-	+	-
Pericoma sp. (trivialis gp/canescens)	-	-	-	+	-	-	-	-	-	-	-	-
Ptychoptera sp.	-	-	+	+	+	-	+	+	+	-	-	-
Dixa maculata complex	+	+	+	-	-	-	+	-	+	-	+	+
Indet. Ceratopogonidae	+	-	+	-	-	+	-	-	+	+	-	-

APPENDIX 3 (continued)

	HURDLESTONE SOURCE	HURDLESTONE 50m	BECTOR WOOD FLUSH A	BECTOR WOOD FLUSH B	BECTOR WOOD FLUSH C	BECTOR WOOD SOURCE	BECTOR WOOD 50m	BECTOR WOOD 250m	BECTOR WOOD 1000m	WHITE HOLE FARM 50m	WHITE HOLE FARM 250m	WHITE HOLE ADJ. 250m
Indet. Chironomidae	+	+	+	+	+	+	+	+	+	+	+	-
Tanypodinae	-	-	+	+	+	-	-	+	+	-	-	-
Diamesinae	+	+	-	-	-	-	-	-	+	-	+	-
Prodiamesinae	-	-	-	-	-	-	-	-	+	-	-	-
Orthocladiinae	+	+	-	+	+	+	+	+	+	+	+	-
Chironomini	-	-	+	+	+	-	+	-	+	-	-	-
Tanytarsini	+	+	+	-	+	+	+	+	+	-	+	-
Simulium vernum gp.	-	-	-	-	-	-	-	-	-	+	-	-
Simulium cryophilum gp.	+	-	-	-	-	-	-	-	+	-	-	-
Simulium costatum Friederichs	+	-	-	-	-	-	+	-	+	-	+	-
Simulium ornatum gp.	+	-	-	-	-	-	-	-	-	-	+	-
Oxycera formosa Meigen	-	-	-	-	-	-	+	-	-	-	-	-
Oxycera pardalina Meigen	-	-	-	-	-	-	-	+	-	-	+	-
Chelifera gp.	-	-	+	-	-	-	+	-	-	-	-	-
Hemerodromia gp.	-	-	-	-	-	-	-	-	?	-	-	-
Indet. Thaumaleidae	+	+	-	-	-	-	+	+	-	-	-	-

+ = taxon present in sample
- = taxon absent from sample

APPENDIX 4 DISTRIBUTION OF SPRING TAXA FOR LEIGH WOOD EAST & WEST, LOWER SOHO FARM, FINGER STR

	LEIGH WOOD WEST 50m	LEIGH WOOD EAST SOURCE	LEIGH WOOD EAST 50m	LEIGH WOOD EAST 250m	LOWER SOHO FARM Site 1	FINGER STREAM WEST FLUSH	FINGER STREAM WEST Site 1	FINGER STREAM WEST Site 2	FINGER STREAM WEST Site 3	CHANTRY EAST Site 1	CHANTRY WEST SOURCE	CHANTRY WEST 50m
Polycelis felina (Dalyell)	-	-	-	-	-	-	-	-	-	+	+	-
Crenobia alpina (Dana)	-	-	-	-	-	-	-	-	-	+	+	-
Potamopyrgus jenkinsi (Smith)	+	-	-	-	-	-	-	-	-	-	-	-
Lymnaea truncatula (Muller)	-	-	+	-	+	-	-	-	+	-	-	-
Lymnaea peregra (Muller)	-	-	-	-	-	-	+	-	-	-	-	-
Pisidium sp.	+	-	+	+	+	-	-	-	-	+	+	+
Naididae	+	-	+	-	-	-	+	+	+	+	-	-
Tubificidae	-	-	+	+	+	-	-	-	-	-	-	-
Enchytraeidae	-	-	+	-	-	-	+	-	+	-	-	-
Lumbriculidae	+	-	-	+	+	-	-	-	-	-	-	-
Lumbricidae	+	-	-	+	-	-	-	-	+	-	-	-
Indet. Oligochaeta	+	-	+	+	+	-	+	+	+	+	-	-
Glossiphonia complanata (L.)	-	-	-	-	-	-	-	-	-	+	-	-
Indet. Hydracarina	-	-	-	-	-	-	-	-	-	-	-	+
Gammarus pulex (L.)	-	-	+	+	+	-	+	+	+	+	+	+
Baetis vernus Curtis	-	-	+	-	-	-	-	-	+	-	-	-
Baetis rhodani (Pictet)	-	-	+	+	+	-	+	+	+	+	-	-
Ephemerella ignita (Poda)	-	-	-	-	-	-	-	+	+	-	-	-
Brachyptera risi (Morton)	-	-	+	-	-	-	-	-	+	-	-	-
Amphinemura standfussi Ris	+	+	+	+	+	-	+	-	+	-	-	-
Nemoura cinerea (Retzius)	+	+	+	+	+	-	-	+	+	-	-	-
Nemoura cambrica gp.	-	-	-	-	-	-	-	-	-	-	+	+
Isoperla grammatica (Poda)	+	-	-	-	-	-	-	+	+	-	-	-
Agabus sp.	-	-	+	-	-	-	+	+	+	-	-	-
Agabus guttatus (Paykull)	+	-	+	-	-	-	-	-	-	-	-	-
Hydraena nigrita Germar	-	-	-	+	-	-	-	-	-	-	-	-
Helophorus grandis Illiger	-	-	+	-	-	-	-	-	-	-	-	-
Anacaena globulus (Paykull)	-	+	-	-	-	-	-	-	-	-	-	-
Cercyon sp.	-	-	+	-	-	-	-	-	-	-	-	-
Elodes sp.	-	-	-	-	+	-	-	-	-	+	+	+
Cyphon sp.	-	-	-	-	-	-	-	-	-	+	-	-
Agapetus sp.	-	-	-	-	-	-	-	-	-	-	+	+
Wormaldia sp.	+	-	-	+	-	-	-	-	-	-	-	-
Plectrocnemia conspersa (Curtis)	-	-	-	-	-	-	-	-	-	+	+	+
Drusus annulatus Stephens	-	-	-	-	-	-	-	-	-	-	+	-
Limnephilus lunatus Curtis	-	-	-	-	-	-	-	-	-	+	-	-
Potamophylax latipennis (Curtis)/cingulatus (Stephens)	-	-	-	-	-	-	-	-	-	-	-	+
Micropterna sequax McLachlan	-	+	+	+	+	-	-	+	+	-	-	+
Chaetopteryx villosa (Fabricius)	-	-	-	-	-	-	-	-	-	+	-	-
Potamophylax gp/Halesus sp.	-	-	-	-	-	-	-	-	-	+	-	-
Crunoecia irrorata (Curtis)	-	-	-	-	-	-	-	-	-	-	-	+
Tipula montium gp.	-	-	-	-	-	-	+	-	-	-	-	-
Limnophila (Elaeophila) sp.	-	-	-	-	-	-	-	-	-	+	-	+
Molophilus sp.	-	-	-	+	-	-	-	-	-	-	-	-
Pericoma pulchra Eaton	-	-	-	-	-	-	-	-	-	+	-	+
Pericoma trivialis gp.	-	-	-	-	-	-	+	-	-	-	-	-
Indet. Psychodidae	+	-	-	-	-	-	-	-	-	-	-	-
Ptychoptera sp.	-	-	-	-	-	-	-	-	-	+	-	+
Dixa maculata complex	-	-	+	-	-	-	-	-	-	+	-	-
Indet. Ceratopogonidae	+	-	+	+	+	-	+	-	-	+	-	-

APPENDIX 4 (continued)

	LEIGH WOOD WEST 50m	LEIGH WOOD EAST SOURCE	LEIGH WOOD EAST 50m	LEIGH WOOD EAST 250m	LOWER SOHO FARM Site 1	FINGER STREAM WEST FLUSH	FINGER STREAM WEST Site 1	FINGER STREAM WEST Site 2	FINGER STREAM WEST Site 3	CHANTRY EAST Site 1	CHANTRY WEST SOURCE	CHANTRY WEST 50m
Indet. Chironomidae	+	+	+	+	+	-	+	+	+	+	+	+
Tanypodinae	-	-	-	-	-	-	-	-	-	+	-	-
Prodiamesinae	-	-	-	-	-	-	-	-	-	+	-	-
Orthocladiinae	+	+	+	+	+	-	+	+	+	+	+	+
Chironomini	-	-	-	-	-	-	-	-	-	+	+	+
Tanytarsini	+	-	+	+	-	-	+	-	+	+	-	+
Simulium vernum gp.	+	-	+	+	-	-	-	-	-	-	-	-
Simulium cryophilum gp.	-	+	+	+	-	-	-	-	-	-	-	-
Simulium costatum Friederichs	-	-	-	-	-	-	-	-	+	+	-	+
Simulium angustitarse gp.	-	-	-	+	-	-	-	-	-	-	-	-
Simulium ornatum gp.	-	-	+	-	-	-	-	-	+	-	-	-
Oxycera formosa Meigen	-	-	-	-	-	-	+	-	-	-	-	-
Oxycera pardalina Meigen	+	-	-	-	-	-	-	-	-	-	-	-
Indet. Stratiomyidae	-	-	+	-	-	-	-	-	-	-	-	-
Indet. Dolichopodidae	-	-	-	-	-	-	-	+	+	-	-	-
Chrysogaster sp.	-	-	-	-	-	-	-	-	+	-	-	-

+ = taxon present in sample
- = taxon absent from sample

APPENDIX 5 DISTRIBUTION OF SUMMER TAXA FOR MELLS RIVER STREAM SITES

	HURDLESTONE	BECTOR WOOD	WHITE HOLE FARM	CHANTRY EAST	CHANTRY WEST
Polycelis felina (Dalyell)	-	+	+	+	+
Crenobia alpina (Dana)	-	-	+	+	-
Pisidium sp.	-	+	+	+	+
Indet. Tubificidae	-	-	-	-	+
Indet. Oligochaeta	+	+	+	+	+
Glossiphonia complanata (L.)	-	+	-	+	+
Hydracarina indet. sp,	-	+	+	-	-
Gammarus pulex (L.)	+	+	+	+	+
Baetis vernus Curtis	-	-	+	-	-
Baetis rhodani (Pictet)	+	+	+	-	-
Baetis muticus (L.)	-	-	+	-	-
Paraleptophlebia submarginata (Stephens)	-	+	-	-	-
Nemoura cambrica gp. (erratica)	-	-	+	-	-
Leuctra nigra (Olivier)	-	+	-	-	-
Leuctra fusca (L.)	-	+	-	-	-
Isoperla grammatica (Poda)	-	+	-	-	-
Velia caprai Tamanini	-	+	+	-	-
Agabus sp.	+	-	+	-	-
Helophorus brevipalpis Bedel	-	+	+	-	+
Anacaena globulus (Paykull)	-	+	-	-	+
Indet. Hydrophilidae	-	-	-	+	-
Elodes sp.	-	+	+	+	-
Elmis aenea (Muller)	-	+	-	-	-
Riolus subviolaceus (Muller)	-	+	-	-	-
Rhyacophila indet. juvenile	-	+	-	-	-
Wormaldia sp.	-	+	+	-	+
Plectrocnemia conspersa (Curtis)	-	+	+	-	+
Tinodes unicolor (Pictet)	-	-	+	-	-
Lype sp.	+	+	-	-	+
Hydropsyche instabilis (Curtis)	-	+	-	-	-
Potamophylax latipennis (Curtis)/ cingulatus (Stephens)	-	-	+	-	-
Micropterna sequax McLachlan	+	+	-	-	-
Chaetopteryx villosa (Fabricius)	+	+	-	+	-
Beraea maurus (Curtis)	-	-	+	+	-
Crunoecia irrorata (Curtis)	-	-	-	-	+
Tipula rufina Meigen	-	-	-	-	+
Pedicia sp. (not rivosa)	+	-	-	-	-
Dicranota sp.	+	+	+	-	-
Pilaria filata gp.	-	-	-	+	-
Pilaria/Oxydiscus?	-	+	-	+	-
Limnophila (Elaeophila) sp.	-	+	-	+	-
Molophilus sp.	+	-	-	-	-
Pericoma calcilega Feuerborn	-	-	+	-	-
Pericoma neglecta Eaton	-	-	+	-	-
Pericoma pulchra Eaton	-	-	-	+	-
Pericoma trifasciata (Meigen)	+	-	+	-	-
Pericoma trivialis gp.	-	-	+	+	+
Pericoma sp. (trivialis gp/canescens)	+	-	-	+	-

APPENDIX 5 (continued)

	HURDLESTONE	BECTOR WOOD	WHITE HOLE FARM	CHANTRY EAST	CHANTRY WEST
Psychoda severini Tonnoir	-	-	-	+	+
Ptychoptera sp.	-	-	-	+	-
Dixa maculata complex	+	-	+	+	+
Dixa puberula Loew	-	-	+	-	-
Indet. Ceratopogonidae	+	+	+	-	-
Indet. Chironomidae	+	+	+	+	+
Tanypodinae	+	+	+	+	-
Diamesinae	+	-	-	-	-
Prodiamesinae	-	+	+	-	-
Orthocladinae	+	+	+	+	+
Chironomini	-	+	+	+	+
Tanytarsini	+	+	+	+	+
Simulium cryophilum gp.	+	-	+	-	-
Simulium costatum Friederichs	-	-	+	+	-
Simulium angustitarse gp.	+	-	-	+	-
Simulium aureum gp.	+	-	-	-	-
Simulium ornatum gp.	+	-	+	+	-
Oxycera pardalina Meigen	-	-	+	-	-
Chelifera gp.	-	-	+	-	-
Hemerodromia gp. ?	-	+	-	-	-
Clinocera sp.	+	-	+	-	-
Indet. Muscidae	-	-	-	?	-
Indet. Fannidae	-	-	-	+	-
Indet. Thaumaleidae	-	+	-	-	+

+ = taxon present in sample
- = taxon absent from sample
? tentative identification

APPENDIX 6 SPRING TAXON LIST FOR HURDLESTONE SOURCE

COMMON NAME	FAMILY	SPECIES
Molluscs	Sphaeriidae	Pisidium sp.
Worms	Oligochaeta	
	Enchytraeidae	
	Lumbriculidae	
Freshwater shrimps	Gammaridae	Gammarus pulex (L.)
May flies	Baetidae	Baetis rhodani (Pictet)
Stone flies	Taeniopterygidae	Brachyptera risi (Morton)
	Nemouridae	Nemoura sp.
Caddis flies	Limnephilidae	Micropterna sequax McLachlan
Flies	Tipulidae	Molophilus sp.
	Dixidae	Dixa maculata complex
	Ceratopogonidae	
	Chironomidae	
	Diamesinae	
	Orthocladiinae	
	Tanytarsini	
	Simuliidae	Simulium cryophilum gp.
		Simulium costatum gp.
		Simulium ornatum gp.
	Thaumaleidae	

APPENDIX 8 SPRING TAXON LIST FOR BECTOR WOOD STREAM FLUSH A

COMMON NAME	FAMILY	SPECIES
Flat worms	Planariidae	Polycelis felina (Dalyell)
		Crenobia alpina (Dana)
Molluscs	Sphaeriidae	Pisidium sp.
Worms	Oligochaeta	
	Tubificidae	
Crustacea	Gammaridae	Gammarus pulex (L.)
Stone flies	Leuctridae	Leuctra nigra (Olivier)
Caddis flies	Rhyacophilidae	Agapetus sp.
	Polycentropodidae	Plectrocnemia conspersa (Curtis)
	Limnephilidae	Micropterna sequax McLachlan
Flies	Tipulidae	Tipulid sp.
		Limnophila (Eloeophila sp.)
	Ptychopteridae	Ptychoptera sp.
	Dixidae	Dixa maculata complex
	Ceratopogonidae	Indet. sp.
	Chironomidae	
	Tanypodinae	
	Chironomini	
	Tanytarsini	
	Empididae	Chelifera gp.

APPENDIX 1 ENVIRONMENTAL VARIABLES FOR MELLS RIVER SPRINGS SUMMER SAMPLING SITES

SITE	ALT	SLP	DCH	DST	WID	DEP	BCB	PGR	SND	SCL	MTP	TRG	LAT	LNG
1. HURDLESTONE	150	200	1	0.05	0.37	1	0	15	20	65	10.30	12.40	51.22	2.45
2. BECTORWOOD	125	100	1	0.75	0.55	7	0	20	30	50	10.30	12.40	51.22	2.45
3. WHITE HOLE FARM	125	200	1	0.25	0.74	4	7	7	14	72	10.30	12.40	51.22	2.45
4. LEIGH WOOD WEST	140	100	1	0.05	0.00	0	0	5	5	90	10.30	12.41	51.22	2.45
5. LEIGH WOOD EAST	125	100	1	0.25	0.00	0	15	40	5	40	10.29	12.41	51.23	2.45
6. LOWER SOHO FARM	125	66.6	1	0.10	0.00	0	0	50	0	50	10.28	12.43	51.23	2.43
7. FINGER STREAM WEST	115	25	1	1.50	0.00	0	10	90	0	0	10.27	12.46	51.22	2.40
8. CHANTRY EAST	150	50	1	0.05	0.40	3.7	0	10	0	90	10.27	12.47	51.22	2.40
9. CHANTRY WEST	160	33	1	0.05	0.70	1.7	15	20	30	35	10.27	12.46	51.22	2.40

KEY

ALT altitude
SLP slope (m km-1)
DCH discharge category
WID width water (metres)
DEP depth water (centimetres)
BCB % cover of boulders/cobbles
PGR % cover of pebbles/gravel
SND % cover of sand
SCL % cover of silt/clay
MTP mean air temperature
TRG air temperature range
LAT latitude
LNG longitude

APPENDIX 2 FULL TAXON LIST FOR ALL MELLS RIVER SITES IN SPRING & SUMMER

COMMON NAME	ORDER	FAMILY	SPECIES
Flat worms	Tricladida	Planariidae	Polycelis felina (Dalyell)
			Crenobia alpina (Dana)
Molluscs	Mollusca	Hydrobiidae	Potamopyrgus jenkinsi (Smith)
		Lymnaeidae	Lymnaea truncatula (Muller)
			Lymnaea peregra (Muller)
		Sphaeriidae	Pisidium sp.
Worms	Oligochaeta	Naididae	
		Tubificidae	
		Enchytraeidae	
		Lumbriculidae	
		Lumbricidae	
Leeches	Hirudinea	Glossiphoniidae	Glossiphonia complanata (L.)
Water mites	Hydracarina		Indet sp.
Freshwater shrimps	Malacostraca	Gammaridae	Gammarus pulex (L.)
May flies	Ephemeroptera	Baetidae	Baetis vernus Curtis
			Baetis rhodani (Pictet)
			Baetis muticus (L.)
		Heptageniidae	Rhithrogena semicolorata gp.
			Ecdyonurus sp.
		Leptophlebiidae	Paraleptophlebia submarginata (Stephens)
		Ephemerellidae	Ephemerella ignita (Poda)
Stone flies	Plecoptera	Taeniopterygidae	Brachyptera risi (Morton)
		Nemouridae	Amphinemura standfussi Ris
			Nemurella picteti Klapalek
			Nemoura cinerea (Retzius)
			Nemoura cambrica gp.
			Nemoura erratica Classen
		Leuctridae	Leuctra nigra (Olivier)
			Leuctra fusca (L.)
		Perlodidae	Isoperla grammatica (Poda)
		Chloroperlidae	Chloroperla torrentium (Pictet)
Bugs	Heteroptera	Veliidae	Velia caprai Tamanini
Beetles	Coleoptera	Dytiscidae	Agabus guttatus (Paykull)
		Hydrophilidae	Hydraena nigrita Germar
			Helophorus brevipalpis Bedel
			Helophorus grandis Illiger
			Anacaena globulus (Paykull)
			Cercyon sp.
			Indeterminate species (indet. sp.)
		Helodidae	Elodes sp.
			Cyphon sp.
		Elmidae	Elmis aenea (Muller)
			Riolus subviolaceus (Muller)
Caddis-flies	Trichoptera	Rhyacophilidae	Rhyacophila septentrionis McLachlan
			Agapetus sp.
		Philopotamidae	Wormaldia sp.
		Polycentropodidae	Plectrocnemia conspersa (Curtis)
			Plectrocnemia geniculata McLachlan
		Psychomyiidae	Tinodes unicolor (Pictet)
			Tinodes dives (Pictet)
			Lype sp.
		Hydropsychidae	Hydropsyche instabilis (Curtis)
		Limnephilidae	Drusus annulatus Stephens
			Limnephilus lunatus Curtis
			Potamophylax latipennis (Curtis)/cingulatus (Stephens)
			Potamophylax gp./Halesus sp.
			Halesus sp.
			Micropterna sequax McLachlan
			Chaetopteryx villosa (Fabricius)
		Beraeidae	Beraea maurus (Curtis)
		Lepidostomatidae	Crunoecia irrorata (Curtis)
True flies	Diptera	Tipulidae (crane-flies)	Tipula montium gp.
			Pedicia sp. (not rivosa)
			Dicranota sp.
			Pilaria filata gp.
			Pilaria/Oxydiscus?
			Limnophila (Eleaophila) sp.
			Molophilus sp.
			Indet. sp.
		Psychodidae (moth-winged flies)	Pericoma calcilega Feuerborn

APPENDIX 2 (continued)

COMMON NAME	ORDER	FAMILY	SPECIES
		Psychodidae (moth-winged flies)	Pericoma (cf calcilega Feuerborn)
			Pericoma neglecta Eaton
			Pericoma pulchra Eaton
			Pericoma trifasciata (Meigen)
			Pericoma trivialis gp.
			Pericoma sp. (trivialis gp/canescens)
			Psychoda severini Tonnoir
			Indet. sp.
		Ptychopteridae	Ptychoptera sp.
		Dixidae (meniscus midges)	Dixa maculata complex
			Dixa puberula Loew
		Ceratopogonidae (biting midges)	Indet. sp.
		Chironomidae (non-biting midges)	
		Tanypodinae	Indet. sp.
		Diamesinae	Indet. sp.
		Prodiamesinae	Indet sp.
		Orthocladiinae	Indet sp.
		Chironomini	Indet sp.
		Tanytarsini	Indet sp.
		Simuliidae (black-flies)	Simulium vernum gp.
			Simulium cryophilum gp.
			Simulium costatum Friederichs
			Simulium angustitarse gp.
			Simulium aurem gp.
			Simulium ornatum gp.
			Simulium ornatum gp. (prob. spinosum)
		Stratiomyidae (soldier-flies)	Oxycera formosa Meigen
			Oxycera pardalina Meigen
			Indet. sp.
		Empididae (dance-flies)	Chelifera gp.
			Hemerodromia gp.
			Clinocera gp.
		Dolichopodidae (long-legged flies)	Indet. sp.
		Muscidae	Indet. sp.
		Fannidae	Indet. sp.
		Thaumaleidae	Indet. sp.
		Syrphidae (hover-flies)	Chrysogaster sp.

APPENDIX 3 DISTRIBUTION OF SPRING TAXA FOR HURDLESTONE, BECTOR WOOD & WHITE HOLE FARM STREAMS

	HURDLESTONE SOURCE	HURDLESTONE 50m	BECTOR WOOD FLUSH A	BECTOR WOOD FLUSH B	BECTOR WOOD FLUSH C	BECTOR WOOD SOURCE	BECTOR WOOD 50m	BECTOR WOOD 250m	BECTOR WOOD 1000m	WHITE HOLE FARM 50m	WHITE HOLE FARM 250m	WHITE HOLE ADJ. 250m
Polycelis felina (Dalyell)	-	-	+	+	+	+	+	+	+	+	+	+
Crenobia alpina (Dana)	-	-	+	+	+	+	+	-	-	+	+	+
Potamopyrgus jenkinsi (Smith)	-	-	-	-	+	-	-	+	-	-	-	-
Lymnaea truncatula (Muller)	-	+	-	-	-	-	-	-	-	-	-	-
Pisidium sp.	+	+	+	+	+	-	+	+	+	-	+	-
Tubificidae	-	-	+	-	+	-	-	+	+	-	-	-
Enchytraeidae	+	-	-	-	-	-	-	-	+	-	+	-
Lumbriculidae	+	+	-	-	+	-	+	+	+	-	+	-
Lumbricidae	-	-	-	-	-	-	-	+	+	-	+	-
Indet. Oligochaeta	+	+	+	-	+	-	+	+	+	+	+	-
Gammarus pulex (L.)	+	+	+	+	-	+	+	+	+	+	+	+
Baetis vernus Curtis	-	-	-	-	-	-	-	-	-	+	+	-
Baetis rhodani (Pictet)	+	+	-	-	-	+	+	+	+	+	+	+
Baetis muticus (L.)	-	-	-	-	-	-	-	+	-	+	+	-
Rhithrogena semicolorata gp.	-	-	-	-	-	-	-	-	-	+	-	-
Ecdyonurus sp.	-	-	-	-	-	-	-	+	-	-	-	-
Paraleptophlebia submarginata (Stephens)	-	-	-	-	-	-	-	-	+	-	-	-
Brachyptera risi (Morton)	+	-	-	-	-	+	-	-	+	-	-	-
Amphinemura standfussi Ris	-	-	-	-	-	+	-	-	+	-	-	-
Nemurella picteti Klapalek	-	-	-	+	+	-	-	-	-	-	-	-
Nemoura sp.	+	-	-	-	-	-	-	-	-	-	-	-
Nemoura cinerea (Retzius)	-	-	-	-	-	+	-	-	-	-	-	-
Nemoura cambrica gp.	-	-	-	-	+	-	+	-	+	+	+	+
Nemoura erratica Classen	-	-	-	-	-	-	-	-	+	-	-	-
Leuctra nigra (Olivier)	-	+	+	+	+	-	+	+	+	-	-	-
Isoperla grammatica (Poda)	-	-	-	-	+	-	+	+	+	-	-	-
Chloroperla torrentium (Pictet)	-	-	-	-	-	-	-	-	-	+	-	-
Agabus guttatus (Paykull)	-	+	-	-	+	-	-	-	-	-	-	-
Helophorus grandis Illiger	-	+	-	-	-	-	-	-	-	-	-	-
Anacaena globulus (Paykull)	-	-	-	-	-	+	-	-	-	-	-	-
Elodes sp.	-	-	-	+	+	-	+	+	+	-	+	+
Elmis aenea (Muller)	-	-	-	-	-	-	-	+	+	+	-	-
Riolus subviolaceus (Muller)	-	-	-	-	-	-	-	+	-	-	-	-
Rhyacophila septentrionis McLachlan	-	-	-	-	-	-	-	-	-	-	+	-
Agapetus sp.	-	+	+	+	+	+	+	+	-	+	-	-
Wormaldia sp.	-	-	-	-	-	-	+	+	+	+	+	-
Plectrocnemia sp.	-	-	-	-	-	-	+	-	-	-	-	-
Plectrocnemia conspersa (Curtis)	-	+	+	+	+	-	+	+	+	-	+	-
Plectrocnemia geniculata McLachlan	-	-	-	+	-	-	+	-	-	+	-	-
Tinodes unicolor (Pictet)	-	-	-	-	-	-	-	+	+	-	+	-
Tinodes dives (Pictet)	-	-	-	-	-	-	-	-	+	-	-	-
Lype sp.	-	-	-	+	-	-	-	-	+	-	-	-
Hydropsyche instabilis (Curtis)	-	-	-	-	-	-	-	+	+	-	+	-
Drusus annulatus Stephens	-	-	-	-	-	-	-	+	-	+	-	-
Potamophylax latipennis (Curtis)/cingulatus (Stephens)	-	-	-	-	-	-	-	+	+	-	-	-
Halesus sp.	-	-	-	-	-	-	-	-	+	-	-	-
Micropterna sequax McLachlan	+	+	+	+	-	+	+	+	-	+	-	-
Beraea maurus (Curtis)	-	-	-	-	+	-	-	-	+	-	-	-
Crunoecia irrorata (Curtis)	-	-	-	+	+	-	+	-	-	-	-	-
Pedicia sp. (not rivosa)	-	-	-	-	-	-	-	+	-	-	-	-
Dicranota sp.	-	-	-	-	-	-	-	+	+	+	+	-
Limnophila (Eloeophila) sp.	-	-	+	+	-	-	+	+	+	-	-	-
Molophilus sp.	+	-	-	-	-	-	-	-	-	-	-	-
Indet. Tipulidae	-	-	+	-	-	-	-	-	-	-	-	-
Pericoma (cf calcilega Feuerborn)	-	-	-	-	-	-	-	-	-	-	+	-
Pericoma sp. (trivialis gp/canescens)	-	-	-	+	-	-	-	-	-	-	-	-
Ptychoptera sp.	-	-	+	+	+	-	+	+	+	-	-	-
Dixa maculata complex	+	+	+	-	-	-	+	-	+	-	+	+
Indet. Ceratopogonidae	+	-	+	-	-	+	-	-	+	+	-	-

APPENDIX 3 (continued)

	HURDLESTONE SOURCE	HURDLESTONE 50m	BECTOR WOOD FLUSH A	BECTOR WOOD FLUSH B	BECTOR WOOD FLUSH C	BECTOR WOOD SOURCE	BECTOR WOOD 50m	BECTOR WOOD 250m	BECTOR WOOD 1000m	WHITE HOLE FARM 50m	WHITE HOLE FARM 250m	WHITE HOLE ADJ. 250m
Indet. Chironomidae	+	+	+	+	+	+	+	+	+	+	+	-
Tanypodinae	-	-	+	+	+	-	-	+	+	-	-	-
Diamesinae	+	+	-	-	-	-	-	-	+	-	+	-
Prodiamesinae	-	-	-	-	-	-	-	-	+	-	-	-
Orthocladiinae	+	+	-	+	+	+	+	+	+	+	+	-
Chironomini	-	-	+	+	+	-	+	-	+	-	-	-
Tanytarsini	+	+	+	-	+	+	+	+	+	-	+	-
Simulium vernum gp.	-	-	-	-	-	-	-	-	-	+	-	-
Simulium cryophilum gp.	+	-	-	-	-	-	-	-	+	-	-	-
Simulium costatum Friederichs	+	-	-	-	-	-	+	-	+	-	+	-
Simulium ornatum gp.	+	-	-	-	-	-	-	-	-	-	+	-
Oxycera formosa Meigen	-	-	-	-	-	-	+	-	-	-	-	-
Oxycera pardalina Meigen	-	-	-	-	-	-	-	+	-	-	+	-
Chelifera gp.	-	-	+	-	-	-	+	-	-	-	-	-
Hemerodromia gp.	-	-	-	-	-	-	-	-	?	-	-	-
Indet. Thaumaleidae	+	+	-	-	-	-	+	+	-	-	-	-

+ = taxon present in sample
- = taxon absent from sample

APPENDIX 4 DISTRIBUTION OF SPRING TAXA FOR LEIGH WOOD EAST & WEST, LOWER SOHO FARM, FINGER STR

	LEIGH WOOD WEST 50m	LEIGH WOOD EAST SOURCE	LEIGH WOOD EAST 50m	LEIGH WOOD EAST 250m	LOWER SOHO FARM Site 1	FINGER STREAM WEST FLUSH	FINGER STREAM WEST Site 1	FINGER STREAM WEST Site 2	FINGER STREAM WEST Site 3	CHANTRY EAST Site 1	CHANTRY WEST SOURCE	CHANTRY WEST 50m
Polycelis felina (Dalyell)	-	-	-	-	-	-	-	-	-	+	+	-
Crenobia alpina (Dana)	-	-	-	-	-	-	-	-	-	+	+	-
Potamopyrgus jenkinsi (Smith)	+	-	-	-	-	-	-	-	-	-	-	-
Lymnaea truncatula (Muller)	-	-	+	-	+	-	-	-	+	-	-	-
Lymnaea peregra (Muller)	-	-	-	-	-	-	+	-	-	-	-	-
Pisidium sp.	+	-	+	+	+	-	-	-	-	+	+	+
Naididae	+	-	+	-	-	-	+	+	+	+	-	-
Tubificidae	-	-	+	+	+	-	-	-	-	-	-	-
Enchytraeidae	-	-	+	-	-	-	+	-	+	-	-	-
Lumbriculidae	+	-	-	+	+	-	-	-	-	-	-	-
Lumbricidae	+	-	-	+	-	-	-	-	+	-	-	-
Indet. Oligochaeta	+	-	+	+	+	-	+	+	+	+	-	-
Glossiphonia complanata (L.)	-	-	-	-	-	-	-	-	-	+	-	-
Indet. Hydracarina	-	-	-	-	-	-	-	-	-	-	-	+
Gammarus pulex (L.)	-	-	+	+	+	-	+	+	+	+	+	+
Baetis vernus Curtis	-	-	+	-	-	-	-	-	+	-	-	-
Baetis rhodani (Pictet)	-	-	+	+	+	-	+	+	+	+	-	-
Ephemerella ignita (Poda)	-	-	-	-	-	-	-	+	+	-	-	-
Brachyptera risi (Morton)	-	-	+	-	-	-	-	-	+	-	-	-
Amphinemura standfussi Ris	+	+	+	+	+	-	+	-	+	-	-	-
Nemoura cinerea (Retzius)	+	+	+	+	+	-	-	+	+	-	-	-
Nemoura cambrica gp.	-	-	-	-	-	-	-	-	-	-	+	+
Isoperla grammatica (Poda)	+	-	-	-	-	-	-	+	+	-	-	-
Agabus sp.	-	-	+	-	-	-	+	+	+	-	-	-
Agabus guttatus (Paykull)	+	-	+	-	-	-	-	-	-	-	-	-
Hydraena nigrita Germar	-	-	-	+	-	-	-	-	-	-	-	-
Helophorus grandis Illiger	-	-	+	-	-	-	-	-	-	-	-	-
Anacaena globulus (Paykull)	-	+	-	-	-	-	-	-	-	-	-	-
Cercyon sp.	-	-	+	-	-	-	-	-	-	-	-	-
Elodes sp.	-	-	-	-	+	-	-	-	-	+	+	+
Cyphon sp.	-	-	-	-	-	-	-	-	-	+	-	-
Agapetus sp.	-	-	-	-	-	-	-	-	-	-	+	+
Wormaldia sp.	+	-	-	+	-	-	-	-	-	-	-	-
Plectrocnemia conspersa (Curtis)	-	-	-	-	-	-	-	-	-	+	+	+
Drusus annulatus Stephens	-	-	-	-	-	-	-	-	-	-	+	-
Limnephilus lunatus Curtis	-	-	-	-	-	-	-	-	-	+	-	-
Potamophylax latipennis (Curtis)/cingulatus (Stephens)	-	-	-	-	-	-	-	-	-	-	-	+
Micropterna sequax McLachlan	-	+	+	+	+	-	-	+	+	-	-	+
Chaetopteryx villosa (Fabricius)	-	-	-	-	-	-	-	-	-	+	-	-
Potamophylax gp/Halesus sp.	-	-	-	-	-	-	-	-	-	+	-	-
Crunoecia irrorata (Curtis)	-	-	-	-	-	-	-	-	-	-	-	+
Tipula montium gp.	-	-	-	-	-	-	+	-	-	-	-	-
Limnophila (Elaeophila) sp.	-	-	-	-	-	-	-	-	-	+	-	+
Molophilus sp.	-	-	-	+	-	-	-	-	-	-	-	-
Pericoma pulchra Eaton	-	-	-	-	-	-	-	-	-	+	-	+
Pericoma trivialis gp.	-	-	-	-	-	-	+	-	-	-	-	-
Indet. Psychodidae	+	-	-	-	-	-	-	-	-	-	-	-
Ptychoptera sp.	-	-	-	-	-	-	-	-	-	+	-	+
Dixa maculata complex	-	-	+	-	-	-	-	-	-	+	-	-
Indet. Ceratopogonidae	+	-	+	+	+	-	+	-	-	+	-	-

APPENDIX 4 (continued)

	LEIGH WOOD WEST 50m	LEIGH WOOD EAST SOURCE	LEIGH WOOD EAST 50m	LEIGH WOOD EAST 250m	LOWER SOHO FARM Site 1	FINGER STREAM WEST FLUSH	FINGER STREAM WEST Site 1	FINGER STREAM WEST Site 2	FINGER STREAM WEST Site 3	CHANTRY EAST Site 1	CHANTRY WEST SOURCE	CHANTRY WEST 50m
Indet. Chironomidae	+	+	+	+	+	-	+	+	+	+	+	+
Tanypodinae	-	-	-	-	-	-	-	-	-	+	-	-
Prodiamesinae	-	-	-	-	-	-	-	-	-	+	-	-
Orthocladiinae	+	+	+	+	+	-	+	+	+	+	+	+
Chironomini	-	-	-	-	-	-	-	-	-	+	+	+
Tanytarsini	+	-	+	+	-	-	+	-	+	+	-	+
Simulium vernum gp.	+	-	+	+	-	-	-	-	-	-	-	-
Simulium cryophilum gp.	-	+	+	+	-	-	-	-	-	-	-	-
Simulium costatum Friederichs	-	-	-	-	-	-	-	-	+	+	-	+
Simulium angustitarse gp.	-	-	-	+	-	-	-	-	-	-	-	-
Simulium ornatum gp.	-	-	+	-	-	-	-	-	+	-	-	-
Oxycera formosa Meigen	-	-	-	-	-	-	+	-	-	-	-	-
Oxycera pardalina Meigen	+	-	-	-	-	-	-	-	-	-	-	-
Indet. Stratiomyidae	-	-	+	-	-	-	-	-	-	-	-	-
Indet. Dolichopodidae	-	-	-	-	-	-	-	+	+	-	-	-
Chrysogaster sp.	-	-	-	-	-	-	-	-	+	-	-	-

+ = taxon present in sample
- = taxon absent from sample

APPENDIX 5 DISTRIBUTION OF SUMMER TAXA FOR MELLS RIVER STREAM SITES

	HURDLESTONE	BECTOR WOOD	WHITE HOLE FARM	CHANTRY EAST	CHANTRY WEST
Polycelis felina (Dalyell)	-	+	+	+	+
Crenobia alpina (Dana)	-	-	+	+	-
Pisidium sp.	-	+	+	+	+
Indet. Tubificidae	-	-	-	-	+
Indet. Oligochaeta	+	+	+	+	+
Glossiphonia complanata (L.)	-	+	-	+	+
Hydracarina indet. sp,	-	+	+	-	-
Gammarus pulex (L.)	+	+	+	+	+
Baetis vernus Curtis	-	-	+	-	-
Baetis rhodani (Pictet)	+	+	+	-	-
Baetis muticus (L.)	-	-	+	-	-
Paraleptophlebia submarginata (Stephens)	-	+	-	-	-
Nemoura cambrica gp. (erratica)	-	-	+	-	-
Leuctra nigra (Olivier)	-	+	-	-	-
Leuctra fusca (L.)	-	+	-	-	-
Isoperla grammatica (Poda)	-	+	-	-	-
Velia caprai Tamanini	-	+	+	-	-
Agabus sp.	+	-	+	-	-
Helophorus brevipalpis Bedel	-	+	+	-	+
Anacaena globulus (Paykull)	-	+	-	-	+
Indet. Hydrophilidae	-	-	-	+	-
Elodes sp.	-	+	+	+	-
Elmis aenea (Muller)	-	+	-	-	-
Riolus subviolaceus (Muller)	-	+	-	-	-
Rhyacophila indet. juvenile	-	+	-	-	-
Wormaldia sp.	-	+	+	-	+
Plectrocnemia conspersa (Curtis)	-	+	+	-	+
Tinodes unicolor (Pictet)	-	-	+	-	-
Lype sp.	+	+	-	-	+
Hydropsyche instabilis (Curtis)	-	+	-	-	-
Potamophylax latipennis (Curtis)/ cingulatus (Stephens)	-	-	+	-	-
Micropterna sequax McLachlan	+	+	-	-	-
Chaetopteryx villosa (Fabricius)	+	+	-	+	-
Beraea maurus (Curtis)	-	-	+	+	-
Crunoecia irrorata (Curtis)	-	-	-	-	+
Tipula rufina Meigen	-	-	-	-	+
Pedicia sp. (not rivosa)	+	-	-	-	-
Dicranota sp.	+	+	+	-	-
Pilaria filata gp.	-	-	-	+	-
Pilaria/Oxydiscus?	-	+	-	+	-
Limnophila (Elaeophila) sp.	-	+	-	+	-
Molophilus sp.	+	-	-	-	-
Pericoma calcilega Feuerborn	-	-	+	-	-
Pericoma neglecta Eaton	-	-	+	-	-
Pericoma pulchra Eaton	-	-	-	+	-
Pericoma trifasciata (Meigen)	+	-	+	-	-
Pericoma trivialis gp.	-	-	+	+	+
Pericoma sp. (trivialis gp/canescens)	+	-	-	+	-

APPENDIX 5 (continued)

	HURDLESTONE	BECTOR WOOD	WHITE HOLE FARM	CHANTRY EAST	CHANTRY WEST
Psychoda severini Tonnoir	-	-	-	+	+
Ptychoptera sp.	-	-	-	+	-
Dixa maculata complex	+	-	+	+	+
Dixa puberula Loew	-	-	+	-	-
Indet. Ceratopogonidae	+	+	+	-	-
Indet. Chironomidae	+	+	+	+	+
Tanypodinae	+	+	+	+	-
Diamesinae	+	-	-	-	-
Prodiamesinae	-	+	+	-	-
Orthocladinae	+	+	+	+	+
Chironomini	-	+	+	+	+
Tanytarsini	+	+	+	+	+
Simulium cryophilum gp.	+	-	+	-	-
Simulium costatum Friederichs	-	-	+	+	-
Simulium angustitarse gp.	+	-	-	+	-
Simulium aureum gp.	+	-	-	-	-
Simulium ornatum gp.	+	-	+	+	-
Oxycera pardalina Meigen	-	-	+	-	-
Chelifera gp.	-	-	+	-	-
Hemerodromia gp. ?	-	+	-	-	-
Clinocera sp.	+	-	+	-	-
Indet. Muscidae	-	-	-	?	-
Indet. Fannidae	-	-	-	+	-
Indet. Thaumaleidae	-	+	-	-	+

+ = taxon present in sample
- = taxon absent from sample
? tentative identification

APPENDIX 6 SPRING TAXON LIST FOR HURDLESTONE SOURCE

COMMON NAME	FAMILY	SPECIES
Molluscs	Sphaeriidae	Pisidium sp.
Worms	Oligochaeta	
	Enchytraeidae	
	Lumbriculidae	
Freshwater shrimps	Gammaridae	Gammarus pulex (L.)
May flies	Baetidae	Baetis rhodani (Pictet)
Stone flies	Taeniopterygidae	Brachyptera risi (Morton)
	Nemouridae	Nemoura sp.
Caddis flies	Limnephilidae	Micropterna sequax McLachlan
Flies	Tipulidae	Molophilus sp.
	Dixidae	Dixa maculata complex
	Ceratopogonidae	
	Chironomidae	
	Diamesinae	
	Orthocladiinae	
	Tanytarsini	
	Simuliidae	Simulium cryophilum gp.
		Simulium costatum gp.
		Simulium ornatum gp.
	Thaumaleidae	

APPENDIX 8 SPRING TAXON LIST FOR BECTOR WOOD STREAM FLUSH A

COMMON NAME	FAMILY	SPECIES
Flat worms	Planariidae	Polycelis felina (Dalyell)
		Crenobia alpina (Dana)
Molluscs	Sphaeriidae	Pisidium sp.
Worms	Oligochaeta	
	Tubificidae	
Crustacea	Gammaridae	Gammarus pulex (L.)
Stone flies	Leuctridae	Leuctra nigra (Olivier)
Caddis flies	Rhyacophilidae	Agapetus sp.
	Polycentropodidae	Plectrocnemia conspersa (Curtis)
	Limnephilidae	Micropterna sequax McLachlan
Flies	Tipulidae	Tipulid sp.
		Limnophila (Eloeophila sp.)
	Ptychopteridae	Ptychoptera sp.
	Dixidae	Dixa maculata complex
	Ceratopogonidae	Indet. sp.
	Chironomidae	
	Tanypodinae	
	Chironomini	
	Tanytarsini	
	Empididae	Chelifera gp.

APPENDIX 6 SPRING TAXON LIST FOR HURDLESTONE SOURCE

COMMON NAME	FAMILY	SPECIES
Molluscs	Sphaeriidae	Pisidium sp.
Worms	Oligochaeta	
	Enchytraeidae	
	Lumbriculidae	
Freshwater shrimps	Gammaridae	Gammarus pulex (L.)
May flies	Baetidae	Baetis rhodani (Pictet)
Stone flies	Taeniopterygidae	Brachyptera risi (Morton)
	Nemouridae	Nemoura sp.
Caddis flies	Limnephilidae	Micropterna sequax McLachlan
Flies	Tipulidae	Molophilus sp.
	Dixidae	Dixa maculata complex
	Ceratopogonidae	
	Chironomidae	
	Diamesinae	
	Orthocladiinae	
	Tanytarsini	
	Simuliidae	Simulium cryophilum gp.
		Simulium costatum gp.
		Simulium ornatum gp.
	Thaumaleidae	

APPENDIX 7 SPRING TAXON LIST FOR HURDLESTONE STREAM 50m

COMMON NAME	FAMILY	SPECIES
Molluscs	Lymnaeidae	Lymnaea truncatula (Muller)
	Sphaeriidae	Pisidium sp.
Worms	Oligochaeta	
	Lumbriculidae	
Freshwater shrimps	Gammaridae	Gammarus pulex (L.)
May flies	Baetidae	Baetis rhodani (Pictet)
Stone flies	Leuctridae	Leuctra nigra (Olivier)
Beetles	Dytiscidae	Agabus guttatus (Paykull)
	Hydrophilidae	Helophorus grandis Illiger
Caddis flies	Rhyacophilidae	Agapetus sp.
	Polycentropodidae	Plectrocnemia conspersa (Curtis)
	Limnephilidae	Micropterna sequax McLachlan
	Dixidae	Dixa maculata complex
	Chironomidae	
	Diamesinae	
	Orthocladiinae	
	Tanytarsini	
	Thaumaleidae	

APPENDIX 8 SPRING TAXON LIST FOR BECTOR WOOD STREAM FLUSH A

COMMON NAME	FAMILY	SPECIES
Flat worms	Planariidae	Polycelis felina (Dalyell)
		Crenobia alpina (Dana)
Molluscs	Sphaeriidae	Pisidium sp.
Worms	Oligochaeta	
	Tubificidae	
Crustacea	Gammaridae	Gammarus pulex (L.)
Stone flies	Leuctridae	Leuctra nigra (Olivier)
Caddis flies	Rhyacophilidae	Agapetus sp.
	Polycentropodidae	Plectrocnemia conspersa (Curtis)
	Limnephilidae	Micropterna sequax McLachlan
Flies	Tipulidae	Tipulid sp.
		Limnophila (Eloeophila sp.)
	Ptychopteridae	Ptychoptera sp.
	Dixidae	Dixa maculata complex
	Ceratopogonidae	Indet. sp.
	Chironomidae	
	Tanypodinae	
	Chironomini	
	Tanytarsini	
	Empididae	Chelifera gp.

APPENDIX 9 SPRING TAXON LIST FOR BECTOR WOOD STREAM FLUSH B

COMMON NAME	FAMILY	SPECIES
Flat worms	Planariidae	Polycelis felina (Dalyell)
		Crenobia alpina (Dana)
Molluscs	Sphaeriidae	Pisidium sp.
Freshwater shrimps	Gammaridae	Gammarus pulex (L.)
Stone flies	Nemouridae	Nemurella picteti Klapalek
	Leuctridae	Leuctra nigra (Olivier)
Beetles	Helodidae	Elodes sp.
Caddis flies	Rhyacophilidae	Agapetus sp.
	Polycentropodidae	Plectrocnemia conspersa (Curtis)
		Plectrocnemia geniculata McLachlan
	Psychomyiidae	Lype sp.
	Limnephilidae	Micropterna sequax McLachlan
	Lepidostomatidae	Crunoecia irrorata (Curtis)
Flies	Tipulidae	Limnophila (Eloeophila) sp.
	Psychodidae	Pericoma sp. (trivialis gp/canescens)
	Ptychopteridae	Ptychoptera sp.
	Chironomidae	
	Tanypodinae	
	Orthocladiinae	
	Chironomini	

APPENDIX 10 SPRING TAXON LIST FOR BECTOR WOOD STREAM FLUSH C

COMMON NAME	FAMILY	SPECIES
Flat worms	Planariidae	Polycelis felina (Dalyell)
		Crenobia alpina (Dana)
Molluscs	Hydrobiidae	Potamopyrgus jenkinsi (Smith)
	Sphaeriidae	Pisidium sp.
Worms	Oligochaeta	
	Tubificidae	
	Lumbriculidae	
Stone flies	Nemouridae	Nemurella picteti Klapalek
		Nemoura cambrica gp.
	Leuctridae	Leuctra nigra (Olivier)
	Perlodidae	Isoperla grammatica (Poda)
Beetles	Dytiscidae	Agabus guttatus (Paykull)
	Helodidae	Elodes sp.
Caddis flies	Rhyacophilidae	Agapetus sp.
	Polycentropodidae	Plectrocnemia conspersa (Curtis)
	Beraeidae	Beraea maurus (Curtis)
	Lepidostomatidae	Crunoecia irrorata (Curtis)
Flies	Ptychopteridae	Ptychoptera sp.
	Chironomidae	
	Tanypodinae	
	Orthocladiinae	
	Chironomini	
	Tanytarsini	

APPENDIX 11 SPRING TAXON LIST FOR BECTOR WOOD STREAM SOURCE

COMMON NAME	FAMILY	SPECIES
Flat worms	Planariidae	Polycelis felina (Dalyell)
		Crenobia alpina (Dana)
Freshwater shrimps	Gammaridae	Gammarus pulex (L.)
May flies	Baetidae	Baetis rhodani (Pictet)
Stone flies	Taeniopterygidae	Brachyptera risi (Morton)
	Nemouridae	Amphinemura standfussi Ris
		Nemoura cinerea (Retzius)
Beetles	Hydrophilidae	Anacaena globulus (Paykull)
Caddis flies	Rhyacophilidae	Agapetus sp.
	Limnephilidae	Micropterna sequax McLachlan
Flies	Ceratopogonidae	
	Chironomidae	
	Orthocladiinae	
	Tanytarsini	

APPENDIX 12 SPRING TAXON LIST FOR BECTOR WOOD STREAM 50m

COMMON NAME	FAMILY	SPECIES
Flat worms	Planariidae	Polycelis felina (Dalyell)
		Crenobia alpina (Dana)
Molluscs	Sphaeriidae	Pisidium sp.
Worms	Oligochaeta	
	Lumbriculidae	
Freshwater shrimps	Gammaridae	Gammarus pulex (L.)
May flies	Baetidae	Baetis rhodani (Pictet)
Stone flies	Nemouridae	Nemoura cambrica gp.
	Leuctridae	Leuctra nigra (Olivier)
	Perlodidae	Isoperla grammatica (Poda)
Beetles	Helodidae	Elodes sp.
Caddis flies	Rhyacophilidae	Agapetus sp.
	Philopotamidae	Wormaldia sp.
	Polycentropodidae	Plectrocnemia sp.
		Plectrocnemia conspersa (Curtis)
		Plectrocnemia geniculata McLachlan
	Limnephilidae	Micropterna sequax McLachlan
	Lepidostomatidae	Crunoecia irrorata (Curtis)
Flies	Tipulidae	Limnophila (Eloeophila) sp.
	Ptychopteridae	Ptychoptera sp.
	Dixidae	Dixa maculata complex
	Chironomidae	
	Orthocladiinae	
	Chironomini	
	Tanytarsini	
	Simuliidae	Simulium costatum gp.
	Stratiomyidae	Oxycera formosa Meigen
	Empididae	Chelifera gp.
	Thaumaleidae	

APPENDIX 13 SPRING TAXON LIST FOR BECTOR WOOD STREAM 250m

COMMON NAME	FAMILY	SPECIES
Flat worms	Planariidae	Polycelis felina (Dalyell)
Molluscs	Hydrobiidae	Potamopyrgus jenkinsi (Smith)
	Sphaeriidae	Pisidium sp.
Worms	Oligochaeta	
	Tubificidae	
	Lumbriculidae	
	Lumbricidae	
Freshwater shrimps	Gammaridae	Gammarus pulex (L.)
May flies	Baetidae	Baetis rhodani (Pictet)
		Baetis muticus (L.)
	Heptageniidae	Ecdyonurus sp.
Stone flies	Leuctridae	Leuctra nigra (Olivier)
	Perlodidae	Isoperla grammatica (Poda)
Beetles	Helodidae	Elodes sp.
	Elmidae	Elmis aenea (Muller)
		Riolus subviolaceus (Muller)
Caddis flies	Rhyacophilidae	Agapetus sp.
	Philopotamidae	Wormaldia sp.
	Polycentropodidae	Plectrocnemia conspersa (Curtis)
	Psychomyiidae	Tinodes unicolor (Pictet)
	Hydropsychidae	Hydropsyche instabilis (Curtis)
	Limnephilidae	Drusus annulatus Stephens
		Potamophylax latipennis/cingulatus gp.
		Micropterna sequax McLachlan
Flies	Tipulidae	Pedicia sp. (not rivosa)
		Dicranota sp.
		Limnophila (Eloeophila) sp.
	Ptychopteridae	Ptychoptera sp.
	Chironomidae	
	Tanypodinae	
	Orthocladiinae	
	Tanytarsini	
	Stratiomyidae	Oxycera pardalina Meigen
	Thaumaleidae	

APPENDIX 14 SPRING TAXON LIST FOR BECTOR WOOD STREAM 1000m

COMMON NAME	FAMILY	SPECIES
Flat worms	Planariidae	Polycelis felina (Dalyell)
Molluscs	Sphaeriidae	Pisidium sp.
Worms	Oligochaeta	
	Tubificidae	
	Enchytraeidae	
	Lumbriculidae	
	Lumbricidae	
freshwater shrimps	Gammaridae	Gammarus pulex (L.)
May flies	Baetidae	Baetis rhodani (Pictet)
	Leptophlebiidae	Paraleptophlebia submarginata (Stephens)
Stone flies	Taeniopterygidae	Brachyptera risi (Morton)
	Nemouridae	Amphinemura standfussi Ris
		Nemoura cambrica gp.
		Nemoura erratica Classen
	Leuctridae	Leuctra nigra (Olivier)
	Perlodidae	Isoperla grammatica (Poda)
Beetles	Helodidae	Elodes sp.
	Elmidae	Elmis aenea (Muller)
Caddis flies	Philopotamidae	Wormaldia sp.
	Polycentropodidae	Plectrocnemia conspersa (Curtis)
	Psychomyiidae	Tinodes unicolor (Pictet)
		Tinodes dives (Pictet)
		Lype sp.
	Hydropsychidae	Hydropsyche instabilis (Curtis)
	Limnephilidae	Potamophylax latipennis/cingulatus gp.
		Halesus sp.
	Beraeidae	Beraea maurus (Curtis)
Flies	Tipulidae	Dicranota sp.
		Lmnophila (Eloeophila) sp.
	Ptychopteridae	Ptychoptera sp.
	Dixidae	Dixa maculata complex
	Ceratopogonidae	Indet. sp.
	Chironomidae	
	Tanypodinae	
	Diamesinae	
	Prodiamesinae	
	Orthocladiinae	
	Chironomini	
	Tanytarsini	
	Simuliidae	Simulium cryophilum gp.
		Simulium costatum gp.
	Empididae	Hemerodromia gp.

APPENDIX 15 SPRING TAXON LIST FOR WHITE HOLE FARM STREAM 50m

COMMON NAME	FAMILY	SPECIES
Flat worms	Planariidae	Polycelis felina (Dalyell)
		Crenobia alpina (Dana)
Worms	Oligochaeta	
Freshwater shrimps	Gammaridae	Gammarus pulex (L.)
May flies	Baetidae	Baetis vernus Curtis
		Baetis rhodani (Pictet)
		Baetis muticus (L.)
	Heptageniidae	Rithrogena semicolorata gp.
Stone flies	Nemouridae	Nemoura cambrica gp.
	Chloroperlidae	Chloroperla torrentium (Pictet)
Beetles	Elminthidae	Elmis aenea (Muller)
Caddis flies	Rhyacophilidae	Rhyacophila septentrionis McLachlan
		Agapetus sp.
	Philopotamidae	Wormaldia sp.
	Polycentropodidae	Plectrocnemia geniculata McLachlan
	Limnephilidae	Drusus annulatus Stephens
		Micropterna sequax McLachlan
Flies	Tipulidae	Dicranota sp.
	Ceratopogonidae	
	Chironomidae	
	Orthocladiinae	
	Chironomini	
	Tanytarsini	
	Simuliidae	Simulium vernum gp.

APPENDIX 16 SPRING TAXON LIST FOR WHITE HOLE FARM STREAM 250m (CASCADE)

COMMON NAME	FAMILY	SPECIES
Flat worms	Planariidae	Polycelis felina (Dalyell)
		Crenobia alpina (Dana)
Molluscs	Sphaeriidae	Pisidium sp.
Worms	Oligochaeta	
	Enchytraeidae	
	Lumbriculidae	
	Lumbricidae	
Freshwater shrimps	Gammaridae	Gammarus pulex (L.)
May flies	Baetidae	Baetis vernus Curtis
		Baetis rhodani (Pictet)
		Baetis muticus (L.)
Stone flies	Nemouridae	Nemoura cambrica gp.
Beetles	Helodidae	Elodes sp.
Caddis flies	Rhyacophilidae	Rhyacophila septentrionis McLachlan
	Philopotamidae	Wormaldia sp.
	Polycentropodidae	Plectrocnemia conspersa (Curtis)
	Psychomyiidae	Tinodes unicolor (Pictet)
	Hydropsychidae	Hydropsyche instabilis (Curtis)
Flies	Tipulidae	Dicranota sp.
	Psychodidae	Pericoma (cf calcilega Feuerborn)
	Dixidae	Dixa maculata complex
	Chironomidae	
	Diamesinae	
	Orthocladiinae	
	Tanytarsini	
	Simuliidae	Simulium costatum Friederichs
		Simulium ornatum gp.
	Stratiomyidae	Oxycera pardalina Meigen

APPENDIX 17 SPRING TAXON LIST FOR WHITE HOLE FARM STREAM adjacent 250m

COMMON NAME	FAMILY	SPECIES
Flat worms	Planariidae	Polycelis felina (Dalyell)
		Crenobia alpina (Dana)
Crustacea	Gammaridae	Gammarus pulex (L.)
Mayflies	Baetidae	Baetis rhodani (Pictet)
Stone flies	Nemouridae	Nemoura cambrica gp.
Beetles	Helodidae	Elodes sp.
Flies	Dixidae	Dixa maculata complex

APPENDIX 18 SPRING TAXON LIST FOR LEIGH WOOD WEST STREAM

COMMON NAME	FAMILY	SPECIES
Molluscs	Hydrobiidae	Potamopyrgus jenkinsi (Smith)
	Sphaeriidae	Pisidium sp.
Worms	Oligochaeta	
	Naididae	
	Lumbriculidae	
	Lumbricidae	
Stone flies	Nemouridae	Amphinemura standfussi Ris
		Nemoura cinerea (Retzius)
	Perlodidae	Isoperla grammatica (Poda)
Beetles		Agabus guttatus (Paykull)
Caddis flies	Philopotamidae	Wormaldia sp.
	Lepidostomatidae	Crunoecia irrorata (Curtis)
Flies	Psychodidae	Indet.
	Ceratopogonidae	
	Chironomidae	
	Orthocladiinae	
	Tanytarsini	
	Simuliidae	Simulium vernum gp.
	Stratiomyidae	Oxycera pardalina Meigen

APPENDIX 19 SPRING TAXON LIST FOR LEIGH WOOD EAST STREAM SOURCE

COMMON NAME	FAMILY	SPECIES
Stone flies	Nemouridae	Amphinemura standfussi Ris
		Nemoura cinerea (Retzius)
Beetles	Hydrophilidae	Anacaena globulus (Paykull)
Caddis flies	Limnephilidae	Micropterna sequax McLachlan
Flies	Chironomidae	
	Orthocladiinae	
	Simuliidae	Simulium cryophilum gp.

APPENDIX 20 SPRING TAXON LIST FOR LEIGH WOOD EAST STREAM 50m

COMMON NAME	FAMILY	SPECIES
Molluscs	Lymnaeidae	Lymnaea truncatula (Muller)
	Sphaeriidae	Pisidium sp.
Worms	Oligochaeta	
	Naididae	
	Tubificidae	
	Enchytraeidae	
Freshwater shrimps	Gammaridae	Gammarus pulex (L.)
May flies	Baetidae	Baetis vernus Curtis
		Baetis rhodani (Pictet)
Stone flies	Taeniopterygidae	Brachyptera risi (Morton)
	Nemouridae	Amphinemura standfussi Ris
		Nemoura cinerea (Retzius)
Beetles	Dytiscidae	Agabus guttatus (Paykull)
	Hydrophilidae	Helophorus grandis Illiger
		Cercyon sp.
Caddis flies	Limnephilidae	Micropterna sequax McLachlan
Flies	Dixidae	Dixa maculata complex
	Ceratopogonidae	
	Chironomidae	
	Orthocladiinae	
	Tanytarsini	
	Simuliidae	Simulium vernum gp.
		Simulium cryophilum gp.
		Simulium ornatum gp.
	Stratiomyidae	Indet. sp.

APPENDIX 21 SPRING TAXON LIST FOR LEIGH WOOD EAST STREAM 250m

COMMON NAME	FAMILY	SPECIES
Molluscs	Sphaeriidae	Pisidium sp.
Worms	Oligochaeta	
	Tubificidae	
	Lumbriculidae	
	Lumbricidae	
Freshwater shrimps	Gammaridae	Gammarus pulex (L.)
May flies	Baetidae	Baetis rhodani (Pictet)
Stone flies	Nemouridae	Amphinemura standfussi Ris
		Nemoura cinerea (Retzius)
Beetles	Hydrophilidae	Hydraena nigrita Germar
Caddis flies	Philopotamidae	Wormaldia sp.
	Limnephilidae	Micropterna sequax McLachlan
Flies	Tipulidae	Molophilus sp.
	Ceratopogonidae	
	Chironomidae	
	Orthocladiinae	
	Tanytarsini	
	Simuliidae	Simulium vernum gp.
		Simulium cryophilum gp.
		Simulium angustitarse gp.

APPENDIX 22 SPRING TAXON LIST FOR LOWER SOHO FARM STREAM SITE 1

COMMON NAME	FAMILY	SPECIES
Molluscs	Lymnaeidae	Lymnaea truncatula (Muller)
	Sphaeriidae	Pisidium sp.
Worms	Oligochaeta	
	Tubificidae	
	Lumbriculidae	
Freshwater shrimps	Gammaridae	Gammarus pulex (L.)
May flies	Baetidae	Baetis rhodani (Pictet)
Stone flies	Nemouridae	Amphinemura standfussi Ris
		Nemoura cinerea (Retzius)
Beetles	Helodidae	Elodes sp.
Caddis flies	Limnephilidae	Micropterna sequax McLachlan
Flies	Ceratopogonidae	
	Chironomidae	
	Orthocladiinae	

APPENDIX 23 SPRING TAXON LIST FOR FINGER STREAM WEST SITE 1

COMMON NAME	FAMILY	SPECIES
Moluscs	Lymnaeidae	Lymnaea peregra (Muller)
Worms	Oligochaeta	
	Naididae	
	Enchytraeidae	
Freshwater shrimps	Gammaridae	Gammarus pulex (L.)
May flies	Baetidae	Baetis rhodani (Pictet)
Stone flies	Nemouridae	Amphinemura standfussi Ris
Beetles	Dytiscidae	Agabus sp.
Flies	Tipulidae	Tipula montium gp.
	Psychodidae	Pericoma trivialis gp.
	Ceratopogonidae	
	Chironomidae	
	Orthocladiinae	
	Tanytarsini	
	Stratiomyidae	Oxycera formosa Meigen

APPENDIX 24 SPRING TAXON LIST FOR FINGER STREAM WEST SITE 2

COMMON NAME	FAMILY	SPECIES
Worms	Oligochaeta	
	Naididae	
Freshwater shrimps	Gammaridae	Gammarus pulex (L.)
May flies	Baetidae	Baetis rhodani (Pictet)
	Ephemerellidae	Ephemeralla ignita (Poda)
Stone flies	Nemouridae	Nemoura cinerea (Retzius)
	Perlodidae	Isoperla grammatica (Poda)
Beetles	Dytiscidae	Agabus sp.
Caddis flies	Limnephilidae	Micropterna sequax McLachlan
Flies	Chironomidae	
	Orthocladiinae	
	Dolichopodidae	

APPENDIX 25 SPRING TAXON LIST FOR FINGER STREAM WEST SITE 3

COMMON NAME	FAMILY	SPECIES
Molluscs	Lymnaeidae	Lymnaea truncatula (Muller)
Worms	Oligochaeta	
	Naididae	
	Enchytraeidae	
	Lumbricidae	
Freshwater shrimps	Gammaridae	Gammarus pulex (L.)
May flies	Baetidae	Baetis vernus Curtis
		Baetis rhodani (Pictet)
	Ephemerellidae	Ephemeralla ignita (Poda)
Stone flies	Taeniopterygidae	Brachyptera risi (Morton)
	Nemouridae	Amphinemura standfussi Ris
		Nemoura cinerea (Retzius)
	Perlodidae	Isoperla grammatica (Poda)
Beetles	Dytiscidae	Agabus sp.
Caddis flies	Limnephilidae	Micropterna sequax McLachlan
Flies	Chironomidae	
	Orthocladiinae	
	Tanytarsini	
	Simuliidae	Simulium costatum Friederichs
		Simulium ornatum gp.
	Dolichopodidae	Indet.
	Syrphidae	Chrysogaster sp.

APPENDIX 26 SPRING TAXON LIST FOR CHANTRY EAST STREAM SITE 1

COMMON NAME	FAMILY	SPECIES
Flat worms	Planariidae	Polycelis felina (Dalyell)
		Crenobia alpina (Dana)
Molluscs	Sphaeriidae	Pisidium sp.
Worms	Oligochaeta	
	Naididae	
Leeches	Glossiphoniidae	Glossiphonia complanata (L.)
Freshwater shrimps	Gammaridae	Gammarus pulex (L.)
May flies	Baetidae	Baetis rhodani (Pictet)
Beetles	Helodidae	Elodes sp.
		Cyphon sp.
Caddis flies	Polycentropodidae	Plectrocnemia conspersa (Curtis)
	Limnephilidae	Limnephilus lunatus gp.
		Chaetopteryx villosa (Fabricius)
		Potamophylax gp/Halesus sp.
		Limnophila (Eloeophila sp.)
Flies	Psychodidae	Pericoma pulchra Eaton
	Ptychopteridae	Ptychoptera sp.
	Dixidae	Dixa maculata complex
	Ceratopogonidae	Indet. sp.
	Chironomidae	
	Tanypodinae	
	Prodiamesinae	
	Orthocladiinae	
	Chironomini	
	Tanytarsini	
	Simuliidae	Simulium costatum Friederichs

APPENDIX 27 SPRING TAXA LIST FOR CHANTRY WEST STREAM SOURCE

COMMON NAME	FAMILY	SPECIES
Flat worms	Planariidae	Polycelis felina (Dalyell)
		Crenobia alpina (Dana)
Molluscs	Sphaeriidae	Pisidium sp.
Freshwater shrimps	Gammaridae	Gammarus pulex (L.)
Stone flies	Nemouridae	Nemoura cambrica gp.
Beetles	Helodidae	Elodes sp.
Caddis flies	Rhyacophilidae	Agapetus sp.
	Polycentropodidae	Plectrocnemia conspersa (Curtis)
	Limnephilidae	Drusus annulatus Stephens
Flies	Chironomidae	
	Orthocladiinae	
	Chironomini	

APPENDIX 28 SPRING TAXON LIST FOR CHANTRY WEST STREAM 50m

COMMON NAME	FAMILY	SPECIES
Molluscs	Sphaeriidae	Pisidium sp.
Water mites	Hydracarina	Indet sp.
Freshwater shrimps	Gammaridae	Gammarus pulex (L.)
Stone flies	Nemouridae	Nemoura cambrica gp.
Beetles	Helodidae	Elodes sp.
Caddis flies	Rhyacophilidae	Agapetus sp.
	Polycentropodidae	Plectrocnemia conspersa (Curtis)
	Limnephilidae	Potamophylax latipennis/cingulatus gp.
		Micropterna sequax McLachlan
	Lepidostomatidae	Crunoecia irrorata (Curtis)
Flies	Tipulidae	Limnophila (Eloeophila) sp.
	Psychodidae	Pericoma pulchra Eaton
	Ptychopteridae	Ptychoptera sp.
	Chironomidae	
	Orthocladiinae	
	Chironomini	
	Tanytarsini	
	Simuliidae	Simulium costatum Friederichs

APPENDIX 29 SUMMER TAXON LIST FOR HURDLESTONE STREAM

COMMON NAME	FAMILY	SPECIES
Worms	Oligochaeta	
Freshwater shrimps	Gammaridae	Gammarus pulex (L.)
May flies	Baetidae	Baetis rhodani (Pictet)
Beetles	Dytiscidae	Agabus sp.
Caddis flies	Psychomyiidae	Lype sp.
	Limnephilidae	Micropterna sequax McLachlan
		Chaetopteryx villosa (Fabricius)
Flies	Tipulidae	Pedicia sp. (not rivosa)
		Dicranota sp.
		Molophilus sp.
	Psychodidae	Pericoma trifasciata (Meigen)
		Pericoma sp. (trivialis gp/canescens)
	Dixidae	Dixa maculata complex
	Ceratopogonidae	
	Chironomidae	
	Tanypodinae	
	Diamesinae	
	Orthocladiinae	
	Tanytarsini	
	Simuliidae	Simulium cryophilum gp.
		Simulium angustitarse gp.
		Simulium aureum gp.
		Simulium ornatum gp.
	Empididae	Clinocera sp.

APPENDIX 30 SUMMER TAXON LIST FOR BECTOR WOOD STREAM

COMMON NAME	FAMILY	SPECIES
Flat worms	Planariidae	Polycelis felina (Dalyell)
	Sphaeriidae	Pisidium sp.
Worms	Oligochaeta	
Leeches	Glossiphoniidae	Glossiphonia complanata (L.)
Water mites	Hydracarina	Indet sp.
Freshwater shrimps	Gammaridae	Gammarus pulex (L.)
May flies	Baetidae	Baetis rhodani (Pictet)
	Leptophlebiidae	Paraleptophlebia submarginata (Stephens)
	Leuctridae	Leuctra nigra (Olivier)
		Leuctra fusca (L.)
	Perlodidae	Isoperla grammatica (Poda)
Bugs	Veliidae	Velia caprai Tamanini
Beetles	Hydrophilidae	Helophorus brevipalpis Bedel
		Anacaena globulus (Paykull)
	Helodidae	Elodes sp.
	Elmidae	Elmis aenea (Muller)
		Riolus subviolaceus (Muller)
Caddis flies	Rhyacophilidae	Rhyacophila sp. (juvenile)
	Philopotamidae	Wormaldia sp.
	Polycentropodidae	Plectrocnemia conspersa (Curtis)
	Psychomyiidae	Lype sp.
	Hydropsychidae	Hydropsyche instabilis (Curtis)
	Limnephilidae	Micropterna sequax McLachlan
		Chaetopteryx villosa (Fabricius)
Flies	Tipulidae	Dicranota sp.
		Pilaria/Oxydiscus?
		Limnophila (Eloeophila) sp.
	Ceratopogonidae	
	Chironomidae	
	Tanypodinae	
	Prodiamesinae	
	Orthocladiinae	
	Chironomini	
	Tanytarsini	
	Empididae	Hemerodromia gp. ?
	Thaumaleidae	

APPENDIX 31 SUMMER TAXON LIST FOR WHITE HOLE FARM STREAM

COMMON NAME	FAMILY	SPECIES
Flat worms	Planariidae	Polycelis felina (Dalyell)
		Crenobia alpina (Dana)
	Sphaeriidae	Pisidium sp.
Worms	Oligochaeta	
Water mites	Hydracarina	Indet sp.
Freshwater shrimps	Gammaridae	Gammarus pulex (L.)
May flies	Baetidae	Baetis vernus Curtis
		Baetis rhodani (Pictet)
		Baetis muticus (L.)
	Nemouridae	Nemoura cambrica gp. (erratica)
Bugs	Veliidae	Velia caprai Tamanini
Beetles	Dytiscidae	Agabus sp.
	Hydrophilidae	Helophorus brevipalpis Bedel
	Helodidae	Elodes sp.
Caddis flies	Philopotamidae	Wormaldia sp.
	Polycentropodidae	Plectrocnemia conspersa (Curtis)
	Psychomyiidae	Tinodes unicolor (Pictet)
	Limnephilidae	Potamophylax latipennis/cingulatus gp.
	Beraeidae	Beraea maurus (Curtis)
Flies	Tipulidae	Dicranota sp.
	Psychodidae	Pericoma calcilega Feuerborn
		Pericoma neglecta Eaton
		Pericoma trifasciata (Meigen)
		Pericoma trivialis gp.
	Dixidae	Dixa maculata complex
		Dixa puberula Loew
	Ceratopogonidae	
	Chironomidae	
	Tanypodinae	
	Prodiamesinae	
	Orthocladiinae	
	Chironomini	
	Tanytarsini	
	Simuliidae	Simulium cryophilum gp.
		Simulium costatum Friederichs
		Simulium ornatum gp.
	Stratiomyidae	Oxycera pardalina Meigen
	Empididae	Chelifera gp.
		Clinocera sp.

APPENDIX 32 SUMMER TAXON LIST FOR CHANTRY EAST STREAM

COMMON NAME	FAMILY	SPECIES
Flat worms	Planariidae	Polycelis felina (Dalyell)
		Crenobia alpina (Dana)
	Sphaeriidae	Pisidium sp.
Worms	Oligochaeta	
Leeches	Glossiphoniidae	Glossiphonia complanata (L.)
Freshwater shrimps	Gammaridae	Gammarus pulex (L.)
Beetles	Hydrophilidae	Indet.
	Helodidae	Elodes sp.
Caddis flies	Limnephilidae	Chaetopteryx villosa (Fabricius)
	Beraeidae	Beraea maurus (Curtis)
Flies	Tipulidae	Pilaria filata gp.
		Pilaria/Oxydiscus?
		Limnophila (Eloeophila) sp.
	Psychodidae	Pericoma pulchra Eaton
		Pericoma trivialis gp.
		Pericoma sp. (trivialis gp/canescens)
		Psychoda severini Tonnoir
	Ptychopteridae	Ptychoptera sp.
	Dixidae	Dixa maculata complex
	Chironomidae	
	Tanypodinae	
	Orthocladiinae	
	Chironomini	
	Tanytarsini	
	Simuliidae	Simulium costatum Friederichs
		Simulium angustitarse gp.
		Simulium ornatum gp.
	Muscidae	
	Fannidae	

APPENDIX 33 SUMMER SPECIES LIST FOR CHANTRY WEST STREAM

COMMON NAME	FAMILY	SPECIES
Flat worms	Planariidae	Polycelis felina (Dalyell)
	Sphaeriidae	Pisidium sp.
Worms	Oligochaeta	
	Tubificidae	
Leeches	Glossiphoniidae	Glossiphonia complanata (L.)
Freshwater shrimps	Gammaridae	Gammarus pulex (L.)
Beetles	Hydrophilidae	Helophorus brevipalpis Bedel
		Anacaena globulus (Paykull)
Caddis flies	Philopotamidae	Wormaldia sp.
	Polycentropodidae	Plectrocnemia conspersa (Curtis)
	Psychomyiidae	Lype sp.
	Lepidostomatidae	Crunoecia irrorata (Curtis)
Flies	Tipulidae	Tipula rufina Meigen
	Psychodidae	Pericoma trivialis gp.
		Psychoda severini Tonnoir
	Dixidae	Dixa maculata complex
	Chironomidae	
	Orthocladiinae	
	Chironomini	
	Tanytarsini	
	Thaumaleidae	

APPENDIX 34 DEFINITIONS AND CRITERIA FOR DIFFERENT LEVELS OF CONSERVATION STATUS

Extinct
Taxa which formerly had breeding populations in Britain but which it is now believed have completely died out.

Endangered (RDB 1)
Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Taxa whose numbers have been reduced to a critical level or whose habitats have been so dramatically reduced that they are deemed to be in immediate danger of extinction. Included are taxa which are known only as a single population in only one 10 km square, taxa which only occur in habitats known to be especially vulnerable, or taxa which have shown a continuous decline over the last twenty years and now exist in five or fewer 10 km squares.

Vulnerable (RDB 2)
Taxa believed likely to move into the Endangered category in the near future. Included are taxa of which most or all of the populations are decreasing because of over-exploitation, extensive destruction of habitat or other environmental disturbance; taxa with populations that have been seriously depleted and whose ultimate security is not yet assured; and taxa with populations that may still be abundant but are under threat from serious adverse factors throughout their range.

Rare (RDB 3)
Taxa with small populations which are not at present Endangered or Vulnerable, but are at risk. These taxa are usually localised within restricted geographical areas or habitats, or are thinly scattered over a more extensive range. Usually, such taxa are not likely to exist in more than fifteen 10 km squares of the National Grid. This criterion might be relaxed where populations are likely to exist in over fifteen 10 km squares but occupy small areas of especially vulnerable habitat.

Insufficiently Known (RDB K)
Taxa suspected of falling within categories RDB 1 - RDB 3, but about which there is insufficient information to be certain. For example, such taxa may be recently discovered or recognised; be particularly difficult to identify; or live in habitats where they are likely to be overlooked. There may be doubts about whether a recently discovered species is native or has been recently introduced by man, and this uncertainty could result in the species being placed in category K.

Notable
Taxa which do not fall within RDB categories 1 - 3 but which are nonetheless scarce in Great Britain and thought to occur in fewer than a hundred 10 km squares of the National Grid. For some well-recorded groups of invertebrates Notable has been subdivided into Notable A (thirty or fewer 10 km squares) and Notable B (thirty-one to one hundred 10 km squares), but this has not been attempted for Trichoptera.

Regionally Notable (NR)
Taxa which are too common nationally to fall within the Notable category but which are uncommon in some parts of the country. Uncommon in this case means found in five or fewer localities. The region to which this status applies is described for each species.

Local
Those species not uncommon enough to fall within any of the preceding categories, but which are nonetheless of some interest. A species may qualify by being, for example, very widely distributed but nowhere common; by being restricted to a specialised habitat such as brackish pools but being a common component of this habitat; or simply by being uncommon but not uncommon enough to be a Notable. Species with few records but which are suspected of being badly under recorded are likely to be placed in the Local category. Local species may also be Regionally Notable.

Common
Sufficiently frequently recorded from a wide area not to signify any particular conservation significance to sites where it occurs. Common species may also be Regionally Notable.

Appendix 35 - BMWP Family Scores

BMWP families with score = 10:

Heptageniidae
Leptophlebiidae
Potamanthidae
Ephemeridae
Ephemerellidae
Siphlonuridae

Capniidae
Chloroperlidae
Perlodidae
Leuctridae
Taeniopterygidae
Perlidae

Aphelocheiridae

Molannidae
Sericostomatidae
Leptoceridae
Odontoceridae
Goeridae
Lepidostomatidae
Phryganeidae
Brachycentridae
Beraeidae

BMWP families with score = 8:

Astacidae

Libellulidae
Lestidae
Calopterygidae
Gomphidae
Cordulegasteridae
Aeshnidae
Corduliidae

Philopotamidae
Psychomyiidae (incl. Ecnomidae)

BMWP families with score = 7:

Caenidae

Nemouridae

Rhyacophilidae (incl. Glossomatidae)
Polycentropodidae
Limnephilidae

BMWP families with score = 6:

Neritidae
Viviparidae
Ancylidae (incl. Acroloxidae)

Unionidae

Gammaridae (incl. Crangonyctidae & Niphargidae)
Corophiidae

Platycnemididae
Coenagriidae

Hydroptilidae

BMWP families with score = 5:

Planariidae (incl. Dugesiidae)
Dendrocoelidae
Naucoridae
Corixidae
Notonectidae
Nepidae
Gerridae
Hydrometridae
Mesovelidae
Pleidae
Chrysomelidae
Dryopidae
Curculionidae
Elmidae
Hydrophilidae (incl. Hydraenidae)
Dytiscidae (incl. Noteridae)
Gyrinidae
Hygrobiidae
Haliplidae
Scirtidae
Hydropsychidae
Tipulidae
Simuliidae

BMWP families with score = 4:

Piscicolidae
Baetidae
Sialidae

BMWP families with score = 3:

Valvatidae
Planorbidae
Lymnaeidae
Hydrobiidae (incl. Bithyniidae)
Physidae
Sphaeriidae
Glossiphoniidae
Hirudinidae
Erpobdellidae
Asellidae

BMWP families with score = 2:

Chironomidae

BMWP families with score = 1:

Oligochaeta

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