

Ecological Survey of the River Teign at Castle Drogo, Devon

M Gravelle, BSc, MSc

P Scarlett, BSc, MSc

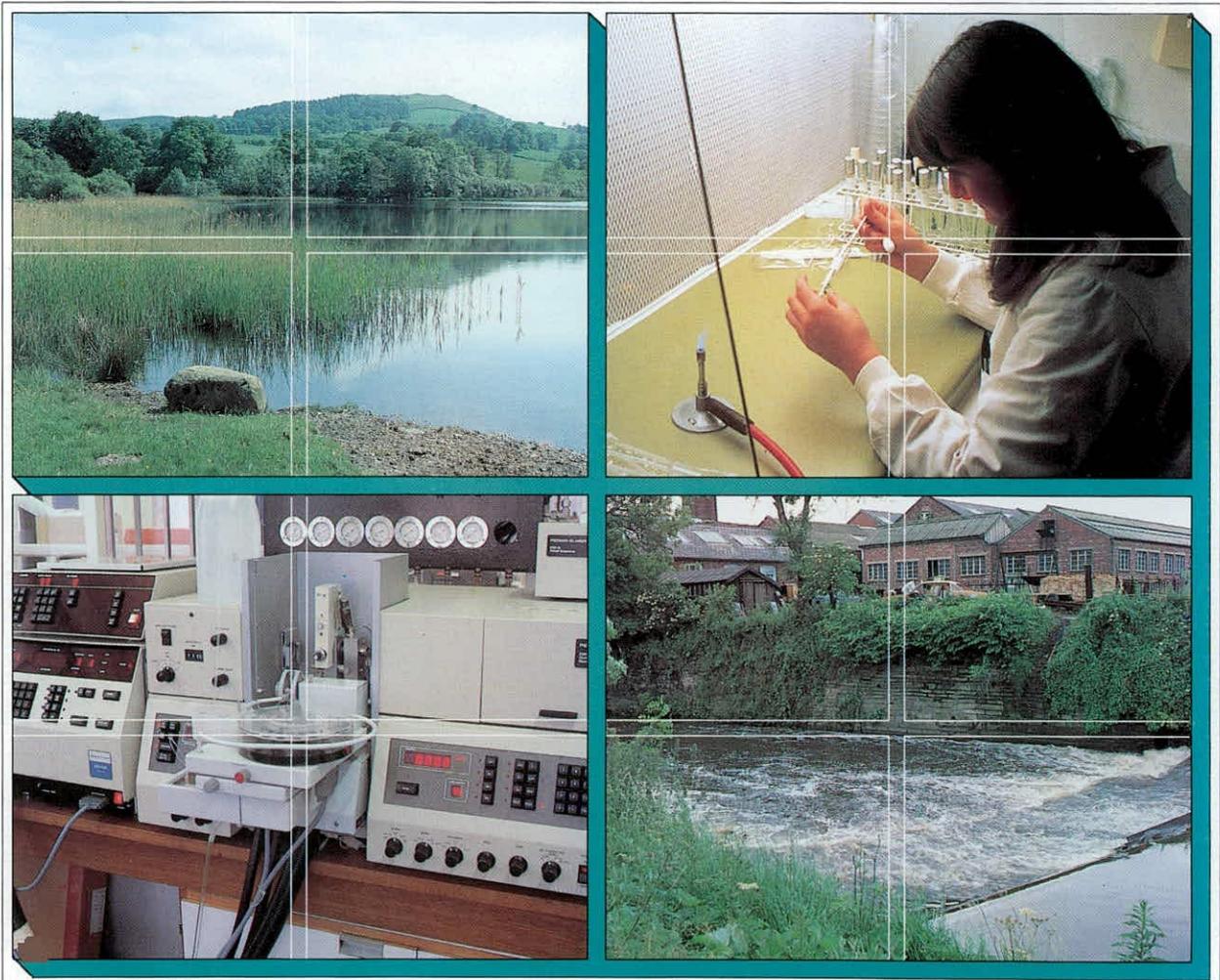
A T Ibbotson, BSc, PhD, Grad IPM, MIFM

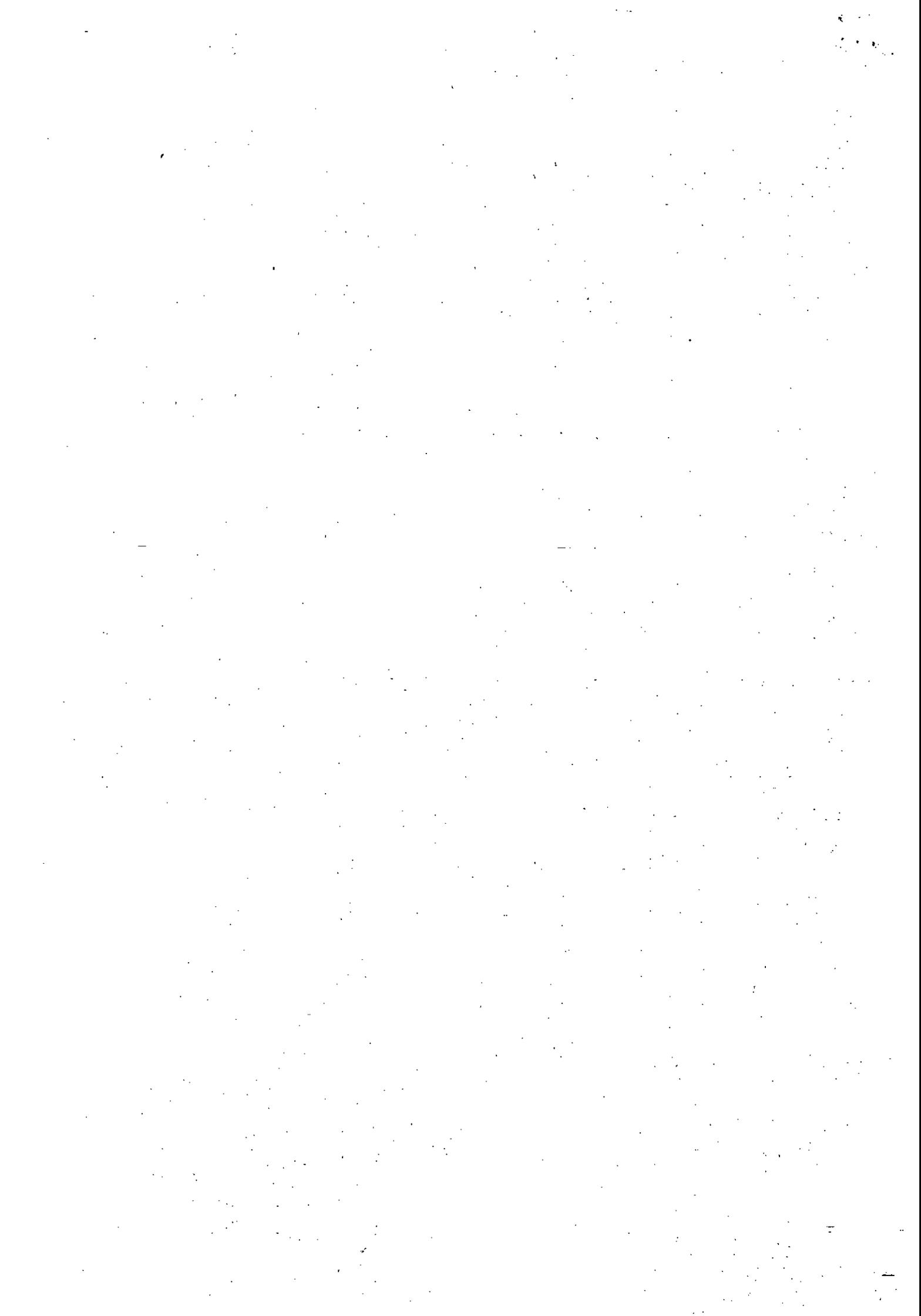
F H Dawson, PhD, CBIol, MCIWEM

J H Blackburn, BSc

Report to:
Report Reference No:

Dulas Ltd
T04073G7/3







**Institute of
Freshwater
Ecology**

River Laboratory
East Stoke, Wareham
Dorset BH20 6BB
United Kingdom

Telephone +44 (0)1929 462314
Facsimile +44 (0)1929 462180
Email

Ecological Survey of the River Teign at Castle Drogo, Devon

M Gravelle, BSc, MSc

P Scarlett, BSc, MSc

A T Ibbotson, BSc, PhD, Grad IPM, MIFM

F H Dawson, PhD, CBiol, MCIWEM

J H Blackburn, BSc

Project Leader:	F H Dawson
Report Date:	August 1997
Report to:	Dulas Ltd
IFE Report Reference No:	T04073G7/3
Project No:	T04073G7

**Centre for
Ecology &
Hydrology**

Institute of Freshwater Ecology
Institute of Hydrology
Institute of Terrestrial Ecology
Institute of Virology & Environmental Microbiology

Natural Environment Research Council

INTELLECTUAL PROPERTY RIGHTS

CONFIDENTIALITY STATEMENT

'In accordance with our normal practice, this report is for the use only of the party to whom it is addressed, and no responsibility is accepted to any third party for the whole or any part of its contents. Neither the whole nor any part of this report or any reference thereto may be included in any published document, circular or statement, nor published or referred to in any way without our written approval of the form and context in which it may appear.'

1. Introduction.

1.1 Background to survey.

Water has previously been abstracted from the River Teign, Devon to generate electricity for use at Castle Drogo. The abstraction took place between 1928 and 1993, although only the smaller of the two turbines were in operation since 1980.

A weir on the River Teign (SX 72258965) retained water for abstraction to the turbine house, from which the water was returned to the river approximately 500 metres downstream of the weir (SX 72978974). The reach between the weir and the turbine house has therefore been subject to reductions in flow during the operation of the hydroelectric scheme.

It is now proposed to reinstate both turbines which would require abstraction from the Teign.

1.2 Objectives of the project

The objective of this project was to conduct an ecological survey of 1.5 kilometres of the River Teign where it flows through the Castle Drogo estate. This continuous survey length included sections upstream and downstream of the impacted section.

The ecological survey included macrophyte, invertebrate and habitat surveys but excluded fisheries investigations.

The results of the survey have been used to assess the historical impacts of the hydroelectric scheme and to assess the most suitable of two abstraction regimes to be used for reinstatement of the turbines. The information will be used by Dulas Ltd as part of an Environmental Statement accompanying the application for an abstraction license.

1.3 General description of site.

The river Teign has its source on Dartmoor and flows through Dartmoor National Park for approximately 15 kilometres before reaching the Castle Drogo estate. In the upstream end of the survey area the river flows through a shallow concave valley with grazed fields on either bank. Within a few hundred metres the river enters a much steeper valley with broad-leaved woodland on both banks. These woodlands are of high conservation value, particularly Whiddon Park which has been notified as a Site of Special Scientific Interest, being outstanding examples of ancient oak and ash woodland.

The river has a cobble and coarse sand substrate with many exposed boulders and a diversity of flow types. There are numerous mature islands in the survey reach including one approximately 150 metres long. The instream habitats are fairly diverse and there are a limited number of hydraulically linked habitats created from the cut off of old channel courses.

2. Methodology.

The portion of the River Teign which flows through the Castle Drogo estate was divided into three reaches of approximately 500m banklength for the purposes of this study. Within each reach a River Corridor Survey (RCS), a River Habitat Survey (RHS), an invertebrate sample and a macrophyte survey were completed.

Photographs of each reach were taken to represent the general character and one of each of the macrophyte survey points were also taken.

Reach One

The downstream end of reach one was the top of the weir from which water was abstracted for the hydroelectric scheme (SX 72258965). The reach extended for 500m upstream to SX 71908940.

Reach Two

The upstream limit of reach two was the weir (SX 72258965) and the downstream limit was the outfall channel from the turbine house (SX 72538990). The total length of this reach was approximately 450m.

Reach Three

The third reach extended for 500m downstream of the turbine house (SX 72538990 to SX 72978974).

Hydrological data supplied by Dulas Ltd were used as the basis for assessing the different abstraction regimes. The data are based on average daily flows for seven years (1988-1995) from a gauging station further downstream on the Teign, at Preston (approximate grid reference SX 855745), multiplied by a factor of 0.382.

A report produced by the National Trust (1990) was available to provide some additional ecological data. This report detailed findings of surveys in 1990 and 1979 from the Castle Drogo estate and included a short section on the flora and fauna of the river itself.

2.1 River Corridor Survey.

One RCS survey map was produced for each reach following the methodology set out in River Corridor Surveys: Methods and Procedures (NRA, 1992). The survey was completed from both banks and the river channel.

Due to the densely wooded river banks and corridor it would have been difficult and time consuming to map the location of every tree, particularly for reaches 2 and 3, and so a general outline of the wooded area was used, with overhanging trees and those separated from the rest of the canopy marked individually.

The RCS was used to identify and locate any habitats or areas previously impacted or at risk from abstraction for the scheme.

2.2 River Habitat Survey.

The RHS was completed by an EA accredited surveyor following the standard methodology as detailed in the 1997 Field Survey Guidance Manual (EA, 1997a). The survey was completed using the new 1997 forms and incorporated SERCON (System for Evaluating Rivers for Conservation).

Comparisons were made between the RHS surveys for the three reaches and rivers of the same segment type (classification of rivers and streams based on geology, altitude, slope and flow category data) from the national data set. A Habitat Modification Index (HMI) and a Habitat Quality Assessment (HQA) score were also calculated from preliminary guidelines produced by the Environment Agency (EA 1996 and 1997b).

The HMI provides a measure, on a scale of 0-100, of the naturalness of the river reach by assessing the extent of resectioning and reinforcement of the banks and channel and the number of artificial features recorded. A high score (near or over 50) indicates a highly modified river whilst a score of 1 or 2 indicates a semi-natural river.

The HQA is a simple scoring system using the presence and extent of natural features to provide a system for comparing RHS sites. The scores used here were calculated from the first working version presented in the River Habitat Survey newsletter 5 (EA 1997b).

2.3 Invertebrate Survey.

In each reach a three minute kick sample was carried out following the standard methodology for RIVPACS (River Invertebrate Prediction and Classification Scheme). Each of the habitats within the reach was sampled in proportion to the percentage of reach they occupied. Thus instream vegetation, bankside tree roots and boulders were sampled in addition to the predominant substrate (cobble and sand) and the section selected represented the diversity of flow types found within the reach.

The samples were immediately preserved in formaldehyde and later sorted and identified by an experienced and accredited (Natural History Museum IdQ examination E062 - Freshwater macro-invertebrates) biologist at the laboratory. Identification was to species level where possible for all specimens except oligochaetes and chironomids.

2.4 Macrophyte Survey.

A 20m (banklength) of each reach was selected for a macrophyte survey. The section was chosen to include representative habitats of the full 500m reach. The full channel width and all boulders or parts of the bank regularly inundated by water (approximately 20cm height above the water level at the time of survey, as indicated by the vegetation observed) were included in the area surveyed. The percentage cover of each species present within this section was estimated.

The upstream and downstream limits of each section were marked by a metal stake with a flat, white top set flush to the ground. The location of these markers were noted and photographs taken to aid relocation (the photographs have been delivered to Dulas Ltd as 35mm transparencies).

The macrophyte transect in reach one was completed just downstream of the bend in the river, with the upstream end being marked by the telegraph pole on the left bank. In reach 2 the survey location was downstream of the mature islands. The third transect was located just upstream of a fence perpendicular to the left bank. All markers were set in the bank, generally near trees to partially hide them from casual observation.

In addition to the 20m section any other species observed over the whole reach were noted as present.

Identifications of all moss and liverwort species and some other macrophytes were confirmed upon return to the laboratory and herbarium samples retained in the IFE collection at the River Laboratory.

3. Results.

3.1 River Corridor Survey.

The maps for the three sections are shown in figures 1a-c and the summary sheets in appendix 1.

The most notable differences between the reaches were caused by the weir which created a stretch of slow flowing, relatively deep water in reach one for a distance of about 150 metres. The upstream reach (one) was also significantly less shaded due to the more open valley form and absence of broad-leaved woodland.

Reach three had the most diverse natural habitats due to the presence of several mature islands in the lower 100 metres. These created different flow patterns including several deep still pools and high energy rapids. There was also an abundance of woody debris caught against boulders and the edges of the islands.

The middle reach had one large mature island in the centre but there was very little flow around the right bank side. There were also several old channels dissecting the island which are now quite silted and dry. Within these channels and a similar one on the right bank there were pools of standing water in which some green algae and tadpoles were observed. Together with a small pond on the left bank and a spring at the extreme downstream end of the reach these are the only habitats in hydrological continuity with the river itself.

Alnus glutinosa (alder) was common along both banks of all three reaches as were several other tree species. Dippers and grey wagtails were observed along the river length and salmon were seen jumping up the fish ladder.

River Teign
 Reach I.
 Name: Michael Gravelle
 Date: 12/6/97

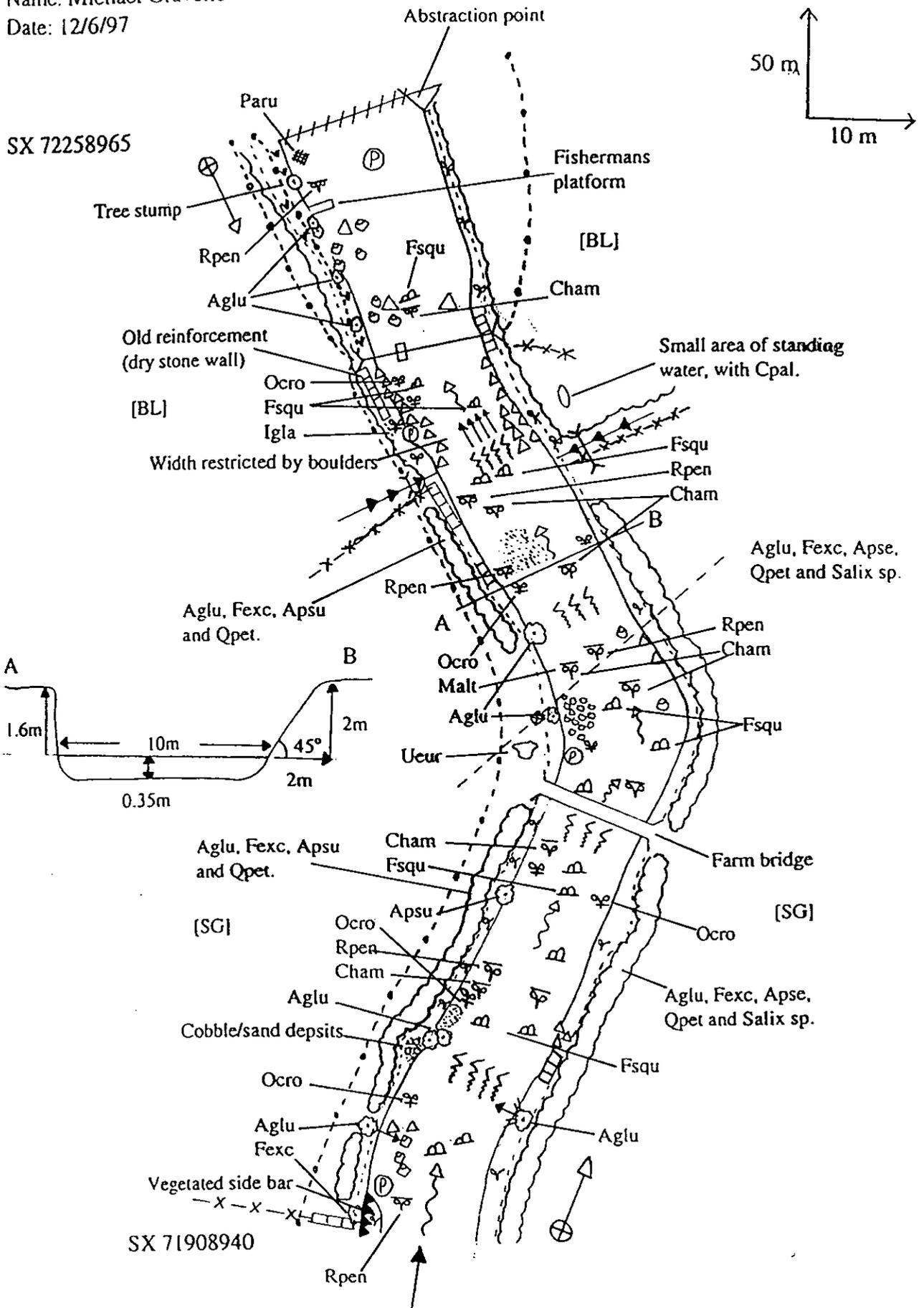


Figure 1a. River Corridor Survey map for Reach I of the river Teign, Castle Drogo, Devon.

River Teign
 Reach 2
 Name: Michael Gravelle
 Date: 12/6/97

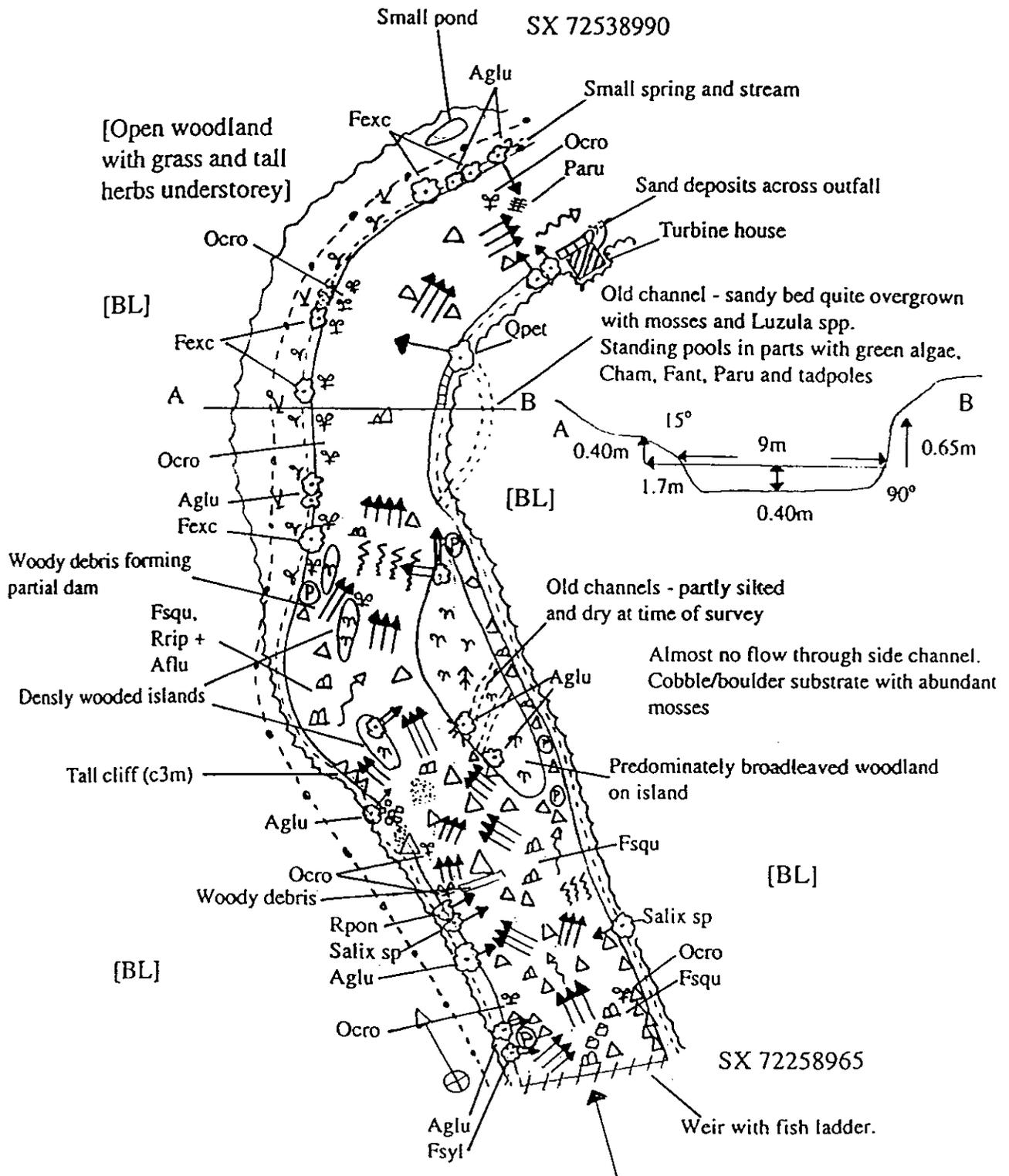
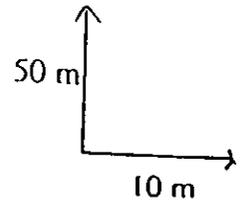


Figure 1b. River Corridor Survey map for Reach 2 of the river Teign, Castle Drogo, Devon

River Teign
 Reach 3
 Name: Michael Gravelle
 Date: 12/6/97

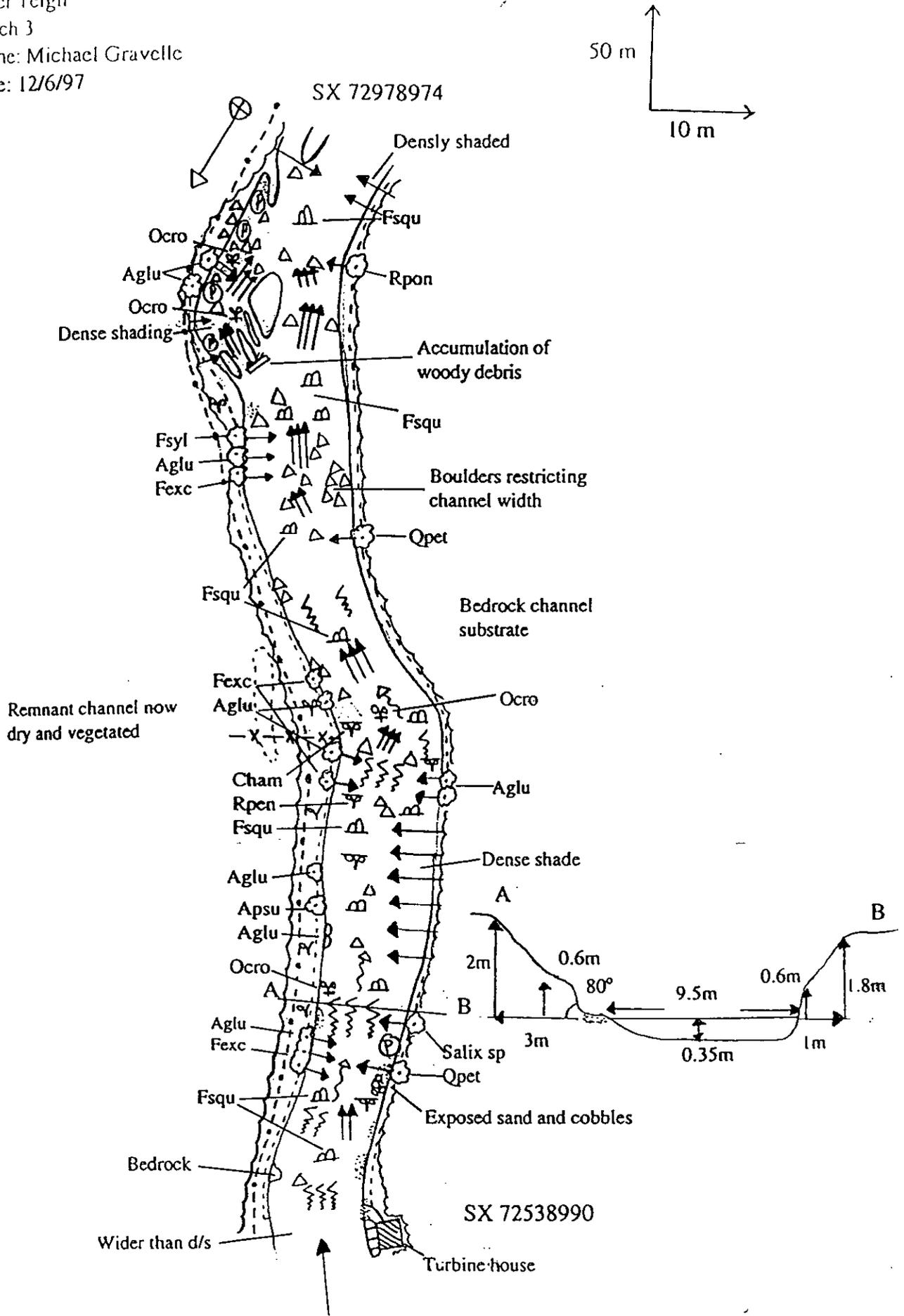
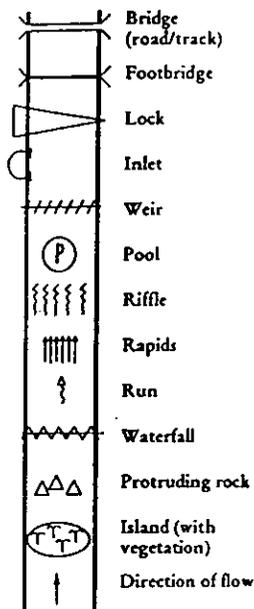


Figure 1c. River Corridor Survey Map for Reach 3 of the river Teign, Castle Drogo, Devon.

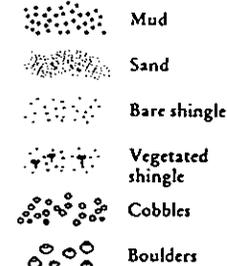
Key to River Corridor Survey maps (Figures 1a-c)

Code	Species	Common name
Aflu	<i>Amblystegium fluviatile</i>	
Aglu	<i>Alnus glutinosa</i>	Alder
Apsu	<i>Acer pseudoplatanus</i>	Sycamore
Cham	<i>Callitriche hamulata</i>	Water star-wort
Cpal	<i>Caltha palustris</i>	Marsh marigold
Fexc	<i>Fraxinus excelsior</i>	Common ash
Fsqu	<i>Fontinalis squamosa</i>	
Fsyl	<i>Fagus sylvatica</i>	Common beech
Igla	<i>Impatiens glandulifera</i>	Himalayan balsam
Malt	<i>Myriophyllum alterniflorum</i>	Water milfoil
Ocro	<i>Oenanthe crocata</i>	Hemlock water-dropwort
Paru	<i>Phalaris arundinacea</i>	Reed canary grass
Qpet	<i>Quercus petaea</i>	Sessile oak
Rpen	<i>Ranunculus penicillatus</i> subsp <i>penicillatus</i>	Water crowfoot
Rpon	<i>Rhododendron ponticum</i>	Rhododendron
Rrip	<i>Rhynchosytem riparioides</i>	
Ueur	<i>Ulex europaeus</i>	Gorse

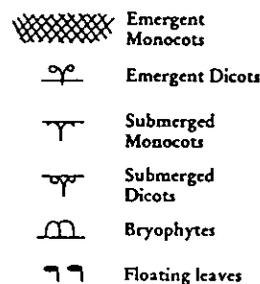
CHANNEL FEATURES



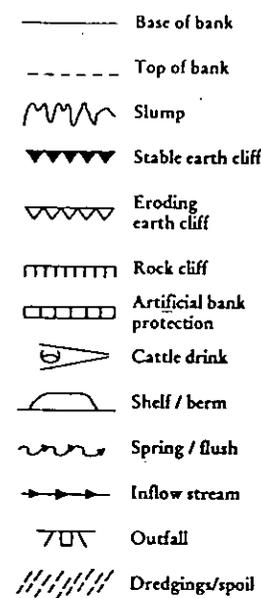
SUBSTRATE



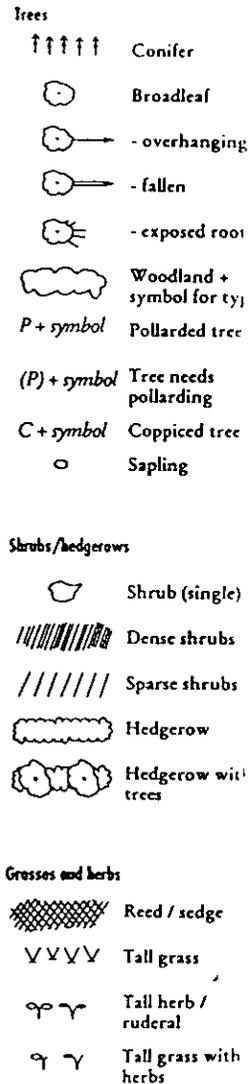
CHANNEL VEGETATION



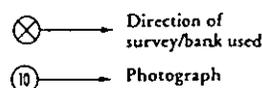
BANK FEATURES



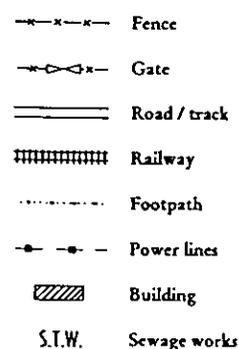
VEGETATION



SURVEY INFORMATION



ADJACENT LAND FEATURES



3.2 River Habitat Survey.

The original RHS forms are included in appendix 1.

Table 1 presents the preliminary Habitat Modification Indices (HMI) and Habitat Quality Assessment (HQA) scores calculated for each reach together with the segment type.

Table 1. Habitat indices and segment type of reaches on the river Teign using River Habitat Survey data.

	Reach 1	Reach 2	Reach 3
Habitat Modification Index	9 slightly modified	7 v. slightly modified	1 semi-natural
Habitat Quality Assessment	35	48	41
Segment Type	2 lowland cobbly river	2 lowland cobbly river	2 lowland cobbly river

Reach 1 is slightly more modified than the other reaches with some old reinforcement of the banks recorded. There is also a modest degree of modification on reach 2 due largely to the weir and turbine house.

The HQA score is highest for reach 2 due to the presence of several mature islands, a diversity of substrate and flow types and a natural side channel. Using the criteria presented in Table 2 this reach is of nationally outstanding quality, having at least one feature in each column of the table. Reach 3 also qualifies using these criteria but reach 1 does not fulfil any of the channel criteria.

Table 2. Qualifying criteria for nationally outstanding quality (reproduced from EA, 1997c).

Channel	Riparian	Adjacent
Waterfall > 5m	Semi-continuous, or continuous, trees on both banks	Extensive broadleaf (or native coniferous) woodland or wetland on both banks, or combination of both
Braided or side channel		
Debris dam(s)	Continuous peat banks in blanket bog areas where trees would not naturally occur	Ox-bows or abandoned channels
Mature island		
Sink holes		
'Floating' reed fringes		

The habitat quality of all three reaches is high with relatively little modification recorded.

All three reaches have more boulder and cobble substrate than the national average for segment 2 rivers and fewer of the other substrate types (Figure 2). The river substrate was a mixture of cobbles and coarse sand, with cobbles generally predominant. The high proportion of boulder substrates in the river is also reflected in the extent of exposed boulders, which were recorded as extensive in all three reaches on the Teign. Nationally they have been recorded at 30% of RHS sites (present or extensive).

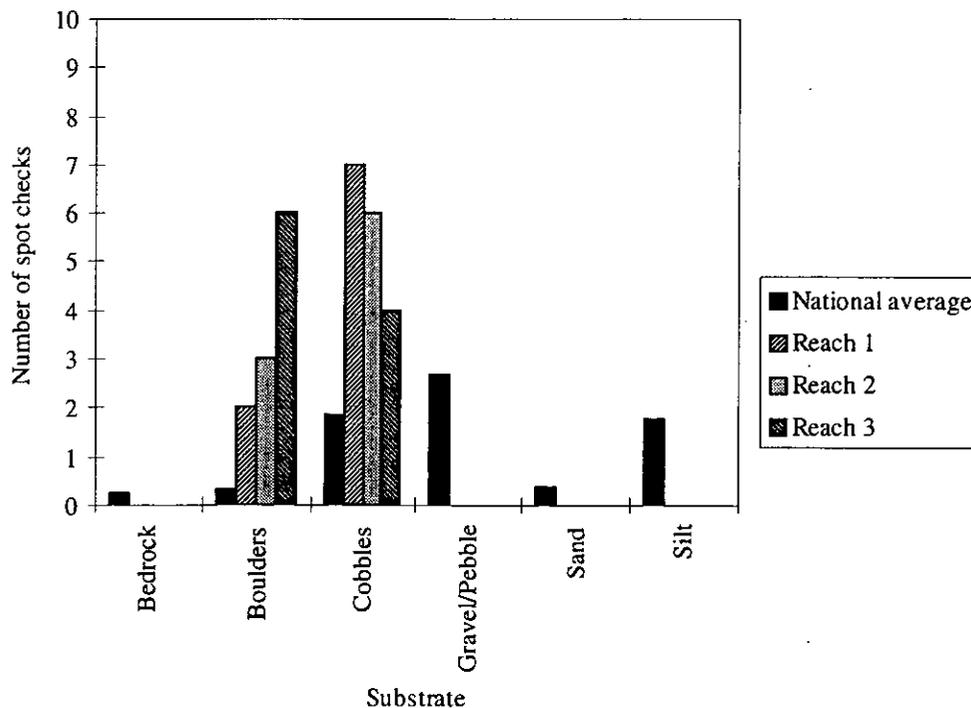


Figure 2. Frequency histogram of the substrate types recorded at spot checks for the RHS survey (1996 national average for type two rivers, and three reaches on River Teign, Castle Drogo)

The flow types recorded are similar to the national average but with slightly more occurrences of rippled flow (Figure 3). The number of riffles recorded in reach 2 and 3, 16 and 20 respectively) were significantly greater than the national average (3.6 ± 9.2 ($p = 0.05$)). Ten riffles were recorded in reach 1 which is also higher than the national average.

The river Teign sites have more trees along the banks and more broad-leaved woodland within 50m of the bank top than the national average. Only 25 percent of national sites have continuous bankside trees and 40 percent have broad-leaved woodland recorded on either bank (present or extensive). Both these features were recorded as extensive on all three reaches.

Nationally otters, dippers and grey wagtails were each recorded at seven percent of segment two rivers. Both dippers and grey wagtails were seen frequently during the two days field work and a salmon tail, probably left by an otter was found at the downstream end of reach 3.

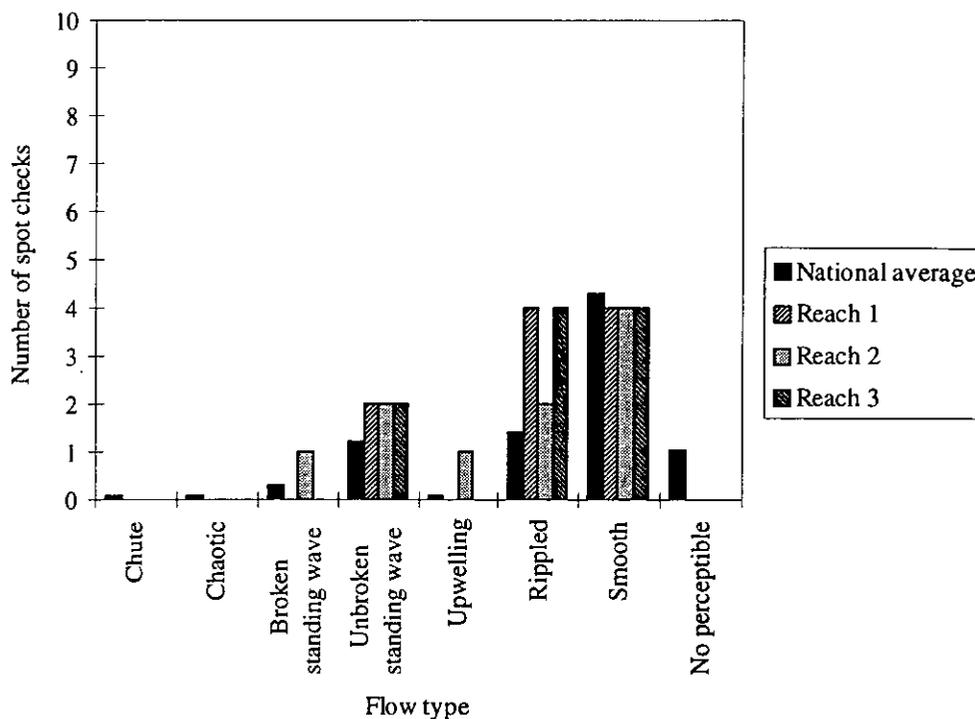


Figure 3. Frequency histogram of the flow types recorded at spot checks for the RHS survey (1996 national average for type 2 rivers and three reaches on River Teign, Castle Drogo)

3.3 Invertebrate Survey.

The full list of species recorded in the three reaches are included in appendix 2. The families and number of individuals in each sample are shown in Table 3.

Fewest families were recorded in reach two (23), with similar numbers in the other two reaches (31 in reach one and 28 in reach 2). The total number of species recorded is also fewest in reach two, as are the number of individuals. These difference were considered to be due to sampling errors caused by only taking a single sample in each reach.

Some differences were apparent in the presence or absence of families (and species) and in the abundance of families (and species) in each reach although these were also considered to be due to sample error rather than ecological differences. The impoundment of water in reach one had a small affect on the species recorded, with *Sigara venusta* and *Plea leachi*, species particularly typical of slow flows/still water, only recorded in the upstream reach.

Table 3. List of invertebrate families, with number of individuals, recorded in a 3 minute kick sample in each reach of the river Teign, Castle Drogo.

Family	Number of individuals in sample		
	Reach 1	Reach 2	Reach 3
Agriidae	1	-	-
Ancylidae	5	24	16
Baetidae	56	136	184
Brachycentridae	32	24	56
Ceratopogonidae	16	-	-
Chironomidae	256	184	440
Chloroperlidae	6	-	-
Cordulegasteridae	-	-	1
Corixidae	1	-	-
Dytiscidae	3	-	-
Elminthidae	89	36	27
Empididae	-	10	-
Ephemerellidae	440	976	1088
Ephemeridae	1	-	-
Gammaridae	3	-	-
Glossiphoniidae	4	-	1
Goeridae	-	1	-
Heptageniidae	-	-	1
Hydracarina	16	8	8
Hydrobiidae	448	12	48
Hydrophilidae	40	1	2
Hydropsychidae	8	64	24
Lepidostomatidae	56	16	24
Leptoceridae	80	2	6
Leuctridae	1	-	1
Limnephilidae	8	2	9
Lymnaeidae	6	-	4
Odontoceridae	-	1	1
Oligochaeta	48	80	168
Philopotamidae	-	-	1
Planariidae	-	-	3
Pleidae	1	-	-
Rhagionidae	6	16	1
Rhyacophilidae	9	38	45
Sericostomatidae	24	16	2
Simuliidae	232	32	128
Sphaeriidae	32	-	7
Tipulidae	34	8	25
Veliidae	-	1	-
Total No. of families	31	23	28
Total No. of species	43	29	39
Total No. of individuals	1962	1701	2321

3.4 Macrophyte Survey.

Table 4 lists the species recorded in each 20 metre section and Table 5 list any additional species noted in the 500 metre reach.

Table 4. Percentage cover of macrophytes recorded in 20 metre sections in each reach of the River Teign at Castle Drogo.

Species	Common name	Percentage Cover		
		Reach 1 (u/s weir)	Reach 2 (weir to turbine house)	Reach 3 (d/s turbine house)
<i>Amblystegium fluviatile</i> (Hedw.)		-	0.5	0.5
<i>Apium nodiflorum</i> (L.) Lag.	Fool's water-cress	< 0.1	< 0.1	-
<i>Callitriche hamulata</i> Kutz. ex W.D.J. Koch	Water starwort	1.5	0.5	0.5
<i>Caltha palustris</i> L.	Marsh-marigold	-	-	0.5
<i>Chiloscyphus polyanthos</i> (L.) Corda		-	< 0.1	0.5
<i>Conocephalum conicum</i> (L.) Underw.		1	-	0.5
<i>Fissidens viridulus</i> (Sw.) Wahlenb.		-	-	< 0.1
<i>Fontinalis squamosa</i> Hedw.		5	15	20
<i>Mnium hornum</i> Hedw.		-	0.5	-
<i>Myriophyllum alterniflorum</i> DC.	Water milfoil	< 0.1	-	-
<i>Oenanthe crocata</i> L.	Hemlock water-dropwort	1	10	0.5
<i>Phalaris arundinacea</i> L.	Reed canary grass	-	< 0.1	-
<i>Ranunculus penicillatus</i> subsp <i>penicillatus</i> (Syme) S.D. Webster	Water crowfoot	5	-	< 0.1
<i>Rhynchosygium riparoides</i> (Hedw.) Warnst.		1	0.5	0.5
<i>Riccardia chamedryfolia</i> (With.) Gott.		< 0.1	0.5	0.5
Total cover		15	28	24
Total number of species		9	10	11
Total number of bryophytes		4	6	7

Table 5. Additional species observed in each reach of the River Teign, Castle Drogo.

Species	Common name	Presence		
		Reach 1	Reach 2	Reach 3
<i>Caltha palustris</i> L.	Marsh marigold	P	-	-
<i>Chiloscyphus polyanthos</i> (L.) Corda		P	-	-
<i>Fontinalis antipyretica</i> Hedw.		P	-	-
<i>Iris psuedacorus</i> L.	Yellow flag iris	-	P	-
<i>Mnium hornum</i> Hedw.		P	-	P
<i>Phalaris arundinacea</i> L.	Reed canary grass	P	-	P
<i>Ranunculus penicillatus</i> subsp <i>penicillatus</i> (Syme) S.D. Webster	Water crowfoot	-	P	-
<i>Vaucheria</i> sp		-	P	P

The number of species recorded in each reach were similar (9-11), although reach one had slightly fewer bryophyte species than the other reaches. The total percentage cover for each 20 metre section was lowest in reach one and similar in the other two reaches. The most significant factor influencing the species present at reach one was the less shaded nature of the river compared to the downstream reaches. *Ranunculus penicillatus* subspecies *penicillatus* and *Callitriche hamulata* were noticeably more abundant than in the downstream sections and the only occurrence of *Myriophyllum alterniflorum* was in reach one.

There were no significant differences in species or abundance of macrophytes between reaches two and three.

4. Assessment of historic impacts of the hydroelectric scheme.

The smaller of the two turbines ceased operation in 1993 and so it would be reasonable to expect any significant impacts of the abstraction regime to still be apparent, although the channel is likely to have recovered from any minor impacts.

There is no obvious evidence from our ecological surveys of any major impacts as a result of the historical abstraction of water from reach 2. The macrophyte and invertebrate samples are very similar in each of the three reaches surveyed and the physical habitats show no significant signs of degradation.

In particular the presence of similar bryophyte populations in reaches 2 and 3 suggests there has been no major impact of abstraction. If the historical abstraction had significantly stabilised the flows or reduced water levels it is probable that this survey would have recorded more terrestrial mosses on the exposed rocks and boulders. The presence of several species of aquatic mosses and liverworts on submerged and periodically inundated surfaces therefore indicates a negligible impact in the recent operation of the turbines.

The remnant channels on the mature island may have become more silted and blocked due to lower flows when the turbines were running but some similar habitats were observed both upstream and downstream of the central reach. The abstraction of water is therefore unlikely to be the principle cause of the siltation of these channels.

Although fewer invertebrates (number of families, species and individuals) were sampled in reach two this was considered to be more likely to be due to sample error than to ecological differences. The invertebrate population of the river is likely to recover relatively quickly from the impacts of abstraction through downstream drift from the unimpacted reach and so minor effects would not be detected.

The biological survey conducted by the National Trust (1990) noted the presence of the nationally rare aquatic moss *Rhynchostegium lusitanicum* on rocks in the river near Logan Stone. This is within reach two but did not coincide with our macrophyte survey site and so the absence of records from our survey does not indicate its absence from the river.

The number of riffles, extent of flow types (cascade to glide), extent of tree features and extent of channel features (islands, exposed boulders, side bars etc.) recorded for RHS were similar in reaches two and three. The lower flows during the sixty years of abstraction did not result in any observable change in physical habitats within the reaches.

5. Assessment of impact of proposed abstraction regimes.

The effect of abstracting a volume of water from reach two will be to reduce both the actual water level in the river and to reduce the variability of flow volume. The impacts can therefore be categorised as those resulting from lower than normal flows and those due to more constant flow rates.

The average flow in the river is $3.5 \text{ m}^3\text{s}^{-1}$ with a range of 0.2 to $50.1 \text{ m}^3\text{s}^{-1}$. In comparison the turbine has a capacity of $1.3 \text{ m}^3\text{s}^{-1}$. The turbine will therefore have relatively little effect on water level during periods of higher flow (particularly winter) but quite a significant impact during low flow conditions in the summer months.

Two abstraction regimes are being considered for the river;

- 1) Removal of 50% of water above Q95 level with a prescribed minimum of $0.6 \text{ m}^3\text{s}^{-1}$
- 2) Removal of 75% of water above Q95 level with a prescribed minimum of $0.8 \text{ m}^3\text{s}^{-1}$

5.1 Potential effects of alteration of the variability of flows.

By reducing the variability of flows in the river the abstraction regime will potentially have effects on several aspects of the river ecology. Firstly, many plants, particularly mosses and liverworts, grow abundantly on rocks and other substrates which are periodically submerged. If the peak flows are reduced then some of these species may suffer a reduction in available habitat.

The second effect may be to increase siltation. With lower flows the river will have less energy to transport sediments and to erode deposits and so a general increase in silt levels could occur. There is some evidence that this has happened in the past on a small scale (section 4.). Increased siltation would particularly affect the invertebrates which require fast flow over boulders and cobbles as there may be a reduction in the quality of these habitats. Any impact on the invertebrate population could also affect the fish and dippers which feed on them.

A reduction in flood water levels could cause drying out of some adjacent habitats although there are few at risk (one small pond and some side channels) as these habitats may not be inundated as regularly as normal.

Having assessed the flow data provided and the models of abstraction it seems likely that the effects on flow variability will be minimal and hence unlikely to affect the ecology of reach 2.

5.2 Potential impacts of reduction in flow levels.

Abstracting water from the Teign will reduce the levels of water in reach 2. This could cause recession of the river bed (drying out and colonisation by terrestrial plants) and impact hydraulically linked habitats.

Recession of the river bed would reduce the available habitat for both invertebrates and macrophytes and could consequently have an impact on bird, mammal and fish life using the river. Baxter (1961) states that recession begins to occur at flows of 1/8 to

1/2 of average daily flow depending on the size of the river. This is equivalent to a flow of approximately $0.45 - 1.8 \text{ m}^3\text{s}^{-1}$ in the Teign.

A lowering of the water level could lead to drying out in hydraulically linked habitats. This would include the standing water on both banks and some parts of the remnant channels as well as the small spring at the bottom of the reach (Figure 1b) and the alder population.

A further impact of lower water levels could be to impair fish migration through the reach. Salmon migrate in the Teign from May to November and require sufficient flows to negotiate the reach. During the summer months salmon tend to migrate from estuaries on the decreasing part of the hydrograph after flood events and will travel upstream on the higher flow or subsequent flood events. The fish will then remain in a suitable habitat within the river until moving to spawning grounds towards the end of summer. The abstraction regime should, where possible, maintain a minimum flow in the river sufficient for salmon migration and minimise the reductions in spate flow discharges to facilitate migration through the reach.

An additional factor affecting the salmon migration is the discharge from the turbine house. Salmon generally follow the parts of the river with most flow and so the turbine should ideally not discharge a greater volume of water than the residual flow. However, at periods of spate flows when migration is most likely to occur, the turbine discharge will generally be less than the volume of water remaining in the river. Therefore there will only occasionally be any potential impact on salmon migration from the turbine discharge.

5.3 Preferred abstraction regime.

The ecological surveys of the river did not record any particularly notable plant or invertebrate species or any extensive areas of adjacent habitats likely to be impacted by abstraction. A previous survey did record a nationally rare aquatic moss, *Rhynchostegium lusitanicum*, (National Trust, 1990) but this was recorded during the previous period of abstraction and there is no reason to suspect that renewed abstraction would have any affect on its population.

There is little difference between the two abstraction regimes in terms of reduced variability of discharge. Both reduce the average summer flows to the prescribed minimum and peak flows at other times are only reduced by a minor amount. The most important criteria is therefore maintenance of an ecologically acceptable minimum flow rate, particularly regarding the migration of salmon during the summer. The preferred scheme is therefore abstraction of 75 percent of the flow with a prescribed minimum of $0.8 \text{ m}^3\text{s}^{-1}$. There is a small risk with this regime that salmon will occasionally attempt to swim up the turbine outfall but maintaining a greater prescribed minimum level is considered a more critical factor.

6. Conclusions and recommendations.

The river Teign at Castle Drogo is a high quality habitat with two of the surveyed reaches being of nationally outstanding quality. The invertebrate fauna is fairly diverse although no particularly notable species were recorded in the samples. Similarly the macrophyte surveys did not record any rare or unusual species although a nationally rare moss species has been recorded during a previous study.

River Corridor Surveys for the three reaches did not indicate any habitats likely to be impacted by abstraction as the steep valley and hard geology prevents the formation of fens, marshes and other wetland habitats.

There was no evidence for detrimental historical impact of the abstraction on reach 2 and hence no reason to suspect that renewed abstraction would have a detrimental effect. The most important criteria is to maintain a sufficient flow in the river to prevent recession of the river bed, i.e. drying and invasion of terrestrial flora. The natural variability of daily flows is extremely high ($0.2-50.1 \text{ m}^3\text{s}^{-1}$) and the turbine abstraction has a minor effect for much of the year. During the period when abstraction does reduce flow variability maintaining the minimum flow volume is a more important criteria.

Our preferred abstraction regime is removal of 75 percent of the flow above Q95 with a prescribed flow of $0.8 \text{ m}^3\text{s}^{-1}$.

Following initiation of the abstraction we recommend that the National Trust consider, for a minimum of three years, regular annual monitoring of the impacted reach during the summer period. This would allow any changes in macrophyte or invertebrate populations to be detected, and in particular impacts on the population of *Rhynchostegium lusitanium*.

At the point of discharge from the turbine house further monitoring of habitats and invertebrates, particularly in the initial period of operation, should be considered to identify any potential impacts in the immediate vicinity, such as scoring of the river bed or erosion of the opposite bank.

7. References

- Baxter, G. (1961) River utilisation and the preservation of Migratory Fish Life. *Proc Instn Civ Engs.* 18:225-44
- EA, (1996) River Habitat Survey Newsletter. 3:4
- EA, (1997a) River Habitat Survey Field Survey Guidance Manual
- EA, (1997b) River Habitat Survey Newsletter. 5:3-4
- EA, (1997c) River Habitat Survey Newsletter. 4:3
- National Trust, (1990) Biological Survey, Castle Drogo, Devon. *National Trust, Cirencester*
- NRA, 1992, River Corridor Surveys - Methods and Procedures. *Conservation Technical Handbook No. 1.*

Summary data for River Corridor Surveys.

Reach 1. Upstream of weir.

Conditions during survey: Dry and overcast. Rain during previous 72 hours but flows relatively low.

Physical Features:

Left Bank: Predominately boulders, more earth in 100m immediately upstream of weir. Bank structure is often complex due to boulders and cattle impact. Some old reinforcements apparent.

Right Bank: Similar to left bank although there are some remnant channel features just upstream of the footbridge - damp conditions and some open water.

Vegetation:

Left Bank: Short grass with bracken and other herbs near/on bank top. More diverse on bank face with ferns and *Oenanthe crocata* particularly abundant and mosses and liverworts on boulders.

Right Bank: Similar to left bank but restricted access to wooded section has meant taller understorey dominated by *Luzula* species and ferns.

Channel: Mosses and liverworts abundant, mainly on boulders and cobbles. Some *Callitriche hamulata* and *Ranunculus penicillatus* subspecies *penicillatus* fairly common and *Oenanthe crocata* is the dominant emergent macrophyte.

Landuse:

Left Bank: Semi-improved grassland adjacent to upstream 300m, broad leaved woodland for rest.

Right Bank: Similar to left bank.

Recreation:

The area is popular with walkers, there is a footpath along the valley and others through the Castle Drogo estate.

Other:

Dippers, grey wagtail, damselflies and dragon flies and salmon all observed.

Reach 2. From weir to turbine house.

Conditions during survey: Dry and overcast. Rain during previous 72 hours but flows relatively low.

Physical Features:

Left Bank: Boulders predominate, particularly upstream of the islands. There is a narrow fisherman's path along the upper 100 metres which is regularly inundated by higher flows (woody debris accumulations frequent on path). One small pond is present towards the downstream end of the reach (unvegetated).

Right Bank: Boulders predominate. Several remnant channels and a side channel around largest island.

Vegetation:

Left Bank: Densely wooded (broad-leaved) for most part. *Alnus glutinosa*, *Fraxinus excelsior*, *Fagus sylvatica* and *Salix* species common in bank. *Luzula* species, *Oenanthe crocata* most common, with mosses and liverworts on boulders.

Right Bank: Denser tree canopy than left bank, more *Luzula* sp., less *O. crocata*

Channel: Mosses and liverworts on all boulders and in splash zone. Some *Oenanthe crocata*, particularly in margins but few submerged higher plants noted.

Landuse:

Left Bank: Broad leaved woodland.

Right Bank: Similar to left bank. Turbine house and pipe also present.

Recreation:

The area is popular with walkers, there is a footpath along the valley and others through the Castle Drogo estate.

Other:

Dippers and grey wagtail observed. Salmon seen in fish ladder.

Reach 3. Downstream of the turbine house.

Conditions during survey: Dry and overcast. Rain during previous 72 hours but flows relatively low.

Physical Features:

Left Bank: Lower section is a boulder strewn bank appearing to be part of the water course during higher flows. Now partly colonised by trees and other vegetation. An old channel is apparent and there are many sandy deposits along the bank. The upstream section is earth and boulders with occasional small sandy deposits.

Right Bank: Similar to reach 2- boulders predominate. Bank height c0.6m.

Vegetation:

Left Bank: Densely wooded (broad-leaved) for most part. *Alnus glutinosa*, *Fraxinus excelsior*, *Fagus sylvatica* and *Salix* species common in bank. *Luzula* species, *Oenanthe crocata* most common, with mosses and liverworts on boulders.

Right Bank: Similar to left bank. Some areas of very dense shading of channel from overhanging trees.

Channel: Mosses and liverworts on all boulders and in splash zone. Occasional *Oenanthe crocata* and some patches of *Callitriche hamulata* and *Ranunculus penicillatus* subspecies *penicillatus*.

Landuse:

Left Bank: Broad leaved woodland.

Right Bank: Broad leaved woodland.

Recreation:

The area is popular with walkers, there is a footpath along the valley and others through the Castle Drogo estate.

Other:

Dippers and grey wagtail observed. Islands and more diverse habitats than upstream sections. Lots of woody debris.

Full species list for invertebrate samples

Family	Species	Number of individuals in sample		
		Reach 1	Reach 2	Reach 3
Planariidae	<i>Polycelis felina</i>	-	-	3
Hydrobiidae	<i>Potamopyrgus jenkins</i>	448	12	48
Lymnaeidae	<i>Lymnaea peregra</i>	6	-	4
Ancylidae	<i>Ancylus fluviatilis</i>	5	24	16
Sphaeriidae	<i>Pisidium spp.</i>	32	-	7
Oligochaeta	Oligochaeta	48	80	168
Glossiphoniidae	<i>Glossiphonia complanata</i>	3	-	1
	<i>Helobdella stagnalis</i>	1	-	-
Hydracarina	Hydracarina	16	8	8
Gammaridae	<i>Gammarus pulex</i>	3	-	-
Baetidae	<i>Baetis rhodani</i>	56	136	184
Heptageniidae	<i>Ecdyonurus sp.</i>	-	-	1
Ephemerellidae	<i>Ephemerella ignita</i>	440	976	1088
Ephemeridae	<i>Ephemerella dancia</i>	1	-	-
Leuctridae	<i>Leuctra fusca</i>	1	-	1
Chloroperlidae	<i>Chloroperla torrentium</i>	6	-	-
Agriidae	<i>Calyopteryx virgo</i>	1	-	-
Cordulegasteridae	<i>Cordulegaster boltoni</i>	-	-	1
Veliidae	<i>Velia caprai</i>	-	1	-
Corixidae	<i>Sigara venusta</i>	1	-	-
Pleidae	<i>Plea leachi</i>	1	-	-
Dytiscidae	<i>Platambus maculatus</i>	3	-	-
Hydrophilidae	<i>Hydraena gracilis</i>	40	1	2
Elminthidae	<i>Limnius volkmari</i>	72	32	16
	<i>Elmis aenea</i>	16	4	9
	<i>Esolus parallelepipedus</i>	1	-	1
Rhyacophilidae	<i>Rhyacophila dorsalis</i>	9	32	40
	<i>Rhyacophila munda</i>	-	2	4
	<i>Agapetus sp</i>	-	1	-
	<i>Glossosoma sp</i>	-	-	1
Philopotamidae	<i>Philopotamus montanus</i>	-	-	1
Hydropsychidae	<i>Hydropsyche siltalai</i>	8	64	24
Limnephilidae	<i>Chaetopteryx villosa</i>	1	2	1
	<i>Halesus digitatus</i>	2	-	5
	<i>Potamophylax latipennis</i>	5	-	3
Odontoceridae	<i>Odontocerum albicarne</i>	-	1	1
Leptoceridae	<i>Oecetis testacea</i>	72	2	4
	<i>Mystacides agunea</i>	8	-	2
Goeridae	<i>Silo pallipes</i>	-	1	-
Lepidostomatidae	<i>Lepidostoma hirtum</i>	56	16	24
Brachycentridae	<i>Brachycentrus subnubilis</i>	32	24	56
Sericostomatidae	<i>Sericostoma personatum</i>	24	16	2
Tipulidae	<i>Dicranota sp</i>	32	8	24

Appendix 2.

	<i>Tipula sp.</i>	2	-	1
Ceratopogonidae	Indent	16	-	-
Chironomidae	Chironomidae	256	184	440
Simuliidae	<i>Simulium reptans</i>	104	24	24
	<i>Simulium ornatum</i>	32	8	24
	<i>Simulium argyreatum</i>	80	16	80
	<i>Simulium aureum</i>	8	-	-
	<i>Simulium venum</i>	8	-	1
Empididae	Hemeradromia gp	-	10	-
Rhagionidae	<i>Atherix marginata</i>	5	8	-
	<i>Atherix ibis</i>	1	8	1
Total No. of families		42	28	38
Total No of species		43	29	39
Total No of individuals		1962	1701	2321

Appendix 3.

River Habitat Survey forms

A BACKGROUND MAP-BASED INFORMATION

Altitude (m)
Solid geology code
Distance from source (km)
Height of source (m)

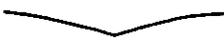
Slope (m/km)
Drift geology code
Significant tributary?
Water Quality Class

Flow category (1 - 10)
Planform category
Navigation?

B FIELD SURVEY DETAILS

Site Number: TEIYN ① Mid-site Grid Reference: _____ River: TEIYN
 Date 12/6/1997 Time 13:50 Surveyor name P. Swales
 Accredited Surveyor? No Yes If yes, state code PF35
 Adverse conditions affecting survey? No Yes If yes, state _____
 Bed of river visible? No partially entirely (tick one box)
 Duplicate photographs: general character? No Yes (tick one box)
 Site surveyed from: left bank right bank channel (tick as appropriate)
 SERCON survey in addition? No Yes (tick one box)

C PREDOMINANT VALLEY FORM (tick one box only)

shallow vee  concave/bowl (If U-shaped glacial valley - add "U") 
 deep vee  symmetrical floodplain 
 gorge  asymmetrical floodplain 

Nb. Latter few got checks are "deep vee"

Terraced valley floor? No Yes

D NUMBER OF RIFFLES, POOLS AND POINT BARS (indicate total number)

Riffles 10 Unvegetated point bars _____
 Pools _____ Vegetated point bars _____

1997 RIVER HABITAT SURVEY : TEN SPOT-CHECKS

Spot-check 1 is at : upstream end downstream end of site (tick one box)

E PHYSICAL ATTRIBUTES (to be assessed across channel within 1m wide transect)

¹ = one entry only

LEFT BANK

Material ¹ NY, BE, BO, CO, CS, EA, PE, CL, CC, SP, WP, GA, BR, RR, BW

Bank modification(s) NK, NO, RS, RL, PC(B), BM, EM

Bank feature(s) NY, NO, EC, SC, PB, VP, SB, VS

CHANNEL

Channel substrate ¹ NY, BE, BO, CO, GP, SA, SI, CL, PE, AR

Flow type ¹ FE, CH, BW, UW, CF, RP, UP, SM, NP, NO

Channel modification(s) NK, NO, CY, RS, RL, DA, FO

Channel feature(s) NY, NO, RO, MR, VR, ML, TR

RIGHT BANK

Material ¹ NY, BE, BO, CO, CS, EA, PE, CL, CC, SP, WP, GA, BR, RR, BW

Bank modification(s) NK, NO, RS, RL, PC(B), BM, EM

Bank feature(s) NY, NO, EC, SC, PB, VP, SB, VS

1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	----

Ring EC or SC if composed of sandy substrate

EA	EA	BO	EA	EA	EA	EA	BR	BO	BO
NO	EM	EM	NO	NO	NO	NO	RE	NO	NO
NO	NO	SB	NO	NO	SB	NO	NO	NO	NO

GP- ring either G or P if predominant

CO	CO	BO	CO	CO	CO	CO	CO	BO	NV	SA
UW	SM	UW	RP	RP	RP	SM	RP	SM	SM	
NO										
RO	NO	NO	NO	NO	RO	NO	RO	RO	RO	

Ring EC or SC if composed of sandy substrate

BO	EA	BO	EA	EA	EA	EA	BO	BO	EA
NO									
NO									

Enter channel substrates not occurring in spot-checks but present in >1% whole site.

F BANKTOP LAND USE AND VEGETATION STRUCTURE (to be assessed over a 10m wide transect)

Land use : choose one from BL, CP, OR, MH, SC, TH, RP, IG, TL, WL, OW, SU, RS

LAND USE WITHIN 5m OF LEFT BANKTOP	IG	BL	BL							
LEFT BANKTOP (structure within 1m) <small>BU/SK</small>	U	S	U	S	S	S	S	S	S	S
LEFT BANK FACE (structure) <small>BU/SK</small>	C	S	S	S	S	S	S	S	S	S
RIGHT BANK FACE (structure) <small>BU/SK</small>	C	C	S	S	S	C	S	S	S	S
RIGHT BANKTOP (structure within 1m) <small>BU/SK</small>	U	U	U	U	U	U	U	S	S	S
LAND USE WITHIN 5m OF RIGHT BANKTOP	IG	BL	BL	BL						

G CHANNEL VEGETATION TYPES (to be assessed over a 10m wide transect : use E (≥33% area) or ✓ (present))

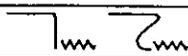
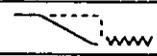
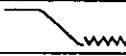
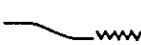
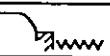
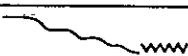
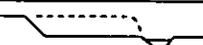
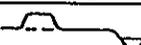
NONE										
Liverworts/mosses/lichens	/	/	E	/	/	/	/	/	/	E
Emergent broad-leaved herbs					/	/				/
Emergent reeds/sedges/rushes										
Floating-leaved (rooted)										
Free-floating										
Amphibious										
Submerged broad-leaved										
Submerged linear-leaved										
Submerged fine-leaved										
Filamentous algae	/	/		/	/	/	/	/		/

Use end "catch-all" column for types not occurring in spot checks as well as overall assessment over 500m (use E or ✓)

H LAND USE WITHIN 50m OF BANKTOP Use E (≥ 33% banklength) or ✓(present)

	L	R		L	R
Broadleaf/mixed woodland (BL)	E	E	Rough pasture (RP)		
Coniferous plantation (CP)			Improved/semi-improved grass (IG)	E	E
Orchard (OR)			Tilled land (TL)		
Moorland/heath (MH)			Wetland (eg bog, marsh, fen) (WL)		
Scrub (SC)			Open water (OW)		
Tall herbs /rank vegetation (TH)			Suburban/urban development (SU)		
			Rock and scree (RS)		

I BANK PROFILES Use E (≥ 33% banklength) or ✓(present)

	L	R		L	R
Natural/unmodified			Artificial/modified		
Vertical/undercut 	E	E	Resectioned 	/	/
Vertical + toe 			Reinforced - whole bank 	/	/
Steep (>45°) 	E	E	Reinforced - top only 		
Gentle 	/		Reinforced - toe only 		
Composite 			Artificial two-stage 		
			Poached 		
			Embanked 	/	
			Set-back embankments 		

J EXTENT OF TREES AND ASSOCIATED FEATURES

TREES (tick one box per bank)

	Left	Right
None	<input type="checkbox"/>	<input type="checkbox"/>
Isolated/scattered	<input type="checkbox"/>	<input type="checkbox"/>
Regularly spaced, single	<input type="checkbox"/>	<input type="checkbox"/>
Occasional clumps	<input type="checkbox"/>	<input type="checkbox"/>
Semi-continuous	<input type="checkbox"/>	<input type="checkbox"/>
Continuous	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

ASSOCIATED FEATURES (tick one box per feature)

	None	Present	E (≥33%)
Shading of channel	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Overhanging boughs	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Exposed bankside roots	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Underwater tree roots	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Fallen trees	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coarse woody debris	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

K EXTENT OF CHANNEL FEATURES (tick one box per feature)

	None	Present	E(≥33%)		None	Present	E(≥33%)
Waterfall(s)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Marginal deadwater	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Cascade(s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Exposed bedrock	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rapid(s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Exposed boulders	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Riffle(s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Unvegetated mid-channel bar(s)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Run(s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Vegetated mid-channel bar(s)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Boil(s)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Mature island(s)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Glide(s)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Unvegetated side bar(s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Pool(s)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Vegetated side bar(s)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ponded Reach(es)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Discrete silt deposit(s)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				Discrete sand deposit(s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

L CHANNEL DIMENSIONS (to be measured at one site on a straight uniform section, preferably across a riffle)

LEFT BANK		CHANNEL		RIGHT BANK	
Banktop height (m)	1.20	Bankfull width (m)	13.5	Banktop height (m)	1.20
Is banktop height also bankfull height? (Y or N)	Y	Water width (m)	9	Is banktop height also bankfull height? (Y or N)	Y
Embanked height (m)		Water depth (m)	0.30	Embanked height (m)	

If trashline is lower than banktop break in slope, indicate: height above water (m) = _____

Bed material at site is: consolidated (compact) unconsolidated (loose) unknown

Location of measurement is: riffle run or glide other

M ARTIFICIAL FEATURES (indicate total number or tick appropriate box)

None	Major	Intermediate	Minor	Major	Intermediate	Minor
<input type="checkbox"/>						
			2			

Is water impounded by weir/dam? No Yes, <33% of site >33% of site

N EVIDENCE OF RECENT MANAGEMENT (tick appropriate box(es))

None Dredging Mowing Weed-cutting
 Enhancement Other (state).....

O FEATURES OF SPECIAL INTEREST (use ✓ or E (≥ 33% length))

None Waterfalls > 5m high Braided/side channels Debris dams Leafy debris
 Artificial open water Natural open water Water meadow Fen
 Bog Carr Marsh Flush
 Fringing reed-bank Floating mat Other (state).....

P CHOKED CHANNEL (tick one box)

Is 33% or more of the channel choked with vegetation? No Yes

Q NOTABLE NUISANCE PLANT SPECIES (Use ✓ or E (≥ 33% length))

None Giant Hogweed Himalayan Balsam Japanese Knotweed Other (state).....

R OVERALL CHARACTERISTICS (Circle appropriate words, add others as necessary)

Major Impacts: landfill - tipping - litter - sewage - pollution - drought - abstraction - mill - dam - road - rail - industry - housing - mining - quarrying - overdeepening - afforestation - fisheries management - silting

Land Management: set-aside - buffer strip - headland - abandoned land - parkland - MoD

Animals: otter - mink - water vole - kingfisher - dipper - grey wagtail - sand martin - heron - dragonflies/damselflies

Other significant observations: The substrate is often a 40/60 mixture of coarse sand and cobbles, recorded in the spot checks as CO.

S ALDERS (tick appropriate box(es))

Alders? None Present Extensive Diseased Alders? None Present Extensive

ADDITIONAL SERCON COMPONENT

To be completed only for SERCON purposes site ①

T. SERCON SWEEP-UP - ITEMS I-IX	List in 'T' the % to nearest number: 0, 1, 5, 15, 25, 35, 45, 55, 65, 75, 85, 95.										
	SC1	SC2	SC3	SC4	SC5	SC6	SC7	SC8	SC9	SC10	T
I: % Planform re-aligned	0	0	0	0	0	0	0	0	0	0	0
II: % long-or cross-section modified	0	0	0	0	0	0	0	50	0	0	15
III: % recovery from I/II								0			
IV: % recovery of bank from engineering								15			
V: % of riparian zone vegetation natural	0	0	0	0	0	0	0	45	100	100	15
VI: % of V with affinity to rivers	0	0	0	0	0	0	0	0	0	0	0
VII: % of bank vegetation with 'aliens'	0	0	0	0	0	0	0	0	0	0	5
VIII: % of bank with vegetation 'natural'	100	100	100	100	100	100	100	100	100	100	100
IX: % of VIII with affinity to rivers	45	45	45	45	45	45	45	45	45	45	45

U. IMPACTS	✓	Notes
1 Acidification		Though there are footpaths on both banks and the area is popular with walkers there is apparently little impact on the river itself. Some reinforcement is present in association with the footbridges.
2 Toxic/Industrial/Agricultural effluent		
3 Sewage effluent		
4 Groundwater abstraction		
5 Surface water abstraction		
6 Inter-river transfers		
7 Channelization		
8 Management for flood defence	✓	
9 Man-made structures	✓	
10 Recreational pressures		
11 Introduced species	✓	

small section of EM at top of stretch

small patches of hindsyan lalham, rhododendron

V. SFs/AFIs	✓	Notes
a Plant/animal observations	✓	Salmon using fish ladder. Good broadleaf woodland at bottom of stretch. Numerous mosses/lichens.
b Waterfalls > 5m high		
c Gorges		
d Floodplain wetlands - recreatable		
e Floodplain wetlands - unrecreatable		
f Notable islands		
g Native pinewoods		
h Wide/special riparian zones	✓	
i Negative - litter		
j Negative - diseased alder		
k Others		

W. NOTES At some areas of the DIS end of the section there is evidence of old bank reinforcing in the form of boulders laid into the bank.

The DIS end of the reach was ponded due to the weir, the majority of the section however was comprised of riffles, runs and swift glides.

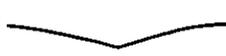
A BACKGROUND MAP-BASED INFORMATION

Altitude (m)	Slope (m/km)	Flow category (1 - 10)
Solid geology code	Drift geology code	Planform category
Distance from source (km)	Significant tributary ?	Navigation ?
Height of source (m)	Water Quality Class	

B FIELD SURVEY DETAILS

Site Number : TE1YN ② Mid-site Grid Reference : _____ River : TE1YN
 Date 12/6/1997 Time 15:15 Surveyor name P. Scarlett
 Accredited Surveyor ? No Yes If yes, state code PF35
 Adverse conditions affecting survey ? No Yes If yes, state _____
 Bed of river visible ? No partially entirely (tick one box)
 Duplicate photographs : general character ? No Yes (tick one box)
 Site surveyed from : left bank right bank channel (tick as appropriate)
 SERCON survey in addition? No Yes (tick one box)

C PREDOMINANT VALLEY FORM (tick one box only)

	<input type="checkbox"/> shallow vee		<input type="checkbox"/> concave/bowl (If U-shaped glacial valley - add "U")
	<input checked="" type="checkbox"/> deep vee		<input type="checkbox"/> symmetrical floodplain
	<input type="checkbox"/> gorge		<input type="checkbox"/> asymmetrical floodplain

Terraced valley floor ? No Yes

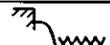
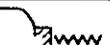
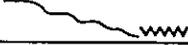
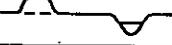
D NUMBER OF RIFFLES, POOLS AND POINT BARS (indicate total number)

Riffles 16 Unvegetated point bars _____
 Pools _____ Vegetated point bars _____

H LAND USE WITHIN 50m OF BANKTOP Use E ($\geq 33\%$ banklength) or \checkmark (present)

	L	R		L	R
Broadleaf/mixed woodland (BL)	E	E	Rough pasture (RP)		
Coniferous plantation (CP)			Improved/semi-improved grass (IG)		
Orchard (OR)			Tilled land (TL)		
Moorland/heath (MH)			Wetland (eg bog, marsh, fen) (WL)		
Scrub (SC)			Open water (OW)	/	
Tall herbs /rank vegetation (TH)			Suburban/urban development (SU)	/	/
			Rock and scree (RS)		

I BANK PROFILES Use E ($\geq 33\%$ banklength) or \checkmark (present)

Natural/unmodified	L	R	Artificial/modified	L	R
Vertical/undercut 	E	E	Resectioned 		
Vertical + toe 			Reinforced - whole bank 	/	
Steep (>45°) 	E	E	Reinforced - top only 		
Gentle 	/	/	Reinforced - toe only 		
Composite 			Artificial two-stage 		
			Poached 		
			Embanked 		
			Set-back embankments 		

J EXTENT OF TREES AND ASSOCIATED FEATURES

TREES (tick one box per bank)

	Left	Right
None	<input type="checkbox"/>	<input type="checkbox"/>
Isolated/scattered	<input type="checkbox"/>	<input type="checkbox"/>
Regularly spaced, single	<input type="checkbox"/>	<input type="checkbox"/>
Occasional clumps	<input type="checkbox"/>	<input type="checkbox"/>
Semi-continuous	<input type="checkbox"/>	<input type="checkbox"/>
Continuous	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

ASSOCIATED FEATURES (tick one box per feature)

	None	Present	E ($\geq 33\%$)
Shading of channel	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Overhanging boughs	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Exposed bankside roots	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Underwater tree roots	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Fallen trees	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coarse woody debris	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

K EXTENT OF CHANNEL FEATURES (tick one box per feature)

	None	Present	E ($\geq 33\%$)		None	Present	E ($\geq 33\%$)
Waterfall(s)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Marginal deadwater	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Cascade(s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Exposed bedrock	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Rapid(s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Exposed boulders	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Riffle(s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Unvegetated mid-channel bar(s)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Run(s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Vegetated mid-channel bar(s)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Boil(s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Mature island(s)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Glide(s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Unvegetated side bar(s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Pool(s)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Vegetated side bar(s)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ponded Reach(es)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Discrete silt deposit(s)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				Discrete sand deposit(s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

L CHANNEL DIMENSIONS (to be measured at one site on a straight uniform section, preferably across a riffle)

LEFT BANK		CHANNEL		RIGHT BANK	
Banktop height (m)	1.10	Bankfull width (m)	12	Banktop height (m)	1.10
Is banktop height also bankfull height? (Y or N)	Y	Water width (m)	8.5	Is banktop height also bankfull height? (Y or N)	Y
Embanked height (m)		Water depth (m)	0.40	Embanked height (m)	

If trashline is lower than banktop break in slope, indicate: height above water (m) = _____

Bed material at site is: consolidated (compact) unconsolidated (loose) unknown

Location of measurement is: riffle run or glide other

M ARTIFICIAL FEATURES (indicate total number or tick appropriate box)

None <input type="checkbox"/>	Major	Intermediate	Minor	Major	Intermediate	Minor
Weirs	1			Revetments		
Sluices				Outfalls		
Culverts				Fords		
Bridges				Deflectors		
				Other (state)		1 (fish ladder)

Is water impounded by weir/dam? No Yes, <33% of site >33% of site

N EVIDENCE OF RECENT MANAGEMENT (tick appropriate box(es))

None Dredging Mowing Weed-cutting

Enhancement Other (state).....

O FEATURES OF SPECIAL INTEREST (use / or E (> 33% length))

None

Waterfalls > 5m high Artificial open water Bog Fringing reed-bank

Braided/side channels Natural open water Carr Floating mat

Debris dams Water meadow Marsh Other (state) woodland

Leafy debris Fen Flush

P CHOKED CHANNEL (tick one box)

Is 33% or more of the channel choked with vegetation? No Yes

Q NOTABLE NUISANCE PLANT SPECIES (Use / or E (> 33% length))

None Giant Hogweed Himalayan Balsam Japanese Knotweed Other (state) Choked stream on

R OVERALL CHARACTERISTICS (Circle appropriate words, add others as necessary)

Major Impacts: landfill - tipping - litter - sewage - pollution - drought - abstraction - mill - dam - road - rail - industry - housing - mining - quarrying - overdeepening - afforestation - fisheries management - silting

Land Management: set-aside - buffer strip - headland - abandoned land - parkland - MoD

Animals: otter - mink - water vole - kingfisher dipper - grey wagtail - sand martin - heron dragonflies/damselflies

Other significant observations: The substrate is often a 40/60 mixture of coarse sand and cobbles, recorded in the spot - checks as CO.

S ALDERS (tick appropriate box(es))

Alders? None Present Extensive Diseased Alders? None Present Extensive

ADDITIONAL SERCON COMPONENT

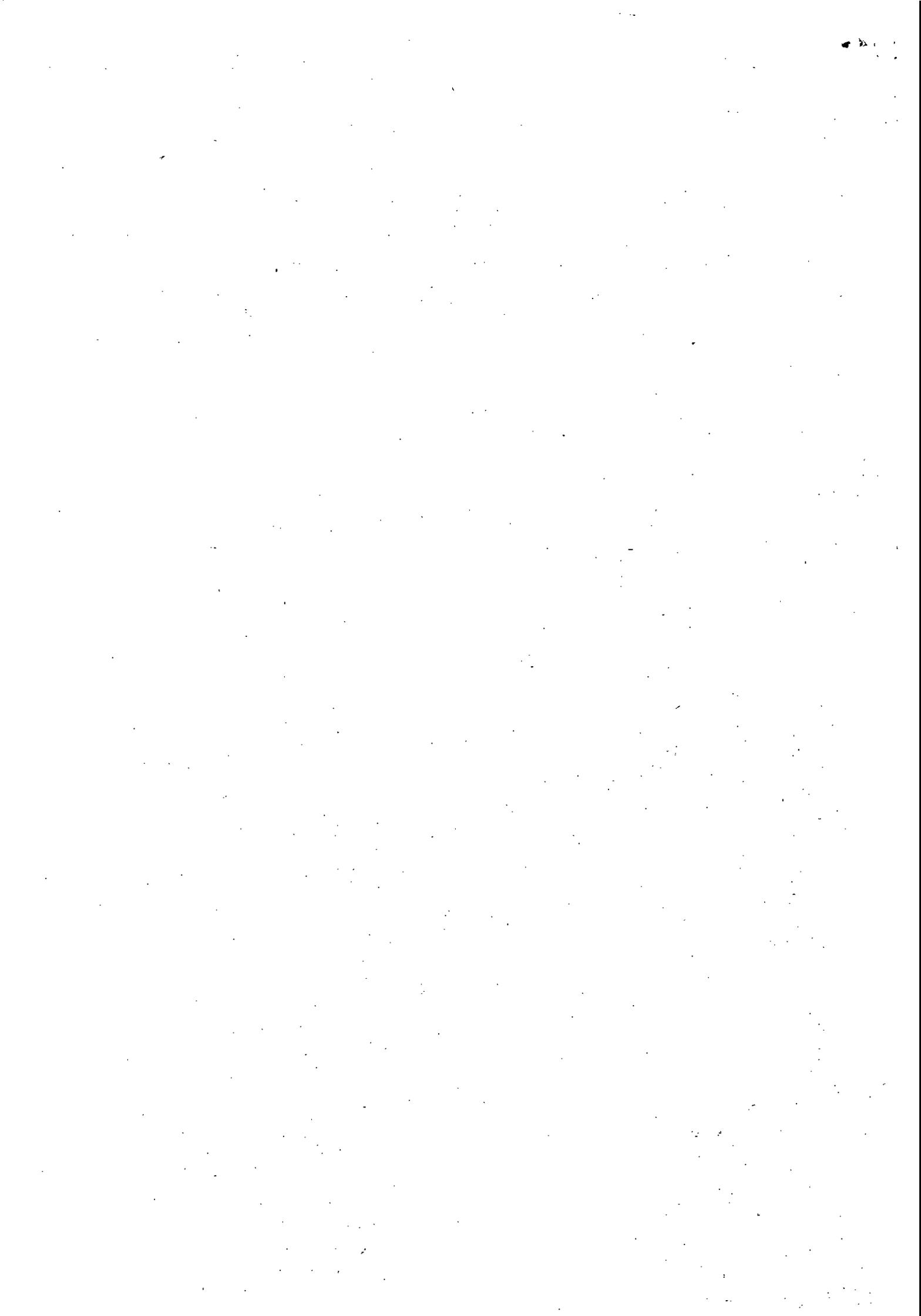
To be completed only for SERCON purposes Site ②

T. SERCON SWEEP-UP - ITEMS I-IX	List in 'T' the % to nearest number: 0, 1, 5, 15, 25, 35, 45, 55, 65, 75, 85, 95.										
	SC1	SC2	SC3	SC4	SC5	SC6	SC7	SC8	SC9	SC10	T
I: % Planform re-aligned	100	0	0	0	0	0	0	0	0	0	5
II: % long-or cross-section modified	100	0	0	0	0	0	0	0	0	0	5
III: % recovery from I/II	0										
IV: % recovery of bank from engineering	5										
V: % of riparian zone vegetation natural	100	100	100	100	100	100	100	100	100	100	95
VI: % of V with affinity to rivers	0	0	0	0	0	0	0	0	0	0	0
VII: % of bank vegetation with 'aliens'	0	0	5	0	0	0	0	5	0	0	5
VIII: % of bank with vegetation 'natural'	100	100	95	100	100	100	100	95	100	100	95
IX: % of VIII with affinity to rivers	45	45	45	45	45	45	45	45	45	45	45

U. IMPACTS	✓	Notes
1 Acidification		Large weir with fish ladder incorporated. Abstraction point not operational. Turbine houses on Right bank. A footpath along the left bank, though popular with walkers has no impact on the river. clumps of <i>Arctostaphylos</i> , patches of Japanese knotweed, Himalayan Balsam.
2 Toxic/Industrial/Agricultural effluent		
3 Sewage effluent		
4 Groundwater abstraction		
5 Surface water abstraction		
6 Inter-river transfers		
7 Channelization		
8 Management for flood defence		
9 Man-made structures	✓	
10 Recreational pressures		
11 Introduced species	✓	

V. SFs/AFIs	✓	Notes
a Plant/animal observations	✓	hippos (1 pair), grey wagtail. Large native island. Old native woodland with many species, and a good diversity of insect species. SSS I
b Waterfalls > 5m high		
c Gorges		
d Floodplain wetlands - recreatable		
e Floodplain wetlands - unrecreatable		
f Notable islands	✓	
g Native pinewoods		
h Wide/special riparian zones	✓	
i Negative - litter		
j Negative - diseased alder		
k Others		

W. NOTES The riparian zone along the stretch is woodland with outcrops. There is much moss on the in-channel boulders. The weir is significant at the most U/S end of the stretch with salmon using the fish ladder. A side channel, possibly caused by trapped floodwater, is present. The turbine house, together with an old side channel (which is notable by its accumulation of coarse sand) occur in this stretch.



A BACKGROUND MAP-BASED INFORMATION

Altitude (m)	Slope (m/km)	Flow category (1 - 10)
Solid geology code	Drift geology code	Planform category
Distance from source (km)	Significant tributary ?	Navigation ?
Height of source (m)	Water Quality Class	

B FIELD SURVEY DETAILS

Site Number : TE14N③ Mid-site Grid Reference : _____ River : TE14N
 Date 12/6/1997 Time 16:20 Surveyor name P. Scarlett
 Accredited Surveyor ? No Yes If yes, state code PF35
 Adverse conditions affecting survey ? No Yes If yes, state _____
 Bed of river visible ? No partially entirely (tick one box)
 Duplicate photographs : general character ? No Yes (tick one box)
 Site surveyed from : left bank right bank channel (tick as appropriate)
 SERCON survey in addition? No Yes (tick one box)

C PREDOMINANT VALLEY FORM (tick one box only)

	<input type="checkbox"/> shallow vee		<input type="checkbox"/> concave/bowl (If U-shaped glacial valley - add "U")
	<input checked="" type="checkbox"/> deep vee		<input type="checkbox"/> symmetrical floodplain
	<input type="checkbox"/> gorge		<input type="checkbox"/> asymmetrical floodplain

Terraced valley floor ? No Yes

D NUMBER OF RIFFLES, POOLS AND POINT BARS (indicate total number)

Riffles 20 Unvegetated point bars _____
 Pools _____ Vegetated point bars _____

1997 RIVER HABITAT SURVEY : TEN SPOT-CHECKS

Spot-check 1 is at: upstream end downstream end of site (tick one box)

E PHYSICAL ATTRIBUTES (to be assessed across channel within 1m wide transect)

¹ = one entry only

LEFT BANK

Material ¹ NY, BE, BO, CO, CS, EA, PE, CL, CC, SP, WP, CA, BA, RR, BW
 Bank modification(s) NK, NO, RS, RI, PC(B), BM, EM
 Bank feature(s) NY, NO, EC, SC, PB, VP, SB, VS

Ring EC or SC if composed of sandy substrate

1	2	3	4	5	6	7	8	9	10
BO	EA	EA	EA	EA	EA	BO	BO	EA	EA
NO									
NO	NO	NO	NO	SB	NO	NO	NO	NO	NO

CHANNEL

Channel substrate ¹ NY, BE, BO, CO, GP, SA, SI, CL, PE, AR
 Flow type ¹ FF, CH, BW, UW, CF, RP, UP, SM, NP, NO
 Channel modification(s) NK, NO, CV, RS, RI, DA, FO
 Channel feature(s) NY, NO, RO, MB, VB, ML, TR

GP- ring either G or P if predominant

BO	CO	CO	CO	CO	BO	BO	BO	BO	BO
RP	RP	SM	SM	UW	SM	RP	RP	UW	SM
NO									
RO	RO	NO	NO	NO	NO	NO	NO	RO	NO

RIGHT BANK

Material ¹ NY, BE, BO, CO, CS, EA, PE, CL, CC, SP, WP, CA, BA, RR, BW
 Bank modification(s) NK, NO, RS, RI, PC(B), BM, EM
 Bank feature(s) NY, NO, EC, SC, PB, VP, SB, VS

Ring EC or SC if composed of sandy substrate

BO	BO	EA	EA	BO	BO	BO	EA	BO	BO
NO									
NO									

Enter channel substrates not occurring in spot-checks but present in > 1% whole site.

F BANKTOP LAND USE AND VEGETATION STRUCTURE (to be assessed over a 10m wide transect)

Land use: choose one from BL, CP, OR, MH, SC, TH, RP, IG, TL, WL, OW, SU, RS

LAND USE WITHIN 5m OF LEFT BANKTOP	BL								
LEFT BANKTOP (structure within 1m) <small>N/U/S/C</small>	S	S	S	S	S	C	C	S	S
LEFT BANK FACE (structure) <small>N/U/S/C</small>	S	S	S	C	S	S	S	S	S
RIGHT BANK FACE (structure) <small>N/U/S/C</small>	C	C	C	S	S	S	S	S	S
RIGHT BANKTOP (structure within 1m) <small>N/U/S/C</small>	S	C	S	S	S	S	C	S	C
LAND USE WITHIN 5m OF RIGHT BANKTOP	BL								

G CHANNEL VEGETATION TYPES (to be assessed over a 10m wide transect: use E (≥ 33% area) or ✓ (present))

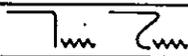
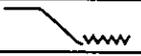
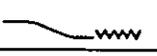
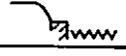
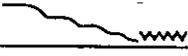
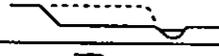
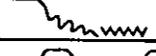
NONE									
Liverworts/mosses/lichens	/	/	/	/	E	/	E	/	E
Emergent broad-leaved herbs	/		/					/	
Emergent reeds/sedges/rushes									
Floating-leaved (rooted)									
Free-floating									
Amphibious									
Submerged broad-leaved									
Submerged linear-leaved									
Submerged fine-leaved		/						/	/
Filamentous algae									

Use end "catch-all" column for types not occurring in spot checks as well as overall assessment over 500m (use E or ✓)

H LAND USE WITHIN 50m OF BANKTOP Use E (≥ 33% banklength) or ✓(present)

	L	R		L	R
Broadleaf/mixed woodland (BL)	E	E	Rough pasture (RP)		
Coniferous plantation (CP)			Improved/semi-improved grass (IG)		
Orchard (OR)			Tilled land (TL)		
Moorland/heath (MH)			Wetland (eg bog, marsh, fen) (WL)		
Scrub (SC)			Open water (OW)		
Tall herbs /rank vegetation (TH)			Suburban/urban development (SU)		
			Rock and scree (RS)		

I BANK PROFILES Use E (≥ 33% banklength) or ✓(present)

	L	R		L	R
Natural/unmodified			Artificial/modified		
Vertical/undercut 	E	E	Resectioned 		
Vertical + toe 			Reinforced - whole bank 		
Steep (>45°) 	/	/	Reinforced - top only 	/	
Gentle 	/		Reinforced - toe only 		
Composite 			Artificial two-stage 		
			Poached 		
			Embanked 		
			Set-back embankments 		

J EXTENT OF TREES AND ASSOCIATED FEATURES

TREES (tick one box per bank)

	Left	Right
None	<input type="checkbox"/>	<input type="checkbox"/>
Isolated/scattered	<input type="checkbox"/>	<input type="checkbox"/>
Regularly spaced, single	<input type="checkbox"/>	<input type="checkbox"/>
Occasional clumps	<input type="checkbox"/>	<input type="checkbox"/>
Semi-continuous	<input type="checkbox"/>	<input type="checkbox"/>
Continuous	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

ASSOCIATED FEATURES (tick one box per feature)

	None	Present	E (≥33%)
Shading of channel	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Overhanging boughs	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Exposed bankside roots	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Underwater tree roots	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Fallen trees	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coarse woody debris	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

K EXTENT OF CHANNEL FEATURES (tick one box per feature)

	None	Present	E(≥33%)		None	Present	E(≥33%)
Waterfall(s)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Marginal deadwater	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Cascade(s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Exposed bedrock	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Rapid(s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Exposed boulders	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Riffle(s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Unvegetated mid-channel bar(s)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Run(s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Vegetated mid-channel bar(s)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Boil(s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Mature island(s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Glide(s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Unvegetated side bar(s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Pool(s)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Vegetated side bar(s)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ponded Reach(es)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Discrete silt deposit(s)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				Discrete sand deposit(s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

L CHANNEL DIMENSIONS (to be measured at one site on a straight uniform section, preferably across a riffle)

LEFT BANK		CHANNEL		RIGHT BANK	
Banktop height (m)	1.0	Bankfull width (m)	14	Banktop height (m)	1.0
Is banktop height also bankfull height? (Y or N)	Y	Water width (m)	11.5	Is banktop height also bankfull height? (Y or N)	Y
Embanked height (m)		Water depth (m)	0.25	Embanked height (m)	

If trashline is lower than banktop break in slope, indicate: height above water (m) = _____

Bed material at site is: consolidated (compact) unconsolidated (loose) unknown

Location of measurement is: riffle run or glide other

M ARTIFICIAL FEATURES (indicate total number or tick appropriate box)

None	Major	Intermediate	Minor	Major	Intermediate	Minor
<input checked="" type="checkbox"/>				Revetments		
				Outfalls		
				Fords		
				Deflectors		
				Other (state)		

Is water impounded by weir/dam? No Yes, <33% of site >33% of site

N EVIDENCE OF RECENT MANAGEMENT (tick appropriate box(es))

None Dredging Mowing Weed-cutting
 Enhancement Other (state).....

O FEATURES OF SPECIAL INTEREST (use ✓ or E (≥ 33% length))

None
 Waterfalls > 5m high Artificial open water Bog Fringing reed-bank
 Braided/side channels Natural open water Carr Floating mat
 Debris dams Water meadow Marsh Other (state) woodland
 Leafy debris Fen Flush

P CHOKED CHANNEL (tick one box)

Is 33% or more of the channel choked with vegetation? No Yes

Q NOTABLE NUISANCE PLANT SPECIES (Use ✓ or E (≥ 33% length))

None Giant Hogweed Himalayan Balsam Japanese Knotweed Other (state).....

R OVERALL CHARACTERISTICS (Circle appropriate words, add others as necessary)

Major impacts: landfill - tipping - litter - sewage - pollution - drought - abstraction - mill - dam - road - rail - industry - housing - mining - quarrying - overdeepening - afforestation - fisheries management - silting

Land Management: set-aside - buffer strip - headland - abandoned land - parkland - MoD

Animals: otter - mink - water vole - kingfisher - dipper - grey wagtail - sand martin - heron - dragonflies/damselflies

Other significant observations: The substrate is occasionally 60/40 cobbles/course sand, recorded in the spot checks of CO. a particularly active section.

S ALDERS (tick appropriate box(es))

Alders? None Present Extensive Diseased Alders? None Present Extensive

ADDITIONAL SERCON COMPONENT

To be completed only for SERCON purposes Site ③

T. SERCON SWEEP-UP - ITEMS I-IX	List in 'T' the % to nearest number: 0, 1, 5, 15, 25, 35, 45, 55, 65, 75, 85, 95.										
	SC1	SC2	SC3	SC4	SC5	SC6	SC7	SC8	SC9	SC10	T
I: % Planform re-aligned	0	0	0	0	0	0	0	0	0	0	0
II: % long-or cross-section modified	0	0	0	0	0	0	0	0	0	0	0
III: % recovery from I/II											
IV: % recovery of bank from engineering											
V: % of riparian zone vegetation natural	100	100	100	100	100	100	100	100	100	100	95
VI: % of V with affinity to rivers	0	0	0	0	0	0	0	0	0	0	0
VII: % of bank vegetation with 'aliens'	5	0	0	0	0	1	0	0	0	0	5
VIII: % of bank with vegetation 'natural'	95	100	100	100	100	100	100	100	100	100	95
IX: % of VIII with affinity to rivers	45	45	45	45	45	45	45	45	45	45	45

U. IMPACTS	✓	Notes
1 Acidification		The footpath along the left bank has no direct impact on the river. clumps of rhododendron, some himalayan bellflower
2 Toxic/Industrial/Agricultural effluent		
3 Sewage effluent		
4 Groundwater abstraction		
5 Surface water abstraction		
6 Inter-river transfers		
7 Channelization		
8 Management for flood defence		
9 Man-made structures		
10 Recreational pressures		
11 Introduced species	✓	

V. SFs/AFIs	✓	Notes
a Plant/animal observations	✓	grey wagtail. Large native island. Old native woodland, species rich and a good diversity of insects.
b Waterfalls > 5m high		
c Gorges		
d Floodplain wetlands - recreatable		
e Floodplain wetlands - unrecreatable		
f Notable islands	✓	
g Native pinewoods		
h Wide/special riparian zones	✓	
i Negative - litter		
j Negative - diseased alder		
k Others		

W. NOTES The most active of the 3 sections with good cascade/chute areas. Much moss is present on the exposed boulders. The most "natural" of the 3 sections.

**Centre for
Ecology &
Hydrology**

Institute of Freshwater Ecology
Institute of Hydrology
Institute of Terrestrial Ecology
Institute of Virology & Environmental Microbiology

Natural Environment Research Council