

Ecological Survey of the River Teign at Castle Drogo, Devon

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> Centre for Institute of Freshwater Ecology Ecology &

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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 where 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).

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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 or 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 oligocheates 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.

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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.

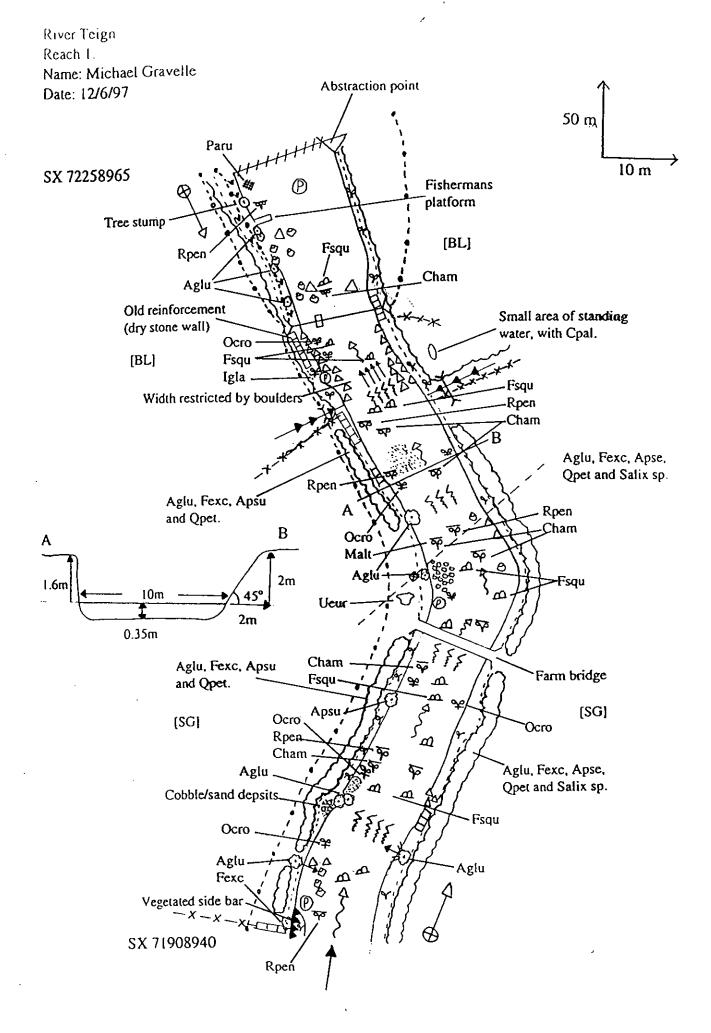
The maps for the three sections are shown in figures 1a-c and the summary sheets in appendix 1.

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.

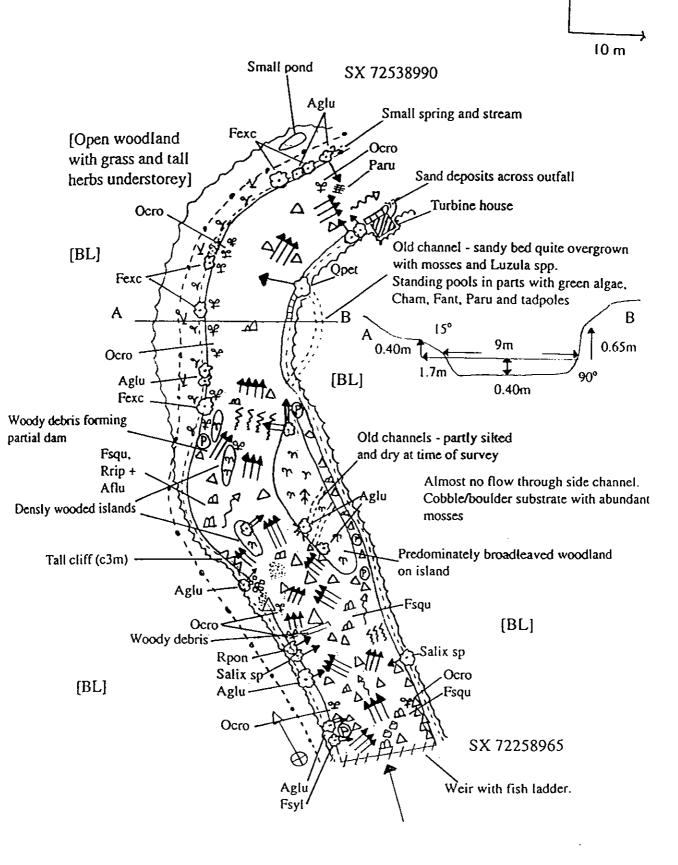
Reach three had the most diverse natural habitats due to the presence of several mature islands in the lower 100 metres. These created different flow patterns including several deep still pools and high energy rapids. There was also an abundance of woody debris caught against boulders and the edges of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

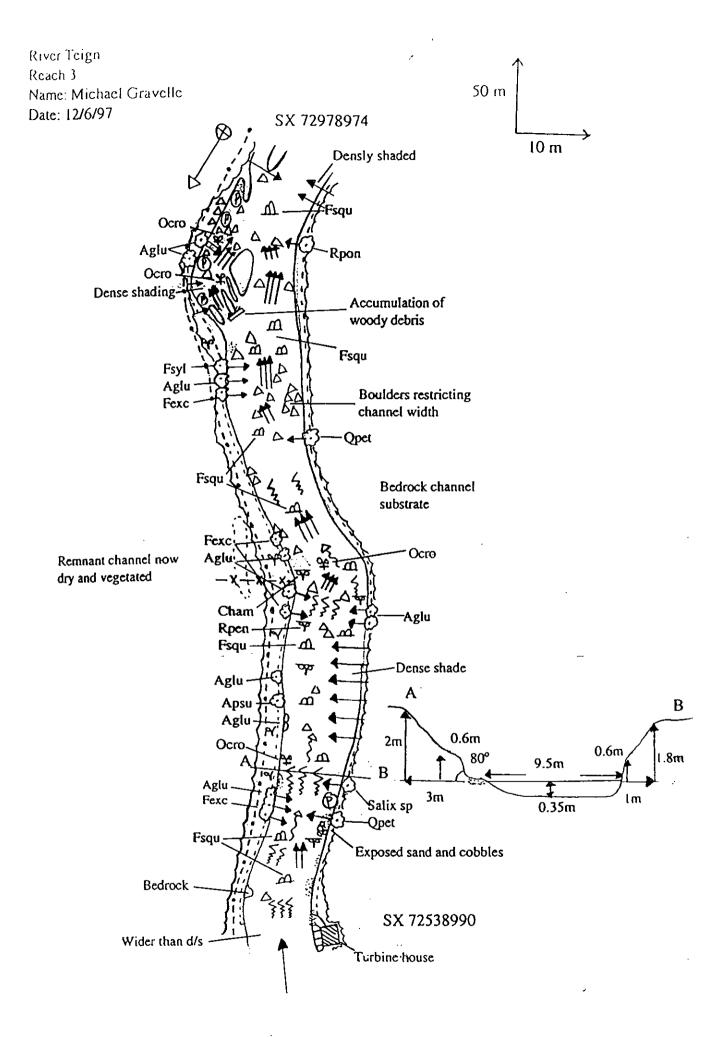


River Teign Reach 2 Name: Michael Gravelle Date: 12/6/97



50 m

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



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

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

Ueur	Olex europa	eus		I	Gorse		
CHANNEL FEA	TURES	SUBSTRATE		BANK FEATUR	ES	VEGETATION	
	/ Bridge (road/track)	in State.	Mud	<u> </u>	Base of bank	Irees ÎÎÌI	Conifer
╶┼──╉	Footbridge		Sand		Top of bank	\odot	Broadleaf
	Lock		Bare shingle	$\mathcal{M}\mathcal{M}$	Slump		- overhanging
d	Inlet		Vegetated shingle	*****	Stable earth cliff	()	- fallen
	Weir		Cobbles		Eroding earth cliff	Ŭ=	- exposed rooi
(P)	Pool	0000	Boulders	mmm	Rock cliff		+ bnelbooW
	Riffle	CHANNEL VEGE			Artificial bank protection	P + symbol	symbol for tyj Pollarded tree
	Rapids		Emergent Monocots		Cattle drink		
ŝ	Run	<u>ar</u>	Emergent Dicots	\square	Shelf / berm	(P) + symbol	pollarding
	Waterfall	- T	Submerged	m	Spring / flush	C + symbol 0	Coppiced tree
_∆^∆	Protruding rock		Monocots Submerged	• •- •••	Inflow stream	0	Sapling
(T-D	Island (with vegetation)	_ملم_	Dicots	זטל	Outfall	Sbrubs/hedgerov	45
$\left \stackrel{\frown}{+} \right $	Direction of flow	m.	Bryophytes	11/1/11/1	Dredgings/spoil	$\overline{\mathcal{O}}$	Shrub (single)
I ' F		77	Floating leaves	•		4 <i>1 1 1 1 1</i> 1	Dense shrubs
SURVEY INFO	RMATION			ADJACENT LAN	D FEATURES		
$\otimes \longrightarrow$	Direction of survey/bank used				Fence	//////	Sparse shrubs
(1)	Photograph			-*- \$~- \$*-	Gate	- human	Hedgerow
				<u> </u>	Road / track		Hedgerow with trees
					Railway		
					Footpath	Gresses and herb:	
					Power lines	*******	Reed / sedge
					Building	$\nabla X \nabla \nabla$	Tall grass
				S.T.W.	Sewage works	፝፞፞፞	Tall herb / ruderal
Ecologia	cal Survey of	River Teir	gn at Castle I	Drogo Dev	on	ግጉ	Tall grass with herbs

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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	9	7	1
Modification Index	slightly modified	v. slightly modified	semi-natural
Habitat Quality Assessment	35	48	41.
Segment Type	2	2	2
	lowland cobbly	lowland cobbly	lowland cobbly
	river	river	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	n
EA, 1997c).	

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

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

Ecological Survey of River Teign at Castle Drogo, Devon. 28/08/1997 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).

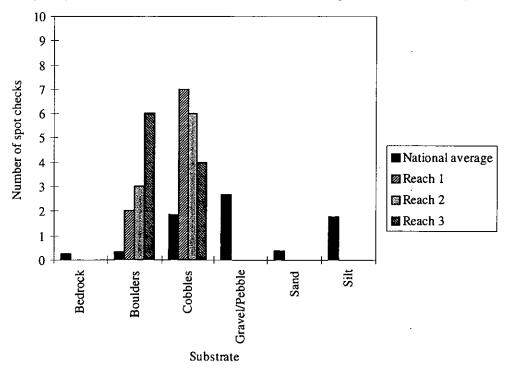
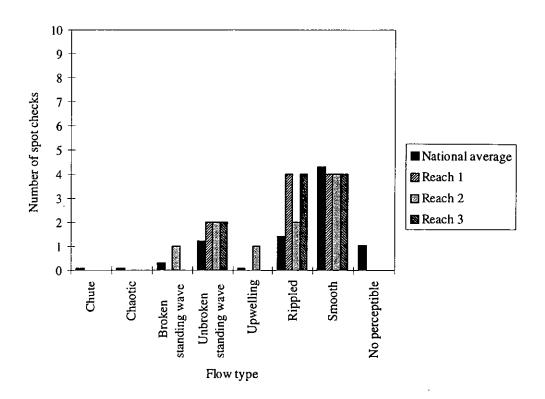


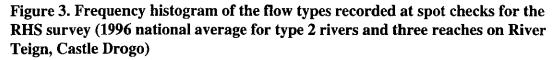
Figure 2. Frequency histogram of the substrate types recorded at spot checks for the RHS survey (1996 national average for type two rivers, and three reaches on River Teign, Castle Drogo)

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 $(3.6 \pm 9.2 (p = 0.05))$. 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.





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.

•	Number of individuals in sample				
Family	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		

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.

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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 eachreach of the River Teign at Castle Drogo.

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		Perc	entage C	over
	-	Reach 1	Reach 2	Reach 3
Species	Common name	(u/s	(weir to	(d/s
		weir)	turbine	turbine
			house)	house)
Amblystegium fluviatile (Hedw.)		-	0.5	0.5
Apium nodiflorum (L.) Lag.	Fool's water-cress	< 0.1	< 0.1	-
Callitriche hamulata Kutz. ex W.D.J. Koch	Water starwort	1.5	0.5	0.5
Caltha palustris L.	Marsh-marigold	-	-	0.5
Chiloscyphus polyanthos (L.) Corda		-	< 0.1	0.5
Conocephalum conicum (L.) Underw.	}	1	-	0.5
Fissidens viridulus (Sw.) Wahlenb.		-	-	< 0.1
Fontinalis squamosa Hedw.		5	15	20
Mnium hornum Hedw.		-	0.5	-
Myriophyllum alterniflorum DC.	Water milfoil	< 0.1	-	-
Oenanthe crocata L.	Hemlock water-dropwort	1	10	0.5
Phalaris arundinacea L.	Reed canary grass	-	< 0.1	-
Ranunculus penicillatus subsp penicillatus	Water crowfoot	5	-	< 0.1
(Syme) S.D. Webster				
Rhynchostegium riparoides (Hedw.) Warnst.		1	0.5	0.5
Riccardia chamedryfolia (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.

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

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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 m^3s^{-1} 2) Removal of 75% of water above Q95 level with a prescribed minimum of 0.8 m^3s^{-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 affects 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 m^3s^{-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

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Appendix 1.

Summary data for River Corridor Surveys.

Reach 1. Upstream of weir.

<u>Conditions during survey:</u> 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.

<u>Conditions during survey:</u> 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.

<u>Conditions during survey:</u> 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.

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

Full species list for invertebrate samples

Ecological Survey of River Teign at Castle Drogo, Devon. 28/08/1997 Appendix 2.

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

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Appendix 3.

River Habitat Survey forms

.

	The second s	1997 RIVER HABITAT SUR	VEY	Page 1
A	BACKGROUND MAI	P-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 DETA	\ILS		
	Site Number : TELYN	() Mid-site Grid Reference :	River : TEI	4N
	Date 12./.6./1997	$10 \cdot \pi$	urveyor name P. Lalet	
	Accredited Surveyor ?	No 🖓 Yes 🗹 If	yes, state codePF35	
	Adverse conditions affectin	ng survey ? No 🗹 Yes 🗌	If yes, state	•••••
	Bed of river visible ?	No 🗌 partially 🗹 er	ntirely (tick one box)	
	Duplicate photographs : g	jeneral character ? No	Yes (tick one box)	
	Site surveyed from : le	eft bank 🗹 right bank 🔲 cha	innel 🛛 (tick as approp	oriate)
	SERCON survey in addition	n? No 🗌 Yes 🗹 . (1	tick one box)	
C	PREDOMINANT VAL	LEY FORM (tick one box only)		
/	sha	allow vee	Concave/bow (If U-shaped g add "U")	
	dec	ep vee	symmetrical f	loodplain
_		-	asymmetrical	floodplain
	Nb. dotter few Terraced valley floor?	No Z Yes	Leep vee	• -
	NUMBER OF RIFFLES,	POOLS AND POINT BARS	(indicate total number)	
	Riffles 10	Unvegetated point bars		
	Pools	Vegetated point bars		

, /

•

1997 RIVE	R HAB	ITAT	SUR	VEY	: TE	N SPO)T-CH	IECK	S .	Pa	age Z c	 of 4
Spot-check 1 is at : upstream end		winstre				of site (
E PHYSICAL ATTRIBUTES (10	be asse	essed a	cross o	:hanne	l withi	n 1 m w	ide trar	isect)				
¹ = one entry only		1	2	3	4	5	6	7	8	9	10	<u>,</u>
LEFT BANK			Ri	ng EC d	or SC il	сотро	sed of s	andy s	ubstra	te		╞══
Material 1 My RE RO, CO, CI, EL PE Q, CC, SP, W7, CA	11, 11, IW	EA	Ef	B	-		E A	EA	BR	Bo	BO	
Bank modification(s) NK, NO, RS, RL, PC(B), BM, I	ЕМ	No	EM	EN	NN	NIN		IND	RI		+	1
Bank feature(s) NV, NO, EC, SC, PB, VP, SB, VS		NO	N	SB	NC	NO	SB	+	No	ND	TATO	1
CHANNEL				GP-	ring ei	ther G d	r P if p	redomi	nant			
Channel substrate 1 NV, BE, BO, CO, GP, SA, SI,		CO	co			co	co	co	C0	BO	NV	SA
Flow type 1 FF, CH, BW, UW, CF, RP, UP, SM, NP, NC		Uω	SM	UW	RP	RP	RP	ISM	RP	Sm		
Channel modification(s) NK, NO, CV, RS, RI, DA,	FO	NO	NO	No	N	N	NO	ND	ND		NO	225
Channel feature(s) NY, NO, RO, MB, VB, MI, TR		RD	No	No	NO	NO	RO	ND	RO	Ro	RO	sent ch
RIGHT BANK	•		Rir	ng EC c	or SC if	сотро	sed of s	andy s	ubstra	te	i i	Enter channel present in >1
Material ¹ NV, BL BO, CO, CS, E4, PE, CL, CC, SP, W7, G4, BR		80	EA	<u>B0</u>	<u> EA</u>	EA	EA	EA	BO	BO	EA	el sut 196 m
Bank modification(s) NK, NO, RS, RL PC(B), BM, E	ЕМ	ND	No	INC	ND	ND	NO	No	No	NO	No	el substrates not occurring 1% whole site.
Bank feature(s) NY, NO, EC, SC, P8, V9, S8, V3		ND	<u>IND</u>	IND	IND		ND	ND	ND	No	ND	tes n site
F BANKTOP LAND USE AND	VEGET	ATIO	N ST	RUCT	URE	to be as	sessed o	ver a 1	0ın wid	e transe	ect)	oto
Land use : choose one from BL, CP, OR, MH, SC	C, TH, RP,	IG, TL,	WL, O	W, SU,	RS							Curn
LAND USE WITHIN Sm OF LEFT BANKTOP		Ha	Ig	Eg	IIY	11g	Th	The	14	BL	BL	ing in
LEFT BANKTOP (structure within 1m)	B/U/S/C	U	5		S	S	S		S	S	5	n spo
LEFT BANK FACE (structure)		C	5	5	S	S	5	5	5	5	5	spot-checks
RIGHT BANK FACE (structure)	\$1U/S/C	C	C.	5	5	5	C	5	5	5	5	
RIGHT BANKTOP (structure within 1m)	#/V/S/C	U	υ	υ	U	U	υ	υ	5	<	5	but
LAND USE WITHIN Sm OF RIGHT BANKTOP		Τy	IY	TY	Ty	IL.	ty	IY	BL	BL	BL	
G CHANNEL VEGETATION TY	PES (to	be asse	ssed ov	ver a 10	m wide	transec	t : use i		¹ orea		(oracant)	
NONE	<u> </u>										<u>Jasan</u>	· . '1
Liverworts/mosses/lichens			/	E	$\overline{}$		7	$\overline{}$	<u></u>			E
Emergent broad-leaved herbs			<u> </u>		-	Í7		<u></u>				5
Emergent reeds/sedges/rushes		-				<u>├</u> ──-	<u> </u>					
Floating-leaved (rooted)					<u> </u>	╞╌╌┨						
Free-floating					<u> </u>						—- †	
Amphibious												
Submerged broad-leaved								-+				
Submerged linear-leaved										—†		
Submerged fine-leaved		\square	\square		Z		71		\mathbf{z}		-†	\nearrow
Filamentous algae									<u> </u>			\square
ise end "catch-all" column for types not occ	urring li	spot (checks	as we	ll as ov	erall as	L Sessme	nt ove	r 500n			 ,+

SITE NO.	1997 RIVE	R HABI	TAT SUR	VEY : 500m SWEEP-UP		Page	3 of 4
H LAND USE W	ITHIN 50m OI	BANK	TOP Üs	e E (\geq 33% banklength) or \checkmark (present)		<u> </u>	
		L	R			1	R
Broadleaf/mixed woodla	ind (BL)	E	E	Rough pasture (RP)		+ <u></u>	1
Coniferous plantation (C				Improved/semi-improved grass	s (IG)	E	E
Orchard (OR)				Tilled land (TL)			+
Moorland/heath (MH)				Wetland (eg bog, marsh, fen) (WL)		+
Scrub (SC)				Open water (OW)	•••• <u></u> ,	·	<u> </u>
Tall herbs /rank vegetatio	on (TH)			Suburban/urban development	(SU)	+	
				Rock and scree (RS)	•		
BANK PROFIL	ES Use E (≥ 339	6 bankler	igth) or 🗸	present)			
Natural/unmodified		L	R	Artificial/modified		L	R
Vertical/undercut		E	E	Resectioned			
Vertical + toe	hm	-		Reinforced - whole bank		/	
	<u></u>	E	E	Reinforced - top only	<u></u> 		
Gentle	<u> </u>	1/		Painformed the set			
Composite	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			Artificial two-stage	<u> </u>		
· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·			Pcached	m	<u></u>	<u> </u>
	-			Embanked		/	
				Set-back embankments		· ·	
EXTENT OF TR	EES AND ASSO	CIATED	FEATUR	ES	<u> </u>		-
TREES (tick one	*					<u> </u>	
None Isolated/scattered Regularly spaced, Occasional clump Semi-continuous Continuous	Left	Right		Shading of channel Overhanging boughs Exposed bankside roots Underwater tree roots Fallen trees	None Present		3%)
EXTENT OF CH	IANNEL FEATU	IRES (tick one bo	x per feature)			
Waterfall(s) Cascade(s) Rapid(s) Riffle(s) Run(s) Boil(s) Glide(s) Pool(s) Ponded Reach(es)				Marginal deadwater Exposed bedrock Exposed boulders Unvegetated mid-channel bar(s) Vegetated mid-channel bar(s) Mature island(s) Unvegetated side bar(s) Vegetated side bar(s)	Image: None Present Image: None Image: None Image: None		33%)

1997 RIVER							Page 4 o
L CHANNEL DIMENSI	DNS (to be	measured at	one site or	i a straight i	uniform sectio	n, preferably a	across a riffle
LEFT BANK		CHANNEL			RIGHT BAN	<u> </u>	
Banktop height (m)	1.20	Bankfull w	idth (m)	13.5	Banktop he	ight (m)	
is banktop height also bankfull height? (Y or N)	У	Water wid	th (m)	9	ls banktop height? (Y c	neight also ba	
Embanked height (m)		Water dep		0.30	Embanked h	eight (m)	
If trashline is lower than banktop							
Bed material at site is: cc Location of measurement is:	insolidated			onsolidated	(loose) 🛛		unknown
		riffle	<u>k</u>		orglide 🗌		other
M ARTIFICIAL FEATUR	ES (indicate	total numbe	er or tick ap	propriate bo	ж)		
None Major Weirs	Interme		linor 🦉	vetments	Major	Intermedia	ite Min
Sluices			- A. C. T. C.	utfalls			
Culverts			Fo	rds .			
Bridges	_			flectors			*** ***
; water impounded by weir/dam				her (state)			
		Yes, <33		/ -	% of site 🔲		
EVIDENCE OF RECEN	T MANA	GEMENT	(tick appro	poiate box(e	2s))		
lone	Dredging			Mowing [Weed-cuttir	
•	Enhanceme	ent 🔲		Other (state)	weeu-cutur	ig 🗋
D FEATURES OF SPECIA		EST /					
			or t (≥ 33%	ength)			
None 📈							
Vaterfalls > 5m high		open water		Bog		Fringing ree	d-bank
Braided/side channels 🗌 Debris dams 🗍		open water		Carr		Floating ma	t
eafy debris	Water m Fen	eadow		Marsh		Other (state)
			<u> </u>	Flush		;	
CHOKED CHANNEL (ick one box)					-	
33% or more of the channel ch	oked with v	regetation?		10			
						Yes 🗌	
	PLANT S	PECIES (U	lse√orE(≱	e 33% lengti	h)		
one 🔲 Giant Hogweed 🗍	Himala	iyan Balsam	Ja Ja	panese Kno	tweed 🔲	Other (state). rhodo de
OVERALL CHARACTE	RISTICS	(Circle appi	ropriate v	ords, add	others as n	_	
ajor impacts: landfill - tippir	 na - litter - s	ewane - nolli	ution dro	ught abst-			rail - industr
- housing - mi anagement: set-aside - buf	ning - quan	ying - Overu	eepening -	anorestatio	n - fisheries n	nanagement	- silting
nimals: otter - mink - v						ron dragonf	ies/damselfli
ther significant observation	UNE F	withthe	્ય વહ	en a	40160 N	victure d	~ Course
		and cut	lles,	records	t in t	ne epst	check
ALDERS (tick appropriate L	ox(es))						
ers? None 🗌 Present 🗍	Extensive		Diseased A	lders? Non	e 🗹 Pre	ent	Extensive [
		-			- yes (10)		CALCHSIVE (

-	-	-	

ADDITIONAL SERCON COMPONENT Pag

To be completed only for SERCON purposes site D

T. SERCON SWEEP-UP - ITEMS I-IX	List in	T' the 9	% to ne	arest n	umber:	0, 1, 5	, 15, 25	5, 35, 4	5, 55, 6	5, 75, 8	15.95
	SC1		SC3		SC5			SC8	SC9	SC10	
I: % Planform re-aligned	0	0	0	6	0	0	0	0	0	0	0
I 11: % long-or cross-section modified	0	0	0	0	0	0	0	50	0	0	15
III: % recovery from I/II IV: % recovery of bank from engineering	<u> </u>	┣──	 					0			
V: % of riparian zone vegetation natural	0	0	0	0	0	0	0	15	100	100	15
VI: % of V with affinity to rivers	0	D	0	0	0	0	0	92	0	0	10
VII: % of bank vegetation with 'aliens'	0	0	6	0	0	0	0	0	0	0	5
VIII: % of bank with vegetation 'natural'	100	00	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 bootfaths on Loth Larks
2 Toxic/Industrial/Agricultural effluent		shough there are bootfatty on Loth Larky and the area is popular with uslkes
3 Sewage effluent	·	
4 Groundwater abstraction		
5 Surface water abstraction		nier itself. Some reinforcement is present in association with the boottridges.
6 Inter-river transfers		in association with the boothridges."
7 Channelization		
8 Management for flood defence	$\mathbf{V}_{\mathbf{r}}$	Enal section of EM at top of stretch
9 Man-made structures	$\overline{\mathbf{V}}$	and a Driver
10 Recreational pressures		
11 Introduced species		Small potchog & timologian halpon hododard

" <u>v</u>	. SFs/AFIs		Notes
a	Plant/animal observations		Blonon very frigh Lodder.
	Waterfalls>5m high		3 8-211 20-21
" <u>c</u>	Gorges	1	-
d	Floodplain wetlands - recreatable		
e e	Floodplain wetlands - unrecreatable		
f	Notable islands		
9	Native pinewoods		
h	Wide/special riparian zones		Good Broadlead woodland at Littom of
i	Negative - litter		
Ĺ	Negative - diseased alder		perfection. Muneroug Mostles / hickory.
k	Others		

W. NOTES at some areas of the DIS and of the Section there is widence of old lark reinforcing in the form of houldes boid into the hank. The DIS and of the reach not ponded due to the weir, the majority of the section however was comprised of ribbes, mus and swith glides.

Page 1 of

		1997 RIVER HABIT	AT SURVEY	Page 1 of 4
	BACKGROUND MAP	-BASED INFORMATION		
	Altitude (m) Solid geology code Distance from source (km) Height of source (m)	Slope (m/km) Drift geology co Significant tribut Water Quality Cl	de Planfoi ary ? Naviga	ategory (1 - 10) rm category ation ?
	FIELD SURVEY DETA	ILS		
	Site Number : TEIYN	Mid-site Grid Referer	ice :	River : TEIYN
	Date 12.1.6./1997	Time 15:15	Surveyor name	P. Scarlett
	Accredited Surveyor ?	No Yes 🗹	/ If yes, state cod	PF35
	Adverse conditions affecting	ng survey ? Nó 🗹 Ye	es 🔲 If yes, state	
	Bed of river visible ?	No partially] entirely	(tick one box)
		general character ? No		· .
	Site surveyed from :	eft bank 📈 right bank	Channel	(tick as appropriate)
	SERCON survey in additio	n? No 🗌 Yes	(tick one box)
, , , , , , , , , , , , , , , , , , ,	PREDOMINANT VAI	LEY FORM (tick one	box only)	
	st	nallow vee		concave/bowl (If U-shaped glacial valley - add "U")
	d d	eep vee		symmetrical floodplain
	√ □ g	orge		asymmetrical floodplain
	Terraced valley floor ?	No Z Yes		
	NUMBER OF RIFFLE	S, POOLS AND POINT	BARS (indicate	total number)
	Riffles 6	Unvegetated point b	ars	
	Pools	Vegetated point bars		

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1997 RIV	/ER H	ABIT	AT SI	JRVF	Υ· 1				<u> </u>			
Spot-check 1 is at : upstream end			stream								Page	2 of
E PHYSICAL ATTRIBUTES	(to be					2 TO	ite (tick	one bo	x)			
¹ = one entry only					inel wit	hin Tr	n wide	transec	:t)			
LEFT BANK			1	2	3	4	5	6	7		9	10
				Ring E	C or SC	if con	nposed	of sand	dy subs	trate		
Material 1 M, R, RO, CO, CS, EA, PE, Q, CC, SP, W7, Bank modification(s) NK, NO, RS, RL, PC(B), B		<u> </u>	50 <u>E</u>	<u>A E</u>	AE	AI	A	A		AF	AE	Δ
Bank feature(s) NV, NO, EC, SC, P8, V7, S8, V5	м, ЕМ ———	-1k	_			IDI	101	JOIN	VON	01	<u>, , , , , , , , , , , , , , , , , , , </u>	6
CHANNEL			10 N			1011	101	10M	JOIN	IDIA	101	Ĩ
Changel and a				GF	- ring	either	G or P	if predo	minon			
Flow type 1 FF, CH, BW, UW, CF, RP, UP, SM, NP,	_	╼╼╢╾┺╴		<u>0 t</u>	0 c	20			o C		0 C	05
Channel modification(s) NK, NO, CV, RS, RI, D			<u> </u>	_	-	_	mu	NS	MR	_		
Channel feature(s) NY, NO, RO, M&, VB, MI, TR		-10			<u> </u>		DN	ON	ON) Ni	_	<u> </u>
RIGHT BANK		R			0/20				h 1700	R		
Material 1 Mr. R. RO, CO, CS, EA, M. Q. CC, SP, WP, CA,				ling EC	or SC	if com	posed o	f sand	y substi	ate) R in >10
Bank modification(s) NK, NO, RS, RI, PC(8), BM		<u> B</u>		기려	川日	1 E	AE	\ Ef	1 Ef	1 BC) EA	8
Bank feature(s) NV, NO, EC, SC, PB, VP, SB, VS			*+			<u> </u>	<u> </u>	ON		DINC	D N	% whole
			<u> N</u>	UN	$\frac{1}{N}$	05	<u>B N</u>	<u>>[N</u>	SINC	N	DINO	e site.
F BANKTOP LAND USE AND	VEG	ETATIO	ON ST	RUC	TURE	(to be	assessed	l over o	10m w	ide tran	sect)	
Cr, OK, MA, S	SC, TH, I	RP, IG, T	'L, WL, (ow, su	, RS							
LAND USE WITHIN Sm OF LEFT BANKTOP		BL.	BL	BL	BL	BI	BL	IBL	BL	BL		
LEFT BANKTOP (structure within 1m)	BAUISIC	5	5	5	C	5			1s		BL	in spot-chec
LEFT BANK FACE (structure)	\$N/5/C	5	5	S	5	Ī	13	5	13	5	5	
RIGHT BANK FACE (structure)	NU/S/C	S	S	S	5	5	ŤŽ	5	17	5	5	
RIGHT BANKTOP (structure within 1m)	MU/S/C	S	5	s	5	5	15	5	5		+	
LAND USE WITHIN 5m OF RIGHT BANKTOP		BL	BL	BL	RI	RI	01	DI	0,		5	
G CHANNEL VEGETATION TY	PES (t	o be ass	essed o	ver a 1) n wide			UL		Br	BL	
NONE								°t(≥3	3% orec	a) or 🗸	(present).
iverworts/mosses/lichens				E		┝-,		<u>├</u>	<u> </u>			
mergent broad-leaved herbs		<u> </u>	Z			\vdash	K	Ķ		\angle	\angle	E
mergent reeds/sedges/rushes					— <u>—</u>		┣──					\leq
loating-leaved (rooted)					- <u>-</u>							
ee-floating												
nphibious												
bmerged broad-leaved	—-∦		╾┼						<u></u>			
bmerged linear-leaved	—-∦-		╼╼╂	╺──┼				- <u>·</u>				
bmerged fine-leaved	╼╼╢				╺╼╶┼							
amentous algae	┈╼╢╴	<u> </u>	+						\triangleleft		Δ	
		n spot c										11

SITE'NO. 2	997 RIVI	ER HAE	SITAT SUR	VEY : 500m SWEEP-UP	<u> </u>	Page	3 of 4
H LAND USE WITHIN	1 50m O	F BAN	KTOP Us	$E (\ge 33\% \text{ banklength}) \text{ or } \checkmark (present)$			
		L	R			L	R
Broadleaf/mixed woodland (BL)	E	E	Rough pasture (RP)		<u></u>	<u></u>
Coniferous plantation (CP)				Improved/semi-improved grass (IG)			+
Orchard (OR)		_		Tilled land (TL)			<u> </u>
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)			
BANK PROFILES	lse E (≥ 33	% bankl	ength) or√(present)			
Natural/unmodified		L	R	Artificial/modified	1		R
Vertical/undercut	7	E	E	Resectioned			
Vertical + toe				Reinforced - whole bank	~~~	7	
Steen (>45°)	~~~	E	E	Reinforced - top only	<u>~~~</u>		
Gentle	·····					·	
Composite	~~~~~			Artificial two-stage			
			ł	Peachad			
•	-			Embanked			
				Set-back embankments		· · ·	
EXTENT OF TREES A	ND ASS	DCIATE	D FEATUR				-
TREES (tick one box pe						·	
	Left	Right		ASSOCIATED FEATURES (tick one box p None	<i>Present</i> Present	E (≽33	396)
None				Shading of channel		Ž	
Isolated/scattered				Overhanging boughs			
Regularly spaced, single				Exposed bankside roots			
Occasional clumps Semi-continuous				Underwater tree roots			
Continuous	\mathbf{Z}			Coarse woody debris			
		-					
EXTENT OF CHANN	<u> </u>	۰.		x per feature)	, - ,	· · ·	
Waterfall(s)	None	Present	E(>33%)	None	Present	E(≥3	33%)
Cascade(s)		Ŋ		Marginal deadwater	N N		
Rapid(s)		Ø		Exposed boulders			
Riffle(s)		Ø		Unvegetated mid-channel bar(s)			
Run(s)		Z		Vegetated mid-channel bar(s)			
Boil(s)		\square		Mature island(s)		Ā	
Glide(s)		\square		Unvegetated side bar(s)	Ā	'n	
Pool(s)	\square			Vegetated side bar(s)			
Ponded Reach(es)	\square			Discrete silt deposit(s)			
			¢.	Discrete sand deposit(s)			

1997 RIVER	HABITA	T SURVEY	: DIMEN	SIONS A	ND INFLUE		Page 4 of 4
L CHANNEL DIMENSIO	NS (to be	measured at	one site or	n a straight i	uniform section), preferably c	cross a riffle)
LEFT BANK		CHANNEL	<u></u>		RIGHT BAN	<u> </u>	
Banktop height (m)	1.10	Bankfull wi	idth (m)	12	Banktop hei		
ls banktop height also bankfull height? (Y or N)	Y	Water widt	:h (m)	8.5	Is banktop h height? (Y o	ieight also ba r N)	
Embanked height (m)		Water dept		0.40	Embanked h	eight (m)	
If trashline is lower than banktop	break in sl	ope, indicate	: height a	above water	r (m) =		L
	nsolidated ((compact)		onsolidated	(loose) 🗌		unknown
Location of measurement is:	No. 1987 States and	riffle	<u> </u>		orglide 🗌		other 📋
M ARTIFICIAL FEATURE	S (indicate	total numbe	r or tick ap	propriate bo) x)		
None Major Weirs	Interme		inor 👯		Major	Intermedia	ite Minor
Sluices			22 22 22 22 22 22 22 22 22 22 22 22 22	vetments utfalls			
Culverts			5576 V-568	rds			
Bridges				eflectors			<u>ran kasari jine persekari</u> Refi
				her (state)	<u></u>		******
Is water impounded by weir/dam	? No 🖊	Yes, <339	% of site	>33	% of site 🔲	(Fish	<u>يد</u>]
N EVIDENCE OF RECEN	T MANA	GEMENT	(tick appro	poiate box(es))	ىرى بىرى ئېچىنى بىرى بىرى مەرىمى بىرى بىرى بىرى بىرى بىرى بىرى بىرى	
		in a construction of the second se		- Canada Sala	24, 24, 2		
None 🛛	Dredging			Mowing [Weed-cuttir	ig 🔲 🕺
	Enhanceme	·····		Other (state			
	Artificiai	EST (use / o open water open water		6 length) Bog Carr Marsh		Fringing ree Floating ma Other (state	t , , , , , , , , , , , , , , , , , , ,
O FEATURES OF SPECIA None Waterfalls > 5m high Braided/side channels Debris dams Leafy debris	Artificiai Natural o Water m Fen	EST (use / o open water open water eadow	or E (≥ 339	% length) Bog Carr		Floating ma	t , , , , , , , , , , , , , , , , , , ,
O FEATURES OF SPECIA None □ Waterfalls > 5m high □ Braided/side channels □ Debris dams □ Leafy debris □ P CHOKED CHANNEL (1)	Artificiai Natural d Water m Fen ick one box,	EST (<i>use</i> / o open water open water eadow	or E (≥ 339	6 length) Bog Carr Marsh Flush		Floating ma Other (state	t , , , , , , , , , , , , , , , , , , ,
O FEATURES OF SPECIA None	Artificiai Natural o Water m Fen ick one box	EST (use / o open water open water leadow	or E (≥ 339	6 length) Bog Carr Marsh Flush		Floating ma	t , , , , , , , , , , , , , , , , , , ,
O FEATURES OF SPECIA None	Artificiai Natural o Water m Fen ick one box	EST (use / o open water open water leadow	or E (> 339	6 length) Bog Carr Marsh Flush No 33% lengt	□ □ □	Floating ma Other (state	t , , , , , , , , , , , , , , , , , , ,
O FEATURES OF SPECIA None	Artificiai Natural o Water m Fen ick one box	EST (use / o open water open water leadow	or E (> 339	6 length) Bog Carr Marsh Flush	□ □ □	Floating ma Other (state Yes	t , , , , , , , , , , , , , , , , , , ,
O FEATURES OF SPECIA None	Artificiai Natural o Water m Fen ick one box ooked with w PLANT S Himal	EST (use / o open water open water leadow) vegetation? DPECIES (U ayan Balsam	or E (≥ 339	6 length) Bog Carr Marsh Flush No ≥ 33% lengt	□ □ □ () () () () () () () () () () () () ()	Floating ma Other (state Yes Other (state	t jurodland
0 FEATURES OF SPECIA None	Artificiai Natural o Water m Fen ick one box ooked with w PLANT S Himal RISTICS	EST (use / o open water open water leadow vegetation? DPECIES (U ayan Balsam (Circle opp)	pr $E (\ge 339)$	6 length) Bog Carr Marsh Flush No ≥ 33% lengt spanese Kno words, odd	□ □ □ h) otweed ✓ d others as in	Floating ma Other (state Yes Other (state ecessory)	t).ivooldand).ivooldand).ivooldand).ivooldand).ivooldand).ivooldand
0 FEATURES OF SPECIA None	Artificiai Natural d Water m Fen ick one box ooked with w PLANT S Himal RISTICS	EST (use / o open water open water deadow vegetation? DPECIES (U ayan Balsam (Circle opp) sewage - polli rying - overd	or E (≥ 339	& length) Bog Carr Marsh Flush No ≥ 33% lengt apanese Kno words, add bught - abst - afforestatio	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □	Floating ma Other (state Yes Other (state ecessory)	t).ivooldand).ivooldand).ivooldand).ivooldand).ivooldand).ivooldand
O FEATURES OF SPECIA None	Artificiai Natural o Water m Fen ick one box oked with w PLANT S Himal RISTICS	EST (use / o open water open water leadow vegetation? OPECIES (U ayan Balsam (Circle oppl sewage - pollo rying - overd eadland - aba	pr E (≥ 339	& length) Bog Carr Marsh Flush No 33% lengt panese Kno words, add pught - abst - afforestatio and - parkla	□ □ □ □ bitweed ✓ fortweed ✓ fortweed ✓ fortweed ✓ fortweed ✓ fortweed MoD	Floating ma Other (state Yes Other (state ecessory) dam - road nanagement	t).issoilland).issoilland e).c.hod.cd.end e).c.hod.cd.end rail - industry - silting
O FEATURES OF SPECIA None	Artificiai Natural o Water m Fen ick one box ooked with w PLANT S Himal RISTICS ng - litter - s ning - quar fer strip - ho vater vole - l She	EST (use / o open water open water leadow vegetation? OPECIES (U ayan Balsam (Circle oppl sewage - pollo rying - overd eadland - aba	pr E (≥ 339	& length) Bog Carr Marsh Flush No 33% lengt panese Kno words, add pught - abst - afforestatio and - parkla	□ □ □ □ bitweed ✓ fortweed ✓ fortweed ✓ fortweed ✓ fortweed ✓ fortweed MoD	Floating ma Other (state Yes Other (state ecessory) dam - road hanagement	t).issoilland).issoilland e).c.hod.col.end e).c.hod.col
O FEATURES OF SPECIA None	Artificiai Natural o Water m Fen ick one box ooked with w PLANT S Himal RISTICS ng - litter - s ning - quar fer strip - ho vater vole - l is: Loo	EST (use / o open water open water leadow vegetation? OPECIES (U ayan Balsam (Circle oppl sewage - pollo rying - overd eadland - aba	pr E (≥ 339	& length) Bog Carr Marsh Flush No 33% lengt panese Kno words, add pught - abst - afforestatio and - parkla	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □	Floating ma Other (state Yes Other (state ecessory) dam - road nanagement ron (dragonf	t). WERDELLAND). WERDELLAND e). Chod. col. R.A. e). Chod. Chod. Col. R.A. e). Chod. Ch

ADDITIONAL SERCON COMPONENT

To be completed only for SERCON purposes Site (2)

k Others

T. SERCON SWEEP-UP - ITEMS I-IX	List in	'T' the 🤋	% to ne	arest n	umber:	0, 1, 5	, 15, 2	5, 35, 4	5, 55, 6	55, 75, 8	25 95
	SC1		SC3		SC5			SC8	SC9	SC10	7
I: % Planform re-aligned	100	0	0	0	D	6	0	0	0	0	5
II: % long-or cross-section modified	100	0	0	6	0	0	D	D	6	5	- S
III: % recovery from I/II	0			-							
IV: % recovery of bank from engineering	5					_		<u> </u>		 	┝╼╾┥
V: % of riparian zone vegetation natural	100	100	00	100	100	100	100	100	100	100	95
VI: % of V with affinity to rivers	6	D	0	0	0	0	0	D	0	0	0
VII: % of bank vegetation with 'aliens'	0	0	5	0	ο	0	0	S	0	\overline{D}	5
VIII: % of bank with vegetation 'natural'	100	100	95	100	100	100	100	95	100	100	वँड
IX: % of VIII with affinity to rivers	45	45	45	45	45	45	45	4,5	45	<u>us</u>	45

	•	
U. IMPACTS	~	Notes
1 Acidification	_	Large where with fish ladder inorporated
2 Toxic/Industrial/Agricultural effluent		and the ment from reason anorporated
3 Sewage effluent	1	abstraction found not operational.
4 Groundwater abstraction		Durbone houses on Right Lank.
5 Surface water abstraction	<u> </u>	
6 Inter-river transfers		a bootpath doing the Left hank, though
7 Channelization	<u> </u>	Doular ill il a hip a find and
8 Management for flood defence	<u> </u>	Popular with walkers has no impact on
9 Man-made structures		the river
10 Recreational pressures		• I
11 Introduced species		clumps of rhotodentron, poteness & Japanese trating
	•	
		Hindayan Ballon
V. SFs/AFIs		Notes
a Plant/animal observations		Lippers (1 pair), grey wogtail.
b Waterfalls>5m high		there is the), from more
<u>c</u> Gorges		
d Floodplain wetlands - recreatable		
e Floodplain wetlands - unrecreatable		
f Notable islands		Large notive island.
g Native pinewoods		
h Wide/special riparian zones	$\overline{}$	All mating maller frankriger provide
i Negative - litter	—	and manue wood with week many speeces,
Negative - diseased alder		Old nature woodland with many species, and a good diversity of insect species.

W. NOTES The reportan zone along the stretch is woodland with outcrops. There is much more on the in-channel loubles. The neir is Digitizant at the most ULS end of the stretch with tolmon using the figh ladder. a side channel, possilly caused by trapped bloodwater, is prepert. The tautine house, together with an old side channel (which is notable by its occumulation of course Land) occurr in this stretch.

SSS I

Page 1 of

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1997 RIVER HABITA	T SURVEY Page 1 of 4
A BACKGROUND MAP-BASED INFORMATION	
Altitude (m)Slope (m/km)Solid geology codeDrift geology codeDistance from source (km)Significant tributationHeight of source (m)Water Quality Class	ry? Navigation ?
B FIELD SURVEY DETAILS	
Site Number : TEIJN Mid-site Grid Reference	e: River: TEIYN
Date 12, 6, 1997 Time 16:20	Surveyor name Percarlett
Accredited Surveyor ? No	If yes, state code PF35
Adverse conditions affecting survey ? No Z 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 SerCON Survey in addition?	(tick one box)
C PREDOMINANT VALLEY FORM (tick one bo	x only)
shallow vee	concave/bowl (If U-shaped glacial valley - add "U")
deep vee	Symmetrical floodplain
gorge	asymmetrical floodplain
Terraced valley floor ? No 🖉 Yes 🗌	
D NUMBER OF RIFFLES, POOLS AND POINT BAP	ts (indicate total number)
Riffles 20 Unvegetated point bars	
Pools Vegetated point bars	

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1997 RIVER HA	BITAT	SUR	VEY :	TEN	SPO	T-CH	ECKS	;	Pa	ge 2 o	
Spot-check 1 is at : upstream end 💋 d	lownstre	am end		0	f site (t	ick one	box)				
E PHYSICAL ATTRIBUTES (to be as	sessed a	cross ci	hannel	within	1 m wie	le tran	sect)				
¹ = one entry only	1	2	3	4	5	6	7	8	9	10	<u> </u>
LEFT BANK		Rin	g EC or	SC if c	ompos	ed of s	ondv si	ubstrat	ο		<u> </u>
Material 1 NY, RE PO, CO, CS, EL PE, CL, CC, SP, WP, CL, EL, BK, BW	80	EA	EA	EA	FA	FA	BO	80	EA	FA	
Bank modification(s) NK. NO, RS, RL PC(B), BM, EM	NO	NO	ND	NO	NO	NO	NO		NA	INO.	ł
Bank feature(s) NY, NO, EC, SC, PB, VP, SB, VS	ND	NO	NO	NO	SB	N _D	NO	ND	Nn	NIN	ĺ
CHANNEL			GP- ri	ng eith	er G or	P if pr	edomir	nont			≰
Channel substrate 1 NY, 8E, 80, CO, GP, SA, SI, CL, PE, A	<u>- B0</u>	CO	CO	CO	CO	BO	Bo	80	Bo	80	SÁ
Flow type 1 FF, CH, BW, UW, CF, RP, UP, SM, NP, NO	RP	RP	SM	SM	νw		RP	RP	UW	SM	
Channel modification(s) NK, NO, CV, RS, RL, DA, FO	NO	NO	NO	No	NO	NO	NO	No	NO		- Ent
Channel feature(s) NY, NO, RO, MB, VB, MI, TR	RO	RO	NO	ND	ND	ND	NO	NO	RX.	No	Enter char present in
RIGHT BANK		Rin	g EC or	SC if c	ompos	ed of s	andy si	ubstrat	е		in >
Material 1 MC BE BO, CO, CS, EA PE, CL, CC, SP, WP, CA BA BE, BW	Bo	BO	EA	EA	Bo	BO	മ	EA	BO	BO	el su 196 v
Bank modification(s) NK, NO, RS, RJ, PC(B), BM, EM	ND	No	INO	No	No	No	ND	ND	NO	ND	95 whole site
Bank feature(s) NV, NO, EC, SC, PB, VP, SB, VS	ND		No		ND		NO	No	NO	NO	tes n site
F BANKTOP LAND USE AND VEGE	TATIO	N STR	υστι	IRE (IC	be ass	essed o	ver o 1 ()m wide	e transec	ct) .	Enter channel substrates not occurring in spot-checks present in $>1\%$ whole site.
Land use : choose one from BL, CP, OR, MH, SC, TH, R						•	_				Curn
LAND USE WITHIN Sm OF LEFT BANKTOP	BL	BL	BL	BL	BL	BL	BL	BL	BL	BL	ing ir
LEFT BANKTOP (structure within 1m) B/U/S/C	5	S	5	S	S	<u> </u>	C	S	S	S	ş
LEFT BANK FACE (structure) BAV/S/C	S	S	S	C	S	s	ŝ	5	S	S	- C
RIGHT BANK FACE (structure)	C	Ċ	C	5	5	S	5	5	S	5	ŝ
RIGHT BANKTOP (structure within 1m)	S	C	5	5	5	S	C	S	c	र्द	but
LAND USE WITHIN Sm OF RIGHT BANKTOP	BL	BL	BL	BL	BL	BL	BL		BL	BL	
G CHANNEL VEGETATION TYPES (1	o be osse	ssed ov					-				
NONE									<u>, v</u>		
Liverworts/mosses/lichens		7	7	7	Et	7	E	7	E		Ē
Emergent broad-leaved herbs	$\overline{\mathbf{X}}$		<u>د از ح</u>	7	-+	<u> </u>	-	\mathcal{A}	<u> </u>		
Emergent reeds/sedges/rushes				<u> </u>							
Floating-leaved (rooted)			-+		-+		-+				
Free-floating				-+	-+					— 	
Amphibious			†		-+					-	
Submerged broad-leaved				-+				-		-†	
Submerged linear-leaved				-+	_		-+	-+		-+	
Submerged fine-leaved		Ζ					+	-+	7†	-†	7
Filamentous algae									+	ť	<u>-</u>
Use end "catch-all" column for types not occurring	In spot	checks	as well	as ove	roll as	essme	nt over		L	L	[

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SITE NO. 3 1997	RIVER HAI	BITAT SUR	VEY : 500m SWEEP-UP	Page 3 of 4
H LAND USE WITHIN 50	m OF BAN	KTOP Use	e 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)	
BANK PROFILES Use E	(≥ 33% bank	length) or√((present)	
Natural/unmodified		R	Artificial/modified	L R
Vertical/undercut	Em E	E	Resectioned	
Vertical + toe			Reinforced - whole bank	
Steep (>45')		- /	Reinforced - top only 77	
Gentle				
Composite	~~~		Artificial two-stage	
	<u> </u>		Posched	
-		•	Embanked	
8			Set-back embankments	
J EXTENT OF TREES AND	ASSOCIATE	D FEATUR		
TREES (tick one box per bar				
	eft Right		ASSOCIATED FEATURES (tick one box per feat None Prese	-
None			Shading of channe!	Ž
			Overhanging boughs · · · ·	
Regularly spaced, single			Exposed bankside roots	
Occasional clumps			Underwater tree roots	
Semi-continuous			Fallen trees	
Continuous	3 0	•	Coarse woody debris	
K EXTENT OF CHANNEL F	EATURES	(tick one bo	x per feature)	
Nor		E(>33%)	None Presen	<u></u>
Waterfall(s)			Marginal deadwater	
Cascade(s)			Exposed bedrock	
Rapid(s)			Exposed boulders	
Riffle(s)			Unvegetated mid-channel bar(s)	
Run(s)			Vegetated mid-channel bar(s)	
Boil(s)			Mature island(s)	
Glide(s)			Unvegetated side bar(s)	
Pool(s)	1		Vegetated side bar(s)	
Ponded Reach(es)			Discrete silt deposit(s)	
		<i>i</i>	Discrete sand deposit(s)	

L	19	97 RIVER	HABITA	T SUR	VEY: DIN	IENS	IONS A	ND IN	FLUE	NCES [Page 4	of 4
L	CHANNEL I	DIMENSIO	NS (to be	measure	d at one sit	e on a	straight	uniform s	section,	preferably a	cross a ri	ffle)
LEFT				CHAN		Contern		RIGHT				To the second
	op height (m)		1.0		ıll width (m	1)	14	Bankto	op heig	ht (m)		1.0
	ktop height al: t? (Y or N)	so bankfull	Y	Water width (m)			11.5	ls banktop height also height? (Y or N)				
Embanked height (m) Water depth (m) 0.25 Embanked height (m)							<u> </u>					
	nline is lower t					ht ab	ove wate	r (m) =				
}	naterial at site i		solidated	·	<u> </u>	uncon	solidated	(loose)			unknowi	ι 🗌
	on of measure			riffl				or glide		······	othe	r 🔲
9 M - A	ARTIFICIAL	FEATURE	S (indicate	e total nu	mber or tic	k appr	o <mark>pr</mark> iate bo) (xc				
None		Major	Interme	diate	Minor			Ma	jor	Intermediat	te N	vinor
	Weirs Sluices		_				lments					
	Culverts		100000		<u>an an a</u>	Outf Ford						8370000 946-45
	Bridges						ectors					
							r (state)	<u></u>	2-97 2 (<u>67</u>)		179	
Is wate	r impounded l	by weir/dam?	No 🔎	Yes,	<33% of si	te 🗌] >33	% of site	. 🗆		_ ,	
N E	VIDENCE (OF RECENT	MANA	GEME	NT (tick ap	оргорс	oiate box(es))			· · · · .	
None		· · · · · · · · · · · · · · · · · · ·		·····					·		· · · ·	
none			Dredging Enhanceme	ent 🗂			owing her (state		١	Weed-cutting	g 🗌	
										······	······································	
	EATURES (JF SPECIA		EST (us	ie √ or E (≽	33%	ength)					1. A.
None								· · · · · · · · · · · · · · · · · · ·				· · · · ·
		۲ <u>ا</u>						·				
Waterf	alls > 5m high		Artificial	open wa	ater 🗌		Bog		ŀ	-ringing reed	d-bank	
Braide	d/side channel		Natural	open wa			Bog Carr			ringing reed		
Braide Debris	d/side channel dams		Natural Water m	open wa			Carr Marsh		F		. 1	Lond
Braide	d/side channel dams		Natural	open wa		-	Carr		F	loating mat	. 1	L L L L L L L L L L L L L L L L L L L
Braideo Debris Leafy c	d/side channel dams	s [] s []	Natural Water m Fen	open wa neadow			Carr Marsh		F	loating mat	. 1	- - - -
Braided Debris Leafy c	d/side channel dams lebris	s C ANNEL ((i	Natural Water m Fen ck one box	open wa neadow		No	Carr Marsh Flush		F	loating mat Other (state)	. 1	Lond Lond
Braided Debris Leafy c P C Is 33%	d/side channel dams lebris HOKED CH or more of the	s C ANNEL ((i e channel cho	Natural Water m Fen ck one box	open wa neadow) vegetatio	ter		Carr Marsh Flush		F	loating mat	. 1	C Land
Braidee Debris Leafy c P C Is 33% Q N	d/side channel dams lebris HOKED CH or more of the IOTABLE N	ANNEL (ti e channel che	Natural Water m Fen ck one box bked with PLANT	open wat neadow vegetatio	ter □ □ □ on? \$ (Use √ or	r E (≥ 3	Carr Marsh Flush	[]	F (loating mat Other (state) Yes	lboori	
Braided Debris Leafy c P C Is 33% Q N None	d/side channel dams lebris HOKED CH or more of the IOTABLE N Giant H	s Compared C	Natural Water m Fen ck one box oked with PLANT Himal	open wat headow vegetatio SPECIE layan Bal	ter □ □ on? S (Use √ or sam 2	r E (≥ E Japa	Carr Marsh Flush 33% lengt	th)	۱ ())))	Ioating mat Other (state) Yes Other (state)	lboori	
Braided Debris Leafy c P C Is 33% Q N None R O	d/side channel dams lebris HOKED CH or more of the IOTABLE N Giant H VERALL C	ANNEL (ti channel cho UISANCE	Natural Water m Fen ck one box oked with PLANT S Himal RISTICS	open wat neadow vegetatio SPECIE layan Bals (Circle d	ter □ □ on? S (Use √ or sam 2 appropria	rE(≥ Japa te wo	Carr Marsh Flush 33% lengt	th) btweed	r () () () () () () () () () () () () ()	Ioating mat Other (state) Yes Other (state) Other (state)	Urona Urona	
Braided Debris Leafy c P C Is 33% Q N None R O Major	d/side channel dams lebris HOKED CH or more of the IOTABLE N Giant H VERALL CH	ANNEL (ti c channel cho UISANCE ogweed IARACTE	Natural Water m Fen ck one box oked with PLANT Himal RISTICS	open wat neadow vegetatio SPECIE layan Bals (Circle of sewage	ter □ □ on? S (Use √ or sam 2 appropria	r E (≥ E Japa te wo	Carr Marsh Flush	th) btweed	as ne	Ioating mat Other (state) Yes Other (state) Cher (state)	Loooni	
Braided Debris Leafy o P C Is 33% Q N None R O Major Land	d/side channel dams lebris HOKED CH or more of the IOTABLE N Giant H VERALL CI IMPACTS: la	ANNEL (ti e channel che UISANCE logweed IARACTE ndfill - tippin housing - min	Natural Water m Fen ck one box oked with PLANT S Himal RISTICS g - litter - s ning - quar	open wat neadow vegetatio SPECIE layan Bals (Circle of sewage - rrying - o	ter □ □ on? S (Use √ or sam 2 appropria pollution - verdeepeni	te (≥ Japa te wo droug ing - a	Carr Marsh Flush 33% lengt anese Kno ords, add pht - abst fforestation	th) though the second	as ne mill - ceries ma	Ioating mat Other (state) Yes Other (state) Cher (state)	Loooni	
Braided Debris Leafy of P O Is 33% Q N None R O Major Land Manag	d/side channel dams lebris HOKED CH or more of the IOTABLE N Giant H VERALL CH Impacts: la - gement: se	ANNEL (i ANNEL (i e channel che UISANCE logweed IARACTEL ndfill - tippin housing - mir	Natural Water m Fen ck one box oked with PLANT S Himal RISTICS g - litter - s ning - quar er strip - h	open wat neadow vegetatio SPECIE layan Bals (Circle of sewage - rrying - o neadland	ter	<i>TE (≥ 1</i> Japa <i>te wo</i> droug ing - a ed land	Carr Marsh Flush 33% lengt anese Kno prds, add pht - abst fforestation d - parkla	th) otweed d others raction - on - fishe nd - Mol	as ne mill - ceries ma	Ioating mat Other (state) Yes Other (state) Other (state) Cessory) dam - road - anagement	rail - inc	lustry
Braided Debris Leafy of P O is 33% Q N None R O Major Land Manag	d/side channel dams lebris INOKED CH or more of the OTABLE N Giant H VERALL CH Impacts: la gement: se	ANNEL (I ANNEL (I e channel che UISANCE Iogweed IARACTE ARACTE Indfill - tippin housing - mir t-aside - buff ter - mink - w	Natural Water m Fen ck one box oked with PLANT Himal RISTICS g - litter - s ning - quar er strip - h vater vole -	open wat headow vegetatio SPECIE layan Bals (Circle of sewage - rrying - o headland kingfisher	ter	Japa Japa te wo droug ing - a ed land grey w	Carr Marsh Flush 33%.lengt anese Kno ords, add ords, add fforestation	th) otweed d others raction - on - fishe nd - Mol	mill - ceries ma D n - herce	Ioating mat Other (state) Yes Other (state) Other (state) Aam - road - anagement	rail - inc - silting	Land Iustry
Braided Debris Leafy of P O is 33% Q N None R O Major Land Manag	d/side channel dams lebris HOKED CH or more of the IOTABLE N Giant H VERALL CH Impacts: la - gement: se	ANNEL (I ANNEL (I e channel che UISANCE Iogweed IARACTE ARACTE Indfill - tippin housing - mir t-aside - buff ter - mink - w	Natural Water m Fen ck one box oked with PLANT Himal RISTICS g - litter - s ning - quar er strip - h vater vole -	open wat neadow vegetatio SPECIE layan Bals (Circle of sewage - rrying - o neadland	ter	E (≥ i Japa te wo drouc ing - a ed lanc grey w creco	Carr Marsh Flush 33% lengt anese Kno prds, add pht - abst fforestation d - parkla	th) otweed d others raction - on - fishe nd - Mol	mill - ceries ma n - herco	Ioating mat Other (state) Yes Other (state) Other (state) dam - road - anagement	rail - inc - silting	Lustry eiffies
Braided Debris Leafy of P O is 33% Q N None R O Major Land Manag Anima Other	d/side channel dams lebris IDKED CH or more of the OTABLE N Giant H VERALL CH Impacts: la cl gement: se significant o	ANNEL (I ANNEL (I e channel che UISANCE Iogweed IARACTE ARACTE Indfill - tippin housing - min t-aside - buff ter - mink - w bservation	Natural Water m Fen ck one box oked with PLANT Himal RISTICS g - litter - s ning - quar er strip - h vater vole - s: Doe contact	open wat headow vegetatio SPECIE layan Bals (Circle of sewage - rrying - o headland kingfisher	ter	E (≥ i Japa te wo drouc ing - a ed lanc grey w creco	Carr Marsh Flush 33% lengt anese Kno prds, add prds, add prds, add prds, add agtall sa Ruo yo	th) though the second	mill - c eries ma D n - herc	Ves Conter (state) Yes Other (state) Cessory) dam - road - anagement	rail - inc - silting	Land Lustry Lustry
Braided Debris Leafy of P O is 33% Q N None R O Major Land Manag Anima Other	d/side channel dams lebris HOKED CH or more of the OTABLE N OTABLE N Giant H VERALL CH impacts: la climpacts: la significant of significant of LDERS (tick	ANNEL (I ANNEL (I e channel che UISANCE Iogweed IARACTE ARACTE Indfill - tippin housing - min t-aside - buff ter - mink - w bservation	Natural Water m Fen ck one box oked with PLANT Himal RISTICS g - litter - s ning - quar er strip - h vater vole - s: Doe contact	open wat headow vegetatio SPECIE layan Bals (Circle of sewage - rrying - o headland kingfisher	ter	I E (> E Japa te wo drouc ing - a ed lanc grey w or Co Lo	Carr Marsh Flush 33% lengt anese Kno prds, add prds, add prds, add prds, add agtall sa Ruo yo	th) otweed d others raction - on - fishe nd - Mol nd marti W 6	mill - c eries ma D n - herc	Ves Conter (state) Yes Other (state) Cessory) dam - road - anagement	rail - inc - silting	Lustry eiffies

ADDITIONAL SERCON COMPONENT

To be completed only for SERCON purposes Sile 3

	r										
T. SERCON SWEEP-UP - ITEMS I-IX	List in T' the % to nearest number: 0, 1, 5, 15, 25, 35, 45, 55, 65, 7							55.75	35 05		
	SC1	SC2	SC3	SC4	SCS	SC6	SC7		-	SC10	
I: % Planform re-aligned	0	P	0	0	0	0	0	0	0	0	0
II: % long-or cross-section modified III: % recovery from I/II	0	0	0	0	0	6	0	Ō	0	0	0
IV: % recovery of bank from engineering		┣───									
V: % of riparian zone vegetation natural	100	100	100	100	18	(00)	100	100	100	100	<u>as</u>
VI: % of V with affinity to rivers VII: % of bank vegetation with 'aliens'	0	0	0	0	0	0	0	0	0	0	0
VIII: % of bank with vegetation 'natural'	5 95	0 100	0	0 100	0 100	1	0	0	0	0	5
IX: % of VIII with affinity to rivers	45	45	45	45	45	45	100 45	45	45	100	<u>95</u> 45

U. IMPACTS		Notes
1 Acidification		
2 Toxic/Industrial/Agricultural effluent	2	- me paperary and some the runs no vo
3 Sewage effluent		The bootpath along the lift last hose no direct impact on the river,
4 Groundwater abstraction		•j. • -
5 Surface water abstraction		4
6 Inter-river transfers		4
7 Channelization		-
8 Management for flood defence	+	4
9 Man-made structures		
10 Recreational pressures	<u> </u>	
11 Introduced species		tolyand dillara and it is
		chings of redoderston, some hindayer lollar
	- 	
V. SFs/AFIs		Notes
a Plant/animal observations		9-4-1
b Waterfalls>5m high	- Y	ging nogeon.
c Gorges		U U
d Floodplain wetlands - recreatable		

e Floodplain wetlands - unrecreatable		· · ·
f Notable islands		large mature island.
g Native pinewoods	- ¥	•
h Wide/special riparian zones		Old mature woodland, greines rich and a
i Negative - litter		good divertity of ineeds.
Negative - diseased alder		o a man o g ancor.
k Others		· · · · · · · · · · · · · · · · · · ·

W. NOTES The most octile of the 3 Lections with good coecode chute areas. Much mores is present on the exposed houlders. The most "natural" of the 3 Lections.

 Centre for
 Institute of Freshwater Ecology

 Ecology &
 Institute of Hydrology

 Hydrology
 Institute of Terrestrial Ecology

 Hydrology
 Institute of Virology & Environmental Microbiology

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Natural Environment Research Council