Advisory Visit

River Lugg, Herefordshire

June 2015

1.0 Introduction

This report is the output of a site visit undertaken by Tim Jacklin of the Wild Trout Trust to the River Lugg at Leominster, Herefordshire, on 15th June, 2015. Comments in this report are based on observations on the day of the site visit and discussions with Brecht Morris, Fisheries Technical Officer, Environment Agency (EA), and Ian Fullwood, Mike Onions, Peter Hutchinson and Robert Warren of Eaton Angling Club.

Normal convention is applied throughout the report with respect to bank identification, i.e. the banks are designated left hand bank (LHB) or right hand bank (RHB) whilst looking downstream. National Grid Reference (NGR) co-ordinates are used to identify specific locations.

2.0 Catchment / Fishery Overview

The River Lugg is a Site of Special Scientific Interest (SSSI) for its entire length of 101 km, from its source on Pool Hill in the Black Mountains, Powys, to its confluence with the River Wye at Mordiford near Hereford. The SSSI citation states:

The Lugg is considered to be one of the best British mainland examples of both a clay river and a river displaying a transition from nutrient-poor to naturally nutrient-rich water chemistry. Despite being canalised in some small sections and running through an intensively farmed catchment in its middle and lower reaches, it is a largely unpolluted natural river and supports river plant communities and otter *Lutra lutra* populations of special interest. Other species of interest include Atlantic Stream Crayfish *Austropotamobius pallipes*, Atlantic Salmon *Salmo salar*, Bullhead *Cottus gobio* and Twaite Shad *Alosa fallax*.
(www.sssi.naturalengland.org.uk/citation/citation_photo/1006616.pdf).

The Lugg SSSI is divided into geographical units, all of which (in the English section) were rated as being in "unfavourable – recovering" condition when last assessed against conservation objectives in 2010. About 5 km downstream of Eaton, the Lugg is also designated as a Special Area of Conservation (part of the River Wye SAC), a European-wide conservation designation.

Under the Water Framework Directive, this part of the River Lugg falls into the waterbody "Lugg – confluence of Norton Brook to confluence of River

Arrow" (reference no. GB109055042030). Under the latest cycle of assessment (2014) by the EA, this waterbody is classified as "good ecological status" indicating that the measured biological and chemical parameters reach the standards expected for a river of this type.

The Eaton Angling Club has been in existence since 1877 and currently has 33 members and controls fishing on 2 km of the River Lugg at Eaton Hall (SO5081557965), to the east of Leominster. The river here contains prolific grayling stocks (approximately 230 recorded on Eaton AC catch returns in 2014 season) and wild brown trout (approximately 80 recorded in 2014). Salmon run the river in small numbers and the occasional kelt has been caught. The club has stocked the river with 500 – 600 rainbow trout annually since 1955. Just over 100 triploid brown trout were stocked in the 2009 season as part of the 500 – 600 total. Prompted by the conservation designations pertaining to the river and the EA's National Trout & Grayling Fisheries Strategy, the club has reviewed its stocking policy and this year are trialling reduced stocking levels, introducing six batches of 70 fish (one batch triploid browns, the rest rainbows). Stocking and catch returns are discussed in more detail in the recommendations section.

3.0 Habitat Assessment

The river was walked in a downstream direction from the bridge and weir at Eaton Hall (SO5081757965) to Volka Bridge (SO5128957262). Reference is made to the numbered pools on the beat map supplied (Appendix 1).

The weir at Eaton Hall bridge (Photo 1) forms part of the bridge footings and the river flumes between two arches, over smooth, sloping faces at an angle of approximately 30° from horizontal. Although there is a standing wave at the base of each flume, slack water is present on each side (Photo 2). In terms of fish migration, the weir is likely to be passable at certain flows to adult salmon and larger trout, which can utilise their leaping and high burst speed swimming capabilities. It is however a notable barrier and will be particularly problematic to sub-adult trout, grayling, eels and smaller fish species. It could also delay the downstream migration of salmon smolts, leading to increased losses through predation. The Environment Agency are working with the Wye & Usk Foundation (WUF) to improve fish passage at numerous barriers on the Lugg on a prioritised cost-benefit basis and are

currently focussing on other sites, including a weir removal upstream of Eaton. An easement such as low-cost baffles combined with eel tiles may represent an affordable improvement at this site.

The weir provides a head of water that feeds into a former mill leat (Photo 3) running along the left bank of the river and re-joining at pool 4. The upstream end of the leat has a fixed crest height so the flow of water into the leat is entirely dependent upon river levels. It is evident from the un-vegetated “tide line” along the margins that water levels vary regularly in the leat. At the time of the visit, water levels were very low. The channel is heavily shaded and has a substrate dominated by fine sediment. Large woody debris is present at a couple of locations closer to the confluence with the river.

It was discussed whether the leat could be improved to provide spawning and/or nursery habitat for trout and grayling. There are a number of factors which work against this. Firstly, the substrate within the channel is mainly silt, sand and fine gravel which is not suitable for spawning. This suggests that coarser sediments are not being transported into the leat from the river upstream, and also possibly that when the river is high, water is backing up from downstream, promoting the settling out of fine sediments. Secondly, the low residual flow within the leat means that even if suitable spawning gravel were introduced, the flows may not be sufficient to attract adult fish to spawn, or to sustain eggs within the gravel throughout the incubation period.

Despite the above, the mill leat does provide some good slack water habitat at its confluence with the main river (Photo 4) which will provide an important refuge area for fish during high water events, particularly juvenile grayling which can be vulnerable to floods during their first summer. The leat is also lined with trees and bushes which are perfect for hinging and laying into the margins. This will provide good cover for juvenile fish, let in light to the heavily shaded channel and hopefully create localised scour (depending upon how much the channel backs up).

Himalayan balsam, a non-native, invasive, plant species was observed along the leat channel. To limit its spread, this should be removed by hand-pulling before in flowers in summer.

Photo 1 Weir at Eaton Hall bridge.

Photo 2 Slack water alongside the flumes of the weir give stronger swimming species a point from which to leap onto the face of the weir and use burst-speed swimming to ascend. However, the high velocity and shallow depth remain a significant obstacle.

Photo 3 The mill leat channel showing the very low residual flow when river levels are low. The substrate is dominated by fine sediment.

Photo 4 Confluence of the mill leat and the main river – a good high-water refuge area.

The main river has generally good in-stream habitat, with a meandering plan-form and a pool-and-riffle sequence. Gravel riffles, shoals and side-bars are present indicating that natural river sediment transport is taking place. The banks have a balance of trees and bushes present which are providing beneficial levels of shading of the channel (helping to regulate water temperatures) and bank stability via their root systems.

At the upstream end of the reach, there is good tree cover along the left bank, providing shade, low cover over the water and bank stability (Photo 5). In contrast, the right bank has fewer trees and livestock have unrestricted access (Photo 6). Grazing on the right bank has prevented taller vegetation and trees from becoming established and this has led to reduced bank stability and increased rates of erosion in places, particularly on the outside of bends (Photos 6, 8-10).

The banks are generally steep, which has limited livestock access to a degree and allowed some smaller trees to take root near the toe of the bank, but these are vulnerable to wash-out at high water and continued grazing pressure, which may prevent them from reaching maturity (Photo 8). Fencing off the river to allow these trees and others to establish would increase bank stability, reduce erosion rates and provide benefits to the fishery. In some areas, livestock can cross the river and the farmer is keen to fence off these areas to prevent this happening (Photo 7).

Installing brushwood at the toe of the bank in selected areas would help to protect the bank in the short term whilst trees and herbaceous vegetation became established in fenced areas. Hinging of selected trees would also provide some bank protection and low cover for holding fish (Photos 9, 10).

Some of the alder trees are displaying signs of *Phytophthora* disease and a number have already died, leaving some areas denuded of tree cover and with lower bank stability. Fencing these areas and allowing natural tree recolonization, or planting whips from nearby willows is recommended. In the short term, “tree kickers” (see recommendations) could be anchored to the bases of the dead alders to provide cover and bank protection (Photo 11).

Photo 5 Good tree cover along the left (far) bank provides good bank stability, shade and low cover over the water (Pool 1B / 2).

Photo 6 In contrast, the right bank has fewer trees and livestock have unrestricted access. The steep bank profile prevents grazing to the very edge of the river, but such areas would benefit from fencing to allow tree succession (Pool 3).

Photo 7 In some areas livestock can access and cross the river. Fencing would prevent this and reduce fine sediment inputs to the river (Pool 2).

Photo 8 Trees are colonising the right bank away from grazing pressure at the toe of the steep banks. However, these small alders are vulnerable to washout and sheep are making pathways behind them, grazing off lower leaves and undermining the roots. Protecting the trees will protect the bank from accelerated erosion (Pool 3).

Photo 9 Areas of bank in-between the alders in the previous photo could be protected with brushwood revetment which would reduce erosion rates whilst vegetation established behind a new fence line (Pool 3).

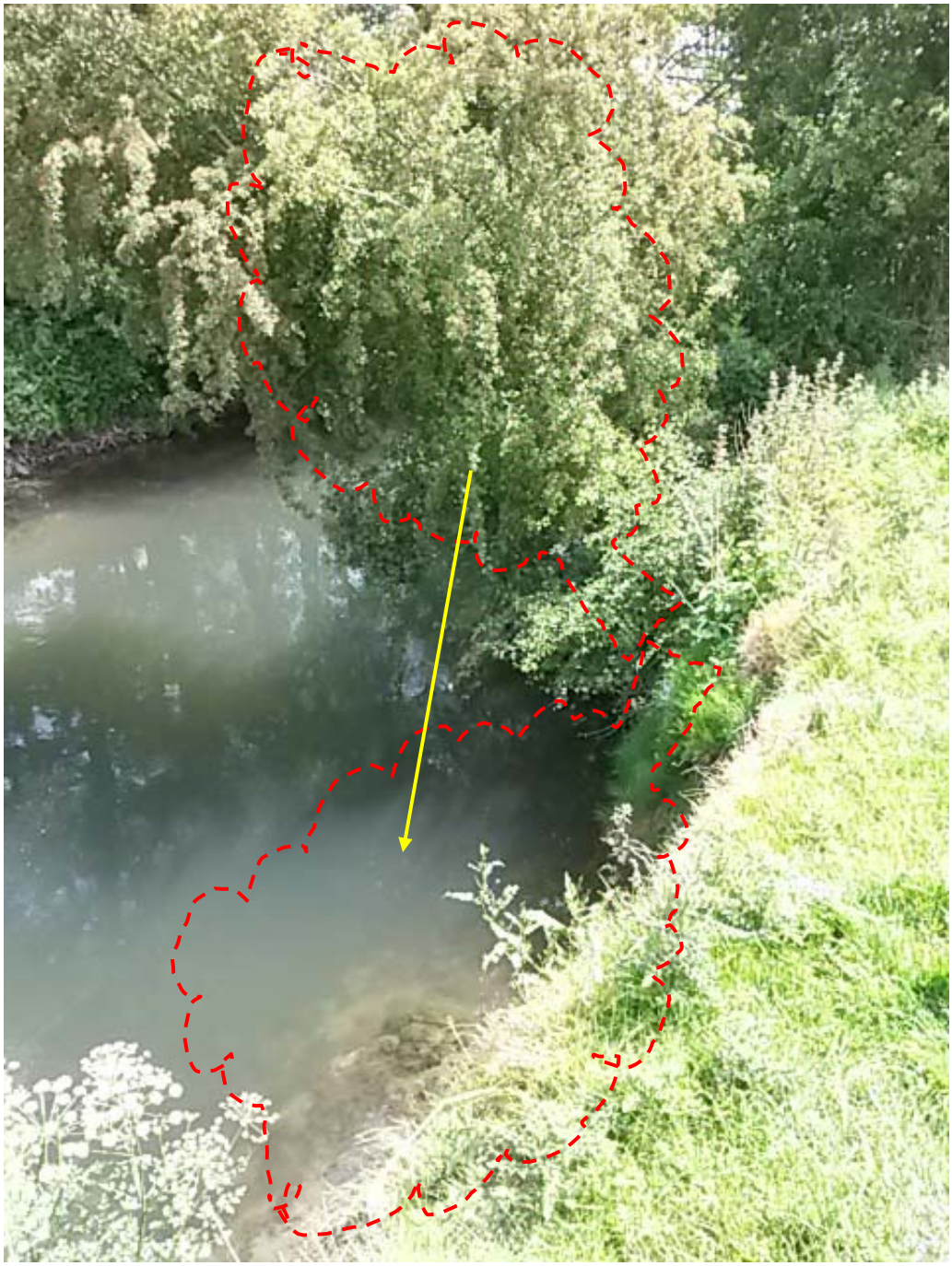


Photo 10 Partially cutting and laying selected trees and staking in place would protect areas of bank such as this from erosion whilst vegetation established behind a new fence line (Pool 3).

Photo 11 Alder disease has denuded tree cover in some areas. Fencing to allow tree succession is recommended here. Tree kickers (hawthorn) could be introduced along the toe of the left (far) bank. Dead wood should be left standing as habitat for woodpeckers, etc. (Pool 4).

Photo 12 Another example of bank erosion on the outside of a bend being exacerbated by livestock access. Although the toe of the bank is currently stable and vegetated, sheep pathways leave a line of bare earth which is easily eroded at higher flows, in this case threatening to outflank and undermine the mature tree (arrow). Fencing is recommended here (Pool 5).

With progress downstream, there are further areas on the outside of bends where excluding livestock would improve vegetation cover and hence the resilience of the bank to erosion (Photos 12, 16 and 18). There are already plans to fence off some substantial headlands between meanders, including between 5 - 6B and 8 - 9 on the right bank and 7 – 9 on the left bank. Extending the fencing to include as much of the left bank as possible, especially the areas identified on the outside of bends, would be ideal.

Some excellent areas of low cover over the water were noted (Photo 14). These provide fantastic lies for trout and increase the carrying capacity of the river, so should be retained and not trimmed back. Equally, where woody debris is found within the channel the presumption should be to retain it (Photo 15). It provides multiple benefits to the fishery including refuge for fish from predators, habitat for invertebrates upon which fish feed and localised scouring and sorting of river bed sediments.

At the downstream extent of the reach, the last field is under different land ownership. The river here is more tree-lined and shaded. There is a point where livestock can access and cross the river and there are plans to fence off the left bank to prevent this (Photo 19). The area on the opposite bank could be formalised to provide a hard-standing drinking area.

Photo 13 A wide shallow riffle which falls within a headland which has been earmarked for fencing. This will prevent livestock access here and lead to natural recolonization with marginal plants and beneficial narrowing of the channel. This process could be speeded up by installing a brushwood "mattress" in the near margin (Area 6A).

Photo 14 Low cover over the water provides excellent holding lies for fish and should be retained (Area 6A / 6B).

Photo 15 Woody debris in the river is also excellent habitat, providing cover, refuge from predators (such as otters and fish-eating birds), and increasing the production of invertebrates. Leave it in place (Area 6B).

Photo 16 Re-instating the fence at the top of the right bank here would benefit the marginal habitat and improve bank stability (Area 6B).

Photo 17 Hinging and staking the tree into this back eddy as indicated would reduce the erosion currently occurring (Area 6B).

Photo 18 A further example of vegetation establishing at the toe of the bank, but being restricted beyond there by grazing. Fencing back from the fall of bank would help increase bank resilience here (Area 8).

Photo 19 A livestock access/crossing point that will fall within one of the planned fenced headlands.

Photo 20 View upstream from Volka Bridge.

4.0 Recommendations

- Overall, this section of the River Lugg has good in-stream habitat and is suitable for wild brown trout and grayling to complete their life-cycles. The quality of the riparian habitat is mixed, with some high quality areas where mature trees and coarse vegetation are present and other areas that are impacted by grazing. There are plans to fence off extensive areas and it would be beneficial if this could be extended to include as much of the area affected by grazing as possible, particularly the areas on the outside of meanders highlighted above.

- Naturally occurring woody debris should be retained within the channel wherever possible. Hinging of trees and the introduction of tree kickers is recommended in selected areas and will be demonstrated during a practical visit later this year (Photos 21, 22).

- Bank revetment using brushwood should be carried out in the areas indicated, to reduce excessive rates of erosion and allow the banks to stabilise. This should be done in combination with fencing of these areas (Photo 23, 24).

- Some members of Eaton AC have recently completed training with the Riverfly Partnership and will be carrying out invertebrate sampling as part of the Anglers' Riverfly Monitoring Initiative (www.riverflies.org).

- The club should support the efforts of the EA and Wye & Usk Foundation to improve fish migration opportunities for all species.

It is a legal requirement that all the works to the river require written EA consent prior to undertaking any works, either in-channel or within 8 metres of the bank. Prior consultation with Natural England is also essential because of the SSSI designation of the river.

Photo 21 Hinging and laying small trees to provide low marginal cover for fish.

Photo 22 Example of a tree kicker. A shorter cable can be used to restrict movement. The kicker rises and falls with water level, providing bank protection at all water levels.

Photo 23 Brushwood bank revetment installed on the River Leadon. This can be used to protect the toe of the bank from erosion.

Photo 24 Brushwood revetment wired and staked in place, in combination with fencing.

4.1 Stocking and Catch Returns

The club should continue to keep catch returns and review its stocking policy in light of the data collected. In recent years, a number of clubs that fish rivers with high quality habitat like the Lugg have reduced the number of fish they introduce or ceased stocking entirely without adversely impacting their members' catches. The Wild Trout Trust is compiling a list of case studies which are available here www.wildtrout.org/content/trout-stocking. In many cases, clubs have found that catch-and-release fishing has become the norm amongst members, yet have not adjusted historic stocking levels. This leads to unnecessary expense and increased competition between stocked and wild fish which is detrimental to the fishery.

A number of studies have shown that stocked trout do not persist very long within river fisheries, usually disappearing within a matter of weeks or months. Whilst they are present however, there is increased and prolonged competition between individuals leading to displacement of both wild and stocked fish (Bachman, 1984). The poor persistence of the stocked fish combined with increased displacement of wild fish can reduce overall numbers of fish within the fishery over a period of time. A study of a river with good quality habitat where stocking ceased showed a substantial increase in the numbers of wild fish (Vincent, 1987). Here the cessation of stocking with farmed rainbow trout in a Montana river resulted in an 8-fold increase in numbers and a 10-fold increase in biomass of wild rainbows over the subsequent four-year period. Interestingly, there was also a 160% increase in wild brown trout numbers and biomass over the same period, suggesting a detrimental interaction between farmed rainbows and wild brown trout also existed. An interesting video about where this study took place is available here https://m.youtube.com/watch?v=U_rjouN65-Q .

Recent catch return data from an angling club which ceased stocking with brown trout on the upper River Ribble has shown a substantial increase in the numbers of grayling being caught, in addition to improved figures for trout. Whilst no firm conclusions can yet be drawn given the limited data available and known variability in grayling year-class abundance, it is something to monitor in future.

The available catch return data for Eaton AC is shown in Figure 1 and Table 1 below. It is recommended that "catch per unit effort" (CPUE) is used for comparative purposes; this is usually expressed as number of fish caught

per visit (or per hour if length of fishing time is recorded) and allows comparison of seasons where more or less fishing took place. The CPUE for rainbow trout is consistent at around 1.2 fish per visit during the period, whereas CPUE for wild brown trout is lower and more variable, between 0.02 and 0.72 per visit. Grayling show a generally increasing trend. The troughs in wild brown trout catches have been attributed to periods of flood affecting fish numbers; this is unlikely given no corresponding impact upon other species. It is interesting to note that one of the dips in wild trout catches is in 2009 which is the year when a batch of farmed brown trout were stocked in addition to the usual rainbows. Whilst it is tempting to speculate that this maybe because of the competitive interactions noted above, it is not possible to say without future data as stocking levels are decreased. The reduction in stocking in 2015 of around 100 fish to a total of 420 is a reasonable annual incremental reduction, whilst monitoring the effect on catches.

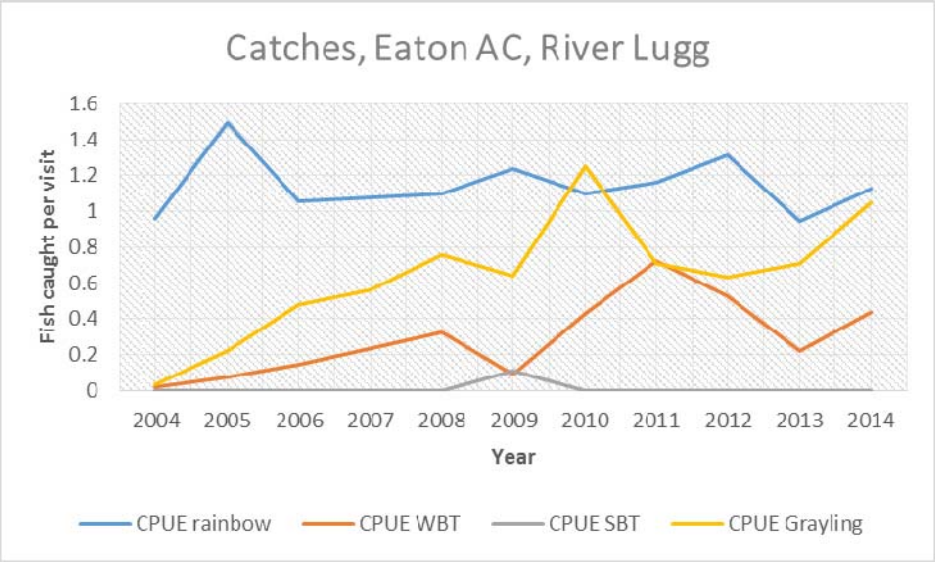


Figure 1 A graphical representation of Eaton AC catch returns based upon fishing effort. CPUE is Catch per Unit Effort (fish caught per visit), WBT is wild brown trout, SBT stocked brown trout.

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Fishing effort (visits)	214	212	263	199	164	195	155	169	174	218	219
Rainbow	205	317	277	215	180	241	170	196	228	206	246
WBT	4	16	39	47	54	18	67	122	92	49	96
Stocked BT	0	0	0	0	0	22	0	0	0	0	0
Grayling	7	47	126	112	124	125	194	120	110	154	230
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CPUE rainbow	0.96	1.50	1.05	1.08	1.10	1.24	1.10	1.16	1.31	0.94	1.12
CPUE WBT	0.02	0.08	0.15	0.24	0.33	0.09	0.43	0.72	0.53	0.22	0.44
CPUE SBT	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00
CPUE Grayling	0.03	0.22	0.48	0.56	0.76	0.64	1.25	0.71	0.63	0.71	1.05

Table 1 Data from catch returns

5.0 Making it Happen

A summary of recommended works for river habitat improvement are listed below in Table 2. A WTT practical demonstration day is planned for later in 2015 and some of recommendations will be implemented then, along with demonstration of the techniques so the club can continue works into the future.

Location (see beat map, Appendix 1)	Recommended works
Weir/bridge footings	Install easement for fish passage such as low-cost baffles and improvements for eel passage.
Mill leat	Hinge and lay bushes into the margins of the leat channel.
Pool 3	• Install brushwood at the toe of the bank, between the pioneer alders to slow the rate or erosion. • Hinge, lay and stake the hawthorn bush (Photo 9) against the bank. • Fence out livestock (see below).

Pool 4	• Install small (hawthorn bush) tree kickers cabled to the base of the alder trees against the left bank. • Fence out livestock (see below)
Pool 5	• As per Pool 4 (if required)
Area 6a	• Install brushwood mattress in margins against right bank.
Pool 6b	• Cut and cable the tree (Photo 17) to create a tree kicker to still the eddying flows which are eroding the bank here. • Repair the fence line (Photo 16)
Throughout reach	Fence off a buffer zone along the river to prevent livestock grazing and allow tree regeneration to improve bank stability. Fencing of headlands at the downstream end of the reach is already planned. Extending this to include sections 2 to 6 would be beneficial. As a minimum, the areas on the outside of bends 3 and 5, and both banks on section 4 should be fenced.
Throughout reach	Control Himalayan balsam

Table 2

We have produced a 70 minute DVD called 'Rivers: Working for Wild Trout' which graphically illustrates the challenges of managing river habitat for wild trout, with examples of good and poor habitat and practical demonstrations of habitat improvement. Additional sections of film cover key topics in greater depth, such as woody debris, enhancing fish stocks and managing invasive species.

The DVD is available to buy for £10.00 from our website shop http://www.wildtrout.org/product/rivers-working-wild-trout-dvd-0 or by calling the WTT office on 02392 570985.

The WTT website library has a wide range of materials in video and PDF format on habitat management and improvement: http://www.wildtrout.org/content/index

6.0 References

Bachman, R.A. (1984) Foraging behaviour of free-ranging wild and hatchery brown trout in a stream. *Transactions of the American Fisheries Society*, **113**, 1-32.

Vincent, E.R. (1987) Effects of stocking catchable-size hatchery rainbow trout on two wild trout species in the Madison River and O'Dell Creek, Montana. *North American Journal of Fisheries Management*, **7**, 91-105.

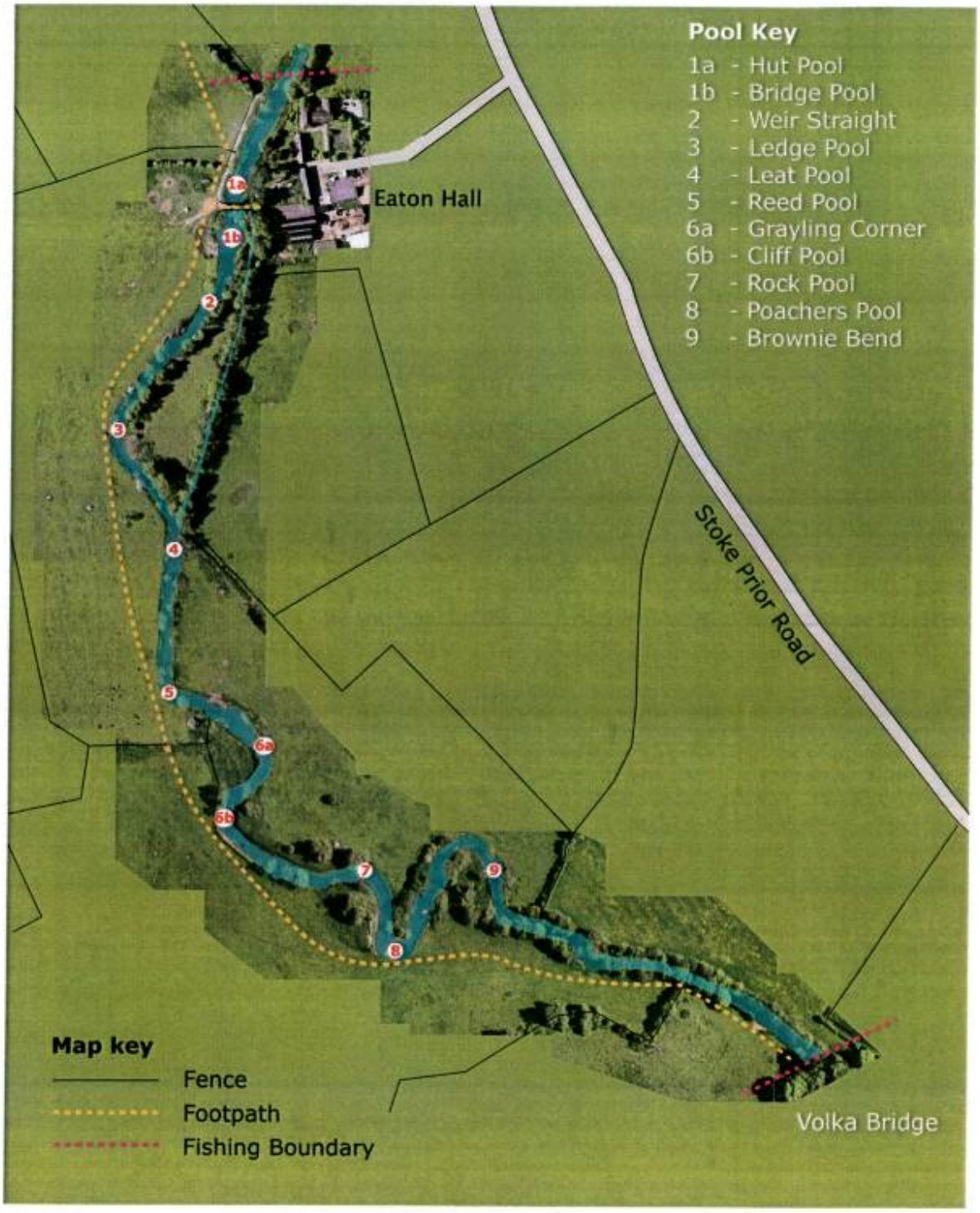
7.0 Acknowledgement

The WTT would like to thank the Environment Agency for supporting the advisory and practical visit programme in England, through a partnership funded using rod licence income.

8.0 Disclaimer

Appendix 1

Eaton Fishing Club - beat map



All members and their visitors **MUST** sign the record book BEFORE starting to fish.

All catches MUST be recorded in the book - see the example below;

Trout 1 R 13", Pool 2	Trout 2 B 10", Pool 6a	Trout 3 R 12", Pool 1b	Etc etc., etc