# Advisory Visit

# River Worfe

# March 2011

## 1.0 Introduction

This report is the output of a site visit undertaken by Tim Jacklin of the Wild Trout Trust to the River Worfe, Shropshire on 7th March, 2011. Comments in this report are based on observations on the day of the site visit and discussions with Tony Bostock of Severn Rivers Trust and Simon Cumming of the Environment Agency.

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.

## 2.0 Catchment / Fishery Overview

The River Worfe rises to the east of Telford and flows south near Ryton, Badger and Worfield where it turns west to join the River Severn just north of Bridgnorth. The river flows off the mid-Severn sandstone plateau and the underlying geology is largely Triassic sandstone, with superficial deposits of till or river terrace material.

The three areas of the river inspected during this visit were to the south of Davenport House (SO752950), upstream of Worfield (SO759961) and downstream of Broad Bridge (SO761981) near Stableford. The lower section of the river from Rindleford down to the Severn was seen from a car.

The river is fished by Salopian Fly Fishers (www.salopianflyfishers.co.uk) although some beats have recently been relinquished. Tony Bostock has fished the River Worfe for 37 years and reports a decline in the trout fishery in recent years based on personal experience and historic records. A full-time river keeper was employed by the Apley Estate in the 1930s and he kept written records regarding the river. The river was visited by Alfred Lunn of the Houghton Club (River Test) who provided advice on river management. Grayling are recorded as being present at this time, but are no longer caught.

Species currently present include chub, dace and perch as well as trout. Through the 1970' and until recent years the Salopian Fly Fishers stocked 9 – 13" brown trout annually. Salmon have been recorded and have known to spawn in the river as high as Broad Bridge.

Riverfly monitoring produces a good invertebrate fauna including large numbers of freshwater shrimp (*Gammarus pulex*).

The River Worfe has experienced low flows as a result of abstraction of groundwater in the upper catchment and has been the subject of a low flow alleviation scheme. In the Severn River Basin Management Plan (Water Framework Directive), the current overall status and ecological status of the Worfe is *poor (very certain)*. The biological element which contributes to this status is invertebrate fauna which is poor (fish and macrophytes are described as good) with a failure code S2b (biological element suspected – sediment from diffuse source agricultural). The objective is good ecological status (GES) by 2027, and the justification for not achieving GES by 2015 is technical infeasibility.

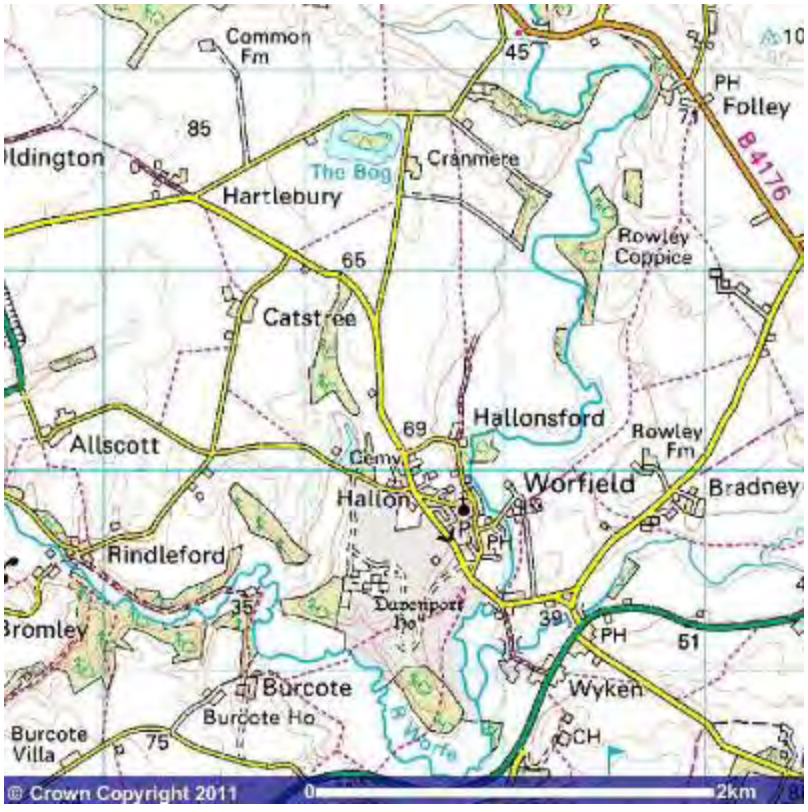


**Figure 1 River Worfe around Worfield (Image reproduced with permission of Ordnance Survey www.ordnancesurvey.co.uk/getamap).**

## 3.0 Habitat Assessment

### Davenport House section

The river here has a meandering planform set in a broad valley cut into the sandstone plateau. The surrounding gently-rolling landscape is used for mixed livestock and arable agriculture and forestry (cover photo). Mature trees are present on both banks, mainly alders, providing a nice balance of light and shade to the river channel. The river was walked along the right bank, which is currently a field being used for sheep grazing; the previous year it had been used for maize cultivation (Photo 1).

The fundamental characteristics of good lowland river habitat are present here, namely a meandering planform and a varied depth profile. However, the most striking observation is the large volume of fine sediment present on the river bed – literally "dunes" of sand are present and where coarser sediments (gravel, cobbles) are present on riffles, these are embedded within sand (Photos 2, 3). Whilst this is undoubtedly a phenomenon associated with the sandstone geology and associated sandy soils, the extent of the sediment accumulation indicates an increased rate of supply of fine sediment to the river. Changes in agricultural practices are a likely reason for increases in fine sediment supply, for example increases in arable cultivation (Simon Cumming, pers.comm.). Soil erosion from maize cultivation in the immediate vicinity of this site was evident last year according to Tony Bostock.

The accumulation of fine sediment is a major problem for successful breeding of trout and salmon. Both species spawn in the autumn/winter and their eggs remain buried in the gravel until the following spring. Fine sediments fill the gaps between the gravel, blocking the supply of fresh water and causing the eggs to suffocate. Various methods of improving the quality of spawning gravels are available, such as gravel cleaning (with water pumps or leaf blowers) and installing structures to locally scour away fine sediment. However, these are "sticking plaster" solutions, treating the symptom rather than the cause; alongside these measures, the supply of fine sediment needs to be tackled at source and on a catchment scale. The large volume of fine sediment currently present in the Worfe suggests that gravel-cleaning remedies would be ineffective and effort should be targeted on soil conservation measures within the catchment.

The bankside trees present were mainly mature alders. Some were displaying signs of *Phytophthora* disease, although by no means to the great extent seen on other Severn tributaries such as the Clun. There is no succession of younger trees here, so as trees are lost the bank becomes vulnerable to increased rates of erosion. This was evident in some areas of this site where fewer trees were present (Photo 4). Creation of a riparian buffer strip (protected from grazing) to allow natural tree colonisation and/or native tree planting is recommended, although note the maintenance requirement this creates (see below). Bank protection using soft revetment techniques may be necessary where trees have been lost, to provide increased bank stability whilst tree re-colonisation takes place.

Himalayan balsam is present along this stretch of the Worfe. This invasive plant species is undesirable because of its tendency to colonise bare ground and recently deposited sediments and exclude native flora. Being an annual, it then dies back in winter leaving bare banks exposed to increased rates of erosion. This leads to increased rates of fine sediment supply to the river and a tendency for the channel to become over-widened, shallow and full of deposited sediments. Presence of balsam creates a dilemma in terms of bankside management if a riparian buffer strip is created; the removal of grazing pressure allows balsam to thrive and control measures are required to allow more desirable vegetation to develop. Options for control are aimed at preventing flowering and best carried out before June; see http://publications.environment-agency.gov.uk/pdf/GEHO0410BSBR-e-e.pdf.

A old water wheel is present on this reach of river and was formerly used to pump water to Davenport House on the nearby hill. A small leat bypasses the area of raised river bed alongside the wheel and trout (Photo 5); in the 1970s trout were observed spawning in this leat (Tony Bostock, pers. comm.). The leat has been dry for a number of years, although it was flowing at the time of the visit. The flow down the leat is determined by the crest level of the river bed alongside the water wheel and it should be possible to re-create a permanent flow. The leat could then be turned into a trout spawning channel by introducing gravel, bed-checks (logs) and overhead cover; this would create an area that could be easily managed and provide some much needed trout spawning habitat.

**Photo 1 Former arable (maize) field now used for sheep grazing; the ploughing contour is still visible. Note the single line of riparian trees.**

**Photo 2 Large accumulations of fine sediment visible on the river bed.**

**Photo 3  Gravel riffle areas also have large accumulations of fine sediment**

**Photo 4 Areas with fewer trees tend to have accelerated rates of bank erosion and a wider, shallower channel. Bank revetment using "soft" techniques (brushwood) are necessary here along with buffer strip creation.**

**Photo 5 Small leat alongside the waterwheel.**

Recommendations

- Investigate catchment sources of fine sediment and options for control
- Create and maintain riparian buffer strips to encourage tree succession, along with soft revetment of rapidly eroding areas.
- Restore flow to the leat and create a spawning channel
- Control Himalayan balsam

Upstream of Worfield

The river channel is narrower here (being upstream of the Stratford Brook tributary) and appears to have been straightened for land drainage in the past. Tony Bostock reports that emergent vegetation grows across almost the whole width of the channel in summer, reflecting the problems with channel modification, low flows and sediment accumulation.

There are fewer trees along this stretch and more evidence of *Phytophthora* disease affecting the alders. Again there is no tree succession taking place, so trees that are lost are not being replaced, with implications for bank stability, shading, water temperature and in-channel habitat. The fields on both banks are rather wet, rushy pasture which is providing an environment for ground-nesting birds like snipe and lapwing (both observed on this visit); the left bank is fenced off (on the initiative of the fishing club) but only 3 strands of barbed wire have been used and sheep are clearly grazing freely on the river side of the fence (Photo 6).

A number of alder trees have fallen into the river channel creating some good in-channel habitat in the form of large woody debris (LWD); this should be retained, but serious consideration given to tree succession so LWD is available in the long-term (Photo 7). Planting blocks of trees and protecting them from grazing may be a better solution than creating a long riparian buffer zone here. This will reduce the maintenance burden (balsam control).

On the right bank, there is an area that has been heavily poached by livestock, over-widening the channel and promoting the deposition of large amounts of fine sediment (Photo 8). However, this is an isolated area and the majority of the banks are not affected in this way.

**Photo 6 Upstream of Worfield (upstream view)**

**Photo 7 Large woody debris (LWD) – good habitat, but where will it come from in future?**

**Photo 8 Area of poached bank**

Recommendations

- Create some blocks of trees
- Introduce in-stream structures as described in the Recommendations section

Downstream of Broad Bridge (B4176)

This section of river forms an S-shape downstream of Broad Bridge, the outside of each meander bounded by steep, sandstone bluffs. This area is still fished by Salopian Fly Fishers and is known as Rochelle's Beat.

Downstream of the farm bridge (SO 76533 98017; where the SFF catch return box is located) there is a short section of steeper gradient channel forming a faster flowing riffle area (Photo 9). Some gravel raking has been carried out here previously and small trout have been recorded in catch returns, indicating some successful spawning. However, large amounts of fine sediment are present throughout the whole of this section, including between the gravel on this riffle area. Pegging some logs to the river bed here to create localised scour and areas of gravel free from fine sediment would be beneficial.

Continuing downstream, the river bed gradient lessens and the channel becomes rather uniform in terms of width and depth (shallow). Alongside the sandstone bluff on the left bank, the river channel is very straight, but becomes more meandering with downstream progress (Photo 10). The uniform sections could be improved by creating pinch points within the channel using flow deflectors, woody debris and/or channel re-profiling with an excavator (the “Nigel Holmes method”) – see recommendations.

The trapezoidal cross-section of the channel suggests past land drainage works, and probable lowering of the river bed. Bank reinforcement and re-profiling has been carried out on sections of the right bank using hardcore rubble and topsoil (Photo 11). Some of this work is recent and some is older; the older work appears to have stabilised and vegetated, but it creates a somewhat sterile margin along the river and a steep bank profile. Use of different techniques including soft revetment and creation of a marginal berm would be better for wildlife, fisheries and amenity (angling access).

At a point where an old mill leat used to re-enter the river channel there is a high point in the river bed with some good quality spawning habitat; the gravels are well-sorted and relatively free of fine sediment (Photo 12). This is the only area of such habitat seen on this visit which emphasises how successful spawning is very likely to be the factor limiting wild trout populations in the Worfe.

Upstream of the farm bridge (SO 76533 98017), the channel is slow-flowing (impounded by the invert of the bridge culvert) and uniform, but becomes more varied with upstream progress. There are some areas of good habitat where woody debris is present within the channel, providing cover for fish and helping to scour and sort bed sediments. There are two old weir structures. The floodplain here (left bank) is wet and rushy and provides excellent habitat for ground-nesting birds and reptiles (grass snakes are common here). The right bank is wet willow carr in the lower parts, and a steep, wooded sandstone slope. The majority of the river described in this Broad Bridge section is within a Countryside Stewardship Agreement started in 2002, so will be coming to an end in 2012; it is worth checking what plans there are to maintain the good habitat status of this area beyond 2012.

Recommendations

- Peg some logs onto the riffle section below the farm bridge to create localised scour
- Create some pinch points in the straighter sections of the channel as described in the Recommendations section.

**Photo 9 Steeper gradient section downstream of farm bridge**

**Photo 10  Straight section downstream of area in Photo 9**

**Photo 11  Recent bank works**

**Photo 12**

Downstream of Rindleford Mill

This section of river was only seen briefly from the road. There is a riffle area downstream of the mill, then the river assumes a meandering plan-form, similar to the Davenport House section. There appear to be fewer mature trees along this section and poaching of the bank by livestock appears to be an issue, particularly on the left bank.

## 4.0 Recommendations

- Clearly the overriding issue facing the Worfe is the supply of fine sediment to the river. This is very likely to be limiting salmonid spawning success and restricting the numbers of wild trout present, despite the WFD classification of 'good' status for fish; there appears to be an anomaly with this classification because invertebrate status is poor due to suspected diffuse sediment pollution. If fine sediment levels are sufficient to impact upon invertebrates, they clearly must have an effect upon gravel-spawning fish.

  This is a problem that needs to be tackled at a catchment scale, in conjunction with land managers. The Worfe catchment is not a priority under the England Catchment Sensitive Farming Delivery Initiative.

However, it may be possible for Severn Rivers Trust to take advantage of resources available under the Pinpoint Project to target the problem locally (www.associationofriverstrusts.org.uk/pinpoint/dwp), or to campaign for its inclusion in ECSFDI.

- Improvements to spawning habitat are difficult to recommend in the face of the fine sediment problem – gravel rehabilitation measures, such as those recommended in the WTT's habitat manuals (www.wildtrout.org - publications), are likely to be futile until fine sediment is brought under control. Some measures that may provide a degree of improvement are:

    - Pinning some logs to the river bed to create localised scour on the riffle areas identified on the Davenport House section and the Broad Bridge section (Figure 2).

    - Restoring flow to the small leat near the water wheel (Davenport section) and introducing suitably-sized spawning gravel (10 – 40 mm diameter) and low log 'weirs' to create plunging flows and keep the gravel scoured and free of fine sediment.

    - Creating pinch-points within the straighter sections of river channel to encourage bed scour and prevent the deposition of fine sediments in these areas. The pinch-points can be created in a variety of ways, including the introduction of large woody debris (root-wads, logs); channel narrowing (cut-and-fill technique; brushwood mattress); and manipulation of the river channel profile with an excavator. Examples of these various methods are illustrated below (Photos 13-16, Figures 3-4).

      These methods are also worth implementing on the more featureless sections of river noted above to improve the diversity of depth and flow patterns. These will improve the fish carrying capacity of these sections.

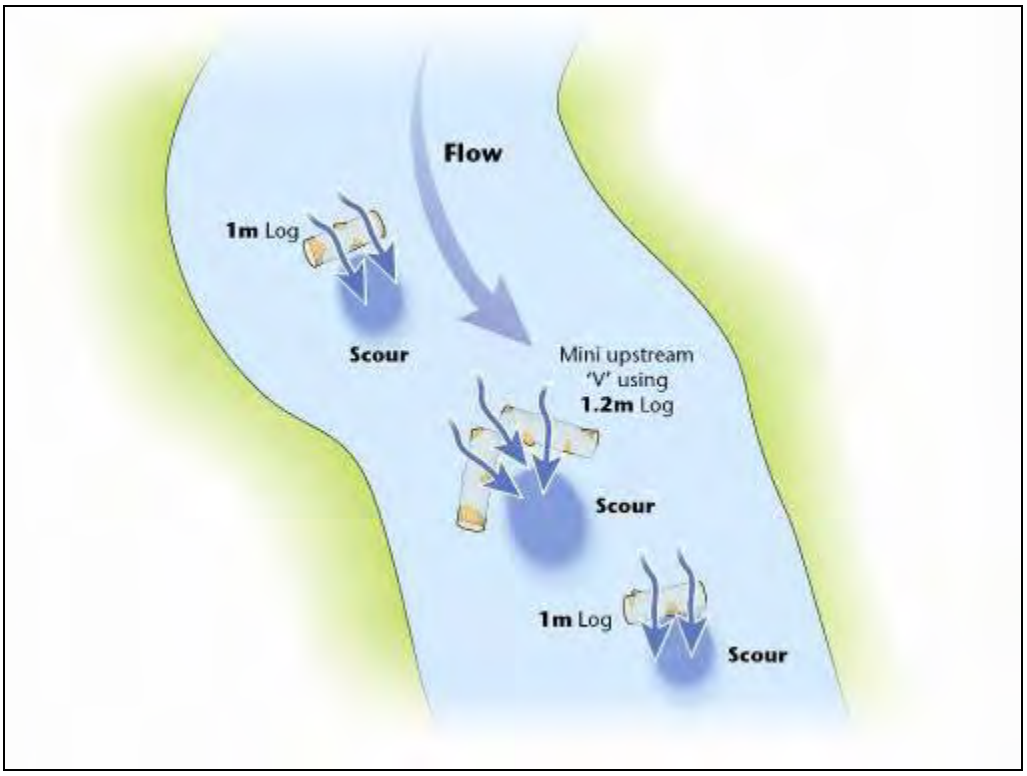


**Figure 2 Logs pinned to the river bed with stakes and wire or steel rebar will create localised scour and sorting of bed material on riffle areas, making more favourable areas for trout spawning.**

**Photo 13 Paired log flow deflectors**

**Photo 14 Root wads introduced to provide some in-channel structure and scour**

**Photo 15 Brushwood mattress consisting of branches from tree coppicing staked and battened or wired down. The mattress accumulated fine sediment and vegetates, narrowing and deepening the channel.**

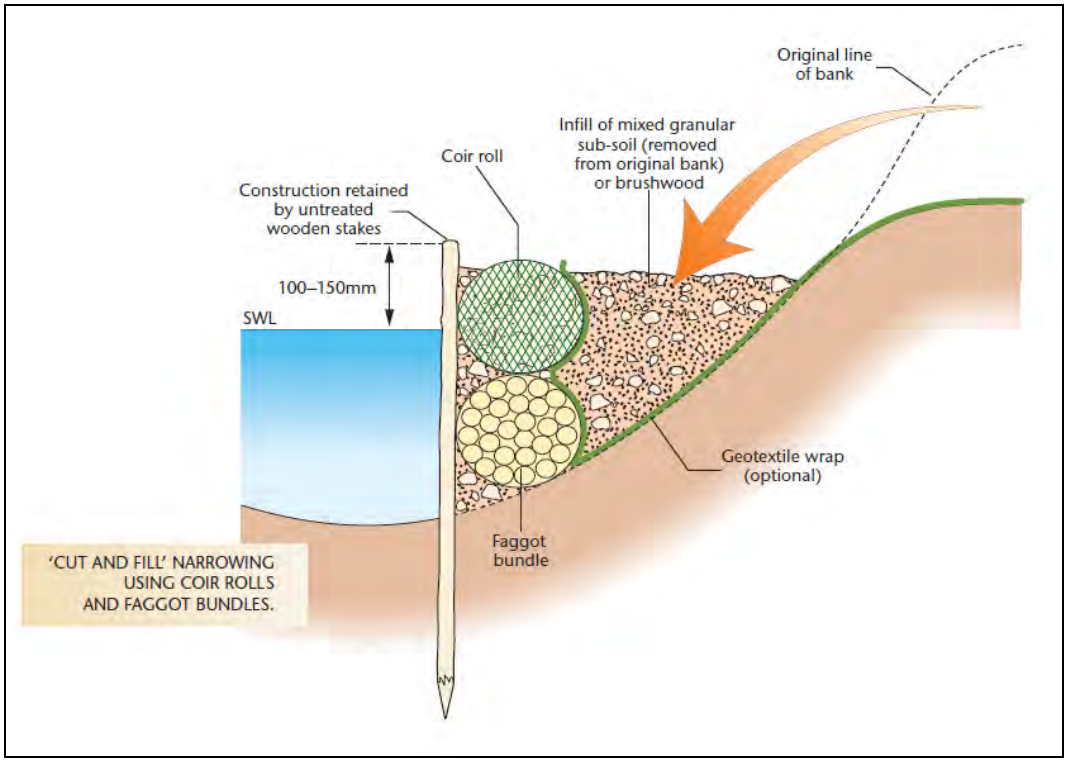


**Figure 3 Cut-and-fill technique can be used to create features like D-groynes (Figure 4 below) to create width and depth variation in the channel, or to create marginal ledges (e.g. in areas such as Photo 11).**

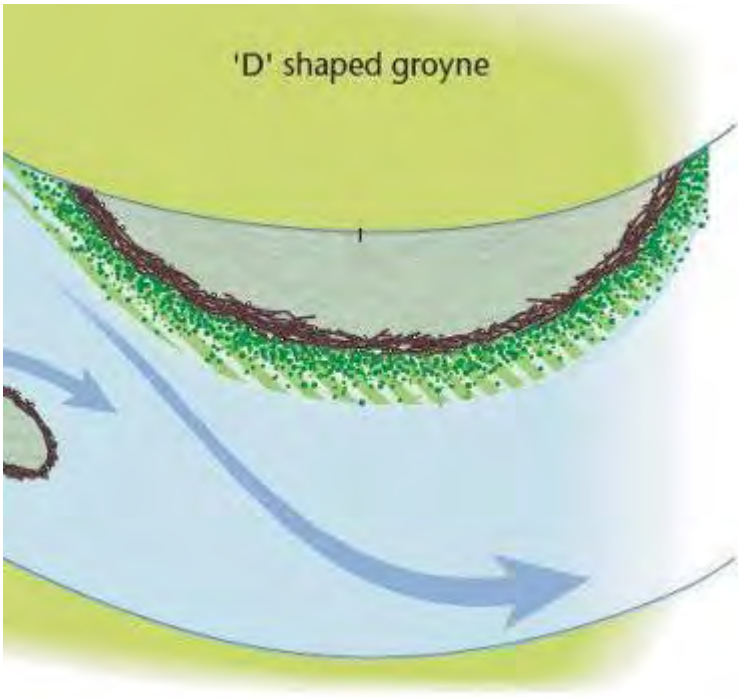


**Figure 4 D-groyne, with an edge of faggot bundles and back-filled with brushwood and bank material.**

**Photo 16 Direct remodelling of the river channel with an excavator can be a quick and cheap method of increasing the diversity of the channel form in lowland rivers. Here a deep pool has been excavated (red arrow) and the material used to make "shoulders" upstream of the pool (yellow arrows) to pinch the channel and create scour which will maintain the pool depth.**

- Bank revetment, fencing and tree succession.

  In areas such as that shown in Photo 4, the establishment of a healthy riparian zone should be a priority. This should involve protection of the banks where accelerated rates of erosion are occurring; this can be achieved using soft revetment techniques (Photo 16). A buffer strip, ideally 10 metres wide, should be fenced out to prevent livestock grazing and a mixture of native trees should be planted inside the buffer strip, including ash *Fraxinus excelsior*, hazel *Corylus avellana*, field maple *Acer campestre*, hawthorn *Crataegus monogyna*, blackthorn *Prunus spinosa*, and goat willow *Salix caprea.*

  Maintenance of the buffer strip will be required, particularly whilst it becomes established, including control of invasive weeds and spot-spraying around young trees. where there is currently a single line of trees along the bank, consideration should be given to the succession of these. Establishment of an un-grazed buffer and management of existing trees by coppicing, pollarding and singling will allow natural tree colonisation and re-growth. Further guidance is available in the WTT's Chalkstream Habitat Manual (www.wildtrout.org – publications).

- SFF carry out sampling as part of the Riverfly Partnership and it is highly recommended that this is continued.

- It is recommended that SFF move to stocking with infertile, triploid brown trout (if not carried out already). There is a growing body of scientific evidence that interbreeding between wild and stocked trout has a negative impact on wild populations. This could be exacerbated in situations where spawning habitat is at a premium, such as here on the Worfe. Stocking with triploids in rivers will be mandatory under the Environment Agency Trout and Grayling Strategy from 2015, but an early move is recommended.

**Photo 17 Brushwood revetment installed along an eroding bank, which was then fenced. Photo taken 8 months after installation. Trees have subsequently been planted here.**

Please note, it is a legal requirement that all the works to the river require written Environment Agency (EA) consent prior to undertaking any works, either in-channel or within 8 metres of the bank.

## 5.0 Making it Happen

In order to put the above recommendations into action it is recommended that a more detailed project proposal is drawn up, including approximate costs. This can then be used to consult with landowners and the Environment Agency, and form the basis of a consent application and funding application. The WTT or a private contractor could provide further assistance in preparing such a proposal.

## 6.0 Acknowledgement

The Wild Trout Trust would like to thank the Severn Rivers Trust for its support which made this visit possible.

## 7.0 Disclaimer