River Monnow, Walterstone, Herefordshire

An Advisory Visit by the Wild Trout Trust, May 2014

Contents

Introduction

This report is the output of a Wild Trout Trust visit undertaken to the Monnow Lodge waters on the River Monnow between Walterstone, Herefordshire and Pandy Monmouthshire, (National Grid Reference: SO 33197 24191 to SO 33511 23340) in May 2014. The visit was requested by the land owner Mr Cedric Mathison and primarily focussed on assessing the river and identifying options to improve habitat for wild trout (*Salmo trutta*).

Comments in this report are based on observations on the day of the site visit, and discussions with Mr. Mathison.

Throughout the report, normal convention is followed with respect to bank identification i.e. banks are designated Left Bank or Right Bank whilst looking downstream.

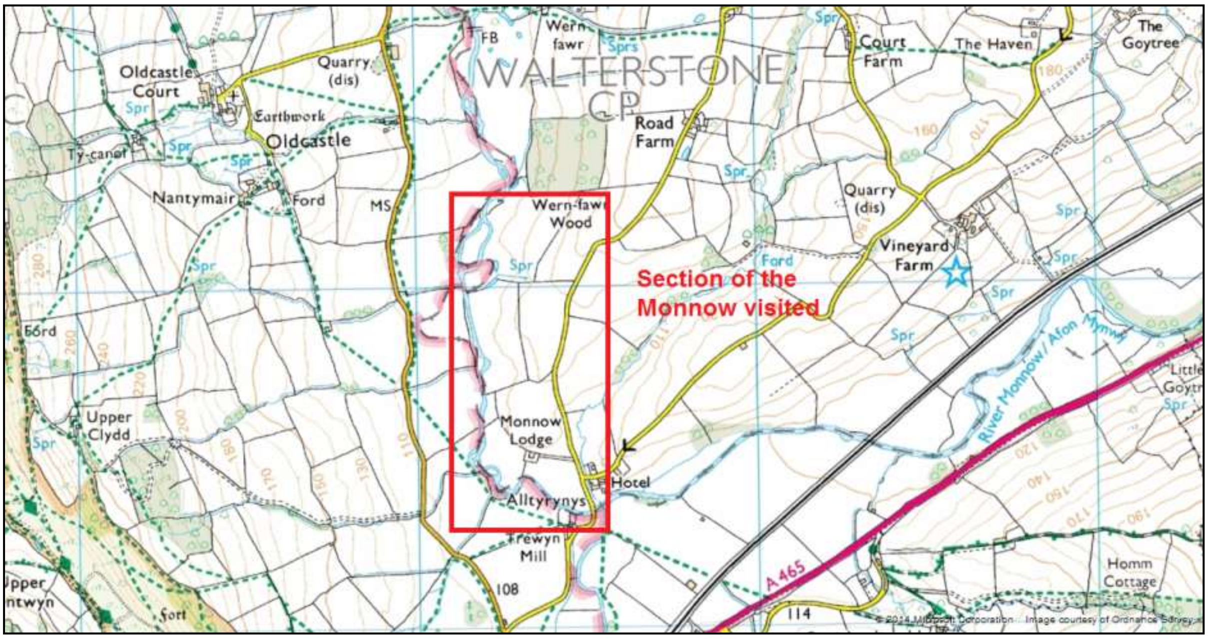

Figure 1: A map showing the section of the River Monnow visited

Catchment and Fishery Overview

The River Monnow rises near Craswall on Cefn Hill just below the High Black Mountains, Wales.
It flows southwards, gaining the waters of its tributaries the Escley Brook and Olchon Brook near Clodock and the waters of Afon Honddu, from the Welsh side of the Black Mountains, near Pandy. The river then flows briefly eastwards before again turning southwards. At Monmouth the river joins into the River Wye with the River Trothy. Its total length is around 26 miles (42 km).

The Monnow historically supported one of the most productive and popular wild trout fisheries in the UK but the quality of the fishery has declined due to increased sediment loads entering the river. This issue has been highlighted in the Environment Agency's River Basin District Management Plan for the whole of the Wye catchment and any measures taken to address bank erosion and sediment input are likely to be encouraged and supported by the statutory authorities.

Fishery quality has picked up recently due to a number of initiatives carried out by various organisations including the Monnow Rivers Association (MRA). The MRA has previously undertaken habitat improvement works along the reach visited and has been instrumental in getting much of the LB fenced to protect it from grazing livestock.

Table 1: Water Framework Directive Information for the River Monnow (Environment Agency)

R Monnow - conf Escley Bk to conf Afon Honddu	
Waterbody ID	GB109055029620
Waterbody Name	R Monnow - conf Escley Bk to conf Afon Honddu
Management Catchment	Wye
River Basin District	Severn
Typology Description	Mid, Small, Calcareous
Hydromorphological Status	Not Designated A/HMWB
Current Ecological Quality	Moderate Status
Current Chemical Quality	Does Not Require Assessment
2015 Predicted Ecological Quality	Moderate Status
2015 Predicted Chemical Quality	Does Not Require Assessment
Overall Risk	At Risk
Protected Area	Yes

Habitat Assessment

For the purposes of this report, the section of the river visited is described from the upstream boundary, working downstream to the boundary of the Mathison's land.

At the upstream extent of the reach, a large tree had fallen into the river during a heavy spate (Figure 2). The response of the river's morphology to the tree is a good indication of the forces acting within the river during high flows. A deep pool had been scoured under the tree and material scoured out from the pool was deposited a short distance downstream to form a number of gravel and cobble shoals and point bars (Figure 3). The redistribution of bed material caused by the undershot scour had introduced a diverse range of habitat features. Within a distance of approximately 50m, deep pool, shallow riffle/glide, slack backwater and fast run habitats were all observed. There was also an abundance of cover habitat in the form of tree roots and woody debris. High-flow channels (dry on the day of the visit) were also observed indicating that the diversity of habitat most-likely increases during periods of higher water levels as the river swells and occupies additional channels.

Figure 2: A large tree fallen into the river at the upstream boundary of the water

Figure 3: Material scoured from the bed has been deposited to create a range of physical features

Some cliffing banks provided evidence of recent bank erosion but the top of the bank was densely populated with trees, shrubs and herbs which should help to reinforce the bank. Most of the upper bank is well-vegetated for a considerable distance back from the river and the rate of erosion is unlikely to be of concern at this location. Bank erosion is a natural process under which rivers adapt to changes in flow energy. It is also the process by which new gravel enters the river. A rich seam of gravel can be seen in Figure 4 suggesting that some bank erosion is probably beneficial at this upstream section of the water. However it is worth noting that the overlying soils of the Monnow valley can be particularly firable and where a natural gravel seam is not present banks can be particularly soft and vulnerable.

Figure 4: A rich gravel seam in the eroding bank will introduce as steady supply of gravel into the river

Downstream of this reach the river is shaped by the natural bedrock of the valley (Figure 5). The stepped formation of the bedrock creates some small pools and good 'pocket water' habitat. The roots of bankside trees, unable to penetrate the hard bedrock, have grown out laterally into the river (Figure 6). This provides excellent refuge habitat for trout – especially juveniles.

Figure 5: The stepped formation of the valley bedrock helps to provide a diverse habitat

Figure 6: Tree roots forced to grow out over the bedrock provide excellent cover and refuge habitat

Marginal cover is abundant as the river flows around an island at SO 3315 2411. Low overhanging branches and small, partially fallen bankside willows (*Salix spp*.) provide good shelter from high flows. In high-energy rivers, sheltered pockets of slack water in the lee of tree roots or fallen limbs (Figure 7) provide a vital refuge where fish can rest out of the strong currents and until flows lessen. They also provide excellent holding habitat in normal flows and increase the carrying capacity of the river.

Figure 7: A partially fallen willow provides an excellent refuge during spate flows

At SO 33148 23995 the character of the river abruptly changes. Upstream the river is morphologically active and physically diverse with a range of flow patterns, whilst downstream habitat diversity significantly reduces and the river exhibits a uniform cross-section with laminar flows (Figure 8). For approximately 200m the river has been significantly straightened. The extent of the artificial straightening of the channel is highlighted by the difference between the shape of the official border between England and Wales (which historically followed the river) and the path of the river at present (Figure 9).

Figure 8: The straightened reach has uniform depth and width and laminar flows

A study of old maps (www.old-maps.co.uk) shows that the channel modifications were undertaken pre-1900. The modification may have been for land drainage or milling, or possibly even to protect the road to the west. Whatever the purpose of the modification, the outcome has been a significant reduction in habitat diversity as the straight and uniformly wide channel evenly distributes bed material transported from upstream.

Figure 9: The England-Wales border shows the historic course of the river and the extent of artificial straightening

Light conditions within the straightened reach are also relatively uniform as a both banks are densely wooded with alder (*Alnus glutinosa*). The uniform height of the alders (Figure 10) suggest they may have colonised (or perhaps been planted to reinforce the banks) at the same time. The result is that the trees cast uniform shade over the river, further contributing towards the homogenous conditions in the reach. There is also a risk that they will start to fall at approximately the same time in the future.

Figure 10: The uniform height of the tree canopy casts uniform shade over the river

Sunlight is a basic requirement for marginal productivity. However, shade from bankside trees helps to regulate river temperature, especially during long periods of warm weather and low flows. The temperature regulation role of bankside trees may be of particular importance in buffering rivers against the potential impacts of global climate change. A roughly 50:50 ratio of direct sunlight to dappled shade is recommended for most (non-chalkstream) rivers.
http://www.wildtrout.org/sites/default/files/news/Keeping_Rivers_Cool_Guidance_Manual_v1.pdf
Tree management is discussed further in the *Recommendations* section of this report.

Along the straightened reach, a number of habitat enhancement features have been installed by the Monnow Rivers Association. Occasional alders have been felled into the river and secured by drilling through the trunk and driving long steel reinforcing bars (rebar) through each hole and into the bed. Braided steel cable has also been used to secure the felled timber to its stump (Figures 11 and 12).

Figure 11: A felled alder secured with rebar and braided steel cable

Figure 12: A felled alder cabled back to its stump

These Large Woody Debris (LWD) habitat features have mostly been installed relatively close to the bank where they both help to protect the bank from erosion and also provide some good marginal refuge habitat. One feature observed had been secured perpendicular to the bank (Figure 13). This feature is acting as flow deflector which has caused a small pool to be scoured in the bed. In the otherwise very uniform reach, this structure introduces some much-needed diversity.

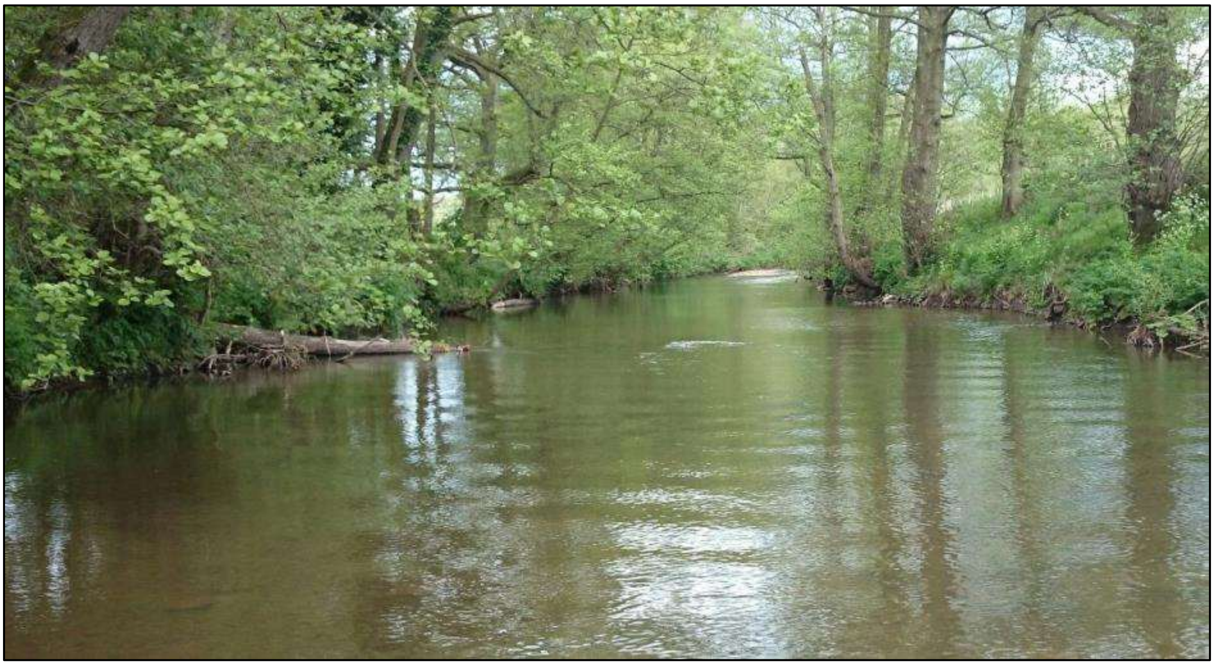

Figure 13: An alder trunk secured perpendicular to the bank introduces some localised diversity

The habitat enhancements have mostly withstood the powerful spates of the Monnow. However, a large piece of LWD was spotted which had once been secured with at least five rebars. It had been torn from the bed during high flows and transported downstream (Figure 14). This emphasises the power of the force acting on such structures during big spates.

Figure 14: An LWD habitat feature has been torn from the bed despite being secured with at least five steel reinforcing bars

Another technique that has been used on the reach is 'hinging' of live willow (*Salix* spp.) trees (Figure 15). Instead of felling the tree completely, a cut is made approximately ¾ of the way through in combination with a vertical cut which allows the willow to be dropped into the river whilst remaining attached to its stump and roots. Willow is a robust genus of tree which (provided it has access to plenty of water) will normally survive the procedure and continue to grow.

Figure 15: A hinged willow provides some cover habitat and flow deflection

The fact that a piece of LWD meticulously anchored to the bed but *not* the bank was moved, and that LWD features attached to a well rooted stump (either by hinging or with cables) are still present, indicates that hinging and cabling (in combination with securing to the bed) are potentially the best practice techniques for this section of river.

Downstream of the straightened reach a greater range of habitat is available. Channel width and depth varies resulting in some areas of slack backwater habitat (holding large shoals of minnows), and some deep pools with good overhead cover and good trout lies. A natural pool-riffle-glide sequence is visible and a diverse range of flow conditions is present.

The LB is stock fenced throughout and there is a wide buffer strip between grazing land and the top of bank for most of the reach. However, the RB is not entirely fenced and much of the fencing present has been installed very close to or at the top of the bank. As a result the RB is generally steeper and less well vegetated, making it vulnerable to excessive erosion and less likely to be retained to form a re-graded bank if it does slump (Figure 16). Of even greater concern is that cattle from RB can access and cross the river and damage the LB (Figure 16).

Figure 16: A fence line too close to the river allows grazing and soil compaction to weaken the top of the bank leading to erosion and block failure.

Figure 17: The impacts of the cattle that cross the river are concentrated between the top of bank and the LB fence line causing severe erosion in places.

At SO 33198 23671 the LB is severely eroded and beginning to cut behind a stand of alder. The cattle accessing the river are significantly exacerbating the problem (as shown in Figure 18). The root cause of the erosion is probably the energised flows which have also caused the development of a point bar mid channel (also Figure 18).

Figure 18: Cattle trampling and grazing the bank are exacerbating the problem but a mid-channel point bar (right of image) is the main cause of the erosion

The point bar is situated on the riffle downstream of the first deep pool at the downstream extent of the straightened reach. It is reasonable to infer that material is deposited here as a result of increased flow speeds through the straightened reach scouring out the pool. Straightening rivers also shortens them which in-turn increases the bed gradient. The steeper gradient in combination with a lack of in-channel friction (normally provided by an uneven bed and natural woody debris) results in fast, energised flows.

A short distance upstream the bank is well-protected by new growth sprouting from hinged willows and some young alder saplings growing on the lower bank (Figure 19). Tree roots and branches help to locally slow flows during spates, reducing erosion and even creating areas of deposition. This principle can be used to help protect the bank. This is explored further in the *Recommendations* section.

Figure 19: Willow and alder saplings help protect the bank upstream

At SO 33156 23482 the river bends sharply to the left. A deep pool has been scoured on the outside of the meander and the arising bed material deposited into a long riffle immediately downstream. At the tail end of the riffle the river turns through a series of sharp meanders. Despite numerous willows helping to hold the bank together (Figures 20 and 21), the forces acting against the banks during high flows have caused substantial erosion.

Figure 20: Despite numerous willows, the banks within the sharply meandering reach are heavily eroded.

Figure 21: The tight meanders have almost cut-off an outcrop

One theory on the formation of meanders is 'Equilibrium Theory'. In this theory, meanders form as a result of the gravitational *potential energy* of the river (the energy of the river flowing down a gradient) being greater than can be absorbed by the *friction* of the bed material being transported within the channel. The excess energy causes erosion which creates a meander; lengthening the river and decreasing the gradient until equilibrium between the 'erodibility' of the terrain and the transport capacity the river is reached.

This process is illustrated by time-lapse photography in the following link: http://socalgis.org/2014/03/12/time-lapse-of-a-river-changing-course/

The tight meanders are probably the result of the river adjusting to the increased gradient of the river locally brought about by the river being straightened. As well as being straightened upstream, it is quite possible that the river was straightened downstream to facilitate the operation of the old corn mill and to protect the road bridge.

In the future, the growing meanders either side of the narrow strip of land shown in Figure 21 will probably intersect and cut-off a meander loop, effectively creating an island. Whilst actions can be taken to delay this event, the benefit of retaining access to such a small outcrop of land is unlikely to equate to the cost of protecting it. So long as no properties or infrastructure are threatened by the erosion, the best option may be to allow the river to naturally adjust and keep an eye on how the river changes as a result.

On the RB on the outside of the meander shown in Figure 21, the field is used for intensive arable agriculture and in wet weather this is likely to be a point source of fine sediment into the river. Whilst the present rate of bank erosion in this reach constitutes a source of excess fine sediment into the watercourse, the ploughed field represents an additional source of sediment loading from the floodplain. This is highly likely to be a source of excess nutrients, potentially fuelling in-channel algal growth and impacting on trout spawning success. .
Downstream of the meandering reach, the river becomes straighter and flows become once again uniform and laminar towards the road bridge and the downstream boundary of the ownership. Despite this there is a good variation in depth and an abundance of overhead cover and refuge habitat (Figure 22).

Figure 22: Despite the river becoming straightened again towards the road bridge, good depth variation and an abundance of cover habitat has been retained

Conclusion

Overall the Monnow Lodge waters provide a good habitat for wild trout. However, the straightened reach highlighted in Figures 8 and 9 is overly uniform and could be improved. Lessons can be learned from previous habitat works undertaken on the reach as to which techniques will withstand strong spate flows. It is also likely that the straightening of the river is aggravating erosion through the more sinuous parts of the river.

Whilst good land management is being practiced on the LB, less care is being taken on the RB and this is having a detrimental effect on habitat quality.

Recommendations

In order for the River Monnow at Monnow Lodge to achieve its full potential as a good quality habitat for resident brown trout and sea trout, the following actions are recommended:

1. Engage with land owners/tenant farmers on the Right Bank and explore options to improve land management regarding the river. Ideally, the bank should be stock-fenced at least 3 metres back from the top of the bank with gated access so that cattle can graze the buffer once or twice a year to manage bankside vegetation and retain biodiversity. (https://www.youtube.com/watch?v=00tcTY_UEk4)

2. Introduce a greater diversity of light by implementing a 5-10 year rotation of tree works. Tree limbs and brushwood arising from these works could be used for bank protection or habitat enhancement structures http://www.wildtrout.org/content/how-videos#tree

3. In areas where excessive erosion is deemed to be a problem, brushwood won from on-site tree works could be used in combination with live willow to stabilise the bank (see example Figures 19 and 20). Densely-packed brushwood is very effective at absorbing energy from the flow and locally slowing water velocity, this in turn encourages deposition of sediment. Live willow 'whips' (thin, straight sections) and live willow stakes driven into the bank will, if successfully planted, continue to grow and strengthen with time. Willow whips and stakes can probably be won from existing bankside willows.

Figure 23: A brushwood bank protection revetment being installed on a spate-prone river

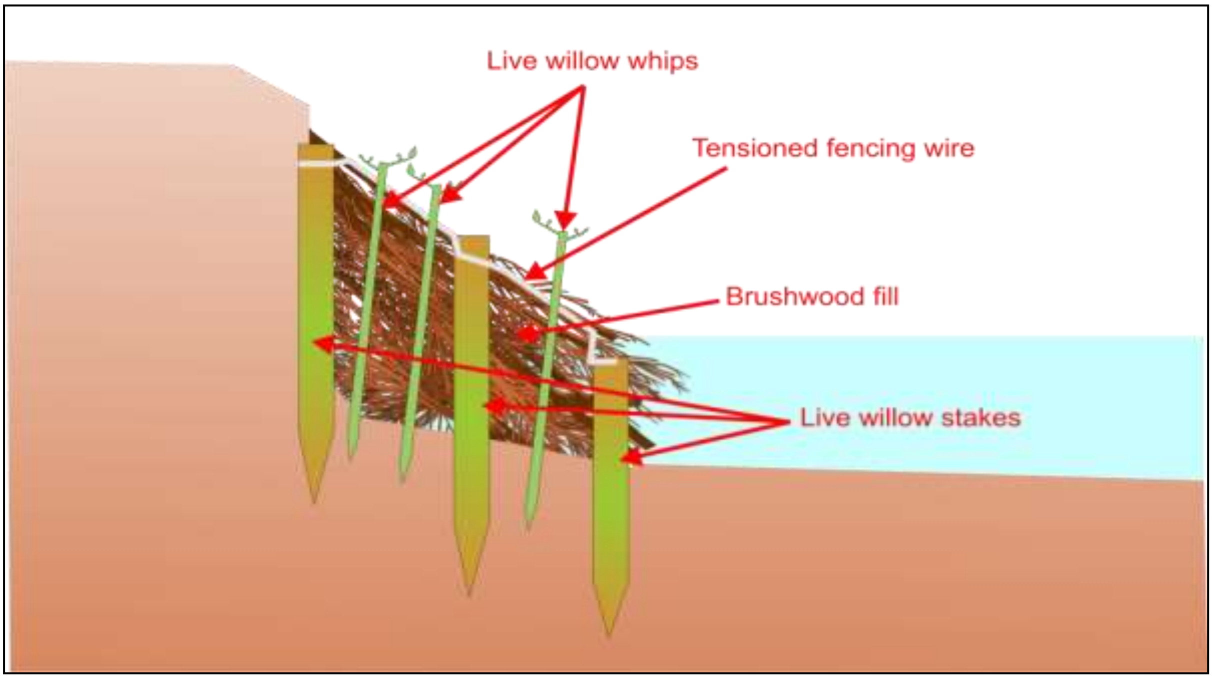

Figure 24: A cross section illustration of a brushwood erosion protection installation with live willow

Willow can be cut and planted at any time of year but the technique is most successful if undertaken in winter or early spring when the willow is still dormant.
(http://www.wildtrout.org/blog/bank-erosion-matter-balance)

4. Capitalise on opportunities to introduce further flow diversity and cover habitat to the straightened reach by hinging or felling bankside limbs into the river and securing with **both** steel reinforcing bars and braided steel cables attached to the bank.

Figure 25: An example of an opportunity to introduce additional woody debris cover habitat

Making it Happen

The creation of any structures within the river or with 8m either side will require formal Flood Defence Consent (FDC) from the EA. An FDC application will have to be submitted to the EA, usually along with a methodology and drawings detailing the proposed works. This enables the EA to assess possible flood risk, and also any possible ecological impacts. Contacting the EA early and informally discussing any proposed works is recommended as a means of efficiently processing an FDC application.

The WTT website library has a wide range of free materials in video and PDF format on habitat management and improvement:

http://www.wildtrout.org/content/index

The Wild Trout Trust has also 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.

There is also the possibility that the WTT could help via a Practical Visit (PV). PV's typically comprise a 1-3 day visit where WTT Conservation Officers will complete a demonstration plot on the site to be restored.

This enables recipients to obtain on the ground training regarding the appropriate use of conservation techniques and materials, including Health & Safety, equipment and requirements. This will then give projects the strongest possible start leading to successful completion of aims and objectives.

Recipients will be expected to cover travel and accommodation (if required) expenses of the WTT attendees.

There is currently a big demand for practical assistance and the WTT has to prioritise exactly where it can deploy its limited resources. The Trust is always available to provide free advice and help to organisations and landowners through guidance and linking them up with others that have had experience in improving river habitat.

Disclaimer

This report is produced for guidance; no liability or responsibility for any loss or damage can be accepted by the Wild Trout Trust as a result of any other person, company or organisation acting, or refraining from acting, upon guidance made in this report.