Advisory Visit

River Leven

Hutton Rudby Fly Fishing Club

25/03/2019

Undertaken by Gareth Pedley (WTT)

Key findings

- The general habitat of Hutton Rudby Fly Fishing Club waters remains good in most areas, although maintenance of in-channel woody material in the area around Hutton Rudby village has reduced the availability of naturally occurring structure.
- The club's hands-off approach to woody material management elsewhere in the majority of the fishery is paying dividends, assisted by some of the previous habitat structure installation.
- Easements on the various obstructions have provided valuable improvements but there is scope for further improvements on all, ranging from removal of the offending structures, through to major or minor modifications to the existing easements.
- Fine sediment inputs further upstream on the catchment remain an issue and degrade the otherwise good physical habitat of the river. This is likely to be an additional impact upon the water crowfoot which thrives in silt-free conditions. For this reason, any assistance and support that can be provided to Tees Rivers Trust in addressing the land management issues would be greatly beneficial.

1.0 Introduction

This report is the output of a visit to Hutton Rudby Fly Fishing Club's (HRFFC's) section of the River Leven on 25 March, 2019. The visit is a follow-up to an advisory visit undertaken by Dr. Tim Jacklin (WTT) in April 2011, to provide an updated assessment and recommendations for future management options. The previous report containing more detailed background on the river can be found on the Wild Trout Trust website:

www.wildtrout.org/assets/reports/Leven%20_2011.pdf

This visit is reported on from the upstream extent visited, progressing downstream. Normal convention is applied throughout this report with respect to bank identification, i.e. the banks are designated left bank (LB) or right bank (RB) whilst looking downstream. The Ordnance Survey National Grid Reference system is used for identifying specific locations.

2.0 Background

Table 1. Overview of the waterbody details for the section visited	
	Waterbody details
Waterbody ID	GB103025071880
River	Leven
Waterbody Name(s)	Leven from Tame to River Tees
River Basin District	Northumbria
Artificial or Heavily Modified	Heavily modified - so assessed against Ecological Potential.
Current Ecological Quality (2016)	**Moderate**: being 'Poor' for Fish (despite good angler catches) and Phosphate.
Grid Ref	NZ47330605 - NZ 45637 06997
Length of river inspected (km)	3.5

(https://environment.data.gov.uk/catchment-planning/WaterBody/GB103025071880)

Since the previous WTT report, the Water Framework Directive (WFD) classification for this waterbody of the Leven has dropped from *Moderate* to *Poor* for *Fish* and *Phosphate* and increased from *Moderate* to *High* for *Invertebrates*. As only juvenile salmonids are assessed and angler catches of adult fish remain good, the *Fish* failure could be down to a recruitment issue or possibly the limitations of the specific survey site. Potto Beck, a major tributary in the HRFFC water also only achieves 'Moderate' for fish – significantly impeded access to the beck is likely to be a major contributing factor. Point source and diffuse pollution, and barriers, are recognised as major issues contributing to the failures.

3.0 Habitat Assessment

Towards the upstream end of the fishery, the barrier at the downstream end of Potto Beck remains a major issue, disconnecting what should be a valuable spawning tributary (Fig. 1: NZ 47311 06068). Some of the previous easements installed have degraded, with passability reverting to a very poor state. Since the last WFD assessment (2015), the classification of fish populations on the beck has dropped from Good to Moderate; poor access for fish from the main river and an associated reduction in spawning on the beck is almost certainly a contributing factor, along with recognised fine sediment issues. Resistance from the owner of the structure to undertake or even allow significant fish passage improvements has been an ongoing issue. The current *Failure* of the beck for *Fish* under the WFD classification system may bring more weight to the case for real fish passage improvements at the structure; something which should be followed up with the Environment Agency (EA).

There are clear easement-type improvement works that could be undertaken on the structure, and the WTT is very happy to assist with this, but the first course of action should be to seek more major improvements through the EA and owner of the structure. It's a 'catch 22': if easements are successful, they can provide an improvement to the rivers and fishery, but it could again reduce the impetus (and potential funding options) for a proper solution to the fish passage issue, so it is best to keep the easement option in reserve in the short-term.

Photo 1. Culvert at the downstream limit of Potto Beck: still a major barrier to fish access.

Downstream of the Potto Beck confluence, some good quality habitat is present, although the continual removal of valuable, naturally occurring woody material is limiting the overall potential. Where present, alder roots provide valuable features, but the more open areas would benefit from occasional willow whip planting along the bankline to increase low cover (Fig. 2). A large fallen tree has been largely removed from the channel (apart from the rootball) and would otherwise have provided far greater habitat enhancement to the area (Fig. 3). The tree is located upstream of Hutton Rudby village but, owing to its sheer size, would have almost certainly remained in place if left untouched. If anything, the remaining rootball is now more likely to move, but even so the chances are slim. Riffle sections provide some good juvenile salmonid habitat and support water crowfoot beds, but additional bankside tree planting and coppicing or laying the very occasional existing tree (1 in 10 or even 20) into the channel would be beneficial to increase the availability of low cover (Figs 2, 4 & 6).

It is understood from discussions with the EA that woody material occurring in the channel upstream of Hutton Rudby may be removed due to perceived flood-risk; material occurring downstream of the bridge should be left *in situ*. The actual requirement to remove woody material from rivers should now also be under increasing scrutiny as maintenance budgets are cut. The weir and raised bridge footings a short distance downstream are likely to be the major impacts upon peak river levels affecting the houses.

Photo 2. Alder roots provide valuable structure but there is a general lack of low/trailing cover. It is suspected this is partly due to the spatey nature of the beck that will break off some low branches, but likely also past maintenance. Coppicing *one/two* of the many trunks on the far bank would encourage low-level regrowth (red circle - NZ 47299 06087).

Photo 3. A large fallen tree that would otherwise have provided great habitat enhancement to the area has been largely removed from the channel. The tree is upstream of Hutton Rudby village but had minimal chance of moving if left alone. If anything, the remaining rootball is now more likely to move, but even that is unlikely. The lack of cover and structure in this area could be improved by planting a few clumps of willow shrubs (goat willow ideally) in open areas along the waterline (NZ 47218 06134).

Photo 4. Almost immediately downstream of the rootball, a tall crack willow on the inside of the bend (NZ 47171 06229) could be laid down into the channel (as shown in red), to complement the existing natural tangle at its base and contribute to the development of structure.

Photo 5. Riffle areas should provide ample habitat for juvenile salmonids, providing that recruitment is sufficient to supply them. Angler catch data for older juveniles and adult fish would suggest it is, on average, but this is no reason for complacency and fish passage improvements should be sought at all structures to increase the sustainability of fish population.

Photo 6. Evidence of valuable in-channel cover and structure being removed through maintenance (red circle). Water crowfoot is also present in some of the shallower areas, and where there there is greater light penetration to the bed. As highlighted in the 2011 WTT report, the generally low occurrence of the aquatic macrophytes is not a major issue on a naturally well tree-lined upland watercourse such as the Leven.

The weir immediately upstream of the bridge in Hutton Rudby poses another obstacle for fish ascending the river and its purpose should be ascertained to identify whether it can be removed (Fig. 6). The benefits of reducing the impoundment and lowering water levels upstream alongside the houses may add even greater weight to the case for removal (and potentially funding). Even aside from flood risk benefits, the improvements to fish and invertebrate habitat upstream within the impounded reach would make removal a very worthwhile exercise. Unlike the situation on Potto Beck, there is no potential conflict from local improvements here impacting upon future funding opportunities.

Photo 7. The weir immediately upstream of the road bridge in Hutton Rudby (NZ47190661). Service checks for the area around this structure would be worthwhile to ascertain whether it can be removed. The small easement mid channel (red circle) provides some improvement, but there is no substitute for full weir removal. The woody material that has accumulated on the weir should ideally be simply eased off into the channel downstream where it will provide a valuable habitat.

An easement has been installed to the road bridge footings and long sloping apron downstream in Hutton Rudby (Fig. 8). Again, this work is a very commendable effort, particularly in light of reluctance from the owners of the structure. The easement works well to capture sufficient water to fill the boxes while also raising water levels under the bridge arch upstream, so improving passage there too. Ending the baulk short of the full width of the arch also facilitates fish ascending the apron alongside the easement if they choose to do so. The easement has clearly been designed to accommodate smaller fish like resident trout, in a range of flows, which is a refreshing change as many easements only cater for larger salmonids in high flows.

Improvements that could be made with this kind of easement include reducing the physical step between the boxes and increasing the width of the boxes (across the gradient). On a structure like this, there would ideally be no solid barrier to flow or fish between each of the boxes, with full bed depth notches at alternating ends of the transverse baffles. This would allow swim-through conditions, rather than a requirement to jump between the boxes. Increasing the width of the boxes would increase the distance the water has to flow across the apron (reducing the effective gradient and increasing channel roughness), increasing the transit time and slowing the overall flow velocity from the upstream to downstream side of the apron. The slowed flow in each pool helps to back up the water level in the adjacent box upstream, without the need for a full width 'weir' to create each pool.

Photo 8. The road bridge footings and apron create an obstruction to fish passage, but the previously installed easement provides a notable improvement (NZ 47155 06605). Further modifications could be undertaken to improve fish passage, particularly if permission could be obtained for a more extensive easement.

Downstream of the bridge, the physical habitat provides good potential for fish and invertebrates, although wider, low-velocity sections highlight the issues from fine sediment inputs upstream (Fig. 9). In addition to suitable flow and light, water crowfoot also requires relatively silt-free conditions. Flow dissipation around the plants can increase the deposition of silt and nutrients, causing smothering by the sit and/or associated excess algal growth.

Photo 9. Good potential invertebrate and juvenile salmonid habitat with areas for adult trout where the predominant flow pathway favours one side of the channel or the other, focussing bed scour to create deeper areas (red shading). This natural flow (moving from one bank side to the other) is vital in maintaining good quality pool, riffle and riffle features, even in straighter sections. Note the smothering of algae and fine sediment over the bed.

Over the years, much improvement work has been undertaken on the river, employing a wide range of techniques, predominantly pinned woody structures of varying descriptions (Fig. 10); HRFFC is to be applauded for its ethos and work. These have created some interesting features, although there is scope for the use of more nature-like techniques such as laid trees and introduced woody material/logjams. This is particularly the case on natural, high energy channels like the Leven (heavily modified, straightened or artificial channels are a different situation), with the benefit being that they encourage natural river processes, rather than fighting them to create features it is perceived would be beneficial.

If you fight a high-energy upland river, it is easy to get things wrong. You could end up trying to create a deeper narrowing where the river processes are trying to create a valuable wider riffle, or vice versa, hence structures like deflectors often get washed out or buried. Even if they do stay, they may not create natural features, which is what will ultimately be best for the river’s ecology. With more natural structures, there is a lot more leeway with the location and installation as they only encourage the development of features lost from the system (like woody material or low branches removed from the channel). Also, while it is tempting to try and increase scour and create deeper pools, it is also important to recognise that wide, shallow areas provide vital fish spawning and invertebrate habitat (Fig. 11)

Photo 10. Past habitat improvements are creating features within the river, but are they simply fighting the river processes at that location, rather than encouraging more natural features?

Photo 11. A valuable and relatively scarce area of wider channel, facilitating the retention of finer gravel substrate (when compared to the generally cobble bed). This area is important to the invertebrate and fish populations of the river as a gravel feature. Sadly, the potential is compromised somewhat by the fine sediment deposition but that is a catchment land management issue and not something that can be effectively tackled at this location.

Often, it is not specific interventions that lead to a healthy river but, instead, doing little or even nothing (again, particularly on energetic upland rivers). Low hanging and trailing trees and vegetation should be left wherever possible, even if they are perceived to impede fishing a pool in the way it has been previously. Figure 12 shows a perfect example where a heavily leaning limb will get lower to the channel over time as it bows under its own weight. It creates valuable shade and cover to the run along the far bank but will ultimately collapse into the water where it will create a different but equally valuable in-channel fish-holding structure (if left alone). Subsequently it may naturally swing round to lie along the far bank and then perhaps wash downstream to lodge somewhere else where it will provide yet another valuable feature. All of these evolutions of the habitat feature create a naturally diverse and healthy river and are what make river fishing interesting and rewarding.

Photo 12. A valuable low-hanging branch that will provide a wide range of valuable features over time if left alone (red circle). Removing it, as would occur on many fisheries, removes those benefits, simply to allow an easy cast to an area that will then support fewer fish.

Figure 13 shows in-channel deflectors creating a feature but fighting the river's natural hydromorphology. By taking up space in the deeper channel, it is forcing more flow energy into the natural depositional area (red circle) on the far side that would otherwise almost certainly increase in size naturally to provide narrowing, deepening and bed sorting through natural scour, without the need for the deflector.

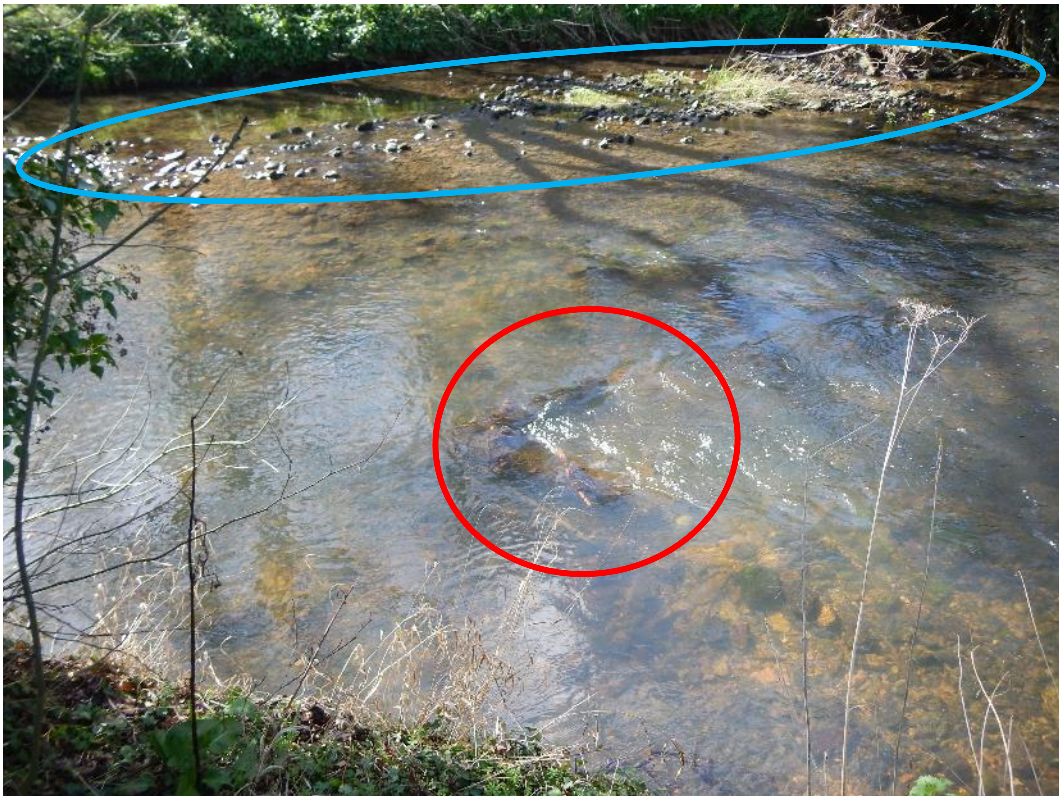

Photo 13. A deflector (red circle) somewhat fighting natural process that would otherwise encourage a similar effect as the deflector is intended to.

A fallen tree just downstream provides another great example of how natural processes (and working with them) can create far better results than some other more artificial interventions (Fig. 14). Note how the roughness and dissipation of flow energy created by the tree has reduced the ability of the river to transport the gravel in that area and encouraged the deposition of a raised bar feature within the channel. That feature then helps to focus flow along the far bank to increase velocities and create and maintain the deeper area downstream. Where channel diversity is lacking, this kind of feature could be replicated elsewhere to potentially develop more natural features, rather than forcing artificial ones; however, allowing features to develop naturally is often the preferable option.

In contrast, a downstream facing paired deflector a short distance downstream artificially focusses flow to the centre of the channel (Fig. 15). Very occasionally this can be beneficial but preventing the natural transition of flow from one bankside to the other is usually detrimental to the development of natural riffles and side bars, as are so evidently beneficial in Fig. 14. Paired deflectors (usually upstream facing to turn overtopping flows in to the centre of the channel, encourage deposition in the channel margins and prevent issues with bank erosion downstream) are better employed on artificially straight or steep channels to create depth in areas where lateral erosion and the development of sinuous flow pathways are not possible: this is not the case on the relatively meandering River Leven.

Photo 14. A fallen tree/woody material in the channel naturally enhancing the river's hydromorphology to develop a gravel bar that focusses flow to the far bank and maintains the deeper area (and water crowfoot beds) downstream.

Photo 15. A downstream facing paired flow deflector that is prohibitive to the kind of feature depicted in Figure 14. One or two are unlikely to create significant detriment to the overall river section but it is far better to employ more natural techniques where possible.

Progressing downstream, excellent habitat features (some aided by tree kickers) are developing, some of which can be tweaked but all of which will naturally adapt over time to benefit the river habitat. Where additional low cover would be beneficial, like alongside debris accumulations (Fig. 16), occasional tree trunks could be laid along the bank. As the tree is an elm it will be important to ensure the limb remains predominantly in the dry, either over debris or the bank, as only willow like to be in the water.

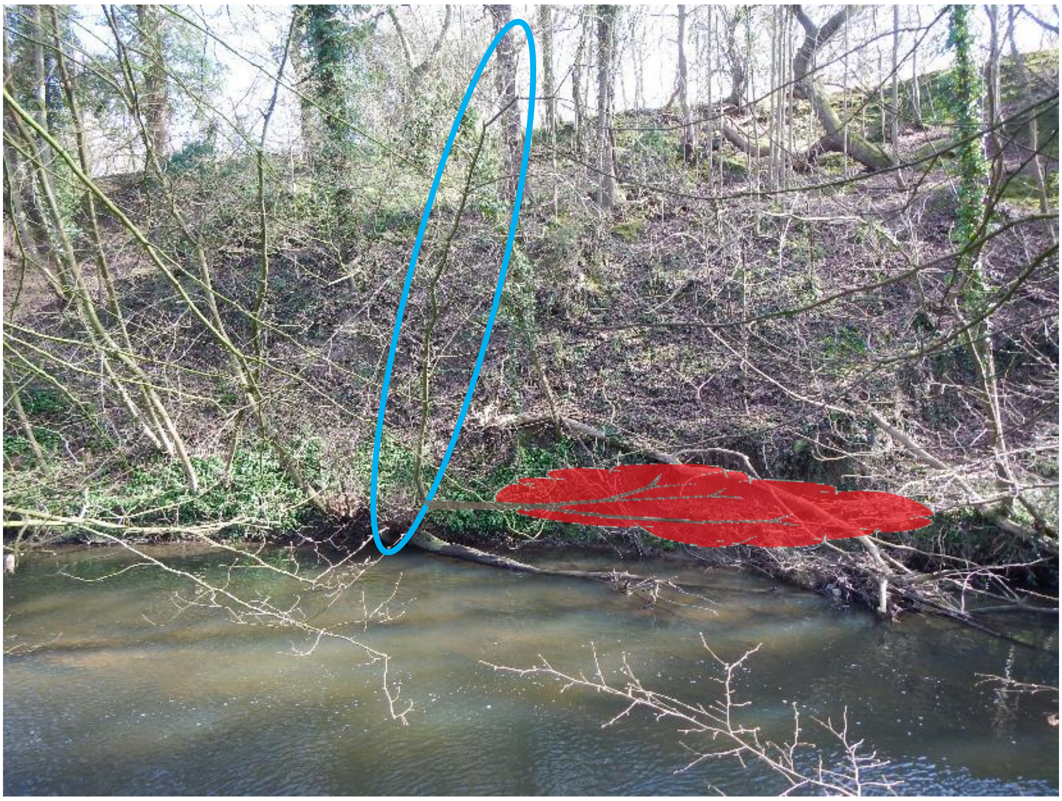

Photo 16. The valuable habitat provided by the submerged log (centre of shot) could be complemented by laying one of the elm trunks (red ellipse) alongside it and over the debris downstream (NZ 46236 07129).

Figure 17 shows how the accumulation of naturally lodged woody material has created a range of different benefits over time. Currently, the flood debris caught on a live tree provides structure, some shade and cover but at higher water (probably with additional debris accumulation), flow has been driven into the bed alongside the tree, scouring a deeper-water feature and an excellent adult trout lie. Figure 18 shows a similarly beneficial logjam structure that creates localised channel narrowing, with an associated deeper channel immediately alongside and incredibly diverse structure within. These features provide vital areas where fish can evade high flows and predators, the latter being particularly pertinent as mink tracks were observed at the bend downstream (Fig. 19).

Photo 17. A great example of the benefits of lodged woody material (blue circle) that will provide a range of benefits and features over time.

Photo 18. The structure and cover provided by logjams creates food and shelter for a range of wildlife, including trout.

Photo 19. Mink tracks observed at NZ 46044 07138. It would be well worth HRFFC undertaking a mink trapping programme on the river.

Paired deflectors downstream create some valuable flow diversity but also disrupt the predominant flow which should be along the outside of the bend where it complements the undercut bank and overhanging trees (Fig. 21). It is probably not worth removing the structure, but it is not worth reinstating when it does fail. At NZ 45852 06975 (Fig. 21), more deflectors have been installed in very close proximity and demonstrate a potential additional issue of over-crowding the channel with artificial structures. When working with river flows, whether using more natural techniques or deflectors, it is important to allow the watercourse space to react to them. In this instance, the upper structure focusses flow into the centre of the channel but the next downstream focusses flow to the RB a very short distance downstream. It would be far better to work with alternating structures and allow more space between them for the flow to transition from one bank side to the other. This would also provide greater potential for valuable depositional features to occur that would complement the structures.

Photo 20. Paired flow deflectors that disrupt the flow at a bend. A diffuse structure like a tree kicker (or similar) on the RB would probably have created a better effect. It is always difficult to mitigate fine sediment issues arising from upstream at the riffles where the impact is occurring.

Photo 21. Somewhat conflicting deflector features: the upstream structure constrains flow to the centre of the channel; almost immediately downstream, the next deflector pushes flow to the RB, with little distance for beneficial erosion or deposition to take place. Deflectors are better utilised to move flows from one bank to the other over a more natural pool-riffle spacing (as occurs elsewhere), thereby reducing the channel gradient and increasing the potential for discrete areas of deposition and deeper pool development.

The occurrence of natural in-channel features downstream is testament to the beneficial hands-off management in the lower fishery. The large fallen tree highlighted in the previous WTT report still remains in place and creates a rare full-width logjam feature with associated benefits of bed scouring and substrate mobilisation that can be observed locally and for some distance downstream. The fact it remains in place many years on demonstrates the stability of large tree structures (when the rootball and trunk are left connected) and provides more support to the case for leaving such features *in situ*.

Photo 22. The large tree highlighted in the previous WTT report remains in place and continues to provide a valuable habitat feature.

Further logjams downstream create valuable features in other areas (Fig. 23) and could be replicated in a *few* areas where in-channel structure is less prevalent (Fig. 24). At the very downstream extent of the fishery, a series of large, fallen trees create incredibly high-quality fish habitat that will undoubtedly now hold more fish than before the trees went in (Fig. 23). In addition to enhancing the quality of habitat in the area, the structures help segment the habitat creating more habitat/additional individual niches for fish and invertebrates, thereby increasing the number the river can produce and support.

Photo 23. More valuable logjam structure.

Photo 24. An area lacking low cover and in-channel structure – possibly exacerbated by historical tree maintenance (red circle)? Installing lodged woody material between some of the live, standing tree stems (blue circles) could be an easy way of introducing more structure to the channel and / or encouraging more logjam habitat.

Photo 25. The highest quality habitat observed during the visit, where numerous trees have accumulated within the channel, creating a wide array of habitat.

4.0 Summary

It is always tempting to try and improve habitat, but it is not always necessary to do so. Allowing habitat to develop naturally is invariably the best course of action where it is capable and not degraded by other ongoing management. In general, the basic habitat quality of HRFFC water is good and all capable of supporting wild trout populations, with the quality improving towards the downstream end. Significant additional habitat work therefore has the potential risk of detracting from what is already there. Laying the occasional tree or limb into the river or securing cut branches could create some localised improvements in specific locations (as highlighted in the **Habitat assessment** and **Recommendations**) but major intervention is unnecessary.

For the time being, it is likely that the area through Hutton Rudby village will be subject to ongoing EA maintenance work but the actual requirement for this should be questioned as each job arises and the extent of work undertaken limited, to mitigate the habitat loss.

Increasing fish passage is undoubtedly one of the top fisheries improvements that can be achieved anywhere. However, rather than attempting to ease fish passage into Potto Beck immediately, it would be more beneficial to re-enter discussions with the EA regarding a more appropriate long-term solution for what is now a failing waterbody. Paul Frear, EA Fisheries Officer for the Wear and Tees catchment has indicated he will be looking in to this too and it would be well-worth the club re-engaging with Paul on this. If an appropriate resolution is not achievable, the WTT can suggest options that would provide easement at the structure. Possible options for Potto and the main river are included in the **Recommendations**).

5.0 Recommendations

- Leave all naturally occurring in-channel woody material wherever possible. This includes low-hanging branches.
- Where appropriate, undertake light-touch tree work such as laying and installing the very occasional in-channel structure.
- Undertake judicious tree planting in the more open areas, particularly upstream of Hutton Rudby.
- Continue to collect angler catch data. This will provide valuable insight into the fishery performance over the years and potentially highlight natural annual fluctuations and any major impacts upon the fish populations.
- As with the above, continuing to undertake routine invertebrate monitoring will be beneficial in maintaining a good understanding of the invertebrate community composition and will potentially highlight issues missed by other monitoring.
- It would be beneficial if the club initiated a mink trapping programme. The best way to do this is with rafts (https://www.gwct.org.uk/wildlife/research/mammals/american-mink/the-gwct-mink-raft/).

5.1 Tree work

5.1.1 Low cover

One or two (max) of the several trees along the RB in Fig. 2 (NZ 47299 06087) could be coppiced to reinvigorate low-level bush regrowth. This should ideally be undertaken within the dormant season to greatly reduce the potential for killing the tree – one of the trees is a multiple stem, which does limit the risk.

5.1.2 Tree laying

- Lay the crack willow tree highlighted in Fig. 4 (NZ 47171 06229) down into the river channel.

- Lay the elm tree highlighted in Fig. 16 (NZ 46236 07129) down into the river channel.

5.1.3 In-channel structure

As highlighted in Fig. 24, there are multiple stems of alder from which one could be cut (with no significant detriment to the overall canopy or other habitats) and lodged between two or more the remaining stems, closely mimicking the natural occurrence in Fig. 17. The technique is also shown in Fig. 25.

Figure 25. A lodged flow deflector – the technique can be used with a single pole (primarily to increase scour) or a branched limb (to create greater flow dissipation). The elevated butt end (bank end) reduces the potential detrimental bank scour usually associated with d/s deflectors as a through-flow is maintained along the bank.

An alternative, nature-like lodged flow deflector method is equally simple but relies upon a deflector with multiple branches. It simply involves hooking one of the branches around an upright tree (Fig. 26). The example uses a medium-sized branch, but any size of branch or tree can be employed providing the anchor tree is stable and of sufficient size.

Figure 26. A medium-sized piece of lodged woody material which is securely anchored in place against an upright tree.

5.1.4 Tree planting

Willow whip planting would be beneficial along the bankline in the area around NZ 47218 06134 (Fig. 3). Goat willow would be the best species to use as being a smaller species it will provide good, low-level cover.

The easiest way of establishing willow is by pushing short sections of freshly cut willow whip into areas of wet ground, ideally close to the waterline. Whip planting can be undertaken at any time of the year but will have the greatest success during the dormant season, shortly before spring growth begins (ideally late Jan-March). This kind of planting should be undertaken sparingly to avoid overpopulation by willows.

Whips should be planted into the ground so that there is a greater length ($^2/_3$) within the ground, to minimise the distance that water has to be transported up the stem. Planting them on a shallow d/s angle will also ease water transport within the developing shrub and reduce the potential for it catching debris and being ripped out. Leaving 300-400mm of whip protruding from the ground is sufficient, providing they protrude well past the surrounding vegetation (to allow access to light). Whips of 5mm-25mm diameter tend to take best, but even large branches can be used. If undertaken during the growing season, care should be taken not to leave excessive amounts of foliage on the whips as these greatly increase the rate of transpiration and can lead to their dehydration.

5.2 Fish passage

5.2.1 Potto Beck (NZ 47311 06068)

First and foremost, investigate options for a proper solution to the fish passage issues on the beck with the EA. As it is currently failing under WFD, there is a far greater driver for initiating improvements.

Lower cost options for Potto Beck could be looked at if the push for a more formal solution fails again. The exact solution would require more detailed site inspection but might include:

- Installing alternating baffles to deflect the flow from side to side across the apron, thereby decreasing the gradient and creating resting areas of lower flow velocity in the lee of the baffles where fish can rest. This could be achieved with additional baffles installed onto to the apron.
- An alternative and potentially even more effective option could be to use more of the reinforced apron/bank area to one or both sides of the current easement, again lowering the overall gradient of the migration route through the easement.

5.2.2 Weir upstream of the bridge (NZ47190661)

The first step should be to undertake service checks for the area to identify whether the weir serves a purpose and if so, what. The multiple benefits of removing for fish passage, habitat improvement and flood risk reduction should make removal a very favourable option. Even if services are present, it would be useful to know what, and whether there could be a longer-term strategy to have it removed through infrastructure improvements. Failing all of that, it may be worth revisiting to look at larger easement options.

5.2.3 Bridge Footings (NZ 47155 06605)

Long-term, the best course of action would be to seek proper approval for a larger, more passable easement on the bridge apron, as described in the **Habitat assessment**. Similar work is regularly undertaken all around the country on other structures and there seems no reason for the owner of this structure to be resistant to the installation of a more effective easement. If there is continued resistance, support from the EA (with their additional powers under the Salmon and Freshwater Fisheries Act 1975) should hopefully facilitate the improvements. Even alongside the existing baffle array, there is the possibility to install another, bed-depth notch easement which might look something like Fig. 27, or could even potentially be located beneath the other arch (although the RB side could be more susceptible to flood debris).

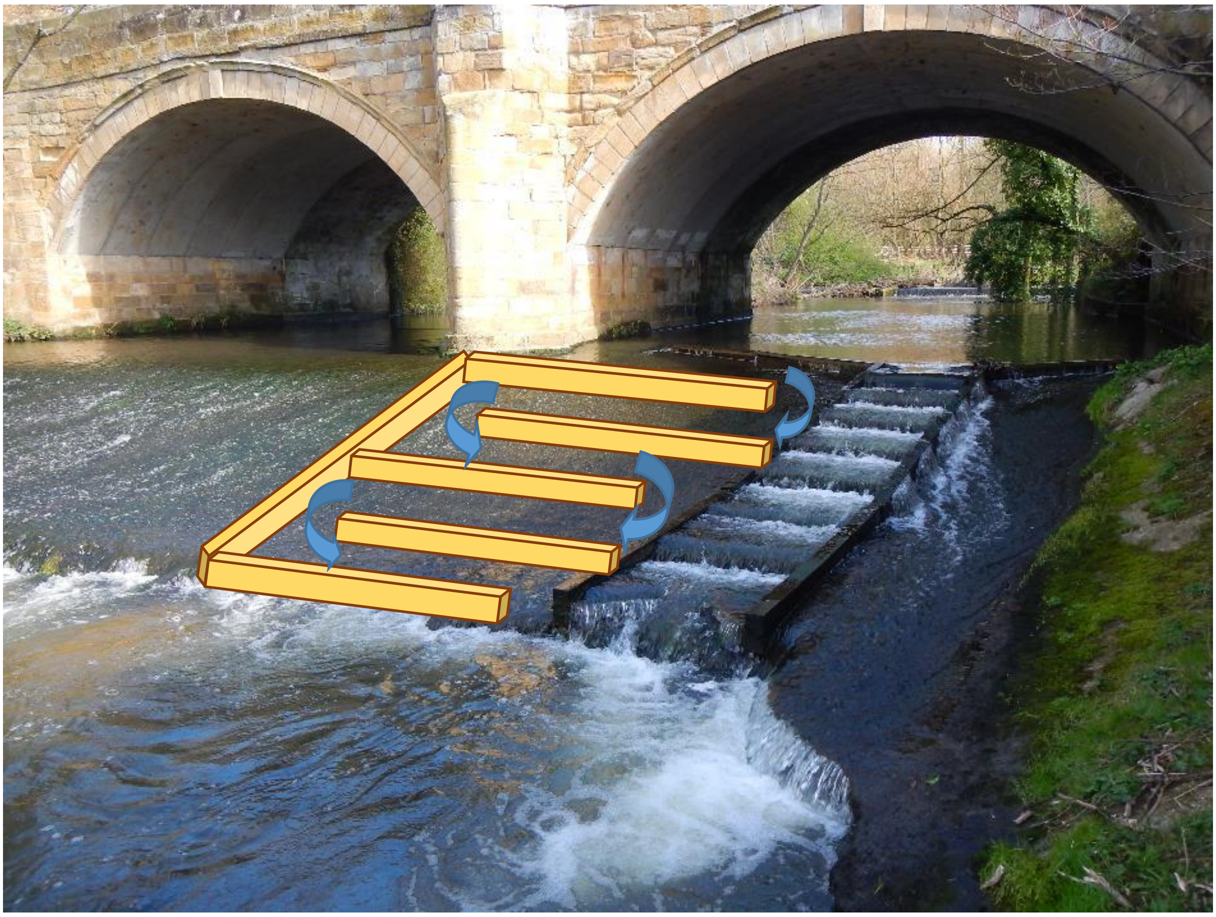

Figure 27. Possible replacement, or additional, baffle array that could be employed on the bridge apron, either alongside or at the opposite side to the existing structure. Note that the baffles stop short of creating an actual barrier, instead they back up the flow to create water depth. The exact number of baffles, width of the easement/length of the baffles and size of free notch required would be dependent upon the available flow and would require further assessment. The diagram is just for illustrative purposes.

There are also potentially options to improve the ease of passage at the existing easement through notching the baffles/downstream walls of the boxes, either partially or down to bed level (assuming the current installation of the structure permits). Further specific assessment of all the obstructions would be required to ascertain the best fish passage/easement options.

6.0 Further information

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

www.wildtrout.org/content/wtt-publications

We have 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 populations and managing invasive species.

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

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

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