WILD TROUT TRUST

Advisory Visit

R Wharfe, Bradford Waltonians, October 2021

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Key Findings

- Historic modification of the Wharfe alongside Ilkley created a realigned and straightened, uniformly proportioned channel, overly incised via dredging and exacerbated by flood embankments on top of rock bank armouring. This artificial character extended to the broad sweeping bend encompassing Crook Farm so that the channel remains perched above its natural position on the floodplain.
- The constant attempts of the river to return to its natural position instigated a bank protection programme ~20y ago resulting in livestock exclusion fencing and willow planting. Now established, the resilient riparian zone has reintroduced some functionality within the upper reaches of the channel and the physical habitat reflected that.
- The fence is now approaching the end of its life-span and various issues need addressing
- Lower reaches remain canalised but mature trees on the RB provide the raw materials with which to make some improvements.
- Hundwith Beck needs some attention to address fish passage and diffuse agricultural pollution issue and hence maximise potential spawning habitat.

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1.0 Introduction & rationale

This report is the output of a site visit to the Wharfe waters of the Bradford Waltonians (Map 1a). The walkover was undertaken by Prof J Grey of the Wild Trout Trust, accompanied by several members of the committee. The rationale was to assess the water and suggest habitat improvements that could be undertaken, primarily to benefit the wild fish community and reinvigorate interest in the water for the membership.

Normal convention is applied with respect to bank identification, i.e. left bank (LB) or right bank (RB) whilst looking downstream. Upstream and downstream references are often abbreviated to u/s and d/s, respectively, for convenience. The Ordnance Survey National Grid Reference (NGR) system is used for identifying locations.

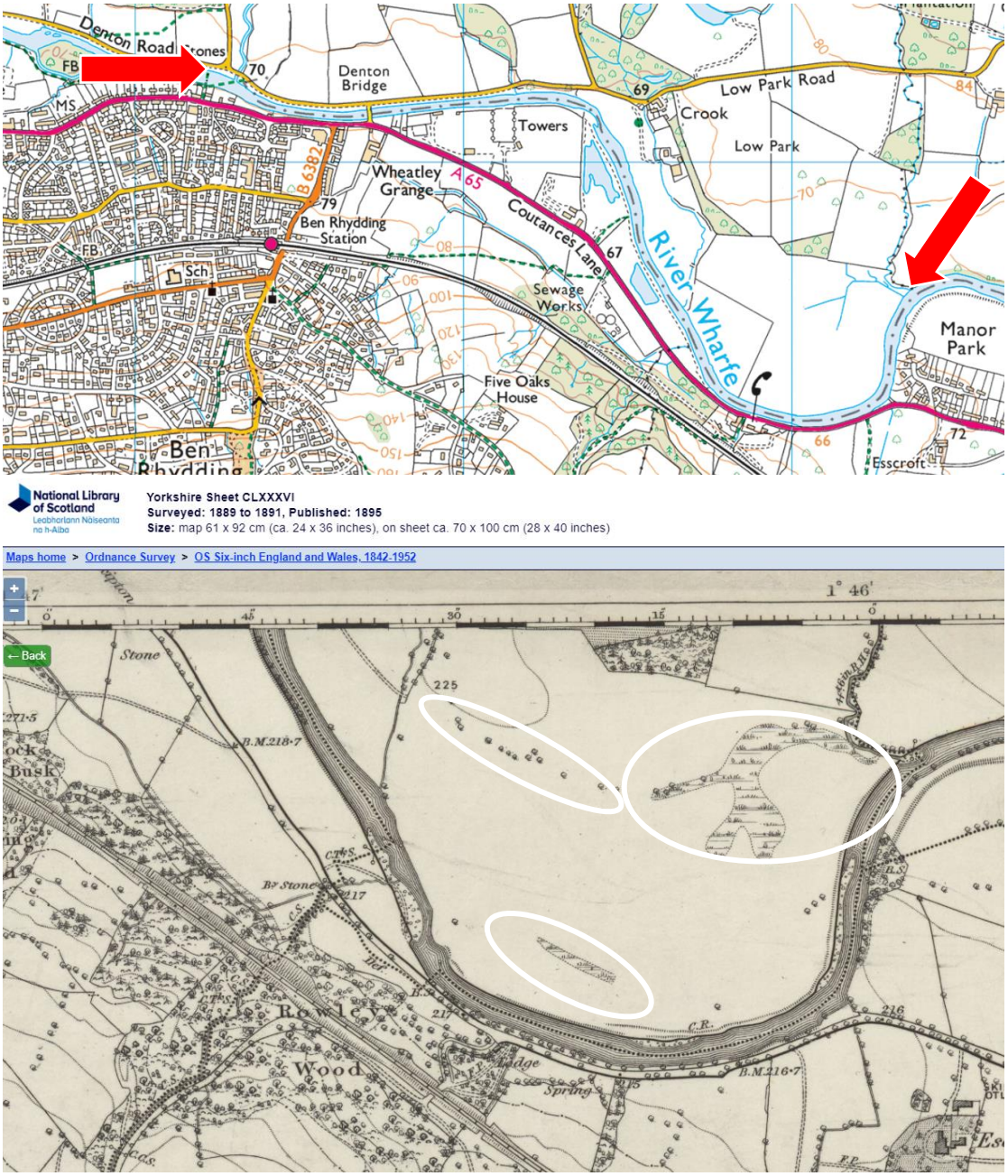
Under the Water Framework Directive (WFD), the club waters fall within the lower stretches of the waterbody: Wharfe from Barben Beck/River Dibb to Hundwith Beck (see Table 1 overleaf). The extent to which the river has been artificially realigned, dredged and then constrained with the arisings is evident from aerial photography and maps (Ordnance Survey, 1846; Map1b): straighter sections to accommodate agriculture and roads, long sweeping bends, and heavily incised into the floodplain.

Ignoring the recent (2019) change in Chemical classification which caused all waterbodies to Fail, the Ecological Potential has been consistently *Moderate* ie not achieving *Good* potential as it should. The ecological parameter, Fish, has been identified as causing the failure but the 'Reasons for not achieving *Good'* potential are not defined! However, it should be noted that these classifications are extremely broad brush for the entire waterbody and may not apply locally at the scale of the club's reach.

An overview of the waterbody is given in Table 1, overleaf.

	Bradford Waltonians
River	Wharfe Middle & Washburn
Operational Catchment	Wharfe & Ouse Lower
River Basin District	Humber
Waterbody Name	Wharfe from Barben Beck / River Dibb to Hundwith Beck
Waterbody ID	GB104027064257
Current Ecological Quality	Consistently **Moderate** potential (Heavily Modified Waterbody) from 2013-2019
U/S NGR inspected	SE 14379 48186
D/S NGR inspected	SE 15370 47655
Length of river inspected	~2000m

Table 1. Overview of the waterbody. Information sourced from:
https://environment.data.gov.uk/catchment-planning/WaterBody/GB104027064257



Map 1a&b. Red arrows denote limits of the club reach on the Wharfe at Crook. Consultation of the Ordnance Survey map from 1895 suggests substantive embankment works had already been undertaken, probably in association with the development of the road network. Note the areas denoted as marshland, as well as the line of trees (highlighted in white ellipses) – evidence of former paleochannels, where the river had meandered across the floodplain.

2.0 Catchment / Fishery Overview

The River Wharfe is a gravel bed river in a glacial valley, rising on Camm Fell in the Yorkshire Dales National Park and flowing for ~115km to join the Yorkshire Ouse near Cawood. The physical characteristics of the Wharfe and hence the potential of the fishery, by the time it reaches Ilkley, are influenced strongly by processes and interventions occurring upstream. Most Yorkshire Dales' rivers have been affected by drainage and intensive stock grazing in both the catchments and floodplains, resulting in rapid transit of water and flashy hydrographs with narrow, high peaks and troughs of flow, excessive erosion, and a scarcity of wetland features. There is typically over-supply of cobble and gravel resulting in pools filling in to become uniformly shallow, especially where natural geomorphology is constrained by bank revetment and channel realignment / straightening (see scale of this in Maps 1a&b).

The Wharfe from Burley and in an upstream direction typically is fished for trout and grayling. With very little understanding of the wild fish populations or carrying capacity, a few clubs still stock the river to varying extents. Many other clubs have ceased stocking, preferring to promote a wild fishery. It is generally accepted from a wealth of scientific evidence that stocked fish are less capable in dealing with environmental pressures (predation, drought, spate flow etc) than wild fish, and detrimental to wild fish via competition for resources and behavioural interaction. If the wild population can be promoted via habitat improvements, then the fishery is far more sustainable and resilient in the longer term. Given that the Wharfe produces plenty of fish where catch & release is practiced (e.g. waters around Buckden and Burnsall, u/s) and of considerable size (historic specimens in glass cases in various pubs along the river, prior to the recognition that unsustainable harvesting would cause their demise), the potential for a wild fishery throughout the Wharfe is considerable. More information is available at:

https://www.wildtrout.org/content/trout-stocking

3.0 Habitat Assessment

3.1 Wharfe

The water was assessed from the LB, from SE 14379 48186 to the d/s limit where Hundwith Beck enters. The first thing of note on the u/s sections was that the presence of livestock exclusion fencing had allowed for the protection and subsequent development of a relatively natural riparian (bankside) strip of vegetation (Fig 1). Subsequent investigation revealed that the fencing was paid for and installed under an Environment Agency bank protection scheme ~20y ago to mitigate the loss of land and consequent ingress of fine sediment into the Wharfe.

Fig 1. The state of the sheep-netting fence-line that has protected the river bank and riparian zone for ~20y. The difference between grazed and non-grazed vegetation is stark.

It cannot be stressed how important a native, diverse and ample riparian zone is, even for aquatic fauna seemingly removed from its influence, and the following is a relatively simple list of the wider ecosystem benefits accrued:

- Often referred to as a buffer strip, the riparian zone can perform a buffering role, protecting the river by intercepting unwanted nutrient, pollutant and particulate material that may be washed or blown toward the channel.
- Trees, shrubs and taller herbs provide shade, helping keep rivers cool and mitigate for climate change.
- A native riparian flora provides vital feeding and breeding areas for many aquatic and terrestrial organisms, along with refugia for emergent aquatic insects.
- A diverse root matrix from trees (deep) and herbs (shallow) promotes much greater resilience to bank erosion.

- Leaf litter falling into the river is an incredibly important energy resource for many aquatic invertebrates.
- Large woody material (whole trees, limbs etc) falling into the rivers helps to trap debris (like leaf litter) as well as forcing water over, under or around, thereby causing localised scour and deposition on the riverbed. Physical diversity begets biological diversity.

The fence of sheep-netting was falling into disrepair and clearly had been patched in places. It is important to maintain the integrity of fencing as even a seemingly inconsequential hole will be exploited by sheep, the grass always being greener…! Much of the Wharfe further u/s in the Dales is devoid of any such protection and the short sward of constantly grazed grass harbours little biodiversity, often eroding badly because of the lack of root matrix.

In conjunction with the fencing scheme was the establishment of willows along the toe of the bank (at the waterline), again to bolster a 'natural' line of defence and stop the river eroding the bank. After 20y of growth, many of the willow trees were of a size to be usefully managed for even greater environmental gains – see Recommendations. Other tree species like alder (especially good because of bacteria in root nodules that can fix atmospheric nitrogen and hence increase the palatability of their leaves), hawthorn, blackthorn and some birch had established. This 'screen' of trees was probably (in part) responsible for protecting the fence-line from flood damage for so long.

Unfortunately, but nevertheless unsurprisingly, Himalayan balsam has also established. Branded an Invasive Non-Native Species, this annual plant is detrimental to river systems by outcompeting native species during the growing season but dying back to leave bare soils and hence unprotected banks during the spate season. The propagule pressure from upstream on the Wharfe is considerable yet many groups (eg Addingham Environment Group) are tackling it to good effect on the tributaries by simply pulling it up and snapping the main stem below the lowest node and the small root mass.

Consultation of satellite imagery and maps allows for a bird's eye view of a river and helps to explain some of the larger scale processes at work. For example, it is not surprising that the Wharfe was eroding heavily into the LB and prompting the fencing & willow schemes described above. The river was historically forced into a relatively abrupt right hand turn away from the Denton Road after having been

routed on an artificially straightened course for 2.25km alongside Ilkley (Fig 2).

Fig 2. The white arrow highlights how the Wharfe has been tightly constrained between the town and Denton Rd on a straightened course for 2.25km before being shunted around the 'U-bend' at Crook.

A straighter channel is shorter and steeper than would naturally occur, delivering water from A to B quicker and, hence increasing erosive power. The erosion of the LB is merely symptomatic of the river trying to return to the lowest point within the floodplain which is remarkably broad at Crook Farm. Indeed, scrutiny of satellite imagery and even a good look at the fields around Crook Farm revealed several shallow depressions or paleochannels, the ghostly former paths of the river still etched in the landscape.

The long, gently sweeping 'U-bend' around Crook Farm (Map 1) and typically consistent channel width are all pointers to the river having been heavily modified historically: shifted out of position in the floodplain and pinned there with artificial banks. To improve the fishery potential to a gold standard would be to remove all these constraints and fully restore ecological functionality to the channel. Rivers should be dynamic and meandering back and forth across the floodplain, not fixed in aspic. However, such 'freedom' for the Wharfe at this location seems unlikely in the near future, so it is within these constraints that the channel habitat improvement options are discussed.

At SE 14516 47938, the thalweg (line of fastest flow; see Fig 3) kicks off from the LB to the RB and deposition bars have formed, pinching the flow and creating a faster, shallow riffle. Over time, marginal plants have colonised the bar and it has stabilised (Fig 3).

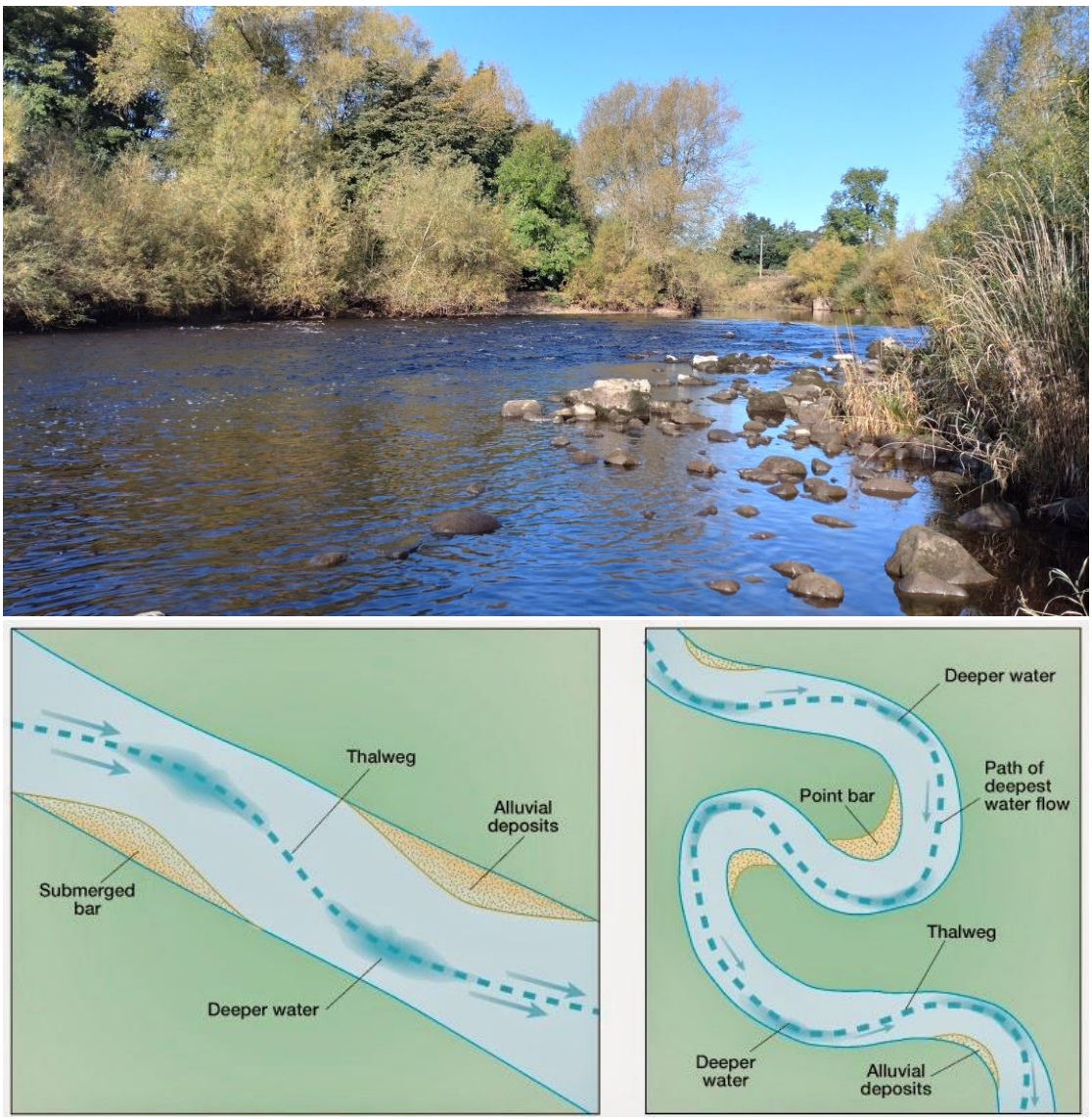


Fig 3. At SE 14516 47938, the thalweg crossed from LB (outside of bend) to RB, resulting in deposition bar formation. Note: even in a straightened channel, a river will start to adopt a sinuous course, and if unconstrained will develop into a meandering planform over time.

For ~350m, there was considerable diversity in the channel cross-sectional profile because of alternating deposition bars and the presence of dense, shrubby willow at the waterline (Fig 4). The latter will help to push water around during spate flow, creating relatively slack water d/s and, hence encouraging further deposition. Slack water is also a safer place for fish to reside under such conditions. Behind the deposition bars, backwater channels had formed and, again, these present water with different flow characteristics to the main channel, particularly useful as fry nurseries.

Several specimens of the larger crack willow had (as their name implies) cracked and toppled towards the channel but remained rooted and alive, providing further important cover and flow deflection (Fig 5). Willows have evolved to strike adventitious roots wherever a limb touches damp ground, providing further stability.

Fig 4. Another pinch between a large deposition bar to the RB and a dense, low spreading willow which provided fantastic cover (and shade).

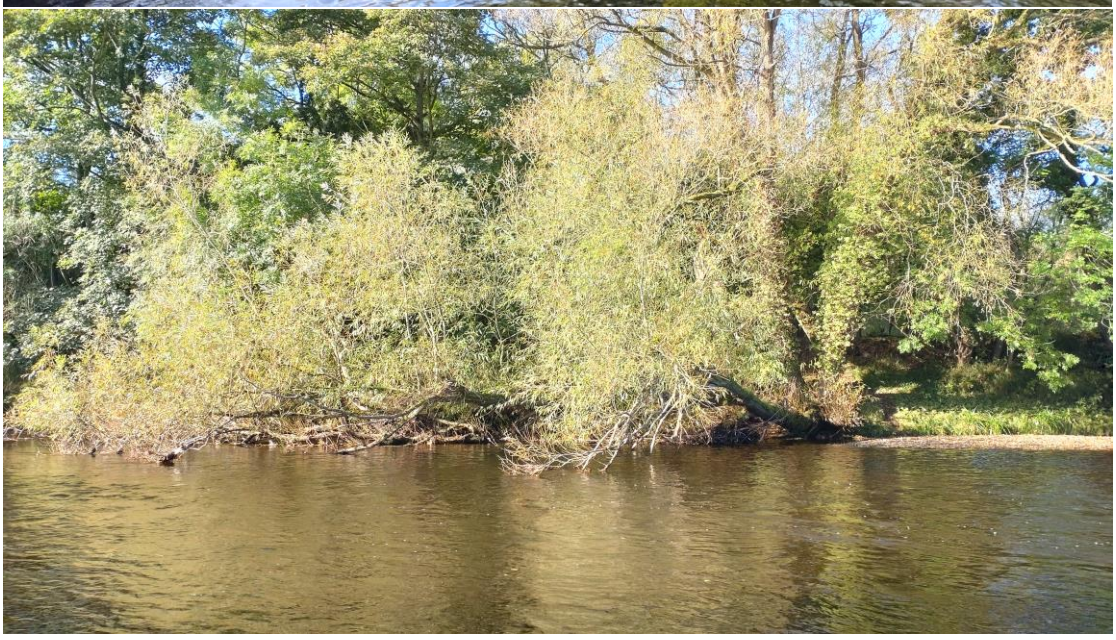


Fig 5. Upper: colonisation of a point bar by willow has led to the creation of a secluded and shady backwater close to the RB. Lower: fabulous examples of leaning crack willow from the RB. The presence of several living limbs over the water will provide more resilience to future spate flow. The outside edge of such willows provides good feeding lines for trout adjacent to ample cover.

Attached (living) trunks and limbs will eventually settle and stabilise after several spates and may go on to provide multiple benefits for years if not decades. These should be retained as they are valuable assets to the fishery. Indeed, even detached limbs are useful and, if quickly stabilised and retained *in situ*, may survive via adventitious rooting; they will further enhance the habitat and hence carrying capacity of the river (Fig 6).

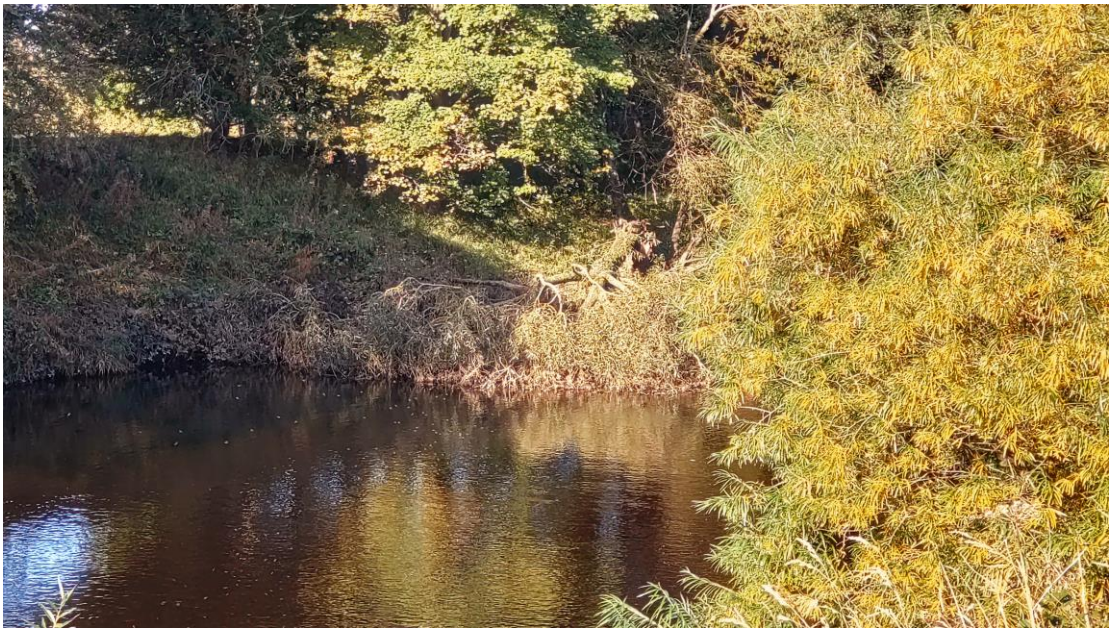
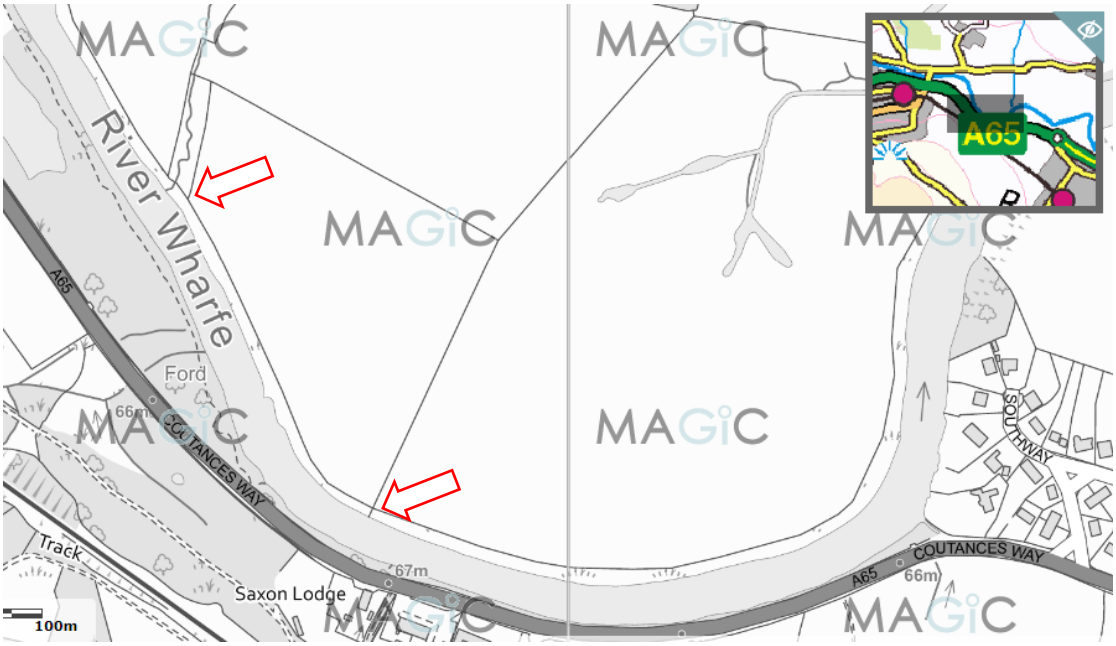


Fig 6. The crown of a detached limb from a crack willow had created a considerable amount of cover in the RB margin on a slower section of the river which was otherwise devoid. There are methods available to retain such material *in situ*.

Towards the 'bottom of the U-bend', the flow was notably sluggish and the channel relatively deep and featureless. The channel had been pushed against the side of the valley for such a distance that it was effectively perched above where it should have been on the floodplain, and the water impounded as a result. There was a stand of mature crack willow on the remaining RB with club fishing rights, several of which had limbs that were leaning toward the river (Fig 7). These could be encouraged to 'hinge' into the channel and provide further diversity and cover (as in Fig 6). The LB was relatively devoid of mature trees that could be managed for environmental gain for the remainder of the club water.

Fig 7. Impounded and relatively featureless water but scope for improvement via judicious management of a few of the crack willows on the RB (upper & mid). The lower image exemplifies the canalised reach and lack of mature trees on the LB aside from shrubby goat willow. Even some of these smaller goat willows can be hinged at a d/s angle to increase cover.



Map 2. Extract from MAGIC of the field boundaries at Crook Farm and the contentious points identified on the fence-line (red arrows).

Two distinct points were noted on the LB fence-line (Map 2):

- At SE 14684 47554, where a small beck joined the Wharfe from Low Park Plantation, the fence to the north of the beck was intact but had collapsed on the south side. Cattle had accessed the confluence and there was considerable poaching. Without reinstatement of that fencing, livestock would have complete access to the formerly protected bank u/s & d/s. NB – this beck, although tiny could represent spawning opportunities for trout – see Recommendations.
- At SE 14836 47293, the fence on the western (u/s) side of the field boundary was intact sheep-netting, whereas on the eastern (d/s) side, it had been replaced by a single strand of breast-high barb. The difference in vegetation structure on the non-grazed (u/s) *versus* grazed section was marked, as was the reoccurrence of erosion scarring where sheep had access (Fig 8).

Reinstatement of the fencing and upgrading the single strand to multi-strand flood-spec would be required to prevent further deterioration. Hurdles or stock access gates could be installed for access for extremely short periods of mob-grazing if required. However, there is always a risk on steep sloping banks that grazing and trampling will rapidly result in bank instability and further loss of land.

Fig 8. At SE 14836 47293 looking u/s (upper) and d/s (lower) at non-grazed and grazed banks, respectively. It was immediately clear that sheep trampling the bank to browse on the willow were causing erosion scars of bare earth which would be less resilient to further erosion under spate flow and lead to further loss of land.

Further d/s in the same large field, there were occasional changes in the format of the fencing but for the remainder of club water, while cattle were excluded, sheep had unfettered access to the waterline (Fig 9). As a consequence, the vegetation was reduced to a short-sward and all the ecosystem benefits of the native herbage to wildlife (diversity / feeding / pollination), flood risk (hydraulic roughness, slowing the flow), and landowner (preventing erosion and loss of land) were lost.

Fig 9. Various images of the LB where sheep had access – loss of native herb-rich vegetation and increased susceptibility to erosion.

At the bottom of the 'U-bend' (SE 15103 47242), there was a short, linear stand of willow which had been planted as part of the original bank protection scheme (Fig 10). While these had established and prevented further retreat of the bank line, there were tell-tale signs of erosion arising beneath them because sheep were trampling the bank to browse. Further deterioration of the bank and exposure of the roots, ultimately leading to the collapse of the trees is inevitable with continued stock access. The multi-stemmed nature of these trees suggested that they had been coppiced in the past. One or two trunks could be hinged in a d/s direction to bolster the banks, prevent sheep access along the waterline, and provide low cover over the water, plus encouraging new low growth. The latter would not occur unless sheep were excluded.

Fig 10. Upper - a clear browse-line evident in the branching, and lower - bare poached earth beneath the willow stand; evidence of the detrimental impacts of livestock access.

3.2 Hundwith Beck

Whilst technically not considered within the waters of the club, Hundwith Beck deserves mention because of it's likely importance as a spawning tributary, particularly for trout. The modified nature of the mainstem Wharfe means that spawning gravel of an appropriate size (15-40mm) is relatively scarce or too dispersed rather than in discrete patches sorted by density. Smaller channels like the beck also make safer nurseries for the weaker swimming fry stage.

Fig 11. At SE 15340 47616, the confluence of Hundwith Beck on the LB would normally have been accessible bar the temporary damming of flow by local kids. However, livestock from the adjacent field d/s had breached the old fence and there was evidence of poaching and grazing.

Access from the Wharfe would normally be unhindered (see Fig 11) but rather exposed compared to the cover around the smaller beck u/s at SE 14684 47554. Hence, the initial obstacle to fish passage was not physical but behavioural – risk of predation may limit passage attempts to the hours of darkness. To improve the habitat would simply require the reinstatement of the fence-line (visible top right of Fig 11) and allow natural regeneration to succeed.

However, within 40m of the confluence, a series of 'Heath Robinson' water-gates that had sequentially failed and been repaired had created a physical barrier that was impassable to fish (Fig 12). So much material and sediment had since accumulated against the collapsed gates that there was a vertical headloss of ~0.5m. The downstream side was becoming incised, effectively starved of gravel and cobble from u/s.

Fig 12. A series of ineffective water-gates had blocked and caused an impassable barrier to fish passage. Note the poaching and fine sediment ingress both above and below the blockage.

Fig 13. Excessive poaching and fine sediment ingress to Hundwith Beck. The bed was smothered with silt and satellite imagery confirmed this was a long-term issue.

Hundwith Beck only flowed through the corner of the field for ~85m but it was clearly the focal drinking point for both sheep and cattle. The banks were heavily poached, and the substrate smothered in fine

silt (Fig 13). Satellite imagery suggested this was a persistent problem. The extent of degradation was a clear breach of the Farming Rules for Water (2018) and should be addressed by excluding livestock from the channel and providing an alternative drinking supply (eg mains supply, pasture pumps, solar etc). A poorer alternative would be limiting access to a specific part of the beck and formalising a drinking bay with hard standing on the approach. The latter is not without issues; it will require ongoing maintenance and still creates a focal point of activity and nutrient (excretion) input.

The remainder of Hundwith Beck was not observed beyond the field boundary (Fig 14) but appeared to be better protected with fencing and a reasonably mature, native, mixed-deciduous woodland strip. Electric-fishing data from near to Low Park Rd ~800m u/s suggest trout use the Beck there but densities were low and should be higher. Removing the physical and behavioural barriers near the mouth of the Beck will help considerably.

Fig 14. U/s of the drinking area, Hundwith Beck appeared better protected.

4.0 Recommendations

Despite the scale of the Wharfe channel, which may initially appear daunting, there are a few relatively simple management techniques that the club could undertake to improve habitat and hence the potential of the wild fishery, as outlined below.

4.1 Channel & riparian habitat

The highest quality habitat and that most beneficial to the fishery was observed toward the start (u/s) of the walkover. Discussions on the day included the need for membership access. Care must be taken not to go overboard with maintenance of the riparian vegetation to 'open up' the water for members. There is little point in creating better access to water that contains fewer fish because of those maintenance activities. If work-parties are proposed, then a definite plan sensitive to the environmental aspects of the fishery, a light touch, and close supervision are required.

To combat the overwhelming canalisation of the channel (particularly d/s), there is a desperate need to introduce some physical structure for the water to work against and around. There were good examples in the u/s section (eg Figs 5&6). Natural wood fall and associated habitat can be simulated by hinging pliant species (eg willow) or using tree-kickers by felling and tethering using appropriately rated cable back to the their living stump or adjacent trunks (Fig 15). In some instances, felled trunks can be wedged between the remaining upright trees and, provided the configuration of the anchors is suitable, effectively pinned in position using opposing forces. The latter is preferable where possible as it removes the need for cabling.

Any activity like this requires careful planning and consent from landowner and the relevant authority (in this case, the Environment Agency for works on main river) but can be achieved relatively easily and cheaply. The idea is to work with the processes of the river, rather than against them, so identifying areas that will not take the brunt of spate flow and are already marginally depositional in character would be ideal. Suitable sites and trees for the above techniques were identified in Figs 7 & 10.

Any structure added at that point will likely encourage further deposition, thereby stabilising and consolidating the new feature. Working with previously coppiced, multi-stemmed trees is advantageous as the felling of one or two trunks does not alter significantly the aesthetic or shading function. The anchor point can also be protected by trunks on the u/s side. Coppicing tends to induce

vigorous regrowth at the stump which again helps to diversify the canopy structure, create more low cover over the water and different niches for terrestrial invertebrates.

The 'mid-field' section of the LB (between the two markers on Map 2) had well-established herb cover but little in the way of natural regeneration of trees. Small clusters (separated by ~25m) of 3-5 saplings of low-growing, shrubby species like hawthorn, blackthorn and hazel could be mixed with a downy birch or rowan to introduce greater diversity (ie ensure that willow spp. do not assume complete dominance). To achieve this idealised density / spacing, planting density would probably need to be double to account for attrition.

Fig 15. Upper panel: goat willow hinged to provide low, trailing cover. Lower panel: a tree-kicker derived from alder, the trunk felled and cabled back to its stump as a living anchor point. Both these examples were carried out on the R Washburn, a nearby Wharfe tributary.

4.2 Thinking outside of the box

'Slowing the flow' - this catchphrase applies almost everywhere but is clearly applicable on the Wharfe and its tributaries. Obviously, there is a considerable area of catchment u/s of the club waters and well outside its direct sphere of influence, but support for organisations like the Yorkshire Dales Rivers Trust that is instigating work to reduce conveyance, plant trees, tackle INNS etc, across the catchment is worthwhile. It would be worth engaging with the YDRT to explore avenues for mutual benefit.

The integrity of the fence-line is of paramount importance in protecting the riparian zone and as discussed following the walkover, via WTT, YDRT has already met with the landowner to discuss whether the fencing could be reinstated and improved. This should include the issues identified on Hundwith Beck and the smaller beck from Low Park Plantation too. If these smaller becks can be protected from livestock, then intervention works similar to those proposed for the main channel (ie hinging trees etc) but scaled appropriately could be undertaken specifically to improve spawning habitat.

There are numerous funding streams available to help with the cost of flood-spec livestock exclusion fencing because of the environmental and flood risk benefits accrued.

5.0 Making it Happen

The WTT may be able to offer further assistance:

- WTT Project Proposal - Further to this report, the WTT can devise a more detailed project proposal report. This would usually detail the next steps to take and highlight specific areas for work, with the report forming part of a flood defence consent application.

- WTT Practical Visit - Where recipients are in need of assistance to carry out the kind of improvements highlighted in an advisory visit report, there is the possibility of WTT staff conducting a practical visit. This would consist of 1-3 days' work, with a WTT Conservation Officer teaming up with interested parties to demonstrate the habitat enhancement methods described above. The recipient would be asked to contribute reasonable travel and subsistence costs of the WTT Officer. This service is in high demand and so may not always be possible.

- WTT Fundraising advice - Help and advice on how to raise funds for habitat improvement work can be found on the WTT website - www.wildtrout.org/content/project-funding

In addition, 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

6.0 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.

7.0 Disclaimer

This report is produced for guidance only; 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.

Legal permissions must be sought before commencing work on site. These are not limited to landowner permissions but will also involve regulatory authorities such as the Environment Agency – and any other relevant bodies or stakeholders. Alongside permissions, risk assessment and adhering to health and safety legislation and guidance is also an essential component of any interventions or activities in and around your fishery.