Advisory Visit

Abbey Brook

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Undertaken by

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Key Findings

- As with most watercourses the Abbey Brook has historically be subjected to dredging and channel realignment which will have affected the flow regime and habitat quality
- Historic tree maintenance activity and removal of bankside trees and in-channel woody material has denuded habitat and inhibited natural channel recovery while unnecessarily accelerating flow conveyance through the site
- In areas where woody material has been allowed to remain in the channel the Brook is recovering and habitat quality is improving
- Future management of the site should be to retain woody material within the channel to enhance/develop habitat slow the transit of water downstream (natural flood risk management). Leaning trees should be allowed to fall into the watercourse.
- The presence of healthy wooded banks and adjacent land greatly reduces the potential for trees and woody material to be transported far downstream and thereby limits any potential flood risk they could pose.
- Excess fine sediment input upstream is impacting upon the substrate habitat quality of the Brook and the source of this should be investigated and addressed

1.0 Introduction

This report is the output of a site visit to Abbey Brook, a tributary of Eller Brook, River Douglas and River Ribble. The visit was undertaken by Gareth Pedley of the Wild Trout Trust (WTT) at the request of John Watt who owns a section of the Brook and surrounding land (predominantly woodland). The land and Brook in this area are managed for the benefit of the resident wildlife and the purpose of the visit was to investigate what, if any, additional management was required, with particular regard to the accumulation of fallen trees and large woody material in the channel.

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. Upstream and downstream references are often abbreviated to u/s and d/s, respectively, for convenience. The Ordnance Survey National Grid Reference system is used for identifying locations. This report covers observations made on the day of the visit and discusses options for future management.

Table 1. Overview of the waterbody details for the section of river visited	
	Waterbody details
River Catchment	Ribble
Waterbody Name	Eller Brook
Waterbody ID	GB112070064810
River Basin District	North West
Current Ecological Quality 2015	Moderate
U/S Grid Ref of reach inspected	SD 44960 10540
D/S Grid Ref of reach inspected	SD 45314 11006
Length of river inspected (km)	0.7

(http://environment.data.gov.uk/catchment-planning/WaterBody/GB112070064810)

Under the Water Framework Directive (WFD) classification, the Eller Brook catchment is classed as being at 'moderate' potential (being a heavily modified waterbody), driven by classifications of: 'poor' for invertebrates, 'moderate' for macrophytes and phytobenthos, 'poor' for phosphate (higher than expected levels) and 'moderate' for supporting elements (surface water). It is the lowest score which dictates the outcome so any one of those factors being below 'good' would bring the waterbody down to 'moderate'. It is likely that the reason that the 'poor' classification for invertebrates does not bring the overall status down to 'poor' because the waterbody is already classified as heavily modified, meaning that a certain level of impact is already allowed for in that classification.

	2015 Cycle 2
Overall Water Body	Moderate
Ecological	Moderate
Biological quality elements	Poor
Invertebrates	Poor
Macrophytes	-
Macrophytes and Phytobenthos Combined	Moderate
Hydromorphological Supporting Elements	Supports good
Physico-chemical quality elements	Moderate
Ammonia (Phys-Chem)	High
Dissolved oxygen	High
pH	High
Phosphate	Poor
Temperature	High
Specific pollutants	-
Supporting elements (Surface Water)	Moderate
Chemical	Good
Other Pollutants	Does not require assessment
Priority hazardous substances	Does not require assessment
Priority substances	Does not require assessment

(http://environment.data.gov.uk/catchment-planning/WaterBody/GB112070064810)

2.0 Catchment overview

The geology of the Abbey Brook catchment area comprises predominantly Sherwood sandstones, with an overlying (superficial) geology of till (glacial sands, silts and clays). This combination creates conditions where any excess bank erosion is likely to result in fine sediment and sand input to the watercourse.

There are no fishery interests on this section of brook but the welfare of all wildlife, aquatic and terrestrial, is of primary concern in management of the predominantly deciduous woodland site. If the conservations aims can be achieved alongside reducing flood risk downstream, this would be considered a welcome benefit.

3.0 Habitat Assessment

Inspection from the bridge at the upper limit of the site revealed that the Brook is suffering significant inputs of fine sediment and sand, as can be seen by deposition on the bed (Fig. 1). This issue greatly limits the habitat quality in the Brook for many of its native species. Fine sediment entering the Brook, particularly in low and medium flows, fills vital spaces between the gravel and cobbles, greatly reducing the quality and diversity of that habitat. Finer sediments trapped within the riverbed also limit the flow-through of oxygenated water that is required by many invertebrates and any fish eggs that may be laid within the gravel. The fine sediment input is therefore likely to be a key contributor to the 'poor' WFD score for invertebrates.

Although there appeared to be no signs of major erosion in the area visible u/s of the bridge, it is strongly suspected that there are issues somewhere further up the catchment. Grazing is often a likely culprit but in this case, it may be due to Himalayan balsam (*Impatiens glandulifera*) infestations, as observed throughout the visit, that shade-out native species but provide little bank protection or stability from their foliage or roots, and then die back in the winter leaving no protection at all. Balsam pulling is undertaken actively throughout the site and does keep it under control in that area but will be an ongoing task unless the u/s source can be eradicated.

The Brook has been subjected to straightening in the past and now flows absolutely straight for c.200m u/s of the site (Fig. 1). This has implications for flow conveyance, geomorphology and ecology of that area and the subject area of the visit d/s, which has also been dredged and straightened to a lesser extent.


Figure 1. Looking u/s of the site at a heavily straightened (c.200m) section.

Watercourse straightening has been undertaken all-over the country to increase flow conveyance and land drainage. At a basic level, this shortens the watercourse (leaving less habitat area), increasing the gradient and accelerating flow velocities. This reduces the capability of the channel to retain sediment in flood flows and creates a simplified geomorphology, lacking in deeper pools that would otherwise accommodate dissipation of flow energy as well as provide important habitat. Lowering of the bed almost invariably also occurs (as an intended or unintended consequence), further exacerbating the issues by constraining high flows between the banks and thus preventing flow energy from dissipating out onto the floodplain.

The result of these factors is that the increased flow volumes and velocities are transported downstream, generally increasing flood risk but also creating a higher energy watercourse than would naturally occur. This in turn creates a more hostile environment for aquatic life and increases the potential for bank erosion. Conversely, sympathetic management of the site and woodland could greatly assist in the creation of habitat, recovery of the brook channel, and would potentially attenuate flood flows.

Just as straightened, simplified watercourses have low habitat value and increase flood risk, complex, meandering watercourses offer more diverse, higher quality habitat and can slow flows. Allowing water onto the floodplain in low flood-risk areas, helps to attenuate peak flows and reduces flooding in higher-risk areas downstream (flooding is a known issue on Eller Brook d/s of the site).

If allowed time and opportunity to adjust, the actual intervention required to achieve a more natural channel is minimal. Figure 2, taken within the woodland site, demonstrates the point perfectly. Over time, trees will naturally grow out into the channel, or fall across it as they move out towards the light or erosion undermines them. Left within the channel, they create increased roughness that slows water transit d/s, helping high flows to spill out of the low-flow channel and onto the floodplain. The restriction within the low-flow channel also diverts and focusses flows, driving them into the bed and banks and developing beneficial in-channel features.

Flows diverted downwards create pools and develop and maintain areas of greater water depth, while flows deflected laterally develop meanders, creating and maintaining natural channel sinuosity. Both diversify and enhance the in-channel habitat quality and further contribute to slowing the transit of water and reducing flood risk downstream.

The management aspirations for the site (conservation) and lack of infrastructure nearby means that the above benefits can be realised without increasing flood risk or negatively impacting upon adjacent land use – it's a win-win situation. As the land at both sides of the brook are under the same ownership and management regime, any bank erosion as a result of channel adjustment to a more natural sinuous course is of little concern. Regular (natural) flow inundation will also diversify adjacent terrestrial habitats within the woodland.

If slowing the flows within the wood slightly increases water levels u/s on the straightened section, this will only be for a very limited time during peak flows and will have no long-term impact upon that land, except possibly even improving it's fertility through the fine sediment and nutrients deposited there. As the land appears to be un-improved grassland, without livestock, no negative implications are expected.

Moving downstream into the woodland, further examples of the benefits of retaining woody material within the channel can be seen. Old, decaying logs provide valuable food and cover for invertebrates but also facilitate the retention and sorting of valuable gravel and cobble substrate that provides further invertebrate refugia and salmonid spawning habitat (Fig. 3).

Figure 2. Fallen trees that increase habitat diversity and provide attenuation of flood flows.

Figure 3. Valuable dead wood within the channel. Note: fine sediments are retained u/s and d/s within the lee of the log (blue oval); flows are focussed between the log and the tree roots on the LB (right of shot) to scour and maintain deeper pool habitat (yellow oval); and the scoured material which is deposited a short distance d/s is maintained relatively free from fine sediments by the accelerated flows (red circle). However, even in these optimal conditions, the excess sediment inputs from u/s cannot be fully mitigated.

In the areas of higher quality gravel and cobble riffle habitat, stone turning revealed the Brook to be supporting freshwater sponge (Fig. 4) and a range of invertebrate species including freshwater shrimp (*Gammarus pulex*), various cased (Trichoptera) and caseless caddis (*Hydropsyche* sp.)(Fig.s 5a.&b. and 6), along with several mayfly species (Ephemeroptera).

Figure 4. A freshwater sponge inhabiting an area of coarser cobble substrate.

Figure 5a & b. Freshwater shrimp and caseless caddis, respectively.

Historically, large woody material was removed from the channel of the Brook by the Environment Agency and its predecessors to reduce the perceived flood risk, to the detriment of vital diverse habitats (like those shown in Figure 6) and natural channel recovery processes.

Figure 6. The type of high quality, natural channel pinch-points that are created by dead and fallen trees – these greatly diversify habitat and create and maintain vital pool features.

In recent years, funding cuts and a realisation that natural woody material within the channel is important in actually reducing flood risk d/s and providing habitat has led to cessation of tree removals at the site. Flood risk is often perceived in the potential for fallen trees being transported downstream and blocking bridges etc; in actual fact, the presence of large trees adjacent to the Brook and within and/or across its channel actually provide natural tree catchers (particularly live willow which will often root to both banks e.g. Fig. 7), preventing the downstream transport of material that does enter the channel. The wooded nature of the adjacent land also prevents that material from being transported far on any out-of-bank flows.

Over time, the straightened channel sections within the woodland are developing natural features, with deposition of substrate diversifying the course and flow patterns and facilitating greater morphological diversity (Fig.s 8 & 9). If left to develop further, these features, aided by natural inputs of woody material (trees etc.) will facilitate the lateral erosion required to further restore the Brook's channel (Fig. 10). For this reason, woody material in the channel and material with the potential to enter the channel should be left. A recent unnecessary attempt to remove a fallen oak tree (*Quercus robur*) from the channel would have only served to denude the habitat and inhibit natural channel adjustment (Fig. 9) - this tree should be left.

Figure 7. A perfect example of how fallen trees provide natural tree-catchers that prevent the downstream transport of other fallen trees. In this case, the willow that has fallen across the channel is likely to have rooted back into the bank opposite via adventitious roots from its branches, thereby completely securing it and any other woody material in place

Figure 8. Valuable gravel bar features with a collapsed tree in the background. The tree is currently helping to create and maintain deeper pool habitat around its root-ball and will, over time, facilitate further lateral scour into the RB (right of shot), creating a much needed increase to the channel sinuosity.

Figure 9. Woody material and deposition are part of the channel naturally adjusting and recovering from the past straightening work. Removing fallen trees from the channel (red circle) will only inhibit the recovery.

Figure 10. Many trees along the bank have the potential to fall into the channel over time (red ovals) as lateral bank erosion destabilises them. These trees should be left as they will provide valuable in-channel structure and the void created in the banks as they fall is also likely to accelerate channel adjustment/recovery.

In some circumstances, it may be beneficial to deliberately introduce material to the channel, particularly live willow which can be laid (as you would hawthorn in a hedge). A few of the natural willows along the banks could be laid to simply lower them into the channel, and willows planted from whips (several throughout the site) could be laid over along the bank to provide a valuable increase in low-level cover and future woody material input to the river (Fig. 12).

Figure 12. Some of the planted willow whips could be laid down into the channel to increase in-channel cover and structure.

4.0 Recommendations

4.1 Tree Work

4.1.1 Promote low and trailing tree cover and in-channel structure

Removal of overhanging or fallen/collapsed bankside trees should be stopped in favour of promoting those features which will undoubtedly increase the habitat quality of the Brook. Allowing the habitat of the woodland and Brook to naturally develop, with minimal intervention is likely to be the optimal course of action as most of the beneficial processes will occur anyway in the absence of maintenance. However, there are a few actions that could be undertaken to assist the natural processes.

4.1.1.1 Planting

Where erosion is deemed less beneficial (e.g. areas of channel that are already sinuous) or where there is a lack of low-level and trailing cover along the river margins, planting could be undertaken. Most native deciduous species would be beneficial but willow is by far the easiest to transplant and manipulate.

The quickest and easiest way of planting is with willow, by pushing short sections of willow whip into the ground. This can be undertaken at any time of the year, but will have the greatest success if undertaken within the dormant season, shortly before spring growth begins (ideally late Jan-March). Whips should be planted into soft, moist earth/sediment (ideally around the waterline) so that there is a greater length within the ground (c. two-thirds) than out of it, to minimise the distance that water has to be transported up the stem; 30-60cm of whip protruding from the ground is sufficient but the more material than can be driven into the ground the better as this will form a substantial base and root structure from which to grow.

Planting the whips on an angle, pointing d/s and over the water will encourage beneficial low-level growth and ease the transportation of water up the stem, reducing the risk of it drying out and dying; this will also reduce their susceptibility to wash-out in high flows. Small, bushier shrub species (like goat willow *Salix caprea*) are often best but most willow can be used in this way.

4.1.1.2 Laying/hinging

Where established trees of suitable, pliable species and size are present (willow, hazel, elm etc.), they can be laid d/s into or over the channel at 30^{O} or less to the bankline. Laying trees simply replicates the natural process observed throughout the reach where tree limbs grow out over the river and sag or collapse into the watercourse.

Laying involves cutting part-way through the stem/trunk while downward pressure is applied to the stem (like laying a hawthorn hedge), until it can be forced over into the channel (Photos 13 & 14). The depth of the cut should be limited only to that which is required to bend the limb over, as this will retain maximum strength in the hinge and maintain the health of the tree/shrub. For small shrubs, cutting the stem at a very shallow angle then putting an axe blade into the cut and hitting it with a hammer can also work effectively.

Photograph 13. Hinged willow.

Photograph 14. Hinged hazel.

4.2 Pollution prevention/water quality

Fine sediment input is a noteworthy problem on the Brook and will undoubtedly be limiting the quality of the aquatic habitat provided and the diversity of species it supports. Identifying the sources upstream would be beneficial and it is worth contacting Ribble Rivers Trust (RRT) - [http://ribbletrust.org.uk -](http://ribbletrust.org.uk) to identify whether they have any ongoing projects that may be able to assist. RRT is a large charitable organisation undertaking a wide range of river improvement and habitat schemes on the Ribble catchment which include riverside buffer fencing and management of non-native invasive species, among many other aspects.

It may also be worth undertaking a regular programme of river fly monitoring (www.riverflies.org/rp-riverfly-monitoring-initiative) at the site. This would give a good overview of the health of the aquatic habitats by the species it supports but, over time, can also show longer-term trends in the water quality and help to identify pollution incidents if the presence of certain regularly recorded species diminishes.

4.3 Invasive Non-native species

Within the site, management of balsam is controlling its prevalence; however, addressing the issue from its source is the only truly sustainable solution long-term. This is again something Ribble Rivers Trust may be able to assist with, possibly through volunteer 'balsam bashing' days or simply by providing contacts for other action groups in the catchment who may be willing to assist.

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 only to reasonable travel and subsistence costs of the WTT Officer. This service is in high demand and so may not always be possible.

6.0 Further information

In addition to this report, 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/index

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/product/rivers-working-wild-trout-dvd-0

or by calling the WTT office on 02392 570985.

7.0 Acknowledgement

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8.0 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.