Project Proposal

River Derwent (Upper catchment)

Cumbria

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Undertaken by Gareth Pedley

1.0 Introduction

This report is the output of site visits undertaken to several sites around the upper Derwent and Bassenthwaite Lake tributaries by Gareth Pedley of the Wild Trout Trust, accompanied by Mike Farrell of the Environment Agency (EA). The visit was requested by Mike to provide advice on options for habitat improvements that could be undertaken as practical demonstration workshops with local anglers and community groups.

Normal convention is applied with respect to bank identification, i.e. the banks are designated left bank (LB) or right bank (RB) while looking downstream. For simplicity references to upstream and downstream are often abbreviated to u/s and d/s, respectively.

2.0 Background and rationale

Due to high rainfall, steep fell catchments and limited areas of workable valley bottom land and a lack of understanding of riverine processes, most of the watercourses within the Lake District area have historically been dredged and realigned from their original course. Consequently, many watercourses are now much straighter than they naturally should be and, through ongoing dredging activity, often display excessive capacity channels with a corresponding significant lack of habitat diversity.

In most cases, dredging simply creates over-capacity channels and a consequent uniformity of depth and substrate composition across the bed as the flow energy is dissipated over a greater cross-section. The dissipation of flow energy, in turn, facilitating greatly increased sediment deposition in those areas, ultimately creating a loss of channel capacity and an ongoing requirement for further dredging. The short-term, interruption of gravel supply downstream can, however, have implications for the channel morphology, habitat quality and bank stability. Cutting off gravel supply to downstream reaches tends to increase erosion, destabilise banks and reduce habitat structural variety.

With realisation of the implications of dredging and the ongoing maintenance burden it creates, along with major negative impact this work can have upon sediment transport and ecology, consenting of non-essential dredging work should now not be occurring. Other options such as allowing more natural channels to develop that can actually convey sediments, the addition of subsidy payments to landowners to allow some flood inundation of land and

more sympathetic management of riverside land should instead be employed.

Unfortunately, this is still not always the case and inappropriate consented and un-consented dredging work is still often undertaken, reinstating the negative impacts upon the watercourses where it is undertaken and preventing the natural recovery process that would otherwise occur.

This report seeks to identify areas of the upper Derwent catchment where habitat improvements can be undertaken without undue impacts upon adjacent land use and demonstrate how creation of a dynamic channel with natural proportions can actually convey sediments more effectively than over-capacity dredged sections. The techniques employed will aim to reinstate/enhance the formation of natural pool and riffle features, which does involve the retention of gravel and cobbles material, but to create a more natural thalweg and low-flow channel that will more actively convey sediments supplied from upstream and provide a self-cleansing channel.

In some cases, reinstatement of these natural processes can also be employed to reduce flood risk downstream, whereby peak flows are temporarily allowed out onto the floodplain in the upper catchment, to attenuate the peak flows. Such events are short-lived (just around the peak flow) and are part of the natural river process, naturally providing nutrients to the topsoil of the floodplain. Owing to the short duration of those events, they need not have a major impact upon land use but can significantly reduce the flow volumes and velocities supplied downstream and prevent/reduce the flooding of more sensitive infrastructure d/s.

3.0 Proposals

Three sites were visited on the upper River Derwent catchment, Newlands Beck, the Derwent d/s of Grange Bridge and the Derwent u/s of Grange Bride. Each section will be covered separately.

3.1 Newlands Beck (NY 23622 25404 - NY 22836 26335)

Newlands Beck is a prime example of a watercourse that has begun to recover post-dredging, greatly assisted by the winter floods of 2016 which mobilised large volumes of sediment and facilitated the formation of beneficial features within the channel. However, towards the upstream end of the reach visited, long straight heavily dredged sections of channel remain (Fig 1) where, owing to the extent of past channel modification, they will take longer to recover.

Figure 1. Even after the major floods of 2016, long sections of the more heavily dredged sections remain over capacity and lacking in discrete morphological features and habitat. These will require further large movements of sediment from upstream to reinstate a more natural channel morphology, a process that could take many more years but could be assisted with in-channel work.

In other areas, even where the Beck still follows an un-natural straightened course, the formation of valuable depositional features within the channel has begun to reinstate a more natural channel morphology. This has re-energising flows within the channel making it more capable of conveying any further sediments supplied from upstream. In-channel structure such as bankside willows greatly assist the deposition of sediments, creating diffusion of flow energy in the margins of the watercourse where bed material supplied from u/s will form bars. These in-turn narrow areas of the channel, focussing flows to provide scour that will maintain sediment transport, maintaining water depth and conveyance of flows. The scoured substrate is then deposited further d/s as sorted materials that provide high quality invertebrate and salmonid spawning habitat (Figs 2 & 3).

It should be considered that the d/s movement of river bed material is a completely natural and unavoidable process. The important thing is to allow a natural channel to develop that will be able to facilitate that process and convey sediment, rather than dredging to maintain an over capacity channel that simply retains the material.

Figure 2. The d/s end of an over-capacity channel section (red ellipse) where deposition (green ellipse) has helped to narrow the channel, accelerating flow velocities that will maintain the water depth (blue ellipse) and clean and sort gravels.

Figure 3. More valuable depositional features that provide invertebrate and salmonid spawning habitat. It is also vital to retain the overhanging and trailing cover that provides habitat features and assist in retaining areas of gravel while facilitating scour in other areas.

Unfortunately, 400m of re-dredging has already been consented in the exact area that the recovery is taking place, despite it lying within a Site of Special Scientific Interest (SSSI) Impact Risk Zone. This work will remove many valuable features but it has to be hoped that this does not completely destroy the recovered habitat; habitat that otherwise greatly improves the area for Biodiversity Action Plan (BAP) species such as salmon (*Salmo salar*), lamprey (*Lampetra planeri* & *fluviatilis*) and brown trout (*Salmo trutta*). Following the dredging, it will be a case of reassessing the remaining habitat to ascertain what mitigation can be achieved.

Figure 4, shows an area further d/s of where fewer bankside trees and trailing branches are available to encourage the formation of in-channel features. Here, pinning live willow into the channel could to kick-start the process. This technique would be used to slow flows within alternate river margins to facilitate gravel deposition there. The deposition will then focus flows from one bank to the other which would maintain depth in those areas. It is important to ensure that sufficient distance is allowed between any installed structures so that mid-channel features are also allowed to form.

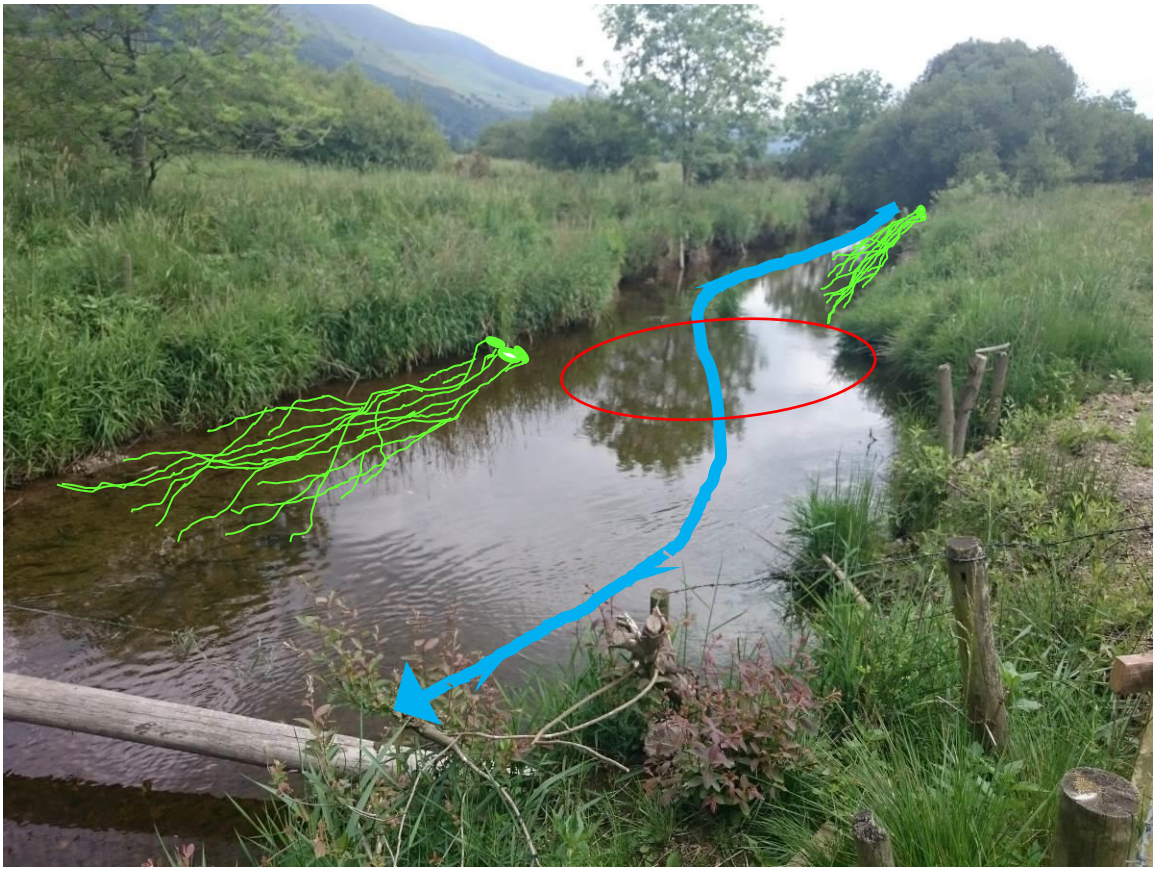

Figure 4. A section of channel that is already beginning to recover some sinuosity within its straightened course. The strategic placement of in-channel structure (willow) could help to accentuate the channel sinuosity, with the narrowing and focussing of the flow created also helping to maintain areas of deeper channel and sediment conveyance, ensuring to allow enough space for shallower gravelly areas (red ellipse).

Immediately d/s, one of the few sharp bends in the section presents an ideal opportunity to enhance deeper pool habitat and naturally protect and reinforce the bank on the outside bend (Fig 5). The remains of old bank revetment can be employed as additional anchor points around which willow can be secured, reducing the requirement for additional posts. In conjunction, planting of willow whips into the bank around the brash will further consolidate the banks (Fig 6). As with u/s, the straight, over-capacity section of channel flowing out of the bend can be enhanced with the installation of alternate willow branches/shrubs (Fig 7) and in other areas, where bankside willows are present, the same effect can be employed by laying occasional trees into the channel.

Figure 5. One of the few sharp bends provides valuable deep-water habitat that could be enhanced with the installation of brash and willow planting that would also consolidate the bank.

Figure 6. The remains of old bank protection can be employed alongside new anchor points (posts and wire) to secure the structure.

Figure 6. Brash pinned in alternate margins can again be employed to diversify flows, accentuate the sinuosity of the channel and encourage the formation of in-channel features.

Figure 13. Laid willow.

It is proposed that the same techniques describes for the locations above are employed at other locations throughout the beck between u/s limit NY 23622 25404 and d/s limit NY 22796 26422, along with any areas that are degraded by the proposed dredging works. The work can be undertaken as workshops involving local community groups and angling clubs to demonstrate techniques and improve skills, and to increase understanding of river processes.

3.2 Derwent d/s Grange Bridge to Derwentwater (NY 25365 17477 - NY 26269 19119)

The Derwent u/s of Derwentwater has been degraded in a similar manner to Newlands Beck, through straightening and dredging; correspondingly, the same techniques are proposed to assist in the recovery of the channel and improvement of habitat quality. Figure 7, a short distance d/s of Grange Bridge, demonstrates the morphological and habitat improvements that have occurred where sediment supplied from u/s is allowed to deposit and form bars with the channel. This has created a narrow, low-flow channel that then maintains water depth and sediment conveyance in mid-low flows and a wider high-flow channel with greater capacity to convey flood water. Such areas should simply be allowed to recover over time. Natural stabilisation of the bars will facilitate scouring of the bed and maintenance of sediment conveyance.

Figure 7. Improving habitat as a result of beneficial gravel and cobble deposition following high flows.

As with sites on Newlands Beck, there are still many areas of over-capacity channel have yet to recover owing to the scale of the channel dredging and realignment that was historically undertaken. In these areas willow laying and/or brash installation would also be highly beneficial. If undertaken at strategic sites throughout this reach (NY 25365 17477 - NY 26269 19119) the work could greatly assist the natural recovery of the channel and improve habitats, including fish cover, thereby providing additional fish holding capacity and greater protection from predators.

Figure 8. Typical over-capacity section lacking in morphological diversity on the upper Derwent.

Figure 9. An example of a mature willow that could easily be laid into the channel to provide habitat structure in the short-term and encourage deposition of valuable morphological features in the long-term.

Figure 10. Smaller willows that could be laid for demonstration/participation during a workshop.

At NY 25763 18133, a large tree has become undermined and fallen into the river and now provides valuable in-channel woody material (Fig 11). The de-stabilisation of the bank has, however, lead to bank erosion and it is proposed that brash mattress type green revetment is employed to stabilise the bank (Fig 12). Aside from the habitat benefits provided by the brash and reinstatement of trees along that area of bank, the greater bank protection should reduce the landowner's requirement to remove the in-channel tree. With the bank stabilised it would be worthwhile reinstating buffer fencing along that section of river bank (and any others not currently protected from stock grazing). This will be important in maintaining bank stability through the root mass of the buffer strip vegetation, encourage tree regeneration and help prevent further tree loss. It is far easier to control bank erosion if the trees are retained in the first place, rather than having to reinstate trees and stabilise a bank afterwards.

The technique to address the bank erosion would be simply to drive posts into the bank (live willow where available) to be used as anchor points for brash (including live willow) that will dissipate flow energy and encourage sediment deposition. The brash would be secured with wire and batons (longer branches secured over the top of the brash). Fencing would then be required to allow a greater diversity of vegetation to develop along the bank.

Figure 11. Before work.

Figure 12. Proposed work, with brash secured into the erosion void to protect the bank.

In some areas the tree lined nature of the banks and inputs of woody material to the channel have already led to habitat improvements, providing in-channel cover and the formation of depositional features with the margins (Fig 13).

Figure 13. A healthy level of light and shade, beneficial depositional features (yellow ellipse) and high quality in-channel structure (blue ellipse) all add to the quality of habitat.

At NY 25679 18286, a small dredged and straightened tributary enters the Derwent and presents an ideal opportunity for improving salmonid spawning and juvenile habitat, particularly for smaller resident trout. The straightened channel would ideally be realigned back to a more natural sinuous channel to fully restore the habitat there but, in the short-term, habitat can be improved by tree planting along the banks to improve cover and provide in-channel structure (Fig 14). The tributary already contains high quality spawning substrate but lacks depth and vital scouring flows to sort the substrate in many places (Fig 15).

Figure 14. A small straightened tributary with potential for enhancement as a spawning and juvenile area.

Figure 15. The tributary already provides the potential of high quality substrate if in-channel structure can be introduced to assist with sorting of the material and creation of deeper parr-holding areas.

Towards Derwentwater, dredging of the channel and the impounding effect of the lake reduce the habitat quality for rheophilic species but areas of low and trailing cover coupled with in-channel structure from trees that have toppled into the channel provide some par and adult salmonid habitat (Figs 16 & 17). The undercutting and loss of trees could well have been exacerbated by past dredging that will have interrupted sediment supply throughout the river, leading long-lasting impacts. To protect the areas of bank from which the trees have been lost (Fig 17), willow stake/whip planting would be beneficial to help consolidate the soil and provide replacement bankside cover.

Figure 16. High quality trailing cover provided by willow, although the lack of flow velocity and diversity resulting from past dredging and impoundment from the lake limit its benefit.

Figure 17. Trees that have become undermined and toppled into the river provide valuable habitat and should be retained in place. Willow planting along the adjacent bank would help to reinstate marginal cover and stabilise the bank.

3.3 Derwent u/s Grange Bridge (NY 25272 17351 - NY 25053 16567)

The situation in the section inspected u/s of Grange Bridge is very similar to that d/s, with over-capacity channel sections resulting from past dredging and realignment work (Fig 18). As such, the prescription for those sections is the same, employing laid willows and pinned woody material within the river margins to encourage flow diversity and facilitate gravel deposition in the margins that will help create a more sinuous, self-cleansing channel (Fig 19). In some areas where pliable, layable species are not present, it may also be beneficial to employ tree kicker techniques which would be used in the same way as laid willows, to create structure within the river margin and improve the channel morphology (Fig 20).

Figure 18. An example of the kind of over-capacity channel and poor quality habitat that could be greatly enhanced through additional in-channel structure.

Figure 19. Over-capacity channel that could be very easily enhanced by laying the bankside willow into the river margin.

Figure 20. An example of a tree kicker fixing. This technique could be used to secure less pliable species that cannot be laid, with the tree cut at a, low coppice and then cable to its own trunk.

Figure 21. Beneficial deposition around a tree kicker.

4.0 Making it happen

The works proposed will be carried out as practical workshops led by the WTT and in conjunction with Mike Farrell. The work habitat work will not only lead to improvements to the geomorphology of the watercourses but also serve as training days in which local stakeholders (including the National Trust, West Cumbria Rivers Trust, local angling clubs and any other interested parties) can learn some of the quick and easy techniques that can be employed to improve geomorphological diversity and habitat quality on degraded channels.

In addition, 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 stocks 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.

5.0 Acknowledgement

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6.0 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 comments made in this report.