WILD TROUT TRUST

Pullaugh Burn and Nick Burn

Galloway Fisheries Trust

(Galloway)

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Summary

- A general lack of spawning substrate was observed within the Pullaugh Burn owing to a relatively steep gradient, areas of straightening and an interrupted sediment supply at the Pullaugh Inlet Hydropower installation.

- Access for fish through Pullaugh Burn is naturally inhibited by small bedrock waterfalls, the first just upstream of the River Dee. However, the major fish passage issue is the Pullaugh Inlet Hydropower Dam which limits the accessible length of the burn for migratory salmonids.

- Juvenile salmonids were observed in generally low numbers throughout the section downstream of the hydropower dam.

- Coniferous planting too close to Pullaugh Burn limits habitat quality and productivity in specific areas and in most areas, deciduous planting alongside the burn would be beneficial.

- Nick Burn appears to suffer from extremes of flow, with very low flow observed during the visit but signs of high peak flows limiting gravel retention in most areas barring the 200m upstream of the Dee. The burn has clearly been realigned in many areas creating a straighter, steeper and more uniform channel than would naturally occur, with a lack of deeper pool habitat.

- Conifer regeneration is becoming an issue in areas alongside both burns, particularly with progression up Nick Burn - to a point that the burn becomes almost completely enclosed.

- In general, the promotion of more deciduous trees and greater diversity of herbaceous vegetation could increase productivity along the burns.

1. Introduction

On the 23nd June 2021, the Wild Trout Trust visited two tributaries of the Black Water of Dee to advise on potential in-channel habitat works that could be undertaken to improve salmonid densities. The visit was accompanied by Galloway Fisheries Trust (GFT).

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 to identify specific locations.

2. Background

Watercourse	Pullaugh Burn
Waterbody Name	Pullaugh Burn
Waterbody ID	10551
Operational Catchment	Black Water of Dee (Pullaugh Burn to Loch Ken)
Management Catchment	River Dee (Solway)
River Basin District	Solway Tweed
Current Ecological Quality	Moderate
U/S Grid Ref inspected	NX5442274140
D/S Grid Ref inspected	NX5494974885
Length of river inspected (KM)	1.2

This work was requested by GFT to support their Black Water of Dee Restoration Project which was initiated after low densities of trout and salmon were identified in key areas. The project has already helped to deliver flow improvements to the Pullaugh Burn and the Black Water of Dee, with further gravel reintroduction work planned to restore potential spawning habitat (see - https://gallowayfisheriestrust.org/black-water-of-dee-restoration-project.php). This report will assess habitat on the Pullaugh and Nick Burns and identify simple in-channel habitat enhancements to complement other aspects of the project, identifying a range of interventions that could be undertaken as workshops using volunteers.

Water Framework Directive data from 2014 (and future predictions) for the Pullaugh Burn are shown below, but they appear overly optimistic for what was then a flow-depleted waterbody, where access for migratory fish is (was?) prevented to the majority (approximately 3.3km of 4.3km) the water body's length. The lower 1.2km of the burn also has restricted access owing to a natural barrier, although that is clearly passable at certain flows.

Condition in 2014 and future objectives				
	2014	2021	2027	Long Term
Overall	Moderate	Moderate	Moderate	Good
Access for fish migration	High	High	High	High
Water flows and levels	Good	Good	Good	Good
Physical condition	Good	Good	Good	Good
Freedom from invasive species	High	High	High	High
Water quality	Moderate	Moderate	Moderate	Good

www.sepa.org.uk/data-visualisation/water-environment-hub

Nick Burn, the other watercourse visited, is too small to feature as a WFD waterbody and is simply a tributary within the Black Water of Dee (Pullaugh Burn to Loch Ken) waterbody.

3. Habitat Assessment

3.1. Pullaugh Burn

Figure 1. At the upstream limit inspected, the watercourse emerges from the Pullaugh Burn Inlet hydropower scheme (NX5442274140). The associated dam appeared to form the effective u/s limit for migratory fish passage on the burn. The structure also creates a barrier to sediment transport downstream. Any substrate removed from the intake area (which it is assumed will be required to maintain the installation) should be relocated to the d/s side of the dam, not removed permanently from the system.

Figure 2. D/s of the dam, the burn has been straightened and flows within a steepened and incised channel. The substrate is correspondingly even coarser than would naturally occur on this relatively high gradient upland burn – an issue exacerbated by interruption of sediment supply at the dam. Consequently, the substrate comprised predominantly large cobble and boulder.

Figure 3. The straightened channel would benefit from re-meandering but, in the absence of such intervention, a lone conifer offers a potential anchor point from which to secure woody material within the channel (NX5441674199). Willows in this area (background) could also be laid into the channel which would create additional low/overhanging/trailing cover and increase flow diversity - also forcing peak flow out of channel to reduce peak flow velocities and hopefully aid gravel retention.

Figure 4. A small section of high-flow/paleochannel on the RB side offers a potential to encourage channel sinuosity if more flow can be diverted there from the current course (NX5440174260). A combination of redistributing bed materials (by hand/with hand tools) and increasing roughness within the current channel with coarse woody material could help to facilitate this. Also note conifer planting too close to the LB.

Figure 5. Low willow shrub (left of shot) developing valuable low cover over a pool. A fallen, dead conifer creates an example of larger-scale interventions that could be initiated on the burn by felling larger trees across the channel to increase the availability of coarse woody material and encourage peak flow out of bank to reduce over-scouring of the bed. This could be a particularly valuable action in the straighter/straightened sections to also encourage lateral scour and activate paleo/high-flow channels.

Figure 6. The occurrence of native deciduous trees along the watercourse is scarcer than desirable, but occasional bankside willow shrubs improve habitat and provide an opportunity to lay stems into the channel to increase cover. This could increase structure within the channel, breaking up the uniformity of the pool and offering natural fish refuge from predators and high flow. This minimal intervention work could be undertaken through a river-walk workshop, utilising only small hand tools.

Figure 7. The main burn and side channels bifurcate at numerous points, creating a range of watercourse sizes and presenting good potential for salmonids from parr stage upward. Juvenile habitat could be improved further if the occurrence of native bankside trees and structure can be increased. Removing bankside conifers and replacing them with natural deciduous species would naturally boost/restore productivity; invertebrates falling from trees would increase the availability of food items and leaf litter would provide additional nutrients, in addition to food and shelter for invertebrates.

Figure 8. For most of its length, the gradient of the burn remains steep, so the gravel and cobble required for salmonid spawning is scarce. Areas of straightening exacerbate this issue by further increasing the gradient. This section of straight channel appeared to have been prioritised by diverting flow at the upstream end with large boulders (NX5450974646), at the expense of a more sinuous LB channel - reducing channel length and habitat quality. Such areas, combined with interruption of sediment supply from upstream and the lack of access to smaller headwater burns, will undoubtedly contribute to reduced fish recruitment and lower overall fish densities than should naturally occur.

Figure 9. In the ~500m upstream of the River Dee, burn gradient reduces and areas of wider channel retain more gravel and cobble substrate. This would be the priority area for installing woody material, where the greatest benefits could be achieved (NX5460474795 - NX5490874835). Conifer planting, too close to the watercourse, has also denuded riparian habitat quality on the LB around NX5460474795.

Figure 10. Clear-felling a short distance downstream could form the start of habitat improvements if complemented with replanting of a deciduous buffer (NX547087483). Installing several discrete in-channel structures could reduce peak flow velocities and improve flow diversity while still retaining areas of the existing channel capacity d/s of each structure to facilitate increased deposition. Strategically placing the structures on inside bends would also accentuate channel sinuosity (e.g. right of shot) and encourage lateral scour/increased meandering over time.

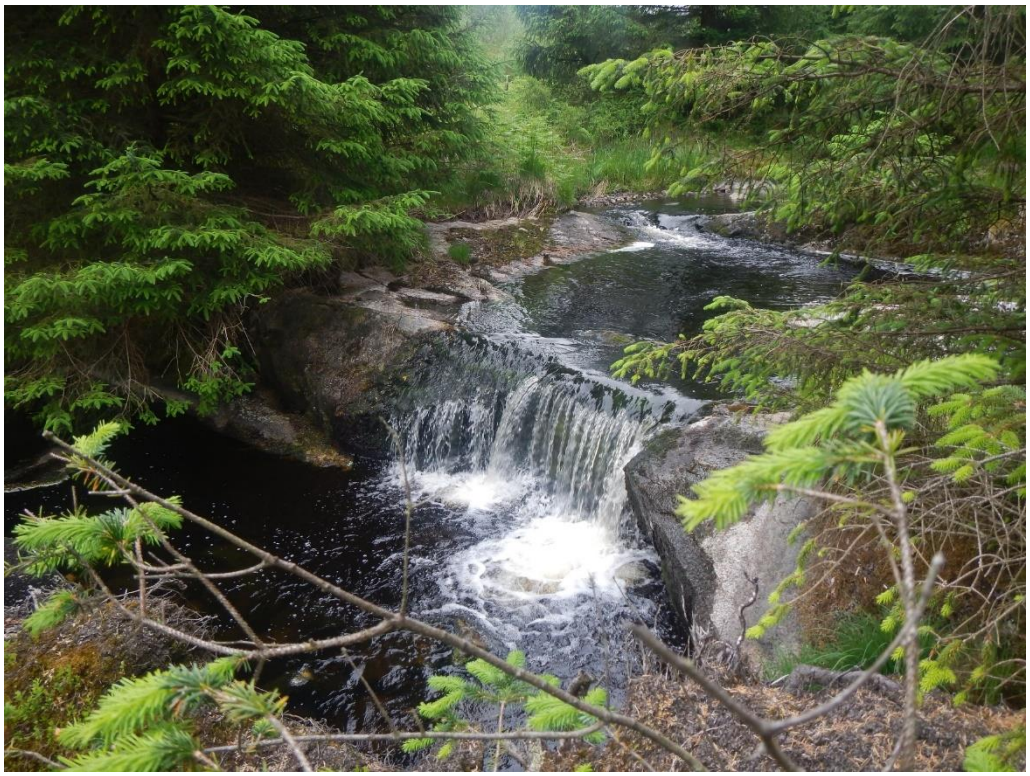

Figure 11. A natural bedrock outcrop just u/s from the confluence with the Dee limits fish access to the burn and is only passable in medium-high flow (NX5493074877). Other natural falls within the reach up to the hydro dam naturally reduce fish access but are not complete barriers. Juvenile salmonids were observed throughout the burn but appeared to be in lower numbers than would be expected - with the lack of gravel and inhibited access to tributaries further up the catchment, this is not surprising.

3.2. Nick Burn

Figure 12. At the u/s limit inspected (NX5785572972), Nick Burn had minimal flow and was enclosed by a combination of deciduous and, predominantly, conifer trees. The burn u/s was poorly accessible and appeared to enter dense coniferous plantation a short distance further u/s.

Figure 13. While the area is currently overshaded, removal of the coniferous contingent along the burn could reinstate a far more natural light:shade regime. Some of this work could potentially be undertaken by physically able members of a workshop (under supervision), with the arisings potentially used as material for in-channel woody material.

Figure 14. The minimal flow of the burn belies the clear influence of peak flows on the substrate composition, with gravel only retained in sheltered areas, behind in-channel structure like large boulders. The heavy coniferous forestry u/s (and associated drainage) will certainly contribute to more extreme flow events. Note how the immobile larger cobble and boulder substrate is covered in moss, indicating it is stable, while the smaller, more mobile gravels are largely absent from the main areas of the channel.

Figure 15. Looking u/s at the particularly straight channel with very low flow, and a severe lack of finer substrate.

Figure 16. Several other sections are also overly straight, exacerbating the extreme flow issues with a corresponding lack of depth variability and pools. This is almost certainly a result of past channel dredging/realignment for drainage.

Figure 17. In the ~200m u/s of the Dee, the burn gradient reduces, and the gravel component of the substrate increases.

Figure 18. From the confluence with White Burn (NX5781573361), the flow and channel size increase, further contributing to the retention of gravel. This general area should therefore be the priority for any habitat work as there is currently the greatest potential for improvement. Increasing the availability of structure within the channel through the installation of woody material and bankside tree planting would be the quickest and easiest way to capitalise upon the improved flow and channel characteristics.

4. Recommendations

4.1. Habitat improvements

5. Pullaugh Burn

Recommended actions:

- Install several woody material habitat structures in the ~500m u/s of the Dee to improve gravel sorting and retention (NX5460474795 - NX5490874835)
- Lay specific willows/willow limbs into the channel throughout, potentially as part of a river-walk workshop
- Ensure that any gravel removed around the Pullaugh Inlet Hydropower Dam during site maintenance is returned immediately downstream to avoid complete gravel depletion of the lower burn

Longer-term, reconnecting side channels that have been bypassed by straightening and installing much larger woody material into the channel would greatly assist natural recovery. Large conifers could be felled over the channel or ideally even pushed/pulled (excavator or winch) over, with their rootball attached (replicating the occurrence in Figure 5 and Figure 23). The benefit of retaining the rootball is that it acts as an anchor and

greatly reduces the potential of the material moving far, even in high flows. With a more naturally dynamic and sinuous channel, there would also be merit in seeking additional gravel augmentation downstream of the Pullaugh Inlet Hydropower Dam.

6. Nick Burn

Recommended actions:

- Install woody material habitat structures in the ~200m u/s of the Dee to improve gravel sorting and retention
- Remove of conifer regeneration along the burn
- Seek clearance alongside the upper burn to facilitate creation of an appropriate deciduous buffer

6.1.1. Trees

6.1.1.1. Laying

Where multiple trees of suitable, pliable species are present, the occasional trunk can be cut and used to create a habitat enhancement feature, with no significant detriment to the overall habitat. This could entail partially cutting through the trunk, so that it remains attached and can be laid into or along the channel (Figure 19). The technique works particularly well with willow, elm and hazel, but only willow will thrive with its canopy partially submerged.

Figure 19. Willow hinged into the river margin to increase cover and structure. The method involves cutting part way through the stem, quickly through the first two thirds, then continuing until it collapses down over the river. The depth of the cut should be limited to only that which is required to bend the stem over, as this will maintain maximum size and strength of the hinge and the health of the tree/shrub.

6.1.1.2. Planting

Tree planting using a range of native species, would be beneficial throughout both burns. To complement the planting of rooted saplings, strategic willow shrubs could be planted as whips/cuttings to rapidly create cover and provide material for laying into the channel in years to come.

The easiest way of establishing willow is by pushing short sections of freshly cut whip into areas of wet ground, ideally around the waterline where plenty of moisture is available. 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). However, it can be successful throughout the year, particularly in damp areas. This kind of planting should be undertaken sparingly to maintain species diversity and avoid overpopulation by willows as the process is usually quite successful.

Whips should be planted so that the majority ($\sim^2/_3$) is within the ground, to minimise the distance that water has to be transported up the stem. Planting on a shallow d/s angle eases water transport within the developing shrub (which starts without any root) and reduces the potential to catch flood debris and be ripped out. Leaving 300-400mm of whip protruding from the ground is usually 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 use whips with excessive amounts of foliage, which greatly increases the rate of transpiration and can lead to the whip dehydrating before the supporting root system can develop.

6.1.1.3. Lodged woody material

Many deciduous tree species can be felled to create a coppice, encouraging low-level regrowth from the stool; in the process, providing material that can be lodged between two or more standing trunks (Figure 20), or hung over another tree if a 'V' branch is available (Figure 21). Again, this should be undertaken very sparingly, to avoid loss of habitat and the creation of a maintenance burden as the bushy regrowth ensues. Owing to the lack of mature trees/shrubs in many areas, this method is limited, but there are areas in which it could be utilised to good effect. These methods can be a great means of kick-starting changes within a channel but have a limited life before they degrade and where possible, willow laying is often a more sustainable technique.

Figure 20. A flow deflector, securely but naturally lodged in place between two upright trees (red circle). The technique can utilise a single pole (primarily to increase scour) or a branched limb (to create greater flow dissipation or diversity, depending upon how it is used). The elevated butt end (bank end) reduces the potential detrimental bank score usually associated with d/s deflectors as a through-flow is maintained along the bank.

Figure 21. Medium-sized, lodged woody material, securely anchored naturally by the 'V' of the branches against an upright tree.

6.1.1.1. Pinned and engineered woody material

Channel sinuosity can be enhanced through the installation of brash, tree canopies or entire shrubs to the river margin (Figure 22). This technique would be applicable throughout the Pullaugh Burn and Nick Burns where bankside trees and shrubs are absent, but particularly in the downstream sections where gradient decreases. Large trees secured across the channel could also provide a range of benefits from dissipation of peak flow energy through to localised bed scour. The example in Figure 23 is natural, but when engineering such structure, it is generally beneficial to lay them at a more acute angle to the channel, reducing the chances of complete blockage and encouraging lateral erosion to increase channel sinuosity.

Figure 22 Alder top (canopy) pinned into the river margin to increase flow sinuosity and focus scour on the opposite side of the channel, while also providing valuable in-channel cover and encouraging deposition/substrate retention downstream.

Figure 23. A natural logjam. Engineered stable log jams could be re-created on the burns with large timber sourced from riparian conifers. This would help encourage peak flows out of bank and create additional areas of scour and deposition. When engineering such structures, it is usually better to align them at a more acute angle, to reduce the potential for total blockage (debris will accumulate at the d/s end, not right across the channel) and promote lateral scour.

7. Further assistance

The WTT may be able to offer further assistance such as:

- WTT Practical Visit
    - Where recipients require assistance to carry out the improvements highlighted in an advisory report, there is the possibility of WTT staff conducting a practical visit or workshop. This would consist of 1-3 days' work, with a WTT Conservation Officer(s) teaming up with interested parties to demonstrate habitat enhancement methods (e.g. tree kickers, lodged woody material, willow laying etc.).
        - In this instance, it is anticipated that the work on Pullaugh could form two sessions (and possibly a larger-scale project). The first session being a river walk during which any easy-win willow laying could be undertaken with light pruning saws. The second would be a more static workshop to install woody material to the lower reaches of the burn(s). This would still utilise relatively light tools, but may require a chainsaw to source materials, a post driver and a small range of other basic tools and materials.

Permission and licences would need to be sought from Forestry and Land Scotland and the Scottish Environment Protection Agency by Galloway Fisheries Trust.

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.

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