Walkover Assessment

River Wear – Upper Weardale Angling Association

July 2014

Contents

1.0 Introduction

This report is the output of a site visit undertaken by Gareth Pedley of the Wild Trout Trust to Upper Weardale Angling Association waters on the River Wear on the 16th July, 2014. Comments in this report are based on observations on the days of the site visit and discussions with Tony Ward (Upper Weardale Angling Association).

The association controls over 13km (8 miles) of water on the upper River Wear, extending from Wearhead, downstream to Westgate. The waters are fished by around 12 members, in addition to visiting anglers, who can purchase daily or weekly tickets. Fishing is permitted by fly and worm until 1st September, after which spinning is also allowed. No stocking has been undertaken in recent years.

The aims of the visit and this report are to:

- assess habitat within the identified sections
- identify priority areas for in-stream habitat improvements;
- provide sufficient details to support a Flood Defence Consent application to the Environment Agency
- produce an approximate bill of quantities for the proposed works.

The section of river visited starts around Wearhead (NY 85745 39662) on the Wear and Burnhope Burn (NY 85495 39501) and extends downstream (d/s), almost to the lower extent of the Association's water (NGR: NY 90413 37952). Normal convention is applied throughout the report with respect to bank identification, i.e. the banks are designated left hand bank (LHB) or right hand bank (RHB) whilst looking downstream.

2.0 Killhope and Burnhope Burns

The upper River Wear forms as the confluence of Burnhope and Killhope Burns, with c. 2/3 of the flow on the day of the visit supplied by Killhope Burn. Around Warhead, Killhope Burn is heavily influenced by the limestone geology of the area, with large areas of bedrock exposed on the riverbed (Figure 2). Such surface exposures of bedrock mean that the typical gravel, cobble and boulder substrate of the middle River Wear is absent in many areas, particularly where the channel is confined and increased bed scouring occurs. The bedrock escarpments also create significant natural obstacles to fish passage.

Fissures and gullies in the bedrock provide some holding water for larger fish, but in general, the habitat is better suited to smaller juvenile fish in most areas, other than the occasional deeper pool. This makes fish populations in this area heavily reliant upon smaller tributaries for spawning, where gravel and cobble substrate is retained.

Figure 1. Looking upstream from the upper bridge in Wearhead. Bedrock is a significant feature of the riverbed in this area

The Burnhope Burn, while also having bedrock outcrops and a significant bedrock waterfall that is an obstacle to fish passage, does have a higher portion of gravel, cobble and boulder substrate. This provides good opportunities for spawning on the burn and good quality juvenile habitat amongst the boulders, particularly for larger migratory salmonids (Figure 2). There is also a good ratio of aerial cover along the channel, creating a mosaic of dappled shade and light. This cover provides protection and security to fish populations in the burn, particularly where bankside willows (*Salix* spp.*)* trail into the water (Fig. 3), while also helping to mitigate high summer water temperatures.

Figure 2. Areas of gravel, cobble and boulder substrate on the Burnhope Burn provide good spawning and juvenile habitat for migratory salmonids

Figure 3. High quality pool habitat created by deep water and overhanging/trailing willow cover

Fish passage is also an issue on the Burnhope Burn, due to both the bedrock outcrops and the presence of several weirs. A waterfall that would ordinarily pose a significant barrier to migration is actually mitigated by the presence of a gauging weir (Fig. 4), just downstream. The downstream proximity of the weir increases the water depth slightly improving passage over the waterfall.

Further downstream, a pipe crossing does pose a negative impact upon fish passage, creating a vertical obstacle in an area of shallow water (Fig. 5); while not impassable, this structure is likely to inhibit fish movements in low water and interrupt the dispersal of juvenile salmonids through the burn.

The main issue on Burnhope Burn, however, is undoubtedly the presence of Burnhope Reservoir and dam c. 1km upstream from the confluence. This impacts upon water levels, substrate transport and fish passage on the burn resulting in reduced potential as a spawning tributary. EA electrofishing data do does suggest, however, that - where fish do have access - they are in good densities.

Figure 4. Gauging weir that may actually improve fish passage over the natural waterfall a short distance upstream

Figure 5. Pipe crossing that is likely to inhibit fish passage through the Burnhope Burn

3.0 **Upper Section –** Wearhead to Carway Bank

Downstream of the Killhope and Burnhope Burn confluence, substrate on the main River Wear comprises a higher proportion of gravel, cobble and boulders; making it more suitable for spawning and allowing the formation of some deeper pools through scour and deposition (Fig. 6). The increased diversity in the substrate of this area is also likely to support a greater diversity of aquatic invertebrates. Bedrock continues to be an influential feature throughout this length, but is well complimented by other, mobile, substrata; making high quality juvenile salmonid habitat. Deeper pool/glide areas created where the substrate has been scoured, particularly upstream of bedrock ledges, provide some deeper holding water for adult trout (Fig. 7 & 8); these areas are further enhanced by valuable low-level aerial cover from bankside trees. The bedrock outcrops also pose a natural barrier to fish migration and may cause fluctuations in fish populations in certain years when water levels will limit access upstream at vital times.

Figure 6. Main River Wear d/s of the Killhope and Burnhope Burn confluence. Mobile substrate allows scour and deposition to form deeper pool areas and valuable spawning areas

Figure 7. Bedrock shelves and gravel depositions combine to provide high quality riffle, deeper pool and glide habitat, complemented by low-level aerial cover along the margins. Good salmonid habitat!

Figure 8. Bedrock pools and ledges provide good habitat but pose a significant obstacle to fish passage in certain flows

4.0 **Middle Section -** Pipe Crossing to Burnfoot Ford

At the upstream end of the middle section visited, the footings of a large pipe crossing pose significant obstacle to fish passage (Fig. 9: NGR - NY 87953 38353). The concrete apron creates a very shallow film of water over a steep gradient. While this is likely to be passable by larger migratory fish in higher flows, it is a significant obstacle to resident trout, particularly juveniles. The crossing also retains a significant volume of bed material upstream, although it appears that it has now filled the void behind the structure and sediment supply past the structure has been partially reinstated.

Figure 9. Pipe crossing, the footings of which pose a significant barrier to fish passage and retain large volumes of bed material upstream

Immediately downstream, another pipe crossing in the riverbed also poses a barrier to fish movement (Fig. 10). This is not such an obstruction but certainly likely to cause delays to fish movements. In assessing the issue posed by this structure it must be considered that it is probably slightly elevating the tail-water level below the footings upstream and so removal may not be beneficial (even if possible) without addressing the larger issue upstream.

Figure 10. Concrete protection around a smaller pipe crossing which also poses an obstacle to fish passage

Downstream of the structures, several areas of high quality habitat were observed. Pool, glide and riffle features scoured along a well-vegetated stable bank provide good flow velocities and maintain valuable deeper water areas. The scouring effect also maintains clean, well-sorted gravels that provide high-quality spawning substrate. Abundant aerial cover provided by the bankside trees further enhances habitat, providing ideal conditions for resident adult trout, and holding water for migratory fish moving through (Fig. 11). The mobile nature of the substrate in this area, which has formed numerous gravel bars, also enhances river habitat in dry conditions, creating a narrower, low flow channel where water depth and velocity are maintained.

Figure 11. High quality pool habitat with low-level aerial cover

In stark contrast to the high quality habitat in un-grazed sections, further downstream horses have grazed both banks and the loss of structure within the banks has led to significant erosion and loss of land (Fig. 12: NGR - NY8831938320). In the absence of stable banks to force scour into the riverbed, the channel is eroding laterally. This has led to the river becoming over-wide, which dissipates the flow energy and leads to increased sediment deposition. The presence of a bar in the centre of the channel is a good indication of this as, being over-wide; the bar has persisted long enough for grass to colonise. In a narrower, self-maintaining channel, the sediment deposits would be re-mobilised on higher flows, preventing vegetation from becoming established.

Figure 12. Horse grazing has led to loss of trees and vegetation and facilitated excessive bank erosion

Figure 13. Heavy grazing/browsing of bankside willows, like this, is likely to lead to loss of the trees and further destabilisation of the bank. It also significantly denudes the bankline of valuable cover habitat

Away from the influence of grazing, river habitat quality returns to a high status, with a pool, glide and riffle sequence, complimented by low overhanging branches and cobble and boulder substrate. Upland rivers such as the Wear are heavily reliant upon flow diversity and tree canopy for cover, as unlike more lowland systems, aquatic weed and associated habitat is often absent. Within the short section depicted in Figure 14, habitat suitable for all trout life-stages is present.

Figure 14. Low Aerial cover over diverse flows and varied water depths provides high quality trout habitat

Harthope Burn joins the River Wear in this section. While the Burn was not inspected in detail, conditions appeared to provide good habitat for spawning and juvenile salmonids. The bed comprised predominantly cobble and boulder, with pockets of smaller gravels. Discussion with Tony Ward confirmed the burn was utilised as a spawning tributary, with large migratory salmonids observed towards the back end of the year. A potential issue for fish passage is present, created by the A689 bridge footings (Fig. 15). The footings are relatively low, but the shallow water d/s and over the apron combined with the vertical concrete step will inhibit access to the burn and prevent optimal habitat utilisation by dispersing juveniles.

Figure 15. The A689 bridge footings on Harthope Burn create an obstacle to fish passage

5.0 Lower Section – Burnfoot Ford to Lower limit

Below Burnfoot Ford, bedrock again becomes a significant influence on the river, with the channel confined between bedrock in several places and the bed comprising exposed bedrock in many areas. This often prevents bed scour and creates a shallow channel, but can also provide deeper pool habitat. Aerial cover remains of a high quality and small bankside willow shrubs create valuable structure within the margins (Fig. 16). Some areas of gravel and cobble substrate are also present, primarily in wider areas or around bends, where the energy of high flows is dissipated (Fig. 17). Throughout the upper Wear, bedrock creates challenges to fish passage; however, they rarely have as severe an impact as man-made angular structures, such as fords or weirs. In most cases, bedrock is uneven, with fissures and wetted channels running through that fish can exploit to pass the obstacle in various flows.

Figure 16. Valuable deeper pool habitat below a bedrock obstruction. Note the multiple options for fish passage that will be available at a range of flows

Figure 17. Good quality pool habitat over exposed limestone bedrock. Bankside willows provide valuable structure and cover

Downstream of the A689 gravel and cobbles become more prominent, and correspondingly, areas of salmon spawning have been noted (T. Ward, pers. com., 16th July 2014). The choice of this area for spawning is probably influenced by the presence of cover provided by the over-hanging trees, which although bare in winter, will provide more security than a completely exposed area (Fig. 18).

The first significant accumulations of algae were noted at this location (NY 89665 38007). This is likely to be caused by an influx of nutrients, possibly by a missed drain connection or septic tank discharge. Although no obvious source could be identified, any increased nutrient supply to what is a relatively oligotrophic system is likely to have a negative impact, particularly in low summer flows.

Figure 18. Stable, well-vegetated RB with good shade and cover over the LB under which salmon are reported to spawn

In a heavily tree lined section downstream, tree roots have reinforced the bank and forced bed scour to create another sizeable pool, providing high quality habitat for adult trout (Fig. 19). The tail of the pool then runs out in to more good quality juvenile habitat through cobble and boulder substrate (Fig. 20).

Figure 19. Good adult trout holding water

Figure 20. High quality juvenile salmonid habitat

A small tributary enters the river in this section and while on the day of the visit there was very little water, it is understood that large sea trout often ascend the watercourse at spawning time (T. Ward, Pers. com., 16th July 2014). This highlights the importance of even the smallest burns for fry and juvenile production, particularly for resident trout and sea trout, when the main river substrate is very coarse.

Figure 21. A very small burn, but a valuable spawning tributary

Towards the downstream extent of Upper Weardale AC waters, a concrete based ford creates another impediment to fish passage (Fig. 22). The structure does not raise the bed significantly, but the fast shallow water flowing over a very flat, uniform base is likely to be an obstacle to all fish in low flows and a particular issue for juvenile salmonids.

Figure 22. Concrete ford, which poses an obstacle to fish passage

6.0 Recommendations

In general, habitat along Upper Weardale AC waters was of a high standard, with good potential habitat for all stages of the salmonid lifecycle. Even though water levels were particularly low on the day of the visit, the naturally active riverbed was capable of channelling the river down a narrower low-flow channel that appeared to be functioning well. There are, however, a few areas that could be improved, which are detailed below.

6.1 Barriers to fish movement

Detailed within this report are four potential barriers:

Pipe crossing on Burnhope Burn (Fig. 5: NGR - NY8574639472**)**

The ideal solution for this structure would be to ascertain whether the pipe is still in use. If not, the structure should be removed. If the pipe is in use, it may be worth installing an easement at the location to aid fish passage; however, in most cases it is likely to be costly to create something that will stay in place, and bearing in mind the other barriers in close proximity, it may be worth focussing efforts and money elsewhere. It was hard to see from the RB, but a pipe appeared to be discharging water on the downstream side of the pipe crossing; it may also be that this structure could be adapted to assist fish passage.

Large Pipe crossing on the main Wear (Fig. 9: NGR - NY 87954 38352**)**

This is the largest and most significant issue for fish passage noted during the walkover and is something that should certainly be improved upon. The ideal solution here would be for the central portion of the footings to be modified into a clear-span across the channel. A clear-span would not only provide uninterrupted fish passage but also allow free movement of bed material from upstream and allow pool formation within the impounded reach.

In the interim, installation of baffles or a baulk on the apron of the structure could be used as a short-term improvement. The Environment Agency's low cost baffle design could be employed here, or simply a series of juxtaposed upstream battens/baffles (oak or concrete), in a similar layout to those used by Chester Le Street AC on several culverts to increase depth in the central channel (Fig. 22). This would still leave a step, which could be improved by installation of a pre-formed adherent nappe.

Alternatively, the incorporation of a concreted rock-ramp type pass (similar to that already installed by Wear Rivers Trust on the River Deerness; Fig. 23) could be created, whereby cobbles and boulders are concreted onto the face of the apron to create hydraulic roughness and divert flows into a narrower, deeper channel.

These options are the type of considerations that the local Environment Agency should be looking to encourage through the Flood Defence Consenting process whenever any work is undertaken to the structure. It may be that, with some additional fish passage funding, the work could be incorporated into the maintenance. It is also possible that Upper Weardale AC or Wear Rivers Trust could undertake, or manage the work if funding could be secured.

Figure 22. Juxtaposed concreted baffles in a culvert on the Cong Burn

Figure 23. Concreted rock ramp on the River Deerness

Bed level pipe crossing (Fig. 10: NGR - NY8801238314**)**

Just downstream of the large pipe crossing, the bed level pipe crossing also poses an obstacle to fish passage. If the pipe is disused, the ideal solution would be to remove it, but it should also be noted that the bed check it creates does reduce the step up onto the footings upstream, so it should only be removed in conjunction with work on the large pipe crossing.

Alternatively, a wooden or concrete baulk could be installed across the structure to increase water depth, shallow the gradient and assist fish passage (Fig. 24).

Figure 24. Possible baulk installation on pipe crossing

A689 Bridge footings on the Harthope Burn (Fig. 15)

As with the pipe crossing on the main river, this issue could be improved with the use of juxtaposed baffles across the apron of the bridge footings and the addition of an adherent nappe on the step (Fig. 22: NGR - NY 88444 37976). Alternatively, a large cobble and boulder (or faced concrete) rock ramp could be employed to smooth the step and increase water level over the apron (Fig. 23).

6.2 Fencing

The other major issue noted during the walkover was excessive grazing of the bank d/s of the large pipe crossing (NGR: NY 88089 38286 - NY 88490 38252). It is strongly recommended that this area is buffer fenced to prevent livestock access to the river in this area on both banks to increase vegetation coverage and slow the rate of erosion. If stock were excluded it would then become beneficial to plant the banks with willow and other hardy deciduous species, to help bind the banks together. The deep roots of larger shrubs and trees act as an effective reinforcement to bank integrity – a stark contrast to the fragile soil structure beneath the shallow root systems of turf vegetation.

It may be possible for the Environment Agency or Wear Rivers Trust to access funding for riverside fencing, and possibly provide technical support for such a project. It is recommended that Upper Weardale AC liaise with those organisations to ascertain what is possible. It may also be that the landowners/tenants could be encouraged into the scheme if they were aware that grazing is causing the issue.

Magic Maps (http://www.magic.gov.uk/MagicMap.aspx) also suggests that the area in question is in a Higher Level Stewardship target area. While this scheme has ended, it is highly likely that the replacement scheme (due in 2015) will seek similar goals and this could include buffer fencing of the watercourse. That being the case, additional money may be available towards the fencing (e.g. 50% of fencing cost in the last scheme). For this reason, it may also be worth contacting the local Natural England HLS advisor.

6.3 Tree management

6.3.1 Planting

If buffer fencing were undertaken, planting would also be beneficial in the areas with bank stability issues. The cheapest and most effective method to plant willow is by pushing short sections of willow (cut from willow whips/branches of a living tree/shrub – first ensuring that they are not providing cover or habitat over the river channel) into the ground around the water line and in areas where bank stabilisation is required. Greatest effect will be achieved in damp areas where they will get plenty of water. This work can be undertaken at any time of the year, but will have the greatest success if undertaken within the dormant season, ideally late Jan-early March shortly before spring growth (can be done Nov-March).

The technique is to drive 400-600mm (c.16-24”) sections of willow into soft, wet earth/sediment, leaving only 1/3 of the whip protruding from the ground to minimise

the distance that water has to be transported up the stem. Any diameter of branch can be used for this but 10-30mm (1/2 - 1”) is ideal.

It is preferable to source willow locally, from adjacent areas of the bank. This ensures that it is suited to the conditions and helps to avoid potential issues with transportation of non-native species. Both crack willow and osier willow can be found locally on the riverbanks and each can be used to good effect, but the smaller shrub varieties are usually the best for these habitat enhancements, as they remain small and low to the water and require less maintenance.

6.3.2 Tree maintenance

In addition to any planting, it is recommended that no maintenance is undertaken to the bankside trees, as occurs by well-meaning anglers on many waters. Upper Weardale AC waters currently support some of the best examples of overhanging and trailing tree cover on the River, primarily due to the lack of historic maintenance. Such high quality habitat should be preserved.

6.4 Nutrient input

Although the input source was not identified, algal growth on the riverbed downstream of the A689 road crossing (NY 89665 38007), Nr Daddry Shield, suggests that excess nutrients are getting into the River Wear. It is recommended that club members are vigilant to this and keep an eye out for any potential sources. If a suspected source is located near this location, or anywhere else on the river, the issue should be reported to the Environment Agency’s Incident Hotline on - 0800 80 70 60.

7.0 Summary recommended actions

Action	Location	Number of structures	Materials	Cost (£)
Easement/removal of Barriers	Pipe crossing on Burnhope Burn (Fig. 5: NGR - NY8574639472) Large Pipe crossing on the main Wear (Fig. 9: NGR - NY8795438352 Bed level pipe crossing (Fig. 10: NGR - NY8801238314) A689 Bridge footings on the Harthope Burn (Fig. 15: NGR - NY8844437976)	4	Removal by hand Removal by excavator 3 pairs of oak beams 3000mm x 200 x 200 (+ fixings) 2 oak beams 3000mm x 200 x 200 (+ fixings) 4 x oak beams 3000mm x 200 x 200 (+ fixings)	Volunteer time c.£300/day x 1 day £1000 + £45 + volunteer time £300 + £15 volunteer time £600 + £30 volunteer time
Fencing – Contact Environment Agency, Wear Rivers Trust and Natural England	NY 88089 38286 to NY 88490 38252		£5-7/metre @ c.350m (LB) and c.150m (RB)	£2500-3500 – could be halved if undertaken as part of a stewardship scheme
Tree planting	Liberally along all open sections	whips/pegs distributed within buffer fenced area	Willow sourced from riverbank – taking care not to remove overhanging/trailing branches	Just time to cut the branches and plant them
Tree Maintenance	Do not undertake tree maintenance			
Be vigilant for possible pollution sources	Throughout Upper Weardale AC waters (particularly d/s Daddry Shield)			Just volunteer time
TOTAL				**£0 – £2290 + volunteers** **Plus possible £3500 (with full fencing cost)**

8.0 Disclaimer

This report is produced for guidance and not for specific advice; 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.