# Fenay Beck Part I: Advisory Visit for Calder & Colne Rivers Trust

**Report by the Wild Trout Trust Arising from Visit on 20/06/2017**

# 1 Introduction
A site visit and habitat appraisal was carried out by Dr. Paul Gaskell of the Wild Trout Trust (WTT), at the request of Judith Milner of Calder and Colne Rivers Trust, to explore the potential for habitat improvement on the middle and lower reaches of the Fenay Beck between Fenay Bridge and Dalton, near Huddersfield. The Water Framework Directive (WFD) identifies the Fenay Beck as an individual waterbody via the code **GB104027063340**. It is formally classed as a "Heavily Modified Waterbody" under WFD.

The most recent (2016, Cycle 2) WFD assessments conducted to assess the ecological status of this waterbody show that, while "good" for overall Chemical quality, the current overall waterbody rating is "moderate". Biological elements such as fish and invertebrates and the physico-chemical element phosphate are notable factors in the classification (all "moderate"). In contrast, dissolved oxygen, pH, ammonia and biochemical oxygen demand are all rated as "high". One surprising scoring, given the impoundments and impacts of channel realignments observed during the visit, is the "supports good" rating given to the hydromorphological supporting elements of the Fenay Beck.

Superficial geology in the catchment consists of alluvium, clay, silt and sand associated with the river corridor within a broader context of glacial sand and gravel. Bedrock is Pennine Lower Coal Measures Formation and South Wales Lower Coal Measures Formation which is described as "interbedded grey mudstone, siltstone and pale grey sandstone, commonly with mudstones containing marine fossils in the lower part, and more numerous and thicker coal seams in the upper part" according to the British Geological Survey.

Throughout this Advisory Visit report, normal convention is followed with respect to bank identification i.e. banks are designated Left Bank (LB) or Right Bank (RB) whilst looking downstream. The features noted during the visit are reported here in an upstream to downstream sequence. The survey was conducted between limits at National Grid Reference **SE 18160 15535** (upstream limit) and **SE 17072 17408** (downstream limit). Consequently, approximately 2.6 km of river habitat was assessed.

The findings in this report are a combination of information supplied by Judith Milner prior-to, during and following the visit, along with discussions held on the day with local stakeholders and local residents that we encountered. The WTT is very grateful for the access granted to the river through private homes and gardens while undertaking this visit.

# 2 Habitat Assessment notes

At the upstream limit of the visited reach, a significant impounding structure and physical barrier to fish-movement was noted (Fig.1). The Beck at this location was significantly altered in the past in order to divert the river under the main A629 road in a manner intended to reduce flooding for a housing development. Although exact dates for this work were not known by local residents, estimations of around 60 years ago were common.

**Figure 1: Degrading weir structure at the upstream limit of the site visit for this report at SE 18160 15535. Now a maintenance liability and health and safety issue.**

The impounding structure is showing signs of damage, and the gabion walls on the LB appear to be relatively recent repair works. Although the effects of barriers like this on famous migratory species such as salmon are relatively widely known, there are many further under-appreciated impacts.

In terms of simple barriers to migration – there are many species that rely on moving between different habitats in order to complete their lifecycles. Less obvious are the impacts of splitting what would otherwise be much larger breeding population into multiple, smaller populations. This restricts the free exchange of genetic material between larger pools of breeding individuals and potentially increases the likelihood of random shifts in population genetics.

Random, rather than adaptive, genetic shifts reduce the chances of long-term persistence of particular breeding populations. Those random shifts become more likely as population size reduces (i.e. the more barriers that prevent free gene-flow there are in a given river system). Similarly, the inhibited *downstream* movement of juvenile fish resulting from barriers (and the negligible influence of most fish-passes to help that downstream movement) are also under-appreciated.

More immediate and wide-ranging impacts of impoundments arise from the combination of habitat simplification (slow flows and uniform sediment deposition/retention across the full channel width) and the interruption of downstream river-bed material transport. While it is easy to imagine the impacts of preventing breeding fish movements upstream, the importance of downstream movement of the raw materials that actually create habitat are often overlooked.

Physically-varied habitat is crucial to the development of diverse biological communities. In other words, an increase in the number of different habitat niches provides opportunities for a wider range of species. Variation in the mobilisation and deposition of riverbed material is one, highly-important, source of that physical variation. Without the “conveyor-belt” supply of material eroded from headwaters and riverbanks, crucial habitat features (such as breeding grounds for gravel-spawning species) are prevented from forming. Similarly, if features remain unchanged over prolonged periods of time, communities become dominated by a limited number of species that are specifically adapted to those uniform conditions. In other words, physical habitat needs to vary both over in a spatial sense and also over the passage of time.

Weirs dramatically reduce spatial and temporal variation in habitat. By reducing the ability of rivers to transport riverbed material downstream – a river loses its capacity to both create habitat and for that habitat to change over time. Holding water back behind weirs and straightening channels (e.g. Fig. 2) also removes important variation in water depth and velocity – both of which are further important sources of habitat diversification.

Here, the potential to remove or reduce the impounding effect of the specific weir at SE 18160 15535 needs to be assessed while taking account of any potential impacts of such works on the safety of the road bridge and the flood risk to housing. Those considerations are worth investigating, since the impact of this, and other, impoundments is substantial. It is particularly important to note that the addition of an engineered fish-pass to this structure would *not* address the majority of the most significant impacts. Liasing with Environment Agency Fisheries and Biodiversity staff who would process any application by the Highways Agency/any other responsible body to repair bridge footings could be invaluable. The consenting officer(s) for such works could insist that the repaired bridge becomes a stand-alone structure that is not reliant on the weir.

**Figure 2: Even downstream of the weir pictured in Fig. 1, the artificial straightening of the channel has made the habitat highly uniform (photographed at SE18152 15573)**

Away from the influence of impoundments – and with at least one naturalised bank – the channel is able to develop some more varied habitat (Fig. 3). However it is important to note the potential impacts on water quality arising from the operation of the Combined Sewer Outfall (CSO) at this location (SE 1803815905). At the same time, the operation of this CSO is clearly responsible for producing localised bed-scour (and associated depth-variation) – but the quality of the water producing that effect is of critical importance. Calder and Colne Rivers Trust are coordinating an impressive Riverfly Monitoring programme to precisely understand such impacts. This is excellent practice.

**Figure 3: Substrate deposition of a variety of particle sizes (from fines to small boulders) creates more varied habitat in the absence of impoundment. However, local concerns about low summer flows are justified.**

Local residents voiced concern during the visit over the perceived shallowness of the channel – compounded by the low flow levels this year. Attempts to dig a deeper channel would, however, not result in lasting changes to the depth profile. Any channels that were dug would rapidly fill in with substrate. A channel's depth and cross-sectional profile emerge automatically through a combination of bed-slope, discharge and the relative erodibility of channel banks and bed. Overlain on that broad-scale process, there are localised impacts of structures that promote localised scour of the channel. The critical thing to note is that those channel dimensions (when not artificially set and maintained) are critically determined by the discharge (flow regime) of the river. That is a combination of the rainfall and characteristics of the catchment (i.e. primarily land-use and topography). The only way to increase depth at a specific location for a given discharge and substrate is to locally narrow the channel in the absence of impounded flow. As long as the materials used to produce that narrowed channel are less erodible than the riverbed, bed-scour would produce a localised increase in depth. Obviously, undertaking such work directly adjacent to housing and associated gardens would be subject to close scrutiny under flood risk management considerations. Perhaps the more important issue is to understand the management of land and water in the upper catchment and any diversion or storage of water undertaken by the local utilities company.

Clearly the major cause of low flows this year is the extremely low rainfall. This will always result in areas of very shallow water – which is understandably worrying. Even so, in the context of climate-change and an increasing societal pressure on water-resources, it is important to understand implications and the most effective potential responses. For instance, the presence of mature tree canopy (e.g. Fig. 3) is incredibly important to these peat-stained rivers with dark riverbeds. In hot, low-flow conditions dark riverbeds heat up rapidly and to a greater extent than rivers with paler substrate, leading to increased rates of water evaporation. Riparian (riverside) woodland is, consequently extremely important to these upland, rain-fed rivers. That importance is increased by the vital inputs of deciduous leaf-litter each autumn. Since peaty rivers have much lower "in-stream" productivity compared to limestone or chalk-geology rivers, much of the aquatic food-chain is supported by energy captured from sunlight in the leaves of riparian woodland canopies. The general rule is that lower productivity rivers with less potential for aquatic weed growth will benefit from higher levels of shading.

As with anything in nature, you can always have too much of a good thing – and 100% shade throughout a river's entire course produces its own kind of uniform habitat with poorer biodiversity. Therefore, a useful rule of thumb is to aim for "patchy" canopy cover – in some areas very dense and shaded and in others dappled light and shade; with a small amount of open water as well.

One aspect of desirable variation that was generally lacking throughout the visited reach was low, partially-submerged vegetation cover. With notable exceptions, where good examples exist, there are many opportunities to increase the proportion of that specific habitat (which is vital for over-winter survival of juvenile fish in the face of predation and spate flows). Although this lack of low-level cover could be partially attributable to competitively-dominant invasive plant species (notably Himalayan Balsam and Japanese Knotweed); the infestation appeared to be at a relatively early/low-level stage (Fig. 4). Finding areas where groups are willing to control Himalayan Balsam would be an extremely valuable undertaking. This will still be the case even if full control cannot, yet, be systematically attempted from the upstream source down. Several factors support a case for local control – firstly the relative ease of Balsam control via hand-pulling (particularly at the current modest densities). Secondly, the finding that even local "patch" control of invasive species provides a significant benefit to overall biodiversity at the landscape scale (more info here:

http://www.sciencecodex.com/global_plant_diversity_hinges_on_local_battles_against_invasive_species-105553).

As with all urban rivers, the impacts of people living close to the Fenay Beck are important to consider; whether through the previously-noted infrastructure such as CSOs, water-management structures or by direct human activity. One issue noted by local stakeholders was cultural differences in customs for food disposal, with specific local communities being accustomed to disposing of significant quantities of food scraps into rivers. Calder and Colne Rivers Trust may be well-placed in their local communities to undertake engagement and education activities to reduce that specific form of fly tipping. As well as water-quality issues, such practices are noted to boost local populations of rats.

**Figure 4: General lack of low-level vegetation cover, but also relatively limited Himalayan Balsam infestation. Efforts to reduce and control such infestations at this stage would be very worthwhile – especially if action would otherwise be delayed until catchment-scale control could be undertaken.**

Extensive channel modification (again somewhat calling into question the relevance of the hydromorphological designation under the WFD assessment) was evident around SE 17960 16052. Here, turf-mowing, artificial channel walls and impoundments all combine to reduce habitat quality (Fig. 5). A large signal crayfish was observed in this reach – an invasive species that reduces invertebrate diversity and can also destabilise riverbanks when they occur in high densities. Signal crayfish can also be infected with a fungal plague to which they are resistant – but which is fatal to native white-clawed crayfish. However, at this time, there are no established means of reducing the densities of non-native crayfish – with conflicting accounts on the effects of trapping being reported to date. Taking actions to minimise the chances of transferring crayfish plague between watercourses is probably the most useful policy in response to known infestations.

Extensive drying of kit between uses and disinfection with compounds such as Virkon may have some protective effect. However, the potential for the plague fungus to survive such treatments means that the only genuinely safe course of action would be to reserve particular kit for specific watercourses.

**Figure 5: Good overhanging cover, but a lack of unmanaged marginal vegetation and heavily modified channel with significant impoundment limits the habitat diversity in this reach.**

A series of four unusual weirs with a shallow v-shaped profile have been constructed to produce a stepped section of channel between SE 17960 16052 to SE 17941 16086 (Fig. 6)

**Figure 6: Four V-shaped weirs in a stepped series photographed at SE17960 16052.**

Although the purpose of this series of structures is unknown, it results in poor, impounded habitat for a significant distance upstream. In addition, these structures pose a serious obstacle for fish passage through the series of stepped pools. It is possible that part of their function is to hold back a head of water in the upstream section and also to act as bed-check weirs installed to cope with the increased gradient following the straightening of the channel. Channels become effectively steeper when straightened, because they undergo the same vertical change over a shorter distance compared to the longer, meandering channel.

With sufficient investment, it may be possible to design and install a suitable combination of channel features that could make this stepped section into more valuable, connected habitat. The requirement for topographical surveying and flow/geomorphological modelling prior to undertaking what would be a relatively technical construction phase means that this would not be a low cost, low-tech solution. However, it is always crucial to pursue a genuinely meaningful solution rather than an option that falsely indicates that real progress has been made.

Directly below that series of four weirs there is some of the best habitat encountered during the visit (Fig. 7).

**Figure 7: Although some Himalayan balsam is present, the greater variety of substrate size and more meandering planform produces much better habitat than the impounded reaches upstream. However, the interception of gravels by that series of impounding structures is, nevertheless, a negative impact on these downstream reaches too.**

Adult trout habitat in the form of lateral scour pools (i.e. deeper water forming on the outside of bends in the river) was evident in spite of historic channel modifications. For instance, the deposition of material on the inside of a bend –

and increased depth on the outside – can be seen in Fig. 8 taken at SE177707 16662.

**Figure 8: Some valuable habitat features have formed where a lack of impoundment allows the river to deposit and scour material according to the variation of current velocity over its full cross-section. Again, a general lack of lower, overhanging or partly-submerged cover is a notable opportunity for improvement – and its absence may be due to current maintenance programmes.**

The channel splits into two, widely separated branches (and the beck becomes locally-known as Roundwood Beck) in the area of Dalton Green. One site at SE17595 16748 was monitored by the author and Martin Smith (and family) during the Calder and Colne Rivers Trust "bioblitz" event (Fig. 9).

**Figure 9: One of the "Bioblitz" sampling points on Roundwood Beck. Extremely high numbers of blue-winged olive nymphs and several flat-bodied mayfly species – along with "true" mayflies of the Ephemeridae were recorded. The presence of many invertebrate taxa that are known to be sensitive to organic pollution indicates high water quality at this point.**

Further downstream (SE17434 17168), within a reach impounded and extensively straightened, invertebrate diversity was extremely low – with only chironomid (non-biting midge) larvae recorded in our sample. As well as the obvious habitat impacts, this result is a cause for concern on the basis of water quality. Those comparative samples are part of the great value of the Riverfly Monitoring that Calder & Colne Rivers Trust are carrying out and act as a trigger for further investigations.

Impacts of impoundment and engineered channels are common within these middle reaches of the Fenay Beck (e.g. Figs. 10 and 11).

**Figure 10: Photo off Albany Bridge at SE 17506 17167. Uniform straightened channel with silt deposition over the full cross-section (due to impounded flow and artificially large, uniform cross-sectional area. More balsam evident here than in some other visited reaches.**

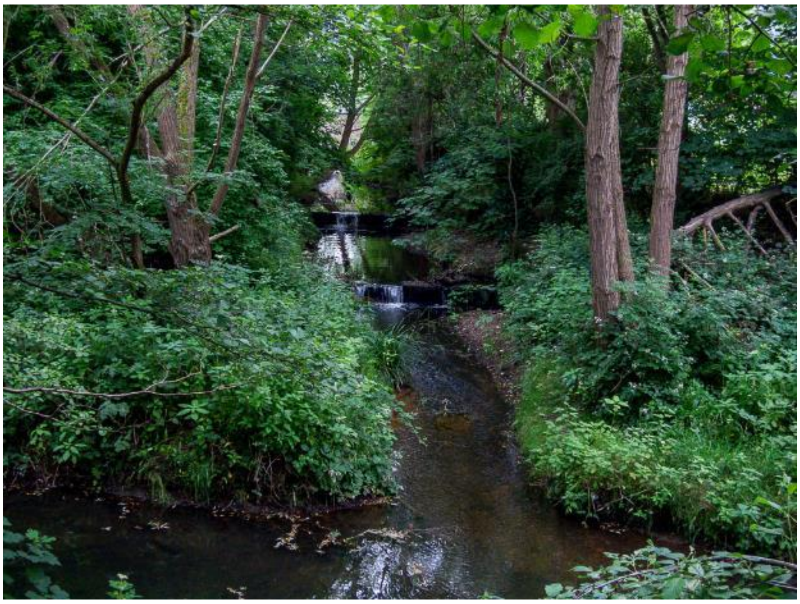

**Figure 11: Two small weirs photographed from SE 17383 17172 on the diverted channel in the area of Fenay Beck known as Round Wood Beck. Here two arms of the Beck skirt around woodland and then rejoin as one channel. It is worth exploring the removal of these structures.**

The impacts of habitat simplification and fragmentation due to barriers previously described obviously apply in these reaches.

Examples of valuable habitat were observed during the visit – and should be used to inspire management of the river corridor to promote more instances of similar habitat. A good example is the cover habitat provided by the fallen willow photographed at SE 17354 17168 (Fig. 12).

**Figure 12: Fallen willow and overhanging woody vegetation – vital habitat that is rarer than would be ideal from the perspective of biological diversity**

Low, trailing and partially-submerged complex cover such as tree crowns, feathery root masses and trailing herbaceous vegetation are excellent protection from predators for juvenile fish – including trout. At the same time, it also provides shelter from spate conditions for all weaker-swimming species while creating and maintaining deeper areas and cool-water refuges during hot weather. This is another example of physical complexity in the habitat which provides a greater variety of niche opportunities. Where suitable colonisation routes and opportunities exist, that greater range of niches can become occupied by a wider range of species of flora and fauna.

Amongst the most significant impacts of habitat simplification and impoundment was noted between the small step weir at SE17321 17236 (Fig. 13) and the downstream limit of this visit at Dalton (SE 17072 17408). Throughout this section, the lack of flow produced by changes to the channel cross section – and the loss of gradient imposed by multiple impoundments – have seriously reduced the habitat quality. The invasive, non-native plant Japanese knotweed was noted at SE 17224 17257 (Fig. 14) – a cause for concern because of the greater difficulty in achieving control (compared to Himalayan balsam). The extensive, spreading root (rhizome) system of Japanese knotweed – and its ability to grow new plants from very small fragments – make removal of this plant a specialist task. That task is also regulated by specific and essential licensing and legislation. See the Recommendations section for advice on achieving control of Himalayan balsam and Japanese knotweed – which is a highly desirable outcome. Both species significantly reduce both floral and faunal diversity when they achieve dominance in an area.

**Figure 13: Step weir, part of an extensively impounded reach.**

**Figure 14: Japanese knotweed stand on the opposite bank and balsam on the nearside**

The large weir at SE17098 17319 creates a hugely significant barrier and impoundment (Fig. 15). The height of this weir has a profoundly negative impact on the Fenay Beck (a relatively small watercourse), reducing the effective bed-slope. A stream's gradient is probably the factor which generates the greatest potential for recovery in many of these Pennine streams. It is through energised flow downhill that riverbed material is sorted, deposited and remobilised to create high quality habitats. Large impoundments take away those streams' greatest source of recovery from their post-industrial condition.

**Figure 15: Weir at SE17098 17319 a severe impact on the ecological potential of the Fenay Beck**

The downstream limit of the reach visited for this report was photographed at SE17072 17408, Briggate Bridge (Fig. 16). Although Himalayan balsam is visible and there was a limited amount of (inert but with the potential to smother) insoluble ochre, the value of gradient is also evident. With gradient and associated flows that can redistribute bed material, the greater physical variety created in this reach in the absence of impoundment is notable.

**Figure 16: Himalayan balsam and ochre, but also a significantly more varied structure to the cross-sectional depth and flow velocity profile in the absence of impoundment**

In spite of these challenges, it appears that trout populations exist on the Beckbut their future resilience and that of the wider communities could certainly be enhanced by a variety of actions. A summary of positive measures is given in the following section.

# 3 Recommendations

Actions that fall into both simple and more ambitious categories are worth pursuing on the Fenay Beck. Activities under both headings have the potential to generate valuable changes for nature and local communities in the river corridor.

### 3.1 Recommended low-cost/relatively simple measures:

- Hand-pulling of Himalayan balsam (can be heaped and composted effectively *in-situ* (well back from the high water level) to avoid the need for treatment as biohazardous waste implied by transporting off site). The comparatively low level of infestation may make it feasible to undertake removal of these plants systematically from source, working downstream
- Meeting with community leaders to help reduce the disposal of food waste from bridges over the Fenay Beck (obviously this extends to other local watercourses as well).
- Continuing the excellent Riverfly Monitoring activities to create both a baseline of healthy conditions and detect pollution impacts as they occur
- Some very light, occasional coppicing of existing bank-side trees would promote low, bushy regrowth that would provide valuable additional cover for a variety of species – including juvenile and adult trout. This work should be planned and also carried out by properly certified personnel
- Planted whips or existing saplings of suitable sizes could also be selectively hinged (or "laid") into the margins of the beck to provide shelter from predation and spate flows for juvenile fish (Fig.17). Some localised bed-scour can also be encouraged by material laid into the margins in this manner.

**Figure 17: Hinging or laying of saplings to create marginal cover (in this case using hazel – but many suitable species exist)**

### 3.2 Recommended higher cost/more ambitious measures:

- Removal (complete if possible, partial if not) of weirs on the Fenay Beck. (will require expert geomorphological advice).
- Design and construction of a channel that incorporates natural geomorphological processes and results in a greatly-reduced barrier to migration to tackle the series of v-notch weirs at SE 17960 16052
- Purchase of stem-injection kit and the appropriate professional training and certification of Calder & Colne Rivers Trust volunteers/personnel in its use for controlling Japanese knotweed (particularly valuable while the infestation is still relatively localised and limited)

In addition, there is great value in identifying and tackling Combined Sewer Outfall (CSO) issues (and associated potential mis-connections or blockages) within the Fenay Beck catchment. However, the excellent Riverfly monitoring programme that is already in place is a terrific tool in that process.

All the above works require permissions and cooperation from a variety of sources. Invasive plant removal and changes to the management of riparian vegetation will require liaison with the local council as well as local community members and any partnership organisations. The Wild Trout Trust may be able to offer advice and assistance in the completion of applications to regulatory authorities who issue relevant permits and permissions for the proposed works.

Part of the process of obtaining permissions for the work may be the generation of a formal project proposal and method statement. The Wild Trout Trust can assist in the preparation of such proposals – although in the cases of weir removal and channel creation, there will need to be additional specialist partner or partners who can lead and/or collaborate on proposal drafting.

Ongoing support in the pursuit of these various aims is available from the Trout in the Town project manager (Paul Gaskell Email: pgaskell@wildtrout.org Tel: 07919 157267) and the rest of the Conservation Team at the WTT.

## 4 Acknowledgement

The WTT would like to thank the Environment Agency for supporting the advisory and project proposal work associated with this project – including a portion of funds arising from rod licence sales. Additional support for this specific visit was also gratefully received from Calder & Colne Rivers Trust.

## 5 Disclaimer

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