Scampston Beck Catchment Walkover

North Yorkshire

04/08/2015

1.0 Introduction

This report is the output of a site visit to the Scampston Beck catchment, undertaken by Gareth Pedley of the Wild Trout Trust on Tuesday 4th August, 2015. The visit was requested by John Shannon of the East Yorkshire Rivers Trust (EYRT), to assess the impacts currently affecting the catchment and provide recommendations to improve the wild fish populations. This report covers observations made on the day of the visit and assesses options for improving and naturalising the Beck.

Normal convention is applied throughout this report with respect to bank identification, i.e. the banks are designated left bank (LB) or right bank (RB) whilst looking downstream. Upstream and downstream references are often abbreviated to u/s and d/s, respectively, for convenience. The Ordnance Survey National Grid Reference system is used for identifying locations.

Table 1. Overview of the WFD waterbody details for the sections of river visited

	Waterbody details
River Basin District	Humber
Management Catchment	Derwent Humber
River	Derwent
Waterbody Name	Scampston Beck catchment (trib of Derwent)
Waterbody ID	GB104027067790
Heavily Modified Waterbody (Y/N)	Y
Current Ecological Quality	Moderate
U/S Grid Ref of reach inspected	SE 88535 71015
D/S Grid Ref of reach inspected	SE 86423 76367
Length of river inspected (km)	7

(http://environment.data.gov.uk/catchment-planning/WaterBody/GB104027067790)

Under the current Water Framework Directive (WFD) classification (2014), this waterbody achieves a 'moderate' potential: it is classed as 'poor' for fish (the poorest scoring indicator always governing the overall classification), and it is a Heavily Modified Waterbody (HMWB) meaning that it is assessed for its ecological 'potential' rather than 'status'. Historic issues with straightening, dredging and weirs/barriers are likely to contribute to the HMWB status, with a corresponding, major impact on habitat degradation and fragmentation driving the 'poor' fish populations.

Table 2. WFD supporting elements

	2009 Cycle 1	2014 Cycle 2	Objectives
Overall Water Body	Moderate	Moderate	(Cycle 2) good
Ecological	Moderate	Moderate	(Cycle 2) good
Biological quality elements	Poor	Poor	(Cycle 2) good
Fish	Poor	Poor	(Cycle 2) good
Invertebrates	-	High	-
Macrophytes	-	-	-
Hydromorphological Supporting Elements	Not-high	Not-high	(Cycle 2) not high
Hydrological Regime	Supports-good	High	(Cycle 2) supports good
Mitigation Measures Assessment	Moderate-or-less	Moderate-or-less	(Cycle 2) good
Physico-chemical quality elements	High	High	(Cycle 2) not assessed
Specific pollutants	High	High	(Cycle 2) good
Supporting elements (Surface Water)	Moderate	Moderate	(Cycle 2) good
Chemical	Does-not-require-assessment	Good	(Cycle 2) good
Other Pollutants	Does-not-require-assessment	Does-not-require-assessment	-
Priority hazardous substances	Does-not-require-assessment	Good	(Cycle 2) good
Priority substances	Does-not-require-assessment	Good	(Cycle 2) not assessed

(**http://environment.data.gov.uk/catchment-planning/WaterBody/GB104027067790**)

2.0 Catchment overview

Newton Beck (the main tributary of Scampston Beck) rises from a chalk aquifer at the northern foot of the Yorkshire Wolds and flows in a general northerly direction across the Vale of Pickering to join the River Derwent, towards the eastern end of the Vale. "The site of a post-glacial lake, the Vale has a predominantly level topography covered by drift deposits, with some rolling ground on boulder clay and moraines in the far east. The underlying Jurassic sandstones and mudstones have little direct influence upon the landscape." The bed of the Beck is dominated by chalk originating from the Wolds which creates a productive, alkaline water chemistry.

> "Whilst rivers have long been a dominant influence in the landscape of the Vale Natural Area, large scale drainage and river engineering has been undertaken since the 18th century. Most of the river habitats within the Vale have been modified to some degree, varying from canalisation to more piecemeal deepening, straightening and embankment. Extensive river engineering has resulted in the widespread loss of natural features such as bends, pools and variations in depth as well as reducing the diversity of riparian habitats.
>
> Despite the legacy of river engineering and land drainage, the rivers of the Vale of Pickering remain one of the most important wildlife features of the Natural Area" (www.naturalareas.naturalengland.org.uk/Science/natural/NA_search.asp).

3.0 Habitat Assessment

This assessment was conducted from the source of the Beck, working d/s towards the River Derwent confluence (with many sections walked fully while others were assessed by spot-checking); the observations are reported in this order. However, for the purpose of recommending subsequent actions, the Beck has been broken down into manageable sections of similar character to aid in the development of a coherent improvement plan.

3.1 **Source (Oaks Plane Spring) to Becks Plantation** – (SE 88538 71017 - SE 88315 71725)

Newton Beck emerges from the Wolds as the main tributary of Scampston Beck, where the remains of a water off-take (now defunct) are still clearly evident. Immediately, the impact of grazing upon the sediment and nutrient input to the Beck are apparent. Bankside vegetation is relatively closely cropped and poached ground with animal faeces drain straight into the Beck (Fig. 1). However, the physical characteristics of the Beck do provide potential for salmonid spawning and juvenile habitat, with the bed comprising loose, 10-40mm sized gravels.

Figure 1. Source of Newton Beck, immediately subject to impact from livestock.

Where trees/shrubs are present (predominantly hawthorn *Crataegus monogyna*), shading inhibits the growth of grass and other vegetation and increases the susceptibility of the ground to poaching and surface runoff (Fig. 2).

Figure 2. Bare earth under hawthorn shading, also subject to cattle poaching.

The Beck clearly has been subject to historic maintenance and realignment which has limited the development of bends and inhibited natural bed scouring that would ordinarily create and maintain pools; this has left it relatively uniform in depth and lacking in parr and adult trout holding habitat. However, there are some areas of high quality spawning and excellent fry habitat available (Fig. 3).

Figure 3. High quality trout spawning and fry habitat.

The first potential obstacle observed was a c.50cm diameter culvert under one of the estate access tracks (Fig. 4). This did not pose a barrier to fish movement at the time of the visit as a bed of natural substrate has developed within the pipe, suggesting at least some sediment transport. However, the pipe is relatively low diameter and has the potential to block easily with debris from u/s. In high flows, velocities within the pipe may also render it more of a barrier to fish. Ideally, the pipe should be at least double the diameter and sunk at least 1/3 below the bed level to reduce the potential for blockages and prevent potential issues with fish passage.

The track itself is a potential source of fine sediment to the watercourse; something that could be mitigated by creating drain points from the track that would discharge to soakaways (shallow scrapes in the ground) in areas of rough vegetation well away from any watercourse, rather than draining directly to the Beck.

Figure 4. Undersized culvert with a potential for blockage (SE 88621 71294).

Downstream of the culvert, the Beck is impounded by a series of 3 disused duck flighting ponds. Such features are common place on sporting estates and, in this case particularly, cause almost complete barriers to fish movement u/s and d/s (Figs. 5a-c). While these do provide some deeper water for adult trout, restoring a natural planform and un-impounded channel would be of much greater benefit, allowing wild fish stocks to populate the Beck.

NGR: SE 88585 71337

NGR: SE 88559 71386

NGR: SE 88529 71414

Figures 5a-c. A series of impoundments creating, now disused, duck flighting ponds. These create impassable barriers to fish and, combined with the ponds, inhibit sediment transport.

Downstream of the ponds, through a lightly tree-lined section, the channel and habitat quality improves, although lack of sinuosity or structure to scour and maintain deeper areas means that it remains relatively shallow and uniform.

Figure 6. Good basic components (flow and substrate), but a lack of natural channel morphology.

As the bank-side canopy opens out and trees become less of an influence, the marginal vegetation begins to take over and, while not actually encroaching far into the channel, starts to over shade the narrow cross-section channel (Fig 7). The issue is exacerbated by the past channel realignment (and lowering of the bed) which confines the Beck within a straighter, uniform width channel that is set further below the bank top.

Figure 7. Vegetation beginning to over-shade the straightened, uniform width channel.

In this section, another culvert was noticed (on Google Maps while undertaking the write-up) at SE 88350 71692. This warrants further inspection/assessment as to the extent of its impact upon fish movement and sediment transport prior to any habitat improvements/restoration.

3.2 **Becks Plantation** (SE 88315 71725 - SE 88689 72431)

At the u/s extent of the plantation, an access track crosses the Beck and creates a significant sediment input (Fig. 8). The track acts as a conduit for surface runoff and the physical disturbance of the bed mobilises fine sediment that can be observed to be deposited along the channel d/s.

Figure 8. Ford and access track (NGR: SE 88315 71725) that pose significant sediment inputs to the Beck which can also be observed as an impact in Figure 9.

A short distance into the plantation, a tributary joins the Beck (Fig. 9). A pheasant release pen approximately 20m u/s on the tributary poses a complete barrier to fish passage and renders it unusable by fish as a spawning tributary (Fig. 10). The solution here should be to completely remove the obstruction from the watercourse as soon as the pheasants have been released from the pen and not reinstate it each year until the pheasants are put out to the pens, thereby limiting the obstruction to a short period over the summer. This would also prevent the potential issue of debris building up against the pen in higher flows and causing damage. Ideally, a small gap should be maintained (e.g. 1 breezeblock wide, centre channel; see Fig. 10) at all times.

The u/s side of the pen was not assessed but it is assumed that a similar setup exists there, and so the same operating procedure should be adopted.

Figure 9. Small tributary entering the Beck (NGR: SE 88293 71742). Note the sediment (centre shot) emanating from the ford just upstream.

Figure 10. A pheasant release pen on the tributary poses a complete barrier to fish passage (SE 88288 71735).

A short distance d/s of the tributary, a forest drain enters the Beck, a potential source of additional sediment in wet conditions (Fig 11). A few metres further d/s another ford presents similar issues to that of the ford u/s (Fig. 12), with sediment impact evident immediately d/s from the disturbance.

Figure 11. Forestry drain (SE 88299 71765).

Figure 12. Second ford (NGR: SE 88317 71765), creating similar sediment issues as the first.

In areas where the channel has developed greater sinuosity and woody material is available, bed morphology is more diverse, and as a consequence there is more deep water and higher quality adult trout habitat (Fig. 13). As a bare minimum, increasing woody material within the channel that will encourage greater scour and deposition would be highly beneficial.

Figure 13. Greater channel sinuosity and LWD creating scour, deposition and more varied channel morphology.

Approximately mid-point down the plantation, a culvert carries another track over the Beck. This culvert is of a more appropriate size and shape, posing no major obstacle to fish movement or sediment transport. It was, however, partially blocked at bed level, highlighting the potential for issues with all fixed apertures on watercourses.

Figure 14. A more suitable sized culvert – larger still would be better to reduce the chances of blockage (NGR: SE 88507 72070).

The channel remains relatively straight and the uniform cross-section is easily observed d/s of the culvert (Fig. 15). Where LWD has accumulated in the channel, the bed is more varied in profile as the substrate is sorted by scour and flow diversity (Fig. 16).

Figure 15. Straight, uniformly-wide channel.

Figure 16. Woody material across the channel that has scoured and sorted the substrate, creating a plunge pool (red oval). Note how the heavier, coarse substrate remains at the upstream end (green oval), with the finest material carried furthest and deposited downstream (orange oval).

At the d/s end of the plantation, a wider, less incised section with depositional features provides a good example of how, even with a simple, low-cost intervention, some sinuosity could be returned to the Beck with the use of LWD (Fig. 17).

Figure 17. Some sinuosity could be returned to this area (blue arrow) by using LWD (brown) to divert flows around the vegetated berm (right of shot).

3.3 **Newton (Estate Buildings)** – (SE 88689 72431-SE 88734 72549)

The Beck enters a walled garden at the edge of the estate, flowing through a small, fools watercress (*Apium nodiflorum*) choked culvert (Fig. 18).

Figure 18. Culvert into walled garden (blue arrow)(NGR: SE 88689 72431).

The wide nature of the channel d/s of a second culvert within the walled garden (Fig. 19), and the low gradient in the area, reduce flow velocities. This has allowed aquatic vegetation to establish across the majority of the channel width in most places, which then impounds the flow (Fig. 19). D/s, the Beck then disappears down a third culvert which takes it under the main buildings and farm yard (Fig. 20); the bottle neck at this point also results in some back-up of flow due to vegetation accumulation.

Re-meandering the Beck through the walled garden section (within its current over-wide channel) would create more sinuosity and narrowing to focus flow energy and maintain a low-flow channel free from vegetation. This would also result in cleaner, better-sorted gravels, of a higher quality habitat to wildlife.

Figure 19. A second small culvert in the walled garden is of little consequence to the Beck (NGR: SE 88692 72438)

Figure 20. The third culvert that takes the Beck under the farm buildings and farm yard, and causes a slight bottleneck/impoundment (NGR: SE 88707 72475).

Where the Beck emerges from under the yard, there was an obvious gutter along which much of the surface water from the yard (including the contents of disconnected roof drains; Fig. 22) could enter the Beck (Fig. 21). This is likely to be a significant source of sediment (and other pollutant) ingress.

Figure 21. A notable sediment input to the Beck where surface water from the farm yard enters (NGR: SE 88734 72549).

Figure 22. Roof drain discharging straight onto the yard/track.

3.4 Downstream of Newton (Estate Buildings) to Manor House Farm (SE 88734 72549 - SE 88379 73036)

D/s of the yard, the Beck flows through a small section of parkland, and while the livestock appear to be maintained at a low density, a long history of grazing is apparent by the lack of herbaceous vegetation and natural tree regeneration (saplings/young trees; Fig. 23).

Figure 23. Grazing of the parkland maintains a predominantly grassy bank line with no natural tree regeneration or herbaceous vegetation. Channel straightening has also been undertaken, as evident by the paleo-channel (red outline).

By this point, the sediment loading is notable anywhere the channel becomes wider or deeper and the lower water velocities allow deposition, but in faster flowing areas the bed remains relatively clear of fine sediment (Fig. 24).

The potential impact, even from light grazing, is apparent throughout this section, where localised livestock activity around the drinking point (Fig. 25) and around a small bend in the Beck (Fig. 26) results in increased erosion rates. It is likely that erosion similar to that occurring in Figure 26 is the reason for the Beck originally having been straightened through here. Although relatively stable when well vegetated, even small bends can suffer accelerated erosion where grazing and trampling/poaching occur.

Figure 24. Areas of faster flow maintain a sediment free bed; however, in the slower, deeper areas the impact of sediment inputs from upstream are evident.

Figure 25. Erosion and over-widening at a livestock drinking point (NGR: SE 88763 72607).

Figure 26. Erosion on a relatively sedate bend. This issue is resulting from trampling/poaching (red circle) that occurs even at low livestock density.

D/s of the park, the Beck enters an on-line pond, although it is bypassed prior to dredging. The bypass provides fish passage and true riverine habitat along the Beck; it would be greatly beneficial to retain this feature permanently, and maintain only a 'sweetening flow' to the pond. This would maintain fish passage and greatly reduce the rate of sedimentation within the pond, reducing the requirement for dredging.

Figure 27. Bypass channel around the drained pond.

Ordinarily, the >1.5m high, pitched stone outflow would represent an impassable barrier to fish migration u/s (Fig. 28), and the pond itself would inhibit downstream passage and sediment transport.

Figure 28. The currently dry outflow to the pond (NGR: SE 88577 72945).

D/s of the pond, a straightened, two-stage channel presents a great opportunity to initiate re-meandering and create a self-maintaining channel with high quality habitat (as shown by a blue line in Fig. 29).

Figure 29. An ideal opportunity for localised re-meandering of the channel.

The road crossing and culvert immediately u/s of Manor House Farm creates a barrier to fish movement in most flows. The stepped entrance creates a difficult jump onto shallow water through the culvert. The width restriction caused by the culvert, and associated fluming of flows means that accelerated velocities will further inhibit fish passage at higher flows.

Figure 30. A stepped invert/base and shallow water make the track crossing culvert an issue for fish passage (NGR: SE 88458 73009).

D/s of the culvert, the impact of heavier grazing can be seen, with the channel being significantly and uniformly wider, creating very shallow water. It also appeared that the 'weed' species (docks *Rumex* spp. and thistles etc.) had been sprayed with herbicide, right along the water's edge. This is potentially damaging to aquatic life: Glyphosate-based herbicides, in particular, are de-activated quickly by contact with soil – but remain toxic for longer in water (with birth-defects in amphibians among their undesirable impacts). Due to the associated risks, a specific licence is required for the use of herbicides by a watercourse.

At the d/s extent of the sprayed field, another pipe culvert poses similar issues to the one immediately u/s, owing to the flow being split between two small pipes, although it is less perched above the river bed. Ideally, the pipes would be replaced to create one large orifice that would more easily pass debris, sediment and wildlife (including fish).

Figure 31. Dead plants along the RB suggest that herbicide has been used along the watercourse. In the background another culvert creates another potential obstruction (NGR: SE 88379 73036).

3.5 D/S Manor House Farm to Willow Garth Plantation (SE 88379 73036 - SE 87399 73715)

Another track crossing/culvert, not seen during the visit, was identified a short distance d/s of Manor House Farm (NGR: SE 88232 73146) via Google Earth while composing this report. Further inspection and assessment of this structure would be beneficial.

The next point, spot-checked, was at the Millennium Pond in Wintringham, a small community pond that is off-line but connected to the Beck. U/s of the pond, a small farm access ford crosses the Beck and the channel is straightened but does have a healthy riparian strip. Increased structure (woody material etc.) within the channel would be of benefit to encourage greater scour and deposition (Fig. 33).

Figure 32. Straightened, channelised section upstream of Millennium Pond.

D/s of the pond, a clay-lined, fixed cross-section with slots for weir boards has been installed in the Beck, presumably to impound water u/s into the pond (Fig. 33). This has been undertaken without due consideration of requirements and regulations for building weirs set out in the WFD and Salmon and Freshwater Fisheries Act 1975, among others. Placing boards in this structure would create a barrier to fish passage and could constitute an offence. This is why qualified fisheries personnel should always be consulted before undertaking in-channel work – something that is often missed with the new consenting system for 'ordinary watercourses'.

Figure 33. Fixed cross section/board weir (Millennium Pond - NGR: SE 87822 73308).

D/s of the pond, the Beck is well protected by buffer strips with dense herbaceous vegetation which appears to extend all the way to Willow Garth Plantation (as observed via Google Earth).

Figure 34. Dense vegetation provided by a generous buffer strip. This situation appears to extend as far as the Willow Garth Plantation.

3.6 **Willow Garth Plantation** (SE 87399 73715 - SE 87102 74195)

Channel morphology improves somewhat within the plantation, being less incised and with a greater potential for meandering; however, the impact of straightening remains and the Beck has begun to deposit bars within the channel, taking up some of the excess capacity (Fig. 35). Where the channel is narrowed, some reasonable quality spawning gravels are maintained. Habitat here could be greatly enhanced by assisting the natural recovery process with the introduction of more woody material to divert flows laterally in some areas, and to drive scour into the bed in others.

Figure 35. Straightened channel that is beginning to recover through natural deposition. Greater in-channel structure would assist the process by diversifying the channel width.

Where the first of two field drains discharges to the Beck, an immediate and significant impact of sediment input occurs (Fig. 36). While the discharge from the drain was low on the day of the visit, the impact on the Beck immediately d/s and the amount of fine sediment accumulating in the lower reaches of the drain suggest that it carries much higher flows and transports more sediment in wetter times.

A brief inspection of the drain revealed that, although it dried up c.300m u/s, a poorly located, leaking cattle drinking trough surrounded by poaching appeared to be a major sediment source (Fig. 36). Relocating the trough away from the drain would greatly reduce the issue.

Figure 35. Immediate impact of sediment input from a small land drain (NGR: SE 87240 73969)

Figure 36. Major sediment input to a field drain resulting from poaching around a leaking water trough (NGR: poaching SE 87101 73702).

Accumulations of fine sediment in all slower flowing areas were noted across the Beck bed d/s of the drain input. LWD in the channel helps to create areas where the fine sediment can accumulate, while also creating faster areas and scouring flows to sort the substrate but the impact of fine sediment is still very apparent (Fig. 37).

Figure 37. Sediment accumulations wherever flow velocities are reduced.

Along with the sediment, there was a marked increase in algal growth, smothering the bed in many areas. Nutrients associated with the sediment may well be contributing to this, but recent tree felling has let in more light, allowing the algae to become established. This area is under the influence of Linton Mill sluice d/s, which reduces flow velocities and furthest increases sediment and nutrient deposition.

Figure 38. Algae and sediment smother the bed upstream of the sluice impoundment.

A second field drain within the plantation further contributes to the sediment and nutrient issues. It is unlikely to be a major issue at low flows, as vegetation across the mouth of the drain appears to limit ingress; however, it will become a sediment source at higher flows.

Figure 39. The second drain which poses another significant sediment source in certain flows (NGR: SE 87201 74075).

3.7 **Linton Mill Sluice to Rock House Plantation** (SE 87102 74195 - SE 86802 75492)

D/s of the sluice, the leat becomes choked by emergent vegetation and takes only a small portion of the total Beck flow (Fig. 40). This leat feeds a series of on-line ponds u/s of, and running through, Scampston Estate. The impact of these impoundments can be minimised by ensuring that the Beck always takes the majority of the flow, and by improving and maintaining fish passage on the Beck to ensure that it is the primary migration route. Reducing the flows passing through the on-line lakes will also reduce the amount of sediment they receive, the rate at which they fill in, and hence reduce the costs of maintenance.

Figure 40. The leat leading off from Linton Sluice.

The sluice is a major barrier and should be removed if at all possible to alleviate the impoundment u/s and issues for fish passage. However, this is not likely to be amenable to the lake/pond owners d/s (unless the ponds remain filled via groundwater), so fish passage via a bypass channel, fish pass or easement may be required.

D/s of the structure and outside the influence of the impoundment, the channel begins to take on a more natural form but the impact of sediment and nutrient is still very apparent (Fig. 41).

Figure 41. Linton Sluice (NGR: SE 87102 74195).

A small culvert to cater for a road crossing poses no real issue to fish or sediment passage (Fig. 42). D/s of the culvert, the Beck again enters farm land where, at the time of the visit, very light grazing appeared to be having no major impact upon erosion or sedimentation but was inhibiting the establishment of bankside trees and herbaceous vegetation. Another small culvert was also noted d/s of this one (on Google Earth) at NGR: SE 87140 74790, but this was not inspected during the visit.

Figure 42. No major issues from an adequately sized road culvert (NGR: SE 87112 74270).

The A64 road culvert poses an issue to fish passage under most flows; the incline of the invert/base and shallow water depth will make it difficult for fish to ascend under low flows (Fig. 43). Similarly, under higher flows, the incline and fluming through the tunnel is likely to create velocities that are difficult for many fish to overcome. A small step at the d/s end makes the entrance difficult for u/s movers.

Figure 42. A64 Bridge, with a shallow flows over an inclined invert/base creates an obstacle to fish passage (NGR SE 87008 75091).

Immediately d/s of the A64, dense tree cover which inhibits the growth of riparian and instream vegetation, and suspected past dredging, leave a uniform, over-capacity, silty channel (Fig. 44).

Figure 43. D/s A64, over shaded and likely dredged channel with excess sediment accumulation on the bed.

As the Beck emerges from the trees it becomes very overgrown with emergent and bankside vegetation, the straightened and incised nature of the channel allowing bankside plants to effectively 'tunnel' the Beck. It remains in this state until it enters Rock House Plantation d/s. While such shading provides valuable cover in small sections, long sections of vegetation-chocked channel reduce light penetration to the Beck and greatly reduce its productivity.

Figure 44. D/s of the tree shading, bankside vegetation envelopes the channel, the issue exacerbated by the incision of the channel.

Within the overgrown section, the Beck enters a small culvert (Fig. 45). While it is far smaller than ideal, and hence susceptible to blockage, it is at least set slightly below the current bed level so sediment transport and fish passage are not greatly inhibited. The vegetation-choked channel u/s of the culvert is likely to be maintaining it free from debris.

Figure 45. Small culvert which poses no major obstruction, providing it remains clear of debris (NGR: SE 86825 75367).

3.8 **Rock House Plantation/Home Wood** (SE 86802 75492 - SE 86631 76120)

As the Beck enters the plantation, the increased tree canopy shading and less incised channel inhibits the over-shading by herbaceous vegetation and the channel becomes more visible (Fig. 46). The substrate is of a relatively high quality but requires a greater degree of sorting to optimise its potential as habitat. Sediment remains an issue.

Figure 46. The channel becomes visible again as it enters the plantation.

As the Beck progresses through the plantation, an influence of ochreous material becomes apparent within the substrate, staining the bed through a short section but not to an extent that is considered to be indicative of a major issue (Fig. 47). The channel is of a reasonable gradient here and a wider range of substrate sizes are present. Increased LWD would help to develop scour features and sort the substrate.

Some form of knotweed, suspected to be Himalayan knotweed *Persicaria wallichii*, was observed weed was observed along the bank and protruding from the adjoining pheasant release pen (Fig. 48).

Figure 47. Some ochreous staining on a varied substrate, including some larger material. Introduction of woody material would beneficially scour and sort this into valuable habitat.

Figure 48. Suspected Himalayan knotweed (NGR: SE8676175611).

Where tree roots reinforce the bank or woody material restrict channel capacity, downwards scour creates some lies for larger fish exist (Fig. 49). However, in low flows some of the lower energy pool areas begin to accumulate excess fine sediment supplied from u/s.

Figure 49. Tree roots and in-channel structure increase bed scour to create adult trout lies.

A perched (c.100mm-150mm), inclined culvert carrying an access track creates another barrier to fish movement (Fig. 49). As the structure looks old and in a poor state of repair, it is recommended that when replaced, the new culvert be larger diameter and set below the bed level (c.1/3 of its capacity).

Figure 50. Perched culvert creating an issue for fish passage (NGR: SE 86730 75700).

As the Beck emerges from the plantation (LB) it again becomes over-deep and sedimentation increases; the Beck takes on an appearance more conducive to coarse fish habitat. The plantation continues down the RB, providing some shade and preventing the channel from becoming completely choked by vegetation.

Figure 51. The plantation stops on the LB and continues for a few hundred metres on the RB. The over-capacity channel in this section has facilitated significant sediment deposition.

3.9 **D/S Rock House Plantation to Derwent** (SE 86631 76120 - SE 85354 78783)

Away from the influence of tree shading on both banks, and subject once again to dredging and realignment, the Beck reverts to an incised, overgrown channel. This continued for the remainder of the section that was walked (Fig. 52). Although the full extent of the Beck down to the River Derwent was not visited, habitat in the lower section, surrounded by arable fields, appeared very similar. Spot checks and brief perusal via Google Earth supports this assumption.

Figure 52. The typical appearance of the lower section of the Beck, overgrown and incised below arable fields.

A railway crosses the Beck further d/s; however, this poses no notable issues as the culvert is of such capacity to prevent blockages and allow light penetration underneath (Fig. 53 a-c).

Figure 53 a-c. Railway culvert crossing (NGR: SE 86422 76369).

4.0 Recommendations

4.1 Source (Oaks Plane Spring) to Becks Plantation – (SE 88538 71017 - SE 88315 71725)

With the substantial amount of channel realignment that has been undertaken on this section of the Beck, the primary recommendation is to reinstate a more sinuous channel that can facilitate the formation of natural bed features. The area immediately d/s of the source is relatively steep and tree-lined, so a lower priority for in-channel work, but the section d/s of the access track, through the ponds to Becks Plantation (SE 88621 71294 - SE 88315 71725) would be ideal for a re-meandering project. The generous buffer strip throughout this section provides plenty of space in which the re-meandering could take place without an impact upon other land use.

The work could take the form of a full-scale realignment, moving from the current course to a restored sinuous channel, or a lower cost 'dig and dump' type project where bends and pools are accentuated by removing material from one bank and placing it within the channel along the opposite bank (Figure 54). The choice of action may depend upon landowner agreement and the available budget. As a very basic option, woody material should be introduced to the channel to enhance scour and depositional features. Increasing woody material would be beneficial in conjunction with any other in-channel restoration options.

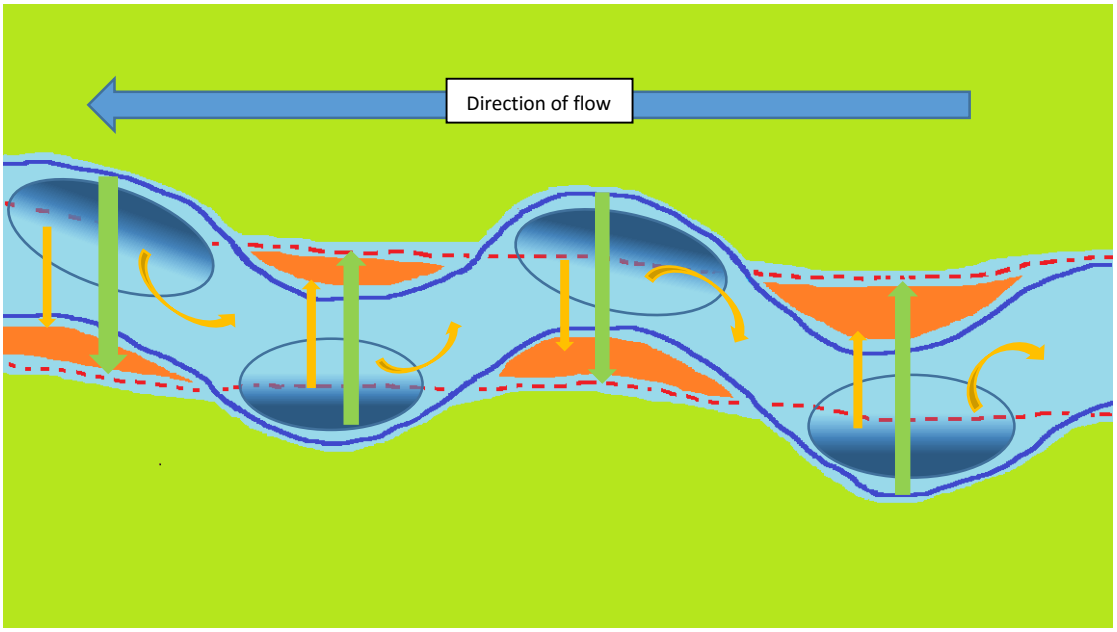

Fig 54. Diagram of a simple 'dig and dump' type river restoration. The dotted red lines represent the original straightened channel course. The dark blue line represents the improved course of the more sinuous channel. The dark to light blue graded ellipses represent deeper pool-shallower areas dug into the bed, with the material generated used to create gravel riffles (curved yellow arrow) and the toe of the gravel bars on the inside of the bends (straight yellow arrows). Green arrows show how material dug out of the bank and bed would be used to create the inside of the bend/gravel bar (orange area).

In addition to restoring the channel morphology, buffer fencing along the Beck, starting at the source and extending downstream throughout the first field, would be highly beneficial in tackling the sediment ingress and pollution issues. It may be possible to offset the lost grazing by seeking Countryside Stewardship subsidy on the land as it is in a target area. Adjacent land is already within Entry Level plus Higher Level Stewardship (www.magic.gov.uk) and it seems strange that the vulnerable watercourse area is excluded. Alternatively, or in conjunction, there may be options for a woodland creation scheme here which would also benefit the pheasant shooting on the estate. If the area can be fenced, an alternative watering source for the livestock would be required but this should be easily possible by creating a feed from the spring.

Several more localised issues were also noted throughout this section including barriers to fish migration and sediment transport and point sources of fine sediment input to the Beck. Table 3 highlights the issues and potential solutions.

Table 3.

	Description	**Figure No.**	**Solution**	**Location**
Barriers	Access track culvert	4	Ideally upgrade to a larger pipe/culvert like Fig 14, but at least monitor for blockage	SE 88621 71294
	Pond weir a.	5a.	Remove weir structure and allow/encourage bed re-grading between pools	SE 88585 71337
	Pond weir b.	5b.	Remove weir structure and allow/encourage bed re-grading between pools	SE 88559 71386
	Pond weir c.	5c.	Remove weir structure and allow/encourage bed re-grading between pools	SE 88529 71414
Sediment inputs	Field around the source	1 & 2	Buffer fencing	SE 88538 71017
	Access track culvert	4	Ensure that track has drainage points that discharge to soak-away areas in rough vegetation, rather than directly to the watercourse	SE 88621 71294

4.2 **Becks Plantation** (SE 88315 71725 - SE 88689 72431)

This section is also subject to significant sectioning and realignment, but being within the plantation, a natural supply of woody debris is available, facilitating the formation of some morphological diversity. However, the channel remains overly straight and wide in many places, and morphology and habitat quality could be improved with additional in-channel structure (LWD). Some dig and dump type work could also be undertaken in easily accessible areas if plant were brought in to initiate improvements on the section u/s.

Table 4 highlights localised issues through point source sediment inputs and barriers.

Table 4.

	Description	**Figure No.**	**Solution**	**Location**
Barriers	Pheasant release pen d/s and possibly u/s end	10	Maintain a free-gap of at least 1 breezeblock wide at all times and remove all blocks and metal grates as soon as the pheasants have left the pen.	SE 88288 71735
Sediment inputs	Access track ford	8 & 9	1. Ideally the ford should be replaced with a clear-span bridge or oversized, sunken culvert similar to that in Fig 14; however, a cheaper solution could be to line the bed with coarse stone that is less susceptible to erosion. 2. It should also be ensured that the track has drainage points that discharge to soak-away areas in rough vegetation, rather than directly to the watercourse.	SE 88315 71725
	Forestry drain	11	Ideally a buffer of deciduous trees should be provided along any watercourse (as per Forestry Commission best practice guidelines). Thinning along the watercourse would be beneficial to allow light penetration and promote bankside vegetation, and	SE 88299 71765

			woody branch structure introduced to the channel to slow flows and reduce erosion.	
	Access track ford	12	Ideally the crossing should be replaced with a clear-span bridge/culvert like Fig 14. It appears that some hard-core has been introduced to improve the track and, at the very least, this should be added to.	SE 88317 71765

4.3 **Newton (Estate Buildings)** – (SE 88689 72431-SE 88734 72549)

The area around the farm has been altered and culverted to accommodate the farm infrastructure. Some improvements are possible, however. Formalising a sinuous central channel within the current over-capacity, weed-choked channel would help to maintain a clear, low flow channel in the walled garden area. The issues with increased sediment input to the watercourse could also be addressed by ensuring that all rainwater downpipes (Fig. 22 etc.) are connected to enclosed drains which discharge directly to the watercourse or to land via soak-aways (rough, well-vegetated depressions in the ground), rather than forming overland flows that will transport sediment and cause erosion, as is evident in Figure 21.

4.4 Downstream of Newton (Estate Buildings) to Manor House Farm (SE 88734 72549 - SE 88379 73036)

The ideal situation to improve the habitat quality and geomorphology in the parkland would be to reinstate the natural, sinuous course of the Beck (e.g. Fig. 23) and to provide a buffer strip that will allow herbaceous vegetation to become established and stabilise the bank. If this is not acceptable, it may be possible to reinstate the old channel and increase channel sinuosity, providing that grazing pressure is maintained at a low level and the banks are created on a low gradient to reduce the potential for erosion.

The bypass channel that has been created to facilitate dredging of the pond should be permanently maintained. This will perform the dual function of providing vital fish passage around the impassable pond system and also reducing the flow, and consequently, sediment input to the lake. This will also greatly reduce the rate at which the lake fills with sediment in the future and reduce the requirement and cost for maintenance.

D/s of the pond, the straight section of channel u/s of the access road could be easily re-meandered within the current over-capacity channel to increase the length of the Beck and improve the habitat quality (Fig. 29). In conjunction with this, planting of a few colonial tree species (willow, alder etc.) that would thrive in the wet ground along the channel would also greatly enhance the area for a range of wildlife.

A very similar prescription, coupled with fencing out the livestock and ceasing spraying the vegetation along the watercourse is also recommended for the field d/s of the road (Fig. 31). Re-meandering there would be very easy as the grazing and spraying have left an over-wide channel that could be easily manipulated with brash and / or woody material to create structure in the channel and deflect flows.

The culvert that carries the road (Fig. 30; SE 88458 73009) is a barrier to fish migration as the shallow water through the culvert and the step up into it are currently a major obstacle to fish. Ideally, when any maintenance is undertaken the culvert should be lowered to bed level, although this is unlikely to happen in the short-term. Until then, fish passage could be improved with a rock ramp, using small boulders, cobbles and gravel d/s to gradually bring the bed level up to slightly above that of the culvert thereby increasing the water depth in the culvert to ease fish passage (Fig. 55).

Figure 55. A small rock ramp, dished in the middle to focus low flows, would significantly increase the chances of fish passage through the culvert.

The culvert d/s, in the background of Figure 31 (SE 88379 73036) should, ideally, be replaced with a larger capacity, single culvert.

4.5 D/S Manor House Farm to Willow Garth Plantation (SE 88379 73036 - SE 87399 73715)

The track crossing culvert identified from Google Earth a short distance d/s of Manor House Farm (SE 88232 73146) should be inspected to assess whether it poses a potential issue to fish or sediment transport.

Throughout the section u/s of the Millennium Pond, the straightened, uniform channel would benefit from realignment to a more natural course, as described for previous sections, but the current land use may limit the feasibility of this. However, the area could still be greatly enhanced through the installation of in-channel structure and LWD. This could be undertaken quickly and easily as a practical day/workshop involving local volunteers (which WTT can help with) and would greatly increase the habitat quality and fish carrying capacity of the reach. The same prescription stands for the section d/s of the pond and there may be potential for undertaking some re-meandering in the rough buffer strips through that section.

At the Millennium Pond site, it would be beneficial to install a bridge or oversized culvert at the field-access ford to prevent vehicular access into the Beck. However, a short term measure could be to introduce a coarser rock base to the ford that is less susceptible to erosion. The sluice structure that has been installed just d/s of the pond should ideally be removed as is poses a potential barrier to fish and sediment transport. If, however, it remains, it must be ensured that boards are never placed in the structure as this could constitute and offence under the Salmon and Freshwater Fisheries Act 1975 and the Water Resources Act 1991 by creating a barrier and impoundment.

4.6 **Willow Garth Plantation** (SE 87399 73715 - SE 87102 74195)

As with Becks Plantation u/s, although straightened, habitat within Willow Garth Plantation is of a higher quality than surrounding sections, primarily due to the reduced level of maintenance and the presence of trees (both living and via provision of natural woody material). For this reason, full restoration is not really required. Management of the woody material and riparian trees would, however, enhance the habitat there and assist with further naturalisation of the channel.

In the section u/s of the sluice, the reduced gradient increases sediment deposition and algal growth becomes an issue. Installation of in-channel structure to consolidate flows into a self-maintaining channel capable of sorting bed materials would be greatly beneficial.

The issue of sediment input from the field drains (Figs. 35 & 39; SE 87240 73969 & SE 87201 74075) should also be addressed, ensuring that maintenance of the drains is limited to reduce the mobilisation of sediment. One option to reduce the impact could be to create a large sump area in the drain to act as a sediment trap, well upstream from the Beck. This could then be emptied periodically during future maintenance, as it becomes full. The leaky water trough located by the upper field drain (Fig. 36; SE 87101 73702) should be repaired and relocated to a location where the inevitable ground poaching around it will not result in sediment reaching any watercourses.

4.7 **Linton Mill Sluice to Rock House Plantation** (SE 87102 74195 - SE 86802 75492)

Ideally the sluice should be removed as it creates an impassable barrier to fish movement and a significant impoundment, greatly reducing the gradient u/s. Unfortunately, this may not be possible as the sluice feeds the Scampston Estate lakes; the feasibility of this would depend upon whether the lakes would remain full via the water table or dry up if the water feed was stopped. Any alterations would have to be agreed with the owner of the sluice and the Scampston Estate. An alternative option here may be to create a bypass channel around the sluice to reinstate fish passage and sediment transport past the structure. An area of rough ground on the RB may facilitate this, although the recent tree felling there may have been undertaken for development of the land.

The channel d/s of the sluice would benefit from re-meandering and bank regrading throughout most of its length to alleviate the issues resulting from the channel being overly deep, uniformly narrow, and incised within its banks. This would help to reduce the issues occurring in many areas where bankside vegetation is enveloping the channel.

Improvements for fish passage could be undertaken at the A64 road culvert (NGR SE 87008 75091) via the installation of a rock ramp, in a similar manner to that of the culvert u/s, or by installing baffles along the base of the culvert (Fig 56a). As a bare minimum, a notched baffle across the d/s end of the culvert would provide some improvement by increasing water depth (Figure 56b).

Figure 56a & b. Potential baffle designs to improve fish passage by increasing water depth while maintaining sediment transport.

The small culvert observed on Google Earth at SE 87140 74790 but not inspected during the visit should be assessed for fish passage and sediment transport. The culvert towards the lower end of the section (Fig. 45; SE 86825 75367) should also be replaced with a larger, sunken culvert when it degrades to a stage that requires repair.

4.8 **Rock House Plantation/Home Wood** (SE 86802 75492 - SE 86631 76120)

As with previous tree-lined sections, habitat has begun to recover within the wood via the natural introduction of woody material, and this should be capitalised upon by installing more, similar features.

The knotweed observed growing in and around the pheasant pen (SE 86761 75611) should be treated to prevent its spread along the watercourse.

The culvert (Fig. 50; SE 86730 75700) should ideally be replaced with a larger structure, sunken into the bed to reduce the step and impoundment upstream. In the short-term, baffles (as described for the A64 road culvert) or, ideally, a small rock ramp, could greatly improve fish passage at the structure.

D/s of the wood, although still straightened, the channel has begun to recover, with some naturally restored meanders having formed but still along a straightened course and the channel is still well-incised; a legacy of the original dredging. Ideally, the banks here should be dug back to create a wider, two-stage channel in which the Beck can re-work. If this were to be undertaken, 'dig and dump' type enhancement of channel features would also be of benefit.

4.9 **D/S Rock House Plantation to Derwent** (SE 86631 76120 - SE 85354 78783)

For the majority of the section d/s of Rock House Plantation to the Derwent, the 'dig and dump' prescription applies, wherever the channel has been significantly straightened and incised. Two areas of rough ground/wooded areas within the section (SE 86300 76545 - SE 86078 77004 & SE 85707 78391 - SE 85353 78779) may offer the potential for more major river restoration and channel realignment, if funding were available and the landowners agreeable. The second of these locations may be easier as it is an area of relatively rough, low productivity ground around the confluence with the Derwent.

5.0 Making it Happen

WTT may be able to offer further assistance such as:

- WTT Project Proposal
  Further to this report, the WTT can devise a more detailed project proposal reports for individual sections. This would usually highlight specific locations for work, with the report forming part of a land drainage consent application.
- WTT Practical Visit
  Where recipients are in need of assistance to carry out the kind of improvements highlighted in an advisory visit report, there is the possibility of WTT staff conducting a practical visit or workshop. This would consist of one or more WTT Conservation Officers teaming up with interested parties to demonstrate the habitat enhancement methods described. <u>This service is in high demand and so may not always be possible.</u>

6.0 Acknowledgement

The WTT would like to thank the Environment Agency for supporting the advisory and practical visit programme in England, through a partnership funded using rod licence income.

7.0 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 guidance made in this report.