River Crane - Twickenham

An advisory visit carried out by the Wild Trout Trust – December 2012

1. Introduction

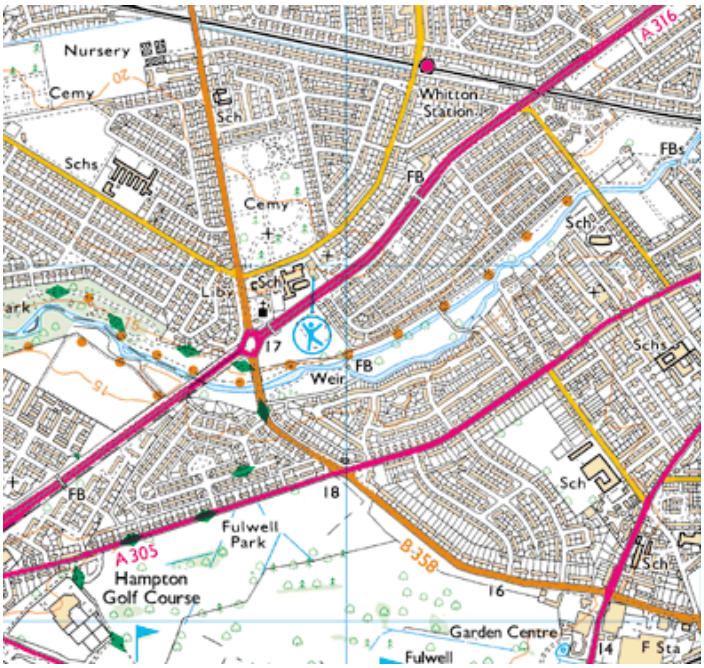
This report is the output of a Wild Trout Trust advisory visit undertaken on a stretch of the River Crane, just to the west of Twickenham, flowing between Crane Park (NGR TQ 150734) to a short distance downstream of Knellar Gardens (TQ150734). The Crane here runs through a mainly green urban corridor in public open space owned by the local authority.

The request for the visit was made by Mr. Joe Pecorelli, Zoological Society of London, who is currently engaged in a number of projects designed to improve passage and habitat for eels *Anguilla anguilla* and Mr. Rob Gray, Chairman of Friends of the River Crane Environment FORCE, a community based group who are actively involved in managing the river and the adjacent corridor.

In October 2011 a large quantity of raw sewage entered the river resulting in a serious pollution incident and substantial fish mortality. Thames Water Utilities Limited have agreed to provide a substantial budget to be put towards improving the environmental quality of the Crane. FORCE are now actively seeking opportunities and ideas for improving in-channel and marginal habitat and are interested in exploring ideas for enhancing the river for a wide range of native fish, plant and invertebrate species.

Comments in this report are based on observations on the day of the site visit and discussions with Mr. Pecorelli, Mr. Grey and volunteers actively engaged on project work for FORCE.

Throughout the 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.



River Crane – reach inspected

The River Crane is classified under the Water Framework Directive (WFD) as a Heavily Modified Waterbody and is assessed as having poor ecological potential. A summary of the WFD assessment taken from the Environment Agency's web site is set out below:

Crane (including part of the Yeading Brook)			
		View data	
Waterbody ID	GB106039023030		
Waterbody Name	Crane (including part of the Yeading Brook)		
Management Catchment	London		
River Basin District	Thames		
Typology Description	Low, Small, Calcareous		
Hydromorphological Status	Heavily Modified		
Current Ecological Quality	Poor Potential		
Current Chemical Quality	Good		
2015 Predicted Ecological Quality	Poor Potential		
2015 Predicted Chemical Quality	Good		
Overall Risk	At Risk		
Protected Area	Yes		
Number of Measures Listed (waterbody level only)	1		

2. Catchment overview

The Crane is an extensively modified water course. Rising from springs north of Hillingdon, the river flows for approximately 14km through a heavily developed urban landscape. Flow is augmented by the Yeading Brook tributary before the

river swings south, skirting the eastern periphery of Heathrow airport. The Crane is then joined by the Duke of Northumberland River (DNR) at North Feltham. The DNR is an entirely man made aquaduct and receives water via a distributary channel from the River Colne, augmenting flow into the Crane before giving its name again to the northern-most channel, which splits off from the main Crane below Knellor Park.

3. Fishery overview

Information about the fish population is available from records taken of fish lost following the pollution incident. The river has been re-stocked following this and previous pollution incidents, with fish reared at the Environment Agency's Calverton Fish Farm. The restocking included the introduction of significant numbers of chub, dace and barbel.

It is apparent that the river is capable of supporting a wide range of fish species, including some important so called minor species such as minnow, stone loach and bullhead. Bullhead, in particular, are fish normally associated with good quality river environments and are a protected Annex 11 species under the Habitats Directive. It is likely that the bullhead population has been wiped out on numerous occasions prior to this latest serious event in 2011. Upstream recolonisation from the main river Thames is impossible due to several impassable structures and it is likely that the re-establishment of a diverse and healthy fish community has relied mainly on downstream drift, in all probability from juvenile fish dropping out of the Colne via the DNR. A possible exception is the presence of eels which may perhaps be migrating up from the Thames and negotiating the structures, which look to be a block to any significant fin fish migration. It is also possible that eels previously found in the Crane may have found their way into the system through downstream movement to populate vacant habitat niches.

There does not appear to be any reference to the Crane ever supporting a viable salmonid population. Some small trout may migrate downstream through the system via rivers like the Chess and Ver, into the Colne and then out to the Thames via the DNR and Crane. Some of the wild brown trout populations that reside in the upper Colne and tributaries may well be genetically predisposed to migration. Whilst the populations that are present are almost certainly dominated by fish that have adapted to a resident freshwater life strategy, occasionally some may turn downstream and migrate to sea as sea trout smolts. The trigger for migration is sometimes sparked by a strong year class for spawning, where individuals move downstream looking for a habitat niche. If suitable food supplies are scarce then smoltification gives an opportunity for survival. Resident brown trout populations that are lost due to pollution or catastrophic drought can be kick started by a small number of returning sea trout. This natural cycling of fish populations is not possible on many regulated lowland rivers due to the presence of numerous impassible structures and the Crane is no exception.

Photo1. The weir located on the Crane at the bottom of Knellor Gardens. The structure appears to block upstream fish migration via this route and is a serious impediment to habitat restoration in the reach immediately upstream. The headloss may be reduced when high spring tides coincide with strong fluvial flow.

The WTT does not hold any information about the Crane as a recreational fishery. It is assumed that prior to the pollution event there would have been low key coarse angling activity, mainly undertaken by local residents in the Twickenham area.

4. Habitat assessment

The availability and quantity of good quality in-channel habitat was mainly restricted to the upper reach of river above the A316 road bridge. This section of channel running through Crane Park supported some reasonably good quality habitat, mainly due to the natural variations in planform and bed topography. Work to encourage channel shape diversity has been undertaken using large imported block stones to form shelves in an attempt to reduce the channel width and elevate water velocities. The success of this work has been variable but does give a graphic indication of what can be achieved.

A gentle gradient was evident through the Crane Park reach, and, coupled with a comparatively relaxed approach to in-channel maintenance, this has enabled significant habitat features to develop. It is not clear if this management regime has been entirely deliberate but the result is that valuable features such as gravel shoals, point bars, shallow pools and vegetated berms have established. In some locations woody debris has been left in the channel margins. This coupled with the mainly low and gently sloping banks have provided some very good bank-side cover in places, which will potentially support a wide range of plant, fish and invertebrate species. The channel was quite heavily tree lined in some sections, providing a mix of dappled light and shade which is essential for providing bank protection, root system cover and an external source of primary food, as well as providing vitally important cooling shade.

Photo 2. River Crane through Crane Park. A good example of varied in-channel habitat

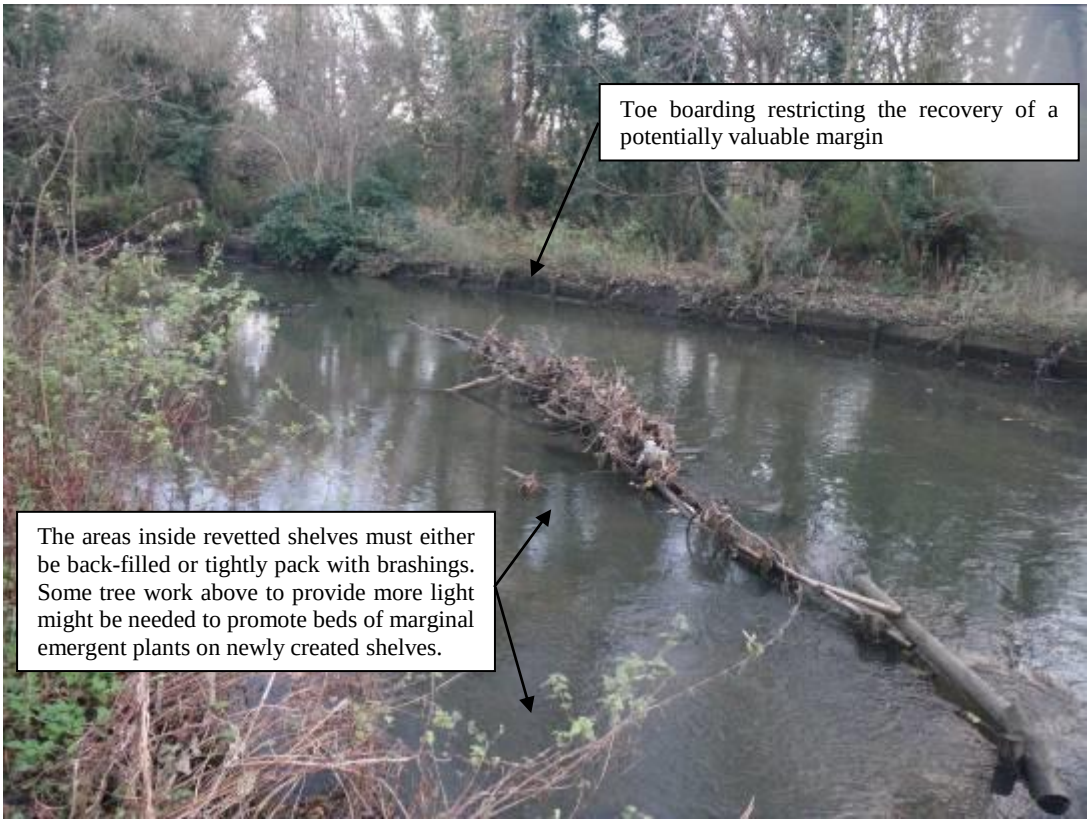


Photo 3. A previous attempt to pinch the channel with log revetment has largely failed to reduce the channel width

Although some good quality habitat is evident, some margins are still defended with lines of vertical toe boarding, which drastically restricts the ecological value of the reach. This method of bank management is understandably felt to be desirble by the authorities in areas where formal bank management is required. However, sections of bank like the one depicted in photo 3 do not require toe boarding to support, or defend the bank and its presence is a maintenance and ecological liability.

In some sections, the channel is excessively wide for the given discharge. Some attempts have been made with both stone and log revetment (photo 3) to pinch the channel and thus elevate mid-channel water velocities. Achieving a greater diversity in channel width would enable increased water velocities to be harnessed and drive the bed down in places to create some slightly deeper pool habitat. This would greatly enhance the value of the reach for larger fish and provide some increased holding capacity during periods of low flow. The log revetment installed has attempted to radically pinch the channel in places. Perhaps a more sustainable approach might be to reduce the width of the revetted line but also to pack the inside of the shelf with a dense matrix of wired down wood and brash. Direct sunlight is required in these wood and brash area if a new, soft, vegetated berm is to be successfully established.

At the very upper reach inspected, the channel is split, with what looks to be an old high level milling leat (photo 4). This channel is a flat shallow glide with relatively few in-channel features. Some attempts to create improved habitat are underway. Improving this channel is important because it appears to link up well with the channel above. The lower level channel, although taking the bulk of the flow, appears to run through a long culvert upstream of the Pevensey Road Nature Reserve which may well limit fish passage.

It is possible that fish passage could be improved by prioritising more flow via the leat and installing a simple easement on the structure at the downstream end (photo 5). Currently there are concrete erosion aprons at the top and bottom of the structure which could be modified to form shallow pools deep enough to enable fish to swim up through a series of steps. The rock weir wall could also be simply notched to help ease fish up through the series of steps. Notching the rock weir may weaken it and any new opening may need to be reinforced to stop it from collapsing. It might also be possible to remove the wall all together and build a new step further downstream. This would have the benefit of reducing the amount of energy in the pool during high flow conditions when fish are often stimulated to migrate. Each step should represent no more than a 200mm rise in head levels. Shaping the invert of the notch, to promote a smooth plume of water, rather than 'white' water with entrained air will also improve the efficiency for fish passage of any constructed easement.

Before any plans to modify this structure are made it is recommended that the off-take structure (not inspected) adjacent to the Hounslow Heath Golf Centre is also evaluated for fish migration. If at some stage in the future there is scope to open up the long culvert that runs downstream of the railway line on the main channel then flow should be prioritised via this main route.

Photo 4. Old high level milling leat in the foreground might be potentially important for upstream fish passage

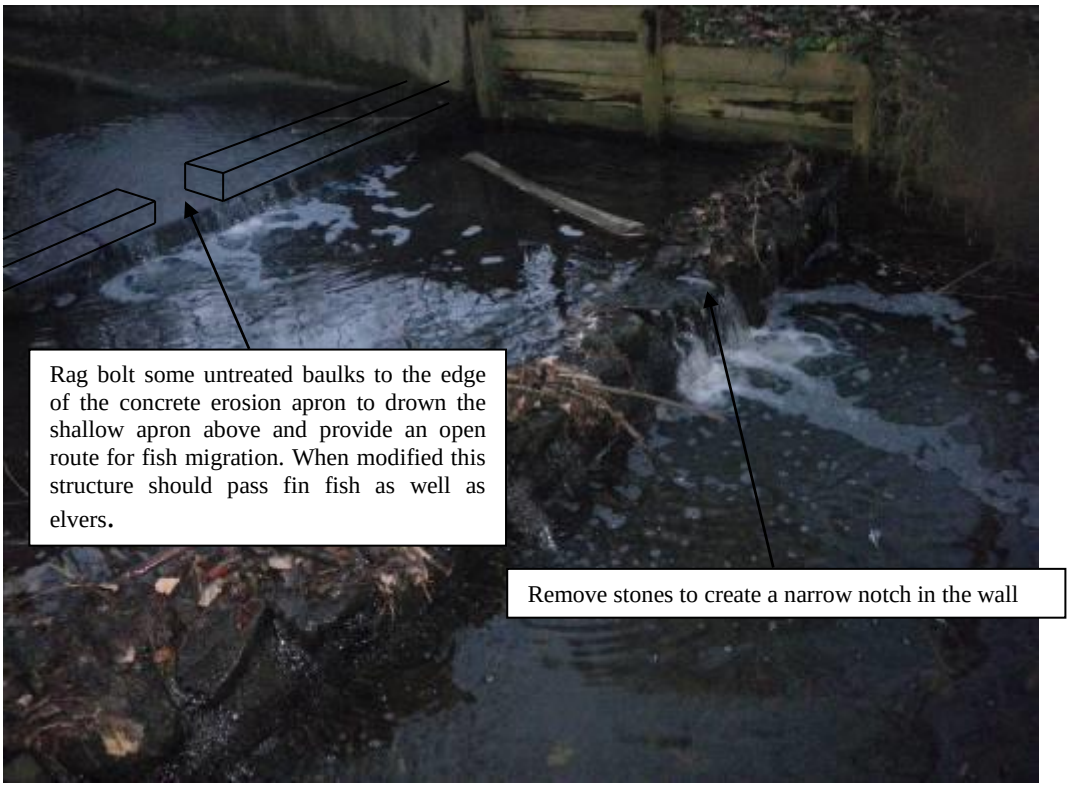


Photo 5. Structure on the tail end of the leat can be easily modified to improve fish passage.

Photo 6. Another box section on the tail of this structure is required to enable fish to swim up to the next step.

Downstream of the A314 road bridge, the in-channel habitat is heavily impacted by the impounding effects of the weir that controls the flow split in the lower Crane Park, and also by the large weir located 200m below the B358 road bridge.

These weirs seriously impact in-channel habitat quality by impounding the flow and slowing upstream water velocities. The downstream weir (photo 1) may, however, be essential for protecting local properties from the effects of tidal flooding. There may be more scope for modifying the weir upstream but a corresponding reduction in bed levels on the mill channel might be required to secure an acceptable flow split around the loop.

Options for habitat improvements within the Knellor Park reach are limited. An obvious improvement might be to tackle the long sections that are currently inappropriately defended by toe boarding. One possibility is to effect an improvement in the in-channel habitat by removing the toe boarding and re-profiling the top of the bank (diagram 1). Cutting into the top of the bank and redistributing the material down into the channel behind a new, low level revetment should satisfy any requirements for maintaining capacity for flood water conveyance and also create a biologically valuable margin. The new low level shelf could be planted and initially defended until plants are fully established and can fully protect the new bank from erosion. Temporary fencing may also be required to control unwanted footfall. Ideally the new margins

should be low, wet and squashy and not attractive for standing or walking. It is not necessary to carry out this prescription along the whole length of the park section; however, where the lack of tree shading might permit strong plant growth, re-profiling of the banks would constitute a significant environmental enhancement.

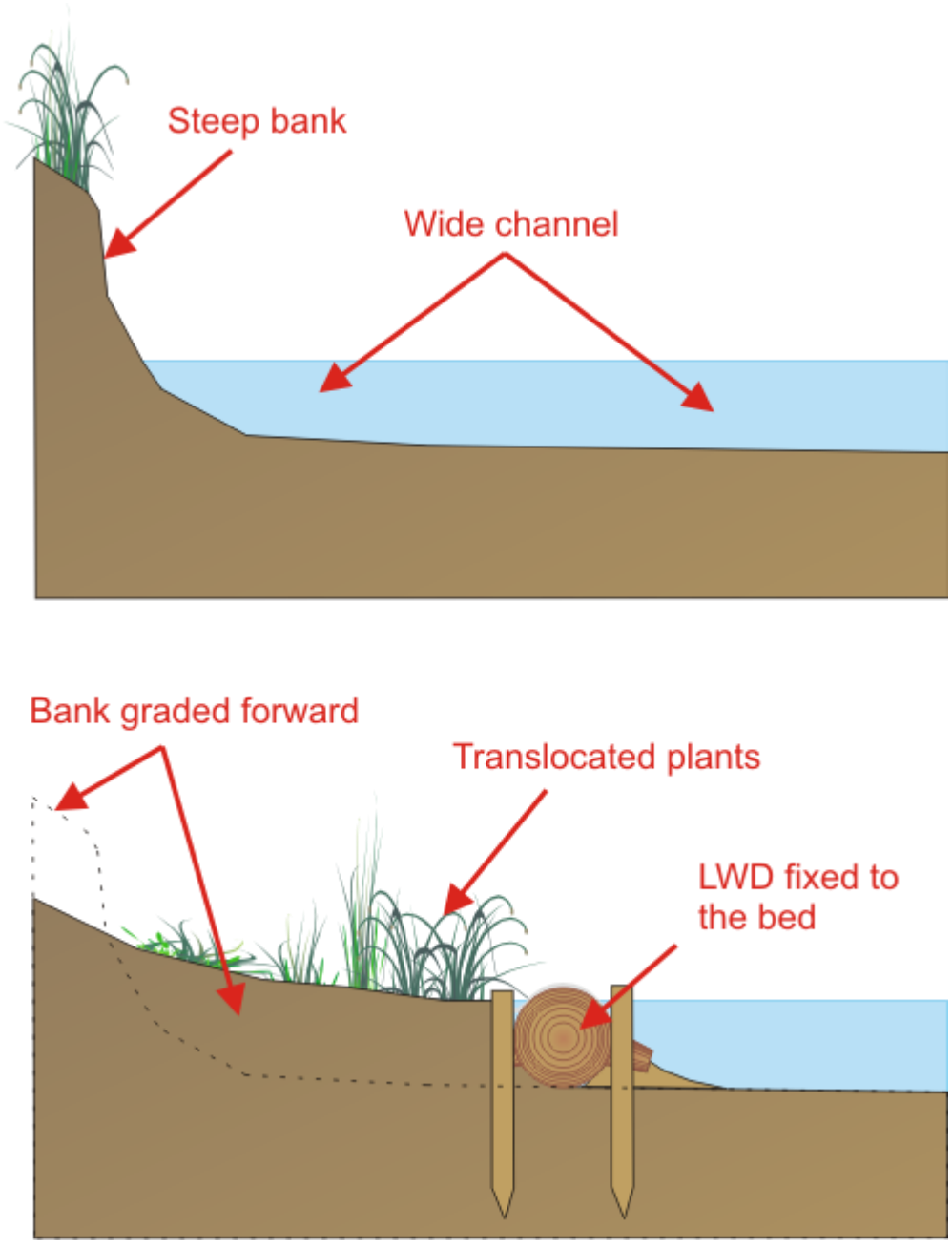


Diagram 1 – a schematic of a re-profiled bank

Downstream of the weir on the Crane and also downstream of the railway bridge on the DNR, the in-channel habitat is very poor. The vertical hard revetment and flat concrete river bed provides precious little habitat for plants, fish or invertebrates. Scope for improving this section of channel might be limited due to sensitivities over flooding adjacent property. There is some scope for providing some in-channel interest via the use of imported woody habitat that can be secured to the hard margins and allowed to float up during flood events. Whole 'brashy' tree sweepers such as thorns, or even complex conifers could be

secured by the lower butt with flexible galvanized cable to anchor points rag-bolted to the brick or concrete banks.

These tree sweepers provide vital cover for a range of species in what would is currently an extremely hostile environment. They are cheap and easy to install and represent an extremely low flood risk as they will rise up in spate conditions. Care must be taken to ensure the fixings are located in such a way that enables the sweepers to float up to the top of a bank full flood, but are sufficiently short so that they are not left high and dry on top of the bank when water levels recede. If trees of a suitable size cannot be procured, or if the physical conditions make it difficult to install large trees then smaller refuge areas can be constructed from brashings that are tightly lashed at the butts and fastened to the margins in similar fashion to the whole tree sweepers.

In a highly engineered channel, the introduction of "rough" woody cover in the margins will promote bird nesting on top, cover for fish below and a source of primary food for grazing bugs. They will also impart variations in flow patterns, areas of upwelling and 'still' zones for fine sediment deposition. In short these imported features could provide biological and aesthetic interest in what is currently a largely sterile chute. It will be advantageous to ensure that the local community is informed of and involved with the introduction of such rough woody cover to ensure its ecological value is appreciated above the commonly perceived aesthetic impact of such material.

Another option in the shallow Crane channel is to bond large rockery sized stones to the concrete bed. This can be achieved either by installing little groups of three, or more stones together of sufficient size to remain stable, or individual stones can be pegged to the bed with short sections or steel reinforcing bar that can be chemically bonded into a short hole drilled into the stone and concrete bed. A small stone the size of a deflated football will be an oasis for any fish in the centre of a flat, fast flowing concrete bottomed channel.

The downside of any woody material in the margins, or stones that crease the surface, is that they will accumulate unwanted debris, especially in an urban environment. Regular maintenance is therefore essential.

Photo 7. The RB margin on the Crane downstream of the weir. A sterile river margin ripe for improvement.

Photo 10. A little bit of central channel debris providing a micro habitat on the DNR below the railway line. Similar micro habitats can be easily installed and provide habitat for small fish.

5. Conclusions

The section of Crane and DNR in the area looked after by FORCE supports some good quality in-channel habitat in the upper reaches and in contrast some sections that are in very poor shape, particularly downstream of the B358 road crossing.

The upper reaches could be further improved by locally narrowing the channel in places with log and brash shelves and through the use of large woody debris flow deflectors configured to pick up the water velocity and scour slightly deeper pool habitat. Concerns over flooding may be a constraint on the type of structures used. Whole trees dropped into the margins and secured (including branch and brash matrix) provide the best flow deflectors but may not be deemed acceptable in an urban environment. Deflectors made from modular sections of tree trunk/branch (photo 11) can be used and reduce the risks associated with large deflectors breaking away in a flood and causing blockages on downstream bridges and weir gates. These deflectors should always be well keyed into the river bank and pegged either at right angles to the flow, or positioned pointing slightly upstream. This configuration may be counterintuitive but it ensures that erosive flows are kicked towards centre of the channel rather than nibbling away at vulnerable river banks (diagram 2).

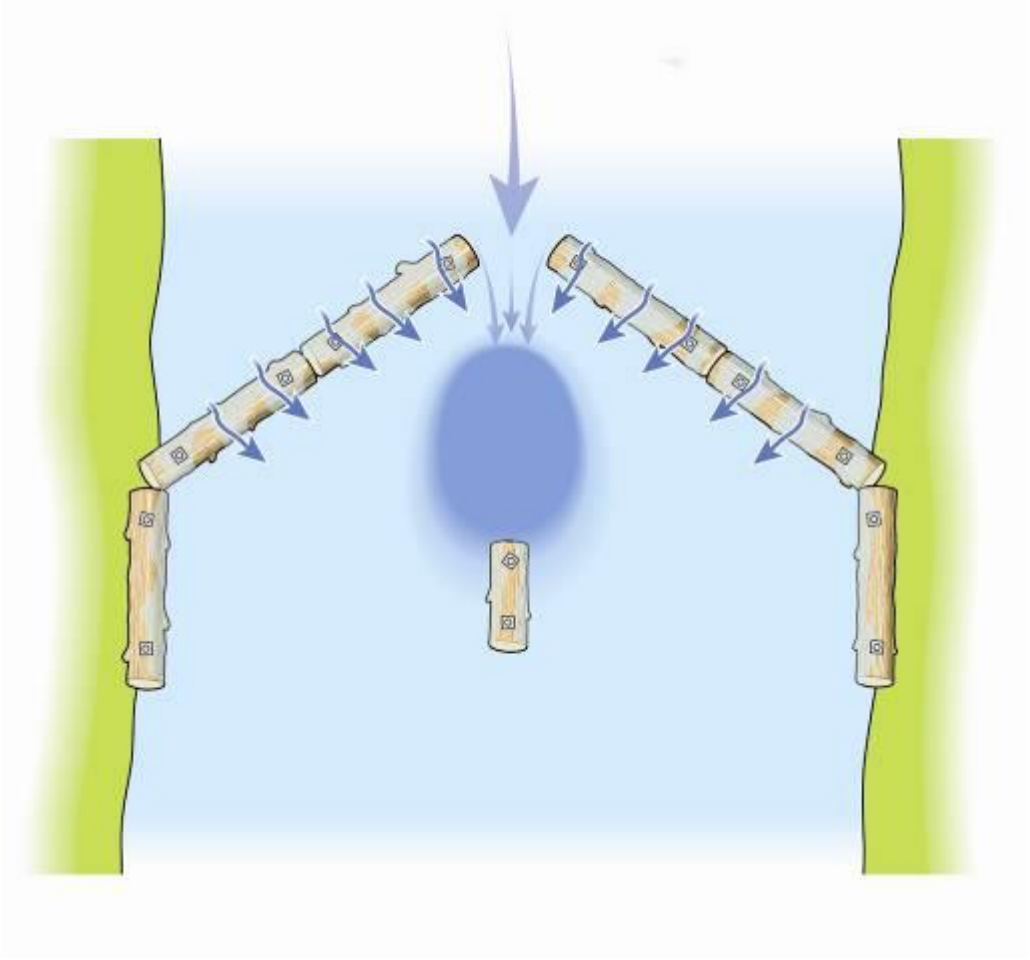


Diagram 2 - opposing upstream V modular deflector designed to scour a pool in a central channel location. The central channel "cover" log is optional, as are the downstream marginal logs.

Photo 11
A single modular deflector designed to promote some scour off the out-side edge. These deflectors still work even when submerged by high water levels.

If channel narrowing is to be undertaken using log revetment then ensure the area inside the logs is well packed with brash (photo 12).

Photo 12 Packing a marginal shelf with lots of wood brashings to help collect sediments and provide a medium for marginal emergent plant growth.

Opportunities to enhance the reach through Knellor Park can be achieved by removing the toe boarding and re-profiling of the RB.

The sections downstream of the bottom weir on the Crane and the railway bridge on the DNR are extremely poor and would benefit enormously from the introduction of floating cover securely tethered to the existing hard banks. Bonding stones or chunks of woody debris to the shallow glide sections that currently run over a smooth concrete bed will provide at least some refuge for fish in what is otherwise an extremely hostile environment.

6. Recommendations

- Carry out further assessments for fish migration on the upper mill leat. The outcome of this investigation will drive future actions for prioritising flow splits between the channels and the necessity, or otherwise, for improving access on the stepped structure lying at the downstream end of the two channels.

- Where the river bank is revetted with toe boarding on the upper reach, lying outside of the formal park environment, then simply rip it out. If possible push down the margin to form a squishy toe to the bank and plant with emergent plants transplanted from within the site.

- Open up a diaologue with the EA over the possibility of lowering the height of the two weirs at either end of Knellor Park.

- Explore the idea of a large project within the park to re-profile the existing vertical revetment to create a low biologically valuble river margin.

- Install tethered floating tree sweepers, or if deemed inappropriate smaller brash bundles to the margins of sections of hard vertical wall.

- Create some river bed roughness over the smooth shallow glides running down from below the bottom weir on the Crane and downstream of the railway line on the DNR.

It is a legal requirement that some works to the river may require written Environment Agency consent prior to undertaking those works, either in-channel or within 8 metres of the bank. Any modifications to hard defences will require a land drainage consent on any river designated as "main river". Advice can be obtained from the EA's Development Control Officer.

7. Making it happen

There is the possibility that the WTT could help to start an enhancement project. We could potentially help to draw up a project proposal (PP) which could be used to support any application for Flood Drainage Consent. The PP might also be used as a document to be shared with potential partners as a vehicle for raising project funding.

Alternatively, physical enhancement works could be kick-started with the assistance of a WTT 'Practical Visit' (PV). This approach is probably more appropriate for works to the side carriers. PV's typically comprise a 1-3 day visit where approved WTT 'Wet-Work' experts will complete a demonstration plot on the site to be restored. This will enable project leaders and teams to obtain on-the-ground training regarding the appropriate use of conservation techniques and materials, including Health & Safety, equipment and requirements. This will then give projects the strongest possible start leading towards successful completion of aims and objectives.

Recipients will be expected to cover travel and accommodation expenses of the WTT staff.

There is currently a big demand for practical assistance and the WTT has to prioritise exactly where it can deploy its limited resources. The Trust is always available to provide free advice and help to clubs, syndicates and landowners through guidance and linking them up with others that have had experience in improving trout fisheries.

Acknowledgement

The WTT would like to thank the Environment Agency for supporting the advisory and practical visit programmes.

Disclaimer