



Advisory Visit

River Witham, Marston, Lincolnshire

April 2015



1.0 Introduction

This report is the output of a site visit undertaken by Tim Jacklin of the Wild Trout Trust to the River Witham, Marston, Lincolnshire on 16th April, 2014. Comments in this report are based on observations on the day of the site visit and discussions with Ken Ordish (landowner representative) and Matthew Parr (Environment Agency Fisheries Technical Officer).

Normal convention is applied throughout the report with respect to bank identification, i.e. the banks are designated left hand bank (LHB) or right hand bank (RHB) whilst looking downstream.

2.0 Catchment / Fishery Overview

The section of river visited is located just to the east of the village of Marston, about 6km north of Grantham, Lincolnshire, at Mill Farm (National Grid Reference SK9015543020). Approximately 1 km of river was inspected, with the weir at Mill Farm in the middle of the reach.

The upper Witham flows off oolitic limestone geology in the Lincolnshire and Rutland Limestone Natural Area

(www.naturalareas.naturalengland.org.uk/Science/natural/profiles%5CnaProfile38.pdf), hence is a calcium-rich, lowland river. The Witham around Grantham supports a trout fishery and many sections are controlled and managed by Grantham Angling Association Fly Fishing Section (GAAFFS). The reach immediately upstream of the section visited is controlled by GAAFFS.

Over recent centuries, and particularly the last 100 years, the once naturally meandering river channel of the Witham has been straightened, deepened, widened, impounded and embanked as part of fluvial engineering schemes designed to reduce flood risk and improve land drainage. These modifications, together with catchment land management practices, have contributed to a decline in river corridor habitat quality in the catchment. These physical modifications have led to the river being classified as 'heavily modified' under the Water Framework Directive (WFD), European legislation requiring EU member states to get rivers into good ecological condition (within the constraints imposed by the 'heavily modified' conditions).

At present, none of the sub-divisions (waterbodies) of the Witham catchment attain good ecological condition and this particular section (WFD waterbody no. GB105030056780, Witham, River Brant confluence to Catchwater Drain confluence) is rated as 'moderate potential'.

The Upper Witham River Corridor Habitat Plan was produced by the Environment Agency in 2013 to address the issues preventing the river from reaching good condition. One of the key issues is the presence of redundant weirs and sluices which impound water and sediment, interrupt natural flow patterns and are barriers to the free movement of fish.

Inspection of the website www.magic.gov.uk indicates that the land immediately adjacent to the river here does not have any statutory conservation designations, is not the subject of any stewardship (agri-environment) schemes and there are no listed buildings or scheduled ancient monuments in the vicinity. It is known that the upper River Witham (including this reach) contains native white-clawed crayfish (*Austropotamobius pallipes*), a nationally threatened species. Water voles, another threatened species, may also be present.

3.0 Habitat Assessment

The most significant feature of the river at this location is the weir at Mill Farm which very much creates a "river of two halves". The habitat quality of these two sections is described below.

3.1 Upstream of Mill Farm Weir

Mill Farm Weir (Photo 1), an Environment Agency owned structure, has a crest about 1.5m high, the water falling vertically onto a concrete sill under the farm track bridge and into the weirpool downstream (Photo 2). The weir crest has a penstock on one side (closed at the time of the visit); if opened, the invert level of the penstock is approximately two-thirds that of the main weir, so would lower upstream water levels but not completely remove the impounding effect.

A short distance upstream of the weir on the right bank there is an offtake via a pipe into a small stream running through the garden behind the converted mill house (Photos 3, 4), re-joining the river at the weirpool downstream of the mill. The stream is known to contain native crayfish.

This stream relies on the impounded water levels provided by the weir to maintain its flow.

The river habitat quality upstream of the weir is very poor, being profoundly affected by the impoundment for the entire length to the upstream boundary. When the mill was constructed, the course of the river would have been moved to the valley side to provide the height of water (held back by the weir) to drive the mill wheel. The channel would also likely have been greatly enlarged and embanked to store water for milling (embankments are evident on the left bank, Photo 7). This means the river does not currently occupy its natural position at the lowest point on its valley floor. Figure 1 is a LiDAR map (a technique of measuring land levels with lasers) which shows the differences in levels at this site and clearly illustrates the old channels occupied by the river before it was altered for milling; these lie largely to the south of the existing channel (Photo 5).

The river upstream of the weir is wide and shallow, the bed substrate dominated by fine sediment accumulated because of the impounding effect (Photo 6). There is little variation in depth, flow velocity or bed substrate composition which makes this reach unsuitable habitat for the earlier life stages of trout (spawning and juveniles) and very poor for adult trout. Only a small number of fish were observed in this section, including pike and possibly adult trout. There is little in the way of overhead cover (which would provide more adult fish holding areas), apart from a small number of willow pollards, the branches of which have leaned over into the channel (Photo 8).

Riparian (bankside) habitat is also poor, with little in the way of marginal aquatic plants and just grass immediately adjacent to the river. This indicates the banks are grazed here and that livestock has unrestricted access to the river. In the absence of grazing, beds of reeds and rushes would be expected to develop, narrowing the channel, and bankside vegetation would become more "shaggy" providing more cover in the margins.



Photo 1 Mill Farm weir, with penstock sluice on right of picture.



Photo 2 Run out from the weir into the pool downstream.



Photo 3 Offtake point on the right bank feeding the stream below.



Photo 4 Stream running through the garden behind the mill house.

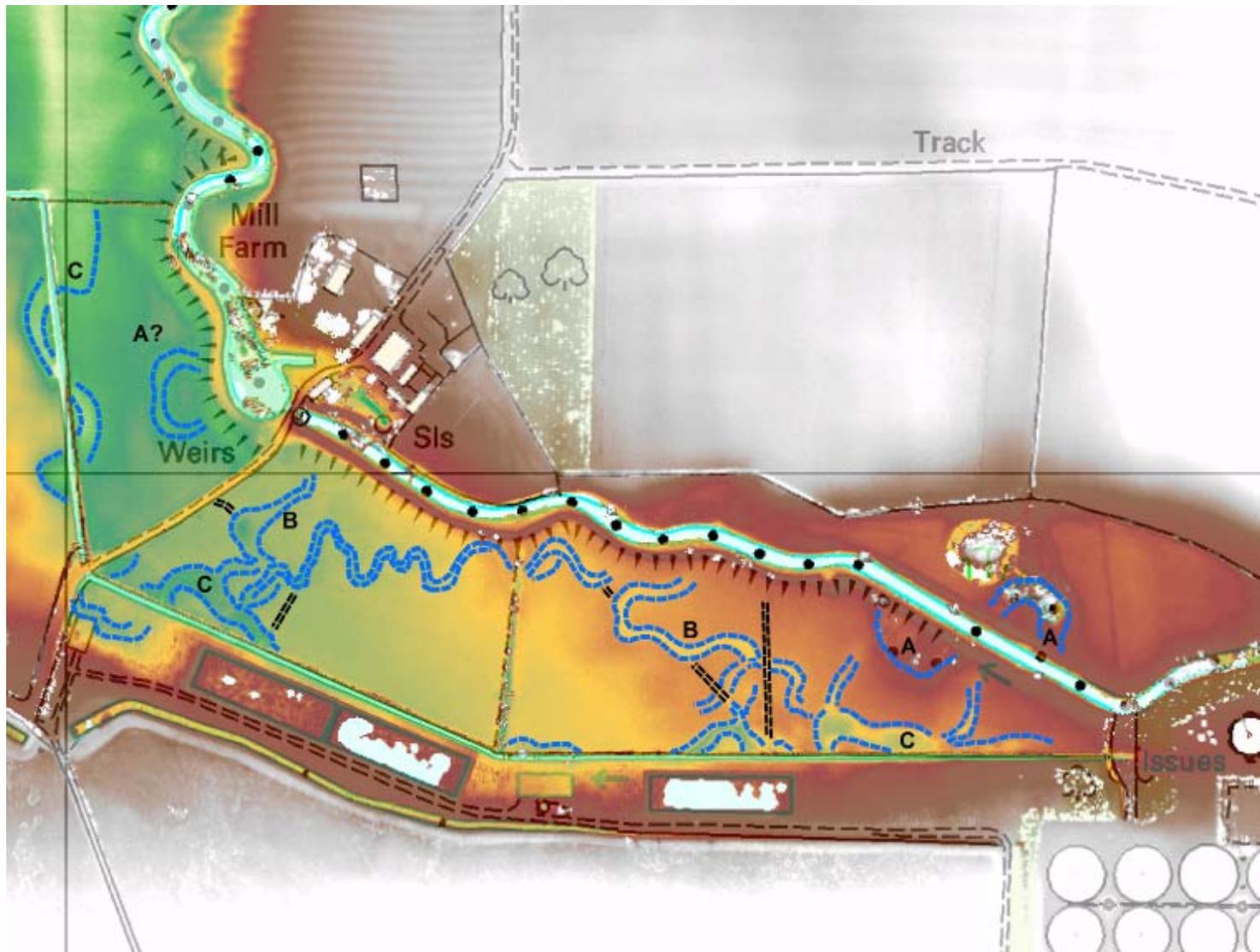


Figure 1 LIDAR image showing the old channels formerly occupied by the Witham prior to modification for milling. Green indicates low lying ground and red/brown is higher ground. Image courtesy of Environment Agency.



Photo 5 The true valley floor, where the original, natural river channel would have been, lies to the south of the existing river in the field pictured.



Photo 6 Upstream of the weir, river habitat quality is poor – wide, shallow, silty and lacking cover.



Photo 7 Embankments which would have provided water storage capacity for milling.



Photo 8 Overhanging willows provide some cover for fish in the impounded section. Any maintenance of these trees should retain the low branches over and in the water at their current extent.

3.2 Downstream of Mill Farm Weir

Below the weir is a large weirpool. The energy from the weir has scoured a deep pool, displacing bed sediment downstream to form an island which has vegetated with willow trees and stabilised. The river bifurcates around the island and a short distance downstream, the effluent from the Anglian Water sewage works on the left bank discharges to the river. There are no reported water quality problems here. Water quality could be simply monitored here by taking kick samples of invertebrates downstream of the discharge; the Riverfly Partnership provide excellent guidance and training (www.riverflies.org). There are some fallen willows in the channel here which are providing excellent cover. Although the river is inaccessible for fishing here, having a few such spots on a fishery is no bad thing, providing fish with some refuge areas (Photo 9).

In contrast to the section upstream of the weir, this reach is not impounded and the in-stream habitat is much better. Although the river has obviously been engineered in the past (steep banks, bed much lower than surrounding land), the channel remains relatively sinuous. These meanders, combined with the free flow of the river, have allowed deep lateral scour pools to develop on the outside of bends and shallow, gravelly riffle areas (Photo 10) to form in between. This pool-riffle sequence is the basis of good in-stream habitat, providing spawning habitat (gravel riffles), juvenile habitat (shallower glides) and adult habitat (deeper pools). A number of trout were observed in this section of the river.

In addition to the good in-stream habitat, the riparian habitat is also much improved compared to the upstream section (Photo 11). The banks are fenced here and no grazing takes place. This reportedly makes access difficult in summer because of high vegetation, but strimming access points and retaining the good bankside habitat is preferable to bare banks. There are some good examples of low cover over the water provided by bushes and trees (Photos 11, 12). These are excellent habitat for adult trout and should be retained and more examples created by tree planting and "hinging" existing trees (see recommendations).

A small area of the invasive, non-native plant, Himalayan balsam (*Impatiens glandulifera*) was observed (Photo 13). The main issue with this species is its rapid rate of spread and the physical damage that results to river systems by blanketing river banks; being an annual it shades out other

species during the growing season, but provides no soil retention over winter leading to erosion problems and sediment inputs. The main method of control, and usually the most appropriate, is hand-pulling plants before they flower and set seed (usually end of June/early July). The arisings from this work should be left off the ground until they have dried out to prevent continued growth. The seed bank from this plant is relatively short-lived (about three years), so regular pulling is an effective control. Further information can be found at

www.ceh.ac.uk/sci_programmes/documents/himalayanbalsam.pdf and www.invasivespeciesscotland.org.uk/himalayan-balsam-impatiens-glandulifera .



Photo 9 Sewage works discharge point.



Photo 10 Shallow riffle areas provide spawning habitat for trout. These could be enhanced by providing more overhanging bankside cover.



Photo 11 Good in-stream and riparian habitat.



Photo 12 Excellent example of low cover over the water provided by the trees and bushes on each bank. This could be enhanced by hinging and laying the tree branches.



Photo 13 Himalayan balsam, an invasive non-native plant species that should be controlled before it gets out of hand.

4.0 Recommendations

4.1 Downstream of Mill Farm weir

The section of river downstream of the weir is good habitat and does not require a great deal to improve it. Recommendations for this section are:

- Retain the woody debris from fallen/overhanging trees. Be judicial when managing trees and leave plenty of cover and refuge areas for fish.
- Control the Himalayan balsam by hand-pulling
- Provide some additional low cover over the water by hinging suitable trees into the margins (Photo 14). This would be a beneficial treatment to undertake on some of the trees in Photos 6, 8 and 12.
- Stake some woody material alongside the riffles to provide cover for adult fish in the winter at spawning time (Photo 15). Plant some trees/bushes in these areas to provide cover in the longer term; sallows such as grey willow and goat willow (*Salix cinerea* and *S. caprea*) are ideal because of their low-growing, bushy habit. Whips could probably be sourced from existing local trees. Hawthorn and alder could also be used in this context.
- Monitor water quality using the Riverfly Partnership's Anglers' Riverfly Monitoring Initiative www.riverflies.org/rp-riverfly-monitoring-initiative

Please note it is a legal requirement that written consent is required from the Environment Agency (EA) prior to undertaking any works in the river (introduction of material to the channel, e.g. tree hinging). Trimming of tree branches, pulling balsam does not require consent.



Photo 14 “Hinging” small trees (like hedge laying) to provide excellent marginal cover.



Photo 15 Staking some brushwood into the margins of riffles and planting trees as indicated would provide good cover for spawning fish and their offspring.

4.2 Upstream of Mill Farm Weir

The overriding influence on habitat quality here is the impoundment of the weir and the straightened, widened, realigned channel. This greatly limits the options for habitat improvement within the existing channel, but provides a great opportunity for substantial improvements in river habitat and fishery quality by diverting the river into a new channel, bypassing the weir and mimicking the natural course.

The Wild Trout Trust and Environment Agency have been involved in similar projects where the river channel has been restored to a course approximating what it would have been in its natural form. Examples can be found here:

- www.wildtrout.org/content/bayfield-project-river-glaven
- www.wildtrout.org/content/river-glaven
- www.wildtrout.org/content/river-bain-project

A similar project is due to be carried out on the upper Witham this year at Stoke Rochford, again a partnership between WTT, EA, the landowner and fishing interests.

The principle of such projects is to re-create a sinuous river channel, with increased connectivity to its floodplain. The latter means the river inundates the surrounding land more frequently than the existing engineered channel, but in doing so provides more floodwater storage and attenuation of flows which reduces downstream flood risk. The schemes are designed in such a way that there is no increased flood risk locally, but there are obvious implications for land use on the floodplain (e.g. grazing rather than arable use).

The benefits from a river habitat and fishery perspective include a longer, more sinuous channel (i.e. more river / fishery within the same area) and restoration of a pool-riffle sequence which provides habitat for all trout life stages. Deep pool areas are created on the outside of bends and shallow gravel riffles provide spawning habitat and areas for the production of fly life. Further benefits would accrue from the improvement in fish passage around the weir; currently the weir is a significant barrier to fish movement (fish were seen leaping at it in an unsuccessful attempt to move upstream

during the visit). Improved fish passage connects the different habitats required for fish to complete their life cycle, making the population more abundant and resilient.

The Environment Agency have indicated that they would be willing to see Mill Farm weir decommissioned, as it would reduce their maintenance burden and provide flood risk reduction benefits. This opens the way to developing a project similar to those described above, re-routing the river from somewhere around the upstream boundary, through the field to the south (in the vicinity of the old channels in Figure 1), under the Mill Farm access track and re-joining the river in the vicinity of the weir pool.

Broadly speaking, the steps for developing such a scheme would include:

- Levels survey and design of channel course and dimensions by a fluvial geomorphologist.
- Gaining agreement of landowner(s)
- Gaining necessary permissions and consents, which would include flood risk assessment to the satisfaction of EA's Flood Defence Consent process.
- Outline tendering and obtaining necessary funding
- Project delivery

Points to be considered if such a scheme were to go ahead:

- Water would no longer flow over the existing weir structure, it would all be diverted down the new river channel.
- The existing river channel would be back-filled with spoil arising from the digging of the new river channel.
- The water feed into the stream behind the mill house would be lost. This could be accepted and the native crayfish re-located, or a means of delivering a continued water flow via a re-located offtake and pipe could be devised.
- A new bridge or culvert to take Mill Farm access track over the new river channel would be required.

- The land adjacent to the new river would inundate more frequently, limiting its agricultural uses. It may be possible to incorporate this into a stewardship scheme.

If re-routing the river is not possible, alternative approaches would be:

- Remove the weir structure and retain the flow within the present channel. Install in-stream structures (flow deflectors, large woody debris, channel narrowing) to the channel upstream.
- Reduce the height of the weir structure, provide a fish pass or easement at the weir and retain the flow within the present channel. Provide upstream structures as above.
- Permanently raise the penstock sluice, provide a fish pass or easement at the weir and retain the flow within the present channel. Provide upstream structures as above.

The habitat and fishery benefits of these approaches are more limited and disadvantages include retention of assets that require ongoing maintenance (weir, fish pass); uncertainty of structural integrity of the weir if altered; retention of the unnaturally straight and (following weir removal/lowering) steeper river channel; the re-grading of accumulated sediments from upstream of the weir following removal/lowering; and potentially a much lower cost-benefit than the river re-routing option.

5.0 Making it Happen

For the section downstream of the weir, the Wild Trout Trust can provide additional support with obtaining consents for recommended works and providing a practical demonstration of techniques; please contact Tim Jacklin for more information.

For the section upstream of the weir it is recommended that the possibility of developing a partnership between the landowner, WTT and EA is explored, to develop a river restoration project.

6.0 Acknowledgement

The Wild Trout Trust would like to thank the Environment Agency for their continued support of the advisory visit service.

7.0 Disclaimer

This report is produced for guidance and not for specific advice; no liability or responsibility for any loss or damage can be accepted by the Wild Trout Trust as a result of any other person, company or organisation acting, or refraining from acting, upon guidance made in this report. Accordingly, 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 comments made in this report.

We have produced a 70 minute DVD called 'Rivers: Working for Wild Trout' which graphically illustrates the challenges of managing river habitat for wild trout, with examples of good and poor habitat and practical demonstrations of habitat improvement. Additional sections of film cover key topics in greater depth, such as woody debris, enhancing fish stocks and managing invasive species.

The DVD is available to buy for £10.00 from our website shop <http://www.wildtrout.org/product/rivers-working-wild-trout-dvd-0> or by calling the WTT office on 02392 570985.

The WTT website library has a wide range of materials in video and PDF format on habitat management and improvement: <http://www.wildtrout.org/content/index>