



Advisory Visit

Rivers Meden and Maun, Thoresby Estate, Nottinghamshire

January 2018



1.0 Introduction

This report is the output of a site visit undertaken by Tim Jacklin of the Wild Trout Trust to the Rivers Meden and Maun on the Thoresby Estate, Nottinghamshire on 4th January, 2018. Comments in this report are based on observations on the day of the site visit and discussions with Andrew Dobson (River Warden, Thoresby Estate) and Ryan Taylor (Environment Agency).

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 River Meden rises to the north of Mansfield and flows east-north-eastwards through a largely rural catchment. The River Maun rises in the conurbation of Mansfield and flows north-eastwards past Ollerton to join the River Meden at Conjure Alders (SK6589872033). The rivers then separate again and re-join approximately 6km downstream near West Drayton (SK7027875118) to form the River Idle (a Trent tributary with its confluence at West Stockwith SK7896894718). Both rivers flow over a geology comprising sandstone with underlying coal measures and there is a history of extensive deep coal mining in the area.

Table 1 gives a summary of data collected by the Environment Agency to assess the quality of the rivers for the Water Framework Directive. Both rivers appear to have a similar ecological quality and closer inspection of the categories which make up this assessment reveal that fish and invertebrates were both 'high' and 'good' for the Meden and Maun respectively in 2016. However, it is known that brown trout are prolific in the River Meden, but largely absent from fishery surveys on the River Maun (Ryan Taylor, pers.comm.). The reasons for this were covered in detail in a previous report (WTT Advisory Visit, River Maun, May 2017 www.wildtrout.org/avs), but may include poor water quality from the urbanised headwaters and lack of access for recolonisation because of obstructions to fish migration.

River	River Meden	River Maun
Waterbody Name	Meden from Sookholme Brook to Maun	Maun from Rainworth Water to Poulter
Waterbody ID	GB104028058060	GB104028058080
Management Catchment	Idle and Torne	Idle and Torne
River Basin District	Humber	Humber
Current Ecological Quality	Overall status of Moderate ecological status in 2016 and Poor ecological status in 2009.	Overall status of Moderate ecological potential in 2016 and Poor ecological potential in 2009.
U/S Grid Ref inspected	SK6129570520	SK6633571070
D/S Grid Ref inspected	SK6484571165	SK6613071385
Length of river inspected	c.2000m	c.500m

Table 1 Summary of data for the relevant sections of the Meden and Maun under the Water Framework Directive, from <http://environment.data.gov.uk/catchment-planning/WaterBody/GB104028058060> and [GB104028058080](http://environment.data.gov.uk/catchment-planning/WaterBody/GB104028058080). The River Maun is designated as a Heavily Modified Waterbody because of physical changes to its channel through urbanisation and flood protection; this constrains the extent to which ecological improvements are possible.

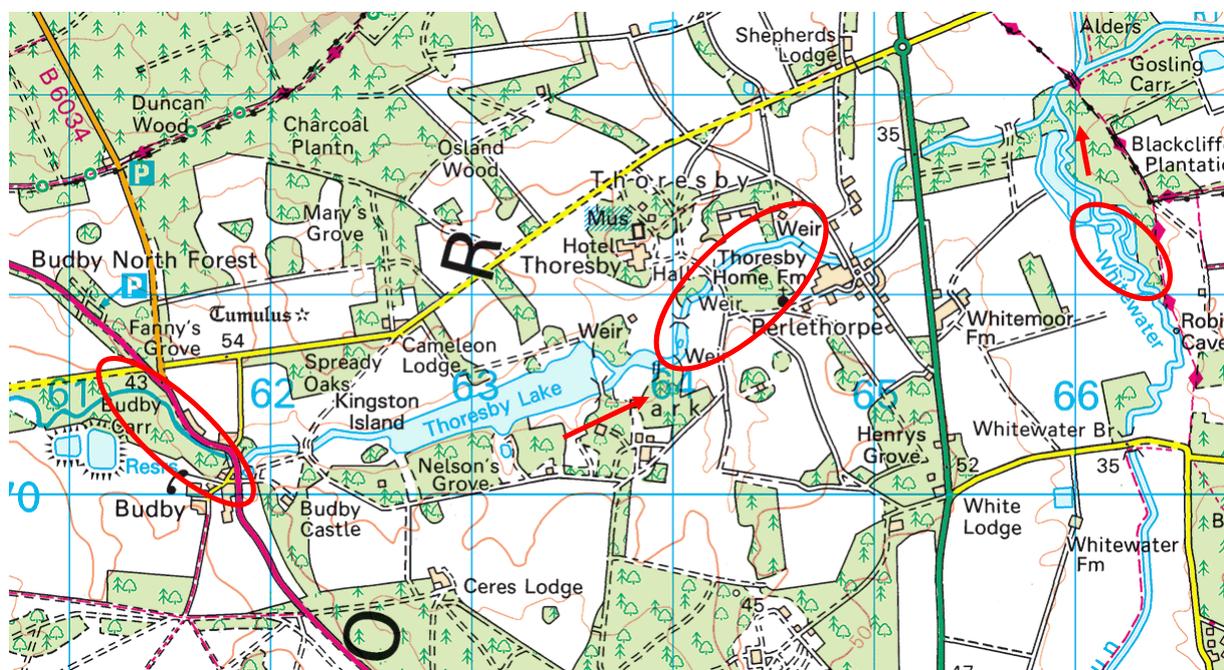


Figure 1 Locations of river reaches inspected at Budby and Thoresby/Perlethorpe (Meden), and Whitewater (River Maun). Red arrows indicate flow direction.

The sections of river visited (Figure 1) are owned by Thoresby Estate. At present, no angling takes place on these waters and the purpose of the visit was to assess the habitat quality of the rivers and their potential for angling.

3.0 Habitat Assessment

3.1 Thoresby Hall – Perlethorpe

This reach of the River Meden is located downstream of Thoresby Lake, an ornamental, online lake. The 320-m section either side of Green Bridge (SK6404270867), adjacent to Thoresby Hall, has a widened channel forming an ornamental broadwater (Photo 1), bounded upstream and downstream by weirs. The channel has narrowed over time as emergent vegetation (reeds and rushes) have colonised the margins, trapping sediment which has gradually consolidated.

The water level is controlled on the Green Bridge section by a weir (Photo 2), which limits the value of the section for trout in two main ways:

- The impounding effect of the weir slows the flow upstream, promoting deposition of fine sediment on the river bed: not favourable habitat for trout or the majority of their food species.
- The weir is a considerable barrier to fish attempting to move upstream. This is particularly relevant here, because this location is isolated by Thoresby Lake from any suitable habitat for trout breeding and recruitment in the River Meden upstream.

The Green Bridge section could be improved by reducing the impounding effect of the weir. This could be achieved by removing the weir entirely, or lowering or notching the weir crest, or by creating a bypass channel around the weir, with the aim of speeding up the flow in the section upstream and improving fish passage across/around the weir. With increased flow speeds upstream, the channel could be narrowed using brushwood bundles to create a new bankline and back-filling behind. It would not be worth pursuing the channel narrowing unless the impounding effect of the weir could be reduced. Consultation with Historic England is recommended as a first step, given the location within a Registered Park and Garden (Thoresby Park) and the numerous Listed structures in the vicinity.



Photo 1 Looking upstream from Green Bridge towards Thoresby Lake. The river channel here has been historically modified into an ornamental broadwater. Note the extensive reed encroachment as the river narrows itself to more natural dimensions.



Photo 2 The weir located at SK6409770982 approximately 130m downstream of Green Bridge which impounds flows and maintains water levels upstream.

Downstream of the weir, the river channel changes character and is free-flowing with a gravel bed. Possible evidence of trout spawning was seen on the ramp of gravel immediately downstream of the weir pool. The river channel has narrowed and deepened below the weir pool, then broadens out and shallows as it approaches the footbridge (Photos 3 and 4), where there is an access point for river study used by the nearby schools' field studies centre. The 170-m section between the weir and the footbridge is the best trout habitat seen on this section.



Photo 3 Access point for river study used by groups at the nearby Perlethorpe Environmental Education Centre (www.nottinghamshire.gov.uk/education/outdoor-and-environmental-education/outdoor-education/perlethorpe)



Photo 4 Footbridge at SK6420771106

Downstream of the footbridge, the river continues to be un-impounded and free flowing for c. 450m until the weir and sluice near Thoresby Home Farm. The planform of the channel is very straight through this section, with no meanders, indicating it has been altered from its natural form. The Historic England list entry (<https://historicengland.org.uk/listing/the-list/list-entry/1000361>) makes the following reference:

By the early C18 the enclosed fields had been given a formal character by the addition of rides, rondpoints, and patte d'oie through woodland, particularly to the north of the Hall (estate map, 1738). The formality was gradually removed during the mid to late C18, a process started by Francis Richardson, the Duke of Kingston's gardener, who in 1760 made a serpentine river from a cascade in the garden to a cascade by the Kennels.

This would appear to encompass this reach of the river, although "serpentine" must refer to curves of a much greater radius than those of natural meanders, given the straightness of this reach.

The straightness of the channel means that it has a higher gradient than that of a naturally meandering (hence longer) channel over the same

distance, and is lacking a natural pool-and-riffle sequence (Figure 2). This means the reach is comprised of mainly long, shallow, riffle-like habitat (Photo 7), with a short section of deeper glide (Photo 8). This type of habitat has some value for the juvenile stages of trout, but lacks deeper areas and areas of cover which fish beyond c. 6" (15 cm) could inhabit.

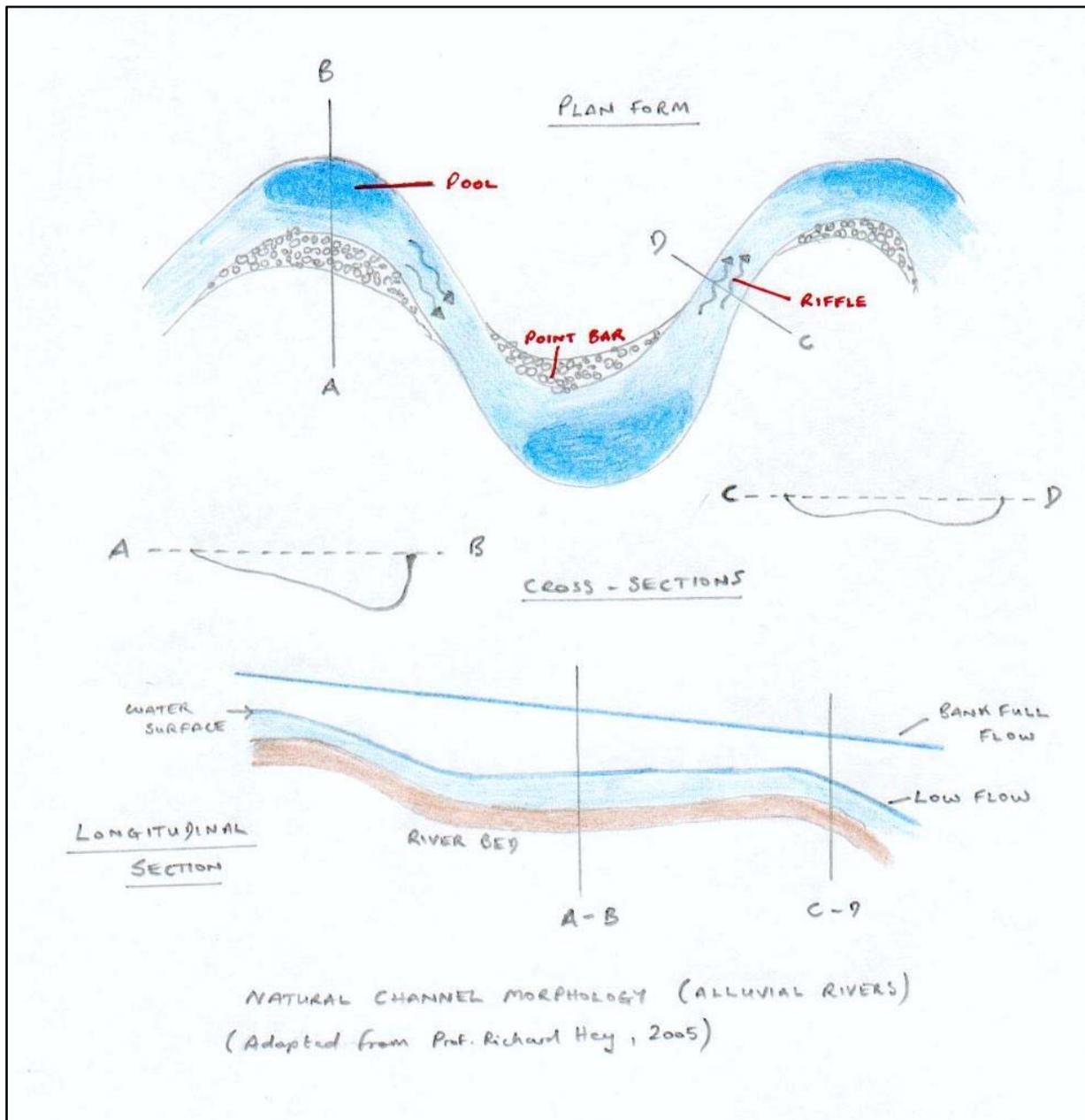


Figure 2 Natural river channel shape, showing how pools occur on the outside of meanders, with riffles in-between, providing natural variation in depths and bed substrate, which in turn provides the habitat variety necessary to support healthy populations of trout and other aquatic wildlife.



Photo 5 Downstream of footbridge showing fine sediment deposition where the channel is wider.



Photo 6 View downstream from the footbridge.



Photo 7 Downstream of the footbridge the river is un-impounded (free flowing), over a gravel bed. The right (near) bank is grazed, in contrast to the left (far) bank. The river channel is artificially straight and largely shallow.



Photo 8 A short section downstream of the footbridge has narrowed and deepened as emergent vegetation has pinched the channel and trapped and consolidated sediment.

Ideally, the planform of the river here should be changed to introduce some meanders and re-establish a pool-riffle sequence, providing depth variation and habitat niches for all trout life stages. This would require design input from a professional fluvial geomorphologist and earthworks to excavate new sections of channel and backfill some existing sections. An example of this type of project can be seen in Figure 3 (with more details at www.wildtrout.org/content/river-glaven). Early consultation with Historic England over heritage considerations and with the Estate over the land-take required is essential. The natural flood management aspects of such a project may be advantageous in the current climate of changing agri-environment subsidies.

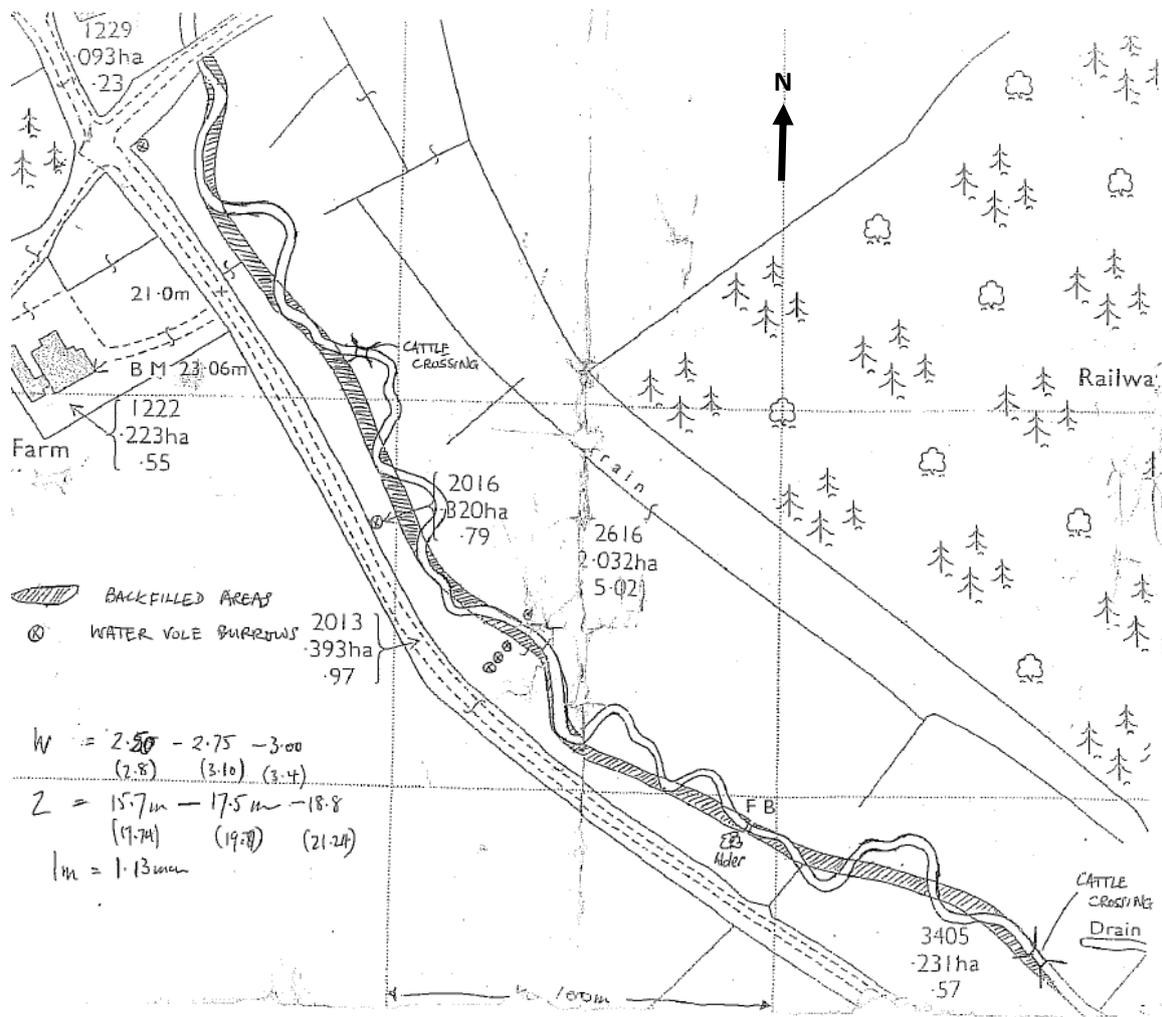


Figure 3 Plan of river re-naturalisation project carried out on River Glaven, Hunworth, Norfolk. Shaded line is the original engineered channel, open line is the new, restored course. The engineered channel was back-filled with spoil excavated from the new channel. (River flowing SE to NW).

A re-meandering project would have a timescale of 2–3 years for delivery. In the meantime, or if such a project were not possible, more immediate (but less permanent and effective) improvements could be made within the existing channel by introducing log flow deflectors and large woody material to create bed scour and depth variation. Some examples are given in Section 4, Recommendations.

Near Thoresby Home Farm, there is a weir and sluice system in the river (Photos 9 and 10) where water is abstracted by the Estate for agricultural irrigation. There is apparently a system of water release from the lakes upstream to supplement flow during periods of abstraction. In the warmer months, an influx of lake water which is warmer and with lower levels of dissolved oxygen, could have potentially detrimental effects to the river ecology. This practice should be checked to ensure it does not limit the fishery potential of this reach.

One of the sluices is permanently shut, but formerly fed a water meadow system (now partly inundated because of mining subsidence). The weir is an impassable barrier for fish migration and the quality and resilience of the fishery in this part of the River Meden would be enhanced if fish passage was improved. There is potential to create a nature-like bypass channel around the weir on the left bank by modifying the existing channel feeding the former water meadow. Further investigation into the feasibility of this is recommended, including consideration of the heritage aspects, existing ground and water levels, and the quantity of flow that could be diverted without compromising the existing abstraction.

A short distance downstream of the weir is an Environment Agency flow gauging station (with a v-crump weir). This has also been affected by mining subsidence and it is understood that it is to be replaced with an open channel, Doppler effect ultrasonic flow gauge.



Photo 9 Weir, sluices and abstraction point where water is pumped for irrigation on Estate farmland (SK6463271236). The sluice on the left is permanently closed, having formerly supplied a water meadow system. The standing water in the background is pooled because of mining subsidence.



Photo 10 Upstream view of the weir at the abstraction point.



Photo 11 Downstream view from the EA flow gauging weir, a short distance downstream from Photo 10.

3.2 Budby

A short section of the River Meden was inspected upstream of Thoresby Lake, alongside the road at Budby and into Budby Carr wood. This section is more natural in character (although its planform also indicates historic alteration and a pool-riffle sequence is generally lacking). The riparian land here (and for considerable lengths upstream) is woodland which is an excellent buffer for the river from more intensive forms of land use and provides abundant natural woody material in the channel. The woody material creates natural flow deflectors, scouring the river bed and providing depth variety and cover for fish. It is likely that this section of the Meden holds reasonable stocks of wild trout and could provide a resource for angling. Fly-fishing by wading the river between access/egress points would be possible and a wild, catch-and-release fishery could be sustained here. Further investigation during the spring is recommended, wading the channel to identify areas for habitat and access improvements. The plentiful riparian trees and in-house forestry expertise at Thoresby could facilitate the creation of habitat improvement features, along with WTT guidance.



Photo 12 River Meden at Budby, alongside the road (SK6159670283).



Photo 13 River Meden at Budby, upstream view away from the road (SK6148970466)

3.3 River Maun (Whitewater)

The section of the River Maun (Whitewater) upstream of Stan's Lake was inspected (Photo 14). Despite the meandering planform on the map, the in-stream habitat present here is disappointing. The river occupies a channel perched above the level of the adjacent land and is embanked along its left bank. The channel dimensions are uniform and there is no pool-riffle sequence. Riparian habitat is reasonably good, especially along the right bank (Walesby Scout Camp) which has trees, bushes and tall herbaceous vegetation. The left bank is grazed, but there are no serious issues with bank poaching or fine sediment ingress.

Trout are not known to be present in this section, although coarse fish including barbel are found throughout and upstream to Ollerton. Cormorants were observed feeding in the river, so in-stream cover is important to protect the fish stocks. There are some opportunities to enhance instream cover by hinging trees into the channel and introducing brushwood structures in the margins.

Stan's Lake was created following mining subsidence in the area. It is stocked with rainbow trout and fished by Thoresby Fly Fishers, who also have access to the Maun alongside the lake (although it is thought this is rarely fished). There have been problems with algal blooms and fish mortalities in the lake during warmer weather and often following inflow of nutrient-rich river water into the lake. There have been some modifications to inflow to make sure river water now bypasses the lake.

This section of the Maun may be attractive to a coarse fishing club, or as part of a package with the other section(s) described above to a club providing coarse and game fishing to its members.



Photo 14 River Maun (Whitewater) SK6643070425

4.0 Recommendations

- Reduce the impounding effect and improve fish passage at the weir downstream of Green Bridge (Photo 2). Lower the weir crest and creating a notch with an 'adherent nappe' (to eliminate entrained air in the water flow), and carry out channel narrowing upstream.

See Appendix 1 for examples and descriptions. Consultation with Historic England regarding heritage aspects would be required.

- Change the planform of the river downstream between the footbridge and the weir at Thoresby Home Farm to make it more sinuous and restore a natural pool-riffle sequence (Figure 4). Consultation with Historic England on heritage aspects would be required, followed by a levels survey and input to the design from a professional fluvial geomorphologist.



Figure 4 Conceptual diagram of river re-naturalisation project, where meanders are restored to the river planform by cut (blue lines) and backfill of sections of existing channel (red lines). Lowering of the land level adjacent to the river (within the meander loops) to restore the floodplain would also be required. There would therefore be excess spoil that would require removing or landscaping.

A re-meandering project would have a timescale of 2–3 years for delivery. In the meantime, or if such a project were not possible, more immediate improvements can be made within the existing channel by introducing log flow deflectors and large woody material to create bed scour and depth variation (Photos 15 and 16).



Photo 15 Example of a log flow deflector.



Photo 16 A sinuous flow pattern achieved by positioning flow deflectors on alternate banks (Photo: Ian Hawkins).

- Create a bypass channel around the weir/sluiice near Thoresby Home Farm to improve fish passage, by modifying the existing channel on the left bank feeding the former water meadow. Further investigation into the feasibility of this is recommended, including consideration of the heritage aspects, existing ground and water levels, and the quantity of flow that could be diverted without compromising the existing abstraction. An example of a bypass channel is shown in Appendix 1.
- Re-visit the Budby section and wade the river, making habitat and angling access improvements, such as 'hinging' small trees (Photo 17) and introducing flow deflectors.



Photo 17 Small trees laid into the river margins to provide improved cover for fish.

- Carry out similar tree hinging works on the Maun (Whitewater).

5.0 Making it Happen

The Wild Trout Trust can provide further assistance with implementing the recommendations by helping to obtain the necessary consents and assisting with practical delivery of the works such as the flow deflectors and tree hinging works. For the longer term projects, such as river re-meandering and fish passage improvements, further assistance with project development can be provided if the concepts are acceptable.

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/library>

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 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

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Appendix 1

The weir in Photo 2 has a level invert (crest) across the entire width of the brook, with a sharp downstream edge which causes two problems for fish passage:

- A shallow, even spread of water across the weir crest
- Water plumes to leave the face of the structure creating an air gap between the plume and the structure (Figure 1). This prevents fish from swimming up and through the plume, and causes them to have to jump. Fish are essentially designed to swim, and while they can clearly jump, especially salmonids, jumping fish is a sign that they are in difficulty.

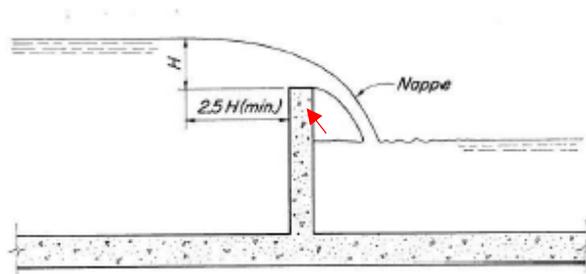


Figure 5 Long section of a weir with a level crest and sharp downstream edge creating an air gap (red arrow). Known as an aerated or ventilated nappe.

To improve fish passage:

- The weir crest should be lowered, reducing the height the fish have to traverse. This would also reduce the water level and speed up the flow upstream of the weir, giving more scope for habitat improvement.
- The weir crest could be made more varied with free gaps, notches, and lateral variations of the structure included in the works to ensure that a wide variety of flow and velocity conditions occur across the structure at any one flow condition. These heterogeneous conditions offer fish of different species, sizes, and abilities a better prospect of surmounting obstructions.
- A notch with an “adherent nappe” (i.e. excluding the air gap) could be created within the structure, which would allow the fish to use its burst speed to swim through, rather than jump. This is normally achieved by having sufficient thickness of cross-wall and providing a curved or 250 -300mm radiused profile (Figures A2 and A3). An alternative means of creating an adherent nappe can be to use a chamfered profile, which is sometimes easier to attain. Scaling up the profiles in these structures gives possible profiles for use in other thicknesses of cross-wall, for example that shown in Figure A4 below for a typically 300mm thick wall
Notches are effective in narrow crested, vertical weirs where the head difference between upstream and downstream water levels is $\leq 0.5\text{m}$ and there is a suitable depth of water below the weir - a depth of at least twice the head difference is required. Where the head difference is

>0.5m (0.3m for trout and coarse fish), two or more weirs in series (with notches) can be used (Figures A5 and A6).

In `streaming flow` situations the gaps, notches must be at least 0.20m wide for trout & large coarse fish. In `plunging` flow situations (more likely) they should be wider and a minimum of 0.3m for trout and coarse fish.

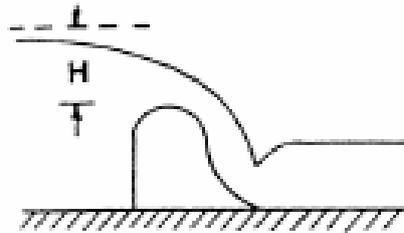


Figure A6 Long section showing radiused profile, excluding air gaps and allowing fish to swim over the weir.

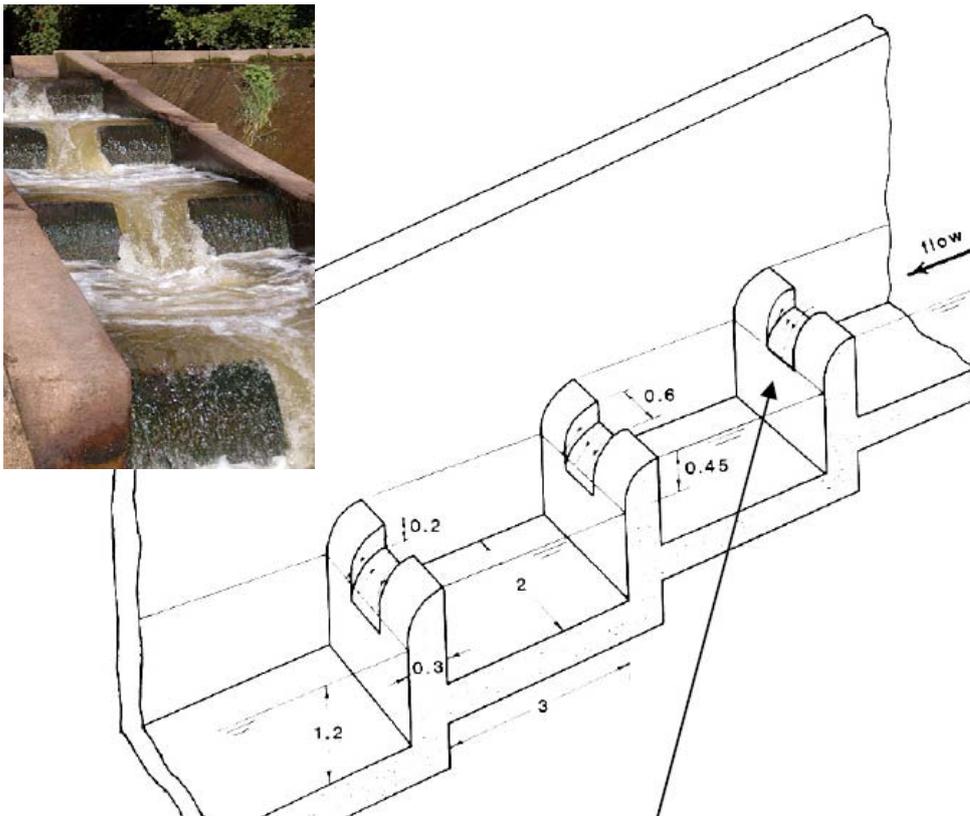
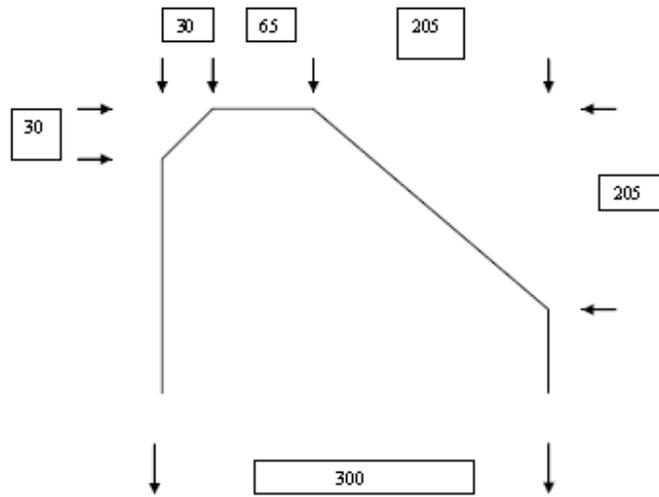


Figure A7 Schematic diagram of a pool-traverse fish pass showing the radiused profile of the weir walls and notches, minimising turbulence. The same principle applies to notches in small weirs.



(measurements in mm)

Figure A8 Measurements (scalable) for a chamfered profile to a 300-mm thick wall which would create an adherent nappe. In some cases, such as when constructing blockstone weirs or using natural materials, it may be difficult to achieve satisfactory profiles. However, the same effect can often be achieved by ensuring that the stones put in the notches are sloped.

Examples



Figure A5 Two rough-crested weirs in series.



Figure A6 Retrofitted fish passage improvement: new pre-weir (foreground), raising water levels at the existing weir (background) with a radiussed notch in each (arrows).

At the Thoresby Home Farm weir, a bypass channel could be constructed around the weir on the left bank, such as the one illustrated in Figure A5.



Figure A9 A rock-ramp fish pass illustrating the concept of a heterogeneous surface providing varied flow patterns conducive to fish passage at most river discharges.