WILD TROUT TRUST

Advisory Visit

River Smite, Nottinghamshire

September 2020

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1.0 Introduction

This report is the output of a site visit undertaken by Tim Jacklin of the Wild Trout Trust to the River Smite near Orston, Nottinghamshire, on 2nd September 2020. Comments in this report are based on observations during the site visit and discussions with members of a local volunteer group, the 'Orston Grafters' and a riparian landowner. The group wish to improve the stewardship of the river for fish and wildlife in the vicinity of Orston village, which may include the formation of an angling club.

Normal convention is applied with respect to bank identification, i.e. 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 specific locations.

2.0 Catchment / Fishery Overview

The section of the River Smite visited is located upstream of its confluence with the River Devon, approximately 10 miles from its ultimate confluence with the River Trent in Newark. The river is located within the Vale of Belvoir with an underlying geology of sedimentary mudstone overlain with superficial alluvial deposits. The Smite is a lowland river, falling around 140m along its 44-km course between its source near Holwell on the Leicestershire Wolds and the Trent confluence, much of that gradient being in the headwaters. The gradient of the reach visited is estimated at 1 in 1000 which is means the river has relatively low energy compared to many watercourses.

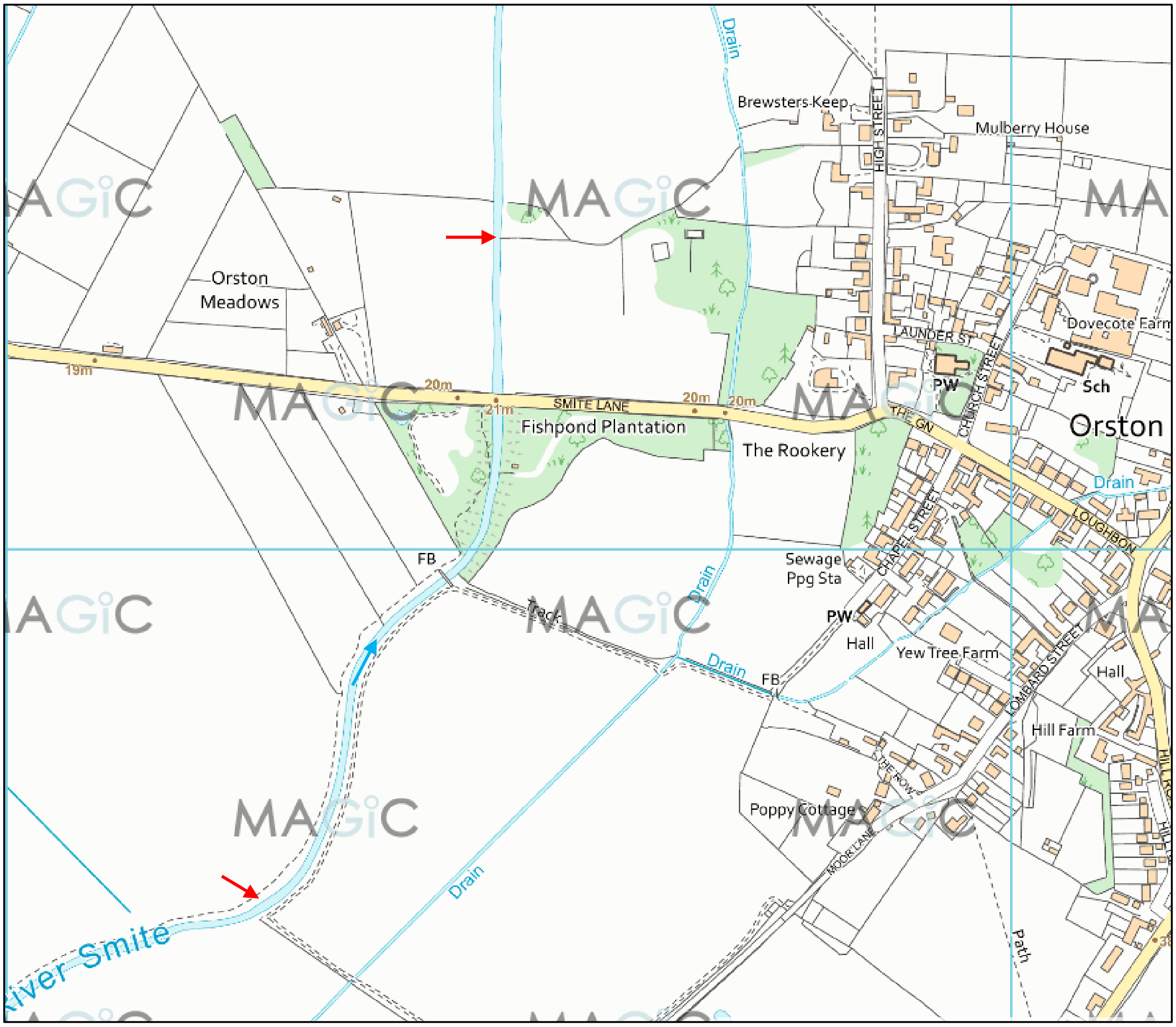

Figure 1 Location of reach visited (between red arrows), flow is south to north (blue arrow). Map from www.magic.gov.uk .

In order to meet the requirements of the Water Framework Directive, the Environment Agency monitor the quality of watercourses using a number of measured parameters including plant, algae, invertebrate and fish populations, along with physical and chemical measures. These are given a rating on a scale of *high*, *good*, *moderate*, *poor* and *fail.* In this case, the section of the Smite near Orston falls within the waterbody described in Table 1, which is currently classified as *moderate* status overall. Invertebrates are rated as *good* and fish as *high*, which is surprising given the habitat observed on this visit. Phosphate is rated as *bad* because of inputs from agriculture and sewage works; why this does not drive an overall classification of *bad* is unclear.

River	**Smite**
Waterbody Name	Smite / Devon from Stroom Dyke to Cotham
Waterbody ID	GB104028052631
Management Catchment	Trent Lower and Erewash > Nottinghamshire South B
River Basin District	Humber
Current Ecological Quality	Overall classification of **Moderate** ecological status in 2016
U/S Grid Ref inspected	SJ5341405561
D/S Grid Ref inspected	SK7624940641
Length of river inspected	~750m

Table 1 Summary of Water Framework Directive information for the waterbody within which the section of the Smite visited is located (https://environment.data.gov.uk/catchment-planning/WaterBody/GB104028052631).

3.0 Habitat Assessment

Habitat quality is assessed upon the availability of the different features required for the key life stages of trout: spawning, juvenile and adult (Figure 2 The impacts on trout populations lacking adequate habitat for key lifecycle stages. Spawning trout require loose mounds of gravel with a good flow of oxygenated water between gravel grains. Juvenile trout need shallow water with plenty of dense submerged/tangled structure for protection against predators and wash-out during spates. Adult trout need deeper pools (usually > 30cm depth) with nearby structural cover such as undercut banks, boulders, sunken trees/tree limbs and/or low overhanging cover (ideally trailing on, or at least within 30cm of, the water's surface). Good quality in one or two out of the three crucial habitats cannot make up for a "weak link" in the remaining critical habitat.). These habitats need not exist solely within a given reach, but they must be accessible for fish to migrate to and from, in order for a wild trout population to thrive. For example, spawning habitat may be present in the headwaters or tributaries of the river and adult habitat in the main stem.

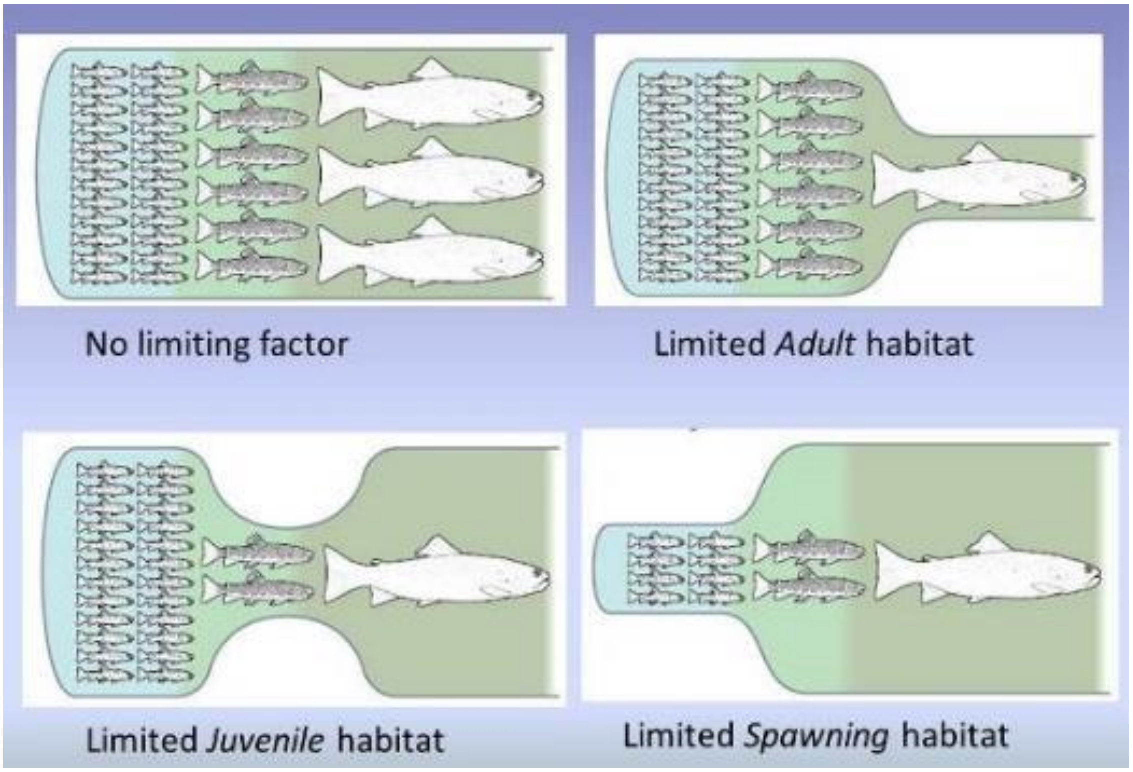

Figure 2 The impacts on trout populations lacking adequate habitat for key lifecycle stages. Spawning trout require loose mounds of gravel with a good flow of oxygenated water between gravel grains. Juvenile trout need shallow water with plenty of dense submerged/tangled structure for protection against predators and wash-out during spates. Adult trout need deeper pools (usually > 30cm depth) with nearby structural cover such as undercut banks, boulders, sunken trees/tree limbs and/or low overhanging cover (ideally trailing on, or at least within 30cm of, the water's surface). Good quality in one or two out of the three crucial habitats cannot make up for a "weak link" in the remaining critical habitat.

The overriding influence on habitat quality in this section of the Smite is its history of channel modification for land drainage. Figure 3 is a late Victorian Ordnance Survey map clearly showing the straightening and incision of the river's course and the cut-off meanders of the previous meandering course. This is likely not the only time channel modification has occurred, and drainage works will have been carried out to varying degrees throughout human habitation of the area, becoming more extensive in modern times. Figure 5 and Figure 4 show the effects upon the physical shape of the channel and the overwhelmingly negative impact upon habitats.

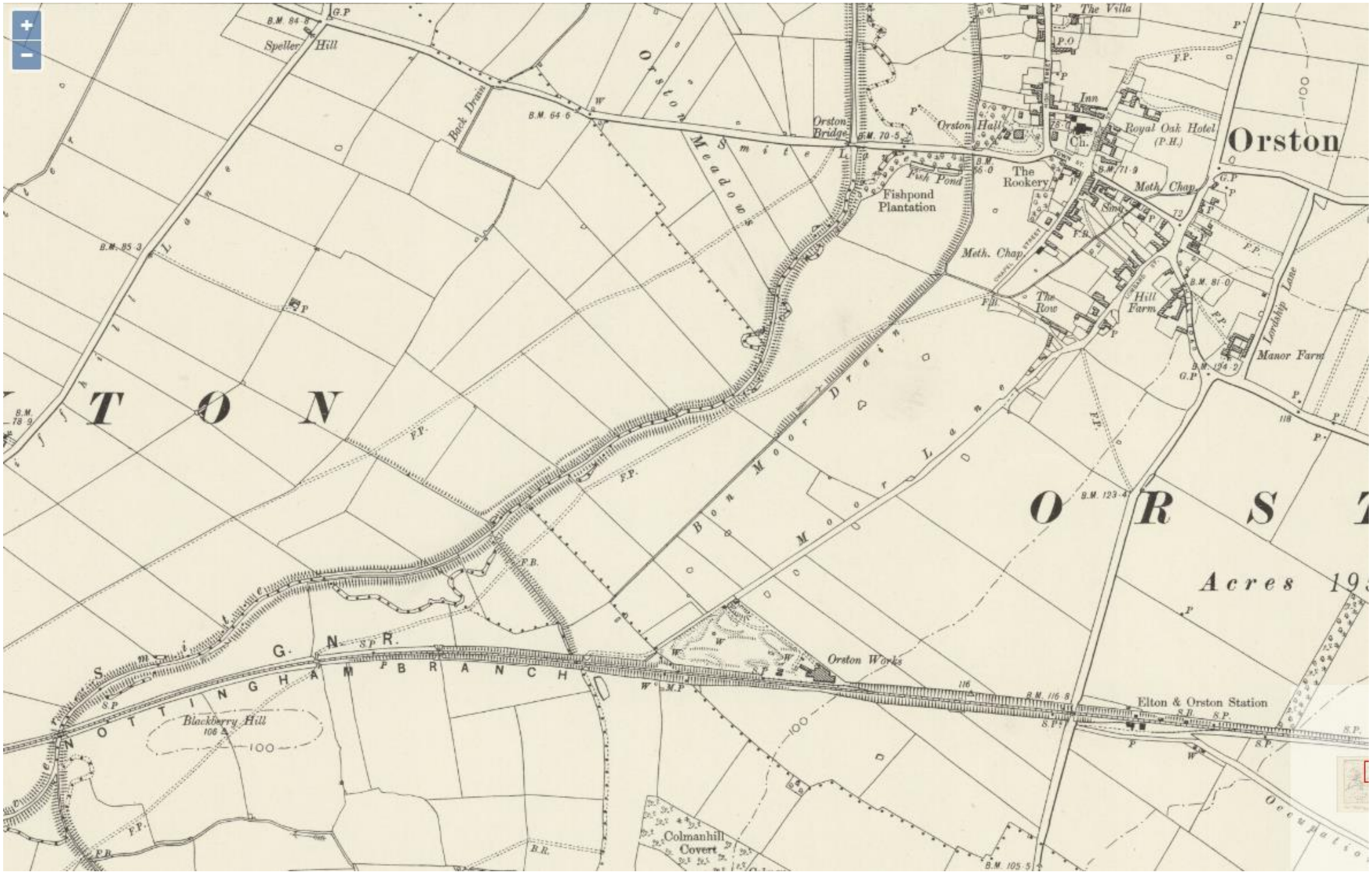

Figure 3 Extract from Ordnance Survey six-inch map (surveyed 1883, revised 1899) which clearly shows the straightening of the course of the river and relict meanders. Link to the full map (https://maps.nls.uk/view/101603367#zoom=3&lat=3123&lon=4233&layers=BT).

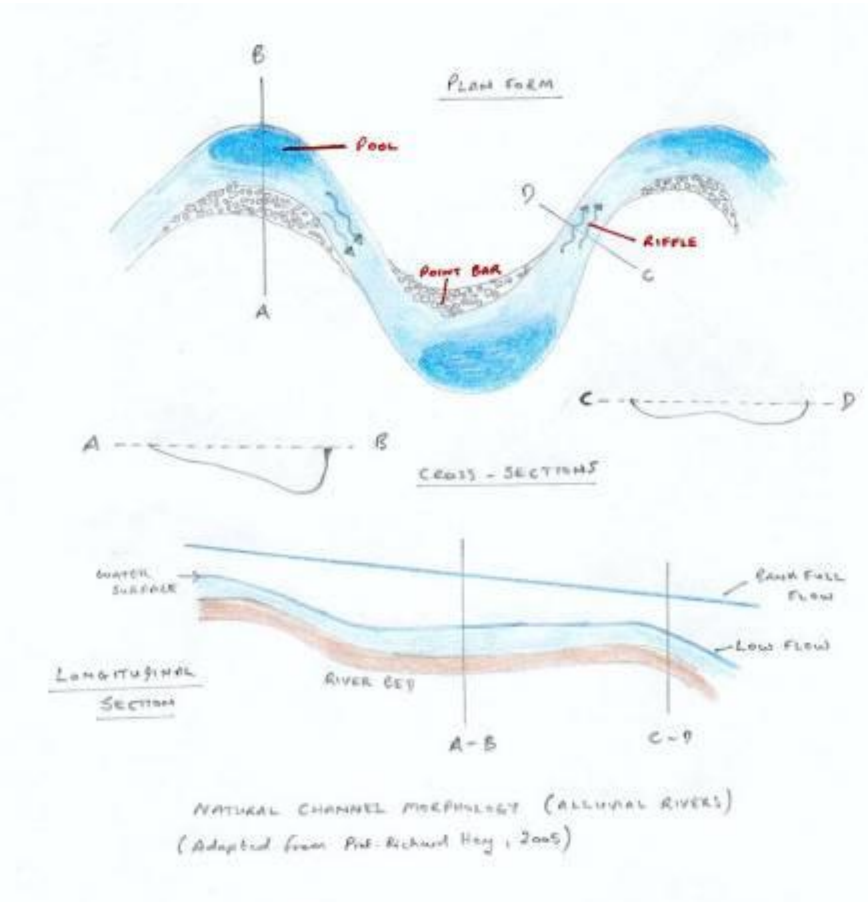

Figure 5 In a natural, un-modified river the course meanders (top), forming deep pools on bends and shallow, gravelly riffles in between. This creates variation in depth, in the composition of the river bed and in flow patterns. This variation provides the different conditions needed by wildlife to survive and thrive. For example, deep areas provide refuge for fish during low flows; shallow areas provide breeding areas for trout and stones for mayflies to live under.

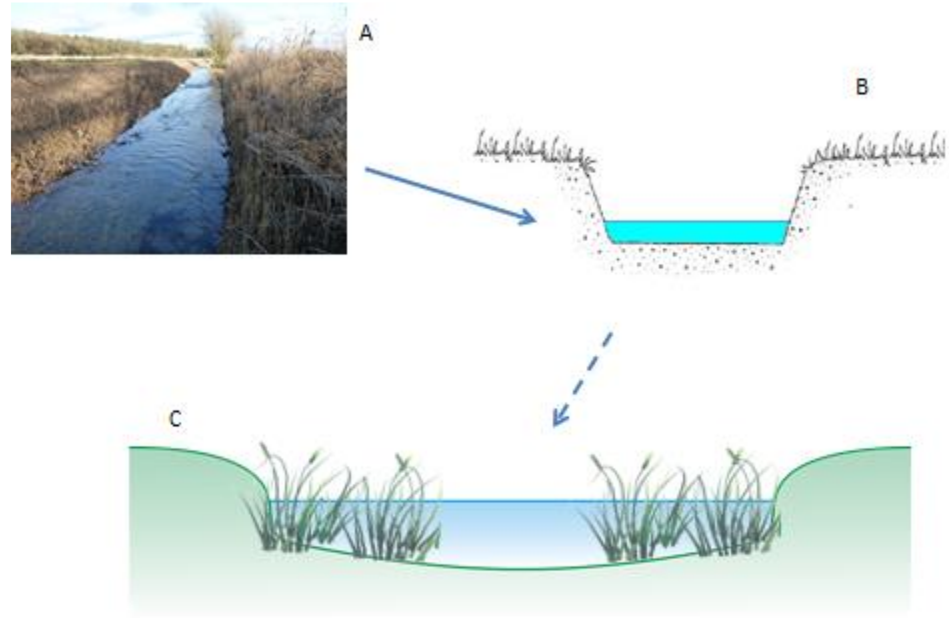

Figure 4 Straightened channels (A) have a uniform, trapezoid-shape cross-section (B) which tends to be shallow and has very little variation in depth, river bed composition and flow pattern. These channels thus lack the features needed for healthy fish populations. Where channels have also been widened, over time the river returns to its former width through deposition of sediment and colonisation with plants (C), subject to shading.

In addition to the loss of river length, meanders and depth variation, the channel engineering has disconnected the river from its floodplain. The lowering and widening of the river bed means that far larger flood flows are contained within the channel than would be the case in a natural river channel. The latter would spill onto its floodplain more frequently (i.e. at lower flow stages), which means energy within the river channel is dissipated and wetland riparian habitats exist. In an engineered river, larger flood flows (and hence energy) are contained within the channel leading to a hostile environment for fish (wash-out of smaller individuals) and loss of wet riparian habitat. Meanwhile low flows are spread out within the enlarged channel, leading to a uniformity of shallow water largely unsuitable for adult fish.

Examples of the above were evident during the visit to the Smite. Figure 6 shows the typical habitat downstream of the road bridge – uniformly shallow (around 10 – 15cm), but within a channel which contains flows up to approximately 4 metres deep before spilling onto the floodplain. Wrack levels in the bankside bushes showed a recent rise in levels of about 0.5m after summer rainfall and rises exceeding channel capacity in recent winters were reported by the landowner. The channel is moderately shaded by hawthorn bushes here, but the north-south aspect allows sufficient light for emergent vegetation to colonise the margins, pinching the channel at low flow levels; encouraging this process by creating brushwood 'berms' (low shelves) is a way of improving in-stream habitat (see Recommendations).

Figure 7 shows the section upstream of the road bridge, which runs through Fishpond Plantation (right bank) and the village Millennium Green area (left bank). This section is impounded by the bridge culvert (Figure 8) and is shaded by mature trees, the result of which is an over-wide, shallow, low-energy reach with poor in-stream habitat. Attempts to improve in-stream habitat here with brushwood berms or flow deflectors are likely to be frustrated by the shade (preventing aquatic vegetation from establishing and pinching the low-flow channel) and the impoundment (low flow energy, hence less bed scouring effect).

Thinning of some trees (particularly the uniformly-sized sycamores on the left bank) may reduce shade and provide material for in-stream structures, but this must be carefully considered given the known presence here of an important bat community.

Figure 9 shows the section of river upstream of the footbridge. In contrast to the previous section, the channel here is choked with burr-reed with only small areas of open water, or narrow channels where shade is present from bankside hawthorns. The uniform size of the hawthorns suggests they are periodically trimmed to the same size; allowing some to develop into larger trees along the right (southeast) bank would provide more shade and reduce the prevalence of burr-reed. Similarly, planting and protecting other native tree species along this bank is recommended for the same reason. Brushwood berms could be installed here to create a low-flow channel closer to the natural width of the river, which should have enough energy to restrict burr-reed to the margins (see recommendations).

At lower flows, the weir at the road bridge is an obstacle to fish movement (Figure 8). It would be possible to improve this with relatively simple techniques (see recommendations), but the priority on this reach would be to concentrate on in-stream habitat improvement in the first instance.

In summary, the reach of the Smite inspected has poor instream habitat quality. It particularly lacks adult fish habitat (deeper pool areas) and spawning habitat (well-sorted gravel areas with faster flows). Juvenile fish habitat is present in the form of shallow water with in-stream and overhanging vegetation, but the high flows contained within the engineered channel will have a wash-out effect on smaller fish. Habitat could be improved by creating a narrower, low-flow channel within the wider engineered channel and managing bankside trees to create varied levels of shading of the channel.

Figure 6 Downstream of the road bridge.

Figure 7 Upstream of the road bridge.

Figure 8 Obstacle to fish migration caused by the bridge culvert.

Figure 9 Upstream of the footbridge.

4.0 Recommendations

- Create a narrower, sinuous low-flow channel by installing brushwood berms on alternate banks (Figure 10 and Figure 11). This would be a suitable technique upstream of the footbridge and downstream of the road bridge. Existing bankside bushes could provide a source of brushwood and an opportunity to manage the riparian tree cover and introduce a greater variety of native tree species.

Figure 10 Brushwood berm created by packing brushwood between stakes driven into the river bed and battening over the top.

Figure 11 Brushwood structures on alternating banks to create sinuosity.

- Introduce some log flow deflectors to create localised bed scour. This should create some deeper areas and also grade the river bed substrate making it more suitable for fish spawning (Figure 12). Logs could be sourced from the sycamore trees on the left bank upstream of the road bridge.

Figure 12 Log flow deflectors arranged into an upstream-V shape to deflect flow into the centre of the channel, scouring a deeper hole and throwing up sorted gravel downstream (river flow towards the camera).

- If overhanging trees need to be managed, do so in a way that retains low cover (in or close to the water surface), as discussed on site regarding the crack willow on the right bank downstream of the road bridge (Figure 13).

Figure 13 Willow growing out into the channel downstream of the road bridge. Retaining cover of this kind is the most beneficial habitat option, but if management is required trimming the higher level branches and retaining those in and just above the water is recommended.

- Retain natural features such as fallen timber, tree stumps etc. The more structure within the channel to provide cover and flow variation, the better (Figure 14). Similar features could be created by partially cutting and laying over suitable trees into the river margins in a similar manner to hedge laying (Figure 15).

Figure 14 Natural cover provided by a fallen hawthorn.

Figure 15 Bankside trees cut and laid to create good cover. Inset: example of steeply angled back-cut to create a hinge.

- The weir under the bridge could be improved for fish passage. The simplest way to do this would be to raise downstream water levels to drown out the drop over the weir. Two or three areas of the river bed downstream of the weir could be raised to create artificial riffles and step-down the water levels. These could also have the benefit of scouring pools downstream of each riffle. Installation would take around 2 – 3 days with an excavator and cost around £10K. Flood risk implications would be neutral given it would simply extend the existing water level at the bridge a short distance downstream.

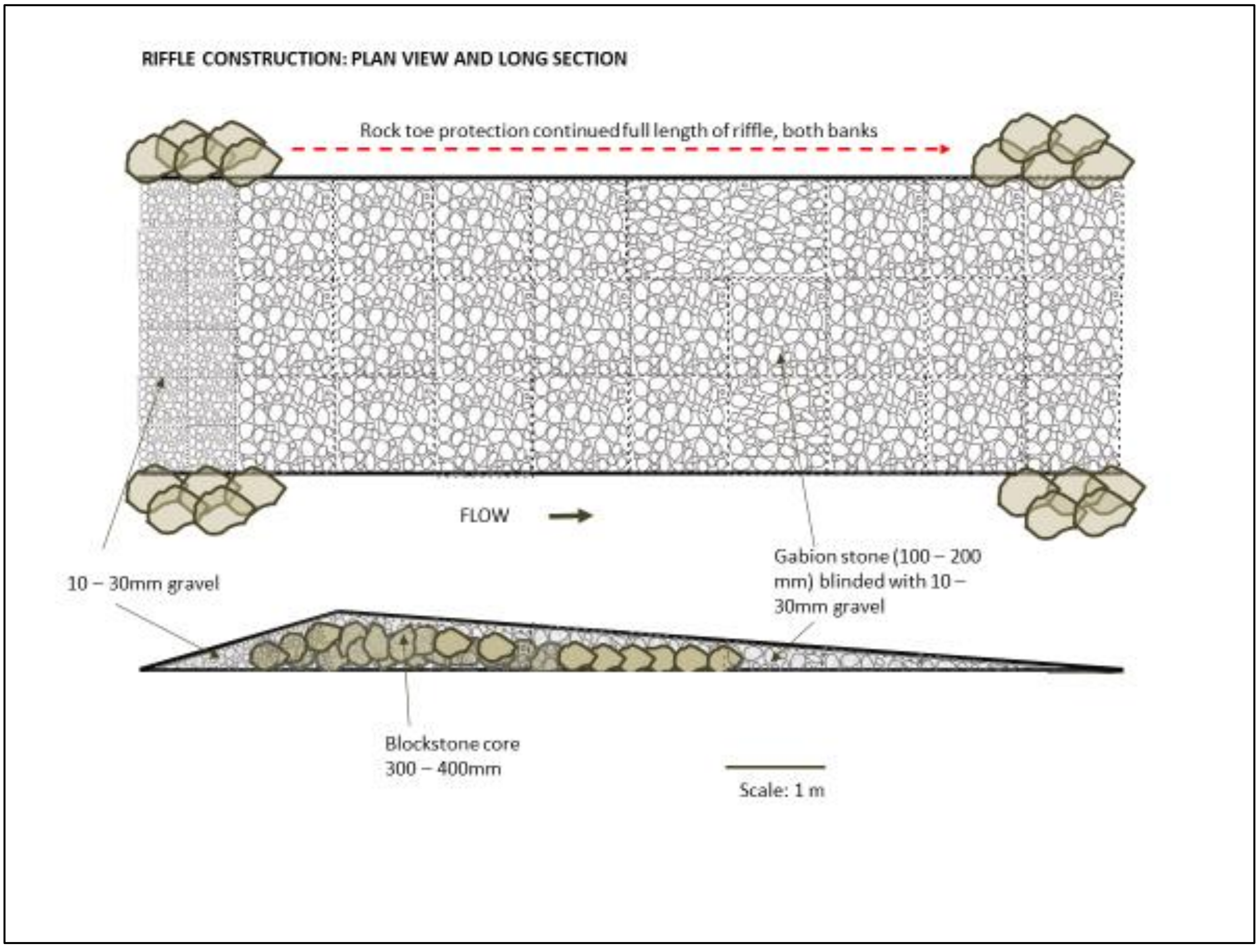

Figure 16 Example of a constructed riffle showing the shallow gradient which allows fish to swim over. The stone used needs to be of sufficient calibre to remain in position during bank-full flows.

Figure 17 Example of a series of three rock 'riffles' installed to step-down water levels downstream of a culvert which was perched above previous water level. NB the perspective – the distance to the culvert from the camera is c.100m.

- Consider getting involved in the citizen science projects run by the Riverfly Partnership (www.riverflies.org) which encourages and supports local groups to monitor the water quality in their local streams and rivers.

Please note it is a legal requirement that works to the river require prior written consent from the Environment Agency (EA). A limited range of activities can be carried out under an exemption via a simple registration process (www.gov.uk/government/publications/environmental-permitting-regulations-exempt-flood-risk-activities/exempt-flood-risk-activities-environmental-permits), for example FRA numbers 13, 15, 18 and 20. More extensive works require a Standard Rules or Bespoke flood risk permit with a more complex application procedure.

5.0 Making it Happen

Further assistance from the Wild Trout Trust is available in the form of:

- Preparing a more detailed project proposal and helping to obtain the necessary permits from the Environment Agency for carrying out in-stream works.
- A practical visit, which involves a visit from a WTT Conservation Officer to demonstrate the techniques described. This enables recipients to obtain on-the-ground training regarding the appropriate use of conservation techniques and materials, including Health & Safety, equipment. This will then give projects the strongest possible start leading to successful completion of aims and objectives. Recipients will be expected to cover WTT travel expenses.

The WTT website library has a wide range of free materials in video and PDF format on habitat management and improvement:

www.wildtrout.org/content/library

The Wild Trout Trust has also 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.

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

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