



Advisory Visit
River Trent, Stoke-on-Trent
October 2014



Introduction

This report is the output of a site visit undertaken by Tim Jacklin of the Wild Trout Trust (WTT) to the River Trent in Stoke on Trent on 17th October, 2014. Comments in this report are based on observations on the day of the site visit and discussions with Liz Horton and Nick Mott of Staffordshire Wildlife Trust (SWT) and subsequent discussion with (and addition of diagrams by) Paul Gaskell of WTT. SWT are the catchment hosts for the Staffordshire Trent Valley area under the government's Catchment Based Approach to the Water Framework Directive (<https://www.gov.uk/government/publications/catchment-based-approach-improving-the-quality-of-our-water-environment>). This advisory visit focussed on areas of the urban River Trent where significant lengths of the river are in single ownership, for example the City Council.

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.

1.0 Area Overview

Stoke on Trent is located on the headwaters of the River Trent, the source of the river being a short distance north of the city on Biddulph Moor. The river flows south from its source, is impounded by Knypersley Reservoir, then enters the urban area at Norton Green and Milton. Tributaries within the city include Ford Green Brook (confluence at National Grid Reference SJ90404960), Fowlea Brook (confluence SJ88004500 approximately) and Lyme Brook (confluence SJ86504250). Other small tributaries include Causley Brook, Chitlings Brook, Adderley Green Brook, Bagnall Brook, Barnfield Brook, Scotia Brook, Longton Brook, and Longton Cockster Brook.

For the majority of the past century, poor water quality has been the dominant influence on this part of the Trent. In 1937* the main river and Fowlea Brook were classified as "animal and plant life totally unable to subsist" and Ford Green Brook as "fish life unable to subsist but plant life may appear". The main reason for this was industrial pollution and sewage effluent which were gradually brought under control during the latter half of the C20th. [**The Ecology of the River Trent and Tributaries*, J. Inglis Spicer, Clerk and Biologist of the Trent Fishery Board, In the Handbook of the British Association for the Advancement of Science, 1937].

However, water quality problems persisted well into the 1990s in the form of combined surface water/sewage overflows (CSOs), which allow sewers to overflow into rivers during periods of heavy rainfall when river flows should provide sufficient dilution to prevent ecological damage. In Stoke, the CSOs regularly discharged untreated sewage into the rivers during relatively low flows causing frequent pollution and preventing sustainable fish populations from re-establishing (the author was responsible for the Environment Agency's fish survey programme at this time which highlighted this problem). Subsequently considerable investment has taken place via the water company's Asset Management Programme, providing additional storm-water storage capacity which is then diverted to the main sewage treatment plant for Stoke, downstream of the city at Strongford.

Trout were observed at most of the sites visited during this advisory visit which is an indicator of greatly improved water quality in recent times. There is always a risk of pollution in such an urban area, but these are likely to be one-off, acute incidents which affect localised areas rather than the blanket, chronic problems of the past. In order to make the river as resilient as possible to such incidents, providing good in-stream habitat and good connectivity between reaches and tributaries is paramount.

2.0 Habitat Assessment

Staffordshire University Site

The River Trent was walked between the footbridge near Seven Arches Way (SJ8824045319) and the footbridge adjacent to the University sports fields (approx. SJ8871945794) (Map 1). This site is Manorfields Pools, a nature reserve managed by Staffordshire University.

The in-stream habitat within the river along this reach is generally poor. The channel is artificially straight and uniform in width and depth. It lacks meanders and a natural pool-riffle sequence, meaning the river-bed substrate is poorly sorted and dominated by fine sediment (sand and silt). Some gravel is present at the downstream end of this reach (adjacent to the pools), where the channel gradient appears to be steeper.

The toe of the river bank is armoured with stone which confines the river to its present course by preventing bank erosion and the re-establishment of channel sinuosity.

Riparian vegetation has been managed sensitively with trees, bushes and tall vegetation allowed to develop. This provides a "shaggy" margin alongside the river which overhangs into the water and provides excellent cover, offsetting to a small degree the deficiencies in the channel form. Himalayan balsam is present, although not as prolific as elsewhere on the river indicating it may have been subject to some control. Trout were observed within the reach. Non-native, American signal crayfish are known to be present here.

The opportunities for improvement of channel form here can be divided into three levels of decreasing cost and complexity:

- Option 1: Re-meander the river channel to create a sinuous planform with a pool-and-riffle structure. This would involve digging out new sections of channel and backfilling some existing sections (Figure 1), plus excavating a floodplain alongside the channel (within the bounds of current bank heights at the outer edges). The latter would be designed to inundate more frequently, but would provide improved flood storage capacity reducing flood risk to property in the area. Some back-filled channel areas could be left as backwaters, adding to the improved habitat value provided by the new river plan-form and floodplain.
- Option 2: Remove the stone toe from the river channel and allow the resulting increased rates of erosion and deposition to create more natural channel features (Figure 2a).
- Option 3: Install in-stream structures (flow deflectors) to create bed scour and sorting of substrate in localised areas (Figure 2b).

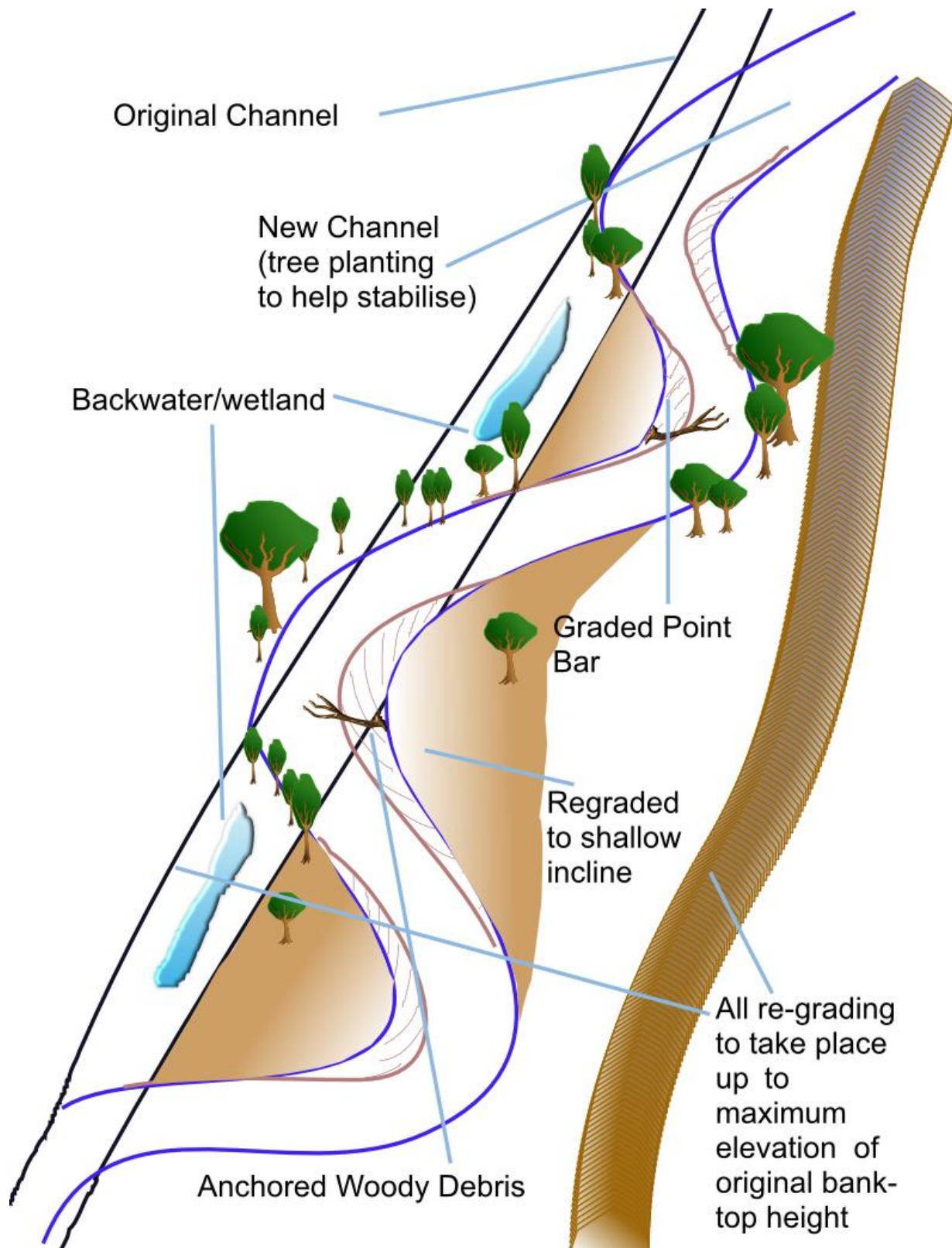


Figure 1: Indicative sketch impression of the measures involved in a designed re-meandering of the channel planform - with attendant reinstatement of significant ecological and geomorphological functions (including improved floodwater storage and control). Sketch is not to scale and does not represent a formal design.

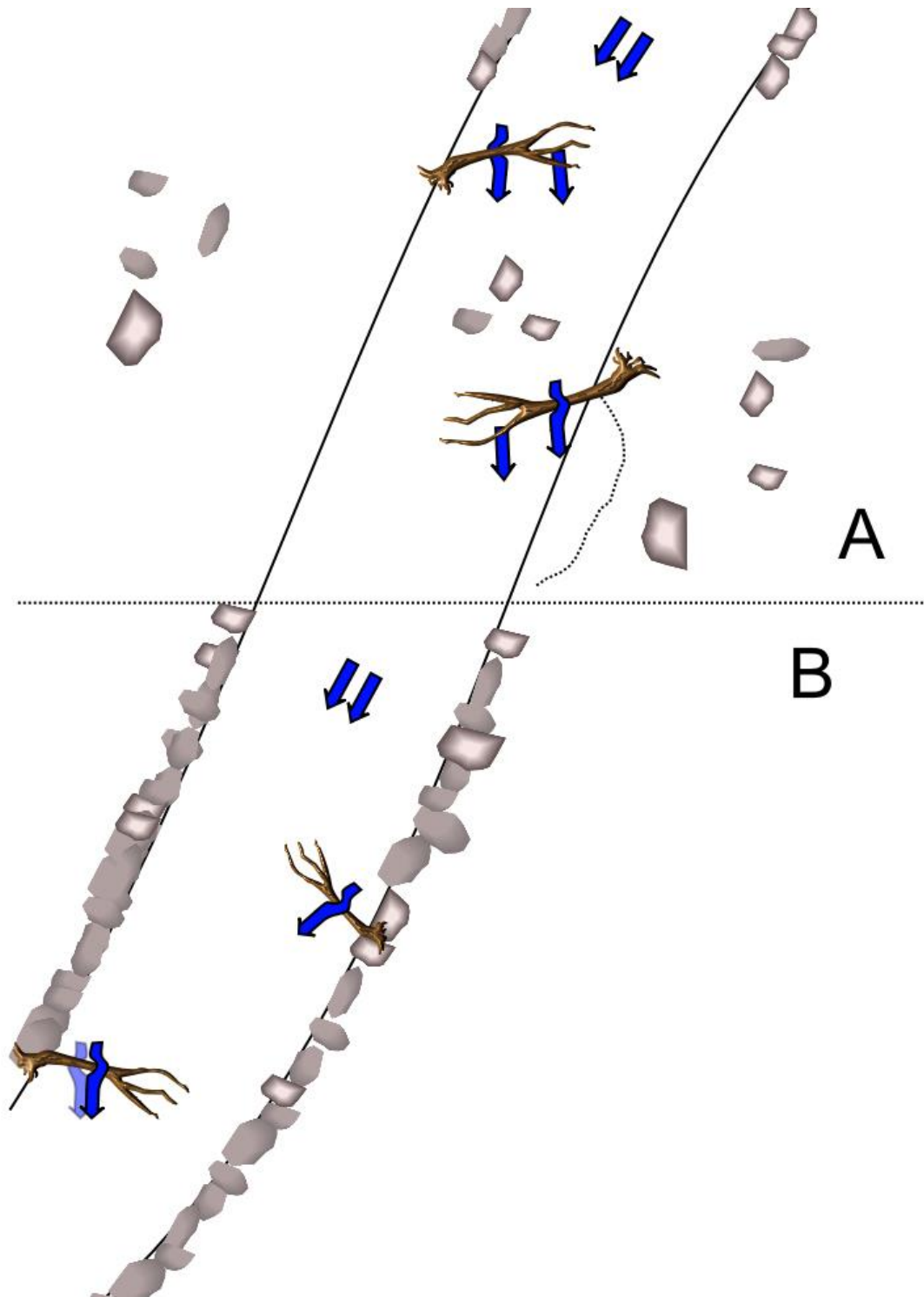


Figure 2: Indicative sketch showing removal of bank armouring and allowing channel to achieve a limited amount of autonomic re-meandering (A) and example of installation of structure within an armoured channel with no realignment of the channel planform (B). Note that in option A, there will be scope to modify the inclusion/design of specific woody debris installations according to desired effects. Blue arrows indicate the impact of structures on current flow (including “downstream” orientation used to deliberately promote bank-erosion, indicated by curved dotted line, in option A).

Table 1 below gives an indication of the aspects involved in each option. Whilst Option 1 is the most complicated, it provides the most benefit in terms of a stable channel, habitat gain and improved flood risk.

Table 1

	Option 1	Option 2	Option 3
Topographical survey including longitudinal bed and bank levels	✓		
Expert fluvial geomorphology input - design of channel form	✓		
Flood risk modelling	✓		✓ ?
Searches/surveys – services, drainage, archaeology, biodiversity	✓	✓	✓ (limited)
Consideration of spoil disposal (contaminated? Disposal site)	✓		
Environment Agency Flood Defence / Lead Local Flood Authority Consent	✓	✓	✓
Planning permission	✓ ?		

Similar recommendations for this section have previously been considered by the Environment Agency as part of an EU Life+ bid in 2010 which unfortunately was unsuccessful (EA contacts: Dan Johnson; Andy Crawford).

The Lyme Brook was also identified as part of the Life+ bid. The EA was planning this year to remove a weir near the confluence with the Trent, but it was washed out during successive high flow events. The funding available for this project has now been moved over to a project through Lyme Valley Parkway, introducing gravels and woody debris (contact Dan Johnson).



Photo 1 Artificially straight channel with uniform width and depth, typical of the University reach.



Photo 2 View at the downstream end of the University reach (parallel to Seven Arches Way). The channel appears steeper here and has some riffle habitat and gravel substrate.



Photo 3 Stone reinforced toe of the bank



Photo 4 Upstream view of the true right bank of the river with the good riparian habitat (nature reserve) and adjacent sports fields.



Photo 5 Downstream view of the true right bank – enough space to re-meander the river



**Photo 6 Illustrating the straight channel, stone toe of the bank, unsorted bed substrate and an outfall structure (left foreground).
The latter if probably a surface water drain – such connections need to be considered during any project.**

Milton

The reach of river between Millrise Road (SJ9027550200) and the A53 Leek Road was inspected (SJ9013750622) (Map 2). The Trent here is a small river and the in-stream habitat is generally poor indicating past channel engineering. The channel lacks a pool-riffle structure and has a uniform depth and width.

Riparian habitat varies depending upon the amount of shading from trees; in open sections the bankside vegetation is dominated by tall herbage which provides reasonable cover in the margins of the river (Photo 7). In shaded sections the marginal cover is lacking, meaning these areas are likely to support fewer fish (Photo 9). At the upstream end of the reach inspected, there is a steeper, gravel-bedded section (below A53 bridge) and a trout was observed here (Photos 10, 11).

A small tributary stream enters the Trent on the left bank in this reach. The habitat is similar to the main river, with riparian habitat varying depending upon the extent of tree-shading (Photos 13, 14). A combined sewer overflow enters the tributary (Photo 15) which may impact water quality on such a small watercourse. Non-native plants species were observed including Himalayan balsam and stands of Japanese knotweed.

Options for habitat improvement at this site are similar to those at the University site. There is scope to re-meander the channel and create a sustainable, pool-and-riffle structure with a diversity of depth and river-bed composition. Similar considerations to Option 1 above would be required.

Alternatively, in-stream structures could be installed within the existing channel to create localised scour. Photo 8 shows some large stone blocks in the channel which are creating some habitat variety compared with the rest of this reach; whilst these are not deliberately introduced, nor desirable in terms of materials and "design", they do illustrate that structures on this scale are not a great cause for concern, for example in terms of increasing flood risk. Similarly sized flow deflectors and woody debris could be introduced.

North of the A53 was not inspected but may provide similar opportunities (Map 3).



Photo 7 River Trent upstream of Millrise Road



Photo 8 “Stepping stones” in the river – a former weir?



Photo 9 Trent alongside the Caldon Canal (approx. SJ9022450449)



Photo 10 Trent at A53 Leek Road bridge – faster flowing with a gravel substrate in a localised area. A trout was observed here (see below).



Photo 11 Trout observed at A53 bridge



Photo 12 Japanese knotweed present between the Trent at the small left bank tributary



Photo 13 Small left bank tributary – open section



Photo 14 Small left bank tributary – shaded section



Photo 15 Combined surface water-sewer overflow entering the small left bank tributary

Finney Gardens

This site was inspected from the bridge into the former city farm at SJ8992247475 (Photo 16) upstream to A5009 Leek Road (SJ8980747632) (Map 4). Several trout were observed in this reach indicating good water quality; a non-native signal crayfish was also observed. There is a weir about halfway along this reach which forms a barrier to fish passage and has a detrimental effect on in-stream habitat by impounding the river (Photos 17, 18). The weir is redundant and an obvious candidate for removal to provide a “quick win” for habitat improvement.

The EA commissioned ARUP to investigate a preferred option at this site in 2012/13 and complete removal (or a rock ramp as a backup option) was recommended. The work included a topographical survey. The project has been put forward internally within the EA for funding WFD funding in 2015/16 to progress this project (ideally staggered removal) but the bulk of the consultation remains outstanding (Dan Johnson, pers. comm.).

Upstream of the weir, the river impoundment extends to within approximately 40m of a disused railway bridge, now a footpath (Photo 20). A short distance upstream is the A5009 road bridge. Removal of the weir will cause re-grading of the river-bed upstream of the weir, with the potential to damage the footings of these bridges; both have been subject to previous maintenance (Photos 21, 22). This risk is likely to be low, but should be quantified as far as reasonably possible (this may have been considered in the above ARUP report). Often in these circumstances it is not possible to accurately assess the risk and it may therefore be better to proceed with a staggered weir removal alongside with a financial provision for bridge work should it be required.

Staggered weir removal should be very straightforward. Photo 18 shows that low flows pass through a channel on the left side of the weir crest. The channel appears to have been in-filled with blocks of stone; these could easily be removed to lower upstream water levels and assess the extent of river bed re-grading which occurs.



Photo 16 View downstream to the footbridge at former city farm



Photo 17 Weir in Finney Gardens



Photo 18 Close up of channel at left side of weir



Photo 19 Low-lying ground on the right bank of the river adjacent to the weir – possibly a former pond or leat fed from the impoundment?



Photo 20 Former railway bridge, photographed from the approximate upstream limit of the impounding effect of the weir.



Photo 21 Under the former railway bridge. Concrete has been cast at the toe of the brickwork on the far bank at some time in the past.



Photo 22 The A5009 road bridge at the upstream extent of this reach. The far bank has been protected with gabion baskets.

Cromer Road

This reach is immediately upstream of the Finney Gardens reach, from the A5009 Leek Road bridge (SJ8980747632) upstream to a small weir at approximately SJ8991948054 (Map 4).

Alongside Cromer Road the river was at the foot of a steep bank and relatively inaccessible. In-stream habitat appeared to be relatively good, with a gravel substrate and variation in flow patterns and depths. The channel has a good degree of shading by trees (Photo 23).

Further upstream there is a footpath through Waterside Park (Photo 24) alongside the river and up towards the Caldon Canal. The river is more open here and as a result has tall herbage alongside it, creating good marginal habitat. The river occupies a wide corridor which has some nice wet, scrubby habitat (Photo 25). The quality of in-stream habitat of the river here is moderate; it has obviously been modified in the past, but appears to have narrowed itself considerably. As at the University and Milton sites there is scope for re-meandering here, or the use of flow deflectors and woody debris.

A small weir is present (Photo 26) which appears as though it may have been used previously for flow gauging. The extent of encroaching vegetation across its crest from the left bank (about a third of the crest) indicates it is not currently in use. The weir may be a barrier to minor fish species and it appears it could be easily and cheaply removed.

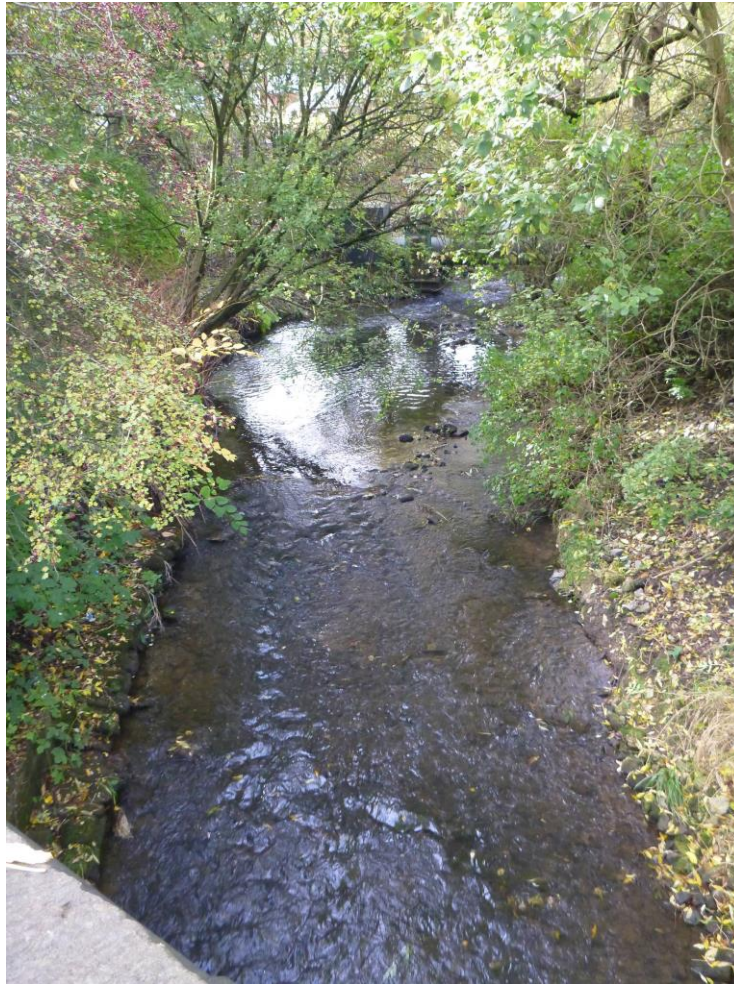


Photo 23 Section alongside Cromer Road, upstream of A5009



Photo 24 Interpretation board



Photo 25 Typical habitat within the upstream end of this reach



Photo 26 Small weir



Photo 27 View upstream from the small weir

3.0 Acknowledgement

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

4.0 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.

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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:

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