Lyme Brook and Causley Brook: Opportunities to Improve Habitat & Connectivity

Report and Proposal by the Wild Trout Trust – 17/02/2016

1 Introduction

Site visits and habitat appraisal was carried out by Paul Gaskell at the request of Groundwork West Midlands (Richard Schneider) and the Environment Agency (EA; Matt Lawrence) to explore the potential for habitat improvement on the Lyme Brook and the Causley Brook on the River Trent system. The Water Framework Directive (WFD) identifies the Lyme Brook and the Causley Brook as individual waterbodies via the codes **GB104028053340** and **GB104028053310** respectively.

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.

2 Habitat Assessment notes

2.1 Lyme Brook weir downstream of Clayton Lane road-bridge

Just downstream of the weir at National Grid Reference (NGR) SJ 85789 44139 the adjoining land features a small vegetated buffer strip on the RB. However, poor siting of silage for animal feed (Fig. 1) will result in polluting inputs of nutrients. Repositioning this away from the bank-top such that runoff from rainfall does not enter the Brook will solve this pollution issue.

Figure 1: Poor siting of silage along the bank top in this photo (middle and right of frame on far bank) is causing inputs of polluting nutrients during rainfall events at SJ 85789 44139.

Just upstream of the location shown in Fig. 1 is a significant weir (Fig. 2). This structure is sited at SJ 85779 44170 and is reported to be associated with underground sewer services. Clarification is, therefore, required as to the depth of the sewer beneath the weir before appropriate measures can be suggested. By far the most desirable option would be a complete removal of the impounding structure that is currently responsible for the following impacts:

- Impoundment and associated habitat degradation upstream of Clayton Lane as far as SJ 85761 44468

- Barrier to longitudinal migration in both upstream and downstream directions
- Potentially undesirable bank erosion where the weir joins the banks at a perpendicular angle (there may not be a "do nothing" option if this erosion is likely to compromise adjacent infrastructure – including the sewer).

Figure 2: The white water (entrained air) below the weir combines with the height of the weir crest to make this a more significant barrier to migration than most observers appreciate. The impounding effect extends far upstream of the road-bridge (Clayton Lane) visible in the background. The erosion (particularly on the RB which is pictured on the LEFT of this photo) is caused by the construction of the weir at right-angles to the original river banks and the soft nature of those banks.

Removal would be a comparatively simple process if the sewer is well below the existing bed-level of the river. Conversely, if the existing structure actually houses the sewer pipe itself – then removal becomes more complicated.

In that instance, it may be possible to construct a boulder, rubble and gravel "mat" downstream of the weir that sufficiently raises the downstream water-level as to mitigate the barrier effect of the weir (Section 3 "Recommendations). *Note that such an option does not improve the degraded, impounded habitat upstream of the weir.*

It may be possible/desirable to incorporate some retaining structures (such as sleepers) that would help to consolidate the gravel riffle component of the boulder/gravel mat. This option would also depend upon suitable access for the delivery and unloading/positioning in the channel of large quantities of stone and gravel (as well as sleepers if required).

Hydrological calculations would also be required to ascertain the volumes of substrate required to sufficiently raise the downstream water-level under a range of flow conditions. The WTT would seek external expert assistance in that eventuality.

2.2 Causley Brook – Weir 1

Figure 3: Causley Brook Weir 1 at SJ 85779 44170 – concrete and wood structure

A complete barrier to upstream fish passage (Fig.3) and also impounding a significant reach upstream (Fig. 4) with associated habitat degradation. The purpose of the weir is unclear (there was no discernible diversion or abstraction of water upstream of the structure). The higher quality habitat below the weir, with much greater variety (Fig. 5), is readily obvious.

Figure 4: Impounded section upstream of weir pictured in Fig. 3

Figure 5: Un-impounded, varied habitat downstream of weir pictured in Fig. 3

The tree-root stabilisation of the RB upstream of the weir and the general lack of infrastructure surrounding the impounded reach on either bank reduces risks associated with weir removal. The rebalancing of longitudinal bed-slope and natural channel width is unlikely to disrupt any of the upstream land-use. Pending suitable kit access (either small 360 digger or even pneumatic drill and generator), this is a good candidate for removal – especially given its concrete construction/low heritage value.

2.3 Causley Brook Weir 2

Figure 6: Causley Brook weir at SJ 90163 46891 – stonework and shuttering

This structure is having a similarly negative impact on both connectivity and upstream habitat quality as the structure in Fig. 3. However, the structure itself is naturally degrading and the brook is beginning to bypass it. This would seem to negate the costly exercises of either arranging removal or, alternatively, digging a bypass channel along the route indicated in Fig. 7.

Figure 7: The brook is to the left of the frame in an incised channel. The bank-top line is indicated by the scrub vegetation. This is the LB and shows the scope for a bypass channel (if ever required). Some care would need to be taken due to the presence of the telegraph pole sited just out of the right of frame in the foreground of this picture.

The only scenario that such a bypass channel may be required is if property-owners on the RB directly upstream of the weir apply to reinstate the structure as a means of stabilising the retaining wall along that RB (see Fig. 6). In such a case, the cost and delivery of digging an appropriate bypass channel should be made a condition of consenting the completion of those works.

3 Recommendations

Taking the structures in order of complexity:

3.1 Causley Weir 2

The first (and easiest) recommendation would be to allow the Causley Brook Weir 2 (Fig. 6) to continue to naturally degrade and be bypassed.

3.2 Causley Weir 1

Some intervention is recommended for Causley Brook Weir 1 (Fig. 6) to effect its complete removal. There would be no need to transport the arising material off-site as it could be distributed within the upstream and downstream channel to create valuable structural variety.

The apparent low-risk nature of the surrounding land-use associated with the upstream reach would seem to make this an ideal candidate for removal. It may be advisable to have an Environment Agency geomorphologist walk over the site and simply estimate the likely limits of channel response. Following permission from the landowner(s) of relevant reaches, this should enable the removal to go ahead without the need for extensive modelling.

There is an excellent opportunity to maximise the habitat benefits (and also regulate the degree of lateral response of the upstream channel) by undertaking grazing exclusion and tree planting on the LB. By producing this vegetated buffer strip, many benefits would be accrued:

The provision of deeper root-structure would help to encourage scour pool formation in favour of bank-erosion. Those deep roots would also increase the soakaway effect within the buffer strip – reducing pollutant and surface runoff inputs. It would also enable greater exchange of aquatic/terrestrial "subsidies" between river-corridor foodwebs (e.g. leaf litter inputs for aquatic food-webs and emergent aquatic invertebrates providing food for terrestrial predators such as birds, bats and spiders).

3.3 Lyme Brook Weir below Clayton Lane

There are significant opportunities for maximising the benefits of habitat works already completed directly upstream of this structure. First of all it is imperative to establish the depth and location of the sub-surface sewer. This critically influences the most appropriate course of action for habitat improvement. If it is found to be unaffected by the work required to completely remove the weir, then this is the best course of action to take. N.B. it would be prudent to have an assessment of the implications of increased flow velocities for the stability of the Clayton Lane road bridge.

It is stressed that this course of action (complete removal) is significantly more valuable and worthwhile compared to all options that result in the retention of the impounding impact upstream of the current structure.

As a secondary alternative (in the event that removal cannot be agreed), it may be possible to use the creation of greater habitat structural variety to reduce the barrier effect of the weir. A formal expert geomorphologist's survey would be required to assess whether the longitudinal bed-slope would require only one – or more than one – downstream "rubble mat" feature (Figs. 8 and 9) to sufficiently raise the downstream water-level. Additionally, the impact that this may have on local flood risk should be taken into account – however, it is worth noting that the current weir height is deemed acceptable in terms of flood risk. Obviously, the aim of the rubble mat would be to reduce the differential between upstream and downstream water height – but not to exceed the level of the weir crest.

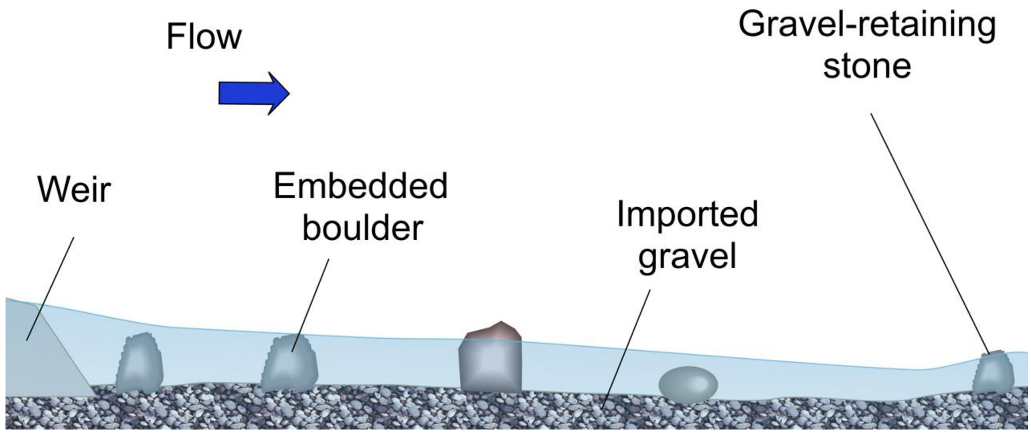

Figure 8: Elevation view showing concept of rubble mat (imported gravel and embedded boulders to stabilise and provide structure). Expert calculations are required to ascertain the required flow conveyance to sufficiently raise the downstream water level.

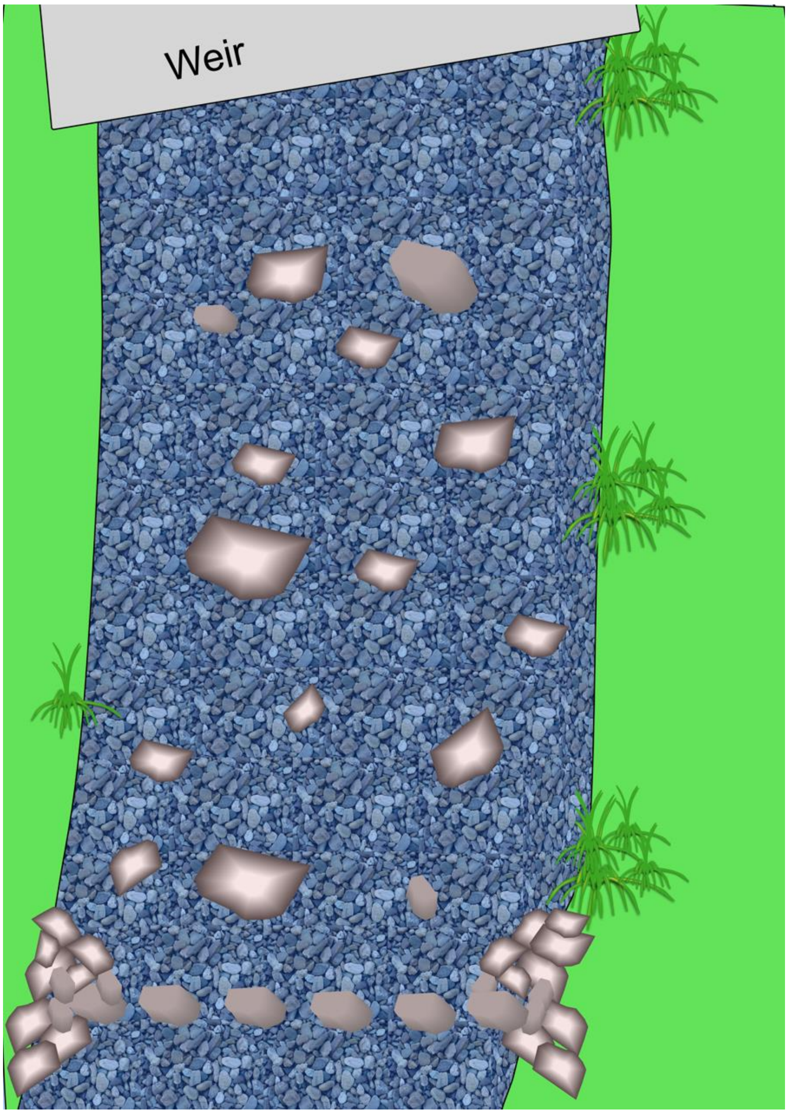

Figure 9: Plan view impression of rubble mat – including downstream retaining stones. Note the bank protection shaped to avoid erosive eddies via inclusion of upstream-angled downstream. Flow is from the top of the frame downwards.

On this section – and the existing upstream habitat works – there is also an opportunity to pursue volunteer mink-raft monitoring with a view to re-establishing water vole populations. To this end, collaboration with Staffordshire Wildlife Trust as well as appropriate mink-control personnel would be extremely valuable.

4 Acknowledgement

The WTT would like to thank the Environment Agency for supporting the advisory and practical visit programmes (through which a proportion of this work has been funded) in part through rod-licence funding.

5 Disclaimer

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