Advisory Visit

Lea Brook, Derbyshire

July 2017

1.0 Introduction

This report is the output of a site visit undertaken by Tim Jacklin of the Wild Trout Trust to the Lea Brook, Lea Mills, near Cromford, Derbyshire on 11th July, 2017. Comments in this report are based on observations on the day of the site visit and discussions with Ian MacLean, Managing Director of John Smedley Ltd www.johnsmedley.com.

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

River	Lea Brook
Waterbody Name	Lea Brook Catchment (trib of Derwent)
Waterbody ID	GB104028052760
Management Catchment	Derwent Upper - Derbyshire
River Basin District	Humber
Current Ecological Quality	Overall status of **Good** ecological status sustained through two assessment cycles in 2009 and 2016
U/S Grid Ref inspected	SK3182656740
D/S Grid Ref inspected	SK3162456104
Length of river inspected	~750m in total

Table 1 Summary of Water Framework Directive information from http://environment.data.gov.uk/catchment-planning/WaterBody/GB104028052760

The Lea Brook is a small tributary stream of the River Derwent in Derbyshire, joining the latter river from the north bank opposite Cromford sewage treatment works. The River Derwent at this point is fished by

Cromford Fly Fishing Club and was the subject of a previous WTT advisory visit in August 2012. (www.wildtrout.org/sites/default/files/private/Derwent_Derbys_2012.pdf). There are no angling clubs on the Lea Brook and it is not stocked with trout; wild trout are present and were observed during the visit.

The section of the Lea Brook inspected is just upstream from the Derwent confluence and is owned by John Smedley Ltd, a high quality knitwear manufacturer based at the Lea Mills factory site. The catchment area of the Lea Brook falls within the Derwent Valley Mills World Heritage Site, the cradle of the Industrial Revolution and factory-based manufacturing. Harnessing water from the river and streams for power and industrial processes has left a legacy of channel modification and impoundments which often restricts the quality of natural habitats and biodiversity within the watercourses.

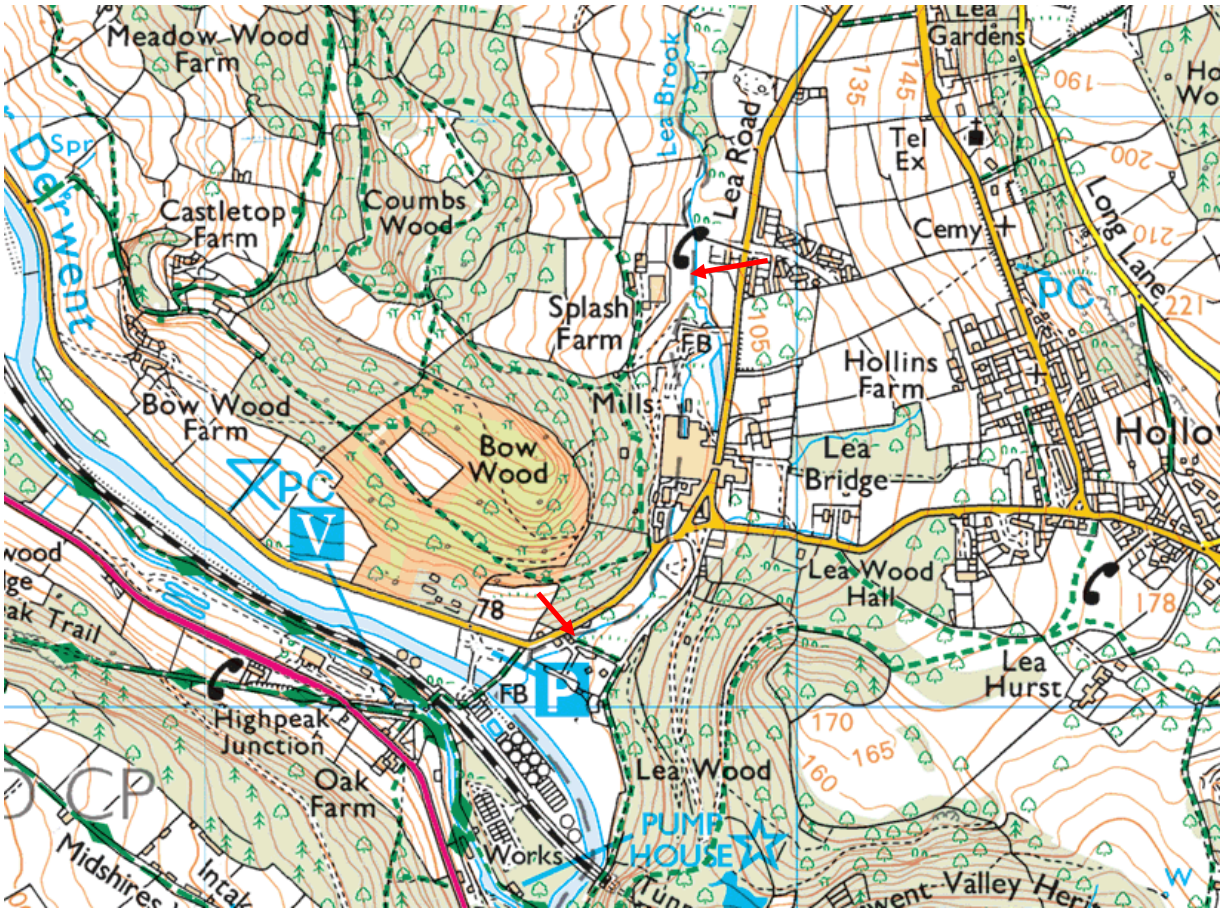

Figure 1 Location of visit showing approximate upstream and downstream limits of inspection (red arrows).

3.0 Habitat Assessment

The Lea Brook is a steep gradient stream, falling from approximately 250m to 75m above sea level at its confluence with the Derwent, an average fall of around 34m per km (3.4%). The visit progressed in an upstream direction from the downstream boundary.

The brook flows through a bridge culvert under a track to some cottages at the downstream boundary, then on to join the River Derwent. Downstream of the bridge was not inspected during this visit. Future inspection to check on access for fish from the Derwent is recommended.

Upstream of the bridge, the gradient of the stream is less than the norm for a short distance because of impoundment by the invert of the bridge culvert; plants favouring slower-flowing water (rushes) are present in the margins here (Photo 1). The brook is bordered on the right bank by the gardens of residential properties and on the left by a sewage pumping station building and a field (Photo 2). The bank alongside the pumping station had been recently mown right to the edge of the brook (Photo 3); leaving a marginal fringe of shaggy vegetation is recommended to provide low cover over the water for trout.

The field is owned by John Smedley Ltd and leased out for grazing or as a paddock; its use is evidently low intensity, giving a nice mix of long grasses and trees. Further up the valley side beyond the field and access track, is Lea Wood, a nature reserve comprising ancient and semi-natural woodland, owned and managed by Derbyshire Wildlife Trust. Land use on the west side of the valley also has significant areas of broad-leaved woodland, including Bow Wood (ancient and semi-natural woodland, Woodland Trust). This is highly beneficial for the brook in terms of its hydrology (buffering of run-off by woodland reduces flood peaks and maintains higher base flows), temperature (shading keeps water cool) and inputs of leaf litter (helping to support the invertebrate food chain).

Approaching the road, the brook has generally good in-stream habitat. There are a number of deeper pool areas, which provide habitat for adult fish, separated by riffles and cascades (Photos 5 – 10). A wide range of river bed substrate sizes are present, from boulders down to sand and silt; these are reasonably well-sorted providing a variety of habitats such as silt beds in slack areas suitable for mayfly nymphs and brook lampreys, and gravel

pockets in faster water suitable for trout spawning. This section is also well-shaded by mature trees and large woody material is present in several places, contributing to good in-stream habitat (for example creating scour pools, Photo 7).

Towards the road, there is evidence that brook channel has been modified in the distant past. Some parts of the channel appear to have been straightened and widened resulting in a predominance of shallow water and a lack of pools (Photo 8). There is also a bund present on the left bank at the edge of the field and some sections of the left bank have been walled. In these areas there is an opportunity to introduce large woody material to mimic the natural features mentioned above.

Surface water drains enter the brook (Photo 9) possibly draining the car park area for the factory. At the source end of such drains, raising awareness that they discharge into the brook can help prevent inadvertent pollution.

Photo 1 Bridge at the downstream end of the section.

Photo 2 Left bank land use is very low intensity, good news for the brook.

Photo 3 Mowing close to the river, alongside the sewage pumping station. Leaving a larger marginal fringe of vegetation next to the brook is recommended.

Photo 4 Boulders just upstream of the pumping station and bridge. These appear to have been deliberately positioned, possibly to provide bed grade control. They have created a nice scour pool downstream in an otherwise relatively uniform and modified section. They do not impede fish movement.

Photo 5 Good in-stream habitat: pool, riffle/cascade and large woody material.

Photo 6 The brook is well-shaded, helping to moderate water temperature. Small watercourses are vulnerable to high water temperatures in the summer and trout's upper lethal limit is quickly reached above 20 degrees Celsius.

Photo 7 Stable large woody material which has helped to create a deeper scour pool – valuable habitat for larger fish.

Photo 8 Wide shallow straight section lacking in pools, probably resulting from historic channel engineering. Introducing large woody material here to mimic effects similar to Photo 8 would improve in-stream habitat.

Photo 9 Headwall from a surface water drain. Clear demarcation of these at their source can assist in pollution prevention (for example by preventing spills being flushed down).

Photo 10 Further good pool habitat, formed where a pinch point between two areas of high bank stability (tree roots) are fluming the water and scouring the river bed.

Upstream of the road, the brook flows through the John Smedley factory site. There is a section bordered by the factory entrance road (right bank) and a garden area on the left bank (Photo 11). Both banks comprise stone walls, but despite this there is a nice fringe of marginal vegetation (particularly on the right bank) and a stand of water crowfoot (*Ranunculus* sp.) is present mid-stream. The shaggy vegetation, which includes meadow-sweet and self-seeded alder and sycamore saplings, provides good marginal cover over an otherwise uniformly shallow section. Trout have been observed here and the marginal cover is likely to be an important factor contributing to their presence. Maintenance of this vegetation should be carried out sensitively to preserve the overhanging cover and shade throughout the year (for example rotational 'coppicing' of the saplings, rather than cutting all in one year).

The uniformly shallow nature of this section limits its trout holding capacity. It may be possible to create some depth variation here by installing features similar to that in Photo 4. Creative placement of boulders using a machine with a grab attachment would be relatively easy from the road side. Alternatively, more engineered structures such as vortex 'weirs' or cross-vanes (see Recommendations) designed to scour pools downstream (not impound water upstream) could be installed. Care would be needed to avoid underground services which are evidently present in this section. There could be synergies between this work and the planned installation of an industrial gas supply to the factory. A recent project on the Porter Brook in central Sheffield involving WTT Urban Project Officer, Dr Paul Gaskell may also provide ideas and inspiration for this section: www.youtube.com/watch?v=XgcTIeRj4WY .

The brook flows in a culvert beneath the factory for approximately 160 metres (Photos 12 and 13). De-culverting is the ideal scenario for the brook, but far more easily said than done in the middle of a working factory which has grown and evolved over more than two centuries. Opportunities to 'daylight' sections of the brook may arise with ongoing development of the site. Historic maps (www.old-maps.co.uk) indicate the brook course was open through the factory site in 1880 but was culverted by the time of the 1899 map. The course of the brook is marked throughout the factory site as part of numerous measures implemented to minimise the risk of pollution of the brook from the yarn and fabric dyeing process.

Consideration of the culvert inevitably raises the question of fish passage and whether it is a barrier to the free movement of fish upstream and downstream. Guidance on culverts can be found on the Environment Agency website (http://evidence.environment-agency.gov.uk/FCERM/en/SC060065/MeasuresList/M7/M7T1.aspx?pagenum=2) which states:

Historic culverts may well be causing either delay to or total exclusion of migrating fish. The common reasons for both of these problems include excessive water velocities, inadequate depth or culvert diameter, sudden change of invert level between the culvert and the watercourse, rapid change in stream hydraulics at the upstream inlet, lack of resting places, and debris accumulations causing physical blockage or combination of any of these factors. Mitigation should therefore be focused on retro-fitting to deal with the above issues, providing that the reduction in channel capacity does not pose an unacceptable increase in flood risk.

If there are no abrupt changes in bed level within the culvert (weirs, sluices, etc.) and the depth and velocity of water is adequate, then trout will pass through; daylight “chimneys” may encourage fish to pass through longer culverts, but there is little evidence to suggest darkness is a behavioural barrier.

Upstream of the culvert, the brook flows beneath a bridge with a twin pipe culvert which is perched at the downstream end (Photo 14). This represents a barrier to fish migration and illustrates the potential problems that may exist within the long culvert under the factory. The drop at the downstream end of the pipes and the shallow, fast flow over the smooth concrete invert lessen the chance of fish successfully crossing this structure. Potential improvements to overcome this can be found via the above link.

Photo 11 View upstream from the road into the factory site.

Photo 12 Downstream end of the factory culvert. The gradual transition from light to dark provided by the vegetation is better than an abrupt change in encouraging fish to pass into the culvert.

Photo 13 The upstream end of the factory culvert. The same comments as above apply. Also, the natural bed is far better than a smooth artificial surface (like concrete), assuming this extends the full length of the culvert.

Photo 14 Above the main culvert under the factory, the brook is crossed by a bridge with a twin pipe culvert. The downstream end is perched above bed level. Along with the thin skim of water over the concrete bed of the pipe, this creates an obstable to fish passage.

Photo 15 Upstream end of twin pipe culvert, showing extent of concrete base and shallow, fast water.

Photo 16 Reservoir located upstream of the factory which supplies water to the factory sprinkler system. The reservoir is topped up by a feed from the brook.

Photo 17 Large weir located on the brook upstream of the reservoir. The conduit channel to the reservoir leaves the brook on the LH bank (not visible, right of shot). A recently created pond is visible in the background on the site of a former mill pond.

Photo 18 The downstream lip of the spillway of the above weir, beneath the footbridge. A trout was observed in the pool downstream but fish will not be able to ascend the weir structure in any flows, fragmenting the habitat of the brook.

Photo 19 Impounded section of brook, upstream of the above weir.

Upstream of the factory, the stream habitat appears to be reasonable, although evidently modified historically by the industrial activities evident on historic maps (www.old-maps.co.uk). The channel is probably straighter and lacking in deeper pools as a result. On the east side of the brook, on the valley side, is an elongated reservoir / mill pond, with a dam at the downstream end (Photo 16). This presumably originally stored water to power the mill but now provides water for the factory's emergency sprinkler system. Water is supplied to the reservoir via a conduit channel taken off the brook above the large impounding weir located a short distance upstream (Photos 17 - 19). Water in the reservoir is for emergency use, so there is no constant abstraction from the brook which might otherwise deplete flows.

The weir is a major detrimental impact upon the brook habitat. It is a total barrier to fish movement and a significant impoundment which interrupts natural sediment transport. The latter means over time there is a net loss of smaller sediment particles downstream of the weir (including gravel suitable for trout spawning). The weir appears to be a long-standing structure, possibly dating back to the construction of the factory. Maps from the late 1800s show an additional mill pond located upstream of the weir, indicating the full width of the valley was dammed (Figure 2); this is evident looking at the present land levels around the houses to the west of the footbridge, above which a pond has recently been created (separate from the brook course).

The prospect for improved fish passage and brook habitat through removal or lowering of the weir or installation of a fish pass seem remote given the likely costs.

The final section of brook inspected was at the former Lea Works where processing of lead historically took place. Although only around 150m upstream of the large weir, there was no evidence of the impoundment here. The channel appeared straight and lacking in deeper pool habitat, suggesting past modification. Installation of features to create scour pools could be carried out here to improve trout carrying capacity, as suggested for other reaches. Caution should be exercised given the history of lead processing: it can cause long-lasting impacts upon the environment and large scale disturbance of spoil or bed sediments could affect water quality. The nature and scale of structures recommended in this report should not pose a threat in this respect.

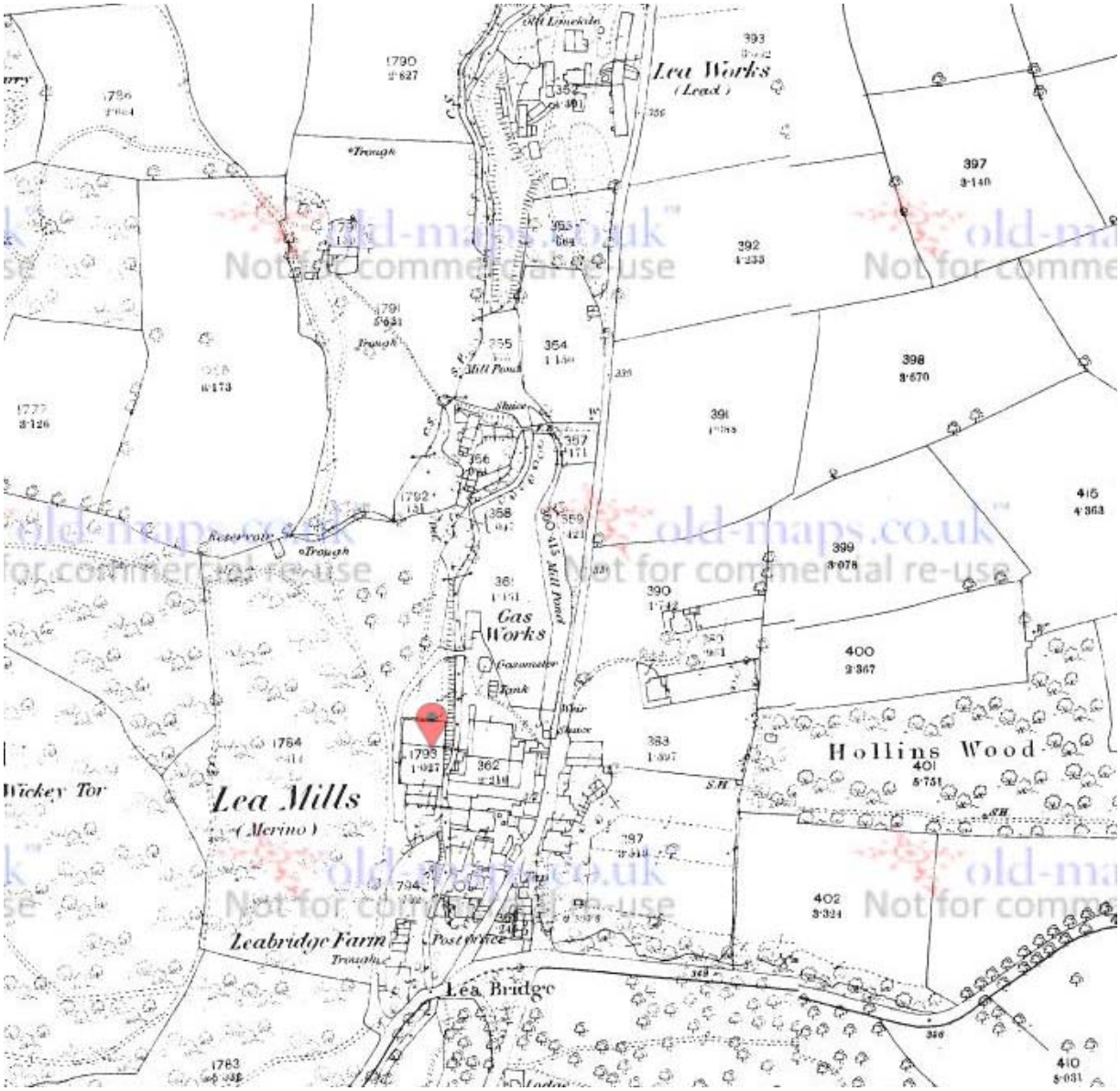

Figure 2 OS County Series: Derbyshire 1:2500, 1880 (www.old-maps.co.uk), showing open brook channel through the John Smedley site and additional mill pond upstream of the large weir.

4.0 Recommendations

- Leave a fringe of vegetation around 1 metre wide alongside the brook next to the sewage pumping station when mowing.
- Leave large woody material in place within the river channel.
- Place and secure large woody structures in straighter shallow sections downstream of the road to encourage pool formation (Photo 20)
- Label surface water drains for pollution prevention.
- Create some deeper pool areas in the reach immediately downstream of the factory (Photo 11) by placing boulders or building structures designed to scour the river bed (Photos 21 and 22).
- Check the factory culvert for fish passability. Seek to daylight sections of the channel, taking any opportunities as they present themselves.
- Improve fish passage at the twin pipe culvert by raising downstream water levels and roughening the surface of the invert.
- Install pool features (large woody material or rock structures) to create and maintain bed scour in the straight, shallow, non-impounded sections upstream of the factory.

Photo 20 Large woody material pinned to the river bed to promote localised bed scour and depth variation.

Photo 21 Stone structures built to improve depth variation without causing flow impoundment on a small burn on Orkney.

Photo 22 Selective boulder placement to improve the diversity of flow and depth.

5.0 Making it Happen

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

- Helping obtain the necessary consents for carrying out in-stream works, from either the Environment Agency or local authority (depending upon whether the brook is designated main river or ordinary watercourse, respectively).
- A practical visit, which involves a visit from a WTT Conservation Officer to complete a demonstration plot on the site to be restored. This enables recipients to obtain on the ground training regarding the appropriate use of conservation techniques and materials, including Health & Safety, equipment and requirements. This will then give projects the strongest possible start leading to successful completion of aims and objectives. Recipients will be expected to cover travel expenses of the WTT attendees.
- Support for design and supervision of boulder placement, pool structures and fish passage improvements.

Support and opportunities for partnership working may also be available from the Derbyshire Derwent Catchment Partnership. More information is available on the website (www.derbyshirewildlifetrust.org.uk/what-we-do/projects/derbyshire-derwent-catchment-partnership) or by contacting Kath Stapley, Living Rivers Officer, Derbyshire Wildlife Trust, Sandy Hill, Main Street, Middleton-by-Wirksworth, Matlock, Derbyshire, DE4 4LR. (Office telephone: 01773 881188, Mobile: 07583 046127).

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 www.wildtrout.org/product/rivers-working-wild-trout-dvd-0 or by calling the WTT office on 02392 570985.

6.0 Acknowledgement

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7.0 Disclaimer

This report is produced for guidance; 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.