Advisory Visit

River Slea, Sleaford, Lincolnshire

February 2015

1.0 Introduction

This report is the output of a site visit undertaken by Tim Jacklin of the Wild Trout Trust to the River Slea, Sleaford, Lincolnshire on 24th February, 2015. Comments in this report are based on observations on the day of the site visit and discussions with Fiona McKenna (Lincolnshire Rivers Trust), Chris and Steve Hayes (Sleaford Navigation Trust), Andrew Greenwood (Slea Tidy Group, Rivercare) and Gary Titmus (Sleaford Town Councillor).

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. National Grid References (NGR) are used to specify locations.

2.0 Catchment / Fishery Overview

The River Slea rises near West Willoughby and flows for approximately 18 miles through Sleaford and South Kyme to join the River Witham at Chapel Hill.

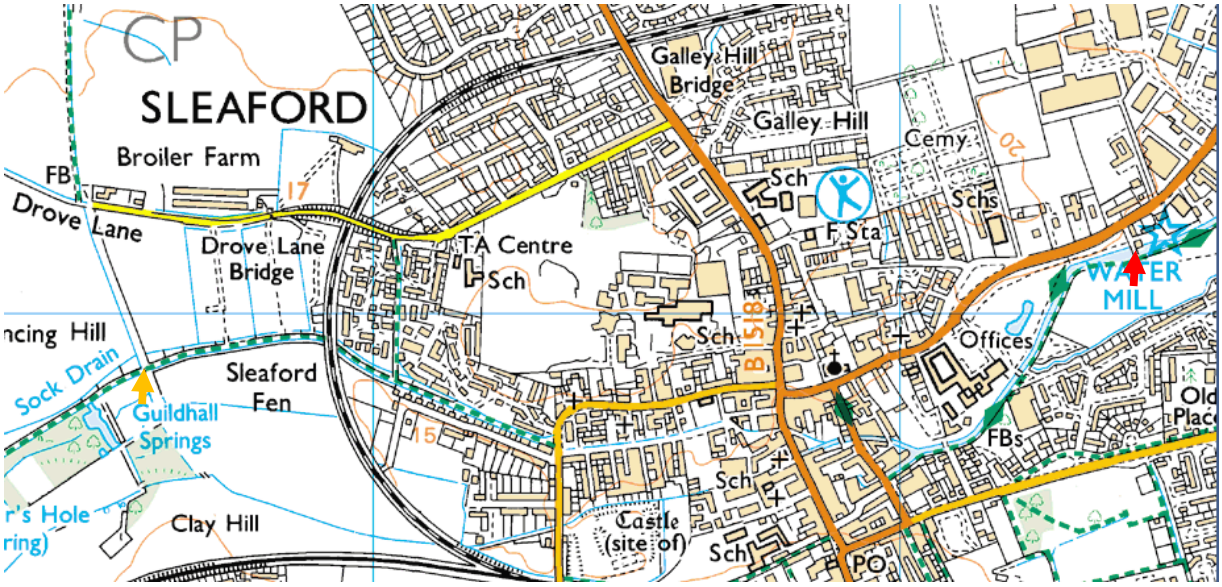

Figure 1 Extent of the reach visited. Upstream limit (orange arrow) at Drove Lane TF0558045895, downstream limit at Coggleford Water Mill TF0745546117.

The Slea was made a navigation from the Witham to Sleaford in the late 1700s. This was superseded by the railways in the late 1800s and the

navigation company abandoned its maintenance responsibilities, although the navigation continued to be used until the mid-C20th. The Slea Navigation Trust (www.sleafordnavigation.co.uk) is working to restore the navigation to the 13 miles from the Witham to Sleaford, and currently the lower 8 miles are open.

Table 1 shows the Water Framework Directive assessment for the River Slea, from the Environment Agency website. The river is categorised as "heavily modified" because of historic channel engineering for land drainage/flood defence. The overall ecological rating is "moderate potential", being made up of the individual elements diatoms (moderate), macrophytes (moderate), fish (poor) and macro-invertebrates (good). Hydromorphological quality is "not high" because of the historic extensive modifications to the channel.

Table 1 Water Framework Directive information from the Environment Agency website

Waterbody ID	GB105030056670
Waterbody Name	Slea New
Management Catchment	Witham
River Basin District	Anglian
Typology Description	Low, Small, Calcareous
Hydromorphological Status	Heavily Modified
Current Ecological Quality	Moderate Potential
Current Chemical Quality	Does Not Require Assessment
2015 Predicted Ecological Quality	Moderate Potential
2015 Predicted Chemical Quality	Does Not Require Assessment
Overall Risk	At Risk
Protected Area	Yes

The River Slea is a spring-fed river based on the Lincolnshire limestone aquifer. The river suffers from low flows due to over-abstraction of groundwater to the extent that the upper reaches regularly dries up and there is a flow augmentation point at TL0604045880.

The Slea suffered a serious pollution incident in February 2003 when the pesticide cypermethrin entered the river via its tributary the Nine-foot river, killing an estimated 100,000 fish and invertebrate life over a 15-mile length. The Environment Agency (EA) successfully prosecuted those responsible who were ordered to pay damages towards re-stocking the river. Since this time, the river has been re-stocked downstream of Sleaford with coarse fish by the EA, and trout have been introduced (including rainbow trout and triploid brown trout) by private individuals.

3.0 Habitat Assessment

The visited reach has been identified by Lincolnshire Rivers Trust as an opportunity to undertake habitat improvement works. This report can be used as a reference for approaches and measures that can help to maximise benefits for overall river corridor biodiversity – as well as for the UK BAP species Salmo trutta (UK native brown trout) in particular.

The watercourse was examined for its general characteristics and broad ecological issues. In addition, the focus of this Advisory Visit was to identify whether there were obvious shortages of (or lack of access to) habitat features that would support the full lifecycle of wild trout (*Salmo trutta*). The sensitivity of trout to low oxygen levels and requirement for physical diversity in riparian and aquatic habitat and associated flora and fauna make it a good species to use as a yardstick of river quality. Figure 2 (below) illustrates the effect that a lack of specific habitat features will have on the structure of trout populations.

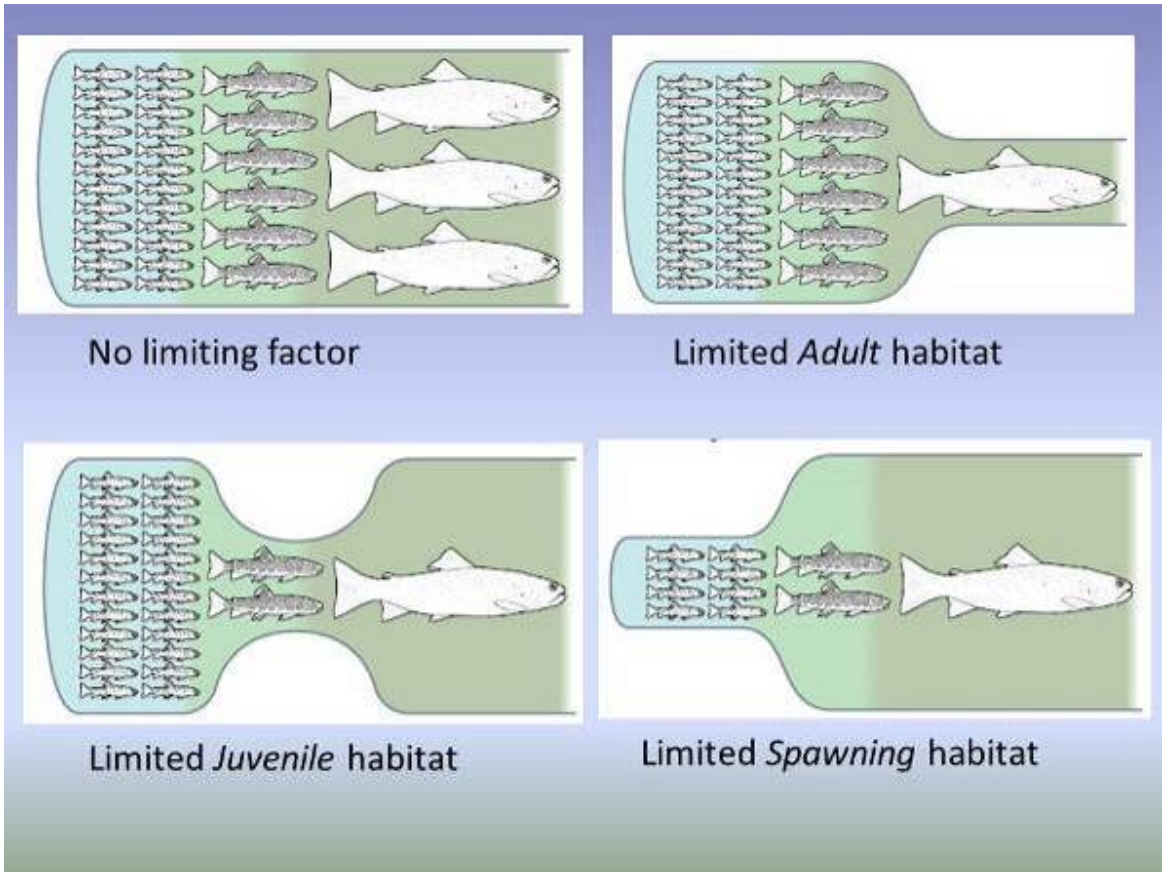

Figure 2: The knock-on impacts to fish populations caused by a lack (or degradation) of specific types of habitat at three crucial lifecycle stages; spawning, juvenile/nursery and adult. Spawning trout require loose gravel deposits with a good flow of oxygenated water between gravel grains. Juvenile trout require shallow water (quite variable around an average of 20-cm) with plenty of dense submerged/tangled structure for protection against predators and wash-out during spates. Adult trout require deeper pool habitat (generally > 30cm depth) with nearby robust structural cover such as undercut boulders, sunken trees/tree limbs and/or low overhanging cover (ideally within 30cm of the water's surface.

The river was walked in a downstream direction from Drove Lane (TF0558045895).

From Drove Lane to the railway bridge (TF0592445933) the river has a uniform width and uniform shallow depth. The channel is canalised and has no natural flow features (such as pools and riffles). The river bed substrate is poorly sorted and dominated by finer sediment (sand and small gravel). Upstream of Drove Lane there are few aquatic plants evident, whereas downstream mare's tail (Hippuris vulgaris), starwort (Callitriche) and forget-me-not (Mysotis) are present. This probably reflects the fact that the channel upstream of Drove Lane dries out regularly and is more shaded than

the section downstream. The latter appears to have had mature trees removed from the right (south) bank recently (they are evident on Google maps aerial photographs), which may have reduced shading and stimulated aquatic plant growth.

At the railway bridge the channel narrows and steepens through the bridge, speeding up the flow. The river bed substrate here is coarser gravel and there was evidence of trout spawning here. There are uprights in the river bed with slots for weir boards, apparently used in the past to retain water during periods of low flow but unused in recent years since the flow augmentation scheme began.

Downstream of the railway bridge (TF0592445933) the flow augmentation enters the river on the left bank. Downstream of this point the river enters the urban area of Sleaford, with houses (Electric Station Road) along the right bank. The left bank footpath continues, being tarmacked from this point.

The river has hard, vertical banks (walled) on the right bank and an earth left bank, downstream as far as Castle Causeway. The channel has uniform shallow depth, width and no variation in flow characteristics (smooth glide); the substrate is a poorly sorted mixture of gravel and finer sediments. There is little aquatic vegetation evident, possibly because of the shading by the wall and houses along the right (south) bank. Service pipes cross the channel at a low level in some places.

Photo 1 View upstream from Drove Lane – note lack of in-stream vegetation, probably because of shading and intermittent flows

Photo 2 Downstream of Drove Lane – more instream vegetation present.

Photo 3 Railway bridge. Some evidence of trout spawning was seen here.

Photo 4 Downstream of the flow augmentation point (Electric Station Road houses on opposite bank).

Photo 5 Service pipes crossing the river not far above water level

Photo 6 Castle Causeway culvert

The river flows through a culvert underneath Castle Causeway (TF0635545741) emerging to run alongside West Banks road towards Sainsburys supermarket. The channel narrows and steepens through the culvert, creating a faster flow and maintaining a bed substrate of coarser gravels which are more suited to trout spawning; indeed a large trout redd was evident just downstream of the culvert. A small number of brown trout were observed in this section of the river in a range of sizes from juvenile fish (1-year olds) through to adult fish of 45cm plus.

Both banks of the river here are vertical brick walls and there are multiple bridges for vehicle access to properties on the left bank. Further downstream from the culvert, the flow returns to a steady glide and the bed substrate is dominated by fine sediment, with occasional aquatic plants evident. There is little variation in depth apart from one area where a semi-submerged service pipe has caused some undershot scour and a deeper area; three trout were occupying this area.

A short diversion was made across Sainsburys car park to the tributary Nine-foot river. This is another heavily modified watercourse with walled banks, but appears deeper than the Slea and has abundant submerged aquatic vegetation characteristic of a calcareous stream. A large trout and a shoal of large roach was present alongside the car park, no doubt taking advantage of the bread fed to the ducks at this point.

Back on the River Slea, the river flows under Water Gate (TF0671845775) and through a pedestrianised shopping area towards another two culverts under a building and then under South Gate. Again the banks are vertical brick walls and the channel a uniform width and depth. An interpretation board is located in the pedestrian area which would benefit from renovation, both physically and in the nature of the information provided.

The culvert under South Gate is reported to be narrow (approximately 1.7 metres diameter) and there was little clearance between water level and the top of the culvert on the downstream side, reflecting the generally low flood risk on the Slea. Downstream from South Gate the river has buildings immediately adjacent to the channel on both banks.

Photo 7 A large trout redd (spawning site) in gravels immediately downstream of Castle Causeway culvert.

Photo 8 The river alongside West Banks

Photo 9 A pipe causing undershot scour and a deeper area occupied by several trout

Photo 10 Pedestrianised area downstream of Water Gate

Photo 11 Interpretation board in need of updating. No rainbow trout (a non-native species) were seen during the visit, only brown trout.

Photo 12 The narrow culvert under South Gate

Just upstream of Carre Bridge (TF0692045760) is an EA flow gauging station with a weir (Photo 13), which is located just downstream of the confluence with the Nine-foot river. The gauging weir is passable by adult trout moving upstream, but is a barrier to smaller trout and other species. The EA have a prioritised programme of addressing gauging station weirs for fish passage; enquiries should be made regarding this structure.

Below Carre Bridge is the beginning of the historic navigation on the Slea and the river bed is owned by the Slea Navigation Trust. The river widens out into a basin in front of the historic navigation company building and there is an in-filled channel branching from the right bank (former access for boat turning). This area has been re-developed and includes a slipway and a lifting bridge (TF0708845750). The banks are mainly hard engineered (concrete, steel pilings) apart from an area on the left bank with mature trees; the bank here is heavily eroded by waterfowl, exposing the tree roots at water level (Photo 14).

Downstream of the lifting bridge, the river channel is maintained artificially wide reflecting its use as a navigation. It is uniformly shallow with aquatic plant growth prolific on the river bed (Photo 15). With progress downstream, past the footbridge near the council offices and leisure centre (TF0722245879), the channel becomes perched above the surrounding land until the level control structure (a tilting weir) is reached at Coggleford Mill (TF0744846116). The Old River Slea leaves the higher level channel through a sluice on the right bank just downstream of the leisure centre bridge.

Photo 13

Photo 14

Photo 15

Photo 16 The tilting weir and Coggleford Mill (background)

Photo 17 The tilting weir

Photo 18 Coggleford Mill bypass

The tilting weir at Coggleford Mill is located in the former lock structure and has a head difference of around 1.5 metres (Photos 16, 17). The channel upstream has recently been cleared of emergent vegetation to improve the water flow to the mill (a tourist attraction). The weir is a barrier to fish movements, preventing fish from moving freely between the reaches upstream and downstream of the mill. Making fish passage possible would greatly improve the resilience of fish populations in the Slea by connecting different habitats used for spawning, feeding and over-wintering and making it easier for fish to naturally recolonise following pollution incidents. If plans are being considered to renovate the lock structure, serious consideration should be given to installing a fish pass in this location. The mill bypass channel may provide a route (Photo 18), although a professional appraisal should be conducted to determine the best option.

Between the lifting bridge and Coggleford Mill, a past project to introduce soft, vegetated margins to the river has been attempted which involved driving in lines of wooden posts to support a geotextile membrane, then backfilling with gravel and planting (Photo 15). This has only been partially successful, with long sections of posts now exposed, with no marginal vegetation present. The left bank appears to have colonised much more successfully than the right, possibly because of its south-facing aspect. There are large numbers of waterfowl in this area, encouraged by public feeding, which will exert considerable grazing pressure and make establishing new planting a challenge

In summary, the habitat quality for a self-sustaining population of brown trout in the River Slea is poor. The uniform, artificial nature of the channel which lacks variation in depth, flow pattern, substrate composition and marginal habitat is deficient for all life stages of trout. However, there is evidence of spawning (on the gravels in the upper sections, Photos 3, 7) and the observation of trout of all sizes indicates some successful recruitment. Although spawning areas are very limited, subsequent survival may be good in the stable flows and calcium-rich waters. There may also be a contribution to the trout population from the Nine-foot river.

4.0 Recommendations

On the lower section of river (between Carre Road and Coggleford Mill) the opportunities for habitat improvement are limited because of the impounded nature of the river. Changing the dimensions of the channel or introducing in-stream structures would not have the desired result (increased localised scour to change depths and sort bed substrate) because of the low energy of the impounded reach; they would also potentially conflict with the use of the channel as a navigation. If works at Coggleford lock are carried out in the future, it would be of benefit to the river to incorporate a multi-species fish pass for the reasons noted above.

The marginal habitat of this lower section has been attempted previously with mixed results. This could be tried again, given that the wooden posts are still in place. The crucial consideration if these margins are re-planted is protection from the abundant waterfowl; this would involve physical barriers (mesh, cages, etc.) which would have to be in place for two growing seasons and may be considered unsightly and prone to interference.

The best opportunities for habitat improvement on the stretch visited are in the sections of river upstream of Water Gate (Sainsburys) through to Drove Lane. The lack of impoundments here makes it possible to changes the low-flow channel dimensions to increase scour and improve variation in depth, flows and substrate composition.

Some examples of potential projects and approximate costs are given below.

<u>Drove Lane to Railway Bridge</u>

Use an excavator to re-shape the river bed, a technique pioneered by the late Nigel Holmes. A thalweg (continuous deep line of flow) is excavated in the river bed and the arising material used to form berms (benches) in the margins of the river. An example is shown in Photo 19.

The cost of this work is approximately £10/linear metre of channel and the section between Drove Lane and the railway bridge is approximately 500 metres, so a budget of £5,000 should be allowed. Tree planting with low-growing sallows (*Salix caprea, S. cinerea*) would also be beneficial here and could be done with volunteers and a budget of £500 for materials.

Allow £1500 for submission of consents and project supervision. Environment Agency Flood Defence Consent (FDC) can take 8 weeks to obtain. Delivery of the project should take approximately 5 days.

Photo 19 River Lark, Suffolk following river bed re-shaping

Railway Bridge to Castle Causeway

A similar approach to the above section could be adopted, assuming access for an excavator is possible in this more restricted environment. This is a section of approximately 700m, so a budget of £7000 should be allowed, plus £1500 for consents and project supervision. If excavator access is a problem, then use of brushwood mattress berms would be an alternative (Photo 20).

A potential issue in this section is shading (from the houses and wall on the south bank) which appears to have limited in-stream vegetation growth. Both the described techniques rely on colonisation of vegetation (on the berms) in the longer term. Concentrating structures against the north bank is advisable here.

Photo 20 Brushwood matress installed on an over-wide chalkstream

Costs of the brushwood work depend heavily upon the availability of materials and cost of labour. If materials can be won on site and installed with volunteer labour (after a WTT demonstration day), then it will be less expensive

If materials have to be imported and installed with paid labour, estimated cost for a 100-m section (10 x 10m berms or 5 x 20m) would be about £6000. With supervised volunteer labour and imported materials this would be around £3500. FDC consent can take 8 weeks to obtain; delivery of 100 metres of brushwood work with a team of 4 would take 5 days. NB this is a 700-m section so costs should be adjusted accordingly.

<u>Castle Causeway to Water Gate</u>

In the more urban setting of this reach, a project similar to that carried out in Midsomer Norton, Somerset (see below) could be considered. More

detailed costings would be required but an approximate budget of £20K would allow a reasonable length to be addressed. FDC could take up to 8 weeks to obtain and works delivered in approximately 2 weeks.

	
	River restoration carried out in Midsomer Norton illustrating the principles of narrowing the channel with low, vegetated shelves. Top left (before), top right (during) and left (after 1 year). http://restorerivers.eu/wiki/index.php?title=Case_study%3ARiver_Somer_channel_enhancement,_Midsomer_Norton

Downstream of the lifting bridge

Restoration of the failed marginal habitat improvement could be attempted, but the limiting factor is protection from waterfowl. More detailed costings could be provided on request. **Acknowledgement**

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

5.0 Disclaimer

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/index