Advisory Visit

River Lymn, Lincolnshire

December 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 Lymn, near Spilsby, Lincolnshire, on 8th December, 2015. Comments in this report are based on observations on the day of the site visit.

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. Specific locations are identified using the Ordnance Survey National Grid Reference (NGR) system, for example, Snipe Dales Country Park (TF 33095 68255).

2.0 Catchment / Fishery Overview

The River Lymn rises in the rolling landscape of the southern Lincolnshire Wolds near Salmonby, south of Tetford. It flows in a south-easterly direction to the north of Spilsby, leaving the Wolds around Halton Holegate and entering a flat, fenland landscape, where it becomes known as the Steeping River. The lower reaches of the river are canalised and regulated, down to its estuary at Gibraltar Point, south of Skegness.

An unnamed tributary of the River Lymn rises in Snipe Dales near Winceby, south of Hagworthingham, and flows east to join the Lymn at Sausthorpe Bridge (TF 37832 68682). A 6-km reach of this tributary, from Sausthorpe Bridge to Snipe Dales, was the subject of the majority of this walkover survey. A 1.5-km reach of the River Lymn between Aswardby Bridge (TF 37409 69461) and downstream of Sausthorpe Bridge was also inspected (Figure 1).

Natural England's National Character Area Prolife for the Lincolnshire Wolds states:

The landscape of the Wolds is strongly influenced by the underlying geology and the later glacial action that reshaped it. The solid geology is largely made up of a sequence of sandstones, clays, sandy limestones, ironstones and chalk deposited between 155 and 95 million years ago during the late Jurassic and Cretaceous periods. The chalk is capped in places by glacial deposits, while glacial meltwater channels have carved away parts of the

Wolds to leave steep valleys. To the south-east, the overlying glacial till creates a rounded edge to the Wolds, and towards the southern end the chalk cap has been removed to reveal the Lower Cretaceous sands, clays and ironstones which form a series of low hills with gravel terraces.

(http://publications.naturalengland.org.uk/publication/9965009?category=587130)

Under the Water Framework Directive, the Lymn/Steeping catchment (waterbody ID no. GB105030062430) is classified as heavily modified because of the engineered nature of the lower river for land drainage. Table 1 summarises the data collected by the Environment Agency to measure whether the catchment is reaching the target of "good ecological potential". Currently, the catchment is "moderate ecological potential", apparently because of a moderate classification for surface water. Biological quality elements are rated as good or high.

	2009 Cycle 1	2014 Cycle 2	Objectives
Overall Water Body	Moderate	Moderate	(Cycle 2) good
Ecological	Moderate	Moderate	(Cycle 2) good
Biological quality elements	High	Good	(Cycle 2) good
Fish	-	Good	(Cycle 2) good
Invertebrates	High	High	(Cycle 2) high
Macrophytes	-	-	-
Hydromorphological Supporting Elements	Not-high	Not-high	(Cycle 2) not high
Physico-chemical quality elements	Moderate	Good	(Cycle 2) good
Supporting elements (Surface Water)	Moderate	Moderate	(Cycle 2) good
Chemical	Good	Good	(Cycle 2) good

Table 1 Water Framework Directive classification data (Source: http://environment.data.gov.uk/catchment-planning/WaterBody/GB105030062430).

There are no angling clubs on the reaches inspected and no fish stocking takes place. There are no statutory conservation designations on the

reaches inspected, although Mavis Enderby SSSI is located on a small tributary stream (noted below). Snipe Dales is a Local Nature Reserve (LNR), owned and managed by Lincolnshire Wildlife Trust (www.lincstrust.org.uk/snipe-dales).

Land use within the catchment is largely arable agriculture, with some areas of grassland and livestock grazing. There are also some intensive pig-rearing units present within the catchment. There is a mixed coverage of the catchment by environmental stewardship schemes, as noted below.

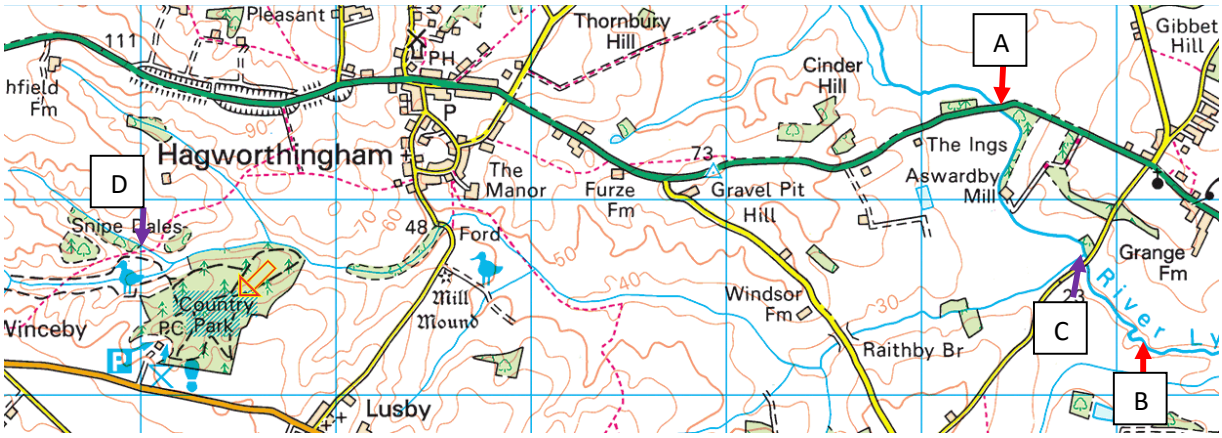

Figure 1 Map of reaches assessed. Points A to B Aswardby Bridge to below Sausthorpe Bridge (Section 3.1) and points C to D Sausthorpe Bridge to Snipe Dales (Section 3.2).

3.0 Habitat Assessment

3.1 Aswardby Bridge (TF 37409 69461) to below Sausthorpe Bridge (TF 37832 68682)

This section was walked in a downstream direction from Aswardby Bridge (A158 road). The river here is in a perched channel on the left side of the valley, above the level of the original course in the valley bottom (Photo 1). The river course has historically been moved and raised to provide a head of water at Aswardby Mill (disused, now a private residence), located on the left bank (TF 37438 69025).

Between the A158 road and the mill, the river channel is straight and embanked. The artificial nature of the channel and the impoundment at the mill means the flow consists of a steady glide, lacking a natural pool-riffle sequence (Photo 3). The river bed consists of clay and fine sands; there is

no gravel present that would provide spawning habitat for riverine, gravel-spawning fish species.

The riparian vegetation consists of trees, bushes and scrubby vegetation which provide good low cover over the river channel and some areas of woody debris within the channel; this provides good habitat and shelter for adult fish (Photo 2). Where there is less shading from bankside trees and bushes, emergent vegetation (such as beds of reedmace *Typha latifolia*) are present, narrowing the channel and providing a small amount of variation in current speed (Photo 1).

Downstream of the mill impoundment, the river channel is free-flowing and varies in wetted width depending upon the degree of shading and resulting abundance of marginal vegetation (Photos 4 and 5). Two ditches join the river from the RHB, one of which (TF 37471 68907) is probably the remnant channel of the original river course. Land use is arable on both banks, with wide grass margins alongside the river, and two areas of tree planting in field corners (TF 37518 68866 and TF 37846 68730). At least one section of the RHB is in Higher Level Stewardship.

The river channel between the mill and Sausthorpe Bridge has been straightened and lowered in the past for land drainage purposes; it may have been realigned from its original course (see Figure 2, Section 3.2). This is reflected in the lack of meanders and the uniform, cross-sectional shape of the channel. The flow pattern is a uniform, swift glide with no pool-riffle sequence and a lack of depth variation. In the intervening years since the channel was engineered, the river has naturally narrowed its wetted width, forming berms (shelves) at a lower level within the over-widened channel. These berms represent a new, lower floodplain level established by the river, essentially creating a two-stage channel: dry weather flows are contained within the narrow channel, whereas elevated flows spill over the berms but are contained within the bank-full channel (Photo 6).

The composition of the river bed here is largely clay, overlain by silts and fine sands in some areas. No gravel suitable for fish spawning was observed, as a result of it having been removed during river bed lowering in the past and a subsequent lack of supply from upstream. Small, relatively low-energy rivers such as this do not transport coarser (20 mm plus) gravel and the mill impoundment upstream will act as a barrier to coarse sediment transport.

Bankside vegetation is mainly tall, scrubby plants such as willow-herb and nettle; trees and bushes are rare. A small patch of sallow, alder and hawthorn occurs at TF 37738 68826 and it is noticeable that the channel is wider here because in-stream vegetation is inhibited by the shading of the trees (Photo 7). Elsewhere, beds of emergent vegetation (such as reedmace) are common.

At the bend in the river at TF 37821 68775, a lateral scour pool has formed which provides some deeper water habitat suitable for adult fish (Photo 8). This illustrates how such habitat is dependent upon a meandering river course and how this is lacking throughout the rest of this reach.

Photo 1 Downstream view towards Aswardby Mill. The river is in a perched, embanked channel above the level of the field to the right which contained the original river course

Photo 2 Downstream of Aswardby Bridge, trees and bushes provide shading and low cover over the river channel.

Photo 3 Impounded river upstream of the mill (upstream view).

Photo 4 Free-flowing river downstream of the mill (upstream view).

Photo 5 Narrow, deeper channel formed by consolidation of marginal vegetation into berms.

Photo 6 Typical section between Aswardby Mill and Sausthorpe Bridge, showing lowered river bed, engineered channel width (red arrow) and berms resulting from river reinstating its natural width (yellow arrows).

Photo 7 Sallow, alder and hawthorn provide some shade, restricting in-stream plant growth.

Photo 8 A lateral scour pool providing some good adult fish habitat (TF 37821 68775).

Photo 9 Sausthorpe Bridge culvert.

Photo 10 Recent river engineering downstream of Sausthorpe Bridge, including the cutting off of a meander (right of picture).

Photo 11 Former meander (upstream view)

Photo 12 Former meander (right) and new channel (left), downstream view.

In summary, the river habitat between Aswardby Bridge and Sausthorpe Bridge is impoverished because of the historic re-alignment and impoundment of the channel (upstream of the mill) and by past land drainage engineering and possible realignment (downstream of the mill). The river has recovered to a degree by narrowing itself, but there remains an absence of meanders, pools, riffles and gravel substrate. These elements of good river habitat will not recover without active intervention to restore them.

At Sausthorpe Bridge, a tributary joins the river from the RHB (the subject of the next section of the report). The tributary has a gravel bed and it appears to be contributing coarser sediment to the main river, as gravel becomes evident for the first time downstream of the bridge.

The bridge culvert has a small drop in level on the downstream side and shallow, fast-flowing water beneath the bridge (Photo 9). This may form a barrier to free migration of fish, particularly during periods of low flow, but was certainly passable by trout of all size ranges at the time of the visit.

Downstream of the bridge, recent engineering of the river channel has been carried out. The channel has been widened, bankside trees and vegetation removed and the channel has been straightened, cutting off a meander loop on the RHB (Photos 10 – 12). These works have severely damaged in-stream habitat, leaving a uniformly shallow river, devoid of any cover for fish. The overwide channel promotes the deposition of fine sediment which tends to smother the areas of gravel that have started to appear (probably supplied from the tributary stream). The removal of meanders is very damaging to river habitat, because it removes lateral scour pools which form on the outside of bends (as in Photo 8); this removes vital deeper areas (which hold adult fish) and prevents them from re-establishing.

In the medium to long term, if allowed to do so, this engineered section of river will recover in the manner of the section upstream of the bridge. The deposited fine sediment will colonise with vegetation, consolidate and form berms and a two-stage channel with enough depth to hold an impoverished fish community (compared with none at present). However, the lack of meanders and resulting uniformity of depth and bed substrate is permanent damage which cannot be rectified without intervention to reinstate the lost channel sinuosity.

3.2 Tributary stream, Sausthorpe Bridge (TF 37832 68682) to Snipe Dales (TF3305568740).

This unnamed tributary was walked in an upstream direction from its confluence with the River Lymn at Sausthorpe Bridge.

The section of stream alongside the road has a straight channel with fast-flowing, uniformly shallow (10 cm) water over a gravel substrate (Photo 13).

Photo 13

Inspection of old maps (www.old-maps.co.uk) indicates the channel was moved to its present course from a longer, sinuous course sometime between 1956 and 1971 (Figure 2).

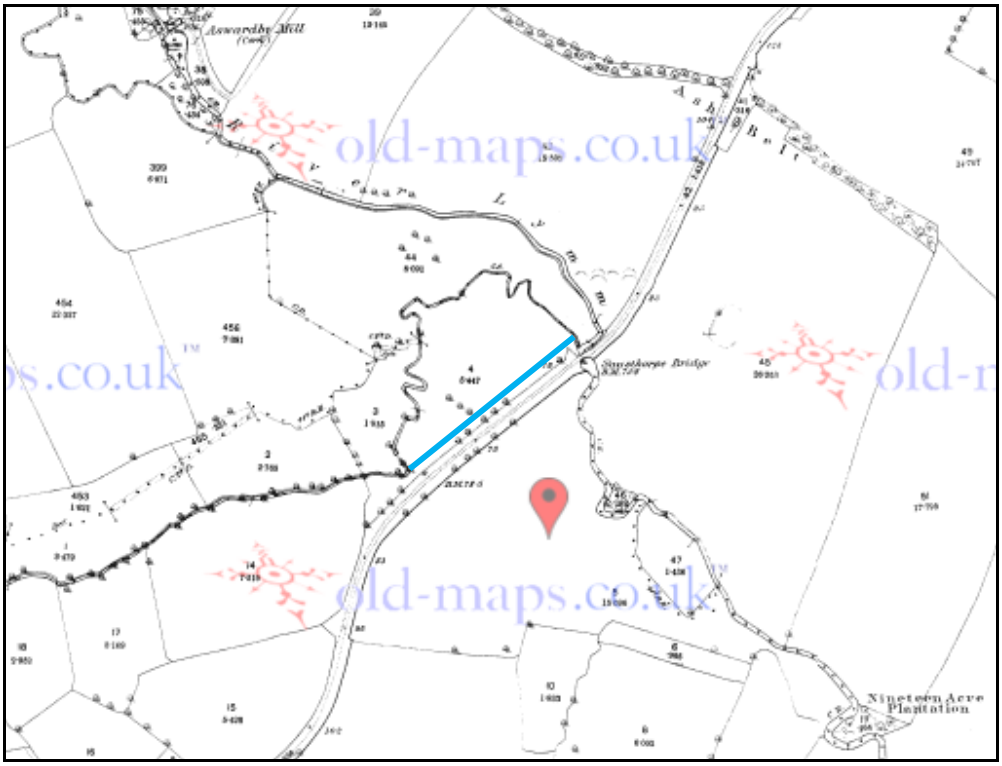

Figure 2 1:2500 OS County Series map dated 1888, showing former sinuous course of River Lymn tributary. Blue line indicates present course. The course changes between maps dated 1956 and 1971 (Source: www.old-maps.co.uk).

There is hardly any depth variation in this straight section, although the occasional tree root or piece of coarse woody debris is causing localised bed scour. This indicates that log flow deflectors could be used through this section to create some deeper areas which would provide holding water for adult trout and assist migration upstream from the main river. A single redd (trout spawning activity) was observed here (Photo 14). Flow deflectors would also benefit spawning by providing areas of well-sorted gravel.

With progress upstream, the channel becomes more sinuous and has some good in-stream habitat. Between the RHB pond (TF3747668544) and the wood (TF3730868448), lateral scour pools are present on the outside of bends and a pool-riffle sequence is present. There is still a lack of large meanders, suggesting this reach has been modified in the past, but has had a long time to recover. Fine sediment (sand) on the river bed becomes more evident with progress upstream.

The woodland area consists of conifers on the RHB and poplars on the LHB, with alders closer to the river. The morphology of the river is more natural here, with extensive meanders, lateral scour pools, submerged tree roots and gravel riffles forming excellent in-stream habitat. Two recently created trout redds were observed in this area. The river bed here and throughout the rest of the stream from this point has a large proportion of fine sediment. This is of concern for the survival of trout eggs which are buried in gravel throughout the winter; smothering with fine sediment greatly reduces the proportion which incubate and hatch successfully.

Continuing upstream to Raithby Bridge, the river habitat is very good with a meandering plan-form, pool-riffle sequence and abundant cover in the form of tree roots and large woody debris. The brook is flanked by native woodland and pioneer alders, and the land use on the right bank is a wet flush and un-improved (or semi-improved) grassland which appears to be managed for conservation (this area is covered by a Higher Level Stewardship agreement). A woodcock (*Scolopax rusticola*) was observed in this area.

The brook circumvents a small lake at TF 36993 68407 and a trout was observed over a fresh redd in this vicinity. Beyond the lake towards Raithby Bridge, although in-stream habitat is good, the channel is straighter suggesting historic modification, and deeper pool habitat is less evident. Bed sediments are dominated by sand, with only occasional patches of clean, well-sorted gravel. The riparian habitat is good, with mature trees, indicating the channel modification took place a long time ago (the present course is the same as an 1888 map).

Upstream of Raithby Bridge, the in-stream habitat is similar to that described above – good but still affected by historic straightening (from the bridge to approximately TF 35765 68511) and large amounts of fine sediment. Riparian habitat is excellent, with abundant mature alders, coarse vegetation, tree roots and in-stream woody debris providing cover. Land use on the RHB is being managed for conservation, with a wet flush and semi-improved grassland (this area is in Higher Level Stewardship (HLS)). The left bank is also low intensity, semi-improved grassland although not in HLS.

Photo 14 Recently made trout redd (spawning area) indicated by the clean gravel. Approximate location TF3771668613.

Photo 15 Better in-stream habitat with increasing channel sinuosity.

Photo 16 "Horseshoe" bend at TF3722468423 with a deep lateral scour pool (not visible, beyond headland) and two riffles, each with trout redds (locations indicated by arrows).

Photo 17 Good in-stream habitat (downstream view from same point as Photo 16). Note high levels of fine sediment.

Photo 18 Low intensity conservation grazing and a wet flush, RHB, TF3713568397.

Photo 19 Trout spawning activity TF3696168422.

Photo 20 Low intensity land use, RHB upstream of Raithby Bridge.

Photo 21 Good habitat upstream of Raithby Bridge – pool-riffle sequence and excellent riparian habitat – but some historic straightening has occurred (Photo 25).

Photo 22 Large woody debris (upstream of Raithby Bridge), providing a superb habitat feature – cover and a deep scour pool.

Photo 23 Large amounts of fine sediment on the bed indicate an excessive supply to the brook and give concern for the survival of trout eggs.

Photo 24 A tributary stream entering at TF3648568139.

Photo 25 Straightening of the channel has occurred in the past upstream of Raithby Bridge, as indicated by the lack of meanders and pool habitat in some sections.

The section of brook from around TF3545468578 upstream to the footbridge into Furze Hill Nature Reserve (TF3497768675) has generally good in-stream habitat, with an excellent natural reach at the downstream end, but evidence of channel alteration with progress upstream. The downstream reach has a sinuous channel with deep lateral scour pools, a pool-riffle sequence, and abundant cover from tree roots and woody debris (Photo 26). Further upstream, there are sections of channel which appear to have been straightened (Photo 27). The bed of the brook is dominated by fine sediment and no evidence of spawning trout was observed in this section.

Riparian habitat is very good and the brook continues to be bordered by a wide strip of woodland. However, outside this strip, land use has become more intensive (Photo 28), with arable crops in cultivation (these areas are in Entry Level Stewardship). The volume of fine sediment in the brook indicates an excessive rate of supply from the surrounding land, despite the wide woodland strip adjacent to the river and the grassed field margins and headlands present in the fields. A number of field drains were observed discharging to the brook which had fans of fine sediment at their base. These could be the pathway by which fine sediment is reaching the brook, bypassing the buffer strips (Photo 30).

In the vicinity of Furze Hill Nature Reserve, the land use on the LHB is improved grazing and on the RHB arable (broad beans) with a grass field margin (Photos 31, 32). The channel is moderately sinuous although appears it may have been straightened at some time in the past (Photo 33). Riparian habitat is very good with mature alder trees providing shading and in-stream habitat via their root masses. The bed of the channel continues to be dominated by fine sediment, with only the very occasional patch of gravel associated with localised scour caused by woody debris (Photos 34, 35). The importance of these areas of woody debris and scour is illustrated by the presence of a trout redd in such an area, just upstream of the footbridge at TF3473468895 (Photo 36).

The ford at TF3456968880 near Hagworthingham (Photo 37) presents a barrier to free movement of fish. There is a drop of around 30cm at the downstream extent (under the footbridge), which is likely to be surmountable by trout (including juveniles) by leaping from the pool below. However, the extensive, very shallow section over the road is probably impassable at all but very high flows.

Photo 26 Excellent habitat on the section midway between Raithby Bridge and the ford at Hagworthingham (TF3564768512), including a sinuous channel, pool-riffle sequence and in-channel woody debris.

Photo 27 Some sections a little further upstream from the area in Photo 26 have been straightened and have much poorer habitat.

Photo 28 More intensive land use beyond the riparian zone of the brook. Although the brook is well buffered, fine sediment is reaching the watercourse via field drains (Photo 30).

Photo 29 A recently cleared area of the LHB (adjacent to the area in Photo 28) where a new field drain has been installed.

Photo 30 A field drain discharging to the brook with a fan of fine sediment. These are likely to be the pathways by which excessive sediment reaches the brook, despite good practice with field buffers and a wide riparian zone alongside the brook.

Photo 31 Low intensity grazing on LHB at Furze Hill Nature Reserve.

Photo 32 Arable farming on RHB with a grass margin.

Photo 33 Reasonably good in-stream habitat alongside Furze Hill, although the channel is straighter and lacking pools compared with sections downstream (e.g. Photo 26). Some brushwood bank protection has been installed here.

Photo 34 Large amounts of fine sediment dominate the bed of the brook.

Photo 35 Woody debris creates some excellent habitat features, providing scour and depth variation.

Photo 36 Trout redd made in a patch of gravel where nearby trailing branches have squeezed the flow and scoured away fine sediment from the river bed.

Photo 37 Ford at TF3456968880 near Hagworthingham.

Upstream of the ford, the brook is bordered by a footpath and wooded bank on the RHB and a grassed area with recently planted blocks of trees on the LHB (Photo 38). In contrast to the RHB, there are few mature trees on the LHB immediately alongside the brook. The channel has a meandering planform, but the lack of trees on the LHB is reducing bank stability and leading to increased rates of erosion, which is in turn preventing deeper pool habitat from establishing (Photos 39, 40). Installing brushwood bank protection on the outside of LHB bends in this area, along with the planting of individual or small blocks of trees, would greatly improve the quality of the in-stream habitat.

Large quantities of fine sediment are still evident in this section of the brook (Photo 41), although the sinuous plan-form and presence of in-channel woody debris promotes better sorting of the river bed substrate. Trout spawning activity was observed on areas of gravel, mainly associated with localised scour caused by woody debris (Photo 42). Undershot scour caused by water forced underneath fallen trunks spanning the channel seems particularly effective at creating depth and sorting sediments (Photo 43). Mimicking this effect in other areas with introduced structures is recommended.

With progress upstream, some sections of the upper course of the brook are straighter and embanked, suggesting past channel engineering. These sections have relatively poor habitat, lacking depth variation and sorting of the bed sediments. A number of significant differences in bed level on either side of the root balls of trees were observed; it is not clear whether these are natural features or indicative of deliberate lowering of the river bed in the past, the areas adjacent to trees being inaccessible for engineering (Photos 44-46). The straighter sections of the channel could easily be improved by introducing woody debris features (see recommendations). Some areas of the RHB have been protected with brushwood revetment, which is also providing some valuable in-stream cover for fish (Photo 47).

A tributary stream joins from the RHB at Snipe Dales Country Park (TF3385168670); this appears to be an important source of gravel for the brook. The bridge just upstream from the confluence is well-designed, allowing natural sediment transport processes to continue and not impeding fish passage (Photo 48). Upstream from the confluence, the brook is small and quite straight with only very occasional pools capable of supporting trout

(Photos 49, 50). Woody debris structures to promote bed scour and the development of a more sinuous course would be beneficial in this area.

Photo 38 Upstream of the ford, the brook has a nice, sinuous course. There is woodland on the true RHB (left of picture) and on the LHB, a grass strip with recently planted blocks of trees set back from the brook. Note the lack of trees adjacent to the brook on the LHB.

Photo 39 On the LHB, fewer trees means less bank stability, leading to increased rates of erosion and poorer pool habitat on the outside of meanders.

Photo 40 In contrast to Photo 39, outside bends against the more stable RHB have better developed lateral scour pools, providing good adult trout habitat.

Photo 41 Fine sediment is still evident in the upper reaches, although sediment is generally better sorted than on the section downstream of the ford. Areas of gravel are more abundant.

Photo 42 Recent trout spawning activity on an area of gravel immediately downstream of a fallen tree, where undershot scour has sorted the river bed sediments.

Photo 43 A large fallen tree creates localised scour and depth variation, as well as a wildlife "bridge" (this is another example, not the one associated with Photo 42).

Photo 44 The channel straightness and bank profiles of some sections of the upper course suggest there has been some engineering of the brook in the past, leaving a dearth of pools and poorer in-stream habitat.

Photo 45 A number of tree-root "waterfalls" were observed. A natural feature, or indicative of past channel engineering?

Photo 46 Another straight section, lacking depth variation and with a bed dominated by unsorted sediments. Installing woody debris in areas such as this would greatly improve in-stream habitat.

Photo 47 Some brushwood bank protection has been carried out on the RHB.

Photo 48 Culvert bridge over a tributary stream on Snipe Dales Country Park. This is an example of good practice with the pipe (or possibly arch) well sunk into the stream bed, allowing natural sediment transport and free fish passage.

Photo 49 A rare pool on the upper section of the brook within Snipe Dales. Features like this are essential for holding trout.

Photo 50 More typical habitat on the upper reaches, with very few pool areas.

4.0 Recommendations

4.1 River Lymn, Aswardby Bridge to below Sausthorpe Bridge

The two main issues affecting river habitat in this section are:

- historic realignment and impoundment of the channel at Aswardby Mill;
- channel engineering (both historic and recent) of the channel downstream of the mill and downstream of Sausthorpe Bridge.

In principle, good river habitat could be restored upstream of the mill by returning the channel to a course approximating that prior to its alteration for milling. This would be in the valley bottom to the west of the present river course. The restored reach would require a design according to the principles of fluvial geomorphology, incorporating a meandering course, pool-riffle sequence and connectivity with its floodplain. Several examples of such a project have been carried out in recent years in which the Wild Trout Trust has been involved (Appendix 1). Practical considerations for such a project include land ownership and permission, retention of land drainage function, the effect upon flood risk, loss (or substantial reduction) of flow at the mill, and potential need for new crossings (e.g. A158 road bridge). The survey of levels and feasibility study by a professional fluvial geomorphologist is recommended as a starting point for consultation.

Downstream of the mill to Sausthorpe Bridge, where river gradient is unaffected by impoundment, river habitat could be improved either by channel alteration (as above) or by installation of instream structures within the existing channel. The former option could be part of a wider initiative including the upstream reach, or a standalone project.

Instream works could include

- Creating sinuosity within the existing bankfull channel, by careful realignment of sections of the existing, natural berms to alternate banks (Photo 51).
- Gravel introduction to provide a spawning medium for trout and other river fish species

- Brushwood bank protection to reduce bank erosion rates on the outside of bends
- Planting additional native trees, including alder (*Alnus glutinosa*) and low-growing sallows (*Salix cinerea* and *S. caprea*)

Photo 51 Introducing sinuosity to the straight channel downstream of Aswardby Mill by excavating a meander and creating a berm on the opposite bank. The outer edge of the new berm and banks at the outside of bends would be protected with brushwood bundles. This pattern would be repeated along this length.

Downstream of Sausthorpe Bridge, the focus should be to mitigate the effects of the recent river engineering by

- Re-connecting and restoring the flow to the meanders cut off by the recent works
- Narrowing the low-flow channel by introducing low berms. These should be positioned on the inside of bends, or where the river is straight on alternate banks (Photo 52).

- Introducing log structures to promote scour of the river bed, increasing the variation in depths and sorting river bed substrate (Photo 53).

Following habitat improvement and with subsequent careful management, the section of river above and below Sausthorpe Bridge has the potential to be a good river trout fishery. Wild trout are evidently present in the tributary stream which joins at Sausthrope Bridge and these would quickly colonise the main river if habitat was made suitable. There is a dearth of wild trout fishing in Lincolnshire and such a fishery could be of interest to an angling club or syndicate.

Photo 52 Creation of berms on inside of bends, back-filled with material cut from higher up the banks (see Photo 53 below).

Photo 53 Installation of log flow deflector to promote river bed scour and increase depth variation. Note low berms with brushwood edges downstream.

4.2 Tributary stream, Sausthorpe Bridge to Snipe Dales

The in-stream habitat on this small watercourse is generally very good and trout are evidently present, given the signs of spawning activity observed. The main issues affecting the brook are as follows.

- Large volumes of fine sediment enter the watercourse, apparently via land drains. Adjacent land use along the brook is largely low intensity (conservation grazing) or is well-buffered by good riparian habitat. This probably reflects previous work under initiatives such as Catchment Sensitive Farming and uptake of stewardship schemes. Unfortunately this does not appear to have controlled the problem sufficiently. It may be possible to map the sources of fine sediment and target vulnerable areas with additional measures, for example

interception and settling of land drain discharges. The Game & Wildlife Conservation Trust's Allerton project may be a useful source of information in this respect (www.gwct.org.uk/allerton/).

- Some sections of the brook have been engineered in the past, leaving a legacy of a straight channel lacking deeper pool habitat. These areas include the most downstream reach (just above the Lymn confluence), around Raithby Bridge, in the area of Furze Hill and the upper course towards and within Snipe Dales. These areas could be significantly improved by introducing woody debris structures such as log flow deflectors, hinged trees and tree trunks spanning the brook. A number of such features exist naturally, so it is evident they do not pose a flood risk and could be reproduced elsewhere.

- The section of brook upstream from the ford near Hagworthingham lacks trees on the LHB and is experiencing accelerated bank erosion as described in section 3.2. These areas should be protected with brushwood revetment followed by native tree planting. This will increase bank stability and promote bed scour, increasing the depth of pools and providing much better trout habitat.

Please note it is a legal requirement that all the works to the river require written consent from the Environment Agency (main river) or Local Authority (non-main river) before undertaking any works, either in-channel or within 8 metres of the bank.

5.0 Making it Happen

The Wild Trout Trust may be able to assist with implementation of the above recommendations in the following ways:

- Production of a project proposal with more detailed designs for in-stream structures, which could be used as the basis for seeking Flood Defence Consent.

- Carrying out demonstration days for habitat improvement techniques with volunteers, for example the structures and bank protection

techniques in the section between Hagworthingham ford and Snipe Dales.

- Becoming a partner in a project to take forward the more ambitious river restoration proposals (channel realignment).

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

6.0 Acknowledgement

The WTT would like to thank the Environment Agency for supporting the advisory and practical visit programme in England.

7.0 Disclaimer

Appendix 1 – Examples of river restoration projects involving channel realignment and the principles of natural river geomorphology.

- River Glaven, Bayfield Hall, Glandford, North Norfolk.

Creation of a 1.2-km long nature-like channel bypassing an estate lake. Completed in September 2014. www.wildtrout.org/content/bayfield-project-river-glaven.

- River Glaven, Hunworth, North Norfolk

Restoration of a straightened 400-m long section of river, including meander creation and restoration of a pool-riffle sequence. Land owned by Stody Estate, subsequently included in Higher Level Stewardship. www.wildtrout.org/content/river-glaven

- River Bain, Donington on Bain, Lincolnshire

Project led by Lincolnshire Chalk Streams Project which involved realigning the river to bypass a former mill. www.wildtrout.org/content/river-bain-project

- River Witham, Stoke Rochford, Lincolnshire

A partnership project between Environment Agency, Wild Trout Trust and landowner Neil McCorquodale which created a new 600-m channel around a weir on the upper River Witham www.wildtrout.org/news/new-old-section-channel-river-witham.