Advisory Visit

Branston Beck, Lincolnshire

August 2016

Contents

Summary

- Approximately 6.5 km of the Branston Beck was inspected between the Branston village and Washingborough Fen. The Beck is a small stream fed by springs from the Lincolnshire limestone aquifer. It has clear water and aquatic plant growth characteristic of calcareous conditions.
- Throughout the course of the beck, the channel has been significantly modified from its natural state, having been straightened, deepened, and its course altered. There are few meanders and a pool-riffle sequence is not evident. Instream habitat quality is generally poor, with uniform channel shape, depth and substrate composition, limiting its value for wildlife. Despite this, some trout were observed above Heighington.
- The opportunities for in-stream habitat improvement within Branston village are limited, apart from Hall Lane where it is possible to extend a previous community-led project.
- Subject to further investigation, there is scope for a significant river re-naturalisation project in “the Jungle” area downstream of Branston village, providing biodiversity, amenity gains and potential flood risk reduction.
- Between Cliff Farm and Heighington, there may be potential for creating a more sinuous channel with better connection to its floodplain, providing natural flood management benefits and improved habitats.
- Between the railway crossing and the mill in Heighington there is scope to improve instream habitat by narrowing the low-flow channel to increase sinuosity, depth variation and sorting of bed substrate.
- Within Heighington village the scope for enhancing in-stream habitat is limited to narrowing the low-flow channel and improving riparian habitat with D-shaped flow deflectors from alternate banks, planted with aquatic plants. Any project here would be dependent upon the level of flood risk. Also the thin layer of gravel over bedrock here would restrict bed scour.

- This section of the brook, from Heighington downstream, is designated main river and maintained by the Environment Agency (EA) which includes mowing of the banks and cutting of in-stream vegetation. Any habitat improvements within this section would have to dovetail with the maintenance regime carried out by the EA, but could include log flow deflectors to create bed scour and planting.

- A search of Lincolnshire Environmental Records Centre data, centred on the Beck, was requested by Lincolnshire Rivers Trust in January 2017 and includes recent records of the following species associated with aquatic habitats: otter. The full search report is available from marie.taylor@lincsrivers.org.uk.

Index of Sections Highlighted in this Walkover Report

Introduction

This report is the output of a site visit undertaken by Tim Jacklin of the Wild Trout Trust to the Branston Beck, near Lincoln, on 17th August, 2016. Comments in this report are based on observations on the day of the site visit and discussions with Matt Parr, Environment Agency Fisheries Technical Officer.

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, High Street bridge, Branston (TF 02061 67389).

Catchment Overview

The Branston Beck (also known as Sandhill Beck) is a small stream which rises near Mere Hall, just to the east of Waddington airfield near Lincoln and flows north-eastwards, through the villages of Branston and Heighington, to join the River Witham drainage system on Washingborough Fen (TF 04268 71336). The Beck is groundwater fed, flowing off the Lincolnshire limestone.

Under the Water Framework Directive, the Sandhill Beck was rated poor ecological status in the 2015 assessment and moderate in 2013. The Directive sets all water bodies the target of achieving good status or good potential by 2027 based on ecological health and water quality. The reasons for the recent "poor" rating are the run-off of nutrients from agricultural land affecting the plant and algae communities within the beck, and the past modification of the shape of the channel.

River	Sandhill Beck
Waterbody Name	Sandhill Beck
Waterbody ID	GB105030062415
Management Catchment	Witham (Operational catchment: Lower Witham)

River Basin District	Anglian
Current Ecological Quality	Overall status of **Poor*** ecological status in assessment cycle 2015, **Moderate** in 2013.
U/S Grid Ref inspected	TF 01892 67092
D/S Grid Ref inspected	TF 04268 71336
Length of river inspected	~7 km

*Ecological elements in 2015: Poor for Macrophytes and Phytobenthos Combined; High for Invertebrates. Chemical elements in 2013 and 2015: Good.

The walkover survey was conducted to identify opportunities for habitat improvement along the Beck which could form part of the potential Lincolnshire Limestone Becks project, a partnership project currently under development.

Habitat Assessment

Throughout the course of the beck, the channel has been straightened and there were no meanders nor a pool-riffle sequence evident at any point. In-stream habitat quality is generally poor, with uniform channel shape, depth and substrate composition.

Hall Lane, Branston (TF 01892 67092) to northern edge of Branston village (TF 02073 68100)

At the upstream end of the village (Hall Lane) there is an area where the brook has been made accessible, with terraced banks (with toe-boarding), stepping stones and a sculptured handrail on the bridge (Photo 1). Upstream of this area is a riverside footpath and footbridge, creating a short, circular walk. This appears to be an area where a community-led project has created a pleasant space for people to enjoy the brook and its surroundings. The area upstream of Hall Lane is densely shaded with previously coppiced alder and willow trees (Photo 2).

There is opportunity in this area to build on the previous works, including:

- selective coppicing on a 3 – 5 year rotation

- introduction of brushwood mattresses to the brook to create some channel sinuosity and improve in-stream habitat (using material arising from the coppicing)
- Removal of the toe-boards and re-grading of the bank.

Downstream of Hall Lane, the brook flows through the grounds of Branston Hall Hotel and behind some private residences (not inspected), then alongside a pub car park at the site of a former sheepwash. The brook here is confined within a walled channel and there is an interpretation board describing the old sheepwash and its archaeological investigation (Photo 3). The brook is then culverted under the B1188 High Street and flows through the gardens of a number of private residences on Paddock Lane. Downstream of the gardens, the brook flows within a concrete-edged channel, deeply incised and uniformly shallow (Photo 4).

Throughout the sections described so far, the brook is confined within a built environment, limiting the scope for habitat improvement through channel restoration (e.g. re-meandering). However, downstream of Paddock Lane, the brook enters a wide, green corridor between residential areas (Photos 5 – 7). Presently this corridor appears to be maintained as a nature reserve and public open space, with areas of trees, bushes, wetland, mown grass, footpaths and walkways. The brook channel remains very straight along the eastern side of this area and is perched above the natural valley floor; this is particularly evident downstream of the footpath which runs perpendicularly across the valley just upstream of Laburnum Close (Photos 7 and 8). There are pipe connections (with inverts above normal water level) between the brook channel and the floodplain area, along with areas where the brook appears to overspill its left bank at high water.

There is considerable scope here for restoring the in-stream habitat of the brook by re-aligning the channel along the valley floor and re-creating a meandering channel with a pool-riffle sequence. The channel was not inspected downstream towards Dye House Farm on this visit; this is recommended, to check whether the channel is perched to provide a head of water and where a realigned channel could potentially be re-joined to the existing channel.

Photo 1 Hall Lane, Branston

Photo 2 Upstream of Hall Lane, Branston

Photo 3 Site of former sheepwash, Branston village

Photo 4 Alongside Paddock Lane, Branston

Photo 5 Open valley area downstream of Paddock Lane.

Photo 6 Walkway through nature area.

Photo 7 Open valley/floodplain area looking downstream from the path crossing the valley close to Laburnum Close. This appears to be the lowest point of the floodplain, but the brook channel is perched, off camera to the right of this picture.

Photo 8 Perched channel of the Beck, elevated on the east side of the floodplain.

Northern edge of Branston village (TF 02073 68100) to Railway Crossing, Heighington (TF 02559 69517)

Downstream of Branston village, the brook is joined by a tributary on the left bank (Photo 9), a short section of which was inspected close to Sycamore Drive. The channel was more meandering than the Branston Beck and had good riparian habitat, bordered by trees and including large woody material within the channel; however, the channel was also incised and the bed substrate dominated by unsorted, fine sediment.

Similar habitat is present on the Branston Beck downstream of the confluence, with the channel shaded by trees and bushes, occasional coarse woody material within the channel and a bed of fine sediment (Photo 10). Downstream of the footbridge at TF 01882 68343, the stream channel is less shaded by trees, resulting in a bankside dominated by tall, herbaceous vegetation with the occasional willow and hawthorn bush. This corridor between arable fields continues downstream to Cliff Farm and as the latter is approached, the right bank of the beck is shaded by a hawthorn hedge (Photos 11 and 12).

The brook here is bordered by a public footpath part of which is the Spires and Steeples Trail, a long-distance hiking trail. The brook is hidden from view for the majority of its length here, with just a very occasional opening revealing the clarity of the water and a substrate comprising some coarser sediments which could be suitable for trout spawning (Photo 13). Although the channel shape here is extremely uniform (straight and shallow), an occasional trout was seen in this section. The dense bankside vegetation provides good cover and narrows/deepens the channel, helping to a degree to offset the habitat deficiencies inherent in the engineered channel.

At Cliff Farm, the gradient of the channel increases and the brook runs over a hard bed with larger gravel and cobble substrate. There are a couple of low, rough stone weirs before a culvert under the farm track; neither the culvert of the weirs are a barrier to fish movement. The channel is shaded by trees here and downstream of the culvert, the channel is wider and the bed is dominated by sand and silt (Photos 14 -16). Emergent vegetation including water parsnip (*Berula* sp.) and bur-reed *Sparganium* sp.is present to varying degrees depending upon shading. Trees are present along the right bank.

Photo 9 Tributary stream which joins Branston Beck on the left bank downstream of the village.

Photo 10 Branston Beck downstream of the confluence with above tributary.

Photo 11 Downstream of the footbridge at TF0188268343

Photo 12 Upstream of Cliff Farm (TF0187768935)

Photo 13 Bench seat alongside a rare opening in the riparian vegetation, upstream of Cliff Farm.

Photo 14 Upstream of the culvert at Cliff Farm.

Photo 15 Downstream of the culvert at Cliff Farm

Photo 16 Fine sediment dominated the bed downstream of Cliff Farm.

Photo 17 Dense stands of common reed (*Phragmites australis*) in the channel.

Photo 18 Bridge and open water at TF0193669244.

Photo 19 Footbridge and dog scrambles.

Photo 20 Cattle drinking area which is creating an input of fine sediment into the beck (TF 02065 69390).

Photo 21 Good riparian habitat upstream of Sheepwash Lane on the Spires and Steeples Trail. In-stream habitat on this reach could be improved by re-meandering the beck and improving the cattle drink (above).

Photo 22 Section alongside Sheepwash Lane – straightened and deepened for drainage.

With progress downstream the brook enters an open area with few trees. Land use is pasture, with a wide, fenced margin along the banks. The channel here is completely overgrown with common reed (Photo 17) and it was not possible to see the brook, except at a couple of crossing points where dog scrambles are keeping the channel relatively clear. At these areas it is clear that the brook bed is dominated by fine sediment (Photos 18 and 19). Excessive inputs of fine sediment are damaging to stream habitat because it deposits on the river bed, filling in the spaces between gravel particles; this suffocates fish eggs and reduces the diversity and abundance of invertebrates.

The last field before reaching Sheepwash Lane had pasture on the left bank (cattle grazing) with a public footpath; the brook is fenced preventing livestock access apart from in one area at a cattle drink where considerable amounts of fine sediment were being mobilised and entering the brook at the time of the visit (Photos 20 and 21). On the right bank there is arable land use with a very wide grassed margin and permissive footpath. The right bank is lined with poplar trees immediately alongside the brook. A number of trout were observed in this reach down to Sheepwash Lane.

Below Sheepwash Lane, the brook is open and runs alongside the road and cycle path down to the culvert under the railway line. The channel is deeply incised, straight and lined with tall herbaceous vegetation (Photo 22).

Railway Crossing, Heighington (TF 02559 69517) to Low Park Lane (TF 04243 69675)

Downstream of the railway, the brook enters the village of Heighington. The channel is bordered by gardens on the right bank and public space/cycle path on the left bank. The channel is straight, relatively wide and shallow and dominated by fine sediment. There is scope here to improve instream habitat by narrowing the low-flow channel (e.g. with brushwood mattresses), to increase sinuosity, depth variation and sorting of bed substrate. One trout was observed here and habitat improvements have the potential to significantly increase that number.

Downstream of Mill Lane, the brook enters a more built-up environment, with walled banks and a very uniform channel which continues through to the village centre. Opportunities to enhance the in-stream habitat here would centre upon narrowing the low-flow channel and increasing sinuosity, for example by extending D-shaped flow deflectors from alternate banks. Any project here would be dependent upon the level of flood risk, which

does increase in this vicinity according to the Environment Agency Flood Map. In addition, it was evident that the bed substrate in this area comprised a thin layer of gravel over bedrock, so the extent of bed scour created by any enhancement works is likely to be very limited, restricting benefits to instream habitat.

The section of brook from the footpath off High Street (TF 03403 69424) to Low Park Lane (TF 04243 69675) was not inspected during this visit.

Photo 23 Downstream of the railway culvert, Heighington

Photo 24 Downstream of the railway culvert, Heighington, closer to the village.

Photo 25 As above.

Photo 26 Hard edging within the village.

Photo 27 As above. It may be possible to extend the existing walled berm on the far bank, at a lower level and with a sinuous outer edge. This could be backfilled and planted with aquatic plant species.

Photo 28 Wide, shallow channel with hard edging within the village. Bedrock is only a few inches under the surface gravel here, so the opportunity for creating varied depths through channel narrowing and bed scour is limited.

Photo 29 As above.

Low Park Lane (TF 04243 69675) to River Witham (TF 04268 71336)

This section of the brook, from Heighington downstream, is designated main river and maintained by the Environment Agency (EA) which includes mowing of the banks and cutting of in-stream vegetation. The latter was ongoing at the time of the visit, with emergent vegetation being cut near the Witham confluence (Photo 36). A culvert under Cowpaddle Lane is slightly perched which would impede fish movements.

Any habitat improvements within this section would have to dovetail with the maintenance regime carried out by the EA, but could include log flow deflectors to create bed scour and planting

Photo 30 View upstream from Fen Road / Brinkle Spring Lane junction TF 04393 69853

Photo 31 View downstream from Fen Road / Brinkle Spring Lane junction TF 04393 69853

Photo 32 View upstream from Washingborough Sandpit Bridge TF 04400 70300

Photo 33 View downstream from Washingborough Sandpit Bridge TF 04400 70300

Photo 34 Sandhill Beck view upstream from Sandhill Beck

Photo 35 Perched culvert under Cowpaddle Lane bridge

Photo 36 Sandhill Beck view downstream towards the Witham from Cowpaddle Lane bridge

Opportunities for Habitat Improvements

The following sections give examples of river habitat improvement techniques that have been used elsewhere, along with where they might be used for projects on the Branston Beck.

River re-naturalisation projects

These are large capital projects which involve significant alterations to previously engineered channels, re-creating meanders and re-connecting the river with its floodplain. Figure 1 and Photos 37 – 38 illustrate such a project carried out on the River Witham, Stoke Rochford, Lincolnshire in 2015, where the river channel was realigned to bypass a redundant weir.

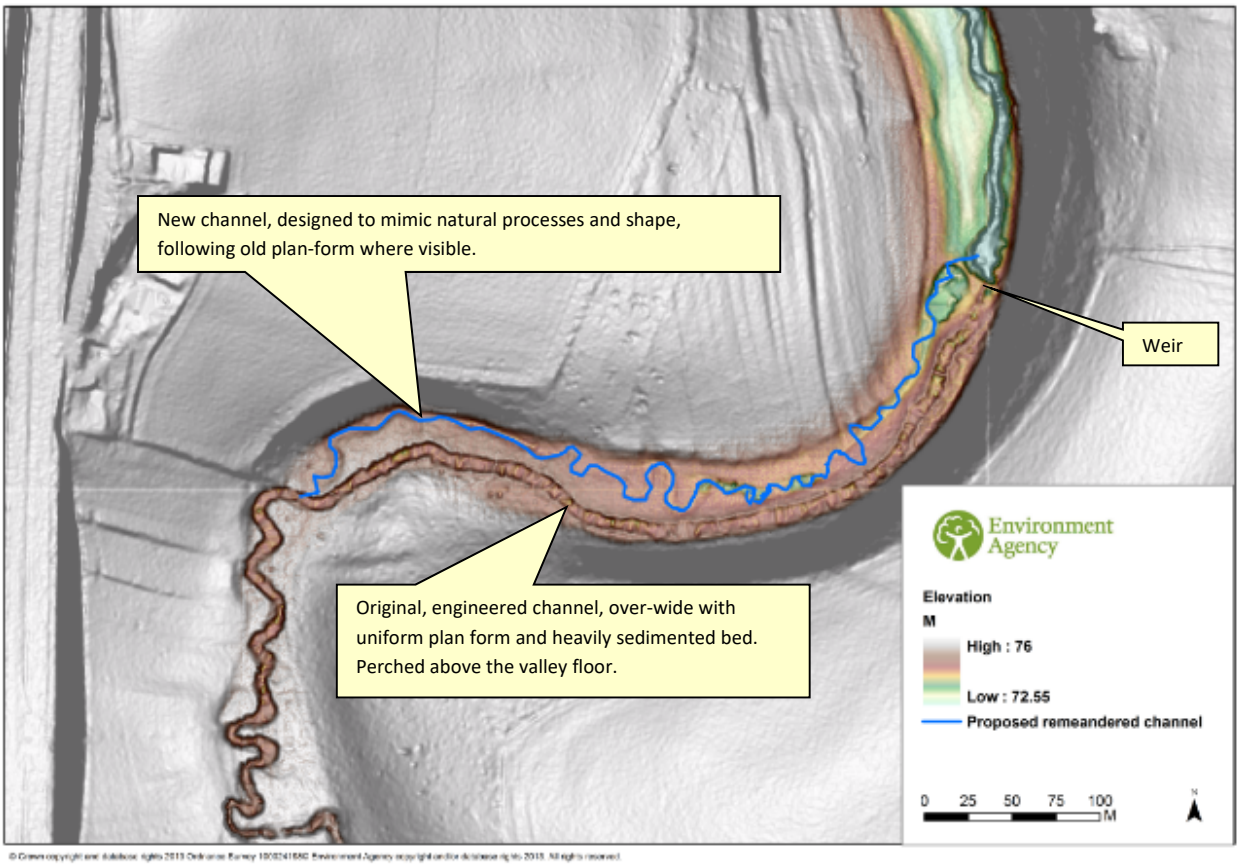

Figure 1 Plan of river re-naturalisation project carried out on River Witham, Stoke Rochford. The original, engineered channel was back-filled with spoil excavated from the new channel. (River flowing left to right).

Photo 37 Typical condition of River Witham pre-restoration – straightened, impounded, silt-choked channel disconnected from the floodplain and lacking a pool-riffle sequence.

Photo 38 River Witham at Stoke Rochford immediately post-restoration. The original channel course followed the tree line on the right. (Picture: David Hutchinson)

Projects of this kind have the potential to reduce flood risk to downstream reaches by providing greatly increased storage capacity for floodwater (on the floodplain) and slowing the flow (in a longer, meandering, lower gradient channel). There are also significant benefits for wildlife and fish, and increased visual and recreational amenity value.

Links to other projects similar to the Witham at Stoke Rochford are provided in Appendix 1. Depending upon scale, the costs of such projects are in the region of £150K – £200K. A project similar to the above could be feasible in the "Jungle" area of Branston village, subject to further investigation and landowner consultation. The existing channel levels and possible impoundments at Dye House Farm are key areas for investigation to establish potential options. The section of beck between Cliff Farm and Sheepwash Lane may also be a potential site for re-meandering (as part of an existing stewardship agreement?), subject to further investigation and landowner consultation.

Cattle drink improvements

Where livestock have access to a watercourse for drinking, the disturbance of the ground can create a source of fine sediment input which impacts upon fish spawning success and the diversity and abundance of aquatic invertebrates. Providing alternative drinking facilities or hard-standing at cattle drinks can reduce fine sediment inputs and improve water quality and in-stream habitat.

Photo 39 illustrates an innovative cattle drink arrangement. A scrape dug behind the existing river bank-line is connected to the river with buried plastic drainage pipes. Fencing along the river bank top excludes livestock from the river. The hard-standing ramp alongside the scrape provides access for drinking whilst reducing ground poaching and fine sediment inputs. Compared to systems using pumps, troughs, solar panels, etc. the opportunity for theft is eliminated and minimal maintenance is required (occasional rodding of the connecting pipes). Also, in this particular case, fish fry have been observed using the scrape as an off-river refuge and feeding habitat.

Similar improvements could be implemented on the Welton Beck upstream of Sheepwash Lane (Photo 20).

Photo 39 Innovative cattle drink on the River Windrush, Oxfordshire. A scrape dug behind the existing river bank-line (fenced) is connected to the river with buried plastic drainage pipes.

Channel narrowing

Creation of a low-flow channel, by establishing marginal shelves (berms) within the over-widened, engineered channel. This creates a two-stage channel, providing improved habitat at low flows, but retaining the larger channel capacity for flood flows. The materials used are generally natural (brushwood bundles, coir fibre rolls) but stone may be used in some circumstances (for example where staking natural materials to the river bed is impossible). The berms are back-filled with material excavated from the river bed or from re-profiled banks, or with brushwood which naturally accumulates silt. The berms can be planted or left to colonise with plants naturally.

The examples below show the technique in an urban environment, using stone to define the outer edges of the berms. Photos 40 – 41 show the before and after of a scheme using natural materials on the upper Witham, Easton.

Areas on the Branston Beck where this technique could be used include usptream of Branston village (near Wheel House), downstream of the railway culvert to the watermill in Heighington, within Heighington village and selected areas downstream of Heighington village.

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

Photo 40 River Witham, Easton (before works).

Photo 41 River Witham, Easton (after channel narrowing works).

Culvert easement

Where culverts have become perched and a drop between upstream and downstream river bed and water levels has occurred, this can impede free movement of fish and natural sediment transport. To rectify this, the culvert could be replaced with a larger diameter structure (larger pipe or box culvert, Photo 42) set well below bed level. Alternatively, the river bed downstream of the culvert can be raised by introducing stone/gravel to raise downstream water levels (Figures 2 – 3). On the lower reaches of the Branston (Sandhill) Beck towards the Witham, the culvert (Photo 35) could be modified in one of these ways.

Photo 42 Large diameter culvert set well below river bed level to allow continuity of the natural river bed, tributary of River Lymn, Lincolnshire.

Figure 2 Before.. A culvert in the Sussex Ouse catchment which was a big problem for trout migration, because of its perched position and high velocities during elevated flows.

Figure 3 The same site after the river bed was raised downstream of the culvert with imported stone and gravel.

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.

Acknowledgement

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

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.

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.

Glossary

Bank-full	The point when , during high flows, the river channel is at full capacity and any further increase in flow results in water spilling onto the **floodplain**. At bank-full flows, the river has its greatest power (for example, for erosion).
Bank re-profiling	Changing the slope of a river bank to a different angle. Usually used on channels previously engineered for drainage/flood reduction, to create a shallower bank angle on the inside of a bend. This helps restore more natural flow patterns and habitats.
Berm	A shelf in the margins of a river. Berms form in channels that have been engineered to be wider than their natural width. They can also be created as part of habitat improvement measures (see **two-stage channel**).
Conduit flow	The flow of groundwater through cracks and fissures in the geology (for example, limestone); this flow is quicker than the more gradual seepage in porous rocks (for example, chalk).
Conveyance	The capacity of a channel to transport water. Straight, smooth channel have a greater conveyance than meandering, rough channels.
Dig and dump	A habitat improvement technique used on previously engineered, lowland rivers involving the re-shaping of the river bed with an excavator. Deeper pools are dug and the resulting material used to pinch the width of the channel upstream, fluming the flow into the pool to maintain its depth.
Easement	A term describing a range of low-tech, low cost techniques to improve the ability of fish to cross barriers (e.g. weirs, culverts) in a watercourse.

Floodplain	The flat land adjacent to a watercourse that is inundated during higher flows. Watercourses engineered for drainage overtop into the floodplain less frequently than unaltered watercourses (the former are often described as disconnected from their floodplain). Floodplains can store floodwater and hence protect downstream areas.
Habitat	The natural environment in which a species or group of species lives and complete their life cycle.
LiDAR	An acronym for Light Detection and Ranging, a surveying method which measures distance with a laser light. Often carried out from an aircraft, it allows terrain maps to be compiled showing differences in height to a high resolution (30 cm or better).
Pool-riffle sequence	In low to moderate gradient rivers, the natural sequence of deeper pools separated by shallow riffles of broken water. **Scour pools** form on the outside of meanders and riffles form on the straighter sections of channel in between. The pool-riffle sequence is the basis of good in-stream habitat in lowland rivers, but is often disrupted or destroyed by engineering for drainage (e.g. river straightening).
Scour pool	A pool formed by flow directed either laterally or obliquely against a partial channel obstruction or bank. Often found on the outside of a meander bend in a river.
Two-stage channel	A channel engineered to have a smaller capacity channel within a larger one. The smaller channel mimics the dimensions (and better habitat) of the natural watercourse, containing low to medium flows. Higher flows overtop the small channel but are retained within the larger channel. The channel therefore works at two different stages of flow.