# Upper River Witham: Little Ponton

Version 2 (01.03.16)

**Location:** Little Ponton, Lincolnshire (c3.5km south of Grantham)

**Upstream Grid Ref:** Phase 1: SK928308; Phase 2: SK929310

**Length:** Phase 1: 220m; Phase 2: c1.4km

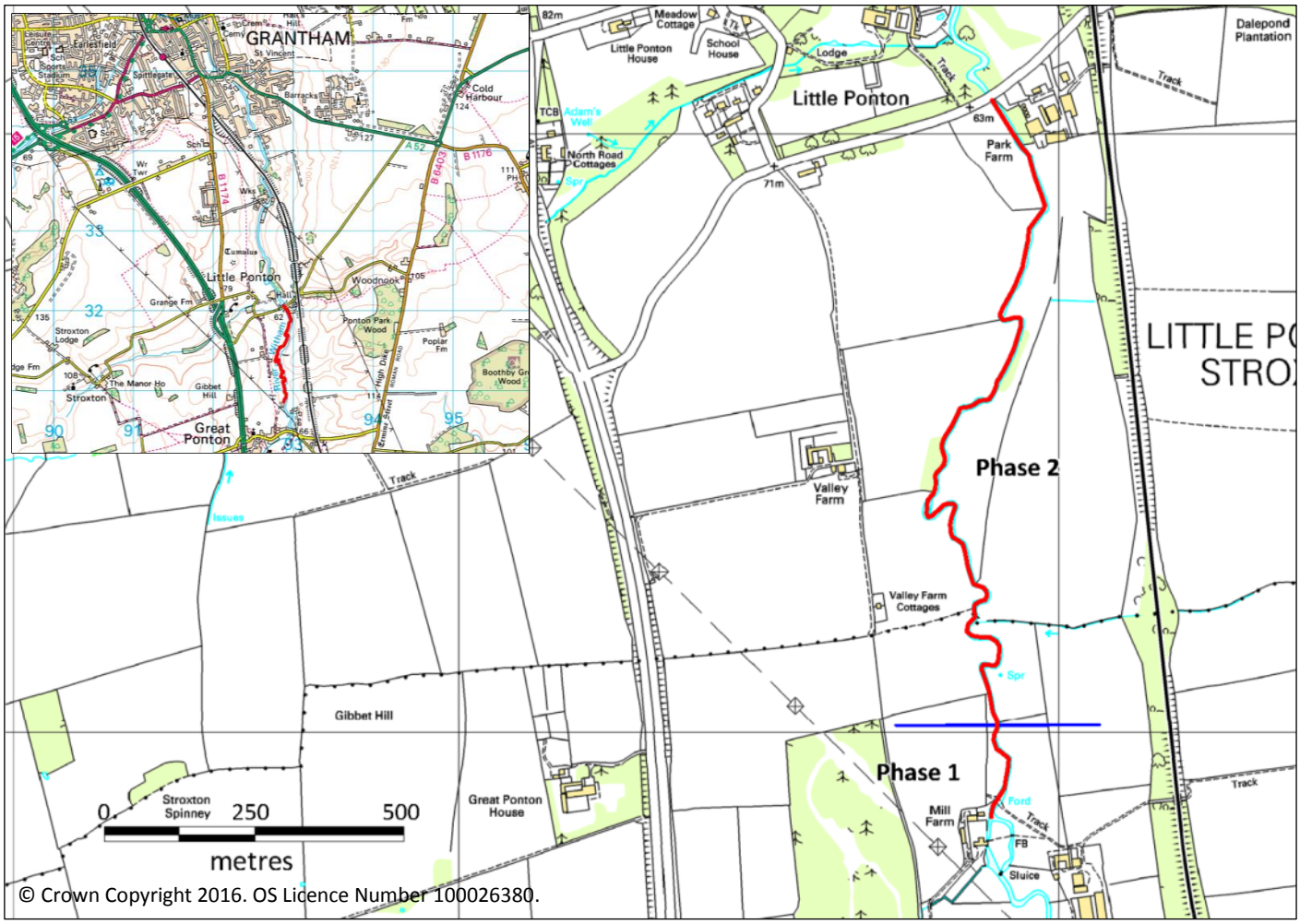
**Completion Date:** Phase 1: February 2013, Phase 2: September 2014

**Cost:** Phase 1: £9K; Phase 2: £14K

**Partners:** The scheme was implemented by the Environment Agency with the co-operation and agreement of the adjacent landowners (Stephen Jackson and Stoke Rochford Estate) and Grantham Angling Association Fly Fishing Section (GAAFFS).

**Summary of Techniques:** Channel narrowing and flow deflection to create flow variation, beneficial bed scour and trap sediments using a variety of techniques: log flow deflectors (vanes), open and enclosed log/faggot and brushwood mattresses; increasing in-stream woody habitat by securing existing deadwood and hinging and pinning (layering) riverside trees; creation of sections of 2-stage channel; and the reduction of sediment inputs by ford refurbishment and localised riverside fencing.

## Location Map






## Background

**The Upper River Witham rises west of South Witham and flows for more than 65 km northwards through Colsterworth, Great Ponton, Grantham, Long Bennington, Bassingham and North Hykeham towards Lincoln. More than 165 km of river and tributary streams drain the c573 km$^2$ catchment.**

**The landscape of the catchment is varied in character, ranging from the livestock-dominated limestone valleys upstream from Grantham, through the mixed farming terrain of the middle reaches, to the flat-lying arable farmlands downstream from Long Bennington. Over recent centuries, and particularly the last 100 years, the once naturally meandering river channels have been straightened, deepened, widened, impounded and embanked to reduce flood risk and improve land drainage. These modifications, together with catchment land management practices, have contributed to a decline in river corridor habitat quality.**

**The Upper Witham and its tributaries are divided into 19 separate waterbodies for Water Framework Directive assessment and only 3 are assessed as having Good Ecological Status. The section of the Upper Witham which includes the Little Ponton reach is currently assessed as "Moderate" due to high phosphate levels, excessive algae (diatoms) and poor fish populations. The enhancement works at Little Ponton seek to address these issues as part of the wider *Upper Witham River Corridor Habitat Plan.***

## Pre-project Survey Work

Walkovers surveys were undertaken to scope the enhancement works. Numerous native white-clawed crayfish galleries were located and the subsequent scheme design ensured that these features were protected.

## Project Objectives

- To reduce fine sediment inputs caused by bank erosion.
- Trap mobile fine sediments already in the river.
- To improve conveyance during higher flows and reduce flood risk.
- To improve in-stream habitats and the bed structure to benefit fish and invertebrates, including white-clawed crayfish.

The two-phase project was prepared by Environment Agency staff in consultation with Grantham Angling Association Fly Fishing Section (GAAFFS) and the riparian landowners.

## Consultation and Consents

An internal Environment Agency application for Flood Defence Consent to refurbish the upstream ford was consented on 18th January 2013 (Consent No. L/002626/12). A second internal Environment Agency Flood Defence Consent application to undertake the remainder of the improvements was approved on 4th July 2014 (Consent No. L/20142986).

## The Enhancement Scheme

The enhancement scheme was completed in two phases. A short section downstream of Great Ponton Mill was completed in February 2013 and the second, the continuation downstream to Whalebone Lane, Little Ponton, was completed in mid-August 2014. Prior to the enhancement work the in-river habitat was in generally good condition, however opportunities were identified to provide additional cover and food supply for a range of aquatic organisms together with measures to modify the flow to improve the structure of the riverbed and reduce the deposition of fine sediment.

The drawings in Annex 1 show all the elements of both phases of enhancement and the techniques used are described below. Several of the techniques used have multi-functional benefits.

### *Channel Narrowing Structures*

In 2008 GAAFFS narrowed a short section at the top of the reach using recently cut willow logs to construct channel-narrowing enclosures. These enclosures created a more sinuous watercourse with increased flow velocity resulting in beneficial bed scour, improved cleansing of the natural gravel bed and a reduction in fine sediment deposition. The enclosures also created valuable stillwater refuge pools on the margins of the channel and encouraged the development of an extended wetland margin by trapping fine sediments. Although these initial works improved the condition of the watercourse the willow logs that used to construct the enclosures rapidly regenerated in to small trees, which, whilst providing beneficial shade, also increased channel roughness and potential flood risk.

The willow regeneration was addressed during the first phase of the enhancement scheme in 2013 using a layering technique. The regenerating saplings were partially cut at the base, leaving a narrow bark and sapwood hinge, and then bent horizontally along the bank to create “layered enclosures” - a tangle of twigs and branches providing important refuges for juvenile fish and invertebrates. Ash stakes and wire bindings were used to secure the layered trees in position. GAAFFS are now committed to a programme of regular maintenance to control future willow regeneration.

Learning lessons from the earlier GAAFFS work, willow logs were was not used in the subsequent phase of enhancement work. Instead logs, branches and brushwood generated by the management of other riverside tree

and shrub species were used to create a variety of structures to protect vulnerable banks from erosion, narrow the channel and trap suspended fine sediment. These included:

***Open (unenclosed) brushwood mattresses:*** small branches firmly secured with posts and wire bindings to create a mattress;
***Log/faggot-faced mattresses:*** as above, but fully enclosed with either secured logs (generated from the riverside tree management) or faggots;
***Log-fronted mattresses:*** brushwood mattresses partially enclosed by secured logs leaving the downstream end open to create a "backwater" which provides a valuable fish/fry refuge;
***Log/faggot enclosures:*** secured logs or faggots without any infill, which create slack pools within the channel and provide a repository for silt.

These structures are particularly valuable for native crayfish and juvenile fish, due to lack of larger rocks and cobbles in this section of the river. The woody habitat provides an important refuge for crayfish, protecting them from predators and preventing them from being washed away during high flows. It also provides additional habitat for a range species such as algae and small invertebrates at the base of the food chain, which in turn increases the food supply for larger species, such as wild brown trout and otters.

*Fig 1. Regeneration of the live willow logs used by GAAFFS to narrow the channel in 2008*

*Fig 2. Willow regeneration managed to create "layered enclosures" (Phase 1)*

*Fig 3. Willow layering detail (Phase 1)*

*Fig 4. Layered enclosure and refuge pool (Phase 1)*

*Fig 5. Log-faced brushwood mattress (Phase 2)*

*Fig 6. Open brushwood mattress (Phase 2)*

### *Hinged Trees*

In addition to the construction of structures to narrow the channel and trap silt, selected riverside trees and shrubs were hinged and securely pinned into the bed of the channel using ash stakes and wire bindings to create live flow deflectors/brushwood mattress. The technique used is similar to the "layering" described above, but the size of the trees and shrubs managed in Phase 2 was much larger.

*Fig 7. Recently hinged and secured ash tree (Phase 2)*

*Fig 8. Hinged and secured alder following winter high flows (Phase 2)*

### *Log Flow Deflectors and Vanes*

Following GAAFFS successful use of a pair of log flow deflectors to enhance the pool below the ford in 2008, a number of log flow deflectors and vanes were installed during Phase 2 of the enhancement works, the logs being derived locally from the management of riverside trees. Flow deflectors are partially exposed above the water level and slope downwards towards the centre of the channel at a very shallow angle. Vanes, however, are permanently submerged so water flows over them at all times. Deflectors and vanes create localised flow variation, help to trap and retain gravels; improve flows over/through gravel beds to keep the free from fine sediment; and improve the bed structure through scouring. Both types of structure, either in pairs or singles, normally point upstream to direct the flow towards the centre of the channel and minimise the potential for bank erosion. In addition to vanes and

deflectors keyed into the bank, paired “micro-vanes” were also installed mid-channel to create more complex flow variation and bed scour.

*Fig 9. The paired flow deflectors below the ford installed by GAAFFS in 2008*

*Fig 10. Off-set flow deflectors under construction (Phase 2)*

*Fig 11. Single flow deflector in conjunction with brushwood mattresses demonstrating how the flow is modified (Phase 2)*

*Fig 12. Paired micro-vanes (Phase 2)*

## *Erosion Control*

**Ford Refurbishment**

Below the mill the river is crossed by a ford which also doubles as a cattle drinker. Prior to refurbishment the ford was in poor condition with bare, severely poached and eroded earth access ramps and nothing to prevent cattle access upstream and downstream. Refurbishment involved reprofiling the access ramps and consolidating the base with crushed limestone to create a porous hard-standing. Post and rail fencing was erected to protect the steep, reprofiled slopes and electrified “scare-wires” now cross the river to discouraged cattle from straying up and downstream.

*Fig 13. The ford (a) before and (b) after restoration (Phase 1)*

**Fencing**

To prevent cattle from entering the river, maintain the integrity of the layered enclosures and allow the development of marginal wetland vegetation the right bank in the vicinity of the ford was fenced with post and 3 lines of barbed wire during Phase 1. New riverside fencing was not required further downstream.

*Fig 14. Riverside fencing protecting the marginal wetland vegetation and layered enclosures (Phase 1)*

## Management

Future management of the fencing and fords is now the responsibility of the landowner. GAAFFS will manage any further willow regeneration to maintain a mix of marginal woody habitat and shade trees.

## Monitoring

A fixed point photographic record has been set up and this, together with visual inspections, will be used to monitor the integrity and performance of the in-stream structures. A programme of fine sediment sampling and Wolman Pebble Counts to monitor the coarser riverbed material has also been established. In combination they will determine and record changes to river morphology as the result of the works. The established crayfish monitoring site at the bottom of the reach is already surveyed every 2 years and this will give an indication of the impact of the scheme on crayfish numbers. Finally additional ongoing invertebrate sampling will identify any ecological and water quality changes that occur.

## Potential Future Projects

- Provision of a fish and eel pass in the vicinity of Great Ponton Mill.
- Protection of the formerly piped flush to enhance floodplain wetland habitat and reduce sediment inputs (SK9288131103).
- Restoration of the ford/drinker at SK9286431245 which is a significant sediment source as a result of heavy poaching.
- Restoration of the poached stock drinker at SK9294631839.

*Fig 15. The sluice on the Great Ponton Mill bypass channel*

*Fig 16. The poached flush*

*Fig 17. Heavily poached ford/drinker*

*Fig 18. Poached drinker*

## Suppliers of Services and Materials

**Fencing, tree works and in-stream structures**

Woodland and Water Management Ltd: dom@woodland-water.co.uk or Tel. 01327 349073

**Machinery works (ford refurbishment and bank reprofiling) plus additional tree works and in-stream structures**

P&R Plant Hire, Fleet, Spalding, Lincs. PE12 8NG. Tel 01406 422669. www.pandrplanthire.co.uk

## Further Information

For further information about the scheme contact:

Matt Parr,
Technical Officer
Fisheries, Biodiversity and Geomorphology Team
Environment Agency
Lincoln
T. 0203 025 5014
E. matthew.parr@environment-agency.gov.uk

## The Water Framework Directive

The Water Framework Directive (WFD) is a major area of work for the Environment Agency. The WFD aims to get all water bodies - lakes and groundwater aquifers as well as rivers - into 'good ecological status' - or better - by 2027, with a series of 'landmarks' (2015 and 2021) to check progress.

The Water Framework Directive became UK law in December 2003. It provides an opportunity for the Environment Agency to plan and deliver a better water environment with the focus on ecology.

The Water Framework Directive will help to protect and enhance the quality of: surface freshwater (including lakes, streams and rivers); groundwater; groundwater-dependent ecosystems; estuaries and coastal waters out to one mile from low water.

The Environment Agency is the lead authority in England and Wales to carry out:

- Improvements on inland and coastal waters through better land management and protect them from diffuse pollution in urban and rural areas
- Drive wiser, sustainable use of water as a natural resource
- Create better habitats for wildlife in and around water
- Create a better quality of life for everyone

The Environment Agency is the leading organisation for protecting and improving the environment in England and Wales. We are responsible for making sure that air, land and water are looked after by today's society, so that tomorrow's generations inherit a cleaner, healthier world.

## Glossary

**Berm:** A low, often wet, ledge or terrace at the edge of the stream that constricts the flow and allows a vegetated wetland margin to develop.

**Brash:** fine woody material including thin branches and twigs.

**Coppicing:** cutting of a tree just above ground level resulting in the regrowth of a number of shoots. The shoots are allowed to grow to provide long straight poles which are re-coppiced on rotation.

**Faggot:** a bundle of brushwood (or brash) tied together into a cylindrical shape. Used as bank revetment; to form flow deflectors; and to promote the deposition of sediment in marginal areas.

**Fish pass:** Structure to enable fish to gain access past a weir, sluice or other structure that would otherwise be impassable.

**Flood Defence Consent:** consent issued by the Environment Agency to carry out works in, over, under or near a watercourse or flood defences. An application for Flood Defence Consent is needed to ensure that any works do not endanger life or property by increasing the risk of flooding or cause harm to the water environment.

**Floodplain:** Area of land bordering a river that is prone to flooding.

**Flow deflector (groyne):** a structure projecting in to the river which is designed to constrict water flow and promote scouring and deposition of sediment.

**Glide:** a section of stream characterised by moderately shallow water with an even flow that lacks pronounced turbulence. Although most frequently located immediately downstream of pools, glides are occasionally found in long, low gradient streams with stable banks and no major flow obstructions. The typical substrate is gravel and cobbles.

**Layering (also laying or pleaching):** A technique where a small tree is partially cut at the base leaving a narrow bark and sapwood hinge which enables the tree to be laid down. The tree remains alive and able to continue growing.

**Large woody material:** pieces of naturally derived timber generally held to have dimensions greater than 10cm in diameter and 1m in length.

**Left/right bank:** the left/right hand bank of a watercourse as observed whilst facing downstream.

**Meander:** a meander is a bend in a watercourse formed as water erodes the outer bank and deposits the eroded sediments on the inside of the bank.

**Poaching:** river bank damage caused by the hooves of livestock resulting in the loss of vegetation and soil erosion.

**Pollarding:** similar to coppicing, except that the tree is cut at approximately head height to prevent damage by grazing animals. Trees managed in this way are known as **pollards**.

**Pool**: a deep section of stream bed with very little surface flow, typically located at the outside of a bend.

**Revetment:** works to protect the bed or banks of a channel against erosion.

**Riffle**: a length of stream with a steep gravel, pebble and/or cobble dominated bed, a fast flow and a broken water surface, where the water flows swiftly over the completely or partially submerged substrate.

**Riparian:** along the banks of a watercourse.

**Run**: differs from a riffle in that, although the water surface is broken, the water depth is typically greater and the slope of the bed is less.

**Scour:** Erosion of the bed or banks of a watercourse by the action of moving water.

**Sediment:** material ranging from clay to gravel (or even larger) that is transported in flowing water and that settles as the flow slows down.

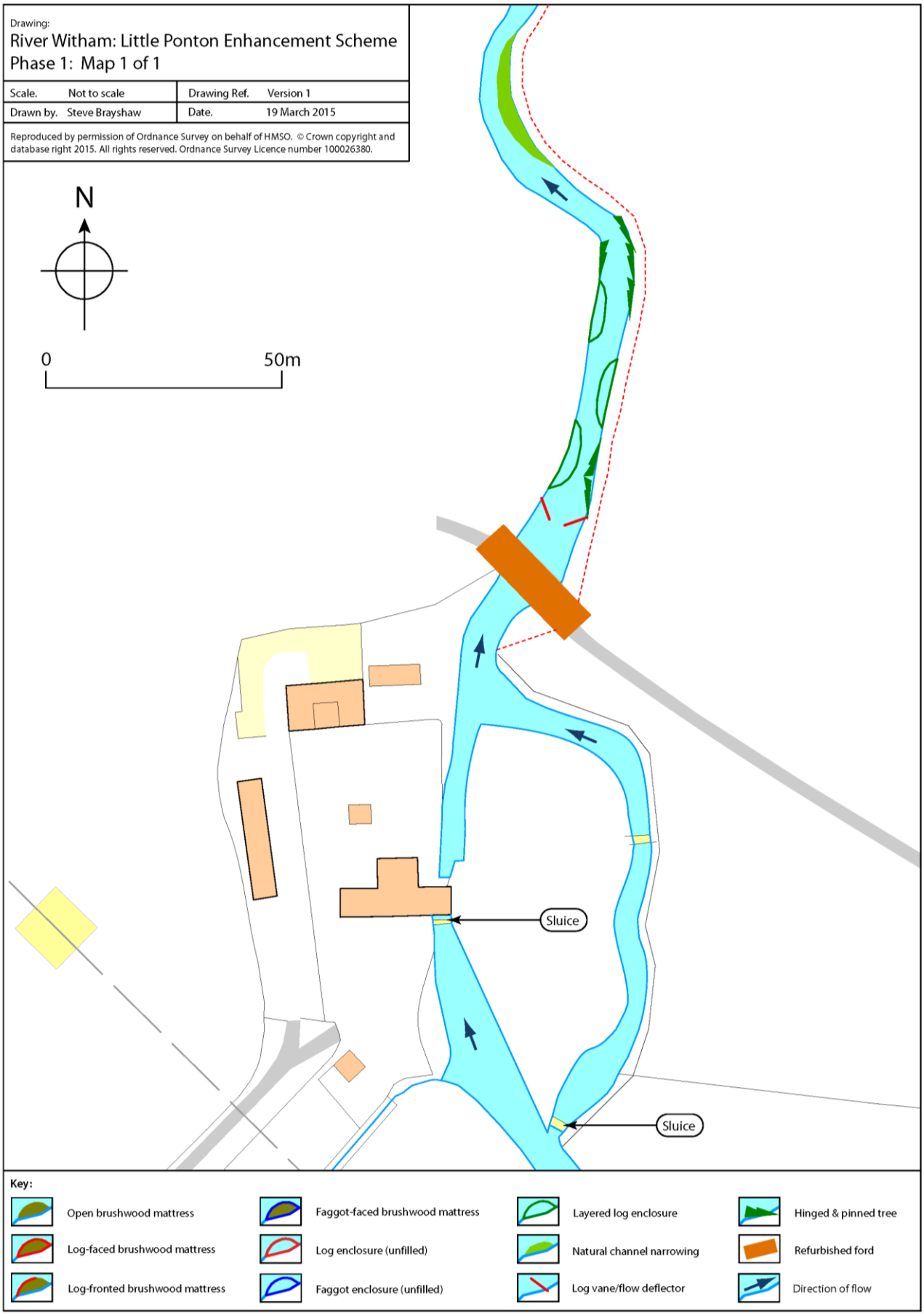
**Shoal:** sedimentation within or extending into a stream or other waterbody, typically composed of sand, silt and/or gravels.

**Spate (freshet):** a period of fast river flow and raised water levels caused by heavy rain (or melting snow).

**Spiling:** the use of thin branches to create a woven ‘fence’ that protects the bank from erosion.

**Toe** (of the riverbank): where the river bed meets the bank.

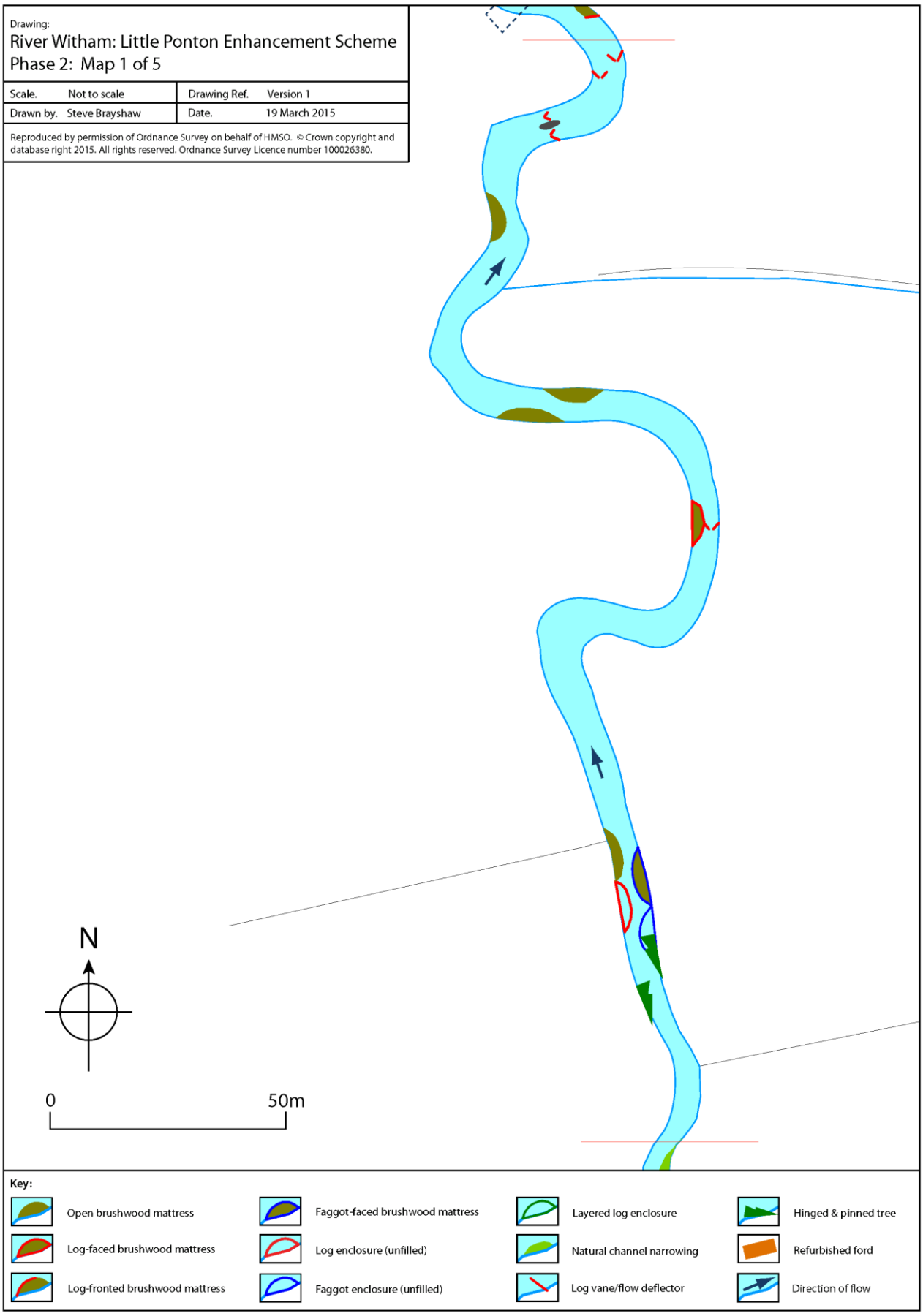
## ANNEX 1: The Completed Enhancement Scheme (mapping commences at the upstream extent)



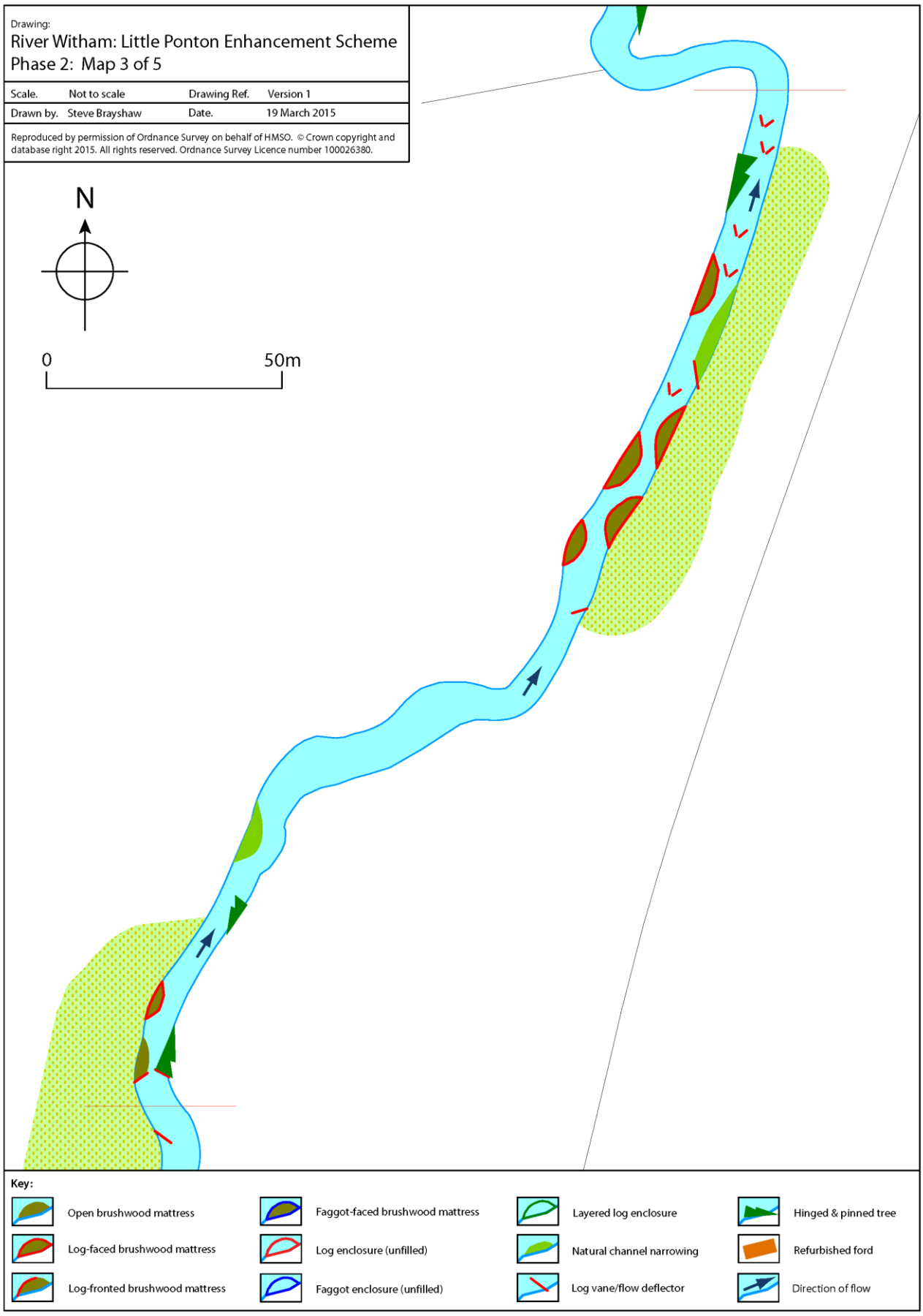
Drawing:
River Witham: Little Ponton Enhancement Scheme
Phase 2: Map 1 of 5

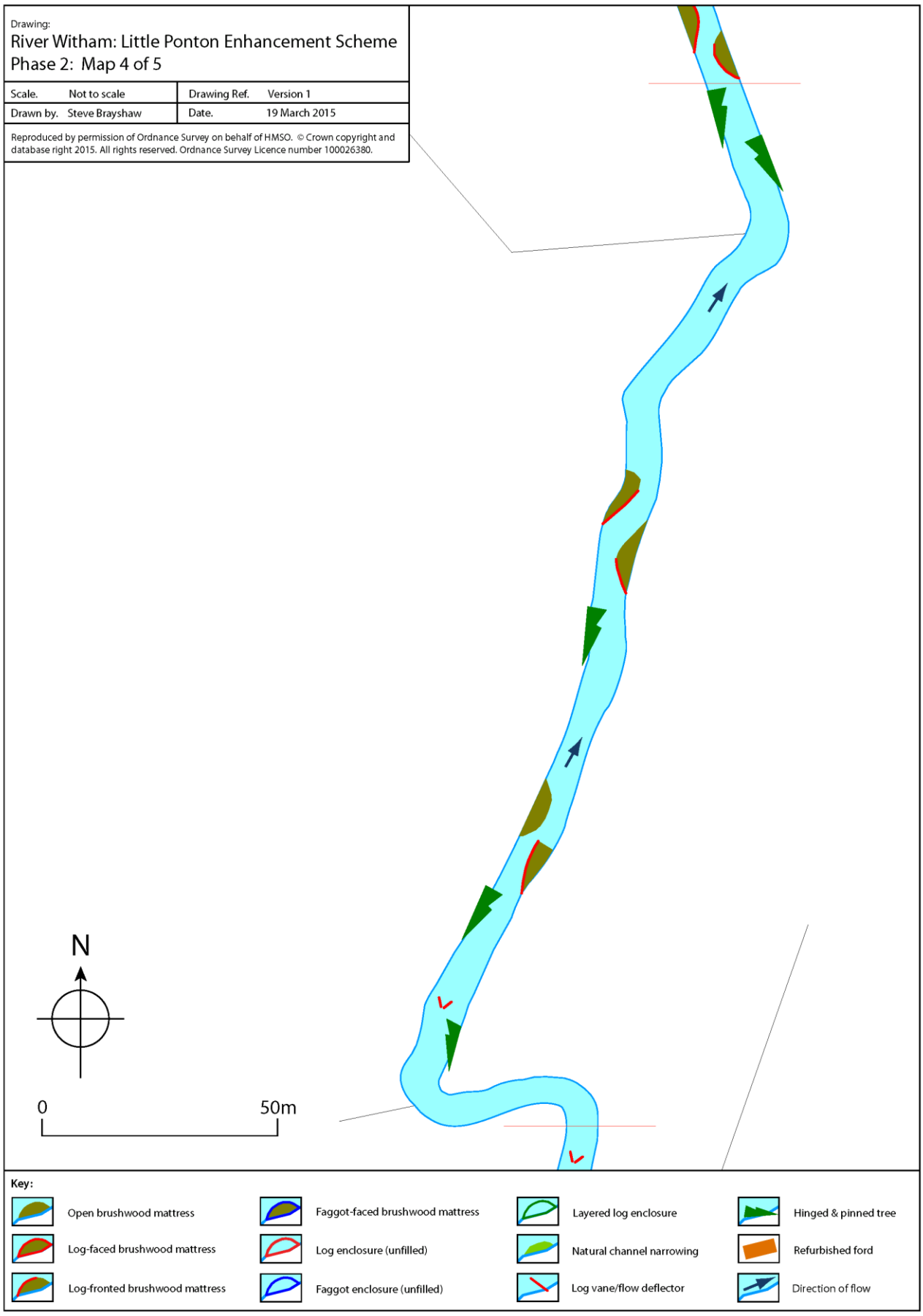
| | | | |
|---|---|---|---|
| Scale. | Not to scale | Drawing Ref. | Version 1 |
| Drawn by. | Steve Brayshaw | Date. | 19 March 2015 |

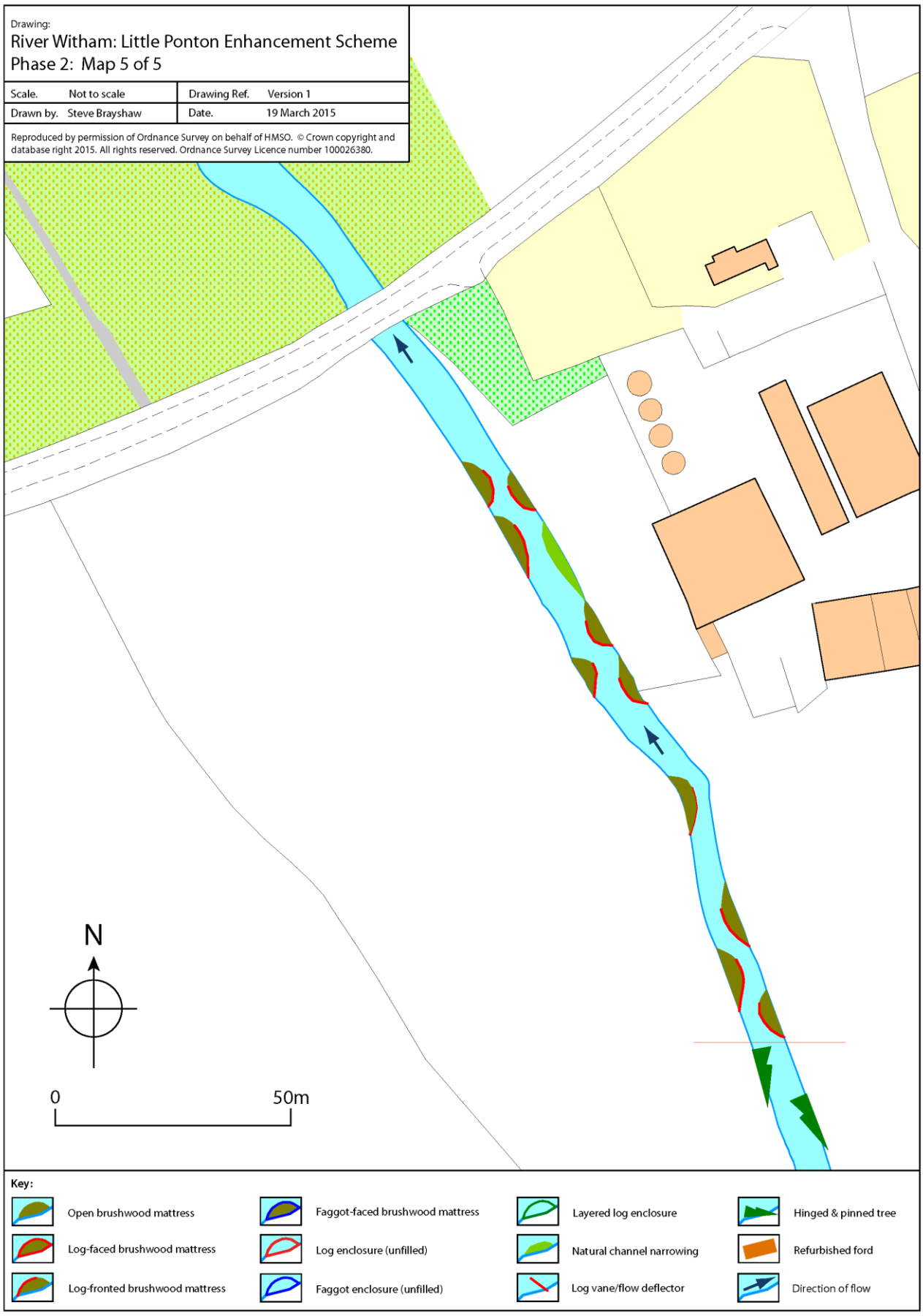





Drawing:
River Witham: Little Ponton Enhancement Scheme
Phase 2: Map 2 of 5
Scale. Not to scale
Drawing Ref. Version 1
Drawn by. Steve Brayshaw
Date. 19 March 2015
Reproduced by permission of Ordnance Survey on behalf of HMSO. © Crown copyright and database right 2015. All rights reserved. Ordnance Survey Licence number 100026380.
N
0
50m
Existing ford
Key:
Open brushwood mattress
Log-faced brushwood mattress
Log-fronted brushwood mattress
Faggot-faced brushwood mattress
Log enclosure (unfilled)
Faggot enclosure (unfilled)
Layered log enclosure
Natural channel narrowing
Log vane/flow deflector
Hinged & pinned tree
Refurbished ford
Direction of flow


Drawing:
River Witham: Little Ponton Enhancement Scheme
Phase 2: Map 3 of 5
Scale. Not to scale
Drawing Ref. Version 1
Drawn by. Steve Brayshaw
Date. 19 March 2015
Reproduced by permission of Ordnance Survey on behalf of HMSO. © Crown copyright and database right 2015. All rights reserved. Ordnance Survey Licence number 100026380.
N
0
50m
Key:
Open brushwood mattress
Log-faced brushwood mattress
Log-fronted brushwood mattress
Faggot-faced brushwood mattress
Log enclosure (unfilled)
Faggot enclosure (unfilled)
Layered log enclosure
Natural channel narrowing
Log vane/flow deflector
Hinged & pinned tree
Refurbished ford
Direction of flow


Drawing:
River Witham: Little Ponton Enhancement Scheme
Phase 2: Map 4 of 5
Scale. Not to scale
Drawing Ref. Version 1
Drawn by. Steve Brayshaw
Date. 19 March 2015
Reproduced by permission of Ordnance Survey on behalf of HMSO. © Crown copyright and database right 2015. All rights reserved. Ordnance Survey Licence number 100026380.
N
0
50m
Key:
Open brushwood mattress
Log-faced brushwood mattress
Log-fronted brushwood mattress
Faggot-faced brushwood mattress
Log enclosure (unfilled)
Faggot enclosure (unfilled)
Layered log enclosure
Natural channel narrowing
Log vane/flow deflector
Hinged & pinned tree
Refurbished ford
Direction of flow


Drawing:
River Witham: Little Ponton Enhancement Scheme
Phase 2: Map 5 of 5
Scale. Not to scale
Drawing Ref. Version 1
Drawn by. Steve Brayshaw
Date. 19 March 2015
Reproduced by permission of Ordnance Survey on behalf of HMSO. © Crown copyright and database right 2015. All rights reserved. Ordnance Survey Licence number 100026380.
N
0
50m
Key:
Open brushwood mattress
Log-faced brushwood mattress
Log-fronted brushwood mattress
Faggot-faced brushwood mattress
Log enclosure (unfilled)
Faggot enclosure (unfilled)
Layered log enclosure
Natural channel narrowing
Log vane/flow deflector
Hinged & pinned tree
Refurbished ford
Direction of flow