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Modifying River Bed Levels, Water Levels and Flows

5.6 Fixing whole trees into the river bank for flow diversity

RIVER AVON

LOCATION - AMESBURY, WILTSHIRE. SU15834257

DATE OF CONSTRUCTION - SEPTEMBER 12TH – MID OCTOBER 2008

LENGTH – 850m

COST – £34,000

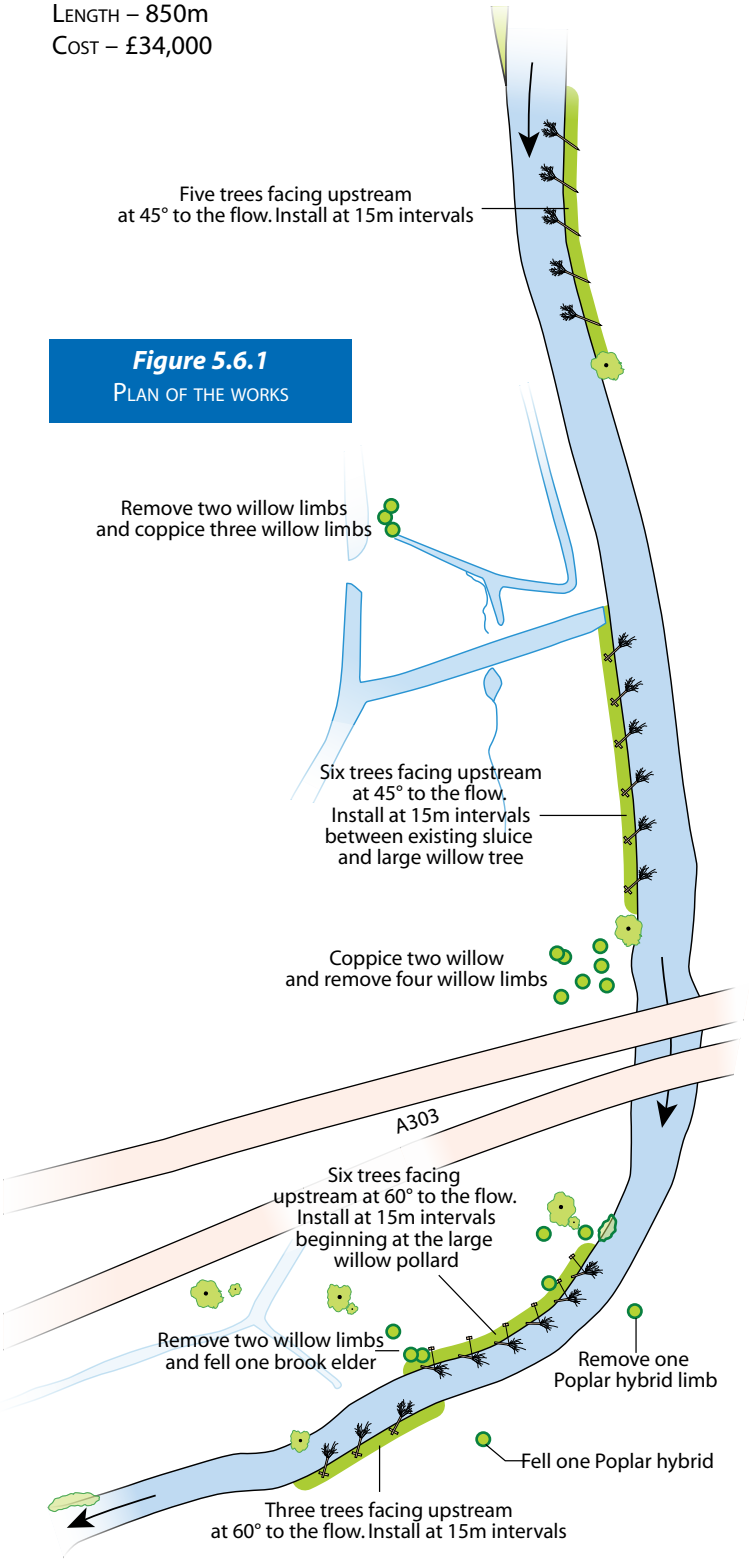

Figure 5.6.1
PLAN OF THE WORKS

River Avon	Low energy, chalk
WFD Mitigation measure	**Click Here** to view details
Waterbody ID	GB108043022350
Designation	SAC, SPA, SSSI
Project specific monitoring	Fixed point photography, habitat mapping, RRC rapid assessment method

Description

The River Avon STREAM EU LIFE project aimed to reinstate physical form and diversity, creating dynamic chalk stream habitats that are sustained by the river's natural flow regime. This particular technique was to introduce woody material (whole trees) to create a diversity of morphology and flow, particularly for SAC species such as bullhead (*Cottus gobio*) , brook lamprey (*Lampetra planeri*), Atlantic salmon (*Salmo salar*) parr and the characteristic water crowfoot (*Ranunculus*) community.

As a result of historic dredging and siltation there was a lack of suitable gravel substrate for migratory salmonids to spawn on and there was a need for a shift from a uniform bed with silt-dominated substrate, to gravel and cobbles.

Though the site was within a well wooded corridor, the river had little in the way of bankside trees and the resultant lack of woody material input, along with historic dredging, had contributed to the lack of physical habitat diversity in the river.

Design

Large whole trees were installed on the left and right bank either side of A303 over a disrtance of 850m (*see Figure 5.6.1*).

Trees large enough to extend approximately 7m into the channel were used to reduce the free flowing width by 35% –50%. This reduction in high flow conveyance was deemed to be acceptable at this site following hydraulic modelling. The trees were placed at 45 – 60 degree angles, facing upstream to deflect overtopping flows towards the centre of the channel.

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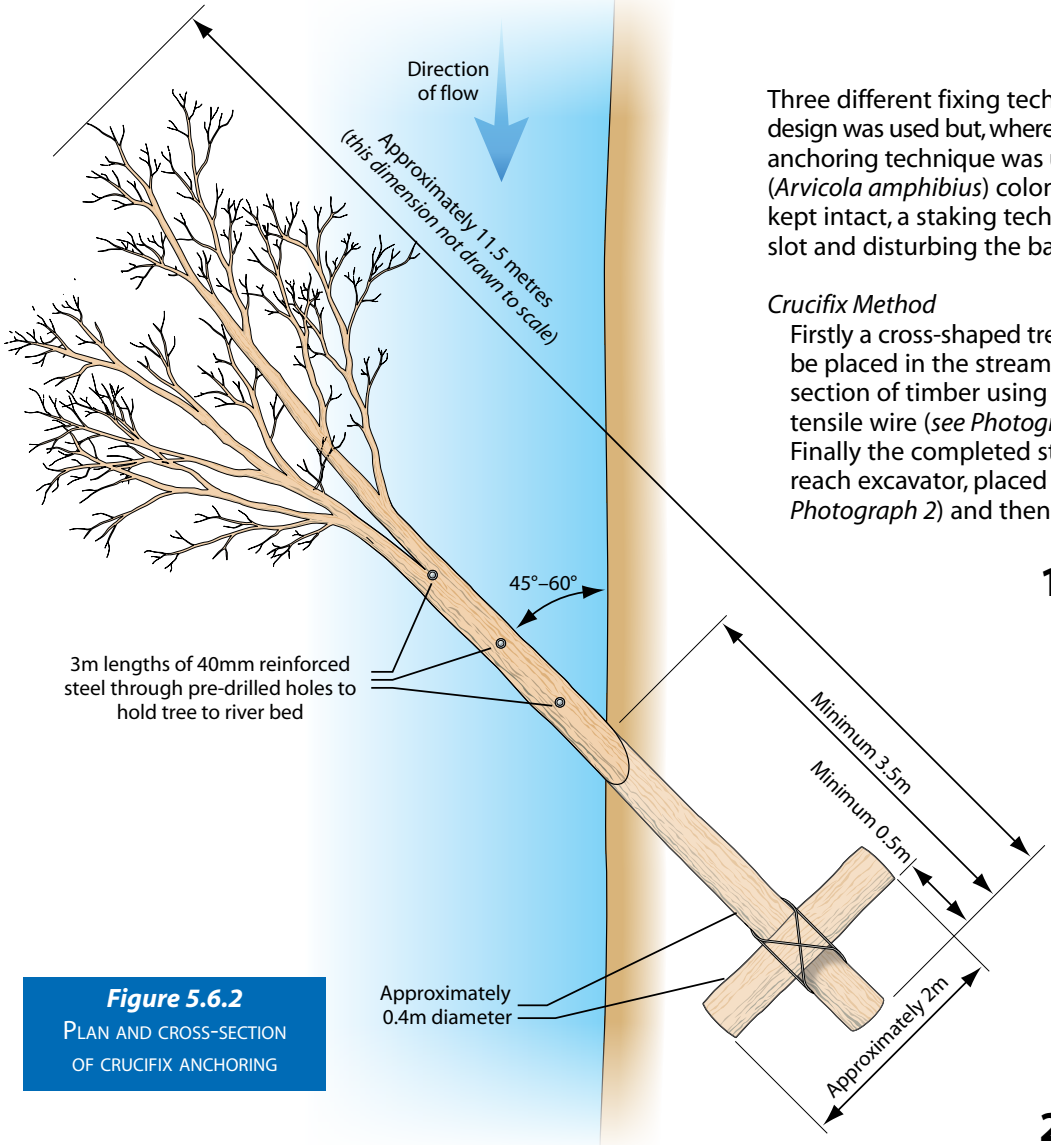

Figure 5.6.2
PLAN AND CROSS-SECTION OF CRUCIFIX ANCHORING

Three different fixing techniques were used. Initially a crucifix design was used but, where the bank was very soft, an alternative anchoring technique was utilised. Where there were water vole (*Arvicola amphibius*) colonies, or the riverside path had to be kept intact, a staking technique was used to avoid cutting a slot and disturbing the bank or path.

Crucifix Method

Firstly a cross-shaped trench was excavated. Then the tree to be placed in the stream was attached to another shorter section of timber using a mortise and tenon joint and high tensile wire (*see Photograph1*), forming a crucifix shape. Finally the completed structure was lifted, using a long reach excavator, placed into the excavated trench (*see Photograph 2*) and then backfilled.

1

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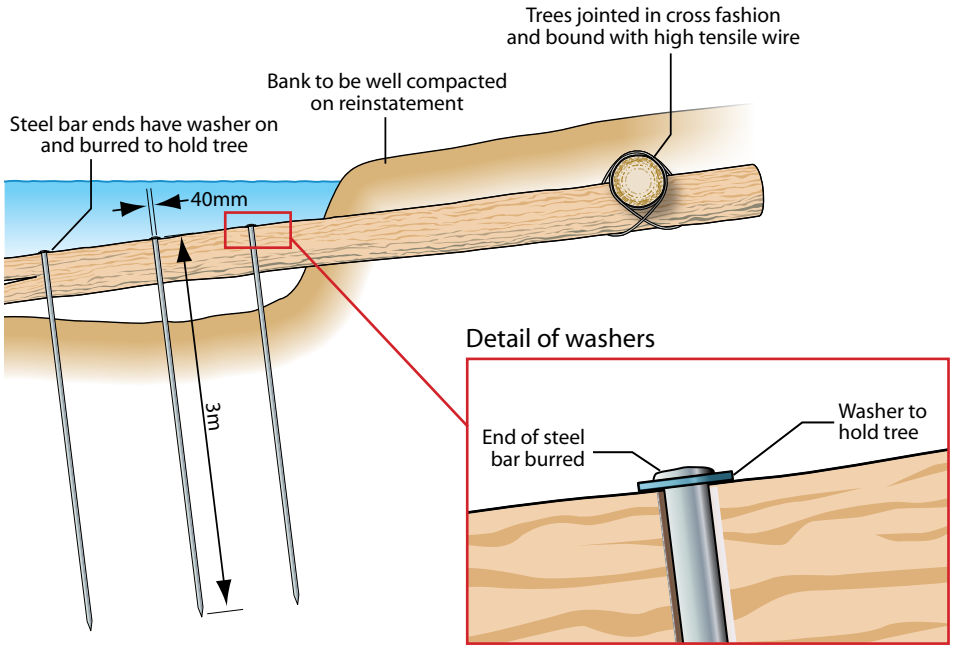

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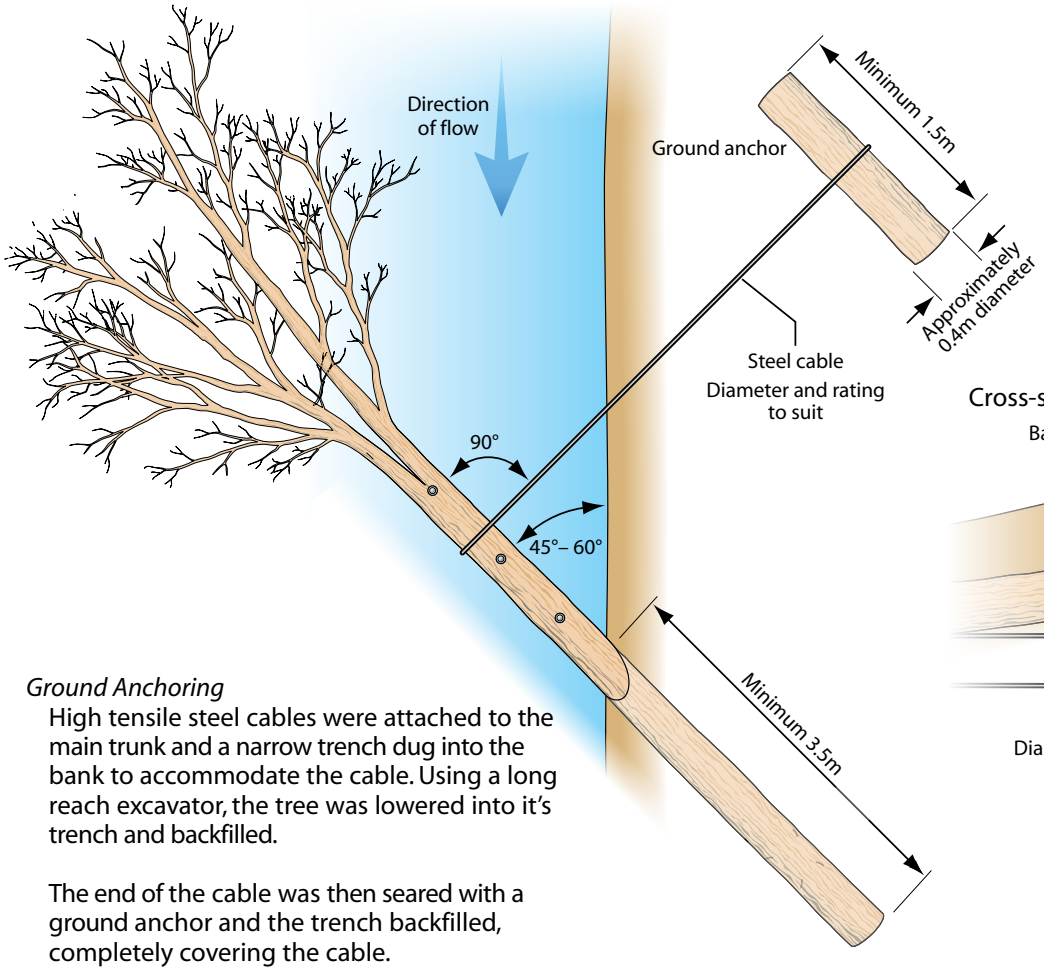


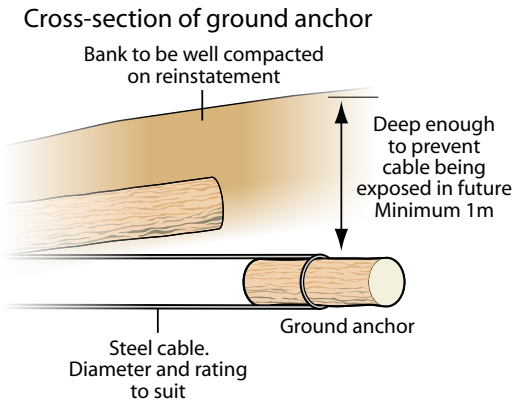


Figure 5.6.3
PLAN AND CROSS-SECTION OF GROUND ANCHORING

Ground Anchoring

High tensile steel cables were attached to the main trunk and a narrow trench dug into the bank to accommodate the cable. Using a long reach excavator, the tree was lowered into it's trench and backfilled.

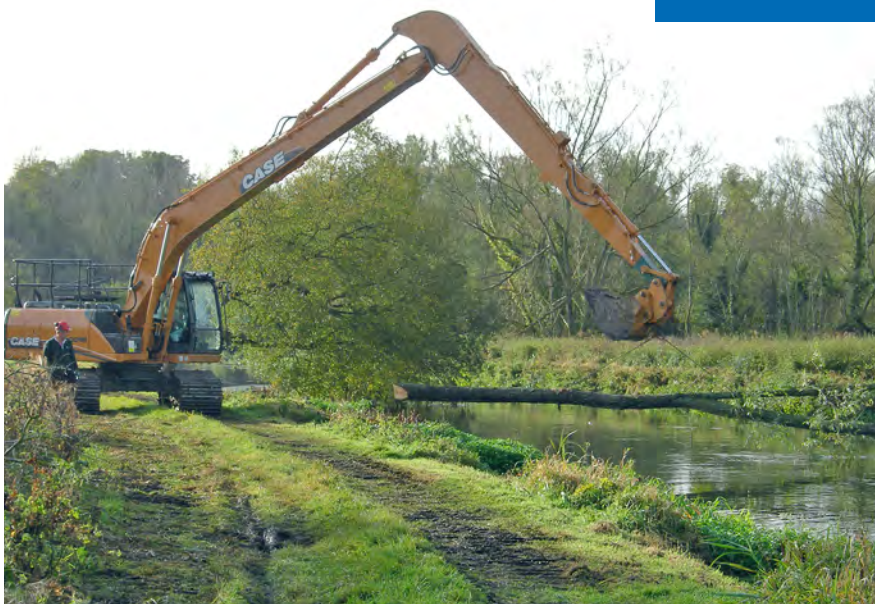
The end of the cable was then seared with a ground anchor and the trench backfilled, completely covering the cable.

Staking

This was used where the river banks were soft. The end of the tree trunk to be used was sharpened and then pulled horizontally into the bank (using the long reach excavator), embeded by approximately 2 metres.

In all cases the trees were pinned to the river bed with 3m long, 40mm diameter reinforced steel bars to ensure that they did not move or pull free from the bank. Holes were drilled into the trunk before it was placed in the river. The structure was then pinned into place by the excavator bucket, pushing the bars through the pre-drilled holes into the river bed to a depth of 2m. The steel bars were a requirement to get flood defence consent for the work. However, understanding of how much achoring is required has improved.

PHOTOGRAPH OF STAKING METHOD



The sharpened end of tree trunks being pushed 2m horizontally into the bank using a long reach excavator – 2008

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Subsequent performance

Reach-scale mapping of all sites was undertaken including fluvial audit, physical biotope mapping, river corridor survey and repeat photography. Results showed that the installation of woody material has created greater flow variability. There are now areas of marginal dead water and faster flowing water creating more varied habitat. Sediment accumulations are now concentrated at the channel margins rather than on the channel bed along the main flow path. This is keeping the gravel bed clean for spawning habitat and provides silty marginal habitat for brook lamprey.

The dominant vegetation remains similar to that observed prior to restoration. Additional species were observed in 2009, including water crowfoot (*Ranunculus spp.*), watercress (*Cruciferae spp.*) and water mint (*Mentha aquatica*). The low gradient and deep channel remains a limitation on the extent and diversity of macrophyte growth within the channel.

The aquatic plants are annually managed by cutting throughout the River Avon catchment. The fishing club initially reported problems for their weed cutting boat, so in some reaches 1.5m to 2m was cut off the outer ends of the submerged trees. In other places they have been trimmed where they protruded above water level to reduce snagging of fishing lines and the cut weed.

Wide slow flowing channel lacking flow variability – August 2008

Trees installed on the right bank. Submerged with branches just protruding out of the water – January 2009

One year later, wood deflectors are collecting rafts of weed and providing shade, cover and habitat. Silt has been deposited between the deflectors.

Marginal plants are now starting to establish in the silt narrowing the channel – July 2009

Contacts

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Reference material – Click here