3

Enhancing Straightened River Channels

3.11 Sinuous low-flow course in an over-wide urban channel

RIVER WANDLE

LOCATION - CARSHALTON, SUTTON, SOUTH LONDON TQ 28166504
DATE OF CONSTRUCTION - NOVEMBER 2014
LENGTH - 120m BED RE-PROFILING AND CHANEL NARROWING
COST - £45,000 (Plus £31,000 for the weir lowering and fishpass adjustment)

Type	Low energy, chalk
Status	Failing for fish (driver physical habitat modification). HMWB
Waterbody ID	GB106039017640
Designation	Site of Metropolitan Importance for nature Conservation (SMI)
Monitoring	Fixed-point photos, fish habitat survey, EA WFD Electrofishing, redd counts

Description

The 1km Carshalton arm of the River Wandle is a chalk stream flowing through a heavily urbanised area. Butter Hill Mill weir is approximately half way along the waterbody with 500m of river upstream to the source at Carshalton ponds and 500m of channel downstream to the confluence with the main Wandle. The weir created a total barrier to fish and impounded ~15% of the river length. The impounded reach, featured here, was straight, over-wide, shallow and possessed a very poor habitat structure and had a bed consisting of deep silty sediments. The site has a housing estate on one side and a road on the other, well-used footpaths on both sides of the river and a brick wall on the left bank for the whole reach.

South East Rivers Trust (SERT) aimed to rehabilitate the Carshalton waterbody by improving fish passage, habitat diversity and quality, hydromorphology and water quality, with wild trout used as the indicator species for the river's recovery.

This project was part of the wider multi-year ambition of SERT (carried out between 2011-2015) to obtain GEP and establish a population of brown trout in the upper Wandle.

Fine sediment fills the impounded river - Feb 2013 © SERT

Design

© SERT

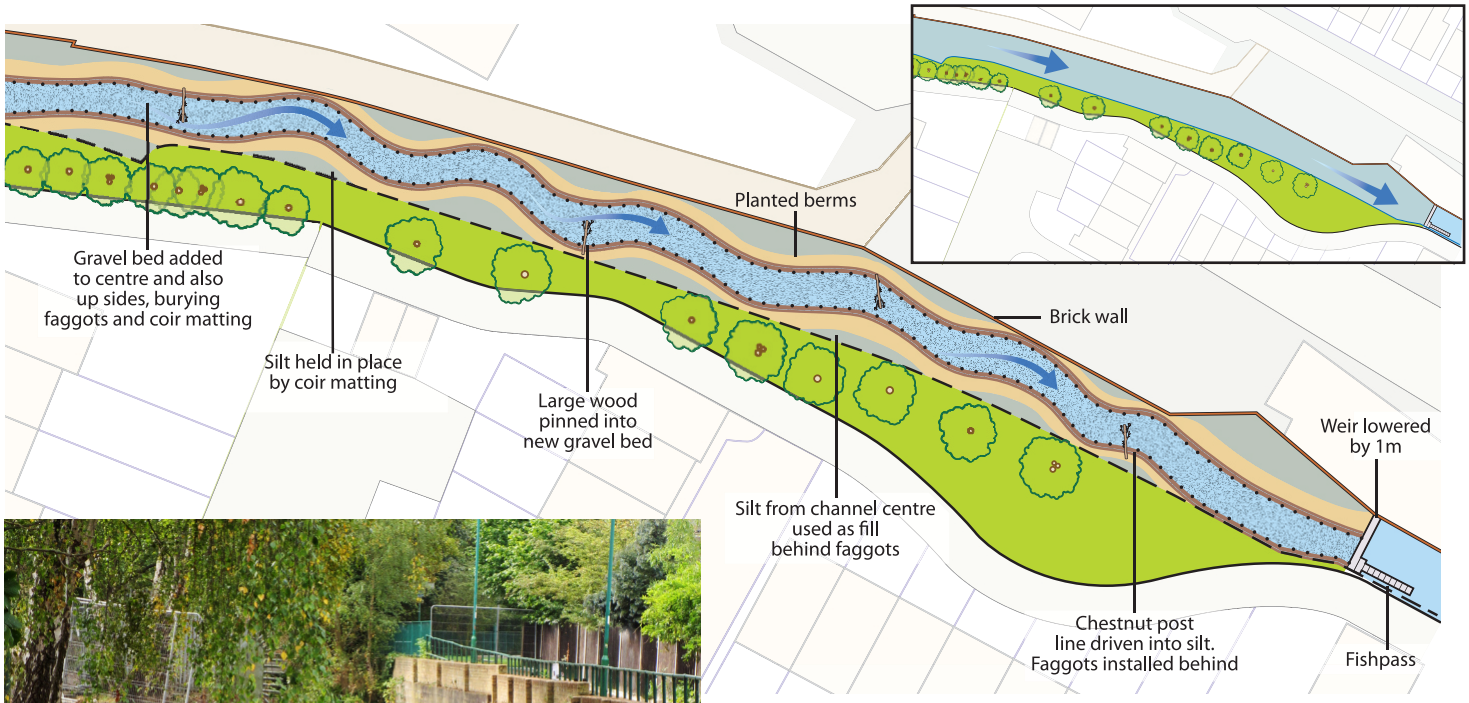
Inset – Weir lowered by 1m and fishpass modified and refitted at 15° gradient. The newly restored channel is visible beyond – 2014

Larinier fishpass originally installed. Too steep to be effective – 2012

Weir and Fishpass

Butter Hill Mill weir was part of an old mill structure, and a Larinier fishpass had previously been installed but had never worked due to its length and steep angle. The weir was not designated and surveys showed the structural integrity of the adjacent building was not dependent on the weir. The weir was lowered by 1m enabling the upstream impoundment to be removed and the fish pass to be modified (shortened and shallowed to a 15 degree gradient) over the remaining head drop to allow fish to pass upstream. Further work was needed throughout the previously impounded reach to address the excessive fine sediment build up and recreate the missing low-flow gravel channel.

Figure 3.12.1
Planform of the new layout



© SERT

Desilted central channel. Spoil placed behind the faggot rows and coir matting – Sept 2014

Channel

The channel design was led by spreadsheet-based hydraulic modelling (this was sufficient for Environment Agency flood defense consent (FDC)) to determine a width of channel that would give an average depth of 30cm along the reach (an EA gauging station was 300m upstream). Then geomorphological calculations were carried out (in-house by SERT but checked with Malcolm Newson at Tyne Rivers Trust) to identify the gravel size to be installed, such that it would be stable and would not result in mass movement of gravel downstream causing blockage of the fishpass.

The objective was to create a sinuous channel within the straight confines of the original channel. This involved narrowing the previous wetted width from 5m to 2-3m, but giving some freedom for the stream to adjust its low flow course; e.g. responding to vegetation growth, etc. An indicative meander spacing of 10-14 channel widths was applied.

Once the channel had dewatered and the old silty bed was exposed, the delivery process followed these stages.

1. Sinuous new bank lines were created with double height green chestnut faggots pushed into the exposed silt. The faggots were held in place using 1.5m chestnut posts which were driven down on either side of the faggots through the rubble strewn bed. The faggots were compressed and secured in position with fencing wire. Coir geotextile lined the back of the faggots with a short skirt laid on the exposed silt and the remaining width sat on the faggots whilst the central channel was excavated. The silt in the central channel was excavated by machine and placed behind the faggots (trapping the skirt of the coir matting).The coir geotextile was then rolled back from the faggots over the silt to prevent it from being mobilised under high flow events.

3

Enhancing Straightened River Channels

Filling the channel with gravel and pushing down the posts and faggots – Oct 2014

© SERT

In this constrained urban location, the above was done in very short sections, by a machine standing on bogmats on the exposed silt. [At less constrained sites, it would be simpler to work along the entire length of the reach: – lay out the entire run of faggots, – secure them with posts, – lay out the coir, – excavate the
central channel and backkfill, – pull over the coir to trap the silt].

2. 110 tonnes of Thames catchment 40mm+ flint reject gravel was placed into the desilted central channel and sculpted to include pools and point bars.

3. The faggots and posts were pushed down further into the silt to follow the dished profile of the new bed. The gravel was raked up to cover all of the faggots to form a seamless transition between the bed and bank.

4. A number of tree limbs were pinned into the bed to add flow diversity and encourage scour to retain pool habitat.

5. Volunteers planted 2000 plugs of marginal plants on the new berms to help stabilise them further and kick-start colonisation of these wet edges. This was deemed necessary as there was no good upstream source of plants for natural colonisation.

The shaped sinuous gravel bed and berms being planted – Oct 2014

© SERT

Enhancing Straightened River Channels

The native marginal plant list was agreed with the EA and London Borough of Sutton's ecologist. A variety of plants included reed canary grass (*Phalaris arundinacea*), greater pond sedge (*Carex riparia*), lesser pond sedge (*Carex acutiformis*), purple loosestrife (*Lythrum salicaria*), yellow flag (*Iris pseudacorus*), hemp agrimony (*Eupatorium cannabinum*), soft rush (*Juncus effusus*), water forget-me-not (*Myosotis palustris*) and water mint (*Mentha aquatica*).

Figure 3.12.2
The initial indicative two-stage design. Main channel and marginal ledge, with a defined faggot edge.

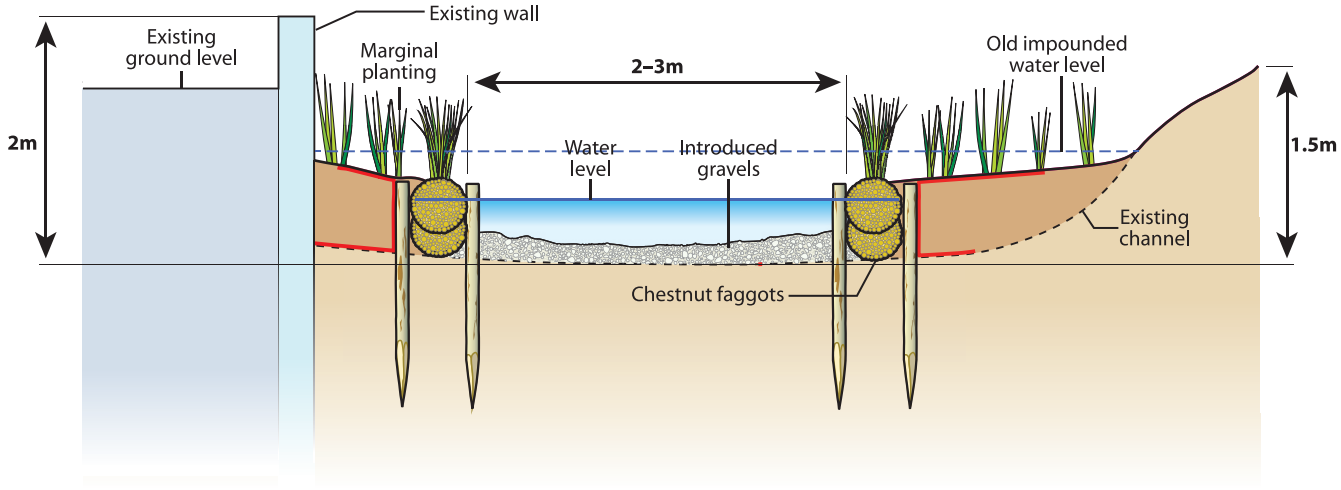
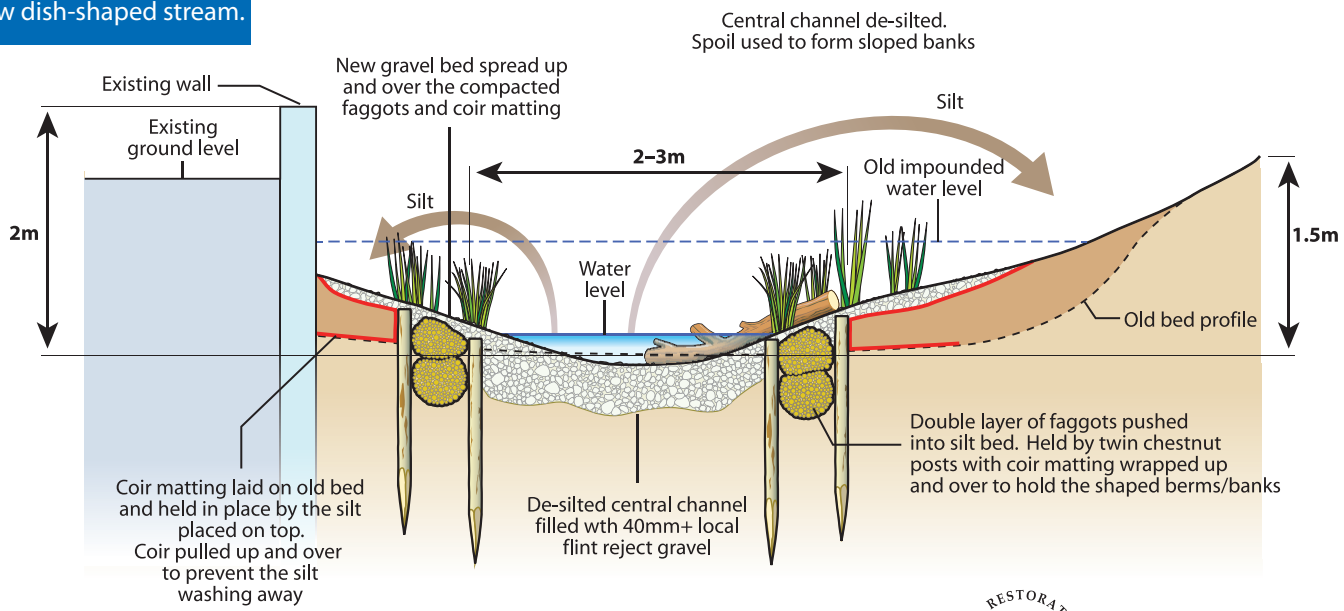


Figure 3.12.3
Indicative as built. By squashing the faggots and posts into the silt bed and adding more gravel. A shallow dish-shaped stream.



Enhancing Straightened River Channels

Subsequent performance – 2014 to 2019

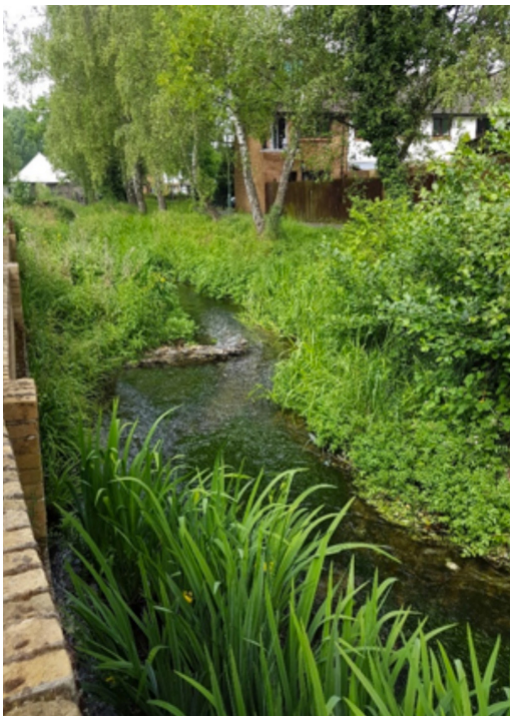
A shallow fast flowing gravel bed chalkstream again – Oct 2014 © SERT

From observation, the hydromorphology of the restored reach has worked as predicted in terms of water depth, flow diversity and movement within the gravel but not excessive mobilisation in a downstream direction.

Very shortly after the work was finished, trout were seen upstream of the pass for the first time in living memory. During the first spawning season, five trout redds were observed in the restored section. The following year, EA fish survey data recorded 67 trout of 0+ age class from immediately downstream of this restored site (but within a section also restored in the same phase of work) demonstrating the first successful recruitment of trout in the Carshalton Arm of the Wandle in over 80 years. Subsequent fish surveys have evidenced up to 12 trout of multiple year classes within a 25m section of the restored channel.

Rapid plant colonisation – Jun 2015 © SERT

Established well-vegetated stream - 2019



© SERT

Informal redd counts have shown spawning activity every year since the work was carried out.

However, for three of the years there have been water utility flow augmentation infrastructure infrastructure failures, significantly reducing water quantity, which have coincided with the spawning season and impacted spawning results.

Lessons

Greater variability in bed depth could have been built into the gravel channel which would have provided greater diversity of fish habitat. There is not enough energy in this groundwater fed chalk system to create large/deep pools. Site constraints dictating that larger gravel sizes needed to be used in order to minimiseed a mass mobilisation of gravel which would have blocked the fish pass.

Some of the pinned wood temporarily collected debris which created deeper fish holding areas. The subsequent fish surveys also suggest that more juvenile trout habitat could also have been incorporated.

In confined and constrained sites such as this, carefully adding further wood can often help to trigger this type of beneficial and localised bed (pool) scour.

The highly modified river is dependent on a completely artificial recirculation/augmentation system during low river levels to mitigate for groundwater abstraction by the local water company. Despite significant investment to restore the river, which builds in features to provide greater resilience, the whole system is still extremely vulnerable to infrastructure failures which could cause the river to dry up.

Contacts

Tim Longstaff - now River Thame Conservation Trust (RTCT), Project Supervisor. enquiries@riverthame.org

Toby Hull/Bella Davies - South East Rivers Trust, Main Project Partner. Tel. 0845 092 0110