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Restoring Meanders to Straightened Rivers

1.9 Reconnecting a remnant meander

RIVER ROTHER

LOCATION - PETWORTH, WEST SUSSEX FROM SU98051906

DATE OF CONSTRUCTION - 2004

LENGTH – 850m

COST – £90,000

River Rother	Medium energy, sand
WFD Mitigation measure	**Click Here** to view details
Waterbody ID	GB107041012810
Designation	None
Project specific monitoring	Fish, cross sections, fixed point photograpy, water levels, macroinvertebrates, macrophytes

Description

The 'Shopham Loop' is a large meander bend which is part of the natural course of the Western River Rother.

The Rother was engineered for navigation in the 18th century. At Shopham a large meander bend was bypassed with a straight navigation channel that featured a lock gate at its downstream end. These gates impounded water to a depth of up to two metres, but did not pass any river flow. The flow was side spilled into the loop via a purpose built structure.

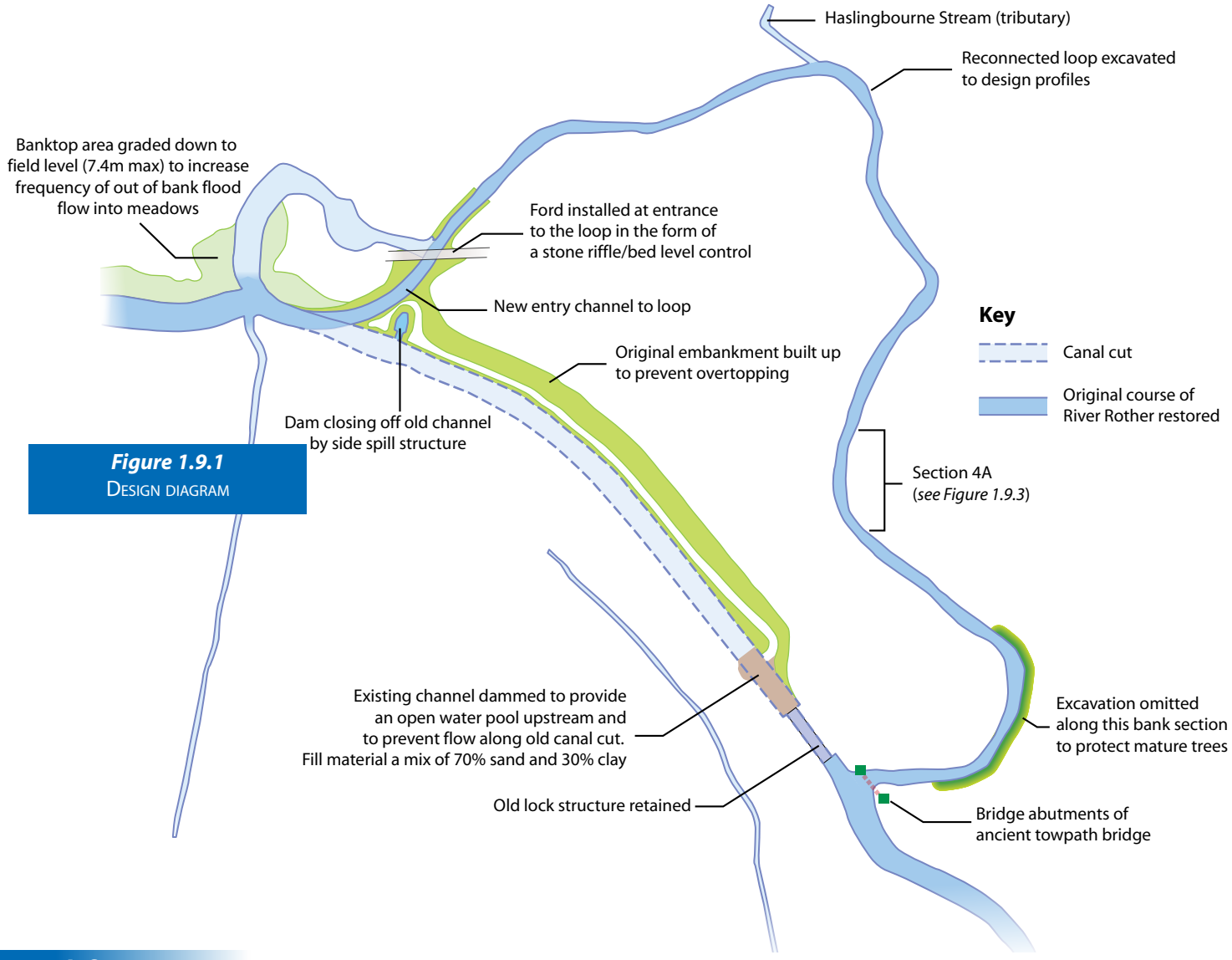

Figure 1.9.1
DESIGN DIAGRAM

These techniques were developed to suit site specific criteria and may not apply to other locations

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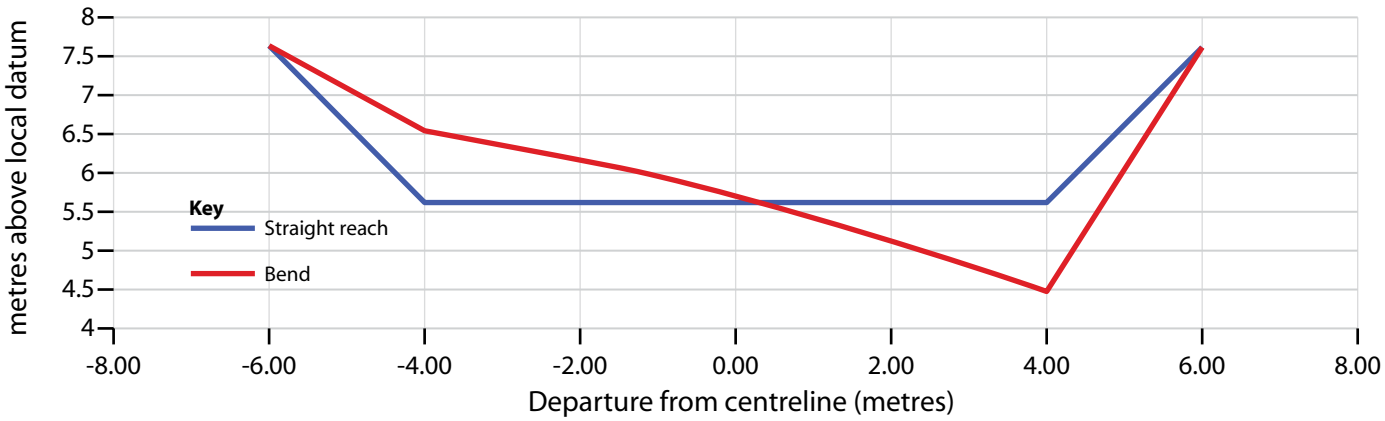

Figure 1.9.2
DESIGN CROSS-SECTIONS FOR STRAIGHT REACH AND BEND APEX

After navigation on the Rother ceased, the lock gates were removed which dropped the river level with flow passing freely down the cut. The side spill structure was also opened up to ensure that at least a part of the river continued to flow along the original course of the meander.

The loop rapidly became blocked with deposits of sand, as the flow velocity fell due to the reduced flow passing into the loop.

Concurrently the cut became enlarged due to bank erosion and the stonework of the old lock was partially washed out by floods. Several attempts were made to keep the old course of the River Rother open, but none was successful.

The project aimed to divert flow back through the meander loop, with a channel capacity that would remain self-cleansing. This would also restore the diversity of habitats associated with a meandering lowland river and increase floodplain connectivity.

Design

The canal cut was never designed to carry the river flow so it was decided to seal it off with an earth bund, just upstream of the old lock. This mimicked the function of the old lock gates. The entire river flow could then be diverted back into the historic course around the loop.

The reference point for the channel restoration design was a survey of the loop carried out in 2002. Additionally, the narrowest cross sections of the main River Rother channel were referenced against the cross sections collected from the loop and compared with channel dimensions sized by a geomorphologist.

The bank top width was determined by on-site observation of two stone abutment walls from an ancient bridge that provided a reliable representation of the historic channel width.

Two ancient stone abutment walls at the exit of the loop indicating the historic channel width – 2004

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Expert judgement and field observation was supported by a model to inform the more detailed channel design However it was impractical to excavate the complex shapes optimised by this model. Therefore the loop was excavated to one of two basic cross-section designs, namely bend apices and straight reaches, while points on the transition between them were interpolated (*see Figure 1.9.2*). The bed level was set to reflect existing conditions in the River Rother at each end of the loop and to improve connectivity with the floodplain during high flow events. A large scrape was excavated to create wading bird habitat and to provide clay for construction of the bund.

In order to prevent undermining of the stone abutment walls (which were of archaeological significance) at the downstream confluence, sheet piling was driven down to bed level across the river and a 'bed check' created from a base layer of coarse locally-sourced sandstone. At the entrance to the loop a ford was created for farm traffic and to serve as another bed check. It too was dressed with gravel to mimic a natural riffle.

A new gravel riffle was also constructed upstream of the site to replace a riffle that had formed in the canal cut, which became obsolete once the cut was sealed off. New gravels totalled £9,000, labour £13,000 and plant hire costs totalled £28,000.

The isolation of the canal cut left a long still water lagoon that provides valuable off river wetland habitat, which helped to achieve the overall biodiversity aims of the project. The old canal embankment alongside the cut was repaired and raised above the flood level, ensuring that this habitat would not be washed out by floodwaters. Conversely, the low canal embankments upstream of the loop were taken down to field level to trigger more frequent out-of-bank flows over the adjacent meadows.

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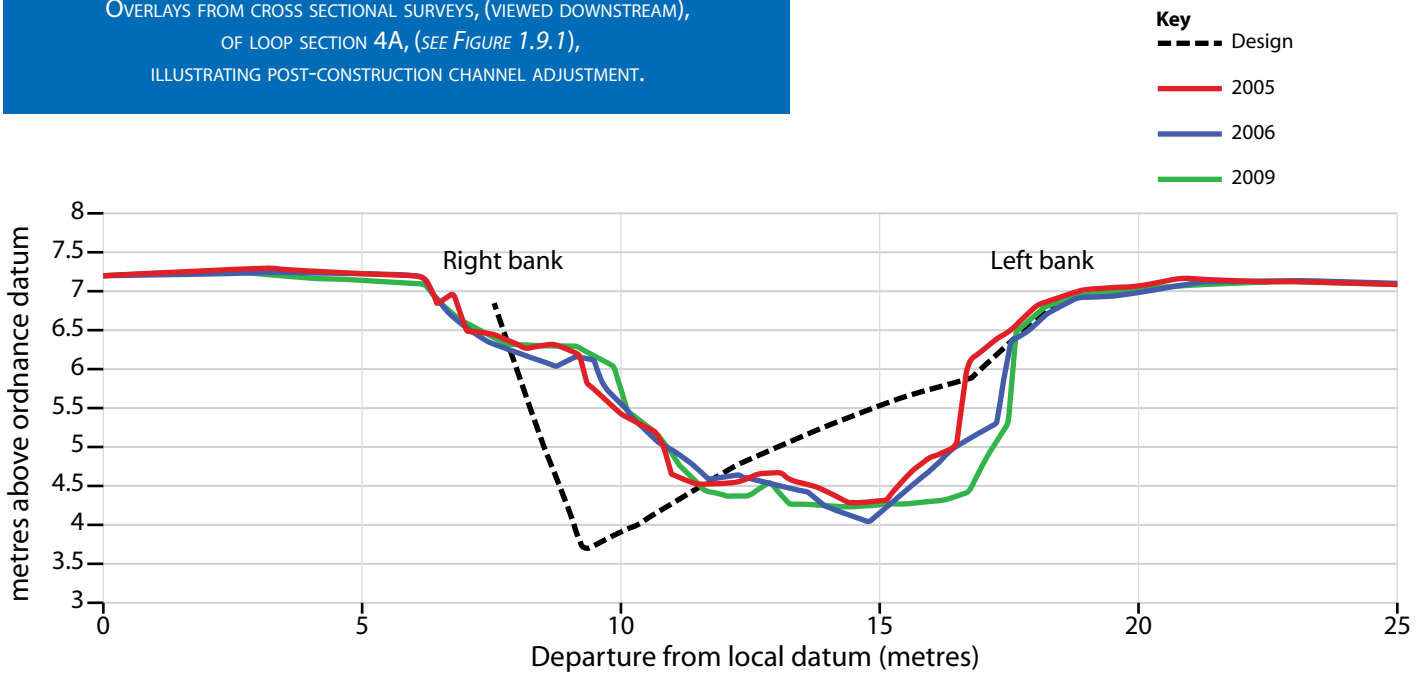
Bed check riffle and ford at entrance to the loop post-construction – 2004

Figure 1.9.3

OVERLAYS FROM CROSS SECTIONAL SURVEYS, (VIEWED DOWNSTREAM), OF LOOP SECTION 4A, (*SEE FIGURE 1.9.1*), ILLUSTRATING POST-CONSTRUCTION CHANNEL ADJUSTMENT.



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© RRC Sand in the meander loop pre-restoration – June 2004

© RRC Flow in the excavated meander loop post-restoration – 2005

© RRC The same meander loop (three years post works) – 2007

Subsequent performance

Virtually all of the initial bare banks had established a good cover of vegetation two years post-construction (2006). Mature woody vegetation retained during the project has contributed woody material to the channel, and species diversity of the floodplain has increased significantly, with many bird species regularly utilising the newly created wetlands.

The fish community of the restored loop was consistent with that of the wider Rother catchment. Higher than average populations of bullhead (*Ameiurus nebulosus*), chub (*Leuciscus cephalus*), brown trout (*Salmo trutta*), grayling (*Thymallus thymallus*), sea trout (*Trutta morpha trutta*) and barbel (*Barbus barbus*) have been observed. The stone bed check structures at the upstream and downstream ends of the loop have acted as spawning grounds for many of these fish species.

Monitoring of the site between 2002 and 2009 indicated a positive performance of the technique. Changes were observed in cross-sectional area (*see Figure 1.9.3*) suggesting a dominance of erosion over deposition in the loop. There was no significant (more than one metre) lateral channel change between autumn 2004 and a survey in 2006, but small-scale channel adjustment has been widespread. Therefore it can be concluded that the pre-restoration issue of sedimentation in the loop has been resolved and that the newly-excavated channel is slowly adjusting to a more natural, and desirable, form.

© RRC Shopham Loop post-restoration – 2009

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Reference material – Click **here**