



# RESTORING MEANDERS TO STRAIGHTENED RIVERS

## 1.4 New meanders to one side of existing channel

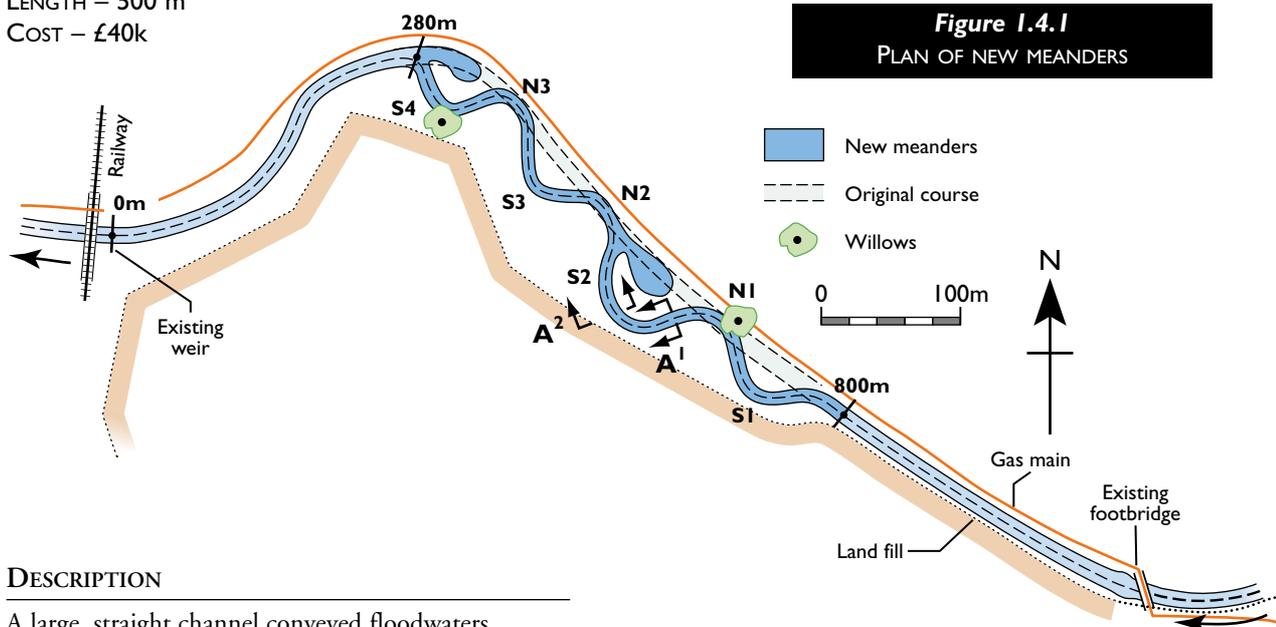
### RIVER SKERNE

LOCATION – Darlington, Co Durham, NZ 301 160

DATE OF CONSTRUCTION – Autumn 1995 to Spring 1996

LENGTH – 500 m

COST – £40k



### DESCRIPTION

A large, straight channel conveyed floodwaters through a reach of grassed public open space that was bordered by housing and old industrial landfill. A new meandering river that partially incorporated the existing channel was created to the south side. The risk of flooding, affecting people and property, was safeguarded.

### DESIGN

#### Longitudinal profile (fig. 1.4.2)

The original mean bed gradient of 1:1300 paralleled the mean bank gradient at a depth of c. 2.4m.



Meander excavation – Autumn 1995

Photo: Northumbrian Water/AirFotos

The new mean bed gradient and level matches the existing but flattens to 1:1500 because of the increased length created. Bed scour around each meander was expected to reach c.1m depth as observed at an existing bend at ch. 1200m. This is shown as 'lowest bed' on the long section 1m below mean bed. Conveyance of floodwaters across the new meanders was facilitated by a general lowering of inter-meander land levels by c. 0.6m. This also enhanced water storage aspects of the 1 in 100 year flood hydrograph, attenuating the peak flow downstream.

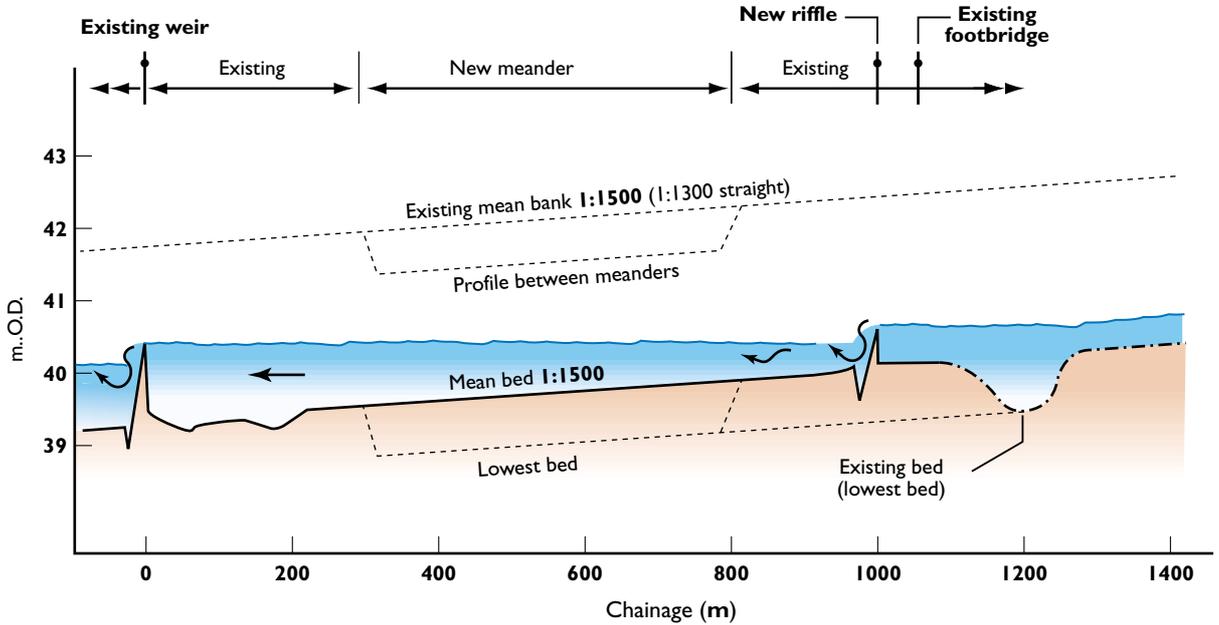
Normal water levels in the reach are controlled by an existing weir at ch. 0m, but the effect of this diminished at ch. 900m where the original straight channel was retained and enhanced. Enhancements included an artificial rock/gravel riffle at ch. 1050m shown on the long section (see Part 3).

#### Alignment of channel (fig. 1.4.1)

The lateral extent of meandering is constrained between a gas main, running closely alongside the north bank of the old course, and landfill tipped to within 10 to 50m of the south bank. Bends S4 and N1 were located to retain two mature willows on the banks. The remaining meanders are set out between and checked against geomorphological criteria to finalise the layout. High flows in this channel and

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**Figure 1.4.2**  
LONGITUDINAL PROFILE



other constraints precluded any possibility of 'mirroring' historic meander patterns that were sustained by entirely different hydraulic criteria.

*Cross-sections (fig. 1.4.3)*

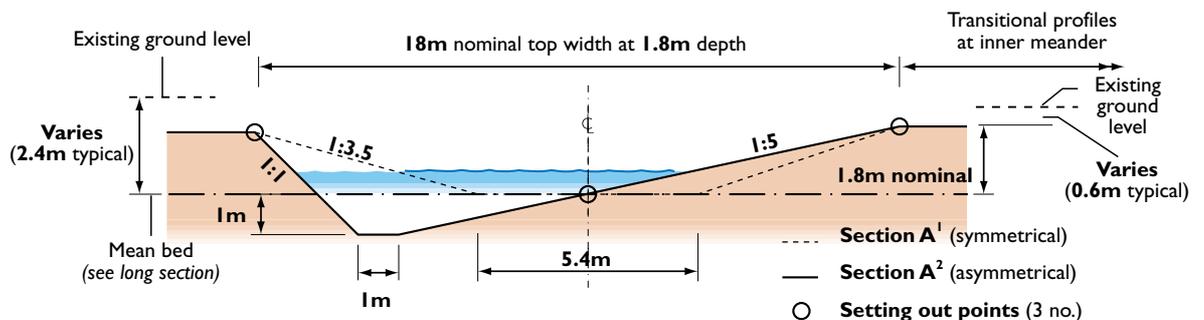
Because of continuously varying vertical depths described for the longitudinal profile, the design needed to be simplified. Two sections (symmetrical and asymmetrical) were developed based on mean depth (1.8m) and mean top width (18m). These applied to two points only on each meander - intermediate profiles required a continuous transition between them. The asymmetrical section allows for 1m of scour at each bend described above.

A variation of the pair of sections shown was developed for bends S1 and S4. A horizontal ledge at normal water level was incorporated around the inside of each to simulate the effects of natural shoaling.

*Profiles within meanders (see 6.2 and 2.1)*

As well as the general lowering of land levels described above, considerable profiling was specified to ensure inundation in time of flood was progressive from the downstream leg back towards the start of each meander. Similarly, special consideration was needed to ensure the safe 'submergence' of backwater features prior to general overbank flow. The safety of

**Figure 1.4.3**  
SECTION THROUGH NEW MEANDERS





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people during rising floods is of particular importance at this urban location. Exceptionally, land within bend N1 could not be significantly re-profiled as a high voltage cable passes underneath.

### SUBSEQUENT PERFORMANCE 1995/8

The newly meandered channel has proved to be stable under frequently occurring flood conditions. The most vulnerable banks, located where bends are incorporated into the backfilled course, are supported

by revetments (*see Part 4*), but elsewhere the indigenous clays have resisted erosion. Sands, silts and mud have deposited as shoals where eddy currents arise around the inner margins of bends and the deeper pools created around the outside appear self-sustaining. Diverse flora and fauna have rapidly colonised the many different features of the new course and local people enjoy relatively safe access to the waters edge.



Completed meanders – Summer 1997



Looking downstream towards large backwater – February 1997