6

Working to restore & enhance our rivers

Managing Overland Floodwaters

6.2 Profiling of land between meanders
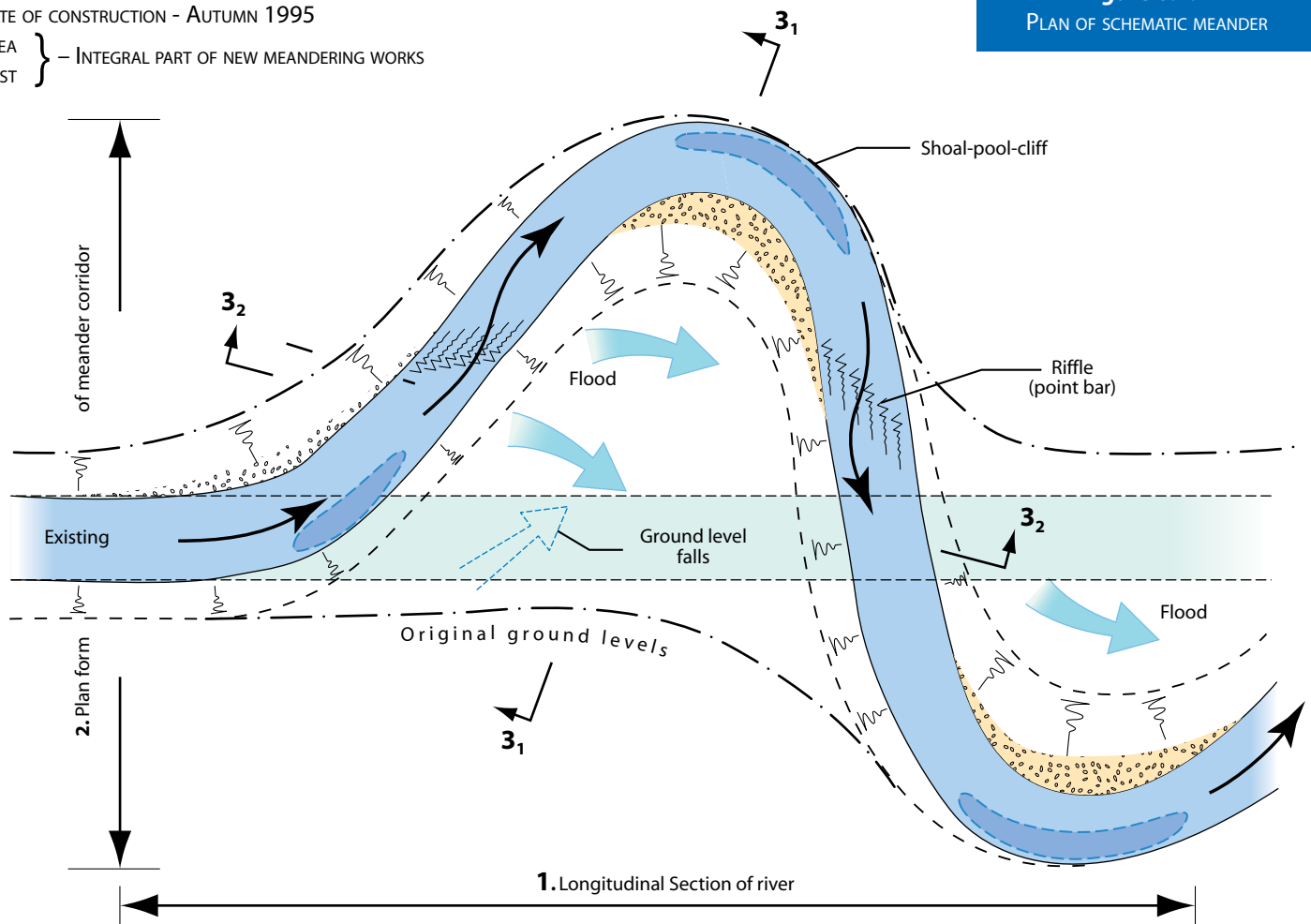
RIVERS COLE AND SKERNE

Location - Coleshill, Oxon/Wilts border, SU234935
— Darlington, Co Durham, NZ301160

Date of construction - Autumn 1995

Area } — Integral part of new meandering works
Cost }

Figure 6.2.1
PLAN OF SCHEMATIC MEANDER

- 3_1
- 3_2
- Shoal-pool-cliff
- Flood
- Riffle (point bar)
- Existing
- Ground level falls
- 3_2
- Flood
- Original ground levels
- 3_1
- of meander corridor
- 2. Plan form
- 1. Longitudinal Section of river

Description

The creation of new meandering channels required a design that reflected the hydro-geomorphological processes that naturally lead to meander formation. The natural geometry of meanders is complex, but certain basic principles were followed at both the Cole and Skerne sites to develop simplified designs that could be implemented using conventional excavation plant.
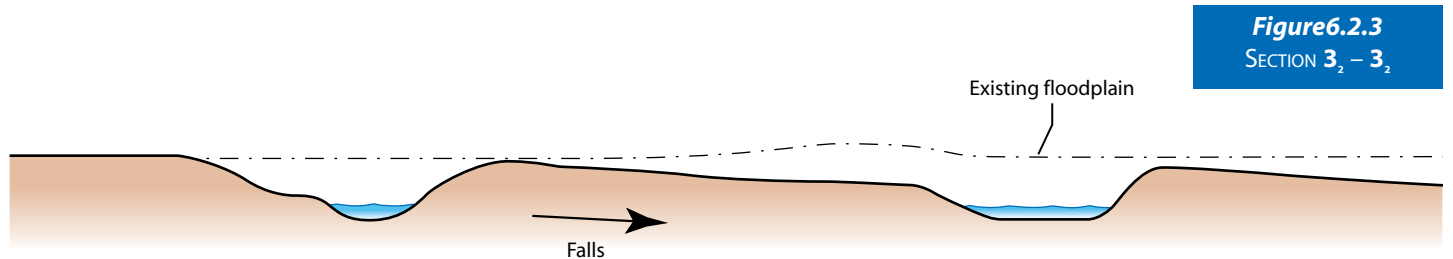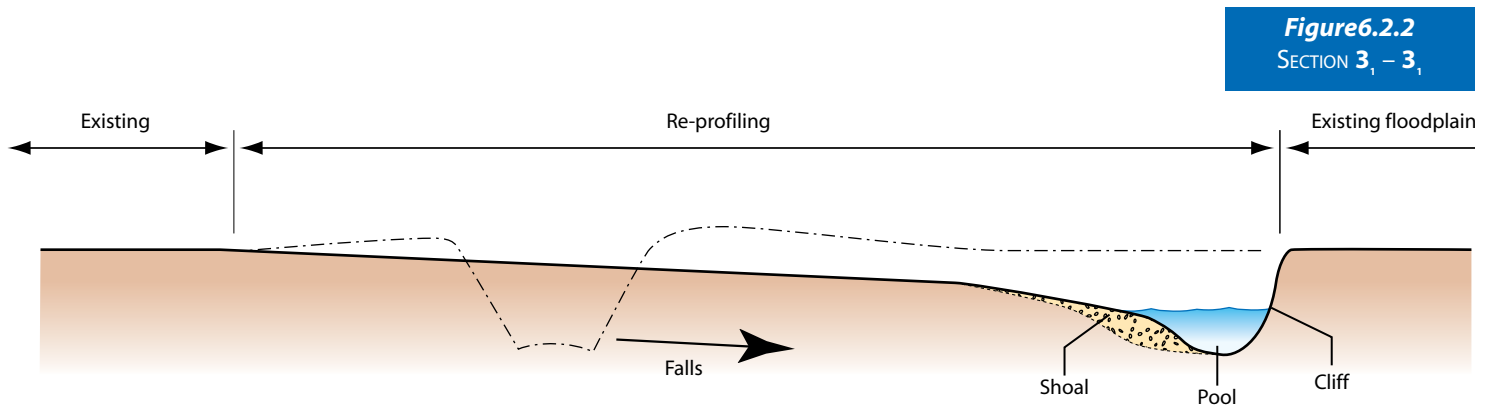
The creation of the new meanders reflected this process by including reprofiling of land within the meander corridor. If this was not done, and works were limited to simply excavating a sinuous channel, then erosive forces would have been un-naturally high, due to the confinement of the river, until such time as the river had itself adjusted to the more balanced form depicted.

The design of meanders at the sites is fully explained in *Techniques 1.1* to *1.4*. This involved the sequential determination of the following dimensional details:

1. The mean longitudinal bed profile of the whole reach;
2. The alignment of meanders in plan;
3. The variable channel cross-sections to suit 1 and 2 above;
4. The profile of the land within the meanders.

Design

Figure 6.2.1 depicts an idealised meander where the outer bank is eroding and the inner bank accreting, thereby generating a slow migration of the meander down the river valley. This fundamental process means that the profile of the land within the meander naturally results from deposition during successive floods, and that it will usually be markedly different from the generally flat profile of the wider floodplain.

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

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6

Figure 6.2.2
SECTION $3_1 - 3_1$

Existing | Re-profiling | Existing floodplain

Falls

Shoal | Pool | Cliff

Figure 6.2.3
SECTION $3_2 - 3_2$

Existing floodplain

Falls

The aim of 4 (re-profiling) was to integrate the other three aspects (bed, bank and plan form) creating a sustainable river corridor. The extent and nature of re-profiling was influenced by the way in which floods would pass between successive meanders before reaching water levels that gave rise to general over-bank flow onto the wider floodplain.

The conveyance of floodwaters between meanders proved to be a significant factor in achieving the necessary hydraulic capacity of the river.

The two most important aspects of re-profiling are indicated in the two cross-sections (*Figures. 6.2.2 – 6.2.3*) and summarised below:

• Gradually falling levels laterally across the meander profile merging into a shoal-pool-cliff profile at the apex (*see Technique 3.1*);

• Gradually falling levels longitudinally between the start of the meander and the return leg (*see Technique 3.2*).

This approach ensures that submergence of the meander in a rising flood will commence at the return leg, starting where shoal deposition is most active and progress back towards the entry bend. This pattern of submergence generates flow currents that are complex and varied but are generally smooth. This contrasts with the turbulent conditions that arise if re-profiling is not undertaken.

Other practical benefits of re-profiling in this way include a safer environment for people and livestock. Easy access down

to the waterside is intrinsic to the design, and the risk of being trapped by floodwater suddenly cutting straight across the meander is greatly reduced.

The formation of sustainable pools, riffles and cliffs in the locations indicated on the plan is similarly an intrinsic feature of these design principles.

Subsequent performance 1995 – 2001

Although the principles of the design were well understood, their full application was compromised for a number of reasons, including underground services, although every meander, at both locations, was subjected to re-profiling to some degree. It was evident after the first winter season that some further re-profiling was desirable to get much closer to the idealised form described (*see Technique s 1.1 – 1.2*).

The re-profiling has proved to be a very important aspect of the design, the best example being the largest meander on the Skerne where a backwater is incorporated (*see Technique 2.1*).