Erosion control

Issues

Where sections of land adjacent to rivers have little or no vegetation cover, it may be necessary to provide a degree of temporary protection from excessive soil erosion, caused by river flow or surface run-off.

It cannot be emphasised enough that instream channel erosion is a natural process, which occurs in all river systems. Erosion only becomes a problem when it is excessive, or when it threatens man-made structural elements, for instance bridges. It is important to try and identify the reasons for excessive erosion; have large numbers of grazing stock damaged fringing vegetation, or have trees been removed locally? Both of these can significantly weaken bank stability, causing excessive erosion. Remedial action at source (for instance erecting adequate fencing) is essential to ensure a long-term solution to erosion. Even if these changes can be affected, there may still be a requirement for the temporary and local protection of banks from erosion.

Erosion caused by overland flow can be very damaging, particularly when it involves the mobilisation of large volumes of fine sediment into chalkstreams. Typically, this situation may occur following channel narrowing that involves a degree of backfilling, or where the bank's profile has been changed to create low-level marginal shelves. This is generally a short-term problem, with the installation of erosion control an entirely appropriate course of action during the period of re-establishment of protective riparian vegetation.

Possible restoration options

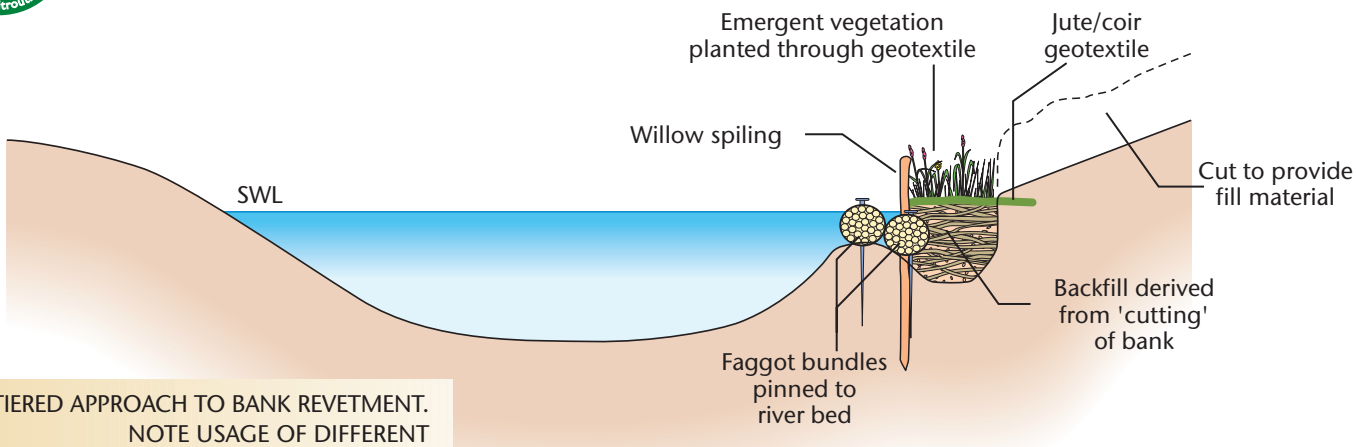
Excessive instream erosion

Identifying and addressing the cause of excessive erosion may be adequate to prevent continued damage to the chalkstream. However, this may not always be possible, resulting in a requirement to take measures to reduce erosion locally.

A wide range of techniques and materials can be used. A number of pre-requisites are common to all if they are to be successfully installed:

- Any erosion protection installed must be adequately 'keyed' into the bank at the upstream and downstream extremities of installation. This involves carefully excavating into the bank for at least 0.5m, and returning the ends of the protection into the excavated trench before firmly backfilling. This effectively protects the vulnerable interface between the bank and the newly installed protection.

'D' STUCTURE ON RIVER WYLYE, LANGFORD.



TIERED APPROACH TO BANK REVETMENT. NOTE USAGE OF DIFFERENT TECHNIQUES FOR EACH ELEMENT.

- **Timing**. Many of the techniques recommended rely on the growth of vegetation for their structural strength. There is thus little point in installing them during the autumn or winter period, when flows will be at their strongest and vegetation growth minimal. Rather, work should ideally take place during the period March–August inclusive, provided that due regard is taken of the need to protect nesting birds, water voles and other protected fauna.

- **Maximum height of bank protection**. Ideally, individual bank protection elements should not exceed 1m in height (1.5m absolute maximum). The risk of structural failure due to excessive lateral loading increases significantly if these heights are exceeded. Where it is necessary to provide protection for banks which are higher than 1.5m, then a series of individual elements not exceeding this height limit should be installed with careful setting back of successive elements (terracing), strong protection can be provided to banks. Selection of suitable techniques to suit their location within the terrace will also improve the chances of success.

Spiling

This technique utilises the extremely strong growing and rooting capabilities of native willow species to provide a living 'hedge' that protects banks from major erosion. To ensure success, all

SPILING INSTALLED ON THE OUTSIDE OF A BEND .....

supported by
Environment Agency
NATURAL ENGLAND
RIVER RESTORATION CENTRE

.....AND BACKFILLED .

willow used in the spiling must be freshly cut. Older material will often be dead, resulting in poor establishment. Non-native species of willow should be avoided to avoid their establishment in the wild. Suitable native willow species for spiling include goat willow *Salix caprea*, and osier *Salix viminalis*.

Freshly cut vertical stakes (diameter 75mm–100mm) of willow are driven vertically at 0.4m–0.6m centres along the length of the eroded bank. Smaller willow 'wands' are then woven horizontally between the posts and packed down vertically to ensure a tight weave. Upstream and downstream ends of the spiling must be returned and keyed into the bank. The area between the spiling and the original bank must be backfilled with a mix of brushwood and locally derived spoil to provide a medium for willow to grow into.

Provided that the willow establishes adequately, there will be a need to manage the spiling. It can be cut as a hedge, with annual trimming, or allowed to grow longer and periodically coppiced.

Faggot bundles, heather bales and straw bales

Deadwood faggot bundles, and heather/straw bales can be used to provide a high degree of bank protection, particularly if installed in tiered layers, orientated at right angles to each other. *See* **Channel Narrowing** for further detail.

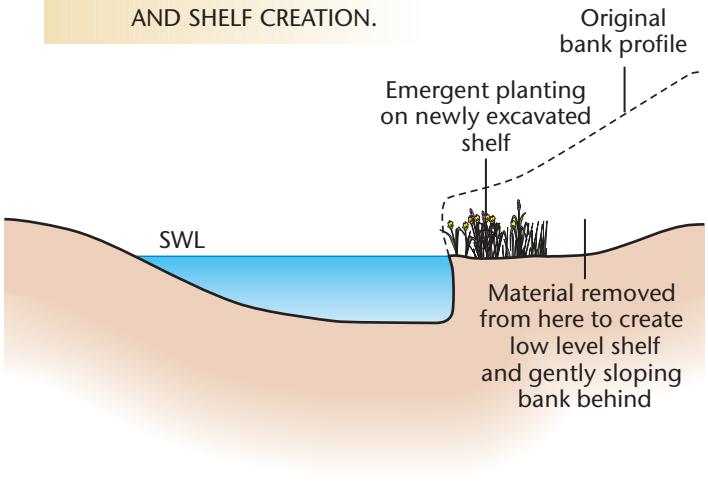
Tree kickers

These can be useful in controlling significant erosion particularly on the outside of bends (*see* **Large Woody Debris** section for details).

Bank Regrading

Where damaging erosion is taking place on steep banks, particularly on the outside of bends, they can be offered a degree of protection by localised regrading. Cutting back of the bank to create a low-level shelf and a more gently sloping bank profile behind, will reduce erosion, particularly if the low level shelf is densely planted with emergent vegetation.

BANK REGRADING AND SHELF CREATION.



supported by
Environment Agency
NATURAL ENGLAND
THE RIVER RESTORATION CENTRE

Removal of redundant bunds

Past dredging of many rivers has created raised bank profiles (bunds) parallel to the channel. These bunds are often located on only one side of the river, where the excavated material was deposited. They can act to constrain river channels artificially, with the result that at higher flows, erosion can be locally damaging. Provided that there is no risk of increased flooding, the removal of these bunds can act to reduce erosion. Equally importantly, it increases periodic inundation of flood-plain meadows, benefiting wildlife interests and providing a degree of flood attenuation.

Whilst it is always preferable to utilise biodegradable materials, this may not be possible in some more high-energy environments. In these situations, other less natural materials may be required. Their use should always be kept to a minimum, with careful consideration of their impact on the conservation value and aesthetics of the river essential.

Rip-rap

Rip-rap is the generic name given to loose stone used to protect riverbanks, particularly their interface with the riverbed. Rip-rap should be sized appropriately for the energetics of the location in which it is to be used. This is a skilled job, for which professional advice should be sought. Generally, rip-rap is introduced using an hydraulic excavator, to create an armoured barrier to erosion. It can be an unsightly product if poorly installed. However, it can provide excellent habitat for juvenile fish and invertebrates, in particular, white-clawed crayfish.

FORMER FLOOD BANK EXCAVATED TO CREATE LOW-LEVEL SHELF. NOTE FAGGOT EDGE AND BIODEGRADABLE GEOTEXTILE MEMBRANE TO MINIMISE EROSION.

MULTI-LAYERED GEOTEXTILES PROVIDE PROTECTION FROM EROSION DUE TO BURROWING SIGNAL CRAYFISH .

Non-biodegradable Geotextile

Where it is necessary to protect steeper banks from erosion, for instance in more formal/urban settings, then the use of non-biodegradable geotextiles may be considered. These are generally made from plastics, sometimes incorporating elements of wire for added strength. Trade products include Terram, Geolon and Nicospan. They are being increasingly used at sites where high densities of the non-native Signal crayfish *Pacifasticus leniusculus* are damaging banks by their burrowing activity. Multi-layers of biodegradable and non-biodegradable membranes can be used to reduce burrowing, and protect vulnerable banks, whilst still providing habitat for plants and invertebrates. The long term efficacy of these products for this purpose is still to be ascertained.

Protection from run-off

Proprietary soil erosion geotextiles are available from a number of suppliers. They fall into two large groups, namely those manufactured from artificial, non-biodegradable materials (for example Terram), and those made from naturally occurring biodegradable fibres such as coir and jute. It is materials from this latter group that are the most acceptable for use in habitat restoration schemes.

Coir/jute geotextiles can be purchased in 100m lengths 'on the roll' or in shorter lengths, cut to size for specific projects. A range of specifications exist, with key variables including mesh size (generally, the smaller the mesh, the greater the retention of fine sediments), twine thickness and overall tensile strength. Selection of the appropriate product is a detailed matter that should be discussed with the supplier at the time of purchase.

The selected geotextile is rolled out over the exposed horizontal surface and fixed, either using metal pins provided, or in the case of a project seeking full biodegradability, with pegs cut from willow, hazel or other trees on site. Once firmly fixed in place, growth of ground vegetation will soon penetrate through the mesh, providing increased resistance to erosion of soil. The geotextile blanket should degrade over a 2-5 year period, depending on its specification and site conditions.