



Watercourse erosion and bank stabilisation

Watercourses flowing through golf courses provide vital outlets for drainage systems to allow water to leave the course. They also often provide interesting playing hazards and add attractive and valuable habitat and landscape features.

When the amount and velocity of water flow changes, or increases in sediment levels occur, (either from changes in land use, bank vegetation, engineering works, increased intense rainfall / climate change), watercourses will naturally adjust their shape, width and depth to adjust to the new conditions. This often results in banks being eroded, and sediments moved and deposited downstream.

Where possible these natural processes should be allowed to continue as they can be beneficial to watercourse habitats, renewing bank vegetation, providing new ecologically valuable pools and riffles and undercuts for fish habitats. However, in playing areas this bank erosion, also caused by human activity on the golf course, such as vegetation removal and golfer traffic, results in the loss of land and often threatens property and structures as well as being a safety hazard.

It is understandable that golf club managers in some situations want to manage, protect and stabilise these watercourse banks, and this document gives information on how to do this as sustainably as possible.

Possible solutions

There are many 'grey' bank protection techniques such as concrete and masonry retaining walls, gabion baskets, stone revetments, and other hard engineering solutions. These are often complex and expensive and will have a limited life span. In many situations they will be undercut by the water flow and eventually collapse.

Other options being more widely used in recent years, and recommended by the Scottish Environment Protection Agency (SEPA), the River Restoration Centre (RRC) and Scottish Golf include

'green' bank protection techniques or 'soft' engineering options that encourage the establishment of vegetation on the eroding bank to bind it and give stability. These soft options are more sustainable in the long term, requiring little maintenance once they are established:

1. **Brushwood bundles** (such as willow, hazel or chestnut) can be set into shallow trenches on the river bank parallel to the direction of flow. They help stabilisation by slowing the flow of water, trapping silt and sediment. They are often used in conjunction with 'log toe' techniques, using tree trunks or large boughs along the water's edge to stabilise the toe of reformed banks.
2. **Willow spiling** is another effective way to protect an eroding bank. Willow stakes are driven vertically into the bank and willow whips are woven between these to give an effect like a fence. This physical barrier will protect the bank, and the stakes and some of the whips will take root. Their root systems will stabilize the bank and give a long term sustainable solution to the problem.
3. **Willow mattress revetment** involves willow branches being laid along reformed river banks, secured with netting. Rapid growth of willow shoots will initiate a long term ecologically sustainable revetment.
4. **Biodegradable geotextiles** are meshes or rolls of natural fibre that protect and stabilise the riverbank while allowing vegetation to grow through. There are many geotextiles available but often **coir** is used (a natural material from the husks of coconut, usually used to make doormats). Coir is woven into either sheets of matting or 3m long 18" diameter rolls and is staked into the bank to create stability. Appropriate marginal vegetation (see list below) is then planted into these rolls, or they can be supplied pre-planted to provide a ready-made well established vegetated edge. The rolls are fairly flexible and can be used to create meanders and shape in water courses. The coir provides a secure base for the plants while they are becoming established within the bank.

Native Marginal Planting

Latin Name	Common Name
<u>Ammophila arenaria</u>	Marram Grass
<u>Alisma plantago</u>	Water Plantain
<u>Caltha palustris</u>	Marsh Marigold
<u>Carex acutiformis</u>	Lesser Pond Sedge
<u>Filipendula ulmaria</u>	Meadow Sweet
<u>Iris pseudocorus</u>	Yellow Flag Iris
<u>Iris sibirica</u>	Siberian Iris
<u>Juncus effusus</u>	Soft Rush
<u>Lythrum salicaria</u>	Purple Loostrike
<u>Mentha aquatica</u>	Water Mint
<u>Myosotis scorpiodes</u>	Water Forget-me-not
<u>Phalaris arundinacea</u>	Reed Canary Grass
<u>Phragmites australis</u>	Common Reed
<u>Primula veris</u>	Cowslip
<u>Primula vulgaris</u>	Wild Primrose
<u>Typha latifolia</u>	Common Reed Mace

Consents / Regulation

SEPA must be consulted and give consent (under the Controlled Activities (CAR) regulations) prior to any works on or near a watercourse being carried out. For a summary of what is required download document from:

<http://www.sepa.org.uk/regulations/water/engineering/engineering-guidance/>

Project Funding

SEPA Water Environment Restoration fund: www.sepa.org.uk/water/restoration_fund.aspx

Scottish Natural Heritage funding www.snh.gov.uk/funding/

Further information

SEPA Online Guidance

WAT-SG-23 Good Practice Guide - Bank Stabilisation

Watercourses in the Community, a guide to watercourse management in the urban environment.

Download these and other useful documents from

www.sepa.org.uk/water/water_regulation/guidance/engineering.aspx

The River Restoration Centre: www.therrc.co.uk has a great deal of experience in designing and implementing such projects.

Manual of River Restoration Techniques (RRC 1999) <http://www.therrc.co.uk/manual-river-restoration-techniques>

British Trust for Conservation Volunteers (BTCV) Handbooks for waterways and wetlands

Scottish Natural Heritage online information about river engineering www.snh.gov.uk/land-and-sea/managing-freshwater/river-engineering/

Directories of professional qualified hydrologists can be found in the British Hydrological Society www.hydrology.org.uk or the Chartered Institute of Water and Environmental Management (CIWEM) www.ciwem.org. It is advised to consult these professionals for more complex watercourses /hydrological river modelling/prediction etc.

Some possible suppliers/contractors (SGL takes no responsibility regarding the quality of these suppliers)

Salix – Coir Rolls Suppliers www.salixrw.com/products/coir_rolls.htm

Land and Water www.land-water.co.uk/coir-rolls.html

Water Lines Solutions www.coir-mats.co.uk/

Riverbank Conservation Ltd www.riverbankconservation.co.uk/erosion.htm

Willowbank Services www.willowbankservices.co.uk/index.cfm