

Instream Erosion Control

EROSION CONTROL TECHNIQUE

Revegetation	✓	Temperate Climates	✓	Short-Term	
Non Vegetation	✓	Wet Tropics	✓	Long-Term	
Weed Control	[1]	Semi-Arid Zones	✓	Permanent	✓

[1] Weed control attributes can be incorporated into many instream erosion control techniques.

Symbol (not applicable)



Photo supplied by Catchments & Creeks Pty Ltd

Photo 1 – Erosion control blankets installed during channel restoration



Photo supplied by Catchments & Creeks Pty Ltd

Photo 2 – Jute mesh scour protection on the upper bank and lower rock protection

Disturbed instream surfaces need to be rehabilitated as soon as practicable after instream works have been completed. Channel banks, and the channel bed where appropriate, should be actively revegetated rather than waiting for natural regeneration.

One of the best ways of minimising instream soil erosion resulting from instream construction and maintenance activities is to minimise any in-channel disturbance, and the disturbance of high-risk areas such as the outside of channel bends. This can be achieved by:

- avoiding unnecessary disturbance of bed or bank vegetation;
- avoiding disturbance on the outside bank of a channel bend;
- minimising the soil disturbance needed to provide access to the site;
- not accessing the site via the outside of a channel bend, or via an unstable bank;
- using long-reach excavation equipment that allows all work to be done from the top of bank rather than allowing machinery to access the channel bed.

Revegetation is one of the most effective long-term stabilisation techniques for both natural and modified waterway channels. In-stream ecology can be further enhanced through the re-establishment of associated bank and over-bank riparian vegetation. Attributes of healthy riparian vegetation include shading for water temperature control, the establishment of habitat diversity, the creation of snags, and the linking of aquatic and riparian habitats.

Wherever reasonable and practicable, vegetation should extend to the water's edge to increase the value and linkage of the aquatic and riparian habitats. Rock protection of the bank toe (Photo 2) is usually required to provide stabilisation during the plant establishment phase.

During plant establishment it may also be necessary to protect disturbed surfaces from short-term erosion with the aid of *Erosion Control Blankets, Mats or Mesh*. *Erosion Control Blankets* and *Mats* reinforced with synthetic netting are **not** recommended for use along waterways containing ground-dwelling wildlife (this is likely to include most natural waterways).

The stabilisation of active channel erosion requires an understanding of the various types of bed and bank erosion, the ability to recognise the causes of such erosion, and the ability to identify appropriate treatment measures. This usually requires the advice of experts, and the approval of the relevant State authorities.

(a) Bank scour:



Photo 3 – Bank scour

Draft

Photo 4 – Bank scour on channel bend

Bank scour is the direct removal of material from the face or toe of the bank as a result of flow velocity.

Causes include: high velocity stream flows, poor vegetation cover, excessive reed growth within the bed of the creek, turbulence caused by fallen trees, or high velocity discharge from stormwater pipes or culverts.

Treatment by vegetation primarily relies on the use of native ground covers in lower bank and along waters edge, and low-lying woody species (e.g. shrubs) on mid and upper bank, especially on the outer bank of channel bends. Generally the banks need to be “hydraulically” rougher than the channel bed.

The use of trees within the channel may increase flow turbulence aggravating the erosion.

(b) Bank slumping



Photo 5 – Bank slump (River Torrens)

Photo 6 – Bank slumping (Murray River)

Bank slumping is the mass movement of bank material. Geological slip circle failures are included in this category.

Causes include: the removal of trees from the top of the bank, deepening of the channel by erosion or dredging, an unusual or rapid lowering of flood waters following saturation of the banks, or excessive fill material placed on or near the top of bank.

Treatment by vegetation primarily relies on the use of shrubs on mid and upper bank, especially on the outer bank of channel bends, and deep-rooted trees on the upper bank and over-bank areas, especially on steep and/or high banks.

(c) Bank undercutting:



Photo 7 – Bank undercutting

Photo 8 – Bank undercutting on channel bend

Bank undercutting is the removal of material from the lower portion of a channel bank by “bank scour”. This erosion often results in the creation of an overhanging bank that usually fails in a more violent slip than observed in traditional “bank slumping”. In effect, it is a combination of bank scour and bank slumping, even though the two events may not occur simultaneously.

Causes include: a migrating low-flow channel, frequent high velocity stream flows that are less than bankfull flow, exposure of a weak soil layer within the bank, changing catchment hydrology (e.g. urbanisation), or the removal of essential bank vegetation.

Treatment by vegetation primarily relies on the use of stabilisation of the lower bank with rock and ground covers, including tall, flexible reeds and grasses. Shrubs are often best placed on mid and upper bank, and on the outer bank of channel bends. Trees are primarily located on the upper bank and overhanging areas, especially on steep and/or high banks.

The lower bank area often requires mechanical support (e.g. rock and/or groynes) during the plant establishment phase.

(d) Bed scour



Photo 9 – Bed scour

Photo 10 – Bed scour

Bed scour is the direct removal of material from the bed of the creek either by high velocity water flow (causing uniform scour along the bed), or the formation of a head cut (waterfall) that migrates up the creek.

Causes include: clearing of vegetation from the channel resulting in increased flow velocities (e.g. weed removal or de-snagging), changes in catchment hydrology (e.g. urbanisation and land clearing), or the exposure of weak (e.g. dispersive) soils below the existing bed.

Bed stabilisation with grasses and other flexible, non-clumping, ground covers may be suitable on ephemeral streambeds, otherwise the bed may need to be stabilised with rock. In gullies, the erosion may expose poor quality soils that will require appropriate adjustment prior to revegetation.

(e) Head-cut (gully erosion and lateral bank erosion)



Photo 11 – Active head-cut

Photo 12 – Lateral bank erosion

Head-cut erosion is a form of bed scour that normally results in a rapid drop in bed level (waterfall) that migrates up the channel. Lateral bank erosion is the erosion of the creek bank resulting from the entry of lateral inflows (usually stormwater) into the creek. The erosion usually takes the form of an upstream progressing erosion head (head-cut) that propagates laterally from the main channel forming a “gully”.

Causes include: lowering of the channel bed, inflow of concentrated stormwater runoff, or overbank floodwater re-entering the main channel.

Treatment normally involves hard engineering such as rock weirs, pool-riffle systems, and grade control structures. In gullies, stiff grasses such as vetiver grass, can be used to slowly stabilise and back-fill the gully with sediment.

(f) Fretting



Photo 13 – Wave induced erosion

Photo 14 – Example of fretting erosion

Fretting is the direct removal of erosion prone material from the bank of a creek by wave action. This erosion results in the undercutting and possible failure of the bank.

Causes include: wave action, exposure of erodible soils at the waters edge (e.g. boat movement along a river and water-skiing), or the removal of essential vegetation such as mangroves.

The bank can be stabilised through the formation of a sandy “beach” in front of the eroded bank. The beach acts as an effective energy dissipater for the waves. Alternatively, the bank can be stabilised with rock, either with or without vegetation.

Table 1 provides general guidance on the use of vegetation in the control of channel erosion.

Table 1 – Vegetation types and erosion control characteristics

Type	Scour control	Bank stability	Hydraulic issues
Aquatic plants	Provide good stability to the low-flow channel and waters edge.		
Ground covers	<p>The most effective form of soil erosion control.</p> <p>Ground covers (including grasses) generally control only soil scour (i.e. erosion of the surface layer), not the mass movement of soil resulting from bank failures.</p> <p>To be effective, ground cover plants should be flexible and continuous. Isolated, clumped plants may aggravate soil erosion.</p> <p>Plants with a matted or fibrous (horizontal) root system are the most effective on sandy soils.</p>		
Shrubs	<p>Shrubs can provide effective scour control if the branches prevent high velocity water from coming into contact with the soil.</p> <p>Localised soil erosion can occur around the edge of isolated plants.</p>		
Trees	<p>Usually provide little protection against soil scour.</p> <p>Some plants have root systems that survive when exposed to air. Such plants can control toe erosion.</p>		

Table 2 outlines the attributes of various short- and long-term channel bank stabilisation methods applicable during the channel revegetation phase.

Table 2 – Bank stabilisation methods during channel revegetation

Bank stabilisation method	Uses and attributes
Short-term measures	
	<ul style="list-style-type: none"> • Includes <i>Bonded Fibre Matrix</i> and <i>Compost Blankets</i>. • Low to medium shear strength, thus only suitable for low velocity channels. • Suitable for application on irregular surfaces and steep bank slopes. • <i>Compost Blankets</i> can provide a nutrient source.
	<ul style="list-style-type: none"> • Low shear strength, thus only suitable for low velocity channels. • Require good soil preparation and removal of surface irregularities from the bank.
	<ul style="list-style-type: none"> • Medium shear strength. • Generally suitable for the short-term protection of drainage channels and minor streams and creeks. • Typical design life in most environments of 12 to 24 months. • Do not represent a threat to wildlife.
	<ul style="list-style-type: none"> • Medium shear strength. • Plastic mesh can represent a threat to wildlife. • Generally not suitable for the stabilisation of watercourses where wildlife such as lizards, snakes and birds may be present.
	<ul style="list-style-type: none"> • Diversion of minor high-velocity flows away from seedlings planted close to the water's edge. • Protection of plants along the water's edge from wave action, particularly in lakes. • Must be used with extreme care if placed parallel to the stream flow, otherwise erosion may occur behind the logs.
Long-term measures	
	<ul style="list-style-type: none"> • High shear strength. • May be damaged by grass fires. • Generally not suitable for the stabilisation of watercourses where ground-dwelling wildlife such as platypus and bank-nesting birds may be present.
	<ul style="list-style-type: none"> • Used in areas where channel velocities are high, but near-bankfull flow velocities are low. • Commonly used to minimise the risk of bank erosion caused by minor flows during the revegetation phase.
	<ul style="list-style-type: none"> • Stabilisation of very steep channel banks, with or without vegetation. • Commonly used on the outside face of high velocity or sharp channel bends, or to minimise the risk of bank erosion caused by near-bankfull flows during the revegetation phase.



Photo supplied by Catchments & Creeks Pty Ltd

Photo 15 – Erosion control blankets



Photo supplied by Catchments & Creeks Pty Ltd

Photo 17 – Gabion



Photo 16 – Geo log

Photo 18 – Hydraulically applied blankets



Photo supplied by Catchments & Creeks Pty Ltd

Photo 20 – Rock & vegetation

Photo 19 – Jute mesh



Photo supplied by Catchments & Creeks Pty Ltd

Photo 21 – Synthetic reinforced blankets

Photo 22 – Vegetation