Bellinger Valley

MANAGING EROSION IN THE BELLINGER AND KALANG RIVER SYSTEM

What is Riverbank erosion?

Riverbank erosion is a process by which soils and other bank materials are moved by water or gravity and transported downstream. This can cause a loss of productive land and valuable habitat and can lead to impacts on water quality and aquatic habitats downstream.

Whilst streams and rivers naturally experience erosion, sediment deposition and other channel changes, the accelerated rates of erosion seen today are the result of the removal of native vegetation through land clearing, over-grazing and other development pressures.

Mechanisms of bank erosion occurring in the Bellinger and Kalang Rivers include:

- Sub-aerial erosion – this occurs when the bank is exposed to the weather and is subject to a variety of processes e.g. rainfall run-off and stock trampling.
- Wave-induced erosion – wind and boat wave action causes undercutting of the bank.
- Scour – the direct removal of bank and riverbed material by flowing water.
- Scour of the base (toe) of the bank can lead to:
  Slumping or Mass Failure – mass movement of soil downward into the stream. Slumps frequently occur in zones where the toe and upper banks are lacking vegetation or other protection and soils have become saturated during flooding rains.

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Erosion in the Bellingen Shire

When Europeans arrived in the Bellinger Valley, the river channel was narrower and deeper with more bends than now. Clearing led to increased bank erosion by fast-flowing floodwaters, which were no longer slowed down by riparian and flood-plain vegetation. During big floods the river channel cut through meanders, growing straighter and shorter; the Bellinger has lost more than 1.2km or 7% of its length since clearing began. This shortening of the channel has steepened the river, further increasing the potential for erosion. Today the Bellinger River channel is 2-3 times wider than before clearing, has up to10 times the flow capacity, and delivers up to15 times as much flow energy.

Bellinger- Kalang Estuary Erosion Study 2010

As part of Bellingen Council's Estuary Management Plan implementation process, an investigation into erosion processes in the Bellinger and Kalang estuaries has been a priority. The Bellinger-Kalang Estuary Erosion Study includes a thorough analysis of the current patterns of erosion occurring in the estuaries.

Findings from the study include:

- A lack of structurally diverse vegetation, unmanaged stock access, low cohesion of soils and in some sites wind and/or boat wave wash were found to increase susceptibility of banks to erosion in the Bellinger and Kalang estuaries.
- The Bellinger River erodes/migrates at a faster rate than the Kalang River. This is inferred to be a function of more cohesive bank materials and better quality and extent of riparian vegetation in the Kalang River estuary.
- A snap-shot survey of bank erosion undertaken in June 2009 revealed that of the 60.3km of banks in the Bellinger estuary, 32.4km (or 54%) are classified as stable, either naturally or through protective works. Minor levels of erosion occur over 19.5 km (32%) of the estuary's banks. Moderate to severe erosion occurs over 7.4km (14%) of the Bellinger estuary. In the Kalang River estuary, of the 60.5km of banks, 41.2 km (or 68%) of banks are stable, 12.8 km (21%) of banks are experiencing minor erosion and 6.5 km (10%) of banks are experiencing moderate to severe erosion.
- In comparison with earlier studies conducted in the early 1980's, the 2009 study showed a very large increase in minor erosion and a net reduction in moderate and severe erosion.
- Through this study, 28 sites of erosion significance were identified in the Bellinger/Kalang estuaries and assigned priority ratings based on a variety of factors including protecting infrastructure and conservation values.

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ARRANGE SITE VISIT

PLAN

FUNDING

CARRY OUT WORKS

Preparing to manage erosion

Getting professional advice on the best way to manage erosion on your property is an important first step. Because each site has specific factors influencing the causes of erosion (such as position on bend, land use, and conditions up-stream), a person trained in understanding river processes is needed to assess the nature of the erosion and plan any control works. Improvement of river health is an important goal that should always be considered when carrying out works on riverbanks, and therefore revegetation and regeneration of local native plant species is essential in any plan to restore a functioning riparian buffer.

1. ARRANGE SITE VISIT

Call Landcare or Council to arrange an initial site visit. Depending on the severity of the erosion a Catchment Management Authority (CMA) representative may also attend the site visit.

2. PLAN

Using advice provided, plan what you are going to do. For structural works, the CMA officer will draw up a site plan. For revegetation and fencing, Landcare and Council can provide advice and guides upon which your plan can be based. To keep costs down, the design of works can be guided by materials available on-farm and locally.

3. LOOK FOR FUNDING POSSIBILITIES

From time to time there are opportunities to gain full or part-funding for erosion control works. The likelihood of success is higher if your project includes substantial environmental benefits such as restoring habitat connectivity. To apply for funding, you will need quotes for materials and contractors and well-drawn plans to enhance your application. Landcare and Council can help with this.

4. CARRY OUT WORKS

- Apply for Permits – Check the Riparian Restoration Process Guide available from Council to see if the works you plan to do will need a permit and from which government department. If in doubt check with Council.
- Source materials – Try to obtain structural materials that are clean and free of soil and debris. This will prevent weeds, pests and diseases from being introduced into the river system.
- Undertake structural works – If possible use contractors who are familiar with riparian works.
- Carry out revegetation and fencing – Follow Landcare guidelines and always use local species.
- Maintain planting – Check recommendations and regulations on herbicide use near waterways.

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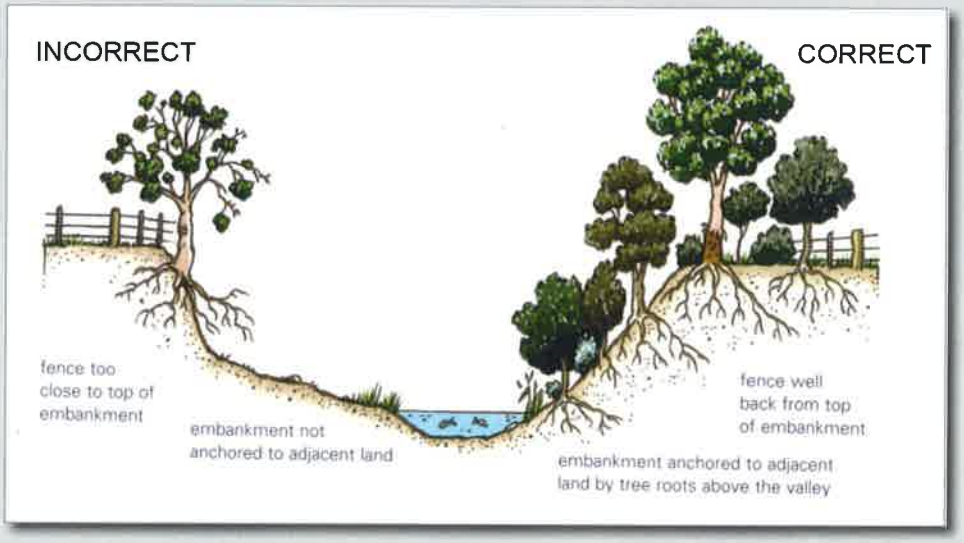
MANAGING EROSION IN THE
BELLINGER AND KALANG RIVER SYSTEM

Managing erosion – current Best Practice Techniques

The following techniques may be recommended for erosion control on your property.
Please note: Any works within the stream channel require permits.

Waterway with steep banks



Source - Stock & Waterways: a manerages guide

Fencing to remove stock and natural regeneration

A simple and low cost way to improve bank stability and river health is to manage stock access to allow natural regeneration to occur. Fences should be at least 5 metres from the top of the bank – and much further where the bank is higher and erosion is actively occurring. Natural regeneration is perhaps better suited to estuarine sites, where there is less weed growth than in fresh-water reaches. In freshwater reaches, fencing and revegetation and active weed control is a better option. In all cases, periodic monitoring and on going weed management will be crucial.

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Revegetation (freshwater & estuary)

Revegetation is recommended on almost all erosion sites, either as a stand-alone measure or combined with structural works. A well-vegetated riparian zone, including trees and ground cover, protects the bank from erosion by slowing water movement. Trees remove water from riverbank soil and prevent slumping.

When revegetating riverbanks for stability it is essential to plant at the toe of the bank, in or at the water's edge. Also, it is important to plant as wide a zone as possible. Planting on the bank toe, middle and upper bank leads to greater stability, as roots become interwoven, holding bank material together, with large trees anchoring the upper bank. It may also be wise to establish a 'sacrificial zone' revegetated with fast-growing species that slow erosion sufficiently for larger, slower-growing species to establish further back from the bank top. The key species for protecting the bank toe are Lomandra hystrix in freshwater reaches and Mangroves in the estuary. Two detailed guides are available to assist in designing and carrying out a revegetation project:

- Bellinger River Estuary Revegetation Guide
- Revegetating Streams in the Bellinger and Coffs Harbour Catchments

Manage River Oaks which are deflecting flows into bank (freshwater)

Gravel deposited during floods can form islands which are then colonised and "locked up" by River Oaks. This is a natural process, but can be a problem when River Oak islands deflect high-energy water flows into weak and unprotected banks. To alleviate the force of water against the vulnerable bank it is possible to cut or thin River Oaks to let the water flow through. This practice must be accompanied by increasing bank strength with structural works and revegetation.

Experts agree that removal of in-channel vegetation alone without the strengthening of the banks will not repair the channel sufficiently to reduce future damage to banks. Like all in-stream vegetation, River Oaks are protected by law, and managing them is a specialized skill. For further information refer to the Landcare pamphlet Managing River Oaks and other in-stream vegetation in Gravel-bed Rivers on the NSW Coast. Refer to contacts for further information and advice.

Battering of bank (freshwater & estuary)

In some circumstances battering or reshaping of the bank is necessary to achieve better revegetation or structural works. This approach alone (without revegetation and /or structural works) is unlikely to alleviate ongoing erosion.

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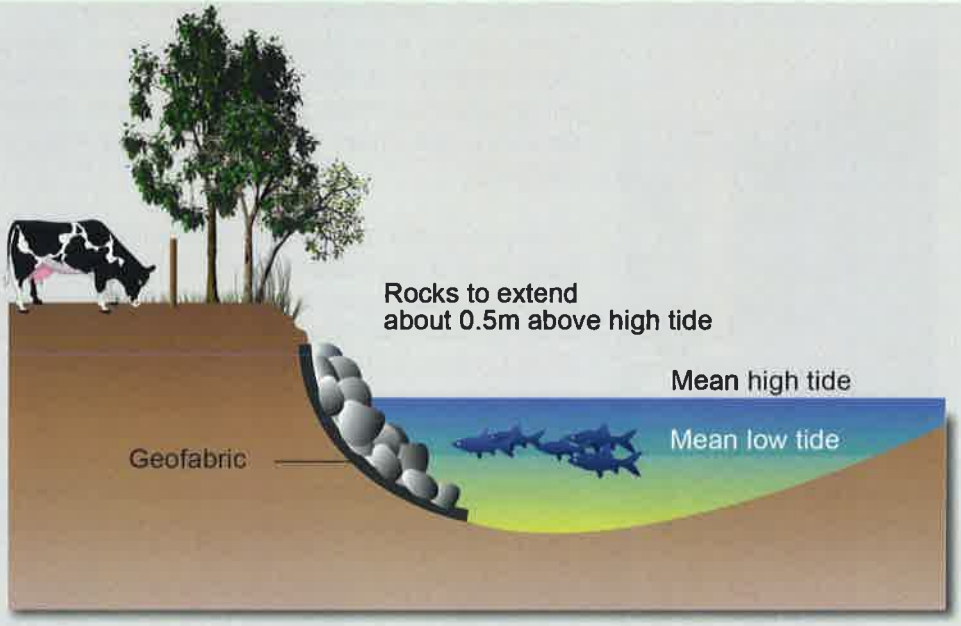
MANAGING EROSION IN THE BELLINGER AND KALANG RIVER SYSTEM

Rock Revetment cross section



Rock Revetment (freshwater & estuary)

A highly successful but relatively expensive technique, often recommended to protect valuable assets such as roads, bridge abutments and buildings. Hard, durable and chunky rocks of various sizes are placed against the base (toe) of the bank up to a height of 1 metre above the low flow water-level. Rock sizes needed are determined by stream power and flow velocity. Generally, rock is dumped on the bank and then arranged by excavator or bulldozer. Sometimes Geofabric is recommended beneath rock to prevent soil from washing out and undermining the works.

Hardwood Root ball revetment (freshwater & estuary)

Hardwood root balls from road construction projects and logging operations can be used to dissipate wave-wash energy from wind and boats and reduce river velocities during floods. Root balls are generally placed with the rough root end outwards and tied with cable to pins driven into the streambed or a low bank. In estuaries, hardwood structures have a limited lifespan due to copra and other organisms, and therefore must be re-enforced with revegetation. If possible Turpentine timber should be used.

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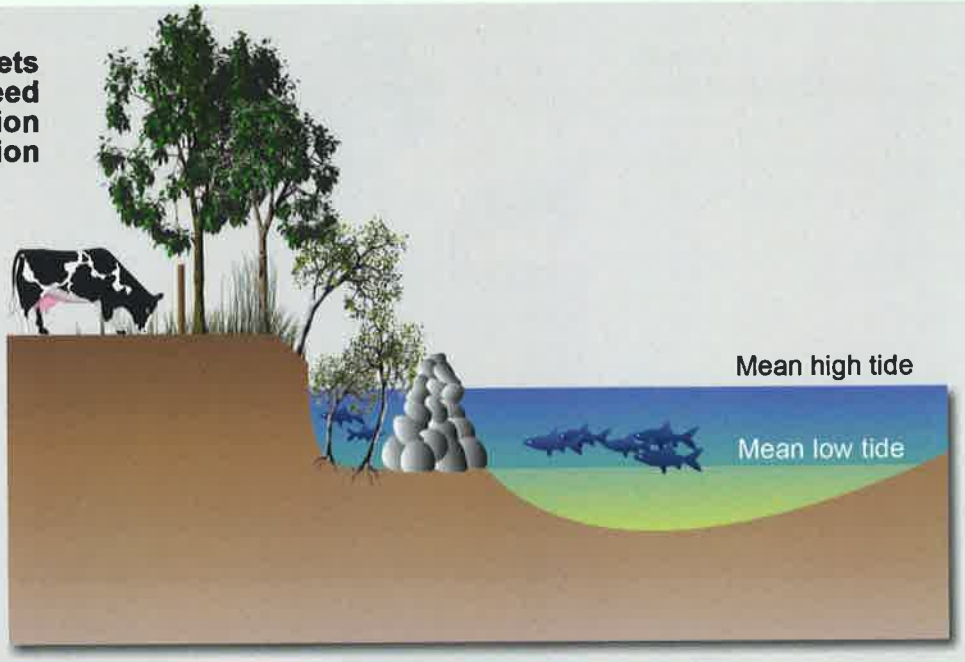
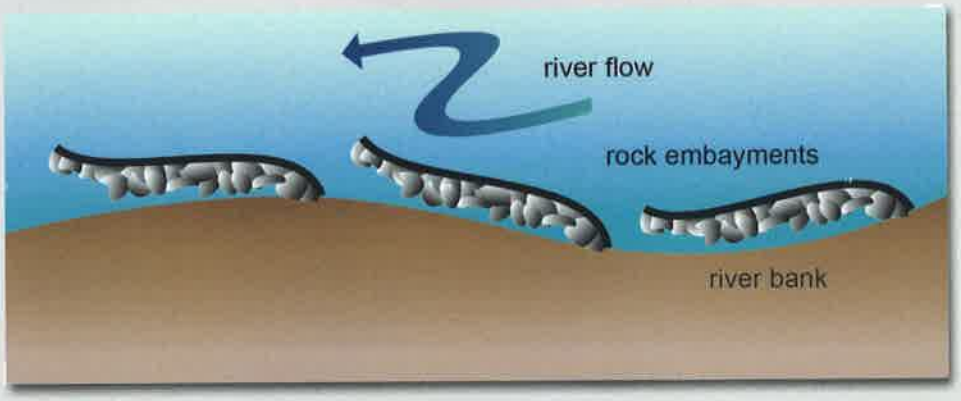
Rock embayments/fillets and mangrove/river reed regeneration cross section



Rock embayments/ fillets plan view



Rock embayments/fillets and mangrove/river reed regeneration (estuary)

A type of rock revetment principally designed to reduce the effect of waves from wind and boats. Rock embayments are constructed to the height of the mean high tide and have openings at the downstream end which allow water to flow behind them and deposit seeds and debris. This technique can only be used where there is a suitable bench upon which to construct the embayment. An excavator is used to place the rock.

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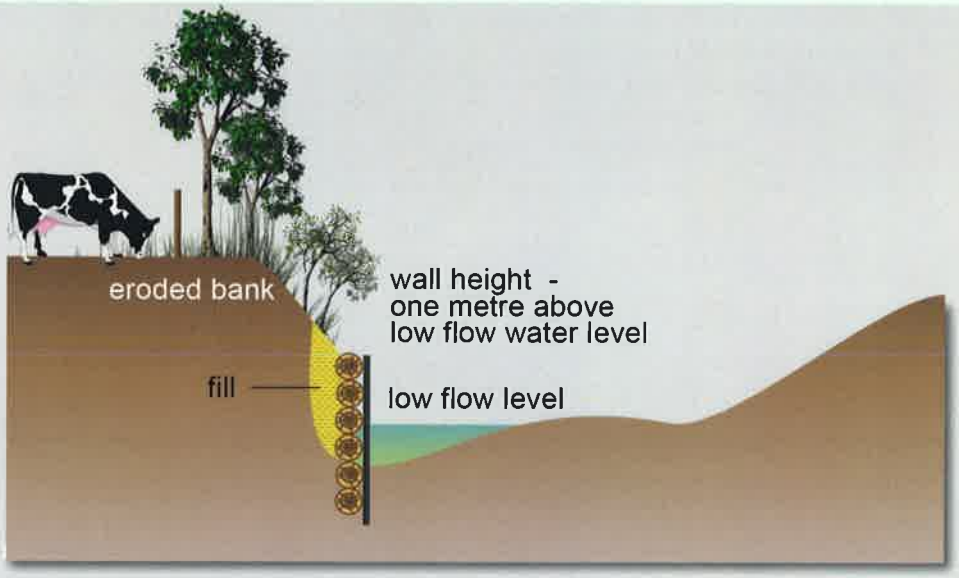
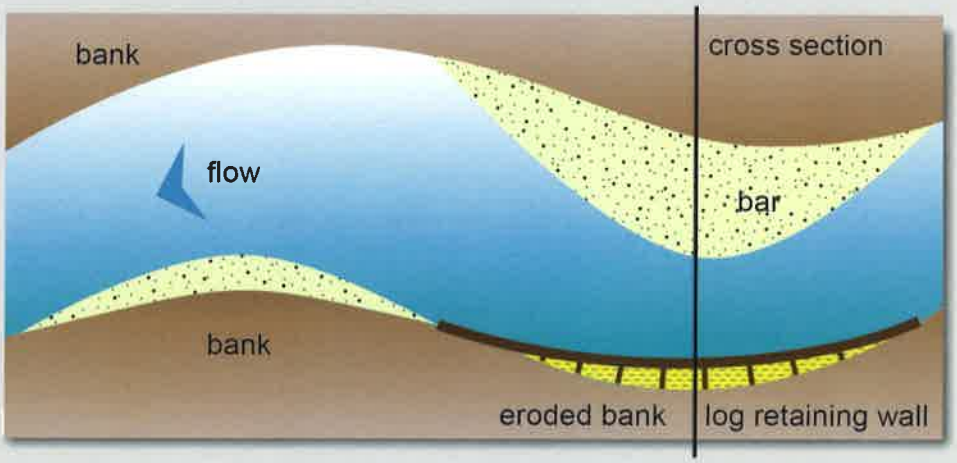
Log wall cross section



Log wall plan view



Log walls (freshwater & estuary)

Log piles are first driven into the stream bed by excavator and then logs are placed horizontally behind them and tied on using wire cable. Any remaining space between logs and bank should be filled with earth. Plant above.

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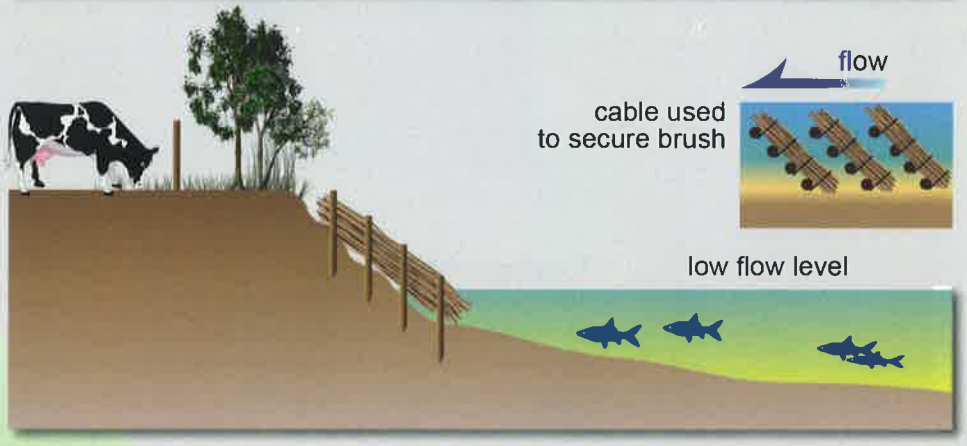
Pin groynes

Mesh Pin groynes

Brush Pin groynes



Timber pin groynes (freshwater & estuary)

A series of groynes made of timber piles are driven into the riverbed extending into the water angled in a downstream direction. These are designed to slow stream velocities, catch flood debris and rebuild the bank over time. Revegetate bank.

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MANAGING EROSION IN THE BELLINGER AND KALANG RIVER SYSTEM

Brush & Mesh groynes (freshwater & estuary)

A series of low walls built out of logs and brush or mesh is constructed along the eroded bank, extending into the stream. The walls slow the stream flow near the bank and direct it downstream. This allows sediment to deposit at the base of the bank. Very useful at sites where vegetation growing on an opposite bar has blocked part of the stream, deflecting flow into the bank. The vegetation can be cut and used to build groynes. For this technique piles are driven into the streambed and brush or mesh is placed on the upstream side, secured to the piles by cable. Revegetate bank. (Refer to diagrams on previous page)

Engineered log jam

Engineered Log Jam

Natural log accumulations in rivers tend to be very stable, providing long-term protection for banks. An engineered log jam is modeled on a natural log jam, and thus restores the natural character and in-stream biota of rivers. Hardwood logs with rootballs are buried in the gravel bed to anchor a structure of interlocking logs. Engineered log jams are pinned with log piles driven into the stream bed and also tied with cable. To protect the bank it is also necessary to key logs into the bank. Over time, flood debris and sediment accumulates around the log jam, resulting in the colonization of vegetation and restoration of the bank profile.

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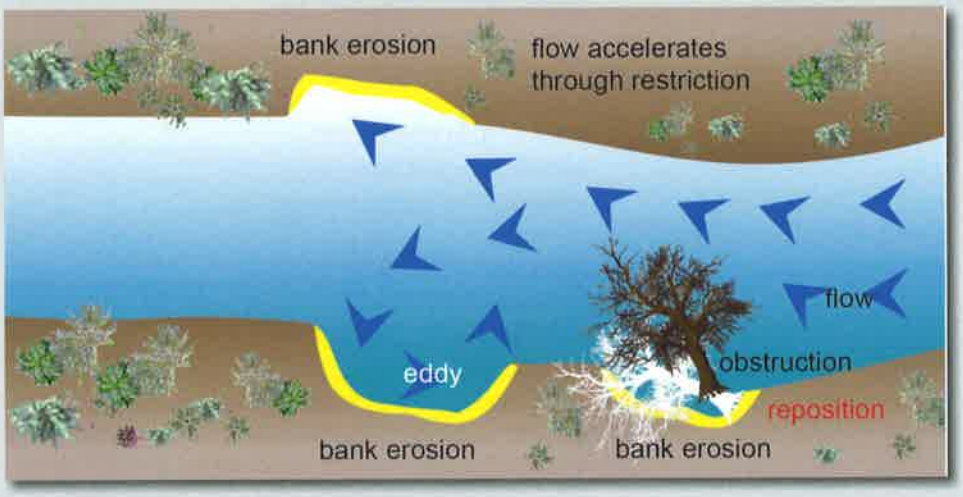
BELLINGER AND KALANG RIVER SYSTEM

Log alignment and positioning



Log alignment and positioning (freshwater and estuary)

Sometimes fallen logs can cause bank erosion through associated bank collapse and by directing the flow into the bank. This is usually only a problem with large individual trees not supported by surrounding vegetation. Fallen logs can actually be useful in protecting the toe of the bank from erosional flows if they are repositioned at an angle of 40 degrees or less to eroding bank, root ball upstream. Ideally the root ball should be secured into the bank toe. This provides armouring against the flow and encourages water to move down the centre of the channel. Accompanying revegetation is crucial to ensure long term resilience.

Further Information

- Bellinger and Kalang River Estuaries Erosion Study (2010). Telfer, D. and Cohen, T.
- Doing it by the book: Process Guide for Undertaking Structural Works in the Bellinger & Kalang Rivers, (2011). Matthews, C. & Rickert, A. Bellingen Shire Council/Bellinger Landcare.
- Revegetating Streams in the Bellinger and Coffs Harbour Catchments- A Guide to Species, Planting Locations and Planting Methods (2007). Northern Rivers Catchment Management Authority.
- Bellinger River Estuary Revegetation Guide. Compiled by Bellinger Landcare
- Managing River Oaks and other in-stream vegetation in Gravel-bed Rivers on the NSW Coast. Bellinger Landcare Inc and Tim Cohen.

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For Advice contact

Bellinger Landcare Inc
Phone: (02) 6655 0588
belland@westnet.com.au
www.bellingerlandcare.org.au

Northern Rivers Catchment Management Authority
Phone: (02) 6653 0150
northern@cma.nsw.gov.au
www.northern.cma.nsw.gov.au

Bellingen Shire Council
Phone: (02) 6655 7300
www.bellingen.nsw.gov.au

Land and Property Management Authority, Crown Lands Division
Phone: Grafton (02) 6591 3500 Coffs Harbour (02) 6691 9610
Information on Natural boundaries including riparian boundaries
http://rgdirections.lands.nsw.gov.au/deposited_plans/natural_boundaries

NSW Office of Water (DECCW),
Grafton, Phone (02) 6641 6521
Information on approvals and link to controlled Activity Application Form
http://www.water.nsw.gov.au/WaterLicensing/Approvals/Controlled-activities/default.aspx

Acknowledgements: Prepared by Flametree Ecological Consulting with assistance by Bellinger Landcare Inc. A joint funded project by Bellingen Shire Council and Department of Environment, Climate Change & Water under the Estuary Management Program: Developing capacity building and education strategies to address future impacts of climate change and manage and improve the health of the Bellinger and Kalang Rivers.

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