

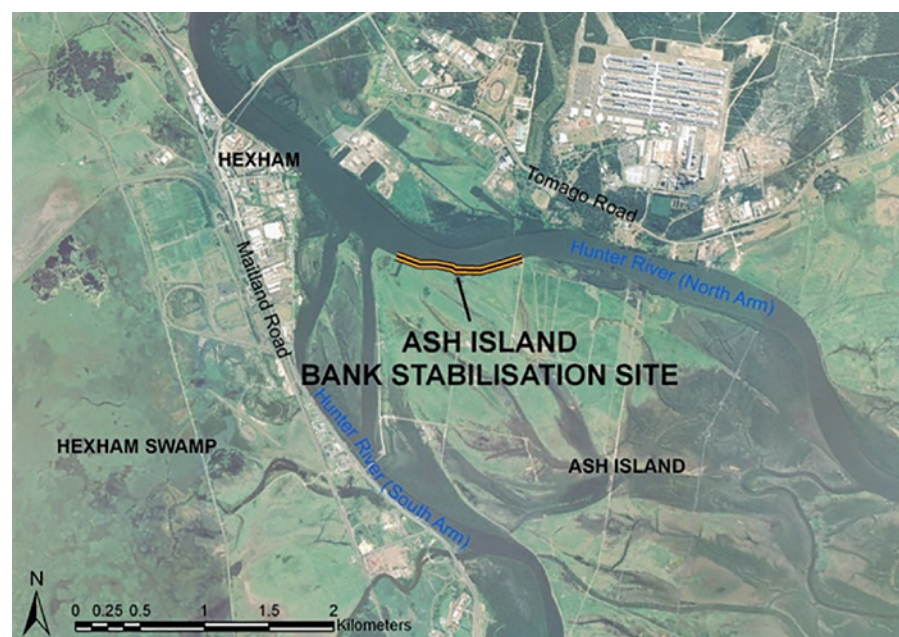
## CASE STUDY

# Scott's Point rock fillets – fish friendly erosion mitigation

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A consortium of government partners remediated 1000m of actively eroding bank on Ash Island in the Hunter River using a range of innovative and environmentally sensitive methods. The project has proven highly successful at both halting and reversing the erosion and facilitating the return of dense mangroves to the foreshore. The \$223,000 funding for rock works and riparian planting was sourced from a range of State and Federal government sources.

## Project need



Large reaches of banks of the lower Hunter River had unnaturally high rates of erosion including Scott's Point on the north eastern banks of Ash Island. This low-lying island is located in the North Arm of the Hunter River about 1.5km from Hexham and 18.5km (river length) upstream of the Hunter River mouth (Figure 1).

Figure 1. Aerial image of the project site at Ash Island.  
Source: Google Earth.

Excessive bank erosion damages the near shore environment, can have long-term impacts on downstream aquatic habitat and degrades water quality through increased turbidity and sedimentation. Continual pressure from erosive wind wave wash, fluvial and tidal processes as well as anthropogenic impacts such as excessive boat wash from recreational boating and denuded riparian zones resulted in an ongoing loss of alluvial soils at Scott's Point. Bank erosion was threatening infrastructure including an access road, navigation signs and power lines (Figure 2).

Past attempts to protect against bank erosion at small areas of Scott's Point, used rock revetment and alternative measures including stock exclusion, riparian revegetation, transplanting *Juncus sp.* (rushes), bank battering and jute matting. However, the benefits of these works were outpaced by the high erosion rates.



Figure 2. a) and b) Depicting bank erosion at Scotts Point.

## Project Steps

### Understanding the problem

In 2008 the Hunter estuary was identified as a national Coastal Hotspot by the Australian Government. The Hunter catchment is heavily populated and industrialised, with high value agriculture and mining across large areas, but the estuary was recognised as still providing significant ecological services such as water quality benefits, and habitat for fish and migratory shorebirds. However, large sections of the lower estuary were at risk of continuing ecological quality decline.

Priority river bank erosion sites were identified during previous assessments. The Hunter Hotspots project aimed to reduce the ecological risk at these priority sites by improving riparian vegetation and bank stability, and increase the community's awareness of and capacity to undertake environmentally beneficial bank protection measures.

No formal assessment to identify the causes of erosion on the river banks at Ash Island was undertaken. However, it was assumed that the causes were likely to be similar to those identified by GHD in the 2006 report on erosion issues in the Williams River (GHD, 2006), namely a combination of anthropogenic activities such as boat wake, historical riparian clearing and nearby channel dredging, combined with natural processes such as floods, wind waves, catchment runoff, soil type and tidal influence.

The combined forces of these activities were expected to continue at Scott's Point which would have resulted in further environmental degradation and the eventual loss of infrastructure.

### Design and planning

A number of options were considered for the site:

1. **Rock revetment (lining the bank with rock)** – historically widely used, although an expensive option and not as environmentally sensitive as other more modern techniques.
2. **River bank revegetation** – high risk of failure due to the high erosion rates. Revegetation alone had been used previously at the site but was inadequate to effectively control the erosion.
3. **Rock fillets** – protect river banks by reducing erosion rates and encourage the natural recovery of mangroves (combined with top-of-bank riparian restoration).

Rock fillets are energy dissipating structures constructed to mean high water level in front of an eroding bank. These structures absorb wave action and create an area of still water between the fillet and the eroding bank. This still water area encourages the accumulation of sediment and provides a habitat that is suitable for the natural regeneration of mangroves or reeds. This erosion control method is only appropriate for areas where there is a wide enough intertidal bench in front of the bank. Generally, rock fillets are keyed into the riverbank at the upstream end and laid parallel to the bank, overlapping each other at the downstream end, allowing tidal flushing, fish passage and natural recruitment of mangrove seedlings into areas behind the structure.

Rock fillets built over the last 15 years have proven very successful in the recovery of river banks in numerous NSW estuaries, including the Wallamba and Manning River estuaries (Figure 3).



Figure 3. Rock fillet erosion control at Dumaresq Island, Manning Estuary showing supported mangrove growth.

Rock fillets were chosen as the most appropriate design option for the majority of the Scott's Point site. The project also included significant riparian planting of locally sourced native vegetation behind the rock fillets.

### Designing and building rock fillet erosion control structures

Full rock fillets were the primary method used along the reach, but rock revetment, low fillets, bank battering and toe protection works occurred strategically considering local circumstances and to reduce costs. Designs were developed by staff from the NSW Soil Conservation Service (Newcastle) in consultation with NSW Department of Primary Industries, Hunter Catchment Management Authority (Hunter CMA) and the National Parks & Wildlife Service (NPWS).

Approximately 484m of full rock fillets were constructed along three main stretches of river bank where significant undercutting or vertical erosion (0.5 – 1m+) was occurring and there were no or few existing mangroves. Rock fillets were 1 to 2m wide, 10 to 30m in length, and constructed to within 300mm of mean high water mark. They were constructed 2 to 4m (minimum) away from eroding banks on intertidal benches, working around any established mangroves and providing sufficient space for future mangrove seedlings to establish.

Juvenile mangroves had established along another 127m reach, however the benefits gained from their sediment retention properties were being out-paced by river erosion and their roots were being rapidly exposed. A single line of low fillet protection rocks was placed along this length to shield the sediment from waves at low tide only.

Other areas, particularly around a Maritime marker had existing rock revetment in place that was incomplete or had developed gaps. Additional revetment work was carried out at these locations to ensure a continuous stretch of protection.

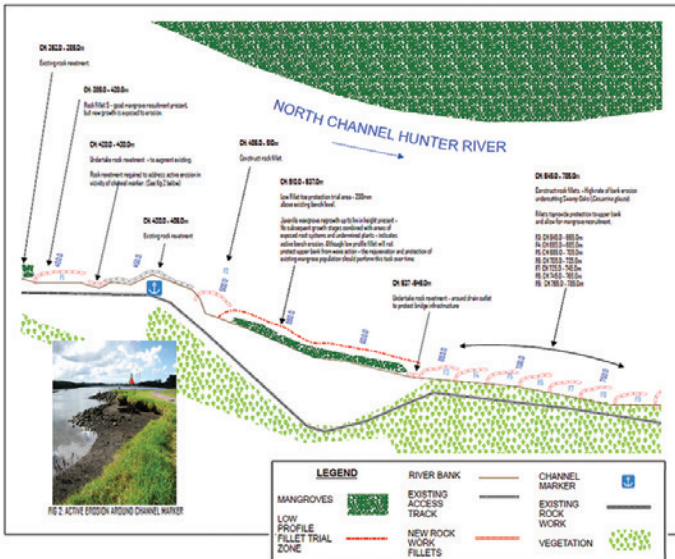


Figure 4. One of four plan diagrams for the rock fillet construction works.

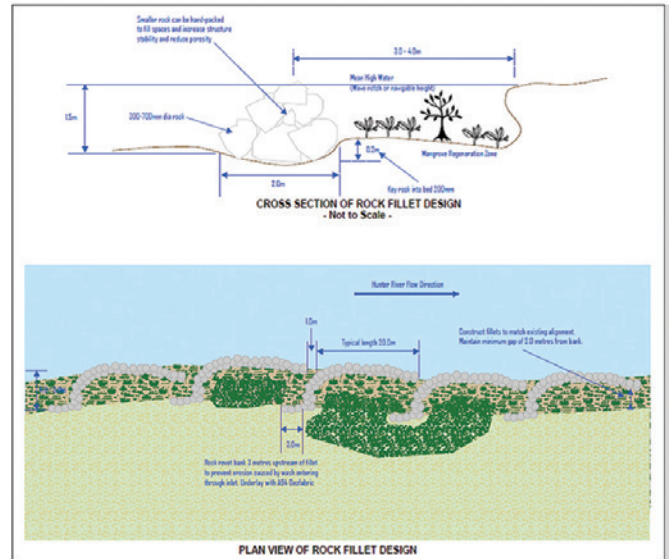


Figure 5. Plan view and cross section of rock fillet design.

## Construction specifics

The works were completed in 3 stages during 2011-12 by the NSW Soil Conservation Service. Details of the construction of works were:

- Access to the site occurred via existing roads.
- Rigid body trucks were used for rock delivery from a local quarry and an 8 tonne excavator was used for rock placement.
- Material used included quarried rock of 100mm – 800mm long axis diameter and geotextile fabric.
- Some limited vegetation trimming and removal was required to gain machinery access to the river banks for the placement of rock fillets.
- A silt curtain was installed around the works site during rock placement to limit impacts of bed disturbance.
- Geotextile fabric was placed where the L-shaped rock fillets were keyed into the river bank to limit erosion beneath rock structures.
- Rock fillets were constructed as detailed in designs.
- Rock revetment used quarried rock placed at the toe of the river bank.



Dense trees, shrubs and ground cover plants were planted in a 2.8ha area (1000m frontage) behind the rock fillets. Plants were sourced from local suppliers, particularly Kooragang Landcare. The plants were installed by local natural resource management and volunteer groups including teams from Kooragang Landcare, Awabakal Green Teams and Conservation Volunteers Australia. Project specific tours and capacity building / working bee field days were conducted with project partners and a broad array of stakeholders including community, industry groups, State and Australian Government.

Figure 6. Rock fillet construction underway.

## Successes and lessons learnt

The project has successfully controlled bank erosion along 1000m of Hunter River foreshore and partner, stakeholder and general community feedback has been positive. Photopoints established along the length of the affected reach, demonstrate the establishment of mangroves behind the fillets in the newly stabilised intertidal bench whilst also clearly indicating the success of riparian plantings.

The work site was affected by a minor flood event during construction and has endured a number of subsequent large scale floods. While considerable flood wrack, including some large logs, has been deposited on them during these events the structures remain in place and their integrity retained.

The mid-construction flood deposited a noticeable layer of sediment behind the rockwork, and was very successful at covering the exposed roots of juvenile mangroves protected by low fillets (Figure 10c). Some rill erosion occurred at gaps between the low fillet rocks and it may be advisable to use either more smaller rocks during construction, fill in the gaps between larger rocks using smaller ones by hand or place two rows of rocks. Overall, this lower fillet technique worked very well at protecting established juvenile mangroves at a significantly reduced cost to full size rock fillets.

Project activity planning required that all rock work be completed prior to riparian planting. A 15 year Maintenance Agreement was developed between the Hunter CMA (now Hunter Local Land Services) and Kooragang Wetlands Project to ensure ongoing future maintenance of the newly planted area.

This approach of addressing foreshore erosion issues and wider riparian zone problems has successfully demonstrated the need for holistic approaches to river bank restoration to ensure the maximum environmental outcome from the investment.



Figure 7. a) Photo point 10, highly undercut eroding bank before works, 2011.



b) Photo point 10 post works, July 2011.



c) Photo point 10 with mangrove recruitment, deep sediment accretion and established riparian vegetation, April 2017.



Figure 8. a) Photo point 7, undercut banks, failing riparian vegetation before works, 2011.



b) Photo point 7 post works with minor flood wrack, July 2011.



c) Photo point 7 with mangrove recruitment, deep sediment accretion and established riparian vegetation, April 2017.

### Fish habitat extras

Whilst rock fillets provide a more environmentally conscious technique of erosion control than historical engineering methods such as rock revetment, further options for enhancing the benefit of these structures for local fish habitat are also available. By enriching the complexity of the rock fillet structures through the incorporation of habitat features such as reef balls or large woody habitat (snags), more opportunities for colonisation by aquatic biota are created. Early indications of bank erosion mitigation and mangrove establishment are promising, with mangroves flourishing at trial sites.



Baited remote underwater video (BRUV) monitoring of additional reef ball structures located in close proximity to reef ball fillets in the Bellinger River identified a diverse fish community rapidly developed over a 2 year period post installation. A range of commercially and recreationally important fish species including Yellowfin Bream, Luderick and Mangrove Jack were identified, while a small number of protected species such as Estuary Cod were also seen.

**Inset: Rock fillets incorporating timber pins and concrete reef balls installed in the Bellinger River estuary, mid north coast NSW.**



Figure 9. a) Photo point 4 before works March 2010, vertical banks and at risk mangrove recruitment.



b) Photo point 4 post works July 2011, showing full scale rock fillet in foreground, low fillets beyond.



c) Photo point 4 with mangrove recruitment and stabilised bank, April 2017.

## Quick facts

Project overview	Reduce bank erosion on a highly erosive island foreshore. Improve riparian vegetation and habitat for fish, retain productive soils and protect infrastructure.
Location	Scott's Point Ash Island, North Arm lower Hunter River (Newcastle Local Government Area).
Cost and time	Total project cost for design and construction \$223,000. Construction and planting completed over about 12 month period in 2011-12.
Funding and technical support	Funding for planning, design and construction from NSW Estuary Management Grants, Habitat Action Grant NSW Recreational Fishing Trust and Australian Government's Caring for our Country. Technical support from NSW DPI Aquatic Habitat Rehabilitation Unit and Soil Conservation Services.
Key project facts and outcomes	1000m of highly eroding Hunter river bank stabilised and rehabilitated. Dense riparian plantings were installed over 2.8ha and natural regeneration of native species was supported including mangroves and saltmarsh.
Project partners	Soil Conservation Services - contracted to develop designs and undertake construction works. National Parks Wildlife Services - adjacent land owners on Ash Island. The Hunter Central Rivers CMA (now Hunter Local Land Services), Newcastle City Council, NSW Recreational Fishing Trusts, and Australian Government all contributed funding.



Figure 10. a) Photo point 5 at risk juvenile mangroves, low fillet area before works, March 2010.



b) Photo point 5 juvenile mangrove low fillet area post works, July 2011.



c) Sediment deposition and minor rill erosion at low fillets following minor flood.



d) Photo point 5 juvenile mangrove low fillet area with mangrove recruitment and stabilised bank, April 2017.

## Planning and approvals

- No development consent was required for bank erosion stabilisation works under the *State Environmental Planning Policy (Infrastructure) 2007* by public authorities, therefore works were considered under Part 5 of the *Environmental Planning and Assessment Act 1979* through a Review of Environmental Factors.
- A permit was required for dredging and reclamation under the *Fisheries Management Act 1994* from NSW Department of Primary Industries (Fisheries), as the rock fillets were constructed on the seaward of the erosion scarp in the intertidal zone of the Hunter River, classed as Key Fish Habitat.
- A permit was required for harm to marine vegetation under the *Fisheries Management Act 1994* from NSW Department of Primary Industries (Fisheries), due to minor mangrove branch cutting required for heavy plant to access the work site.
- Land Owners Consent under the *Crown Lands Act 1989* was required by NSW Department of Industry, Lands and Forestry division, as part of the land (river bed) on which the works occurred is Crown Land.
- Access Approval was required from National Parks and Wildlife Service (NSW Department of Environment, Climate Change and Water) as access was required through National Park land to conduct the works.
- Concurrence for the proposed works was obtained via provision of the REF from NSW Department of Environment, Climate Change and Water, Newcastle City Council, NSW Maritime.
- An Awabakal Local Aboriginal Land Council heritage survey was conducted at the project site with no cultural heritage material found.
- Support for the proposal was additionally provided via review of the REF from Hunter Central Rivers Catchment Management Authority and the Hunter Coastal Hotspots project steering committee.



## Softer solutions



**Coir logs** (densely packed coconut fibre bound together with coir netting) staked horizontally along the toe of riverbanks and in strategic sites upon the bank can provide short-term protection for re-establishing vegetation. The coconut fibre is biodegradable, gradually breaking apart through exposure to water movements and weather and as such do not provide long-term bank stabilisation. Coir logs are relatively inexpensive compared to other techniques, lightweight and easily installed by hand. They are flexible, curve easily around banks and existing vegetation and can be used as a single row or to create terraces. This technique is applicable at sites of low rates of erosion with low water velocity applied in unison with revegetation and stock management fencing, where required.

Image credit: Brunswick Valley Landcare.



**Brush bundles** are locally-sourced cut branches tied with biodegradable cord and entrenched in a woven pattern between closely placed driven poles to create quite robust low 'fences' on the intertidal flat in front of an eroding bank. Brush bundles have been extensively implemented in Europe and America during the past 100 years as it is often a practical and cheaper alternative to conventional engineering works. The technique is applicable for banks with low-level erosion (scour/undercutting) that are susceptible to low to medium flow velocities and low to medium wave heights. It can also be applied to heavily eroded banks if the area is accessible for machinery to regrade and compact the soil. The bundle structure generally has a life between 5 to 10 years while vegetation is established. Long-term stability relies on the success of establishing vegetation.

NOTE: Always consult with your local Council prior to undertaking any foreshore works or adjustments. They will be able to provide information on what approvals may be required and which government agencies provide these.

## References

GHD (2006) *Williams River Bank Erosion Study*. Report to Port Stephens Council.

## Find out more

Fish Friendly Marine Infrastructure is a NSW Department of Primary Industries (Fisheries) developed program. This project has been assisted by the NSW government through its Environmental Trust. More information on Fish Friendly Marine Infrastructure can be found at: [www.fishhabitatnetwork.com.au](http://www.fishhabitatnetwork.com.au), or by calling the NSW Department of Primary Industries (Fisheries) Aquatic Habitat Rehabilitation team on 02 6626 1396.

To find out more about the Scott's Point rock fillets project also contact the NSW Department of Primary Industries (Fisheries) Aquatic Habitat Rehabilitation team.

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