Reef Trust IV
MACKAY WHITSUNDAY STREAMBANK EROSION PROGRAM

Reef Trust IV (the Project) is a gully and streambank erosion control project funded by the Australian Government as a part of the Reef Trust investment program to support the delivery of the Reef 2050 Long-Term Sustainability Plan (Reef 2050 Plan)

The Reef Trust IV project primarily seeks to reduce fine sediment loads entering the Great Barrier Reef (GBR) lagoon from agricultural landscapes. Additionally, the program also seeks to:

- Test the use of remediation approaches across a range of gully and stream bank environments to guide investment in sediment reduction programs
- Increase protection of riparian habitat
- Seek continual improvement of understanding and capacity to manage sediment losses
- Build a legacy of capacity to address erosion from these landscapes into the future.

The Reef Trust IV project in the Mackay Whitsunday's focuses solely on streambank erosion control in the O'Connell Basin. This included four reach scale projects including: Lower O'Connell River, Upper O'Connell River, St Helens and Murray Creeks.

Key Outcomes:

- Modelled sediment reduction of 10,356 tonnes of fine sediment at the coast per annum.37 project sites on 31 properties
- 11 engineered sites
- More than 70,000 trees planted along approximately 25 ha of riparian corridors
- Riparian fencing has protected over 45 ha of riparian area, with 20 off-stream watering points installed
- Engaged 23 local businesses and invested into the local economy

The O'Connell Basin covers approximately 2,387 km² between Mackay and Proserpine in central Queensland with roughly 1,750 kms of major stream network. The basin's predominant use is grazing on native pastures with sugarcane production also covering a large proportion of the basin. The dominant geology within the basin are granites and mixed volcanic sedimentary with some large alluvium pockets in the floodplains.

The O'Connell River, St Helens Creek and Murray Creek have been classified as high priority within the O'Connell Basin, as all three systems export large sediment loads to the GBR lagoon. They predominantly have a macro channel configuration which is confined by terraces and the bedrock valley margins. Through meander migration, inset floodplains have been found to release the most amount of sediment into these waterways. Catchment and riparian vegetation have been significantly cleared throughout the O'Connell Basin which has increased rainfall runoff with the basin recognised as one of the highest anthropogenic contributors in terms of tonnes per km² exported to the coast (Table 5 Chapter 2, Scientific Consensus Statement, 2017).

Analysis from two LiDAR datasets of the O'Connell River and St Helens and Murray Creeks collected in 2009 and again in 2018 identified approximately 2.9 million m³ of streambank erosion over the nine years lost along 82.5 kms of the channel (i.e. 165 kms along both sides of the river). Of the volume lost approximately ~26 percent (758,000m³) of the total came from major stream bank erosion sites with the bulk of the erosion coming from along the length of the channel i.e., non-major erosion sites.

To address streambank erosion the Reef Catchments Reef Trust IV project sought to implement mostly low risk solutions such as cattle exclusion fencing, weed control and revegetation. High risk solutions utilising engineered approaches were only implemented at very active erosion sites (i.e., erosion hot spots) due to cost of implementation and risk of failure. It's also generally accepted that engineered approaches shift the focus of erosive stream energy downstream and reduce the overall net benefit of a reach scale approach.

Engagement – Social and Community Outcomes

The Project sought to work along continuous stretches of each waterway and therefore engagement with all landholders with river frontage was essential to develop and connect project sites. Reef Catchments utilised a landholder database from years of engagement and known local champions to identify landholders and arrange an initial meeting. Through desk top assessments, LiDAR analysis, and landholder identification and engagement, Reef Catchments were able to develop a well connected reach scale project. Having the desktop assessment and LiDAR analysis available for meetings with landholders helped to highlight the rates of erosion and the key erosion processes. This assisted with development and planning of key activities to minimise future erosion which the landholders actively participated in.

The main social objective of the Project was to increase landholder appreciation and capability for implementing best practice waterway management. The engagement component of the Project is designed to take landholders on a practice change journey from degradation and financial losses to restoration and financial gains available through strategic natural resource management. The Project also set foundations for successful delivery of region-specific catchment scale restoration programs. The scale of the Project allowed Reef Catchments to invest heavily in increasing the capacity and skillset of local contractors. This has not only expanded local knowledge, but also increased regional economic stimulus and built a foundation of skilled contractors for potential future works. Some of the contractors and groups engaged include Landcare groups, nurseries, quarries, landscapers, and earthmovers. On-going project legacies - in the form of community engagement, local contractor upskilling and strengthening landholder relationships – increases community ownership of sites, and will ensure project learnings and achievements are recognised into the future.

"The Mackay Natural Environment Centre (MNEC) team and volunteers have grown more than 60,000 local provenance plants for the Reef Trust IV Project. Our relationship with Reef Catchments has enabled MNEC to expand and increase our team's knowledge of how to deliver quality planting stock on time with resilient species that not only benefits our local region but also the Great Barrier Reef."

– Sue McCormack, MNEC Coordinator

Methodology for the quantification of sediment savings:

Methodology for quantifying historical sediment loss:

Establishing the historical streambank erosion from a site was calculated in two ways, depending on whether specific hotspots of erosion were being targeted, or whether interventions were designed to have an effect at the reach scale. For both approaches a Digital Elevation Model of Difference (DEMoD) was created and analysed comparing datasets from 2009 and 2018 along both sides of the river for 47 km (94 km of streambank).

For all sites eroded mass was calculated as:

$$\textit{Eroded Mass (t)} = \textit{Eroded Volume } (m^3) \times \textit{bulk density} \times \textit{\%fines} \quad \text{Eq. 1}$$

Where major erosion hotspots were identified (e.g. bank collapse) and quantified the historical sediment erosion rate was calculated as:

$$\text{Hotspot Erosion Rate} = \frac{\textit{Eroded Mass} \times \textit{Bulk Density} \times \textit{\%fines}}{\textit{No. of Years between Lidar Captures}} \quad \text{Eq. 2}$$

This value was then corrected for streamflow using:

$$\textit{Streamflow Correction Factor} = \frac{\textit{Mean Annual Flow across entire record}}{\textit{Mean Annual Flow between Lidar Captures}} \quad \text{Eq. 3}$$

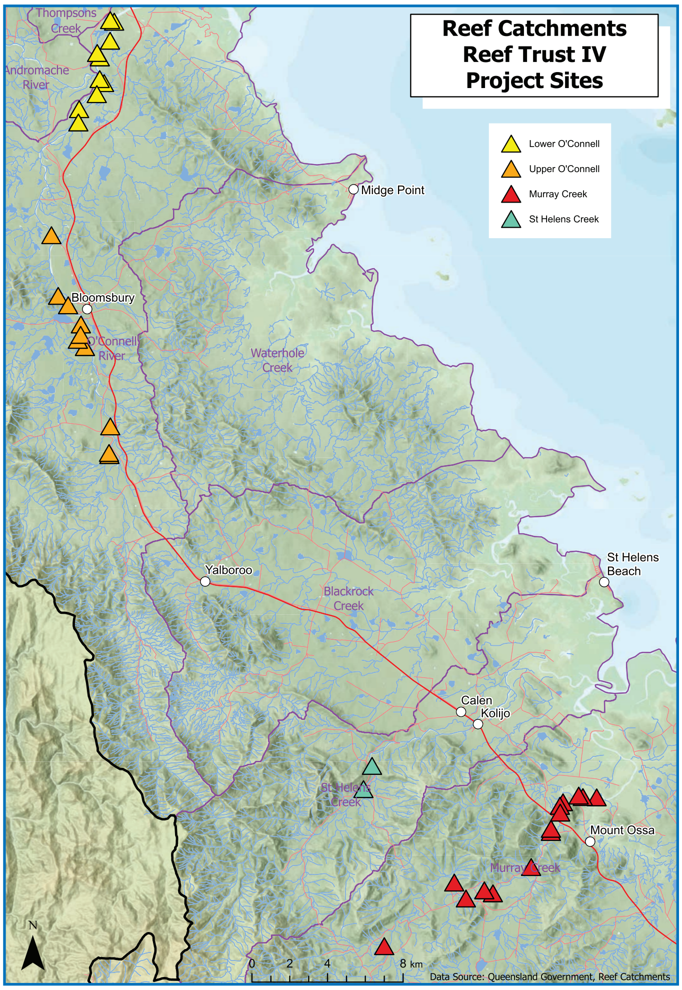
with the expectation that wetter years should result in higher rates of erosion than average. For the lower O'Connell project the years between LiDAR capture had 24% more flow than the entire gauge record (since 1976). For the remainder of sites (i.e. non hotspots) historical rates of erosion were apportioned equally throughout the entire reach to enable assigning sediment savings to interventions undertaken at locations where erosion may have been slight. This was done on the understanding that interventions such as revegetation will likely see reductions in erosion throughout the reach, hence revegetation efforts do not necessarily align with observed erosion hotspots. For these sites historical erosion rate for the entire reach captured within the LiDAR, excluding the hotspots, was calculated using:

$$\textit{Annual rate of non-hotspot erosion (t/yr)} = \frac{\textit{(Total Eroded Mass throughout 47km-Sum of Hotspot Erosion)}}{\textit{No. of Years Between Lidar Captures}}$$

This was then apportioned amongst non-hotspot interventions using:

$$\textit{Site proportion of non-hotspot erosion} = \frac{\textit{Length of Intervention}}{\textit{Total length of Reach-Combined Length of Hotspots}}$$

Finally, apply the same Streamflow Correction Factor described in Eq. 3 to the Site proportion of non-hotspot erosion.



Key Facts on Streambank Erosion and management

- Streambank erosion is increased in areas with poor riparian vegetation health (i.e., poor species diversity, bare soil/no ground coverage). Riparian vegetation should be allowed to establish along top of bank, down the bank slope and in-channel which acts to reduce peak velocities.
- Structurally diverse root systems made up of trees, shrubs and grasses work together to bind soil and act to minimise erosion.
- Meander migration is the dominant driver of streambank erosion in the Mackay Whitsundays. Outside bends with little to no vegetation have the highest rates of erosion. Pre-emptive management to address any lack of vegetation should be a high priority.
- There are three main processes that cause streambank erosion – scour, mass failure and slumping. The cause of the erosion needs to be determined to ensure an appropriate management strategy.
- Cattle accessing the river for water is a key driver of stream bank erosion. Riparian fencing and off-stream watering points should be installed where possible. If this is unworkable from a management perspective, armouring cattle access to the river will likely reduce future bank erosion issues.

Key Learnings:

- All rivers move and erosion is a natural process which can be event driven or gradual. Understanding the governing geological and hydrological factors of a river system helps identify erosional processes and inform project planning.
- Revegetation sites need to be carefully considered so that plants are tailored to the appropriate Regional Ecosystem, occupy specific environmental niches along the riparian zone (i.e., grasses/lomandras along bank toe, taller trees in the middle to upper bank) and have diverse rooting depths and growth speeds. This should also be planned with the landholder to avoid any risk of shading out cropping land.
- Budget allowances need to be made for ongoing site maintenance, watering schedules and, if needed, a feral animal control program to ensure the successful long-term establishment of rehabilitation sites.
- Landholders are more willing to engage and cooperate when extra efforts are made to provide them with project context, rationale, and evidence of streambank erosion.
- Site success is dependent on not only the amount of sediment saved each year, but also the establishment of strong community relationships, where landholders, contractors and stakeholders are invested in and care about the project sites. Having strong community buy-in helps ensure the longevity of the rehabilitation sites after project closure.
- Address the cause and not the symptom when working in streambank erosion. Time should be taken to identify the broader cause or likely trajectory of the erosion issue rather than focusing on a single 'ugly' site.

Monitoring and Evaluation:

A key part of the project is to quantify the improvements made due to the implementation of the project works. Reef Catchments therefore implemented a Monitoring and Evaluation component which aims to evaluate the benefits of sediment reduction, improvements in riparian condition and extent, and to also understand knowledge gaps and management actions of landholders. To achieve this the Monitoring and Evaluation included:

- LiDAR comparing erosion rates using digital elevation models of difference (DEMoD) between 2009 – 2018
- Vegetation Assessment using CSIRO developed Tropical Rapid Assessment of Riparian Condition (TRARC)
- Photo point monitoring to help visualise site progression over time
- Plant counts to track and assess plant survival rates of revegetation sites
- Regular site visits to monitor on-ground conditions, including plant health, weed growth, and streambank erosion
- Social Survey to understand knowledge gaps and current actions of landholders in streambank management and remediation.

REEF CATCHMENTS (MACKAY WHITSUNDAY ISAAC) LIMITED
Phone: 07 4968 4200
Email: info@reefcatchments.com
www.reefcatchments.com