

# Severe Tropical Cyclone Debbie (March 2017)

## Natural Disaster Relief and Recovery Arrangements Category D Environmental Recovery Package: Riparian, mapping and watercourse recovery

### Overview

On 28 March 2017, Severe Tropical Cyclone Debbie (STC Debbie) made landfall as a Category 4 system near Airlie Beach, after crossing the Whitsunday islands. The cyclone, with isolated rainfalls of 400 millimetres and wind gusts of up to 265 kilometres per hour, caused significant damage in the Airlie Beach, Proserpine and Bowen regions, and further inland to Collinsville. The system then continued down the Queensland coast as a tropical low, causing major flooding in central and southeast Queensland.

The landfall of STC Debbie caused widespread damage to catchments from the Great Barrier Reef to the eastern Queensland Murray-Darling Basin (Figure 1).

Following the event, a jointly funded \$35 million Environmental Recovery Package under Category D: Exceptional Circumstances assistance of the [Natural Disaster Relief and Recovery Arrangements](#) (NDRRA) was activated by the Commonwealth and Queensland Governments. The package was designed to assist communities impacted by STC Debbie to rebuild stronger and more resilient environments that can stand up to future natural disasters.

The Environmental Recovery Package included \$15.5 million for riparian, mapping and watercourse recovery. The aim of this investment was to recover waterways from damage caused by STC Debbie, enhance catchment resilience and reduce the volume of sediment flowing to the Great Barrier Reef and Moreton Bay. Delivery of the package was managed by the Department of Environment and Science, in partnership with the Queensland Reconstruction Authority. Delivery organisations included six Regional Natural Resource Management (NRM) bodies, spanning from North Queensland to the Queensland Murray-Darling Basin, working with River Improvement Trusts, Local Governments, environmental groups and communities.

### Projects

In total, 88 projects were completed by 30 June 2019. These included:

- **67 on-ground works** to repair riparian zones and watercourses damaged by the extreme weather event. Works included re-sloping, stabilisation and revegetation of banks to improve long-term stability and build resilience.
- **21 mapping projects** to improve mapping and data collection of the impacted area and inform location of on-ground works. Light detection and ranging (LiDAR) data obtained through these projects is available via the Queensland Spatial Information Database.

The works have increased resilience in the impacted regions and have resulted in improved water quality, increased riparian vegetation connectivity and decreased erosion.

Approximately 290,000 tonnes of sediment has been prevented from polluting the coastline every year; including the Great Barrier Reef and Moreton Bay environments.

### Acknowledgements

Delivery of these works would not have been possible without the help of the staff and volunteers at:

- Reef Catchments
- Healthy Land and Water
- Burnett Mary Regional Group for Natural Resource Management
- Fitzroy Basin Association
- NQ Dry Tropics
- Southern Queensland Landscapes (formerly Condamine Alliance and the Queensland Murray-Darling Committee)
- Queensland Reconstruction Authority

To be commended for going above and beyond are the Department of Environment and Science officers leading the delivery of this program.

This project was jointly funded by the Commonwealth and Queensland Governments through the Natural Disaster Relief and Recovery Arrangements.



Australian Government



Queensland  
Government

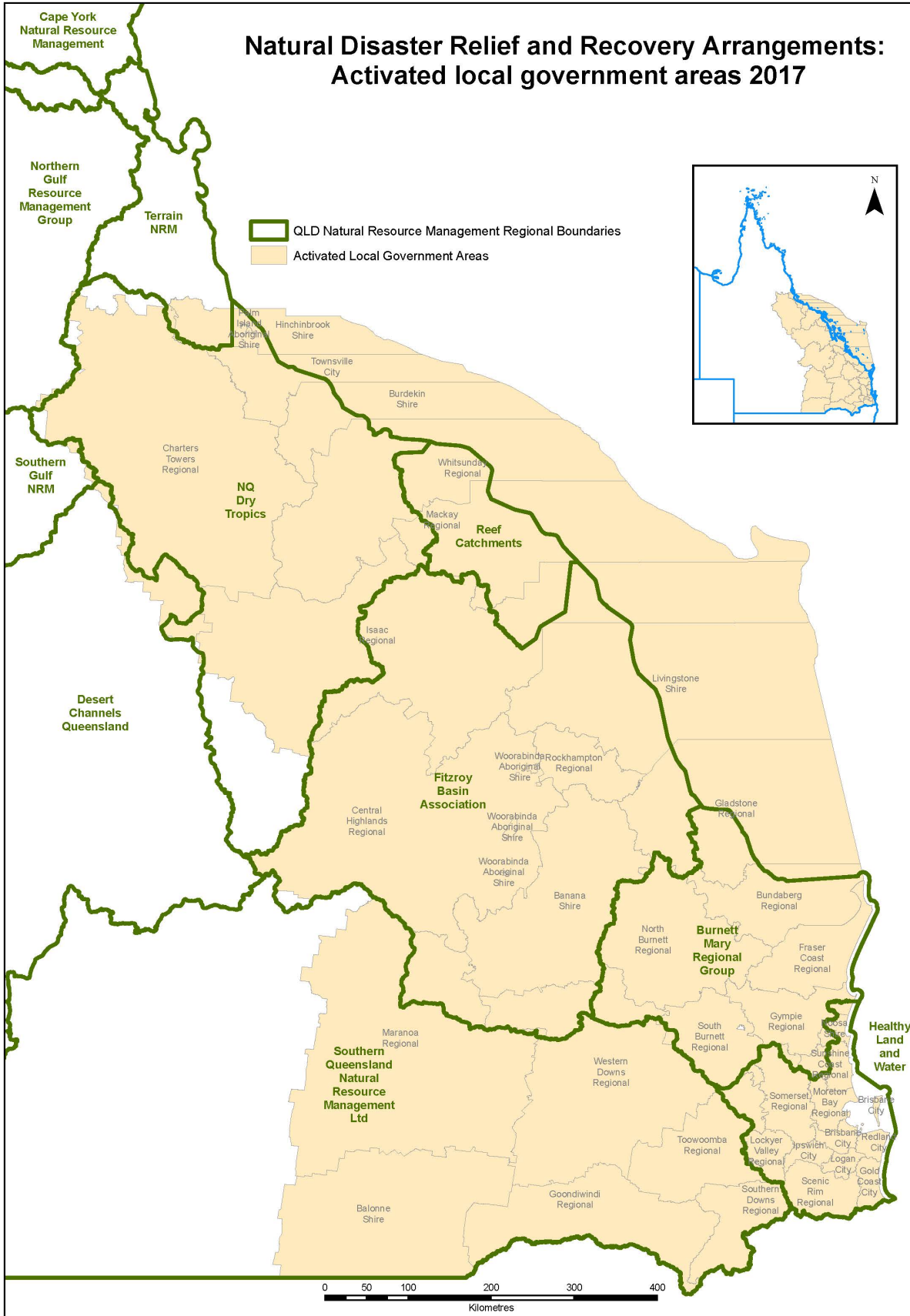


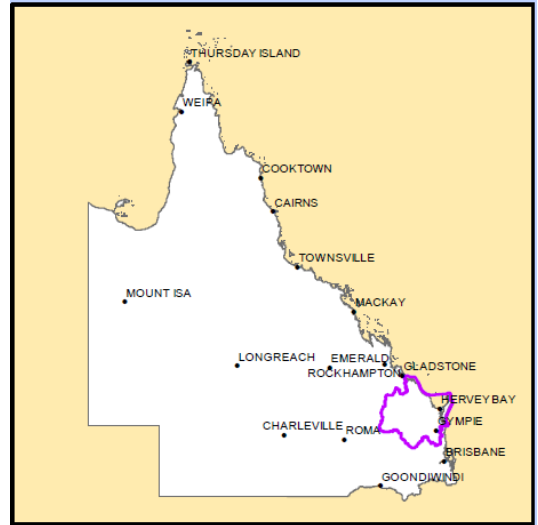
Figure 1 - NDRRA Activation Summary (STC Debbie March 2017)

## Burnett Mary Regional Group (BMRG)

STC Debbie caused significant flooding in the Mary River catchment, exacerbating existing erosion and impacting the natural environment and productive agriculture land. The riparian restoration works to address the environmental damage in this region were delivered in partnership with the Burnett Mary Regional Group (BMRG), the peak body for natural resource management within the Burnett Mary region.

Under the NDRRA Environmental Recovery Package, two projects were funded to address bank erosion on the Mary River upstream of Kenilworth, for a total value of approximately \$800,000. These works resulted in preventing an estimated 14,400 tonnes of sediment from reaching the Great Barrier Reef lagoon annually, through 100 metres of best practice bank stabilisation measures (i.e. pile fields).

The Mary River has been identified as one of the five highest contributors of fine sediment to the Great Barrier Reef and the highest contributor to the Great Sandy Strait. Riparian restoration works in this catchment not only contribute to making the region more resilient to future extreme weather events, but also help improve the water quality of the Mary River, improve habitat for the endangered Mary river turtle, and decrease sediment reaching important coastline environments.



### Case study: BMRG Elliot and Boundary Sites on the Mary River

The works undertaken at the Elliot and Boundary sites on the Mary River aimed to stabilise 100 metres of streambank to prevent ongoing erosion causing sediment mobilisation, land loss and threatening existing riparian vegetation (Figure 2).

The eroded riverbank was reprofiled to its former natural slope, allowing for the re-establishment of native vegetation. Pile fields, consisting of rows of 6-metre-long logs driven vertically into the ground, were installed across the face of the new slope (Figure 3)

Combined, the Elliot and Boundary sites resulted in the prevention of approximately 14,400 tonnes of sediment from reaching the Great Barrier Reef lagoon annually.



Figure 2 - Erosion caused by TSC Debbie at the Elliot Site



Figure 3 - The Boundary Site in February 2019 - Post on-ground works

## Fitzroy Basin Association (FBA)

The extreme rainfall due to STC Debbie resulted in major flooding across the Fitzroy Basin, with flood levels in Rockhampton reaching 8.75 metres. The flood event caused significant damage to riverbanks in the lower Fitzroy River. The riverbanks were unlikely to recover without management intervention and would have continued to generate large volumes of sediment that would have continued to impact on the ecosystem health in the river and the Great Barrier Reef lagoon. The riparian restoration works to address the environmental damage in this region were delivered in partnership with the Fitzroy Basin Association (FBA), central Queensland's leading natural resource management group.



Under the NDRRA Environmental Recovery Package, four projects were funded to address bank erosion on the Lower Fitzroy River at Yaamba, for a total value of around \$4 million. These works prevented approximately 110,500 tonnes of sediment from reaching the Great Barrier Reef lagoon annually and more than 2 kilometres of banks being stabilised with best practice measures (e.g. pile fields).

### Case study: FBA Site 7 on the Lower Fitzroy River at 'Nine Mile' Yaamba

Located on the lower Fitzroy River at Yaamba, FBA's Site 7 was the largest project completed under the program and considered to be the largest riparian restoration site in Australia.

The STC Debbie flood event caused significant erosion to the riverbanks at the site, resulting in a steep, 15 metre high streambank along a length of about 1200 metres (Figure 4). The riverbank is estimated to have retreated approximately 20 metres during the flooding event, resulting in the mobilisation of 266,000 tonnes of fine sediment into the Fitzroy River and subsequently the Great Barrier Reef lagoon.

The objective of the management intervention was to create an environment for vegetation to re-establish and to provide natural bank stability and future erosion protection. The works for this site included a combination of pile fields, bank reprofiling and revegetation along the length of the bank (Figures 5 and 6). For six months, the project created twelve full-time jobs in the region. In addition, effective collaboration with Rockhampton Regional Council and Livingstone Shire Council saw more than 75,000 native trees supplied to FBA to further stabilise the banks.

Historical land clearing and unrestricted stock access at this site had previously resulted in a degraded riparian zone with very little vegetation providing resistance to erosion. Riparian restoration works resulted in increased bank stability, protecting vegetation and valuable agricultural land, as well as decreased erosion and improved water quality.

It is estimated that this project will save 90,000 tonnes of sediment from entering the river system annually, with long-term benefits to not only the local waterways but also to the health of the iconic Great Barrier Reef.



Figure 4 - Erosion at Site 7 before works



Figure 5 - Aerial image of the stabilised streambank at Site 7



Figure 6 - Site 7 on the open day, October 2019

## Healthy Land and Water

After making landfall in Airlie beach in late March 2017, STC Debbie continued south on the Queensland coast as a tropical low. In the following days, flash flooding occurred on the Gold Coast, isolating areas in the hinterland. Major flood levels were recorded within the Albert and Logan catchments.

The riparian restoration works to address the environmental damage in this region were delivered in partnership with the Healthy Land and Water (HLW), South East Queensland's leading natural resource management group.

Under the NDRRA Environmental Recovery Package, thirteen projects were funded to address bank erosion in the Lockyer River, Logan River, Albert River, Coomera River and Currumbin Creek catchments, for a total value of around \$2.4 million. These works resulted in approximately 91,906 tonnes of sediment prevented from reaching Moreton Bay annually and more than 2 kilometres of banks being stabilised with best practice measures (e.g. pile fields).



### Case study: HLW Logan River at Illbogan sites

Two sites were funded for a total value of **\$1.4 million** under the NDRRA Environmental Recovery Package to recover major damage to banks on the Logan River at Illbogan.

At this location, flooding caused by STC Debbie left sections of the riverbank severely eroded. The erosion posed a significant threat to nearby infrastructure, including an Energex powerline and a residential property (Figure 7).

Works to stabilise 440 metres of streambank included reshaping 40,500 tonnes of soil and using 10,400 tonnes of rock to stabilise the stream bank. Approximately 3,500 trees were planted to improve bank stability and restore connectivity within the riparian zone.

It is estimated this project will save **57,672 tonnes** of sediment from reaching Moreton Bay annually.



Figure 7 - Major erosion on the Logan River at Illbogan, before works



Figure 8 - Site ready for revegetation on the Logan River at Illbogan



## NQ Dry Tropics (NQDT)

The landfall of STC Debbie caused significant damage in the Bowen region and further inland to Collinsville. Flooding on the Don River reached a level of approximately 5.4 metres and caused major damage to Reibel's bank.

The riparian restoration works to address the environmental damage in this region were delivered in partnership with NQ Dry Tropics (NQDT), the leading delivery agent of land and water management across the Burdekin Dry Tropics region, including the Don River catchment.

Under the NDRRA Environmental Recovery Package, two projects were funded to address bank erosion at Reibel's bank on the Don River for a total value of around \$900,000. These works will prevent approximately 54,000 tonnes of sediment from reaching the Great Barrier Reef lagoon annually.



### Case study: NQDT Reibel's Bank on the Don River

The Reibel's bank projects, for a total value of around \$900,000, aimed to repair a large break in the Don River at Reibel's Bank caused by STC Debbie flooding in March 2017. The break had reduced the ability of the Don River to carry floods, thus increasing the likelihood of flood waters spilling into the community west of Reibel's Bank.

Works included re-establishment of the site through rock armoring and revegetation to stabilise the bank (Figure 9). This resulted in a decreased likelihood of associated erosion from future major flooding and increased water quality in the Don River catchment. It is estimated this project will save 54,000 tonnes of sediment from reaching the Great Barrier Reef lagoon annually.

During the North Queensland Monsoon Trough in 2019, the works funded under the STC Debbie NDRRA Environmental Recovery Package held up during flooding, demonstrating the enhanced resilience in the catchment produced through the investment (Figure 10)



Figure 2 Reibel's bank works ready for revegetation



Figure 10 - Reibel's bank works after the 2019 North and Far North Queensland Monsoon Trough

## Reef Catchments

Making landfall in Airlie Beach on 28 March 2017, STC Debbie and associated floodwaters caused widespread destruction throughout the Reef Catchments region. Flooded waterways in many areas, including regions of productive land, eroded banks up to 30 metres and left vertical banks of up to 6 metres high. Banks were stripped of vegetation, producing sheer unstable banks that were highly susceptible to further erosion.

The NDRRA Environmental Recovery Package to address the catchment damage in this region was delivered in partnership with Reef Catchments, the peak resource management body in the Mackay Whitsunday Isaac region.

Under the NDRRA Environmental Recovery Package, 33 projects were funded to address bank erosion across the Reef Catchments region, for a total value of around **\$6.2 million**. These works will prevent more than **17600 tonnes** of sediment from reaching the Great Barrier Reef lagoon annually.



### Case study: Reef Catchments - St Helens Creek sites

Following STC Debbie and its associated rainfall and flooding, six sites along St Helens Creek were funded a total value of **\$1.5 million** under the NDRRA Environmental Recovery Package.

Major erosion occurred on St Helens Creek, with 5 to 35 metres of bank retreat at each of the six sites for up to 225 metres along the length of the bank (Figure 11). Banks were left near-vertical to vertical, with heights of up to 6 metres. The bank retreat resulted in the loss of approximately 24,300m<sup>2</sup> of productive sugarcane and grazing land along St Helens Creek.

Following consultation between Reef Catchments, the landholder and the river restoration engineer, a combination of earthworks, rock toes and pile fields were agreed as the best solution to restore the sites.

During the project, 33 pile fields were created to secure the banks at four sites and allow sediment deposition and revegetation (Figure 12). The pile fields will increase the hydraulic roughness of the creek, reduce the sediment transport capacity and promote deposition of sediment within the enlarged channel which will aid vegetation establishment. Works at each site were complemented with rock reinforcement where required.

All sites, and many adjacent areas along St Helens Creek, were revegetated with over 5,000 native plants selected from the local Regional Ecosystem.

It is estimated these projects will cumulatively save **11,236 tonnes** of sediment from reaching the Great Barrier Reef lagoon annually.

During the North Queensland Monsoon Trough in 2019, St Helens Creek was impacted by major flooding, with flood waters covering up to two thirds of the pile field sites. All sites on St Helens Creek held up well during the flooding and demonstrated increased resilience in the region from the investment.



Figure 11 - Erosion at a St Helens Creek site before works



Figure 12 - Revegetation and pile fields at St Helens Creek site - post- works



Figure 13 - St Helens Creek site during the 2019 North and Far North Monsoon Trough

## Southern Queensland Landscapes

STC Debbie and associated rainfall caused significant damage in parts of Southern Queensland. Extreme flooding levels were experienced through the Balonne-Condamine, Moonie, and Border Rivers basins, causing widespread impacts on the condition of waterways and riparian areas.

The riparian restoration works to address the environmental damage in this region were delivered in partnership with Southern Queensland Landscaped, Millmerran Landcare Group and directly with impacted landholders.

Under the NDRRA Environmental Recovery Package, four projects involving a total of 11 works sites, were funded to address gully and bank erosion, for a total value of \$119,040. These works will result in approximately 426 tonnes of sediment being saved from entering the Condamine and Weir River catchments annually.

### Case study: Southern Queensland Landscapes - Creek

This project, for a total value of \$29,280, repaired a 200-metre gully section in Goomburra, which experienced significant erosion as a result of flooding associated with STC Debbie. The gully reached a depth of over two metres and up to 13 metres wide, mobilising many tonnes of valuable, black cracking-clay soil into the waterways.

Works included battering 100 metres upstream and downstream of the active gully head (Figures 14 and 15), fencing out livestock, rapidly establishing grass cover using an irrigation system, and installing coir log weirs (Figure 16). This resulted in a stabilised channel with more controlled water flow, reducing future soil mobilisation. Figures 17 and 18 highlights the gully transformation, showing the change from severe erosion into a more resilient system able to withstand future large rainfall events.



Figures 14 and 15 - The active gully head area before and after NDRRA battering and revegetation



Figure 16 - A series of 4 degradable coir log weirs installed to further stabilise the channel bed



Figure 17 - The channel transformation as part of the NDRRA environmental recovery package