



# MACKAY-WHITSUNDAY WATER QUALITY PROGRAM

## Achievements and learnings

August 2024



Australian Government

REEF TRUST



Great Barrier  
Reef Foundation

# Introduction

The Great Barrier Reef is globally renowned for its intrinsic beauty, immense spatial scale, outstanding biodiversity as well as its natural, social, economic, and cultural values. A healthy and resilient Great Barrier Reef is critical to protect the vast array of ecological communities and species that inhabit coastal, marine, and terrestrial ecosystems. However, the health of the Reef is at risk from a range of factors including climate change, expanding coastal development, direct human use and poor water quality from land-based runoff.

In a bid to significantly improve the health of the Great Barrier Reef, the Reef Trust Partnership (the Partnership) – a landmark collaboration between the Australian Government’s Reef Trust and the Great Barrier Reef Foundation – was awarded \$443M to elevate and amplify efforts to build Reef resilience. As part of the Partnership, the Water Quality Program received \$199M to address poor water quality from land-based runoff and respond to the priorities of the Reef 2050 Water Quality Improvement Plan (WQIP).



# Mackay-Whitsunday Water Quality Program

The Mackay Whitsunday Water Quality Program was one of ten regional water quality programs delivered under the Partnership between 2020 and 2024. Through the adoption of improved land management practices, this \$21M program aimed to prevent 26 tonnes of dissolved inorganic nitrogen and approximately 3 million pesticide risk units that are lost from sugarcane land from entering the Reef's waters every year.

Dissolved Inorganic Nitrogen (DIN) and pesticide were identified as priorities for the Mackay-Whitsunday region by the WQIP. The four-year Mackay-Whitsunday Water Quality Program (the Program) was delivered by seven organisations implementing nine on-ground projects, each with its own pollutant reduction target.

Projects tracked their progress to targets using the Paddock to Reef ([P2R](#)) Projector Tool for DIN and the Pesticide Decision Support Tool for Pesticides ([Warne et al 2023](#)), which estimate water quality improvements based on a reported change in the management practices and/or in the selection of pesticide by farmers involved in the program.

Program activities mostly centred around tailored agronomic extension support, with projects working one-on-one with growers for management practice changes that will reduce nutrient and pesticide losses at the end of catchment.

Key cross-cutting activities included a regional practice change and engagement strategy, demonstration trials, financial incentives, water quality monitoring technical support, and wetland monitoring which together strengthened the coherence of the program and contributed to critical behavioural, technical, economic and environmental goals.

The success of the Program is reflected by the nearly 300 sugarcane farmers engaged over four years who improved nutrient and pesticide management practices, positively impacting over 50,000 hectares of sugarcane growing land. That represents approximately 30% of growers in the region and 40% of available farmed land. Thanks to this collective effort, the program achieved reductions of more than 28 tonnes of DIN and more than 6 million risk units (RUs) of pesticide per year, exceeding the original goals while maintaining or improving productivity or profitability for engaged growers.

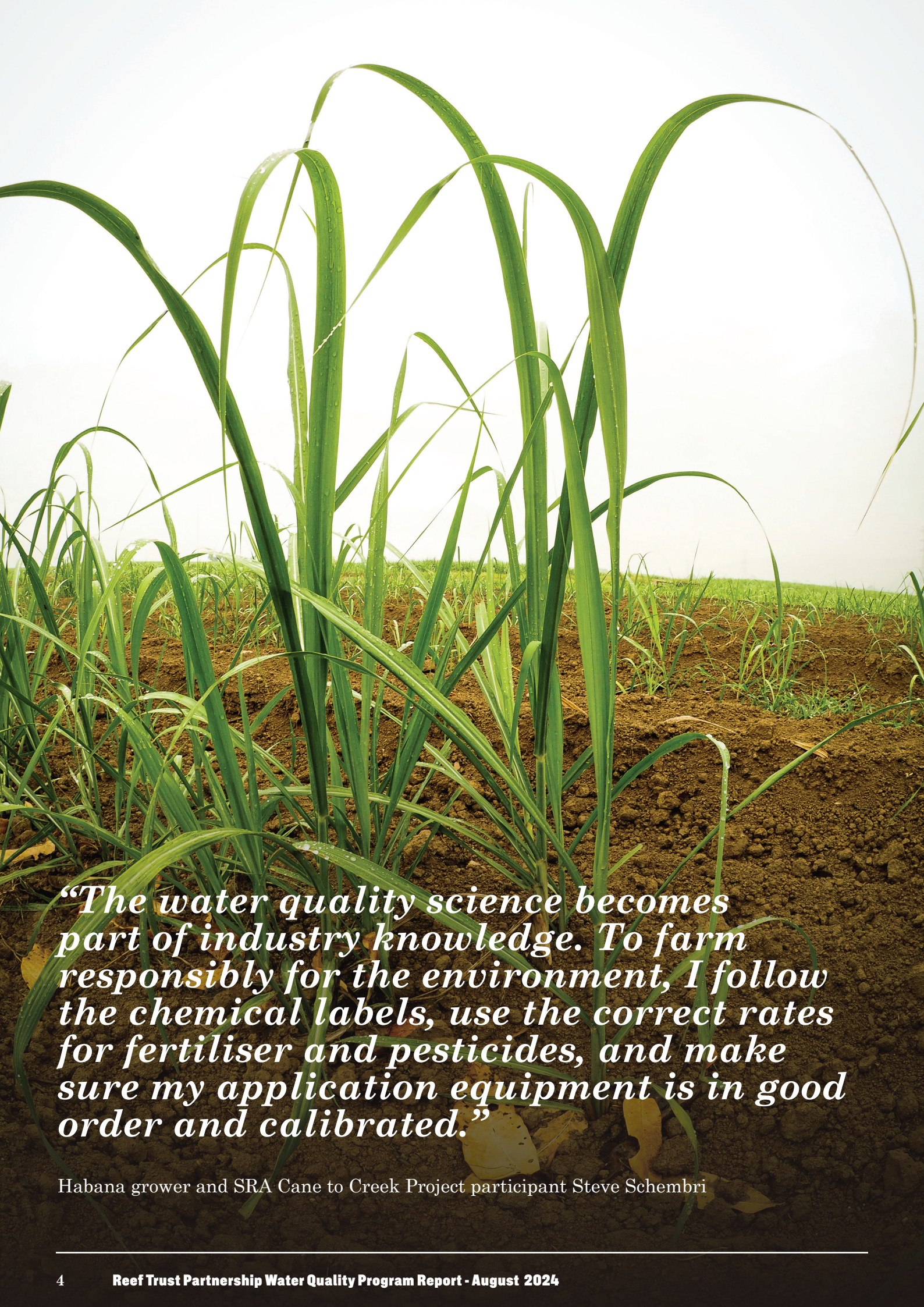


Great Barrier Reef Foundation



CANE GROWERS MACKAY









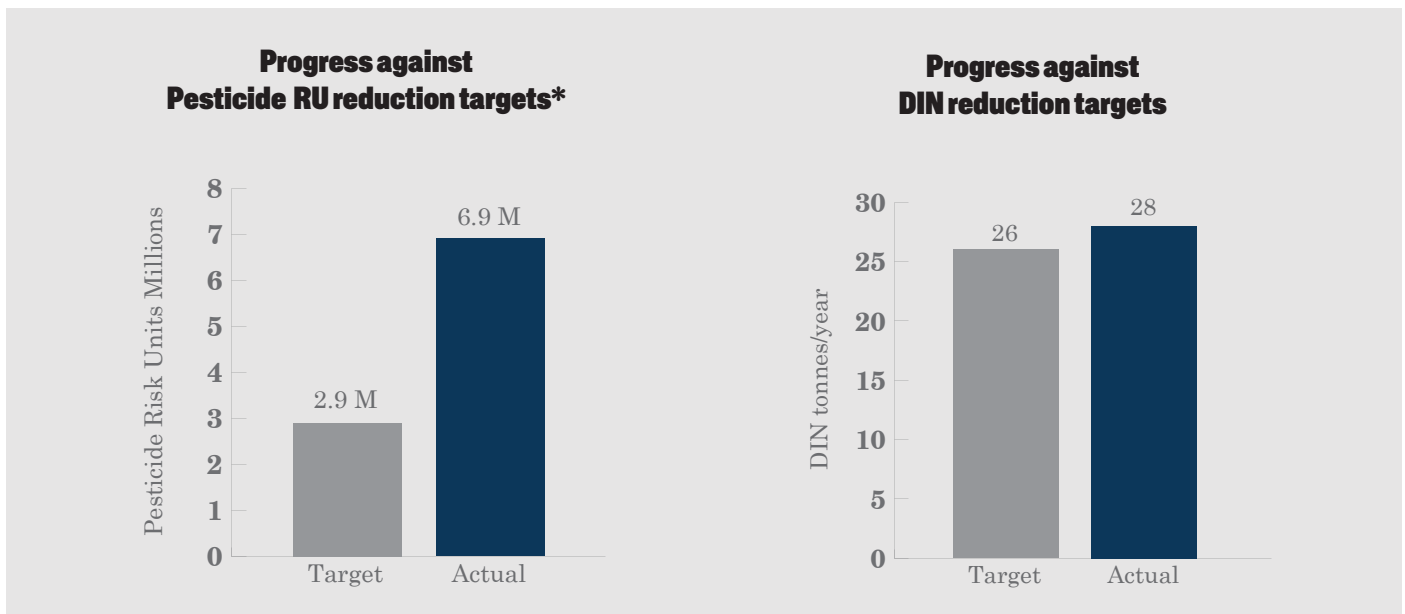
*“The water quality science becomes part of industry knowledge. To farm responsibly for the environment, I follow the chemical labels, use the correct rates for fertiliser and pesticides, and make sure my application equipment is in good order and calibrated.”*

Habana grower and SRA Cane to Creek Project participant Steve Schembri

# Achievements

 <p><b>50,000</b></p> <p>hectares of cane under changing management practices.</p>	 <p><b>490</b></p> <p>on-ground projects completed for improved farming practices.</p>	 <p><b>300</b></p> <p>sugarcane farmers taking direct action to improve water quality.</p>	 <p><b>11</b></p> <p>water quality trials comparing impacts of common management practices.</p>
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## PROGRAM IMPACTS ON THE MACKAY-WHTSUNDAY REGION



\*A pesticide decision support tool, based on toxicity rather than quantity, was developed as a more appropriate method assessing water way risk from pesticide use and provides an output in nominal waterways Risk Units (RU).

 <p>Dedicated regional industry website</p> <p><a href="http://www.canerise.com.au">www.canerise.com.au</a></p>	 <p><b>40%</b></p> <p>Hectares of improved practices</p> <hr/> <p>Improved practices recorded across over one third of the available farmed land</p>	 <p><b>30%</b></p> <p>Growers taking direct action</p> <hr/> <p>Improved practices recorded across almost one third of all growers in the region</p>
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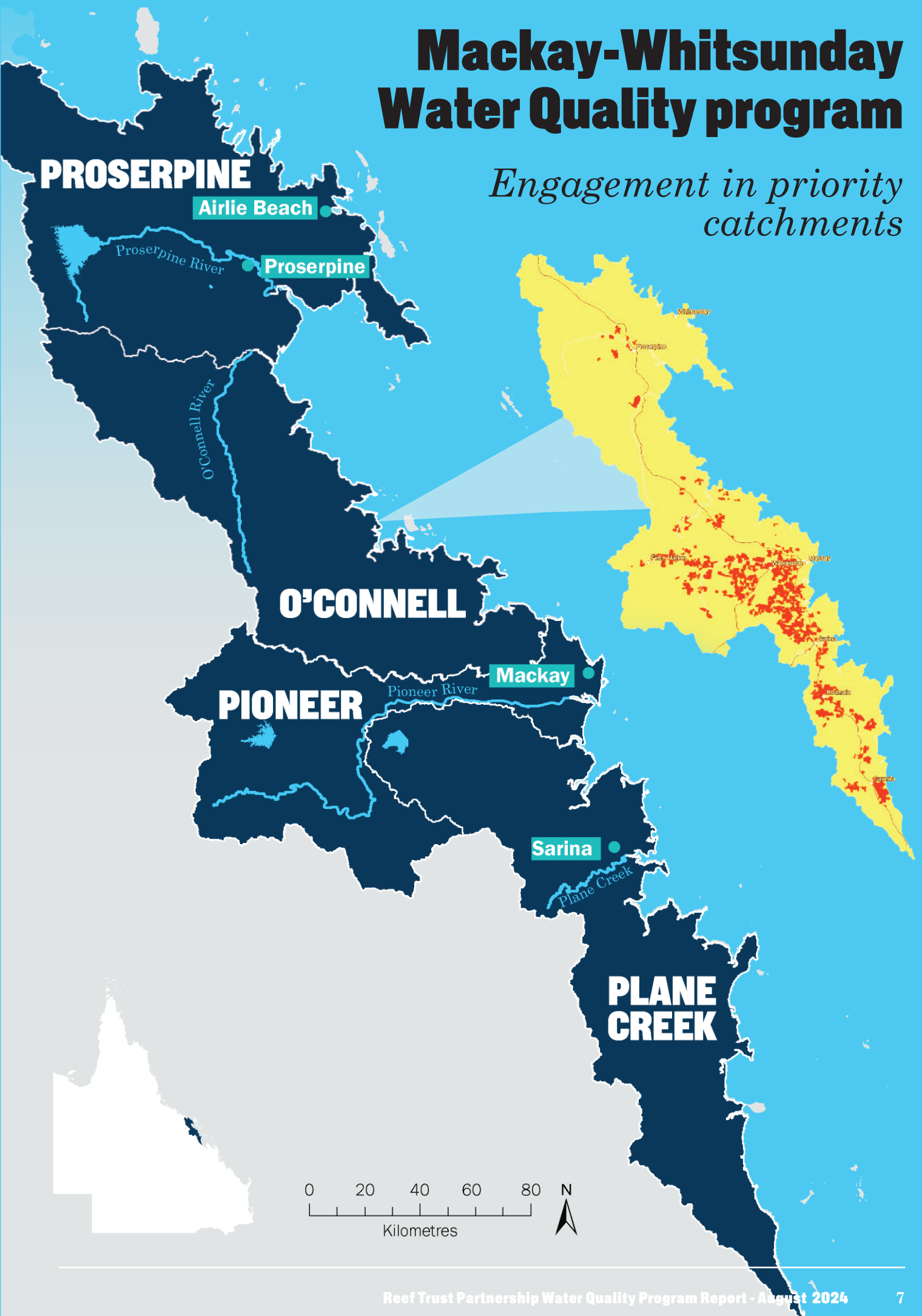


*“Water quality improvement, for me, is protecting the Reef. We all love to go fishing. Protecting the Reef means stopping runoff from your farm, a waste of dollars or chemical. If its in the waterways, its not on paddock doing its job.”*

Grower and participant in Point of Difference and Bluewater 2 projects Trent Condon

# Mackay-Whitsunday Water Quality program

*Engagement in priority  
catchments*



# Program Model

Governance arrangements for the program ensured projects delivering on the ground reported directly to the Foundation while also being supported by a regional program manager and partnership coordinator.

This model has increased transparency of outcomes and agility to manage contractual commitments while providing access to local support to manage risk, coordinate activities, identify synergies, and promote the program to the wider regional audience.

A key role of the regional program manager and partnership coordinator was to oversee the program’s spatial reporting dashboard, which allowed checking for historical overlaps, vetting of farm-level projects to ensure adoption of practices not previously funded, and tracking of progress towards targets.

The program manager and partnership coordinator reported directly to a regional steering committee made up of key stakeholders including CANEGROWERS Mackay, Reef Catchments NRM, the Australian Government and the Foundation. The steering committee was supported by a technical advisory group and the water quality working group, which provided technical and strategic advice across the whole of the Reef Trust Partnership Water Quality Program.

The design of the governance model recognised the importance of independent local leadership and oversight, as well as strategic and technical guidance and collaboration.

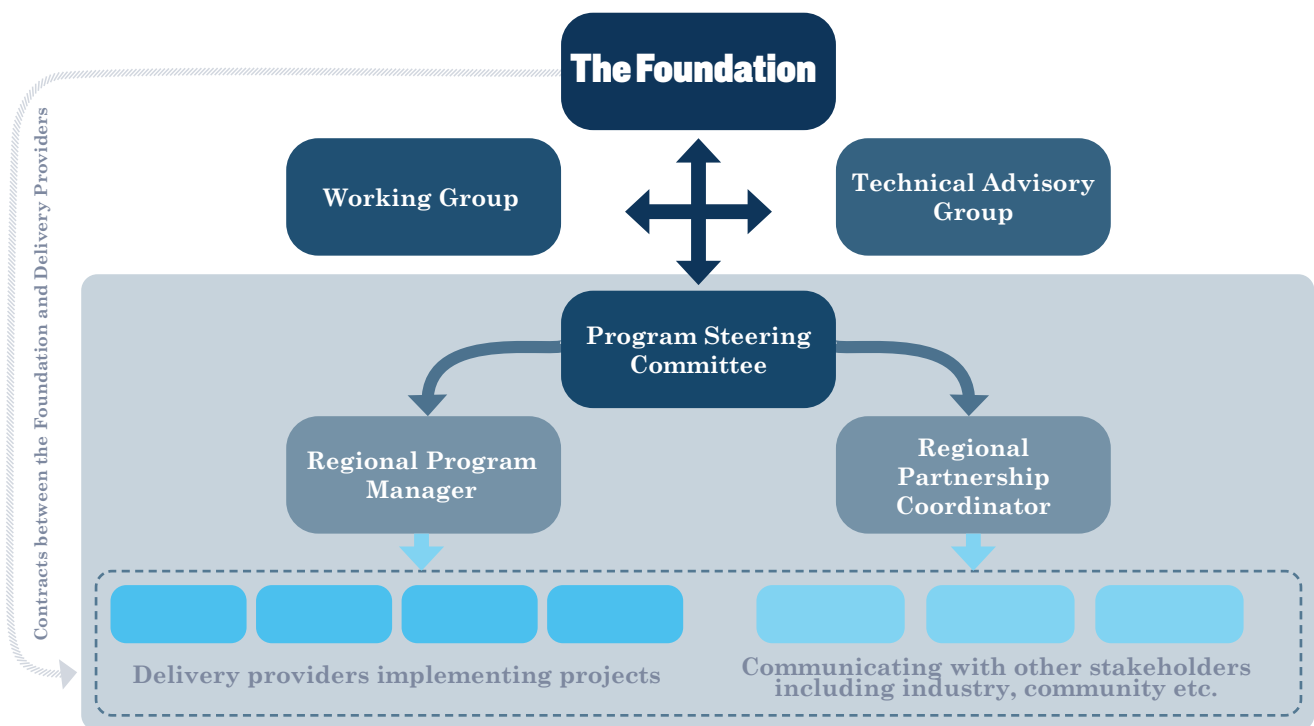


Figure 1. Mackay Whitsunday Water Quality Program governance model





*“Fertiliser that leaves my paddock is money lost, it does not grow my crop, and it is not good for the environment or for water quality.”*

Grower and LAND project participant Colin Bourke

# Funded Projects

## REEF CREDITS (1 Kg Of Nutrient = 1 Reef Credit)

This market-based solution incentivises water quality improvements to support a healthy Great Barrier Reef. Farmers in the Mackay-Whitsunday region undertook projects that improve water quality through changes in land management to generate and sell units of nutrient reduction through validated and audited activities that go above and beyond regulatory requirements. Investors seeking water quality improvements, such as the Partnership Water Quality Program, purchased Reef Credits in the region creating impact to endure far beyond the program.



## PROJECT CATALYST BROADER ADOPTION

Through Project Catalyst, Catchment Solutions promoted the uptake of tested and novel methodologies to improve on-farm management practices and significantly reduce pollutant loads. The project supported 34 growers to undertake 129 management practice changes across 4,580 hectares of sugarcane land.

Nutrient management plans were developed, proven practices were embedded into sugarcane farming operations, and a broad range of education resources were published. The project has resulted in positive environmental and productivity outcomes.

## NUTRIENT MANAGEMENT PLANS AND AGTRIX SUPPORT

The Mackay Area Productivity Services (MAPS) project developed and implemented property-specific nutrient management plans with 66 growers to manage fertiliser applications more efficiently using the Agtrix Farming spatial data recording platform. Growers made management practice changes over 11,000 hectares of cane growing land.

Break crop management was integrated into farming systems on 170 hectares through demonstrations and use of the MAPS legume planter. Growers are now developing nitrogen and phosphorus budgets that meet regulatory requirements, through the N & P budgeting capability built into the Agtrix platform. This has resulted in improved production, profitability, and sustainability.



# Funded Projects

## POINT OF DIFFERENCE REFINING FARM NUTRIENT MANAGEMENT

Farmacist engaged with 60 sugarcane farmers who manage over 17,000 hectares across 142 farms. Tailored agronomic support was provided and soil variability and yield constraints were identified for the development of nutrient management plans and variable rate prescriptions that reduced the amount of nutrients running off the farm.

The collection and analysis of precision farm data, including EM mapping and satellite imagery, has provided critical information for future decision-making. Improved management practices that result in enduring environmental and productivity outcomes are imbedded into the farming systems.



## LAND hub (LOCAL AREA NUTRIENT DATAHUB)

The LiquaForce LAND hub collects critical data such as crop history, land topography, EM mapping, and soil composition to produce optimised Six Easy Steps nutrient management plans that reduce excess nutrients flowing into local waterways. This all-in-one solution for fertiliser management has provided growers with the tools for informed and efficient decision-making.

The combination of agronomic and technological support provided to 28 growers has improved both the economic and environmental sustainability of 3,955 hectares of sugarcane farming operations. The quality and accessibility of the data in the LAND hub has supported digital literacy, widespread practice change, and water quality improvements.



## PROJECT BLUEWATER 2

Through Project Bluewater, Farmacist supported 121 sugarcane farmers to improve pesticide management practices across over 27,000 hectares. The toxicity risk that pesticides pose to aquatic ecosystems was reduced by 66%.

Pesticide management plans, spray rig assessment and upgrades, technical knowledge of products and constraints, and support with application data recording was provided. A Pesticide Decision Support Tool and Risk Unit Model to guide the selection of pesticide active

ingredients that pose a lower risk to aquatic environments was developed with the University of Queensland. This tool will be publicly available to support prioritisation and reporting by future projects.

The extension support provided has resulted in a significant improvement in the understanding of pesticide use practices and regional stewardship reflecting social and environmental outcomes.

# Funded Projects

## CANE TO CREEK

Sugarcane farmers were engaged by Sugar Research Australia (SRA) to evaluate alternative management strategies related to pesticide and nitrogen and to develop a better understanding of how different management decisions change the quality of water running off farms.

Paddock runoff monitoring trials identified a range of common management practices which minimised losses of pesticides and nitrogen and

compared these practices when assessing productivity outcomes.

The Cane to Creek project used the CSIRO ADOPT Tool to predict adoption of lower risk, trial-validated management practices by the wider cane growing community.

This social diffusion project demonstrated some uptake with ongoing dissemination of the messaging required to ensure those improved practices are widely incorporated in to farming business.

## MACKAY-WHITSUNDAY MAJOR GRANTS PROGRAM

Reef Catchments administered financial incentives for the upgrade or purchase of equipment in support of sustaining or improving practices that reduce nutrient and pesticides runoff losses. Seventy-two growers, who met the eligibility requirements, accessed over \$1.8M in incentive grants with farmers investing over \$3.4M of their own money.

Access to major grant incentives accelerated adoption of new practices where they are constrained due to costs. This funding approach coupled to a pollutant reduction target was trialled for the first time as part of a water quality program and has successfully driven positive and enduring on-ground changes and environmental outcomes.



## MACKAY IRRIGATION PROJECT

Canegrowers Mackay supported 12 sugarcane farmers across 3,713 hectares to optimise water use efficiencies, improve irrigation timing, mitigate nutrient losses, and provide management strategies to increase productivity and profitability.

Utilising available irrigation scheduling platforms and linking to in-field sensing equipment, growers now have the knowledge and tools to ensure effective scheduling and utilisation of available water to increase crop potential.

A series of factsheets with practical information on improved irrigation practices that increase productivity and produce environmental outcomes are now available to irrigators in the region.





*“The program has allowed me to identify constraints of both the crop and soils, and develop a method to effectively manage those constraints appropriately.”*

Carmilla West grower Bryce Jackson



# Cross-cutting activities

## Practice Change Strategy

The Social Deck was contracted to develop a practice change strategy with associated actions to encourage grower engagement in Water Quality programs. The strategy identified a range of factors to increase regional participation in Reef-funded programs including influences on practice change such as capability, motivation, and opportunities.

A key outcome identified through the process was the need to increase access to relevant and local information and promote positive stories of local growers.

The centrepiece of the strategy was a web portal, [CaneRise](#) which is a springboard to centralise regional information, promote key messages, funding opportunities, engage and connect farmers in a positive way to actions that improve water quality.

The portal has a significant amount of content and is regularly updated with grower stories, resources for education, etc. and has been well received by the community.

## Biobeds

This Farmacist value-add project identified the importance of monitoring pesticide mixing sites on sugarcane farms given their high concentration of pesticides. The concept of biobeds was designed and tested as a treatment system that can easily be established on most farms.

Originally researched and developed in Europe, in a first of its kind, the Farmacist Project Bluewater team commenced evaluation of biobeds on sugarcane farms to assess if these structures can operate effectively to reduce pesticide concentrations before being released to the receiving environment.

Trials of three biobeds demonstrated they could effectively reduce pesticides from mixing sites before reaching receiving waters.

## Wetland Monitoring

The James Cook University (JCU) Centre for Tropical Water and Aquatic Ecosystem Research (TropWATER) project undertook monitoring of a constructed wetland south of Mackay over a two seasons to assess the efficacy of constructed wetlands for nitrogen removal.

This project provided much needed data to inform the scientific community through increased understanding of wetland hydrological and nutrient and sediment dynamics.

The information gained from this monitoring will be used to support the future incorporation of wetland processes into the Paddock to Reef Integrated Monitoring and Reporting Program.

# Cross-cutting activities

## Water Quality Monitoring and Communication Support

This JCU-TropWATER project supported delivery providers with improving the design and implementation of paddock water quality monitoring as part of on-ground extension projects to ensure monitoring activities were fit for purpose. The project also assisted projects with interpreting and communicating water quality results to growers and produced key messages around common water quality questions to improve understanding and knowledge for growers and extension staff. This distinctive approach integrated scientific expertise from leading water quality researchers with strategies from science communication specialists.

## Independent verification and engagement

This initiative, led by Central Resource Services, focused on independently verifying the extent and quality of the on-ground projects which were being reported to ensure the accuracy of the spatial dashboard. The process also provided the unique opportunity to hear first-hand from sugarcane growers their experiences participating in the program while facilitating communication between growers, delivery providers and funders. This included discussion on communication and engagement, effectiveness and extent of practice change and legacy outcomes relating to the program.



# Learnings

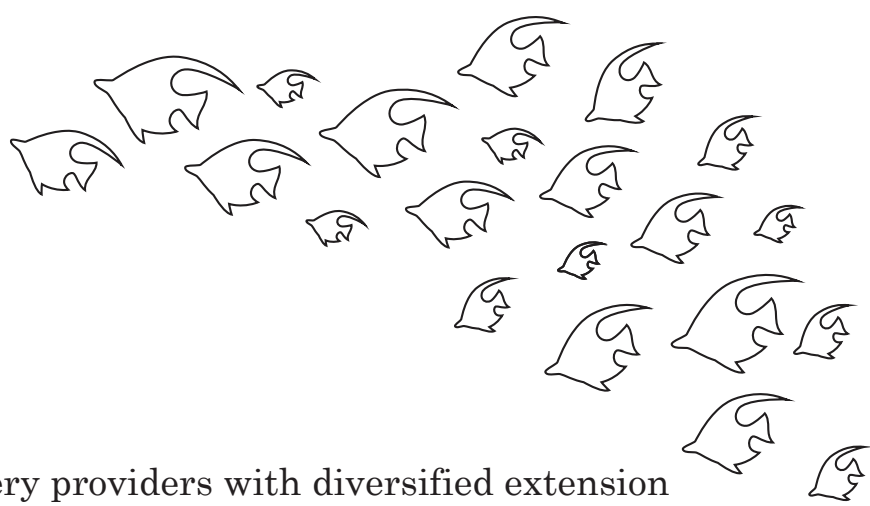
1. A functional governance structure tailored to the program provided transparency and accountability of the on-ground delivery by effectively tracking progress as well as tangible support to delivery providers by swiftly addressing any risks or issues identified during the implementation phase.
2. Maintaining a real-time spatial data platform coupled with on-ground verification provided transparency of on-ground actions and allowed effective and real-time reporting of water quality improvements to stakeholders, including funders, industry, and the community, over the duration of the program.
3. Including water quality targets as a contractual commitment initially increased competition between delivery providers for access to growers under the perception that grower participation or pollutant savings would rapidly diminish. However, these concerns did not eventuate given the high level of grower interest in joining the program. Rather, available funding and timeframes were identified as the limiting factors for further engagement.



*“Without the funding from Major Grants, it would have taken us at least another 4 years of saving to purchase this new equipment.”*

Grower and Major Grants project participant Alan McFazden





# Learnings

4. Involving a broad range of delivery providers with diversified extension support and approaches has been critical to accommodate a larger cohort of growers with different needs and requirements. However, there needs to be better communication between delivery providers particularly when two or more projects work with the same grower to ensure any extension advice and recommendations are not conflicting.
5. Using spatial data platforms has improved decision making and streamlined the implementation of improved management practices. Since digital literacy amongst growers is generally low, high levels of extension support are still needed to ensure both sustained utilisation of digital platforms and associated adoption of improved practices.
6. Water quality monitoring is a great engagement tool that needs to be designed to fit the purpose and communicated back to growers in a way that matters. Technical expertise offered as part of cross-cutting activities has been critical to ensure water quality data empowers collective action to meet both environmental and productivity needs.
7. The combination of agronomic and technical support together with targeted financial incentives to identify constraints and address barriers to change by accessing major grants have promoted rapid adoption of practices and further accelerated progress to water quality targets.
8. Assessing major grants projects based on their water quality benefits is highly desirable, however the P2R projector tool has limited ability to provide project-scale predictions to service this approach. Future programs should consider ways of strengthening the process to assess water quality benefits from major grants projects.
9. Growers continue to rely heavily on subsidised extension services, with continued reluctance to invest in agronomic support. Future programs should incorporate cost-sharing to encourage the transition to a more sustainable fee-for-service extension model. Delivery providers must demonstrate the value proposition for investment by growers into non-subsidised agronomic support as per other industries.

# Summary

Over the four years of the Reef Trust Partnership Water Quality Program, 300 sugarcane farmers improved nutrient and pesticide management practices increasing the productivity and sustainability of over 50,000 hectares of sugarcane growing land in the Mackay-Whitsunday region.

The combination of agronomic extension support with a suite of additional cross-cutting activities enhanced the outcomes achieved through the Program. New information on the use of wetlands as treatment systems and the effectiveness of biobeds in reducing pesticide losses, as well as improved design, delivery and communication of water quality monitoring, a centralised regional web platform and a robust verification process of on-ground projects have all contributed to strengthened regional stewardship and enduring outcomes.

Transparency and accountability were delivered through a regional-specific governance model. Real-time data of on-ground actions provided timely and public progress towards pollutant reduction targets. The broad range of delivery providers represented across the nine projects provided different approaches to suit all growers. Digital literacy increased through the use of new data platforms for nutrient and pesticide planning and management. Financial incentives removed the financial barriers to the timely adoption of best management practices.

The combination of all the above has contributed to the Program exceeding its original pollutant reduction targets with a reduction of more than 28 tonnes of DIN and more than 6 million risk units (RUs) of pesticide per year. This has resulted in a more sustainable sugar industry and better water quality in the local waterways and the Great Barrier Reef lagoon.



# Acknowledgements

Reef Traditional Owners have been caring for land and sea Country for more than 60,000 years, using Traditional Knowledge passed down through ancestral lines for millennia. The Great Barrier Reef Foundation extends its deepest respect and recognition to all Traditional Owners of the Great Barrier Reef and its Catchments, as First Nations People holding, the hopes, dreams, traditions and cultures of the reef.

The Mackay-Whitsunday Regional Water Quality Program was funded by the partnership between the Australian Government's Reef Trust and the Great Barrier Reef Foundation.

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PROJECT  
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