



Paddock to Reef

Mackay Whitsundays



Queensland Government



Australian Government

Reef Catchments is the regional NRM body responsible for the delivery of a number of components of the Paddock to Reef program within the region. Paddock to Reef seeks to measure and track progress for improved water quality for the Great Barrier Reef. This booklet aims to highlight the work undertaken by Reef Catchments and other partners to report on and quantify the hard work undertaken by landholders to improve the water quality as it leaves their properties and reaches the Great Barrier Reef.

This booklet provides a broad overview and information about the regional delivery of the Paddock to Reef program. For more information contact **Reef Catchments** on (07) 4968 4200 or info@reefcatchments.com.



REEF 2050 WATER QUALITY IMPROVEMENT PLAN

The new five-year Reef 2050 Water Quality Improvement Plan (the Plan) now aligns with the Australian and Queensland governments' Great Barrier Reef 2050 Long-Term Sustainability Plan (Reef 2050), agreed in 2015. In particular, it seeks to improve the water quality flowing from the catchments adjacent to the Reef. The plan builds on previous water quality plans developed in 2003, 2009 and 2013 by:

- **INCLUDING ALL SOURCES** of land-based water pollution (agriculture, industry, urban and public lands), while recognising that the majority of water pollution still arises from agricultural activities
- **INCORPORATING HUMAN DIMENSIONS** of change - our social, cultural and economic values and how they drive our adoption of actions to improve water quality
- **SETTING INDIVIDUAL TARGETS** for reduced water pollution from the catchments, enabling better prioritising where the most management action is needed

*Paddock monitoring
trial with water
quality monitoring
shed and flume*



PADDOCK TO REEF A REGIONAL PERSPECTIVE

The Paddock to Reef Integrated Monitoring, Modelling and Reporting program (Paddock to Reef program) is a collaboration involving governments, industry bodies, regional Natural Resource Management (NRM) bodies, landholders and research organisations. The program is a world-leading component of the Reef 2050 Water Quality Improvement Plan (the Plan) (www.reefplan.qld.gov.au) which seeks to reduce the impact of land based runoff to the Great Barrier Reef (GBR).

The Plan is a collaborative program of coordinated projects and partnerships designed to improve the quality of water flowing to the Great Barrier Reef through improved land managed in the Reef's catchments. The Plan sets ambitious targets for improved water quality, catchment indicators and management practices and identifies actions to improve water quality. It identifies targets at the whole of Great Barrier Reef catchment scale (see Table 1).

The Plan is an update of the Reef Water Quality Protection Plan 2013 and supports delivery of the Reef 2050 Long-Term Sustainability Plan.

Each year results from the Paddock to Reef program are used to produce the Paddock to Reef Report Card, which highlights the progress towards the Reef plan goal and targets.

In the Mackay Whitsunday region, Reef Catchments (NRM) is responsible for delivering a number of components of the Paddock to Reef program. This includes reporting on the adoption of improved management practices, collecting water quality samples and monitoring regional wetlands. Reef Catchments works closely with other delivery components of the program including regionally based modellers, extension providers and water quality experts.



O'Connell River

Table 1: Water quality targets with the relative priority for water quality improvement shaded

Mackay Whitsunday NRM Region	Catchment/ Basin Area	Dissolved inorganic nitrogen target		Fine sediment target		Particulate phosphorus target		Particulate nitrogen target		Pesticide (priority only)
	Ha	%	t	%	kilo-t	%	t	%	t	Rating
Proserpine River	249,440	70	110	0	0	0	0	0	0	Not assigned
O'Connell River	238,760	70	130	40	96	40	120	40	250	Moderate
Pioneer River	157,360	70	140	20	35	20	23	20	16	High
Plane Creek	253,870	70	260	0	0	0	0	0	0	Very high

Priority for water quality improvement legend

Not assessed
Minimal
Low
Moderate
High
Very High

MANAGEMENT PRACTICE ADOPTION

The management practice adoption component of Paddock to Reef seeks to develop estimates of the current benchmark or the existing range of management practices for soil, nutrients and pesticides on agricultural land including sugarcane, grazing, horticulture, grains and dairy. A target is that by 2025, 90 percent of land managers have adopted best management practices. The adoption of best practices have been shown to reduce the loss of pollutants to the environment (see Paddock Trials page 5) and is essential to meet the long-term goal of the Plan for water quality to have no detrimental impact on the Reef.

When landholders adopt improved or 'best practice' methods the differences in old and new practices can be measured and quantified as a reduction of pollutant (tonnes for sediment and nutrient and kilograms for pesticides). When aggregated up to a regional scale, the Paddock to Reef program can highlight the total reduction of pollutants from the region between years.

An example of an improvement in sugarcane is the movement away from broadcast application of residual herbicides to banded spraying of residuals and the management of inter-rows with knockdowns. Using this method, a reduction in the volume of residual pesticides applied is achieved. This reduction can be quantified and reported as a reduction in total volume of herbicide applied.

A further example is of an improvement is the use of a variable rate nitrogen application program based on assessment of the yield potential of individual zones. This helps in optimising nutrient use by matching fertiliser applied with the crop requirement.

Landholders can access grants and extension advice through a number of regionally delivered projects to improve their practices. All projects delivered in the region are required when possible to be reported under Paddock to Reef. This includes both Australian and Queensland Government programs.

To get involved in any of the management practice adoption program being delivered in the region please contact Reef Catchments.



*Shielded spray unit
to distribute pesticide
directly where it is needed*

PADDOCK TRIALS

The Paddock monitoring component conducts various trials throughout the GBR Catchments on different land uses to assess the water quality results from differing management practices. The trials compare conventional and / or dated management practices to improved or newer management practices. Data generated from the trials is used to promote management practices and also provides model parameters for the existing paddock model. The trials capture runoff either from rainfall events or from rainfall simulated events and analyse the difference in pollutant concentrations. Previous trials have been used to validate management practices such as: banded Vs broadcast herbicide applications, comparing knockdown and residual herbicide products, controlled traffic vs non-controlled traffic treatments and sub-surface Vs surface applied products. On-farm refrigerated auto-samplers and monitoring equipment is used to measure and sample paddock runoff for the determination of fertiliser and pesticide concentrations as it leaves the cane row.

The Queensland Government Department of Natural Resources, Mines and Energy currently deliver the sugarcane paddock monitoring trials in the Mackay Whitsunday region. Current trials are investigating nitrogen runoff and productivity differences from sub-surface applied urea and enhanced efficiency fertilisers at two different application rates based on a Six Easy Steps approach – using district and productivity unit yield potentials. A pilot study into runoff losses from sub-surface applied imidacloprid is also being undertaken.

- Moving from conventional to improved management practices (controlled traffic and to industry recommended nitrogen rates in Six Easy Steps) can reduce total nitrogen (N) lost in surface runoff by 32 per cent, with no change in net financial return.
- Every additional 21 days between nitrogen fertiliser application and first runoff, halves N loss (per cent of applied) to runoff.
- Un-graded urea in runoff was a significant contributor to the runoff nitrogen loads.

PADDOCK MODELLING

The paddock modelling program seeks to quantify the water quality improvement; at a paddock scale, from the adoption of improved management practices. To achieve this, a number of industry specific models are used together, running the model before and after a practice change quantifies the difference in water quality run-off between the practices.

Through the extension programs provided throughout the region, a landholder is benchmarked for their current practices. With extension and provision of funding for new equipment or technologies a landholder is re-benchmarked after investment and the difference is modelled for the improvement in water quality.

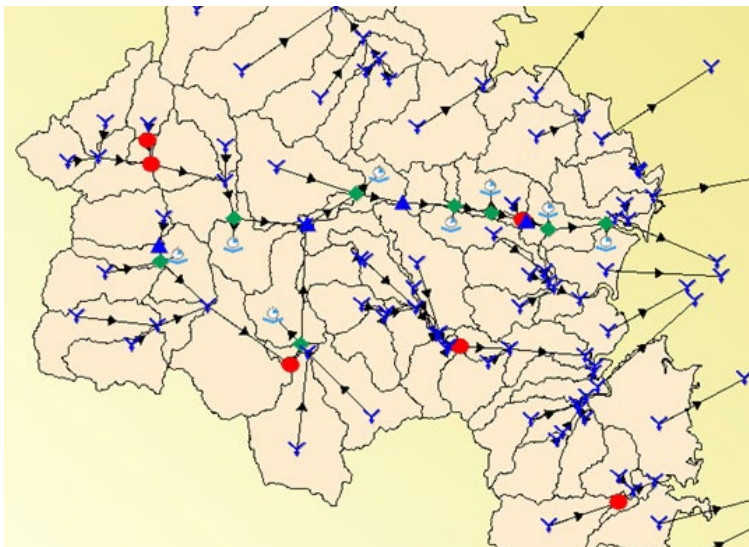
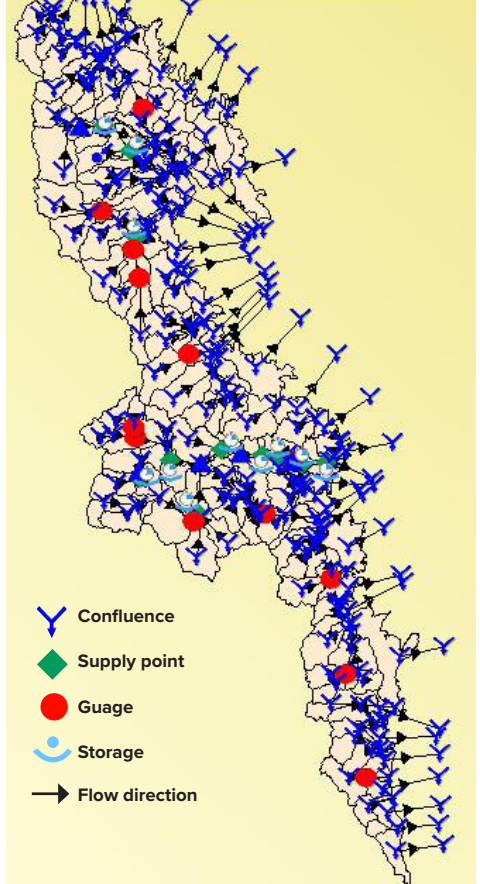
For modelling water quality improvement from management practice adoption in sugarcane, 40 different combinations of management practices can be modelled.

The paddock model results are then used by the catchment model to quantify the region wide water quality improvement.

CATCHMENT MODELLING

The Catchment loads modelling program estimates average annual loads of key pollutants for each of the 35 catchments draining into the GBR. The Reef Catchments NRM region has four catchments: Proserpine, O'Connell, Pioneer and Plane Creek (Figure 1). The program provides the baseline levels of pollutants and the change in loads that is associated with the reduction in pollutants from the adoption of improved management practices as mentioned in Paddock Trials.

The catchment modelling uses a number of models to calculate the annual pollutant loads and is validated using the catchment loads monitoring program (Page 8). The catchment model also uses additional information when it is available to validate the model such as river stability assessments.



Conceptual diagram shows how water flows through the landscape linked by nodes before reaching the inshore Great Barrier Reef

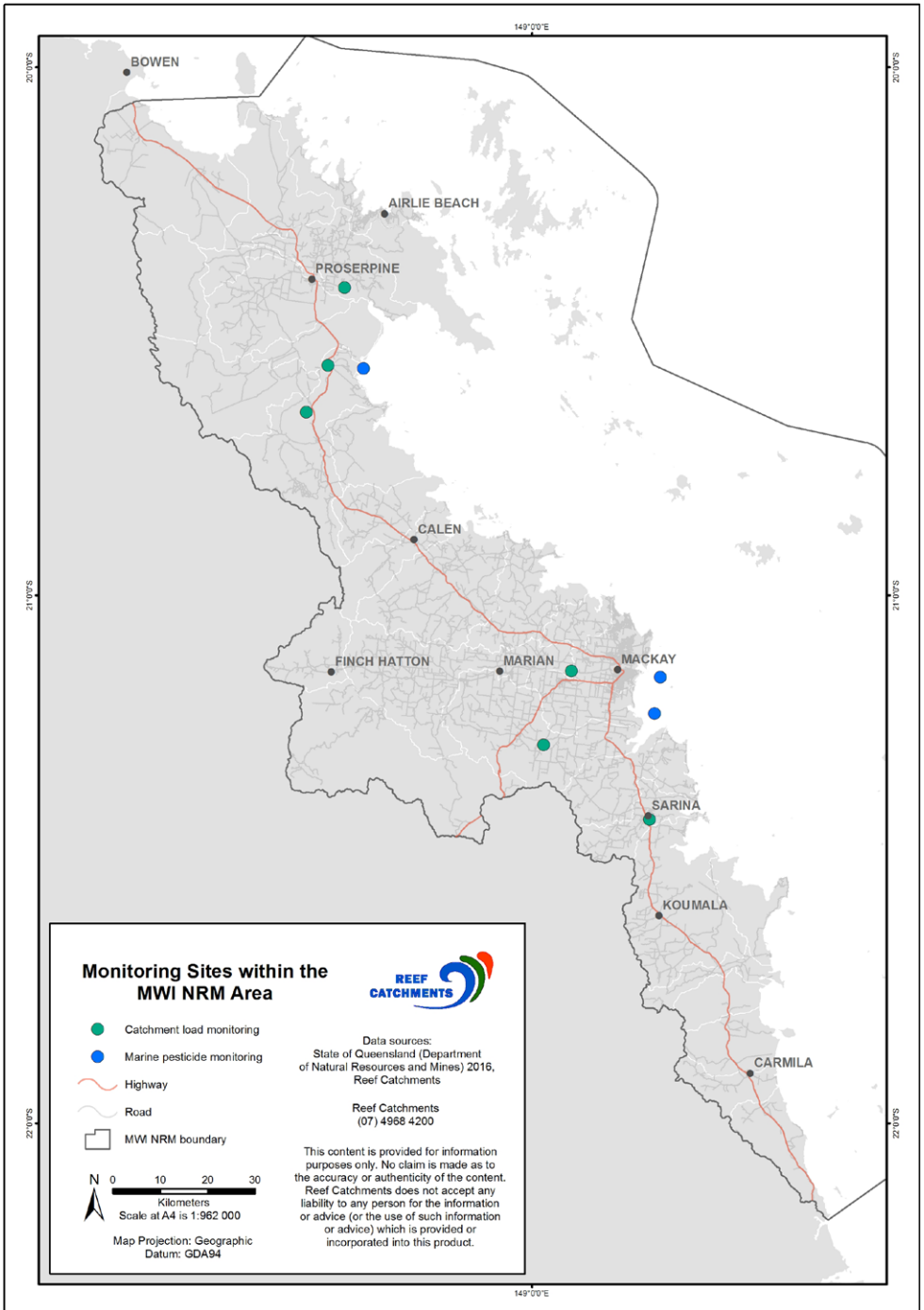


Figure 1: Monitoring sites in Reef Catchments NRM region for Catchment loads and marine pesticides.

CATCHMENTS LOADS MONITORING PROGRAM

The Great Barrier Reef (GBR) Catchments Loads Monitoring Program tracks long-term trends in water quality from priority catchments. Within the 35 drainage basins, monitoring is undertaken at 43 sites in 20 key catchments for sediment and nutrients and a further 19 sites for pesticides. Data is utilised to model annual loads from each of the 35 basins. Monitoring data is used to calibrate and validate water quality models and report on targets through annual report cards, which measure and report on the progress towards the Plan goals and targets (www.reefplan.qld.gov.au).

In the Mackay Whitsunday region there are six monitoring sites. These are along the O'Connell, Proserpine and Pioneer Rivers and Sandy and Plane Creeks.

From all of the collected samples the concentrations are determined, with the volume of water flowing in the river used to determine the load (either tonnes or kilograms depending on pollutant) of each of the pollutants.

Each year the monitoring program releases a report detailing the results from each of the sites monitored. This can be found at www.reefplan.qld.gov.au/measuring-success/paddock-to-reef/catchment-loads/

Autosamplers





Deployed pesticide sampler off the mouth of the O'Connell River

MARINE MONITORING PROGRAM (MMP)

The Marine Monitoring program, led by the Great Barrier Reef Marine Park Authority (GBRMPA), monitors the health of the inshore Great Barrier Reef by testing water quality including specifically checking for passive pesticides and monitoring sea grass and coral reef ecosystems. Data collected from the MMP is combined with data collected at the paddock and catchment level to produce the annual Great Barrier Report card.

In the Mackay Whitsunday region Reef Catchments contributes to the marine monitoring program through the deployment and retrieval of pesticide samplers at three sites within the region. The samplers sit just off the coast adjacent to major rivers and passively absorb pesticides in the water and provide information of what pesticides are present and at what concentrations.

Pesticides from agricultural land uses are being detected in the marine environment with the Mackay Whitsunday sites providing historical records of areas with the highest concentrations.

The program is vitally important in understanding the health of the marine environment across the whole Great Barrier Reef Catchment, including the Mackay Whitsunday region. Data is limited, so every sample is important.

Retrieving pesticide sampler





DeMoylans Wetlands Mirani

WETLANDS

The condition of natural freshwater wetlands across the Great Barrier Reef catchments are being assessed as part of a monitoring program that is collecting data on the pressures and state of wetland ecosystems. The monitoring program is tracking progress towards an important target of the Reef 2050 Plan to improve the condition of natural freshwater wetlands.

Three randomly selected wetlands in the Mackay Whitsunday region are being monitored as part of the program. These wetlands will contribute to gaining a broad understanding of current wetland condition across the Great Barrier Reef (GBR) catchment as part of the Paddock to Reef program.

Remnant wetlands in the GBR catchment maintain high biodiversity, aesthetic and cultural values, provide important connections between freshwater and marine ecosystems of the GBR region and provide ecosystem services such as water quality improvement and carbon storage.

Coastal freshwater wetlands continue to be affected by a range of chronic and acute

pressures such as excess nutrient, sediment, and pesticide loads, loss of connectivity, changes in hydrology, and invasive species. These modifications have led to secondary impacts such as poor water quality, algal blooms and hypoxia.

Gaining a better understanding of wetland conditions will help scientists, land managers and decision makers improve our future actions and ensure those actions have the most beneficial impact on wetland and Reef health.

As the region's wetlands are located on private properties, Reef Catchments coordinates the engagement with landholders and arrangements with the Department of Science Information Technology and Innovation (DSITI) to visit the site to undertake the assessment.

For more information about the program visit the Reef Plan website www.reefplan.qld.gov.au/measuring-success/paddock-to-reef/wetlands.

For more information about wetlands visit the Wetland Info website www.wetlandinfo.ehp.qld.gov.au/wetlands.