

Paddock to Reef Program

**Integrated monitoring,
modelling and reporting**

Reef Water Quality Protection Plan



Australian Government

CARING
FOR
OUR
COUNTRY



Queensland
Government



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Objective

The long-term goal of the Reef Water Quality Protection Plan (Reef Plan) is to ensure that the quality of water entering the Great Barrier Reef (the Reef) from adjacent catchments has no detrimental impact on its health and resilience.

The objective of the Paddock to Reef Integrated Monitoring, Modelling and Reporting Program is to measure and report on the progress towards the Reef Plan goals and targets.

Reef Plan 2009

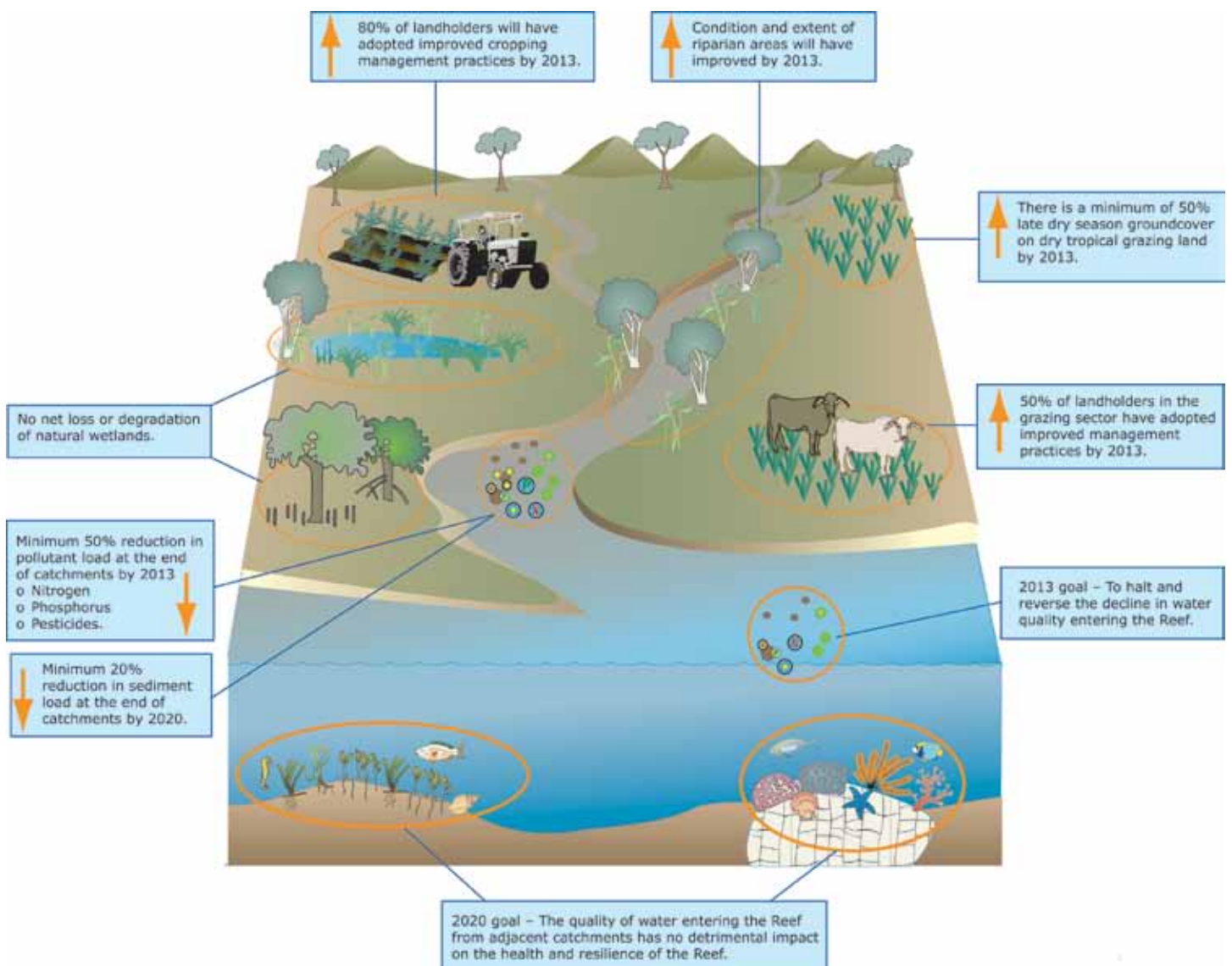
Reef Plan, first introduced in 2003, is a joint commitment of the Queensland and Australian governments to minimise the risk to the Reef ecosystem from a decline in the quality of water entering the Reef from the adjacent catchments. Reef Plan specifically focuses on non-point source pollution from broad-scale land use with other programs dealing with pollutant sources outside this scope.

The plan was updated in 2009 (Reef Plan 2009) to ensure that reef water quality is improved and that the Reef has the resilience to cope with the stresses of a changing climate.

Reef Plan 2009 is underpinned by a suite of targets linking land management, water quality and ecosystem health from the paddock to the Reef. Achieving these targets will help achieve the long-term goal.

Reef Plan 2009 includes a robust monitoring and evaluation strategy to evaluate the efficiency and effectiveness of implementation and report on progress towards the Reef Plan (and Reef Rescue) goals and targets. A key action of Reef Plan 2009 is the development and implementation of the Paddock to Reef Integrated Monitoring, Modelling and Reporting program.

Reef Plan goals and targets - Paddock to Reef



Development approach

A collaborative approach was used to develop the program including a suite of Reef-wide and regional workshops and forums involving a broad range of expertise from the following areas:

- paddock scale land management practices and processes
- catchment water quality processes (including monitoring and modelling)
- marine water quality and ecosystem health processes
- remote sensing technologies
- program managers and policy officers.

More than 100 scientific and technical personnel from 18 organisations were involved in the program design and their contribution is acknowledged.

The program design built upon the knowledge generated since the commencement of Reef Plan in 2003 and utilised current research, development and innovation. This design minimised costs as it utilised, refocused and integrated existing monitoring and reporting programs.

Program components

The framework for the design involves monitoring and modelling a range of attributes at a range of scales including management practices, water quality at the paddock, sub catchment, catchment levels and in adjacent marine areas. This approach provides the ability to link the monitoring and modelling outputs at each scale and across scales.

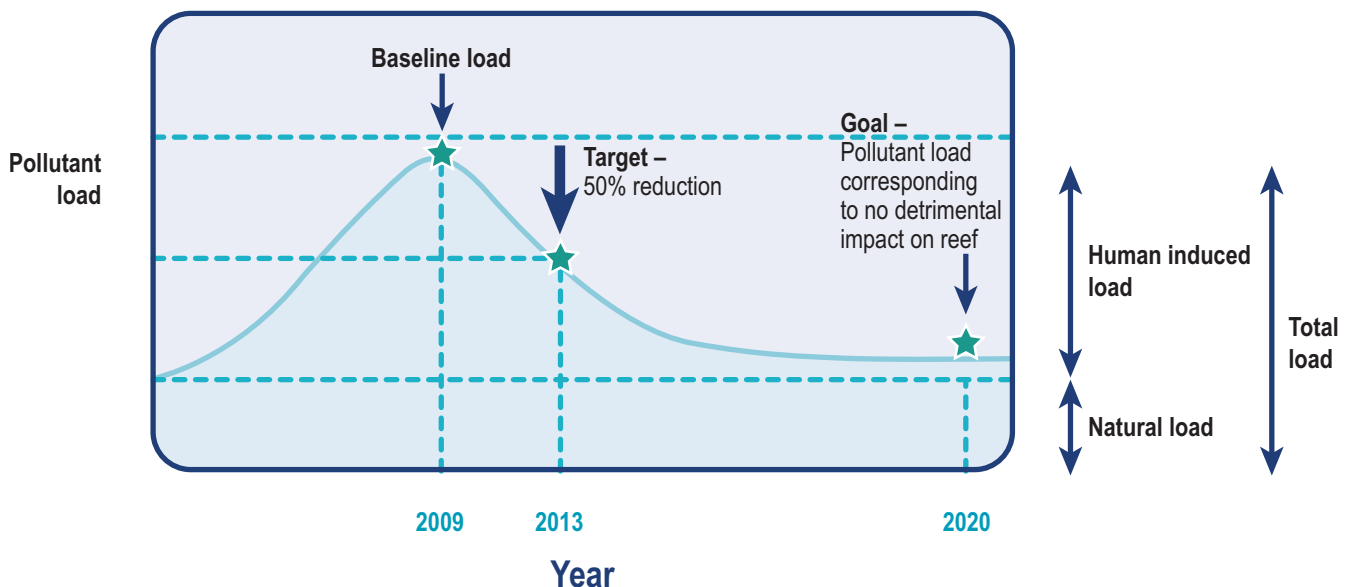
Monitoring involves recording changes as they happen and reporting them after the event. Modelling provides the opportunity to forecast changes prior to their occurrence and separate the management impacts upon water quality from other influencing factors such as climate change.

Combining monitoring and modelling provides a robust tool for measuring and predicting change and highlighting and forecasting trends in data.

The monitoring data will also be used to validate and improve the models at each scale, continuously improving the confidence in the estimates of water quality over time.

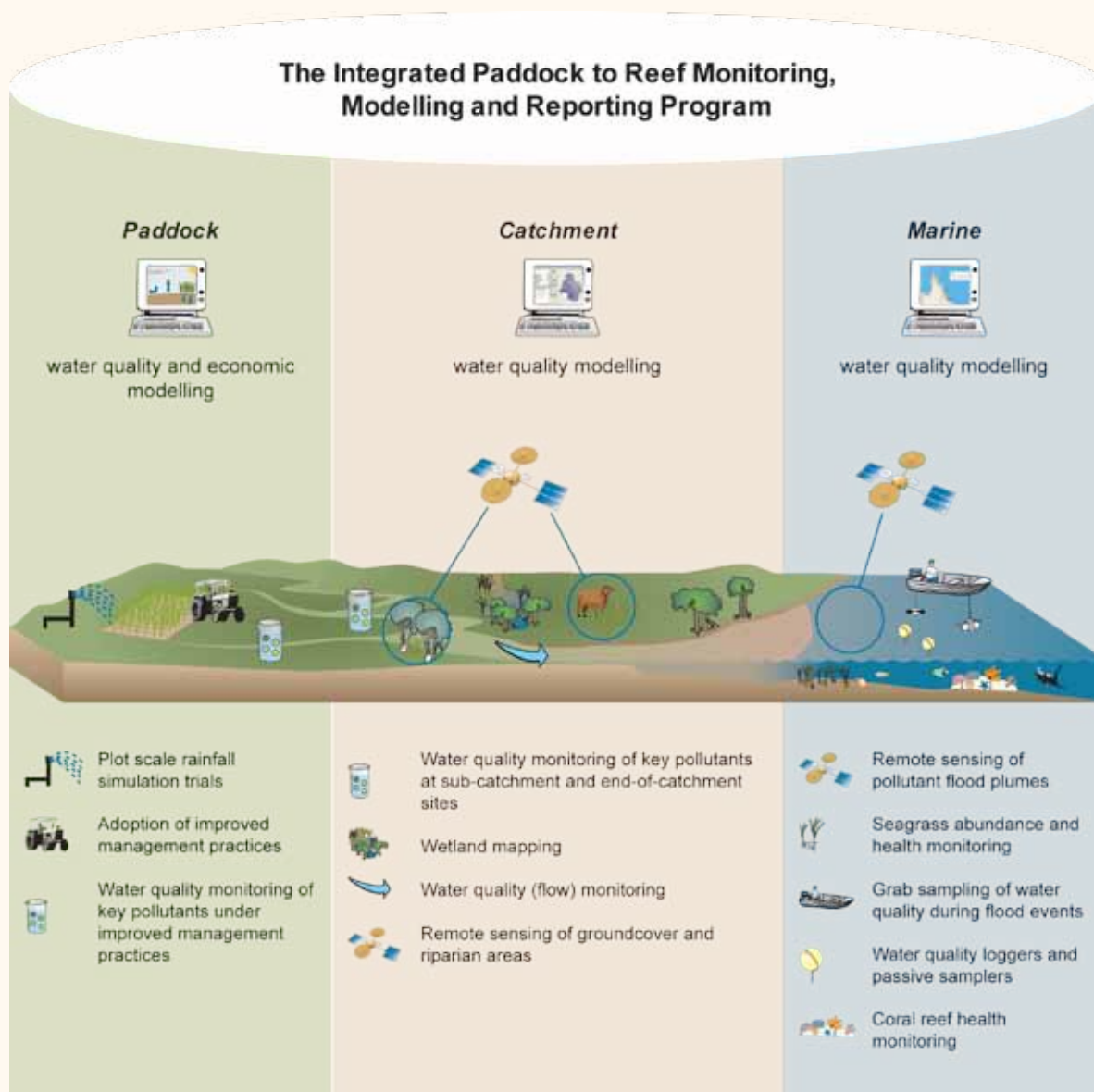
The program uses cutting edge monitoring and modelling tools across each of the scales (paddock, catchment, marine) to enable reporting against the Reef Plan goals and targets in the short to medium term.

Defining the pollutant load targets



The Paddock to Reef integrated monitoring, modelling and reporting program

Monitoring and modelling from the paddock to the reef allows us to measure and report on progress towards the Reef Plan goals and targets.



Management practice adoption

The objective of collecting management practice information for each industry and each region is to determine the extent of change in land management practices that lead to water quality improvement over time.

Management practice adoption information will be used to report against the Reef Plan targets and provides essential information for the paddock and catchment scale models which, in turn, predict water quality improvement.



Monitoring water quality leaving the paddock from improved sugarcane management practices.

Paddock monitoring and modelling

Paddock scale monitoring provides information on the water quality changes related to specific management practices. Paddock models such as Agricultural Production Systems Simulator (APSIM), HowLeaky and GRASP are used to corroborate this information.



Paddock scale rainfall simulation field trials in sugarcane.

The program consists of three monitoring and modelling activities:

1. **Paddock monitoring** – collecting run-off during actual rainfall events from a uniform portion of a paddock. Over time, the paddock monitoring provides temporal data to capture variability in rainfall and other climatic factors, changes in management and changes in system responses.
2. **Rainfall simulation** – collecting run-off from a simulated rainfall event from a plot within a paddock. Over time, the rainfall simulation work progressively extends the spatial coverage by capturing the variation in response at sites with different soil or land type characteristics.
3. **Paddock modelling** – over time, the paddock modelling progressively develops spatial coverage across soil and land types with improved estimations from using paddock monitoring and rainfall simulation information.

Catchment monitoring and modelling

The objective of catchment monitoring and modelling activities is to improve the ability to measure water quality change at sub catchment and end of catchment scales. Pollutant load monitoring is conducted at 27 sites across the Reef catchments. The catchment water quality monitoring objectives are to:

- Assess the water quality entering the Reef lagoon from catchments and determine trends in water quality over time.
- Identify potential source areas of contaminants.

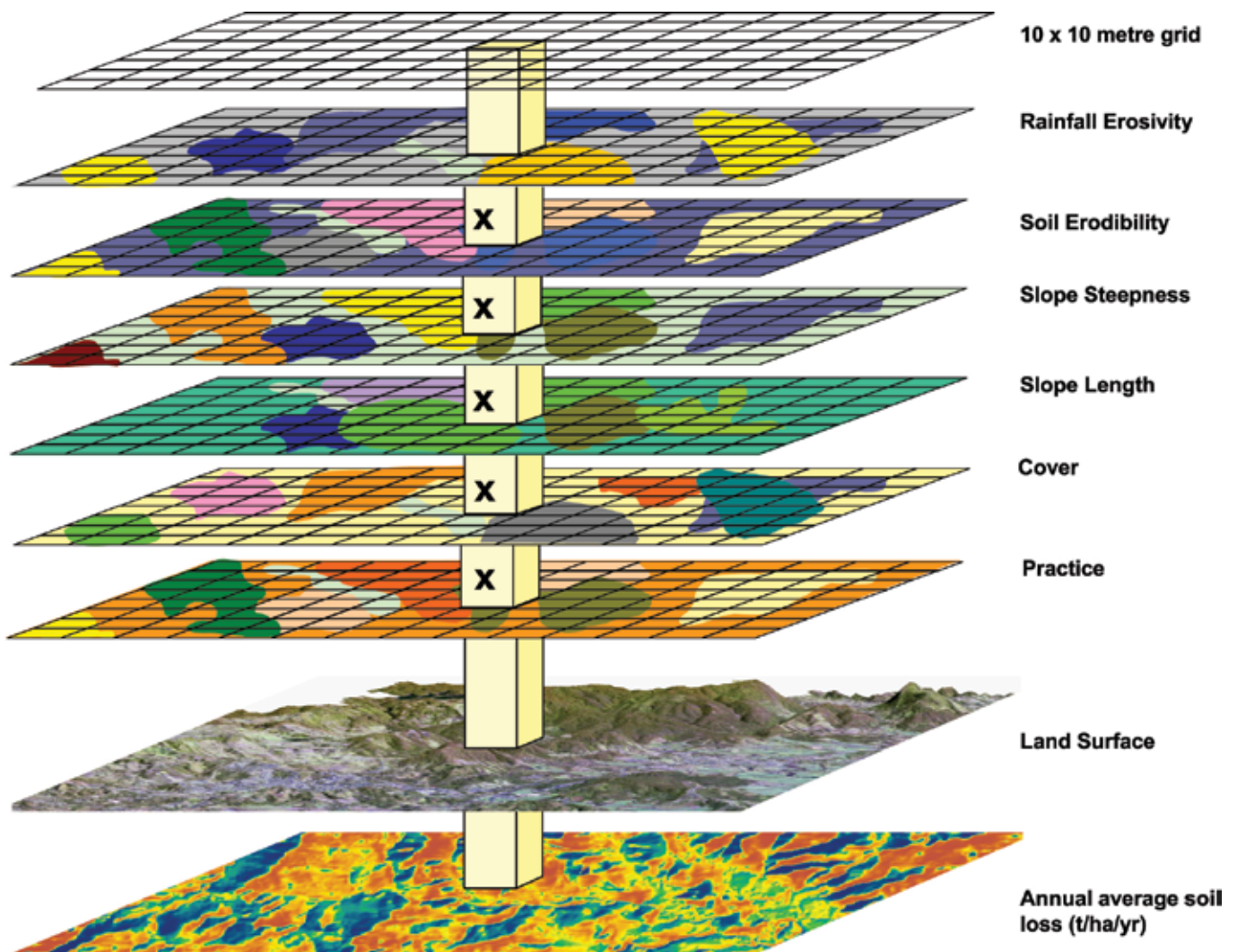
- Link to paddock scale and marine monitoring and modelling.
- Validate and calibrate the catchment models.

In order to assess the water quality improvements due to management practice change, models are required. In particular, water quality improvements measured in focus areas will need to be scaled up to the entire Reef catchment. Current catchment models have limitations that are being overcome by development and use of the (eWater Cooperative Research Centre) Source Catchments catchment modelling tool.

Source Catchments can produce annual loads due to its short time-step capabilities and is being developed to represent catchment trapping mechanisms and dissolved nutrients.

Information on the condition of the catchment will also be collected and reported including an assessment of ground cover in dry land grazing areas and the extent and condition of riparian areas. This information is used to report on progress towards the Reef Plan targets and provides useful input data for the catchment modelling.

Data layers used in catchment water quality modelling





Airborne laser technology is being used to improve our knowledge of gully erosion processes.



Monitoring the water quality at the end of the catchment.

Marine monitoring and modelling

The Reef Water Quality Marine Monitoring Program, led by the Great Barrier Reef Marine Park Authority (GBRMPA), assesses the health of key marine ecosystems (inshore coral reefs and intertidal seagrasses) and the condition of water quality in the

inshore Reef lagoon. The program is critical for the assessment of long-term improvement in water quality and marine ecosystem health associated with the adoption of improved land management practices in the Reef catchment.

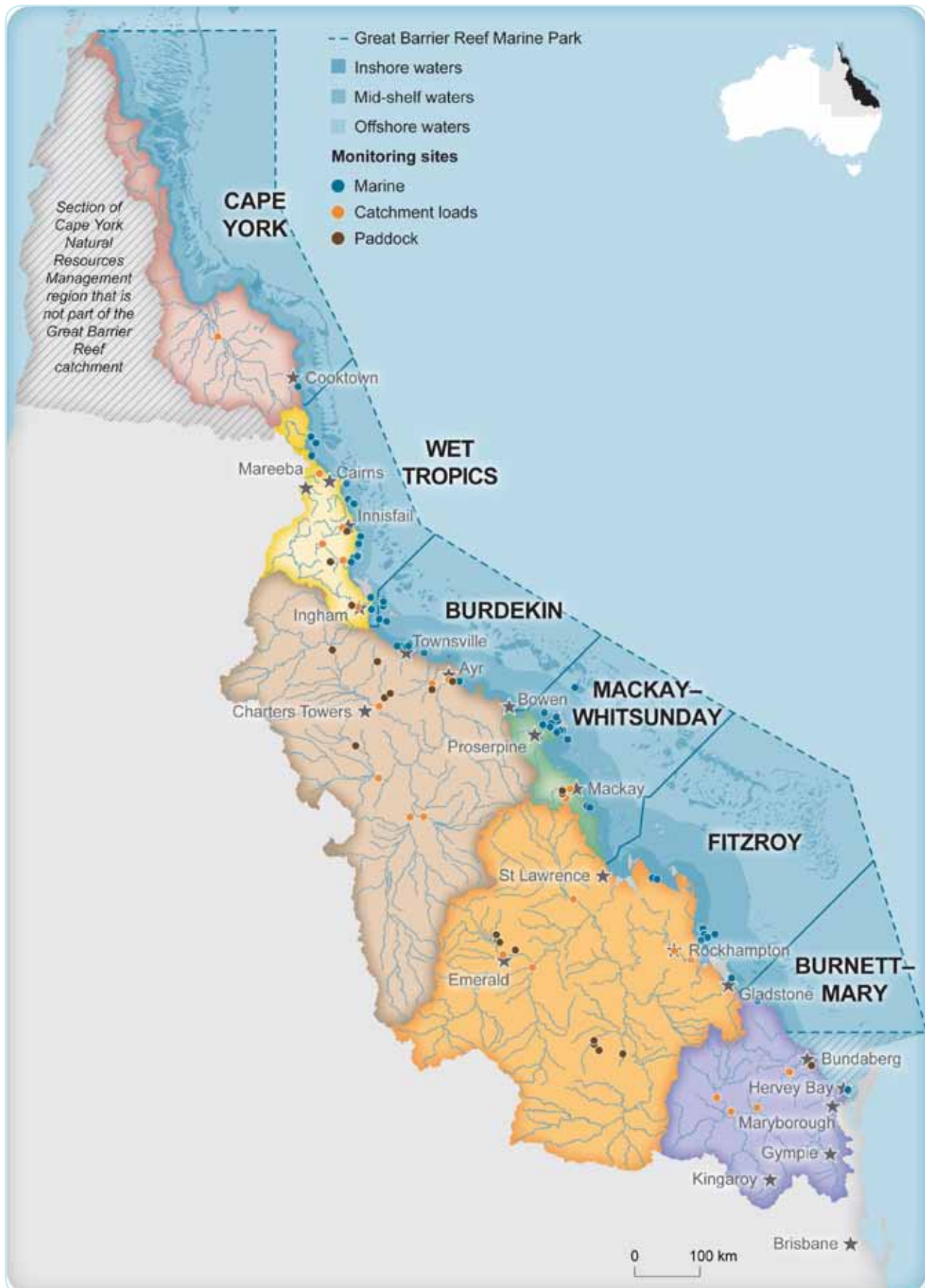
Linking end-of-catchment loads with marine trigger values will also require a receiving water model to simulate the fate and impacts of these contaminants as they pass through estuaries and into the Reef lagoon and beyond.

Core programs	Sub-programs
Inshore biological monitoring	Inshore coral reef monitoring
	Intertidal seagrass monitoring
Water quality monitoring	Inshore marine water quality monitoring
	Flood plume water quality monitoring
	Inshore pesticide monitoring
	Remote sensing water quality in the Great Barrier Reef



Inshore coral reef monitoring as part of the marine monitoring program.

Map of monitoring locations for the Paddock to Reef Integrated Program



Reporting

The Reporting Framework for the program is driven by the Reef Plan goals and targets and the principles outlined in the Reef Plan Monitoring and Evaluation Strategy. The First Report Card covers monitoring up to 2009 and provides the baseline for key indicators. Subsequent report cards will measure progress towards goals and targets from the paddock to the reef.

Partners

The Paddock to Reef Program is funded jointly by the Australian and Queensland governments. Implementation of the program is a collaborative effort involving governments, key industry partners, research organisations, regional Natural Resource Management bodies and individuals.

Oversight of the Reef Plan Monitoring and Evaluation arrangements is provided through the Reef Plan Intergovernmental Operational Committee and a Partnership Committee made up of key stakeholders. Leadership and coordination is provided through a range of organisations including:

- Queensland Department of the Premier and Cabinet
- Queensland Department of Environment and Resource Management
- Great Barrier Reef Marine Park Authority
- Australian Government Department of Sustainability, Environment, Water, Population and Communities
- Queensland Department of Employment, Economic Development and Innovation
- Regional Natural Resource Management Bodies
- agricultural industry groups
- research and development organisations.



Water quality monitoring in the Reef lagoon as part of the marine monitoring program.

