



Reef Water Quality
Protection Plan

**Research, Development
and Innovation Strategy**

2009–2013



Australian Government





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Executive summary

Water quality is a critical issue in the management and protection of the Great Barrier Reef World Heritage Area. Advances in research, development and innovation are vital to addressing the issue sooner rather than too late.

Investment in reef water quality research has grown significantly over the past few decades, but so too has the demand for knowledge. The variety and number of questions being asked by managers, landholders and the community continues to grow beyond the capacity of combined investment.

In recognition of this limited capacity, this Research, Development and Innovation Strategy aims to establish a process that will help identify the most critical questions that need to be answered and the knowledge gaps that need to be filled to provide long term solutions for declining water quality entering the reef.

This strategy does not specifically outline current priorities for research, development and innovation, but instead establishes the process, criteria and consultation arrangements for identifying which knowledge gaps are most critical to fill. A list of priorities will be prepared each year in consultation with end users (such as organisations promoting research outcomes) and in accordance with the strategy. These priorities will be outlined in an annual Research, Development and Innovation Plan from 2009/2010 onwards. An annual review will be undertaken of those gaps that have been filled and any emerging issues will be identified and weighted against existing priorities. This annual evaluation will inform the preparation of the plan each year.

Determining what the most important management questions are, and how to answer them, requires a range of expertise. This strategy advocates that end users of research, development and innovation, such as reef managers, landholders, regional bodies and conservation groups identify the most important questions to ensure that activities are focused on achieving practical results and outputs that can be widely adopted and supported.

Providers of research, development and innovation will play a different, but equally important role in determining how those questions can best be answered by filling specific knowledge gaps. This process, which draws upon the expertise and knowledge of all stakeholders and scientists, will ensure a cohesive and focused set of priorities that will help improve the management of impacts on reef water quality.

This strategy will be valuable to investors in research, development and innovation and will promote a more coordinated and streamlined approach to reef water quality research and development. It will also be a valuable resource

for providers trying to tailor their work towards management priorities and targets. The focus of investment is strongly directed at solving the problem, rather than further defining it, in recognition of, and to build upon, the previous extensive work in this area.

Introduction

The Reef Water Quality Protection Plan (Reef Plan) was launched in 2003 as a 10-year joint Australian and Queensland Government commitment to halting and reversing the decline in water quality entering the Great Barrier Reef lagoon.

The Reef Plan has recently been reviewed and updated, to refocus actions on improving water quality. The updated Reef Plan is more strategic and outcomes focused, with improved accountability for actions and better monitoring to measure success.

One of the 11 actions identified in the updated Reef Plan is the development of a Research, Development and Innovation Strategy to guide reef water quality research over the next five years.

Scope

This strategy provides guidance and direction for reef related research, development and innovation over the next five years.

It covers all research, development and innovation related to the effects of broadscale land use on reef health. It has the same scope as the Reef Plan, in that it does not address point source or urban pollution.

The monitoring and evaluation arrangements for Reef Plan are covered in a separate Monitoring and Evaluation Strategy. However there is an evaluation component of this strategy to monitor uptake of research, development and innovation priorities.

While this strategy does not cover climate change research specifically, it may cover research into the interactions between water quality and climate change. The main focus of the strategy is to target research, innovation and investment efforts at solving the problem of water quality decline. At its core, this strategy emphasises a fundamental shift away from collecting knowledge about the declining nature of water quality in the reef catchments, to identifying, trialling and validating solutions to this problem.

This strategy is informed by other strategic documents such as the Great Barrier Reef Outlook Report.



Who will use this strategy

This strategy should be used by both research providers and investors.

Research providers will find this strategy useful when tailoring research programs and projects to management needs.

Investors will find this strategy valuable when assessing research, development and innovation proposals, and may use it in conjunction with an Annual Research, Development and Innovation Plan to assess how important a proposal is in comparison to other reef water quality research priorities.

An annual plan will be developed from 2009/2010 onwards to update priorities in response to any emerging management needs identified by end users. This will be useful for investors to reduce the duplication of projects and ensure that investment is continuously directed at solving the problem.

A report will be compiled each year outlining how research, development and innovation priorities are being addressed, and will be made publicly available through the Reef Water Quality Protection Plan annual report.

Current challenges

It must be acknowledged that since the identification of water quality as a critical issue for the reef, significant advancements have been made both in the level of investment in research, development and innovation and the outputs being delivered. However, the coordination and prioritisation of investment in research, development and innovation has been slow. As a result, there has been duplication of investment, and opportunities for the integration of projects and further collaboration may have been missed or foregone.

In the past, limited investment has been applied to innovation and the development of solutions. These areas represent an opportunity to draw upon the expertise and wisdom of landholders and other stakeholders, which can lead to significant water quality gains.

This strategy focuses on ways of addressing these challenges and improving the coordination of research, development and innovation in this advancing and important field.

Current investment environment

Investment in reef water quality research is currently delivered through a range of programs and government initiatives, as well as co-investment from industry and the private sector. Sources of investment include:

- research and development councils (such as the Sugar Research and Development Corporation) that are funded through industry levies and government contributions
- collaborative initiatives (such as the Marine and Tropical Science Research Facilities, funded through the Department of Environment, Water, Heritage and the Arts)
- research funding provided through the Australian Government's Caring for our Country program (in particular the Reef Rescue initiative)
- Australian Government investment in university research through the Australian Research Council
- Australian Government investment in research providers such as CSIRO, the Australian Institute of Marine Science and the Australian Research Council Centre of Excellence for Coral Reef Studies
- investment by the Queensland Government in research by state agencies such as the Department of Employment, Economic Development and Innovation, and the Department of Environment and Resource Management
- investment by the Australian Government Department of Environment, Water, Heritage and the Arts and the Great Barrier Reef Marine Park Authority in individual research projects
- private investment in research through non-government organisations such as the World Wildlife Fund and the Great Barrier Reef Foundation.

Achievements by 2013

A key part of this strategy is to identify what is to be achieved by 2013 in order to see tangible benefits to the reef. The next step is then ensuring that there is appropriate investment applied to priority areas that will help achieve these outcomes.

By 2013, the objective is to:

- promote innovative solutions to solve the problem
- have more tools in the toolbox to mitigate the impacts of declining water quality
- have used investment in research, development and innovation to more efficiently and effectively achieve the improved water quality outcomes targeted by the Reef Plan
- have stakeholders jointly involved in setting the research, development and innovation agenda and promoting and implementing its outputs
- understand what impacts the reef can absorb while still remaining healthy and resilient to climate change and episodic events.

Guidelines

A number of guiding principles need to be followed to achieve the 2013 objectives.

Focus on end user needs

Research, development and innovation should focus on the needs of end users and deliver on-ground improvements, while ensuring that outputs answer the necessary questions to promote continuous improvement in water quality. With a stronger end user focus, research has the potential to influence new policies, extension work, industry development, innovation and new product development. End users for reef water quality research include:

- landholders
- reef managers
- catchment managers
- public land managers
- regional natural resource management bodies
- extension officers
- researchers, scientists and knowledge brokers
- local government
- Commonwealth and Queensland ministers and members of parliament
- tourism operators
- Indigenous landholders.

Synthesise information and knowledge

Research, development and innovation should be synthesised across programs, and data and findings shared to maximise return on investment, reduce duplication of effort across research providers and make the most of available science expertise.

Build partnerships and collaboration

Reef water quality research, development and innovation should be based on positive partnerships and collaborative arrangements to share skills and knowledge across different research providers and provide results that would not be possible alone.

Identify win-wins

Reef water quality research, development and innovation should recognise that land use and a sustainable reef can co-exist. It should wherever possible, aim to achieve win-win outcomes for both landholders and the reef.

Promote innovation

Research, development and innovation should encourage innovative management practices, innovation in research techniques, and new technologies that can improve water quality. Co-investment in innovation can help identify practices that benefit landholders through on-farm efficiency and also improve water quality.

Management questions

With a stronger end user focus there is a need to clearly articulate the suite of questions faced by land managers. For managers, there are often two broad questions: what is the extent of the problem; and how can it be fixed? Solving the problem is considered the priority for research, development and innovation activities over the next five years.

Solving the problem

- Which land management practices, or suites of practices, deliver positive water quality benefits?
- Which water quality benefits derive from individual land management practices?
- What is the time lag between making a management change and seeing a water quality benefit?
- How much water quality benefit is derived from water quality filters like floodplains, riparian areas and wetlands?
- Which new technologies can reduce the impact of certain nutrients or chemicals?
- What are the economic benefits to farmers of adopting different land management practices?

- Which practices both improve profitability for the farmer and also improve water quality?
- What are the best methods of encouraging uptake of new land management practices?
- What are the relative contributions of education and extension, financial and non-financial incentives for voluntary adoption, and regulation and enforcement to the adoption of improved land management in reef catchments?
- What factors influence the effectiveness of these, and what water quality improvements can be attributed to these activities?

Understanding the problem

- Is the problem getting worse or better?
- Which areas and/or pollutants contribute most to the problem?
- What are the sustainable loads or thresholds of nutrients, chemicals and sediments that the reef can tolerate while still remaining healthy and resilient?
- What pesticides remain in the ecosystem the longest and/or cause the greatest damage?
- How does the problem with water quality compare to the problem of climate change? Which is the greater risk? Are there synergistic or conflicting issues?
- How are the effects of land use and management identified in the context of large natural variability, such as large flood events?
- How do big flood events influence the problem?
- What are the current social and economic barriers to landholders adopting improved practices?
- What is the area of broad-scale land managed under improved practices and what is the net effect?

Research themes

To help organise research, development and innovation, five themes have been identified, which link to the above broad management questions.

A focus on solving the problem

As part of this strategy, it is proposed that the balance of investment should be weighted towards solving the problem. This recognises that research, development and innovation investment should be based on the likelihood that a theme will produce outputs that can have a positive impact on water quality.

The following explanation of the themes from Figure 1 are ranked in order of priority for investment, indicative of the effort required to focus on 'solving the problem'.

1. The **management effectiveness** theme aims to link changes in management to quantitative water quality benefits. It includes the design of monitoring programs

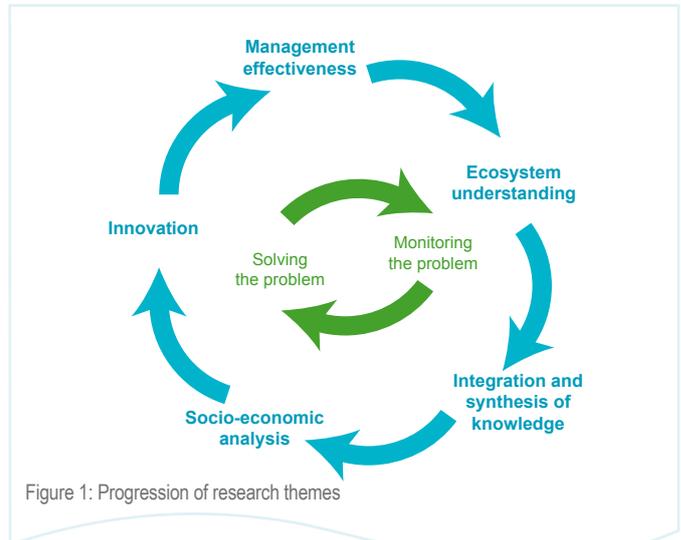


Figure 1: Progression of research themes

to effectively measure progress in achieving water quality targets or staying within acceptable thresholds. This is a high priority because of the clear need to understand the water quality benefits associated with different land management practices, and to ensure that investment is directed into the areas with the greatest potential for water quality outcomes. An investigation of management effectiveness is the most significant area of investment required to focus on solving the problem.

2. The **integration and synthesis** of knowledge theme aims to promote collaborative data sharing and partnerships to maximise positive outcomes, as well as effectively use existing data and knowledge to answer fundamental questions. It includes a refinement of models linking activities and knowledge from the paddock to the reef. This is a high priority for investment because integrating existing information can help us better understand the sources of pollutants, the role of positive influences such as wetlands, and help direct management responses.
3. The **socio-economic analysis** theme includes an assessment of current barriers to the uptake of improved land practices, the best ways to overcome those barriers, and the social and economic benefits that can be derived from changes in management. An identification of barriers to uptake that limit management effectiveness will guide faster implementation of improved practices.
4. The **innovation** theme aims to identify innovative land management practices, develop more innovative research or monitoring techniques, and create new technologies to improve water quality. Investment in this area is critical, as a continual focus on promoting innovative solutions to the problem can help assess which practices are having the greatest benefit. This theme strongly supports management effectiveness, which remains the highest priority for investment.

- The **ecosystem understanding** theme aims to improve knowledge of system processes including the sources and fates of nutrients, sediments and chemicals. An assessment of sustainable loads or levels of pollutants is an important component, as well as time lags between management changes and evidence of water quality benefits. Ecosystem understanding includes the role of floodplains and wetlands, and the interactions between water quality and climate change. Understanding ecosystems assists in monitoring the problem. A large amount of work has been, and continues to be undertaken in this area. However, the focus of this strategy has shifted towards minimising impacts and solving the problem.

A process for prioritising research

A three stage adaptive process will be used to prioritise reef water quality research. This process builds on the work completed to date to identify knowledge gaps, but proposes a more rigorous prioritisation process and annual evaluation to determine and report on uptake.

Stakeholder involvement

A variety of stakeholders will play a role in setting the research, development and innovation agenda.

End users, such as industry and conservation groups and regional bodies will play a critical role in identifying research needs and prioritising research (Stages 1 and 2). This will occur annually and be coordinated through the partnership committee which has been established under Reef Plan.

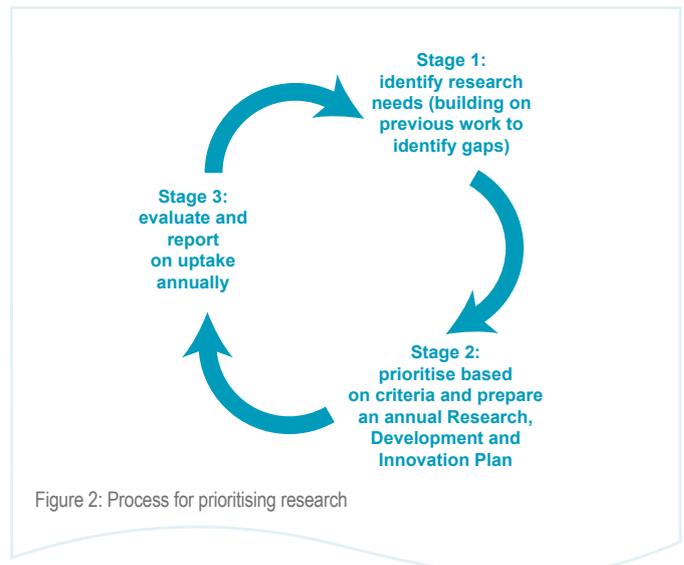
Researchers and science providers will play a role in identifying how the key research needs can be met through the collection of specific information or development of particular research projects. They will also play a role in the evaluation of uptake of research priorities each year (Stage 3).

Stage 1: identifying research needs

Exercises to identify and confirm knowledge gaps and information priorities have already been undertaken. In March 2008, the then existing Reef Water Quality Partnership held a workshop attended by representatives from peak industry bodies, conservation groups, science institutions and natural resource management bodies in reef catchments to develop reef water quality science priorities. The emerging priority research and information needs identified through this process included the following.

Support for delivering on-the-ground works through:

- understanding the effectiveness of land management practices in achieving water quality benefits
- understanding costs and cost effectiveness of management actions
- facilitating delivery of management practice change
- using models to understand impacts across landscapes.





Whole-of-system understanding for reporting and evaluation through:

- monitoring and applied science capacity to operationalise rigorous integrated assessment and reporting assessment of outcomes
- linking management actions to reef health.

Contact the Reef Plan Secretariat on reefplan@premiers.qld.gov.au to obtain a copy of the full workshop outcomes.

The Reef and Rainforest Research Centre hosted a workshop of similar stakeholders in early 2009, which confirmed these research priorities.

This strategy advocates using the outcomes from these processes as the foundation for identifying research needs. The focus of this strategy is primarily on Stage 2.

Stage 2: prioritising research

The second stage involves a ranking process to assess where the priority areas are for investment in relation to filling the various information gaps, recognising that not every knowledge gap can be filled over the next five years. This prioritisation will rely heavily on stakeholder input to ensure an appropriate end user focus.

Broadly, each research area will be ranked according to its feasibility and impact. Table 1 below demonstrates the matrix approach to prioritising research. Those research areas that are both feasible and have a strong ability to reduce the impact of nutrients, pesticides and chemicals on the reef would have the highest priority.

Table 1

Impact	Extremely high (18-20)				
	High (11-17)				
	Moderate (4-10)				
	Low (1-3)				
		Low (1-3)	Moderate (4-10)	High (11-17)	Extremely high (18-20)
Feasibility					

Using the prioritisation matrix above would result in an overall assessment of the priority ranking, as outlined in Table 2.

Table 2

Total score (feasibility score + impact score)	Overall priority
1-6	Low
7-21	Medium
22-37	High
38-40	Critical



Ranking

The following criteria are to be used to prioritise research for investment. Each proposal will be ranked from one to 10 (one being the lowest and 10 being the highest) according to its impact and feasibility. Restricting the assessment to four criteria keeps the process simple, focused and clear.

Impact

Criteria	Ranking value from 1 (low) to 10 (high)
<p>Benefit</p> <p>Expected value from implementing the outcomes of the research by 2013. For example, the research or innovation:</p> <ul style="list-style-type: none"> clearly contributes to achieving Reef Plan targets and is value for money emphasises management effectiveness or integration and synthesis of knowledge (which are identified as high priority themes within this strategy) is recognised by end users as having clear benefits will make a key contribution to an industry or problem identified as high risk will benefit a catchment or area identified as high risk maximises benefits by addressing cross regional or multiple regional needs and through partnership, collaboration and information sharing addresses the information needs identified in Stage 1. 	
<p>Adoption</p> <p>The likelihood that the research will be implemented/adopted by 2013. For example:</p> <ul style="list-style-type: none"> research is outcome focused effective stakeholder consultation and collaboration is demonstrated ability and likelihood of end users implementing research outcomes is high (i.e. not cost-prohibitive) barriers to uptake are identified and addressed (as per the socio-economic analysis theme identified within this strategy). 	

Feasibility

Criteria	Ranking value from 1 (low) to 10 (high)
<p>Probability of success</p> <p>Ability to successfully conduct the research. For example:</p> <ul style="list-style-type: none"> research conducted using appropriate research methods that are high quality and evidence-based consultation, partnerships, collaboration and information sharing strategies are used opportunities for co-investment are used there are appropriate timeframes and budgets benefit can be realised by 2013 the benefits of using the research outcomes outweigh the cost of the research. 	
<p>Risk</p> <p>Ecological, social or economic risks are low or mitigated. For example:</p> <ul style="list-style-type: none"> the research does not duplicate an existing area of knowledge identified barriers to uptake of research outcomes do not impede the usefulness of the research (e.g. the cost of implementing the research outcomes could inhibit uptake) delivery risk (e.g. risk associated with research providers being able to deliver on time and on cost). 	



Summarising the priorities – an annual Research, Development and Innovation Plan

An annual Research, Development and Innovation Plan will be prepared each year from 2009/2010 onwards to identify the most current list of research priorities based on the ranking process above. The annual Research, Development and Innovation plan will effectively be a table of research priorities, prepared in consultation with stakeholders. This could also take the form of a prospectus, where research providers could identify research projects to answer the questions.

The annual Research, Development and Innovation Plan will be provided to the Independent Science Panel for review and advice.

Stage 3: evaluation of uptake

An evaluation report outlining the extent of uptake of Research, Development and Innovation Priorities by providers will be compiled each year. This will be made publicly available in the Reef Water Quality Protection Plan annual report. It will inform the following year's Research, Development and Innovation Plan by providing an update on which research needs are outstanding.

The effectiveness of this strategy will be monitored broadly by an assessment of how many of the key management questions have been answered. It is recognised that there are likely to be time lags in viewing evidence of change from research projects and hence answering these management questions. However it is also recognised that it is critical to continue the stages outlined in this strategy to help deliver against Reef Plan's targets.