



Australian Government

Department of the Environment and Energy

Submission to the Senate Standing Committee on Rural and Regional Affairs and Transport Inquiry - Identification of leading practices in ensuring evidence-based regulation of farm practices that impact water quality outcomes in the Great Barrier Reef

6 November 2019



W Craik. Commonwealth of Australia Great Barrier Reef Marine Park Authority ©

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Introduction

The Department of the Environment and Energy (the Department) welcomes the opportunity to provide this submission to the Senate Standing Committee on Rural and Regional Affairs and Transport.

The submission:

- Provides strategic context for the protection and management of the Great Barrier Reef under the *Reef 2050 Long-Term Sustainability Plan*, the *Reef 2050 Water Quality Improvement Plan 2017-2022* and through the *Environment Protection and Biodiversity Conservation Act 1999*;
- Outlines how the Department is investing in expanding the scientific knowledge base pertaining to Reef water quality; and
- Provides details of the Department's science-based investment in the Great Barrier Reef's catchments to improve water quality, and the results being achieved.

1. The Reef Planning Framework

The Great Barrier Reef (the Reef) is one of the world's natural wonders. It is the largest coral reef on Earth. It was inscribed on the World Heritage List in 1981 in recognition of its superb natural beauty and biological diversity.

The state of conservation of the Reef has been under review by the UNESCO World Heritage Committee (the Committee) since early this decade. The Committee has focused on a number of key pressures impacting the Reef. The poor quality of water entering the Reef lagoon from river catchments adjacent to the Reef has been a key area of focus.

The [Reef 2050 Long-Term Sustainability Plan](#) (the Reef 2050 Plan) has been in place since 2015. This joint plan of the Australian and Queensland governments is a shared blueprint for managing the Reef and improving its health and resilience over the next few decades in a partnership approach involving governments, Traditional Owners, the community industry and scientists. The Reef 2050 Plan was endorsed by the World Heritage Committee in 2015.

The Committee expressed concern in 2017 that progress towards achieving water quality targets in the Reef 2050 Plan has been slow and indicated that implementation of the Reef 2050 Plan will need to be accelerated to ensure that the intermediate and long-term targets of the Plan will be met.

1.1 Reef 2050 Long-Term Sustainability Plan

The Reef 2050 Plan provides the overarching framework for the management of the Reef. The Reef 2050 Plan includes clear actions to address threats and build the Reef's resilience in the face of a changing climate. The Reef 2050 Plan was updated in 2018 in response to the consecutive mass coral bleaching events of 2016 and 2017, and Cyclone Debbie.

The best available science underpins the Reef 2050 Plan. This includes programs funded by the Australian and Queensland governments, science and research undertaken by academic and research institutions, and work funded by non-government organisations. The Plan recognises that the effects of climate change are the most serious and increasing threat to the Reef. The Plan also states that the impacts of increasing ocean temperatures and ocean acidification are being amplified by the accumulation of impacts caused by land-based run-off from catchments adjacent to the Reef.

The Reef 2050 Plan sets out clear actions to address threats to the Reef and build its resilience in the face of a changing climate. The actions are structured around seven overarching themes — ecosystem health, biodiversity, heritage, water quality, community benefits, economic benefits and governance. These themes reflect the priority areas for action identified by governments and partners to protect the Reef's World Heritage values.

The Reef 2050 Plan has been endorsed, and its implementation commended by UNESCO's World Heritage Committee. It builds on the strong, long-standing commitment by the Australian and Queensland governments to protect and manage the Reef; and incorporates the knowledge and expertise of scientists, communities, Traditional Owners, industry, farmers and non-government organisations. Successful implementation of the Reef 2050 Plan relies on ongoing productive partnerships between all parties.

Implementation of the Reef 2050 Plan is overseen by the Great Barrier Reef Ministerial Forum, comprised of ministers from both the Australian and Queensland governments. Its implementation is supported by two key advisory bodies:

- the Reef 2050 Independent Expert Panel, which provides independent scientific advice
- the Reef 2050 Advisory Committee, which provides industry and community perspectives

Information on progress in implementing the Reef 2050 Plan is provided in annual reports that are published on the Department's website. Reporting progress of water quality improvement is described in more detail in Section 2 of this submission.

The Reef 2050 Plan has a five-yearly review cycle to ensure action on the Reef remains current, consistent with the most recent science, and effective in addressing pressures. The first review is due in 2020 and will be informed by the findings from the Outlook Report 2019 and advice from the advisory bodies and other stakeholders. The outcome of the review will be a revised Reef 2050 Plan that reflects the current state of the Reef and its future management needs and ensures government investments continue to focus on addressing the highest priority threats.

1.2 Reef 2050 Water Quality Improvement Plan

The [Reef 2050 Water Quality Improvement Plan 2017-2022](#) (the Reef 2050 WQIP) is a joint plan of the Australian and Queensland governments. The first Reef Water Quality Protection Plan was released in 2003, and updated in 2009 and 2013. The Reef 2050 WQIP aligns with and is nested within the Reef 2050 Plan. The purpose of the Reef 2050 WQIP is to identify management and monitoring requirements for all land-based pollution (including: agricultural, urban and industrial) to improve the quality of water flowing from catchments adjacent to the Reef.

The Reef 2050 WQIP is based on monitoring, modelling and a large body of peer-reviewed science. It was informed by the [2017 Scientific Consensus Statement – Land use impacts on Great Barrier Reef water quality and ecosystem condition](#) (the Scientific Consensus Statement). The Scientific Consensus Statement concludes that the greatest water quality risks to the Reef are from:

- nutrients, which are an additional stress factor for many coral species, promote crown-of-thorns starfish outbreaks with destructive effects on mid-shelf and offshore coral reefs, and promote macroalgal growth
- fine sediments, which reduce the light available to seagrass ecosystems and inshore coral reefs
- pesticides, which pose a toxicity risk to freshwater ecosystems and some inshore and coastal habitats.

The Reef 2050 WQIP sets targets for improving water quality in each of the 35 catchments flowing to the Reef, for the six management regions (Cape York, Wet Tropics, Burdekin, Mackay Whitsunday, Fitzroy and Burnett Mary) and for the whole Reef. The water quality targets are for the year 2025, and are:

- a 60 per cent reduction in anthropogenic end-of-catchment dissolved inorganic nitrogen loads
- a 25 per cent reduction in anthropogenic end-of-catchment fine sediment loads
- a 20 per cent reduction in anthropogenic end-of-catchment particulate nutrient loads (dissolved inorganic nitrogen, particulate phosphorous and particulate nitrogen)
- to protect at least 99 per cent of aquatic species at the end-of-catchment.

The targets are prioritised based on the pollutant risk each river catchment poses to local reef habitats. The targets and catchment prioritisation in the Reef 2050 WQIP are a significant improvement on previous water quality protection plans, because they enable actions and investments to be better targeted.

The Reef 2050 WQIP describes a range of on-ground actions to improve water quality. Coordination and delivery of actions to achieve water quality targets will be implemented through the joint efforts of government, industry, land managers and communities. Key actions include:

- applying minimum practice standards across all industries and land uses
- supporting industries and communities to build a culture of innovation and stewardship that takes them beyond minimum practice standards
- restoring catchments through works to improve or repair riparian vegetation, streambanks, gullies, waterways and wetlands.

Governments will use the Reef 2050 WQIP catchment management priorities and targets to direct regional investment. Modelling scenarios and local and regionally developed plans, including regional Water Quality Improvement Plans and other decision support tools, will also assist with prioritising investment at a finer scale. This will build on the Scientific Consensus Statement and the [Great Barrier Reef Outlook Report 2019](#) (the Outlook Report).

Partnerships with local organisations, natural resource management bodies, industries, community groups and Traditional Owners will guide local delivery and implementation of the Reef 2050 Plan. They will inform decision making and priority setting through regional partnerships and representation on the Reef 2050 Advisory Committee.

The [Reef Water Quality Report Cards](#) track progress towards achieving the Reef 2050 WQIP targets. The [Report Card 2017 and 2018](#) was released in August 2019 and covered the two years up to June 2018. This report card showed encouraging improvements in water quality in some areas, such as reduction of sediment in the Burdekin region, but also that overall progress is slow, and more work is needed across all catchments.

Preparation of Reef Water Quality Report Cards draws on multiple lines of evidence including industry surveys, land management practice data, high-resolution satellite imagery, validated modelling, and on-the-ground assessments and field surveys. Significant work goes into validating the data and analysing and reviewing it for each update.

1.3 Environment Protection and Biodiversity Conservation Act 1999

The Department has a regulatory role for the Reef under [the Environment Protection and Biodiversity Conservation Act 1999](#) (the EPBC Act) as both the Great Barrier Reef Marine Park and Great Barrier Reef World Heritage Area are matters of national environmental significance. Under the EPBC Act, a person must not take an action that has, will have or is likely to have a significant impact on a matter of national environmental significance. This includes actions taken outside the Reef that will have a significant impact on the environment in the Reef and/or its World Heritage values.

State and territory governments in Australia have primary responsibility for land management within their jurisdiction. Approval by the Australian Government under the EPBC Act is only required for activities that are likely to have a significant impact on a matter of national environmental significance, for example new, expanded, or intensified activities. This may include land clearing. Routine land management and other practices undertaken by farmers are exempt under the EPBC Act if they are a lawful continuation of historical practices.

The Department's approach to supporting compliance with the EPBC Act is focused on helping land managers understand their obligations. This includes working with agricultural peak bodies to help farmers consider national and state environment law in parallel when planning new agricultural development.

All compliance activities are undertaken in accordance with the Department's published compliance policy.

2. The Scientific Knowledge Base

The Reef 2050 Plan and Reef 2050 WQIP are underpinned by best available science. This scientific evidence base includes the Australian Government National Environmental Science Program; the Great Barrier Reef Outlook Report; the Scientific Consensus Statement; the Paddock to Reef Integrated Monitoring, Modelling and Reporting Program; and advice from the Reef 2050 Independent Expert Panel.

2.1 Scientific Consensus Statement

The Australian and Queensland governments jointly funded the process to establish the [2017 Scientific Consensus Statement](#). The Scientific Consensus Statement is a foundational document that provides the scientific understanding underpinning the design and implementation of the Reef 2050 WQIP.

The 2017 Scientific Consensus Statement was produced by a multidisciplinary group of 48 scientists and additional technical experts with expertise in Reef water quality science and management, led by TropWATER James Cook University, with contributions from universities, government and scientific agencies. Oversight was provided by the [Independent Science Panel](#) (see section 2.5).

The panel reviewed more than 1600 peer-reviewed published papers and technical reports based on scientific studies prepared using a variety of approaches including sediment cores, coral cores, modelling and monitoring. The Scientific Consensus Statement identified that poor water quality, including nutrients, sediments and pesticides flowing to the sea, is a major threat to the Reef; and that key Reef ecosystems are in poor condition. The largest contributor to nutrient, sediment and pesticide run-off is identified as broad-scale agriculture.

The 2017 Scientific Consensus Statement concluded that *“Key Great Barrier Reef ecosystems continue to be in poor condition. This is largely due to the collective impact of land runoff associated with past and ongoing catchment development, coastal development activities, extreme weather events and climate change impacts such as the 2016 and 2017 coral bleaching events.”*

2.2 Great Barrier Reef Outlook Report 2019

The [Outlook Report](#) is published every five years by the Great Barrier Reef Marine Park Authority. The first Outlook Report was published in 2009 and the most recent report was published in 2019. The Outlook Report aims to provide a regular and reliable means of assessing Reef health and management in an accountable and transparent way. The 2019 report finds that the Reef faces significant pressures ranging in scale from local to global.

Drawing on over 1400 references, the Outlook Report finds the greatest threat to the Reef is climate change, while declining marine water quality from land-based run-off is another significant threat to the long-term health and resilience of the Great Barrier Reef. The Outlook Report finds that initiatives that will halt and reverse the effects of climate change at a global level and effectively improve water quality at a regional scale are the most urgent to improve the Reef's long-term outlook.

The Outlook Report found that: *'inshore water quality is improving on a regional scale, but too slowly; poor water quality continues to affect many inshore areas of the Reef. The rate of reduction of pollutant loads has been slow, reflecting modest improvements in agricultural land management practices. Future initiatives need to deliver timely, best practice agricultural land management over a wider area to improve water quality'*.

The Outlook Report notes that planning approaches to address land-based run-off continue to improve and that the Reef 2050 Plan includes actions to protect the values, health and resilience of the Reef while allowing for ecologically sustainable use.

2.3 Paddock to Reef Modelling Program

The [Paddock to Reef Integrated Monitoring, Modelling and Reporting Program](#) (the Paddock to Reef program) provides the framework for evaluating and reporting progress towards the Reef 2050 WQIP through the Reef Water Quality Report Cards. The program, launched in 2009, is jointly funded by the Australian and Queensland governments and hosted by the Queensland Government.

The Paddock to Reef program collects, evaluates and integrates data and information on land management practices, catchment condition, catchment loads and the health of the inshore Reef. It monitors and models the impact that management practice change is having on water quality at a number of scales: catchment, paddock scale and marine.

Modelling is used to estimate the long-term annual reductions in pollutants as land management practices improve. Modelling is used because pollutant loads leaving catchments vary significantly from year to year, mainly due to differences in annual rainfall. This means that the impact of factors such as climate variability are removed, and the expected benefits of improved land management can be determined now rather than by monitoring for decades to see a trend.

The program maintains a high standard of scientific rigour through the employment of a high standard of requirements for peer review, the maintenance of quality assurance and quality control procedures, and a commitment to continuous improvement based on the best available science. For example, the Independent Science Panel reviews and provides scientific advice on key elements of the Paddock to Reef program including the program design and major outputs such as the Reef Water Quality Report Cards. For the Source Catchment modelling framework, it has been reviewed extensively, with international independent reviewers finding the modelling approach is best practice and highly innovative.

Improving data confidence and reducing uncertainty in measurements and modelling has been a key principle of the program since its inception. The program maintains a periodic independent review process and implements improvements in the program design and methods based on the review recommendations. This process ensures that issues of data confidence and uncertainty are constantly considered and addressed.

All Australian Government funded water quality improvement projects must report into the Paddock to Reef program. Delivery partners and service providers provide information about land use changes sourced from a variety of interactions with landholders, including attending training sessions with farmers, doing on-farm surveys, and providing extension services to farmers to assist them apply new knowledge to their farm management.

The Independent Science Panel provides advice to the Paddock to Reef program on the possible inclusion of new and innovative methods to support monitoring and reporting activities. The Panel contributed to the design of the program for 2018-22 and reviewed the final design document.

2.4 Reef 2050 Plan Independent Expert Panel

The Reef 2050 Plan Independent Expert Panel is chaired by former Australian Government Chief Scientist Professor Ian Chubb. Panel members have a range of expertise in climate change, water quality, agriculture, reef ecology, fisheries and environmental economics, amongst other disciplines. The Panel provides scientific and expert advice related to the Reef, including support for the implementation and review of the Reef 2050 Plan, Reef 2050 WQIP and other matters. The Panel also advises the Australian Government Minister for the Environment on funding priorities for the Reef Trust.

The Panel has provided formal advice on a range of matters, including the definition of 'resilience', coral bleaching and climate change and responding to mass coral bleaching. On 19 August 2019, the Panel wrote to the Great Barrier Reef Ministerial Forum to express its members' unanimous support for the science that underpins the evidence of the extent and probable causes of damage to the Great Barrier Reef. That letter has been published on the Department's website, and is included at **Attachment A**. Further information about the panel can be accessed on the [Department's website](#).

2.5 Independent Science Panel

The Independent Science Panel is a working group of the Reef 2050 Plan Independent Expert Panel and is chaired by Dr Roger Shaw. The Independent Science Panel has a skills-based membership with expertise that includes agronomic and landscape processes, marine and freshwater biochemistry, information integration and synthesis, statistics, social and economic methodologies, coastal ecosystems and ecotoxicology.

The [Independent Science Panel](#) provides independent science-based and technical advice to the Australian and Queensland governments on water quality science needs. This includes advice on knowledge gaps and science priorities in relation to the implementation of the Reef 2050 WQIP. Advice from the Panel ensures that Reef 2050 WQIP implementation is being undertaken in a scientifically credible and cost-effective manner and is being managed according to best scientific and environmental standards.

2.6 National Environmental Science Program

The Department is responsible for the National Environmental Science Program (NESP), a long-term commitment to environment and climate research with funding of \$145 million over the six years from 2015-16 to 2020-21. Funding public good, end-user driven research, NESP supports decision-makers to understand, manage and conserve Australia's environment. NESP research investments provide the scientific evidence to support the implementation of the Reef 2050 WQIP and the Reef 2050 Plan, including by supporting investments in on-ground Reef protection activities (see Section 3).

NESP projects deliver collaborative, practical and applied research to inform decision-making and on-ground action. NESP supports six themed research hubs, along with projects to address emerging environmental research needs. The hubs are selected through a competitive process at the start of the program for their science leadership capability and their capacity to deliver a high-quality program of research. Hub leaders oversee each hub's research and operations and are highly respected researchers of international repute. Hub steering committees, comprising Departmental officials, an independent chair, and research users including industry and Non-Government Organisations, also provide research oversight.

In line with standard research practice, NESP research is frequently published in peer-reviewed scientific journals. Partnerships and collaboration with research users, including all levels of government, Indigenous communities, industry groups and natural resource management organisations, provide an additional layer of quality assurance for NESP research in terms of its practical applicability to environmental management needs.

The key objective of the NESP is to improve understanding of Australia's environment through collaborative research that delivers accessible results and informs decisions. Research and scientific evidence generated by NESP supports the government in meeting its obligations under international conventions, such as the Convention of Biological Diversity, the United Nations Framework Convention on Climate Change and the [Convention Concerning the Protection of the World Cultural and Natural Heritage](#).

The Tropical Water Quality Hub is one of the six thematic NESP research hubs, with Australian Government funding of \$31.98 million (2015-16 to 2020-21). The Hub is a partnership of four universities (Central Queensland University, Griffith University, James Cook University and the University of Queensland), the Australian Institute of Marine Science, and CSIRO, and is administered by the Reef and Rainforest Research Centre, based in Cairns. The Tropical Water Quality Hub provides innovative research for practical solutions to maintain and improve tropical water quality from catchment to coast under three research themes:

Theme 1 – Improved understanding of the impacts, including cumulative impacts, and pressures on priority freshwater, coastal and marine ecosystems and species

Theme 2 – Maximise the resilience of vulnerable species to the impacts of climate change and climate variability by reducing other pressures, including poor water quality

Theme 3 – Natural resource management improvements based on sound understanding of the status and long-term trends of priority species and systems.

To date, the Hub has invested over \$13 million of NESP funding in research aimed at directly or indirectly improving water quality in the Reef. The \$13 million, together with co-contributions, totals an investment exceeding \$31 million. Additional information on Tropical Water Quality Hub projects that directly relate to water quality in the Reef are provided at **Attachment B**. Links to published water quality research are provided at **Attachment C**.

3. Australian Government Reef Water Quality Investments

Improving water quality in the Reef is a significant, system-wide challenge. The largest contributor to poor quality is nutrient, sediment and pesticide run-off from broad-scale agriculture. The changes in land management needed to address poor water quality require substantial investment and take time to implement – this means it can be years before the results are seen on the ground and in the water.

The Australian Government has committed approximately \$417 million to improving water quality from 2014-15 to 2023-24, primarily through the Reef Trust (2014-15 to 2023-24) and the former [Reef Programme](#) (2013-2018). Additional investments have been made through Reef Rescue (2011-2013). Over the period 2014-15 to 2023-24, \$333.3 million has been provided under the Reef Trust for on-ground water quality improvement projects. This includes \$200.7 million through the \$443.3 million partnership with the Great Barrier Reef Foundation.

The Australian Government has focused its Reef water quality improvement effort on working with agricultural land managers to support voluntary practice change, which leads to improvements in water quality and a reduction in farm costs. The focus of Australian Government on-ground projects includes improving grazing practices, improving fertiliser-use efficiency, gully and streambank remediation, erosion prevention and reducing pollutant run-off.

Delivery of on-ground projects is done in partnership with others, including the Queensland Government, Natural Resources Management organisations, and peak bodies such as the Queensland Farmers' Federation and Canegrowers to provide farmers with on-farm support, including direct support through agricultural extension. The success of this approach is shown through the high level of engagement of farmers and their achievements through Australian Government Reef projects, including:

- 111 sugarcane farmers in the Burdekin and Wet Tropics regions managing more than 27,800 ha engaged through the Reef Trust Repeat Tender projects
- 150 graziers engaged through the [Reef Trust Project Pioneer](#)
- 582 sugarcane, 194 grazing and 72 grain enterprises and 71 farmers in the horticulture sector managing more than 596,000 ha of agricultural land with improved management practices through the [Reef Trust Reef Alliance Growing a Great Barrier Reef project](#).
- 36 farming groups assisted to transition to more efficient farming systems for sugar cane, through the [Reef Trust MSF Sugar project](#).

CASE STUDY: Project Pioneer – Innovation in grazing land management

Pioneering innovation in grazing land management, this \$2.9 million Reef Trust project provided in-farm support education and professional advice to graziers to transition to a more resilient, productive and profitable business and landscape. Work completed up to December 2018 achieved more than 1.2 million hectares of land under improved management practices, with 150 graziers adopting sustainable practice change, and 300 graziers completing formal training courses. Because of its success, the project has been extended through an additional \$2.9 million as part of the Reef Trust Partnership with the Great Barrier Reef Foundation.

3.1 Technical advice

In undertaking its water quality projects, the Department engages technical advice to help ensure the best available science guides delivery and help ensure best outcomes are achieved. For example, the department engaged CSIRO in the development and implementation of the Gully and Streambank Restoration Program. CSIRO was tasked with developing a '[Gully and Streambank Toolbox](#)', designed to assist applicants under the accompanying grant program, and to help delivery partners to target, design and implement erosion control solutions for a range of site conditions. CSIRO was also engaged to provide technical advice to delivery partners, advise on monitoring and reporting requirements and contribute to an evaluation of performance at the conclusion of the program of work.

CASE STUDY: Gully and Stream Bank Erosion Control Program

Through a \$36.5 million project, the Reef Trust is helping landholders undertake on-farm erosion control work, including remediating gullies and increasing riparian habitat protection, to reduce fine sediment entering the Great Barrier Reef lagoon from across the Reef catchments. Work completed up to September 2019 is preventing approximately 14,600 tonnes of fine sediment entering the Reef every year. Accelerating this progress is the focus of investments being made by the Australian and Queensland governments. Learnings from an earlier phase of this investment is informing the design of projects focused on maximising cost-effective sediment reductions.

The 'Reverse Tenders' engaged technical input from CSIRO to provide advice on the design and implementation of a reverse auction to decrease nitrogen lost to the environment from the sugarcane industry. Pilot programs were conducted in the Wet Tropics and Burdekin cane-growing regions, followed by a larger program covering both regions. The Department also engaged delivery partners who were required to have a knowledge of cane farming systems and an established network within the relevant regions, and who were tasked with promoting the tender, encouraging and supporting cane farmer participation and undertaking site visits.

CASE STUDY: Reverse Tenders – Wet Tropics and Burdekin

Through a \$19.7 million program, the Reef Trust is assisting cane growers in the Wet Tropics and Burdekin to improve their nitrogen fertiliser and land management practices to reduce pollutant runoff. The project supports cane growers to determine their own nitrogen use efficiency targets to reduce fertiliser use. This has the benefit of providing farmers with a cost-effective means of achieving targets without affecting yield. For 2017-2018, 111 sugar cane farmers in the two regions, representing an area of 27,854 hectares have prevented 643 tonnes of dissolved inorganic nitrogen entering waterways by reducing fertiliser application by approximately 2,600 tonnes. The amount of nitrogen entering waterways is expected to decrease further with additional voluntary reductions in fertiliser applications, as canegrowers refine their practices.

3.2 Reporting

All Australian Government-funded investments in water quality improvement report into the Paddock to Reef program and results are captured in Reef 2050 Plan reporting and the Reef Water Quality Report Cards. In addition, projects are monitored in accordance with the [Reef Trust Monitoring and Reporting Plan](#). This includes six-monthly progress reporting, mostly through the Atlas of Living Australia monitoring and reporting process ([MERIT](#)) including an evaluation of a project's success at the conclusion of the project.

The Department may also evaluate a program of investment to obtain information about project performance and enable continuous improvement in program delivery. In January 2019 the CSIRO published its report '[Technical findings and outcomes from the Reef Trust Gully Erosion Control Program](#)' which examined the first stage of this program of works. Further work is planned to review and evaluate the success of the reverse tenders.

See **Attachment D** for a full list of Reef Trust water quality improvement projects, and results where available. See **Attachment E** for links to farmers giving their own perspective on their experience of being involved with Australian Government-funded Reef projects.

3.3 Reef Trust - Great Barrier Reef Foundation Partnership

The \$443.3 million Reef Trust- Great Barrier Reef Foundation Partnership (the Reef Trust Partnership) with the Great Barrier Reef Foundation is a six-year agreement between the Foundation and the Australian Government. It has been established to build on and support delivery of the Reef 2050 Plan.

The Reef Trust Partnership includes \$200.7 million to address water quality improvement by funding activities such as improved farming and land management practices, reduced fertiliser use and uptake of new technology.

As described in its Annual Work Plan for 2019-20, a significant focus of the Reef Trust Partnership will be to build on the actions and approaches that have demonstrated success, while also identifying innovative delivery strategies. More than 85 per cent of the water quality improvement funding will be allocated to on-ground actions which aim to build and improve on previous initiatives, focusing on the most cost-effective interventions in highest priority locations.

The first round of water quality grants under the Reef Trust Partnership was announced on 14 March 2019 after a competitive open funding round process. More than \$19 million has been allocated to 11 projects being delivered by 10 recipients, including the Queensland Farmers Federation, the Reef Alliance, Greening Australia and Canegrowers. The purpose of this first funding round was to build on prior investments and initiatives that had made significant contributions towards achieving the Reef 2050 WQIP targets. The projects are being delivered in partnership with landholders and industry, who plan to contribute a projected \$13 million of in-kind co-contributions.

A second round of water quality grants under the Reef Trust Partnership was announced on 29 October 2019 for the Mackay Whitsunday and Fitzroy regions.

4. References

[Reef 2050 Long-Term Sustainability Plan](#)

[Reef 2050 Water Quality Improvement Plan 2017-2022](#)

[Great Barrier Reef Outlook Report 2019](#)

[Scientific Consensus Statement: Land use impacts on Great Barrier Reef water quality and ecosystem condition](#)

[Reef Water Quality report cards](#)

[Environment Protection and Biodiversity Conservation Act 1999](#)

[*Paddock to Reef Integrated Monitoring, Modelling and Reporting Program*](#)

Website: [Department of the Environment and Energy](#)

[MERIT](#)

Gully and Streambank Toolbox

Attachment A: IEP support for reef science letter



Reef 2050 Plan

The Hon Sussan Ley MP
Chair, Great Barrier Reef Ministerial Forum
Minister for the Environment

The Hon Leeanne Enoch MP
Minister for Environment and Great Barrier Reef
Minister for Science and Minister for the Arts

The Hon Karen Andrews MP
Minister for Industry, Science and Technology

The Hon Anastacia Palaszczuk MP
Premier of Queensland

Dear Ministers,

At its most recent meeting (Tuesday 13 August), your Independent Expert Panel (IEP) asked that I write to you to express the members' unanimous support for the science that underpins the evidence of the extent and probable causes of damage to the Great Barrier Reef (GBR).

This advice to you was triggered by the roadshow of Dr Ridd and the associated industry response to new regulations aimed at improving water quality in the GBR area. We do not have a particular view on the regulations, which is outside our remit, but we chose not to sit by and watch the science being disputed and sometimes misrepresented.

Our support for the science and the rigorous processes that underpin science is unequivocal.

It is our advice to you that the science we have seen and discussed during our fifteen meetings has been conducted according to the most rigorous and widely accepted processes employed by professional scientists.

The genuine scientific process involves publishing the results of work in peer reviewed journals openly available to any interested readers.

Critics of peer review usually imply that the two or three 'experts' reviewing manuscripts presented for publication can be wrong, or biased in favour of a particular outcome. Of course, that is possible. An essential part of the peer review process, however, is the intense scrutiny of publications and reports by numerous experts before and after publication. That scrutiny can extend beyond publications, to data sets, computer code and software.

The scientific process is essential for ensuring the transparency, communication, veracity and replicability of science: 1. because it allows the work (publications and reports) to be subject to evaluation against scientific standards by multiple (possibly hundreds and sometime thousands) of experts in the field; 2. because there is implicit validation of the work when other scientists use it to help formulate their hypotheses that are the bases of their own experimental designs. Flaws can be revealed, and it is part of the process of science to expose any such flaws and to put that, too, into the public domain for a similar level of scrutiny.

Science advances by developing evidence to disprove previous ideas or notions about how the world works. What we know in any field is therefore the accumulated evidence that survives intense scrutiny and has not been disproven.

The findings and conclusions in individual papers and reports are subject to even further scrutiny before being adopted in evidence-based policy, programs or regulation.

Our advice to you, therefore, is that the science as we currently know it is robust and the conclusions appropriate.

We commend to you the science and the scientific evidence that underpins our present understanding of the condition of the GBR. It clearly demonstrates that the northern two thirds of the GBR was severely bleached in 2016 and 2017. There are signs of recovery in some areas. There is strong evidence that the recruitment of coral spawn into the bleached areas has decreased by as much as 89%. There is evidence that water quality is important in that surviving coral or newly growing coral have a better chance of continued survival in cleaner water.

The greatest risk to the GBR, as we have advised before, is global warming and consequential climate change caused substantially by human activity – greenhouse gas emissions through activities such as burning fossil fuels, clearing vegetation and making concrete.

We also advised before that until global action limits future increases in temperature we have to do what we can to improve resilience of the GBR. This includes actions to improve water quality.

The 2017 Scientific Consensus Statement for the GBR identified that poor water quality, including nutrients, sediments and pesticides flowing to the sea, is a major threat. The Consensus Statement was the result of a review of hundreds of peer reviewed published papers and technical reports based on scientific studies using a variety of approaches including sediment cores, coral cores, modelling and monitoring. The Consensus Statement was produced by a multidisciplinary group of 48 scientists with expertise in the GBR, coordinated by James Cook University with oversight from the Reef Water Quality Independent Science Panel.

The IEP has confidence in the rigorous process that led to the Science Consensus Statement.

Conclusion

We believe that given the direction that quality science points, suitable policy and focussed regulation are both essential if we are to give the GBR a decent chance of survival in anything like its historically recognisable form.

We will learn more, and we will get more knowledge. But we have more than enough to know that without action to address climate change and to improve water quality the risk to the GBR is substantial. It is our view that the matter requires urgent attention and that policy development should not be distracted from the goal. The evidence is strong, the science robust, the conclusions drawn from the science are sound.

Serious effort is needed to address the state of the GBR, and the effort is needed now to ensure that future generations will have a GBR to enjoy.

Yours sincerely,



Em Professor Ian Chubb AC FAA FTSE

19 August 2019

CC Senator the Hon Simon Birmingham
The Hon Warren Entsch MP
The Hon Kate Jones MP
The Hon Dr Anthony Lynham MP
The Hon Mark Furner MP

enc

For information

There is a strategy to delay suitable policy responses to particular issues that was clearly articulated by the tobacco industry many years ago. While it existed in different forms over many earlier decades the tobacco industry summarised the approach in an internal memo now on the public record. They describe how: *Doubt is our product since it is the best means of competing with the 'body of fact' that exists in the minds of the general public. It is also the means of establishing a controversy.*

More recently, the CEO of Cambridge Analytica makes it clear that the tactic continues: *It sounds a dreadful thing to say, but these are things that don't necessarily need to be true as long as they're believed.*

We have seen the sowing of doubt play out over the years: tobacco use, lead in petrol, anti-vaccination, climate change are examples. And now possibly the GBR. In all cases, scientific evidence is, or was, disputed, only sometimes for obvious reasons – usually money. It is a reason why research on important matters of public interest should be funded by the public - again after a rigorous process of review and within a sound ethical framework.

The tactic of sowing doubt works, because there can be reluctance to change policy or regulation in the face of doubt. But absolute certainty is rare. It does not mean that what we know is wrong.

Science works by steadily accumulating evidence from which deductions can be drawn and modified if ideas and the conclusions are disproven by further work. When the accumulated evidence converges on a particular conclusion, a consensus is reached - by scientists working independently, both individually and in teams.

It is up to people or scientists with another view to provide evidence established by rigorous application of the same scientific process and have it subjected to the same level of scrutiny by experts.

When the sowing of doubt doesn't work out, the next step in the now time-honoured tactic is to invoke the notion of a conspiracy of the world's scientists all working together to stop the outsider getting their results published, or accepted. While it might be impossible for a rational person to imagine that there is any possible way for the hundreds of scientists of the world who work on, say, the coral reefs or climate change, to agree in secret to draw the same conclusions regardless of their observations, it does have currency in some quarters. It doesn't have to be true *as long as they're believed.*

The sowing of doubt is such a common tactic used to delay, confuse, obfuscate and frighten that it even has its own field of study: Agnotology is the study of culturally-induced ignorance or doubt, particularly the publication of inaccurate or misleading scientific data.

Attachment B: NESP Tropical Water Quality Hub Projects that directly or indirectly relate to water quality in the Great Barrier Reef

Project	Title	NESP FUNDING	Co-contribution
NESP Research Plan 1			
1.2	Developing an approach to evaluate the effectiveness of investments in riparian management in the GBR catchments	99,972	68,022
1.3	A validation of coral geochemical records to reconstruct suspended sediment loads to the Great Barrier Reef lagoon	22,500	14,686
1.6	Multiple and cumulative impacts on the GBR: assessment of current status and development of improved approaches for management	99,944	87,569
1.7	Reducing sediment sources to the Reef: testing the effectiveness of managing alluvial gully erosion	100,000	160,000
1.8	Sub-catchment scale monitoring, modelling and extension design to support reef water quality improvement	100,000	130,000
1.9	The establishment of a future NESP dredging research investment framework	25,000	11,197
1.10	Identification, impacts and prioritization of emerging contaminant's present in the Great Barrier Reef and Torres Strait marine environments	100,000	103,022
2.2	A tradable permit scheme for cost effective reduction of nitrogen runoff in the sugarcane catchments of the Great Barrier Reef	99,721	181,361
3.3	Light thresholds for seagrasses of the GBR: a synthesis and guiding document for managing seagrass	29,755	51,746
3.10	Benchmarking costs of NRM improvements for the GBR	29,487	65,193
3.12	Development of an offset financial contribution calculator for Reef Trust	80,595	36,967
NESP Research Plan 2			
2.1.2	Scoping options for low-lying, marginal cane land to reduce DIN in priority wet tropics catchments	94,000	130,250
2.1.3	Harnessing the science of social marketing and behaviour change for improved water quality in the GBR: an action research project	480,000	983,193
2.1.4	Demonstration and evaluation of gully remediation on downstream water quality and agricultural production in GBR rangelands	600,000	797,018
2.1.5	What's really damaging the Reef? Tracing the origin and fate of the environmentally detrimental sediment	600,000	829,259

Project	Title	NESP FUNDING	Co-contribution
2.1.6	From exposure to risk: novel experimental approaches to analyse cumulative impacts and determine thresholds in the GBRWHA	410,165	427,998
2.1.7	Engaging with farmers and demonstrating water quality outcomes to create confidence in on-farm decision-making (also known as Project 25)	600,000	490,500
2.1.8	Improved water quality outcomes from on-farm nitrogen management	700,000	1,034,503
2.1.9	Risk assessing dredging activities	515,806	1,419,651
2.1.10	The application and adaption of mine site rehabilitation approaches to alluvial gully rehabilitation in the Bowen Catchment	100,000	130,000
2.3.1	Benthic light as ecologically validated GBR wide indicator for water quality: drivers, thresholds and cumulative risks	499,471	544,860
2.3.2	'Human sensors' for monitoring GBR environmental changes and quality of marine waters through harnessing Big Data analysis	227,145	242,002
NESP Research Plan 3			
3.1.2	Improving water quality for the GBR and wetlands by better managing irrigation in the sugarcane farming system	458,103	426,878
3.1.3	Harnessing the science of social marketing in communication materials development and behaviour change for improved water quality in the GBR: a desktop review (Project 2.1.3 – Stage 2)	19,000	21,857
3.1.5	Ecotoxicology of pesticides on the Great Barrier Reef for guideline development and risk assessments	602,839	677,556
3.1.7	Reducing sediment loads to the Great Barrier Reef: developing optimal approaches for treating alluvial gully erosion	600,000	750,000
3.2.1	Deriving ecologically relevant load targets to meet desired ecosystem condition for the Great Barrier Reef: a case study for seagrass meadows in the Burdekin region	497,765	770,690
3.2.5	Testing and implementation of the water quality metric for the 2017 and 2018 reef report cards	140,000	532,374
3.3.1	Quantifying the linkages between water quality and the thermal tolerance of GBR coral reefs	590,264	590,400
3.3.2	Science evaluation of coastal wetland systems repair projects across GBR catchments	536,932	682,867
NESP Research Plan 4			
4.8	'Project 25' – farmers, water quality and on-farm decision-making	600,000	600,000
4.9	Gully characterisation framework to underpin GBR catchment water quality management	53,429	58,475

Project	Title	NESP FUNDING	Co-contribution
4.10.	Evaluating the costs and benefits of agricultural land conversion to wetlands	482,947	500,083
4.11	Sources, transformations and fate of dissolved organic carbon – implications for the GBR	26,470	102,069
4.12	Measuring cost-effectiveness and identifying key barriers and enablers of lasting behavioural change in the cane industry	404,985	475,471
NESP Research Plan 5			
5.2	From exposure to risk: Novel experimental approaches to analyse cumulative impacts and determine thresholds in the Great Barrier Reef World Heritage Area (GBRWHA)	120000	193,052
5.3	Benthic light as ecologically-validated GBR-wide indicator for water quality: Drivers, thresholds and cumulative risks	137350	164,461
5.4	Deriving ecologically relevant targets to meet desired ecosystem condition for the Great Barrier Reef: A case study for seagrass meadows in the Burdekin region	200886	235,245
5.8	What's really damaging the Reef? Tracing the origin and fate of the environmentally detrimental sediment and associated bioavailable nutrients	682,746	926,054
5.9	Gully remediation effectiveness	472,000	526,600
5.10	Development and application of automated tools for high resolution gully mapping and classification from LiDAR data	357,297	364,472
5.11	Improved water quality outcomes from on-farm nitrogen management	418000	785,200
5.12	Scoping land use conversion options for high DIN risk, low-lying sugarcane areas in Burdekin and Mackay Whitsunday regions	185,850	250,345
5.13	Coastal wetland systems repair across GBR catchments – values based causal framework validation	146,000	211,145
Total		13,346,424	17,784,291

Attachment C: NESP Tropical Water Quality Hub water quality-related publications

NESP TWQ Hub	
<p>Lewis, S.E., Lough, J.M., Cantin, N., Matson, E. Kinsley, L., Brodie, J.E. (2016) <i>An examination of the ability of coral geochemical records to reconstruct suspended sediment loads to the Great Barrier Reef lagoon</i>. Report to the National Environmental Science Programme. Reef and Rainforest Research Centre Limited, Cairns (20pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2016/08/NESP-TWQ-1.3-FINAL-REPORT.pdf</p>
<p>Greiner, R. (2015) <i>Ex-post evaluation of an environmental auction: Legacy of the 2008 Lower Burdekin Water Quality Tender</i>. Report to the National Environmental Science Program. Reef and Rainforest Research Centre Limited, Cairns (46pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2016/01/NESP-TWQ-1.5-FINAL-REPORT.pdf</p>
<p>Uthicke, S., Fabricius, K., De'ath, G., Negri, A., Warne, M., Smith, R., Noonan, S., Johansson, C., Gorsuch, H., Anthony, K. (2016) <i>Multiple and cumulative impacts on the GBR: assessment of current status and development of improved approaches for management: Final Report Project 1.6</i>. Report to the National Environmental Science Programme. Reef and Rainforest Research Centre Limited, Cairns (144pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2016/08/NESP-TWQ-1.6-FINAL-REPORTA.pdf</p>
<p>Davis, A.M., Waterhouse, J. (2016) <i>Sub-catchment scale monitoring, modelling and extension design to support reef water quality improvement in sugarcane catchments</i>. Report to the National Environmental Science Programme. Reef and Rainforest Research Centre Limited, Cairns (114pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2016/07/NESP-TWQ-1.8-FINAL-REPORT-A.pdf</p>
<p>Kroon, F.J., Berry, K.L.E., Brinkman, D.L., Davis, A., King, O., Kookana, R., Lewis, S., Leusch, F., Makarynsky, O., Melvin, S., Müller, J., Neale, P., Negri, A., O'Brien, D., Puotinen, M., Smith, R., Tsang, J., van de Merwe, J., Warne, M., Williams, M. (2015) <i>Identification, impacts, and prioritisation of emerging contaminants present in the GBR and Torres Strait marine environments</i>. Report to the National Environmental Science Programme. Reef and Rainforest Research Centre Limited, Cairns (138pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2016/05/NESP-TWQ-1.10-FINAL-REPORTa.pdf</p>

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<p>Smart, J.B., Hasan, S., Volders, A., Curwen, G., Fleming, C., Burford, M. (2016) <i>A tradable permit scheme for cost-effective reduction of nitrogen runoff in the sugarcane catchments of the Great Barrier Reef</i>. Report to the National Environmental Science Programme. Reef and Rainforest Research Centre Limited, Cairns (75pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2016/04/NESP-TWQ-2.2-FINAL-REPORT.pdf</p>
<p>Collier, C.J., Chartrand, K., Honchin, C., Fletcher, A. Rasheed, M. (2016) <i>Light thresholds for seagrasses of the GBR: a synthesis and guiding document. Including knowledge gaps and future priorities</i>. Report to the National Environmental Science Programme. Reef and Rainforest Research Centre Limited, Cairns (41pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2016/05/NESP-TWQ-3.3-FINAL-REPORTa.pdf</p>
<p>Collier, C.J., Langlois, L. Zemoui, R., Martin, K., McKenzie, L. (2016) <i>Developing and refining biological indicators for condition assessments in an integrated monitoring program</i>. Report to the National Environmental Science Programme. Reef and Rainforest Research Centre Limited, Cairns (31pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2016/03/NESP-TWQ-3.4-FINAL-REPORT.pdf</p>
<p>Addison, P., Walshe, T., Sweatman, H., Jonker, M., MacNeil, A., Thompson, A., Logan, M. (2015) <i>Towards an integrated monitoring program: Identifying indicators and existing monitoring programs to effectively evaluate the Long Term Sustainability Plan</i>. Report to the National Environmental Science Programme. Reef and Rainforest Research Centre Limited, Cairns (118pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2016/01/NESP-TWQ-3.8-FINAL-REPORT.pdf</p>
<p>Rolfe, J., Windle, J. (2016) <i>Benchmarking costs of improving agricultural water management in GBR catchments</i>. Report to the National Environmental Science Programme. Reef and Rainforest Research Centre Limited, Cairns (52pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2016/03/NESP-TWQ-3.10-FINAL-REPORT.pdf</p>
<p>Lewis, S., Bainbridge, Z. Stevens, T. Garzon-Garcia, A. Chen, C. Burton, J. Bahadori, M. Rezaei Rashti, M. Gorman, J. Smithers, S. Olley, J. Moody, P. Dehayr, R. (2018) <i>Sediment tracing from the catchment to reef 2016 to 2018: Flood plume, marine sediment trap and logger data time series</i>. Report to the National Environmental Science Program. Reef and Rainforest Research Centre Limited, Cairns (94pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2019/04/NESP-TWQ-Project-2.1.5-Final-Report.pdf</p>

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<p>Bell, M.J., Moody, P.W., Webster, A.J., Skcoaj, D., Masters, B., Dowie, J. (2019) <i>Improved Water Quality Outcomes from On-Farm Nitrogen Management. Report to the National Environmental Science Program</i>. Reef and Rainforest Research Centre Limited, Cairns (50pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2019/08/NESP-TWQ-Project-2.1.8-Final-Report.pdf</p>
<p>Waterhouse, J., Petus, C., Brodie, J., Bainbridge, S., Wolanski, E., Dafforn, K.A., Birrer, S.C., Lough, J., Tracey, D., Johnson, J.E., Chariton, A.C., Johnston, E.L., Li, Y., Martins, F., O'Brien, D. (2018) <i>Identifying water quality and ecosystem health threats to the Torres Strait and Far Northern GBR from runoff of the Fly River</i>. Report to the National Environmental Science Program. Reef and Rainforest Research Centre Limited, Cairns (162pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2019/07/NESP-Project-2.2.1-Final-Report.pdf</p>
<p>Apte, S.C., Angel, B.M., Hunter, C., Jarolimek, C.V., Chariton, A.A., King J. and Murphy, N. (2019) <i>Impacts of mine derived contaminants on Torres Strait environments and communities</i>. Report to the National Environmental Science Program. Reef and Rainforest Research Centre Limited, Cairns (126pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2019/08/NESP-Project-2.2.2-Final-Report.pdf</p>
<p>Robson, B., Canto, M., Collier, C., di Perna, S., Logan, M., Menendez, P., McKinna, L., Noonan, S. and Fabricius, K. <i>Benthic light as an ecologically-validated GBR-wide indicator for water quality</i>. Report to the National Environmental Science Program. Reef and Rainforest Research Centre Limited, Cairns (40pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2019/07/NESP-TWQ-Project-2.3.1-Final-Technical-Report.pdf</p>
<p>Bartley, R., Hawdon, A., Henderson, A., Wilkinson, S., Goodwin, N., Abbott, B., Baker, B., Matthews, M., Boadle, D., Telfer, D., Smith, B., Jarihani, B. and Burkin, G., 2017. <i>Quantifying the effectiveness of gully remediation on offsite water quality: preliminary results from demonstration sites in the Burdekin catchment</i>. Project 2.1.4. Report to the National Environmental Science Programme. Reef and Rainforest Research Centre Limited, Cairns (76pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2017/10/NESP-TWQ-2.1.4-TECHNICAL-REPORT-1.pdf</p>
<p>Bartley, R., Hawdon, A., Henderson, A., Wilkinson, S., Goodwin, N., Abbott, B., Baker, B., Matthews, M., Boadle, D. and Jarihani, B. (2018) <i>Quantifying the effectiveness of gully remediation on off-site water quality: preliminary results from demonstration sites in the Burdekin catchment (second wet season)</i>. Report to the National Environmental Science Program. Reef and Rainforest Research Centre Limited, Cairns (75pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2018/07/NESP-TWQ-2.1.4-TECHNICAL-REPORT-2.pdf</p>

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<p>Bartley, R., Wilkinson, S., Henderson, A. Hawdon, A. (2018) <i>Cost effectiveness of gully remediation in the Burdekin catchment: preliminary insights based on measured data from NESP monitoring sites and progress with new Lidar methodologies</i>. Report to the National Environmental Science Program. Reef and Rainforest Research Centre Limited, Cairns (28pp.).</p>	<p>3 https://nesptropical.edu.au/wp-content/uploads/2018/07/NESP-TWQ-2.1.4-TECHNICAL-REPORT-3.pdf</p>
<p>Eagle, L., Hay, R., Farr, M. (2016) <i>Harnessing the science of social marketing and behaviour change for improved water quality in the GBR: Background review of literature</i>. Report to the National Environmental Science Programme. Reef and Rainforest Research Centre Limited, Cairns (98pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2017/01/NESP-TWQ-2.1.3-INTERIM-REPORT-1.pdf</p>
<p>Hay, R., and Eagle, L., (2016) <i>Harnessing the science of social marketing and behaviour change for improved water quality in the Great Barrier Reef: A documentary analysis of Reef Trust Tender (Burdekin) and Reef Programme</i>. Report to the National Environmental Science Programme. Reef and Rainforest Research Centre Limited, Cairns (95pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2017/01/NESP-TWQ-2.1.3-INTERIM-REPORT-2.pdf</p>
<p>Farr, M., Eagle, L. Hay, R., and Churchill, M. (2017) <i>Questionnaire Design, Sampling Strategy and Preliminary Findings: The Burdekin region. NESP Project 2.1.3 Interim report</i>. Report to the National Environmental Science Program. Reef and Rainforest Research Centre Limited, Cairns (124pp.)</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2018/07/NESP-TWQ-2.1.3-INTERIM-REPORT-3.pdf</p>
<p>Hay, R. & Eagle, L. (2018) <i>Land Managers Decision Making about Water Quality: Views from Extension Officers of the Wet Tropics, Queensland, Australia</i>. Report to the National Environmental Science Program. Reef and Rainforest Research Centre Limited, Cairns (47pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2019/04/NESP-TWQ-Project-2.1.3-INTERIM-REPORT-7.pdf</p>
<p>Barber, M., Dale, M., Pearse, R., Everson, B., Perry, J., Jaffer, T., Winer, M., Creek, D. (2016) <i>Scoping market-based opportunities for Indigenous provision of water quality services and associated conservation governance in the Northern Great Barrier Reef: Interim Project Report and Discussion Paper</i>. Report to the National Environmental Science Programme. Reef and Rainforest Research Centre Limited, Cairns (51pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2017/01/NESP-TWQ-2.3.3-INTERIM-REPORT-1a.pdf</p>

<p>Hay, R., Eagle, L. and Chan, J. (2018) <i>Harnessing the science of social marketing and behaviour change for improved water quality in the Great Barrier Reef: Final report best practice guide for development and modification of program communication material</i>. Report to the National Environmental Science Program. Reef and Rainforest Research Centre Limited, Cairns (69pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2018/07/NESP-TWQ-Project-3.1.3-Final-Report.pdf</p>
<p>Robillot, C., Logan, M., Baird, M., Waterhouse J., Martin, K. and Schaffelke, B. (2018) <i>Testing and implementation of an improved water quality index for the 2016 and 2017 Great Barrier Reef Report Cards – Detailed technical report</i>. Report to the National Environmental Science Program. Reef and Rainforest Research Centre Limited, Cairns (150pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2018/08/NESP-TWQ-Project-3.2.5-Final-Report.pdf</p>
<p>Robillot, C., Logan, M., Baird, M., Waterhouse J., Martin, K. and Schaffelke, B. (2018) <i>Testing and implementation of an improved water quality index for the 2016 and 2017 Great Barrier Reef Report Cards: Summary Report</i>. Report to the National Environmental Science Program. Reef and Rainforest Research Centre Limited, Cairns (65pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2018/08/NESP-TWQ-Project-3.2.5-Summary-Report.pdf</p>
<p>Burrows, R.M., Lewis, S.E., Garzon-Garcia, A., Burton, J., Brodie, J.E., Mehrtens, J., Erbacher, J., Gale, K., Burford, M.A. (2018) <i>Sources, transformations and fate of particulate and dissolved organic carbon: Implications for the Great Barrier Reef</i>. Report to the National Environmental Science Program. Reef and Rainforest Research Centre Limited, Cairns (88pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2019/09/NESP-TWQ-Project-4.11-Final-Report.pdf</p>
<p>NESP TWQ Hub - Crown-of-thorns Starfish Publications</p>	
<p>Westcott, D.A., Fletcher, C.S., Babcock, R., Plaganyi-Lloyd, E. (2016) <i>A Strategy to Link Research and Management of Crown-of-Thorns Starfish on the Great Barrier Reef: An Integrated Pest Management Approach</i>. Report to the National Environmental Science Programme. Reef and Rainforest Research Centre Limited, Cairns (80pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2016/04/NESP-TWQ-1.1-FINAL-REPORT.pdf</p>
<p>M.R. Hall, C.A. Motti and F. Kroon (2017) <i>The potential role of the giant triton snail, Charonia tritonis (Gastropoda: Ranellidae) in mitigating population outbreaks of the crown-of-thorns starfish. Integrated Pest Management of Crown-of-Thorns Starfish</i>. Report to the National Environmental Science Programme. Reef and Rainforest Research Centre Limited, Cairns (58pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2018/06/NESP-TWQ-2.1.1-TECHNICAL-REPORT-1b.pdf</p>

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<p>Sweatman, H. and Cappo, M. (2018) <i>Do no- take zones reduce the likelihood of outbreaks of the Crown-of-thorns starfish?</i>. Report to the National Environmental Science Program. Reef and Rainforest Research Centre Limited, Cairns (38pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2018/11/NESP-TWQ-2.1.1-TECHNICAL-REPORT-2-.pdf</p>
<p>Fletcher, C.S. and Westcott, D.A. (2016) <i>Strategies for Surveillance and Control: Using Crown-of-Thorns Starfish management program data to optimally distribute management resources between surveillance and control</i>. Report to the National Environmental Science Programme. Reef and Rainforest Research Centre Limited (22pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2016/07/NESP-TWQ-2.1.1-INTERIM-REPORT-1.pdf</p>
<p>Beaman, R. J. (2018) <i>Assessment of deep- water habitat for crown-of-thorns starfish (COTS) in the Great Barrier Reef</i>. Report to the National Environmental Science Program. Reef and Rainforest Research Centre Limited (45pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2019/01/NESP-TWQ-Project-3.1.1-TECHNICAL-REPORT-1.pdf</p>
<p>Westcott, D. and Fletcher, C. (2018) <i>How Effective Are Management Responses In Controlling Crown-of-Thorns Starfish and their Impacts On The Great Barrier Reef? Report to the National Environmental Science Program</i>. Reef and Rainforest Research Centre Limited, Cairns (20pp.).</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2018/12/CSIRO-COTS-Control-Effectiveness-Report.pdf</p>
<p>Bartley, R., Hawdon, A., Henderson, A., Wilkinson, S., Goodwin, N., Abbott, B., Bake, B., Boadle, D., and Ahwang, K. (2019) <i>Quantifying the effectiveness of gully remediation on off-site water quality: preliminary results from demonstration sites in the Burdekin catchment (third wet season)</i>. Report to the National Environmental Science Program. Reef and Rainforest Research Centre Limited, Cairns (111pp.)</p>	<p>https://nesptropical.edu.au/wp-content/uploads/2019/08/NESP-TWQ-Project-5.9-Technical-Report-1.pdf</p>

Attachment D: Reef Trust water quality investments and reported achievements

Reef Trust water quality improvement investments have supported all commodities to implement management practice improvements.

Projects addressing all pollutants and management targets

Reef Alliance - Growing a Great Barrier Reef (2015-16 to 2018-19)

A **\$45.7 million** project led by the Reef Alliance to:

- improve water quality across the GBR by enabling landholders to change practices in cane, grazing, dairy, horticulture, bananas, grains and cropping.
- provide training, extension and on-ground support to agricultural land managers in 'best practice management' of their agricultural practices.
- Grazing three year target: 186 graziers to be engaged in the project across 1,476,500 ha.
- Cane three year target: 779 cane farmers to be engaged in the project across 103,710ha.
- Horticulture, dairy and grain three year target: 261 growers to implement improved nutrient, pesticide and erosion management practices across 261,270 ha.

Reported achievements (up to the end of June 2019)

- **1,464 landholders** receiving one-on-one extension across the project
- **194 graziers** undertaken practice change
- **467,277 ha** of demonstrated grazing practice change
- **582 cane farmers** undertaken practice change
- **76,266 ha** of demonstrated cane practice change
- **72 grain producers** undertaken practice change
- **48,360 ha** of demonstrated Grains practice change
- **71 landholders** undertaken Horticulture practice change
- **4000 ha** of demonstrated Horticulture practice change

Note: this project is being continued through \$3.5 million awarded under the Reef Trust Partnership with the Great Barrier Reef Foundation to support cane farmers and graziers by using one-to-one agricultural experts (extension officers) to move 462 land holders, covering 209,750 ha, towards best practice to reduce sediment, nitrogen and pesticides.

Reef Trust - Great Barrier Reef Foundation Partnership (2017-18 to 2023-24)

Through the \$443.3 million Reef Trust Great Barrier Reef Foundation Partnership, \$201 million will be invested in priority water quality actions. To date the Foundation has funded 11 projects to the value of \$19 million including projects to help improve agricultural land management practice and gully remediation.

Projects addressing sediment, particulate nutrients and grazing management

Project Pioneer: Innovation in Grazing Land Management (2015-16 to 2018-19)

A **\$2.9 million** project to:

- engage 50 graziers managing an estimated land area of 625,000 ha and ensure at least 80 per cent by area of participating properties will be at or above 65 per cent ground cover, with management arrangements in place consistent with achieving A class land condition
- exclude stock on these properties from areas prone to erosion, or have management arrangements consistent with achieving A class land condition
- enable properties to generate a 2.5 per cent increase in return on assets.

Reported achievements (up to December 2018)

- **150 graziers** have adopted sustainable practice change
- **More than 1.2 million Ha area of land** under which improved management practices have been implemented
- **370 new participants** have attended project events and/or activities
- **300 graziers** have completed formal training courses

Note: this project is being continued through \$2.9 million awarded under the Reef Trust Partnership with the Great Barrier Reef Foundation to promote the adoption of regenerative grazing operations to increase ground cover in grazing lands and reduce sediment in runoff to the Great Barrier Reef.

Reef Trust Gully and Stream Bank Erosion Control Program (2015-16 to 2021-22)

A **\$29 million** project to help landowners address sediment through gully and streambank erosion remediation. The project follows an initial **\$7.5 million** pilot program which saw gully erosion control undertaken on 210 gullies and 88 properties. The current project comprises:

- 9 projects to address sediment run-off from gully and stream bank erosion, including in minor streams and drainage lines, large river channels, and high-energy streams in wet coastal catchments.

Reported achievements (to September 2019)

- Gully and streambank erosion projects have reduced sediment run-off from reef catchments by **14,600 tonnes per year**.

Technical support from CSIRO has been an important part of this project.

Promotion of A-Class Grazing ([Saving Our Soils project](#)) (2014-15)

Delivered in partnership with the Queensland Government, this project provided \$3 million to graziers in the Fitzroy and Burdekin natural resource management regions to enhance their productivity and profitability while reducing their impact on the environment. The project sought to:

- Engage with 20 targeted graziers, managing 350,000 ha in the Fitzroy and Burdekin catchments;
- Reach a sediment reduction target of 11,000 tonnes per year following implementation of practice change; and
- Engage with an additional 500 graziers managing over 600,000 ha

The project succeeded in:

- engaging 18 targeted (10 Burdekin, 8 Fitzroy) graziers managing **357,710 ha** of land in hot spot areas plus an additional 10 graziers in the Fitzroy catchment who were provided with one-on-one support to improve their practice.
- achieving **67,029 ha** of practice change over the 18 properties.
- maintaining groundcover at over 70% during the life of the project which was in line with the Reef Water Quality Improvement Plan 2013.
- engaging with an additional **975** landholders managing **4.9 million hectares** of land through 49 events and workshops and information provision activities.

Projects addressing dissolved inorganic nitrogen and sugarcane management

Reverse Tenders: Wet Tropics and Burdekin (2015-16 to 2021-22)

A **\$19.7 million** project to assist cane farmers with the management of dissolved inorganic nitrogen (DIN) run-off from their properties. The project aims to:

- engage farmers to improve their nitrogen fertiliser and farm management practices to reduce pollutant run off into the Reef lagoon
- provide flexibility for farmers to determine their own nitrogen use efficiency targets and cost-effective means of achieving those targets
- reduce fertiliser application by approximately 2,600 tonnes

Reported achievements (up to end of June 2019)

- **111** sugarcane farmers in the Burdekin and Wet Tropics regions managing **27,854 ha** applied **643 tonnes** less fertiliser nitrogen in 2017-2018

Project Uplift Farming Systems Initiative (2016-17 to 2021-22)

The Australian Government is providing **\$4.5 million** to support an estimated \$12.8 million investment by the sugar-cane industry to improve on-farm nutrient management and improve the quality of water entering the Reef. The project is being led by sugar milling company, MSF Sugar, and aims to assist 36 farming groups to transition to more efficient farming systems, including controlled traffic, minimum tillage, trash blanketing and legume rotation crops.

- To date, more than **40** sugar cane growers engaged in the project have committed to implementing improved practices on over **14,000 ha** of their land.

Support of cane farmer trials of enhanced efficiency fertiliser in the catchments of the Great Barrier Reef (2016-17 to 2020-21)

The Australian Government is providing **\$5 million** for this \$7.1 million joint project with the Queensland Government. The project is being delivered by Queensland Cane Growers Organisation Ltd and aims to improve the quality of water entering the Great Barrier Reef by targeting fertiliser nitrogen losses to the Reef from sugarcane farms.

Complete Nutrient Management (2017-18 to 2022-23)

This **\$3.4 million** project, delivered by Queensland Department of Environment and Science, aims to encourage participating sugarcane farmers to reduce their nutrient application rates through on-farm demonstration and agronomy support. It builds on the previous participation of farmers in the [Queensland Government RP161 project](#).

- As at 30 September 2019 more than **100** growers had been recruited in the Burdekin and Mackay Whitsundays regions, to undertake a second year of involvement, and **50** growers had signed up or expressed interest in the Herbert region.

Project Catalyst Revamp - game changing farm management practices (2015-16 to 2018-19)

ATTACHMENT D

This **\$3 million** project delivered by Catchment Solutions Pty Ltd, supported cane farmers to trial new and innovative technologies and practices and move beyond industry best practice for nutrient, irrigation, pesticide and soil management. The project built on Project Catalyst – a grower led innovation project – and aimed to:

- involve 120 innovative and early adopter sugar cane growers plus a further 200 early majority growers in the Great Barrier Reef with a major focus on improving nutrient and chemical management from Sarina to Mossman.

At the completion of the project:

- More than **100** farming families had actively participated by conducting **133** innovation or early adoption trials.
- The area of cane land covered by the trials was approximately **26,000 hectares**.
- **2978** participants attended **67** events including annual grower forums, field days, shed meetings, training sessions and site visits.
- From a 2009 baseline the project achieved an annual reduction in recommended fertiliser application that has delivered Nitrogen reduction of **176.83 tonnes** in the Mackay Whitsunday region; **63.82 tonnes** in the Dry Tropics; and **127.30 tonnes** in the Wet Tropics. This represents an annual saving in fertiliser costs (in total) of approx. **\$480,000**.

Mackay Whitsunday Isaac [Sustainable Agriculture](#) – Cane (2015-16 to 2018-19)

This **\$4.4 million** project delivered by Reef Catchments (Mackay Whitsunday Isaac) Ltd, aimed to reduce nutrient and pesticide loads from sugar cane farms and help farmers to adopt best management practices.

- At the project end, **244** growers managing over **34,800 hectares** of land had received one-on-one education to improve their farm management practices for nitrogen and herbicides.

Projects addressing water quality through other mechanisms, including coastal habitats

Marine Debris Clean-up and Prevention in the Great Barrier Reef ([ReefClean](#)) (2018-19 to 2022-23)

Tangaroa Blue Foundation, working in partnership with Conservation Volunteers Australia, will deliver a five-year **\$5 million** program of local actions to clean up and prevent litter from entering the waters of the Great Barrier Reef.

Restoration of Great Barrier Reef Wetlands and Coastal Ecosystems (2015-16 to 2018-19)

A **\$4 million** project, delivered by Greening Australia Limited, comprising \$2 million in Reef Trust funding and \$2 million in private funding raised by Greening Australia. The project, delivered with partner organisations Conservation Volunteers Australia and BirdLife Australia, aimed to address the loss and modification of coastal habitat and wetlands by rehabilitating more than 340 ha of priority wetland areas in Reef catchments.

- The project was completed in June 2019 and restored and/or enhanced the key ecosystem components and processes occurring in **342 ha** of coastal wetland habitat adjacent to the Great Barrier Reef.
- The project also had locally important social outcomes including working with Traditional Owners, improved aesthetic amenity and recreational values. The project supported local jobs and utilised local contractors.

Repair and Restoration of Priority Coastal Habitat and Wetlands (2016-17 to 2020-21)

A **\$10 million** project, delivered by Greening Australia Limited, comprising \$5 million in Reef Trust funding and \$5 million private funding raised by Greening Australia. The project aims to rehabilitate **500 ha** of wetlands and coastal ecosystems in partnership with landholders along the Reef. Six priority wetland areas have been identified with a range of restoration works being undertaken including revegetation and weed control.

Attachment E: Land owner videos and case studies from Reef programs

Farmers tell their own stories about their participation in Australian Government-funded Reef projects and the land management improvements they have achieved.

Projects addressing all pollutants and management targets

Reef Alliance - Growing a Great Barrier Reef (2015-16 to 2018-19)

2018 Impact Statement

ARTICLE:	https://www.gff.org.au/wp-content/uploads/2016/11/2018-Impact-Statement-online.pdf
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Projects addressing sediment, particulate nutrients and grazing management

Project Pioneer: Innovation in Grazing Land Management (2015-16 to 2018-19)

ARTICLE:	https://www.rcsaustralia.com.au/project-pioneer/producer-stories/brownlie/
ARTICLE:	https://www.rcsaustralia.com.au/project-pioneer/producer-stories/krafft/
ARTICLE:	https://www.rcsaustralia.com.au/project-pioneer/producer-stories/acton/
ARTICLE:	https://www.rcsaustralia.com.au/project-pioneer/producer-stories/hughes/
ARTICLE:	https://www.rcsaustralia.com.au/project-pioneer/producer-stories/robinson/

Reef Trust Gully and Stream Bank Erosion Control Program (2015-16 to 2021-22)

VIDEO:	NQ Dry Tropics: Tackling gully erosion in the Burdekin Dry Tropics http://www.nqdrytropics.com.au/video-outlines-range-of-gully-strategies/
VIDEO:	FBA/Catchment Solutions RTIV Landholder Gully https://www.youtube.com/watch?v=KUKW1kkxd4Q&feature=youtu.be
VIDEO:	Catchment Solution RTIV Gully Project: Collinsdale Site: https://www.youtube.com/watch?v=LLr5sQkiOJ4

Promotion of A-Class Grazing (Saving Our Soils project) (2014-15)

ARTICLE:	Queensland Country Life News Article
VIDEO & ARTICLES:	http://www.nqdrytropics.com.au/projects/sustainable-agriculture/saving-our-soils-project/
VIDEO:	Central Queensland (CQ) Graziers sums up their learnings from Reef Trust 1 https://www.youtube.com/watch?v=QFm8FUyxyMQ
VIDEO:	CQ graziers outline the benefits of undertaking Grazing BMP https://www.youtube.com/watch?v=2cWAuRs_8oU
VIDEO:	CQ Graziers talk about the value of attending training

	https://www.youtube.com/watch?v=IQ376YdkNYc
VIDEO:	CQ graziers talk about why FBA projects matter to them https://www.youtube.com/watch?v=xkukklImzk
VIDEO:	CQ Graziers talk about challenges facing the grazing industry https://www.youtube.com/watch?v=gb6jGY01FZc

Projects addressing dissolved inorganic nitrogen and sugarcane management

Reverse Tenders: Wet Tropics and Burdekin (2015-16 to 2021-22)

Links to case studies of 13 cane farmers who participated in the pilot Reef Trust reverse Tender in the Wet Tropics region.

ARTICLES:	https://terrain.org.au/projects/reef-trust/reef-trust-case-studies/
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Support of cane farmer trials of enhanced efficiency fertiliser in the catchments of the Great Barrier Reef (2016-17 to 2020-21)

ARTICLE:	http://www.canegrowers.com.au/content/Document/16_Fertiliser%20application%20improvements.pdf
ARTICLE:	http://www.canegrowers.com.au/content/Document/21_Fertiliser%20application%20improvements.pdf
ARTICLE	http://www.canegrowers.com.au/content/Document/20_Fertiliser%20application%20improvements.pdf
VIDEOS & ARTICLES:	http://www.canegrowers.com.au/page/cane-to-coast/our-growers-our-story
VIDEO:	https://www.youtube.com/watch?v=xFYTjgwr31g&feature=youtu.be

Complete Nutrient Management (2017-18 to 2022-23)

ARTICLE:	http://www.farmacist.com.au/blog/rp161-the-story
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Project Catalyst Revamp - game changing farm management practices (2015-16 to 2018-19)

VIDEOS:	https://www.projectcatalyst.net.au
ARTICLES:	http://www.farmacist.com.au/blog/tag/project%20catalyst

Mackay Whitsunday Isaac Sustainable Agriculture – Cane (2015-16 to 2018-19)

ARTICLES:	https://reefcatchments.com.au/land/cane/reef-trust-3-farmer-case-studies/
VIDEO:	https://reefcatchments.com.au/land/cane/
VIDEO:	https://www.youtube.com/watch?v=ZwdftkmAUf4
VIDEOS:	https://www.qld.gov.au/environment/agriculture/sustainable-farming/reef/reef-program-collaborations

Projects addressing water quality through other mechanisms, including coastal habitats

Restoration of Great Barrier Reef Wetlands and Coastal Ecosystems (2015-16 to 2020-21)

ARTICLE:	https://www.greeningaustralia.org.au/projects/restoring-reef-kidneys-at-crooked-waterhole/
ARTICLE:	https://www.greeningaustralia.org.au/projects/working-on-country-at-mungalla-station/
ARTICLE:	https://www.greeningaustralia.org.au/projects/rehabilitating-land-at-fig-tree-lagoon/