



REEF TRUST PARTNERSHIP END OF PORTFOLIO EVALUATION

**Prepared for the Great Barrier
Reef Foundation**

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Clear Horizon

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Dictionary

Acronyms and abbreviations	Description
AIMS	Australian Institute of Marine Science
The Reef Authority	Great Barrier Reef Marine Park Authority
CCIP	Crown of Thorns Starfish Control Innovation Program
COTS	Crown of Thorns Starfish
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCCEEW or the Department	Australian Government Department of Climate Change, Energy, the Environment and Water
DIN	Dissolved Inorganic Nitrogen
DMS	Data Management System
DSS	Decision Support System
ECY	Eastern Cape York
The Foundation	Great Barrier Reef Foundation
FPIC	Free Prior and Informed Consent
IMR	Integrated Monitoring and Reporting
JCU	James Cook University
KEQ	Key evaluation questions
M&E	Monitoring and Evaluation
MMP	Marine Monitoring Program
OGBR	Queensland Government Office of the Great Barrier Reef and World Heritage
The Partnership	The Reef Trust Partnership Grant Agreement
P2R	Paddock to Reef
PMC	Partnership Management Committee
RIMReP	Reef Integrated Monitoring and Reporting Program
The Reef	The Great Barrier Reef World Heritage Area.
RRAP	Reef Restoration and Adaptation Program
RRAS	Reef Restoration and Adaptation Science
RRRC	Reef and Rainforest Research Centre
UQ	The University of Queensland
QUT	Queensland University of Technology
WQWG	Water Quality Working Group

EXECUTIVE SUMMARY

Introduction

This report presents the 2024 End-of-Portfolio Evaluation of the Reef Trust Partnership (the Partnership) for the Partnership Components of Water Quality, Crown of Thorns Starfish (COTS) Control, Reef Restoration and Adaptation Science, and Integrated Monitoring & Reporting (IMR), commissioned by the Great Barrier Reef Foundation (the Foundation). The remaining Components – Community and Traditional Owner Reef Protection - will be evaluated in 2025 and 2026 respectively.

The end-of-portfolio evaluation was led by Clear Horizon Consulting and focuses on compliance and satisfying the accountability and performance requirements of the Partnership Grant Agreement. The evaluation covers the outcomes, implementation, legacy and impacts of the Partnership. The evaluation was informed by existing available monitoring data collected by each Component and the collection of additional data primarily through interviews with Foundation staff and independent informants.

An independent panel of experts (see 1.4 Evaluation approach) was engaged to review and endorse the evaluation findings and evidence regarding the Partnership's progress towards its principal objective under the Partnership Grant Agreement: *a significant, measurable improvement in the health of the Great Barrier Reef World Heritage Area...underpinned by innovation, science and community engagement*.

Outcomes of the Partnership

The Partnership has demonstrated the achievement of the agreed end-of-Component outcomes and associated performance expectations, and through this, the expected Grant Agreement outcomes. These findings have been endorsed by a panel of independent experts.

Water quality

The Water Quality Component has satisfied the performance expectations for its core end-of-Component outcomes (see Appendix A: Water Quality Results Table). It has:

- exceeded the performance targets for Dissolved Inorganic Nitrogen (DIN) and pesticides reductions and made significant progress toward the fine sediment target
- successfully demonstrated a new investment framework for water quality improvement that is transparent, accountable, effective, and efficient
- invested in conserving less-disturbed catchments and a portfolio of innovation projects that have the potential to make significant contributions to improving future efforts to maintain or improve water quality.

This was achieved through a multi-disciplinary portfolio of 75 large impact-driven on-ground projects (11 early investment projects, 35 regional projects, 22 innovation projects and 7 conservation projects) and 56 smaller enabling and/or supporting projects which together involve more than 150 partner organisations, and the securing of an additional \$132.8M in co-investment funding.

The Component leaves an important legacy including demonstrating a new and effective investment framework; landholders and Traditional Owners have increased capacity for water quality improvement; a significant volume of new knowledge and insights addressing key gaps for use by future land, water and Reef managers; and most importantly, significant reductions in pollutants flowing to the Reef.

The Foundation has made a significant and measurable improvement to the impact of Water Quality affecting the health of the Great Barrier Reef
- Dr. Roger Shaw

COTS Control

The COTS Control Component has satisfied the performance expectations for its core end-of-Component outcomes (see Appendix B: COTS Control Results Table). It has:

- achieved reductions in coral mortality from COTS outbreaks at key reefs
- increased coral cover in key reefs and reductions in density and size of COTS
- expanded delivery partner involvement in COTS management to include citizen scientists and Traditional Owners
- successfully embedded Traditional Owners in COTS Control management, research and governance.
- delivered a portfolio of multi-disciplinary research focused on improving the effectiveness and efficiency of the COTS Control Program, through the COTS Control Innovation Program (CCIP).

This was achieved through the management of 354 high value reefs to protect coral from COTS and the culling of 434,623 COTS across 30,780ha of Reef, resulting in a six-fold reduction in COTS numbers and up to 44% increase in coral cover when reefs and regions received timely and sufficient control effort. The Component also delivered a portfolio of 24 innovation projects involving 92 experts in multi-disciplinary research teams across 11 institutions, with many of these project outcomes now being embedded into ongoing COTS Control activities. An additional \$11.8M of co-investment funding was secured for this Component.

Funding has also been secured for COTS Control to continue through to 2030, and ongoing efforts are being made to secure additional funding for the Crown of Thorns Control Innovation Program (CCIP), with bridging funding secured through to 2025/2026.

You've achieved a significant outcome - the strength of the outcomes, the value benefit that you've brought, you haven't just ticked the boxes!
– Prof. Chad Hewitt

RRAS

Through the delivery of the Reef Restoration and Adaptation Program (RRAP), the RRAS Component has satisfied the performance expectations for its core end-of-Component outcomes. The Component scored assessments of 'good' and 'very good' against its effectiveness rubrics (see Appendix C: RRAS Results Table). It has:

- delivered a toolbox of restoration and adaptation techniques which are ecologically effective and deployable,
- demonstrated international leadership in coral reef restoration science
- established new pathways for Traditional Owner education, employment and enterprises
- established strong and effective program governance.

The Component secured an additional \$228.5 million in co-investment funding and delivered 40 reef restoration and adaptation projects in collaboration with 32 partners.

The RRAP Translation to Deployment subprogram has systematically assessed the maturity of RRAP interventions and identified potential delivery models. Pathways to implementation have been mapped, integrating scale-up targets, technology development priorities, industry capability audits, and advanced logistic modelling. A process is currently underway to establish a collaborative framework between RRAP, the Australian Institute of Marine Science (AIMS), and the Reef Authority for delivery and approval of the RRAP Pilot Deployments Program.

Yes, I endorse these findings, there's definitely evidence supporting the evaluation's finding
– Prof. Bronwyn Harch

IMR

The IMR Component has not satisfied all performance expectations for its core end-of-Component outcomes, despite best endeavours by the Foundation. The Component scored assessments of 'good' and 'adequate' against its effectiveness rubrics (see Appendix D: IMR Results Table) and has demonstrated that targeted critical Reef Integrated Monitoring and Reporting Program (RIMReP) data needs and gaps and critical monitoring projects and a fully developed data management system (DMS) have been delivered. The absence of a clear plan on future Reef monitoring priorities from the Reef Authority (as the lead agency of RIMReP) and long-term funding to secure a permanent operational custodian for the DMS means it is difficult to see how the full potential of this Component can be best leveraged and maintained.

The Component delivered 26 critical monitoring projects in partnership with 12 organisations. This included 13 biophysical projects, four human dimensions projects and three integration projects (including the DMS). An additional \$18.2M of co-investment funding was secured by this Component.

While an operational Data Management System was designed and developed through the Partnership, progress on securing ongoing operational arrangements was only made six months after the Component formally ended (January 2025), with the Reef Authority contracting AIMS to be the operational partner for the next 12 months while long term funding can be secured.

The Foundation have done what they can, but we need strong Reef Authority ownership to achieve effective integration into RIMReP and to achieve the important step changes in our understanding of the conditions of the Great Barrier Reef World Heritage Area which this Component addressed. While there appear to be opportunities for several of the methodological and technical advances to be utilised, the outcomes of the IMR Component should be underpinning a major renewal of the investment in long term monitoring programs for the Reef and commensurate modelling and reporting. Without

this the legacy of the IMR Component is at risk of being lost.
- Ms. Di Tarte

Implementation of the Grant Agreement

In regard to the implementation of the Grant Agreement the Foundation has:

- Implemented the Partnership in accordance with the Investment Strategy and Annual Work Plans¹. While some activities experienced minor delays due to external factors such as weather events, and some activities were extended to enhance their impact, the majority of projects spanning water quality, COTS, RRAS and IMR Components were completed, with the funding for these Components fully committed.
- Exceeded its co-investment target, having raised \$456 million (125%) against the \$357 million target as of 30 June 2024. With the Department's support, the Foundation continues to proactively fundraise for activities and programs within the Reef 2050 Plan.
- Operated in accordance with the terms of the Partnership Grant Agreement in consultation with the funding partners and in compliance with the policies, processes and business rules approved as part of the Partnership governance and risk framework.
- Intentionally committed funding in line with its guiding principles. This has included taking the time to establish partnerships and quarantining funding for opportunities for adaptive management, such as providing additional funding for projects performing especially well and/or demonstrating potential to leverage further Reef outcomes.

The Impacts and legacy of the Partnership

The Partnership impacts are also its legacy. They comprise a range of enduring outcomes that align closely with the Strategic Principles that guided the Partnership's design and delivery. These legacies include:

- The demonstrated value and effectiveness of the unique **public-private partnership model**. By taking program delivery outside of government and then taking a holistic and outcomes-focused approach, the Foundation was able to deliver outcomes at a scale and pace that governments had not been able to achieve.
- The **partnerships and culture of collaboration** that were advanced in what was previously a highly competitive and fractured sector. This was attributed to a range of factors, including the Partnership model design as a 'one-stop shop' for key reef programs - but also the Foundation's strategic focus on fostering and advancing partnerships and collaboration.
- **Empowerment of Traditional Owners**, including governance arrangements and capability uplift for both Traditional Owners and non-Indigenous people that will endure beyond the Partnership.
- The **science outputs**, including knowledge, expertise, and capacity uplift and publications, which will provide benefits for the Reef scientific and management community both locally and internationally into the future.
- The demonstration of **alternative sources of funding**, including industry and philanthropy, which can complement future government investments into the Reef, growing the overall funding pool available to support the Great Barrier Reef.

¹ [Reef Trust Partnership Plans and Strategies - Great Barrier Reef Foundation](#)

The Foundation has also worked closely with the other key Reef management agencies through the Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW) Legacy Committee and the Natural Resource Management organisations within Reef catchments to support the adoption of program learnings and critical design elements for success into future Reef programs.

The Partnership was established by the Australian Government to improve the health of the Great Barrier Reef and enhance efforts in the management, protection, and restoration of the Marine Park. While this evaluation was prepared as a contractual deliverable to support the conclusion and reconciliation of the Partnership, Clear Horizon and the Great Barrier Reef Foundation acknowledge its broader, long-term value. The insights gathered will inform future program and delivery model design. At the time of this report, all four Components remain ongoing concerns for the Great Barrier Reef and a focus of government investment. This evaluation, and by extension the Partnership, serves as a vital resource for the government in pursuing greater effectiveness, efficiency and transparency.

1. INTRODUCTION

1.1. About this report

This report presents the 2024 End-of-Portfolio Evaluation of the Reef Trust Partnership Grant Agreement (the Partnership) for the Partnership Components of Water Quality, Crown of Thorns Starfish Control, Reef Restoration and Adaptation Science and Integrated Monitoring & Reporting for the Great Barrier Reef Foundation (The Foundation). The remaining Components of Traditional Owner and Community Reef Protection will be evaluated in 2026 and 2025 respectively.

The evaluation was conducted as per the Partnership Monitoring and Evaluation (M&E) Plan². The evaluation was led by Clear Horizon Consulting and included the engagement of an independent panel of experts to review and endorse the evaluation findings and evidence regarding Partnership progress towards its principal objective under the Partnership Grant Agreement: a significant, measurable improvement in the health of the Great Barrier Reef World Heritage Area (the Reef).

The evaluation addresses a set of key evaluation questions, based largely on the original questions provided in the Partnership M&E Plan. The questions cover the outcomes, legacy and implementation of the Partnership.

The report is structured as follows:

- Section 1: Executive summary
- Section 2: Introduction
- Section 3: Evaluation Findings
- Appendices

1.2. The Reef Trust Partnership

The Partnership is a \$443.3 million Grant Agreement between the Australian Government and the Foundation³ to build on and support delivery of the Reef 2050 Plan⁴. Updated during the Partnership period, the Reef 2050 Plan's vision for the Reef in 2050 is that *the Great Barrier Reef is sustained as a living natural and cultural wonder of the world*.

The principal objective of the Partnership is to achieve a *significant, measurable improvement in the health of the Great Barrier Reef World Heritage Area...underpinned by innovation, science and community engagement*, via three specific outcome areas:

- **Improved management** of the Reef and relevant activities in the adjacent catchments.
- **Protection of attributes** that contribute to the outstanding universal value of the Reef, including species, habitats and Indigenous values.
- **Management of key threats** to the Reef, including poor water quality and crown-of-thorns starfish outbreaks.

² Reef Trust Partnership Monitoring and Evaluation Plan, Great Barrier Reef Foundation, Updated October 2022.
<https://www.barrierreef.org/uploads/Partnership-M-E-Plan-21-22-FY-updated-Oct-22.pdf>

³ Grant Agreement Between The Reef Trust And Great Barrier Reef Foundation, June 2018.
<https://www.dcceew.gov.au/sites/default/files/documents/reef-trust-gbr-foundation-grant-agreement-20180627.pdf>

⁴ Reef 2050 Long-Term Sustainability Plan 2021-2025, Commonwealth of Australia 2023.
<https://www.dcceew.gov.au/parks-heritage/great-barrier-reef/protecting/reef-2050-plan>

The Partnership brings six outcomes-focussed Components together into one Portfolio to deliver on these outcomes in an integrated way that maximises co-benefits, synergies and efficiency dividends. These six Components focus on Water Quality, Crown-of-thorns starfish (COTS) Control, Reef Restoration Adaptation Science (RRAS), Traditional Owner Reef Protection, Community Reef Protection, and Integrated Monitoring and Reporting (IMR).

Figure 1 outlines the Partnership's Outcomes Framework, showing the Component-specific outcomes that will contribute individually and collectively to these three outcomes areas. Detailed Component level program logic models clarifying the expected cause and effect relationships between Component activities and their intermediate and end of Partnership outcomes informed the Component specific monitoring plans and end-of-Component performance expectations, which are also provided in the Partnership M&E Plan.

The Foundation adopted a collaborative investment model to amplify the impact of the \$443.3M investment with a target to secure an additional \$357m through in-kind contributions, philanthropy, corporate partnerships and individual giving.

The Partnership approach utilised a suite of guiding principles to guide effective practice and a more enduring approach to securing the health of the Reef. Outlined in the Investment Strategy⁵, the guiding principles are a consolidation of the guiding principles of the Grant Agreement, Reef Trust investment principles, and Reef 2050 Plan principles and priorities. For the purposes of this evaluation, these were further consolidated into the following guiding principles:

- Advance partnerships and approaches to build and accelerate the delivery of enduring outcomes for the Reef.
- Leverage investment and co-investment from local and global actors.
- Empower Traditional Owners and Reef 2050 Plan community partners.
- Adopt Traditional Owners' ways of knowing and doing in Partnership processes.
- Use innovation to accelerate the achievement of enduring outcomes.
- Integrate and/or create synergies between Components.

The Partnership commenced on 1 July 2018, with the Portfolio of Components originally contracted to conclude on 30 June 2024. Many of the Components were granted extensions to ensure the full impact of the Partnership investment was realised for the Reef. Component end-dates are now - RRAS: June 2024; IMR: June 2024, with some activities extended to 2025; COTS Control: June 2024, with some activities extended to 2025; Water Quality: June 2025; and Traditional Owner Reef Protection and Community Reef Protection: June 2026.

⁵ Reef Trust Partnership Investment Strategy, Great Barrier Reef Foundation, 2018.
https://www.barrierreef.org/uploads/RTP_InvestmentStrategy_FINAL%20for%20web.pdf

THE BROADER GOAL FOR THE GREAT BARRIER REEF WORLD HERITAGE AREA					
To ensure the Great Barrier Reef is sustained as a living natural and cultural wonder of the world.					
THE REEF TRUST PARTNERSHIP OBJECTIVE					
Achieve significant, measurable improvement in the health of the Great Barrier Reef World Heritage Area in accordance with the Reef 2050 Plan and underpinned by innovation, science and community engagement.					
THE REEF TRUST PARTNERSHIP OUTCOMES					
Improved management Protection of attributes Management of key threats					
REEF TRUST PARTNERSHIP COMPONENT OUTCOMES					
Water Quality Broader goals: - Good water quality sustains the Great Barrier Reef, builds resilience, improves ecosystem health and benefits communities and Traditional Owners - The quality of water entering the Reef has no detrimental impact on the health and resilience of the Great Barrier Reef - The cultural significance of our water is maintained End of component outcomes: - Maintenance or improvement of water quality from less disturbed catchments - An enduring reduction in the long-term end-of-catchment pollutant loads - An improved approach for implementing Water Quality improvement programs - Innovative solutions for systems change in water quality improvement are available - Increase in Traditional Owner led water quality improvement projects and Traditional Owner involvement in non-Traditional Owner led projects	COTS Control Broader goals: - Coral cover is improved across the Great Barrier Reef - Primary outbreaks are suppressed - COTS Control Program has sustainable long-term funding that complements government funding. - New and emerging Traditional Owner Reef related enterprises flourish End of component outcomes: - Reduced coral mortality from COTS outbreaks at key reefs - Improved methods to manage COTS at scale have been identified - Strategy for long term funding is available for influencing / advocacy. - Expanded delivery partners involved in COTS management (Traditional Owner enterprises)	Reef Restoration and Adaptation Science Broader goals: - Coral restoration and adaptation techniques are being actively used in resilience-based management of the Great Barrier Reef - A new marine restoration industry is enabled End of component outcomes: - A toolbox of restoration and adaptation techniques ready for investment in implementation, at a range of scales. - Australia is recognised internationally as leading coral reef restoration science - New pathways implemented for Traditional Owner education, employment and enterprises across RRAS research and delivery activities	Traditional Owner Reef Protection Broader goals: - Great Barrier Reef Traditional Owner Funding Facility is established - Relationships brokered between Traditional Owners and partners are based on mutual respect and trust - Reef policy and programs are in line with Traditional Owner Principals - Knowledge sharing agreements are established - Traditional Owners have the resources and capability to manage Country - Traditional Owner commercial interests and Intellectual Property are protected (includes culture) - Capacity of Traditional Owner Land and Sea management organisations and enterprises are established and strengthened End of component outcomes: - Traditional Owner co-design action framework is implemented across the Partnership to help build capability - Benefits to Traditional Owners engaged in Sea Country management improve - Traditional Owner participation in governance arrangements for Reef protection and management is improved - The first stage of a Great Barrier Reef Traditional Owner Futures Fund is in place and operating effectively - Traditional Owner's on-country activities contribute to Reef biocultural health - Improved cultural awareness within Partnership projects and partners	Community Reef Protection Broader goals: - Community action is valued as a cornerstone of Reef resilience and enabled through enduring funding & program models - People and communities take individual and collective action to maintain Reef resilience - Governance systems are inclusive, coherent and adaptive End of component outcomes: - A suite of tools for funding and models of community action are available and useful - Community action project contributions are recognised, valued and celebrated - Projects are delivering effective outcomes for the Reef and community (including other RTP component outcomes) - Community informs decision making through collaborative planning and community data use	Integrated Monitoring and Reporting Broader goals: - Resilience based management of the Great Barrier Reef is operationalised. - A fit for purpose Great Barrier Reef data / knowledge value chain is in place End of component outcomes: - Critical RIMREP data needs/gaps have been prioritised by the IMR Component and are met - Decision support platform integrating Data Management and Decision Support systems is operational

Figure 1. Reef Trust Partnership outcomes framework (Source: Reef Trust Partnership Monitoring and Evaluation Plan, Great Barrier Reef Foundation, 2022)

1.3. About the evaluation

The focus of the end-of-portfolio evaluation is on compliance and satisfying the accountability and performance requirements of the Partnership Grant Agreement. Specifically, the purpose of the 2024 end-of-portfolio evaluation services is to assess:

- the extent to which the Partnership was implemented in accordance with the Grant Agreement
- the performance and achievements of the Components closing in 2024 - IMR, COTS, RRAS and Water Quality - against the Grant Agreement outcomes
- how well the Partnership upheld its strategic principles
- the legacy of the Partnership.

The primary audiences for the evaluation include:

- the Australian Government via the Department of Climate Change, Energy, the Environment and Water (DCCEEW)
- the Foundation – Board and Partnership team
- the Partnership Management Committee (PMC), which includes representatives from the Great Barrier Reef Marine Park Authority (The Reef Authority), the Office of the Great Barrier Reef and World Heritage (OGBR) at the Queensland Department of Environment and Science, and DCCEEW
- Partnership delivery partners and the Australian public.

The evaluation considers the IMR, COTS, RRAS and Water Quality Component activities to deliver the Grant Agreement between 1 July 2018 and 30 June 2024. Activities delivered for the Water Quality, IMR and COTS Components between 1 July 2024 and 30 June 2025 will be considered in a 2025 evaluation addendum report. The activities associated with the continuing Components (Traditional Owner and Community Reef Protection) are out of scope of this evaluation and will be considered in a 2026 evaluation study. The evaluation does not include broader monitoring and reporting on the condition of the Reef.

The evaluation utilises a suite of key evaluation questions (KEQs) to assess the Partnership's Outcomes, Impact, Legacy and Implementation (below). While largely based on the KEQs in the Partnership M&E Plan (2022), the questions have been refined to better accommodate the broader Portfolio-level story of change. The questions inform the evaluation approach and methodology, including data collection tools, and will also provide the organising structure for the evaluation report.

Key evaluation questions

1. **To what extent did the Partnership contribute to a significant and measurable improvement in the health of the Great Barrier Reef World Heritage Area?**
2. **To what extent was the Partnership implemented in accordance with the Grant Agreement?**
3. **What has been the impacts and legacy of the Partnership?**

1.4. Evaluation approach

Planning for delivering the evaluation was led by Clear Horizon in collaboration with the Foundation executive and Component teams and involved reviewing the purpose, scope and KEQs for the evaluation, identifying available information and potential information gaps to answer the KEQs, and establishing the expert review panel.

The data collection phase then involved the collation of existing available monitoring data collected by each Component, primarily regarding the outcomes and implementation of the individual Components,

and collection of additional data through surveys and semi-structured interviews. Portfolio-level interviews, primarily regarding the outcomes and legacy of the Partnership were informed by the Most Significant Change techniques to analyse for significant examples of change, unintended outcomes and legacies. Clear Horizon also conducted interviews and a survey to fill gaps in the COTS Control Component results table. Table 1 provides the details for the interview and survey sample.

Table 1. Interview and survey sample

Data collection sample		Number of respondents
Portfolio interviews	Executive: Interviews with Foundation staff with a whole-of-portfolio perspective, inc. the Managing Director, Executive Director Projects & Partnerships and Director – Delivery.	2
	Component: One interview for each Component (IMR, COTS, RRAS and Water Quality), attended by the Component Director and relevant Component team members.	4
	Independent: Interviews with Partnership Management Committee (PMC) ⁶ members and Water Quality Working Group (WQWG) members to provide independent perspectives.	8
Crown of Thorns (COTS) Control	COTS Control Program and CCIP stakeholder interviews, including CSIRO, The Reef Authority, Australian Institute of Marine Science (AIMS), James Cook University, University of Tasmania, and University of Queensland.	9
	COTS Control Program and CCIP stakeholder survey, including researchers, program managers, Steering Committee members and COTS vessel crews.	27

Clear Horizon analysed all interview and survey data, with data from each source and method analysed separately. Quantitative data was analysed using descriptive statistics and qualitative data analysed using themed clustering, with individual comments presented in the report to illustrate findings.

To address KEQ1, results tables (Appendix A-D) were created for each Component, aligning evaluation findings with the outcome statements and performance expectations from the Partnership M&E Plan. The performance expectations for each Component are detailed in their respective results tables and are summarised below.

- Water Quality: Targets for modelled end-of-catchment pollutant loads (Dissolved Inorganic Nitrogen (DIN), Pesticides and Sediment).
- COTS Control: Targets for reductions in coral mortality from COTS outbreaks at key reefs, increased coral cover, and reduced density and size of COTS at key reefs.
- RRAS: Rubrics that describe Component performance criteria for key outcome areas across five levels (Very good, Good, Adequate, Poor, Detrimental). The key outcome areas are the Component's effective delivery of a toolbox of restoration and adaptation techniques, international leadership in coral reef restoration science, and program governance.
- IMR: Rubrics that describe Component performance criteria for key outcomes areas across five levels (Very good, Good, Adequate, Poor, Detrimental). The key outcome areas are the Component's effective delivery of monitoring activities that address critical RIMReP needs/gaps, and delivery of a data management system (DMS).

⁶ The Partnership Management Committee (PMC) was an independent committee appointed by the Great Barrier Reef Foundation Board to provide independent and strategic oversight of Partnership delivery consistent with the Grant Agreement.

An expert panel was then utilised to bring additional rigour and independence to the preparation of evaluation findings regarding the effectiveness of Partnership Components in achieving their intended outcomes and their contribution to *a significant and measurable improvement in the health of the Reef*.

Independent experts with relevant expertise and/or deep experience with similar systems or programs were secured to review each Component (Table 2). Clear Horizon guided the experts through an independent desk-based process to review the evaluation findings and synthesised supporting evidence and then participated in Component-specific workshops with the respective Component Director to discuss the outcomes of their review. Experts were invited to consider the evaluation findings and supporting evidence, ask clarifying questions for the Component Director and invited to make a formal statement of endorsement (or otherwise) of the findings. Component Directors made revisions to their results tables in response to the expert reviewer's feedback. Clear Horizon then drafted the evaluation report and submitted it to the Foundation and expert reviewers for comment and endorsement. A final report was provided to the Foundation and endorsed by the expert reviewers.

Table 2. Independent expert reviewers

Expert	Current role
Dr. Roger Shaw	Independent scientist, formerly Chair of the Independent Science Panel of the Great Barrier Reef Water Quality Improvement Plan
Mr. Greg Claydon (PSM)	Independent water industry professional, Board Chair and Independent Director of eWater Ltd.
Ms. Di Tarte	Independent marine ecosystem management professional, Director at Marine Ecosystem Policy Advisors.
Adj. Prof. Iain Gordon	Adjunct Professor CQ University & Australian National University , Chair Threatened Species Scientific Committee (DCCEEW).
Prof. Bronwyn Harch (FTSE, FQA)	Vice President Industry & External Engagement Griffith University
Prof. Marnie Campbell	Executive Dean, Edith Cowan University
Prof. Chad Hewitt	Provost, Lincoln University (NZ)

1.4.1. Limitations

While every effort was made to ensure a rigorous evaluation within the resources available, we note the following limitations with the methodology:

- The evaluation of Component performance relied on information collected through the implementation of Component M&E plans. Clear Horizon did not conduct any independent verification of this information and relied on the Partnership's quality assurance processes.
- At the time of the evaluation, while 100% of the Component funds had been committed, a small number of projects had been awarded extensions of up to a year. These have been considered in all evaluative assessments and performance calculations.
- Interviewees were purposefully sampled, with both Partnership staff and non-Partnership stakeholders interviewed to provide information regarding impact and legacy. As such, while the data collected provides a range of views, it does not represent the views of all Reef stakeholders.
- Due to the limited sample size and voluntary nature of the COTS Control survey, the findings are indicative rather than representative.

2. EVALUATION FINDINGS

2.1. Outcomes of the Partnership

The Partnership has demonstrated the achievement of the agreed end-of-Component outcomes and associated performance expectations, and through this, the expected Grant Agreement outcomes. These findings have been endorsed by a panel of independent experts.

The following section presents a summary of the evaluation findings for each Component, with the detailed findings, supporting evidence and citations, and details regarding the Component performance expectations and rubrics presented in Appendices A-D: Component Results Tables.

2.1.1. Water quality

The Water Quality Component has satisfied the performance expectations for its core end-of-Component outcomes. It has:

- exceeded the performance targets for DIN and pesticides reductions and made significant progress toward the fine sediment target
- successfully demonstrated a new investment framework for water quality improvement that is transparent, accountable, effective, and efficient
- invested in conserving less-disturbed catchments and a portfolio of innovation projects that have the potential to make significant contributions to improving future efforts to maintain or improve water quality.

This was achieved through a multi-disciplinary portfolio of 75 large impact-driven on-ground projects (11 early investment projects, 35 regional projects, 22 innovation projects and 7 conservation projects) and 56 smaller enabling and/or supporting projects which together involve more than 150 partner organisations, and the securing of an additional \$132.8M in co-investment funding.

Ensuring the pollution reduction outcomes endure beyond the program period is a complex challenge that is not unique to the Partnership and is dependent on factors beyond the Foundation's influence. Nonetheless, the Component leaves an important legacy including demonstrating a new and effective investment framework; land holders and Traditional Owners have increased capacity for water quality improvement; a significant volume of new knowledge and insights addressing key gaps for use by future Reef managers; and most importantly, significant reductions in pollutants flowing to the Great Barrier Reef.

The Foundation has made a significant and measurable improvement, to the impact of Water Quality affecting the health of the Great Barrier Reef
- Dr. Roger Shaw

The human element, the culture, integrity of the approach, which are often not mentioned, which contribute to building trust, and are essential to success, and my observation is that's fundamental, and that has been achieved. So congratulations to those that have been involved from the Foundation
- Greg Claydon (PSM)

An enduring reduction in the long-term end-of-catchment pollutant loads

The Water Quality Component achieved significant modelled pollutant load reductions at the end-of-catchment across all ten regional programs. The regional programs exceeded the performance targets for DIN (469 / 456 tonnes DIN, 103% of the target) and pesticides (8.5 million / 4.1 million Pesticide Risk Units⁷, 207% of the target). Significant progress was made toward the fine sediment target (346 / 462 kilo tonnes of sediment, or 75% of the target) with the shortfall attributed to the assumptions used to inform the targets rather than the program underperforming. The assumptions were made with best available data at the time of target-setting but turned out to be overstated.

The five cane regional programs effectively engaged and influenced a significant proportion of canegrowers across Queensland's sugarcane industry. More than one-third of all sugarcane farms in Queensland (1,221 out of 3,286 growers) demonstrated adoption of practices to improve water quality across 172,516 ha as a result of the agronomic and technical support and targeted financial incentives delivered through the program.

The five grazing regional programs promoted engagement with graziers operating in sediment hotspots (486 graziers improving management of 997,129ha), undertaking large scale remediation projects (17 streambanks and 55 gullies) and demonstrating best practice grazing land management to reduce pollutant loads. Both the sugarcane and grazing programs were supported by multiple lines of evidence investigating the social and behavioural dimensions of practice change utilised in the programs to enhance their effectiveness and contribute to the evidence base that will inform the design of future water quality investments.

While the pollutant load reductions achieved during the program period have been significant and rigorously validated, the GBRF's research into the social conditions demonstrates there remains a high likelihood that the landholders engaged may revert to old practices and may not maintain the restored gullies on their land. This is an issue that is not unique to the Partnership, and while the GBRF did utilise a range of strategies to increase the likelihood of practice change enduring, many of the important factors were beyond their influence.

A water quality investment framework that is transparent, accountable, effective, and efficient

The Water Quality Component successfully demonstrated a new investment framework for water quality improvement that is transparent, accountable, effective, and efficient. The framework incorporated a

⁷ A new methodology for assessing the reduced risk to marine species related to pesticides was developed during the time the Partnership ran, represents the impact of pesticide concentration and the toxicities on marine ecosystems. The method, called the Pesticide Decision Support Tool, expresses the relative risk from pesticide runoff using pesticide risk units (RU) (5a). Using this method, the target was updated from 250kg reduction in pesticide loads presented in the M&E Plan, to the 4,066,772 Risk Units reported against here. This method has also now been endorsed by Paddock to Reef and the Queensland Government Department of Environment and incorporated into the P2R Projector Tool. Warne et al 2023 [A Pesticide Decision Support Tool to guide the selection of less environmentally harmful pesticides for the sugar cane industry | Environmental Science and Pollution Research](#).

range of novel elements to overcome shortcomings in previous large scale Reef water quality investments and was found to be an improvement on previous Water Quality programs in the Reef.

Detailed in Appendix A, the elements of the framework included: A strategic approach to the allocation of funding that informed the adoption of water quality targets at the portfolio, program and project level; a custom-built water quality spatial database to track real time progress towards pollutant targets and supported adaptive management; and a new governance model for regional programs. The framework also included investing in less-disturbed catchments and a portfolio of innovation projects.

A purpose-built investment decision support tool was used to inform a strategic approach to the allocation of funding. The development and use of such a tool was a first for Reef water quality investments and was found to strengthen the accountability and transparency of investment decisions. The tool used the latest information on catchment loads, intervention options, costs and benefits to develop a range of investment scenarios. Based on the tool, pollutant reduction targets were set for the Program with projects selected to maximise water quality improvements. Progress towards targets was tracked using a custom-built water quality spatial database that enabled greater accountability for the achievement of targets and also assisted spatial assessments of historic activities undertaken to avoid duplication, further contributing to greater accountability and transparency.

The governance model adopted as part of the framework was also the first of its kind, and was found to improve the effectiveness, efficiency, transparency, and accountability of the water quality investments. The governance model sought to avoid conflicts of interest and provide transparency and accountability through the use of an independent Water Quality Working Group to oversee the strategic delivery of the Program, a Technical Advisory Group to provide technical and scientific guidance to subprograms and projects, Regional Program Managers and Partnership Coordinators to locally manage and coordinate on-ground projects, and regional Steering Committees to guide regional programs. The Foundation retained ultimate responsibility to manage contractual commitments across all levels, and incorporated contractual pollutant targets at a project and program level to ensure effective use of funds.

The Water Quality investment framework supported other initiatives beyond pollutant reductions to establish new knowledge, tools and opportunities to advance future water quality improvement efforts. While the bulk of the Component funding (78%) was allocated to regional water quality programs focussed on practice change and landscape repair activities to reduce priority pollutants, the remaining funds were invested in supporting innovative interventions, conservation and protection actions, and Traditional Owner engagement and co-design opportunities (further detailed below).

The transferability of the framework to other organisations or future programs implementing equivalent activities in the Reef catchments has been demonstrated through the effective application of the framework within this program and through the pollution load reductions achieved.

Maintenance or improvement of water quality from less disturbed catchments

Through the Eastern Cape York (ECY) Program, the Component has made significant contributions to establishing the foundations for future efforts to maintain or improve water quality in this unique and less-disturbed catchment of the Reef. The program adopted an integrated catchment management approach composed of seven projects delivered by four local organisations, with participation from at least ten Traditional Owner groups.

The Program contributed to improving the understanding of catchment water quality and sediment discharge in the ECY, addressing extensive gaps in knowledge and science-based evidence identified by the Program. The data and insights generated through the Program have the potential to significantly improve the Paddock to Reef (P2R) catchment model used to calculate sediment contributions to the

Reef from this region and inform future funding and management priorities. This included increasing the volume and quality of information regarding actual (measured) sediment export from these short-run coastal sub-catchments and contributing to critical knowledge regarding hotspots for sediment run-off from primitive tracks, the use of early dry season burns to prevent late dry season fires and associated erosion, and seagrass mapping.

The ECY Program has enhanced capacity and collaboration of local organisations, Traditional Owners and other land managers in catchment management practices for water quality improvement. Importantly, the Program has contributed to enhancing the capacity of Traditional Owners in water quality monitoring and fire management, in alignment with their aspirations. The Program employed 81 Traditional Owners providing on-the-job learning opportunities, with an additional 115+ Traditional Owners engaged through the projects. Many of those employed reported improvements in their knowledge, technical skills, self-efficacy, collective efficacy and confidence along with a range of other skills developed on Country. Project teams are embracing the two-way learning process, learning from Traditional Owners about their ways, aspirations, and local knowledge.

The on-ground gully restoration and fire management projects piloted through the Program demonstrated cost-effectiveness in reducing erosion and sediment loads, addressing important knowledge gaps. The fire management projects also contributed to a notable decrease in damage from late dry season wildfires. The methods used in these on-ground pilot projects have informed draft Best Management Practice guidelines for use by the local Cook Shire Council.

The Component also contributed to establishing the foundations of future efforts to utilise wetland restoration, rehabilitation, and construction for improving water quality across the GBR. These included undertaking monitoring, modelling and synthesising a scientific consensus statement on the subject.

Innovative solutions for systems change in water quality improvements

The Water Quality Innovation program delivered a portfolio of 22 innovation projects investigating innovative financing, technology transformation for key pollutants, and new tools to improve planning and decision making.

While all innovation projects made important contributions to their respective fields, four were specifically identified as 'game changers', demonstrating the potential for producing transformative changes at scale in the water quality Reef space. These included: 1. Nitrogen Risk Insurance to help farmers manage the risk of reduced yields from reduced fertiliser application; 2. Seaweed biofilters to capture nitrogen and carbon dioxide and reduce water pollution and climate change effects; 3. Cleaner Road Runoff package to identify the points within the road network responsible for the most serious erosion and sediment loss; and 4. Autoweed technology to manage weed in sugarcane using deep learning, machine vision and robotics to reduce application of herbicides.

Traditional Owner led water quality improvement projects

Traditional Owners were engaged in leading a number of water quality improvement projects, including projects under the ECY Program, and a few examples within the regional programs. Most notably, the Healthy Water Grants, co-designed by Traditional Owners and being delivered by the Foundation's Traditional Owner team provides opportunities for Traditional Owners to lead water quality improvement projects and will be evaluated in 2026.

2.1.2. COTS Control

The COTS Control Component has satisfied the performance expectations for its core end-of-Component outcomes. It has:

- achieved reductions in coral mortality from COTS outbreaks at key reefs
- increased coral cover in key reefs and reductions in density and size of COTS
- expanded delivery partner involvement in COTS management to include citizen scientists and Traditional Owners
- successfully embedded Traditional Owners in COTS Control management, research and governance.
- delivered a portfolio of multi-disciplinary research focused on improving the effectiveness and efficiency of the COTS Control Program, through the COTS Control Innovation Program (CCIP).

This was achieved through the management of 354 high value reefs to protect coral from COTS and the culling of 434,623 COTS across 30,780ha of Reef, resulting in a six-fold reduction in COTS numbers and up to 44% increase in coral cover when reefs and regions received timely and sufficient control effort. The Component also delivered a portfolio of 24 innovation projects involving 92 experts in multi-disciplinary research teams across 11 institutions, with many of these project outcomes now being embedded into ongoing COTS Control activities. An additional \$11.8M in co-investment funding was secured by this Component.

Funding has also been secured for COTS Control to continue through to 2030, and ongoing efforts are being made to secure additional funding for the CCIP, with bridging funding secured through to 2025/2026.

You've overachieved, but in such a great way. There's evidence of a lot of effort and great outcomes and it just shows that you can actually make a difference, but that it has to be [done through] that whole big picture approach. By bringing everyone together to play nicely, sharing, and making sure it was clear what the objectives are and what you wanted out of it, you've done it. So well done.

– Prof. Marnie Campbell

You've achieved a significant outcome, the strength of the outcomes, the value benefit that you've brought, you haven't just ticked the boxes.

– Prof. Chad Hewitt

On-water COTS Control Program

The COTS Control Program achieved significant reductions in coral mortality from COTS outbreaks at key reefs – contributing to a six-fold reduction in COTS numbers and up to 44% increase in coral cover

when reefs and regions received timely and sufficient control effort. The Program also reduced the density and size of COTS towards sustainable thresholds.

The COTS Control Program governance and program management models effectively supported the delivery of COTS control activities and achieved delivery efficiencies. The COTS Partnership Group (CPG) oversaw the strategic delivery of the COTS Control Program and met 22 times throughout the Program. The COTS Action Group was established as a tactical working group and met 29 times during the Program. Both governance groups maintained strong member engagement throughout the Program.

COTS Control Program data was effectively managed and shared to monitor progress in achieving Integrated Pest Management (IPM) goals. The quality of the Program's data was routinely checked and shared with partners, vessel operators, and stakeholders. Online dashboards ensured that data, activities and outcomes of the Program were widely accessible. These improvements in data management and sharing have supported more timely and adaptive COTS management, enabling mobilisation of a surge response to suppress a new wave of outbreaks on the Reef.

The COTS Control Program vessels delivered activities in accordance with the IPM Strategy, as per the Program's Annual Work Plans which were established under the Partnership. These Annual Work Plans set operational and performance targets for the COTS Control Program and ensured that outcomes of the Program were measured and evaluated to drive improvements in effectiveness and efficiency over time. For example, in 2023-24 the COTS Control Program protected over 160,000 hectares of high value coral reef, exceeding its 75% target for number of sites where COTS numbers are culled to sustainable levels, and delivered these outcomes under the target cost per on-water day.

Expanded delivery partner involvement in COTS management

The Partnership expanded delivery partner involvement in COTS management to citizen scientists and Traditional Owners. Citizen scientists engaged in the Great Reef Census, where they collected data to inform COTS management. As part of the Great Reef Census, 72 citizen scientists were engaged in data collection activities. The data collected was used by researchers to develop criteria to inform COTS Control decision-making.

Traditional Owners are now embedded in COTS Control management, research and governance. In 2024, the Reef Authority accepted a Traditional Owner-led business to their Panel of Providers, which should provide future opportunities for Traditional Owners to be involved in COTS management. Collaborations with Traditional Owners were also established under the CCIP. The CCIP involved Traditional Owners through a dedicated project, fieldwork, workshops, and the appointment of a Traditional Owner representative to the CCIP Steering Committee.

CCIP researchers and COTS managers and vessel crew operators became more aware of their responsibility to engage and partner with Traditional Owners over the course of the Partnership. While there is growing awareness and action regarding Traditional Owner engagement, more work is required to ensure that Traditional Owner interests and aspirations for COTS management and the Reef are realised.

COTS Control Innovation Program

The COTS Control Innovation Program (CCIP) delivered a portfolio of multi-disciplinary research focused on improving the effectiveness and efficiency of the COTS Control Program.

The collaborations and governance model enabled the effective design and delivery of the CCIP. A collaborative research partnership between leading Australian research institutions with expertise in delivering innovation in COTS surveillance and control was established to design and deliver the CCIP.

The CCIP was underpinned by a governance model that included a Steering Committee to provide strategic oversight, which met 26 times. A Program Director oversaw day-to-day program management, and technical team leads drove the design and delivery of research projects. Most interviewees and survey respondents acknowledged the effectiveness of CCIP collaborations. This included collaboration between researchers and between researchers, managers and on-water vessel crews.

The benefits, costs, feasibility, and risks of potential research opportunities were considered and prioritised to design the CCIP. The CCIP design phase engaged 43 technical experts who worked collaboratively to identify, develop, and prioritise innovations in COTS control and surveillance, considering the benefits, costs, feasibility, and risks of potential research opportunities. Full proposals and budgets were developed for 21 research projects, prioritised from over 300 knowledge and capability gaps identified. A total of five expert workshops were delivered to review, discuss, and refine the research opportunities followed by a workshop to prioritise the research portfolio.

The Partnership invested approximately \$8.6M in the 21 R&D Phase projects across the Prediction, Detection, and Response subprograms. Three Early Investment Projects were also funded using underspend from Design Phase activities. Three interviewees independently noted the quality of the design process, with two who commented on the appropriate allocation of 'applied' and 'innovation' research projects in the CCIP.

All CCIP R&D Phase activities were delivered as planned, with some minor and strategic adjustments. As of June 2024, 19 out of the 21 R&D Phase projects had been completed. One project was terminated early due to the departure of the Project Lead and another technically complex project received a six-month extension and was expected to finish in December 2024.

A Research Impact Plan was developed to support a mission-driven approach to delivering the complex, integrated research portfolio and ensure the multi-disciplinary team was aligned on delivering a suite of research outputs that improved the capability and innovation of the COTS Control Program. This included an expanded toolbox for COTS detection using eDNA, robotics and machine learning, targeted decision support tools and models to guide strategic prioritisation and operational response at scale, novel data on outbreak drivers and social license for COTS management, and development of new methods for biocontrol including pheromone attractants and targeted management of COTS predators.

Draft Final Technical Reports have been submitted for all 19 R&D Phase projects that finished in June 2024, and these are in the process of undergoing peer-review prior to publishing. Once finalised, all Technical Reports will be made publicly available on the CCIP webpage. Most projects are also producing peer-reviewed journal articles, with twelve articles published to date and more manuscripts being prepared for a forthcoming Special Issue in the journal *Coral Reefs*.

The CCIP was designed to develop new knowledge, tools, technologies, and methods to be trialled and/or implemented. The CCIP Project Outputs Register identifies more than 100 outputs from the CCIP research that can be trialled or implemented in COTS management.

The trialling and implementation of research outputs in COTS management has begun and is planned to continue in 2024-2025, with \$1.7M in additional funding secured for a CCIP bridging year that will support research translation activities.

Long term funding for COTS Management

In January 2022, the Reef Authority secured \$162M from the Australian Government to continue delivering the COTS Control Program through to 2030. As a result, advocacy efforts were shifted to

developing the 2030 COTS Research and Innovation Roadmap to secure additional funding for the CCIP.

The Roadmap set out agreed priorities for COTS research and innovation and advocated for an investment of \$2M per year to address the most important research and innovation priorities, with \$2-\$4M per year addressing all priority areas. The Roadmap was endorsed in December 2023. In June 2024, DCCEEW approved the use of \$1.7M in Partnership funds for a bridging year for the CCIP.

2.1.3. RRAS

Through the delivery of the Reef Restoration and Adaptation Program (RRAP), the RRAS Component has satisfied the performance expectations for its core end-of-Component outcomes. The Component scored assessments of 'good' and 'very good' against its effectiveness rubrics. It has:

- delivered a toolbox of restoration and adaptation techniques which are ecologically effective and deployable
- demonstrated international leadership in coral reef restoration science
- established new pathways for Traditional Owner education, employment and enterprises
- established strong and effective program governance.

The Component secured an additional \$228.5 million in co-investment funding and delivered 40 reef restoration and adaptation projects in collaboration with 32 partners.

The RRAP Translation to Deployment subprogram has systematically assessed the maturity of RRAP interventions and identified potential delivery models. Pathways to implementation have been mapped, integrating scale-up targets, technology development priorities, industry capability audits, and advanced logistic modelling. A process is currently underway to establish a collaborative framework between RRAP, AIMS, and the Reef Authority for delivery and approval of the RRAP Pilot Deployments Program.

Yes, I endorse these findings, there's definitely evidence supporting the evaluation's finding.

– Prof. Bronwyn Harch

A toolbox of restoration and adaptation techniques ready for investment

Through RRAP, the RRAS Component has effectively delivered a toolbox of Reef restoration and adaptation techniques ready for investment in implementation. In assessing the Component's achievements against its performance rubric, the Component has achieved a score of 'Good' against this outcome, through demonstrating the toolbox of restoration and adaptation techniques are logistically feasible at reasonable scales, culturally appropriate, socially acceptable and supported by effective regulatory frameworks. RRAP was designed under the RRAS Component in 2019 as a 10-year journey and the progress made towards end of program outcomes during the Partnership funding period (2020-2024) is appropriate.

RRAP has researched, developed and tested a range of interventions, leading to the identification of two intervention strategies ready for pilot deployment (at scale) from 2025-2026. These interventions are *Conservation Aquaculture* and *Coral Slick and Larval Reseeding*.

Supported by the Translation to Deployment subprogram, focusing on capacity building, logistics modelling and enabling engineering activities, RRAP has secured funding to plan and deliver these targeted pilot deployments across three GBR locations, and is putting in place a regulatory approval plan with the Reef Authority which will cover risk, social licence and Traditional Owner consent and participation.

Two additional intervention strategies, focusing on protection by reducing solar radiation (and associated heating), have demonstrated strong potential, including in the field. These are referred to as *Marine Cloud Brightening* and *Fogging*. Both will require further development, social engagement and research to achieve cost/energy targets and social licence.

In parallel, RRAP has conducted significant social research, Traditional Owner and community engagement, to assess the support for its interventions and to develop place-based implementation pathways. Significant training and capacity building programs for industry and Traditional Owners have started for more mature interventions, in support of proposed pilot deployments.

Australia recognised internationally as leading coral reef restoration science

Through RRAP, the Component has contributed to Australia being recognised internationally as a leader in coral reef restoration science. In assessing the Component's achievements against its performance rubric, the Component has achieved a score of 'Good' against this outcome, through demonstrating sharing of knowledge, publication in high-impact journals, international collaborations and international funding in Australian collaborations.

While it is too early to measure the international uptake of RRAP outputs, there is evidence of improved best practice to date with systematic sharing of technical knowledge in the form of Standard Operating Procedures (SOPs) and detailed technical publications. From 2018-2024 RRAP researchers have been either lead or contributing authors to over 170 scientific articles.

The Reef Resilience Symposium 2024 represented a major platform for international dissemination of knowledge generated within RRAP (<https://www.reefresiliencesymposium.org/>). RRAP has been actively involved in a range of international activities, including the design and rollout of the G20 Coral Reefs Research Accelerator Program and the collation and disseminating of best practice guidelines for coral reef restoration.

The RRAP Intervention Risk Review Group includes several independent international experts and has demonstrated the value of international collaboration to manage intervention risk across a range of dimensions.

RRAP as a program, and also individual RRAP projects, secured investments from a range of international investors, including competitive granting bodies (such as CORDAP, Revive and Restore, the Paul G Allen Foundation), Global corporations (such as L'Oréal, McLaren Racing Limited, Qantas, and Life-Space) and international philanthropic donors (including Oceankind, Paul M Angell Family Foundation and Builders Initiative). The program also received a major philanthropic investment through The Audacious Project to transfer RRAP coral aquaculture and seeding technologies to local communities across Pacific Small Island Developing States.

It is difficult to evaluate how much influence, direct or indirect, RRAP has had on Partner countries and their level of investment in reef restoration and adaptation. Nevertheless, since RRAP's inception, several large-scale programs (>USD50-100M) have arisen, including Mission Iconic Reefs and Reefense in the US (Florida) and the Kaust Coral Restoration Initiative in Saudi Arabia. These programs reflect a global convergence underpinned by growing scientific evidence for reef restoration and technical development.

New pathways for Traditional Owner education, employment and enterprises

New pathways for Traditional Owner education, employment and enterprises are being implemented and established across RRAP research and delivery activities. In assessing the Component's achievements against its performance rubric, the Component has achieved a score of 'Good' against this outcome, through demonstrating the nature of involvement of Traditional Owners both in RRAP as a program and also individual RRAP projects.

On the implementation of the RRAP Indigenous Engagement Framework RRAP is guided by Traditional Owner representatives on the Board and Steering Committee and by the RRAS-COTS Traditional Owner Technical Working Group (established under the Partnership).

Under this framework, on-ground engagement has occurred with more than 30 Traditional Owner groups, all RRAP activities have obtained Free, Prior and Informed Consent (FPIC) (collated in a central register) and field work has included systematic Traditional Owner participation. RRAP has supported the development of a Biocultural Assessment Framework for interventions and is implementing a Traditional Owner training and capacity building program.

Across over 150 separate engagements, more than 500 days of work have been contracted to Traditional Owners, not including Traditional Owner and First Nations staff within RRAP institutions.

Strong, transparent, inclusive, and effective governance and program management

RRAP effectively established strong, transparent, inclusive, and effective governance and program management. In assessing the Component's achievements against its performance rubric, the Component has achieved a score of 'Very Good' against this outcome. This was achieved through demonstrating the governance system ensured relevant, scientifically sound, effective and efficient progress, prioritisation frameworks and decision support tools are being used and contribute to a robust and informed discussion around decision making and are continually evaluated and adapted.

Best-practice governance framework, systems and processes have been put in place to ensure program performance is measured in a transparent manner and improvements implemented in a responsive and adaptive manner. Independent advice and guidance are achieved by the Board and Steering Committees, including from Traditional Owners, with a specific focus on risk management through the Independent Intervention Risk Review Group.

Program/intervention prioritisation frameworks and decision support tools have been developed at a range of temporal and spatial scales, addressing ecological as well as broader socio-economic dimensions. Those are continually adapted and contribute to informed and robust decision making, by considering combinations of interventions within the broader reef decision space.

2.1.4. IMR

The IMR Component has not satisfied all performance expectations for its core end-of-Component outcomes, despite best endeavours by the Foundation. The Component scored assessments of ‘good’ and ‘adequate’ against its effectiveness rubrics (See Appendix D: IMR Results Table) by demonstrating that targeted critical RIMReP data needs and gaps, and critical monitoring projects and a fully developed data management system (DMS) have been delivered. The absence of a clear plan on future Reef monitoring priorities from the Reef Authority (as the lead agency of RIMReP) and long-term funding to secure a permanent operational custodian for the DMS means it is difficult to see how the full potential of this Component can be best leveraged and maintained.

The Component delivered 26 critical monitoring projects in partnership with 12 organisations. This included 13 biophysical projects, four human dimensions projects and three integration projects (including the DMS). An additional \$18.2M of co-investment funding was secured by this Component.

While an operational Data Management System was designed and developed through the Partnership, progress on securing ongoing operational arrangements was only made six months after the Component formally ended (January 2025), with the Reef Authority contracting AIMS to be the operational partner for the next 12 months while long term funding can be secured.

Noting the very recent progress with the Data Management System to be delivered by AIMS, I would endorse the achievements as ‘adequate’. Overall, I think that the program has not performed as would be expected as, although datasets have been translated to DMS, they have not yet been fully integrated into RIMReP.

- Adj. Prof. Iain Gordon

The Foundation have done what they can, but we need strong Reef Authority ownership to achieve effective integration into RIMREP and to achieve the important step changes in our understanding of the conditions of the Great Barrier Reef World Heritage Area (GHR WHA) which this Component addressed. While there appear to be opportunities for several of the methodological and technical advances to be utilised, the outcomes of the IMR Component should be underpinning a major renewal of the investment in long term monitoring programs for the GBR WHA and commensurate modelling and reporting. Without this the legacy of the IMR Component is at risk of being lost.

- Ms. Di Tarte

Critical RIMReP needs prioritised and met

Critical RIMReP data needs and gaps were prioritised and delivered by the IMR Component. In assessing the Component’s achievements against its performance rubric, the Component has achieved a score of ‘Good’ against this outcome, through demonstrating monitoring priorities are fully aligned with

RIMReP and investment in monitoring was underpinned by a clear and transparent prioritisation process supported by key partners and stakeholders.

The IMR Component and RIMReP were found to be well aligned to each other. However, fully integrating critical monitoring project data into RIMReP did not occur during the term of the Component, despite considerable efforts from the Foundation in supporting and facilitating this process. Achieving this integration was dependent upon the following factors: having an operational data management system (the DMS was also developed through this Component, discussed further below); strong ownership and leadership from the Reef Authority as the lead agency of RIMReP; and long-term funding. Without these factors coming together, data is currently only partially available to the broader community, with instances of use across few formats on a single platform with a limited number of users. However, at the time of writing (January 2025, 6-months after the formal completion of the Component) formal arrangements are now being put into place which will see the DMS fully operational by end of January 2025 for a 12-month period, with efforts to secure long term funding also underway. Ongoing commitments to the broader portfolio of critical monitoring projects have yet to be secured.

The critical monitoring activities invested in through the Component were delivered effectively and efficiently against the performance rubric. All projects demonstrated effectiveness in achieving their intended outcomes, specifically in improving data coverage or cost effectiveness, and many projects improved data timeliness and accessibility (detailed in Appendix D: IMR Results Table). The projects have also generated substantial new scientific knowledge and successfully piloted new methods, as evidenced by the majority of projects producing scientific publications. Many projects also demonstrated their data added value across a range of areas, with the majority of projects demonstrating their data have been used to inform reef management decisions to date, and findings have been disseminated through conferences, technical reports and various forms of media. However, until integrated into RIMReP, their effectiveness and associated value and return on investment will not be fully realised.

Delivery of a data management system

Following a scoping study completed early in the Partnership, the establishment of a data management system (DMS) through the IMR Component was identified as an immediate priority. The DMS project is currently underway and in its transition phase and, as stated above, as of end of January 2025 the DMS will be fully operational under an initial contract of 12 months duration, with efforts underway to secure long term funding.

In assessing the Component's achievements against its performance rubric, the Component has achieved a score of 'Adequate' against this outcome, through demonstrating the DMS's functionality in addressing a broad range of strategic and tactical issues, and that (at the time of the evaluation process) it is operational for a limited number of critical applications with a model that has been recommended for long-term maintenance and operation. While a small group of Reef Authority stakeholders and policy makers are using the DMS it remains out of reach for the broader community.

Embedding Traditional Knowledge and sharing benefits

The Strong Peoples-Strong Country Framework is the primary mechanism through which the Component is supporting the recognition and embedding of Traditional Knowledge alongside western knowledge in Reef governance. However, as outlined in section 1, this project is out of scope of this evaluation and will be considered as part of the Traditional Owner Partnerships Component in 2026.

Beyond this specific project, 15 of the 17 critical monitoring projects included Traditional Owner engagement in some form. This includes three projects that have included co-design elements with Traditional Owners, and the establishment of meaningful relationships and knowledge sharing.

2.2. Implementation of the Grant Agreement

The Partnership has been implemented in accordance with the Investment Strategy and Annual Work Plans. While some activities experienced minor delays due to external factors such as weather events, and some activities were extended to enhance their impact, the majority of projects spanning Water Quality, COTS, RRAS and IMR Components were completed, with funding for these Components fully committed.

The Foundation exceeded its co-investment target, having raised \$456 million (125%) against the \$357 million target as of 30 June 2024. With the Department's support, the Foundation continues to proactively fundraise for activities and programs within the Reef 2050 Plan.

The Foundation has been operating in accordance with the terms of the Partnership Grant Agreement in consultation with the funding partners and in compliance with the policies, processes and business rules approved as part of the Partnership governance and risk framework.

The Foundation has been intentional in committing funding in line with its guiding principles. This has included taking the time to establish partnerships and quarantining funding for opportunities for adaptive management, such as providing additional funding for projects performing especially well and/or demonstrating potential to leverage further Reef outcomes.

The Partnership's guiding principles were central to the design and implementation of the Partnership, demonstrated through effectively:

- advancing partnerships and approaches to build and accelerate the delivery of enduring outcomes for the Reef
- leveraging investment and co-investment from local and global actors
- empowering Traditional Owners and Reef 2050 Plan community partners
- adopting Traditional Owners' ways of knowing and doing in Partnership processes.
- integrating and/or creating synergies between Components.

The guiding principles provided a common thread across the Partnership Components and facilitating the 'portfolio approach' that integrates program design and delivery. They informed a consistent, robust, defensible, and transparent approach to investment decisions, consolidating stakeholder confidence in the decisions and actions of the Foundation in delivering the Partnership. They also provide the basis for benefits to extend beyond the Partnership period, and form part of the Foundation's legacy.

2.2.1. Activities delivered as planned - on time and to budget

The Partnership has been implemented in accordance with the Grant Agreement. To date, the Partnership has been implemented as planned, on time and to budget in accordance with the Investment Strategy and Annual Work Plans, with annual progress reports outlining minor adjustments to delivery timelines where relevant. Governance and program management systems and processes across the Foundation and Partnership Components have effectively met the needs of the Partnership with no issues having arisen during the Partnership period.

Across the entire Partnership a total of 462 projects have been, or are, being delivered with 639 unique partners. For the completed Components of Water Quality, COTS, RRAS and IMR this includes:

- Water Quality Activities: 75 project grants (11 early investment projects, 35 on-ground regional projects, 22 innovation projects and 7 conservation projects) and 56 consultancies delivered by more than 150 partner organisations across almost all reef catchments, with 100% of Component funds committed.
- COTS Control: 54 projects with 19 partners, with 100% of Component funds committed.
- RRAS (\$100M): 40 projects with 32 partners, with 100% of Component funds committed.
- IMR (\$40M): 26 projects with 12 partners, with 100% of Component funding committed.

The Foundation has been deliberate and intentional in their approach to committing funding in line with their principles. This has meant taking the necessary time to establish partnerships, quarantining funding for activities to be co-designed with Traditional Owners, and quarantining funding for emergent adaptive management opportunities. These opportunities include providing additional funding for projects that may be performing especially well, demonstrating the potential to leverage further Reef outcomes. The Foundation has also continued to work within their contractual administration budget.

2.2.2. Co-investment targets delivered

The Foundation exceeded their Collaborative Investment Strategy target of \$357m, with \$456m (125% of target) raised as of 30 June 2024⁸. While the majority of this investment was in-kind contribution from partners (\$217M), Corporate Partnerships was the most productive gift market for the Foundation, which represents the largest private fundraising effort for coral reefs in the world. Over the period of the Partnership, the Foundation secured many multimillion-dollar partnerships from domestic and international philanthropic and corporate funders. The value of gifts secured clearly demonstrates broad support for the protection and restoration of Australia's iconic Reef and proves the viability of a blended funding pipeline for future reef programs. Table 2 shows the funds leveraged against the initial targets set out in the Collaborative Investment Strategy.

Table 3. Collaborative Investment Strategy Pledges (as of June 30, 2024)

Revenue Stream	Target	Total Pledged
Contributed Funds Through Partnership Components	\$200M	\$218,797,479
Individual Giving	\$7M	\$5,648,777
Corporate Partnerships	\$50M	\$144,015,588
Capital Campaign	\$100M	\$89,528,786
Pro bono	\$0	\$2,401,708
Total	\$357M	\$456,392,338

The achievement of the Contributed Funds target reflects the opportunity of co-investment in Reef programs and shows the progress made in delivering the Component programs. The Mid-Term Evaluation (2021), described how the Community Reef Protection Component made especially strong progress, attributed to the significant in-kind contributions associated with volunteer programs, as has the RRAS Component through the commitment of partners through the Un-incorporated Joint Venture. It also describes how the Foundation's Water Quality team grappled with the challenge of capturing meaningful and relevant co-investment figures from their delivery partners and instead promoted the notion that co-investment itself was not the goal, but rather another mechanism for achieving outcomes

⁸ Reef Trust Partnership – Final and Progress Report, Great Barrier Reef Foundation, June 2024

for the Reef. As such, through their commitment to funding the most cost-effective projects, the team considered any co-investment as simply further enhancing value for money.

After experiencing delays in international philanthropic efforts due to the challenges associated with the COVID-19 pandemic and the adverse publicity around the procurement process to award the grant, from 1 July 2021 co-contributions, corporate partnerships and donations grew in scale and yield. Highlights over the period include:

- McLaren Racing: A partnership with the McLaren Accelerator program and the RRAP to streamline the production of corals and increase the scale of deployment on the Reef while raising global awareness of the threats they face.
- Qantas: Building on a 15-year relationship, Qantas committed \$10M from 2024-2034 to the newly established Reef Restoration Fund. This initiative aims to support scientists, Traditional Owners, and local tourism operators in restoring coral ecosystems.
- Coles: A 10 year \$10M partnership focused on restoring blue carbon ecosystems such as seagrass and intertidal wetlands which are essential for Reef health.
- The Audacious Project: the Foundation secured pledges to the value of \$55M USD over 2024-2030 toward scaling up coral restoration in the Pacific utilising the science and technology developed through RRAP.
- L'Oréal: A ten-year AU \$7.5m investment to develop a world-first method of calculating the value of coral reef biodiversity and support the deployment of corals with improved temperature tolerance.

2.2.3. Operations in accordance with governance and management plans

The Foundation has operated in accordance with the terms of the Partnership Grant Agreement, in consultation with the funding partners and in compliance with the policies, processes and business rules approved as part of the Partnership governance and risk framework.

The following review mechanisms demonstrate the Foundation's commitment to best practice governance and continuous improvement:

- A Partnership Management Committee (PMC) comprised of 10 experts to oversee the investment for the Foundation. The majority of the experts were science, research, marine and project management professionals.
- Independent mid-term and end-of-Partnership evaluations of the performance of the Partnership with independent expert review undertaken in accordance with the Partnership Monitoring and Evaluation Plan.
- Annual internal evaluations of the performance of the Partnership in accordance with the Partnership Monitoring and Evaluation Plan.
- Annual independent financial audits undertaken by statutory auditors, Ernst and Young, in accordance with Australian Accounting Standards and relevant regulatory requirements.
- An ongoing internal audit program undertaken by KPMG, reporting directly to the Board's Audit, Risk and Compliance Committee (ARCC).

The Partnership was also the focus of two Australian National Audit Office (ANAO) Audits:

- Auditor-General Report No. 22 2018–192, focused on the assessment and decision-making processes that led to the award of an ad hoc grant to the Foundation through a non-competitive process. In responding to the first audit, the Australian Government identified that the partnership

with the Foundation was an innovative model that could be adopted to address other policy priorities for Australia⁹.

- Auditor-General Report No. 35 2020–21, focused on the implementation of the Partnership. The audit found the Australian Government grant had been appropriately invested and design and early delivery had been partially effective. In response to the Audit, the Foundation specified their ongoing commitment to fundraising despite the impacts of COVID-19 and provided additional context to explain their procurement processes and decisions.

2.2.4. Operations in accordance with guiding principles

The guiding principles represent the Foundation's new and more enduring approach to securing the health of the Reef. Collectively, they guided effective practice as well as helped to more readily identify partners that shared a common vision for the Reef. The Foundation's use of these principles distinguished their processes for decision making, and gave the Foundation's Board, the PMC, the Australian Government as the grant manager, and stakeholders confidence that the Foundation was investing Partnership funds to deliver the most impact.

"We operationalise these principles through the very conscious process and strategy we have gone through to make decisions. First, we used the best available science and expert knowledge to understand the field and design the options. Then we brought in some key structured decision-making processes, where key values included these other principles: achievement of multiple benefits (which we specifically named, based on stakeholder input); complementing investments; focusing on the highest priority threats and locations. Then the structured decision-making process led us to being able to select options that we thought were the ones with the highest potential for success and impact. And then delivering improvement for on-ground change is in-built, we have a 10 per cent administration cap, so everything else is on ground" – Partnership Component Director.

The Water Quality Investment Strategy is an example of the application of the guiding principles within a Component. The Investment Strategy addresses each of these principles as guiding decisions on the level of investment to be made in each priority catchment. This was a strategic approach to investment that relied on a science-based approach, with funding linked to the cost-effectiveness of options and the setting of measurable outcomes. The methodology was clearly documented, providing transparency to the process.

"For water quality, we're updating the model and we're going to check that against what we decided to do and then that will allow us, using the [same] process, to potentially re-allocate funding, if we wanted to. So that system is scientific enough and systematic enough and transparent enough that you can actually probe it, question it and adapt it, which you don't get if you don't do something of this kind [of process]". – Partnership Component Director.

Advancing partnerships and approaches to build and accelerate the delivery of enduring outcomes for the Reef

The Foundation was effective in advancing partnerships and approaches to build and accelerate the delivery of enduring outcomes for the Reef. With its history as a partnering organisation, it brings an excellent partnering culture and nous to the way it approaches partnering and how it 'behaves' in

⁹ Auditor-General Report No. 35 2020–21, Australian National Audit Office, © Commonwealth of Australia 2021

partnership with others. Where this culture has also been adopted and institutionalised by broader Reef partners, it provides a foundation for benefits beyond the Partnership period.

The Foundation has led by example, demonstrating what ‘good partnering’ looks and consistently demonstrated leadership and commitment to the vision for the Reef and invested the time to establish the meaningful and effective relationships across its 639 delivery partners to achieve that vision. Interviewees provided examples of what that looks like, including taking a ‘listening’ stance, engaging in productive conversations about both what is and isn’t working well, and providing an extra level of support where required.

The Foundation has successfully contributed to the establishment of a number of effective collaborative governance arrangements built on strong principles and systems, for example the Partnership Management Committee.

“The principle of setting out ‘well, what are we trying to achieve?’, setting up transparent processes, an expertise base [to] objectively review both the objectives and the proposals, [and] a committee that was independent of all these things to run that process, is just a fundamental quantum leap forward” – PMC member.

A range of novel approaches and models to working in partnership are being utilised through the delivery of Components. This includes the RRAP and CCIP unincorporated joint ventures, Traditional Owner governance arrangements to facilitate a co-design approach, the collaborative governance arrangements between the Reef Authority and the Reef and Rainforest Research Centre (RRRC) to deliver the COTS Control Program, and the governance arrangements overseeing regional water quality programs.

While the Foundation is empowered to broker key relationships by having the Partnership funding behind them, it is really the emphasis on strong governance and partnership principles that is enabling a stronger culture of accountability and transparency and creating a more ‘productive’ partnering dynamic. In addition, the continual focus on impact for the Reef supports productive partnering:

“Just by saying “How’s that helping the Reef?” Partners [are able to] use the Foundation and the Partnership governance as a way for them to focus on their core strength” – Partnership Component Director.

While partnering came naturally to the Foundation, a key assumption underpinning the Partnership model was that partners would bring the required capacity and willingness to work in novel partnerships. The Foundation identified where that capacity and willingness lay, and where trade-offs needed to be made between collaboration and the effective delivery of outcomes. Examples include the willingness of many of the community organisations to trial new ways of working.

Across the partners involved in the Water Quality regional programs the capacity and willingness to work in novel partnerships was more variable, with examples of new collaborations between delivery providers emerging for greater impact as well as examples of less comfort with working in collaborative ways.

Leveraged investment and co-investment from local and global actors

The Foundation has successfully leveraged the Australian Government investment to secure co-investment and fundraising from local and global actors who share a vision of driving change at scale for the Reef. As reported in Section 2.2.2 Co-investment targets delivered, the Foundation raised an additional \$456m, representing the largest private fundraising effort for coral reefs in the world, and exceeding the set target. The value of gifts secured clearly demonstrates broad support for the protection

and restoration of Australia's iconic Reef and proves the viability of a blended funding pipeline for future Reef programs.

Empowering Traditional Owners and Reef 2050 Plan community partners

The Foundation led by example in empowering Traditional Owners to actively participate in building Reef resilience. It also provided leadership for community groups and partners to work towards a common vision for the Reef and, through this, the Foundation provides a platform for empowering community partners in Reef protection.

Empowerment occurred through the governance and delivery processes used, building on well-established foundations that have made a significant difference. This includes the deliberate separation of the originally combined Traditional Owner and Community Reef Protection Components into two distinct Components, quarantined funding for the Traditional Owner Component, and the delivery of these as standalone and 'cross-cutting' Components that seek and take opportunities for integration with other Partnership Components.

The Traditional Owner and Community Reef Protection Components will be the focus of an evaluation in 2026 to assess the achievements and outcomes of these efforts to empower Traditional Owners and Community Reef Partners.

Feedback from community project partners has been positive, with partners indicating the Foundation's approach to grant making is unique, flexible, and appreciated.

"We feel like you are standing along-side us, wanting and helping us to succeed" –Community Partner.

Traditional Owners' ways of knowing and doing being adopted in Partnership processes

The recognition of and respect for Indigenous knowledge, and the intentional adoption of Traditional Owners' ways of knowing and doing and ethical practice, is a central pillar of the Foundation's implementation of the Partnership. The creation of staff positions for Aboriginal/Torres Strait Islander people and the adoption of a co-design approach with articulated principles and mindsets in Partnership processes, has ensured the establishment of Traditional Owner governance arrangements and partnerships that address power sharing and bring Aboriginal/Torres Strait Islander voices into the organisation and the design, delivery, and governance of the Partnership.

The co-design action framework developed through the Partnership has delivered important two-way capacity development. Responsiveness in grant program design ensures evolving Traditional Owner priorities for capacity development can be addressed, spanning on-ground field skills to governance and administration competencies. Within the Foundation, the Traditional Owner Partnerships team provides advice to other Component areas on engagement practices and evolving Traditional Owner priorities based on their experience and learnings from working with governance members and grant recipients.

Significantly, a leading Australian co-design expert has recognised the Foundation's co-design approach as best-in-class and largest ever in scale co-designed program. They are working with the team to write up the experience of the Program and its outcomes and impact as a scientific paper and case study, with accompanying questionnaire to guide others in a co-design approach.

While the Foundation has successfully brought this voice into the Partnership, the effectiveness of the adoption of Traditional Owners' ways of knowing and doing is also reliant on partners and the broader system of Reef actors listening and investing in Traditional Owner capacity. There is evidence that the

Partnership has changed the conversation and in many instances the practices within partner organisations in relation to cultural awareness, engagement and partnerships with Traditional Owners. But greater transformation is needed, and Traditional Owners have reported that many institutions that partner with the Foundation and Traditional Owners still need a major uplift (for example through governance members and at the Healthy Water Forum).

Further insights regarding the adoption of Traditional Owners' ways of knowing and doing in Partnership processes will likely emerge through the 2026 evaluation of the Traditional Owner Reef Protection Component.

Using innovation to accelerate the achievement of enduring outcomes

Innovation is a defining feature of the Foundation and was central in the delivery of the Partnership. As a nimble organisation with a culture of innovation and a mandate for Reef outcomes, the Foundation created, tested, refined and adapted its approaches to ensure outcomes were achieved – albeit within the constraints of the Grant Agreement. In addition, a significant proportion of the Partnership investments were for on-ground innovation projects through the RRAS, COTS Control and Water Quality Components.

The Foundation, by its nature as a charity rather than a government agency, found they were able to bring a unique perspective to problems previously unaddressed by government, and the risk appetite to demonstrate how things can be done differently to achieve enduring outcomes.

The Innovation Strategy for the Partnership provides a set of innovation principles that enable the Foundation to effectively communicate what innovation for the Reef looks like, as well as an operational strategy for 'how innovation is done' at the Foundation and thus for the Partnership. It describes how the innovation strategy supported the active and consistent consideration of innovation across the Partnership through:

- programming activities, decision points and roles
- individual competencies and the culture of the Partnership team
- a tool to support Foundation decisions on its role versus the role of partners in delivering on the intent of the Partnership
- a corporate engagement framework to help structure and develop the process and pathways for engaging corporates, to maximise impact, increase value and mitigate risk.

Integrating and/or creating synergies between Components

The identification and leveraging of integration opportunities and synergies was an expectation of bringing different areas of Reef investment together under the banner of the Partnership, led by a single organisation. However, formal integration across Components was not deliberately designed into the Partnership and, while the Foundation is achieving this, the extent to which those opportunities exist is less than might have been presumed. The nature and design of the Water Quality regional programs and the COTS Control on-water programs (which collectively comprise a substantial proportion of the Partnership) do not lend themselves readily to meaningful integration with other aspects of Reef management within the Partnership.

The most notable current examples of integration between Components are through the delivery of the Traditional Owner Reef Protection Component which will be explored further in the 2026 evaluation. There have also been some modest examples of integration occurring between Components, including:

- The Cairns-Port Douglas Hub project: the Community Reef Protection led project that includes investments from the Traditional Owner Reef Protection and RRAS Components for integrating community led Reef stewardship and restoration, with RRAP research priorities and Traditional Owner knowledge and cultural values.
- The Eastern Cape program: the Water Quality Component led program is an integrated catchment management demonstration designed and delivered in part with Traditional Owners.
- COTS modelling: an opportunity was identified through a partner delivering modelling for both the COTS and RRAP Components that resulted in consistency in how COTS impacts are modelled across programs, as well as sharing of models and modelling resources.
- The Great Reef Census: The IMR-funded citizen science project was delivered with support from the Community Reef Protection Component team and later received investment from the COTS Component to support integration of data into Control Program decision-making.
- Involving COTS Control vessels in water quality sampling to inform future monitoring applications under the IMR Component. This was co-funded and co-designed by the IMR, COTS and Water Quality Components.
- More generally, operational synergies and efficiency dividends are being achieved through the delivery of the Partnership as a single portfolio.

“[There are synergies emerging through] the knowhow that is circulating within the [Partnership]. So, if you’ve done it well in one space, then it immediately propagates through the whole system [and] we can just replicate the process immediately in another area, and that’s just super high efficiency” - Partnership Component Director.

2.3. The Impacts and legacy of the Partnership

The Partnership impacts are also its legacy. They comprise a range of enduring outcomes that align closely with the Strategic Principles that guided the Partnership's design and delivery. These legacies include:

- The demonstrated value and effectiveness of the unique **public-private partnership model** and the Foundation's **outcomes-focused approach**. Many independent interviewees described the Partnership as a leading example of a highly effective outcomes-focused public-private partnership. By taking program delivery outside of government and then taking a holistic and outcomes-focused approach, the Foundation was able to deliver outcomes at a scale and pace that governments had not been able to achieve.
- The **partnerships and culture of collaboration** that were advanced in what was once a highly competitive and fractured sector. This was attributed to a range of factors, including the Partnership model – designed as a 'one-stop shop' for the key Reef programs - but also the Foundation's approach and the strategic focus on fostering and advancing partnerships and collaboration. Interviewees emphasised that this must continue to be actively fostered in future Reef investments, or the sector may revert to being fragmented and competitive.
- **Empowerment of Traditional Owners**, including governance arrangements and capability uplift for both Traditional Owners and non-Indigenous people that will endure beyond the Partnership.
- The **science outputs**, including knowledge, expertise, and capacity uplift and publications, which will provide benefits for the Reef scientific and management community both locally and internationally into the future.
- The demonstration of **alternative sources of funding**, including industry and philanthropy, which can complement future government investments into the Reef.

The Foundation has also worked closely with the other key Reef management agencies through the DCCEEW Legacy Committee to ensure the programs, learnings and associated materials are used by future managers.

2.3.1. The public-private partnership model and outcomes-focused approach

The Partnership has demonstrated and evidenced the effectiveness and impact of the public-private partnership model, and the strategic principles utilised in its delivery. This provides a legacy for the future adoption of this model and approach.

The Partnership is described by many of the independent interviewees as a leading example of a highly effective outcomes-focused public-private partnership model. By taking the delivery of the programs outside of government and then taking a holistic and outcomes-focused approach, the Foundation was able to deliver outcomes at a scale and pace that government have not been able to do.

The power of an intermediary, a convener, a middleman, cannot be overstated. We are the coordinator; we're a partnering group. From a government client perspective there's just no way that they would, with their resourcing, be able to maintain 512 individual contracts at that kind of level. But they were able to maintain one contract with the Foundation with clear deliverables and accountabilities, have lines of sight of governance at key points. And as that intermediary, we were able to deliver profound efficiency and value for money to the Commonwealth. There was no

putting money aside for us for 'doing', which really helped because it meant that there was room for the partners to be great because we weren't replicating their work or taking it off them. It was their work – Foundation Executive

One of the key achievements was establishing the value of a model like it – reminding government that there are things that only [government] can do and there are things that others can do that [government] can't and that it's only in the combination of those things at scale that some really unique things can happen. [The Partnership] is one of the better examples of the verification of the value of the model that I can think of in Australia, certainly in an environmental context and absolutely for the Reef. - PMC member.

A Foundation Executive interviewee reflected on how the Reef Advisory Committee, a diverse group of stakeholders, all supported the model.

An experience that was incredible was sitting at the Reef Advisory Committee (RAC) table with all the senior level Reef stakeholders... All the soft infrastructure in the relationships that we invested in, then got its own momentum. We had a letter from RAC go to the Qld and Australian Government Environment Ministers, and it was about a whole lot of things, but one of the things was just saying, "you've got a model right in front of you for the coordinated, effective and high impact delivery of Reef programs and it's The Reef Trust Partnership" – and this is the consensus from every stakeholder across the Reef space at the RAC table. – Foundation Executive.

The monitoring and evaluation process was also an important part of the model for transparently evidencing the outcomes and impact achieved and informing learning and adaptation. The value of the Water Quality Dashboard and underpinning database for real time reporting was specifically identified in the independent evaluation of the Australian Government Reef Trust water quality investments¹⁰, with the report recommending its adoption in future Reef Trust investments.

The M&E was absolutely vital that anybody could go in and see where [the money] was spent, what regions benefitted and that this was the outcome. I think that was absolutely key. I've actually sent out the website version of the M&E from the Foundation to a whole bunch of different people and said look I think these guys have done a good job in that transparency and you can see what the outcomes were. - PMC member.

2.3.2. Partnerships and culture of collaboration

The advancement of partnerships to build and accelerate the delivery of enduring outcomes for the Reef was one of the strategic principles of the Partnership, and the partnerships and collaborative relationships built across the Reef sector are an important legacy that many hope will continue.

I do feel there are deep embedded legacies of empowerment and participation across the space as a result [of the Partnership], a very active empowered community. You can have a lot of data and outcomes, but I think that there has been a cultural shift, the formal establishment of a Reef protection community in Australia and I think that is quite powerful. The shift was really palpable at the Reef Symposium that was held in Cairns a few months ago. If you look at where we were in

¹⁰ Alluvium 2022, 'An evaluation of the Australian Government Reef Trust water quality investments and prioritisation to inform future water quality investment, Alluvium Consulting Australia Pty Ltd for the Department of 'Climate Change, Energy, the Environment and Water.

<https://www.dcceew.gov.au/sites/default/files/documents/alluvium-part-a-evaluation-report.pdf>

2016/17 at the time of the grant, where there was no getting together of the entire community and [First Nations] weren't even in the room. The recent Symposium was more bottom up, everybody felt empowered to be sharing their work and understanding the collective vision of Reef protection. The Partnership] was a total system change and disruption and empowerment of a community. There is now an establishment of players and collaboration which I think is extremely powerful. – Foundation Executive

Many of the independent expert interviewees described how, prior to the Partnership, the sector was highly fractured and competitive, and through the delivery of the Partnership, competition between actors was reduced and greater collaboration and collective action was achieved. This was attributed to a range of factors, including the Partnership model – designed as a ‘one-stop shop’ for the key Reef programs, but also Foundation’s approach and the strategic focus on fostering and advancing partnerships and collaboration. Interviewees raised concerns that unless this continues to be actively fostered in future Reef investments, the sector may revert to the fragmented and competitive sector it was before the Partnership.

This is the first time that I really felt there truly [was an] institutional ecosystem. Getting that collective approach, I think was pretty groundbreaking, and I think it will continue hopefully to be a legacy Component. The ability to drive and broaden participation across a whole range of different groups focusing on specific areas, there's always going to be competitive tension when there's government funding dollars, so ensuring that competitive tension is driving to a common purpose and that each player is really clear on the strengths that they bring to the equation. – PMC Member

However, the culture and mindsets of individuals and organisations who have been working in this space for a long time pose a challenge for enduring partnership approaches.

“We have some very entrenched players in the Reef space... [and while] there are some real signs that they're sharing responsibility and joining in collaboratively into governance mechanisms...at the end of it, it may well be that they'll just flip back” – PMC member.

The Foundation led by example, demonstrating what ‘good partnering’ looks like for better outcomes for the Reef. Where the novel approaches and models to working in partnership have been adopted and institutionalised by broader Reef partners, they provide a foundation for benefits beyond the Partnership period. For example, the RRAP program has successfully institutionalised these principles through the collaboration framework which has been designed to endure beyond the Partnership.

2.3.3. Traditional Owner empowerment

The empowerment of Traditional Owners achieved through the Foundation’s delivery of the Partnership is described by many as the most important legacy of the Partnership including the establishment of Traditional Owner governance arrangements, the deep co-design processes including the co-design action framework developed, and the capability uplift across the Reef partners in Traditional Owner engagement principles.

The recognition of and respect for Indigenous knowledge and lived experience, and the intentional adoption of Traditional Owners’ ways of knowing and doing and ethical practice, was a central pillar of the Foundation’s implementation of the Partnership. This work has been critical in setting a new standard in the Reef space for Traditional Owner engagement, partnership and leadership that is being, at least in part, adopted by many of the Reef partners, and is the standard Traditional Owners will expect to be maintained and built upon into the future. In addition, the Traditional Owner governance arrangements

and partnerships established to address power sharing and bring Aboriginal/Torres Strait Islander voices across the Reef sector will continue beyond the Partnership.

Indigenous engagement, involvement and empowerment was not something that was stipulated in the original contract. What the Foundation did was the game changer of the last few decades and how [Traditional Owners] are now equipped, how they govern, how they coordinate activities –
PMC Member

The involvement of Traditional Owners in COTS Control is an example of this legacy, with Traditional Owners now delivering COTS control services due to the work of the Partnership.

Before 2018, I remember some leaders in the Traditional Owner space saying “our vision is that one day we have vessels that are Traditional Owner led and operated that are doing COTS control work and we’re able to tender for the work. We’re invited and seen as valuable tenderers”. At that time there was literally nothing - there was no mention of Traditional Owners or the need to even work with them. Last year, the Reef Authority went out for tendering for the next five years and specifically asked for Traditional Owner led services on sea country. That is a great legacy outcome of the Reef Trust Partnership. That is now embedded in the future of the COTS Control program. We have a long way to go, but that is an example of how the space has changed in ways that you don’t backtrack from. – Partnership Component Director

Another important element of this legacy is the capability uplift experienced by many of the Reef partners in engaging with Traditional Owners.

I think what has probably been the biggest change – and will be a big legacy as well – is how people engage with Traditional Owners. We are just one-stepping stone in that long journey [but] there’s transformational change in that space, from all of our partners. There isn’t a conversation that doesn’t [now] go to, ‘why are the Traditional Owners not in this discussion?’ – Foundation Executive

2.3.4. Good science

An important legacy of the Partnership is the scientific knowledge and outputs developed throughout its delivery for continued use in decision making under future investments. The Partnership’s commitment to strong science ensured all Components generated substantial volumes of scientific knowledge, evidenced and documented in publications and technical reports.

There’s been some really great science done, and I put that out in front because this is a scientific issue and at the end of the day, good science is a really important commodity and is not often achieved. The [Partnership] organised itself, took an aim at those particular problems and I think was able to extract some really great science that hadn’t been done before, which of course passed on to decision making in those areas. We’re losing the Reef very rapidly. This is an emergency. We don’t have the opportunity to watch something for the sake of watching it - PMC member.

The evidence supporting the COTS Control IPM strategy is one strong example.

The collaborative work [between the Reef Authority and the Foundation] on COTS was really excellent. In the early days it was very much about what new things can we do, and as we went through the process, we came to – “how can we get better and more efficient at what we know works?” Now that the IPM model has been finessed, I think that that’s one of the great success stories of the last five years. - PMC Member

The science generated through the Water Quality Component, including filling knowledge gaps and generating new insights about what works and what doesn’t, are key scientific outputs that have the potential to have a strong legacy beyond the Partnership.

Part of overall legacy is that we have developed so many decision support tools and filled science gaps. Like for prioritising gully erosion, wetland rehabilitation and the Eastern Cape York Program. We realised there was a bunch of different pathways to improve water quality that didn’t have methods to estimate them and measure them. So, we took it upon ourselves to cover the cost of contracting experts to develop methods for that. We broke ground in terms of widening the science that underpins measuring water quality impact. - Partnership Component Director

The DMS and research funded through the IMR Component also has the potential to provide a substantial legacy for the Partnership but is dependent upon being used and adopted by end-users, most importantly the Reef Authority.

We’ve done what we said we would do. We’ve developed and delivered these monitoring projects, but that’s not the important bit. It’s “how does it then get adopted and used across the Reef monitoring landscape?” That question, that’s for RIMREP. – Partnership Component Director.

2.3.5. Demonstrated alternative funding opportunities

The Foundation have achieved the largest private fundraising effort for coral reefs in the world, leaving a legacy of demonstrating the viability of a blended funding pipeline for future Reef programs. The Foundation have also fortified themselves as the lead charity for the Reef, able to activate global philanthropic sources of funding for the Reef and with the Department’s support, they continue to proactively fundraise for activities and programs within the Reef 2050 Plan, with a focus on reef restoration R&D and deployment.

We also fortified [ourselves] as the lead charity for the Reef in a way that you can never undo, that more people are picking up the phone and wanting to just dispense investment for the Foundation for the work of the Reef than ever before. And we have such a broadened view of the landscape and such an amazing network of trusted partners, and the Reef will be better, coral reefs globally will be better as a result. – Foundation Executive.

This fact was also reflected on by the independent interviewees, attributing the demonstrated opportunities for future funding opportunities to the Foundation’s efforts.

The future funding environment looks different. Others see value in investing in this space because of the work the Foundation has done and that’s a tremendous legacy Component. When you see the breakdown of the investment in, say RRAP, there’s such a significant proportion that was from the private sector. Because it isn’t just government at the table, and it can’t just be [government] because the scale of what we need to achieve is pretty tremendous. PMC Member

There's an opportunity there to expand on the fact that the Foundation has been operating as science plus industry and connecting up parts of the landscape to the point where there's a lot more funding and support than was originally coming from industry and business and so on. - PMC Member

2.3.6. Transition

A Legacy Committee was established by DCCEEW in 2023 to support the proactive management of transitioning the Partnership as the Grant Agreement ends. At the time of this report (January 2025), the Water Quality regional programs, the COTS on-water Control Program and some programs from the IMR Component, including the Data Management System and some critical monitoring projects, have confirmed funding pathways post-Partnership. Bridging funding has been provided for the COTS Control Innovation Program and funding programs are still being explored for RRAP. The Eastern Cape York Water Quality Program and Water Quality Innovation Program have unconfirmed funding pathways. The Foundation has also been active in sharing key materials in terms of administration, grants management, governance and reporting with the Reef Authority, the Department, the OGBR and the Traditional Owner Taskforce.

2.3.7. Conclusion

The Partnership was established by the Australian Government to improve the health of the Great Barrier Reef and enhance efforts in the management, protection, and restoration of the Marine Park. While this Evaluation was prepared as a contractual deliverable to support the conclusion and reconciliation of the Partnership, Clear Horizon and the Great Barrier Reef Foundation acknowledge its broader, long-term value. The insights gathered will inform future program and delivery model design. At the time of this report, all four Components remain ongoing concerns for the Great Barrier Reef and a focus of government investment. This evaluation, and by extension the Partnership, serves as a vital resource for the government in pursuing greater effectiveness, efficiency and transparency.

APPENDIX: COMPONENT RESULTS TABLES

See documents:

- Appendix A: Water Quality Results Table
- Appendix B: COTS Control Results Table
- Appendix C: RRAS Results Table
- Appendix D: IMR Results Table

WATER QUALITY IMPROVEMENT RESULTS TABLE

Introduction

This document presents the Results Table for the Water Quality Improvement (WQ) Component, developed as part of the 2024 End-of-Portfolio (EOP) Evaluation of the Reef Trust Partnership (The Partnership or RTP). This document has been collaboratively developed by the evaluators (Clear Horizon) and the Great Barrier Reef Foundation (GBRF) WQ Component team.

As outlined in the EOP Evaluation Project Plan (Clear Horizon, 2024), Results Table present the component specific findings and evidence that will be used to respond to Key Evaluation Question 3: *‘To what extent did the Partnership contribute to a significant and measurable improvement in the health of the Great Barrier Reef World Heritage Area (the Reef)?’* and are the focus of the independent expert review process.

The following Results Table presents the evaluations findings and supporting evidence structured against the component specific evaluation questions presented in the table below. These have been synthesised from the end-of-component outcomes and performance expectations presented in the WQ Component Monitoring and Evaluation (M&E) Plan (p.30 – 36, RTP M&E Plan, GBRF 2022).

The evidence presented in the Results Table includes the results of a review of more than 60 documents (references listed in page 13) and discussions with the GBRF Component team. Many of the evidence sources are targeted reviews or evaluations that focus on specific projects or elements of the program. This evaluation seeks only to synthesise the findings from these and does not seek to comment on the validity or rigour of these individually.

Table 1. WQ Component Evaluation Questions

Water Quality Component Evaluation Questions
1. An improved framework for implementing water quality improvement programs
a. To what extent has the component established a new framework that can be transferable to other water quality investments and is transparent, accountable, effective, and efficient?
2. An enduring reduction in the long-term end-of-catchment pollutant loads
a. To what extent were the long-term end-of-catchment pollutant loads targets met?
b. To what extent were on-ground activities effective in reducing pollutant loads?
c. To what extent are the pollutant load reductions achieved likely to endure?
3. Maintenance or improvement of water quality from less disturbed catchments
a. To what extent were on-ground interventions in less-disturbed catchments effective in laying the foundations for future water quality investments?
4. Innovative solutions for systems change in water quality improvements
a. To what extent were innovative and cost-effective approaches to improving water quality identified and demonstrated?
5. Traditional Owner led water quality improvement projects
a. To what extent were Traditional Owner engaged in leading water quality improvement projects?

Water Quality Component Results Table

WQ Component Evaluation questions and performance measures	Evaluation Findings	Evidence
1. Improved framework		
a. To what extent has the component established a new framework that can be transferable to other water quality investments and is transparent, accountable, effective, and efficient?	The WQ component has successfully demonstrated a new framework for water quality improvement that is transparent, accountable, effective, and efficient. The framework utilises a range of novel mechanisms to overcome short comings in previous Reef water quality investments and was found to be an improvement on previous Water Quality programs in the Reef. The mechanisms include a strategic regional investment prioritisation approach, a focus on cost-effectiveness, the use of transparent water quality targets, and a unique governance model. The transferability of the framework to other organisations or future programs implementing equivalent activities in the Reef catchments has been demonstrated through the effective application of the framework within this program and through the pollution load reductions achieved (KEQ2).	The Framework The Water Quality improvement program utilised a novel framework to address the shortcomings of previous Reef water quality investments and to improve the effectiveness, efficiency, transparency, and accountability of the investment. The framework and rationale are detailed in the Overview of the RTP Water Quality Program authored by the GBRF (1), and include the following eight elements 1. A strategic approach to the allocation of funding. 2. Adoption of water quality targets at the portfolio, program and project level. 3. Tracking progress towards targets 4. A new governance model for regional programs 5. Increased transparency. 6. Ensuring quality of outcomes on the ground 7. A portfolio of innovation and systems change projects 8. Investment in improved understanding of and on ground actions in less-disturbed catchments Two of the particularly unique elements of the approach were independently evaluated to inform learning and adaptation, the governance model and the strategic funding approach, their findings are detailed below. Effective governance model Two separate independent reviews of the governance model demonstrated its effectiveness in improving the effectiveness, efficiency, transparency, and accountability of water quality investments. The first review, undertaken in 2021 as part of the Mid-Term Evaluation of the Partnership, found the Water Quality Regional Program's novel governance model to be effective and that it could be adapted to other regions (2). This review was undertaken to inform learning and improvement of the governance model at the mid-point of the Partnership, this finding remains relevant at this end point of the component. <i>The Water Quality Regional Program's novel governance model is successfully enabling the effective delivery of regional programs, maximising accountability, preventing conflicts of interest and fostering collaboration. The model improves project progress visibility for the Foundation and is enabling the adaptive management of regional programs to better achieve water quality outcomes. The design of the governance model is sufficiently adaptable to different regional contexts and an improvement on other water quality governance models. Limited regional industry capacity is the major barrier to consistent implementation of the model as designed.</i> - Water Quality Regional Programs Governance Case study (2) The second independent evaluation, conducted in 2024, found that key stakeholders preferred most of the elements of the GBRF's design and approach over past models. Many of the challenges identified through the evaluation were not directly related to the model itself and were associated with the specific opportunities and frustrations experienced in different roles and locations, particularly in regions with high staff turnover, limited staff availability, or fewer delivery providers and stakeholders to engage with. The evaluation also identified that success is dependent on having the right people involved with the right skills, competencies, attitudes and behaviours, and continuing to build and retain capacity (3). <i>The majority of participants expressed a preference for retaining most elements of the current structure and GBRF's management approach, rather than reverting to the previous model whereby project funding was administered to and managed by natural resource management organisations.</i> <i>GBRF staff statements about the positive and negative new differences in the governance model aligned with those of other participants, identifying enhanced collaboration, increased flexibility and autonomy, and increased accountability as key new elements in the model.</i> <i>Many participants found the roles of the Regional Project Manager (RPM) and Regional Partnership Coordinator (RPC) beneficial, particularly the synergy between the two roles. Overall, many participants recommended retaining these roles in future programs.</i> - Water Quality Regional Program: Delivery Network & Governance Evaluation (3) Effective funding approach An independent review of the project funding approach undertaken in 2022 found the approach strengthened the accountability and transparency of investment decisions (4). As the majority of the funding has been committed by this time, this finding is considered to remain true at the point of this evaluation (2024).

		<i>[The approach ensured investments] are explicitly focused on achieving cost effective water quality outcomes with various stages during delivery to ensure the projects' activities and efforts are delivering these outcomes as modelled.</i> <i>Contractually binding water quality improvement targets have influenced the way delivery providers approach water quality improvement projects in a range of ways, including focusing on proven practice changes for the projects, selecting growers and graziers whose properties can deliver the most cost effective water quality improvements, the ways delivery providers work with those landholders, the processes of designing and managing projects including a focus on adaptive management and risk management to ensure targets can be met.</i> <i>[Delivery providers and regional program managers] have a clear understanding of what they need to achieve and an improved capacity to communicate clear and meaningful outcomes from landholders' involvement in the projects.</i> - Water Quality Improvement Program Review (4)
		Transferability The transferability of the framework to other organisations or future programs implementing equivalent activities in the Reef catchments has been demonstrated through the effective application of the framework within this program and through the pollution load reductions achieved (KEQ2). The Component Director describes how the framework is not organisation-specific or dependent – that the approaches used can be adopted by other implementing organisations undertaking equivalent activities in the Reef catchments without any requirement to first prove or alter the approach. The approach and lessons from implementation have been shared with other implementing organisations, including to Commonwealth and State officials and other Reef stakeholders (4b, 4c), and reports demonstrating the effective implantation and associated achievements and lessons from the Mackay-Whitsundays (4d), Lower Burdekin (4e) and Fitzroy (4f). While many of the contextual challenges that informed the framework design continue to exist, such as the challenges associated with the P2R Project Tool, and the capacity and capability limitations across the regions, this does not limit its application to future Reef investment programs.

2. An enduring reduction in the long-term end-of-catchment pollutant loads

a. To what extent were the long-term end-of-catchment pollutant loads targets met? • 456t reduction in dissolved inorganic nitrogen (DIN) loads • 462kt reduction in sediment loads • 250kg reduction in pesticide loads	The modelled pollutant load reductions achieved through the regional programs are significant and exceed the end-of-catchment pollution load targets for DIN and pesticides. Significant progress was made toward the sediment target, with the shortfall attributed to the assumptions used to inform the targets turning out to be overstated rather than the program underperforming.	The pollutant loads targets The long-term end-of-catchment pollutant loads reductions achieved are presented in Table 2, and are reported publicly through the component dashboard (screenshot and link in Figure 1 below). Table 2. The long-term end-of-catchment pollutant loads reductions achieved, accurate as of September 2024 (5). <table><tr><th>Pollutant</th><th>Achievement / target</th><th>Activities</th></tr><tr><td>Dissolved inorganic nitrogen (DIN) expressed in tonnes (t).</td><td>Exceeded (103%): 469t / 456t</td><td>Supporting land managers to change land management practices primarily in sugarcane (443t), and to a lesser extent in Bananas (26t).</td></tr><tr><td>Pesticide expressed in Risk Units (RU)*</td><td>Exceeded (275%): 8,509,203 RU / 4,066,772 RU</td><td>Supporting land managers to change pesticide management practices in sugarcane in two target regions. In the Mackay Whitsunday region, the risk of pesticides to the aquatic environment reduced on average by 66%. In the Burdekin the risk of pesticides was reduced by 26%. * As outlined in the Overview of the RTP Water Quality Program (1), a new methodology for assessing the reduction risk to marine species related to pesticides was developed during the time the Partnership ran, and it better represents the impact of pesticide concentration and the toxicities on marine ecosystems. The method, called the Pesticide Decision Support Tool, express the relative risk to specific from pesticide runoff using pesticide risk units (RU) (5b). Using this method, the target was updated from 250kg reduction in pesticide loads presented in the M&E Plan, to the 4,066,772 Risk Units reported against here. This method has also now been endorsed by Paddock to Reef and the Queensland Government Department of Environment and incorporated into the P2R Projector Tool.</td></tr><tr><td>Sediment expressed in kilo tonnes (kt)</td><td>Significant progress (75%): 346 kt /462 kt</td><td>Supporting landholders to change land management practices (278kt) and remediate stream gully (68kt), targeting graziers operating in sediment hotspots. One grazing program is still underway and will conclude in 2025 (the Bowen, Broken Bogie). While its final saving have not been reported, it is estimated the contribution will not change much hence the sediment target will not be met. The GBRF Component Directors associate the under performance against the sediment target with the assumptions used in the model to inform the target turning out to not be true in practice, as opposed to the program underperforming. Through the delivery of the component, it was observed there to be less capacity among landholders, and in turn opportunities to deliver grazing land management (GLM) interventions than was assumed when</td></tr></table>	Pollutant	Achievement / target	Activities	Dissolved inorganic nitrogen (DIN) expressed in tonnes (t).	Exceeded (103%): 469t / 456t	Supporting land managers to change land management practices primarily in sugarcane (443t), and to a lesser extent in Bananas (26t).	Pesticide expressed in Risk Units (RU)*	Exceeded (275%): 8,509,203 RU / 4,066,772 RU	Supporting land managers to change pesticide management practices in sugarcane in two target regions. In the Mackay Whitsunday region, the risk of pesticides to the aquatic environment reduced on average by 66%. 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calculating the targets, and the cost of on-ground actions for both GLM and gully restoration was found to be significantly higher than originally estimated, and further increased during the program following COVID.

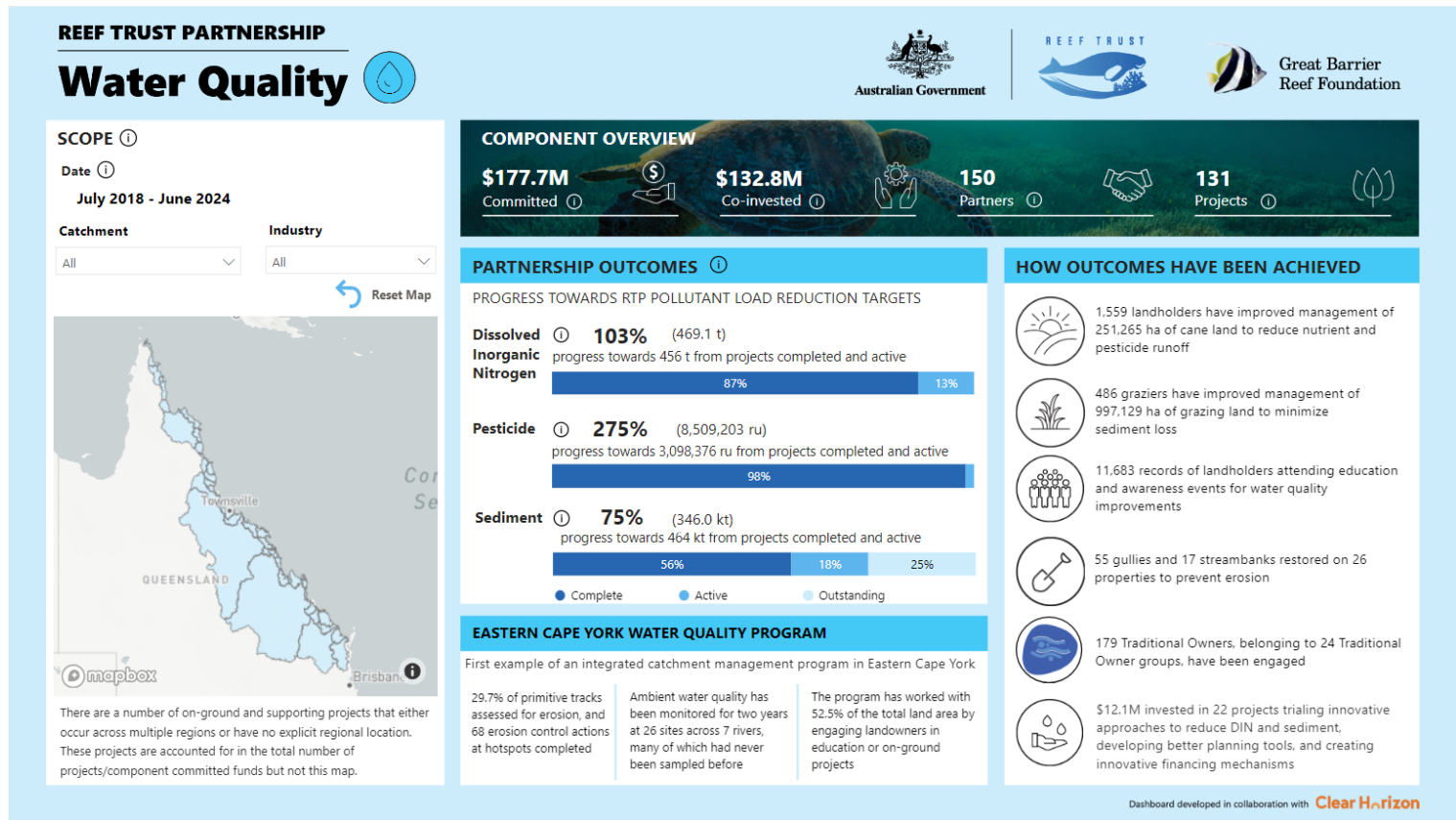


Figure 1. Water Quality Improvement component public dashboard ([link](#)).

b. To what extent were on-ground activities effective in reducing pollutant loads?

The on-ground activities delivered through the regional programs were effective in engaging and influencing a significant proportion of land managers across Queensland's sugarcane industry, and graziers in sediment hotspots to improve land management practices and remediate streams and gullies, leading to the demonstrated pollutant load reductions achieved. Both the sugarcane and remediation programs were supported by multiple lines of evidence investigating the social dimensions of practice change to enhance the effectiveness of the program, and to contribute to the evidence base to inform the design of future water quality investments.

Land manager engagement

Land managers in the sugarcane and grazing industries were engaged through the regional programs to seek to improve their land management practices. Across the regional programs, delivery providers undertook substantial work to disseminate information, conducting more than 291 engagement events in person (231 in cane and 59 in grazing) which attracted 11,683 records of attendance (unique participants unknown). These same events also went beyond extending information to growers and graziers to also disseminate information to other stakeholders, such as extension providers, resellers and other parts of the public, logging 32,224 records of attendance by the general public (5). The events included a range of face-to-face meetings, field days, demonstrations, shed meetings, training sessions, workshop, stalls at agricultural shows, forums and conferences, AGMs and other in person gatherings. The events sought to promote practice change through a variety of lenses including productivity, profitability, displays of equipment and experiences of other growers. Peer to peer discussions were held through producer forums, demonstrations or field days where water quality improvement monitoring results were shown.

Demonstrated practice change in sugarcane

A significant proportion of the Queensland's sugarcane industry were directly engaged through the program and demonstrated a practice change on their farm that resulted in water quality improvement. More than one-third of the sugarcane farms in Queensland – about 37% of farms (1,221 out of 3,286 farms in Queensland) - received support through the regional programs and demonstrated that they changed their management practices. This reflects 71% of the harvested sugarcane land in 2022 (172,516 of the 349,206 hectares of sugarcane harvested in Queensland) (5,6).

The sugarcane behaviour change programs design and ongoing adaptive management was informed by multiple lines of evidence associated with the social dimensions of practice change to improve the effectiveness of the program. These included:

- In 2022, GBRF commissioned Mosaic Insights to conduct **social science research** to build a deeper understanding of the social context of Reef sugarcane landholders and how different social factors might enable or inhibit practice change (7). The research presents 5 landholder group typologies, and revealed a suite of factors that shape practice change across the different system levels, from the individual through the microsystem, exosystem, and macrosystem. The report then presents four approaches that can be used individually or in combination when engaging with landholders to help optimise engagement effectiveness,

		and guidance on how these approaches might be applied across the different landholder profiles. The GBRF authored a case study outlining how they were considering these findings, including in considering ways to work with mills and commercial resellers (7b). • In 2023, the GBRF documented the lessons from the Partnership Sugarcane programs constructed from multiple lines of evidence through their monitoring and evaluation activities as well as from open dialogue with delivery partners and growers (8). The lessons covered themes of industry engagement, overlapping investments, and important considerations regarding enduring outcomes (discussed further in KEQ2c). • In 2023, the GBRF funded a targeted behaviour practice change program delivered in the Mackay Whitsunday region for one year. The program was informed by a research project also funded under the component into the social factors affecting practice change in sugarcane (9). The program delivered a web platform called CaneRise Mackay Whitsunday which offered tools and resources to support canegrowers to adopt sustainable practices. An evaluation of the platform undertaken in 2024 found it was ‘performing well in terms of reach and engagement within its target community’, and that it ‘has the potential to reach more growers, and a more diverse range of growers’ (10). The Foundation advocated for future investments into water quality improvement to be informed by the social factors affective practice change identified through the research project (9), and for ongoing investment into the CaneRise behaviour change program (10). The Queensland Government has since committed to funding another year of the behaviour change program (https://www.canerise.com.au/). • In 2024, The GBRF commissioned an evaluation of impacts on sugarcane growers in the Mackay Whitsunday region from their involvement in local water quality monitoring as part of the Cane-to-Creek project (11). The evaluation set out to identify the effects of participatory monitoring type of projects on growers’ understanding and trust in water quality science, and their level of willingness to make changes to farming practices. The evaluation findings highlighted the complex attitudes of growers have towards water quality science, the impact of their agricultural practices on the Great Barrier Reef, and the positive influence of the project on enhanced knowledge, trust, and advocacy among growers. <i>While scepticism and calls for more localised data persist, there is a growing recognition among landholders of the importance of improved farming practices and the role that projects like Cane-to-Creek can play, which is dependent upon the strong, trusted relationships with the delivery personnel</i> - <i>Evaluation of the impact on growers of the Cane-to-Creek water quality monitoring project (11).</i> Grazing practice change and stream gully remediation Graziers operating in target sediment hotspots were engaged in projects to improve land management practices and also to undertake large scale restoration of streambanks and gullies. A total of 486 graziers were directly involved in the program, undertaking practice change on a total of 997,129 ha of land (5). The GBRF engaged an independent technical advisor to review the extent and quality of grazing land management (GLM) projects undertaken to ensure that program outcomes were being achieved. A semi-random sample of on-ground project reviews were undertake for the validation of improved GLM practices. The independent advisor found that all projects were being completed as per the project descriptions, and produced a report outlining key lessons, risks and recommendations to enhance the ongoing and future effectiveness of GLM practices (12). The GBRF authored a case study synthesising the results of this verification, further describing the specific skills and experience required to complete independent verification visits across the regional programs with three separate processes identified 1) guidelines for verification of practice changes, 2) a Technical Panel to support the WQ program by providing access to flexible and fit-for-purpose technical expertise and 3) Skills-appropriate independent technical advisors from the Technical Panel engaged to undertake site visits and provide reports and recommendations (12b). Catchment restoration works were also undertaken in 17 large streambanks and 55 gullies across the regions. Remediation projects focused on incised gully systems and streambanks subject to accelerated erosion, with investments ranging from \$350,000 to \$5,000,000 per site. The GBRF engaged an independent technical advisor to review the extent and quality of remediation works undertaken, identify risks to their effectiveness as well as provide recommendations to address these risks, and to minimise or avoid creating similar risks in future projects. The review found that works were carried out using accepted industry practices and techniques and were delivering anticipated reductions in sediment loads, but that a number of issues were identified that create risks for the medium and long-term effectiveness of some of those works (13). <i>In general, the works carried out have used accepted industry practices and techniques, are broadly consistent with the designs prepared and – in the short term – are delivering anticipated reductions in sediment loads. However, the inspections identified a number of issues that create risks for the medium and long-term effectiveness of some of those works, particularly for the incised gully systems.</i> - <i>Landscape Remediation Learnings and Recommendations Report (13)</i> In their final report to the Australian Government (29), the GBRF discuss how the on-ground verification of landscape remediation sites revealed that gullies in general have a higher risk of failure due to the significant movement of soil required, type of remediation materials available and the very unstable subsoils they are located on. In particular, the Bowen Broken Bogie (BBB) catchment presents unique and complex challenges that require additional investment into detailed site-specific soil testing and works-in-place modelling at the planning stages to ensure works are appropriate to the site limitations. Remediated gullies in general require ongoing monitoring and maintenance regimes, yet the BBB may require significant maintenance with potential re-remediation. Where revegetation was well established, streambanks showed less evidence of failure, however, ongoing monitoring and maintenance are required. Enabled by comprehensive program oversight and detailed financial reporting requirements, the Foundation identified several significant underspends in some of its projects. These funds have been recovered and repurposed to support to landscape remediation sites that had presented civil works issues and/or where there was a need to accelerate revegetation and maintenance (accompanied in some cases with program extensions) (29).
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		The GBRF Component Directors described how they ensured each recommendation was addressed where they could, including funding repairs by channelling underspends from other projects, and educating landholders about the importance of reliable fencing and cattle exclusion. The most extreme example was a gully site located on very poor soils close to the Burdekin River which had major failures and was found to require significant repair to achieve sediment reduction outcomes. The GBRF has directed program resources to fund this repair in the 2024-25. The Component Directors go on to describe how many of the large-scale remediation sites have also withstood recent wet seasons, with some addition funding directed to action maintenance and repairs, further demonstrating the effectiveness of the design and construction approaches used. <i>In the Bowen-Broken-Bogie region, six large-scale gully remediation sites have withstood one or two wet seasons so far and have required some maintenance. In the Fitzroy, five streambank sites and one major gully have withstood one to two wet seasons with only minor maintenance required. In the Upper Herbert, the large gully and streambank sites have withstood an extremely intense and prolonged wet season requiring only minor maintenance. And finally, in the Mary, which is undertaking 12 large-scale streambank remediation projects, a major flood in 2022 ran through the restored sites. Impressively, the one-year-old restored sites withstood the flood, needing only minor maintenance, with another year of funding provided to support this maintenance effort.</i> - GBRF Component Director Component Directors described that while the restoration projects have, for the most part, been successful, their cost-effectiveness have been less than initially anticipated, with the costs for gully restoration found to be significantly higher than originally estimated, and further increased during the program following COVID. This was also exacerbated by many of the projects requiring additional funding to address maintenance issues identified. GBRF commissioned an evaluation to identify and assess the social outcomes (both positive and negative) experienced by the landholders participating in the large-scale gully and large-scale streambank restoration projects (14). The evaluation found the primary motivation for landholders to participate in the projects was to stop erosion from ‘eating away’ at their farm land, with additional reasons including land stewardship and concern for the Great Barrier Reef. The evaluation found the projects to be largely successful from the landholders' perspective, with positive outcomes for erosion control and land management. The evaluation also presented a set of recommendations to further enhance the success of future landholder engagement in gully and streambank restoration projects.
c. To what extent are the pollutant load reductions achieved likely to endure?	While the pollutant load reductions achieved during the program period have been significant and rigorously validated, the GBRF's research into the social conditions demonstrates there remains a high likelihood that the landholders engaged may revert to old practices and may not maintain the restored gullies on their land. This is an issue that is not unique to the Partnership, and while the GBRF did utilise a range of strategies to increase the likelihood of practice change enduring, many of the important factors were beyond their influence.	Enduring outcomes Ensuring the outcomes achieved endure beyond the program period is dependent on a range of factors beyond the influence of the program, and is a complex issue that is not unique to the Partnership. While the pollutant load reductions achieved during the period have been rigorously validated (see KEQ2b), the insights gained through investigating the social dimensions of landholder practice change identified a range of factors that led to practices reverting following the end of programs such as these. <i>While many previous Reef water quality programs have reported change to improved practices, following the end of the program growers often found themselves reverting to old practices. With this in mind, the Foundation wanted to investigate how practice change could be made more sustainable and long-lasting. The main factors identified by delivery providers that may contribute to practices reversal were: Weather - Unusual weather patterns could lead growers to doubt their confidence in the new practice and how they could adapt it to maximise benefits; Time: Lack of time, especially when harvest or planting seasons are shortened. This could be due to unusual weather or personal circumstances; Profit: The new practices were not profitable in the long term.</i> - Lessons from Canegrower Programs (8). In their internal 2023 annual evaluation (1b), GBRF describe how they utilised the following four strategies to increase the likelihood of practice change enduring beyond the partnership period: • Demonstrate to farmers the benefits to their business through the improved practices so they have an internal motivation to continue. • Build knowledge and capacity in farmers to be able to make their own decisions around nutrient management and productivity more widely. • Provide access to equipment through the major grants. The grants required a 50% co investment of farmers, meaning that they have to have a strong personal motivation to apply and are unlikely to dis-adopt. • Extending as much as possible, within the life of this program, the support provided to farmers. The Foundation encouraged delivery providers to maintain contact with the growers and support them as long as the Partnership lasts, even after the practices have been adopted (usually 3-12 months). During this time, management plans could be adapted to the new conditions. The report goes on to describe how despite this, some of the important social factors that are the greatest predictors for long-lasting or enduring practice change were beyond the influence of the program. For example the Programs did seek to improve group norms and link growers to opportunities for ongoing support outside of the Partnership, however the lack of long-term agronomic support to growers remains as the greatest challenge to ensure enduring improved practices. A known challenge, many of the innovation projects (described in KEQ4) below were also examples of how the component sought to utilise novel financial mechanisms to encourage enduring outcomes, such Reef Credits or Nitrogen Insurance initiative (1b).

		<i>Of some concern is that while the program is effective and 'hitting the right buttons' for adoption, the greatest predictors of long-lasting practice change are not in our favour. These are group norms and the long-term support to growers. This is not unique to the Partnership. Previous sugarcane programs have lacked influencing the leavers that affect longevity of the outcomes. From our historical data checks we know that reversal of practices from previous funding programs has been significant.</i> – GBRF 2023 Annual Evaluation (1b)
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3. Maintenance or improvement of water quality from less disturbed catchments

a. To what extent were interventions in less-disturbed catchments effective in laying the foundations for improving future water quality investments?	The component has made a significant contribution to establishing the foundations of future efforts to maintain or improve water quality in the Eastern Cape York - a less disturbed catchment of the Reef. These contributions cover: • Improving the understanding of catchment water quality and sediment discharge in the ECY. • Enhancing the capacity and collaboration of local organisations, Traditional Owners and other land managers in catchment management practices for water quality improvement in the ECY. • Demonstrated results of best management practices through road, track, and fire management projects to promote adoption. • Identifying priorities for future investment for catchment management in the ECY. Under this stream, the component also contributed to establishing the foundations of future efforts to utilise wetland restoration, rehabilitation, and construction for improving water quality across the GBR. These included undertaking monitoring, modelling and synthesising a scientific consensus statement on the subject.	The Eastern Cape York Water Quality Program (ECYWQP) was composed of seven projects delivered by four local organisations, summarised in Table 3 below. The program was evaluated through a reflection process (15) that brought together evidence from an evaluation of the program that focused on assessing the progress made in building capacity of partners and Traditional Owner groups involved and supporting the aspirations of those Traditional Owner groups (16), as well as the progress reports of each of the individual projects (17-23), and a program management report (24). The findings of the evaluation are summarised below. <i>Improving the understanding of catchment water quality and sediment discharge in the ECY.</i> The ECY Program has contributed critical knowledge regarding water quality and sediment loads, hotspots for sediment run-off from primitive tracks, the use of early dry season burns to prevent late dry season fires and associated erosion, and sea grass mapping (15). Through the Program, substantial data was collected on sediment loads from the Annan and Endeavour rivers over the (2021-2024) period, improving the availability of empirical data and generating valuable insights. The Program was also able to document the extreme sediment load that was discharged to the Reef over the 2023-24 wet season due to cyclone Jasper, a 'once-in-a-lifetime opportunity' to contribute to better understanding the region. Targeted projects under the program also generated valuable knowledge about the contribution of sediment from the erosion of primitive tracks and roads, early dry season fire management, and coastal seagrass ecosystem mapping. This knowledge has been documented in products and resources, and will inform future catchment management activities to reduce erosion in the region. Critical knowledge was provided through mapping all accessible tracks in the program area, ECY region, classifying them, identifying hot spots and priority areas. The resulting product is a map informing us on the track's contribution to sediment runoff and priority areas for repair. The project has also generated knowledge around the most effective interventions to repair or prevent track erosion The fire projects have contributed to improving the understanding the extent and timing of early dry season burns required to prevent late dry season fires, and the human, logistical components along with the natural conditions that inform fire planning. The data and insights generated through the program have the potential to significantly improve the Paddock to Reef catchment model used to calculate sediment contributions to the Reef from this region, and inform future funding and management priorities. The GBRF Component Directors described how conversations between Cape York Water Partnership lead researcher and the P2R catchment modellers have taken place and an agreement for data provision is in place. If incorporated this change will be in place in a few years. The program has also demonstrated the need for ongoing monitoring in the region to better understand the region's sediment budget, and the full climate variability spectrum and changes over time. <i>Enhanced capacity and collaboration of local organisations, Traditional Owners and other land managers</i> The ECY program has enhanced capacity and collaboration of local organisations, Traditional Owners and other land managers in catchment management practices for water quality improvement. Importantly, the Program has contributed to enhancing the capacity of Traditional Owners in water quality monitoring and fire management, in alignment with their aspirations. The Program employed 81 Traditional Owners providing on-the-job learning opportunities, with an addition 115+ engaged through the projects. Of the employed Traditional Owners: • 27 were in water quality and ecosystem monitoring where Traditional Owners learnt the technical aspects of scientific monitoring which they could combine with their cultural knowledge. They reported improvements in their knowledge, skills and confidence in water quality monitoring, along with a range of other skills developed on Country. • Eight Traditional Owners were provided Level 1 Certified Fire Management training. Fire management projects were also successful in increasing participants' knowledge in safety, equipment, techniques, communication, and the link between fire management and erosion control. Participants also noted increased self-efficacy and collective efficacy, with certificates boosting confidence. The program also fostered increased motivation among participants, promoting a holistic and sustainable approach to environmental management (16). Projects also contributed to increased technical knowledge and skills among project officers, as well as mindset changes and broader knowledge dissemination. Project teams are also learning from Traditional Owners about their ways, aspirations, and valuable local knowledge. Acknowledging this as a two-way learning process, the project teams embrace these lessons (16). The ECY program's partnership model fostered engaging, collaborative activities, with program's extensive partner network including 29 organisations and 33 private landowners. Among these are 11 Indigenous entities, such as Aboriginal corporations, land trusts, and Traditional Owners. Other partners include fire services, Ergon, Queensland Wildlife and Park Services, Cook Shire Council, and CSIRO. The GBRF Component Directors reflect that a significant outcome of the
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		collaboration is bringing together multiple partners that did not previously work together, such as private landowners and Traditional Owners who had been removed from the land long ago. Additionally, influential organisations like Cook Shire Council, the Queensland Department of Transport and Main Roads, and Ergon are now more aware of the issues and exploring their roles in mitigating sediment. The GBRF also authored a case study demonstrating this program as a pathway to reconciliation (25). <i>Demonstrated results of best management practices through gully restoration, road, track, and fire management projects to promote adoption.</i> The integrated catchment management approach piloted in the ECY was demonstrated to be effective in reducing erosion and sediment load in the Annan River, as well as effective in withstanding severe weather. Through restoring two large gullies, repairing 10 road segments (primitive tracks and unsealed council roads) with improved methods that lead to reduced erosion, as well as through fire management – the pilot reduced an estimated 375 tonnes/year of fine sediment from entering the Reef Lagoon at a cost of about \$1,600 per tonne/year. This cost-effectiveness is comparable to other programs, though costs in Eastern Cape York are generally higher. Remediated gullies withstood the near-record 2022-23 wet season. The demonstration of improved road and track repair methods that lead to reduced erosion is informing draft Best Management Practice guidelines, with conversations with Cook Shire Council taking place to advocate for their involvement in adopting these practices (17). The fire projects contributed to a notable decrease in damage from late dry season wildfires. The key success identified through the evaluation included fire plans that identify ideal conditions for early burns, coordination among players across the landscape (including private landowners), and community education and communication, which have reduced arson. Better fire management directly reduces sediment runoff by preventing hot fires that strip the land of vegetation (15). <i>Priorities identified for future investment in catchment management for water quality & aquatic habitats in ECY</i> In addition to the Program working on a strategy to inform future investment in the protection and improvement of the ECY, the knowledge developed through the program is expected to contribute to additional investments being directed to the region. The ECY Program is currently undertaking a legacy project which will culminate in a strategy for future investment in water quality protection and improvement in Eastern Cape York to be completed in March 2025 (24). The GBRF Component Directors described how, to date, the knowledge developed through the ECY Program has informed two “future investment” initiatives - the Australian Government funded Reef Trust Landscape Repair Program (which commenced planning December 2023), and the OGBR-funded Reef Place-based integrated projects (applications opened in 2024). Prior to this, the East of the Cape York region had been excluded from funding programs. This program and the success it has to show, has brought light to this region and awareness about its relevance for addressing sediment to the Reef (Pers. Comm with SCYC Project Lead). <i>Improved knowledge of wetlands</i> While not in the ECY, funding from this stream of work was directed toward establishing additional evidence to support the utilisation of wetland restoration, rehabilitation, and construction for improving water quality across the GBR. As reported in GBRF’s 2023 Annual Evaluation (1b), these include: • Data synthesis: C2O consulting were contracted to develop a detailed scientific consensus of new scientific knowledge and integrate that with the revised 2022 the Scientific Consensus Statement for the Reef being developed by the Australian And Queensland Governments and found here. • Monitoring: Two wetland monitoring projects were contracted to provide data to understand the role of constructed wetlands and treatment systems for reducing DIN runoff in the GBR. This was identified as an area that currently has very little information and as such receives limited investment. • Modelling: Alluvium were contracted to establish a wetland model and platform that is specifically configured for the characteristics of hydrology, ecology and water quality that are found in the GBR, to demonstrate with confidence the role of wetlands in water quality improvement. It will incorporate the empirical data from the monitoring programs cited above. Completed working models and associated documentation will be delivered by early 2025 (54). • eReefs Modelling: The Component Director described how the CSIRO was also engaged to develop a GBR-wide tidal model that provides accurate tidal movements up estuaries and across floodplains that can then be used to define conditions for project scale assessment of inundation as part of continued investment to build and enhance this tool. This work is foundational to building additional coastal wetlands functionality in particular assessing the role of tidal movements in a) providing nutrient filtration to meet end of catchment water quality targets; b) the coastal protection service afforded by these wetlands from fluvial and storm and surge inundation events; and c) assessing environmental market and future landscape opportunities for Reef catchments.
4. Innovative solutions for systems change in water quality improvements		
a. To what extent were innovative and cost-effective approaches to improving water quality identified and demonstrated?	The component invested in 22 innovation projects across the thematic areas of Technology Transformation, Planning for Future Investments and Innovative Funding. Of these 4 have been identified as ‘game changers’, with 1 having been taken to a commercial stage. The majority of the projects made important	The water quality innovation program provided grants to programs aiming to result in new or better practices, tools and approaches for farming, grazing and land restoration that achieve better outcomes for the landholder while also improving water quality; new systems to support better decisions related to investing in water quality improvement, and more funding sources to support water quality improvement. As presented in their final report to the Australian Government (27), the GBRF’s Innovation portfolio included 22 projects across Technology Transformation, Planning for Future Investments and Innovative Funding thematic areas (summarised in Table 4). A simple rubric was developed by the Component Directors and Clear Horizon to assess each of the projects based on their relative contribution to establishing ‘new or better practices, tools and approaches’. • #A Game changer: Projects that demonstrated significant potential for step change, and progressing through additional development phases. • #B Contribution: Projects that have provided valuable insights and outputs that will contribute to advancing the field. • #C Further research needed: Projects that were deemed to require further research before progressing through additional development phases.

	contributions to their respective fields.	Of the 22 projects funded, 18 are complete and 4 were deemed ‘game changers’ and supported to progress through additional stages. The number of initiatives in each domain, and there assessed status include: • Innovative financing and funding initiatives: 4 (1 Game changer, 3 Contribution, 1 Further research needed) • Technology transformation in DIN reduction: 7 (1 Game changer, 5 Contribution, 1 Further research needed) • Tools to improve planning and decisions in Sediment reduction: 8 (1 Game changer, 6 Contribution, 1 Further research needed) • Technology transformation in Pesticide reduction: 1 (Game changer) • Technology transformation in pollutant reduction: 1 (Contribution) • Sharing and management of industry and landholder-owned data: 1 (Further research needed).
5. Traditional Owner led water quality improvement projects		
a. To what extent has there been an increase in Traditional Owner led water quality improvement projects?	Traditional Owners were engaged in leading water quality improvement projects. This includes the Healthy Waters Grants, co-designed by Traditional Owners and being delivered by the GBRF's TO engagement team, projects under the ECY Program, and a few examples within the Regional Program.	Traditional Owner engagement The component successfully enabled Traditional Owners to lead water quality improvement projects through: • The Healthy Waters Grants: In line with the Partnership's Traditional Owner commitment, 10% of the Water Quality Component funding was allocated to the Traditional Owner co-designed program for water quality improvement – the Healthy Waters Grants. This was delivered by the TO engagement team and will be evaluated as part of their end-of-portfolio evaluation in 2026. • The ECY program: The ECY Program included projects that were led by Traditional Owners, and many that had significant traditional owner engagement components, as reported under KEQ4. • The regional programs: With the regional program's primary focus on engaging private land-holders to adopt practice to improve water quality, there was limited opportunity for appropriate involvement of traditional owners, unless the private land-holders were themselves indigenous. The Component Directors provided the following examples: a project in the Fitzroy with Greening Australia and one in the BBB with a cattle station owned by a Traditional Owner pastoral company (Urannah Properties Associations engaged in the BBB program on the homelands of the Wiri and Birri peoples of the Birri Gaba Nation).

Project summary tables

Table 3. Eastern Cape York Water Quality Program, summary of projects (Further details found on the [GBRF Website](#)).

Project title and delivery organisation	Objective	Summary of achievements	Indigenous people engaged	Outputs
Shire Council Gravel Road Erosion Control in the Annan Catchment South Cape York Catchments (SCYC) in partnership with the Cook Shire Council (CSC). WQ-CP-001	To develop and demonstrate practical and implementable best management practices (BMPs) for road construction and maintenance for the reduction of soil erosion along unsealed Council roads.	High resolution Terrestrial Laser Scanning (TLS) monitoring quantifying baseline erosion and deposition over the 2022 and 2023 wet season. Erosion treatments demonstrated to be cost-effective.	5 employed	Report (17)
Primitive Road Mapping, Risk Assessment and Erosion Control Project Cape York Water Partnership Inc. (CYWP) WQ-CP-002	To map and assess erosion along primitive roads, tracks, fencelines and other linear disturbances in South East Cape York Catchments, and control erosion at prioritised pilot demonstration sites using appropriately applied BMPs.	Surveyed an overall total of 2850 kms of roads and tracks. Of this, 1590 kms (55.8%) were unique roads, and 1260 kms (44.2%) were resurveys to assess erosion change. One high priority road segment (10 km long) was treated with erosion control measures. Pre-wet season erosion rate monitoring was conducted using TLS and drone photogrammetry surveys.	28 employed 16 engaged	Report (18)
Water quality and aquatic ecosystem monitoring project CYCP WQ-CP-003	To collect data from eastern Cape York rivers for which there is very little existing information and assess the condition of critical coastal wetlands and seagrass meadows. This data will help define baseline conditions, and establish local water quality improvement objectives, assess and quantify potential water quality impacts, and calculate sediment loads delivered to the reef. Wherever possible, Traditional Owners will be fully engaged in monitoring on their country.	New water quality monitoring data sets and maps of seagrass meadows. CYWP are able to undertake water quality monitoring in the Annan and Endeavour catchments at a scale not previously achieved and with monitoring equipment not previously affordable.	27 employed 50+ engaged	Report (19)
Integrated Fire Management for ECY SCYC WQ-CP-004	Late dry season wildfire events leave bare earth exposed and vulnerable to erosion when the wet season arrives, which can have substantial implications for water quality in rivers which flow out to the reef. This project aims to increase ground cover across 65,000 ha through coordinating fire planning and management, conducting early burns in line with Traditional Owner and Landholder aspirations, working with Traditional Owners, freehold landowners and leaseholders to increase capacity to undertake fire management activities	Traditional owner now have an increased knowledge of fire management on their respective lands. The project has successfully contributed to reducing the intensity of fires in the seasons they have operated, have built capacity of other landholders and built a network of people that are collaborating to prevent widespread wildfire (15).	12 employed 14 engaged	Report (20)

	and preventing the spread of late season/high intensity wildfires by implementing burnt fire breaks.			
Gully Erosion Control in the Annan Catchment SCYC WQ-CP-005	To control gully erosion in high priority gullies at known accessible hotspots to reduce anthropogenic fine sediment loads.	Two large gullies treated resulting in an estimated 375 tonnes/year of fine sediment reduced at the Reef Lagoon. A roadside gully treated resulting in an estimated 181 tonnes/year fine sediment reduced from the Reef lagoon. A Gully on SET property will be finished by the end of August saving 360 tonnes/year of fine sediment.	7 employed	Report (21)
Improving water quality in the Annan and Endeavour Catchments South Endeavour Trust (SET) WQ-CP-006	To improve water quality in the Annan and Endeavour Catchments through integrated fine scale fire management and managing erosion on primitive tracks.	A better understanding of both the extent and timing of fire and the priority areas for fire management. With the reporting period covering the wet season and early dry season, there were no new learnings regarding the effectiveness of reducing late fire frequency.	2 engaged	Report (22)
Understanding the impacts of erosion control and fire management on water quality in Yuku-Baja-Muliku Country Yuku Baja Muliku Landowner & Reserves Ltd (YBM) WQ-CP-010	To map, assess and control erosion along roads, tracks, fire breaks, fence lines on Yuku Baja Muliku (YBM) owned lands with a focus on the Annan River and its estuary as well as the mangrove lined coastline that runs through their traditional estates. YBM Rangers will be at the forefront of the project, supported by elders (as key knowledge holders) at key points of the project.	Improved skills, confidence and leadership in conducting water quality monitoring, erosion control and fire management activities on YBM country.	2 employed 21 engaged	Report (23)

Table 4. Innovation projects summary

Project title	Project focus	Project description (description of focus)	Current status	Assessment / findings	Outputs
N insurance CSIRO in partnership with WTW	Innovative financing and funding initiatives	A world-first nitrogen (N) insurance prototype concept that offered a win-win for water quality (lower N application rates), farm (premiums possibly less the savings in N costs) and commercial (net revenues, brokerage) profitability. The prototype was turned into a commercial parametric insurance product to help farmers manage the risk of reduced yields from reduced fertiliser application.	A commercial product in the Wet Tropics, Herbert and Mackay	Game changer Demonstrated threefold benefit potential by 1. removing 900 tonnes of DIN per year (ca 19% of total DIN discharge if adopted by half of land under cane), 2. ensuring the risk of reduced yield is protected while sugarcane farmers save money on fertiliser usage and 3. allowing public funds to be redistributed or repurposed	The N insurance webpage , factsheet (30) and case study (31).
Seaweed Biofilters Australian Seaweed Institute in partnership with Central Queensland University	Technology transformation in DIN reduction	This project represents the concept design and proof of concept stages of a multi-stage plan to develop a network of seaweed biofilters at large scale and then utilise the harvested seaweed as bioproduct promoting a circular economy. Through a network of seaweed biofilters between the coast and the Reef, nitrogen and carbon dioxide would be captured by native seaweed to help protect the Reef from water pollution and build resilience to climate change.	Stage 2 progressing: Proof of concept Stage 2: Field trials - extension provided	Game changer Based on latest science and information, it has potential to remove around 3,000 tonnes of DIN per year (ca. 28% of total DIN discharge).	The Seaweed Biofilters webpage , Concept Design Final Report (32), Marine Spatial Planning and Modelling Interim report (33) and Field Trials Interim Report (34).
Cleaner Road Runoff Local Government Association of Queensland in partnership with AECOM	Tools to improve planning and decisions in Sediment reduction	Seeks to create an innovative package method to allow Reef catchment councils identifying the points within the road network responsible for the most serious forms of erosion and sediment loss. Outputs will facilitate road managers to prioritise and implement best management practices to improve water quality in the Reef catchments. Data and information collected will be incorporated into Paddock to Reef modelling.	Stages 2 and 3 progressing: Pilot projects and Communication, knowledge transfer and adoption	Game changer Demonstrated potential across 42,000 kilometres of combined State and Local Government unsealed roads.	The Clear Roads webpage and methods report (35) and results report (35b).
AutoWeed. James Cook University in partnership with AutoWeed and Sugar Research Australia	Technology transformation in Pesticide reduction	Novel technology to weed management in sugarcane using the latest advances in deep learning, machine vision and robotics, to reduce pollutants through smarter application of herbicide. A prototype was designed and developed and is being trialled in three regions. The system utilises smart detection and spot spraying grass	Stage 6 progressing: Spray trials, datasets, economics, water quality trials, R&D, marketing and	Game changer Demonstrated 96% effectiveness using an average of 44% less pesticide compared to blanket spraying, reducing chemical runoff by up to 78%	The Autoweed webpage , project handout (36), paper (37) and economics case study (38).

		and weed species within any target crop or pasture environment. The project aims to improve the Autoweed technology readiness and develop a business case/economic analysis to understand its commercial feasibility.	promotion, business case		
Banana yield monitoring system Farmacist	Technology transformation in DIN reduction	A nutrient management approach that brings together a range of technologies to develop a banana yield monitoring system and a purpose-built software to acquire and process data to deliver consistent and well-defined outputs. From prototype to pre-commercial stage, this technology supports the adoption of Precision Agriculture in banana production systems operating at different enterprise scales and landscapes to reduce nutrient inputs and hence DIN in water run-off.	Completed	Contribution. Developed an industry-first precision agriculture approach for banana nutrient management. If commercialised and adopted across the Wet Tropics, DIN reductions of 10-25% could be achieved.	The Banana System webpage , GBRF website story and the summary report (39).
Multispecies cropping Farmacist	Technology transformation in DIN reduction	Trialling a new multi-species crops approach in sugarcane that is cost-effective and can benefit soil health and improve water quality from better crop uptake of applied nutrients and reduced water run-off. Limitations to increased adoption of these practices include equipment availability to allow other crops with variable seed size to be simultaneously planted in the sugarcane system, and costs to purchase new equipment that can efficiently plant multi species.	Completed	Contribution Developed affordable, practical options for growers to use existing machinery to plant multispecies crops and led to a significant increase in the area planted (over 1,200 ha) in the Mackay-Whitsunday region	The Multispecies webpage and final report (40).
The Enhanced Efficiency Fertiliser (EEFs) Sugar Research Australia in partnership with CSIRO	Technology transformation in DIN reduction	On-ground testing and modelling of the effectiveness of Enhanced Efficiency Fertilisers at matching the nitrogen requirements of growing crops by releasing nitrogen over time. The ability to better match nutrient supply with crop uptake expects to see a reduction in nitrogen running off farm into the Reef's waters whilst maintaining productivity and potentially improving profitability.	Completed	Contribution. Demonstrated that EEFs applied at N rates 20% below industry standard (Six Easy Steps) can reduce nitrogen losses while maintaining productivity and profitability.	Sugar Research Australia website .
Regenerative grazing to improve land condition CSIRO in partnership with University of Southern Queensland	Technology transformation in sediment reduction (research)	Quantify the benefits of regenerative grazing which can help accelerate landscape recovery and improve run-off and water quality for a healthy Reef. Involved a space for time method along with vegetation and soil data collection from a range of properties that have, and have not implemented regenerative grazing strategies for between 5 to 20 years.	Completed	Contribution Demonstrated that regenerative grazing approaches can improve vegetation, soil and land condition. Ancillary research suggested that such improvements will lead to reduce sediment run-off but it takes long time to be realised.	The regenerative grazing summary report (41) and published paper (42).
Nutrient exports from remediated gully systems Greening Australia in partnership with DESI and Griffith University	Technology transformation in sediment reduction (research)	Investigate if large-scale remediated gullies that reduce significant amounts of sediment run-off are also reducing nutrient pollution, therefore enabling the greatest cuts to Reef pollution from any investment.	Completed	Contribution Data from different sites suggested gully remediation can both decrease and increase bioavailable nitrogen (BAN) forms (i.e., DIN, adsorbed ammonium-nitrogen, and mineralisable nitrogen). This disagreement requires further investigation	The final report (43)
Trialling the use of drones in riparian restoration Greening Australia	Technology transformation in pollutant reduction	Identify where drones can be used to address limitations with riparian and wetland restoration due to boggy terrain and safety issues. The project considers mapping for project work design and monitoring, weed control, and seed distribution. Drone assisted restoration and monitoring techniques could change the cost structure of wetland and riparian repairs, significantly reducing implementation, maintenance and monitoring costs.	Completed	Contribution Developed best practice guidelines when considering using drones in riparian and wetland restoration across Reef catchments.	The drones webpage and guidelines (44).
Irrigation rapid assessment tool i-RAT James Cook University in partnership with Agritech Solutions	Tools to improve planning and decisions in DIN reduction	An irrigation rapid assessment visualisation tool to assess the economic and environmental impacts of different sugarcane irrigation practices. The tool was designed to accelerate widespread practice change in irrigation and induce pathways for innovative ways to finance water quality improvements. i-RAT serves as a boundary object to navigate conversations, converge thinking from key stakeholders and bridge the gap between better irrigation management and sustainable finance systems.	Completed	Contribution Enables canefarmers in the Burdekin and Mackay-Whitsunday regions to perform what-if scenarios to reduce or increase water/energy consumption and reduce DIN pollution without compromising productivity	The i-RAT webpage , i-RAT tool and paper (45).
Electromagnetic Induction Soil Mapping in the Russell River catchment	Tools to improve planning and decisions in DIN reduction	Uses state-of-the-art electromagnetic induction (EMI) technology, combined with conventional soil surveys, to develop detailed soil maps required by the sugarcane industry to implement precision nutrient management for a reduction in pollutants running off into the Reef, while improving farm productivity.	Completed	Contribution Delivered a set of soil and soil attribute maps at 1:5000 scale for over 2,000 ha of cane in the Russell River catchment. With appropriate extension and technical support and further soil	The final report (46).

Jaragun in partnership with DNRME				information, this data could facilitate improved land management in the region.	
Hydrodynamic modelling of pile field bank stabilisation works Alluvium	Tools to improve planning and decisions in sediment reduction	Combines the latest river restoration science with advanced three-dimensional hydrodynamic modelling to advance pile field groyne stream bank stabilisation approaches in the Reef catchments. A variety of river reaches were selected for analysis to determine the impact of river width, flow depth bend sinuosity on the hydraulic effectiveness of pile field groynes.	Completed	Contribution Developed guidelines present several improved design approaches which can significantly increase both the cost effectiveness and the certainty around design performance.	The pile field modelling and guidelines (47).
Assessing gully and streambank risk with LiDAR CSIRO	Tools to improve planning and decisions in sediment reduction	Aiming to provide Natural Resource Management agencies with publicly available tools that identify the gullies and stream banks with the greatest risk potential for erosion, to assist prioritisation for control actions. Targeted gully and streambank erosion control can provide cost-effective reductions in sediment and nutrient loads to the Reef, leading to substantial improvements in water quality.	Completed	Contribution Delivered important datasets that along with other information can contribute to understanding gully extent and gully risk area across 7,900 km ² of Reef catchments. The data is also suitable for fine-resolution vegetation assessment. Currently, the project is developing a new method for assessing vegetation condition in areas at risk of gully erosion. The tool is available publicly.	The data access portal and gully mapping brochure (48).
Extracting riverbank and gully erosion data Griffith University	Tools to improve planning and decisions in sediment reduction	Filling a major gap in understanding the source of fine sediment erosion that is degrading Queensland rivers and the Reef. This project provides access to 620 terabytes of privately held data collected for powerline asset management, equivalent to 71 years of continuous Netflix streaming. This information provides a technological breakthrough to significantly improve the ability to identify, quantify and prioritise erosion sites for Reef-wide water quality management.	Completed	Contribution Provided access to a significant dataset that along with other information supports measurement and monitoring of riverbank and gully erosion. Data is available to the public and has been used across a wide range of industries Engineering, Environmental/NRM, Agriculture, Defence, Mining, Surveying and Education.	The ELVIS portal
Wetland ecological and hydrological data capture into positive management DESI – Queensland Herbarium	Tools to improve planning and decisions in sediment reduction	Turning wetland ecological and hydrological data capture into a targeted positive wetland and water quality management tool/app. The project concept included the collation of data from app submissions into a dataset. This has been upgraded to a database enabling the development and implementation of more features. These features include streamlined assessment process for submitted information.	Completed	Contribution Delivered an application “Wetland Spotter” to capture critical information on the location and characteristics of wetlands in Queensland. This app is publicly available via the iOS App Store and the Android Play Store.	The app: Wetland Spotter
Reef Credit Scheme Ecomarkets Australia	Innovative financing and funding initiatives	Transition of the Reef Credit Scheme architecture from a “start-up” to a independent administered scheme – with the creation of Ecomarkets Australia, the first Australia independent market administrator of environmental markets, This includes a fully independent governance structure, with on-line smart trading (and integrated data) tools, registry, validation and verification process.	Completed	Contribution Established Eco-Markets Australia (EMA) a fully independent and operational administrator. The Reef credits are now operating and trading. It is worth noting DESI contributed the most to Ecomarkets Australia transition.	The Reef Credits website .
Redefining and reconfiguring Reef catchment land use NCEconomics	Innovative financing and funding initiatives	Developing a comprehensive understanding of the socio-economic benefits and costs of a broad scale, targeted land reconfiguration (consolidation and retirement) process that simultaneously improves outcomes for the Reef, improves economic viability of agriculture through enhanced scale and efficiency, and improves social resilience for communities.	Completed	Contribution Advanced knowledge on potential avenues to redefine and reconfigure land use and how they could work in conjunction with other initiatives and emerging environmental product markets to ‘crowd in’ co-investment from a broader suite of sources.	The final report (49).
Farmland to Reef Regeneration Fund TNC in partnership with Kilter Rural	Innovative financing and funding initiatives	Feasibility study into a long-term, landscape scale, impact investment fund to deliver positive environment and biodiversity outcomes for the Reef and its catchments. The process was broken into three phases – the first focused on the scoping of potential sectors and geographies, the second on developing an investment model and related financial and environmental modelling, and the third to develop legal structure and governance arrangements.	Completed	Contribution Developed the Great Barrier Reef Natural Capital Fund as a mechanism to invest in the sugarcane sector to both produce a return on investment as well as achieve significant water quality improvements on those properties. It is ready for deployment when the market landscape improves.	Reports and data are commercial in confidence.
Reefinace Cultivate Farms Pty Ltd	Innovative financing and funding initiatives	Cultivate farms aimed to help eliminate the biggest barrier to farm ownership for next generations – access to capital and land – by matching aspiring (next generation) farmers with those looking to retire from the land. The transition will also be linked to improved management practises, which will result in improved water quality outcomes for our Reef.	Completed	Further research needed	The final report (50).

E-shepherd Agersens Pty Ltd	Technology transformation in Sediment reduction	Developed a virtual fencing technology by installing a device on the cattle that can protect the Reef from sediment runoff caused by eroding gullies and streambanks in terrain typically unsuitable for traditional fencing. The technology relies on devices set on cattle.	Completed	Further research needed	The final report (51).
Robust, cost-effective sensor for dissolved inorganic nitrogen IntelliDesign Pty Ltd	Technology transformation in DIN reduction	Investigate if a lower cost Nitrate Sensor system could be developed for research, scientific and commercial purposes and specifically utilising the world-class, UV LED technologies available here in Queensland.	Completed	Further research needed	The final report (52).
The Sharing and management of industry and landholder-owned data	Sharing and management of industry and landholder-owned data	To develop a long-term end-to-end solution for data governance, sharing, protection, consolidation, and management in the cane industry.	Completed	Further research needed The Component Director described how the haring and management of industry and landholder-owned data theme was not pursued due to multiple complexities inherent to the roll out of a program of this nature. An Options Paper developed by an independent consultant did not provide a clear value proposition within budget and timeframes with final recommendation towards reallocating funds. A knowledge exchange session was held with both Australian and Queensland government representatives to share the learnings, strategy, and options to consider when implementing a data sharing and management program in the future .	The options paper summary (53)

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COTS CONTROL RESULTS TABLE

Introduction

This document presents the Results Table for the Crown-of-Thorns Starfish (COTS) Control Component, developed as part of the 2024 End-of-Portfolio (EOP) Evaluation of the Reef Trust Partnership (The Partnership). This document has been collaboratively developed by the evaluators (Clear Horizon) and the Great Barrier Reef Foundation (GBRF) COTS Control Component director.

As outlined in the EOP Evaluation Project Plan (Clear Horizon, 2024), Results Table present the component specific findings and evidence that will be used to respond to Key Evaluation Question 3: *'To what extent did the Partnership contribute to a significant and measurable improvement in the health of the Great Barrier Reef World Heritage Area (the Reef)?'* and are the focus of the independent expert review process.

The following Results Table presents the evaluations findings and supporting evidence structured against the component specific evaluation questions presented in the table below. These have been synthesised from the end-of-component outcomes and performance objectives presented in the COTS Control Component Monitoring and Evaluation (M&E) Plan (p.44 – 53, RTP M&E Plan, GBRF 2022).

Table 1. COTS Control Component Evaluation Questions

COTS Control Component Evaluation Questions
1. On-water COTS Control Program
a. To what extent was coral mortality reduced from COTS outbreaks at key reefs?
b. To what extent were effective governance and program management models in place to support the COTS Control Program in delivering activities and striving towards efficiencies?
c. To what extent was data collected through the Program managed and shared effectively to monitor progress in achieving IPM goals?
d. Did COTS Control Program vessels deliver activities in accordance with the IPM strategy as per the Program's Annual Work Plans?
e. To what extent were on-water COTS Control activities maintained without gaps in delivery, in accordance with the IPM strategy?
2. Expanded delivery partner involvement
a. To what extent was delivery partner involvement in COTS management expanded (including Traditional Owner enterprises and citizen science groups)?
3. COTS Control Innovation Program
a. To what extent have improved methods to manage COTS at scale been identified?
b. Were the right collaborations and governance model in place to design and deliver the CCIP?
c. To what extent were the benefits, costs, feasibility, and risks of potential research opportunities considered and prioritised in order to design the Innovation Program?
d. Were CCIP R&D Phase activities delivered as planned?
e. To what extent did the COTS Control Innovation Program develop new knowledge, tools, technologies and methods to be trialled or implemented?
4. Long-term funding strategy
a. To what extent has a strategy for long-term funding been made available for influencing/advocacy?

Evidence

The evidence presented in the Results Table includes the results of a review of 57 documents (referenced page 22 below), and the results of the analysis of semi-structured interviews with 9 program stakeholders, and a survey of 27 program stakeholders undertaken specifically for this evaluation. Evidence is cited, with documents numbered (1- xx) and quotes from interviewees coded (INT#) and from Survey responses coded (S#). The demographic profile of interview and survey participants is presented below.

Table 2 Interviewee roles

Interviewee roles	Number of interviewees (9)
COTS Control Program	2
CCIP	7

Table 3 Interviewee organisations

Interviewee organisations	Number of interviewees (9)
CSIRO	3
The Reef Authority	2
AIMS	1
James Cook University	1
University of Tasmania	1
University of Queensland	1

Table 4 Survey respondent roles

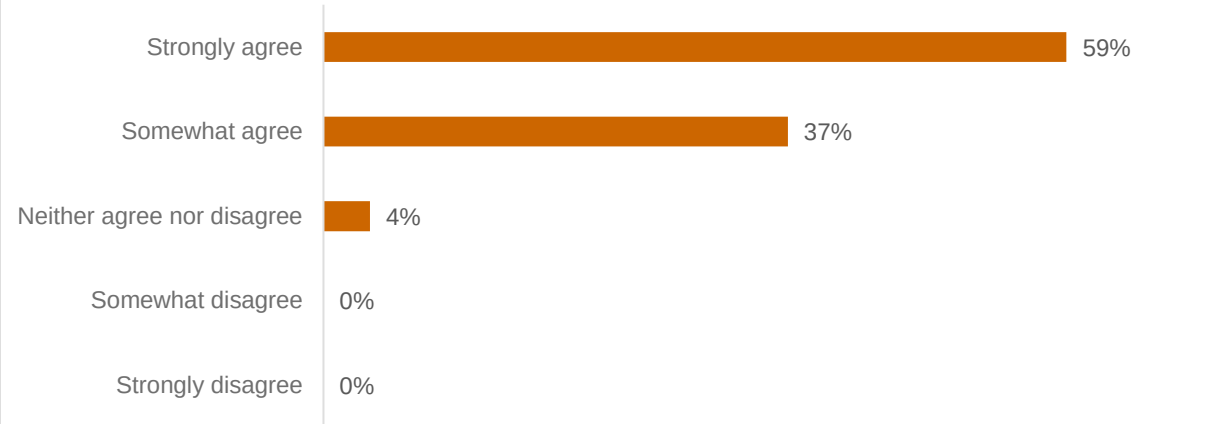
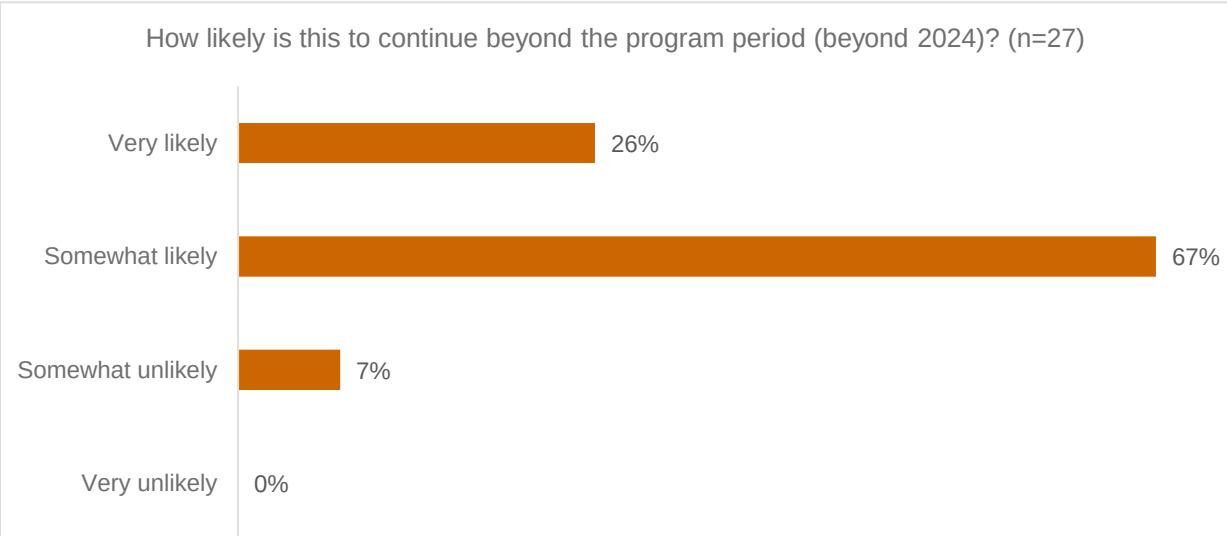
Survey respondent roles	Number of survey respondents (27)
COTS Control Program - Management Representatives	5
COTS Control Program - Vessel Crew Representatives	2
COTS Control Program - Stakeholders	1
CCIP Research Project Leaders	15
CCIP Steering Committee Members	8
CCIP Project Collaborators	4

COTS Control Component Results Table

COTS Control Component Evaluation questions and performance measures	Evaluation Findings	Evidence
1. On-water COTS Control Program		
a. To what extent was coral mortality reduced from COTS outbreaks at key reefs? Performance measures: - Target: Reduction of COTS density at priority reefs Indicator: Number and area of priority reefs where COTS density is maintained below ecological thresholds (the threshold at which coral cover is lost to COTS). 'Area' = total area managed (surveillance and culling). 'Priority reefs' = those with ecological (connectivity) and/or economic (tourism) value - Target: Reduction of average size of COTS at priority reefs Indicator: Trend toward smaller size classes	Achieved The COTS Control Program achieved significant reductions in coral mortality from COTS outbreaks at key reefs – contributing to a six-fold reduction in COTS numbers and up to 44% increase in coral cover. The program also reduced the density and size of COTS towards sustainable thresholds.	Reductions in coral mortality from COTS outbreaks The effectiveness of the COTS Control Program was demonstrated by the peer-reviewed article: <i>Protecting Great Barrier Reef resilience through effective management of crown-of-thorns starfish outbreaks</i> (Matthews et al. 2024; 8). The article compared COTS density and coral dynamics between the 3rd outbreak wave (before the COTS Control Program) and the 4th outbreak wave (COTS Control Program implemented in some reefs/regions) and found that: - When reefs and regions received timely and sufficient control effort during the 4th outbreak, there was up to a six-fold reduction in COTS numbers and up to 44% increase in coral cover (8). - Outbreaking reefs with higher levels of culling had net increases in coral cover, and moderate levels of culling led to reductions in the rate of coral loss (8). - Outbreak wave progression to adjoining sectors was delayed, probably via suppression of COTS larval supply (8). <i>“Our findings provide compelling evidence that proactive, targeted, and sustained COTS management can effectively suppress COTS outbreaks and deliver coral growth and recovery benefits at reef and sector-wide scales. The clear coral protection outcomes demonstrate the value of targeted manual culling as both a scalable intervention to mitigate COTS outbreaks, and a potent resilience-based management tool to “buy time” for coral reefs”. (8)</i> Moreover, in addition to the demonstrated benefits for the Great Barrier Reef being delivered now through the COTS Control Program, projections of the future benefits are also positive. Another peer-reviewed article that modelled present-day control efforts (five vessels) and compared that to a scenario with no control showed that when control occurred “...the number of individual reef subject to COTS outbreaks is reduced by 50-65% annually, yielding a benefit of 5-7% of healthy Reefarea per decade, equivalent to gaining 104-150 km² of live corals by 2035” (Castro-Sanguino et al. 2023; 54). Reducing the density and size of COTS towards sustainable thresholds The COTS Control Program reduced coral mortality by reducing the density and size of COTS. GRBMPA’s 2021 Annual Report (18) noted that “across all reefs actioned during 2021-22, analyses of catch-per-unit-effort (CPUE) data at an individual cull site level shows that COTS densities are being effectively reduced towards sustainable thresholds by repeat visitation” (18). The report also noted that reductions in COTS size are being achieved through repeat treatments (18). This is a critical result, as the largest individuals have a disproportionately higher direct impact on coral during feeding and are also the most fecund and capable of perpetuating the onward spread of the outbreak through dispersal of their larva (18). Moreover, research has continued to assess whether the ecological thresholds the COTS Control Program are fit-for-purpose to achieve program goals. A recent study by Rogers et al. 2024 (58) concluded that the current thresholds used in the program are effective at limiting coral loss, and the thresholds are robust to variation in coral growth rates that may occur following bleaching under present day conditions. Although the Control Program is delivering demonstrable benefits for the health of the GBR, there is still significant opportunity to improve effectiveness and efficiency. Further research is needed to: - better understand dynamic interactions between COTS and coral under a range of climate scenarios, and how this may influence COTS Control Program strategies and operations into the future. - improve detection and monitoring tools and capabilities to support timely decision-making and enable robust evaluation of performance and outcomes - develop new methods for control that complement culling and enable control on a larger scale than currently possible with the finite resources available for the program. Delivering clear benefits for Reef health and resilience 85% (n=22/26) of survey respondents strongly or somewhat agreed that the COTS Control Program (2020-2024) delivered clear benefits for Reef health and resilience. The remaining 15% indicated they ‘neither agreed nor disagreed’, with no respondents who disagreed (Figure 1). Figure 1. The COTS Control Program has delivered clear benefits for Reef health and resilience (n=26)

		The COTS Control Program has delivered clear benefits for Reef health and resilience (n=26) <table><tr><td>Strongly agree</td><td> </td><td>65%</td></tr><tr><td>Somewhat agree</td><td> </td><td>19%</td></tr><tr><td>Neither agree nor disagree</td><td> </td><td>15%</td></tr><tr><td>Somewhat disagree</td><td></td><td>0%</td></tr><tr><td>Strongly disagree</td><td></td><td>0%</td></tr></table>	Strongly agree		65%	Somewhat agree		19%	Neither agree nor disagree		15%	Somewhat disagree		0%	Strongly disagree		0%
Strongly agree		65%															
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Strongly disagree		0%															
b. To what extent were effective governance and program management models in place to support the COTS Control Program in delivering activities and striving towards efficiencies? Performance measures: • Number of COTS Partnership Group meetings • Number of COTS Action Group meetings	Achieved The COTS Control Program governance and program management models effectively supported the delivery of COTS control activities and achieve delivery efficiencies. The COTS Partnership Group (CPG) oversaw the strategic delivery of the COTS Control Program and met 22 times throughout the Program. The COTS Action Group was established as a tactical working group and met 29 times during the Program. Both governance groups have maintained strong member engagement throughout the program.	Program governance and management model The two-tiered governance model for the COTS Control Program included the COTS Partnership Group (CPG) and COTS Action Group (CAG), which supported Program delivery at a strategic and operational level and supported the program to achieve greater effectiveness and efficiencies. The CPG The CPG oversaw the strategic delivery of the Program. Its objectives were to provide strategic oversight of the program, manage relationships with key stakeholders, consider new initiatives/innovations, and identify and manage the Program's risk and reputation (22). CPG membership included representatives from The Reef Authority, RRRC, the Foundation, and an independent Chair (22). This group met at least every quarter (22 meetings in total) (30). The CPG participated in and oversaw several strategic components of the Program including (30): • Leading the development of the Program's Communications and Engagement Strategy. • Driving improvements in data management and data sharing and reviewing program performance. • Overseeing the development and endorsement of the Program's Annual Work Plans. • Coordinating the transition to a co-funded program with The Reef Authority. • Participating in the development and endorsement of the COTS Control Program's new performance metrics and the 2030 COTS Research and Innovation Roadmap. • Providing advice to the MPA Board about future opportunities for Traditional Owner participation and partnership in the COTS Control Program. (30) • Endorsing new targets designed in 2022-23 to assess the Program's operational and performance outcomes (CPG Meeting Minutes March 2022, 30), which were integrated into annual Work Planning processes and drove greater efficiencies in COTS Control and were integrated into the Annual Work Planning processes (14). The CAG The CAG was established under the RTP. Its objective was to share knowledge and lessons across vessel crews delivering the Program to ensure consistency in Integrated Pest Management (IPM) delivery and identify opportunities for enhanced efficiencies (23). The CAG was chaired by RRRC and The Reef Authority staff on a rotating basis and included representatives from all vessel delivery providers and key CCIP researchers. Key program stakeholders from the Reef Joint Field Management Program (RJFMP) and the AIMS Long-term Monitoring Program (LTMP) were also welcomed as members to share learnings across related field-based programs (23). The CAG met every six to eight weeks (29 meetings in total) (29). The CAG participated in and oversaw several operational components of the Program including (29): • Coordinating culling and surveillance activities across vessels, especially when working in the same region • Addressing technical challenges with data management and WHS processes and procedures to ensure best practice and ongoing improvement. • Managing COVID-19 impacts on the delivery of the Program and its 100+ employees. • Coordinating training and engagement with Traditional Owners across program operations															

		Reviewing progress in implementing the IPM Strategy across the Program's different regions of operation and discussing opportunities to refine the approach to drive further efficiencies. The CAG's recommendations were presented to the CPG in 2021-2022 for their consideration and support in implementing these improvements in the Program (29). Throughout the RTP, the engagement in these two governance groups specifically, and the delivery of the Control Program more generally, has continued to be strong and has expanded over time. Attendance at online governance meetings is routinely high and face-to-face workshops with the broader stakeholder community have further supported information sharing and a culture of shared purpose and achievement across the many people and organisations involved in delivering COTS Control across the Great Barrier Reef. For example, the strategic planning process has expanded considerably with a broad range of stakeholders now consulted and engaged in the annual prioritisation process that guides on-water activities. For example, over 40 participants attended the Reef Prioritisation workshop on 21 April 2023, including representatives from the COTS Control Program as well as those from complementary programs (i.e. COTS Control Innovation Program, Reef Restoration and Adaptation Program, AIMS Long-term Monitoring Program, Reef Joint Field Management Program). This workshop familiarised all parties with the steps in the process and sought input on the list of reefs to be targeted by the COTS Control Program under its 2023-2024 Annual Work Plan (15). During the workshop, CCIP researchers presented the results of an expert elicitation, including the participant's weightings of ecological and economic metrics considered as part of the prioritisation process. The outcome was a selection of 225 reefs of high ecological and economic value that were the focus of COTS management in 2023-2024 (15).
c. To what extent was data collected through the Program managed and shared effectively to monitor progress in achieving IPM goals? Performance measures: COTS Control Program data quality checked and made available to partners, vessel operators and stakeholders	Achieved COTS Control Program data was effectively managed and shared to monitor progress in achieving IPM goals. The quality of the Program's data was routinely checked and shared with partners, vessel operators, and stakeholders. Online dashboards ensured that data, activities and outcomes of the Program were widely accessible.	Improved data collection and sharing Under the Partnership, The Reef Authority, RRRC and the Foundation worked together to achieve significant improvements in data sharing processes and transparent decision-making. - The Reef Authority quality-checked COTS Control Program data and routinely shared it through PowerBI Dashboards, which allowed vessel crews to visualise their data, plan their IPM activities, and track progress in achieving targets. This process was highly efficient considering the large volume of field data collected on a weekly basis, with all Program data shared within 5 days of return from each voyage. All vessel providers could access the data from other vessels, which promoted knowledge sharing and coordinated delivery (12, 13, 14, 15, 16). - A suite of new public-facing dashboards is now available on the The Reef Authority website. Beginning in 2021-2022 these dashboards have been published annually to ensure that data, activities and outcomes of this government-funded program are widely accessible - Crown-of-thorns starfish project dashboard qbrmpa (25). These improvements in data management and sharing have enabled more timely and adaptive COTS management. For example, in late 2021 data coming in from a combination of sources including the COTS control vessels, CCIP researchers (37), the AIMS Long-term Monitoring Program and the Reef Joint Field Management program all suggested that the fifth primary outbreak on the Great Barrier Reef had begun to develop. The COTS Partnership Group acted quickly in response to this emerging information, identifying a need for surge capacity vessels to be mobilised in the initiation region to address this elevated threat in the north, while also maintaining pest management progress in the central and southern regions of the GBR. A procurement process was quickly actioned, and contracts were executed in early 2022 with two additional surge vessels mobilised to boost the program's capability to undertake early pest management action to suppress the emergence of the new outbreak. Furthermore, the data collected through the COTS Control Program has become one of the primary sources of data used by the The Reef Authority in assessing coral bleaching events across the Great Barrier Reef. As this data becomes used more widely, it will continue to be important to strive towards best-practice methods for collection and ensure data security. 96% (n=26/27) of survey respondents strongly or somewhat agreed that the programs improved data and knowledge sharing across COTS research and management. The remaining 4% indicated they 'neither agreed nor disagreed', with no respondents who disagreed (Figure 2). Figure 2. The programs have improved data and knowledge sharing across COTS research and management (n=27)

		The programs have improved data and knowledge sharing across COTS research and management (n=27) <table><tr><th>Response</th><th>Percentage</th></tr><tr><td>Strongly agree</td><td>59%</td></tr><tr><td>Somewhat agree</td><td>37%</td></tr><tr><td>Neither agree nor disagree</td><td>4%</td></tr><tr><td>Somewhat disagree</td><td>0%</td></tr><tr><td>Strongly disagree</td><td>0%</td></tr></table> 93% (n=25/27) of survey respondents believed that improved data and knowledge sharing across COTS research and management was likely to continue in the future. The remaining 7% indicated that this was ‘somewhat unlikely’, with no respondents who indicated this was ‘very unlikely’ (Figure 3). Figure 3. How likely is this to continue beyond the program period (beyond 2024)? (n=27)  <table><tr><th>Response</th><th>Percentage</th></tr><tr><td>Very likely</td><td>26%</td></tr><tr><td>Somewhat likely</td><td>67%</td></tr><tr><td>Somewhat unlikely</td><td>7%</td></tr><tr><td>Very unlikely</td><td>0%</td></tr></table> Two interviewees specifically noted the improvements in collection and management of data collected through the on-water operations as a significant Program achievement (INT01, INT02). <i>“The data and the tools that the Reef Authority has to do the job have been revolutionised through this process and so that’s very much a legacy.” (INT02)</i>	Response	Percentage	Strongly agree	59%	Somewhat agree	37%	Neither agree nor disagree	4%	Somewhat disagree	0%	Strongly disagree	0%	Response	Percentage	Very likely	26%	Somewhat likely	67%	Somewhat unlikely	7%	Very unlikely	0%
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d. Did COTS Control Program vessels deliver activities in accordance with the IPM strategy as per the Program’s Annual Work Plans? Performance measures: • Number of voyages and days on water delivered by vessel program • Number of target reefs actioned • Kilometres of Target reef surveyed	Achieved The COTS Control Program vessels delivered activities in accordance with the IPM Strategy, as per the Program’s Annual Work Plans. The Program used the IPM strategy established every year to control COTS.	IPM strategy reflects best practice An Independent Review commissioned at the start of the RTP concluded that the COTS Control Program had undergone a suite of continuous improvements and adaptive changes since 2012. The reviewers concluded that “<i>the current iteration of the COTS Control Program under the guidance of the IPM Strategy provided a strategic and conservative approach to application of best available science and best practice</i>” (26). This provided an independent assessment of the IPM strategy, and the conclusion supported its continued implementation under the RTP.																						

- Dive hours spent culling

On-water activities

The COTS Control Program employs more than 100 people, and five to six vessels per year conduct their core on-water activities (surveillance and culling) using IPM decision rules to control coral-eating starfish to ecologically sustainable levels where coral growth and recovery outpaces the impact of COTS feeding, in accordance with the Annual Work Plans (12, 13, 14, 15, 16).

In 2022-2023, new targets were designed for the COTS Control Program, to assess the Program's operational and performance outcomes. The CPG endorsed these performance metrics in March 2022 (CPG Meeting Minutes March 2022, 30), and they were subsequently integrated into the Annual Work Planning processes (14).

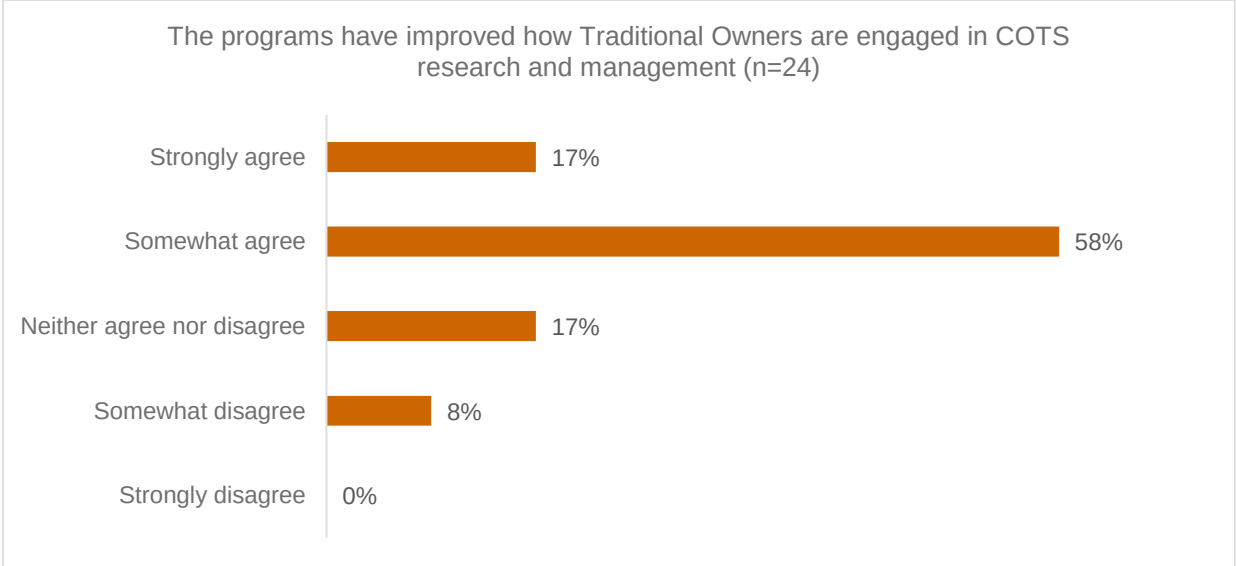
The table below presents the Program's performance each year, with performance against the targets set for the new metrics tracked from the financial year 2022-23.

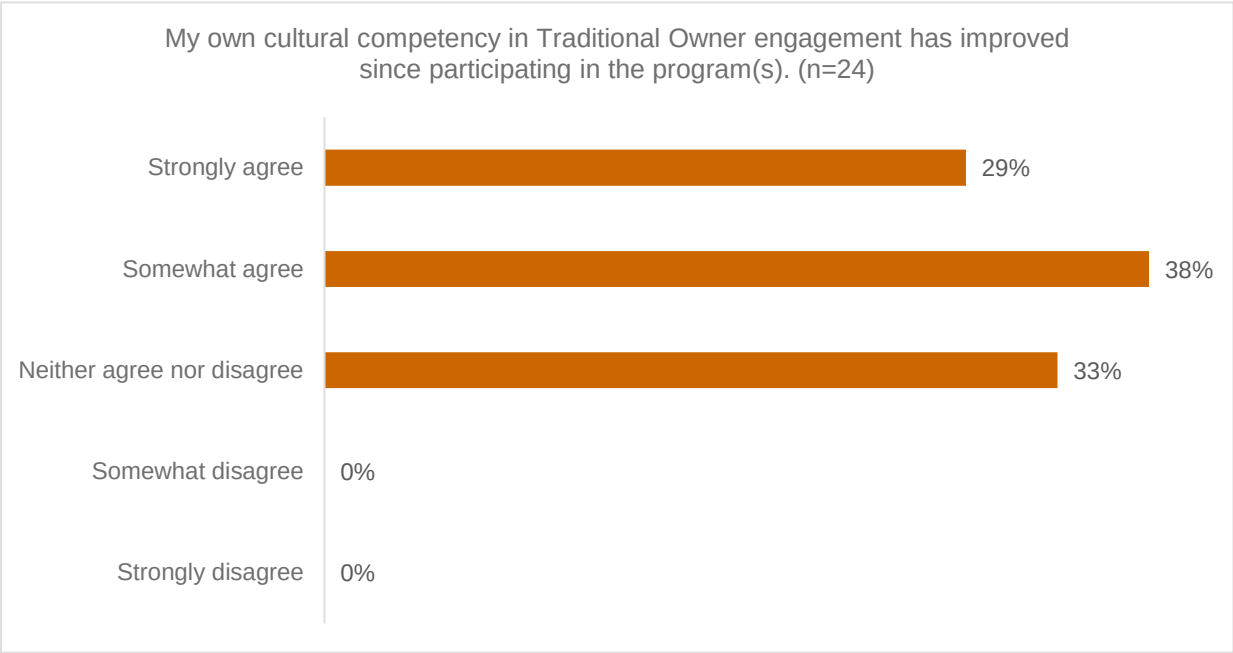
In both the 2022-2023, and 2023-2024 years the Program exceeded its targets for culled sites where COTS numbers are sustainable, with 91% and 93% respectively of culled sites where numbers are sustainable, against targets of 75%. Furthermore, the 2023-2024 year was delivered under the target cost per on-water day.

Table 5. COTS Control Activities by Financial Year. Note targets and metrics were adjusted from 2022.

COTS Control Program Performance Metric	2019-2020 Actual	2020-2021 Actual	2021-2022 Actual	2022-2023 Target	2022-2023 Actual	2023-2024 Target	2023-2024 Actual
Number of target reefs actioned (# and %)	187 reefs	113 reefs	155 reefs	> 162 reefs (65% of 250 target reefs identified)	161 reefs (64% of 250 target reefs identified)	> 146 reefs (65% of 225 target reefs identified)	149 reefs (65.9% of 225 target reefs identified)
Culled sites where COTS numbers are sustainable (%)	n/a	n/a	n/a	≥ 75%	91%	> 75%	93%
Total area of coral reef directly culled to sustainable levels (ha)	10,380 ha	7,940 ha	12,240 ha	13,570 ha	13,740 ha	11,480 ha	10,790 ha
Total area of coral reef managed (surveillance and culling) to achieve sustainable levels (ha)	n/a	n/a	n/a	60,038 ha	54,910 ha	43,167 ha	46,120 ha
Total area of reef habitat protected to achieve sustainable levels (ha)	n/a	n/a	n/a	270,966 ha	411,493 ha	175,446 ha	160,146 ha
Cost per hectare (\$): Coral reef managed to sustainable levels Coral reef protected to sustainable levels	n/a	n/a	n/a	a) \$354/ha managed b) \$79/ha protected	a) \$387/ha managed b) \$52/ha protected	a) \$436 / ha managed b) \$107 / ha	a) \$378 / ha managed b) \$109 / ha managed
Number of on-water days (#)	1,195 days	1,219 days	1,344 days	1,570 days	1,534 days	1,370 days	1,340 days
Cost per on-water day (\$)	n/a	n/a	n/a	\$13,057/day	\$13,871/day	\$13,468/day	\$13,023/day
Average in-water diver hours per day (hr)	n/a	n/a	n/a	≥ 14 hrs/day	19 hrs/day	≥ 14 hrs/day	19.6 hrs/day
Total in-water diver hours (hr)	13,139 hrs	15,514 hrs	15,269 hrs	21,545 hrs	22,971 hrs	20,533 hrs	19,758 hrs
Starfish culled	74,793	87,150	59,517				
Voyages	123	116	125				
Citation	(19, 20)	(17)	(18)	(21)	(21)	(21)	(16)

		Improved efficiency and performance 84% (n=21/25) of survey respondents strongly or somewhat agreed that the COTS Control Program had improved its efficiency and performance. The remaining 16% indicated they 'neither agreed nor disagreed', with no respondents who disagreed (Figure 4). Figure 4. The COTS Control Program has improved its efficiency and performance (n=25) <table><caption>The COTS Control Program has improved its efficiency and performance (n=25)</caption><thead><tr><th>Response</th><th>Percentage</th></tr></thead><tbody><tr><td>Strongly agree</td><td>48%</td></tr><tr><td>Somewhat agree</td><td>36%</td></tr><tr><td>Neither agree nor disagree</td><td>16%</td></tr><tr><td>Somewhat disagree</td><td>0%</td></tr><tr><td>Strongly disagree</td><td>0%</td></tr></tbody></table>	Response	Percentage	Strongly agree	48%	Somewhat agree	36%	Neither agree nor disagree	16%	Somewhat disagree	0%	Strongly disagree	0%
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e. To what extent were on-water COTS Control activities maintained without gaps in delivery, in accordance with the IPM strategy? Performance measure: Maintenance of current capacity to respond to current outbreak (no gap in funding due to Partnership management)	Achieved The capacity of COTS Control providers to deliver the IPM strategy was maintained throughout the Program period, with no gap in funding.	No gap in funding The COTS Control Program’s capacity was maintained to deliver integrated pest management throughout the Program period. An investment of \$41.5M through the Reef Trust Partnership supported the delivery of five to six vessels with no gap in program funding over the grant period (2019-2024) (12, 13, 14, 15). Program partners worked collaboratively to integrate the \$162M in funding provided to The Reef Authority by the Australian Government in January 2022 for ongoing COTS control until 2030 (30). This additional sum ensured that Program’s capacity was maintained at five to six vessels throughout the grant period and beyond.												
2. Expanded delivery partner involvement														
a. To what extent was delivery partner involvement in COTS management expanded (including Traditional Owner enterprises and citizen science groups)? Performance measures: - Number, nature and extent of involvement of expanded delivery partners - Number of trips from involving expanded delivery partners - Dive hours from expanded delivery partners on existing fleet or new vessels	Achieved The RTP expanded delivery partner involvement in COTS management to citizen scientists and Traditional Owners. Citizen scientists engaged in the Great Reef Census, where they collected data to inform COTS management. As part of the Great Reef Census, 72 citizen scientists were engaged in data collection activities. The data collected was used by researchers to develop criteria to inform COTS Control decision-making. Traditional Owners are now embedded in COTS Control management, research and governance. In 2024, The Reef Authority accepted a Traditional Owner-led business to their Panel of Providers, which should provide future opportunities for Traditional Owners to be involved in COTS management. Collaborations with Traditional Owners were also established under the CCIP. The CCIP involved Traditional Owners through	Citizen science involvement in COTS management Citizen scientists engaged in data collection for the Great Reef Census, to fill knowledge gaps for the COTS Control Program. While the Great Reef Census was funded through the Community Reef Protection component of the RTP for several years, the COTS component funded the \$100K project described below. In 2021-2022, the CPG was consulted on potential opportunities to engage community and citizen scientists in COTS management. CPG members agreed that citizen scientists could contribute to the collection of monitoring data. This resulted in the RTP’s COTS Component investing \$100K into a project strengthening the links between the Great Reef Census and the COTS Control Program (9). The Great Reef Census delivered two expeditions in November 2022 to fill knowledge gaps for the COTS Control Program. The expeditions visited a total of 54 reefs, completed 319 surveys and collected 8,458 images for analysis. 11 citizen scientists engaged and upskilled during the expeditions, including volunteers from conservation NGO Green Heroes. An additional 61 citizen scientists collected data for the Great Reef Census beyond these dedicated expeditions, including at reefs of interest for COTS management (34). Following on from the field effort, the Great Reef Census worked with The Reef Authority to draft a Standard Operating Procedure (SOP) detailing the pathways for Census data use in the COTS Control Program (33). The main data use pathway involved benthic coral data collected through the Census being used by University of Queensland (UQ) researchers to develop ‘Importance Scores’ provided to COTS Control Program managers at The Reef Authority to consider when prioritising reefs for COTS control (33). Traditional Owners embedded in COTS management and research Traditional Owners are now embedded in COTS Control management, research and governance. Traditional Owners and First nations people were engaged through the program in a variety of ways, including training, partnering, roles created in the Governance arrangements for research and management, with many engagements now set to continue beyond the Partnership period. Traditional Owner engagement in COTS management												

a dedicated project, fieldwork, workshops, and the appointment of a representative to the CCIP Steering Committee. CCIP researchers and COTS managers and vessel crew operators became more aware of their responsibility to engage and partner with Traditional Owners over the course of the RTP. While there is growing awareness and action regarding Traditional Owner engagement, more work is required to ensure that Traditional Owner interests and aspirations for COTS management and the Reef are realised. Overall, there is now more interest and preparedness for Traditional Owner partnerships in COTS research and management into the future.	Traditional Owners engaged in COTS management in several ways. • The CPG has now added a Traditional Owner to the membership. An EOI process was run in 2024 and the new Traditional Owner member has been contracted by the Reef Authority (56). He attended his first meeting in July 2024 (30). • The CAG now routinely discusses activities underway by reef managers and vessel crews to engage with Traditional Owners in areas where the control program operates (29). • The on-water COTS Control Program employed eight to eleven First Nations people every year (32). • Through the RTP’s Traditional Owner Reef Protection Component, a \$1.4M COTS Training and Leadership Program was delivered to build skills and career pathways for Reef Traditional Owners in COTS control. The program finished in June 2024. Ten trainees graduated with rescue diving certification, eight of whom also completed a Certificate I in Tourism. Three graduates successfully completed advanced training which included Divemaster certification and a Certificate II in Marine Operations (Coxswains Grade 1). Several trainees also completed a Certificate III in Conservation and Ecosystem Management. The evaluation of that training program will be undertaken as part of the Traditional Owner Reef Protection Component Evaluation. • In 2023-2024 the Reef Authority ran an open tender process to establish a new Panel of Suppliers for the COTS Control Program (the current panel expired in June 2024). In that process they specifically sought out tenders for ‘Sea Country-specific COTS culling and/or reef surveillance by Reef Traditional Owners’ for the first time. The outcome has been that two Traditional Owner-led businesses are now on the Panel of Suppliers (27). • One of those businesses, Malu Ventures, has just received a Work Order from the Reef Authority to deliver COTS control services in 2024-25 in the Far Northern Great Barrier Reef. This is the first-ever Indigenous-led control vessel. The vessel is employing 4-5 graduates from the RTP’s COTS Training and Leadership Program (Pers comm, CCIP Steering Committee Traditional Owner representative). Traditional Owner engagement in COTS research Traditional Owners were engaged in COTS research in several ways. • A Traditional Owner representative was appointed to the CCIP Steering Committee through an open Expression of Interest process in 2021 (43). When the Traditional Owner member had to resign due to competing priorities, another EOI process was run in 2024 and a new Traditional Owner member was appointed to the Committee (44). • \$300K was invested to support an Indigenous research fellow under the CCIP engaging with Traditional Owner groups to understand their aspirations and interests for COTS research and management (45). • Traditional Owners were invited to join and participated in the workshops and symposia convened throughout CCIP (1, 2, 3). • CCIP researchers engaged with at least 20 Traditional Owner groups in the places where their fieldwork took place (35). Overall, these activities over the past four years have generated more interest and preparedness for Traditional Owners to engage in COTS research and management into the future, beyond the RTP. Improvements in engagement with Traditional Owners and cultural competency 75% (n=18/24) of survey respondents strongly or somewhat agreed that the programs had improved how Traditional Owners are engaged in COTS research and management. 17% indicated they ‘neither agreed nor disagreed’, 8% indicated they ‘somewhat disagreed’, and no respondents strongly disagreed (Figure 5). Figure 5. The programs have improved how Traditional Owners are engaged in COTS research and management (n=24)  <table border="1"><caption>The programs have improved how Traditional Owners are engaged in COTS research and management (n=24)</caption><thead><tr><th>Response</th><th>Percentage</th></tr></thead><tbody><tr><td>Strongly agree</td><td>17%</td></tr><tr><td>Somewhat agree</td><td>58%</td></tr><tr><td>Neither agree nor disagree</td><td>17%</td></tr><tr><td>Somewhat disagree</td><td>8%</td></tr><tr><td>Strongly disagree</td><td>0%</td></tr></tbody></table>	Response	Percentage	Strongly agree	17%	Somewhat agree	58%	Neither agree nor disagree	17%	Somewhat disagree	8%	Strongly disagree	0%
Response	Percentage												
Strongly agree	17%												
Somewhat agree	58%												
Neither agree nor disagree	17%												
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	67% (n=16/24) of survey respondents strongly or somewhat agreed that their own cultural competency in Traditional Owner engagement had improved since participating in the program(s). The remaining 33% indicated they ‘neither agreed nor disagreed’, with no respondents who disagreed (Figure 6). Figure 6. My own cultural competency in Traditional Owner engagement has improved since participating in the program(s). (n=24)  <table border="1"><caption>Figure 6 Data</caption><thead><tr><th>Response</th><th>Percentage</th></tr></thead><tbody><tr><td>Strongly agree</td><td>29%</td></tr><tr><td>Somewhat agree</td><td>38%</td></tr><tr><td>Neither agree nor disagree</td><td>33%</td></tr><tr><td>Somewhat disagree</td><td>0%</td></tr><tr><td>Strongly disagree</td><td>0%</td></tr></tbody></table> Most interviewees (7/9) noted that there had been a positive change in the engagement of Traditional Owners, cultural awareness and competency in COTS management since the RTP (INT01, INT03, INT05, INT06, INT07, INT08, INT09). <i>“Certainly 10 years ago, five years ago, probably we would have talked about Traditional Owners as if they were just another stakeholder group and now there's recognition that they're not stakeholders, they're rights holders. This is their country. They are much more empowered. They're much more involved. They're provided a leadership role.” (INT05)</i> Changes in Traditional Owner skills One interviewee specifically noted that some Traditional Owners had gained skills in COTS management through the RTP, providing them with an opportunity to care for their sea country in the future (INT05). <i>“The fact that people get trained in all sorts of things, boating skills, diving skills, certificate fours in various fields is great for Traditional Owner communities. Not all of those people will necessarily stay in Crown-of-Thorns control then they might go to tourism or marine park management. But I think that's really exciting because being on country and caring for country, is not just a job for Traditional Owners. It's part of their identity, their spiritual and cultural identity.” (INT05)</i> Continuous improvement in Traditional Owner engagement While CCIP researchers and COTS Control Program managers became more aware of their responsibility to engage and partner with Traditional Owners, the survey and interview data revealed that there is still room for improvement. Most interviewees (8/9) noted that while important steps had been taken to engage Traditional Owners, more needs to be done (INT01, INT02, INT04, INT05, INT06, INT07, INT08, INT09). This was supported by additional commentary from four survey respondents (S06, S08, S11, S13). <i>“It's moving in the right direction, but we're not at the point yet where we've really realised the potential that is there within these programs in terms of involvement in the strategic planning and involvement in the governance involvement in the on-water operations, the reporting, the outreach, nurturing advocates and ambassadors for these programs.” (INT01)</i> Three interviewees specifically noted that collaboration to coordinate the engagement of Traditional Owners could be more effective (INT01, INT06, INT09). This was supported by additional commentary from one survey respondent (S14).	Response	Percentage	Strongly agree	29%	Somewhat agree	38%	Neither agree nor disagree	33%	Somewhat disagree	0%	Strongly disagree	0%
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		<i>“Everyone is working in their own capacity with little cross pollination between major organisations such as GBRF, The Reef Authority, CSIRO, AIMS and delivery providers and smaller stakeholder organisations.” (S14)</i> <i>“It seems like GBRF general investment in First Nations could better support the outcomes from CCIP. It appears to be siloed and not coordinated enough to really get maximum bang for buck out of everyone’s involvement.” (INT01)</i> <i>“Next time we go through this process, I would be tempted to have a little bit more centralized coordination of that because if you have 20+ projects all reaching out individually, it doesn’t work very effectively and if any of those projects assume that the Traditional Owner engagement’s being done somewhere else, then it doesn’t happen at all.” (INT09)</i> Two interviewees independently noted that engagement expectations could be better aligned between Traditional Owners and scientists (INT06, INT07). <i>“The few Traditional Owner groups that I’ve worked closer with have said, we want you to come here and spend a few days with us before you go out and do that, and expectations are huge. And there’s so many groups, and they all want it done slightly differently. If you’re working across five countries, you could spend four months just doing that bit and we’ve got eight days to do a whole field work project. So, if you were truly going to do what they wanted you to do, the budgets would have to be quadrupled, at least.” (INT06)</i> Two interviewees and one survey respondent independently noted that there needs to be an appropriate funding allocation for Traditional Owners to engage (S14, INT03, INT06). <i>“We need to build in funds for Traditional Owners to get paid to participate in the knowledge sharing.” (S14)</i> One survey respondent provided additional commentary the engagement of Traditional Owners in research projects being unclear, beyond the need to acquire consent and provide informative feedback (S26). Two interviewees specifically noted that while there was an aspiration for CCIP project CCIP-R-09 to clarify how to engage and collaborate with Traditional Owners in COTS research, its insights were not ready in time to apply during the roll-out of the CCIP (INT04, INT09). <i>“With my project, which is primarily lab-based, it is challenging to engage beyond acquiring consent and providing informative feedback. I recognise that this is an area that needs attention and careful thinking. With field work there is a clearer path for engagement. Further effort is needed (by managers, funders, researchers and Traditional Owners) to develop these pathways in a meaningful and respectful manner.” (S26)</i> <i>“They’ve been, over the last two to three years, working collaboratively with Traditional Owners to develop sort of protocols around how Traditional Owners could and should be engaged in COTS research going forward. So, there’s almost a mismatch in the timeframes where in a perfect world you would have had those protocols designed and developed in the leading to the R&D program.” (INT04)</i> One survey respondent specifically noted that Traditional Owner engagement could be more effective if it was managed with input from Traditional Owner leaders (S03). <i>“Traditional Owner engagement was largely left to project leaders and important lessons were learned in the process. However, the entire process would have been much more effective and rewarding if managed centrally with input from Traditional Owner leaders. Critically, Traditional Owners need to be involved in the design, not just implementation of proposed activities.” (S03)</i>
3. COTS Control Innovation Program		
a. To what extent have improved methods to manage COTS at scale been identified? Performance measure: Development of methods that generate significant improvements in effectiveness and/or cost efficiency in areas of surveillance, intervention and decision support	Achieved The COTS Control Innovation Program (CCIP) delivered a portfolio of multi-disciplinary research focused on improving the effectiveness and efficiency of the COTS Control Program. Draft Final Technical Reports have been submitted for all 19 R&D Phase projects that finished in June 2024 and these are in the process of undergoing peer-review prior to publishing. Once finalised, all Technical Reports will be made publicly available on	Improved methods The COTS Control Innovation Program (CCIP) has delivered a portfolio of multi-disciplinary research focused on improving the effectiveness and efficiency of the COTS Control Program. The CCIP webpage provides an overview of the program. The CCIP included three early investment projects that were fast-tracked during the Design Phase, and 21 projects that were delivered across the R&D Phase. A brief summary of each project and its outcomes is provided below. Note that one of the 21 R&D Phase projects (CCIP-P-02) was terminated early due to the departure of the Project Lead and another technically complex project (CCIP-D-04) has received a six-month extension and will finish in December 2024 (31). All CCIP projects are required to produce Final Technical Reports that are targeted at communicating project findings to managers, stakeholders and policymakers (31). Draft Final Technical Reports have been submitted for all 19 R&D Phase projects that finished in June 2024 and these are in the process of undergoing peer-review prior to publishing (36). Once finalised, all Technical Reports will be made publicly available on the CCIP webpage.

the CCIP webpage, with most projects also producing peer-reviewed journal articles.

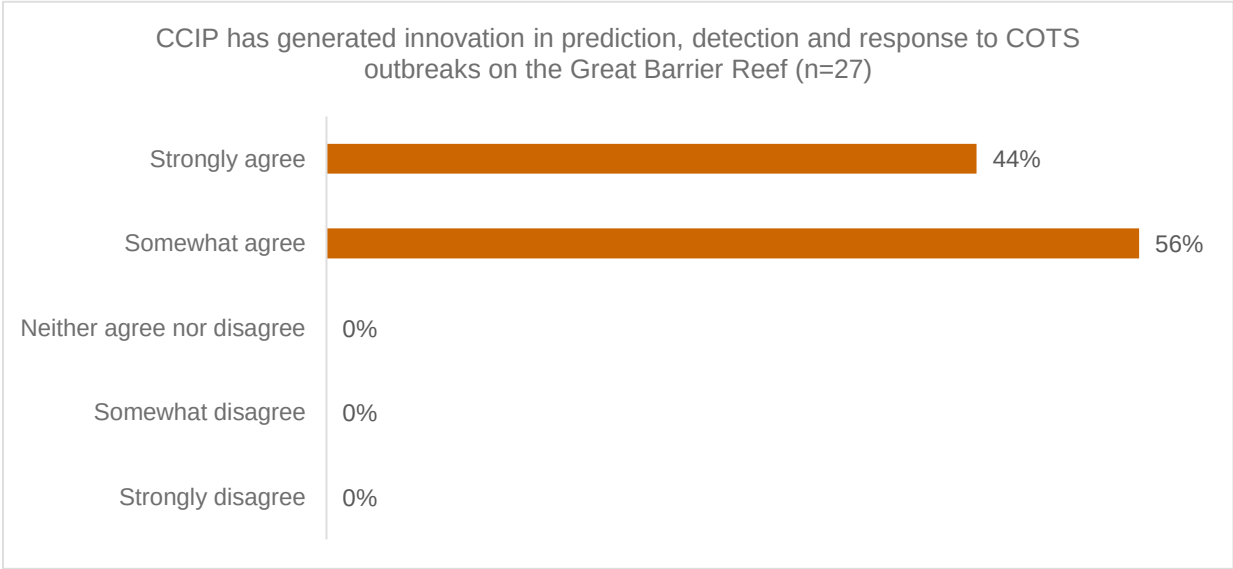
Most CCIP projects are also producing peer-reviewed journal articles. This is an ongoing process, with six manuscripts currently under review and 12 published to date. DOI links to published articles are provided in the table below.

All datasets produced by CCIP projects are being made publicly available under Creative Commons licensing to support ongoing innovation in Australia and globally.

CCIP is also leading a Special Issue in the journal *Coral Reefs* which will be used to share the Program's findings with the broader research community, both in Australia and internationally. The deadline for submissions is February 2025 (57).

Notably, all survey respondents (n=27) strongly agreed or somewhat agreed that CCIP had generated innovation in prediction, detection and response to COTS outbreaks on the Great Barrier Reef (Figure 7).

Figure 7. CCIP has generated innovation in prediction, detection and response to COTS outbreaks on the Great Barrier Reef (n=27)

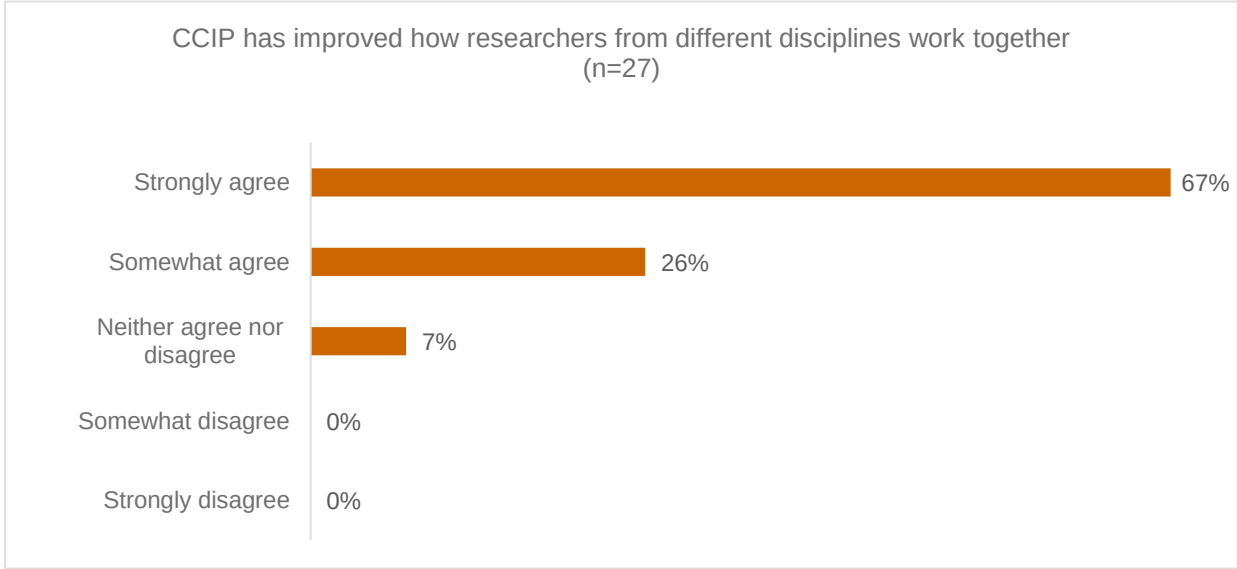


Project code Brief title Collaborators	Project outcome summary
Early Investment Projects	
CCIP-EIP-1 Semiochemical deployment AIMS, UQ, CSIRO, USC	This early investment project developed hydrodynamic models to understand the spatial and temporal footprint of semiochemical delivery around reefs, and, based on these, reviewed delivery strategies and systems for semiochemical biocontrol of COTS, building on applications developed for other aquatic organisms. Motti et al. 2022 Deployment of semiochemical control agents to manage Crown-of Thorns starfish populations (47)
CCIP-EIP-2 Initiation zone surveys JCU, AIMS	This early investment project conducted time-sensitive surveys in 2020-2021 to explicitly test for spatial variation in density, distribution and demography of COTS populations in different regions of the northern and far northern GBR. The immediate priority was to undertake detailed surveys in areas to the north of the perceived "initiation box", testing whether there was already emerging evidence of elevated COTS densities. Chandler et al. 2023 Increasing densities of Pacific crown-of-thorns starfish (Acanthaster cf. solaris) at Lizard Island, northern Great Barrier Reef, resolved using a novel survey method (37)
CCIP-EIP-3 Initiation zone water quality monitoring AIMS, CSIRO	This early investment project leveraged existing eReefs model outputs and water quality guidelines to conduct modelling scenarios that assessed whether improvements in land management are likely to deliver water quality improvements sufficient to reduce the frequency of outbreaks of Pacific Crown-of-Thorns Starfish. Kroon et al. 2023 The effect of catchment load reductions on water quality in the crown-of-thorn starfish outbreak initiation zone (48)
Prediction Subprogram	
CCIP-P-01 In-situ feeding rates	This project provided highly resolved feeding rates for COTS based on extensive field-based sampling, which are critical to population modelling and decision support for effective outbreak response. The project made use of new opportunities afforded by structure from motion (SfM) photogrammetry to effectively

		JCU, USYD, UTAS	account for the morphological variation and fine-scale complexity of different corals. Daily feeding rates varied greatly with the size of COTS and local availability of coral prey, with no apparent effect of local COTS densities. These results suggest that individual feeding rates are likely greatest during the early initiation of outbreaks.
		CCIP-P-02 Population collapse JCU, AIMS	This project intended to use a combination of field and laboratory experiments to determine the causes of abrupt population decline at the end of outbreaks, testing whether local depletion of prey resources results in subsequent starvation and reduced immunity against opportunistic pathogens. The project was terminated early after six-months due to the loss of the technical lead to another role overseas. The CCIP partners agreed to terminate the project due to lack of personnel with the required expertise to deliver the project.
		CCIP-P-03 COTS juvenile ecology and resilience USYD, CSIRO, AIMS, SCU, USC	This project investigated the behaviour, growth traits and biochemistry of juvenile COTS. It found that the juveniles have distinct chemosensory capabilities. They respond to olfactory information not previously encountered in their life exhibiting attraction to cues that signpost the location of their food/nursery area and the presence of live coral prey. They were deterred to cues from adults. Quantification and modelling of 8 growth traits revealed their potential application as age markers. Webb et al. 2024 Chemosensory behaviour of juvenile crown-of-thorns sea star (Acanthaster sp.), attraction to algal and coral food and avoidance of adult conspecifics (49)
		CCIP-P-04 Pre-outbreak monitoring JCU, AIMS	This project conducted extensive field surveys (using SALAD and eDNA sampling) to assess inter-annual changes in the abundance of COTS across the northern and far northern GBR. Elevated densities of large-sized COTS were documented in the Cape Grenville and Lizard Island regions, signifying the initiation of renewed population irruptions on the GBR. Because densities in the far north were detected prior to increases within the putative initiation box, these results challenge underlying paradigms regarding the location and cause(s) of outbreak initiation.
		CCIP-P-05 Benthic predation in rubble UQ, AIMS, SCU	This project identified 31 new juvenile COTS predators. The decorator crab, <i>Schizophrys aspera</i> , demonstrated the highest reported rate of predation on benthic COTS. COTS DNA was detected in ~15% of wild predators, which were inversely correlated with outbreaks at reef and regional scales. This confirms these newfound predators as important bioindicators of COTS outbreaks with their consumption of juveniles potentially accumulating to have disproportionate impacts on COTS population success. Desbien et al. 2023 Novel rubble-dwelling predators of herbivorous juvenile crown-of-thorns starfish (Acanthaster sp.) (50) Wolfe et al. 2023 Habitat and distribution of the red decorator crab, Schizophrys aspera, a cryptic crown-of-thorns seastar predator (51)
		CCIP-P-06 Fish predation rates and zoning JCU, SCU, UTAS	This project used standardised predation assays to assess differential risk of predation on adult COTS at reefs within different fisheries management zones. This research demonstrated that adult COTS are at substantially higher risk of predation at sites closed to fishing compared to sites open to fishing. The spangled emperor was identified as the foremost predator of adult COTS, highlighting a potential role for targeted fisheries management in mitigating outbreaks.
		Detection Subprogram	
		CCIP-D-01 COTS monitoring design CSIRO, AIMS, JCU, The Reef Authority	This project developed a monitoring strategy for COTS and coral that integrates information from a range of survey tools to guide decision making in the COTS Control Program. The strategy is focused on generating an unbiased, comprehensive dataset that captures both temporal and spatial variability in COTS populations, detects outbreaks early and will significantly improve the ability to evaluate program effectiveness in reducing COTS numbers and protecting coral outcomes.
		CCIP-D-02 Tool comparison CSIRO, AIMS, JCU	This project undertook an ambitious large-scale experiment, deploying the COTS and coral monitoring platforms side-by-side and developed statistical models to calibrate the estimates produced by each tool with each other relevant tool. These models, along with a qualitative tool comparison, will increase the ability to incorporate multiple sources of data into the decision-making process, reducing uncertainty and facilitating more informed management decisions, ultimately leading to improved coral protection.
		CCIP-D-03 Operationalising eDNA monitoring AIMS, CSIRO	This project developed methodologies and sampling strategies that utilise eDNA for early detection of COTS. We employed statistical modelling to refine sampling strategies and validated a standard operating procedure. Transfer of the research method to on-water operators including COTS control boat operators, tourist operators and Reef Joint Field Management Program was successful, demonstrating this new monitoring technique can be implemented as part of a wider monitoring program and tool for early detection. Thus, eDNA techniques to detect COTS developed here are highly versatile and can be adapted to a variety of operational applications, ranging from quantification at pre outbreak densities (early detection, several sites and replicated samples needed) to presence/absence determination once outbreaks are established or post culling (few samples peer reef/site needed).

			Uthicke et al. 2024 eDNA monitoring detects new outbreak wave of corallivorous seastar (Acanthaster cf. solaris) at Lizard Island, Great Barrier Reef (52)
		CCIP-D-04 The COTS surveillance system AIMS, CSIRO	This project is developing an end-to-end system for COTS and coral surveillance across the GBR, including an image-based towed survey platform, machine learning models, data workflows, and user interfaces. This system intends to deliver a major step-change in the accuracy, safety, and spatial scale of COTS outbreak surveillance. The project includes development and field testing of the technology alongside COTS Control Program vessel crews and managers to ensure the system is fit-for-purpose. Due to the complexity of the technology development, the project has been granted a six-month extension to provide additional time required to field-test, finalise and certify the three systems that will be delivered to the Control Program.
		Response Subprogram	
		CCIP-R-01 Information infrastructure CSIRO, JCU, UQ, QUT, The Reef Authority	Effective and innovative COTS control requires information from multiple places to be collated and analysed, and the interpreted outcomes to be delivered quickly and accurately to decision makers. This project designed and implemented the COTS Information System to: 1) increase efficiency by making data sharing easier; 2) increase effectiveness by delivering research results directly to managers; and 3) multiply innovation by sharing data and methods between researchers.
		CCIP-R-02 Empirical decision support CSIRO, JCU, The Reef Authority	The COTS Control Program uses data to make decisions and adaptively refine operations. This project provided four key areas innovations in the way data is used to improve efficiency and effectiveness: 1) automated data processing using Reusable Digital Workflows; 2) adaptive refinement of key Control Program parameters with empirical analysis; 3) research delivery using Manager Dashboards; and 4) on-water decision support using the COTS Control Centre app.
		CCIP-R-03 Reef-scale modelling CSIRO	This project modelled reef-scale COTS and coral dynamics to develop ecological thresholds responsive to variation in coral cover and COTS populations across reefs targeted by the COTS Control Program. Leveraging new empirical data, it evaluated management interventions and included synthesis of how management strategies may be evaluated to ensure control resources are not over-invested and effectively used under coral bleaching scenarios to achieve the best (and most robust) coral outcomes. Rogers et al. 2023 Improving coral cover using an integrated pest management framework (53) Rogers et al. 2024 Validating effectiveness of crown-of-thorns starfish control thresholds to limit coral loss throughout the Great Barrier Reef (58)
		CCIP-R-04 Regional modelling UQ, CSIRO	This project used two COTS-coral community models, CoCoNet and ReefMod, to identify COTS control strategies that would maximise the resilience of coral populations across the GBR. The study demonstrated that targeted and continuous COTS control significantly enhances coral cover and reef resilience. It also validated the effectiveness of current GBR-wide control strategies and highlighted the importance of dynamic, adaptive management to optimise resource allocation and improve outcomes for coral conservation. Castro-Sanguino et al. 2023 Control efforts of crown-of-thorns starfish outbreaks to limit future coral decline across the Great Barrier Reef (54) Skinner et al. 2024 Advancing projections of crown-of-thorns starfish to support management interventions (55)
		CCIP-R-05 COTS dispersal ensemble modelling JCU, QUT, CSIRO, UQ, UCL	The project has developed a novel approach to accounting for uncertainties at both the physical and biological level when estimating larval dispersal. By developing an ensemble of biophysical models, the project has focused on identifying and evaluating the uncertainties in each step required to estimate COTS dispersal in the GBR. This approach has focused on enhancing the accuracy, robustness, and applicability of dispersal predictions to support effective reef management and conservation efforts. The improved dispersal predictions are key to understand reef organism dynamics and underpin effective management strategies to preserve and restore this vital ecosystem. Choukroun et al. (2024) Larval dispersal predictions are highly sensitive to hydrodynamic modelling choices (59)
		CCIP-R-06 Cost effectiveness of control CSIRO, UQ, The Reef Authority	This project conducted an economic assessment of alternative scenarios to inform the strategic allocation of COTS Control Program resources. The project finds that targeted and continuous control generates a net benefit to the Australian people (allocative efficiency), with different benefit types (e.g., non-use, tourism) maximised under different scenarios. The results further suggest that which of the assessed scenarios generates the most value-for-money (cost-effectiveness) depends on the chosen management objective(s).
		CCIP-R-07 MCDA for reef prioritisation	This project developed a formal Multi-Criteria Decision Analysis (MCDA) framework to inform the prioritisation of reefs for control in the COTS Control Program. The project developed a formal method of incorporating multiple data streams, values and perspectives into prioritisation to: 1) innovate the quantity

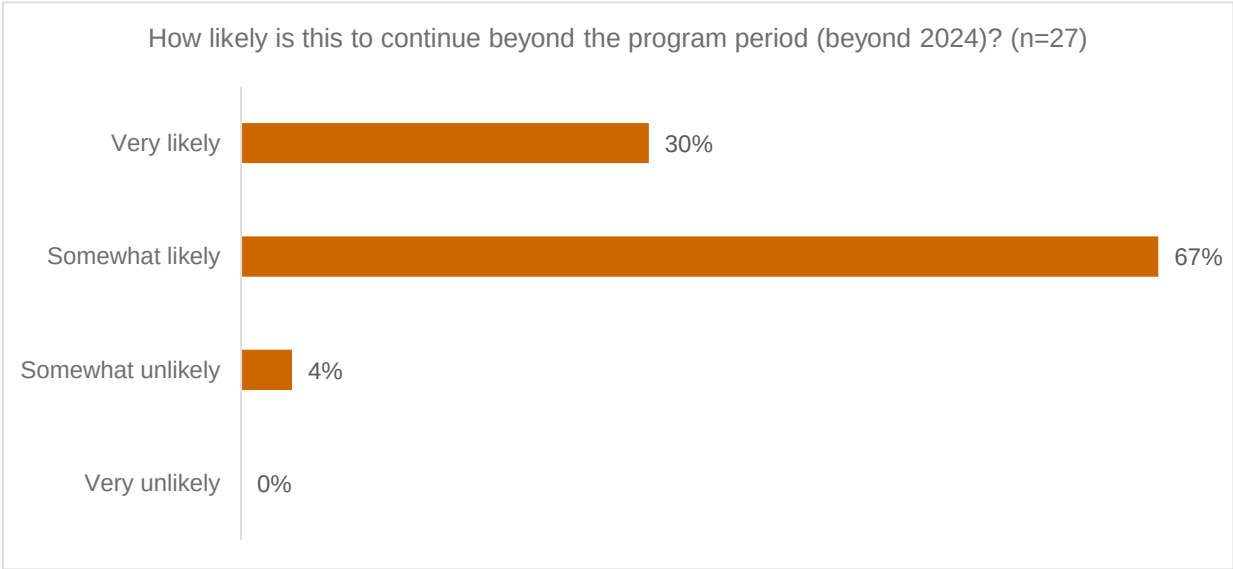
		CSIRO, QUT, The Reef Authority	and quality of data used for prioritisation; 2) innovate the repeatability and transparency of prioritisation, and 3) to include a broader cross-section of stakeholder values.
		CCIP-R-08 Stakeholder perceptions and co-benefits JCU, CSIRO	This project has collected baseline data on sociocultural perceptions of COTS as a native species, as well as its role as a significant pest in the Reef and beliefs about the need for COTS management, from a diverse range of Reef stakeholder groups. The project also explored attitudes towards possible control scenarios (predator control and the use of semiochemicals), with a focus on stakeholder perceptions of acceptability and risk. Lockie et al. 2024 Quantifying public support for culling crown-of-thorns starfish on the Great Barrier Reef (60)
		CCIP-R-09 Reef Traditional Owner co-design and values assessment JCU, CSIRO	The project developed a co-design approach for co-production to support delivery of two place-based case studies with Reef Traditional Owner research partners: (i) Ngana Muruk Junkurrjiku Janay (Standing up very strong together) Research and Management Protocol, (ii) Yadaba Darumbal Respect Protocol for Research and Management on Country. The protocols guide research and management to align with local community priorities and needs. The project also supported the training and employment of First Nation Research Assistants contributing to existing undergraduate Work Integrated Learning programs and sharing information with Indigenous COTS divers and sitting members of COTS advisory committees. The project highlighted the urgent need for meaningful and respectful relationships between Traditional Owners and all Reef stakeholders operating across Sea Country.
		CCIP-R-10 Fish predator conservation for biocontrol AIMS, CSIRO, UQ	This project used CoCoNet, a regional-scale model, to assess the efficacy of fish predator conservation scenarios (e.g. zoning, fisheries management) to control COTS outbreaks along the Great Barrier Reef. Simulations corroborated the benefits of the 2004 rezoning of the Reef in terms of increased fish predators and coral cover, and lower COTS densities. Additional COTS control sites may have the strongest potential to reduce COTS outbreaks in 20–30 years, yet forecasts indicate that the effects of climate change will ultimately have a greater influence on coral cover in the longer term.
		CCIP-R-11 Semiochemical biocontrol AIMS, UQ, CSIRO, USC	This project focused on understanding pheromones which are naturally occurring signalling compounds that are critical for species-specific aggregations. It established a novel pipeline for the discovery of aquatic animal semiochemicals, leading to the elucidation of adult COTS attractant pheromones. These pheromones hold exciting potential as environmentally friendly and economically efficient mechanisms for COTS control and monitoring, within an integrated pest management framework. Overall, the findings reinforce the immense potential of aquatic pheromones to overcome current and emerging problems with aquatic pests.
b. Were effective collaborations and governance model in place to design and deliver the CCIP? Performance measures: • Collaborative research partnership in place across research institutions • Number of technical experts engaged • Number of CCIP Steering Committee meetings	Achieved The collaborations and governance model enabled the effective design and delivery of the CCIP. A collaborative research partnership between leading Australian research institutions with expertise in delivering innovation in COTS surveillance and control was established to design and deliver the CCIP. The CCIP was underpinned by a governance model that included a Steering Committee to provide strategic oversight, which met 26 times. A Program Director oversaw day-to-day program management, and technical team leads drove the design and delivery of research projects. Most interviewees and survey respondents acknowledged the effectiveness of CCIP collaborations. This included collaboration between researchers and between researchers, managers and on-water vessel crews.	Collaborative research partnership A collaborative research partnership was established between GBRF, AIMS, CSIRO, JCU and UQ to design and deliver the CCIP. The Collaboration Agreement between these parties, which was executed on 13 May 2021 (38), fostered a cooperative and outcome-focused approach where multidisciplinary teams work across institutional boundaries to maximise impact and ensure the CCIP's findings are widely supported. 43 research scientists with expertise in a wide range of disciplines, including biology, ecology, genetics, engineering, machine learning, decision support, modelling, and social science, were engaged in designing and delivering the CCIP. Thirty-seven of these experts were from the four core partner institutions (39). An open EOI process was run from May to June 2020 to identify additional technical experts beyond the four core research partner institutions and this process resulted in experts from six additional organisations joining in the design and delivery of the program (39). About half of interviewees (4/9) commented on the effectiveness of CCIP's collaborative design process for setting up a collaborative environment (INT01, INT04, INT07, INT09). Three specifically noted that the process fostered positive relationships, and delivered a robust program informed by a range of expertise (INT04, INT07, INT09). <i>“CCIP had that 12-month design and feasibility phase that was quite distinct from the way that it had run under the previous research program. [...] So, it was very collaborative and we surfaced a huge a number of ideas and then collaboratively prioritised them and looked for synergies. That's probably the most extreme version of that that I've been involved with in my career. It really got proper buy-in and didn't feel like anyone had the reins to me. So, it's like everybody had an opportunity to contribute.” (INT09)</i> The CCIP was underpinned by a governance model that includes a Steering Committee to provide strategic oversight, a Program Director to oversee day-to-day program management, and technical team leads to drive the design and delivery of research projects across subprograms (41). The CCIP Steering Committee met regularly (26 meetings in total), and membership included representatives of the GBRF, AIMS, CSIRO, JCU and UQ, RRRC, The Reef Authority, DCCEEW, the tourism industry, and a Traditional Owner (24, 31). Three interviewees specifically commented on the governance group making a positive contribution to collaboration (INT02, INT04, INT08). <i>“It's gotten better because the shift into CCIP has engaged a wider range of groups in the governance and oversight of the R&D program. So, there's a much wider shared ownership and visibility across the different contributing partners as well as having the R&D</i>	

	providers around the table and that steering committee, you've also got managers and end users and others and so it just feels like it has this greater visibility.” (INT04) Effective collaboration Most interviewees (8/9) acknowledged the effectiveness of the CCIP collaboration (INT01, INT02, INT03, INT04, INT05, INT06, INT07, INT09). Most (7/9) noted that collaborative processes had already been established under NESP (INT01, INT02, INT03, INT04, INT07, INT08, INT09). However, more than half (6/9) also noted that the CCIP had led to greater collaboration than what had been achieved previously (INT02, INT03, INT04, INT05, INT06, INT07). Two interviewees specifically noted that the CCIP had helped create a ‘COTS practitioner community’ (INT02, INT03). <i>“I [have been] involved in research in this part of the world for 22-23 years. And there's often been a fairly fractious relationship between several different research organisations, government and university sector. So, something that's the CCIP did quite well is actually making everybody play in the same sandpit.” (INT01)</i> <i>“I think it's been one of the main benefits of this whole CCIP program is that it's led to much closer collaboration.” (INT03)</i> <i>“When we had this big showcase in April, the Reef Summit Symposium, it felt like you were in this big sort of collaborative family, and anyone who's doing research in that space has signed up for it because they know that this is for coming up with tools to inform management. [...] We have choices of what we work on and, if it's a highly collaborative kind of and approach, then we're much more likely to spend our time on that than on something else.” (INT03)</i> Changes in collaboration between researchers 93% (n=25/27) of survey respondents strongly or somewhat agreed that the CCIP improved how researchers from different disciplines work together. The remaining 7% indicated they ‘neither agreed nor disagreed’, with no respondents who disagreed (Figure 8). Figure 8. CCIP has improved how researchers from different disciplines work together (n=27)  <table><thead><tr><th>Response</th><th>Percentage</th></tr></thead><tbody><tr><td>Strongly agree</td><td>67%</td></tr><tr><td>Somewhat agree</td><td>26%</td></tr><tr><td>Neither agree nor disagree</td><td>7%</td></tr><tr><td>Somewhat disagree</td><td>0%</td></tr><tr><td>Strongly disagree</td><td>0%</td></tr></tbody></table> 93% (n=25/27) of survey respondents believed that improvements in how researchers from different disciplines work together were likely to continue in the future. The remaining 7% indicated this was ‘somewhat unlikely’, with no respondents who indicated this was ‘very unlikely’ (Figure 9). Figure 9. How likely is this to continue beyond the program period (beyond 2024) (n=27)?	Response	Percentage	Strongly agree	67%	Somewhat agree	26%	Neither agree nor disagree	7%	Somewhat disagree	0%	Strongly disagree	0%
Response	Percentage												
Strongly agree	67%												
Somewhat agree	26%												
Neither agree nor disagree	7%												
Somewhat disagree	0%												
Strongly disagree	0%												

		How likely is this to continue beyond the program period (beyond 2024) (n=27)? <table><tr><th>Response</th><th>Percentage</th></tr><tr><td>Very likely</td><td>30%</td></tr><tr><td>Somewhat likely</td><td>63%</td></tr><tr><td>Somewhat unlikely</td><td>7%</td></tr><tr><td>Very unlikely</td><td>0%</td></tr></table> Most interviewees (7/9) acknowledged the effective collaboration between researchers of different organisations and disciplines (INT01, INT02, INT03, INT06, INT07, INT08, INT09). <i>“I think that there's bit more tight collaboration across institutions for sure. And some people who might previously have worked together have found that they can work together, and those relationships will live beyond CCIP.” (INT07)</i> Two interviewees specifically commented on cross-institutional skills improving the quality of research (INT06, INT07). <i>“Through CCIP, we’ve really expanded the number of people from a range of different backgrounds, including social backgrounds, modelling oceanography, and those people bring a whole range of different perspectives. And now the program is much more a balanced view of a whole range of perspectives.” (INT07)</i> Changes in collaboration between researchers, managers, and on-water control crews 93% (n=25/27) of survey respondents strongly or somewhat agreed that the programs improved how COTS researchers, managers and on-water control crews work together. The remaining 7% indicated they ‘neither agreed nor disagreed’, with no respondents who disagreed (Figure 10). Figure 10. The programs have improved how COTS researchers, managers and on-water control crews work together (n=27) <table><tr><th>Response</th><th>Percentage</th></tr><tr><td>Strongly agree</td><td>70%</td></tr><tr><td>Somewhat agree</td><td>22%</td></tr><tr><td>Neither agree nor disagree</td><td>7%</td></tr><tr><td>Somewhat disagree</td><td>0%</td></tr><tr><td>Strongly disagree</td><td>0%</td></tr></table>	Response	Percentage	Very likely	30%	Somewhat likely	63%	Somewhat unlikely	7%	Very unlikely	0%	Response	Percentage	Strongly agree	70%	Somewhat agree	22%	Neither agree nor disagree	7%	Somewhat disagree	0%	Strongly disagree	0%
Response	Percentage																							
Very likely	30%																							
Somewhat likely	63%																							
Somewhat unlikely	7%																							
Very unlikely	0%																							
Response	Percentage																							
Strongly agree	70%																							
Somewhat agree	22%																							
Neither agree nor disagree	7%																							
Somewhat disagree	0%																							
Strongly disagree	0%																							

96% (n=26/27) of survey respondents believed that improvements in how COTS researchers, managers and on-water control crews work together were likely to continue in the future. The remaining 4% indicated this was ‘somewhat unlikely’, with no respondents who indicated this was ‘very unlikely’ (Figure 11).

Figure 11. How likely is this to continue beyond the program period (beyond 2024)? (n=27)



All interviewees acknowledged the effective collaboration between researchers and managers (INT01, INT02, INT03, INT04, INT05, INT06, INT07, INT08, INT09). One interviewee and one survey respondent specifically commented on the CCIP expanding the number of researchers who work with managers (INT07, S03).

“I think there's been a much closer, tighter relationship between many of the researchers, and to some extent with the management community as well.” (INT08)

Three interviewees specifically commented on the involvement of managers in the CCIP research setting a foundation for research outputs to be adopted into management in the future (INT01, INT02, INT06).

“The very close relationship with the manager and the operators, that's been quite distinctive. So, the researchers can see how their research is going to be taken up and used. And the operators and the managers can give really quite direct feedback to the research to help them focus their research on the most important things. So, I think that to me, they're probably the main ingredients of success.” (INT02).

Contributors to collaboration

More than half of interviewees (6/9) noted that the forums and workshops contributed to collaboration and information sharing (INT02, INT03, INT04, INT05, INT06, INT08).

“I think this is a special thing about CCIP is that we have these annual meetings of the whole project and in those meetings it's very common that will be having a conversation to somebody who's just got their data analysed on this thing and they will share that information with us even if it's not yet published. And that's pretty rare in science that people are willing to do that. And it takes a certain amount of trust, and I think this is where having a longer-term investment in the partners working together means that you build those relationships that can make this thing much more efficient than it would otherwise be.” (INT03)

“When I see those groups of people getting together, it's really positive. There's a lot of good energy in the room. There's a lot of honest conversation about, ‘that's all well and good, but I don't know what to do with that or I don't know how to make that work or thanks for that, but could we tweak it?’ (INT05)

Three interviewees noted that having management and on-water control crew staff with a science background and a deep appreciation for the science had contributed to effective collaboration (INT02, INT03, INT06).

“A lot of the people in the vessels are scientifically trained, they got people with marine PhD's. That's unusual. It means that they're really interested in the research, they're educating their own staff, and they're educating the public.” (INT06)

		<i>“I have previously worked in Commonwealth government where a lot of the people working on these management areas are not trained scientifically, and so don't necessarily appreciate the outcomes of science as much as the COTS control program currently do.” (INT06)</i> Gaps in collaboration While most acknowledged the effectiveness of the CCIP collaboration, one interviewee raised that collaboration arrangements between managers and researchers could be confusing at times (INT01). <i>“It can be a little bit confusing at times, who's responsible for what and what the timelines look like. There can be pressures that come from both sides that make it awkward.” (INT01)</i> Future of collaboration About half of interviewees (5/9) believed that collaborative systems were well set up to continue in the future (INT02, INT03, INT04, INT05, INT07). <i>“I think the bond and their professional relationships will certainly outlast the CCIP program itself and continue to have benefits and same for the managers that those researchers are working with, a lot of them will continue to do so no matter where their funding comes from.” (INT07)</i> However, several survey respondents (7/27) provided additional commentary on the risk of collaboration not enduring after the conclusion of the CCIP (S01, S02, S03, S04, S08, S23, S26). Several respondents (5/27) independently raised that funding was a key element sustaining the collaboration (S02, S06, S08, S23, S26). <i>“Good collaboration often depends on specific contexts and individuals, which takes some time to establish. With the CCIP ending there is a risk that these collaborations also end.” (S01)</i> <i>“Building relationships is important and CCIP has done this. Everyone is under pressure to perform though, and researchers must source external funds to support their work. Without additional funding for COTS research, they will drift into other areas which will impact their ability to keep working together and with managers on COTS.” (S06)</i>
c. To what extent were the benefits, costs, feasibility, and risks of potential research opportunities considered and prioritised in order to design the Innovation Program? Performance measures: - Number of research opportunities identified, and their benefits, costs, and risks assessed - Number of expert workshops delivered to assess research opportunities - Research portfolio prioritisation workshop	Achieved The benefits, costs, feasibility, and risks of potential research opportunities were considered and prioritised to design the CCIP. The CCIP design phase engaged 43 technical experts who worked collaboratively to identify, develop, and prioritise innovations in COTS control and surveillance, considering the benefits, costs, feasibility, and risks of potential research opportunities. Full proposals and budgets were developed for 21 research projects, prioritised from over 300 knowledge and capability gaps identified. A total of five expert workshops were delivered to review, discuss, and refine the research opportunities followed by a workshop to prioritise the research portfolio. The RTP invested approximately \$8.6M in the 21 R&D Phase projects across the Prediction, Detection, and Response Subprograms. Three Early Investment Projects were also funded using underspend from Design Phase activities. Three interviewees independently noted the quality of the design process, with two	CCIP design phase The design phase of the CCIP was completed in 2020-2021, supported by an investment of \$1.5m (39, 40, 41). The design phase focused on assessing the benefits, costs, feasibility, and risks of research opportunities that could potentially deliver innovations in COTS surveillance and control, prioritising the most promising research opportunities for investment in the 3-year R&D Phase (39). The CCIP design phase engaged a total of 43 technical experts, including 37 from four core partner institutions and six from third parties. The technical experts worked collaboratively to identify, develop, and prioritise innovations in COTS control and surveillance, considering the benefits, costs, feasibility, and risks of potential research opportunities. Full proposals and budgets were developed for 21 research projects, prioritised from over 300 knowledge and capability gaps identified. A total of five expert workshops were delivered to review, discuss, and refine the research opportunities followed by a workshop to prioritise the research portfolio (39, 40). The RTP invested approximately \$8.6M in the 21 R&D Phase projects across three subprograms of research to boost capability in prediction, detection, and response to outbreaks. CCIP research partners from AIMS, CSIRO, JCU and UQ co-invested approximately \$7M in the R&D program (41). The three sub-programs were: - The Prediction Subprogram would deliver new knowledge of when, where and how outbreaks develop in order to inform effective and efficient early detection and response across a total of 6 projects, with an investment of \$1.743m or 21% of the overall R&D program budget. - The Detection Subprogram would deliver a step-change in monitoring and surveillance strategies, tools and technologies for efficient early detection of outbreaks, in order to inform effective outbreak response across a total of 4 projects, with an investment of \$2.49m or 30% of the overall R&D program budget. - The Response Subprogram would deliver innovation in outbreak response models, strategies and decision support tools, with exploration of the technical, cultural, social and regulatory feasibility of selected novel control methods (e.g. semiochemicals) across 11 projects, with an investment of \$3.237m or 39% of the overall R&D program budget. During the Design Phase, three Early Investment Projects were also funded using underspend from the Design Phase activities. These three projects filled urgent knowledge gaps and reduced risk for the CCIP R&D phase (31). Three interviewees independently noted the quality of the design process (INT04, INT06, INT07), with two interviewees commenting on the appropriate allocation of ‘applied’ and ‘innovation’ research projects in the program design (INT04, INT06).

	who commented on the appropriate allocation of ‘applied’ and ‘innovation’ research projects in the CCIP.	<i>“CCIP has thought really carefully upfront about what the higher order goals are and how we organise the program and how teams are going to work together to achieve different outcomes.” (INT04)</i> <i>“There's a very clear ‘research for applied benefit’ focus, but there's also been a sense of ‘look we need to make sure we're pursuing innovation by discovery and not just innovation through action learning’.” (INT04)</i> One interviewee noted that the CCIP Program Director, who had work experience at the Reef Authority, understood the needs of reef managers well. This helped ensure the CCIP design effectively addressed those needs (INT01). <i>“We're quite fortunate in the Program Director, someone who had worked at the Reef Authority for several years and actually knew the program very well. She had intimate knowledge of this program and what's required.” (INT01)</i> However, one interviewee believed the CCIP program design process wasn't inclusive enough of COTS managers (INT08). The same interviewee felt that the design did not sufficiently account for the time that The Reef Authority would need to dedicate to the CCIP (INT08). <i>“I think that the work program for the design of that program was driven too much by the research scientists and not enough by the managers. There hasn't been enough recognition of the needs of the delivery partner and the management agency in the design.” (INT08)</i> <i>“There was a very significant lack of recognition of the Marine Park Authority within the costing of the research programs and what I mean by that is not necessarily in terms of the funding, but actually the time requirements to be able to contribute.” (INT08)</i>
d. Were CCIP R&D Phase activities delivered as planned? Performance measures: Extent to which CCIP R&D Phase project milestones and deliverables were delivered on time and as planned.	Achieved All CCIP R&D Phase activities were delivered as planned, with some minor and strategic adjustments. As of June 2024, 19 out of the 21 R&D Phase projects had been completed. One project was terminated early due to the departure of the Project Lead and another technically complex project received a six-month extension and will finish in December 2024.	CCIP project delivery The CCIP Investment Plan (41) was operationalised in 2021-2022 with all 21 R&D phase projects starting during that year and continuing through 2022-23 and 2023-24 (38). Overall, the R&D Phase engaged 92 experts from 11 institutions in the delivery of 21 projects. Each project had an approved workplan (38) and progress in achieving milestones and deliverables was tracked through six-monthly reporting cycles (11). The Program Director reported to the CCIP Steering Committee on progress, highlights and issues at each Committee meeting (31) throughout the duration of the R&D Program which concluded in June 2024. Any delivery issues arising were identified early and managed collaboratively across the team. As of June 2024, 19 out of the 21 R&D Phase projects had been completed. One project (CCIP-P-02) was terminated early due to the departure of the Project Lead and another technically complex project (CCIP-D-04) had received a six-month extension and will finish in December 2024 (31). Three interviewees specifically commented on the Program Director being key to keeping delivery on track and well-coordinated (INT04, INT06, INT07). <i>“The commitment that the Program Director has had in keeping the ship together and making sure that delivery was coordinated and sequenced and it wasn't just shotgun projects happening all over the place was important.” (INT04)</i> CCIP research impact planning A <u>Research Impact Plan</u> (42) was developed to support delivery of the complex research portfolio and ensure the multi-disciplinary team was aligned on delivering a suite of research outputs across seven key areas to improve the capability of the COTS Control Program to predict, detect and respond to outbreaks: - An expanded toolbox for COTS detection including eDNA, robotics and machine learning, along with a plan for coordinated deployment of these tools alongside existing methods. - New methods for control identified and trialled, with a focus on the identification and testing of pheromone attractants to enhance culling efficacy and identification of fisheries management strategies for biocontrol. - Enhanced modelling capability developed to refine the ecological thresholds used in culling, more accurately predict highly connected reefs, and identify vessel fleet deployment strategies that maximise the benefits of COTS management under climate change. - Targeted Decision Support Tools developed to support early warning of outbreaks, prioritisation of reefs for management, and more cost-efficient on-water operational response. - Improved empirical understanding of COTS–coral dynamics and the role of predators in suppressing outbreaks, to improve modelling predictions and shed new light on the drivers of outbreaks. - New knowledge of social perspectives and Traditional Owner values related to COTS management, and a socio-economic assessment of the impact of COTS control for Reef communities. - High quality data from across the research program generated, processed, and integrated into management decision-making tools, while also driving further innovation.

		CCIP workshops and forums Throughout the CCIP, workshops and forums were convened regularly to support research delivery, share knowledge and foster collaboration across researchers, COTS managers, and key stakeholders from the tourism industry and Traditional Owner groups. These included: COTS Control Forum (March 2021) The Forum provided an opportunity to review and discuss the current state of knowledge for COTS IPM control and opportunities for innovation (4). With in-person attendance by 105 delegates, the event brought together a diverse group of stakeholders, promoting cross-sector dialogue across domestic and international researchers, reef managers, control program vessel crews, tourism industry representatives and Reef Traditional Owners (10). CCIP Innovation for Impact Workshop 1 (October 2022) The workshop aimed to connect the COTS innovation community, share and celebrate research progress, identify opportunities for collaboration and integration, and map collective pathways to impact and actions to achieve them. The workshop was attended by 44 participants. It surfaced insights and proposed actions for on-water engagements, research integration with COTS Control Program planning, technical synergies and coordination between CCIP projects, and program impact and continuity (1). Using insights from this workshop, a CCIP Research Impact Plan (42) and a detailed Program Logic were developed (2). CCIP Innovation for Impact Workshop 2 (May 2023) The workshop aimed to connect and share progress within the COTS Innovation community, strengthen critical synergies and integration across COTS Innovation Program projects, map out synergies with other programs and identify opportunities for further integration. The workshop was attended by 50 participants. It surfaced insights and proposed actions for technical synergies and coordination between CCIP projects, and program impact and continuity (2). CCIP Innovation for Impact Workshop 3 (November 2023) The workshop aimed to connect and share CCIP progress across the COTS community, strengthen critical synergies and integration across CCIP projects, and strengthen management interfaces and plan for the translation of outputs to COTS management outcomes. The workshop was attended by 55 participants. It surfaced insights and proposed actions for integration and collaboration across research and with COTS management, capacity building, engagement and communities of practice, knowledge and data, and communications for impact. Together the attendees identified 147 opportunities for translation of research outputs into the COTS Control Program (3). Reef Resilience Symposium (April 2024) The Symposium provided an opportunity to connect, share learnings, identify future priorities, and consider how stakeholders might work more effectively to meet current and future challenges. The program included over 120 speakers, touching on cross-cutting themes including innovation in coral reef protection and restoration, cross-sector partnerships and collaboration, and First Nations leadership and local stewardship (5). The program included 20 presentations showcasing CCIP research, including a co-plenary on collaborations across COTS research and management.
e. To what extent did the COTS Control Innovation Program develop new knowledge, tools, technologies and methods to be trialled or implemented? Performance measures: Number and type of new knowledge, tools, technologies and methods developed	Achieved The CCIP was designed to develop new knowledge, tools, technologies, and methods to be trialled and/or implemented. The CCIP Project Outputs Register identifies more than 100 outputs from the CCIP research that can be trialled or implemented in COTS management. The trialling and implementation of research outputs in COTS management has begun and is planned to continue in 2024-2025, with \$1.7M in additional funding secured for a CCIP bridging year that will support research translation activities.	CCIP research translating to management The CCIP Project Outputs Register (6) identifies >100 outputs (i.e. new knowledge, tools, modelling capabilities, technology, plans, recommendations) that can be trialled or implemented in COTS management. The trialling and implementation of research outputs in COTS management has begun and is planned to continue in 2024-2025, with \$1.7M in additional funding secured for a CCIP bridging year that will support research translation activities (31). The future integration of these outputs into management was well planned. During the third Innovation for Impact workshop in November 2023 over 50 researchers, managers, Traditional Owners and other stakeholders worked together to map the planned research outputs into COTS Control Program systems and processes (3). Together the attendees identified 147 opportunities for translation of research outputs into the COTS Control Program including: 16 outputs that can improve Governance, Engagement and Communications. 34 outputs that can improve the COTS Strategic Management Framework. 26 outputs that can improve Annual Reef Prioritisation Process. 24 outputs that can improve the Integrated Pest Management Framework. 21 outputs that can improve On-Water Operations and Data Collection. Data from the survey and interviews support this finding. 85% (n=23/27) of survey respondents strongly agreed or somewhat agreed that CCIP research outputs have a clear pathway to real-world impact. 7% indicated they 'neither agreed nor disagreed' and 7% indicated they 'somewhat disagreed', with no respondents who strongly disagreed (Figure 12). Figure 12. CCIP research outputs have a clear pathway to real-world impact (n=27)

		CCIP research outputs have a clear pathway to real-world impact (n=27) Strongly agree 44% Somewhat agree 41% Neither agree nor disagree 7% Somewhat disagree 7% Strongly disagree 0% Three interviewees specifically noted the clear pathway to impact of the CCIP research (INT01, INT02, INT04) and about half (4/9) commented on the strong foundations in place to drive the future uptake of CCIP research into management including the collaborations in place and the output mapping process that was conducted (INT01, INT04, INT06, INT09). <i>“There’s quite a clear pathway and that’s historically been quite rare.” (INT01)</i> <i>“If you’re going to achieve that step, change the ways of working. That CCIP has continued and improved over the last four years. Multidisciplinary teams, strong partnerships with managers and deliverers. Outcomes-oriented research design. All of those factors are essentially what’s going to lead to the step change.” (INT04)</i> <i>“CCIP put a bit of energy over the last 12 months into integration mapping of the various outputs. Where would they go and how would how would we integrate them. I think that was a great exercise.” (INT01)</i> Trialling and implementation of research outputs in COTS management As mentioned above, the trialling and implementation of research outputs in COTS management has already begun and is planned to continue in 2024-2025 using additional funding secured for a CCIP bridging year (31). About half of interviewees (5/9) and one survey respondent noted that while the CCIP projects had produced a range of useful outputs for management, it is normal that most of the translation process would occur after the conclusion of this phase of the CCIP (INT02, INT03, INT05, INT07, INT09, S23). Innovation projects especially, need more time to provide tangible management outputs (INT02, INT05, INT07). <i>“There’s a number of research outcomes or outputs that are on the cusp of making a big difference.” (INT09)</i> <i>“I think we just need to recognise that some of the outcomes and impacts are coming in the next year because that’s the nature of what we’re doing, there’s a lag.” (INT02)</i> <i>“If you’re just doing research to support the on-ground control boats, then you would expect a fairly short distance to uptake. Whereas the blue-sky stuff, the process for uptake is very different and it may take many years before it gets taken on and it may not happen at all, which happens in research too, it doesn’t make the research invalid.” (INT07)</i> <i>“I think there is some great progress, but some of the lines of innovation they’re not fully mature yet. There is not a finished product and we’ve now got a year of transition funding and if we can secure ongoing funding and maintain the collaboration that the program has demonstrated, there is a very great future for this.” (INT05)</i> Still, some initial outputs of CCIP research were already being trialled or implemented in COTS management: • The new survey methods deployed in the early investment project CCIP-EIP-02 provided an early warning of the fifth primary outbreak wave initiating on the Great Barrier Reef (37). In response to this new information, the COTS Control Program mobilised additional vessel capacity in early 2022 to suppress the emergence of the primary outbreak (9). <i>“One of CCIP’s Early Investment Projects has been trialling new survey methods that have contributed to the detection of the fifth primary outbreak. The research team brought together expertise from JCU and AIMS to deploy two new methods for monitoring low-</i>
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		density COTS populations—scooter-assisted surveys and eDNA sampling. In October through December 2021, the team undertook intensive monitoring across 14 reefs in four key regions across the Northern and Far Northern Reef where outbreaks are hypothesised to initiate. Their findings suggested that COTS numbers were already beginning to increase, and on several reefs in the Far Northern Reef they were already approaching outbreak densities. This information corroborated reports of higher than usual COTS densities emerging in the initiation region from surveys conducted by the AIMS Long-term Monitoring Program and the Reef Joint Field Management Program. Collectively, the data and observations coming in from multiple sources verified that the fifth primary outbreak had begun to develop. The COTS Control Program acted quickly in response to this new information, mobilising two additional surge vessels in early 2022 to boost the Program’s capability to suppress the emergence of the primary outbreak. The CCIP research team has continued to conduct monitoring in these regions in 2021-2022 and 2022-2023 and is supplying the data to the Control Program to inform ongoing response planning. This monitoring data is also being integrated with CCIP modelling innovations into a new decision support tool called the Early Warning System. This Early Warning System intends to identify when and where there is increased risk of COTS outbreaks, enabling rapid response by the Control Program which is expected to boost the benefits of COTS control at regional scales.” (9) • The new COTS Information System developed in project CCIP-R-01 is being rolled out across research and management organisations (e.g. The Reef Authority, CSIRO, JCU, AIMS). This system intends to break down data silos and facilitate the exchange and processing of field and modelled data to accelerate innovation and inform management decision-making (46). • The comparison and calibration of new COTS detection tools delivered in project CCIP-D-02 was conducted in partnership with COTS Control program vessel crews and Marine Parks rangers, enabling end-users to get first-hand experience in using the new methods (9). <i>“In March 2023 a major fieldtrip was delivered to trial and calibrate new COTS detection tools (e.g. COTS Surveillance technology, eDNA, scooter surveys) alongside existing methods currently used in COTS management (e.g. manta tow, cull dives). This trip was a major collaborative effort, with two large vessels, 7 organizations and 24 researchers, managers and COTS control crew members working together to deliver the research objectives. There was significant in-kind support from the COTS Control Program and Queensland Parks and Wildlife Service, who were able to learn about the new methods and trial them in an operational setting. Calibration data was collected at 16 sites across 7 reefs and is being analysed to inform the design of a multi-tool monitoring program.” (9)</i> About half of interviewees (4/9) also shared examples of innovative knowledge, tools, technologies and methods developed under CCIP that were already being used to improve COTS control. Examples included: • IPM framework and model improvements (e.g., regional scale and economic models, COTS and coral larvae models, COTS feeding rates models) (INT01, INT03, INT04, INT09). <i>“The program has been really important in the ongoing refinement and improvement of that IPM framework and the environmental informatics and decision support work.” (INT04) referencing projects CCIP-R-01 and CCIP-R-02</i> <i>“Some of the really interesting stuff is the regional scale modelling work that's been done. There's also economic modelling associated with looking at the cost benefit of doing operational control effort on the reef.” (INT01) referencing projects CCIP-R-04 and CCIP-R-06</i> <i>“There's been fantastic work done on the dispersal and connectivity of both crown-of-thorns starfish larvae and coral larvae. So that's the most advanced 3D biophysical modelling that's been done to date for crown-of-thorns starfish and it's actually quite a step change in resolution and confidence that we have in the models. [...] Certainly, the larvae connectivity we've got plugged into the reef prioritisation process for the 24-25 financial year. So, the old model outputs that we used have been substituted for the new ones.” (INT01) referencing project CCIP-R-05</i> <i>“There's been some really good foundational biology and ecology done on feeding rates of COTS. That allows us to potentially refine the ecological threshold that we're looking to achieve when we deploy control effort on the reef, how far we have to push populations down before there is sustainable levels where coral growth can outpace the rate at which the starfish are eating it. There's some interesting modelling that's been done around that.” (INT01) referencing project CCIP-P-01</i> • A tool allowing vessel crews to compare the results of different monitoring methods (INT06). <i>“We've made a tool, a piece of code that allows managers to use that information so that when they're trying to compare COTS densities across the reef, which for various reasons are collected using all different monitoring tools, they're able to make a direct comparison between the different data types.” (INT06) referencing project CCIP-D-02</i> • New knowledge on the most efficient number of boats to use for COTS control (INT03). <i>“One of the outstanding questions that we addressed was ‘how many boats should you have for COTS control?’. We did an analysis survey. ‘Well, if you increase the number of boats, what does the return look like in terms of improved reef health, coral cover?’ I've heard people from the Reef Authority trot out those results numerous times to argue that it's not like we're anywhere near getting to</i>
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		<i>the point where you saturate the benefits. So extra boats mean extra value. So that was like an important outcome.” (INT03) referencing project CCIP-R-04</i> Enablers to the uptake of CCIP research into management Three interviewees specifically noted that the Research Translator role had been key in enabling the uptake of research into management so far (INT04, INT06, INT09). <i>“One of the big things we did was put on a dedicated research translation position that that acted as a point of contact between the researchers and managers. That’s the most comprehensive example of that I’ve ever seen in my career. It’s worked really well.” (INT09)</i> Barriers to the uptake of CCIP research into management Interviewees raised several barriers to the uptake of CCIP research into management including: - The limited resourcing of reef managers to incorporate CCIP research into their work (INT02, INT06, INT08, INT09). <i>“An issue that we need to confront is that the Reef Authority isn’t necessarily resourced to accept all the research that it’s getting and act on it.” (INT02)</i> - The lack of knowledge and skills among researchers for driving the uptake of their research (INT01). <i>“I think the researchers are often very good at doing the research work. They’re often not very good at thinking about the process beyond the development of that tool or technology or knowledge into operations.” (INT01)</i> - The limited flexibility to adjust the research agenda to focus on the research found most important to managers (INT08). <i>“One of the outputs from CCIP has been the now confirmed understanding that we have a lower frequency of COTS outbreaks in areas that are no take. Now that’s really important from a management agency point of view, but because those findings came on stream part way through the CCIP program, even though the management agency is going, ‘that’s the most important thing you’ve found. Now let’s drill into that’, there was no capacity to do it because the program was already set.” (INT08)</i>
4. Long-term funding strategy		
a. To what extent has a strategy for long-term funding been made available for influencing/advocacy?	Achieved In January 2022, The Reef Authority secured \$162M from the Australian Government to continue delivering the COTS Control Program through to 2030. As a result, advocacy efforts were shifted to developing the <i>2030 COTS Research and Innovation Roadmap</i> to secure additional funding for the CCIP. The Roadmap set out agreed priorities for COTS research and innovation and advocated for an investment of \$2M per year to address the most important research and innovation priorities, with \$2-4M per year addressing all priority areas. The Roadmap was endorsed in December 2023. In June 2024, DCCEEW approved the use of \$1.7M in RTP funds for a bridging year for the CCIP.	Long-term funding and roadmap Long-term funding for the COTS Control Program was secured until 2030. In January 2022, the Australian Government announced \$162M for ongoing delivery of the COTS Control Program until 2030 as part of its Reef Protection Package (28). This addressed the issue of lack of ongoing funding for the COTS Control Program beyond the end of the RTP. Following the funding announcement, this activity was re-focused on securing ongoing investment in COTS research beyond the end of the RTP and the <i>2030 COTS Research and Innovation Roadmap</i> was developed. The Independent Chair of the CPG and CCIP Steering Committee led the development of the Roadmap in close consultation with the members of these governance groups. This Roadmap sets out agreed priorities for COTS research and innovation and presents a business case for future investment (7). The process included a desktop assessment of the COTS research and innovation priorities that emerged from CCIP, in consultation with the Program Director and subprogram leads and stakeholder interviews with institutional leaders across the Reef Authority, RRRC, AIMS, CSIRO, JCU, UQ to understand the range of views on COTS research and innovation priorities into the future (7). The Roadmap sets out the key research priorities for investment until 2030, including data and decision support systems, monitoring and surveillance technology, ecological and economic modelling, Traditional Owner research priorities, targeted biology and ecology, new control methods, interactions between COTS control and climate change, and outbreak dynamics and drivers of collapse (7). This Roadmap recommends an investment of \$2-4M pa in research and innovation out to 2030, to complement the approximately \$20M pa investment in the COTS Control Program. The Roadmap highlights the strong Return on Investment from funding research that drives further improvements in the efficiency and effectiveness of the COTS Control Program (7). The members of the CCIP Steering Committee and the COTS Partnership Group unanimously endorsed the Roadmap’s recommendations in late 2023 (31, 30) and the document was subsequently used by partners to advocate for future funding. In June 2024, DCCEEW approved the use of \$1.7M of RTP funds to secure a transition year for CCIP (31). This funding will support two major activity streams in 2024-25: Research Translation projects - Scoping and delivering new projects focused on translating and operationalising high priority CCIP outputs for use in COTS management. This could also support final work to integrate outputs across research projects or fill urgent gaps.

- Future R&D Program Planning – designing a five-year R&D program and developing a detailed investment case, building on the recommendations of the 2030 COTS Research and Innovation Roadmap.

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RRAS RESULTS TABLE

Introduction

This document presents the Results Table for the Reef Restoration and Adaptation Science (RRAS) Component, developed as part of the 2024 End-of-Portfolio (EOP) Evaluation of the Reef Trust Partnership (The Partnership). This document has been collaboratively developed by the evaluators (Clear Horizon) and the Great Barrier Reef Foundation (GBRF) RRAS Component director.

As outlined in the EOP Evaluation Project Plan (Clear Horizon, 2024), this Results Table presents the RRAS component specific findings and evidence that will be used to respond to Key Evaluation Question 3: *‘To what extent did the Partnership contribute to a significant and measurable improvement in the health of the Great Barrier Reef World Heritage Area (The Reef)... underpinned by innovation, science and community engagement?’* and is the focus of the independent expert review process.

The following Results Table presents the evaluations findings and supporting evidence structured against the component specific evaluation questions and rubrics used to inform assessments of component performance (detailed in p9-10). The evaluation questions and corresponding rubrics are shown in Table 1 and have been drawn from the RRAS Component Monitoring and Evaluation (M&E) Plan (p.54 – 63, RTP M&E Plan, GBRF 2022). All evidence cited is presented in the reference list (p7).

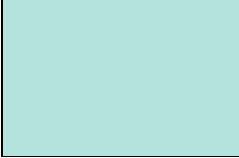
Table 1. RRAS Component Evaluation Questions

RRAS Component Evaluation Questions	Performance criteria
1. To what extent has the RRAS component delivered a toolbox of restoration and adaptation techniques ready for investment in implementation, which are ecologically effective, and deployable at a range of scales?	See Rubric in Table 2
2. To what extent is Australia recognised internationally as leading coral reef restoration science?	See Rubric in Table 3
3. To what extent has the RRAS component implemented new pathways for Traditional Owner education, employment and enterprises across RRAS research and delivery activities?	Indicators: • Number and nature of involvement of Traditional Owners in RRAS activities • Number of RRAS projects involving or led by Traditional Owners
4. To what extent has the RRAS component established strong, transparent, inclusive, and effective governance and program management?	See Rubric in Table 4

RRAS End-of-portfolio evaluation overview table

Evaluation questions and performance criteria (from 2021 revised M&E Plan)	Findings	Evidence sources
To what extent has the RRAS component delivered a toolbox of restoration and adaptation techniques ready for investment in implementation, which are ecologically effective, and deployable at a range of scales? <i>Summary of rubric (see Table 2 below)</i> <i>The toolbox of restoration and adaptation techniques is:</i> - Logistically feasible and able to be deployed at reasonable scales to have at least local impact [Adequate] and production techniques have been demonstrated that are compatible with impact on a larger scale [Good] - Culturally appropriate [Good] - Socially acceptable and supported by Reef stakeholders and communities [Good] - Supported by effective and robust regulatory frameworks and permission systems. [Good]	The RRAS component has delivered a toolbox of RRA techniques ready for investment in implementation to a good extent. RRAP was designed in 2019 as a 10-year journey and the progress made towards end of program outcomes during the RTP funding period (2020-2024) is appropriate. RRAP has researched, developed and tested a range of interventions, leading to the identification of two intervention strategies ready for pilot deployment (at scale) from 2025-2026. These interventions are <i>Conservation Aquaculture</i> and <i>Coral Slick and Larval Reseeding</i>. Supported by the Translation to Deployment subprogram, focusing on capacity building, logistics modelling and enabling engineering activities, RRAP has secured funding to plan and deliver these targeted pilot deployments across three Reef locations, and is putting in place a regulatory approval plan with the Reef Authority which will cover risk, social licence and Traditional Owner consent and participation. Two additional intervention strategies, focusing on protection by reducing solar radiation (and associated heating), have demonstrated strong potential, including in the field. These are referred to as <i>Marine Cloud Brightening</i> and <i>Fogging</i>. Both will require further development and social engagement & research to achieve cost/energy targets and social licence. In parallel, RRAP has conducted significant social research, Traditional Owner and community engagement, to assess the support for its interventions and to develop place-based implementation pathways. Significant training and capacity building programs for industry and Traditional Owners have started for more mature interventions, in support of proposed pilot deployments.	The RRAP Impact Report 2020-2024 [1] provides an overview of program achievements during the first phase of R&D funded by the Reef Trust Partnership. An overview of RRAP Outcomes was also provided to the Reef 2050 Independent Expert Panel at their April 2024 meeting [2]. Since 2018, RRAP has investigated new intervention pathways that could help coral reefs withstand an increase in the frequency and intensity of marine heatwaves. RRAP is pursuing novel intervention strategies in all three areas of <i>Protection</i>, <i>Recovery</i> and <i>Assisted Adaptation</i>, as summarised in the table below. Factsheets [3,4,5,6,7,8] referenced and hyperlinked included in the table below were produced as explainers in 2022 and interventions have evolved significantly since. Conservation Aquaculture and Coral Slick and Larval Reseeding are the more mature interventions that are scheduled to be piloted at the scale of multiple reefs from 2025-26. These interventions, piloting considerations and the framework applied to evaluate their readiness is described in RRAP Pilot Scale Deployments Concept Design V3.0 [9]. Sections below describe the type of interventions developed (toolbox), as well as enabling frameworks and systems to ensure effective translation to deployment, Traditional Owner and community support, regulatory approval and appropriate risk management. <u>Moving from a toolbox of techniques to intervention pathways</u> Reef Interventions are an essential part of the management of the GBR. In general terms, best-practice ecosystem management relies on a combination of removing threats and pressures where possible, mitigating the impact of such pressures when they cannot be entirely removed, and helping the system recover and adapt. Interventions are an essential part of coral reef management and can be summarised based on their functional objective, which can be defined as Protection, Recovery and Assisted Adaptation. All these interventions contribute to maintaining the resilience of the system. Protection is about <i>avoiding loss by addressing threats and minimising their impact on existing biodiversity</i>. - Protecting an existing ecosystem and its rich biodiversity is always more cost-effective than restoring or rehabilitating after significant losses. - Water quality improvement, COTS control and zoning are examples of interventions that have been implemented to address specific threats in the Marine Park. - Currently there are no direct interventions able to protect corals from the threat of climate change and associated marine heatwaves. Recovery is about <i>helping an ecosystem bounce back or recover from losses</i>. - This approach relies on the causes of the losses being addressed in parallel. - In some cases, a critical threshold has been reached and recovery will not naturally happen. Foundations must be ‘rebuilt’, commonly referred to as restoration. - An entire system such as the Reef is far too vast to be ‘rebuilt’, however some targeted restoration can occur at the scale of a single reef. - Current restoration methods do not improve the long-term outlook of the Reef as they operate at a sub-reef scale and generally replace corals ‘like-for-like’, meaning these corals remain vulnerable to future climate change driven events. Assisted Adaptation is about <i>improving the ability of an ecosystem to withstand current and future pressures</i>. - This is the only long-term option to sustain resilience if pressures cannot be fully removed and the system cannot naturally adapt, or cannot adapt fast enough. - Currently there are no assisted adaptation methods being implemented to improve the ability of corals to withstand the impact of marine heatwaves.

Evaluation questions and performance criteria (from 2021 revised M&E Plan)	Findings	Evidence sources		
		Recovery and Assisted Adaptation	Conservation Aquaculture	Enhancing Temperature Tolerance of Corals
			- Corals from multiple key species are reproduced sexually in aquaculture facilities, before being deployed at a young age (~1 month) using specially designed devices to maximise their survival and remove the need for divers. - A focus on automation and process industrialisation has increased production capacity to 10s of millions per year, orders of magnitude higher and at a fraction of the cost of existing practices. https://gbrrestoration.org/wp-content/uploads/2023/08/ENHANCED-CORALS.pdf	- RRAP is actively researching new strategies to improve the ability of corals to withstand an increase in temperature - This includes selecting and breeding the right corals to be propagated in aquaculture as well as targeting symbiont-driven resistance. - When coupled with Conservation Aquaculture and Larval Reseeding, such temperature tolerance enhancements can drive Assisted Adaptation, whereby beneficial traits are spread within wild coral populations over time, accelerating natural adaptation processes. https://gbrrestoration.org/wp-content/uploads/2023/08/ENHANCED-CORALS.pdf
			Slick Collection and Larval Reseeding	
			- Collection from coral spawn slicks and improved larval cultivation lead to 10s of millions of diverse coral larvae deployed on reefs needing recruitment support. - This method is relatively low cost and harnesses the high coral biodiversity that is still present on the GBR. https://gbrrestoration.org/wp-content/uploads/2023/08/MOVING-CORALS.pdf	
		Protection	Rubble stabilisation	
			- In many areas where coral reefs are damaged, natural recovery can be restricted, delayed or interrupted because of unstable dead coral fragments i.e. rubble on the seabed. - Methods to improve stability and reduce the motion of rubble are explored to support the ability of young corals to settle and grow, boosting reef recovery. https://gbrrestoration.org/wp-content/uploads/2023/08/RUBBLE-STABILISATION.pdf	
			Marine Cloud Brightening and Fogging	
			- Cloud brightening produces aerosols from seawater to increase the ability of clouds to reflect solar radiation, thereby reducing increases in sea surface temperature during heatwaves. The technology is in its infancy but is the only approach that could protect corals over large areas. - Local scale benefits could be achieved with a different approach called fogging, reducing light over a smaller area, for example for high value sites. https://gbrrestoration.org/wp-content/uploads/2023/10/COOLING-AND-SHADING.pdf	
		Protection	Cryopreservation	
			Preserving coral biodiversity is achieved by freezing sperm and larvae, as part of the Taronga Conservation program, and is a critical insurance policy against widespread losses which could occur during mass bleaching event.	

Evaluation questions and performance criteria (from 2021 revised M&E Plan)	Findings	Evidence sources
		 - By focusing on high-throughput strategies, this approach could also be applied to Conservation Aquaculture as a reliable supply of coral stock for production. https://gbrrestoration.org/wp-content/uploads/2023/08/CRYOPRESERVATION.pdf%20 <u>Production techniques</u> The focus of the program has been on selecting, research and developing production techniques that are compatible with delivering impact on a large scale. The criteria vary depending on the type of interventions, but in each case performance targets/thresholds that the method could in theory achieve were identified, and projects were designed to verify assumptions and demonstrate that the techniques and end-to-end processes would result in achieving these targets. For illustration: - For coral conservation aquaculture, production strategies delivered a 10-fold reduction in cost per coral reaching one-year of age after deployment, with a target of ~\$10 per coral which was achieved (currently assessed as \$10-12 per unit). - Larval reseeded were demonstrated in the field and cost-effectiveness was consistent with assumptions, and production techniques (spawn collection, larval pool rearing, pre-settlement on devices and larvae release) were refined to reduce the unit cost. - For cloud brightening, the field testing and modelling allowed verification of assumption in terms of the amount and properties of aerosols required to affect cloud properties, which could be extrapolated to regional and whole-of-Reef applications. The energy efficiency and therefore cost were assessed as too high for large scale application and development objectives and strategies to address this issue have been identified for Phase 2 R&D. - Rubble stabilisation was assessed and new methods to increase scale researched. The program concluded that there was no cost-effective path to scale and the technique will not be pursued in phase 2. <u>Ecological Underpinning and Planning</u> As described in [2], from inception, RRAP has recognised the inherent complexity of planning interventions with a view to maximise benefits in diverse situations and across a range of spatial and temporal scales. Knowledge gaps were identified during the feasibility study which RRAP has been systematically addressing to enable transparent and robust decision making. This includes establishing world-leading capabilities and expertise, the development of a suite of methods and models, and the implementation of an integrated ecological research and monitoring subprogram. Ecological Research and Monitoring. Ecological (including environmental and genetic) research and monitoring data are essential for spatial prioritisation of future interventions. RRAP is developing ecological intelligence to inform what types of interventions would likely be effective where and when, along a GBR-wide network of Reef Reference Sites (<u>EcoRRAP</u>). In particular: - RRAP has developed customised monitoring tools (3D photogrammetry) which capture ecological information across wide spatial scales (millimeters to kilometers; <u>Ferrari et al. 2021</u>). For the first time in coral reefs, those are used to collect vital rates of corals (recruitment, growth, survival) at scale. These tools will also be used to monitor the success and ecological benefits of future deployments. Ecological decision heuristics have been developed for within-reef optimisation of site choices, to maximise the probability of survival and growth of deployed corals. - Data on empirical vital rates of corals, especially of their early life stages, their interactions with algae and fish, and improved estimates of larval production from reefs and connectivity to neighbouring reefs, can help identify sites and regions yielding the greatest benefits for the Reef, and identify lower priority reefs such as those that are unlikely to support high survival of deployed corals. The empirical ecological field data are embedded into the RRAP ecological models. Modelling and Decision Support. RRAP has developed a unique capability, integrating a range of existing, new or improved models, designed to inform understanding of the potential benefits, costs, risks, and uncertainties associated with proposed management interventions for the GBR, and support the identification of strategies that maximise the likelihood of successful outcomes being realised through those interventions. The value proposition of such strategies needs to be considered relative to a 'counterfactual' of no intervention. Projections of the outlook for the Reef without intervention, and the potential benefits with them, need to consider the diversity of drivers acting upon the Reef including climate change which can only be done using models. In particular:

Evaluation questions and performance criteria (from 2021 revised M&E Plan)	Findings	Evidence sources
		- Models being used are state-of-the-art and have been tested rigorously against historical long-term monitoring data from the Australian Institute of Marine Science (AIMS). - RRAP has developed the most advanced and resolved counterfactual modelling outputs for the GBR, with findings summarised in the draft report entitled <i>Future Scenarios for the Great Barrier Reef: Projecting the Impact of a Warming Climate</i> [10]. - The suite of models developed within RRAP, in combination with the empirical data collected by other subprograms (such as EcoRRAP, larval reseedling, conservation aquaculture, enhanced corals), allow spatial prioritisation and planning to occur at a range of scales, from within reef, between reefs and at regional and GBR-wide scales. <u>Social Licence, Enabling Environment and Capacity Building</u> RRAP recognises that interventions will only be successful if delivered in partnership with Traditional Owners (acknowledging their ancestral knowledge and the benefits of seeing the Great Barrier Reef as a cultural landscape beyond its biophysical features) and if local communities and industry are involved in their implementation, under the guidance of reef managers. The Program's approach therefore extends beyond the concept of social licence and is exploring how local actors can drive and benefit from this new reef restoration and adaptation industry. RRAP is guided on implementation of the RRAP Indigenous Engagement Framework by Traditional Owner representatives on the Board and Steering Committee and by the <u>RRAS-COTS Traditional Owner Co-Design Group</u> (established under the RTP). Under this framework, on-ground engagement has occurred with more than 30 Traditional Owner groups, all RRAP activities have obtained FPIC, field work has included systematic Traditional Owner participation, RRAP has supported the development of a Biocultural Assessment Framework for interventions [11] and is implementing a Traditional Owner training and capacity building program (see evaluation question further down). The Stakeholder and Traditional Owner Engagement subprogram has significantly advanced our understanding of public perceptions of RRAP interventions (including risks and benefits of R&D and implementation) and opportunities to deliver community and stakeholder co-benefits. It has led the design and evaluation of best-practice, place-based, engagement opportunities for Reef communities and the general public that are informed by global leading practice for regional ecosystem adaptation (<u>Vella et al. 2021</u>, <u>Lockie et al. 2024</u>). Key outcomes to date are summarised in <u>this presentation</u> [12] and include: - Over 8000 respondents (including >750 ATSI respondents) to two national and reef resident surveys (2018 & 2022) on their views of reef health, climate impacts, risks, benefits and acceptability of RRAP and non-RRAP interventions and, role of science organisations in large scale restoration and adaptation efforts (Lockie et al, submitted) - Establishment of an eleven-member <u>Reef Stakeholder Advisory Group</u> which met on five occasions over 12 months to develop recommendations to RRAP on best-practice engagement (<u>presentation</u> here), two regionally based <u>Community Panel forums</u> in Townsville and Cairns (with 13 and 18 members respectively to facilitate two-way dialogue and knowledge exchange with RRAP researchers), and a collaborative monitoring project in Moore Reef (improving transparency and joint data production from RRAP field trial sites). - A comprehensive series of over 160 deep dive interviews conducted with regional reef communities who may be impacted by RRAP interventions, providing qualitative social science data to support engagement. - Research and insights completed for prospective industry, community, and Traditional Owner partner involvement in scaling a newly unfolding reef restoration industry, including existing capability and capacity gaps. The Translation to Deployment subprogram has systematically assessed the maturity of RRAP interventions and identified potential delivery models. Pathways to implementation have been mapped, integrating scale-up targets, technology development priorities, industry capability audits and advanced logistic modelling. The first Industry Forum, focused on conservation aquaculture, was held in February 2024. RRAP takes a coordinated and prioritised approach to strategic and operational engagement with all relevant agencies that have roles and responsibilities relevant to the delivery of the current program, as well as future R&D and interventions. This includes the establishment and coordination of a Regulator Forum. A priority continues to be engaging with the Reef Authority as the lead managing agency for the Marine Park. A process is underway to establish a collaborative framework between RRAP, AIMS, and the Reef Authority for delivery and approval of the RRAP Pilot Deployments Program under Section 5.4 of the Reef Zoning Management Plan. Regulatory frameworks RRAP has developed a regulatory risk treatment plan which covers all aspects of regulatory risk and enabling strategies to address these risks, focusing on the following control areas: Strategic Engagement, Reef policy, Intervention Risk and Social Licence, Capacity and Knowledge, Adaptive Planning, Governance and Partnering. The success of this mitigation strategy is evidenced by

Evaluation questions and performance criteria (from 2021 revised M&E Plan)	Findings	Evidence sources
To what extent is Australia recognised internationally as leading coral reef restoration science? <i>Summary of rubric (See Table 3 below)</i> - Improved best practice based on shared knowledge and R&D outcomes [good] - Formalised international collaboration pathways are being used and supported [good] - Co-publication of high impact papers [good] - Active engagement with international partner organisations [very good] - International funding agencies and governments are investing in collaborations with Australian teams [good] - Partner countries increase investment in reef restoration and adaptation R&D [good]	Australia's leadership in coral reef restoration science is recognised internationally and this has been achieved to a good extent. While it is too early to measure the international uptake of RRAS outputs, there is evidence of improved best practice to date with systematic sharing of technical knowledge in the form of Standard Operating Procedures (SOPs) and detailed technical publications. The Reef Resilience Symposium 2024 represented a major platform for international dissemination of knowledge generated within RRAP. (https://www.reefresiliencesymposium.org/) RRAP has been actively involved in a range of international activities, including the design and rollout of the G20 Coral Reefs Research Accelerator Program and the collation and disseminating of best practice guidelines for coral reef restoration. From 2018-2024, RRAP researchers have been either lead or contributing authors to over 170 scientific articles. The <u>RRAP Intervention Risk Review Group</u> includes several independent international experts and has demonstrated the value of international collaboration to manage intervention risk across a range of dimensions.	the collaborative approach with the Reef Authority to enable Pilot Deployments to be approved under Section 5.4. of the Zoning Management Plan, underpinned by the outputs of the independent Intervention Risk Review Group as discussed below [23]. Evidence of shared knowledge and R&D outcomes. While there is a growing number of publications, the evidence that RRAP is committed to sharing the detailed technical knowledge to underpin adoption of new developments can be found in: - publications (such as <i>The AutoSpawner system - Automated ex situ spawning and fertilisation of corals for reef restoration</i> https://doi.org/10.1016/j.jenvman.2024.121886), - technical reports (such as <i>Preliminary testing of larval transfer systems in downscaled trials</i> [13]) and SOPs that are planned to be released in a systematic manner over the course of 2024-25. These reports and SOPs are subjected to a Quality Control process, generally in accordance with internal processes of lead institutions, and are submitted under Creative Commons for public sharing. They cover a range of technical aspects including aquaculture techniques (companion species, settlement, automation, diets), monitoring technologies, cryopreservation, larval slick collection and reseedling etc... An example of SOP is <i>In-Situ Experiments to Estimate Fertilisation Success During Coral Spawning – Standard Operating Procedure</i> [14] - The delivery of the Reef Resilience Symposium which was run as a hybrid event opened to international scientists and the public via https://www.reefresiliencesymposium.org/ - RRAP publications which can be found at https://gbrrestoration.org/rrap-about-us/publications/journal-articles/. With more than 170 publications and submissions (104 published) and 5 book chapters. Of the 104 publications, 48 involved 2 or more RRAP Partners and 51 included external collaborators. Evidence of formalised international collaboration pathways being used and supported and active engagement with international partner organisations. RRAP has leveraged its Partners to formalise these pathways (mostly through GBRF and AIMS) and partnerships, leading to significant memberships on advisory committees and advisory groups. RRAP has actively engaged across a range of areas of global significance, including: - Strong involvement in global initiatives such as the G20 Coral Reef R&D Accelerator Program and engagement in international events (UN Ocean, CBD-COP15, the International Coral Reef Symposium and Reef Futures). - In the case of CORDAP, GBRF and AIMS are represented on the Governing Body and RRAP scientists are directly involved in the Scientific Advisory Committee and have co-led several global technology roadmaps and scoping studies, notably <u>Natural adaptation and assisted evolution of corals to climate change</u>, <u>Exploring the frontier of coral aquaculture</u> and <u>Managing the ecological risks of coral reef interventions</u>. - In the area of global sustainable conservation finance, the <u>Verra Nature Framework Development Group</u> and the <i>Biodiversity Credits Alliance</i>. Evidence of international funding agencies and governments investing in collaborations with Australian teams, and Partner countries increase investment in reef restoration and adaptation R&D. RRAP as a program or individual RRAP projects have been able to secure investments from: - Competitive funding from granting bodies such as CORDAP, Revive and Restore, the Paul G Allen Foundation, - Global corporations such as L'Oréal (via the <u>L'Oréal Fund for Nature Regeneration</u> and <u>Garnier</u>), <u>McLaren Racing Limited</u>, <u>Qantas</u>, <u>Life-Space</u>. - Philanthropic donations from international donors, including Oceankind, Paul M Angell Family Foundation and Builders Initiative. - A major philanthropic investment in the Pacific (<u>TED Audacious</u>) to transfer RRAP coral aquaculture and seeding technologies to local communities across Pacific Small Island Developing States. It is difficult to evaluate how much influence, direct or indirect, RRAP has had on Partner countries and their level of investment in reef restoration and adaptation. Nevertheless, since RRAP's inception, several large-scale programs (>USD50-100M) have arisen, including Mission Iconic Reefs and Reefense in the US (Florida) and the Kaust Coral Restoration Initiative in Saudi Arabia. Those reflect a global convergence underpinned by growing scientific evidence for reef restoration and technical development.
To what extent has the RRAS component implemented new pathways for Traditional Owner education, employment and enterprises across RRAS research and delivery activities?	New pathways for Traditional Owner education, employment and enterprises are being implemented and established across RRAS research and delivery activities to a good extent. RRAP is guided on implementation of the RRAP Indigenous Engagement Framework by Traditional	RRAP was not responsible with the delivery of the RRAS-Traditional Owner component for which 10% of the original RRAS Component funding was reserved. This element is evaluated separately under the Traditional Owner Partnerships component. RRAP's approach was informed by a Traditional Owner workshop in May 2019 during which Traditional Owners shared their aspirations and expectations in terms of participation and co-design. From inception and throughout implementation, RRAP sought and benefited from the guidance of Traditional Owners, from representation on governance bodies to on-Sea Country experimental

Evaluation questions and performance criteria (from 2021 revised M&E Plan)	Findings	Evidence sources																											
<i>Indicators</i> - Number and nature of involvement of Traditional Owners in RRAS activities - Number of RRAS projects involving or led by Traditional Owners	Owner representatives on the Board and Steering Committee and by the <u>RRAS-COTS Traditional Owner Co-Design Group</u> (established under the RTP). Under this framework, on-ground engagement has occurred with more than 30 Traditional Owner groups, all RRAP activities have obtained FPIC (collated in a central register), field work has included systematic Traditional Owner participation, RRAP has supported the development of a Biocultural Assessment Framework for interventions [11] and is implementing a Traditional Owner training and capacity building program. Across >150 separate engagements, more than 500 days of work have been contracted to Traditional Owners, not including Traditional Owner and First Nations staff within RRAP institutions.	campaigns. Engagement with Traditional Owners was enabled by dedicated communication products to explain the program, its interventions and the experiments proposed to be conducted. In terms of <u>RRAP Governance</u>: - The Collaboration Agreement includes an RRAP Indigenous Engagement Framework, building on a model established by AIMS pre-RRAP inception [15] - Continuous independent Indigenous representation on the RRAP Board, with Liz Wren succeeding Michelle Deshong who stepped down in early 2024. - Harry Van Issum and Chrissy Warren are independent Traditional Owner representatives on the RRAP Steering Committee - Phil Rist is a Traditional Owner representative on the Intervention Risk Review Group - RRAP is guided as a program by the <u>RRAS-COTS Traditional Owner Co-Design Group</u> - The RRAP Pilot Deployments Program (PDP) and on-ground engagement for field trials and training/capacity building activities are guided by a Traditional Owner Working Group with increased representation from within a subset of Reef Traditional Owner groups. - A Biocultural Assessment Framework [11] has been co-designed with Traditional Owners with support from CSIRO, and is being piloted on the Reef over the 2024-25 financial year. It is anticipated to provide a clear and cultural appropriate framework for RRAP institutions and others engaging with Traditional Owners on Country, complementing and possibly superseding the RRAP Indigenous Engagement Framework. Within RRAP, First Nations Peoples and Traditional Owners are engaged in a number of ways: - As per governance framework above - As employees, within the dedicated AIMS Indigenous Partnerships Team, which is partly funded by RRAP and provides management, planning and engagement services within the RRAP Managing Entity. As of December 2023, this included: <table> <tr> <td>Bob Muir</td><td>0.6FTE/yr</td><td>RRAP Indigenous engagement and biocultural project</td></tr> <tr> <td>Manuwuri Forester</td><td>0.6FTE/yr</td><td>RRAP Indigenous engagement and biocultural project</td></tr> <tr> <td>Carl Grant</td><td>0.7FTE/yr</td><td>RRAP Indigenous engagement and biocultural project</td></tr> <tr> <td>Dion Devow</td><td>0.25FTE/yr</td><td>RRAP Indigenous engagement and biocultural project</td></tr> <tr> <td>Jordan Ivey</td><td>0.5FTE/yr</td><td>RRAP Indigenous Futures training and capacity building project</td></tr> </table> - As employees within each RRAP Partner institution, as part of RRAP delivery activities. As an example, below are Indigenous staff members recruited for SeaSim aquaculture activities: <table> <tr> <td>Taleatha Pell</td><td>1FTE/yr</td><td>Trainee tutor and research assistant ECT/CAD RRAP funded</td></tr> <tr> <td>Adam Napier</td><td>1FTE/yr</td><td>Aquaculture assistant trainee, ECT/CAD RRAP funded</td></tr> <tr> <td>Billie Homuk</td><td>1FTE/yr</td><td>Aquaculture assistant trainee, ECT/CAD RRAP funded</td></tr> <tr> <td>Wahjtjah Johnson</td><td>1FTE/yr</td><td>Aquaculture assistant trainee, ECT/CAD not RRAP funded</td></tr> </table> Traditional Owners have been involved in a number of field trips, such as those related to cloud brightening and larval resettlement activities. Traditional Owner participation took place in several activities including recent Moving Corals trip to Heron Island, Cooling and Shading experiments in March 2021, and November 2020 Boats4Corals re-seeding work. - Casually to contribute to RRAP field work activities (as part of FPIC conditions or for capacity building), to engage in workshops, planning and capacity building activities. As of December 2023, it is estimated that RRAP had engaged Traditional Owners for more than 500 paid workdays. RRAP Indigenous Futures Phase 1 – Indigenous Ranger Intervention Training [16] This project is foundational to the scaling up strategy of RRAP. In partnership with Indigenous Reef ranger organisations, RRAP-AIMS have created and are trialling a skills-development framework that takes new reef restoration and adaptation knowledge and innovations emerging from RRAP projects, and delivers them in the first instance to a pilot group of the reef's Traditional Owner workforce. This nationally accredited training is aiming to add value to each ranger's existing maritime skillset, give life and	Bob Muir	0.6FTE/yr	RRAP Indigenous engagement and biocultural project	Manuwuri Forester	0.6FTE/yr	RRAP Indigenous engagement and biocultural project	Carl Grant	0.7FTE/yr	RRAP Indigenous engagement and biocultural project	Dion Devow	0.25FTE/yr	RRAP Indigenous engagement and biocultural project	Jordan Ivey	0.5FTE/yr	RRAP Indigenous Futures training and capacity building project	Taleatha Pell	1FTE/yr	Trainee tutor and research assistant ECT/CAD RRAP funded	Adam Napier	1FTE/yr	Aquaculture assistant trainee, ECT/CAD RRAP funded	Billie Homuk	1FTE/yr	Aquaculture assistant trainee, ECT/CAD RRAP funded	Wahjtjah Johnson	1FTE/yr	Aquaculture assistant trainee, ECT/CAD not RRAP funded
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Evaluation questions and performance criteria (from 2021 revised M&E Plan)	Findings	Evidence sources
		application to RRAP research outcomes, and establish the foundation for further scaling of training and employment pathways for a future Indigenous reef workforce. Specifically, this phase 1 project will: • Develop a Training Framework: Training packages for deployment-ready intervention skills in larval rearing and coral aquaculture deployment will be combined with marine monitoring of coral survival and growth. Indigenous pedagogies will be applied to design fit-for-purpose curricula. • Deliver Training: The package will be delivered over 3 years to a pilot group of ten Indigenous rangers with maritime skills and currently employed across the GBR. In addition to scholarship for learning outcomes and skills development, the training will also prioritise cultural safety and provide mentorship. • Measurable accreditation: Through collaboration with the Australian Vocational Education and Training sector (VET) and alignment of new curricula with units of competency within existing training packages, the project will deliver an accredited training pathway. The tested and validated training materials will subsequently be made available to the VET sector for future broader delivery.
To what extent has the RRAS component established strong, transparent, inclusive, and effective governance and program management? <i>Summary of rubric (see Table 4 below)</i> <i>The governance:</i> • system ensures relevant, scientifically sound, effective and efficient progress • committees and sub-committees are engaged and actively contributing to decisions • The program management team actively engages the best possible program partners and is perceived as open, transparent and inclusive. <i>Program/intervention prioritisation frameworks and decision support tools are:</i> <i>in place and are being used</i> • continually evaluated and adapted, and they contribute to a robust and informed discussion around decision making • are being used, continually evaluated and adapted [Very Good], and they: ○ Contribute to a robust and informed discussion around decision making ○ Reduce uncertainty ○ Integrate with broader Reef-related DSS ○ Consider single as well as combinations of interventions	The RRAS component, through the Reef Restoration and Adaptation Program (RRAP), has established strong, transparent, inclusive, and effective governance and program management to a very good extent. Best -practice governance framework and systems and processes have been put in place to ensure program performance is measured in a transparent manner and improvements implemented in a responsive/adaptive manner. Independent advice and guidance is achieved on the Board and Steering Committees, including from Traditional Owners, with a specific focus on risk management through the Independent Intervention Risk Review Group. Program/intervention prioritisation frameworks and decision support tools have been developed at a range of temporal and spatial scales, addressing ecological as well as broader socio-economic dimensions. Those are continually adapted and contribute to informed and robust decision making, by considering combination of interventions within the broader reef decision space.	Evidence of establishment of governance and program management framework. Based on recommendations from the feasibility study and engagement with key stakeholders, RRAP established a governance framework which has proven effective and efficient in delivering a complex and integrated program of R&D, generating significant breakthroughs in a record time and making clear progress towards achieving program goals. • The RRAP Collaboration Agreement [17] was executed on 24 December 2020, describing the governance framework, roles and responsibilities, decision making, communication protocols, IP and confidentiality management, dispute resolution and other standard legal matters. The Collaboration Agreement includes the Tableers for the <u>Board and Risk Sub-Committee</u>. and the following was implemented: ○ Declaration of Interests were collated and regularly updated for Board and Steering Committee members; ○ A register of minutes and resolutions was assembled and maintained; Strategic planning sessions were run by the Board and Steering Committee, informed by whole-of-program assessments and culture surveys, as well as a specific Board performance and culture survey. • As described as a schedule in the Collaboration Agreement, AIMS was appointed as Managing Entity to coordinate across program Partners and manage the integrated delivery of the R&D program, including planning activities, tracking of milestones, payments of invoices, coordination of fieldwork, WHS oversight, risk management and communication. A custom-designed Microsoft Project management system was implemented to streamline these processes for 7 Partners and >30 sub-contractors, and embed several levels of independence and control in reviewing deliverables and approving milestone payments. • The RRAP Investment Plan 2020-2024 [18] was formally approved by the RRAP Interim Board (Executive Committee) on 10 August 2020. These detail the program R&D and program management structure. This has led to the execution of >30 individual multi-party Project Agreements to contract R&D activities which were subsequently varied, through a similar Board approval process, on three occasions in June 2022, June 2023, June 2024 (reflecting annual updates to the funding environment). • Subsequently, several groups were established as follows: ○ the RRAP Risk-Sub Committee of the Board was formally established [19] whose responsibility is to review the design, implementation and monitoring of the RRAP risk management framework [20]. It is led by an independent Board member. ○ A joint Traditional Owner Engagement Partnership was established between RRAP (via AIMS) and the RTP Traditional Owner Partnerships team, leading to the establishment of a joint RRAS Traditional Owner Technical Working Group (discussed above). ○ Several Working Groups (Fundraising, Communications, WHS, Traditional Owners and Stakeholder Engagement) were established to support and provide advice to the collaborative delivery of RRAP. ○ The Intervention Risk Review Group [21] was established to provide advice on the assessment and management of intervention risk, at a range of scales. Independently chaired and composed of independent international and Australian experts highly recognised in their field, the group meets at least quarterly, including bi-annual in-person workshops. The Reef Authority is represented in an observer capacity at each of these workshops. • Planning processes, including the feasibility and prioritisation of the phase 1 R&D program, allowed multi-institutional teams to assemble based on expertise, with involvement of non-RRAP partners via subcontracting arrangements to ensure the necessary skills were available to the program. A June 2022 review of the program allowed some targeted adjustments,

Evaluation questions and performance criteria (from 2021 revised M&E Plan)	Findings	Evidence sources
○ Include technical and governance/funding elements		accompanied by budget transfers between subprograms and institutions, which were reflected in variations to existing project agreements, demonstrating the adaptive capacity of the program. ● The managing entity invested resources to establish a culture of collaboration and associated soft infrastructure, including webinars, newsletters, regular workshops, and a forum and development program for early-career researchers (future leaders). Evidence of program/intervention prioritisation frameworks and decision support tools Through the Modelling and Decision Support Subprogram, RRAP has developed a unique capability, integrating a range of existing, new or improved models, designed to inform understanding of the potential benefits, costs, risks, and uncertainties associated with proposed management interventions for the GBR, and support the identification of strategies that maximise the likelihood of successful outcomes being realised through those interventions. The value proposition of such strategies needs to be considered relative to a 'counterfactual' of no intervention. Projections of the outlook for the Reef without intervention, and the potential benefits with them, need to consider the diversity of drivers acting upon the Reef including climate change which can only be done using models. In particular: ● Models being used are state-of-the-art and have been tested rigorously against historical long-term monitoring data from the Australian Institute of Marine Science (AIMS). ● RRAP has developed the most advanced and resolved counterfactual modelling outputs for the GBR, with findings summarised in the draft report entitled <i>Future Scenarios for the Great Barrier Reef: Projecting the Impact of a Warming Climate</i> [10]. ● The suite of models developed within RRAP, in combination with the empirical data collected by other subprograms (such as EcoRRAP, larval reseeding, conservation aquaculture, enhanced corals), allow spatial prioritisation and planning to occur at a range of scales, from within reef, between reefs and at regional and GBR-wide scales. Decision-making within RRAP was summarised in a briefing note to IEP in July 2024 [22]. In addition, RRAP has contributed to the broader reef decision environment by: ● Contributing modelling outputs to the <u>Australian Academy of Science Reef Futures Roundtables Review</u> ● Funding and leading a series of workshops to bring together modellers involved in RIMREP, COTS Control and RRAP. ● Presenting to the Reef 2050 Plan IEP on a number of occasions. ● Organising the Reef Resilience Symposium in Cairns in April 2024. ● Including COTS Control, the Reef Authority, Tourism and Traditional Owner representatives in RRAP R&D Planning activities.

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19. RRAP_Board_Risk Subcommittee_Tableer
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21. RRAP_IRRG Terms of Reference
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23. RRAP_Regulatory Risk Treatment Plan_V1.04

Rubrics

Table 2. Effectiveness rubric for RRAS Component KEQ1

KEQ1. To what extent has the RRAS component delivered a toolbox of restoration and adaptation techniques ready for investment in implementation, which are ecologically effective, and deployable at a range of scales?	
Very good	In addition to that defined as 'good': the toolbox of restoration and adaptation techniques is at a price point that it is affordable to deploy across significant scales, impacting a sufficient percentage of the Reef to retain core functional values
Good	In addition to that defined as 'adequate': the toolbox of restoration and adaptation techniques is logistically feasible to deploy at scales required to have the necessary impact
Adequate	The toolbox of restoration and adaptation techniques is: - Logistically feasible and able to be deployed at reasonable scales to have at least local impact - Culturally appropriate - Supported by effective and robust regulatory frameworks and permission systems - Socially acceptable and supported by Reef stakeholders and communities
Poor	The toolbox of restoration and adaptation techniques: - Does not demonstrate improvements to already existing restoration and adaptation technology - Is logistically feasible and able to be deployed at reasonable scales to have at least local impact
Detrimental	The toolbox of restoration and adaptation techniques: - Is culturally and socially unacceptable - Has detrimental impacts on the coral reef ecosystem

Table 3. Effectiveness rubric for RRAS Component KEQ2

KEQ2. To what extent has the RRAS Component contributed towards Australia being recognised internationally as leading coral reef restoration science?	
Very good	As for 'good', plus: - Active engagement with international partner organisations - International funding agencies and governments are investing in collaborations with Australian teams - Partner countries increase investment in reef restoration and adaptation R&D
Good	As for 'adequate', plus: - Formalised international collaboration pathways are being used and supported - Co-publication of high impact papers
Adequate	Evidence of international uptake of guidelines, techniques, policy and regulations Improved best practice based on shared knowledge and R&D outcomes
Poor	No apparent international impact or collaboration towards Australia being recognised internationally as leading coral reef restoration science
Detrimental	Australia gets a poor reputation due to lack of sharing or through poor or non-existent forms of collaboration Australia exports technologies or interventions that have detrimental impacts on coral reefs or associated (or unintentionally impacted) ecosystems

Table 4. Effectiveness rubric for RRAS Component KEQ4

KEQ4 for foundational activity: To what extent has the RRAS component established strong, transparent, inclusive and effective governance and program management ?	
Very good	As for 'good', plus: • Program/intervention prioritisation frameworks and decision support tools are in place, are being used, are continually evaluated and adapted, and they: • Contribute to a robust and informed discussion around decision making • Reduce uncertainty • Integrate with broader Reef-related DSS • Consider single as well as combinations of interventions • Include technical and governance/funding elements
Good	As for 'adequate', plus: • The governance and program management team actively engages the best possible program partners and is perceived as open, transparent and inclusive • Program/intervention prioritisation frameworks and decision support tools are continually evaluated and adapted, and they contribute to a robust and informed discussion around decision making
Adequate	• The governance system ensures relevant, scientifically sound, effective and efficient progress • The program committees and sub-committees are engaged and actively contributing to decisions • Program/intervention prioritisation frameworks and decision support tools are in place and are being used
Poor	One or more of the following: • The governance system does not facilitate progress • The governance and program management team are perceived as exclusive and have a poor record of engaging with teams outside the core research partners • The Program committees and sub-committees do not engage • There are no useable program/intervention prioritisation frameworks and decision-support tools
Detrimental	The governance system and program management team are dysfunctional and are contributing to, or worsening the divisions within the coral reef science community

IMR RESULTS TABLE

Introduction

This document presents the Results Table for the Integrated Monitoring and Reporting (IMR) Component, developed as part of the 2024 End-of-Portfolio (EOP) Evaluation of the Reef Trust Partnership (The Partnership). This document has been collaboratively developed by the evaluators (Clear Horizon) and the Great Barrier Reef Foundation (GBRF) IMR Component Director and team.

As outlined in the EOP Evaluation Project Plan (Clear Horizon, 2024), this Results Table presents the IMR component specific findings and evidence that will be used to respond to Key Evaluation Question 3: *‘To what extent did the Partnership contribute to a significant and measurable improvement in the health of the Great Barrier Reef World Heritage Area (the Reef)... underpinned by innovation, science and community engagement?’* and is the focus of the independent expert review process.

The following Results Table presents the evaluations findings and supporting evidence structured against the component specific evaluation questions presented in the table below. These have been synthesised from the end-of-component outcomes and rubrics presented in the IMR Component Monitoring and Evaluation (M&E) Plan (p.54 – 63, RTP M&E Plan, GBRF 2022).

The evidence presented in the Results Table includes the results of a review of 26 documents (references listed in page 11) and discussions with the GBRF Component team.

Note, an important project under this component is the development of the Strong Peoples – Strong Country framework for monitoring Indigenous Heritage values. While funded under this component, this project is being delivered by the Traditional Owner Partnerships Component team and will be evaluated in 2026 as part of that component evaluation. As such, the Strong Peoples -Strong Country Framework is out of scope of this evaluation.

Table 1. IMR Component Evaluation Questions

IMR Component Evaluation Questions	Performance criteria
1. To what extent have critical RIMReP needs/gaps been prioritised and met by the IMR Component?	See rubric in Table 4. Rubric ratings cover: Very good, Good, Adequate, Poor, Detrimental. Factors considered in this rubric are: a) Alignment, b) Prioritisation, c) Integration d) Effectiveness f) Data availability.
2. To what extent has the IMR Component delivered and made operational an integrated decision-support system?	See rubric in Table 5. Rubric ratings cover: Very good, Good, Adequate, Poor, Detrimental. Factors being considered in this rubric are a) Functionality, b) Operation, c) Use, d) International interest.
3. In what ways has Traditional Knowledge been recognised and embedded at equal standing to western knowledge in Great Barrier Reef governance?	NA

IMR Results Table

IMR Component Evaluation Questions	Finding	Evidence
To what extent have critical RIMReP needs/gaps been prioritised and met by the IMR Component?	Rating: Good While critical RIMREP data needs and gaps were prioritised and delivered by the IMR component, the availability of this data is dependent on the Reef Authority integrating the Data Management System with RIMReP. The component has put considerable time and effort into supporting this integration process, and at the time of the evaluation it remains an ongoing process. Assessments against the rubric criteria are as follows: • Alignment – Very Good: Monitoring priorities are fully aligned with RIMReP. • Prioritisation – Very Good: Investment in monitoring is underpinned by a clear and transparent prioritisation process supported by key partners and stakeholders. • Integration - Good: The IMR Component and RIMReP are well aligned to each other. Integration of the IMR projects is dependent on the Reef Authority, with the component putting significant effort into supporting and facilitating this process. • Effectiveness - Adequate: Monitoring activities were delivered very effectively and efficiently, however until integrated into RIMReP, their effectiveness and associated value and return on investment will not be fully realised. • Data availability - Adequate: Data is partially available to the broader community, with instances of use across few formats on a single platform with a limited number of users. Broader availability and use is dependent on DMS integration into RIMReP.	Alignment - Very Good: Monitoring priorities are fully aligned with RIMReP. Prioritisation - Very good: Investment in monitoring is underpinned by a clear and transparent prioritisation process developed in collaboration with key partners and stakeholders. The IMR component funded 17 monitoring projects prioritised in collaboration with RIMReP, the Reef Authority and key partners to address critical RIMReP needs and gaps. The projects, summarised in Table 3 below include one Decision Support System, four Human Dimensions projects, ten biophysical projects and two Integration projects. The process used to identify the priority investments involved two-stages to overcome the external delays experienced in the close-out of RIMReP design phase and the start of the RIMReP implementation phase through 2020 (1). • Stage 1 (early 2020) utilised two parallel approaches to ensure its investment was targeted to deliver maximum impact in the absence of RIMReP priorities. Critical monitoring undertook a top-down identification of monitoring needs that were critical to the implementation of Reef 2050 Plan, the Reef Trust Partnership and identified as priorities during RIMReP initial implementation phase. Five Stage 1 critical monitoring opportunities were identified, endorsed by the Reef Authority, endorsed by the PMC and approved for investment by the GBRF Board that were consistent with the findings of RIMReP, supported by a broad range of stakeholders and most aligned to the objectives of the Partnership (8): • Stage 2 (late 2020) used a RIMReP-led prioritisation process based on structured decision-making principles to identify critical monitoring investment needs in late 2020, (informed by the 2021 RIMReP Prospectus (2)). Eleven Stage 2 critical monitoring opportunities emanating from the process, were endorsed and approved for investment. The final priority for investment emerged following an independent consultancy in late 2020 that scoped the design of a Great Barrier Reef decision support system (DSS) (03). In response to the findings of this study, RIMReP and the Partnership developed a detailed roadmap for the implementation of a DSS under RIMReP, and in the process identified the priority for investment under IMR was for a fit-for-purpose data management system (DMS) to underpin RIMRePs work to progress the DSS. The decision to shift from a whole of Reef DSS to initially establishing a DMS are captured in the RTP Annual Workplan 2021-2022 (1). Integration - Good: The IMR Component and RIMReP are well aligned to each other. The majority of the IMR projects are well aligned to RIMReP, with the integration of these projects largely dependent on the Reef Authority's integration of the DMS project into their Reef Knowledge System. While integration of these projects into RIMReP is the Reef Authority's responsibility, GBRF have put significant effort into supporting integration through collaborative governance and extending project timelines to better prepare projects and facilitate infrastructural integration. As outlined in Table 3 below, 12 projects are aligned with RIMReP with the integration pathway via DMS dependent on the Reef Authority. 5 projects are isolated from RIMReP, including 3 whose integration pathway are via the MMP and P2R. The 2021 Mid-Term Evaluation found that there was a high level of confidence that the governance arrangements in place could support the implementation of an operational decision-support system with RIMReP progressing as a multi-institutional partnership with a clearly defined governance framework that allows buy-in from managers and delivery providers. The evaluation cited evidence of progress of multi-institutional partnership with defined governance framework contained in minutes/notes from heads of RIMReP agency meetings/workshops, RIMReP business plans, and business strategy consultations (4b). Effectiveness - Adequate: Monitoring activities are delivered effectively and efficiently and according to current practice, with limited opportunities for co-benefits from outputs. While all projects have been delivered effectively and efficiently, their overarching effectiveness, and associated return on investment is dependent on their integration into RIMReP via the DMS, which as described above, is the responsibility of the Reef Authority. As such, until their integration is complete, there are limited opportunities for the outputs to add value across a range of areas. All projects have demonstrated effectiveness in achieving their intended outcomes, specifically in improving data coverage or cost effectiveness, and many projects improving data timeliness and accessibility. The projects have also generated substantial new scientific knowledge and successfully piloted new methods, as evidenced by the majority of projects producing scientific publications. Many projects also demonstrated their data added value across a range of areas, with the majority of projects demonstrating their data

		have been used to inform reef management decisions to date, and findings have been disseminated through conferences, technical reports and various forms of media (Table 3). All projects have demonstrated efficiency in being delivered to time and to budget. Six projects were extended beyond their initial scope, and one was provided additional resources in order to enhance the outcomes they had achieved and support their integration into RIMReP (Table 3).																				
		Data availability - Adequate: Data is partly available to the broader community in a few key formats, and can be used across a limited number of platforms. With the majority of projects specifically dependent on the DMS's integration into RIMReP to make data fully available to the boarder community, the data outputs from many of these projects are available through only one source or platform, such as published papers or technical reports. Each project was rated against the following revised criteria (Table 2). Table 2. Data availability revised rubric and assessments <table><tr><th>Rating</th><th>Description</th><th>Number of projects</th><th>Comments</th></tr><tr><td>Very Good</td><td>Datasets integrated and available through RIMReP as well as a range of other platforms.</td><td>0</td><td>Availability of datasets dependent on DMS integration, which dependent on the Reef Authority</td></tr><tr><td>Good</td><td>Datasets are publicly available through a range of platforms, including published papers</td><td>5</td><td>This includes multiple platforms such datasets published to GEONadir, as well as published technical reports and/or peer-reviewed papers.</td></tr><tr><td>Adequate</td><td>Datasets are available through one source, ie, a platform, published paper or technical report.</td><td>11</td><td>This covers a single publication, such as peer reviewed paper or platform.</td></tr><tr><td>Poor</td><td>Datasets are not generally available,</td><td>1</td><td>Solely dependent on DMS to be available</td></tr></table>	Rating	Description	Number of projects	Comments	Very Good	Datasets integrated and available through RIMReP as well as a range of other platforms.	0	Availability of datasets dependent on DMS integration, which dependent on the Reef Authority	Good	Datasets are publicly available through a range of platforms, including published papers	5	This includes multiple platforms such datasets published to GEONadir, as well as published technical reports and/or peer-reviewed papers.	Adequate	Datasets are available through one source, ie, a platform, published paper or technical report.	11	This covers a single publication, such as peer reviewed paper or platform.	Poor	Datasets are not generally available,	1	Solely dependent on DMS to be available
Rating	Description	Number of projects	Comments																			
Very Good	Datasets integrated and available through RIMReP as well as a range of other platforms.	0	Availability of datasets dependent on DMS integration, which dependent on the Reef Authority																			
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Poor	Datasets are not generally available,	1	Solely dependent on DMS to be available																			
To what extent has the IMR Component delivered and made operational an integrated decision-support system?	Rating: Adequate It was decided that the Reef Authority would take carriage of the decision support system (DSS) and the establishment of a data management system (DMS) was identified at the immediate priority. The DMS project is currently underway, due to be completed in Dec 2024. It is currently in its transition phase, with the Reef Authority responsible for its integration, ongoing maintenance and use. Assessments against the rubric criteria are as follows: • Functional – Very Good: The DMS is fully functional addressing a broad range of strategic and tactical issues. • Operational – Adequate: The DMS is operational for a limited number of critical applications and a model has been recommended for long-term maintenance and operation. • Use – Adequate: the Reef Authority and policy makers are using the DMS but it remains out of reach for the broader community. • International interest - NA: The project is still underway and the extent to which it may be	Functional – Very Good: The DMS is fully functional addressing a broad range of strategic and tactical issues. As described above, informed by the decision support system (DSS) scoping study (3), the need for investment into a fit-for-purpose data management system (DMS) was identified to underpin the RIMReP information management systems (i.e. the Reef Knowledge System) and existing or future DSS, emerged as the highest immediate priority. Given this, the Partnership prioritised funding for the DMS, commencing with a detailed scoping and design phase (July to December 2021), followed by an development and implementation phase (January 2022–June 2023) and a final year (July 2023– Dec 2024) to support integration into the Reef Authority infrastructure and maintenance. While the project is still underway, the DMS has demonstrated it is fully functional, and has ingested 167 datasets across a range of strategic and tactical issues, including the other priority projects funded through the component (see Table 3). Operational – Adequate: The DMS is operational for a limited number of critical applications and a model has been recommended for long-term maintenance and operation. The DMS currently has over 110 registered users and is being used in select the Reef Authority reporting /decision making processes. It is however yet to be integrated into RIMReP, with a process underway to facilitate and support the Reef Authority to integrate it and ensure its long-term maintenance and operation (see Table 3). Use – Adequate: the Reef Authority and policy makers are using the DMS but it remains out of reach for the broader community. As stated above, to date the DMS has 110 registered users, including users from the Reef Authority, AIMS and CSIRO, and has been used in select the Reef Authority reporting and decision making processes. however as it has yet to be integrated into the Reef Authority's operations, it remains largely out of reach to the broader community, or broader use by policy makers (see Table 3).																				

	replicated or inspire similar initiatives outside the Great Barrier Reef and Australia is unevaluable at this stage.	International interest - NA: Project still underway While the DMS is innovative and fit for purpose, the project is still underway and the extent to which it may be replicated or inspire similar initiatives outside the Great Barrier Reef and Australia is unevaluable at this stage.
Embedding Traditional Knowledge and sharing benefits		
In what ways has Traditional Knowledge been recognised and embedded at equal standing to western knowledge in Great Barrier Reef governance	The Strong Peoples-Strong Country Framework is the primary mechanism through which the component is supporting the recognition and embedding of Traditional Knowledge alongside western knowledge in Great Barrier Reef governance, however as stated above, this project is out of scope of this evaluation and will be considered as part of the Traditional Owner Partnerships component in 2026. Beyond this specific project, 15 of the 17 critical monitoring projects included Traditional Owner engagement in some form. This includes three projects that have included co-design elements with Traditional Owners, and the establishment of meaningful relationships and knowledge sharing.	The Strong Peoples-Strong Country Framework is the primary mechanism through which the component is supporting the recognition and embedding of Traditional Knowledge alongside western knowledge in Great Barrier Reef governance, however as stated above, this project is out of scope of this evaluation and will be considered as part of the Traditional Owner Partnerships component in 2026. Beyond this specific project, 15 of the 17 projects included Traditional Owner engagement in some form. When considering the collaboration spectrum, six projects consulted with Traditional Owners, six involved them, and 3 collaborated with them. This included for the first time on the GBR, select monitoring projects have been co-designed with Traditional Owners (6). Strong and meaningful relationships have been established, knowledge has been shared both ways, and scientists/TOs have learned a lot from one another (see Table 3). The engagement spectrum (5) • Inform: Providing the community with factual information • Consult: Obtaining feedback from the community • Involve: A two way exchange of information that encourages discussion and provides an opportunity for the community to influence the outcome. • Collaboration: Working in partnership with the community, as a team, sharing agenda setting and jointly formulating solutions. • Empower: Placing final decision-making in the hands of the community.

Project summary table

Table 3. IMR Project Summary table

Project details		Delivery status			Engagement			Research outcomes		
Project	Description	Status and next steps	RIMReP Integration status	Data availability	Integrated governance and end-user engagement.	Traditional Owner (TO) Engagement	Dissemination of findings	Use of data in Reef mgmt to date	Improved data timeliness and accessibility	Improved data coverage or cost effectiveness
Total 17 Projects Value \$28.8M	Decision Support System: 1 Human Dimensions: 4 Biophysical: 10 Integration: 2	Completed: 11 Extended: 6 (4: Dec 2024, 1: June 2025, 1: Sep 2025)	Aligned - Integration pathway via DMS dependent on the Reef Authority: 12 Isolated: Separate to RIMReP: 5 (3 integrate into MMP/P2R).	VG: 0 G: 5 A: 11 P: 1	the Reef Authority involved in Governance: 15: Other end-users involved in governance: 2	NA: 2 Inform: 0 Consult: 6 Involve: 6 Collaborate: 3 Empower: 0	All demonstrated dissemination of findings, including through conference presentations or social media.	Yes, demonstrated use in Reef Management to date: 13. NA, project underway and use yet to be demonstrated: 2 No demonstrated use: 2	Yes: 13 NA: 4	Yes: 16 NA: 1 (unfinished and no data)
RIMReP Data Management System (DMS) University of Tasmania - Integrated Marine Observing System (IMOS) \$2.357M (Report #1)	Decision Support System The RIMReP DMS is a fit-for-purpose system that offers data services to the Reef Authority and authorised external users.	In progress (to Dec 2024) Now entering the transition phase to facilitate integration with the Reef Authority systems and infrastructure.	Aligned Integration into RIMReP dependent on the Reef Authority.	Poor Datasets translated to DMS, but not yet integrated into RIMReP and/or DSS (integration dependent on the Reef Authority).	Yes the Reef Authority on project Steering Committee and co-funder TO member on project Steering Committee	Consult Planned TO engagement was not realised. TO-user benefits identified through TO member on Project Steering Committee.	Yes Regular newsletter, conference presentations	Yes The system currently has over 110 registered users and is being used in select the Reef Authority reporting /decision making processes.	Yes Demonstrated improvements to the efficiency of reporting and analysis activities, and timely implementation of data and metadata services that can be immediately utilised by our customer.	Yes To date, the DMS ingested 167 datasets, allowing users to quickly browse through the metadata catalogue, explore individual items or use simple filters.
Enabling Social & Economic Long-Term Monitoring (SELTMP) CSIRO \$1.224M (Report #2)	Human Dimensions SELTMP provides the only long-term continuous human dimensions (social and economic data) collected specifically to inform Reef management since 2013.	Completed (Jun 2024) A proposal has been shared with management partners for the next phase, including integration of the SEABORNE project (described below).	Aligned Integration pathway via DMS (dependent on the Reef Authority).	Good Datasets translated to DMS, but not yet integrated into RIMReP and/or DSS (integration dependent on the Reef Authority). Datasets accessible via CSIRO's dashboard, and Technical reports are peer-reviewed papers and published on CSIROs website.	Yes The Human Dimensions Steering Committee includes RIMReP and the Reef Authority representation. SELTMP End-User Reference Group (SERG) includes end-user management agency partners.	NA Indigenous data is out of scope of SELTMP, this is addressed by the 'Strong People-Strong Country' program.	Yes Conference presentations, webinars and brochures.	Yes Data informed regional report cards and Reef report card.	Yes Datasets made publicly available within approx. 6 months of data collection, where prior to 2020 it typically took >12 months.	Yes Estimated cost per respondent of new methods is was approx. \$18, almost half of pre 2020 method (approx. \$35).

Project details		Delivery status			Engagement			Research outcomes		
Project	Description	Status and next steps	RIMReP Integration status	Data availability	Integrated governance and end-user engagement.	Traditional Owner (TO) Engagement	Dissemination of findings	Use of data in Reef mgmt to date	Improved data timeliness and accessibility	Improved data coverage or cost effectiveness
The sustainable use and benefits for marine (SEABORNE) project CSIRO \$0.49M (Report #3)	Human Dimensions Synthesis of existing data to improve understanding about who is using the GBR, how it is being used and the benefits enjoyed from this use.	Complete (Sep 2024). A proposal has been shared with management partners to integrate the project into the next phase of SELTMP (see above).	Aligned Integration pathway via DMS (dependent on the Reef Authority).	Good Datasets translated to DMS, but not yet integrated into RIMReP and/or DSS (integration dependent on the Reef Authority). Datasets accessible via CSIRO's Data Access Portal (DAP), and Technical reports are peer-reviewed papers and published on CSIRO's website.	Yes The Human Dimensions Steering Committee includes RIMReP and the Reef Authority representation. Technical Working Group comprised of a range of end users.	Consult Workshops held with four TO groups to inform the framework.	Yes Conference presentations, CSIRO Website and App.	Yes ESVCs used by the Reef Authority in development of the Southern POM	Yes Accessibility of existing data improved through App (SYNTHESEAS) to allow users to filter records.	Yes Established and tested the application of a proof of concept to organise existing data and quantify benefits derived from Reef ecosystem services by end users - referred to as an Ecosystem Service Value Chain (ESVC).
People & Reef Organisations Tackling Environmental Change Together (PROTECT). University of Queensland \$0.59M (Report #4)	Human Dimensions Integrated Stewardship Monitoring & Reporting - how individuals and community organisations engage in Reef stewardship.	In progress (to Dec 2024). Human Dimensions integration work led by the Reef Authority	Aligned Integration pathway via DMS (dependent on the Reef Authority).	Adequate Datasets translated to DMS, but not yet integrated into RIMReP and/or DSS (integration dependent on the Reef Authority). Peer-reviewed paper	Yes The Human Dimensions Steering Committee includes RIMReP and the Reef Authority representation. Project Steering Committee and Expert Advisory Group comprised end users.	Consult TO included in each stage of theory of change, framework, and visualisation tool development.	Yes Online and conferences	N/A Project not complete	N/A Project not complete	N/A Project not complete

Project details		Delivery status			Engagement			Research outcomes		
Project	Description	Status and next steps	RIMReP Integration status	Data availability	Integrated governance and end-user engagement.	Traditional Owner (TO) Engagement	Dissemination of findings	Use of data in Reef mgmt to date	Improved data timeliness and accessibility	Improved data coverage or cost effectiveness
Governance Queensland University of Technology \$0.4M [Report #5]	Human Dimensions Monitoring collective capacity and effectiveness of governance.	In progress (to Dec 2024)	Aligned Integration pathway via DMS (dependent on the Reef Authority). Human Dimensions Integration work being led by the Reef Authority.	Adequate Peer-reviewed papers (planned)	Yes the Reef Authority on project steering committee.	Consult Interviews with members of the Reef Traditional Owner Steering Committee undertaken in the design phase.	Yes Conference and government presentations (planned).	NA Use dependent on completion.	NA	Yes A preliminary framework for monitoring the health of the Reef 2050 Plan governance system, consisting of 20 measurable attributes categorised into four dimensions. Supported by an approach to data collection and analysis that involves the synthesis of multiple lines of evidence as a basis for appreciative inquiry
Fitzroy Basin: Marine Monitoring Program (MMP) for Inshore Water Quality Australian Institute of Marine Science (AIMS) \$1.799M (Report #6)	Biophysical Re-initiate the in-shore water quality monitoring in the Fitzroy River under the MMP after it was discontinued in 2015 due to funding priorities.	Completed (Jul 2024) MMP is now being coordinated by the Reef Authority who are working towards continuation of the project.	Isolated Integration via MMP (Paddock to Reef).	Adequate Peer-reviewed paper	Yes Routine collaboration with the Reef Authority and MMP committee.	Involve Traditional owner representatives invited to participate in every AIMS run field trip, resulting in two TO shipboard engagement activities. Presentations at TUMRA Steering Committee meetings and participation in the Darumbal BROLGA Junior Rangers Program. Shared results to the TO steering committees.	Yes Social media, Technical Reports, presentations at MMP workshops.	Yes Used to update the IMOS Bio-optical Database to improve the accuracy of satellite products. Used to validate the eReefs model to improve the accuracy of eReefs modelling products. The Fitzroy Partnership for River Health used data in the local NRM regional report card.	Yes Interpretive products (such as the Water Quality Index) generated and improved to improve access to data for the Fitzroy region for the Reef Authority.	Yes Improved coverage with re-commencement of discontinued Fitzroy River MMP, complementing a long-term dataset.

Project details		Delivery status			Engagement			Research outcomes		
Project	Description	Status and next steps	RIMReP Integration status	Data availability	Integrated governance and end-user engagement.	Traditional Owner (TO) Engagement	Dissemination of findings	Use of data in Reef mgmt to date	Improved data timeliness and accessibility	Improved data coverage or cost effectiveness
Coral Reef Indicator Framework AIMS \$0.5M (Report #7)	Biophysical Deliver an indicator framework, acknowledging the spatial, temporal, and ecological complexity in defining reef condition.	Completed (Oct 23) Operationalizing reporting platforms across the Reef to integrate framework – including a specific use case for the regional report cards.	Aligned Integration pathway via DMS (dependent on the Reef Authority).	Adequate Datasets translated to DMS, but not yet integrated into RIMReP and/or DSS (integration dependent on the Reef Authority). AIMS hosting the indicator toolkit.	Yes Co-designed with the Reef Authority and other end-users.	Consult Five Traditional Owner groups engaged,	Yes Social media	No Operationalisation dependent on integration into RIMREP	YES Synthesised different coral monitoring data into indicators, acknowledging the spatial, temporal, and ecological complexity in defining reef condition and producing a guided approach to describe the condition of reef habitats in space and time.	Yes Potential to improve cost effectiveness by sythesising coral data and providing automated interpretations to guide managers
Sea Cucumber monitoring Macquarie University \$0.97M (Report #8)	Biophysical Provide critical baseline information on the distribution, population demography and dynamics of sea cucumber species, to inform stock assessments and sustainable use.	Complete (Sep 2024)	Aligned Integration pathway via DMS (dependent on the Reef Authority).	Good Datasets translated to DMS, but not yet integrated into RIMReP and/or DSS (integration dependent on the Reef Authority). Datasets published to GEONadir Technical reports are peer-reviewed papers.	Yes the Reef Authority on project steering committee. Close collaboration with end-users including RIMReP, QDAF, Citizens of the GBR, the fisheries, and the Reef Authority.	Involve TO groups participated in fieldtrips, workshops and open days.	Yes Social media posts, media releases, articles, conference presentations, Early Childhood Education Centre	Yes QDAF report findings to commercial fishery industry.	Yes Provided data for commercial fishery where there is limited independent information. Critical baseline data on the distribution, population demography and dynamics of sea cucumber species made available	Yes The new survey method covers a greater depth range (up to 60m) and allow long continuous transects (up to 1km). The project developed a method for the commercial fishers to conduct/ enhance their monitoring.
Great Reef Census Citizens of the Great Barrier Reef \$0.65M (Report #9)	Biophysical Pilot a citizen science photographic imagery method to expand benthic habitat reconnaissance data on the GBR	Completed (Aug 2022)	Isolated No formal integration pathway into RIMReP, despite concerted efforts by GBRF.	Adequate Dataset published via Citizens of the GBRF website.	Yes The GBRF engaged the Reef Authority and the RIMReP Operations Committee. Despite multiple attempts by the Partnership, the Reef Authority and RIMReP did not endorse inclusion of Reef Census data into the DMS.	Consult One group consulted to inform program, and 3 groups involved in data collection.	Yes Social and traditional media stories. National and international media coverage and other promotional and comms products.	Yes Results used by UQ to update models for the Reef Authority to inform COTS control activities. Results informed coral cover estimates (Marine Spatial Ecology Lab, UQ) and 'Importance Score' modelling.	NA	Yes Demonstrated cost-efficient large-scale and multi-partner citizen science monitoring methodology. Increased coverage of data on previously data poor reefs. Of the 441 reefs surveyed, including were 130 previously unsurveyed reefs.

Project details		Delivery status			Engagement			Research outcomes		
Project	Description	Status and next steps	RIMReP Integration status	Data availability	Integrated governance and end-user engagement.	Traditional Owner (TO) Engagement	Dissemination of findings	Use of data in Reef mgmt to date	Improved data timeliness and accessibility	Improved data coverage or cost effectiveness
Reef Fish monitoring Australian Institute of Marine Science (AIMS) \$5.76M Report #10	Biophysical Implemented Reef wide Reef Fish Monitoring including annual in-shore reef monitoring, Nursery seascape monitoring, Annual Deep water and inter-reef monitoring, development of reef fish indicators and Indigenous Ranger training and competency sign off for Cert III.	In progress (to Dec 2024) AIMS, TropWATER and USC have applied for DCCEEW's Community Stewardship grant to continue to engagement with Traditional Owners established during the Nursery Seascape component.	Aligned Integration pathway via DMS (dependent on the Reef Authority).	Adequate Datasets translated to DMS, but not yet integrated into RIMReP and/or DSS (integration dependent on the Reef Authority). Peer-reviewed paper	Yes the Reef Authority on project steering committee	Collaborate Two-way knowledge sharing with Traditional Owners, co-design of the Nursery Seascape component, sampling done in partnership with rangers and Traditional Owners (providing on-the-job training and accredited certifications).	Yes Conference presentations, social media posts Peer-reviewed scientific journal publications	Yes Data used for commercial fishery As a result of this project, AIMS produced an accredited Cert. III in subtidal monitoring, an Australian first, to be used by Traditional Owners around Australia to help advance their ability to monitor their Sea Country and contribute to its sustainable management. This project provided the impetus for the establishment of the Mingga Mingga Rangers from the Manbarra Traditional Owners. Videos from the project used to train a new AI developed through the Queensland Governments BRII Challenge.	Yes Provided data for commercial fishery where there is limited independent information. BRUVS and ROVS have proven effective at categorizing reef fish assemblages in these areas and should prove instrumental in any future monitoring efforts	Yes Efficiency: Remote technologies such as BRUVS and ROVS have proven effective at categorizing reef fish assemblages. Developed and trained an A.I. algorithm to improve cost effectiveness of analysing imagery, saving time in processing videos. Coverage: Two previously under-represented environments of the GBR: the coastal nursery seascape and deep-water inter-reefal areas. Improved coverage of Inshore Fringing Reef component and has doubled the number of reefs on which surveys are conducted, compared to the legacy project.

Project details		Delivery status			Engagement			Research outcomes		
Project	Description	Status and next steps	RIMReP Integration status	Data availability	Integrated governance and end-user engagement.	Traditional Owner (TO) Engagement	Dissemination of findings	Use of data in Reef mgmt to date	Improved data timeliness and accessibility	Improved data coverage or cost effectiveness
Biosecurity monitoring Queensland Department of Environment and Science and Innovation (DESI) / Queensland Parks and Wildlife Service (QPWS) / Reef Joint Field Management Program (RJFMP) \$0.56M (Report #11)	Biophysical Develop and test novel surveillance methods for early detection of cryptic pest fauna	Complete (Apr 2024) The six monitoring units used in the project will continue to be used by QPWS. Further testing of eDNA is required to confirm soil sampling utility. Software will be made available for use by other organisations into the future.	Isolated Integration pathway via QPWS/ RJFMP	Adequate Project focused on tech development rather than data collection. The online user interface of images captured by the CritterPic units and locations of currently deployed units is accessible by DES personnel. eDNA assays are available for broad use at request.	YES Integrated within DESI with QPWS as the end-user. The project's partnership between key organizations, including TropWATER, DESI, the National Electric Ant Eradication Program, the Yellow Crazy Ant Program and the Whitsundays Regional Council, has been instrumental in enhancing the relevance, accessibility, and utility of the collected data.	Involve Select TO rangers trained on tools being developed.	Yes Conference presentation and presentations to broader RFJMP team.	Yes Government organisations will adopt CritterPic devices for future monitoring. Modified CritterPic devices and rodent detection AI available through manufacturer. Integration of eDNA techniques into broader monitoring and eradication programs.	Yes Advanced technology and automation will significantly reduce the lag time between data collection and analysis, to response. The partnership approach has enhanced data relevance, accessibility, and facilitated technology capability within DESI for ongoing use.	Yes New methods demonstrate improved cost effectiveness of data collection.
Island habitat monitoring DESI QPWS \$0.66M (Report #12)	Biophysical Baseline data on vegetation diversity, distribution, and general condition for 89 Reef islands. Fauna surveys on priority islands Development of cay classification and monitoring system and collection of baseline data on priority islands.	Complete (Jun 2024) QPWS have adopted the cay monitoring framework as part of BAU.	Aligned Integration pathway via DMS (dependent on the Reef Authority) Integrated via QPWS/ RJFMP adoption.	Good Some datasets translated to DMS, but not yet integrated into RIMReP and/or DSS (integration dependent on the Reef Authority). Datasets to be publicly available as part of the Queensland Herbarium's Regional Ecosystem Mapping v14 in 2025. Fauna datasets are available in WildNet, Cay datasets are freely available on GeoNadir.	Yes QPWS is end-user and the Reef Authority endorsed project outputs.	Involve Drone mapping training for two First Nations ranger groups, to develop skills to capture data and map features of interest to them and hopefully contribute to the ongoing drone-based monitoring of cays in the Reef. Indigenous Ranger involvement in fauna survey completion.	Yes Social media posts and presentations	Yes QPWS have adopted cay monitoring framework as part of BAU and will continue to map cays opportunistically via RJFMP. Data outputs generated from regional ecosystem mapping and fauna surveys will be used to inform future management decisions.	Yes One 20-minute drone flight can capture a much better 3D model and aerial photograph of a cay than mapping using traditional in situ surveying techniques which would take more than a day to cover the same area at lower resolution. Post-processing methods developed to geo-correct the drone datasets to an appropriate level of accuracy without the need for any in situ surveying.	Yes Eighty-nine RIMReP Island Habitat Monitoring priority islands' regional ecosystems mapped 107 new species added to WildNet not previously recorded for a particular island. An unprecedented spatial database of attributes for all 233 cays created. A framework to classify cays based on their geomorphology and environmental drivers.

Seabirds monitoring DESI, QPWS \$0.79M (Report #13)	Biophysical Trial several methods to improve monitoring of seabird population trends throughout the GBRWHA.	Complete (Sep 2024) Lessons from tested devices to be integrated into future field planning, Collaboration with QUT to continue to further enhance machine learning and acoustic recorders. Little Tern monitoring to be adopted into Ranger Country Management Plans to support continuous monitoring.	Aligned Integration pathway via DMS (dependent on the Reef Authority) Integrated via QPWS/ RJFMP adoption.	Good Datasets publicly available through Birdlife Australia, Wildnet and QUT Ecosounds website.	Yes QPWS is end-user with close engagement with the Reef Authority.	Involve Formal arrangements with Aboriginal Business Corporations to monitor little tern colonies throughout the season.	Yes Social Media posts, Birdlife Australia media articles, presentations.	Yes Little tern monitoring influenced threat mitigation strategies for nesting birds. Data collected will inform future monitoring schedules of RJFMP and contextualise results	Yes Timeliness and accessibility of data has been improved through the combination of technologies trialled for monitoring, and increased monitoring frequency at all of the study sites, compared with the standard annual QPWS survey schedule. Accessibility of data was improved through the development of various platforms and tools during the project. The acoustic recognisers have allowed for data to be more rapidly processed without the requirement of expert knowledge of the species, meaning all staff have the capability to monitor changes in the colony.	Yes Drone surveys are more cost effective and time efficient than ground-based counting for species that nest in open habitats, allowing more frequent and detailed monitoring. Drone surveys enable additional coverage through the collection of data on all seabird species rather than solely gathering data on focal species. The use of acoustic recorders for seabird monitoring in this project improved coverage of study sites both spatially and temporally, allowing continual monitoring throughout an entire breeding season; not feasible using other methods. The use of machine learning models automated the detection and counting of seabirds in drone orthomosaics. The cost of acoustic recorders is generally small compared to costs associated with multiple visits to Reef islands. Coverage and cost effectiveness increased via training of volunteers and ranger groups to conduct monitoring.
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Project details		Delivery status			Engagement			Research outcomes		
Project	Description	Status and next steps	RIMReP Integration status	Data availability	Integrated governance and end-user engagement.	Traditional Owner (TO) Engagement	Dissemination of findings	Use of data in Reef mgmt to date	Improved data timeliness and accessibility	Improved data coverage or cost effectiveness
Inshore Dolphin monitoring Southern Cross University \$0.56M (Report #14)	Biophysical Distribution, abundance, and threats to inshore dolphins in the Great Barrier Reef	In progress (to Jun 2025) The strong collaboration developed through the project has allowed for further collaboration beyond the life of this project. The Reef Dolphin Project is seeking funds for continuity.	Aligned Integration pathway via DMS (dependent on the Reef Authority).	Adequate Datasets translated to DMS, but not yet integrated into RIMReP and/or DSS (integration dependent on the Reef Authority). Peer-reviewed papers (in development)	Yes the Reef Authority on project steering committee	Collaborate Engaged with 12 Traditional Owner Groups in the study area that provided FPIC to sea country after a comprehensive 12-24 month consultation process. Two representatives from each group joined the boat-based survey in their sea country. Outcomes to be shared (co-presented) with Traditional Owners who participated in 2023 dolphin monitoring surveys at the Biennial Conference of Marine Mammals in November 2024.	Yes Social media, online, peer reviewed papers in development, Marine Mammal Conference.	Yes New knowledge for Traditional Owners and their sea country as well for the conservation of Australian humpback and snubfin dolphin. The results were used in the recent Commonwealth's assessment of humpback and snubfin dolphin under the EPBC act and in the ongoing identification under the Protocol for Designation of Biologically Important Areas for Protected Marine Species.	Yes Collaboration with 12 Traditional Owners Groups. over the two years allowed the removal of critical bottlenecks in accessibility and knowledge due to prior limited contacts and relationships with Traditional Owners Group in the remote region of north Queensland.	Yes A large-scale vessel survey covering more than 20,000 km2. Data addressed knowledge gap of the abundance and distribution of two inshore dolphins species listed as vulnerable in the northern Great Barrier Reef.

Project details		Delivery status			Engagement			Research outcomes		
Project	Description	Status and next steps	RIMReP Integration status	Data availability	Integrated governance and end-user engagement.	Traditional Owner (TO) Engagement	Dissemination of findings	Use of data in Reef mgmt to date	Improved data timeliness and accessibility	Improved data coverage or cost effectiveness
Dugong monitoring James Cook University TropWATER \$1.737M (Report #15)	Biophysical Monitoring the distribution and abundance of dugongs (and in-water, large marine turtles) using a combined aerial observer and imagery approach.	In progress (to Sep 2025) An extension from 2024 to 2025 using unallocated IMR funds (\$0.842M total project value to \$1,74M) to foster partnerships with Traditional Owners including additional studies. The team are seeking additional investment to improve the accuracy of the AI processes to develop a cost-effective approach to using imagery in large scale wildlife population surveys.	Aligned Integration pathway via DMS (dependent on the Reef Authority). Including all historical data.	Adequate Datasets translated to DMS, but not yet integrated into RIMReP and/or DSS (integration dependent on the Reef Authority). Peer-reviewed paper	Yes the Reef Authority on project steering committee. The project catalysed collaboration with intra and interstate researchers (e.g., SCU, Charles Darwin Uni, Western Australian Government, DESI, the Reef Authority, and governmental (DCCEEW) managers, as well as communities within and beyond the GBR.	Collaborate Facilitated the renewal of connections between scientists and community members, including engagement with Traditional Owners across the GBR, fostering a collaborative approach to marine conservation and two-way knowledge sharing about dugongs establishing trusted relationships with Traditional Owner groups - building strong collaborations is key to reshaping the way we approach dugong research, monitoring, and management.	Yes Conference presentations Substantial media coverage Publication of Technical Reports.	Yes Used in global dugong conservation reports - The new United Nations' report entitled 'Dugong: status report and action plans for countries and territories' (not yet published). Used as decision support tool at the state and federal Government levels. Used in Great Barrier Reef Outlook Report 2024. Used by a PhD student. Shark data shared with JCU PhD student and with Queensland, Department of Agriculture and fisheries.	NA	Yes Continued time series of Dugong Surveys across the Inshore Waters of the Reef, enabling the continuation of a four-decade-old time-series of surveys. Advances large-scale imagery surveys for more spatially accurate and expansive data collection methods. The project contributes to the development and refinement of artificial intelligence algorithms tailored to process large image datasets, facilitating the detection of marine megafauna.

Project details		Delivery status			Engagement			Research outcomes		
Project	Description	Status and next steps	RIMReP Integration status	Data availability	Integrated governance and end-user engagement.	Traditional Owner (TO) Engagement	Dissemination of findings	Use of data in Reef mgmt to date	Improved data timeliness and accessibility	Improved data coverage or cost effectiveness
eReefs AIMS, BoM, CSIRO) technical reports.AIMS, BoM, CSIRO \$9.668M (Report #16)	Integration Phase 5 of eReefs services delivery had three components: 1: AIMS aimed to enhance the usability and accessibility of the eReefs models for researchers and reef managers. 2: BoM aimed to develop a near real-time catchment modelling system for freshwater and water quality inflows into the GBR. 3: CSIRO were responsible for regional and high resolution marine modelling, critical observations from satellites and in situ ,and data management and visualisation.	Complete (Aug 24) AIMS will continue to maintain the eReefs platform and is seeking funding through the Department of Climate Change, Energy, the Environment and Water (DCCEEW) for eReefs Phase 6.	Isolated RIMREP and Paddock to Reef (which eReefs informs) are not integrated. Several eReefs datasets are also integrated into the DMS.	Adequate eReefs is a publicly accessible information platform operating for more than twelve years delivering rigorous scientific data, analytic and visualisation products and services used by management agencies, regional entities, industries, and researchers, to support both strategic and operational management decision-making.	Yes the Reef Authority, DESI and DCCEEW on project management committee. Also on the Integrate HD Steering Committee	Involve Engaged with TO Groups to incorporate datasets, testing of Governance Health Framework. Inclusion of TO member on Steering Committee.	Yes Social media	Yes The eReefs models are utilized to generate key water quality metrics essential for the Reef Report Card. User engagement with the eReefs visualization portal and data services was significant, with a monthly average of 1,500 views from 800 unique users. The project played a vital role in the production of the Reef 2050 WQIP Reef Report Cards water quality scores Maps derived for the Scientific Consensus Statement and the the Reef Authority Outlook report. Supported JCU TropWATER's dugong surveys, leading to more precise modelling of dugong distributions.	Yes The AIMS project has eased use and accessibility of eReefs data through an expanded suite of visualisation products and streamlined data services. The BoM project has made Water quality and quantity historic simulations and near real-time simulations available.	Yes eReefs offers comprehensive coverage of the Reef and Coral Sea across numerous environmental variables, surpassing the coverage of field-based monitoring techniques. New eReefs modules developed by CSIRO enabling oil spill and pesticide modelling.
Pilot study for water quality sampling on COTS Control vessels JCU \$0.11M [Report #17]	Integration Test if COTS control program could expand MMP sampling to mid-outer reefs and validate remote sensing products.	Complete (July 2023) Recommendations provided for continuation of sampling and utilisation of insights.	Isolated Integration pathway via MMP and the Reef Authority	Adequate Technical report published.	Yes End-users were engaged by being the project lead (JCU - MMP) and key partner COTS Control Program (the Reef Authority)	NA. Engagement was through the COTS Control Program vessels.	Yes Communications through the COTS Control Program vessels.	No - not adopted due to funding constraints.	Yes Demonstrated opportunistic WQ sampling by COTS Control vessels can improve access and timeliness to WQ data.	Yes Demonstrated opportunistic WQ sampling by COTS Control vessels can expand MMP activities to mid-outer reefs and validate remote sensing as a cost effective method.

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- 04a. MTE 2021, Reef Trust Partnership Mid-term evaluation, Clear Horizon
- 04b. MTE 2021, Reef Trust Partnership Mid-term evaluation, Appendix: IMR Component results Table, Clear Horizon.
05. The Engagement Spectrum Factsheet, Department of Social Services.
06. IMR Component Impact presentation RIMReP _ Sept 2024Presentation

Project Reports

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| 01: RIMReP Data Management System (DMS) | 11. Biosecurity monitoring |
| 02 Enabling Social & Economic Long-Term Monitoring (SELTMP) | 12. Island habitat monitoring |
| 03. The sustainable use and benefits for marine (SEABORNE) project | 13. Seabirds monitoring |
| 04. People & Reef Organisations Tackling Environmental Change Together (PROTECT). | 14. Inshore Dolphin monitoring |
| 05. Governance | 15. Dugong monitoring |
| 06. Fitzroy Basin: Marine Monitoring Program (MMP) for Inshore Water Quality | 16a. eReefs: AIMS Final Report |
| 07. Coral Reef Indicator Framework | 16b. eReefs: Alluvium final report |
| 08. Sea Cucumber monitoring | 16c. eReefs: CSIRO Final Report |
| 09. Great Reef Census | 16d. eReefs: CSIRO Methods Report |
| 10. Reef Fish monitoring | 16e. eReefs: BoM report. |
| | 17. Pilot study for water quality sampling on COTS Control vessels |

Rubrics

Component will be judged at the end of the Partnership and will support - Assessment of the contribution of the IMR Component to the Reef 2050 Plan; and Assessment of the overall effectiveness of the Partnership.

Table 4. Rubric for IMR Evaluation Question 1

To what extent have critical RIMReP needs/gaps been prioritised and met by the IMR Component?	
Factors being considered in this rubric are: a) Alignment, b) Prioritisation, c) Integration d) Effectiveness f) Data availability.	
Very good	a) Alignment: Monitoring priorities are fully aligned with RIMReP. b) Prioritisation: Investment in monitoring is underpinned by a clear and transparent prioritisation process supported by key partners and stakeholders c) Integration: The IMR Component and RIMReP are fully integrated and adding value to each other d) Effectiveness: Monitoring activities are delivered very effectively and efficiently (high return on investment) and outputs add value across a range of areas e) Data availability: Data is fully available to the broader community in a variety of formats and is used across multiple platforms
Good	a) Monitoring priorities are mostly aligned with RIMReP. b) Investment in monitoring is underpinned by a transparent prioritisation process which involves key partners and stakeholders c) The IMR Component and RIMReP are well aligned and contribute to each other d) Monitoring activities are delivered effectively and efficiently (good return on investment) and outputs add value across a range of areas e) Data is generally available to the broader community in a variety of formats and can be used across multiple platforms
Adequate	a) Monitoring priorities are generally aligned with RIMReP. b) Investment in monitoring is underpinned by a prioritisation process developed in collaboration with a select number of key partners and stakeholders c) The IMR Component and RIMReP collaborate and do not conflict with each other d) Monitoring activities are delivered effectively and according to current practice, with limited opportunities for co-benefits from outputs e) Data is partly available to the broader community in a few key formats, and can be used across a limited number of platforms
Poor	a) Monitoring priorities are only partly aligned with RIMReP. b) Investment in monitoring is justified but not consistently or transparently prioritised c) The IMR Component and RIMReP operate in relative isolation d) Monitoring activities are partly delivered; cost effectiveness and return on investment are low e) Data is not generally available to the broader community and outputs can only be accessed in a few formats on a single platform
Detrimental	a) Monitoring priorities are conflicting with RIMReP in some instances. b) Investment in monitoring is not subjected to a consistent prioritisation process c) The IMR Component and RIMReP operate mostly in isolation d) Monitoring activities are poorly delivered; cost effectiveness and return on investment are very low e) Data is not available externally and outputs can only be accessed by a limited number of users on a 'research grade' platform

Table 5. Rubric for IMR Evaluation Question 2

To what extent has the IMR Component delivered and made operational an integrated decision-support system?

Factors being considered in this rubric are a) Functionality, b) Operation, c) Use, d) international interest.

Very good	a) Functionality: The DSS is fully functional addressing a broad range of strategic and tactical issues. It is aligned with DIPSR and integrates a broad range of drivers and pressures b) Operation: The DSS is operational, fully scalable and maintenance and operating costs are fully funded c) Use: Key Reef 2050 partners are using the DSS and the broader community is supportive of the DSS and how it enables transparent management decisions d) International interest: The DSS is highly innovative and a unique example is being replicated or inspiring similar initiatives outside the Great Barrier Reef and Australia
Good	a) The DSS is functional addressing a limited range of key strategic and tactical issues. It is aligned with DIPSR and integrates key drivers and pressures b) The DSS is operational, maintenance and operating costs are funded for a limited number of critical applications c) Key Reef 2050 partners are using the DSS and the broader community is aware of its role in management d) The DSS is innovative and is generating interest outside the Great Barrier Reef and Australia
Adequate	a) The DSS allows decision making of limited complexity and scenario running by integrating key drivers and pressures b) The DSS is operational for a limited number of critical applications and a model has been recommended for long-term maintenance and operation c) the Reef Authority and policy makers are using the DSS but it remains out of reach for the broader community d) The DSS builds on existing systems and can be applied outside the Great Barrier Reef but is not flexible enough to attract interest outside Australia
Poor	a) The DSS only allows decision making and scenario running for simple situations involving few drivers and pressures b) The DSS runs in research mode, is not operational as such and presents no clear path to long-term funding and operation c) the Reef Authority and policy makers do not have confidence in using the DSS outside research projects; it is opaque to the broader community d) The DSS adds limited value and cannot compete with other existing systems
Detrimental	a) The DSS is not capable of dealing with any significant level of integration of multiple drivers and pressures b) The DSS displays limited functionality and can only be deployed as a research product and at great cost c) the Reef Authority, policy makers and the broader community see no value in the DSS or any specific application which would benefit from the DSS d) The DSS is not seen by experts as a step forward and negatively impacts the decision-making space