REPORT ON THE JOINT WORLD HERITAGE CENTRE/IUCN REACTIVE MONITORING MISSION TO THE GREAT BARRIER REEF (AUSTRALIA)

FROM 21 TO 30 MARCH 2022

© Ko Hon Chiu Vincent

Eleanor Carter (IUCN) and Hans Thulstrup (UNESCO)

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This mission was conducted by IUCN representative Ms Eleanor Carter (from Sustainable Solutions International Consulting) and UNESCO representative Dr Hans Dencker Thulstrup (Senior Programme Specialist for Water and Environmental Sciences with UNESCO's Regional Sciences Bureau for Asia and the Pacific in Jakarta, Indonesia).

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EXECUTIVE SUMMARY AND LIST OF RECOMMENDATIONS

The Great Barrier Reef (GBR) World Heritage property in Australia was inscribed in 1981 as the world's most extensive coral reef ecosystem. The array of biodiversity and seascapes collectively provide some of the most spectacular ecological biomes and marine scenery in the world.

However, over the past decades, and particularly in recent years, the GBR has faced considerable pressures that threaten the Outstanding Universal Value (OUV) of the property. These pressures are related in particular to climate change, coastal development, degrading water quality resulting from sediment and pollutant run-off from agricultural activities, and unsustainable resource use, among others.

Since 2010, the World Heritage Committee has raised concerns that activities within the GBR and its surrounding coastal areas are irrevocably threatening the OUV of the property. A joint World Heritage Centre/IUCN Reactive Monitoring mission (RM mission) was conducted in 2012, resulting in 14 recommendations to the State Party to prevent further decline of the OUV and to address significant threats to the property. In 2013, the World Heritage Committee decided, at its 37th session, to consider the inscription of the property on the List of World Heritage in Danger at its 38th session, in the absence of substantial progress.

At its 38th session in 2014, the World Heritage Committee welcomed the progress made by the State Party, in particular the establishment of the 2013 Reef Water Quality Protection Plan, the strategic assessment of the property and the intention to focus port development to the priority areas.

At its 39th session in 2015, the World Heritage Committee decided not to inscribe the property on the List of World Heritage in Danger, following significant progress made by the State Party. Progress included the adoption of the Reef 2050 Long Term Sustainability Plan (Reef 2050 Plan) that set out a comprehensive framework for the protection of the property for the next 35 years, the restriction of all major new port developments to four existing port areas, a permanent ban on dumping of dredged material from capital dredging and the commitment to establish an investment framework for the plan's implementation and a 5-yearly evaluation of the performance of the plan. Nonetheless, the Committee noted with concern the conclusion of the 2014 GBR Outlook Report that the overall outlook for the property was poor, and that climate change, poor water quality and impacts from coastal development remained major threats to the property.

At its 41st session in 2017, the World Heritage Committee noted with serious concern the coral bleaching and mortality that affected the property in 2016 and 2017 and encouraged the State Party to accelerate efforts toward meeting the intermediate and long-term targets of the Reef 2050 Plan.

In 2021, at its extended 44th session, the World Heritage Committee noted with utmost concern and regret the conclusions of the 2019 GBR Outlook Report that the long-term outlook for the ecosystem of the property had further deteriorated from poor to very poor, that the deterioration of the ecological processes underpinning the property's OUV had been more rapid and widespread than was previously evident, and the property had suffered significantly from consecutive mass coral bleaching events in 2016, 2017 and 2020. It further noted that progress had been insufficient in meeting key targets of the Reef 2050 Plan, in particular those related to water quality, which are critical to the resilience of the property. It urged the State Party to finalize the revision of the Reef 2050 Plan, accelerate action to address the threat of climate change in accordance with the Paris Agreement on Climate Change and create opportunities for recovery of the property, in particular on water quality. The Committee requested the State Party to invite a joint World Heritage Centre/IUCN RM mission to the property in 2022 to assess whether the updated Reef 2050 Plan addresses adequately the threats posed to the property by climate change and determines a pathway for accelerated actions in other areas affecting the conservation of the property.

This joint RM mission took place between 21 March to 30 March 2022, with the key objectives as follows:

I. Review the status of the Reef 2050 Plan's review and update, which was made available in December 2021, and assess the revised contents in light of the conclusions of the 2019 Great Barrier Reef Outlook Report, including accelerating action at all possible levels to address the threat from climate change and other factors affecting the Outstanding Universal Value (OUV) and integrity of the property;
II. Assess the State Party's progress towards addressing the impact of climate change on the OUV of the property, and how the revised Reef 2050 Plan addresses the threat posed to the property by climate change and determines a pathway for accelerated actions in other areas affecting the conservation of the property;
III. Assess the State Party's progress towards meeting key targets of the Reef 2050 Plan, in particular, but not limited to, the water quality and land management targets;
IV. In line with paragraph 173 of the Operational Guidelines for the Implementation of the World Heritage Convention, assess any other relevant issues that may negatively affect the OUV of the property, including its conditions of integrity and protection and management.

The mission team travelled through the GBR region, from Brisbane to Cairns, and met with a wide range of stakeholders to address the objectives of the mission and to determine whether the property meets the criteria for inscription on the List of World Heritage in Danger, in line with paragraph 180 of the *Operational Guidelines for the Implementation of the World Heritage Convention*.

The mission team concludes that, despite the unparalleled science and management efforts made by the State Party in recent years, the OUV of the property is significantly impacted by climate change factors. The resilience of the property to recover from climate change impacts is substantially compromised, in particular – but not exclusively – due to degraded water quality. While both comprehensive and thorough, the management frameworks, strategies and plans that are in place to protect the OUV of the property (a) are lacking clear climate change targets and implementation measures which are of upmost urgency to protect the OUV of the property, and (b) are not fully implemented, particularly in relation to water quality and fisheries activities.

Climate change is an ongoing and increasingly serious challenge to the OUV of the property. The GBR has suffered a series of widespread coral bleaching events, occurring with increasing frequency, including four events over the last seven years. A new mass bleaching of the property occurred during the mission team's visit and took place, for the first time in history, in a traditionally cooler La Niña period.

While the Reef 2050 Plan promotes the advancement of Australia's climate change mitigation commitments towards the attainment of the 1.5°C Paris Agreement target, the mission noted concerns amongst key stakeholders that the associated plans and strategies referred to in the Plan do not provide any clear pathway to avoid significant negative impacts to the OUV of the property. Whilst efforts towards climate change adaptation have accelerated considerably in recent years, particularly with regards to research into coral restoration, it remains of upmost urgency to establish more concrete actions that are sufficient to conserve the OUV of the property under existing global temperature increase scenarios, including the necessary mechanisms to track progress of strategic actions in addressing the impacts of climate change to the property.

The property's inshore region continues to face many threats from land-based activities impacting water quality. While considerable work is underway to address these threats via accelerated efforts to achieve the Reef 2050 goals (through the associated Reef 2050 Water Quality Improvement Plan - WQIP), progress has not been made to achieve the targets set out in the

WQIP, in large part due to the sheer scale of the challenge. While significant efforts have been made to reduce run-off of nitrates and phosphates from farms and to implement land-based restoration (including gully[1] repairs and associated remediation activities) to reduce sedimentation, there is a need to secure a greater reduction of these pollutants in the next three years than has been achieved since 2009 to achieve the WQIP targets. The proposed development of the new large-scale Hells Gate and Urannah dams in the region also threatens to counteract progress, both through their construction and the anticipated subsequent industrial and agricultural expansion plans.

Considering the above, the mission team concludes that the property is faced with major threats that could have deleterious effects on its inherent characteristics, and therefore meets the criteria for inscription on the List of World Heritage in Danger, as set out in paragraph 180 b) of the *Operational Guidelines*. Therefore, **the mission recommends that the Great Barrier Reef be inscribed on the List of World Heritage in Danger**.

The mission team acknowledges that the threat of climate change is a global threat requiring a global solution and underlines that it is critically important for all States Parties to undertake the most ambitious, rapid and sustained implementation of the Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC).

However, the mission team considers that a rapid implementation of the recommendations detailed in this report could drastically improve the State Party's ability to ensure and advance the conservation of the property and its OUV for future generations. The mission team therefore encourages the State Party to take full advantage of the property's extraordinary access to state-of-the-art managerial and scientific expertise, institutional and political support, and access to significant financial resources in order to implement these recommendations.

Finally, the mission team recognizes the excellent and outstanding work of numerous stakeholders actively endeavouring to effectively manage and conserve the GBR. The mission team witnessed exceptional levels of pride and commitment towards the GBR amongst wide segments of society. It is hoped that the energy and commitment towards GBR protection that was exemplified during the mission can be utilized effectively to accelerate the protection and effective management of this important national and global asset.

Based on the above, the mission team has the recommendations below. They consist of **10 priority recommendations** that require to be implemented with the upmost urgency and **12 additional recommendations** that would further strengthen the resilience of the property in the face of climate change.

High Priority Recommendations

Recommendation P1: Identify priority areas of grazing land for gully repairs and associated restoration and remediation activities, and significantly scale up activities in these priority areas through extensive mobilization of the necessary engineers and associated personnel, equipment and materials, alongside key engagement with relevant farmers and grazers to achieve existing WQIP targets.

Recommendation P2: **Require proposed and in-progress dam developments to show clear alignment with water quality improvement for the GBR** as a condition for approval under relevant legislation, including mandatory compliance with the 2018 Reef 2050 Net Benefit Policy, industrial guidelines associated with the reef protection regulations, and climate-ready design considerations to be assessed by appropriate environmental impact assessment, which also includes consideration of indirect impacts such as associated agricultural expansion. Mechanisms

[1] A gully is a ravine formed by the action of water.

and innovations should also be developed and implemented to address existing dam sediment impacts (from build-up and release) in priority catchments vulnerable to sedimentation (as prioritized for management in the WQIP).

Recommendation P3: Increase significantly the scale and pace of adoption, monitoring and enforcement of best management practice in sugarcane and banana farming to achieve WQIP targets; and advance the upscaling of land restoration activities, including where feasible the purchase and/or buy-back of land areas for restoration and return to wetland or riparian ecosystems.

Recommendation P4: Prioritise the protection of remnant native vegetation across the GBR catchments through strengthened native vegetation clauses under existing laws, and through improved identification and enforcement of permissible activities in areas of high conservation value (HCV) forests and woodlands. This would include review of sites where clearing is currently allowed without permits (Category X under the Vegetation Management Act 1999) and updating zonation and corresponding permits which limit conversion of HCV areas. Such advances should also incorporate full consideration of traditional owner land management principles.

Recommendation P5: Ensure Reef 2050 WQIP water quality targets, to be updated in 2023, and actions implemented through the WQIP **are sufficient** to ensure the OUV of the property is not further adversely impacted by low water quality, including through hitherto overlooked sources of poor water quality, such as dams, emerging crop industries and marine debris, with associated legislative compliance strengthened.

Recommendation P6: Review and strengthen, by 31 December 2022, the Reef 2050 Plan to include clear government commitments to reduce greenhouse emissions consistent with the efforts required to limit the global average temperature increase to 1.5°C above pre-industrial levels. Commitments should harness the State Party's significant capabilities to take accelerated action on this issue, at all possible levels, and should include timebound, actionable and practical steps **to limit the impacts of climate change on the OUV of the property**, including the following actions:

a) Continue to comprehensively assess and report on the impact of climate change on the property, and to include in this process an evaluation of the impact of the implementation of national climate change and emissions reduction strategies, based on best available science and information.

b) Develop and implement ambitious emissions reductions activities consistent with limiting the global average temperature increase to 1.5°C above pre-industrial levels, taking into account the above assessments and the additional 'climate related activities' concerning emissions reductions as recommended by the Independent Expert Panel (IEP), in its letter to the State Party in March 2022.

c) Establish a formal mechanism for the IEP and Reef Advisory Committees to advise the State Party on the required carbon emissions reductions to attain the goals set out in the Reef 2050 Plan.

Recommendation P7: Ensure that the carbon and water quality related credit schemes being deployed in the GBR catchments deliver overall net benefits to the OUV of the property and are monitored and regulated by the relevant agencies through fully transparent, science-driven and evidence-based management to that end.

Recommendation P8: Continue support for scientific research and increase financial resources to enable deployment of climate adaptation mechanisms developed through this research at the required scale to be effective in mitigating and adapting to climate change impacts across the property, including initiatives undertaken by AIMS (SeaSim and associated research activities), as

well as wider restoration initiatives that directly support the rehabilitation of habitat and concurrent carbon sequestration.

Recommendation P9: **Accelerate the implementation of the Queensland Sustainable Fisheries Strategy**, including the finalization of harvest strategies for all key species as a priority, and ensure management mechanisms outlined in the Strategy (including temporary closures of some fisheries areas to enable recovery and promote restocking, particularly in areas of spawning aggregations) are implemented in collaboration with the fisheries industry to achieve the target maximum economic yield (60% biomass) by 2027.

Recommendation P10: Phase out destructive gill net fishing in the property through appropriate mechanisms, including purchasing, and/or retiring all remaining industrial (N4) gill-net licences; retiring of other gill-net fisheries (N2) and the establishment of net-free sub-zones in areas of high conservation value for protected species.

Other Recommendations

Recommendation O1: Undertake the comprehensive and transparent scientific assessments recommended in the Maintenance Dredging Strategy, ensuring the results are made publicly available regarding the impact of maintenance dredge spoil dumping within the GBR, to guide and inform enhanced measures to minimize the impact of dredge spoil on the property.

Recommendation O2: Effectively enforce the Waste Reduction and Recycling (Plastic Items) Amendment Act, including by developing partnerships with existing civil society initiatives focused at: (a) reducing primary production and consumer purchase of single-use plastics goods; (b) repurposing of waste; (c) reimagining of products to transition to renewable materials (e.g., packaging); (d) recycling; and (e) proactive removal of debris.

Recommendation O3: Prioritize delivery of new and sufficient research into the impacts of emerging replacement crops in former cane-farming regions (e.g., macadamia nut, avocado, etc.) to ensure impact on GBR is well understood and set minimum practice standards in accordance with WQIP targets based on this research, to promote industry best-practice within GBR catchment.

Recommendation O4: Explore additional mechanisms for sediment capture in tributaries, including scientific and engineering assessments and innovations to establish whether sediment capture is possible at scale, and deployable without impact to the relevant ecological systems of the creeks, rivers and tributaries connected to the GBR.

Recommendation O5: Optimize the opportunity presented by the revision and update of the GBRMPA Blueprint for Resilience (that is scheduled for 2022) to more clearly demonstrate the actions that will be undertaken within the GBR to increase awareness of climate mitigation needs and present clear and actionable activities to reduce climate impacts on the OUV of the property.

Recommendation O6: At the State level (Queensland government), ensure the 1.5°C target is supported by legislation, and clear, actionable steps to achieve this target are set within the state's existing climate related strategies and plans; with associated opportunities optimized to become a 'climate action hub' for the GBR.

Recommendation O7: Develop and implement appropriate mandatory independent mechanisms for discard and bycatch monitoring, such as e-monitoring via vessel-based cameras, on all gill-net and trawl vessels within the property.

Recommendation O8: Advance research into effective bycatch reduction devices (BRDs) and accelerate the adoption and proactive installation of devices across relevant fisheries,

including the production of associated regulatory requirements to ensure the adoption is legislated.

Recommendation O9: Finalize and implement protected species management strategies for all formally recognized protected species (or suites of protected species in particular biomes), which should include appropriate regulations to effectively prohibit catch or harvest of these protected species.

Recommendation O10: Undertake a comprehensive review of current coral harvesting practices (given the escalation of this activity in recent years) to appropriately assess the extent and sustainability of this fishery in order to identify and implement appropriate fishery management measures and restrictions, where required.

Recommendation O11: Ensure that all relevant stakeholders review the Traditional Owner Implementation Plan and provide input to enable its finalization, adoption and roll out in the coming months and years in order to improve engagement and representation of TOs in co-planning and co-management that is vital for the future of the property and the region.

Recommendation O12: Provide clarity on overarching targets (and associated indicators) related to each goal of the Reef 2050 Plan, and ensure transparent mechanisms are established to monitor progress towards the targets, alongside an improved communications strategy for informing and engaging the relevant stakeholders, organizations, agencies and institutions through the upcoming revision of the Reef 2050 Plan.

I. THE PROPERTY

Great Barrier Reef, Australia

Date of Inscription: 1981

Criteria: (vii)(viii)(ix)(x)

Property: 34,870,000 ha

Summary of Outstanding Universal Value

As the world's most extensive coral reef ecosystem, the Great Barrier Reef (hereafter referred to as GBR) is a globally outstanding and significant entity. Within the GBR there are some 2,500 individual reefs, and over 900 islands, of varying size and geomorphology. Collectively these landscapes and seascapes provide some of the most spectacular maritime scenery in the world.

The latitudinal and cross-shelf diversity, combined with diversity through the depths of the water column, encompasses a globally unique array of interconnected ecological communities, habitats and species. There are over 1,500 species of fish, 4,000 species of molluscs, and some 240 species of birds, plus a great diversity of sponges, anemones, marine worms, crustaceans, and other species. As the world's most complex expanse of coral reefs, the reefs contain some 400 species of corals in 60 genera. This diversity, especially the endemic and threatened species, means the GBR is of enormous scientific and intrinsic importance.

The ecological integrity of the GBR is enhanced by the unparalleled size of the property. At the time of inscription, it was felt that to include virtually the entire Great Barrier Reef within the property was the only way to ensure the integrity of the coral reef ecosystems in all their diversity.

Some of the key ecological, physical and chemical processes that are essential for the long-term conservation of the marine and island ecosystems and their associated biodiversity occur outside the boundaries of the property and thus effective conservation programs are essential across the adjoining catchments, marine and coastal zones.

Summary reference to key SOC decisions and issues

The World Heritage Committee at its **35th session** (UNESCO, 2011) examined the state of conservation of the property and requested the State Party to invite a joint World Heritage Centre/IUCN Reactive Monitoring Mission (RM mission) to the property to assess the state of conservation of the property as a whole, and to contribute to the strategic assessment process (Decision 35 COM 7B.10).

The joint RM mission was undertaken from 6 to 14 March 2012.[2] The mission concluded that while the property continues to demonstrate its Outstanding Universal Value (OUV), it is affected by a number of current and potential threats, notably climate change, catchment runoff, coastal development, ports and shipping, and direct extractive use. Ten high priority recommendations and twelve other recommendations are proposed by the mission for implementation by the State Party to prevent a further erosion of the OUV and address important threats to the property.

The Committee at its **36th session** (Saint-Petersburg, 2012) took note of the findings of the 2012 RM mission, and also requested the State Party to address the mission recommendations in its

[2] The report of the 2012 joint World Heritage Centre / IUCN Reactive Monitoring mission is available here.

future protection and management of the property (Decision 36 COM 7B.8). In the same decision, the Committee requested the State Party to submit an updated report on the state of conservation of the property at its 37th session in 2013, with a view to consider, in the absence of substantial progress, the possible inscription of the property on the List of World Heritage in Danger, and further decided to consider the findings of the second GBR Outlook Report, and the completed Strategic Assessment and the long-term plan at its 39th session in 2015.

The Committee at its **37th session** (Phnom Penh, 2013) noted limited progress made by the State Party in implementing Decision **36 COM 7B.8** and the 2012 mission recommendations, and requested the State Party to submit an updated state of conservation report for examination at its 38th session in 2014, with a view to consider, in the absence of substantial progress, the possible inscription of the property on the List of World Heritage in Danger (Decision 37 COM 7B.10).

The Committee at its **38th session** (Doha, 2014) welcomed progress made by the State Party, notably with the Strategic Assessment and the preparations for the Long-Term Plan for Sustainable Development (LTPSD), and with regard to water quality including the endorsement of the 2013 Reef Water Quality Protection Plan. At the same time, the Committee noted that significant concern remained regarding the long-term deterioration of key aspects of the OUV of the property, including approvals for coastal developments in the absence of a completed Strategic Assessment and resulting LTPSD, and therefore requested the State Party to submit an updated report for examination at its 39th session in 2015, with a view to consider, in the absence of substantial progress, the possible inscription of the property on the List of World Heritage in Danger (Decision 38 COM 7B.63).

The State Party submitted the 2014 GBR Outlook Report and the Reef 2050 Long-Term Sustainability Plan (Reef 2050 Plan) for evaluation at the **39th session** of the Committee (Bonn, 2015). The Committee noted with concern the conclusion of the 2014 Outlook Report that the overall outlook for the property was poor, and that climate change, poor water quality and impacts from coastal development are major threats to the property's health. The Committee however welcomed the establishment of the Reef 2050 Plan which the State Party prepared in consultation with stakeholders to address the threats to the property and protect its OUV over the next 35 years (Decision 39 COM 7B.7). The plan included the commitment to reduce pollution run-off, outlined additional water quality investment, and announced the restriction of major new port developments in and adjoining the property, with a commitment to undertake five-yearly evaluations and adaptation of the plan, aligned with the post-production of future GBR outlook reports. The State Party further committed to the establishment of a permanent ban on dumping of dredged material within the property.

The World Heritage Committee requested the State Party to rigorously implement the Reef 2050 Plan and decided to review the overall state of conservation of the property at its 40th session in relation to the science-based conclusions of the anticipated 2019 GBR Outlook Report. It further requested an intermediate update on progress to confirm the inception of the plan had been effective for examination by IUCN and the World Heritage Centre ahead of the 41st session of the World Heritage Committee in 2017.

In 2017, the World Heritage Committee at its **41st session** (Krakow) noted with serious concern the coral bleaching and mortality that affected the property in 2016 and 2017 and encouraged the State Party to accelerate efforts toward meeting the intermediate and long-term targets of the Reef 2050 Plan, in particular those related to water quality (Decision 41 COM 7B.24). As confirmed in the State Party's report and previous assessments, improving water quality is central to reverse the deterioration of the property. The results of the 2017, 2018 and 2019 Reef Water Quality Report Cards confirmed that despite some commendable achievements, particularly on the dissolved inorganic nitrogen (as demonstrated by the 2019 Report Card), and although the

Reef 2050 Plan now provided a coherent framework to improve the management of the property, progress towards achieving the water quality targets had been very slow in many key areas.

In 2021, at its extended **44th session** (Fuzhou/Online, 2021), the World Heritage Committee noted with the utmost concern the widespread effects of consecutive coral bleaching events that further added to the significant concerns regarding the future of the property. It noted the conclusions of the 2019 GBR Outlook Report that the long-term outlook for the ecosystem of the property has further deteriorated from poor to very poor, and that the deterioration of the ecological processes underpinning the property's OUV has been more rapid and widespread than was previously evident. The Committee concluded that the 2050 Plan required stronger and clearer commitments, in particular towards urgently countering the effects of climate change, but also towards accelerating water quality improvement and land management measures. It was further requested that the mid-term review of the Reef 2050 Plan fully incorporate the conclusions of the 2019 GBR Outlook Report, and provide clear commitments to address the threat from climate change.

Noting the deterioration of the current condition and the long-term outlook of the property, the World Heritage Centre and IUCN considered at the time that the property faced danger according to Paragraph 180 a) of the *Operational Guidelines* and hence recommended that the Committee inscribe the property on the List of World Heritage in Danger. The Committee did not inscribe the property on the Danger List, however requested the State Party to invite another joint World Heritage Centre/IUCN RM mission to the property in 2022 to assess the updated Reef 2050 Plan to ensure that it addresses adequately the threats posed to the property by climate change and determines a pathway for accelerated actions in other areas affecting the conservation of the property (Decision **44 COM 7B.90**).

II. SUMMARY OF THE NATIONAL MANAGEMENT SYSTEM FOR THE PRESERVATION AND MANAGEMENT OF THE WORLD HERITAGE PROPERTY

The GBR covers approximately 348,000 square kilometres (km^2). Most of the property lies within the GBR Marine Park: at 344,400 km^2 this Federal Marine Park comprises approximately 99% of the property. The World Heritage property is a multiple-use area. Uses include a range of commercial and recreational activities.

The property is managed by overlapping State and Federal jurisdictions.

Key National institutional framework

The Great Barrier Reef Marine Park Authority (GBRMPA) was established in 1975 as an Australian Government non-corporate Statutory Authority, responsible for managing the Great Barrier Reef Marine Park, with the Queensland Government responsible for management of areas between low and high-water marks (the GBR Coast Marine Park) and most of the islands. Since 1979 the Great Barrier Reef Intergovernmental Agreement has facilitated collaboration between successive Federal and Queensland governments.

Within the Queensland Government, the Department of Environment and Science (DES) is the lead agency on environmental management matters including the states internal waterways and catchment. It includes the Office of the GBR and is supported by Queensland Parks and Wildlife Service responsible for day-to-day joint field management of the marine park and islands, in collaboration with GBRMPA. In addition to this, property governance is supported by Maritime Safety Queensland, and the Department of Agriculture and Fisheries.

Within the Australian Commonwealth Government, the Department of Agriculture, Water and the Environment (DAWE) is responsible for implementing the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), which provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, including protecting the World Heritage area's Outstanding Universal Value from inappropriate development.

Other national agencies with varying responsibilities over GBR governance include the Maritime Border Command providing aerial surveillance, and the Australian Maritime Safety Authority controlling safety, search and rescue. The Australian Institute of Marine Science (AIMS) and the Commonwealth Scientific and Industrial Research Organisation (CSIRO) are entities engaging significantly in supporting research throughout the property.

GBRMPA governance is supported by Traditional Owner Groups through representation on the Indigenous Reef Advisory Committee (IRAC), and the tourism industry through the Tourism Reef Advisory Committee (TRAC). Governance also involves the engagement of local governments and Councils.

Key National Legislation

The Great Barrier Reef Marine Park Act 1975 serves as the statutory document for the long-term protection of the Great Barrier Reef Region, and assists with meeting Australia's international responsibilities to protect the property's Outstanding Universal Value. The Act also acknowledges

Aboriginal and Torres Strait Islander peoples as the Traditional Owners of the Great Barrier Reef Region and supports their rights to exercise sustainable management of their sea Country. Associated regulations to the Act were most recently updated in 2019.

The EPBC Act (1999) requires development proposals to undergo a rigorous Environmental Impact Assessment (EIA) process to assess potential impact on the Outstanding Universal Value of the property. The process includes public consultation after which the Federal Minister may decide, to approve, under conditions designed to mitigate any significant impacts, or to reject the development proposal.

In addition, there are a number of state legislations which provide additional protection for the Outstanding Universal Value of the GBR. This includes the Queensland Vegetation Management Act 1999 (with an associated Planning Act released in 2016) which regulates land clearing and development activities; the Queensland Fisheries Act (1994); the Sustainable Ports Development Act 2015 (which provides a legislative framework to balance the protection of the Reef with the development of major bulk commodity ports in the GBR region), and more recently the Queensland government reef protection regulations.

Management system

The Reef 2050 Long Term Sustainability Plan (hereafter referred to as the **Reef 2050 Plan**) provides the strategic framework for long-term action across the Reef. Updated most recently in 2021, it outlines priority areas and financial commitments made by government, industry and community. The Plan aims to bring together all stakeholders connected to the Reef, including governments, industries, scientists, Traditional Owners and land managers, to detail efforts in protecting the Reef and future responsibilities. The Plan was first released in 2015, updated in 2018 and again in 2021 and sets out the following vision for the Reef in 2050:

> *"The Great Barrier Reef is sustained as a living natural and cultural wonder of the world."*

Given the deterioration and ongoing threats to the reef, this vision recognizes that complete restoration of the Reef to its condition at the time of inscription is unlikely. The Reef 2050 Plan aims to create a future in which the Reef's condition improves and is sustained for future generations.

The Reef 2050 Plan is supplemented by a number of other plans and frameworks with additional regional/thematic focus, including the Reef Blueprint to strengthen the Reef's resilience; regional level 'Plans of Management' (e.g. Cairns; Whitsundays; Hitchinbrook; Shoalwater Bay); and Marine Park Special Management Areas that go beyond the foundational GBR zoning to further conserve species, resources, cultural or heritage values through limits to resources use, seasonal closures, specific species conservation (e.g. dugongs). The plan provides an overarching framework through which supplementary implementation plans are linked. For example, the Reef Water Quality Protection Plan 2013 was reviewed in 2017, and as part of that process was renamed to the Reef 2050 Water Quality Improvement Plan 2017, as a joint commitment of the Australian and Queensland governments that seeks to improve the quality of water flowing from the catchments adjacent to the GBR.

The Reef 2050 Plan has its own advisory bodies, including the Reef Advisory Committee (RAC), which provides strategic advice on the implementation of Reef 2050 actions; and the Independent Expert Panel (IEP), which provides scientific and expert advice related to the GBR (see here: Reef 2050 Plan Advisory Bodies).

In terms of **monitoring and reporting,** the Outlook Report is produced every five years by the GBRMPA which examines the reef's health, pressures and likely future. In 2019, the long-term

outlook was downgraded from 'poor' to 'very poor', strongly driven by trends in global greenhouse gas emissions and forecasts of climate change.

A Long Term Monitoring Program has been routinely conducted by AIMs (for more than 30 years) to survey the health of 47 mid-shore and off-shore reefs across the GBR region. A Paddock to Reef Integrated Monitoring, Modelling and Reporting program has provided the framework for evaluating and reporting progress on water quality targets. These, and wider monitoring activities, are now in the process of being rolled up into a Reef 2050 Integrated Monitoring and Reporting Program (RIMReP) to support the centralized collation of data and the adaptive management of the Reef. RIMReP which will provide Reef managers with information to guide management decisions and help them track progress against the Plan. It will also drive better alignment between existing programs, while helping to fill monitoring and modelling knowledge gaps.

Other international treaties and programmes

In addition to the World Heritage Convention, the property is protected through a range of international conventions and programmes, including the following:

- 1946 International Convention for the Regulation of Whaling
- 1971 Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Bowling Green Bay listed in 1993; Shoalwater and Corio Bays listed in 1996)
- 1973 International Convention for the Prevention of Pollution from Ships
- 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- 1979 Convention on the Conservation of Migratory Species of Wild Animals (CMS)
- 1982 United Nations Convention on the Law of the Sea
- 1986 Convention for the Protection of the Natural Resources and Environment of the South Pacific Region
- 1992 Convention on Biological Diversity
- 2001 Indian Ocean–South-East Asian Marine Turtle Memorandum of Understanding
- 2001 Agreement on the Conservation of Albatrosses and Petrels

The property was also designated as a Particularly Sensitive Sea Area in 1990, under the International Maritime Organization, and is adjacent to UNESCO Biosphere Reserves, located to its immediate south.[3]

[3] Noosa, approved in 2007 (https://en.unesco.org/en.unesco.org/biosphere/aspac/noosa), Great Sandy, approved in 2009 (https://en.unesco.org/biosphere/aspac/great-sandy), and Sunshine Coast (undergoing approval at the time of the mission).

III. THE MISSION

This mission was undertaken in response to Decision **44 COM 7B.90** adopted at the extended 44th session of the World Heritage Committee and following a series of consultation meetings between the Australian authorities between September 2021 and January 2022 (see Annex 1 for the mission terms of reference and full decision).

Mission dates: 21 March to 30 March 2022

Mission experts: Ms. Eleanor Carter (representative for IUCN) and Dr. Hans Dencker Thulstrup (UNESCO).

The mission experts were accompanied by: Mr James Larsen (Department of Agriculture, Water and the Environment - DAWE); Dr Simon Banks (Heritage Reef and Ocean Division, DAWE); Ms Elisa Nichols (Office of the Great Barrier Reef – OGBR - Queensland Department of Environment and Science - DES); Dr David Wachenfeld (Great Barrier Reef Marine Park Authority - GBRMPA); and Ms Patricia (Patty) McMahon (International Support Unit). (See Annex 2 for more information).

Summary of the Terms of Reference

The main objective of the Reactive Monitoring mission was to assess the updated Reef 2050 Plan to ensure that it addresses the threats posed to the property by climate change and determines a pathway for accelerated actions in other areas affecting the conservation of the property. The mission was therefore tasked with:

1) Reviewing the status of the Reef 2050 Plan's review and update, which was made available in December 2021, and assessing the revised contents in light of the conclusions of the 2019 Great Barrier Reef Outlook Report, including accelerating action at all possible levels to address the threat from climate change and other factors affecting the Outstanding Universal Value (OUV) and integrity of the property;

2) Assessing the State Party's progress towards addressing the impact of climate change on the OUV of the property, and how the revised Reef 2050 Plan addresses the threat posed to the property by climate change and determines a pathway for accelerated actions in other areas affecting the conservation of the property;

3) Assessing the State Party's progress towards meeting key targets of the Reef 2050 Plan, in particular but not limited to the water quality and land management targets;

4) In line with paragraph 173 of the Operational Guidelines for the Implementation of the World Heritage Convention, assessing any other relevant issues that may negatively affect the OUV of the property, including its conditions of integrity and protection and management.

See *Annex* 1 for full TOR.

Mission Programme

A summary of the mission programme is provided here. The full itinerary can be seen in *Annex 3*.

Day Zero (Brisbane)	Dinner with Minister for the Environment (The Hon Sussan Ley MP) and associates, (including the Hon Penny Wensley).
Day One (Brisbane)	Welcome to Country & Ministers Welcome Overview of GBR Legislative and Governance Frameworks (GBRMPA, QPWS) Overview of Reef 2050 plan, Outlook 2019 report & current status of GBR (DAWE, OGBR, GBRMPA)
Day Two (Brisbane)	Discussion with GBR 'Independent Expert Panel' (IEP) Discussion with GBR 'Reef Advisory Committee' (RAC) Discussion with e-NGO representatives Overview of Australia's efforts to limit climate change (DISER) Overview of efforts to address other key threats (DES) Introduction to collaborations and partnerships (GBRF)
Day Three (Lady Elliot Island)	Site visit. Best practice tourism management. Aerial view of southern GBR boundary. In-water reef viewing. Stakeholder discussions with tourism managers. Dinner with tourism managers and introduction to Master Reef Guides
Day Four (Goondicum)	Site visit. Best practice farming practice, graziers. On-ground review of gully repair. Stakeholder discussions with farmers and regional NRM agency representatives.
Day Five (Townsville)	Site visit. Compliance vessel. Overview of on-water compliance (vessel monitoring, response systems, on-water management) (GBRMPA, QPWS) Site visit. GBRMPA HQ. Overview of sustainable fisheries management (DAF) Overview of threatened species management Site visit. AIMS Overview of science, the long-term adaptive monitoring program [LTMP] and adaptive management (AIMS) Introduction to the National Sea Simulator [SeaSim] (AIMS) Overview of the Reef Restoration and Adaption Program [RRAP] (AIMS) Pre-dinner meeting with e-NGO representatives (AMCS,WWF) and dinner with GBRMPA team and regional representatives
Day Six (Burdekin region)	Site visit. Burdekin catchment Helicopter views of land management practices and challenges of gully erosion. Site landings to gully restoration areas and discussions with farming stakeholders and regional NRM agency representatives Site visit. Vessel Tracking Service (VTS) Operations Introduction to VTS operations Overview of ports management (AMSA, QLD DTMR, Harbour Master) Dinner with GBR Special Envoy (Hon Warren Entsch MP) and associates.
Day Seven (Cairns region)	Site visit. Yirrganydji Traditional Owners area Overview of activities, engagement and Traditional Use of Marine Resources Agreements (TUMRA) (Yirrganydji representatives)

	Discussion with Indigenous Reef Advisory Committee (IRAC) and the Reef 2050 Traditional Owner Working Group Discussion with Tourism Reef Advisory Committee (TRAC) Discussion with Cairns Regional Council Dinner with Queensland Government Minister for the Environment and the Great Barrier Reef (The Hon Meaghan Scanlon MP) and Queensland officials
Day Eight (Cairns region)	Site visit. Moore Reef Discussion with tourism operators In-water view of reef in green zone and site-based restoration efforts Overview of COTS management Introduction to 'Eye on the Reef' initiative Dinner with the Secretary of the Department of Agriculture, Water and the Environment and Australia's Director of Biosecurity (Andrew Metcalfe, AO)
Day Nine (Cairns region)	Site visit. Sugarcane farms Overview of adaptation activities to reduce dissolved inorganic nitrogen [DIN] and other pollutant run-off into GBR Overview of land restoration activities Discussions with farmers, restoration and program representatives (Greening Australia, regional NRM agency, Mulgrave Landare, DAWE, DES).
Day Ten (Cairns)	Deep dive water quality and report card overview (DAWE, DES) RIMReP Overview of innovative financing and investment Final reflection and review

Overall, the mission programme covered all key interest areas of the mission experts well. It was a full itinerary, and the logistical support was excellent to facilitate transitions between meetings and activities, and enable the participation and involvement of a wide range of stakeholders.

The programme focused on the best-practice exemplars and achievements in GBR management in recent years. While time was given to the e-NGOs (on day one, and again on day five through their request), the mission recognizes that more time could have been provided to groups keen to express and share their concerns for the reef and their opposing and varied attitudes towards the issue of a possible inscription on the List of World Heritage in Danger ("in-danger listing"). Nonetheless, a great deal of information was effectively provided, shared and discussed fully. And while the itinerary understandably focused on the positive elements that the State Party were keen to share, the discussions were open and transparent; and agency representatives and stakeholders were forthcoming throughout about the challenges, needs, failings and opportunities facing the Great Barrier Reef.

It is noted that street demonstrations arranged to coincide with the mission took place on two occasions (in Brisbane, organized by Greenpeace, and in Cairns, organized by Cairns and Far North Environment Centre); and the programme did not include formal meetings with participation by either of these entities.

IV. ASSESSMENT OF THE STATE OF CONSERVATION OF THE PROPERTY

As per the mission TOR, the key issues that were examined during this mission were as follows:

- Issue 1: **Water Quality & Land Management**
- Issue 2: **Climate Change**

These two issues had been identified in the TOR as key threats to the OUV and integrity of the GBR World Heritage site; and particular attention was required to assess the progress of the Reef 2050 Plan and State Party's achievements in addressing these threats and plans underway to accelerate progress.

Additional issues identified through mission and addressed here are as follows:

- Issue 3: (a) **Sustainable Fisheries** (including threatened species); (b) the effective empowerment and engagement of **Traditional Owners**; (c) the **Reef 2050 Plan** (coordination and representation); and (d) **GBR financing**.

Issue 1: Water Quality & Land Management

Water quality has long been a concern for the GBR, particularly related to land management practices leading to run-off of the following:

a) **Sediment**. There is an extensive history of vegetation clearing for development and agricultural land in the 35 catchments (and 47 sub-catchments) of the GBR, covering a combined 424,000 km^2 (see catchment map in *Annex 4*). This dates back to the first western settlers to the region. Since this time, vegetation removal and land conversion has continued, exacerbated by the overgrazing of paddock areas, causing soils to erode and fine sediment to run-off into creeks and rivers that ultimately discharge onto the reef. The catchment area is host to several major dam constructions, which influence accumulation and discharge of sediments; and the dumping of maintenance dredge spoils from ports throughout the GBR continues to be permitted for port management throughout the GBR. Sediment from these activities causes turbid plumes that can smother inshore habitats, reducing the available sunlight necessary for the growth and reproduction of corals and seagrasses.

b) **Agricultural run-off** from farming practices throughout the catchments, include:
Excess nutrients, particularly dissolved inorganic nitrogen (DIN) caused by excess fertiliser and particulate phosphorus use, and particulate nitrogen run-off attached to sediment. This can cause extensive algal blooms in the inshore areas which reduces the amount of light required for healthy seagrasses and corals. High nutrient loads have also been linked to crown-of-thorns starfish outbreaks which can be enormously destructive, although the dynamics of outbreaks are complex and not fully understood. Pesticides and herbicides, that threaten marine plants and animals, in particular impacting seagrass beds.

c) **Marine debris**, particularly plastic pollution can enter the reef from land run-off, urban stormwater discharge, and from ocean-based activities such as at-sea dumping as well as from international waters. This debris poses a major threat to marine life such as turtles, dugongs, dolphins and seabirds. According to GBRMPA, more than 80% of marine debris found in the Reef is plastic, including macro and micro-plastics.

The Reef 2050 Plan (updated 2021), work area 2, has set two broad goals to addressing water quality:

1) The quality of water is improved through increased effective land management practices in catchments.[4]
2) Integrated catchment-to-Reef management reduces cumulative impacts.[5]

In addition to these, work areas 3 (sea-based activities), 4 (international sources of impact) and 5 (protect, rehabilitate, restore) also include goals related to water quality threats:[6]

1) Marine debris, rubbish pollution and at-sea disposal of waste is reduced.[7]
2) Australia actively engages in international forums and agreements to minimise international sources of impact to the Reef.[8]
3) Key habitats are being actively rehabilitated or restored.[9]

Some of these goals (and associated strategic actions) have been further developed and elaborated upon in the accompanying Water Quality Improvement Plan (WQIP) developed in 2017. The WQIP was also developed in response to the 2017 Scientific Consensus Statement that found the decline of marine water quality associated with land-based run-off from the adjacent catchments is a major cause of the current poor state of many of the coastal and marine ecosystems of the GBR.[10]

The WQIP outlines detailed objectives, actions, targets and indicators for success under eight key frameworks (see *Annex 5* for summary information); as well as providing clear expectations on lead roles and responsibilities and engagement across a range of institutions and stakeholder groups. Numerous initiatives are now being implemented by a range of agencies, institutions and stakeholders that feed into WQIP targets.

Targets for water quality (WQ) improvements are focused around **reductions in fine sediment**, **DIN**, and **particulate nutrients** (phosphorus and nitrogen), with reduction expectations tailored for each of the 34 key catchments. These catchments are grouped into six key regions with

[4] Strategic action 2.1 under this goal is to 'Implement the Reef 2050 Water Quality Improvement Plan to meet its targets and undertake a 5-yearly review'.
[5] Strategic action 2.2 under this goal is to 'Implement the Wetlands in the Great Barrier Reef Catchments Management Strategy and undertake a review'.
[6] Water quality also referenced briefly in the associated Reef 2050 Objectives and Goals (2021-2025) document, in relation to habitat management of coral reefs and seagrass; with indicators provided related to reef health.
[7] Strategic action 3.9 under this goal is to 'Implement domestic measures that reduce marine debris and manage waste disposal'
[8] Strategic action 4.1 under this goal is to 'Foster international efforts to reduce marine debris entering the Reef'
[9] Strategic action 5.3 under this goal is to 'Enhance protection, rehabilitation and restoration of key coastal and catchment ecosystems'
[10] The statement suggested 'greater effort to improve water quality is urgently required', and there is an 'urgent need for greater investment in voluntary practice change programs, the use of regulatory tools and other policy mechanisms to accelerate the adoption of practice change, and robust monitoring and evaluation programs to measure the rate and effectiveness of adoption'. Priorities at a catchment scale should be used to guide investment, with greater and more effective coordination of 'Australian and Queensland government policies and programs, further collaboration with farmers and other stakeholders' and the establishment of 'strong evaluation systems', with a 'greater focus on experimentation, prioritization and evaluation at different scales, coupled with the use of modelling and other approaches to understand future scenarios.'

dedicated natural resource management (NRM) agencies[11] actively supporting WQIP implementation (see *Annex 6* for the breakdown of targets by catchment).

The mission found that sediment reduction activities predominantly relate to gully repair, erosion control projects, streambank stabilization, coastal wetlands rehabilitation, reduction of vegetation removal, and riparian revegetation projects. This is particularly relevant in lands managed by graziers, which represents the most extensive land use practice[12] in the region (figure 1) (with 90% of fine sediment delivered to the GBR coming from sub-surface erosion, e.g., from gully, bank, scald or deep rill erosion).[13] The impact on sediment load from the 100+ dams throughout the catchment (from accumulation and release during periods of high rains) is not covered in the WQIP.

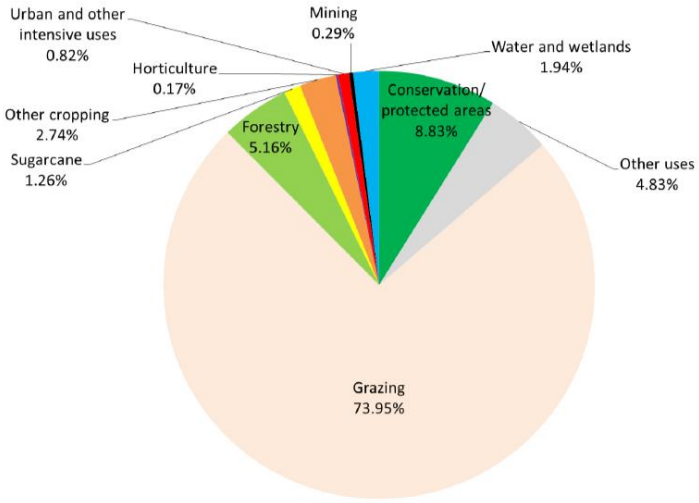


Figure 1: Portion of catchment area by land use.
Source: Queensland Department of Environment and Science

Activities to reduce nutrient loads generally relate to the promotion of best management practices (BMP) amongst farmers (particularly sugarcane and banana farmers) to reduce excess use of fertilizers and pesticides, the promotion of land fallowing and set-asides, conversion of farmland to natural vegetation and associated wetland and riparian restoration.

The mission reviewed a wide range of programs and initiatives supporting these activities. The Queensland Reef Water Quality Program promotes various Best Management Practice (BMP) programs, and a number of other projects and initiatives related to WQ (prioritized each year through an annual investment plan), including: Smartcane BMP (delivered by CANEGROWERS), Banana BMP (delivered by the Australian Banana Growers' Council), Hort360 GBR program (delivered by Growcom) and the Grazing Resilience and Sustainable Solutions (GRASS) program (delivered by the Department of Agriculture and Fisheries, Burnett Mary Regional Group, Fitzroy Basin Association and NQ Dry Tropics). The Department of Agriculture and Fisheries provides a range of extension services to support growers and graziers adopt better business and farming

[11] These NRM agencies are generally civil society organization or locally established NGOs, and are part of a network of natural resource management bodies around Australia.
[12] Graziers manage 311,000 km^2 of land and over 100,000km of streambank in the GBR catchments.
[13] Data from the 2017 Scientific Consensus.

practices within Reef regions.[14] Other implementation initiatives have included the Growing a Great Barrier Reef (GGBR) project (2016-2019), and the Innovative Gully Remediation Project (2017-2020) (amongst others). Such initiatives are generally delivered through industry and NRM agency partners, with a focus on extension support and incentives[15] to advance farmer practices beyond industry BMP and fast track the implementation of innovative practices.

In December 2019, reef protection regulations[16] were strengthened to address land-based sources of water pollution flowing to the Great Barrier Reef, with new minimum standard agricultural practices[17] to be rolled out over five years. The regulations include requirements for improved record keeping[18], the establishment of sugarcane nitrogen and phosphorus budgets, and new permitting systems[19], as well as new industrial discharge standards.[20] (see *Annex 7* for more information).

Each of these activities requires the full engagement and proactive involvement of farmers and graziers throughout the catchments; and it became clear through the mission that this confers both challenges and opportunities. Challenges relate to a range of factors, including: entrenched intergenerational practices and beliefs, issues of isolation and scale (vast distances between neighbours), distrust of government, risk-averse approaches to behaviour change, and – more recently – a sense of victimization and blame for negative impacts on the GBR. Each of these challenges requires interpersonal engagement, and slow-but-steady advances to encourage engagement and practice changes.

Nonetheless, the opportunities are also considerable. Through the mission there was a clear message that many farmers and graziers want to be a part of the solution, and are ready to adopt changes, but require the technical support and capacity (financial and practical) to do so. The mission visited exemplar sites, where graziers and farmers are leading by example. This included three grazier stations (Goondicum,[21] Glen Bowen and Strathalbyn[22]) where extensive gully remediation and improved land management practices have reduced sediment discharge by up to 98%[23] (see *Annex 8*). The Rossi Brothers sugarcane farm provided an example of how effective management (through replacement of fertilizers with organic carbon compost) has reduced their farms nitrogen loads from an average 140 kilograms (kg) of nitrogen (N) per hectare (ha) per year (yr) to 40 kg/N/ha/yr.

Many such exemplar initiatives are being directly supported by the NRM agencies active in each catchment. NRM agency-led initiatives that feed into the WQIP targets and align with the Reef

[14] Extension staff and agricultural economists provide hands-on technical assistance for: economic support, on-farm assistance to trial new practices, information resources, economic decision support tools, participation at field days and other events, and research into improved farming systems.
[15] Incentives programs require farmer commitments. Results from the GGBR initiative showed a [1.41: 1] AUD ratio of farmer cash or in-kind contributions to monies invested in incentives. This initiative also introduction the motivational 'Reef Champion Awards' for primary producers (2017 and 2018).
[16] These regulations complement the National Environment Protection and Biodiversity Act (EPBC) 1999
[17] The standards are for key primary producers, to be rolled out over 5 years (with a commitment that these standards will remain substantially unchanged for the next five years, i.e. until 1 December 2024).
[18] For priority area graziers, sugarcane and banana producers and agricultural advisors; to demonstrate activities are undertaken are in accordance with the minimum practice agricultural standards.
[19] New or expanding cropping and horticulture activities to require a permit if utilizing ≥ 5 ha without a cropping history.
[20] For new, expanded or intensified industrial land use activities such as sewage and water treatment plants, land-based aquaculture or mining in any Reef region, to ensure there is no increase in nutrient or sediment pollutant loads.
[21] In the Burnett Mary catchment (Campbell family).
[22] In the Bowen Broken Bogie catchment, Burdekin (Cormack family and Hughes family respectively)
[23] Based on assessments conducted by Greening Australia

2050 goals include the Burnett Mary Region Water Quality Improvement Plan and the Bowen, Broken, Bogie Water Quality Program that is building from the existing Burdekin Landholders Driving Change initiative (amongst others). Such initiatives are often times being supported locally through partnerships with non-profit organizations such as Greening Australia, with financial support leveraged under the Great Barrier Reef Gully and Streambank Joint Program (between national and state government), largely administered through the Great Barrier Reef Foundation (GBRF).[24] Technical support and financing (particularly related to incentivization mechanisms) is also being leveraged through the Reef Credits Scheme (see box 1) and through carbon farming-related support under the Queensland Land Restoration Fund (see box 4 under Issue 2).

It was clear to the mission that there has been a considerable escalation of efforts in recent years with regards to reducing sediment from grazier land and nutrient loads from farming. Mechanisms to monitor and track progress towards WQIP targets have also advanced considerably in recent years (see box 2). NRM agencies, industry bodies and farmers / graziers themselves deserve considerable recognition of their tireless efforts on-the-ground.

Overall however, progress towards WQIP targets has been slow, and in order to meet them there will need to be more of a reduction of pollutants in the next three years than has been achieved since 2009 (figure 2).

Box 1: The Reef Credits scheme

The Reef Credit Scheme enables land managers who undertake projects that improve WQ through changes in land management to generate a tradeable unit of pollutant reduction or 'Reef Credit'. One Reef Credit is currently equal to 1kg of Nitrogen or 538kg of sediment prevented from entering the GBR catchment.[25] A Reef Credit can then be sold to those seeking to invest in water quality improvements, such as government, private industry and philanthropists. These entities can then choose to 'retire' the reef credit (either as a positive contribution to the region, or to claim pollutant reduction offsets against their own activities).

The scheme is overseen by an independent non-profit entity (Eco-Markets Australia) who also act as the Reef Credit Secretariat. To date the reef credit scheme has generated >30,000 credits, reducing nitrogen pollution by 30 tonnes and returning > $1 million AUD to land managers. More than 24,000 of these credits have already been 'retired'.

While this scheme offers a credible mechanism for incentivizing the adoption of BMP across sectors, it has been criticized in some sectors for generating rewarding non-compliant farmers through an inadequate verification process. Inclusion of credit owners on the publicly accessible register is also optional (non-required), reducing transparency; and the retirement of credits as an option to offset other pollutants has unclear tracking and without publicly accessible net benefit analysis. And while efforts continue to improve the standards, methodologies and verification processes, the demand and interest for crediting schemes of this nature is growing; including interest to include the Reef Credits scheme in stackable carbon offset markets. Caution is warranted in this regard. Unless net benefit analysis is thoroughly understood, and the process entirely transparent, there is risk of the crediting scheme itself taking on more value than the end-target of WQ support.

[24] The GBRF was recipient of $443 million AUD through a landmark Reef Trust Partnership grant from the Australian Government in 2018, with an expectation of raising matching grants through the six-year initiative (to 2024). Through their Investment Strategy just over $200 million AUD of these funds is dedicated to addressing WQ; with the reef partnership providing an interactive dashboard showing their progress towards targets.

[25] The relative value of a reef credit is periodically reviewed by the Reef Credit Secretariat.

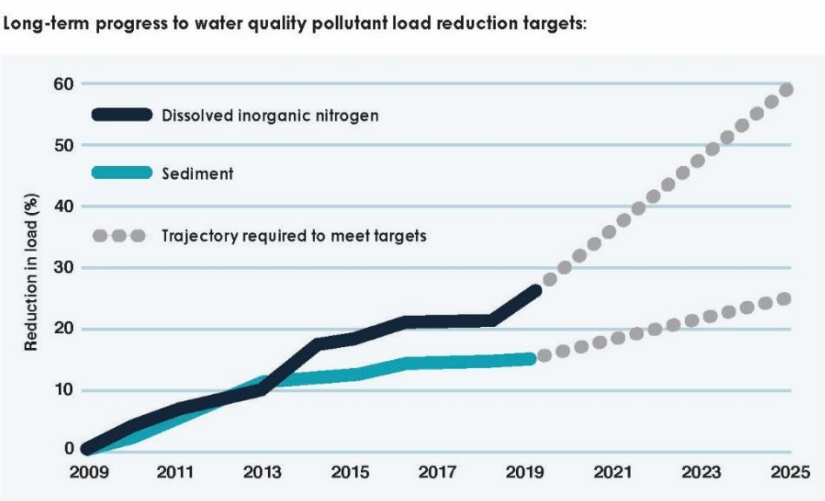


Figure 2: Trajectory of achievements to date and acceleration needed to achieve WQIP 2025 targets. Adapted from source: Australian Marine Conservation Society & World Wildlife Fund-Australia.

The mission recognizes that achievements are not expected to be linear, and an acceleration of results may be expected later in the program as the impacts of interventions are realized. However, considering the scale of the challenge[26], and the need for inter-personal engagement with farmers and graziers to accelerate efforts, the mission believes there will need to be considerable further escalation of efforts across the priority catchments in order to achieve WQIP targets. Data from the Queensland Government shows more than 50% of sugarcane farmers still operate at 'high risk' to the reef, and the majority of graziers operate at 'moderate risk' (figure 3).

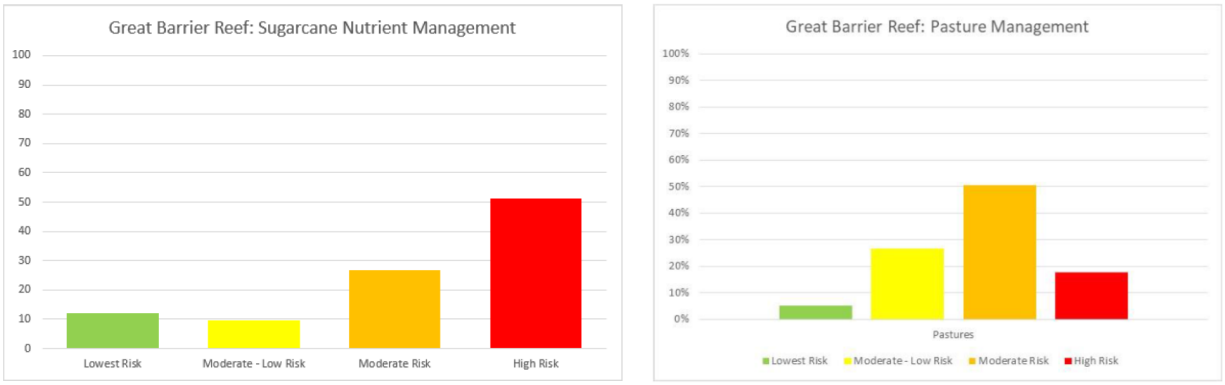


Figure 3: Risk levels of sugarcane (left) and grazier land (right). Source: Queensland Government

[26] It is worth noting that the GBR catchments are larger than the nation of Sweden.

Box 2: Monitoring WQIP targets

The Paddock to Reef Integrated Monitoring, Modelling and Reporting Program has been the tool to assess WQ impacts since its launch in 2009. It supports the monitoring of WQ targets and wider attributes to evaluate the levels of adoption of management practices, as well as management effectiveness (in terms of water quality benefits and economic outcomes), catchment condition (riparian, wetlands and ground cover), pollutant run-off and marine condition.

The program is a collaboration involving Australian and Queensland government agencies, industry bodies, regional Natural Resource Management bodies, landholders and research organisations. It is jointly funded by the Australian and Queensland governments, and has evolved through time as WQ plans and activities have advanced. Early reporting (2009) was reef-wide and not scaled to catchments. In 2016, assessment went to the NRM agency scale (six regions) for reporting, and in 2018 this was once more refined to catchment scale (35 catchments).

Today, progress towards the Reef 2050 WQIP targets and objectives are managed through the publicly accessible Reef Water Quality Report Card. All findings from the report cards are verified by the independent science panel.[27] Total funding for the program is approximately $8 million AUD annually.

At this time, the Paddock to Reef program is in the process of being integrated into the Reef 2050 Integrated Monitoring and Reporting Program (RIMReP). This initiative is a partnership involving key Australian government environmental management and science agencies, GBRMPA, DAWE, AIMS, the Integrated Marine Observing System (IMOS), CSIRO and the Queensland Government.

The RIMReP is an ambitious and advanced data management and tracking tool that will provide a comprehensive understanding of how the broader Reef 2050 Plan is progressing and guide future management of the Reef. Information will be publicly accessible through a reef knowledge portal (in development).

Opportunities exist to accelerate efforts, and the mission observed that all stakeholders involved (from government to NRM agencies and industry representatives) have a good understanding of the scale needed to achieve change. **Escalating sediment reduction** will require large-scale support to priority gully restorations (and associated threat areas). Effective and rapid upscaling of restoration must be based on the principle that gullies are 'not all equal'[28], and rely on both science-based assessment (to identify the locations where remedial action would have the greatest impact) and on knowledge of communities and individual landholders (to ensure cooperation, active engagement and support) alongside sufficient investment and extensive mobilization of the necessary engineers and associated personnel, equipment and materials. The mission also notes with concern that the WQIP does not currently address sedimentation caused by other key activities, and attention is needed to account for hitherto overlooked sources of poor water quality, including from emerging crop industries, marine debris, as well as dredging and dam construction and operation (see box 3).

Escalating nutrient reductions will require a scaling up and adoption of BMP across key areas where land use may contribute to nutrient run-off. As a subset of farmers may be 'aspiring for retiring',[29] opportunity also exists for acquisition and restoration of lands. And with new and emerging transitions to wellness crops in some regions (e.g., macadamia nut, avocado, etc.) it will be important to assess and set appropriate BMP standards for these emerging crop industries

[27] The group is a sub-panel of the IEP, with additional experts in WQ.
[28] Assessments done via remote sensing and Lidar show the extent of the challenge and provide guidance on key problematic areas. NRM bodies estimate that addressing 10-20% of the most problematic sites would reduce the vast majority of site-derived sediment load, making identification and prioritization critical elements of this work.
[29] The average age of sugarcane farmers is 67 years.

from the outset, with associated incentives in place for rapid adoption. Compliance support will also require greater investment.[30]

Effective catchment management. With regards to re-vegetation activities and conversion of farmland to reinstate wetlands and riparian areas[31], the Queensland Vegetation Management Act 1999 (with an associated Planning Act released in 2016) regulates land clearing and management activities.[32] Within this act, five categories of vegetation are defined, each requiring different conditions or permits for clearing (which can impact sedimentation) and / or development (with implications on sediment and nutrients when transitioned to farm land or involving industrial discharge).[33] One of these, 'category X' is allocated for all lands that are otherwise unregulated and, where freehold, clearing can be for any purpose under the exemptions. Category X lands cover approximately 15.5 million ha (~37%) of all GBR catchment vegetative areas. The Queensland Government has utilized a Statewide Land Cover and Trees Study (SLATS)[34] to assess vegetative cover through the catchments, which was enhanced in 2018 to adopt a methodology incorporating the latest satellite technology and scientific capabilities to provide a more comprehensive and accurate representation of the state's woody vegetation extent.[35]

While efforts under a range of initiatives have included land restoration support and rejuvenation of wetlands, data from the Queensland government shows that vegetation clearing has continued. Report data from 2018-19 shows 217,419 ha were cleared in that period (0.8% of the entire wooded area of GBR catchments), with clearing particularly on category X land. Therefore, it will be important moving forward to enhance efforts to secure remnant native vegetation and areas of high conservation value across the GBR catchments (particularly on lands currently under category X) in the coming years through strengthened native vegetation clauses under existing laws, and improved identification and enforcement of permissible activities in areas of high conservation value (HCV) forests and woodlands.

Another WQ issue that was only briefly explored during the mission is that of marine debris, particularly plastic pollution. Actions promoted in the WQIP have been largely achieved. At the legislative level, Queensland Government introduced the Waste Reduction and Recycling (Plastic Items) Amendment Act in 2021, banning the supply of single-use plastics[36] in the state. The ban came into effect on 1 September 2021. An assessment into Urban Water Management Practice and Stewardship was also undertaken (2018-2020), but the findings have yet to be fully

[30] There are currently only ~20 compliance staff under DES distributed across catchments, though plans are in place to double this workforce.
[31] As exemplified by the Fig Tree Lagoon initiative visited during the mission, implemented by the Parisi family and Wanyurr-Majay Aboriginal Corporation.
[32] Regulatory arrangements are guided by the Queensland Department of Environment and Science (DES) Regulatory Strategy (latest 2022-2027) and includes protecting the reef as a government priority. Based on this, DES prepares annual strategic compliance priorities, which include a reef compliance strategy targeted at the wide range of producers active in the GBR catchments to ensure environmental regulations are met.
[33] Category A — includes environmental offset areas and voluntary declaration areas. Special conditions apply for compliance. Category B — defines remnant vegetation areas, for example well established trees. Category C — are high-value regrowth vegetation areas (i.e., an area that has not been cleared for at least 15 years). Category R — defines regrowth vegetation areas within 50 meters of a watercourse or drainage feature in GBR catchment.
[34] This has built upon the former Landsat analysis to enable comprehensive Earth-i and Sentinel-2 annual analysis of vegetation clearing, density estimates, regrowth monitoring and spatial biocondition modelling.
[35] The SLATS is independently peer reviewed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and monitors and reports on changes in woody vegetation cover in Queensland.
[36] Including straws, stirrers, plates, unenclosed bowls, cutlery and expanded polystyrene (EPS) takeaway food containers and EPS cups.

incorporated into the WQIP report card. Actions to address marine debris are generally reliant on civil society interventions. The Reef Guardian Councils[37] play a strong role in this work, as well as Traditional Owner groups[38], with the Reef Trust also supporting community clean-ups and awareness raising activities.

Nonetheless, marine debris continues to be a challenge, and GBRMPA position statement on this issue (2019) states:

> *"Marine debris is a major threat to the health of the Great Barrier Reef and kills marine life such as turtles, dugongs, dolphins and seabirds. Collective action by community, industry and government to choose sustainable options, minimise waste and undertake stewardship activities is required to reduce the impacts of marine debris on the Reef."*

The WQIP is expected to be updated in 2023, following completion of the next Scientific Consensus Statement for the GBR (currently in preparation, and due later this year). This represents an opportunity to incorporate hitherto overlooked sources of poor water quality identified in this report, including dams and associated agricultural expansion, port maintenance dredging and marine debris.

Box 3: Sediment-causing activities not addressed under WQIP

***Port maintenance dredging*.** While a study conducted by AIMS in 2015 found that maintenance dredging will likely produce no more than 5 to 10% of the long-term average river contribution of sediment to the GBR, concern exists regarding loopholes in the Sustainable Ports Development Act (2015)[39]. For example, the use of dredge spoils for land reclamation is a contentious issue that would benefit from improved stakeholder consultation. Additionally, a Maintenance Dredging Strategy was released by the Queensland Government in 2016 that includes numerous recommendations for further assessment, and it will be important for these to be followed up to ensure the best-available information and means are considered when dumping dredge spoils.

Dam (construction and operation). More than 100 dams are situated throughout the GBR catchments, predominantly providing water to irrigate crops and other developments in the catchments of the GBR. Detailed analysis does not appear to be available on the impact of sediment loads generated during dam construction, and through expansion of agricultural lands enabled, as well as generated from sediment build up and flash-releases during extreme rains. The WQIP has no reference to dam-related assessments or actions. Several new dam constructions are proposed for the region, and during the mission the Australian Government announced a commitment of $5.4 billion AUD to build the Hells Gate Dam in the Burdekin catchment (one of the most sensitive regions for sedimentation). If built, this would be the largest dam in Queensland, anticipated to enable expansion of agriculture across approximately 50,000 to 60,000 ha, with the associated sediment and nutrient loads generated by these activities entering the catchments rivers and tributaries. This commitment is clearly in contradiction to the Reef 2050 Plan, and has been made prior to any environmental impact assessment being undertaken, and prior to declaration as a Coordinated Project under the Queensland State Development and Public Works Organisation Act[40].

[37] There are 19 Reef Guardian Councils through the GBR region, covering ~60% of the catchment area. They are local councils that are showcasing environmentally sustainable practices (e.g., river management, waste water discharge, illegal dumping etc.) to support the effective management and protection of the Reef. Some councils (such as Cairns) are also shifting their own operations to renewable energy and aiming for institutional level net zero emissions by 2030.

[38] See issue 3 (ii) for more information on Traditional Owners and their vital role in GBR management.

[39] Section 5 states capital dredging may still be carried out for the purpose of establishing, constructing or improving a port facility', with section 36.2 restricting the dumping of these dredge spoils but allowing 'land reclamation' as an acceptable use.

[40] As required under the Act.

A further $2.9 billion AUD has been earmarked to support the construction of the Urannah Dam. First proposed in the 1960s, there have been more than 25 feasibility studies conducted for this dam without progress beyond that stage. If built it will be the second largest dam in Queensland, predominantly supporting water provision for new and existing coal mines, as well as the expansion of agriculture across 25,000 ha. The dam has been opposed by the Traditional Owners, but was nonetheless declared a coordinated project by Queensland's Coordinator-General in 2020, with a business case already submitted (but not publicly available) and environmental impact assessments underway. Considering the impact such infrastructural developments may have to the GBR, it seems propitious to consider them in WQ initiatives. At the least to ensure inter-governmental commitment that such developments are incumbent upon meeting the principles of the Reef 2050 Net Benefit Policy, namely to: (1) maintain and enhance Outstanding Universal Value in every action; (2) base decisions on the best available science; (3) deliver a net benefit to the ecosystem; and (4) adopt a partnership approach to management.

Impact on OUV

Overall, while efforts to address WQ have escalated considerably in recent years, corresponding improvements to water quality are not on track to meet the targets set out in the WQIP, according to the most recent (2019) Outlook Report and the most recent Report Card released in April 2022, especially for dissolved inorganic nitrogen and sediment. As such, it can be concluded that poor WQ continues to impact the OUV of the GBR (see *Annex 9* for a full extracted and adapted summary of findings from the Outlook Report, reflected against the Statement of OUV for the GBR).

In February 2021, the GBRMPA released its position statement on water quality stating that: '*Poor water quality still remains a major threat to the Reef and improving water quality is critical and urgent*'. The Reef 2050 Plan was also criticized by some stakeholders during the mission as not being ambitious enough, with implementation '15 years too slow'. The mission concurs with this observation, and concludes that poor WQ remains an important threat and continues to contribute to the degradation of the OUV; and while important efforts have been undertaken, they remain insufficient to achieve the targets set and need to be strengthened urgently.

Criteria (vii, viii, ix and x)

The Report Card shows that inshore corals have remained in an overall 'poor' condition, noting this is due to cumulative pressures (including climate change), with the effects of poor water quality (especially during high rainfall years) influencing the condition and recovery of inshore corals. Turf algal condition is deteriorating in some inshore locations due to sedimentation, and in high-sediment areas, and where macroalgae are dense, herbivory is reduced. Particulate feeders (including echinoderms, molluscs, sponges and corals) are being impacted by high nutrient levels and turbid waters, with poor WQ anticipated to be adversely affecting other invertebrates across a range of habitats. Changes in water temperature and water quality are also thought to be negatively impacting plankton and microbial communities.

Integrity

The Outlook Report 2019 recognized nutrient run-off as a 'major' threat to the GBR, and noted there may be a significant lag time between changes in agricultural practice and measurable water quality improvements, with 'potentially major consequences on biodiversity'. High anthropogenic sediment loads continue to be 'transported to, and remain in, the region'. While work has progressed since the 2019 report, practice changes are slow, and emerging issues threaten to compound the challenge, i.e., with projected increased rainfall variability due to climate change anticipated to further exacerbate sedimentation in the future, with likely 'major effects on

biodiversity'; and the potential development of major dam constructions expanding agricultural lands and generating further sediment and nutrient contributions to catchments.

Protection & Management

In the Outlook Report 2019, nearly all management criteria[41] are ranked **good**, with outcomes ranked **poor**, and the mission considers these rankings remain relevant today. Considerable efforts have been undertaken to advance management practices related to WQ, and these efforts are slowly showing results. However, challenges to WQ have been recognized for many years / decades, while practice changes (beyond pilot sites) are relatively recent. Nonetheless, the framework now exists (particularly through the NRM and industry partners) to advance efforts considerably, with appropriate investment, engagement and support. The mission also recognizes that in the recently announced $1 billion AUD funding support to the GBR, $579.9 million AUD has been allocated to support WQ initiatives over 9 years (21/22 – 29/30).

Specific Recommendations

The following are specific recommendations for the State Party, relevant federal and state government agencies and associated stakeholders and organizations.

HIGH PRIORITY RECOMMENDATIONS

Recommendation P1: Identify priority areas of grazing land for gully repairs and associated restoration and remediation activities, and significantly scale up activities in these priority areas through extensive mobilization of the necessary engineers and associated personnel, equipment and materials, alongside key engagement with relevant farmers and grazers to achieve existing WQIP targets.[42]

Recommendation P2: **Require proposed and in-progress dam developments to show clear alignment with water quality improvement for the GBR** as a condition for approval under relevant legislation, including mandatory compliance with the 2018 Reef 2050 Net Benefit Policy, industrial guidelines associated with the reef protection regulations, and climate-ready design considerations to be assessed by appropriate environmental impact assessment, which also includes consideration of indirect impacts such as associated agricultural expansion. Mechanisms and innovations should also be developed and implemented to address existing

[41] The effectiveness of existing management and protection measures are categorized and ranked as: context, planning, inputs, process, outputs and outcomes (see annex 9).

[42] * Scaling such work up will require widespread positive engagement of graziers and land-holders. Mechanisms to advance this could include consideration of the following: (i) Greater peer-to-peer learning (cross-regionally) and industry engagement, building on the achievements of NRM agency and industry initiatives to date; (ii) Greater involvement of local governments and councils, and the Local Government Association of Queensland (LGAC); (iii) Promotion of further incentives (noting caution on any perverse incentives), for example certification of reef-safe products for market, awards of excellence etc.; (iv) Justification of 'repairs to property' in areas with leaseholders resistant to change (as the government and / or traditional owners are ultimately the title holders of such land).

* Opportunity exists within this recommendation to enable wider employment opportunities of engineers and related personnel, many of whom may come from mining backgrounds. This would provide a positive alternative livelihood opportunity for those wishing to diversify and find alternate employment from existing industries that are likely to be in decline in some sectors in the coming years. With this engagement of former mining personnel, opportunity also arises for financing streams to come from the employment support sector of federal government reserves, in addition to the existing streams of financing from Queensland and Federal governments.

dam sediment impacts (from build-up and release) in priority catchments vulnerable to sedimentation (as prioritized for management in the WQIP).

Recommendation P3: Increase significantly the scale and pace of adoption, monitoring and enforcement of best management practice in sugarcane and banana farming to achieve WQIP targets; and advance the upscaling of land restoration activities, including where feasible the purchase and/or buy-back of land areas for restoration and return to wetland or riparian ecosystems.[43]

Recommendation P4: Prioritise the protection of remnant native vegetation across the GBR catchments through strengthened native vegetation clauses under existing laws, and through improved identification and enforcement of permissible activities in areas of high conservation value (HCV) forests and woodlands. This would include review of sites where clearing is currently allowed without permits (Category X under the Vegetation Management Act 1999) and updating zonation and corresponding permits which limit conversion of HCV areas. Such advances should also incorporate full consideration of traditional owner land management principles.

Recommendation P5: Ensure Reef 2050 WQIP water quality targets, to be updated in 2023, and actions implemented through the WQIP **are sufficient** to ensure the OUV of the property is not further adversely impacted by low water quality including through hitherto overlooked sources of poor water quality, such as dams, emerging crop industries and marine debris, with associated legislative compliance strengthened.

OTHER RECOMMENDATIONS

Recommendation O1: Undertake the comprehensive and transparent scientific assessments recommended in the Maintenance Dredging Strategy, ensuring the results are made publicly available regarding the impact of maintenance dredge spoil dumping within the GBR, to guide and inform enhanced measures to minimize the impact of dredge spoil on the property.

Recommendation O2: Effectively enforce the Waste Reduction and Recycling (Plastic Items) Amendment Act, including by developing partnerships with existing civil society initiatives focused at: (a) reducing primary production and consumer purchase of single-use plastics

[43] * Scaling BMP work up will require widespread positive engagement of farmers and the relevant industry organizations. Mechanisms to advance this could include consideration of the following: (i) Greater peer-to-peer learning (cross-regionally) and industry engagement, building on the achievements of NRM agency and industry initiatives to date; (ii) Greater involvement of local governments and councils, and the LGAC, (iii) Promotion of relatively low-tech, high input advancements (such as composting for organic carbon replacement of nitrogen fertilizers); both on individual farms, and at collective scales; (iv) Promotion of further incentives (noting caution on any perverse incentives), for example certification of reef-safe products for market, awards of excellence etc.; (v) Inclusion of minimum fallowing requirements in BMP standards.
* Incentives may be considered for farmers to transition high risk land to low risk uses, such as treatment wetlands. However, such incentive schemes need to be established for long-term sustainability of the restored systems (beyond temporary fallowing or short-term restoration).
* Coastal reparation activities will also need to prepare for sea level rise in key areas, with planning appropriately integrated between land and sea.
* Purchase of lands/ return to state could be targeted towards older cane-farming generations without succession plans (those 'aspiring for retiring').
* Restoration activities will need to consider issues related to invasive plant and animal prevention and management (e.g., 'transformer' weed species in riparian ecosystems that impact canopy cover and can cause subsequent increased bank erosion).

goods; (b) repurposing of waste; (c) reimagining of products to transition to renewable materials (e.g., packaging); (d) recycling; and (e) proactive removal of debris.[44]

Recommendation O3: Prioritize delivery of new and sufficient research into the impacts of emerging replacement crops in former cane-farming regions (e.g., macadamia nut, avocado, etc.) to ensure impact on GBR is well understood, and set minimum practice standards in accordance with WQIP targets based on this research, to promote industry best-practice within GBR catchment.[45]

Recommendation O4: Explore additional mechanisms for sediment capture in tributaries, including scientific and engineering assessments and innovations to establish whether sediment capture is possible at scale, and deployable without impact to the relevant ecological systems of the creeks, rivers and tributaries connected to the GBR.

Achievement of the above recommendations will require the involvement of all sectors of society, including Traditional Owners, local governments, civil society organizations, councils and NRM agencies.

[44] Efforts under this recommendation would require strong engagement and involvement of local government, traditional owner groups and civil society organizations. In urban areas in particular, strong engagement of LGAC and local government agencies will be important to mobilise and engage local communities.

[45] As further transition to these wellness crops is anticipated, opportunity exists to establish BMP expectations from the outset, and to provide incentives and encouragement for adoption. This may include, for example, reef-safe certification for BMP farms, which would hold traction in the wellness industry and may enable premium market sales.

Issue 2: Climate Change

The impacts of climate change on reef systems are varied and wide-reaching: with increased water temperatures causing bleaching and coral mortality, sea level rise and changes in storm frequency causing coastal land inundation and subsequent sedimentation, and ocean acidification threatening coral communities (and other calcium carbonate-based lifeforms).[46]

The GBR has suffered considerable climate change impacts in recent years, most notably a series of widespread bleaching events occurring with increasing frequency, including four over the last seven years.

- In 2016, GBRMPA reported nearly one-third of in-shore coral cover was impacted, with the majority of loss (> 75%) occurring in the northern region. The total cover of reef crest corals on the Great Barrier Reef declined by 29-30% between March and November, which equated to a loss billions of corals, unprecedented in scale and severity.[47]
- The 2017 bleaching event was also unprecedented in terms of occurring only one year after the last event. This time the central region of the GBR was most affected, and overall two-thirds of the GBR was impacted. Also, as a consequence of mass mortality of adult broodstock in 2016 and 2017 due to heat stress, the amount of larval recruitment across the Great Barrier Reef declined in 2018 by 89% compared to historical levels, although coral cover increased and recruitment density increased in areas that escaped bleaching.[48]
- In 2020, GBRMPA stated that another bleaching event had impacted around 60% of the reefs, and while the impact was not as damaging overall as the 2016 event, it highlighted the escalation of occurrence over time, with impacts diffuse throughout the GBR. During the mission, AIMS noted that the better recovery witnessed in 2020 may have related to temperature-sensitive corals already being less prevalent on reefs due to prior bleaching events.
- In 2022, during the visit of the mission, another mass bleaching event unfolded. This is again unprecedented as it is occurring during a La Niña year, when increased cloud cover and rainfall would normally cause lower air and sea temperatures.

Through discussions with representatives from GBRMPA, AIMS and members of the IEP, the mission team learned of the varied responses to these events among coral species, with some thermally tolerant “winners” and more sensitive “losers”. In the aftermath of each mass bleaching

[46] Numerous scientific publications exist that further explain these impacts, including: Hughes TP, JT. Kerry, AH. Baird, SR. Connolly, A. Dietzel, CM. Eakin, SF. Heron, AS. Hoey, MO. Hoogenboom, G. Liu, MJ. McWilliam, RJ. Pears, MS. Pratchett, WJ. Skirving, JS. Stella, G. Torda. (2018b). Global warming transforms coral reef ecosystems. Nature. 556: 492 – 496. https://www.nature.com/articles/s41586-018-0041-2; Lough, JM., KD Anderson, and TP Hughes. (2018). Increasing thermal stress for tropical coral reefs: 1871-2017. Scientific Reports 8, 6079. https://www.nature.com/articles/s41598-018-24530-9; Oliver J.K., Berkelmans R., Eakin C.M. (2009) Coral Bleaching in Space and Time. In: van Oppen M.J.H., Lough J.M. (eds) Coral Bleaching. Ecological Studies, vol 205. Springer, Berlin, Heidelberg.

[47] Great Barrier Reef Marine Park Authority (2017). Final report: 2016 coral bleaching event on the Great Barrier Reef. GBRMPA, Townsville.

[48] Hughes TP, Kerry JT, Baird AH, Connolly SR, Chase TJ, Dietzel A, Hill T, Hoey AS, Hoogenboom MO, Jacobson M, Kerswell A, Madin JS, Mieog A, Paley AS, Pratchett MS, Torda G, Woods RM. Global warming impairs stock-recruitment dynamics of corals. Nature. 2019 Apr;568(7752):387-390. doi: 10.1038/s41586-019-1081-y. Epub 2019 Apr 3. PMID: 30944475.

event, reefs have shifted in their assemblages[49], with recovery reliant on an adequate supply of larvae from non-impacted reefs, and sufficiently stable substrate for settling larvae. The replacement of dead corals following a mass bleaching event (by larval recruitment and subsequent colony growth) takes at least a decade for fast-growing weedy corals, such as species of *Acropora, Pocillopora, Seriatopora* and *Stylophora*, and far longer (decades) for slower growing species.

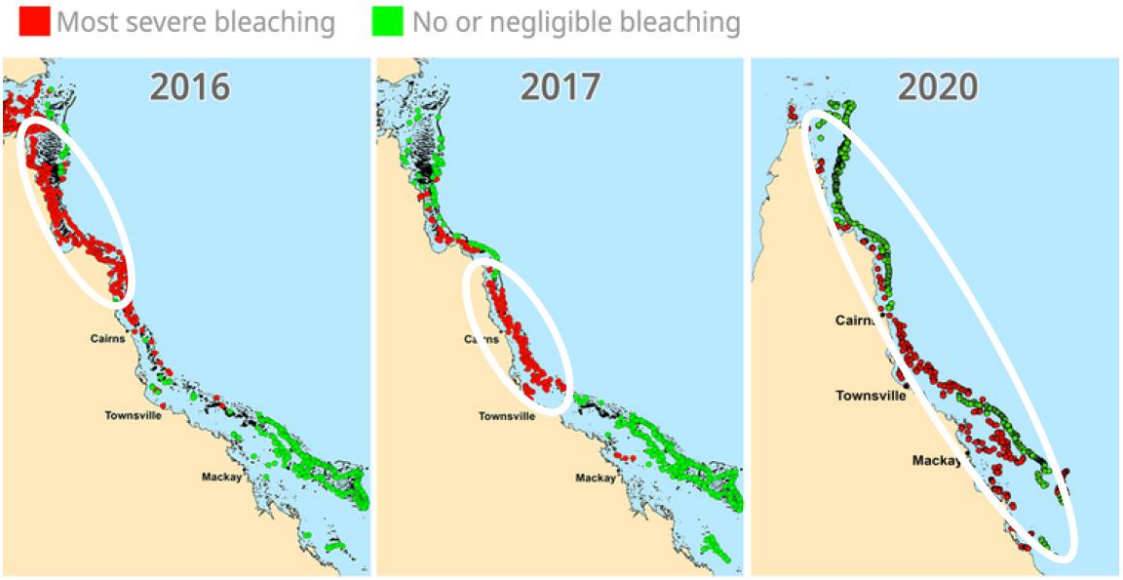


Figure 4: Areas impacted in the mass bleaching events of 2016, 2017 and 2020. Source: ARC Center of Excellence for Coral Reef Studies.

Figure 5: Photos from the aerial bleaching surveys conducted in March 2022. Left: Category 1 bleaching (estimated @ 1-10%). Right: Category 5 bleaching (estimated @ > 91%).

The increase of ocean CO_2 through the carbon sink process has also already resulted in a decline of pH of 0.1 from pre-industrial times, taking it to 8.1.[50] This corresponds to a 26% increase in acidity; with the impacts already expected in reef skeletal integrity (slower growth rates and

[49] According to Professor Terry Hughes of James Cook University, this shift tends away from the dominance of fast-growing, three-dimensional, branching and tabular species with dense skeletons, to a depauperate assemblage dominated by taxa with simpler morphological characteristics and slower growth rates.
[50] De'Ath, G., J.M. Lough, and K.E. Fabricius. (2009). Declining coral calcification on the Great Barrier Reef. Science 323, 116-119.

weaker structure), and impacts on plankton (the foundation of the food chain) as well as fish and marine species reproduction and productivity. Further decreases may be fatal, as reef development is thought to cease at pH 7.8.

Additionally, Australia has seen an increasing incidence of severe weather events in recent years, with a resulting impact on the GBR. Between 2004 and 2018, 10 cyclones of category three or more crossed the GBR, causing significant damage to reefs; and in recent years flash floods have inundated coastal regions, sweeping debris and sediment onto the reef.

The threat of climate change is a global challenge, and to address this challenge nations around the world are working towards the Paris Agreement target to limit global warming to well below 2°C, preferably to 1.5°C, compared to pre-industrial levels; with an aim of achieving net-zero emissions by the second half of this century.

The updated Reef 2050 Plan (2021) reflects this agreement, and includes three key goals related to climate change:

1) "Australia contributes to an effective global response to climate change through the Paris Agreement, to hold the increase in the global average temperature to well below 2°C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels.
2) The capacity of Reef communities, Traditional Owners and industries to adapt to a changing climate is increased.
3) Species and habitats are supported to adapt to a changing climate".

The strategic actions related to each of these goals refer to implementing various associated plans and strategies. This includes the following commonwealth and state strategies.

During the mission each of these was shared, presented and discussed.

Climate change mitigation strategies referred to in the Reef 2050 Plan

National Level

Australia's Long-Term Emissions Reduction Plan (LTERP) and associated Technology Investment Roadmap are referred to in the **Reef 2050 Plan goal 1** in relation to climate change mitigation and outline the path to achieving net zero emissions by 2050.[51] During the mission progress of this plan and roadmap was presented, showing Australia is on track to exceed its nationally determined contribution (NDC)[52] to reduce emissions by 26% to 28% below 2005 levels by 2030, with projections suggesting achievements are likely to be greater (in the region of 30%

[51] Key approaches to achieve net zero by 2050 are outlined in the LTERP as: (a) driving down the costs of low emissions technologies — including clean hydrogen, ultra low-cost solar, energy storage, low emissions steel and aluminium, carbon capture and storage and soil carbon; (b) enabling the deployment (of new technologies) at scale — by investing in infrastructure, promoting awareness and advancing voluntary programs (carbon markets, individual actions); (c) seizing opportunities in new and traditional markets — including building new industries like clean hydrogen, renewable energy and critical minerals to create new export markets and jobs; and making specific mention that Australia "will continue to export our traditional energy exports (fossil fuels) for as long as our customers demand them." "Australia's coal and gas export industries will continue through to 2050 and beyond,"; and (d) fostering global collaboration— through bi- and multi-lateral agreements for new technology advancement and carbon offset schemes through the Indo-Pacific.

[52] NDCs are climate action plans outlining a nations' targets to cut emissions and adapt to climate impacts. Each Party to the Paris Agreement is required to establish an NDC and update it every five years.

to 35%).[53] Various work underway was presented regarding advancing emission reduction technologies in the country, and the various voluntary programs underway, including the following:

- Australia's carbon neutral certification scheme (Climate Active) is a partnership between the Government and Australian businesses to encourage voluntary climate action, with certification linked to the business calculating the greenhouse gas emissions generated by their activity, reducing those emissions through new technology or changes in operations, and offsetting any remaining emissions by purchasing carbon offset units.
- The Emissions Reduction Fund (ERF) incentivizes Australian businesses to cut the amount of greenhouse gases they create and to undertake activities that store carbon. Participants in the scheme can earn Australian Carbon Credit Units (ACCUs). These units are managed under the clean energy regulator through voluntary emission reduction initiatives, with 1 ACCU equal to 1 ton of CO2 avoided or stored. ACCUs can be sold and can generate participants an income, and to ensure emissions reductions aren't displaced by a rise in emissions elsewhere in the economy, the ERF includes a safeguard mechanism which encourages large businesses to keep their emissions within historical levels. Since its launch $2.5 billion AUD in ERF credits have been generated, with increasing interest on opening ACCUs through exchange platforms to boost participation in this scheme. The ERF has also promoted an increase in climate risk reporting amongst the private sector, both in response to shareholder pressures but also to enable scheme participation and the acquisition of related benefits.

Plans being implemented by the Australian Renewable Energy Agency (ARENA) and the Clean Energy Finance Corporation (CEFC) to achieve the plans targets were outlined, and various data presented. This included data showing how Australia is a relatively small contributor to overall global emissions (1.3%), and how Australia's reduction in emissions over the last decade and a half have been more rapid than average for OECD nations. The investment roadmap also includes 'stretch goals'[54] for technological advancements to further emission reductions.

Discussions during the mission also recognized however that the LTERP and associated Technology Investment Roadmap have been heavily criticized in the international climate discourse, as they strongly rely on the future technical advancement and capabilities of low-emissions technology, along with land use reductions and international offsets, with no plans to phase out coal or curb fossil fuel exports.[55] Data was also questioned during the mission. For example, while Australia may only contribute 1.3% of global emissions this is disproportionate to the 0.3% of global population represented by the nation. The consequential emissions associated with key commodity exports of fossil fuels from Australia have been estimated to account for

[53] The mission acknowledges that the Australian NDCs were adjusted post-mission on 16.06.2022 (reference: NDC Registry and Australia's NDCs Communication 2022) after completion of the draft of this report, which remains focused on observations and status at the time of the mission.

[54] Stretch goals for technology investment and their anticipated timeframes for deployment are: (a) Clean hydrogen production under $2 AUD/kg using steam methane reforming with carbon capture and storage (CCS) (2025–2030) and renewable electrolysis (2028–2035); (b) Ultra low-cost solar electricity generation at $15 AUD/MWh (2030–2035); (c) improved energy storage for firming under $100 AUD/MWh using lithium-ion batteries (2025–2030); (d) low emissions steel production under $700 AUD/t through new build direct iron reduction plant using hydrogen (2030–2040); (e) low emissions aluminium production under $2,200 AUD/t using renewable electricity and inert anodes (2035–2040); (f) CCS using CO2 compression, hub transport and storage under $20 AUD/t of CO2 (2025–2030); and (g) soil carbon measurement under $3 AUD/ha/year using advancements in proximal sensing, modelling and remote sensing technologies (2025–2030).

[55] Summary critiques of the emissions reduction plan are available from Climate Analytics and the New Climate Institute.

around 8.6% of total greenhouse gas emissions in Asia and the Pacific and about 4% of global emissions[56]. According to an analysis released by British climate and energy thinktank Ember at the COP 26 summit in Glasgow, Australia has the highest greenhouse gas emissions from coal power in the world on a per capita basis.[57] Additionally, the 2050 net zero emissions target remains 'aspirational' and is not yet legislated at the commonwealth level.

State/Territory Level

In addition to the national plans above, each state/territory in Australia has set its own mitigation targets and associated strategies/plans[58], and the Queensland Climate Action Plan (2020–2030) is also specifically referred to in the **Reef 2050 Plan goal 1**. This plan outlines more ambitious mitigation targets than the commonwealth plan (at least 30% emissions reduction below 2005 levels by 2030), and during the mission the Queensland government presented data showing a 14% reduction had already been achieved by 2019. The plan is supported by a recently introduced Zero Emission Vehicle Strategy (2022-2032), Queensland Hydrogen Industry Strategy (2019-2024), and a Queensland Resources Industry Development Plan (in development), that aim to support transformational resource industries that are 'resilient, responsible and sustainable' in the coming years. Many of these initiatives are relatively new and have been launched within the last two years, showing a considerable acceleration of climate mitigation efforts at the state level. Queensland is also committed to the net zero target by 2050, however the state has yet to legislate for this, and has not yet provided a clear pathway to reach it.

Also associated with Queensland's climate action plan, the state has been implementing a Queensland Land Restoration Fund (see box 4).

Therefore, with regard to the mitigation of climate change through the reduction of emissions, the mission took note that progress has been made, and has been accelerated in recent years at both the commonwealth and state level.

Box 4: The Land Restoration Fund (LRF)

The LRF was launched in 2017/8 (Round 1) as a $500 million AUD commitment to support carbon farming in Queensland that delivers co-benefits, including advances in land management practices, improved water quality and habitat protection. It is linked to the ERF (and the acquisition of ACCUs) but requires additional benefits beyond carbon trading. Since its launch over 1.7 million ACCUs have been issued in Queensland through this scheme, resulting in over 1.7 million tons of CO2 sequestered or avoided up to a 15-year period from issuance; with many of the benefits linked to concurrently supporting wider GBR-related targets in the Reef 2050 Plan. The LRF was also recently augmented by the Queensland Natural Capital Fund (2021) for Round 2 investments, and to support the purchase and funding of properties to be sustainably managed and able to access to credit schemes. (See box 5 on carbon offsets and financing schemes).

[56] Burke, P.J., Beck, F.J., Aisbett, E., Baldwin, K.G.H., Stocks, M., Pye, J., Venkataraman, M., Hunt, J. and X. Bai (2022). Contributing to regional decarbonization: Australia's potential to supply zero-carbon commodities to the Asia-Pacific, Energy, Volume 248, 2022. https://doi.org/10.1016/j.energy.2022.123563.

[57] Data based on the 2021 Global Electricity Review (https://ember-climate.org/app/uploads/2021/03/Global-Electricity-Review-2021.pdf)

[58] Amongst the eight Australian states/ territories, two have already legislated for the 2050 net zero emissions target (Victoria-VIC, and the Australian Capital Territory-ACT), and five have established 2030 targets that go beyond commonwealth commitments. These are: VIC (45-50% below 2005 levels); ACT (65-75% below 1990 levels); New South Wales-NSW (50% below 2005 levels); QLD (30% below 2005 levels); and South Australia-SA (More than 50% below 2005 levels).

Nonetheless, during the mission, e-NGOs pointed out that Australia's overall targets and fair share rankings are 'Highly Insufficient' and not Paris Agreement compatible. And while the NDCs are likely to be exceeded, the targets themselves are too low compared to other developed nations. The Australian data also relies heavily on the inclusion of 'land use, land-use change and forestry' (LULUCF) elements in the calculations, in doing so prioritizing sequestration over real-term emissions reductions. While LULUCF inclusion is acceptable and in line with UNFCCC accounting procedures, the data shows that greenhouse gas (GHG) changes overtime (in kt CO_2 equivalent) 'without' LULUCF stands at +23.99% for Australia, while comparable regions such as the USA and European Union are achieving negative reductions even prior to the incorporation of LULUCF calculations (-7.32% and -34.3% respectively).[59] Various commitments and plans exist to transition to renewable energies, though Australia is positing gas-derived 'clean' hydrogen using carbon capture storage (CCS) as one preferred mechanism, that will prolong engagement with fossil fuel industries. Additionally, much of the mitigation strategy relies on carbon sequestration opportunities, with concerns shared during the mission that the nation's energy grid would not be capable of transitioning quickly without considerable investment.

The recent 2022-23 budget papers (announced just after the mission) also reveal planned reductions in climate spending over the coming years (a 35% reduction by 2025-26)[60].

	2000	2005	2019	2020	2030
	National Greenhouse Gas Inventory				Projections
Emissions (Mt Co_2-e)	558	624	531	513	439

Figure 6: Australia's emissions projections to 2030. Source: DISER

Climate change adaptation strategies referred to in the Reef 2050 Plan

The National Climate Resilience and Adaptation Strategy (2021-2025) is referred to in relation to **goal 2** of work area 1 in the **Reef 2050 Plan**, and outlines three national level broad adaption objectives.[61] This recently developed strategy has resulted in the establishment of a National Adaptation Policy Office (in 2021)[62] and strengthened support to the existing National Recovery and Resilience Agency; and has guided climate investment nationally and internationally (with >70% of Australia's international climate finance supporting adaptation and resilience initiatives across the Indo-Pacific region).

Box 5: Carbon offsets and financing schemes

During the mission a range of project-level credit (finance incentives) and offset schemes were presented. These are integrated to address a range of threats to the GBR, with the aim to advance blended finance through environmental social governance (ESG) private sector contributions for conservation outputs and provide potentially stackable, tradeable mechanisms for carbon offsets and associated biodiversity benefits.

For example, Reef Credits focus on marketable improved water quality through changes in land management with quantifiable reductions in pollutants (see issue 1). The Biodiversity Credit Exchange (BCE) focuses on protecting, managing and restoring areas of high conservation value paid by buyers

[59] UNFCCC Time Series-Annex 1, https://di.unfccc.int/time_series
[60] Morton, A. (2022) The Guardian, 29 Mar.
[61] Objectives: (1) drive investment and action through collaboration; (2) improve climate information and services; and (3) assess progress to improve over time.
[62] In development at this time, this policy office will be situated within DAWE and will coordinate adaptation advice across industry and governments on matters including house and commercial building design, urban tree plantings, and environmental restoration programs.

required to offset vegetation clearances in the same region. ACCUs are units managed under the clean energy regulator through voluntary emission reduction initiatives, with 1 ACCU equal to 1 ton of CO2 avoided or stored. Additional schemes (amongst others) include 'Bio-token' and renewable energy certification (REC) trading schemes being explored through private sector and world bank support, and Carbon + Biodiversity (C+B) initiatives being trialled by government (DAWE).

Elements of the above include **Impact Investment** (project level) → **Markets** (potentially stackable) → **Acquisition** (opportunities), with carbon reduction (sequestration/ offset) being one of the anticipated (sometimes integrated) deliverables.

While some of these schemes have been in action for several years, others are relatively new, and the level of interest and expansion of opportunities in these market-based mechanisms is accelerating quickly at this time. These schemes are considered essential tools in promoting financial incentives for programmatic engagement as well as advancing carbon reduction targets.

While such approaches are globally recognized and relevant, they are not without considerable challenges; and during the mission, 'cautionary notes' (or 'foundations for success') were recognized and discussed as follows:

1. Governance arrangements for these schemes need to be completely transparent and fully science-driven. Net benefit calculations and pricing mechanisms need to be entirely accurate and appropriate, otherwise the system fails to deliver and perverse incentives can be created that detract from (and can ultimately impede) the overall aims.
2. These schemes should not replace or override regulatory arrangements, and must be only 'add on' / complementary to wider programmatic activities.
3. There are capacity gaps in the understanding and effective implementation of these schemes amongst the diverse stakeholders involved. These gaps need to be addressed in order for these approaches to have the necessary integrity and impact desired.
4. Innovative financing should not be seen as an opportunity to 'replace' government financing.
5. Stack-ability needs to be carefully managed. While stakeholders (such as farmers) may get improved cost/benefits with stackable credits, and they may be appealing to financiers for impact investment, there is risk of duplication / muddying of reporting net benefit calculations and assessments.
6. Elements of these schemes have limited sustainability, as credits have a life-span and there is a lack of clarity of expectations (and the continued benefits derivable) once credit terms end.

Therefore while these schemes confer exciting potential benefits for incentivizing change and advancing the Reef 2050 goals, they are not a panacea for success; and it is essential that the above issues be addressed moving forward.

Goal 3 of work area 1 of the Reef 2050 Plan (also related to adaptation) specifically mentions the Reef Restoration and Adaptation Program (RRAP), a partnership[63] to help the GBR resist, adapt and recover from the impacts of climate change.

The mission learned that the RRAP currently supports 34 multi-institutional projects, involving more than 250 researchers, and planning and tracking more than 2,000 major deliverables. RRAP is a 'Public Good Program', sharing results and engaging with international organizations who are also striving to address reef resilience and restoration. It is exploring an extraordinary range of interventions involving advanced science. This includes the National Sea Simulator (SeaSim) research aquarium facility hosted by AIMS that is exploring assisted evolution and coral

[63] Partners include: the Australian Institute of Marine Science, CSIRO, the Great Barrier Reef Foundation, the University of Queensland, QUT, Southern Cross University and James Cook University. The program has been funded to date by the Australian Government's Reef Trust ($100 million AUD) and the Great Barrier Reef Foundation and research partners ($50 million AUD), with a further $92.7 million AUD committed over for the coming 8 years.

enhancement, amongst many other initiatives. The program is supporting world-leading advances in understanding the mechanisms, options, opportunities and challenges related to securing the health of the reef in the face of changing climate; and includes ambitious restoration scenarios related to the 'manufacture' and deployment of resilient coral assemblages at scale.

This work is undoubtedly vital to find workable adaptation mechanisms for reef preservation (not only in Australia, but globally), and shows exceptional advances for GBR management for climate adaptation. Nonetheless, many stakeholders met during the mission (including the scientists involved in these endeavours) recognize that it will require vast financing to deploy these adaptation measures at the scale required. And while efforts are underway to improve the economy of scale and explore public-private partnership financing, the economic outlook alone suggests investments in reducing emissions remain vital for overall cost-effectiveness, and to enable any form of replication of these efforts in wider regions/ nations (as intended under the RRAP).

Other plans and strategies specifically referenced in the Reef 2050 Plan[64] and reviewed and discussed during the mission related to climate change actions include the following:

- The Queensland Climate Adaptation Strategy (2017-2030) outlines clear actions for climate adaptation across a range of social sectors (including health, tourism, agriculture, development infrastructure etc.). It provides strong foundational guidance with broad targets, but is lacking measurable indicators.
- The GBRMPA Blueprint for Resilience was developed collaboratively with the scientific community, industry, Traditional Owners and NGOs. The blueprint recognizes the importance of emissions reductions but focuses on tangible adaptation activities necessary for GBR protection. It outlines 10 key initiatives[65] aimed to deliver maximum benefits for reef resilience. These are embedded each year into the Authority's corporate and operating plans, and while led by GBRMPA, the initiatives rely on the involvement of a wide range of stakeholders and sectors of society. It is a foundational plan for GBRMPA activities and links with wider initiatives (under RRAP etc.), but is not currently supported under any form of legislation. The blueprint is due to be updated this year (2022).

Notably, while the Blueprint focuses on adaptation measures, the GBRMPA position statement on climate change (2019) is unequivocal in recognizing the importance of mitigation efforts.

> *"Climate change is the greatest threat to the Great Barrier Reef. Only the strongest and fastest possible actions to decrease global greenhouse gas emissions will reduce the risks and limit the impacts of climate change on the Reef. Further impacts can be minimised by*

[64] Additional supportive policies and programs referred to in Reef 2050 Plan, but not specifically cited in relation to the goals include: the Clean Energy Finance Corporation Reef Funding Program, (supporting small-scale private sector partners in the GBR catchment to improve energy efficiency and advance sustainable business infrastructure); the Decarbonisation of the Great Barrier Reef Islands Program (supporting tourism resorts and 'whole island' communities to reduce emissions as well as land-based impacts on the reef); the National Disaster Risk Reduction Framework, (that recognizes climate change as a key driver of increasingly frequent and intense natural disasters with the potential for future hazards to occur at 'unimagined scales', and providing clear recommendations for improved science-informed policy decisions and priority investment areas); and the Policy on Great Barrier Reef interventions (to support restoration and/or adaptation interventions designed to directly support and build ecosystem resilience and provide conservation benefits).

[65] These fall under four categories: (i) building a resilience network; (ii) delivering on-ground actions to enhance resilience; (iii) empowering people to be part of the solution; and (iv) fostering change.

limiting global temperature increase to the maximum extent possible and fast-tracking actions to build Reef resilience."

The above policies, plans and initiatives involve an enormous range of stakeholders, all contributing efforts towards effective and resilient reef management.

During the mission, all key stakeholder groups expressed their concern for the impacts that climate change is having on the GBR. The IEP advisory group informed the mission that while influencing national policy was not the role of the panel, the issue of climate change was raised consistently in each meeting, encouraging GBR to become a hub for climate change action, including a shift to renewable energy and electrification infrastructure.[66] There was commentary from the IEP that the Reef 2050 Plan was not strong enough regarding the impacts of climate change and insufficient to deal with the impacts of extreme weather. The Plan needs 'greater ambition' beyond 'business as usual', and requires clear indicators for success and adaptive management.

The Reef Advisory Committee (RAC) likewise noted that climate change is at the heart of the challenges facing the GBR and should be pivotal within the Reef 2050 Plan. The Queensland Resources Council expressed their support for the Paris Agreement and for pioneering renewable energies, with its constituent groups supporting a shift from fossil fuel extraction to focus on critical minerals for new energy (e.g. lithium, copper etc.). The Indigenous Reef Advisory Committee (IRAC) and Traditional Owner Working Group noted the influence of climate change as 'alarming', with the human behaviours causing climate change having a devastating impact on sea country. These groups noted that the lack of synchronicity between stakeholders to adequately address this challenge would ultimately show itself in the loss of nature, and requested stronger action on this issue. The Reef Guardian Councils[67] revealed the results of surveys suggesting 91% of constituents targeted were concerned for climate change. And the Local Government Association of Queensland (LGAC), while acknowledging that the Reef 2050 revisions in 2021 effectively responded to a number of concerns raised by local governments, nonetheless remain concerned about climate change and are supporting local government entities to accelerate actions in their regions.

Impact on OUV

The most recent (2019) Outlook Report and numerous other publications shared and scientific assessments discussed during mission are clear about the impact climate change is having on the OUV of the property (see *Annex 9* for a full extracted and adapted summary of findings from the Outlook Report, reflected against the SOUV of GBR).

[66] In March 2022, the IEP submitted a formal letter to the Ministers of Environment (commonwealth and Queensland state) urging additional actions that could be taken to protect and conserve the GBR, and emphasising that 'as we have advised on multiple occasions, climate change .. is the biggest threat' to the property. It continues 'it is undeniably in Australia's national interest for the countries of the world to reduce their use of fossil fuels. That requires leadership, and leadership is exactly what Australia should provide.' The letter advises on climate change actions to advance GBR as an action hub, alongside further recommendations related to the need for dynamic environmental assessments to guide policy (based on the changes to stable state that has occurred), and considerations for improvements in fisheries management and communications.

[67] There are 19 Reef Guardian Councils through the GBR region, covering ~60% of the catchment area. They are local councils that are showcasing environmentally sustainable practices (e.g., river management, waste water discharge, illegal dumping etc.) to support the effective management and protection of the Reef. Some councils (such as Cairns) are also shifting their own operations to renewable energy and aiming for institutional level net zero emissions by 2030.

Criteria (vii, viii, ix and x) - Key habitats

Coral reefs were ranked as **very poor** and **declining** in the Outlook Report 2019, with 'unprecedented mass coral bleaching due to global warming' as a key factor reducing coral diversity and abundance, with widespread loss of key habitat-forming coral species at many locations. 'Coral recruitment has declined significantly', and 'evidence of cascading effects on coral dependent species, such as fish and invertebrates is emerging.' More than 60% of the reef area has been exposed to cyclones and destructive waves since 2014; and reef building has deteriorated in response to mass bleaching events and changes in ocean pH. Connectivity between reef habitats has also been disrupted with negative alternations to the reefs' integrity intensifying over time.

During the mission, scientists (from GBRMPA, AIMS and the IEP) emphasized to the experts the importance of recognizing the heterogeneity of the system, with the GBR including over 3,000 individual reefs along 2,300km of Queensland's coastline. Some reefs have been impacted more than others; and AIMS presented findings from their monitoring report for 2021 showing that throughout the property, corals were starting to recover from prior bleaching events (noting that these findings are prior to the 2022 event). They also noted however that the long-term picture is not positive, with the number of reefs resilient to combined pressures declining over time, and the number of reefs in poor condition increasing; with climate change cited as 'the single biggest threat to the future of the GBR'.

Seagrass meadows remain in poor condition overall across the property through degradation by a range of factors, including thermal stress in shallower habitats (through desiccation and increases in salinity), disturbance from sea level rise and destruction from storm actions. ***Mangroves*** are in overall good condition across the property but have also been impacted by cyclones and sea level rise, whose impacts are likely to increase with climate change.

Other key habitat areas impacted by climate change include: the ***lagoon floor*** (with some areas exposed to prolonged thermal stress and damaging cyclone waves); ***islands*** (with many experiencing damage from severe weather and temperature extremes); ***mainland beaches and coastlines*** (with modifications occurring at some sites through sea level rise and erosion).

Overall, habitats for the conservation of biodiversity are ranked as **poor** in the Outlook Report (2019), with 'significant habitat reduction and alteration' resulting in 'persistent and substantial effects' on some dependent species.

Criteria (vii, viii, ix and x) - Key species

Marine turtles are facing increasing and critical threats, with 'concerns high for the future of loggerhead, hawksbill and northern green turtle populations'. Destruction of forage areas (seagrass meadows) are impacting food supply. Coastal erosion is limiting viable nesting areas at some sites, with tidal inundation from sea level rise also posing risks to nests. Heat stress on nests is resulting in predominantly female hatchlings. On Raine Island, for example, 99% of Green Turtle hatchlings produced each season are female; threatening the future viability of the population. 'Significant' mortalities are also being observed from heat exhaustion and disorientation of nesting females.

Dugongs have shown evidence of recovery in some areas since 2011, when the population in the property was severely impacted by loss of seagrass habitat, with findings of starved dugongs and reduction of breeding observed, as well as increasing instances of being caught as bycatch as a result of dugongs leaving safer zones to go into fishing areas in search of food. However, the stability in dugong populations, particularly surrounding urban areas, would be strongly dependent on the condition of seagrass meadows and efforts to reduce direct mortality threats.

Whale populations are generally stable and have improved in the GBR in recent years. However, baleen whales are reliant on krill stocks that are being impacted by climate change outside the Region.

With climate change affecting reef dynamics, assemblages and ecological processes, the impact on wider species dependent on the habitats in the GBR is likely to be significant but is not yet appropriately assessed or understood. This includes impacts on sponges, anemones, marine worms, crustaceans, molluscs etc., with the latter also impacted by climate change-induced acidification of marine waters.

With the impacts of climate change intensifying, the negative effect on marine organisms is expected to accelerate in the coming years.

Integrity

The Outlook Report (2019) notes that the property's integrity is deteriorating. 'An altered disturbance regime due to climate change has impaired the resilience of the ecosystem', noting also that the size of the property is becoming 'less effective as a buffer against reef-wide disturbances.' With changes expected in stratification, currents and oceanographic conditions, existing refugia within the GBR zones may experience changes in conditions, and the impacts on (and from) changing conditions in deeper water areas may cause further changes still. Current modelling of upwelling actions is not yet clear and there is a need to better understand cascade effects across scales. Again, AIMS and IEP scientists reminded the mission of the importance of recognizing the heterogeneity of the GBR, with some areas being impacted by climate change more than others. They noted the importance of improved understanding of these heterogenous effects and the impacts on overall site integrity. They also noted that the issue of the lagging effect[68] is little recognized, and makes the importance of climate change mitigation and adaptation all the more pressing.

Protection & Management

As this report has shown, there is considerable work underway to effectively manage the GBR, with work on climate adaptation (particular research science) likely second to none globally. The sheer volume of strategies and plans across all stakeholder sectors is impressive, even though it poses challenges in terms of coordination. And despite this extensive management planning response, efforts have been insufficient to fully address degradation of values and integrity of the property. Climate change actions outlined in these strategies are heavily reliant on adaptive mechanisms through (emerging) research science; with factors of likely cost (immediate term and long-term) little factored into management decision-making beyond recognizing the need to generate vast resources. Meanwhile mitigation elements of the plans are relying on offset and credit schemes, prioritizing sequestration over real-term emissions reductions and risking tangible net benefits (particularly when concurrent levels of land clearing, particularly in category X areas, continues). Mitigation efforts in terms of net reductions in emissions continue to fall below the internationally recognized accepted standard for reef protection. In the Outlook Report 2019, nearly all management criteria[69] are ranked **poor** to **very poor** with regards to climate change.

[68] The lag effect relates to the time from which emissions is released into the atmosphere, to when the impacts of those emissions are felt, and is generally anticipated to be in the region of years to decades.

[69] The effectiveness of existing management and protection measures are categorized and ranked as: planning, inputs and process (all ranked poor and declining), outputs and outcomes (ranked very poor and declining). Only the measure of 'context' is regarded as good and stable (see annex 9).

Specific Recommendations

The following are specific recommendations for the State Party, relevant federal and state government agencies and associated stakeholders and organizations.

HIGH PRIORITY RECOMMENDATIONS

Recommendation P6: Review and strengthen, by 31 December 2022, the Reef 2050 Plan to include clear government commitments to reduce greenhouse emissions consistent with the efforts required to limit the global average temperature increase to 1.5°C above pre-industrial levels. Commitments should harness the State Party's significant capabilities to take accelerated action on this issue, at all possible levels, and should include timebound, actionable and practical steps **to limit the impacts of climate change on the OUV of the property**, including the following actions:

a) Continue to comprehensively assess and report on the impact of climate change on the property, and to include in this process an evaluation of the impact of the implementation of national climate change and emissions reduction strategies, based on best available science and information.
b) Develop and implement ambitious emissions reductions activities consistent with limiting the global average temperature increase to 1.5°C above pre-industrial levels, taking into account the above assessments and the additional 'climate related activities' concerning emissions reductions as recommended by the Independent Expert Panel (IEP), in its letter to the State Party in March 2022.
c) Establish a formal mechanism for the IEP and Reef Advisory Committees to advise the State Party on the required carbon emissions reductions to attain the goals set out in the Reef 2050 Plan.

Recommendation P7: Ensure that the carbon and water quality related credit schemes being deployed in the GBR catchments deliver overall net benefits to the OUV of the property and are monitored and regulated by the relevant agencies through fully transparent, science-driven and evidence-based management to that end.[70]

Recommendation P8: Continue support for scientific research and increase financial resources to enable deployment of climate adaptation mechanisms developed through this research at the required scale to be effective in mitigating and adapting to climate change impacts across the property, including initiatives undertaken by AIMS (SeaSim and associated research activities), as well as wider restoration initiatives that directly support the rehabilitation of habitat and concurrent carbon sequestration. [71]

[70] * This will involve strengthening the capacity of key parties to appropriately engage in / oversee the schemes to the highest standards, with due diligence in place to avoid the creation of perverse financial incentives.
* Thorough and transparent reporting and accounting mechanisms need to be in place across-incentives, particularly related to 'stackable credits', to ensure that the overall net benefits are appropriately understood and represented.
* Credit schemes should also have clear long-term sustainability goals, and where schemes are time-bound (e.g., credits have a fixed life-span) clear processes need to be in place for the continuation of benefits beyond the credit terms.
[71] Restoration activities involve a wide range of stakeholders, and emphasis should be given to the proactive engagement and involvement of Traditional Owners, local councils, tourism enterprises, extractive industry representative bodies, and (in the case of land use management) farmers and graziers.

OTHER RECOMMENDATIONS

Recommendation O5: Optimize the opportunity presented by the revision and update of the GBRMPA Blueprint for Resilience (that is scheduled for 2022) to more clearly demonstrate the actions that will be undertaken within the GBR to increase awareness of climate mitigation needs and present clear and actionable activities to reduce climate impacts on the OUV of the property.

Recommendation O6: At the State level (Queensland government), ensure the 1.5°C target is supported by legislation, and clear, actionable steps to achieve this target are set within the state's existing climate related strategies and plans; with associated opportunities optimized to become a 'climate action hub' for the GBR.[72]

[72] The opportunity for Queensland to be a showcase region for climate is outlined in the recommendation to the Minister from the Reef 2050 Independent Expert Panel, and includes transitioning state infrastructure shift to renewable energy and advancing technologies across the region to be carbon neutral.

Issue 3: Other topics

In addition to the recommendations outlined in the previous section, the mission considers that four further topics warrant additional consideration.

3.i. Sustainable Fisheries (including threatened species)

Approximately two thirds of the GBR is open to commercial and recreational fishing, with areas designated through the Great Barrier Reef Zoning Plan (2003). Net, trawl, line, pot and hand harvest have been identified as the most common fishing methods that impact the Reef and its biodiversity.[73] The commercial fishing industry supports more than 1,000 commercial fishing jobs[74] and generates approximately $104 million AUD for the Australian economy annually.[75] A further 90,000 recreational fishing vessels are registered for use in the GBR region (including charter fishing), and approximately 200,000 recreational fishers are thought to be active through the region.

Fisheries management is governed under several legislative frameworks, including the Great Barrier Reef Intergovernmental Agreement (2015), Queensland Fisheries Act (1994), and the EPBC Act (1999). Most recently, the ten-year Queensland Sustainable Fisheries Strategy (QSFS) was released in 2017, and is referred to in the Reef 2050 Plan as the key mechanism to advance effective management. This includes the establishment of harvest strategies with defined quotas for key fisheries. In addition, the Reef 2050 Plan (objectives 3.5 and 3.6) promotes the delivery of protected species and bycatch management strategies, and improved fisheries monitoring (including discard monitoring).

The QSFS has no doubt enabled considerable improvements in sustainable fisheries management since its launch. Fifteen fisheries are now managed through Individual Transferable Quotas, five through Individual Transferable Effort. Commercial fishing licenses now have standardised reporting requirements. However, progress in many areas of the policy remains slow, and challenges persist.

1) **Overfishing** — The QSFS aims to establish harvest strategies (HS) for each key fishery to build and maintain fished stock biomass to achieve maximum sustainable yield (MSY) (around 40% - 50% biomass) by 2020 and maximum economic yield (MEY) (around 60% biomass) by 2027. At this time (2022) however the implementation of many of these harvest strategies are behind schedule, and several species' stocks remain overfished.[76]

[73] Miller, S. (2022). World Heritage Briefing Great Barrier Reef. Fisheries: Threats & Solutions. A report for the Australian Marine Conservation Society and WWF-Australia.
[74] BDO Econsearch (2020). Summary Economic and Social Indicators for Queensland's Commercial Fisheries, 2017/18 and 2018/19
[75] Deloitte Access Economics 2017, At What Price? The Economic, Social and Icon Value of the Great Barrier Reef, Deloitte Access Economics, Brisbane.
[76] For example, while a Snapper and Pearl Perch HS is in development, stock assessments suggest current fished stock biomass is at 25-30% and ~20% respectively (with modelling suggesting 10-15 years of fishery closure would be required to achieve MEY of 60%). Spawning aggregations of Spanish mackerel have declined significantly, with a (disputed) current level of 17% biomass in the fishery. In the East Coast Trawl Fishery, Scallops biomass declined to just 12% by 2020; and while some regions were then closed in response (in 2021), the closure is only planned until biomass reaches 30% (still below the MEY of the QSFS). Source: Tanzer, J. (2022). Implementing the Queensland Sustainable Fisheries Strategy 2017 – 2027: A Review of Progress. A report for the Australian Marine Conservation Society.

2) **By-catch** — This includes discards and incidental catch of protected species.
   - The mission learned that information on the composition, quantity and survival rate of discarded species[77] is lacking, but according to the Outlook Report 2019 and GBRMPA Position Statement on fishing, in fisheries such as trawl, discards may be greater that the level of retained catch (averaging an estimated 25,000 tonnes / year)[78].
   - Incidental catch of threatened species is a major fishery concern, and can include dugongs, turtles, dolphins and protected shark species amongst others. Even low levels of mortality in these populations can significantly affect their viability; with these species particularly at risk from gill-net and trawl activities. Protected Species Management Strategies exist in several areas of the property, including a recently released Queensland strategy for the gill-net fishery. However, bycatch data relies on fishers self-reporting (with implications of penalties deterring information-sharing amongst fishers and to authorities). Industrial gill-net licences (N4) (that allow for nets of up to 1,200m) are considered to pose one of the greatest threats to protected species; and in recent years the World Wildlife Fund Australia have been purchasing and retiring these industrial licences in an effort to secure areas of high conservation priority as net-free.

   At present there is no method for independently validating data on discards and bycatch as it is returned to the ocean while vessels are at sea.[79] According to an independent observer-based assessment conducted by the Australian Marine Conservation Society (2006-12) data on dugongs and dolphin bycatch is approximately 10-fold under-reported, while data on turtle bycatch is more than 100-fold under-reported.[80] Protected species management is supported by a GBRMPA policy on managing activities that include the direct take of a protected species from the GBR marine park (2005). These species include: (a) those that occur in the GBR property that are listed under EPBC Act (1999); (b) those that are prescribed as endangered or vulnerable under the Nature Conservation Act 1992 of Queensland; and (c) those species mentioned in section 30 of the Great Barrier Reef Marine Park Regulations 2019.

3) **Damage to habitats** — Fishery activities continue to impact habitat health. Trawling in particular is an indiscriminate form of fishing that removes or damages entire areas of seabed habitat, while other forms of fishery (gillnets, line fishing) can directly damage live coral colonies and contribute to increased coral disease. Coral harvesting for the global aquarium trade involves the direct removal of habitat, and has increased 600-fold from 2006/07 to 2019/20[81] with 59 commercial harvest licences authorised for Queensland by 2019 (Outlook Report, 2019). The GBRMPA Position Statement on fishing recognizes that risks to the biodiversity of the property have been reduced by zoning and improved

[77] Discards are species caught that may not meet regulations or have no commercial or recreational value and are returned to the sea, often injured through the process.
[78] Keneally, S.J. (2020). Australia's first national bycatch report. FRDC Final Report Project Number 2018/114.
[79] E-monitoring via vessel-based cameras is already compulsory for most commercial fishing boats in the Eastern and Western Tuna and Billfish Fishery; the Gillnet, Hook and Trap fishery (southern Australia) and the Midwater Trawl Sector of the Small Pelagic Fishery (Southern Australia). It provides a more cost-effective mechanism for independent monitoring compared to human scientific observers, and the mission considers that full coverage is achievable within the property.
[80] (Miller, 2022)
[81] (Miller, 2022)

harvesting techniques, but notes that further research is required to understand the impacts on some habitats.

Box 6: Scalloped Hammerhead Shark in GBR

Until 2018, reporting of shark discards were not required in Queensland fisheries. This led to the realization that at least 2,491 endangered hammerhead sharks had been dumped overboard by commercial fishers in the east coast gillnet fishery that year. Of these, nearly 2,000 were the critically endangered Scalloped Hammerhead (*Sphyrna lewini*) (with a total of 3,359 of this species caught overall).

This discard data is on top of the 480t of shark permitted to be fished in the east coast fishery (2019 data, equating to approximately 120,000 individual sharks)[82]. A 2019 study revealed that Queensland fisheries are responsible for a decline of up to a 92% in large sharks off Queensland's coast, with an estimated 84% decline in scalloped hammerhead shark populations in the last 50 years.

In the last two years the East Coast Inshore Fishery lost its Wildlife Trade Accreditation, and with it, its ability to legally export, and 'Fins Naturally Attached' became a requirement for the whole of Queensland including the GBR property. This is expected to have reduced proactive harvesting, but is expected to have increased discards (as bycatches are less likely to be retained). The average sizes of scalloped hammerheads reported as caught has shown a decline, from 2.06m in 2001 to 1.38 m in 2019 (data from Queensland Shark Control Program).

While recognized on the IUCN Red List as critically endangered globally, the scalloped hammerhead is listed only as 'Conservation Dependent' in Australia, enabling bycatch to be sold as by-product. This designation is currently under review by the Threatened Species Scientific Committee (a body established under the EPBC Act 1999). It is the missions view that where species are recognized as globally critically endangered (such as the scalloped hammerhead shark) the protection designation of that species within the GBR World Heritage property should consider and reflect that globally recognized concern, and appropriate management measures should be implemented accordingly.

The mission learned that illegal fishing activities have reduced in recent years due to improved vessel tracking systems, and high-level compliance monitoring through the Joint Field Management Program and integrated compliance program.[83] Today, regulation infringements are more commonly related to issues of discards and bycatch.

HIGH PRIORITY RECOMMENDATIONS

Recommendation P9: **Accelerate the implementation of the Queensland Sustainable Fisheries Strategy**, including the finalization of harvest strategies for all key species as a priority, and ensure management mechanisms outlined in the Strategy (including temporary closures of some fisheries areas to enable recovery and promote restocking, particularly in areas of spawning aggregations) are implemented in collaboration with the fisheries industry to achieve the target maximum economic yield (60% biomass) by 2027.

[82] Readfearn, G. and B. Vozzo (2019). Endangered hammerhead sharks being dumped by their thousands, new data reveals. Australia Marine Conservation Society and Human Society International. April 11,2019 ; Roff, G., Brown, C.J., Priest, M.A. et al. Decline of coastal apex shark populations over the past half century. Journal of Comm Biol 1, 223 (2018).

[83] The integrated compliance program involves wide-ranging agencies and stakeholders, including: Queensland Parks and Wildlife Service, GBRMPA, Indigenous Ranger Groups, Queensland Boating and Fisheries Patrol, Queensland Police Service, the Australian Maritime Safety Authority, Maritime Border Command, Maritime Safety Queensland, the Australian Federal Police, and the Commonwealth Director of Public Prosecutions.

Recommendation P10: Phase out destructive gill net fishing in the property through appropriate mechanisms, including purchasing, and/or retiring all remaining industrial (N4) gill-net licences; retiring of other gill-net fisheries (N2) and the establishment of net-free sub-zones in areas of high conservation value for protected species.

OTHER RECOMMENDATIONS

Recommendation O7: Develop and implement appropriate mandatory independent mechanisms for discard and bycatch monitoring, such as e-monitoring via vessel-based cameras, on all gill-net and trawl vessels within the property.

Recommendation O8: Advance research into effective bycatch reduction devices (BRDs) and accelerate the adoption and proactive installation of devices across relevant fisheries, including the production of associated regulatory requirements to ensure the adoption is legislated.

Recommendation O9: Finalize and implement protected species management strategies for all formally recognized protected species (or suites of protected species in particular biomes), which should include appropriate regulations to effectively prohibit catch or harvest of these protected species.

Recommendation O10: Undertake a comprehensive review of current coral harvesting practices (given the escalation of this activity in recent years) to appropriately assess the extent and sustainability of this fishery in order to identify and implement appropriate fishery management measures and restrictions, where required.

3.ii. Effective empowerment and engagement of Traditional Owners

Traditional Owners (TOs) have a vital role in GBR management. In recent years, TO engagement has been enhanced through a range of initiatives, including the Indigenous Land and Sea Country Partnerships Program, and enterprises supported by the Reef Trust Partnership. Across the GBR catchments, 72 TO groups are now involved in activities that further the achievements of the Reef 2050 Plan (with an Indigenous Reef Advisory Group – IRAC - actively involved in Reef 2050 review processes). GBR zoning recognizes title rights, with legislative support for TO recognition continuing to be strengthened. Ten Traditional Use Marine Resource Agreements (TUMRAs) are now in place (providing coverage across ~45% of the GBR geographic area), which the mission recognizes is a considerable achievement.[84]

Nonetheless, the mission observed that engagement varies considerably across the GBR and many TOs remain under-represented and marginalized. TOs expressed concern to the mission about the levels of practical engagement and recognition, often sensing that assumptions are made about what TOs would be interested in, inhibiting more holistic involvement. There remains a lack of access to opportunities, a lack of sector-specific engagement (in areas such as biosecurity), and support provisions across TO groups is not always equitable (with some groups still lacking the necessary materials and equipment to undertake activities). Work exists – and advances have been made – with regard to the recognition and reflection of traditional knowledge within GBR management mechanisms, but is limited, and TOs feel their stories are not yet sufficiently embedded. TOs also expressed their concern to the mission regarding the rates of degradation across the GBR, with a great concern expressed for sea level rise and climate change impacts.

[84] TUMRAs are community-based plans for the management of traditional resources which are accredited in legislation and support joint management of the Reef.

During the mission TOs expressed on several occasions the desire for improved co-planning and co-management, to advance self-sufficiency and sustainable environmental management for culture and health. In 2021, a TO Working Group began work on a 'Traditional Owner Implementation Plan' (TOIP) that links directly with the Reef 2050 goals and targets. This provides a framework for 'Strong People, Strong Country' and incorporates findings from an earlier (2018) initiative on 'TO aspirations'. The TOIP has been provided to the Australian and Queensland government agencies by the Traditional Owner Working Group. While not yet publicly available, a draft was shared with the mission experts. The plan outlines detailed, action-oriented and proactive objectives and activities under six key sectors.[85] The TOIP also re-galvanizes the aim to have a 'Sea Country Alliance' to oversee coordination, delivery and reporting of the TOIP. This would support a 'systems change' to advance further engagement of TOs across the region, with the initiative 'led by TOs, for TOs'.

Recommendation O11: Ensure that all relevant stakeholders review the Traditional Owner Implementation Plan and provide input to enable its finalization, adoption and roll out in the coming months and years in order to improve engagement and representation of TOs in co-planning and co-management that is vital for the future of the property and the region.

3.iii. The Reef 2050 Plan

The mission found that the Reef 2050 Plan has proven essential in bringing together most of the key elements required for effective GBR management under one umbrella framework. It has provided the framework for disparate initiatives to come together towards common goals, and is the 'glue' for inter-stakeholder and inter-institutional collaboration and cross-learning learning – an essential quality for a site as vast and complex as the GBR.

However, to reach the potential promised by the Reef 2050 Plan, some further work on cohesion is required. The current plan (2021) has a separate associated objectives and goals document that reflects elements that are only briefly listed in the master document and appear disconnected strategically. The plan also lacks a clear line of sight between anticipated investments and achievements in terms of reef health. The strategic actions are largely broad and without specified timelines, targets and indicators, oftentimes reflecting instead on associated strategic plans and programs. Some of these plans (like the WQIP) do have clear targets, indicators and timelines for actions, along with clear roles and responsibilities of stakeholders. Others do not. And while the RIMReP is providing an exceptional platform for tracking and monitoring impacts of activities, it is limited to only those aspects where clear, trackable objectives are available against prescribed activities. This means that portions of the Plan are without any clear or actionable monitoring, evaluation and learning framework.

The Plan has also received criticism for lacking ambition, with strategic actions not reflecting the urgency required for proactive advancement. The mission heard concern expressed by some stakeholders concerning transparency, and the need for a clear communications strategy that enables greater cross-sector awareness, understanding and accountability.

Recommendation O12: Provide clarity on overarching targets (and associated indicators) related to each goal of the Reef 2050 Plan, and ensure transparent mechanisms are established to monitor progress towards the targets, alongside an improved communications strategy for informing and engaging the relevant stakeholders, organizations, agencies and institutions through the upcoming revision of the Reef 2050 Plan.

[85] The six key sectors are: (i) land, (ii) sea, (iii) partnerships and capacity, (iv) knowledge, (v) investment, and (vi) education, employment and economic enterprises.

3.iv. GBR Financing

The corrective measures presented in this report will require considerable financing and investment. The $1 billion AUD package to support GBR activities announced in 2022 is commendable and will provide much needed financial support. (*Annex 10* outlines the planned expenditure areas for these funds).

Nonetheless it is important to put these funds in context.

The National Climate Resilience and Adaptation Strategy (2021-2025) recognizes that climate impacts are imposing economic costs to Australia that are projected to increase with global warming. Research shared with the mission from Deloitte Access Economics found that climate-induced extreme weather events have already cost Australia around AU$120 billion in the last 50 years, with this expected to increase to AU$150 billion over the next decade (to 2032).[86] This year alone (2022) the Australian National Recovery and Resilience Agency have (so far) paid out more than AU$1.6 billion in flood disaster payments (in Queensland and NSW).

Context is also important when considering priorities of investment areas. For example, the AU$5.4 billion committed to construction of the Hells Gate dam is anticipated to generate up to AU$6 billion in GRP annually, and create more than 3,000 jobs once operational. Conversely, government figures show the GBR contributes around AU$6.4 billion per year to the economy, and supports around 64,000 jobs.[87]

Therefore the mission feels that the level of financial support to effective GBR management should be commensurate with the nation's financial capabilities and prioritized as the GBR is a vital asset of the nation.

Finally, the mission recognizes that with the upcoming Brisbane Olympics scheduled in 2032, an opportunity exists to conjoin financing opportunities to showcase Australia as exemplary in issues of sustainability, and promote the GBR as a world class, globally significant site of natural heritage.

[86] This research calculates that investing appropriately in comprehensive advances in climate mitigation and adaption will save Australia around 380 billion in GDP over the next 30 years, as well as deliver around 73,000 additional jobs in the economy (in sectors such as construction, transport, and manufacturing).
[87] Data from the Reef 2050 Plan.

V. CONCLUSIONS AND RECOMMENDATIONS

The mission endeavoured to thoroughly assess all key aspects of GBR management. As the report has shown, management measures have improved and escalated notably in recent years, however the OUV of the property remains at risk, primarily due to issues of climate change and water quality.

Through the mission all elements of the **terms of reference** were executed as follows.

I. Review the status of the Reef 2050 Plan's review and update, which was made available in December 2021, and assess the revised contents in light of the conclusions of the 2019 Great Barrier Reef Outlook Report, including accelerating action at all possible levels to address the threat from climate change and other factors affecting the Outstanding Universal Value (OUV) and integrity of the property.

Each key issue was assessed through the lens of the Reef 2050 Plan (latest version), with reflections on the results of the Outlook Report 2019. Efforts underway to accelerate action at a range of levels to address the threat from climate change and other factors affecting the OUV were thoroughly reviewed. The mission found that while the latest iteration of the Plan is responsive to several key findings of the Outlook Report (particularly around issues of water quality and the related production of the WQIP), key considerations are still absent from the Plan and more clarity is required in some areas (as outlined in the recommendations).

II. Assessing the State Party's progress towards addressing the impact of climate change on the OUV of the property, and how the revised Reef 2050 Plan addresses the threat posed to the property by climate change and determines a pathway for accelerated actions in other areas affecting the conservation of the property.

State Party's progress towards addressing the impact of climate change on the OUV of the property was fully assessed. The mission found that the revised Reef 2050 Plan, while recognizing the need for accelerated action on climate change (and referencing numerous associated strategies being implemented cross-sectorally by partner agencies), remains without a clear pathway for specified actions in this area, while other areas have more detailed plans and targets through sub-plans that are nested directly within the Reef 2050 framework (such as the WQIP).

III. Assessing the State Party's progress towards meeting key targets of the Reef 2050 Plan, in particular but not limited to the water quality and land management targets.

The section on Issue 1 provides detailed information on the progress towards meeting key targets of the Reef 2050 Plan with regards to water quality and land management. The mission recognizes target attainment remains slow and requires considerable escalation; while also recognizing that target achievements do not transpire in a linear fashion over time, but as a result of accumulated action. Climate change mitigation is without specific, measurable Reef 2050 Plan targets beyond those nationally recognized (or implemented by state). Progress towards the nation's NDCs is on track, but as outlined under Issue 2, the mission noted concerns amongst key stakeholders that the associated plans and strategies referred to in the Plan, do not provide any clear pathway to avoid significant negative impacts to the OUV of the property. Climate change adaptation targets are progressing, but will require considerable investment to reach the scale required for meaningful preservation of the property's OUV. Issues around sustainable fisheries (including threatened species) were also addressed, in particular around concerns of destructive fishing gear, lack of bycatch- and discard-monitoring and protection of endangered species. Traditional Owner empowerment and engagement was also briefly assessed and the mission supports the recently developed TO Implementation Plan. Considerations for

improvements and consolidation of the Reef 2050 Plan were also presented, as were considerations around GBR financing.

IV. In line with paragraph 173 of the Operational Guidelines for the Implementation of the World Heritage Convention, assessing any other relevant issues that may negatively affect the OUV of the property, including its conditions of integrity and protection and management.

All key concerns around the priority issues are addressed, and their impact on OUV outlined. Conditions of integrity and protection and management are reviewed in each issue section.

Criteria for inscription on the List of World Heritage in Danger

Under the *Operational Guidelines for the Implementation of the World Heritage Convention*, the 'criteria for the inscription of natural properties on the List of World Heritage in Danger' are referred to in paragraph 180, detailing that a World Heritage property can be inscribed on the List of World Heritage in Danger by the Committee when it finds that the condition of the property corresponds to at least one of the criteria related to ascertained (A) or potential (P) danger.

The table below examines the status of the GBR through this lens.

CRITERIA	GBR STATUS (in brief)
A i) A serious decline in the population of the endangered species or the other species of Outstanding Universal Value for which the property was legally established to protect, either by natural factors such as disease or by human-made factors such as poaching.	While some areas of the GBR have indeed faced 'serious decline' in coral cover, the scale and heterogeneity of the region makes an overarching assessment of this status challenging. Endangered species have faced decline for some species (e.g. dugong, turtles, some species of sharks etc.), while for others the status is unknown. Declines have been caused by human-made factors (fishing activities, climate change and water quality).
A ii) Severe deterioration of the natural beauty or scientific value of the property, as by human settlement, construction of reservoirs which flood important parts of the property, industrial and agricultural development including use of pesticides and fertilizers, major public works, mining, pollution, logging, firewood collection, etc.	Deterioration of the property has been evident from agricultural development, pollution and major public works. However, efforts in recent years are starting to address these concerns, though a far greater escalation of activities is required to achieve the changes required to protect the property's OUV.
A iii) Human encroachment on boundaries or in upstream areas which threaten the integrity of the property.	Some level of human encroachment has occurred in port areas. Human activities in the catchments of the GBR continue to have deleterious effects on the property.
P i) a modification of the legal protective status of the area;	No legal modification. However, the protective status of the area remains threatened by illegal activities, particularly related to fisheries bycatch and discards. Agricultural standards under DES regulations are also not yet being achieved, impacting the areas' OUV.
P ii) planned resettlement or development projects within the property or so situated that the impacts threaten the property;	Development remains a challenge throughout the region. However, considering the scale of the GBR urban development remains proportionally relatively low across the catchments; while agricultural and grazier development poses greater scale-based risk to the regions' OUV.
P iii) outbreak or threat of armed conflict;	n/a

CRITERIA	GBR STATUS (in brief)
P iv) the management plan or management system is lacking or inadequate, or not fully implemented.	The mission considers this factor to be particularly relevant for the GBR. While significant progress has been made over the past decade and extensive and impressive management frameworks, strategies and plans put in place, these remain: a) Lacking in relation to clear climate change measures that are urgently needed to protect the OUV of the property (see *Note 1*). b) Not fully implemented, particularly in relation to water quality and fisheries activities (see *Note 2*).
P v) threatening impacts of climatic, geological or other environmental factors.	The mission considers this too as a particularly relevant criteria of concern for the GBR. Climate factors (human-induced) are having a considerable impact on the OUV of the property; with models suggesting that with increasing temperatures the more extreme weather conditions anticipated (floods, cyclones etc.) will also escalate damages to the property and loss of its OUV.

Note 1: The current World Heritage Climate Change Policy (2007) (Page 6-7, in reference to Article 4)[88] notes that "*In the context of climate change, this provision will be the basis for States to ensure that they are doing all that they can to address the causes and impacts of climate change, in relation to the potential and identified effects of climate change (and other threats) on World Heritage properties situated on their territories*."[89]

It also references Article 5 of the World heritage Convention "*To ensure that effective and active measures are taken for the protection, conservation and presentation of the cultural and natural heritage situated on its territory, each State Party to this Convention shall endeavour, in so far as possible, and as appropriate for each country (…) To take the appropriate legal, scientific, technical, administrative and financial measures necessary for the identification, protection, conservation, presentation and rehabilitation of this heritage.*

While the property has undoubtedly witnessed accelerated efforts towards climate change mitigation and adaptation, particularly at the state and GBR-related institutional levels, the mission finds that further and reinforced efforts are needed in order for the State Party to fully adhere to the spirit of the provisions of the Convention and the Policy cited above.

During the mission, the State Party's emission reduction targets, and the lack of a clear pathway or legislated commitment to the 1.5°C target, was raised in discussion on several occasions.

Note 2: The GBR inshore region continues to face multitudinous threats from land-based activities impacting water quality. While considerable work is underway to address these threats, progress is slow, in large part due to the sheer scale of the challenge. And while significant efforts have been made to reduce run-off from farms and land-based restoration to reduce sedimentation, plans to accelerate the development of two new (large-scale) dams in the region threatens to counteract this progress. Addressing the impacts of large-scale dam construction and related expansion of agricultural activity is currently not incorporated into the Reef 2050 Plan; and as industrial and agricultural expansion plans progress, the deleterious consequences will place further pressure on the marine ecosystem.

[88] Article 4: Each State Party to this Convention recognizes that the duty of ensuring the identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage referred to in Articles 1 and 2 and situated on its territory, belongs primarily to that State.

[89] The mission notes that a revised policy on World Heritage and Climate Change has been developed and is awaiting adoption by the General Assembly of States Parties to the World Heritage Convention in 2023.

The *Operational Guidelines* go on to make it clear that such threats need to be '***amenable to correction by human action***' (paragraph 181). The ongoing threats facing the GBR, while extraordinarily challenging, are indeed amenable to correction by human action, through the implementation of the recommendations outlined in this report as well as wider actions at the commonwealth and state level.

It is fully recognized that the issue of climate change impacts, while amenable to correction by human action, is not an issue that can corrected by the action of the State Party *alone*, as it is a global issue and requires all nations to accelerate their climate change mitigation and achieve the Paris Agreement targets as soon as possible. It is also fully recognized and acknowledged that issues related to a nation's independent commitments are beyond the remit of the World Heritage Convention, though the impact of a state's decisions with regards to a World Heritage property still pertain and are appropriate to be '*judged according to the intensity of its effects and analyzed case by case*' (paragraph 182).

With this in mind, it is the conclusion of the mission that the property meets the criteria for inscription on the List of World Heritage in Danger, in recognition that the key relevant threats relate to the considerable impact of water quality and climate factors on the OUV of the property, and the management frameworks, strategies and plans put in place that are (a) **Lacking** in relation to clear climate change measures that are urgently needed to protect the OUV of the property, and (b) **Not fully implemented**, particularly in relation to water quality and fisheries activities.

Therefore, **the mission recommends that the Great Barrier Reef be inscribed on the List of World Heritage in Danger**.

The mission wishes to take particular note of the significant potential impact that a rapid escalation of the corrective measures below may have on fulfilling the State Party's obligations to advance the conservation of the property and its OUV.

Desired State of Conservation for the Removal of the property from the List of World Heritage in Danger (DSOCR)

The mission provides the following provisional Corrective Measures in relation to the recommendations outlined in this document for consideration for the Desired State of Conservation for the Removal of the property from the List of World Heritage in Danger (DSOCR).

The mission takes note of the State Party's and property's extraordinary access to state-of-the-art managerial and scientific expertise, institutional and political support, and potential access to significant financial resources. It is the view of the mission that, if fully utilized, these make the implementation of the Corrective Measures below and a resulting removal of the property from the List of World Heritage in Danger both achievable and realistic.

Provisional Corrective Measures	Link to Rec #
Priority areas for gully repairs and associated restoration and remediation activities are identified across the four high and very high-risk catchments responsible for the majority of sediment load impacting the GBR (namely: Herbert River, Burdekin River, Fitzroy River and Mary River).	P1
Gully and associated land-based restoration and remediation activities in the four high and very high-risk catchments are significantly scaled up through extensive mobilization of the necessary engineers and associated personnel, equipment and materials, alongside key engagement with relevant farmers and graziers, to show accelerated action towards achieving existing WQIP targets (quantifiable through the existence of remediation plans and commitment of financing).	P1
Policies and associated legislation are in place to require proposed and in-progress dam developments to show clear alignment with water quality improvement for the GBR as a condition for approval. These requirements should include mandatory compliance with the 2018 Reef 2050 Net Benefit Policy, industrial guidelines associated with the reef protection regulations, and climate-ready design considerations to be assessed by appropriate environmental impact assessment, which also includes consideration of indirect impacts such as associated agricultural expansion.	P2
The scale and pace of adoption, monitoring and enforcement of best management practice (BMP) in sugarcane and banana farming is increased significantly to achieve WQIP targets; quantifiable through statistically 'significant' increases (compared to 2017 data) in: (i) BMP accreditation amongst farmers, (ii) the coverage in hectares of land purchased or bought-back for restoration, and (iii) the coverage, in hectares, of accomplished (or in progress) land restoration and return to wetland or riparian ecosystems.	P3
Native vegetation clauses are strengthened through improved identification and enforcement of permissible activities in areas of high conservation value forests and woodlands, including a review of sites where clearing is currently allowed without permits (Category X under the Vegetation Management Act 1999) and updated zonation and corresponding permits which limit conversion of HCV areas. This work should also incorporate full consideration of traditional owner land management principles.	P4
The updated Reef 2050 WQIP water quality targets are sufficient and the WQIP is implemented to ensure the OUV of the property is not further adversely impacted by low water quality, including by accounting for hitherto overlooked sources of poor water quality, such as dams, emerging crop industries and marine debris, with associated legislative compliance strengthened.	P5
The Reef 2050 Plan is strengthened to include clear government commitments to reduce greenhouse emissions consistent with the efforts required to limit the global average temperature increase to 1.5°C above pre-industrial levels; including: • comprehensive assessment on the impact of climate change on the property, and the impact of the implementation of national climate change and emissions reduction strategies, through the best available science and information; • development and implementation of ambitious emissions reductions activities consistent with limiting the global average temperature increase to 1.5°C above pre-industrial levels, taking into account the above assessments and the additional 'climate related activities' concerning emissions reductions as recommended by the IEP, in its letter to the State Party in March 2022; and • establishment of a formal mechanism for the IEP and Reef Advisory Committees to advise the State Party on the required carbon emissions reductions to attain the goals set out in the Reef 2050 Plan.	P6

Provisional Corrective Measures	Link to Rec #
An assessment of carbon and water quality related credit schemes being deployed in the GBR catchments show that these schemes are delivering overall net benefits to the OUV of the property and are monitored and regulated by the relevant agencies through fully transparent, science-driven and evidence-based management to that end.	P7
Scientific research is supported and financial resources are increased (from 2021 levels) to enable the deployment of climate adaptation mechanisms at the required scale to be effective in mitigating and adapting to climate change impacts across the property, including the AIMS initiatives (SeaSim and associated research activities), as well as wider restoration initiatives that directly support the rehabilitation of habitat and concurrent carbon sequestration.	P8
Implementation of the Queensland Sustainable Fisheries Strategy is accelerated, measurable through: • harvest strategies finalized for all key species; and • management mechanisms outlined in the Strategy (including temporary closures of some fisheries areas to enable recovery and promote restocking, particularly in areas of spawning aggregations) are implemented in collaboration with the fisheries industry to achieve the target maximum economic yield (60% biomass) by 2027.	P9
Gill net fishing is phased out across the property through appropriate mechanisms, including purchasing, and/or retiring all remaining industrial (N4) gill-net licences; retiring of other gill-net fisheries (N2) and the establishment of net-free sub-zones in areas of high conservation value for protected species.	P10

The mission recognizes the excellent and outstanding work of numerous stakeholders actively endeavouring to effectively manage and conserve the GBR. These include:

- the farmers and graziers who are advancing BMP at their sites and showcase the solutions to many of the land-based challenges that can now be built upon and advanced across the catchments;
- the tourism operators who have taken on rehabilitation and educational awareness raising to advance restoration at the site and showcase exemplar practices to wider communities;
- the Traditional Owners and associated groups who have galvanized awareness and commitments to integrate traditional management practices on their sea country;
- the numerous local, state and national organizations and NRM agencies providing the much-needed technical support throughout the region; and
- the numerous state and national government agencies and individuals working tirelessly to accelerate and implement existing plans.

These stakeholders are to be commended at the highest level.

The mission is aware of the sensitivities and concerns amongst stakeholders of the GBR regarding an inscription on the List of World Heritage in Danger. These were particularly high amongst key sectors, such as the tourism industry, who expressed concern that an inscription on the List of World Heritage in Danger would impact their businesses, as they felt that it would send a message to the world that the GBR is “dying” and no longer worth visiting. The mission sympathizes with these concerns. However, whether the property is on the List of World Heritage in Danger or not, media interest in the decline of GBR health will continue and will be widespread, particularly as bleaching events escalate in frequency (and potentially severity). By inscribing the property on the List of World Heritage in Danger, it enables recognition of these threats and

provides a platform for the State Party to showcase their solutions, best practice reforms and responsiveness, potentially positioning Australia as a world leader in conserving globally significant natural heritage.

Finally, the mission witnessed exceptional level of pride and commitment towards the GBR amongst wide sectors of society. It is hoped that the energy and commitment to GBR protection that was exemplified during the mission can be utilized effectively to accelerate the protection and effective management of this important national and global asset.

VI. ANNEXES

ANNEX 1: Mission TOR

TERMS OF REFERENCE

Joint World Heritage Centre / IUCN Reactive Monitoring mission Great Barrier Reef (Australia)

At its extended 44th session, the World Heritage Committee requested the State Party of Australia to invite a joint World Heritage Centre/IUCN Reactive Monitoring mission to the World Heritage property "**Great Barrier Reef**" (Decision **44 COM 7B.90**). The main objective of the Reactive Monitoring mission is to assess the updated Reef 2050 Long-term Sustainability Plan (Reef 2050 Plan) to ensure that it addresses the threats posed to the property by climate change and determines a pathway for accelerated actions in other areas affecting the conservation of the property.

The mission will therefore carry out the following tasks:

1. Review the status of the Reef 2050 Plan's review and update, which was made available in December 2021, and assess the revised contents in light of the conclusions of the 2019 Great Barrier Reef Outlook Report, including accelerating action at all possible levels to address the threat from climate change and other factors affecting the Outstanding Universal Value (OUV) and integrity of the property;
2. Assess the State Party's progress towards addressing the impact of climate change on the OUV of the property, and how the revised Reef 2050 Plan addresses the threat posed to the property by climate change and determines a pathway for accelerated actions in other areas affecting the conservation of the property;
3. Assess the State Party's progress towards meeting key targets of the Reef 2050 Plan, in particular but not limited to the water quality and land management targets;
4. In line with paragraph 173 of the Operational Guidelines for the Implementation of the World Heritage Convention, assess any other relevant issues that may negatively affect the OUV of the property, including its conditions of integrity and protection and management.

Based on the above, the mission will make a recommendation as to whether the property meets the criteria for inscription on the List of World Heritage in Danger, in line with paragraph 180 of the Operational Guidelines.

To enable the mission's preparation, the State Party should, as soon as possible and preferably no later than one month prior to the mission, provide the World Heritage Centre and IUCN with necessary background information and technical materials on the property, including the following documents:

a. Information on: a) National legislation, b) Institutional framework, and c) Management Plan/System in force;
b. Updated information on the current status of the revision of the Reef 2050 Plan, including the most recent version of the updated Reef 2050 Plan;
c. A comprehensive update on the state of conservation of the property, including relevant publications since the State Party's February 2021 report;
d. Fully updated information – with maps if relevant – regarding the implementation of changes in land use practices within the river catchments that discharge into the property, in order to increase the protection of OUV. This includes details regarding positive and negative changes since 2015 and the measures currently in place or planned, with particular reference to:
    a. The use of fertilizers and pesticides,
    b. Land clearance, including clearance adjacent to watercourses,
    c. Other land uses considered to result in significant positive or negative impacts on the property's OUV;

e. Fully updated information in case of new/ongoing coral bleaching events, if any.

Additional information may be requested during the mission, as required.

The State Party should facilitate necessary site visits to key locations illustrating the impacts of recent coral bleaching events. The mission should hold consultations with the relevant national, State and local authorities of Australia as well as other relevant stakeholders, including local communities and Traditional Owners; non-governmental organisations (NGOs) and civil society; and relevant leading scientists and experts. The State Party should facilitate and organize site visits and meetings with the abovementioned stakeholders and submit a draft agenda for the mission no later than one month prior to the mission, as well as a final agenda, taking into account any comments made by the World Heritage Centre and IUCN, well ahead of the mission.

Based on the results of the abovementioned reviews and assessments and on discussions with State Party representatives, authorities and stakeholders, the mission team will prepare a concise report on its findings and recommendations following the on- site mission (see the Mission Report Format in Annex II). This report will be shared with the State Party for comments, and subsequently shared with the World Heritage Committee; it will also be made publicly available on the World Heritage Centre's website. The mission's recommendations to the World Heritage Committee will provide guidance to the State Party as it continues to ensure the ongoing conservation of the property's OUV. It should be noted that recommendations will only be provided in the Mission Report and not during the mission.

Committee Decision

Great Barrier Reef (Australia) (N 154) Decision: 44 COM 7B.90

The World Heritage Committee,

1. Having examined Document WHC/21/44.COM/7B.Add,
2. Recalling Decisions **39 COM 7B.7** and **41 COM 7B.24**, adopted at its 39th (Bonn, 2015) and 41st (Krakow, 2017) sessions, respectively,
3. Commends the State Party for the strong and continued efforts to create conditions for the implementation of the Reef 2050 Long-term Sustainability Plan (Reef 2050 Plan), including through unprecedented financial commitments;
4. Notes with the utmost concern and regret the conclusions of the 2019 Great Barrier Reef Outlook Report (2019 GBR Outlook Report) that the long-term outlook for the ecosystem of the property has further deteriorated from poor to very poor, that the deterioration of the ecological processes underpinning the Outstanding Universal Value (OUV) of the property has been more rapid and widespread than was previously evident, and that the property has suffered significantly from mass coral bleaching events in 2016, 2017 and 2020;
5. Also notes with the utmost concern that despite many positive achievements, progress has been largely insufficient in meeting key targets of the Reef 2050 Plan, in particular the water quality and land management targets, as evidenced by the conclusions of the 2017-2018 and 2019 Reef Quality Report Cards;
6. Noting the conclusion of the 2019 GBR Outlook Report that climate change remains the most serious threat to the property, and recognizing that action by the international community and all States Parties to the Convention is urgently required to address threats from climate change, considers that actions to build resilience of the property and address other factors remain of utmost importance;
7. Urges the State Party to ensure that the revised Reef 2050 Plan, expected to be finalized in 2021, fully incorporates the conclusions of the 2019 GBR Outlook Report that accelerated action at all possible levels is required to address the threat from climate change, in accordance with the Paris Agreement on Climate Change (2015), and to urgently create opportunities for recovery of the property, in particular with regard to water quality;

8. Requests the State Party to invite a joint World Heritage Centre/IUCN Reactive Monitoring mission centred around ensuring that the revised Reef 2050 Plan addresses the threat posed to the property by climate change and determines a pathway for accelerated actions in other areas affecting the conservation of the property;

9. Also recalling Decision **41 COM 7** in which the Committee 'reiterate[d] the importance of States Parties undertaking the most ambitious implementation of the Paris Agreement of the United Nations Framework Convention on Climate Change (UNFCCC) by "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and by pursuing efforts to limit the global average temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change"', strongly invites all States Parties to undertake actions to address Climate Change under the Paris Agreement consistent with their common but differentiated responsibilities and respective capabilities, in the light of different national circumstances, that are fully consistent with their obligations within the World Heritage Convention to protect the OUV of all World Heritage properties;

10. Further requests the State Party to submit to the World Heritage Centre, by **1 February 2022**, an updated report on the state of conservation of the property and the implementation of the above, for examination by the World Heritage Committee at its 45th session.

ANNEX 2: Composition of the Mission Team

Eleanor Carter — IUCN Representative

As the Founder and Executive Director of Sustainable Solutions International Consulting (SSIC), Eleanor has more than 25 years of experience supporting marine and coastal management in Africa, South-East Asia and the Pacific islands. Her clients range from international NGOs and Government agencies to community groups. She is both an ecologist & social scientist, holding a distinction-level MPhil from the University of Cambridge, UK. In addition to her consulting work she is Co-Director of the multi award-winning Chumbe Island MPA in Zanzibar, and Expert Advisory Board Member of 'Blue Finance' social enterprise.

Hans Thulstrup — UNESCO Representative

Hans Dencker Thulstrup serves as Senior Programme Specialist for Water and Environmental Sciences with UNESCO's Regional Sciences Bureau for Asia and the Pacific in Jakarta, Indonesia. He has an academic background in international science networking and cooperation, holding a PhD in Scientific Communication. Hans has worked with UNESCO's Natural Sciences programmes – in particular UNESCO-designated sites such as Biosphere Reserves and natural World Heritage sites - since 1996. He has been posted in Indonesia, China, Samoa, Thailand as well as at UNESCO's Headquarters in Paris.

ANNEX 3: Itinerary, Programme & People Met

PERMANENT DELEGATION

Mr James Larsen Deputy Secretary, Department of Agriculture, Water and the Environment; Permanent Delegation of Australia to UNESCO

James Larsen is based in Istanbul, where he currently leads the DAWE staff in the Paris based Permanent Delegation of Australia to UNESCO. Prior to this role, James worked as Climate Coordinator for the Department of Prime Minister and Cabinet. Past roles include the Director of National Parks, and First Assistant Secretary of the National COVID Coordination Commission. James has had an extensive career as a diplomat, having worked as Chief Legal Officer for DFAT, Australian Ambassador to Turkey, Georgia and Azerbaijan, Ambassador for People Smuggling Issues and Australian Ambassador to Israel.

Dr Simon Banks First Assistant Secretary, Heritage Reef and Ocean Division, Department of Agriculture, Water and the Environment

As First Assistant Secretary, Simon is responsible for the Heritage, Reef and Ocean Division, which includes the Supervising Scientist Branch. Prior to joining the department, Simon was the General Manager, Reef Protection Branch with the Great Barrier Reef Marine Park Authority, responsible for the Reef Joint Field Management Program, policy and planning, environmental assessment and protection and oversight of the crown-of-thorns starfish control, program and Douglas Shoal Remediation program.

As an Assistant Secretary in the Environment portfolio Simon has led the Commonwealth Environmental Water Delivery and Environmental Assessment and Approvals (SA, Vic, WA) branches. Simon has held senior positions in the New Zealand Department of Conservation, and the NSW and Queensland governments. Simon holds Bachelor of Applied Science (coastal management), a Master of Applied Science from Southern Cross University and a Doctor of Philosophy (biological sciences and decision support) from The University of Queensland. He is a graduate of the Australian Institute of Company Directors.

Ms Elisa Nichols Executive Director, Office of the Great Barrier Reef

Executive Director of the Office of the Great Barrier Reef, within the Queensland Government's Department of Environment and Science. She has led environmental policy and legislative projects for Queensland Government at Executive Director and Director level for over a decade, specialising in regulatory reform and innovation. A qualified solicitor, Ms Nichols was previously a solicitor with the Environmental Defenders Office and holds a Master of Laws in Environment and Natural Resources Law.

Dr David Wachenfeld Chief Scientist, Great Barrier Reef Marine Park Authority

Working at the Authority since 1997, David has covered a diverse range of Marine Park management activities, including: adaptation to climate change, development of Marine Park zoning, improving sustainable fishing, development our COTS control program, and development of reef restoration techniques. He has dived on coral reefs all around the world, conducting research, taking photographs, teaching people and working to protect the environment. In 1993, he completed a PhD studying the behaviour and ecology of coral reef triggerfish in the Red Sea and Indian Ocean. Although his career has concentrated on coral reef management, he has also worked in reef tourism and science.

Ms Patricia (Patty) McMahon Director, International Support Unit

Patty has a background in protected area management, having worked for Parks Australia for 8 years. Patty has been working in the Reef space since 2015, having been part of the Reef 2050 Plan team and project manager for the Reef Trust Partnership. As Director of the International Support Unit, Patty leads a team supporting the Paris based Counsellor (Environment) role as well as communications planning for the Great Barrier Reef. Patty has a Bachelor (Hons) degree in Environmental Science, Graduate Diploma in Environmental Law and a Masters in Applied Anthropology and Participatory Development.

Mission experts and permanent delegation (pd) present throughout unless otherwise indicated

Day 0 – Sunday 20 March TRAVEL JAKARTA- BRISBANE			
Time	**Activity**	**Purpose**	**Attendees**
	Fly Jakarta/Denpasar to Brisbane.		
1900	Dinner with the Australian Government Minister for the Environment		The Hon Sussan Ley MP Simon Fontana (Chief of Staff) James Thomas (Advisor) James Larsen The Hon Penny Wensley (other pd members absent)

Day 1 – Monday 21 March BRISBANE (OFFICES) Reef 2050 Long-Term Sustainability Plan			
Time	**Activity**	**Purpose**	**Attendees**
0830 – 0900	**Welcome to Country** 1 William St	**Welcome** Welcome the mission delegation to country and to Australia	Shannon Ruska Brisbane Traditional Owner The Hon Sussan Ley MP, Australian Government Minister for the Environment Simon Fontana James Thomas The Hon Meaghan Scanlon MP, Queensland Government Minister for the Great Barrier Reef Nick Heath (Chief of Staff) Danielle Shankey (Advisor) Jamie Merrick, Director-General, Department of Environment and Science

Day 1 – Monday 21 March BRISBANE (OFFICES) Reef 2050 Long-Term Sustainability Plan			
Time	**Activity**	**Purpose**	**Attendees**
0900 – 0930	**Ministers' Welcome**	**Welcome** Ministers Ley and Scanlon welcome the delegation and outline the shared roles of the Commonwealth and State governments in the protection and conservation of the Reef.	The Hon Sussan Ley MP Simon Fontana James Thomas The Hon Meaghan Scanlon MP Nick Heath Danielle Shankey Jamie Merrick, Director-General, Department of Environment and Science
0930 – 1015	**Mission Purpose and Program Overview**	**Mission Program and TORs** Discuss our shared objectives for the mission and provide an overview of mission program-designed around the work of the Reef 2050 Plan. Purpose of reflection sessions at the end of each day.	Jamie Merrick, Director-General, Department of Environment and Science
1015 – 1045	Morning tea		
1045 – 1200	**Welcome to the Great Barrier Reef World Heritage Area**	**Legislative and Governance Frameworks** Demonstrate governance of the Reef from the establishment of the marine park to the inscription on the WH list, to engagement with UNESCO, comprehensive strategic assessment and the establishment of the Reef 2050 Plan.	Josh Thomas, Chief Executive Officer, GBRMPA Margaret Johnson, General Manager, Strategic Policy and Partnerships, GBRMPA Julia Chandler, Director Environmental Assessment and Protection, GBRMPA Neil Cambourn, Executive Director, Department of Environment and Science Mark Say, A/g Assistant Secretary, Environment Assessments Queensland and Sea Dumping Branch, DAWE
1200 – 1230	Lunch		

Day 1 – Monday 21 March BRISBANE (OFFICES) Reef 2050 Long-Term Sustainability Plan			
Time	**Activity**	**Purpose**	**Attendees**
1230 – 1430	**Reef 2050 Long-Term Sustainability Plan**	**Reef 2050 Plan** Overview of the comprehensive management plan for the Reef. Most recent updates on management, regulation, and policies protecting the Reef, monitoring and reporting, stakeholder engagement and contribution to management. Seek mission views on gaps / actions in our strategic planning framework. Demonstrate how existing and new investments support adaptation and resilience.	Paula Perrett, Assistant Secretary, Reef Branch, DAWE Margaret Johnson, GBRMPA Elisa Nichols, OGBR
1430 – 1500	Afternoon tea		
1500 – 1600	**GBR Outlook 2019** **Current State of the Reef**	**Science and Knowledge** Provide an overview of how we monitor Reef health, role of the Outlook Report and provide a Reef health update. LTMP foreshadowing.	Jessica Hoey, Director, Science for Management, GBRMPA David Wachenfeld Margaret Johnson, GBRMPA
1600 – 1700	**Reflections**		
	No formal dinner		

Day 2 – Tuesday 22 March BRISBANE OFFICES Stakeholder engagement and Australia's emissions policies			
Time	**Activity**	**Purpose**	**Attendees**
0800 – 0820	**Pre-Briefing with Reef 2050 Independent Expert Panel Chair**	**Science and Knowledge; Collaboration and Partnerships**	Professor Ian Chubb (pd members absent)

Day 2 – Tuesday 22 March BRISBANE OFFICES Stakeholder engagement and Australia's emissions policies			
Time	**Activity**	**Purpose**	**Attendees**
0820 – 0920	**Meeting with Reef 2050 Independent Expert Panel members**	**Science and Knowledge; Collaboration and Partnerships**	Professor Ian Chubb IEP Members: Dr Richard Brinkman, AIMS Professor Damian Burrows, TropWATER Dr Romy Greiner, River Consulting Professor Terry Hughes, James Cook University Professor Catherine Lovelock, University of Queensland Professor Helene Marsh Dr Russell Reichelt Dr Britta Schaffelke, AIMS Ms Jane Waterhouse
0920 – 0935	Break (15mins)		
0935 – 0955	**Pre-Briefing with Reef 2050 Advisory Council Chair**	**Science and Knowledge; Collaboration and Partnerships**	The Hon Penny Wensley
0955 – 1030	**Meeting with Reef 2050 Advisory Committee – Welcome and Plenary Session**	**Science and Knowledge; Collaboration and Partnerships**	The Hon Penny Wensley RAC member organisations in attendance
1030 – 1130	**Meeting with Reef 2050 Advisory Committee – Industry members session**	**Science and Knowledge; Collaboration and Partnerships**	The Hon Penny Wensley Jo Sheppard, Queensland Farmers Federation Mick Quirk, CANEGROWERS The Hon Ian McFarlane, Queensland Resources Council Ranee Crosby, Queensland Ports Association Gareth Phillips, Association of Marine Park Tourism Operators
1130 – 1230	**Meeting with Reef 2050 Advisory Committee – Traditional Owners and community session**	**Science and Knowledge; Collaboration and Partnerships**	The Hon Penny Wensley Chrissy Grant, Traditional Owner – female Dennis Ah-Kee, Traditional Owner – male Paul Aubin, Carefish Cr Jeff Baines, Local Marine Advisory Committees Kristy Gooding, Local Government Association of Queensland Katrina Dent, NRM organisations

Day 2 – Tuesday 22 March BRISBANE OFFICES Stakeholder engagement and Australia's emissions policies			
Time	**Activity**	**Purpose**	**Attendees**
			Theresa Fyffe, Great Barrier Reef Foundation
1230 – 1300	Lunch with RAC		
1300 – 1400	**Meeting with Reef 2050 Advisory Committee – Environmental NGOs session**	**Science and Knowledge; Collaboration and Partnerships**	The Hon Penny Wensley Richard Leck, WWF-Australia Imogen Zethoven, Queensland Conservation Council/Australian Marine Conservation Society Diane Tarte, Australian Committee for IUCN Standing invited observers to RAC (Matthew Fullerton DES).
1400 – 1615	**Contributing to global efforts on climate change** Includes 15 minute break for afternoon tea at 1540	**Limit the impacts of climate change** Framing of our approach to limiting emissions and reducing the impacts of climate change: emissions reduction, building resilience and adaptation. Australia's emissions policies. Australia's climate adaptation policies and programs Emissions reduction commitments by different sectors. Clean Energy Finance Corporation Queensland Climate Action Plan and Land Restoration Fund.	Jo Evans, Deputy Secretary, Climate Change and Energy Innovation Group, Department of Industry, Science, Energy and Resources (DISER) Maya Stuart-Fox, First Assistant Secretary, Climate Adaptation and Resilience Division, DAWE Dr Karen Hussey, Deputy Director General, Queensland Department of Environment and Science
1615 – 1715	**Regulation and management of other threats**	**Limit the impacts of other threats** Reef regulations and compliance programs. Science and regulation of land clearing.	Lyall Hinrichsen, Executive Director, Lands Policy and Support, Department of Resources Dr Gordon Guymer, Queensland Herbarium

Day 2 – Tuesday 22 March BRISBANE OFFICES Stakeholder engagement and Australia's emissions policies			
Time	**Activity**	**Purpose**	**Attendees**
			Scott Sullivan, Executive Director, DES
1715 – 1800	**Collaboration and Partnerships– Reef Trust**	**Collaboration and Partnerships** Great Barrier Reef Foundation to present on the Reef Trust Partnership Innovation that this has generated in Reef protection along with partnerships across community and industry. Partnership story – Raine Island	Anna Marsden, Managing Director, Great Barrier Reef Foundation (GBRF) Theresa Fyffe Executive Director, Projects and Partnerships, GBRF Craig Rosner-Moore, Principal Director, Reef Program Delivery, DAWE Neil Cambourn, Executive Director DES
	No formal dinner		

Day 3 – Wednesday 23 March LADY ELLIOT ISLAND (OVERNIGHT) Building Resilience- Restoration and Adaptation			
Time	**Activity**	**Purpose**	**Attendees**
0545 – 0630	*Travel to Lady Elliott Island*		
0715 – 0845	*Travel to Lady Elliott Island*	Aerial view during flights – demonstrate variability, scale, islands etc Focus on Reef Management	
0900 – 0945	Island orientation/ familiarisation		
1000 – 1200	In-water Coral inspection with Master Reef Guide to understand Reef Health	**Biodiversity**	Peter Gash (lessee)
1200 – 1215	Refresh		
1230 – 1330	Lunch		
1330 – 1600	**Building Reef Resilience – Island restoration**	**Protect, rehabilitate, and restore** View aerial photos.	Peter Gash (lessee)

Day 3 – Wednesday 23 March LADY ELLIOT ISLAND (OVERNIGHT) Building Resilience- Restoration and Adaptation			
Time	**Activity**	**Purpose**	**Attendees**
	Tour of revegetation, built environment and sustainability initiatives	Focus on Reef resilience Commonwealth Island managed by the Reef Authority (in partnership with LEI Resort and GBRF) Inspect island restoration undertaken by resort owner Peter Gash, funded personally, by the Australian/Queensland Government and private donors (through GBRF). **Limit the impacts of climate change** LEI Carbon offsetting work	
1600 – 1700	Free Time		
1700 – 1730	**Sustainable Tourism**	Lighthouse	Peter Gash (lessee)
1800	**Dinner with Peter, Julie and Amy Gash**		Peter and Julie Gash Amy Gash
2000 – 2100	**Biodiversity and Turtles**	**Protect, rehabilitate, and restore**	Peter and Julie Gash Amy Gash Josh (LEI Staff)

Day 4 – Thursday 24 March GOONDICUM PASTORAL STATION Building Resilience – Water Quality (Part 1)			
Time	**Activity**	**Purpose**	**Attendees**
0800 – 0845	*Travel LEI to Monto Airport*	Charter flight (departs 0800)	
0900 – 0955	*Bus from Monto to Goondicum*	Bus (16 seats)	Bus travel: Peter Kafka, Operations Manager, BMRG Nadia Campbell (property owner)
0955 – 1000	Goondicum induction		All
1000 – 1030	**Morning tea with property owners and BMRG**	Present on what they are doing on the property.	Rob & Nadia Campbell (property owners)

Day 4 – Thursday 24 March GOONDICUM PASTORAL STATION Building Resilience – Water Quality (Part 1)			
Time	**Activity**	**Purpose**	**Attendees**
			Sheila Charlesworth, CEO, Burnett Mary Regional Group Peter Kafka, BMRG Craig-Rosner Moore, DAWE Chris Johnson, Program Manager, Reef Programs, OGBR (DES) Steve Skull (engineer, Alluvium Regional Manager in Queensland)
1030 – 1230	**Site inspection: sediment works** *(Note 20 minutes to get there and 20 minutes back)*	View Rock chutes Scale of the works.	Craig-Rosner Moore, DAWE Chris Johnson, Program Manager, Reef Programs, OGBR Sheila Charlesworth, BMRG Peter Kafka, BMRG Steve Skull (engineer, Alluvium Regional Manager in Queensland)
1230 – 1330	Lunch		
1330 – 1500	**Reef 2050 Water Quality Improvement Plan – Focus on sediment investments** Includes afternoon tea	**Reduce impacts from land-based activities** Water Quality Improvement Plan Demonstrate the scale and complexity of the problem and the scale and complexity of our response. High level results	Craig-Rosner Moore, DAWE Chris Johnson, DES Sheila Charlesworth (CEO Burnett Mary Regional Group) Rob & Nadia Campbell (landowners)
1500 – 1600	*Bus from Goondicum to Monto airport*		Sheila Charlesworth, BMRG Peter Kafka, BMRG Craig Rosner-Moore, DAWE Chris Johnson, DES
1600 – 1900	*Charter Flight Monto Airport to Townsville*		

Day 5 – Friday 25 March TOWNSVILLE Marine Park Management; Reef Restoration and Adaptation Science			
Time	**Activity**	**Purpose**	**Attendees**
0600 – 0700	Breakfast at accommodation		
0700 – 0900	**Field Management Vessel Trip with GBRMPA to Cleveland Bay**	Marine Park management Zoning Joint Field Management Program	James Larsen Simon Banks David Wachenfeld (other PD members absent) GBRMPA Vessel Staff Josh Thomas, GBRMPA Margaret Johnson, GBRMPA Chris Cochrane, Director of Field Management Operations, GBRMPA
0900 – 1030	**World leading marine park management**	**Reduce impacts from water-based activities** Continuous adaptation to address threats (e.g COTS) and build the resilience of the Reef. Ops Room	Josh Thomas, GBRMPA Ian Poiner, Chair, GBRMPA Board Margaret Johnson, GBRMPA Jess Hoey, GBRMPA John Tapim, GBRMPA Assistant Director of the Southern Region (TUMRA), Policy and Planning Section Julia Chandler, GBRMPA Duane Fraser, GBRMPA Board Member, Wulgurukaba and Bidjara Traditional Owner Anthony Contarino, Queensland Parks and Wildlife Service
1030 – 1100	Break		
1100 – 1145	**Biodiversity and Species Protection**	**Biodiversity** Threatened species	Dr Helene Marsh, Chair, Threatened Species Scientific Committee Graeme Bolton, Department of Agriculture and Fisheries Dallas d'Silva, Department of Agriculture and Fisheries Dr Teena Browning, Director, GBRMPA

Day 5 – Friday 25 March TOWNSVILLE Marine Park Management; Reef Restoration and Adaptation Science			
Time	**Activity**	**Purpose**	**Attendees**
1145 – 1230	**Fisheries management**	**Biodiversity** Queensland's Sustainable Fishing Strategy	Graeme Bolton, Department of Agriculture and Fisheries Dallas d'Silva, Department of Agriculture and Fisheries Dr Teena Browning, Director, GBRMPA Dr Helene Marsh, Chair, Threatened Species Scientific Committee
1230 – 1330	*Lunch and Travel*		
1330 – 1420	**Great Barrier Reef - Marine Science** Includes 20 minute Q&A and refreshments	**Science and Knowledge** **Monitoring, evaluation and adaptive management** AIMS Long-Term Monitoring Program data. Established science. DNA and Coral recovery. In water drones, coral genetics.	Paul Hardisty, Chief Executive Officer, AIMS Scientist (LTMP data) Dr Britta Schaffelke, Research Program Leader, AIMS Dr Mike Elmslie, Senior Research Scientist, Reef Monitoring and Recovery Processes, AIMS Dr Neal Cantin, Research Scientist, Reef Monitoring and Recovery Processes, AIMS
1420 – 1700	**Reef Restoration and Adaptation Science Solutions for coral reef futures** **Includes visit to SEASIM**	**Limit the impacts of climate change** **Protect, rehabilitate and restore** Ensuring a resilient Reef in the face of a changing climate. AIMS briefing on latest science and monitoring, including RRAP broadly. **Science and Knowledge** The Australian Institute of Marine Science's National Sea Simulator (SeaSim) is a world-class marine research aquarium facility for tropical marine organisms in which scientists can conduct cutting-edge research not	Paul Hardisty, AIMS Dr David Mead, Executive Director, Strategic Development, AIMS Anna Marsden, GBRF Cedric Robillot, Executive Director of the Reef Restoration and Adaptation Program (RRAP) R&D Program, GBRF Craig Humphrey, SeaSim Manager, AIMS

Day 5 – Friday 25 March TOWNSVILLE Marine Park Management; Reef Restoration and Adaptation Science			
Time	**Activity**	**Purpose**	**Attendees**
		previously possible in Australia.	
1700 – 1740	**Return to Townsville & Reflections**	**Reflection to be held on bus**	
1800 – 1900	**Meeting with eNGOs and Scientists**		James Larsen, DAWE David Wachenfeld, GBRMPA Imogen Zethoven, Queensland Conservation Council/Australian Marine Conservation Society Dr Jon Day, Scientist Associate Professor Scott Heron, Scientist Richard Leck, WWF (other PD members absent)
Dinner	Dinner hosted by GBRMPA		Josh Thomas Margaret Johnson, GBRMPA Dr Britta Schaffelke, AIMS Graeme Bolton, Queensland Department of Agriculture and Fisheries Anna Marsden, Great Barrier Reef Foundation Lisa Woolfe, Townsville Enterprise Limited

Day 6 – Saturday 26 March BURDEKIN REGION Building Resilience- Water Quality (Part 2)			
Time	**Activity**	**Purpose**	**Attendees**
0700 – 1400	**Water Quality Improvement – sediment impacts** Depart Townsville Helicopter-based tour of the Bowen, Broken Bogie catchments, focusing on showing the	**Reduce the impact from land-based activities** **Collaboration and Partnerships** Fly over (helicopter), inspect and visit sites in Burdekin / Bowen areas that have received funding to fix	Simon Banks Elisa Nichols (Other PD members absent) Dr Scott Crawford (CEO NQ Dry Tropics) Dan Hazelman, Landscape Remediation Officer, NQDT Marc McConnell, NQDT

Day 6 – Saturday 26 March BURDEKIN REGION Building Resilience- Water Quality (Part 2)			
Time	**Activity**	**Purpose**	**Attendees**
	nature and scale of efforts to remediate the landscape. Return to Townsville	gullies and streambanks and reduce sediment flowing to the Reef. Emphasis is on demonstrating the contrast between gullies and streambanks that have not received treatment and those that have, and to give an understanding of scale.	Dr Lynise Wearne, Greening Australia Melissa & Christian Cormack (Glenbowen) Bristow Hughes, Diane Hughes (Strathalbyn)
1400 – 1530	Break		
1530 – 1630	**Building Reef resilience – Ports and Shipping** Visit to Reef VTS operations room and board room.	**Influence the reduction of international sources of impact** Management of Shipping – rules and regulations (GBRMPA - RQ) Remediation of shipping incidents.	Maritime Safety QLD Christina Heffner, Department of Transport and Main Roads Captain Frank D'Sousa, Regional Harbour Master - Townsville Tony Melrose, Reef Vessel Tracking Service – Maritime Safety Queensland Dr Mel Cowlishaw, Director, Charging Structure Review, GBRMPA
1700	*Charter flight to Cairns*		
1900	Check in and dinner with the Great Barrier Reef Special Envoy	The Hon Warren Entsch MP Tamara Srhoj (Chief of Staff), Samuel Batt (Advisor) James Larsen, Dr David Wachenfeld, Elisa Nichols (Other PD members absent). Sheriden Morris, CEO, Ref and Rainforest Research Centre. Chrissy Grant, Traditional Owner and Chair, Wet Tropics Management Authority. Tony Baker, Quicksilver Cruises. Gareth Phillips, Association of Marine Park Tourism Operators	

Day 7 – Sunday 27 March CAIRNS Building Reef Resilience through Partnerships			
Time	**Activity**	**Purpose**	**Attendees**
0830 – 1200	**On-country site visits**	**Traditional Owner Collaboration and Partnerships**	Brian Singleton, Yirrganydji Traditional Owner Gavin Singleton, Yirrganydji Traditional Owner

Day 7 – Sunday 27 March CAIRNS Building Reef Resilience through Partnerships			
Time	**Activity**	**Purpose**	**Attendees**
		Introduction to local Traditional Owner groups on country visit to hear from Traditional Owners on how they are managing sea country.	
1200 – 1300	Lunch		
1300 – 1415	**Meet with Indigenous Reef Advisory Committee members** (online) **Traditional Owner Management of Sea Country- Strategy and Governance**	**Traditional Owner Collaboration and Partnerships** Briefing on Traditional Owner Management of GBR Sea Country, including: • Reef 2050 Traditional Owner Implementation Plan • GBRMPA's Indigenous Reef Advisory Committee • RIMReP Traditional Owner partnerships	Malcolm Mann, Darumbal Traditional Owner (Chair) Dr Kerry Blackman, Gurang and Gooreng Gooreng Traditional Owner – Gladstone/Bundaberg region Mr Frank Loban, Western Torres Strait Islander Traditional Owner – Badu, Moa, Besi and Boigu region Christabel Warren, Wuthathi Traditional Owner Gavin Singleton, Yirrganydji Traditional Owner (also a member of TRAC) Margaret Johnson, GBRMPA Fred Nucifora, GBRMPA
1415 – 1445	**Meet with the Reef 2050 Traditional Owner Working Group**	**Traditional Owner Implementation Plan for Reef 2050 Actions** Ensuring fair, equitable and active participation from Traditional Owners in delivering Reef 2050 actions	Chrissy Grant Malcolm Mann Malachi Johnson Jessica Courtney Larissa Hale
1445 – 1500	Break		
1500 – 1615	**Meet with Tourism Reef Advisory Committee members**	**Collaboration and Partnerships**	Margaret Johnson, GBRMPA Fred Nucifora, GBRMPA Daniel Gschwind, Queensland Tourism Industry Council (Chair) Annie Judd, bareboat industry, Townsville/Whitsundays Christine Grant, Aboriginal (Kuku Yalanji from the Jalunji-Warra clan) and Torres StraitnIslander (Mualgal from Kubin on Moa Island) Elder Christabel Warren, Wuthathi Traditional Owner

Day 7 – Sunday 27 March CAIRNS Building Reef Resilience through Partnerships			
Time	**Activity**	**Purpose**	**Attendees**
			Gareth Phillips, Association of Marine Park Tourism Operators Crystal Lacey, tourism business Townsville/ Whitsundays, Master Reef Guide David Boyd, island resorts and tourism business, Townsville/ Whitsundays Jan Claxton, ecotourism Cairns/Cooktown and Townsville/Whitsundays Amy Gash (proxy for Peter Gash), island tourism operations Mackay/Capricorn Tony Charters, ecotourism, environmental education and recreation Stephanie Hicks, personalised tours, Master Reef Guide, Townsville/Whitsundays Martina Neidig-Quinlan (proxy for Racheal Klitscher), tourism marketing and events Gayle O'Brien, tourism policy and industry engagement. GBR Island Resort Rejuvenation Program Wendy Morris, GBRMPA Board Member [tourism]
1615 – 1700	**Local Government** Cairns Regional Council – Reef Guardian Council	**Collaboration and Partnerships- Local Government**	Mica Martin, Chief Executive Officer, Cairns Regional Council Amy Eden, Councillor, Cairns Regional Council Margaret Johnson, GBRMPA Fred Nucifora, GBRMPA
1700 – 1730	**Reflections**	Discussion with attendees and experts.	
1730 – 1745	**Day 8 Briefing**	Briefing about how the day will run and what to bring	Fiona Merida, GBRMPA Margaret Johnson, GBRMPA Fred Nucifora, GBRMPA
	Dinner with Queensland Government Minister		The Hon Meaghan Scanlon MP Nick Heath (Advisor) Elisa Nichols James Larsen

Day 7 – Sunday 27 March CAIRNS Building Reef Resilience through Partnerships			
Time	**Activity**	**Purpose**	**Attendees**
	for the Environment and the Great Barrier Reef		(Other PD members absent)

Day 8 – Monday 28 March MOORE REEF (OFFSHORE FROM CAIRNS) Reef Resilience – Impacts, Restoration and Recovery			
Time	**Activity**	**Purpose**	**Attendees**
0900 – 1600	**Visit to Moore Reef** Charter vessel for Moore Reef visit *Reef Magic vessel* View current condition of high value tourism site in a no-take Green Zone: - Guided snorkel - Glass bottom boat tour - Underwater semi-submarine tour Tourism Partnerships State of the art tourist pontoon Sea Country management discussion COTS control demonstration	**Traditional Owner Management of Sea Country** Highlight the on-Reef work being undertaken with Traditional Owners and their partners. **Collaboration and Partnerships** Working in partnership with tourism - the largest economic contributor to the Australian economy from Marine Park dependent activities. **Science and Knowledge** Impacted by cyclones and bleaching, COTS control site, GBR Biology hosts localised site stewardship trials including collaboration with MARS Inc **Monitoring, Evaluation and Adaptive Management** Long-term monitoring site – AIMS LTMP and Eye on the Reef guiding site interventions	Craig Rosner-Moore, DAWE Wendy Morris, GBRMPA Board member - Tourism Margaret Johnson, GBRMPA Fred Nucifora, Director Education and Engagement, GBRMPA Thea Waters, GBRMPA Fiona Merida, Assistant Director, Reef Stewardship, GBRMPA Gareth Phillips, AMPTO Paul Hardisty, AIMS COTS program: Roger Beedon, Director Reef Interventions, GBRMPA Mary Bonin, Program Director, COTS Control Innovation Program, GBRF Adam Jones, Experience Co Master Reef Guide Program: Justin Bovery-Spencer, GBR Biology, Experience Co - Reef Magic Cruises Samantha Gray, Education Manager, Experience Co

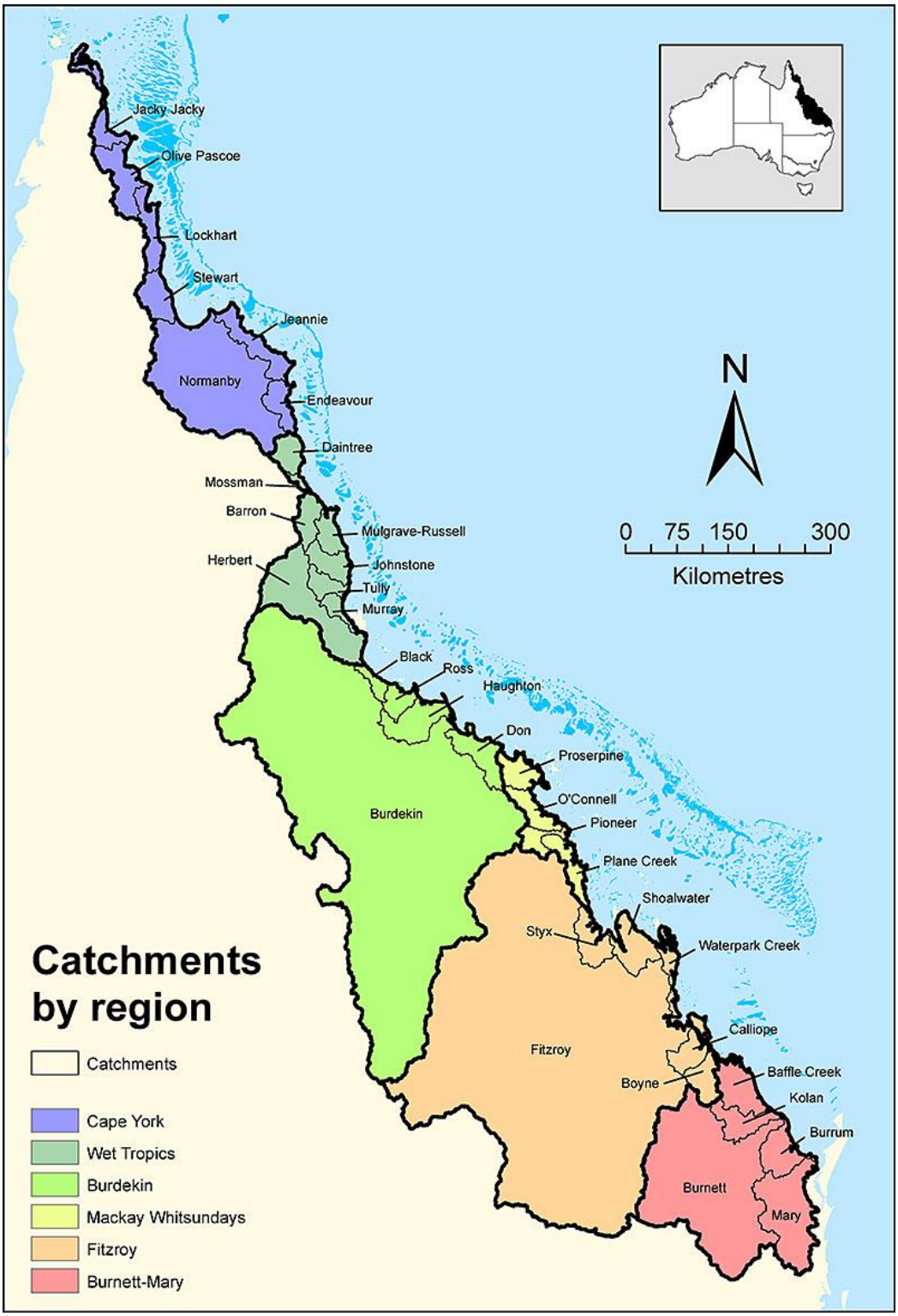
Day 8 – Monday 28 March MOORE REEF (OFFSHORE FROM CAIRNS) Reef Resilience – Impacts, Restoration and Recovery			
Time	**Activity**	**Purpose**	**Attendees**
	Wrap and Reflection (on return to Cairns)	Discussion with attendees and experts.	
1900	Dinner with the Secretary, DAWE		Andrew Metcalfe AO, Secretary, DAWE Chris Locke, Deputy Secretary, DAWE James Larsen Paula Perrett, DAWE (Other PD members absent)

Day 9 – Tuesday 29 March CAIRNS Reef Resilience- Water Quality and Coastal Habitat Restoration			
Time	**Activity**	**Purpose**	**Attendees**
0900 – 1000	**WQ Deep Dive – Progress to Reef 2050 WQIP targets & P2R Program** Link to marine monitoring/GBRMPA monitoring/water quality. Report card reductions	**Deep dive on water quality** To share current status of progress against targets ~30min ppt & 30min discussion	Craig Rosner-Moore, DAWE Nyssa Henry, Chief Scientific Officer, DES Scott Robinson, DES
1000 – 1100	*Travel*		
1100 – 1300	**Site visit: Water Quality improvement – nitrogen**	**Reduce the impact from land-based activities** Visit to Rossi brothers cane farm - innovation in cane farming inc farm tour. Property restoration. Overview of roles, responsibilities and regulatory practices. Insight into projects being administered. Introduction to site visit.	Stewart Christie, Chief Executive Officer, Terrain NRM Charles Hammond, Terrain Tony Rossi, cane farmer Chris Rossi, cane farmer Mark Rossi, cane farmer Craig Rosner-Moore, DAWE Scott Robinson, DES

Day 9 – Tuesday 29 March CAIRNS Reef Resilience- Water Quality and Coastal Habitat Restoration			
Time	**Activity**	**Purpose**	**Attendees**
1300 – 1400	**Lunch/presentation on DIN/CANE**	**Reduce the impact from land-based activities** Dissolved Inorganic Nitrogen water quality improvement projects/ Blue Carbon	Craig Rosner-Moore, DAWE Scott Robinson, DES
1400 – 1430	*Travel*		
1430 – 1530	**Wetland restoration project Fig Tree Lagoon**	**Reef Trust Phase 5 project with Greening Australia**	Ian Jensen, Wanyurr-Majay Aboriginal Corporation Clive Murray, Wanyurr-Majay Aboriginal Corporation Lindy Murray Dr Lynise Wearne, Reef Aid Program Director, Greening Australia Lenny & Grace Parisi, landholders Tony Rossi, Mulgrave Landcare Group Lynda Gregg Mark Richards Russell Wild Sean Browne
1530 – 1600	**Reflections**	Discussion with attendees and experts.	
1800	No formal dinner		

Day 10 – Wednesday 30 March CAIRNS to BRISBANE Reef Resilience and Adaptation Planning and Investment for the Future			
Time	**Activity**	**Purpose**	**Attendees**
1000 – 1100	**Innovative financing and investment**	**Investment** GBRF innovative finance Nature capital fund/carbon and biodiversity credit markets. Reef Credits	Theresa Fyffe Executive Director, Projects and Partnerships (GBRF) Dr Karen Hussey, DES Rich Gilmore, Carbon Growth Partners Jo Sheppard, Board Chair, Eco-Markets Australia Craig Rosner-Moore, DAWE
1100 – 1230	**Full circle - back to Reef 2050 Plan**	Review what the mission experts have seen and link back to the Reef 2050 Plan. Terms of Reference	Jamie Isbister, Ambassador for the Environment, Department of Foreign Affairs and Trade Paula Perrett, DAWE Dr Karen Hussey, DES Margaret Johnson, GBRMPA
1230 – 1330	Lunch		
1330 – 1430	**Final Reflection Panel Q&A Session**	Facilitated discussion with attendees and experts reviewing Cairn's leg and program as a whole. Discussion around next steps in partnerships to manage the Reef.	Jamie Isbister, Ambassador for the Environment, Department of Foreign Affairs and Trade Dr Karen Hussey, DES
	Travel to Brisbane		

ANNEX 4: Map of GBR catchments



ANNEX 5: Summary of WQIP Objectives, Targets and Outcomes

Eight key frameworks (each of which has detailed actions, targets and indicators in the WQIP)

A. **Responding to the challenge** includes on-ground delivery actions to implement the changes required to support progress towards the targets. This is divided into three concurrently implemented work areas:

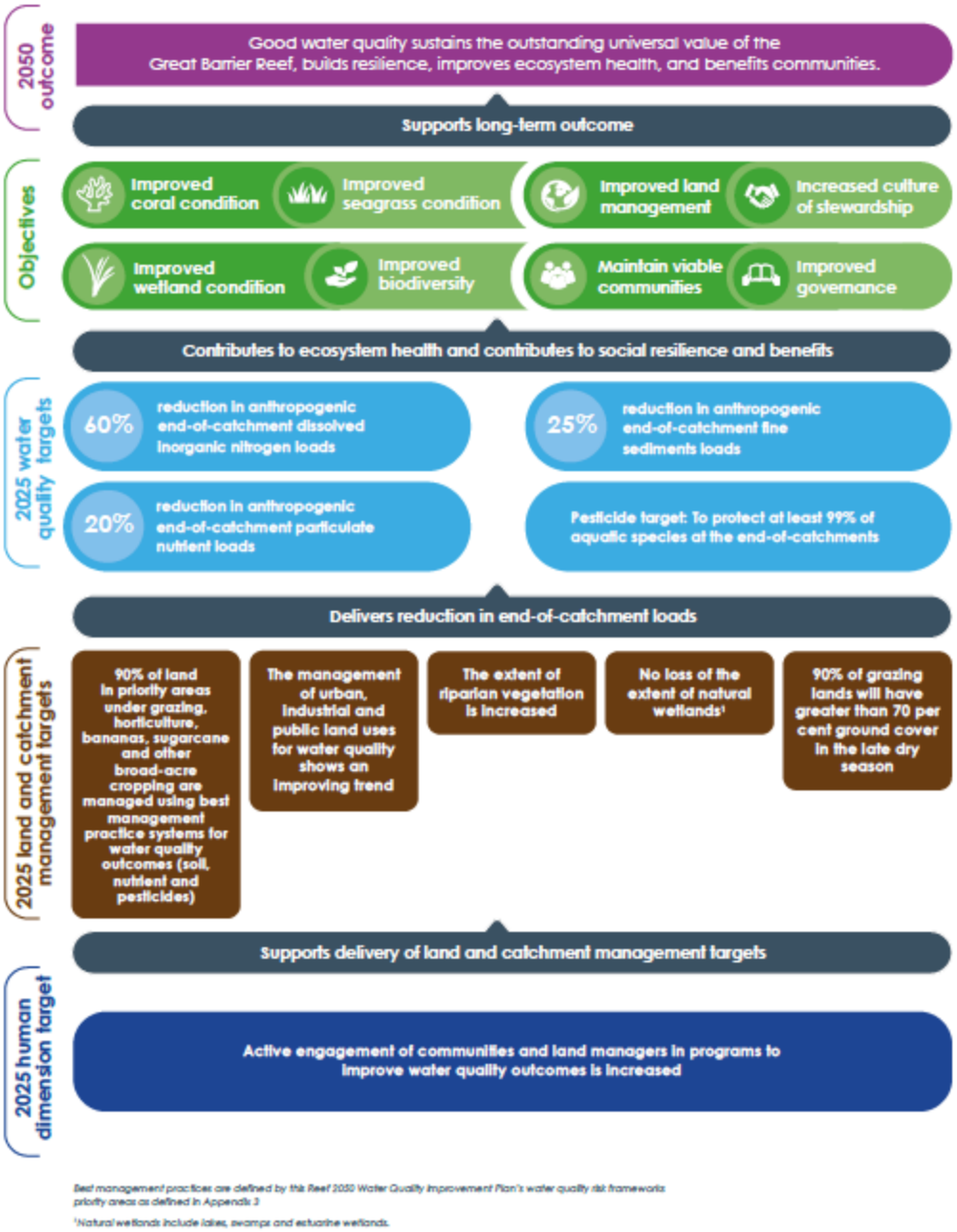
- A1. Minimum practice standards will be applied across all industries and land uses. Achieving this will eliminate the highest risk practices to deliver a step-change in progress towards the water quality targets across all catchments.
- A2. Industries and communities will be supported to build a culture of innovation and stewardship. This will deliver further improvements to water quality by building capacity of land managers to exceed minimum practice standards and trial innovations through a range of approaches that maintain viable communities and support lasting change.
- A3. Catchment restoration will address legacy issues of land development and past practices. Targeted restoration of riparian vegetation, streambanks, gullies, waterways and wetlands is needed to meet the targets. It will also slow the movement of water to the Reef, and improve biodiversity and the natural environment for all to enjoy.

B. **Enabling delivery** includes actions that support on-ground delivery through Responding to the Challenge, divided into four work areas:

- B1. Best available science and knowledge provides a foundation for improved on-ground responses.
- B2. Investment is coordinated, prioritised based on risk to the Reef and supported by local decision-making.
- B3. Governance supports coordinated decision-making and accountability of investments to the actions and outcomes of this Plan.
- B4. Evaluating performance tracks progress towards the targets and evaluates the effectiveness of activities to feed into the adaptive management of responding to the challenge.

Extracted from the Water Quality Improvement Plan , page 24

An overview of the plan's targets and anticipated outcomes is provided below.



Extracted from the Water Quality Improvement Plan , page 15

ANNEX 6: Summary of WQIP catchment targets

Extracted from the Water Quality Improvement Plan , pages 18 & 19. Note: targets are set based on the catchments' relevance and contribution to the problem. For example, areas that do not contribute significantly to sediment run-off do not have sediment reduction targets. The targets are also ranked in terms of priority catchments based on impact.

Region	Catchment/ Basin	Area (ha)	Targets								Pesticide target to protect min 99% of aquatic species at end-of-catchment
			Dissolved inorganic nitrogen		Fine sediment		Particulate phosphorus		Particulate nitrogen		
			tonnes	% reduction	kilo-tonnes	% reduction	tonnes	% reduction	tonnes	% reduction	
Cape York	Jacky Jacky Creek	296,330	MCL	MCL	MCL	MCL	MCL	MCL	MCL	MCL	
	Olive Pascoe River	417,950	MCL	MCL	MCL	MCL	MCL	MCL	MCL	MCL	
	Lockhart River	288,330	MCL	MCL	1	2	2	2	5	2	
	Stewart River	274,280	MCL	MCL	2	6	2	6	7	6	
	Normanby River	2,439,490	MCL	MCL	15	10	5	10	15	10	
	Jeannie River	363,750	MCL	MCL	2	6	2	6	9	6	
	Endeavour River	218,240	MCL	MCL	3	10	3	10	11	10	
Wet Tropics	Daintree River	210,670	MCL	MCL	MCL	MCL	MCL	MCL	MCL	MCL	
	Mossman River	47,240	52	50	MCL	MCL	MCL	MCL	MCL	MCL	
	Barron River	218,880	52	60	MCL	MCL	MCL	MCL	MCL	MCL	
	Mulgrave-Russell River	194,400	300	70	16	10	19	10	53	10	
	Johnstone River	232,390	350	70	100	40	250	40	490	40	
	Tully River	168,350	190	50	17	20	23	20	68	20	
	Murray River	110,840	120	50	8	20	11	20	32	20	
	Herbert River	984,590	620	70	99	30	57	30	200	30	
Burdekin	Black River	105,970	ND	ND	ND	ND	ND	ND	ND	ND	
	Ross River	170,820	74	60	ND	ND	ND	ND	ND	ND	
	Haughton River	405,080	640	70	MCL	MCL	MCL	MCL	MCL	MCL	
	Burdekin River	10,310,940	100	60	840	30	440	30	720	30	
	Don River	373,620	MCL	MCL	55	30	43	30	75	30	
Mackay/ Whitsunday	Proserpine River	249,440	110	70	MCL	MCL	MCL	MCL	MCL	MCL	
	O'Connell River	238,760	130	70	96	40	120	40	250	40	
	Pioneer River	157,360	140	70	35	20	23	20	61	20	
	Plane Creek	253,870	260	70	MCL	MCL	MCL	MCL	MCL	MCL	
Fitzroy	Styx River	301,340	MCL	MCL	MCL	MCL	MCL	MCL	MCL	MCL	
	Shoalwater Creek	360,180	MCL	MCL	MCL	MCL	MCL	MCL	MCL	MCL	
	Waterpark Creek	183,650	MCL	MCL	MCL	MCL	MCL	MCL	MCL	MCL	
	Fitzroy River	14,254,470	MCL	MCL	390	30	380	30	640	30	
	Calliope River	224,060	MCL	MCL	15	30	54	30	107	30	
	Boyne River	249,630	MCL	MCL	6	40	5	40	9	40	
Burnett Mary	Baffle Creek	408,470	16	50	11	20	15	20	33	20	
	Kolan River	290,450	34	50	6	20	5	20	14	20	
	Burnett River	3,319,540	150	70	85	20	29	20	68	20	
	Burrum River	337,170	93	50	3	20	3	20	8	20	
	Mary River	946,580	180	50	130	20	160	20	470	20	

Management priority					
	Very high		Moderate		Minimal
	High		Low		Not assessed

ANNEX 7: Summary of Reef Protection Regulations

Extracted from Queensland government information and presentations provided during mission.

The new requirements under the Reef protection regulations (launched 1 December 2019) are:

Record keeping — All graziers, sugarcane and banana producers in the Wet Tropics, Burdekin, Mackay Whitsunday, Fitzroy and Burnett Mary regions must keep records. Agricultural advisers must also keep records now. Records need to be kept to demonstrate activities are being undertaken on the property in accordance with the minimum practice agricultural standards.

The government has committed to not commencing the regulation to acquire specific agricultural data from the broader agricultural sector, such as data about fertiliser and chemical use, soil testing and crop yield.

Minimum practice agricultural standards — Primary producers in the Wet Tropics, Burdekin, Mackay Whitsunday, Fitzroy and Burnett Mary regions will need to comply with industry specific minimum practice agricultural standards. These have been developed for sugarcane, grazing and bananas at this stage, and take effect for different commodities in different regions over five years (see the timeframes below).

SUGARCANE MINIMUM STANDARDS	GRAZING MINIMUM STANDARDS
• Focus on retaining nutrients and sediments on farm • Whole of farm nitrogen and phosphorus budget (N&P Budget): • Calculation of N and P rates using prescribed method to identify farm cap – aligns with industry 6 Easy Steps • Growers decide which areas need more or less nutrients and adjust rates across the farm to meet the N & P budget. • Erosion risk must be managed including covering fallow block	• Focus on retaining and improving groundcover and land condition • Measures to improve land condition and ground cover where groundcover is <50% • Measures to prevent severely degraded areas from further degrading, e.g. – Adjusting grazing pressure – Wet season spelling – Managing preferential grazing – Managing land around gullies and early signs of gullying
BANANA MINIMUM STANDARDS	
• Minimum practice standards focus on retaining nutrients and sediments on farm. • Annual nutrient rates are set in regulation or can individualise through a nutrient management plan. • Erosion risk must be managed including adequate covering of fallow blocks and between rows	

The Queensland Government has made a commitment that the minimum practice agricultural standards for these commodities will remain substantially unchanged for the next five years (i.e. until 1 December 2024).

Minimum practice agricultural standards for grains and horticulture production have not yet been developed and are not proposed to come into effect until 1 December 2024.

Farm nitrogen and phosphorus budget (sugarcane only) **—** All sugarcane producers in the Wet Tropics, Burdekin and Mackay Whitsunday regions must have a farm nitrogen and phosphorus budget from 1 December 2021 and then in the Fitzroy and Burnett Mary regions from 1 December 2022.

New or expanding cropping and horticulture activities — New or expanding cropping and horticulture activities in any Reef region on five hectares or more of land that does not have a cropping history requires an environmental authority (permit) before the activity or any work takes place. A cropping history is when the land has been used for cropping or horticulture activities in at least three out of the last 10 years.

New, expanded or intensified industrial land use activities — New, expanded or intensified regulated industrial land use activities such as sewage and water treatment plants, land-based aquaculture or mining in any Reef region must meet new discharge standards to ensure there is no increase in nutrient or sediment pollutant loads.

TIMEFRAMES FOR REEF REGULATION ROLL OUT

Commodity	Region	Record keeping requirements	Minimum practice agricultural standards	Farm nitrogen and phosphorus budget (sugarcane only)	New or expanding cropping activities
Bananas	Cape York	N/A	N/A	N/A	1 June 2021
Bananas	Wet Tropics	1 December 2019	1 December 2020	N/A	1 June 2021
Bananas	Burdekin, Mackay Whitsunday, Fitzroy and Burnett Mary	1 December 2019	1 December 2022	N/A	1 June 2021
Grains	Wet Tropics, Burdekin, Mackay Whitsunday, Fitzroy and Burnett Mary	Proposed 1 December 2024	Proposed 1 December 2024	N/A	1 June 2021
Grains	Cape York	N/A	N/A	N/A	1 June 2021
Grazing	Cape York	N/A	N/A	N/A	N/A
Grazing	Burdekin	1 December 2019	1 December 2020	N/A	N/A
Grazing	Fitzroy	1 December 2019	1 December 2021	N/A	N/A
Grazing	Wet Tropics, Mackay Whitsunday and Burnett Mary	1 December 2019	1 December 2022	N/A	N/A
Horticulture	Wet Tropics, Burdekin, Mackay Whitsunday, Fitzroy and Burnett Mary	Proposed 1 December 2024	Proposed 1 December 2024	N/A	1 June 2021
Horticulture	Cape York	N/A	N/A	N/A	1 June 2021
Sugarcane	Cape York	N/A	N/A	N/A	1 June 2021
Sugarcane	Wet Tropics, Burdekin and Mackay Whitsunday	1 December 2019	1 December 2019	1 December 2021	1 June 2021
Sugarcane	Fitzroy and Burnett Mary	1 December 2019	1 December 2022	1 December 2022	1 June 2021

ANNEX 8: Examples of Gully Remediation

Photos of gully remediation work over time clearly demonstrate the efficacy of this land restoration initiative.

Glen Bowen Station

1

2

3

4

Mt. Wickham

ANNEX 9: SOUV of the Property & Status Rankings (2019)

Statement of Outstanding Universal Value

Extracted from https://whc.unesco.org/en/list/154/

BRIEF SYNTHESIS

> As the world's most extensive coral reef ecosystem, the Great Barrier Reef is a globally outstanding and significant entity. Practically the entire ecosystem was inscribed as World Heritage in 1981, covering an area of 348,000 square kilometres and extending across a contiguous latitudinal range of 14o (10oS to 24oS). The Great Barrier Reef (hereafter referred to as GBR) includes extensive cross-shelf diversity, stretching from the low water mark along the mainland coast up to 250 kilometres offshore. This wide depth range includes vast shallow inshore areas, mid-shelf and outer reefs, and beyond the continental shelf to oceanic waters over 2,000 metres deep.

Within the GBR there are some 2,500 individual reefs of varying sizes and shapes, and over 900 islands, ranging from small sandy cays and larger vegetated cays, to large rugged continental islands rising, in one instance, over 1,100 metres above sea level. Collectively these landscapes and seascapes provide some of the most spectacular maritime scenery in the world.

The latitudinal and cross-shelf diversity, combined with diversity through the depths of the water column, encompasses a globally unique array of ecological communities, habitats and species. This diversity of species and habitats, and their interconnectivity, make the GBR one of the richest and most complex natural ecosystems on earth. There are over 1,500 species of fish, about 400 species of coral, 4,000 species of mollusk, and some 240 species of birds, plus a great diversity of sponges, anemones, marine worms, crustaceans, and other species. No other World Heritage property contains such biodiversity. This diversity, especially the endemic species, means the GBR is of enormous scientific and intrinsic importance, and it also contains a significant number of threatened species. At time of inscription, the IUCN evaluation stated "… if only one coral reef site in the world were to be chosen for the World Heritage List, the Great Barrier Reef is the site to be chosen".

The SOUV continues with the outline of **Attributes** related to criterion vii, viii, ix and x of the WH guidelines, as well as attributes for integrity, protection and management. These are presented below along with the accompanying rankings related to these OUV values as extracted and synthesized from the Outlook Report 2019.

Rankings given in Outlook Report

Very good	All elements necessary to maintain the outstanding universal value are essentially intact and their overall condition is stable or improving. Available evidence indicates only minor, if any, disturbance to this element of OUV.
Good	Some loss or alteration of the elements necessary to maintain the outstanding universal value has occurred, but their overall condition is not causing persistent or substantial effects on this element of OUV.
Poor	Loss or alteration of many elements necessary to maintain outstanding universal value has occurred, which is leading to a significant reduction in this element of OUV.
Very poor	Loss or alteration of most elements necessary to maintain the outstanding universal value has occurred, causing a major loss of OUV.

Description of trends shown - measures since last report

↑ Improved ↓ Deteriorated ↔ Stable — No consistent trend

Explanation of confidence levels

Adequate	High quality evidence and high level of consensus
Limited	Limited evidence or limited consensus
Very Limited	Inferred, very limited evidence

Areas in the below SOUV criterion text for the GBR have been highlighted to show the attributes assessed through the outlook report 2019. These have been extracted from the outlook report and compiled by Tarte and Day (2019), whose report[90] also recommends an alternate attribute assessment process that would enable a greater expression of criterion assessment than currently available in the Outlook Report, and is recommended for future reporting processes.

CRITERION VII - to contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance.

The GBR is of superlative natural beauty above and below the water, and provides some of the most spectacular scenery on earth. It is one of a few living structures visible from space, appearing as a complex string of **reefal** structures along Australia's northeast coast.

From the air, the vast mosaic patterns of **reefs, islands** and coral cays produce an unparalleled aerial panorama of seascapes comprising diverse shapes and sizes. The Whitsunday Islands provide a magnificent vista of green vegetated **islands** and spectacular sandy **beaches** spread over azure waters. This contrasts with the vast **mangrove** forests in Hinchinbrook Channel, and the rugged vegetated mountains and lush **rainforest** gullies that are periodically cloud-covered on Hinchinbrook Island.

On many of the cays there are spectacular and globally important breeding colonies of **seabirds** and **marine turtles**, and Raine Island is the world's largest green turtle breeding area. On some continental islands, large aggregations of over-wintering butterflies periodically occur.

Beneath the ocean surface, there is an abundance and diversity of shapes, sizes and colours; for example, spectacular coral assemblages of **hard and soft corals**, and thousands of species of **reef fish** provide a myriad of brilliant colours, shapes and sizes. The internationally renowned Cod Hole near Lizard Island is one of many significant tourist attractions. Other superlative natural phenomena include the annual coral spawning, migrating **whales**, nesting **turtles**, and significant spawning aggregations of many **fish** species.

Grade	Confidence		Criterion and component summaries
2019	Grade	Trend	
↔	Limited	Limited	**Islands:** Localised damage to some islands has occurred from severe weather, temperature extremes and pests. Recovery from past impacts is occurring and monitoring of island condition is improving.
↔	Limited	Limited	**Mainland beaches and coastlines:** Some beaches and coastlines have been modified as a result of natural processes, coastal development and climate change. However, most remain in a relatively natural state.
↔	Limited	Limited	**Mangrove forests:** Cyclones have caused localised habitat loss and degradation; recovery is occurring.
—	Adequate	Adequate	**Seagrass meadows:** Degradation of inshore seagrass meadows has occurred in a number of areas and recovery has been slowed by a number of disturbances. The absence of seed banks and low reproductive effort have resulted in many seagrass meadows being vulnerable.

[90] Tarte, D and J. C. Day (2019). Review of World Heritage Assessments in Great Barrier Reef Outlook Report 2019. Report prepared for Australian Marine Conservation Society.

Grade	Confidence		Criterion and component summaries
2019	Grade	Trend	
↓	Adequate	Adequate	**Coral reefs:** Multiple severe disturbances have caused widespread damage and loss of coral reef habitat in a number of areas. Coral recruitment has declined significantly. Evidence of cascading effects on coral dependent species, such as fish and invertebrates is emerging.
↓	Limited	Limited	**Bony fishes:** Little is known about the condition of most bony fish species on a Region-wide scale given it is a highly diverse group. Some coral-dependent fishes have decreased in areas affected by mass bleaching events. Some herbivore populations have remained stable or increased in some areas. Current extraction rates for some fished bony fish species are considered sustainable, however, there are concerns for other species. There is likely to be a lag in detecting effects on bony fishes following multiple impacts on their habitat.
—	Adequate	Limited	**Marine turtles:** Heightened concerns exist for the future of loggerhead, hawksbill and northern green turtle populations. The southern green turtle population continues to recover. The trend for flatback turtles is not clear.
—	Limited	Limited	**Seabirds:** Limited information is available on the condition and trend of seabird. Reef-wide trends indicate slight declines in six seabird populations between 1980 and 2017. The population of one species is increasing.
—	Very Limited	Very Limited	**Shorebirds:** Population estimates for the Region's shorebirds are not differentiated from the national level analyses, making condition assessments difficult for the Region. Large numbers of multiple shorebird species have declined in the Mackay area, whereas other areas have retained populations of shorebird species.
↔	Limited	Limited	**Whales:** Populations of whale species within the Region are believed to be currently stable. Humpback whales have recovered strongly. Climate change is the greatest threat to baleen whale populations and the related effect on their food sources outside the Region.
↔	Limited	Limited	**Rainforests:** Extent in the catchment remains stable. Although little is known about the condition of this ecosystem, the inferred protection of rainforests in protected areas increases the confidence in this grade.
↓	Limited	Very Limited	**Aesthetic heritage values:** Aesthetic beauty is closely aligned to the condition of the ecosystem. Strong evidence has established that several disturbances have damaged parts of te Reef's naturalness. Widespread and localised impacts are also inferred to have diminished some of the Region's aesthetic heritage values.
↓*	Limited	Limited	**Natural beauty and natural phenomena:** At a broad scale, the Region retains much of its spectacular scenery. However, its natural beauty is being affected in some areas (for example, by poor inshore water quality). Components of natural phenomena, such as turtle breeding, whale migration and coral spawning, continue but these elements (criterion vii) are being increasingly challenged by climate change, resulting in the condition being good borderline poor. Much of the evidence is inferred from the assessments in Chapters 2 and 3.

* *Marginal poor*

CRITERION (VIII): to be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features.

The GBR, extending 2,000 kilometres along Queensland's coast, is a globally outstanding example of an ecosystem that has evolved over millennia. The area has been exposed and flooded by at least four glacial and interglacial cycles, and over the past 15,000 years reefs have grown on the continental shelf. During glacial periods, sea levels dropped, exposing the reefs as flat-topped hills of eroded limestone. Large rivers meandered between these hills and the coastline extended further east. During interglacial periods, rising sea levels caused the formation of **continental islands**, **coral cays** and new phases of coral growth. This environmental history can be seen in cores of old massive corals.

Today the GBR forms the world's largest **coral reef ecosystem**, ranging from inshore fringing reefs to mid-shelf reefs, and exposed outer reefs, including examples of all stages of reef development. The processes of geological and **geomorphological evolution** are well represented, linking continental islands, coral cays and reefs. The varied seascapes and landscapes that occur today have been moulded by **changing climates** and **sea levels**, and the erosive power of wind and water, over long time periods. One-third of the GBR lies beyond the seaward edge of the shallower reefs; this area comprises **continental slope** and deep **oceanic waters** and abyssal plains.

Grade	Confidence		Criterion and component summaries
2019	Grade	Trend	
↔	Limited	Limited	**Islands:** Localised damage to some islands has occurred from severe weather, temperature extremes and pests. Recovery from past impacts is occurring and monitoring of island condition is improving.
↓	Adequate	Adequate	**Coral reefs:** Multiple severe disturbances have caused widespread damage and loss of coral reef habitat in a number of areas. Coral recruitment has declined significantly. Evidence of cascading effects on coral dependent species, such as fish and invertebrates is emerging.
↔	Very Limited	Very Limited	**Continental slope:** Much of this habitat remains undisturbed and minimally affected. The upper continental sloe around the Swain Reefs is exposed to high levels of trawl effort. Clarification on the extent of this habitat has resulted in a grade of very good.
↓*	Limited	Limited	**Water column:** The water column has deteriorated in some inshore areas due to the impacts of land-based run-off. Alteration of the water column may have occurred in a number of areas following record-breaking temperatures extremes potentially leading to substantial effects on some species. The condition of water column habitat is good borderline poor.
—	Adequate	Adequate	**Cyclones and wind:** Since 2014, over 60% of the reef area within the Region has been exposed to destructive waves from five severe tropical cyclones. Location and intensity of cyclones remain highly variable. Given other cumulative impacts, cyclones have damaged the Region's structure and impacted its function, particularly around Lizard Island and the Whitsundays.
↓	Adequate	Adequate	**Sea level:** Sea level is rising, with the fastest rates being recorded in the Region's north. Coastal areas, islands and cays will be most affected by increases in sea level.
↓	Limited	Limited	**Reef building:** Reef building has deteriorated, largely due to the combined effects of unprecedented declines in coral cover and crustose coralline algae in some areas in response to thermal bleaching events. The slow decrease in ocean pH affects reef building.
↓	Adequate	Adequate	**Ocean pH:** Inshore areas are more vulnerable to ocean acidification than the open ocean due to higher respiration and nutrients levels. Ocean pH is slowly decreasing.
↓	Limited	Limited	**Major stages of the Earth's evolutionary history:** The Reef's ability to regenerate and grow over millennia following periods of climatic and sea-level change is well documented. However, new evidence has identified that some alteration to processes that influence reef formation, and maintain sediment accumulation on reefs and islands

			has occurred. This alteration is intensifying in a negative way due to climate change (criterion viii).

* *Marginal poor*

CRITERION (IX): to be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals.

The globally significant diversity of **reef** and island morphologies reflects ongoing geomorphic, **oceanographic** and **environmental** processes. The complex cross-shelf, longshore and vertical **connectivity** is influenced by dynamic oceanic **currents** and ongoing **ecological processes** such as upwellings, **larval dispersal** and **migration**.

Ongoing erosion and accretion of coral reefs, sand banks and coral cays combine with similar processes along the coast and around continental islands. Extensive beds of **Halimeda algae** represent active calcification and accretion over thousands of years.

Biologically the unique diversity of the GBR reflects the maturity of an ecosystem that has evolved over millennia; evidence exists for the evolution of **hard corals** and other fauna. Globally significant marine faunal groups include over 4,000 species of molluscs, over 1,500 species of **fish**, plus a great diversity of **sponges, anemones, marine worms, crustaceans**, and many others. The establishment of vegetation on the cays and continental islands exemplifies the important role of **birds**, such as the Pied Imperial Pigeon, in processes such as seed dispersal and plant colonisation.

Human interaction with the natural environment is illustrated by strong ongoing links between Aboriginal and Torres Strait Islanders and their sea-country, and includes numerous **shell deposits (middens)** and **fish traps**, plus the application of **story places and marine totems**.

Grade	Confidence		Criterion and component summaries
2019	Grade	Trend	
—	Very Limited	Very Limited	***Halimeda* banks:** Improved spatial analysis has increased understanding of the spatial coverage of *Halimeda* banks. Understanding its ecological role and condition remains limited. Exposure to potentially damaging cyclone waves and thermal stress has occurred since 2014, but impacts are inferred to be limited given their isolation and depth.
	Limited		**Benthic algae:** Overall benthic algal diversity appears to be maintained and abundance has increased in some areas, resulting in good condition across the Region. However, some species of coralline alga were affected by thermal stress in 2016 and 2017 and are showing signs of stress from ocean acidification. Turf algal condition is also deteriorating in some inshore locations due to sedimentation. A trend cannot be provided due to macroalgae and benthic microalgae being combined in 2019.
↓	Adequate	Adequate	**Corals:** Unprecedented mass coral bleaching due to global warming, outbreaks of crown-of-thorns starfish and cyclone impacts have reduced coral diversity and abundance, with widespread loss of key habitat-forming coral species at many locations.
↓	Limited	Limited	**Bony fishes:** Little is known about the condition of most bony fish species on a Region-wide scale given it is a highly diverse group. Some herbivore populations have remained stable or increased in some areas. Current extraction rates for some fished bony fish species are considered sustainable, however, there are concerns for other species. There is likely to be a lag in detecting effects on bony fishes following multiple impacts on their habitat.
↓	Very Limited	Very Limited	**Other invertebrates:** Prolonged thermal stress, substantial loss of coral habitat, poor water quality and fishing have probably adversely affected many invertebrate species

Grade	Confidence		Criterion and component summaries
2019	Grade	Trend	
			across a range of habitats. Populations of bioeroding species may have increased with more dead coral substrata available in affected areas.
↓	Very Limited	Very Limited	**Plankton and microbes:** There is little information on plankton and microbe populations in the Region. Changes in water temperature and water quality are likely to be negatively impacting plankton and microbial communities.
—	Very Limited	Very Limited	**Currents:** Ocean currents continue to transport and connect species and habitats.
↔	Adequate	Adequate	**Freshwater inflow:** Between 2013 and 2018, freshwater flow was near or below the long-term average for the Catchment.
↔	Adequate	Adequate	**Sediment exposure:** Sediment loads continue to contribute to the poor state of many inshore coastal and marine ecosystems. The majority of sediment is delivered to the Region during flood events and the amount varies between catchment.
↓	Adequate	Adequate	**Sea level:** Sea level is rising, with the fastest rates being recorded in the Region's north. Coastal areas, islands and cays will be most affected by increases in sea level.
↓	Adequate	Adequate	**Sea temperature:** Extreme thermal stress due to global warming occurred in the summers of 2016 and 2017, resulting in widespread coral mortality. Impact on other organisms (such as fish and seabirds) are emerging.
↓	Limited	Limited	**Light:** It is likely that underwater light availability has decreased substantially in the inshore areas of the southern two thirds of the Region due to land-based run-off, resuspension of existing sediment in the system and extreme weather.
↔	Adequate	Adequate	**Nutrient cycling:** Since 2012, the dissolved inorganic nitrogen discharged to the Catchment has been generally lower than previous years, primarily due to low river flow.
↓	Adequate	Adequate	**Ocean pH:** Inshore areas are more vulnerable to ocean acidification than the open ocean due to higher respiration and nutrient levels. Ocean pH is slowly decreasing.
↔	Adequate	Limited	**Ocean salinity:** Localised changes to salinity occur as a result of freshwater inflow, largely affecting inshore areas. Overall, this process is stable.
—	Very Limited	Very Limited	**Microbial processes:** Microbial processes are central to the flow of carbon through the ecosystem and are sensitive to changes in environmental conditions. Environmental stressors associated with a warming climate have disrupted microbial processes in corals and other organisms, lowering their ability to resist bleaching and disease. Very little information exists on microbial processes across the Region.
↓	Limited	Limited	**Particle feeding:** Particle feeding is undertaken by broad range of species, including echinoderms, molluscs, sponges and corals. High nutrient levels have affected some particle feeders. Following two thermal stress events, there have been significant declines in particle-feeding corals in some areas. It also likely that particle-feeding fish, which rely heavily on coral habitats for shelter, have also decreased.
—	Limited	Limited	**Primary production:** Some seafloor primary producers, such as seagrasses and benthic algae, have increased in some areas. However, high levels of nutrients, sediment and temperature are causing negative impacts. Corals have declined sharply. Phytoplankton is variable across the Region and depends o a combination of freshwater inflow and nutrients.
↔	Limited	Limited	**Herbivory:** The process of herbivory supports nutrient cycling, is important for reinforcing a corral-dominated state through the removal of competing algae, and increases the productivity of seagrass meadows. Fish herbivore abundance has generally remained stable across the Region, with some changes in offshore locations.

Grade	Confidence		Criterion and component summaries
2019	Grade	Trend	
			In high-sediment areas, and where macroalgae are dense, herbivory is reduced. The condition of herbivory as a process across the Region and the mechanisms that affect it are not well understood.
—	Limited	Limited	**Predation:** Generally, changes in the abundance of reef-associated predators across the Region have been variable. A large group of predators, the sharks and rays, has been assessed as being in poor condition.
↓	Limited	Adequate	**Symbiosis:** Based on the unprecedented decline off coral cover and the changes in coral community composition, the majority of symbioses involving coral have been significantly affected since 2016. Many symbiotic relationships between small benthic invertebrates remain data deficient.
↓	Limited	Limited	**Recruitment:** Recruitment is reduced for many key species, in particular, corals, fishes and some marine turtles and seabirds, largely due to chronic and acute disturbances.
↓	Limited	Limited	**Reef building:** Reef building has deteriorated, largely due to the combined effects of unprecedented declines in coral cover and crustose coralline algae in some areas in response to thermal bleaching events. The slow decrease in ocean pH affects reef building.
↓	Very Limited	Very Limited	**Competition:** Habitat loss and population declines are changing competition on a broad scale, which is likely to have flow-on effect on the fitness of organisms. It is likely that coral-algal competition has increased.
↓	Limited	Limited	**Connectivity:** Marine species and habitats remain connected. However, effects of climate change have altered connectivity patterns. Connectivity with some coastal ecosystems remains disrupted.
↔	Very Limited	Very Limited	**Cultural practices, observances, customs and lore:** Loss of Indigenous knowledge is a threat to this component. It is assume that knowledge transfer is being maintained across the Region, supported by the expansion in land and sea management and cultural activities.
↔ ↔	Very Limited Very Limited	Very Limited Very Limited	**Sacred sites, sites of particular significance and places important for cultural tradition:** The location of sacred sites are not widely known outside Traditional Owner groups, but the Keppel island region is well documented. Only a very small portion of the Region has dated archaeological sites, contributing to lack of understanding and recognition of these important areas in management frameworks. **Stories, songlines, totems and languages:** The location-based importance of this component, which can san land and sea, means other uses and pressure can break, damage or displace these values. This value is reliant on healthy populations of totemic species, some of which are in poor condition. The condition of this component is not well understood by managers and is inferred to be poor.
↔	Very Limited	Very Limited	**Indigenous structures, technology, tools and archaeology:** The location-based importance of this component, which can span land and sea, means other uses and pressures can break, damage or displace these values. Some heritage components have been documented on and around islands, but limited monitoring of their condition occurs.
↓	Limited	Limited	**Ecological and biological processes:** Overall, some ecological and biological processes (criterion ix) remain in good condition. However, many ecological processes have deteriorated since 2014 due to the combine effects of climate change and inshore land-based run-off. As a result, the condition is considered good borderline poor.

CRITERION (X): to contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened

species of outstanding universal value from the point of view of science or conservation.

The enormous size and diversity of the GBR means it is one of the richest and most complex natural ecosystems on earth, and one of the most significant for biodiversity conservation. The amazing diversity supports tens of thousands of marine and terrestrial species, many of which are of global conservation significance.

As the world's most complex expanse of **coral reefs**, the reefs contain some 400 species of **corals** in 60 genera. There are also large ecologically important **inter-reefal** areas. The shallower marine areas support half the world's diversity of **mangroves** and many **seagrass** species. The waters also provide major feeding grounds for one of the world's largest populations of the threatened dugong. At least 30 species of **whales** and **dolphins** occur here, and it is a significant area for humpback whale calving.

Six of the world's seven species of **marine turtle** occur in the GBR. As well as the world's largest green turtle breeding site at Raine Island, the GBR also includes many regionally important marine turtle rookeries.

Some 242 species of **birds** have been recorded in the GBR. Twenty-two **seabird** species breed on cays and some continental islands, and some of these breeding sites are globally significant; other seabird species also utilize the area. The **continental islands** support thousands of plant species, while the coral cays also have their own distinct flora and fauna.

Grade	Confidence		Criterion and component summaries
2019	Grade	Trend	
↓	Adequate	Adequate	**Coral reefs:** Multiple severe disturbances and caused widespread damage and loss of coral reef habitat in a number of areas. Coral recruitment has declined significantly. Evidence of cascading effects on coral dependent species, such as fish and invertebrates is emerging.
↓	Limited	Very Limited	**Lagoon floor:** Some areas of the lagoon floor have been exposed to prolonged thermal stress, impacts associated with dredging and disposal, bottom trawling, shipping and potentially damaging cyclonic waves.
↓	Limited	Very Limited	**Shoals:** Underwater mapping has increased understanding of shoal extent but not condition. Since 2014, over 10 % of shoals have been exposed to potentially damaging cyclonic waves and many have been exposed to prolonged thermal stress.
↔	Limited	Limited	**Mangroves:** The diversity and abundance of mangrove species are being maintained, with several new species being recorded in Region.
↔	Limited	Limited	**Seagrasses:** Inshore seagrass community composition continues to change in many inshore meadows as the habitat recovers from past disturbances.
↔	Limited	Limited	**Islands:** Localised damage to some islands has occurred from severe weather, temperature extremes and pests. Recovery from past impacts is occurring and monitoring of island condition is increasing.
—	Adequate	Limited	**Marine turtles:** Heightened concerns exist for the future of loggerhead, hawksbill and northern green turtle populations. The southern green turtle population continues to recover. The trend for flatback turtles is not clear.
—	Limited	Limited	**Seabirds:** Limited information is available on the condition and trend of seabirds. Reef-wide trends indicate slight declines in six seabird populations between 1980 and 2017. The population of one species is increasing.
—	Very Limited	Very Limited	**Shorebirds:** Population estimates for the Region's shorebirds are not differentiated from the national level analyses, making condition assessments difficult for the Region. Large numbers of multiple shorebird species have declined in Mackay area, whereas other areas have retained populations of shorebird species.
↔	Limited	Limited	**Whales:** Populations of whale species within the Region are believed to be currently stable. Humpback whales have recovered strongly. Climate change is the greatest threat to baleen whale populations and the related effect on their food sources outside the Region.

Grade	Confidence		Criterion and component summaries
2019	Grade	Trend	
↓	Very Limited	Very Limited	**Dolphins:** Data on the Region's dolphins are very limited. Offshore dolphin species are considered more stable as they are less likely to be exposed to human-related threats than inshore dolphin species. Concerns continue for the condition of Australian humpback and snubfin dolphins (both inshore species), which may be in decline due to human-related mortality.
↑	Adequate	Adequate	**Dugongs:** The Region is home to globally significant populations of dugongs. Over the entire Region there is a high probability that the dugong population declined between 2005 and 2016. Along the urban coast, from Hinchinbrook south, the breeding rate has improved since the impacts of cyclone Yasi and widespread flooding in 2011.
↓	Limited	Limited	**Habitats for conservation of biodiversity:** The property contains a diverse range of habitats (criterion x), many of which are under pressure. Overall, significant habitat reduction and alteration in a number of areas has led to persistent and substantial effects on populations of some dependent species.

INTEGRITY

The ecological integrity of the GBR is enhanced by the unparalleled size and current good state of conservation across the property. At the time of inscription it was felt that to include virtually the entire Great Barrier Reef within the property was the only way to ensure the integrity of the coral reef ecosystems in all their diversity.

A number of natural pressures occur, including cyclones, crown-of-thorns starfish outbreaks, and sudden large influxes of freshwater from extreme weather events. As well there is a range of human uses such as tourism, shipping and coastal developments including ports. There are also some disturbances facing the GBR that are legacies of past actions prior to the inscription of the property on the World Heritage list.

At the scale of the GBR ecosystem, most habitats or species groups have the capacity to recover from disturbance or withstand ongoing pressures. The property is largely intact and includes the fullest possible representation of marine ecological, physical and chemical processes from the coast to the deep abyssal waters enabling the key interdependent elements to exist in their natural relationships.

Some of the key ecological, physical and chemical processes that are essential for the long-term conservation of the marine and island ecosystems and their associated biodiversity occur outside the boundaries of the property and thus effective conservation programs are essential across the adjoining catchments, marine and coastal zones.

Comment in Outlook Report 2019:

'While the property remains whole and intact, is integrity is deteriorating. An altered disturbance regime due to climate change has impaired the resilience of the ecosystem resulting in the condition being good borderline poor. The property's size is becoming less effective as a buffer against Reef-wide disturbances.'

Rankings provided in Outlook Report 2019:

World heritage criteria and integrity test criteria	Assessment	Integrity score
(vii) Natural beauty and natural phenomena		
The Great Barrier Reef depends on scenic beauty as a value and areas that are integrally linked to the maintenance of the aesthetic qualities of the property	The aesthetic value and naturalness of the world heritage property are heavily reliant on the condition of the Region's biodiversity (Chapter 2) and ecosystem health (Chapter 3). The wholeness and intactness of the Reef's aesthetic attributes, above and below the water, are in good condition overall. But many elements which contribute to this criterion (such as clear water and bright colourful reef fish) are deteriorating. Some critical elements of natural phenomena, such as coral spawning, have deteriorated on a broad scale due to significant loss of coral broodstock following back-to-back bleaching events in 2016 and 2017. The criterion overall is considered good borderline poor. Quantifying the condition of this attribute on a Region-wide scale is difficult as it relies upon the state of the system, its appearance and perceptions of beauty.	
(viii) Major stages of the Earth's evolutionary history		
The Great Barrier Reef contains all or most of the key interrelated and interdependent elements in their natural relationships	At a Region-wide scale the Reef continues to provide outstanding examples of the Earth's evolutionary history and geomorphological diversity. However, unprecedented recent disturbances will have long-lasting effects. Processes that influence reef formation and maintain sediment accumulation on reef islands (for example, ocean acidification, sea temperature and sea-level rise) have deteriorated since 2014. The processes are intensifying in a negative way due to climate change, and pose the greatest threat to the Reef's contemporary geomorphology. Further deterioration of this element may occur if supporting physical and chemical processes continue to alter the geomorphology of the Region.	
(ix) Ecological and biological processes		
The Great Barrier Reef is a sufficient size and contains the necessary elements to demonstrate the key aspects of processes that are essential for the long-term conservation of the ecosystems and the biological diversity they contain	The condition of key processes that interlink and operate to keep the ecosystem functioning are assessed in Chapter 3. Ecological processes have not ceased to operate, although processes that are fundamental to a functioning ecosystem (such as symbiosis, recruitment and reef building) are considered to be in poor condition and are causing the good grade to be borderline with poor. Multiple disturbances have transformed the ecosystem on a broad scale and cumulatively hindered recovery. Historically, the Region's size has provided a buffer to periodic and dispersed damage due to its broad latitudinal extent. However, given the global scale of human-induced climate change, the size of the Region is becoming a less effective buffer to some broadscale impacts. Deterioration has been more rapid and widespread than was evident in the period 2009 to 2014.	
(x) Habitats for conservation of biodiversity		
The Great Barrier Reef is one of the most important properties for the conservation of biological diversity and those that contain habitats for maintaining the most diverse fauna and flora characteristic of the bio-geographic province and ecosystems under consideration	As a value distributed throughout the whole of the property, habitats to support species continue to deteriorate and are assessed as poor overall. Habitats for conservation of biodiversity face growing direct threats and external pressures. Safeguard measures to mitigate climate change are essential for the long-term conservation of the ecosystem. Declines in key habitats have been more rapid and widespread than was evident in the period 2009 to 2014. An emerging field of science around intervention and restoration measures has established since 2014, but many measures are yet to be fully tested or implemented.	
Safeguarding (protection and management)		
The Great Barrier Reef World Heritage Area has adequately delineated boundaries	The size of the world heritage property has remained consistent since inscription, at about 348,000 square kilometres. The Region's size is becoming a less effective buffer to some broadscale impacts. A buffer zone to the boundary of the World Heritage Area has never been a feature of the property. However, the Wet Tropics World Heritage Area provides an upstream buffer to a small part of the property. The health of the adjacent coastal ecosystems which link to the property, influences the Reef's outstanding universal value.	
The Great Barrier Reef is adequately protected at the national, regional, municipal, and/or traditional level by legislative, regulatory and contractual measures. Appropriate management plans are in place, specifying how the outstanding universal value of the property will be preserved	Adequate regulatory controls continue to be in place to protect and manage direct use of the property (Chapter 7). Aspects of management effectiveness for some management topics have improved since 2014 (ports, defence, shipping and research). However, management effectiveness has declined in some areas, particularly for complex and spatially broad topics (climate change and biodiversity). Complementary management arrangements between the Australian and Queensland governments strengthen the regulatory protection of outstanding universal value. The zoning regime of the Reef encompasses about 33 per cent of the World Heritage Area in 'no-take' or 'no-entry' zones. The *Environment Protection and Biodiversity Conservation Act 1999* (Cth) also provides protection and management of potential impacts from proposed actions outside the World Heritage Area that may significantly impact on its values. External pressures from global drivers, such as climate change, remain the greatest threat to the World Heritage Area and other properties globally.	

PROTECTION AND MANAGEMENT REQUIREMENTS

The GBR covers approximately 348,000 square kilometres. Most of the property lies within the GBR Marine Park: at 344,400 square kilometres, this Federal Marine Park comprises approximately 99% of the property. The GBR Marine Park's legal jurisdiction ends at low water mark along the mainland (with the exception of port areas) and around islands (with the exception of 70 Commonwealth managed islands which are part of the Marine Park). In addition the GBR also includes over 900 islands within the jurisdiction of Queensland, about half of which are declared as 'national parks', and the internal waters of Queensland that occur within the World Heritage boundary (including a number of long-established port areas).

The World Heritage property is and has always been managed as a multiple-use area. Uses include a range of commercial and recreational activities. The management of such a large and iconic world heritage property is made more complex due to the overlapping State and Federal jurisdictions. The Great Barrier Reef Marine Park Authority, an independent Australian Government agency, is responsible for protection and management of the GBR Marine Park. The Great Barrier Reef Marine Park Act 1975 was amended in 2007 and 2008, and now provides for “the long term protection and conservation ... of the Great Barrier Reef Region” with specific mention of meeting "... Australia's responsibilities under the World Heritage Convention".

Queensland is responsible for management of the Great Barrier Reef Coast Marine Park, established under the Marine Parks Act 2004 (Qld). This is contiguous with the GBR Marine Park and covers the area between low and high water marks and many of the waters within the jurisdictional limits of Queensland. Queensland is also responsible for management of most of the islands.

The overlapping jurisdictional arrangements mean that the importance of complementary legislation and complementary management of islands and the surrounding waters is well recognised by both governments. Strong cooperative partnerships and formal agreements exist between the Australian Government and the Queensland Government. In addition, strong relationships have been built between governments and commercial and recreational industries, research institutions and universities. Collectively this provides a comprehensive management influence over a much wider context than just the marine areas and islands.

Development and land use activities in coastal and water catchments adjacent to the property also have a fundamental and critical influence on the values within the property. The Queensland Government is responsible for natural resource management and land use planning for the islands, coast and hinterland adjacent to the GBR. Other Queensland and Federal legislation also protects the property’s Outstanding Universal Value addressing such matters as water quality, shipping management, sea dumping, fisheries management and environmental protection.

The Federal Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) provides an overarching mechanism for protecting the World Heritage values from inappropriate development, including actions taken inside or outside which could impact on its heritage values. This requires any development proposals to undergo rigorous environmental impact assessment processes, often including public consultation, after which the Federal Minister may decide, to approve, reject or approve under conditions designed to mitigate any significant impacts. A recent amendment to the EPBC Act makes the GBR Marine Park an additional 'trigger' for a matter of National Environmental Significance which provides additional protection for the values within the GBR.

The GBR Marine Park and the adjoining GBR Coast Marine Park are zoned to allow for a wide range of reasonable uses while ensuring overall protection, with conservation being the primary aim. The zoning spectrum provides for increasing levels of protection for the 'core conservation areas' which comprise the 115,000 square kilometres of ‘no-take’ and ‘no-entry’ zones within the GBR.

While the Zoning Plan is the 'cornerstone' of management and provides a spatial basis for determining where many activities can occur, zoning is only one of many spatial management tools and policies applied to collectively protect the GBR. Some activities are better managed using other spatial and temporal management tools like Plans of Management, Special Management Areas, Agreements with Traditional Owners and permits (often tied to specific zones or smaller areas within zones, but providing a detailed level of management not possible by zoning alone). These statutory instruments also protect the Outstanding Universal Value of the property.

Many Aboriginal and Torres Strait Island peoples undertake traditional use of marine resource activities to provide traditional food, practice their living maritime culture, and to educate younger generations about traditional and cultural rules and protocols. In the GBR these activities are managed under both Federal and Queensland legislation and policies including Traditional Use of Marine Resource Agreements (TUMRAs) and Indigenous Land Use Agreements (ILUAs). These currently cover some 30 % of the GBR inshore area, and support Traditional Owners to maintain cultural connections with their sea country.

Similarly non-statutory tools like site management and Industry Codes of Practice contribute to the protection of World Heritage values. Some spatial management tools are not permanently in place nor appear as part of the zoning, yet achieve effective protection for elements of biodiversity (e.g. the temporal closures that are legislated across the GBR prohibit all reef fishing during specific moon phases when reef fish are spawning).

Other key initiatives providing increased protection for the GBR include the comprehensive Great Barrier Reef Outlook Report (and its resulting 5-yearly reporting process); the Reef Water Quality Protection Plan; the GBR Climate Change Action Plan; and the Reef Guardians Stewardship Programs which involve building relationships and working closely with those who use and rely on the GBR or its catchment for their recreation or their business.

The 2009 Outlook Report identified the long-term challenges facing the GBR; these are dominated by climate change over the next few decades. The extent and persistence of damage to the GBR ecosystem will depend to a large degree on the amount of change in the world's climate and on the resilience of the GBR ecosystem to such change. This report also identified continued declining water quality from land-based sources, loss of coastal habitats from coastal development, and some impacts from fishing, illegal fishing and poaching as the other priority issues requiring management attention for the long-term protection of the GBR.

Emerging issues since the 2009 Outlook Report include proposed port expansions, increases in shipping activity, coastal development and intensification and changes in land use within the GBR catchment; population growth; the impacts from marine debris; illegal activities; and extreme weather events including floods and cyclones.

Further building the resilience of the GBR by improving water quality, reducing the loss of coastal habitats and increasing knowledge about fishing and its effects and encouraging modified practices, will give the GBR its best chance of adapting to and recovering from the threats ahead, including the impacts of a changing climate.

Note: This description is out of date related to more recent protection and management measures.

Rankings in Outlook Report 2019:

Grade 2019	Criterion and component summaries
↓	**Understanding of context:** Context is assessed as the strongest management effectiveness element in 2019. Across most management topics this element was mostly stable or improving. However, context has declined for biodiversity and traditional use of marine resources. Understanding of values, direct and indirect threats and stakeholders is generally strong. Some aspects of biodiversity, ecosystem health and environmental conditions are less understood as a consequence of the bleaching events and other cumulative pressures, such as cyclones and crown-of-thorns starfish predation. Tourism, defence activities, ports, recreation, research activities, shipping and land-based run-off are well understood. This reflects a solid information and research base and a very mature understanding of the key values in the Region.
↔	**Planning:** Significant efforts have been made in planning for a number of topics, such as ports, fishing, research activities, shipping and coastal development. However, planning effectiveness has continued to decline for climate change measures specific to the Region, principally as a result of defunding, changing policy and a lack of clarity about future directions. Planning has also declined for recreation largely because plans have not been reviewed since 2014. The lack of systems to ensure adequate monitoring is the weakest aspect of planning overall.
↑	**Financial staffing and information inputs:** Adequacy of inputs is variable across management topics, being least effective for climate change. Most topics did not adequately understand and apply Indigenous heritage and historic heritage information inputs. Resourcing has significantly increased for many areas of Reef management, through the Reef 2050 Plan and associated investment strategy. The Reef Joint Field Management Program and the Marine Park Authority have received significant stabilisation funding. The Queensland Government has also provided significant funding through the Office of the Great Barrier Reef. Staff inputs have been variable since 2014 across both governments, with injections in some places (biodiversity and community benefits) and reductions in others (climate change and coastal ecosystems).
↔	**Management systems and processes:** Management processes are particularly strong for defence activities, shipping, research activities and management of land-based run-off. They are weakest for climate change. Stakeholder and community engagement and application of biophysical information are the strongest aspects of management across all topics. Governance is generally strong, except for climate change. The application of socio-economic and heritage knowledge, and setting of targets to benchmark performance are problematic for many topics, but processes are generally stable to improving.
↔	**Delivery of outputs:** Delivery of desired outputs was rated as effective or mostly effective for all topics except climate change and recreation. It is strongest for commercial marine tourism, defence activities, research activities and traditional use of marine resources. The knowledge base of managing agencies and the community has consistently improved. While the majority of management programs are progressing satisfactorily, timeframes frequently slip and it is not yet clear that the programs are achieving all their desired objectives.
↑	**Achievement of outcomes:** Achievement of desired outcomes is highly variable across the management topics. Objectives are being achieved in relation to community understanding of issues and development of effective partnerships. Overall, performance is strong, particularly for research activities, shipping, ports, commercial marine tourism and defence activities. Performance is weakest for climate change and the management of climate change is ineffective. Biodiversity outcomes have declined markedly, principally as a result of cumulative impacts and bleaching events in 2016 and 2017.

Additional overview of the effectiveness of management measures (extracted directly from Outlook Report, 2019)

Increasing complexity

Effectiveness of existing measures						Management topic	Summary
Context	Planning	Inputs	Processes	Outputs	Outcomes		
↔	↘	↓	↘	↓	↘	Climate change	Management focus has significantly declined for climate change, particularly for outputs and outcomes.
↔	↑	↑	↑	↑	↗	Coastal development	Planning systems to effectively address coastal development have continued to evolve and improve.
↔	↔	↑	↔	↗	↔	Land-based run-off	Knowledge of water quality continues to be well understood, although outcomes continue to be poor due to significant time lags.
↑	↑	↔	↗	↑	↑	Ports	Ports within the Region are well managed. Coordinated and holistic planning for future port developments are undertaken through legislation and policy processes.
↔	↑	↑	↔	↔	↔	Fishing	The Sustainable Fisheries Strategy has improved planning and inputs of fishing.
↔	↔	↔	↔	↔	↗	Heritage values	Outcomes for the Region's heritage values have improved over the last five years.
↔	↔	↗	↔	↔	↔	Commercial marine tourism	A comprehensive suite of management tools contributes to the sustainable management of tourism activities.
↔	↘	↔	↔	↓	↔	Recreation (not including fishing)	Recreation is generally managed effectively. Outputs have declined as emphasis has shifted to emerging risks.
↓	↔	↔	↔	↑	↔	Traditional use of marine resources	Sound agreements and cooperative management are in place to address traditional use of marine resources.
↓	↔	↔	↔	↔	↓	Biodiversity values	Back-to-back bleaching events in 2016 and 2017 have dramatically changed the situation in relation to outcomes for biodiversity in the Region.
↗	↗	↑	↑	↔	↔	Community benefits of the environment	Community benefits are better defined and there has been a significant management focus in this area since 2014.
↑	↑	↑	↑	↗	↔	Shipping	Shipping is well regulated and managed.
↔	↑	↑	↑	↔	↔	Research activities	Planning, inputs and processes have all improved, largely as a result of enhanced systems and processes relating to management of research permits.
↔	↔	↑	↔	↔	↔	Defence activities	Defence activities continue to be managed effectively with close cooperation between agencies.

ANNEX 10: $1 billion AUD Reef Package

Information provided by DAWE

Australian Government - $1 billion Reef Package (March 2022)		2021-22 ($m)	2022-23 ($m)	2023-24 ($m)	2024-25 ($m)	2025-26 ($m)	Total 5yrs ($m)	2026-27 ($m)	2027-28 ($m)	2028-29 ($m)	2029-30 ($m)	Total 9yrs ($m)
Accelerating Actions to Meet Water Quality Targets	Total	3.2	14.0	34.8	83.1	86.7	221.9	90.4	89.5	89.1	89.0	579.9
	Department of Agriculture, Water and the Environment	3.2	8.0	6.8	5.1	4.7	27.9	5.4	4.5	4.1	4.0	45.9
	Special Account - Reef Trust (Administered)	0.0	6.0	28.0	78.0	82.0	194.0	85.0	85.0	85.0	85.0	534.0
	~ Water quality investment program (incl $50 m for Urban)	*0.0*	*1.3*	*23.0*	*70.6*	*73.2*	*168.1*	*77.6*	*77.6*	*77.6*	*76.2*	*477.1*
	~ Modelling, monitoring and reporting for water quality outcomes	*0.0*	*4.7*	*5.0*	*7.4*	*8.8*	*25.9*	*7.4*	*7.4*	*7.4*	*8.8*	*56.9*
Turning Innovative Science Into Real Reef Solutions	Total	0.0	1.1	1.1	20.9	21.0	44.1	15.9	14.9	8.9	9.0	92.7
	Department of Agriculture, Water and the Environment	0.0	1.1	1.1	0.9	1.0	4.1	0.9	0.9	0.9	1.0	7.7
	Special Account - Reef Trust (Administered)	0.0	0.0	0.0	20.0	20.0	40.0	15.0	14.0	8.0	8.0	85.0
Protecting the Outstanding Universal Value of the Reef through Strong Partnership and Stewardship	Total	1.1	3.8	7.9	13.1	10.0	35.9	11.0	9.1	9.1	9.3	74.4
Community and Traditional Owner on-ground Reef protection projects (DAWE)	Sub-total	0.4	2.1	3.9	6.6	7.5	20.5	7.1	6.6	6.6	6.8	47.6
	Department of Agriculture, Water and the Environment	0.4	1.3	1.2	1.0	1.9	5.8	1.5	1.0	1.0	1.2	10.5
	Special Account - Reef Trust (Administered)	0.0	0.8	2.7	5.6	5.6	14.7	5.6	5.6	5.6	5.6	37.1
	~ Traditional Owner Projects	*0.0*	*0.0*	*0.6*	*2.0*	*2.0*	*4.6*	*2.0*	*2.0*	*2.0*	*2.0*	*12.6*
	~ Community Projects	*0.0*	*0.0*	*0.5*	*2.0*	*2.0*	*4.5*	*2.0*	*2.0*	*2.0*	*2.0*	*12.5*
	~ Marine Debris	*0.0*	*0.5*	*1.0*	*1.0*	*1.0*	*3.5*	*1.0*	*1.0*	*1.0*	*1.0*	*7.5*
	~ Citizen Science	*0.0*	*0.3*	*0.6*	*0.6*	*0.6*	*2.1*	*0.6*	*0.6*	*0.6*	*0.6*	*4.5*
Reducing the impact of fishing - independent data validation	Sub-total	0.6	1.7	4.1	6.5	2.5	15.4	3.9	2.5	2.5	2.5	26.7
	Department of Agriculture, Water and the Environment	0.6	1.7	1.3	0.8	0.7	5.1	1.0	0.7	0.7	0.7	8.2
	Special Account - Reef Trust (Administered)	0.0	0.0	2.7	5.7	1.8	10.3	2.8	1.8	1.8	1.8	18.6
Reef ProtectionThrough World Leading Management Reef Management		0.9	27.6	30.9	29.9	30.2	119.6	30.1	31.9	34.2	37.2	252.9
Tourism Industry Activation and Reef Protection Initiative	Great Barrier Reef Marine Park Authority	0.4	6.7	8.0	0.0	0.0	15.1	0.0	0.0	0.0	0.0	15.1
Community Education and communication	Great Barrier Reef Marine Park Authority	0.0	0.6	0.5	0.5	0.5	2.1	0.5	0.5	0.5	0.5	4.0
Increasing Traditional Owners Involvement in management	Great Barrier Reef Marine Park Authority	0.0	1.8	2.0	2.2	2.2	8.1	2.2	2.4	2.3	2.4	17.4
World class innovative management - trialling new tools	Great Barrier Reef Marine Park Authority	0.0	2.0	2.1	2.2	2.2	8.5	2.2	2.7	2.6	2.2	18.2
Enhancing on-water presence and compliance	Great Barrier Reef Marine Park Authority	0.0	0.8	0.8	0.8	0.8	3.2	0.7	0.7	0.7	0.7	6.0
Enhanced Protection of at-risk marine species	Great Barrier Reef Marine Park Authority	0.5	1.6	1.9	1.6	1.9	7.5	1.6	1.9	1.7	1.8	14.5
Reef 2050 Integrated Monitoring and Reporting	Great Barrier Reef Marine Park Authority	0.0	2.1	2.1	2.0	2.0	8.1	2.0	2.0	2.0	2.0	16.1
Crown of thorns starfish control	Great Barrier Reef Marine Park Authority	0.0	12.1	13.5	20.6	20.7	66.9	20.8	21.8	24.3	27.7	161.5
	Total Package	5.2	46.6	74.7	147.0	147.9	421.5	147.4	145.4	141.2	144.5	999.9
	Sub-total Department of Agriculture, Water and the Environment	4.3	12.1	10.4	7.8	8.3	42.9	8.9	7.1	6.6	6.9	72.4
	Sub-total Special Account - Reef Trust (Administered)	0.0	6.8	33.4	109.3	109.4	259.0	108.4	106.4	100.4	100.4	674.7
	Sub-total Great Barrier Reef Marine Park Authority	0.9	27.6	30.9	29.9	30.2	119.6	30.1	31.9	34.2	37.2	252.9