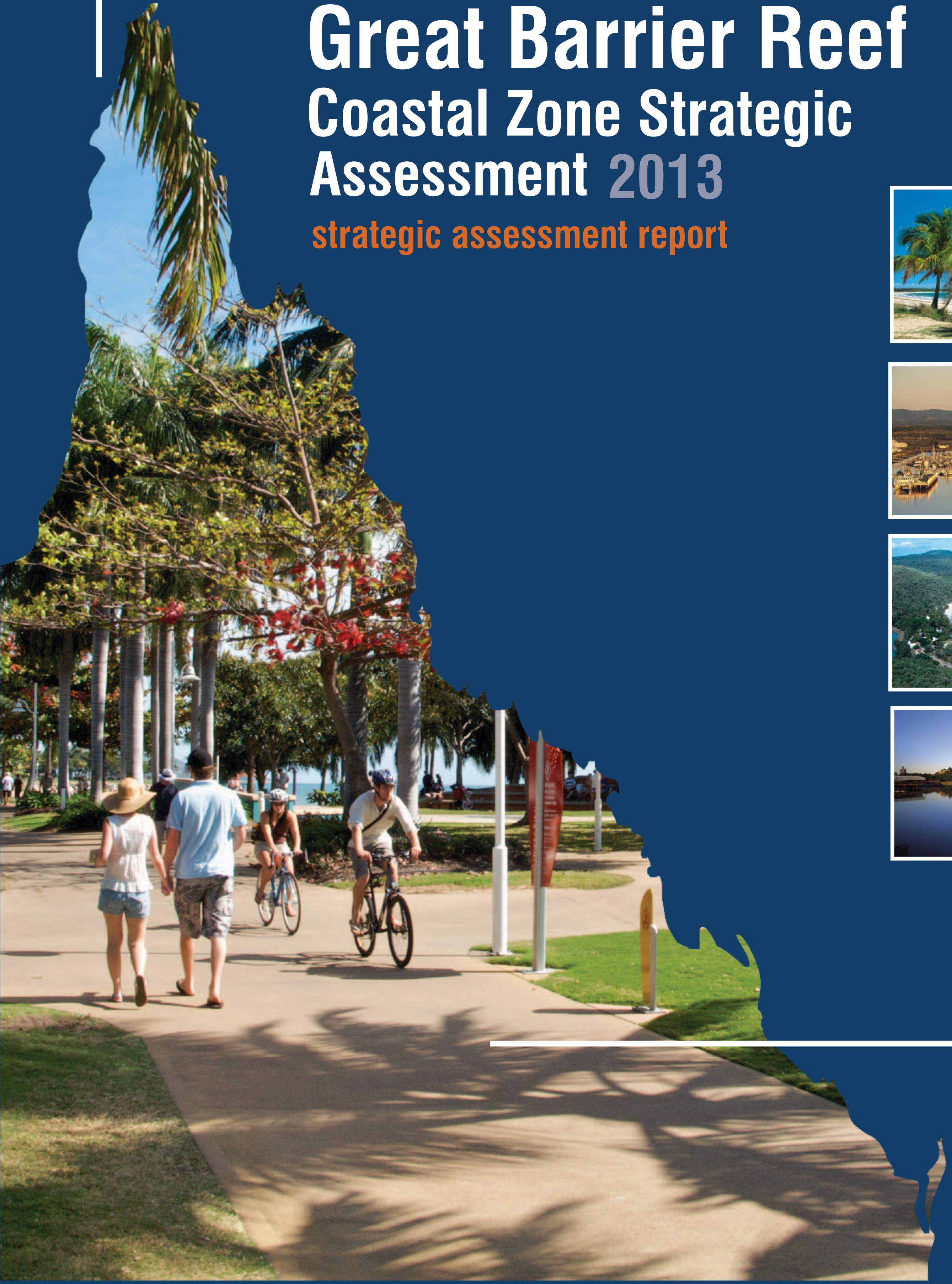
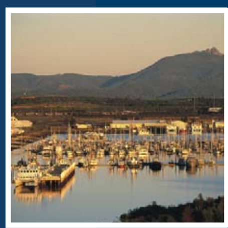
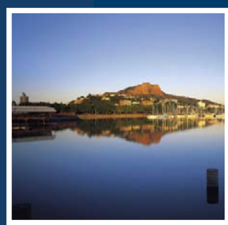
DRAFT for consultation

# Great Barrier Reef Coastal Zone Strategic Assessment 2013

## strategic assessment report







Queensland Government

**The Department of State Development, Infrastructure and Planning is responsible for driving the economic development of Queensland.**



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# Acknowledgements

Consultation processes on a range of Queensland Government initiatives have informed the Strategic Assessment of the coastal zone, including on the draft Great Barrier Reef Ports Strategy, the draft Queensland Ports Strategy, the draft State Planning Policy, the draft Coastal Management Plans and the draft Queensland Offsets Policy. The Queensland Government acknowledges and thanks all who have made contributions to these consultation processes.

Additionally many others have provided input into the Queensland Government strategic assessment during its development, including member organisations of the Strategic Assessment Stakeholder Reference Group, chaired by the Deputy Premier.

The Queensland Government has worked closely with the Australian Government, including the Great Barrier Reef Marine Park Authority (GBRMPA) in preparing this report and would like to thank the GBRMPA for its contributions of data and expertise, as well as its ongoing spirit of collaboration between the two Governments without which this report would not have been made possible.

The Queensland Government also acknowledges the contribution of the GBRMPA's committees which have provided advice on both the Queensland and GBRMPA strategic assessments.

A number of scientists have reviewed the technical framework that underpins the Queensland Government and the GBRMPA strategic assessment. Thank you to the Independent Science Panel members: Dr Roger Shaw, Dr Peter Doherty, Dr Neil Byron, Professor Eva Abal and Dr Mike Grundy who ensured a strong foundation for developing the Strategic Assessment reports through a rigorous and transparent methodology.

The contribution of a wide range of experts, both within and outside the Queensland Government who have provided advice and assistance during the preparation of the Queensland Government Strategic Assessment coastal zone is gratefully acknowledged.

An early draft version of this Strategic Assessment has been independently reviewed by Sinclair Knight Merz, to ensure the rigour of the assessment in accordance with the terms of reference. While some of the recommendations of this review have been addressed in this version of the Strategic Assessment, others could not be addressed within the short time between the finalisation of the review and the release of the Strategic Assessment for public consultation. Outstanding recommendations will be addressed during the public consultation period.

**Jeff Seeney MP**

Deputy Premier and Minister For State Development, Infrastructure and Planning

**Andrew Powell MP**

Minister for Environment and Heritage Protection

# Executive Summary

The Great Barrier Reef (GBR) is the world's largest coral reef ecosystem, spanning more than 348 000 square kilometres of the continental shelf of Queensland. It is internationally and nationally recognised to have significant environmental, social, cultural and heritage values. The recognition of these values carries an obligation and responsibility to protect and conserve the values for the future.

The Australian and Queensland governments have entered into an agreement to complete a comprehensive strategic assessment of the Great Barrier Reef World Heritage Area (GBRWHA) and adjacent coastal zone. The comprehensive strategic assessment comprises two parts: The Great Barrier Reef Region Strategic Assessment, undertaken by the Great Barrier Reef Marine Park Authority (the GBRMPA) addressing the marine environment; and the Great Barrier Reef Coastal Zone Strategic Assessment, undertaken by the Queensland Government. This report addresses the latter.

The coastal zone is defined as Queensland Coastal Waters, islands and inland areas to a distance of five kilometres or the 10 metres Australian Height Datum (AHD) contour, whichever is further. The AHD is the reference level adopted by the National Mapping Council of Australia, with 0.0 metres AHD approximately mean sea level.

The strategic assessment provides for review and assessment of the effectiveness of management arrangements at protecting the GBR's World Heritage values as well as all other matters of national environmental significance (MNES) which are afforded protection under the Environmental Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act). The goal is to help identify, plan for and manage existing and emerging risks to the unique environmental values of the MNES GBR coastal zone.

This strategic assessment is the largest in scale ever to be undertaken. The GBR coastal zone encompasses two world and national heritage areas – the Wet Tropics and the Great Barrier Reef – and two Ramsar wetlands of international importance – Bowling Green Bay and Shoalwater/Corio Bay. Across these the GBR coastal zone supports 11 key threatened species, 38 key migratory species and two key threatened ecological communities. Given the vast area and array of species supported by the GBR coastal zone this assessment has adopted a 'systems approach'. This enables targeted examination of the effectiveness of existing policies, plans and programs the Queensland Government uses to protect and manage MNES, including the outstanding universal value (OUV) of the World Heritage Areas (WHAs). It also provides a critique of how applicable the Queensland Government Program will be for protecting MNES over the next 25 years and how it will currently protects MNES, its expected performance over the next 25 years and how it will respond to emerging issues.

Two reports have been produced for the GBR coastal zone strategic assessment – a *program report*, which outlines the suite of policies, plans and programs being assessed, and this strategic assessment report – which analyses how effective these policies, plans and programs are at protecting MNES, including OUV. The complementary strategic assessment being completed by the GBRMPA focusses on the marine values of the GBRWHA, the condition and trend of those values, impacts and effectiveness of management arrangements. This report, therefore, focuses primarily on the terrestrial values of the GBR coastal zone. Where there are areas of joint management or overlap in values, they are covered in both strategic assessment reports.

This GBR coastal zone assessment highlights some systemic long-term and chronic impacts on MNES that largely influence their future outlook, such as climate change, poor catchment water quality and the impacts of historical broadscale clearing. There are also a range of relatively small scale and very localised impacts identified, including urban, industrial and port development.

The systemic threats to MNES are similar to those experienced nationwide and internationally. Climate change, a dominant feature in the outlook for the GBR, will put pressure on threatened and migratory species as as extreme weather events become more frequent. The Queensland Government Program includes management strategies that focus on building health and resilience so that MNES can better adapt and respond to climate effects.

Broadscale clearing for agriculture that occurred in Queensland until 2006 resulted in significant loss and fragmentation of habitat. This impacted directly on migratory and threatened species habitat and reduced the extent of threatened ecological communities. However, today Queensland maintains the highest level of biodiversity of any state or territory in Australia. Landmark reforms in legislation and natural resource management programs have begun to slow the decline in biodiversity by providing mechanisms to achieve significant reductions in the loss of habitat and vegetation, and improvements in water quality.

Major expansion in agricultural production over the last 150 years has led to significant declines in the quality of water flowing through catchments and into the GBR lagoon, with elevated levels of sediment, nutrients, pesticides and other pollutants observed. This affects not only the GBRWHA, but also adjacent wetlands and the threatened species that rely on both habitats.

Poor water quality remains one of the most significant issues facing the GBR. The 2013 Scientific Consensus Statement prepared by over 40 leading scientists identified that the decline in water quality from catchment runoff is the major cause of the current poor state of many of the key ecosystems. It identified the three major risks as nitrogen, fine sediment, and pesticide discharge. It also identified that the major source of the key pollutants is broadscale agriculture and that other sources such as urban areas, ports and shipping are relatively small but may be locally and over short time periods highly significant. In terms of risks, the consensus statement noted

that overall, nitrogen poses the greatest risk to coral because of its influence on crown of thorns starfish outbreaks, while sediment poses the greatest risk to seagrass.

Recognising the need to halt and reverse impacts from the decline in water quality the Queensland and Australian governments established the Reef Water Quality Protection Plan (Reef Plan) in 2003. The most recent Reef Report Card (2011 data) showed that runoff of sediment, nutrients and pesticides to the reef is reducing – a massive achievement following a long history of declining water quality. Although such water quality impacts will take several decades to reverse the effects of long term exposure, significant improvements are evidence of the suitability of the Reef Plan to continue to address this issue.

The estimated annual average sediment load delivered to the reef reduced by six per cent and pesticides by 15 per cent since the baseline report card (2009 data). The total nitrogen load reduced by seven per cent; however dissolved nitrogen, the key pollutant of concern, reduced by 13 per cent. This is a result of significant uptake of improved land management, with 34 per cent of sugarcane growers, 17 per cent of graziers and 25 per cent of horticulture producers having adopted improved farm management practices. However, the latest report card also showed a decline in marine condition from moderate to poor as a result of much higher than normal river discharge and the effects of cyclone Yasi (a highly destructive Category 5 tropical cyclone which crossed the Great Barrier Reef and Coastal Zone in February 2011). This reinforces the need to strengthen the resilience of the reef to the impacts of natural disaster by controlling the impacts from land-based activities.

In terms of site specific impacts, population growth and economic development are expected to drive further urban, port and industrial development within the GBR coastal zone. This has potential to cause a number of impacts on MNES. Impacts may include further loss and fragmentation of habitat, and downstream impacts from poor water quality. Relative to climate change, land clearing and runoff from broadscale agriculture, these impacts are less significant and more localised. Understanding the scale and pathway of impacts provides the ability to target relevant management action.

This *strategic assessment report* provides evidence that demonstrates the Queensland Government Program is broadly effective in protecting MNES, including OUV of the WHAs. Queensland's protected area estate is the cornerstone of protection for MNES. A large proportion (32 per cent) of the GBR coastal zone is within conservation areas. Eighty-nine per cent of the Wet Tropics WHA is contained in national parks, and large proportion of the Bowling Green Bay and Shoalwater/Corio Bay Ramsar wetlands are within terrestrial or marine protected areas (approximately 99 per cent and 80 per cent respectively). Ninety-six per cent of the area of the GBRWHA within the GBR coastal zone is within a marine protected area.

This review provides information demonstrating that Queensland Government's Program is broadly effective at protecting MNES, including OUV of the WHAs. There is a strong legislative system in place which enshrines a hierarchy to 'avoid, mitigate, offset' potential impacts. There is also a strong system of monitoring and reporting in place, particularly for water quality, that underpins an adaptive management process enabling continuous improvement of the Program. Supporting this is a robust system facilitating identification of areas of importance for MNES, particularly through mapping of areas of significance. This mapping is integrated into regional planning, port planning and industrial planning, although not explicitly in all cases. This helps ensure that areas critical for MNES are avoided from the outset. Measures to mitigate impacts on MNES through development assessment and conditioning are also effective and often require proponents to go beyond the minimum standard to ensure impacts are minimised as far as possible. The Australian Government, through a bilateral agreement under the EPBC Act, already accredits Queensland Government's process of assessing the impacts of individual developments on MNES. Compliance measures are in place to enforce approval conditions, backed by significant staffing resources. Through the existing Program, unacceptable impacts on MNES, including OUV should not occur.

This assessment has also identified some aspects of Queensland Program that are only partially effective at protecting MNES. This includes the current approach to offsets, which often delivers piecemeal outcomes. Recognising this, Queensland is proposing a new offsets policy aimed at delivering more strategic offsets that will have a net benefit for MNES by tackling the most significant threats.

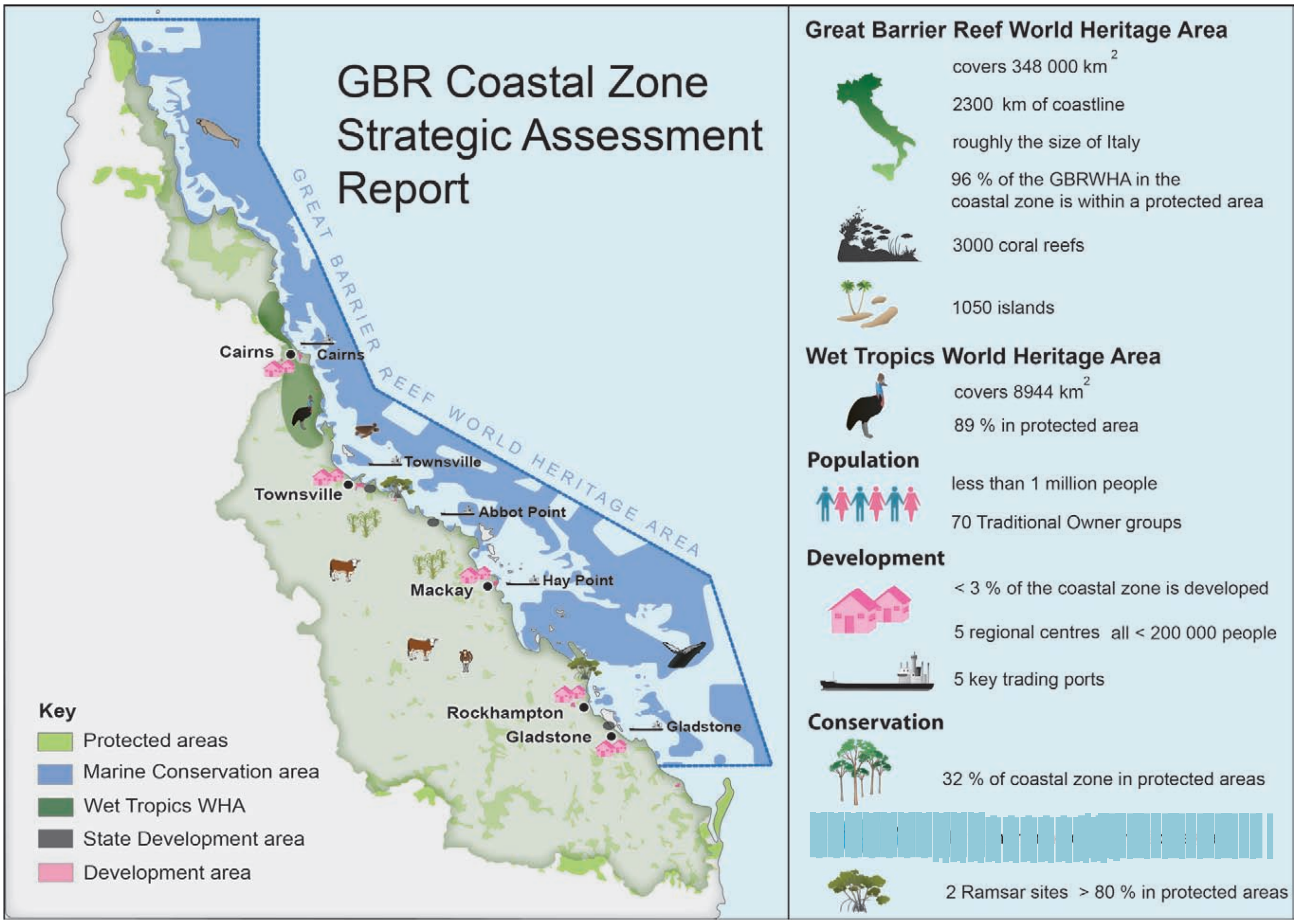
Management of port development also represents an area where further improvement is needed. The draft Great Barrier Reef Ports Strategy demonstrates the government's commitment to a planned and measured approach to future port development, which will ensure significant port development only occurs within existing port limits for the next ten years.

Building on the commitment to the Great Barrier Reef Ports' Strategy, the Draft Queensland Ports Strategy 2013, released for public comment in October 2013, provides the Queensland Government's blueprint for managing and improving the efficiency and environmental management of the state's port network over the next decade. It will further strengthen the effectiveness of environmental management at ports. Key actions will focus on the concentration of port development around long-established major ports in Queensland, and will provide guidance for port master planning through consistent principles for environmental, social and economic planning.

This strategic assessment has also identified a number of information gaps or data deficiencies. In response, Queensland Government also recommends a number of other changes to the Program to more explicitly capture MNES in Queensland Government's planning and development system. This will provide clearer line of site from the international and national level down to the local level for management and protection of MNES.

The strengths of Queensland Government's Program at protecting and managing MNES are summarised with supporting evidence within this report. The opportunities for improvement and adaptation identified by this review have directly informed the *Strengthening Management* and *Forward Commitments* sections in the *strategic assessment report.* With the range of policies, plans and programs in place, and the proposed changes and forward commitments, it is expected there will be improvements in the way the Program addresses impacts on MNES including OUV of the WHAs over its 25 year life.

With regard to reversing the decline in water quality being a major pressure on the health of the GBR, there is no doubt that this may take decades given the cumulative impacts of agricultural activity since settlement, however continual refinement of the Program and the adaptive management approach will ultimately result in an improved GBR environment. Continuing to build resilience in the system is the key to halting the decline, reversing the trend and minimising the all encompassing impacts of severe weather events, sea level rise and increased sea temperatures influenced by climate change.



# Contents

# Glossary and abbreviations

| Acronym / Abbreviation | Definition |
|---|---|
| ABS | Australian Bureau Of Statistics |
| AES | Areas of Ecological Significance |
| AGCS | Australian Standard Geographical Classification |
| AHD | Australian Height Datum |
| AIMS | Australian Institute Of Marine Science |
| AIS | Automated Identification System |
| ALC | Automatic location communicator |
| ALUM | Australian Land Use and Management |
| AMSA | Australian Maritime Safety Authority |
| APSDA | Abbot Point State Development Area |
| APVMA | Australian Pesticides and Veterinary Medicines Authority |
| AquaBAMM | Aquatic Biodiversity Assessment and Mapping Methodology |
| ASS | Acid Sulfate Soils |
| BAMM | Biodiversity Assessment Mapping Methodology |
| BMP | Best Management Practice |
| BoM | Bureau of Meteorology |
| BPA | Biodiversity Planning Assessments |
| BREE | Bureau of Resources And Energy Economics |
| CAMBA | China-Australia Migratory Bird Agreement |
| CBD | Central Business District |
| CFISH | The Commercial Fisheries Information System |
| CG | Coordinator-General |
| CIA | Cumulative Impact Assessment |
| CISDM | Cumulative Impact and Structured Decision-Making |
| COAG | Council of Australian Governments |
| COTS | crown of thorn starfish |
| CRC | Cooperative Research Centre |
| CSG | Coal seam gas |
| CSIRO | Commonwealth Scientific and Industrial Research Organisation |
| Cwth | Commonwealth |
| CY | Cape York |
| CYPAL | Cape York Peninsula Aboriginal Land |
| DA | Development assessment |
| DAFF | Department of Agriculture Fisheries and Forestry (Qld) |
| DBMP | Direct Benefit Management Plans |
| DEHP | Department of Environment and Heritage Protection (Qld) |
| DEO | Desired environmental outcomes |
| DERM | (Former) Department of Environment and Resource Management (Qld) |
| DEWHA | (Former) Department of Environment Water Heritage and The Arts (Commonwealth) |
| DNPRSR | Department of National Parks, Recreation, Sport and Racing (Qld) |
| DNRM | Department of Natural Resources and Mines (Qld) |
| DPC | Department of Premier and Cabinet (Qld) |
| DPIF | (Former) Department of Primary Industries and Fisheries |
| DRO | Desired Regional Outcomes |
| DSDIP | Department of State Development, Infrastructure and Planning (Qld) |
| DSITIA | Department of Science, Information Technology, Innovation and The Arts (Qld) |
| DTMR | Department of Transport and Main Roads (Qld) |
| ECD | Ecological Character Description |
| ED Act | *Economic Development Act 2012* (Qld) |
| EFAP | Environmental Flows Assessment Program |
| EIS | Environmental Impact Statement |
| EMP | Environmental Management Plan |
| EP Act | *Environment Protection Act 1994* (Qld) |
| EPA | Environmental Protection Agency |
| EPBC Act | *Environmental Protection and Biodiversity Conservation Act 1999* (Commonwealth) |
| EPP water | Environmental Protection (Water) Policy 2009 |
| ERAs | Environmentally relevant activities |

GLOSSARY & ABBREVIATIONS

| Acronym / Abbreviation | Definition |
|---|---|
| ESD | Ecologically Sustainable Development |
| EV | Environmental values |
| FBA | Fitzroy Basin Association |
| FC | Forward commitment |
| FFMP | Flora and Fauna Management Plan |
| FHA | Fish Habitat Areas |
| FNQ | Far North Queensland |
| GBR | Great Barrier Reef |
| GBR Marine Park | Great Barrier Reef Marine Park |
| GBR Marine Park Act | *Great Barrier Reef Marine Park Act 1975* (Cth) |
| GBRMPA | Great Barrier Reef Marine Park Authority |
| GBRWHA | Great Barrier Reef World Heritage Area |
| GCI | Ground Cover Index |
| GDP | Gross Domestic Product |
| GES | General Ecological Significance |
| GHHP | Gladstone Healthy Harbour Partnership |
| GIS | Geographic Information System |
| GPC | Gladstone Ports Corporation |
| GPS | Global positioning system |
| GSP | Gross State Product |
| HES | High Ecological Significance |
| HWMP | Healthy Waters Management Plans |
| IDAS | Integrated Development Assessment System |
| IGAE | Intergovernmental Agreement on the Environment |
| ILUP | Interim Land Use Plan |
| IMO | International Maritime Organization |
| IPA | Indigenous Protected Area |
| ISP | Independent Scientific Panel |
| IUCN | International Union for Conservation of Nature and Natural Resources |
| LGA | Local Government Area |
| LMS | Listed Migratory Species |
| LNG | Liquefied Natural Gas |
| LP Act | *Land Protection (Pest and Stock Route Management Act) 2002* |

| Acronym / Abbreviation | Definition |
|---|---|
| LTSEC | Listed Threatened Species and Ecological Communities |
| LUP | Land Use Plan |
| MARPOL | International Convention for the Prevention of Pollution from Ships |
| MEDQ | Minister for Economic Development Queensland |
| MES | Marine Ecological Significance |
| MIW | Mackay Isaac Whitsunday region |
| MNES | Matters of National Environment Significance |
| MOU | Memorandum of Understanding |
| MP | Marine Park |
| MP Act | *Marine Parks Act 2004* (Qld) |
| MPA | Master Plan Area |
| MSES | Matters of State Environmental Significance |
| MSQ | Maritime Safety Queensland |
| MTSRF | Marine and Tropical Sciences Research Facility |
| NC Act | *Nature Conservation Act 1992* (Qld) |
| NERP | National Environmental Research Program |
| NHA | National Heritage Area |
| NP | National Park |
| NPRSR | Department of National Parks, Recreation, Sport and Racing (Qld) |
| NQBP | North Queensland Bulk Ports |
| NRM | Natural Resource Management |
| NWQMS | National Water Quality Management Strategy |
| OCS | Offshore Constitutional Settlement |
| OESR | Office of Economic and Statistical Research |
| OUV | Outstanding Universal Value |
| PCIMP | Port Curtis Integrated Monitoring Program |
| PDA | Priority development areas |
| PMST | Protected Matters Search Tool |
| QASSIT | Queensland Acid Sulfate Soils Investigation Team |

| Acronym / Abbreviation | Definition |
|---|---|
| QGEOP | Queensland Government Environmental Offsets Policy |
| QGIS | Queensland Government Spatial Geographic Service |
| Qld | Queensland |
| QLUMP | Queensland Land Use Mapping Program |
| QPP | Queensland Planning Provisions |
| QPWS | Queensland Parks and Wildlife Service |
| QWP | Queensland Wetlands Program |
| RAA | Resource Allocation Authority |
| RE | Regional ecosystem |
| REC | Recommendation |
| REEFREP | Mandatory ship reporting system |
| REEFVTS | Great Barrier Reef and Torres Strait Vessel Traffic Service |
| RIS | Regional investment strategies |
| ROKAMBA | Republic of Korea-Australia Migratory Bird Agreement |
| SAR | Strategic assessment report |
| SARA | State Assessment and Referral Agency |
| SCL | Strategic Cropping Land |
| SDA | State development area |
| SDM | Structured Decision-Making |
| SDPWO Act | *State Development and Public Works Organisation Act 1971* (Qld) |
| SEAP | Stream and Estuary Assessment Program |
| SEIS | Supplementary Environmental Impact Statement |
| SEQ | South East Queensland |
| SEWPaC | (former) Department of Sustainability, Environment, Water, Population and Communities (Commonwealth) |
| SLATS | Statewide Landcover and Trees Study |
| SOCI | Species of Conservation Interest |
| SoE | State of the Environment |
| SP Act | *Sustainable Planning Act 2009* (Qld) |
| SPI | State planning instruments |
| SPL | Strategic port land |
| SPP | State planning policy |
| SPRAT | Species profile and threats database |
| SPRP | State planning regulatory provisions |
| SRA | Strategic Rehabilitation Area |
| SRP | Statutory Regional Plan |
| SWAN | Surface water ambient network |
| TDEV | Total Domestic Economic Value |
| TEC | Threatened Ecological Community |
| TI Act | *Transport Infrastructure Act 1994* (Qld) |
| TIEV | Total Inbound Economic Value |
| TIPA | Tourism In Protected Areas |
| TLPI | Temporary Local Planning Instrument |
| TOMP Act | *Transport Operations (Marine Pollution) Act 1995* |
| TOMS Act | *Transport Operations (Marine Safety) Act 1994* |
| TOR | Terms Of Reference |
| TPC Act | *Transport Planning and Coordination Act 1994* |
| TUMRA | Traditional Use of Marine Resources Agreements |
| UDA | Urban Development Area |
| ULDA | Urban Land Development Authority |
| UNESCO | United Nations Educational, Scientific, And Cultural Organization |
| VAST | Vegetation Assets, States, and Transitions |
| VM Act | *Vegetation Management Act 1999* (Qld) |
| VMS | Vessel Monitoring System |
| VTS | Vessel Traffic Service |
| WBDDP | Western Basin Dredging And Disposal Project |
| Wet Tropics WHPM Act | *Wet Tropics World Heritage Protection and Management Act 1993* (Qld) |
| WHA | World Heritage Area |
| WHPM | World Heritage Protection and Management |
| WII | Wetlands of International Importance |
| WildNet | Queensland Government's corporate application for wildlife information and survey data across Queensland |
| WQG | water quality guidelines |
| WQIP | Water Quality Improvement Plan |
| WQO | Water Quality Objective |
| WRP | Water resource plan |

| Term | Definition |
|---|---|
| Strategic assessment | As described under Part 10 of the Environment Protection and Biodiversity Act 1999 |
| Bioregion | A region defined by characteristics of the natural environment rather than by man-made divisions |
| Action | Includes a project, a development, an undertaking, an activity or series of activities, and an alteration to any of these things. (Adapted from the EPBC Act) |
| Benthic | Relating to organisms living on or in sediment (including the sea floor) |
| Biodiversity | The variability among living organisms from all sources (including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part). It includes diversity within species and between species; and diversity of ecosystems. (EPBC Act) |
| Coastal ecosystem | Inshore, coastal and adjacent catchment ecosystems that connect the land and sea and have the potential to influence the health and resilience of the Great Barrier Reef |
| Coastal zone | That area of land and sea in or adjacent to the Great Barrier Reef containing Queensland waters plus adjacent inland areas that are either within 5 km of the coast or are less than 10 m above sea level (whichever is the further). |
| Cumulative impact | The impact on the environment resulting from the impacts of one or more pressures, and the interactions between those pressures, added to other past, present, and reasonably foreseeable future pressures. |
| Cumulative risk | The combined risks to the environment of multiple impacts |
| Driver | An overarching cause that can drive change in the environment. (Australia State of the Environment Report 2011) |

| Term | Definition |
|---|---|
| Ecologically sustainable use | Use of natural resources within their capacity to sustain natural processes while maintaining the life support systems of nature and ensuring that the benefit of the use to the present generation does not diminish the potential to meet the needs and aspirations of future generations. (EPBC Act) |
| Ecosystem | A dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit. (EPBC Act) |
| Ecosystem based management | An integrated approach to managing an ecosystem and matters affecting that ecosystem, with the main object being to maintain ecological processes, biodiversity and functioning biological communities. (GBRMP Act) |
| Ecosystem services | Actions or attributes of ecosystems of benefit to humans, including regulation of the atmosphere, maintenance of soil fertility, food production, regulation of water flows, filtration of water, pest control and waste disposal. It also includes social and cultural services, such as the opportunity for people to experience nature. (Australia State of the Environment Report 2011) |
| Environment | Includes ecosystems and their constituent parts, including people and communities; natural and physical resources; the qualities and characteristics of locations, places and areas heritage values of places; and the social, economic and cultural aspects of the above. (EPBC Act) |
| Geomorphology | Scientific study of landforms and the processes that shape them. (Australia State of the Environment Report 2011) |
| Habitat | The environment occupied by an organism or groups of organisms. (Adapted from the EPBC Act) |
| Heritage Value | A place's natural and cultural environment having aesthetic, historic, scientific or social significance, or other significance, for current and future generations of Australians. (EPBC Act) |

# Glossary and abbreviations

| Term | Definition |
|---|---|
| Impact | An event or circumstance which has an effect, either positive or negative, on a value. |
| Indigenous person | A person who is a member of the Aboriginal race of Australia; or a descendant of an Indigenous inhabitant of the Torres Strait Islands. (GBRMP Act) |
| Indirect impact | An impact that is not the direct result of a particular action but has been made possible by that action. These include downstream or upstream impacts and facilitated impacts (impacts which result from further actions). |
| Integrity | A measure of the wholeness and intactness of the natural and/or cultural heritage and its attributes. (Operational Guidelines for the Implementation of the World Heritage Convention paragraph number 88-95) |
| Listed migratory species | A migratory species that is native or that is included under a relevant international convention, which has been included by the Minister on the published list of migratory species. (Adapted from the EPBC Act) |
| Listed threatened species | A native species which is extinct, extinct in the wild, critically endangered, endangered, vulnerable or conservation dependent, as set out in the published list of threatened species established by the Minister. (Adapted from the EPBC Act) |
| Outstanding Universal Value | Cultural and/or natural significance which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity |
| Pelagic | Relating to the open sea |
| Protected species | A species that is a cetacean; a listed marine species, a listed migratory species, a listed threatened ecological community, or a listed threatened species; a species of marine mammal, bird or reptile that is prescribed as endangered wildlife, vulnerable wildlife or rare wildlife under the Nature Conservation Act 1992 of Queensland; a species declared to be a protected species for the purposes of this definition; a species declared to be a strictly protected species for the purposes of this definition. (GBRMPA Act) |
| Precautionary principle | The principle that lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degradation of the environment where there are threats of serious or irreversible environmental damage. (GBRMP Act) |
| Pressure | An activity or group of activities that cause an impact on a value |
| Recreation | An independent visit for enjoyment that is not part of a commercial operation. It is distinct from tourism where a visitor has paid to be part of a commercial operation |
| Risk | The possibility of something happening that impacts on your objectives. It is the chance to either make a gain or a loss and is measured in terms of likelihood and consequence. (Australia/New Zealand Standard for Risk Management (AS/NZS 4360:2004)) |
| Tourism | Commercial activities that provide transport, accommodation or services to people who are visiting principally for recreation. (Derived from GBRMP Act) |
| Traditional Owner | An Indigenous person who is recognised in the Indigenous community or by a relevant representative Aboriginal or Torres Strait Islander as having spiritual or cultural affiliations with a site or area in the Marine Park or as holding native title in relation to that site or area; and who is entitled to undertake activities under Aboriginal or Torres Strait Islander custom or tradition in that site or area. |
| Value | Those aspects or attributes of an environment that make it of significance |
| Vulnerability | The degree to which a system, organism or community is susceptible to, and unable to cope with, an impact. |
| World Heritage values | The natural and cultural heritage contained in a World Heritage property. (Adapted from the EPBC Act) |

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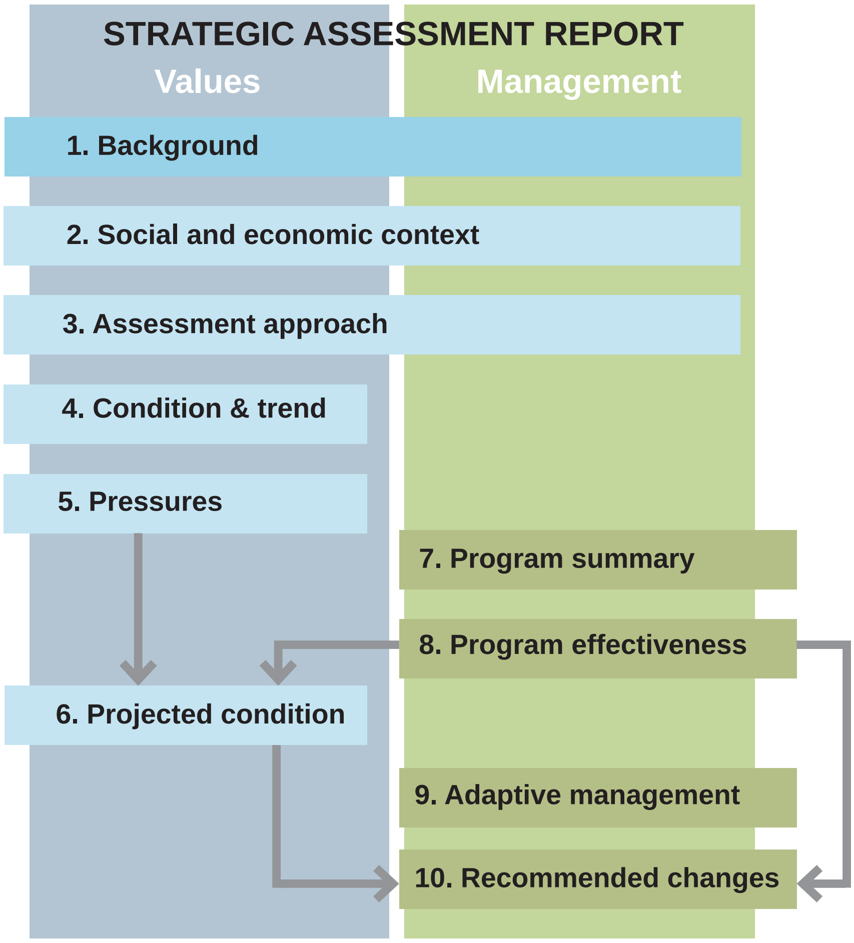
# Chapter 1

## background

# 1. Background






## 1.1 The Great Barrier Reef

The Great Barrier Reef (GBR) is one of Australia's most treasured natural wonders and is internationally renowned for its biodiversity and beauty. It was inscribed on the World Heritage list in 1981 for its outstanding universal value (OUV).

The GBR is a multiple-use area that supports a range of activities and industries, such as tourism, fishing, boating and shipping. Its adjacent catchments also support many communities and diverse industries that generate more than $40 billion annually.[10] The region is critical to the economic and social wellbeing of more than one million Australians. The Queensland and Australian governments have responsibility for different elements of management of the GBR:

- The Queensland Government manages urban, industrial, port and infrastructure land use and development within Queensland, including the GBR coastal zone. It also manages fisheries within Queensland waters, shipping within port limits, coastal vegetation and biodiversity conservation and pollution, including rural diffuse runoff.
- The Australian Government, through the Great Barrier Reef Marine Park Authority (the GBRMPA), manages activities occurring in the GBR Marine Park. The Australian Government is also responsible for shipping generally, and particularly through the GBR Marine Park.
- Under the EPBC Act, the Australian Government also makes decisions about actions that have the potential to significantly impact MNES in the GBR and elsewhere.

- The two governments have joint responsibility in some areas, including field management within the GBR Marine Park and national park islands, such as enforcement of marine park regulations
- While pollution management is Queensland Government's responsibility, both governments manage an integrated program to improve water quality from diffuse rural sources.

The Queensland and Australian governments are committed to ensuring the GBR is passed on to future generations retaining the values for which it was declared a World Heritage Area (WHA), as well as continuing to be one of the best-known and iconic marine protected areas in the world and an outstanding part of Australia's heritage, managed by Australians for global benefit.

The Great Barrier Reef World Heritage Area (GBRWHA)

- Covers an area of 348 000 square kilometres – it is bigger than Victoria and Tasmania combined or equivalent to the area of Italy or Japan
- Spans more than 2300 kilometres along the Queensland coast - equal in length to the entire west coast of the USA from the Canadian to the Mexican borders
- Extends between 70 and 250 kilometres offshore from the low water mark on the mainland coast
- Includes around 3000 separate coral reefs and 1050 islands
- Includes extensive aquatic biodiversity, from coastal estuarine systems, shallow inshore fringing reefs, 43 000 square kilometres of seagrass meadows and more than 2000 square kilometres of mangroves

Source: [3]

## 1.2 Two complementary strategic assessments

Two complementary strategic assessments are being undertaken, which together make up the comprehensive strategic assessment requested by the World Heritage Committee:

1. The Queensland Government has prepared the coastal zone component, describing and assessing the Program governing GBR coastal zone planning, development and management.
2. The GBRMPA has prepared the marine (GBR region) component which looks at the arrangements in place to manage and protect the GBRWHA.

The marine and coastal ecosystems are intrinsically linked and their functions are inter-related. In preparing the strategic assessments the GBRMPA and the Queensland Government have worked together to analyse impacts at the marine–coastal interface from activities such as shipping, water quality, coastal development and island management (Figure 1.2 1).

The Queensland and GBRMPA strategic assessments each deliver two reports:

- **a *program report*** containing a detailed description of the planning, development and natural resource management arrangements, including future commitments, to protect and manage MNES, including OUV
- **a strategic assessment report** containing an assessment of the state of MNES and the effectiveness of the Program to protect MNES, or reverse the decline in the extent or condition of MNES from current or potential future impacts based on changes arising from the forward commitments.

The two strategic assessments will inform development of a long term sustainability plan for the GBRWHA by 2015 (Figure 1.2 1).

It is important to note that the nature of the management responsibilities of the Queensland Government and the GBRMPA vary considerably and therefore the scope and scale of the strategic assessments vary.

The marine and coastal ecosystems are intrinsically linked and their functions are inter-related. The Queensland Government and the GBRMPA have worked closely together to ensure a complementary approach. Where there are joint management responsibilities, the management measures are outlined in both *program report*s to ensure consistency. Such issues include marine threatened species management, island management, water quality, and the regulation of Ramsar wetlands.

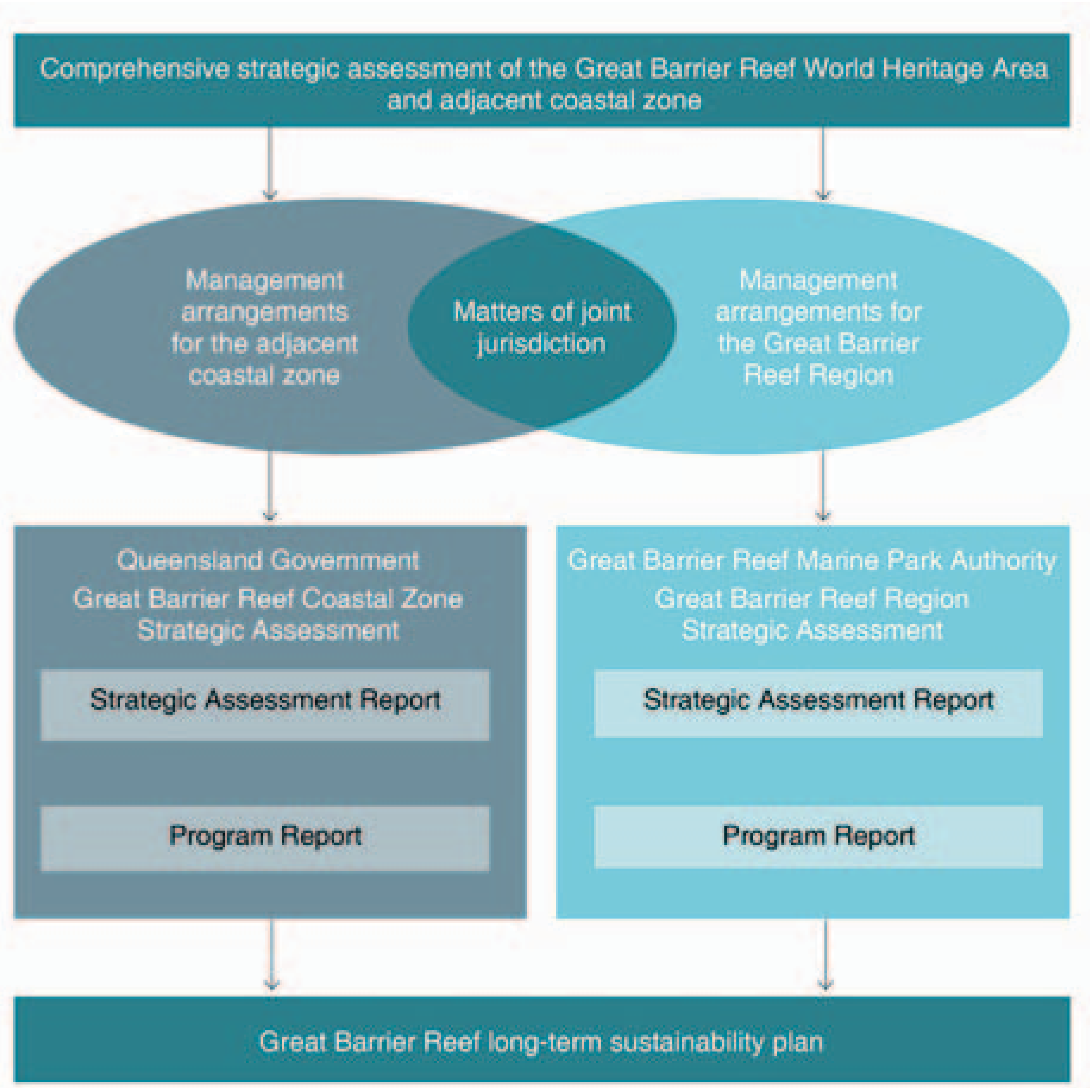



Figure 1.2-1 Reports delivered as part of the two complementary strategic assessments and link to the GBR long term sustainability plan

## 1.3 Objectives and purpose of the strategic assessment

This strategic assessment is a broad systems and landscape scale assessment of Queensland Government's policies, plans or programs that relate to the management and protection of matters of national environmental significance (MNES). It has been prepared in accordance with section 146 of the EPBC Act. It contrasts with project by project environmental impact assessment by looking at existing mechanisms that manage all or a range of activities that may significantly impact matters of national environmental significance (MNES), including OUV.

This comprehensive strategic assessment will help identify, plan for and manage existing and emerging risks to ensure ongoing protection and management of the unique environmental values of the GBRWHA and adjacent GBR coastal zone. This will be achieved in the GBR coastal zone by ensuring:

- the adequacy of existing management arrangements for MNES in and adjacent to the GBRWHA
- planning, development and land management in the GBR coastal zone avoids, mitigates or offsets significant direct, indirect and cumulative impacts on MNES.

This assessment describes how Queensland Government's policies, plans and programs protect and enhance MNES, both for existing and emerging risks. The assessment achieves this by:

- determining the current extent, condition and trend of MNES within the GBR coastal zone
- identifying the past and present activities and pressures acting on MNES that are the cause of these trends
- demonstrating how Queensland Government's Program (planning, development and land management components) will stabilise and reverse declining trends, and improve the resilience of MNES to cope with impacts beyond the control of the Program (such as severe weather events and climate change related impacts).

The strategic assessment is intended to demonstrate the Queensland Government Program's effectiveness, with proposed improvements (forward commitments) aimed at ensuring that future significant direct, indirect and cumulative impacts on MNES will be avoided and that legacy impacts from past land clearing and longstanding agricultural practices will be ameliorated.

Both the Queensland and Australian governments aspire to streamline environmental approvals as a result of the strategic assessment and ensure the best possible environmental outcomes through the process.

This strategic assessment also forms part of Australia's response to the World Heritage Committee's concerns regarding the impact of development on the GBRWHA (Terms of Reference, i-11).

## 1.4 Scope of the Queensland Government strategic assessment

Queensland Government's strategic assessment covers the coastal zone adjacent to the GBR, including Queensland's Coastal Waters, islands and adjacent inland areas (see Figure 1.4 1).

The coastal zone is defined as Queensland Coastal Waters, islands and inland areas to a distance of five kilometres or the 10 metres AHD contour, whichever is further. The AHD is the reference level adopted by the National Mapping Council of Australia, with 0.0 metres AHD approximately mean sea level.

Queensland Government's *Coastal Protection and Management Act 1995* (Coastal Act) also defines the coastal zone. Queensland has jurisdictional responsibility over Queensland Coastal Waters, defined by a line three nautical miles seaward of the territorial sea baseline including islands.

The GBR coastal zone incorporates parts of the GBRWHA and GBR Marine Park. The strategic assessment also considers activities within the broader GBR catchment areas to the extent that water quality management arrangements apply.

The strategic assessment addresses the following MNES components, as required by the terms of reference (TOR):

- World Heritage properties (GBRWHA and the Wet Tropics WHA)
- National Heritage places (GBRWHA and the Wet Tropics WHA)
- Commonwealth marine areas
- the GBR Marine Park
- wetlands of international importance (Ramsar wetlands – Bowling Green Bay, and Shoalwater and Corio Bay)
- listed threatened species and ecological communities
- listed migratory species.

The Commonwealth marine area falls outside the GBR coastal zone and is assessed in the GBR Region Strategic Assessment. The GBR Marine Park and GBRWHA also extend beyond the GBR coastal zone.

In investigating impacts on these MNES, there is explicit consideration of matters relating to the OUV of the GBRWHA and the Wet tropics WHA, being those internationally recognised exceptional qualities that make these areas worthy of special

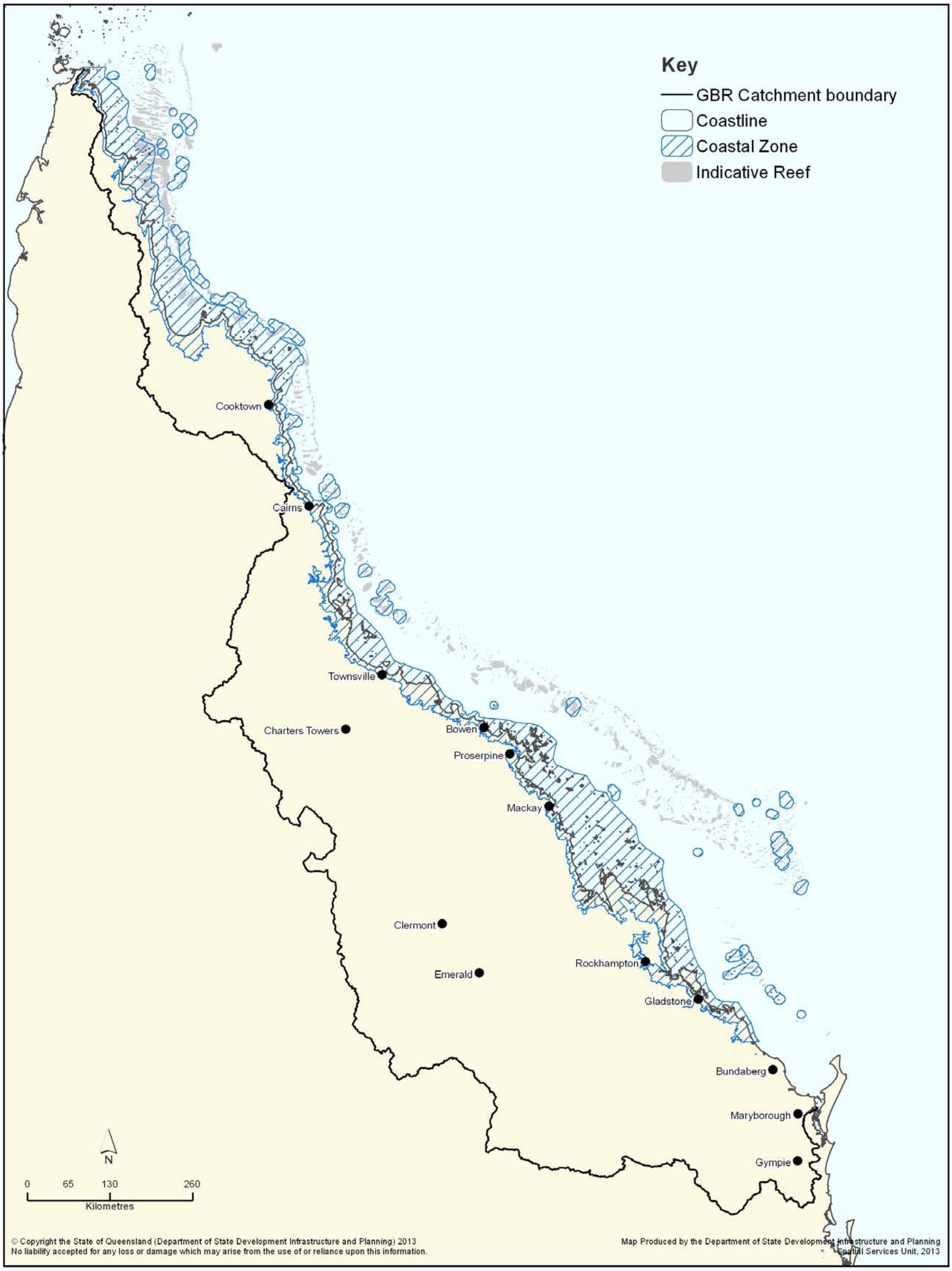



Figure 1.4-1 Spatial scope of the Great Barrier Reef coastal zone strategic assessment

protection. The WHAs are considered to be of OUV on the basis that they meet all four of the natural criteria specified in the Convention concerning the Protection of the World Natural and Cultural Heritage (the World Heritage Convention).

The GBR coastal zone strategic assessment considers potential impacts on MNES from a range of activities, including coastal urban and industrial development, port development, agriculture and natural resource management. The types of major development that may occur in the GBR coastal zone during the 25 year lifespan of the Program include:

- development activities (e.g. urban, infrastructure, aquaculture, tourist developments) consistent with state and local planning instruments under Queensland Government's *Sustainable Planning Act 2009* (SP Act) and/or assessed under the *State Development and Public Works Organisation Act 1971* (SDPWO Act) or *Environment Protection Act 1994* (EP Act)
- planned urban development within a priority development area under Queensland Government's *Economic Development Act 2012* (ED Act) where it is consistent with an approved development scheme
- planned industrial development within a state development area (assessed under the SDPWO Act) where it is consistent with an approved development scheme
- proposed port developments within existing port limits where it is consistent with a port land use plan (LUP) under Queensland Government's *Transport Infrastructure Act 1994* (TI Act) and the Queensland Government's strategy for port developments

The strategic assessment also covers Program components to enhance MNES. These are targeted at the main pressures and impacts on MNES in the GBR coastal zone including loss of habitat extent and condition, decline in water quality and pest and weed species.

Planning and decision making for development outside the GBR coastal zone, including mining, agriculture and water resource projects, is not included in the *strategic assessment report*, except in relation to the impacts of these activities on MNES within the GBR coastal zone.

## 1.5 Environmental management

### 1.5.1 Governance of the GBR

Environmental issues regarding the GBR came to the fore in the 1970s and 80s and much of the foundation work to establish jurisdictional arrangements for environmental management was established at that time.

Prime Minister Malcolm Fraser and Premier Joh Bjelke-Petersen signed the first GBR intergovernmental agreement (known as the Emerald Agreement) in 1979. It set out how the two governments would work together in joint management of the GBR. At the time, it was agreed that it was the policies of the respective governments to prohibit mining and drilling on the GBR.[11] In 2009 the Intergovernmental Agreement was updated to include more contemporary issues. Its objective is to ensure an integrated and collaborative approach is taken by the Australian and Queensland governments to manage marine and land environments within the GBRWHA.

An Offshore Constitutional Settlement was also signed by both governments in 1979, clarifying the jurisdictional arrangements that apply in coastal areas. The Offshore Constitutional Settlement established that, in general, Queensland Government's laws would apply in Queensland coastal waters, noting that in the GBR region the *Great Barrier Reef Marine Park Act 1975* (Cth) (GBR Marine Park Act) also applies where the Marine Park overlaps with Queensland's coastal waters. In 1999 the Australian Government established its statutory role for environmental management of MNES under the EPBC Act, including decisions about actions that have the potential to significantly impact MNES in the GBR and elsewhere.

The Great Barrier Reef Ministerial Forum drives implementation of the Intergovernmental Agreement. It will continue to be an important mechanism for the Queensland and Australian governments to work together to ensure the protection and joint management of the GBR.

### Jurisdictional Framework

The Australian Government is responsible for the management of the GBR Marine Park, established under the Great Barrier Reef Marine Park Act.

Queensland is responsible for the management of the GBR Coast Marine Park, covering approximately 63000 square kilometres, which is 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 mark in addition to many other marine areas within Queensland waters.

The majority of the islands in the GBRWHA fall within the jurisdiction of Queensland and almost half of these are national parks under the NC Act. There are around 70 islands that are owned by the Australian Government and form part of the GBR Marine Park.

The Queensland and Australian governments each have responsibilities relating to fisheries in the GBRWHA under the *Fisheries Management Act 1991* (Cth), the *Fisheries Act 1994* (Qld) and the EPBC Act (Cth).

The Queensland Government is responsible for natural resource management (NRM), land use planning and development assessment within the GBR coastal zone, through the SP Act and the Coastal Act and non-statutory NRM programs.

The Australian Government is responsible under the EPBC Act for regulating activities having or likely to have a significant impact on MNES as defined by the EPBC Act, and on the environment within Commonwealth land and waters.

Source: Great Barrier Reef Intergovernmental Agreement (2009)

### 1.5.2 Queensland management

The Queensland Government has a strong history of environmental management of the reef and adjacent catchments. The Queensland Government environmental management of the GBR has evolved over time to respond to emerging threats and issues, as illustrated below (Figure 1.5 1).


Figure 1.5-1 History of management of the Great Barrier Reef.

Further details regarding key events in Queensland environmental management of the GBR are outlined below.

**1980s** The crown-of-thorns starfish outbreak was a focus for research and monitoring activities and localised control at high value sites was undertaken.

**1990s** Queensland introduced a suite of new environmental protection legislation , including the *Fisheries Act 1994* (Fisheries Act), Coastal Act, EP Act, *Nature Conservation Act 1992* (NC Act) *Integrated Planning Act 1997* and *Vegetation Management Act 1999* (VM Act). Together these important pieces of legislation provide the foundation for ongoing environmental protection in Queensland and they continue today (apart from the Integrated Planning Act which was replaced by the SP Act). The 1990s also saw significant reforms in the trawl fishery, the establishment of dugong protection areas and the formation of both the Queensland Parks and Wildlife Service (QPWS) and the Wet Tropics Management Authority (WTMA).

**Early 2000s** The Queensland Government implemented marine park zoning for the Great Barrier Reef Coastal Marine Park to complement the GBRMPA's marine park zoning. During

CHAPTER 1 I background

this period there was recognition that one of the greatest threats to the reef was from poor water quality resulting from agricultural runoff. A consensus statement on the latest science prompted the establishment of the first Reef Water Quality Protection Plan (Reef Plan) in 2003. Both the Australian and Queensland governments agreed in 2003 to jointly fund the Queensland Wetlands Program to provide vital information on wetland management.

**2006** Broadscale clearing ended - a landmark reform that will have enduring benefits for biodiversity and water quality well into the future.

**2009** Queensland introduced further vegetation management reforms to protect riparian and regrowth vegetation in priority reef catchments (Mackay Whitsundays, Wet Tropics and Burdekin).

**2009** The Reef Plan was updated to accelerate actions to improve water quality, as a new scientific consensus statement indicated that management actions were not effectively addressing the problem. Queensland committed to invest $175 million over five years in water quality initiatives and has more recently recommitted investment for the next phase of Reef Plan beyond 2013.

**2009** The SP Act replaced the *Integrated Planning Act 1997*.

**Late 2000s** Queensland Government implemented reforms to the reef line and net fisheries which significantly reduced commercial fishing and helped solidify the long-term sustainability of both fisheries. To complement the reforms, a $9 million buyout of the net fishery is currently being implemented which will both improve profitability for the industry and have conservation benefits.

**2011** The avoid, mitigate, offset principle was enshrined in the Queensland Government Environmental Offsets Policy and through acts such as the SP Act and EP Act. This has helped establish a solid framework for considering the potential impacts of future development and will ensure that unacceptable impacts do not occur.

The contemporary management focus for Queensland is around sustainable coastal development and continuing efforts to address water quality. The strategic assessment is a unique opportunity to identify the key areas of reform over the next 25 years to ensure the Queensland Government is appropriately addressing these and other emerging issues, and that the management system continues to adapt as we identify new issues.

#### 1.5.2.1 Natural resource management

The intent of natural resource management (NRM) is to ensure natural resources are sustainable and resilient in the long-term. In Queensland, regional NRM operates at a landscape level within state and national policy frameworks.[12]

Thirteen community-based regional NRM bodies deliver the regional NRM arrangements. They develop, review, implement and coordinate regional NRM plans and build partnerships with key stakeholders, including:

- Community
- Industry groups
- Indigenous groups
- Land managers
- Research and education institutions
- National, state and local governments.

The Queensland Regional NRM framework provides a statement of the regional NRM arrangements needed to build, align and harness effort and investment for NRM outcomes.[12] It also identifies a number of NRM objectives which define the areas of activity that will be targeted for NRM investment. The NRM objectives also endeavour to protect, manage and enhance MNES.

Six NRM regions are within the GBR catchment (Figure 1.5 2), including:

- Cape York
- Wet Tropics
- Burdekin
- Mackay Whitsundays
- Fitzroy
- Burnett Mary

Both the Queensland and Australian Governments provide funding support for the regional NRM organisations in addition to funding bilateral NRM programs with industry, such as the sugar industry.

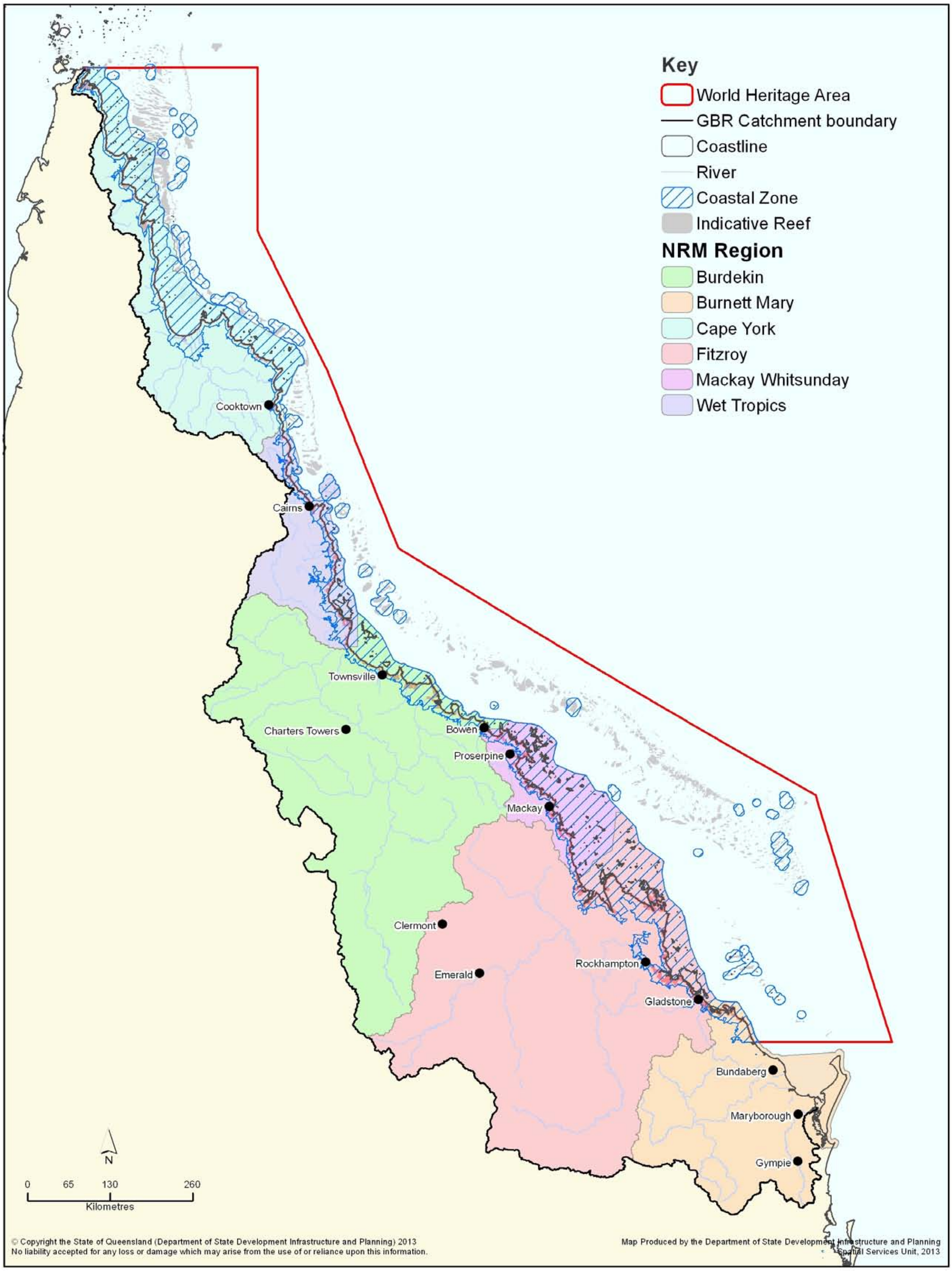



Figure 1.5 2 NRM regions within the GBR catchment

## 1.6 Strategic assessment process

Stage one of the strategic assessment process is an assessment of the the Queensland Program's effectiveness at identifying and protecting MNES as defined and described in this chapter and in the *program report* in general.

If the Australian Government Minister for the Environment is satisfied that processes in place adequately identify and protect MNES, the minister may then endorse the Program.

Stage two of the strategic assessment process consists of the specification of actions or classes of actions addressed by the Program, including recommended improvements to the Program. Accreditation of actions will allow these activities under the Program to be comprehensively managed and, subject to the 'avoid, mitigate and offset' policy, proceed without need for further Australian Government approval of individual proposals or developments.

Recommendations for changes to the Program to improve the protection of MNES are included in chapter 10. These recommendations have directly informed the development of *strengthening management and forward commitments* as outlined in the complementary *program report.* The minister will take into account these recommendations for improvement in making a decision on whether or not to endorse the Program.

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# Chapter 2

## social and economic context

*Extract from Great Barrier Reef Coastal Zone Strategic Assessment terms of reference*

*2.2 Identification and analysis of the potential impacts*

*The Strategic Assessment Report must describe how potential future impacts of activities taken under the Program are identified and taken into account in relevant decision making processes, in the context of past and existing impacts as described in Section 2.1.*

*………*

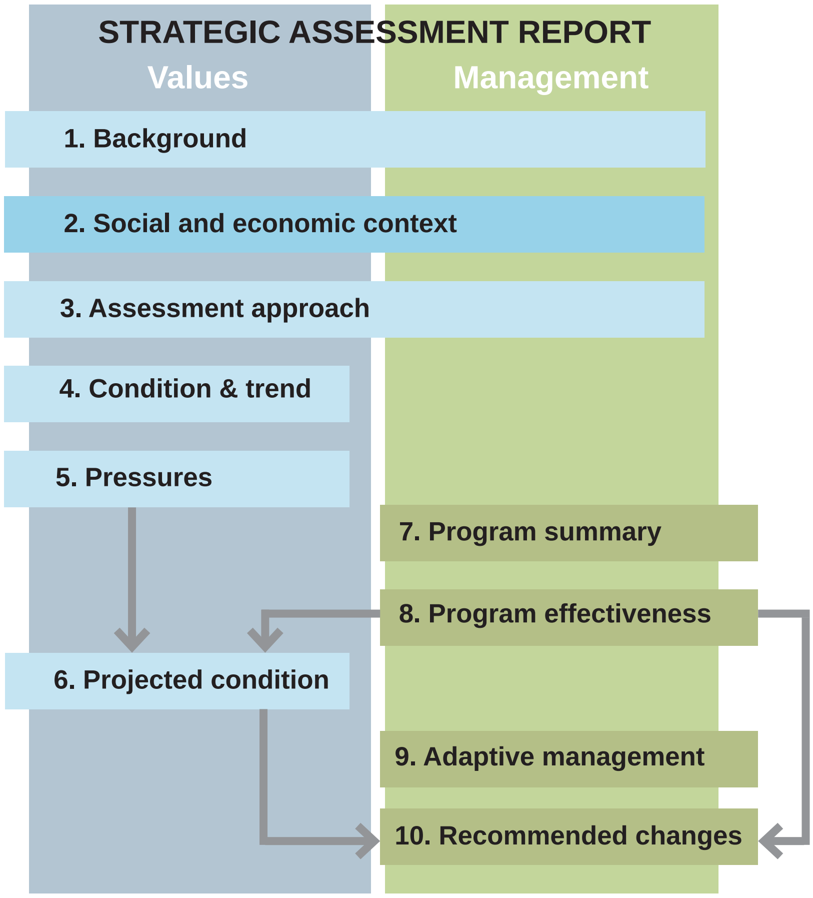
*In doing so, the Strategic Assessment Report must:*

*………*

*(f) describe how social and economic impacts and issues are considered and assessed*

*………*

# 2. Social and economic context






## 2.1 Introduction

The GBR coastal zone covers approximately 120 000 square kilometres of mixed use area that supports a diverse range of social and economic activities; it is recognised by the Queensland Government and internationally as a region of significant environmental, social, cultural heritage and economic importance.

The GBR coastal zone makes a vital contribution to the Queensland and Australian economy. It is a region which employs almost half a million people, has a population of just less than one million residents and attracts more than two million visitors from Australia and all over the world each year. These visitors are mostly drawn to experience the regions superlative natural ecosystems and tropical climate. The GBR coastal zone also serves as the gateway for Queensland's extensive resources sector through the location of ten trading ports, four of these being long established bulk commodity export ports.

As part of its commitment to ecologically sustainable development (ESD) the Queensland Government aims to ensure development within the GBR coastal zone is planned and balanced, supporting economic development and social wellbeing while maintaining MNES and the OUV of the GBRWHA and the Wet Tropics WHA. The way in which Queensland Government's Program achieves the principles of ESD, and therefore how social and economic impacts and issues are addressed in the Program is outlined in section 9.1.

This chapter provides a brief overview of the socio-economic and environmental management factors relevant to the GBR coastal zone.

### 2.1.1 Socio economic data

Social and economic data is not available to match the boundary of the GBR coastal zone or the NRM regions used throughout the *strategic assessment report*. To account for this, this section of the assessment uses local government area (LGA) data. LGAs generally extend beyond the coastal zone. However, given the concentration of social and economic activities in proximity to the coast, the LGAs present a reasonable proxy for the GBR coastal zone.

The GBR coastal zone is positioned alongside the GBRWHA and includes all or part of 21 LGAs, being: Bundaberg; Burdekin; Cairns; Cassowary Coast; Charters Towers; Cook; Gladstone; Hinchinbrook; Hope Vale; Isaac; Lockhart River; Mackay; Northern Peninsula Area; Palm Island; Rockhampton; Tablelands; Torres; Townsville; Whitsunday; Wujal Wujal; and Yarrabah. Figure 2.1 1 shows the location of the GBR coastal zone, the GBR catchment, the NRM regions, the GBRWHA and the LGAs within the GBR catchment.

To assist with this strategic assessment, the Queensland Government produced an Economic Baseline report to provide an overview of the GBR coastal zone's community and economy, with particular attention to population, employment, and industrial structure. A copy of the report is at Appendix C.

Complementing this discussion, with specific reference to the combined GBR and the GBR coastal zone is a report titled Economic contribution of the Great Barrier Reef 2013.[5]

## 2.2 Land use

Since European colonisation, settlement in Queensland has been concentrated in the south eastern corner of the state (south of the GBR coastal zone) and along the coast to Cairns. In June 2011, approximately 912 000 people were living in the GBR coastal zone – equivalent to 20 per cent of Queensland's resident population.[1] Over 62 per cent of the GBR coastal zone's residents live within the local government boundaries of Cairns, Mackay, Rockhampton, and Townsville. These urban centres account for less than one per cent of the total area of the GBR catchment.

Between 2006 and 2011, the GBR coastal zone experienced an average annual population growth of 1.3 per cent, which was lower than Queensland's population growth over the same period.[1] The Australian Bureau of Statistics (ABS) projects the population of the GBR coastal zone will continue to grow over the next 25 years, concentrating around existing medium to large coastal towns and countered by a decline in the population of some of the smaller, more remote coastal communities. This trend is driven by both economic and lifestyle factors.

Aboriginal and Torres Strait Islander people are the Traditional Owners of the GBR Region and evidence of their land and sea country connections goes back over 60 000 years. In the past 200 years since European settlement, Queensland's regional land use patterns have shifted significantly. Despite the primacy of south-east Queensland, the population outside that area has continued to grow since European settlement, due to factors including:

- the discovery of minerals and subsequent mining and resource development
- agricultural development
- irrigation schemes
- tourism industry development.

The mining and related activities in areas adjacent to the GBR coastal zone have driven economic and population growth in some coastal towns. It is common for people to live in the coastal towns and commute inland to work. Increased activities related to population growth – particularly urban and industrial development – have also increased the pressures on MNES in the coastal zone.

As a mixed use zone with high environmental values the GBR coastal zone presents challenges for addressing the impacts of historical land use, and catering for current and future growth in a sustainable manner.

## 2.3 Economic activities

Many industries in the GBR coastal zone are heavily reliant on the environment for their output, including agriculture, aquaculture, forestry, fisheries, mining, manufacturing, construction and tourism.

Industries in and adjacent to the GBR coastal zone along with their associated infrastructure requirements, directly and indirectly affect ecosystems by modifying land- and seascapes and generating pollution and waste. In contrast industries such as tourism rely heavily on the maintenance of Queensland's environmental assets for their viability.

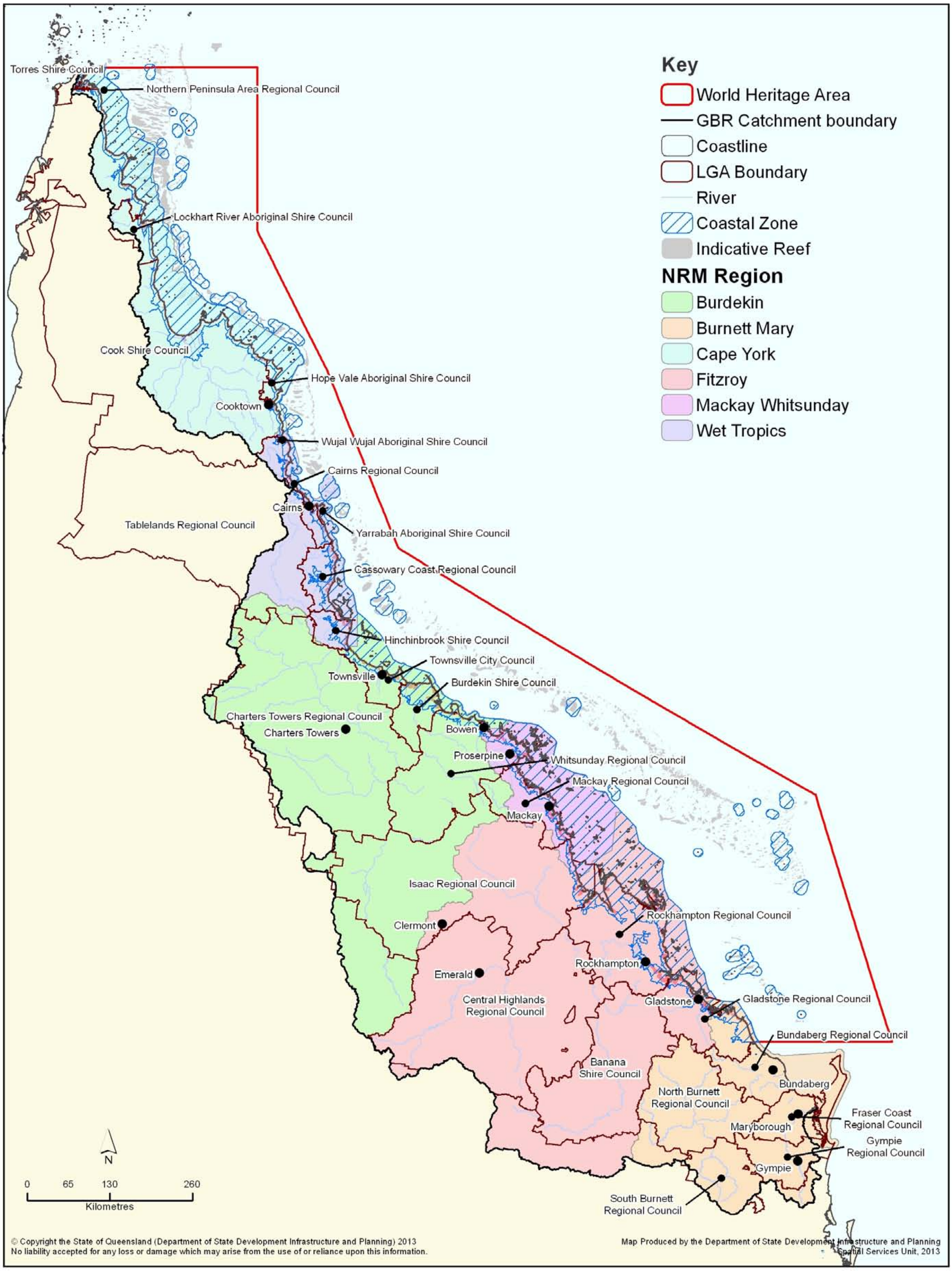



Figure 2.1-1 Local government areas (LGA) within the GBR catchment

# GBR Population and Economic Quick Facts

## PEOPLE

The population of the LGAs that include the GBR coastal zone was 912 000 at 2011, 20.4 % of Queensland's population.

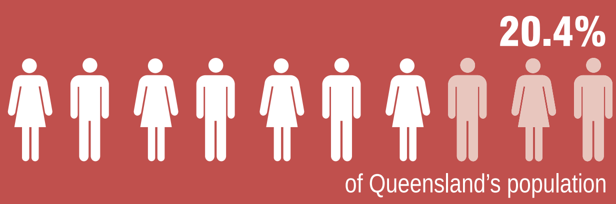
- In addition to small towns, the GBR coastal zone also compromises 8 regional urban centres with populations over 30 000:

  - Cairns (163 000 )
  - Gladstone (59 000)
  - Mackay (116 000)
  - Rockhampton (112 000)
  - Tablelands (45 000)
  - Townsville (180 000)
  - Whitsundays (32 000)

- Over 60 % of the population in the GBR coastal zone is concentrated in the regional centres of Cairns, Mackay, Rockhampton and Townsville.
- The population within the GBR coastal zone increased by 148,000 persons over the 10 years to 2011.
- Between 2006 and 2011 the strongest population growth rates per annum for the regional urban centres within the GBR coastal zone were in Cairns (2 %), Gladstone (1.9 %), Mackay (1.5 %) and Townsville (1.8 %).

## TOURISM

- The GBR is one of Australia's most iconic tourism assets and is a draw card for visitors around the world.
- Between 2007 and 2012, total visitor nights/days for the visitors in the GBR coastal zone increased by 4 %.[2]
- The total Australia-wide value-added economic contribution generated in the Reef catchment in 2012 was $5.7 billion with employment of just below 69,000. $5.2 billion of this was generated by Tourism.[5]
- Tropical North Queensland was Australia's leading non-capital city tourism destination by value for the year ending March 2012.[7]




## ECONOMY & EMPLOYMENT

- In September 2012, the GBR coastal zone employed nearly half a million people, with an average unemployment rate of 6.0 %.[1]
- The largest five employers in the GBR coastal zone in 2011 were Health care and social services, Retail trade, Construction, Manufacturing and Accommodation cafes and restaurants.[1]
- The largest land use in the GBR coastal zone is Agriculture.[6]
- The gross value of agriculture production was $3 billion in Queensland in 2010-11, an increase of 4.3 % from 2005-06.[1]
- Almost 97 % of Queensland's sugarcane production occurs within the GBR coastal zone.[8]
- Agricultural irrigation decreased 18 % between 2005-06 and 2008-09.[6]
- Although no mining occurs within the GBR coastal zone, resources industries located inland of the GBR coastal zone, rely on ports within the GBR coastal zone to link with international markets.
- In 2011-12, almost 200 million tonnes per annum passed through ports in the GBR, including 173 mtpa of exports.[9]
- Major resource and infrastructure projects draw workers from both within and outside the GBR coastal zone.

## 2.3.1 Agriculture

Queensland has the largest area and highest proportion of land dedicated to agriculture in Australia. Approximately 30 500 businesses in Queensland are dedicated to agriculture and the industry contributes $10 billion to the state's economy each year.[13]

Agricultural production is a significant industry within the LGAs in the GBR coastal zone, providing a gross value of $3 billion in 2010-11 and accounting for an estimated one-third of the state's agricultural production (Appendix C). Nearly three-quarters of the land in the LGAs in the GBR coastal zone is used for grazing beef cattle or the production of sugarcane, horticulture and broad acre cropping.[6]

### 2.3.1.1 Sugarcane growing

Almost all (97 per cent) of Queensland's sugarcane production occurs in the GBR LGAs.[1] The gross value of Queensland's sugarcane production in 2012-13 (from 2012 harvest) is forecast at $1.2 billion, 4 per cent higher than the Queensland Government final estimate for 2011-12 (2011 crop) and 14 per cent above the average for the past five years.[14]

Approximately 3800 sugar-growing farms operate within Queensland. In most circumstances, the industry is the sole reason for the development of regional townships, which means cane growing and sugar production underpins the economic stability of many of the GBR coastal zone's communities.

### 2.3.1.2 Livestock

Livestock industries are a significant contributor to the Queensland economy. The value of livestock (including livestock slaughtering and livestock products) in the LGAs within the GBR catchment was approximately $895 million in 2010–2011 (over 19 per cent of total production in Queensland), with the main production coming from the LGAs of Charters Towers, Isaac, Tablelands and Whitsunday. This represents an increase in the value of livestock of 5.4 per cent from 2005-06 ($737 million).[1]

### 2.3.1.3 Horticulture

The total gross value of Queensland's fruit and nut production in 2012-13 is forecast at $1.3 billion, which is 20 per cent greater than the average for the last five years.[14] Approximately $491 million worth of fruit and $668 million worth of vegetables was produced in 2010–2011, which is around 57 per cent and 48 per cent of the state total, respectively.

## 2.3.2 Tourism

Tourism is an important industry for the Queensland economy. In 2010-11, tourism contributed $17.5 billion to the Queensland economy and accounted for 6.6 per cent of Queensland's Gross State Product (GSP).[7] Tourism directly employs 124 000 Queenslanders or 5.4 per cent of all persons employed in the state.[7]

The GBR is one of Queensland's and Australia's most iconic tourism assets, and tourists visit from around the world. The number of tourist days/nights spent in the GBR catchment has increased by four per cent since 2007, with total visitor days/nights growing to 42.8 million over the five years to end-June 2012.[5]

However, the number of international visitor nights spent in the GBR catchment has declined by around 10 per cent over the five year period from 2007 to 2012. This likely reflects weak global economic conditions, the strong Australian dollar and the impact of recent natural disasters in both Queensland and New Zealand.

Queensland's competitive advantage in the global tourism market lies not only in the beauty and ecology of the GBR, but in assuring visitors it is well managed.

## 2.3.3 Resource and energy

The LGAs most specialised in mining are Isaac, Mackay, Rockhampton, Tablelands, Whitsunday, Gladstone and Charters Towers. As a significant coal producer the Isaac LGA has 21 times the state average share of employment in the mining industry. LGAs more specialised in services tend to have a larger population base, such as Townsville, Cairns and Rockhampton.[1]

Global demand for Queensland's natural resources has been steadily increasing. Over the last 10 years this demand has led to an increase in sector investment. Investment in the resource and energy sector has slowed substantially over the last 12 months as a result of changes in commodity prices.

All of the major resource projects proposed in Queensland are in areas outside the GBR coastal zone, in the Bowen Basin, Galilee Basin and Surat Basin regions. However, many of the existing and proposed projects require export through ports located in the GBR (see section 2.3.4 for further detail).

Major resource and infrastructure development projects are subject to a rigorous environmental impact assessment process managed by the Office of the Coordinator-General, which is regulated by strict legislation including requirements to identify impacts on MNES (see section 7.7 describes the EIS process).

## 2.3.4 Supporting infastructure

Ports in the GBR coastal zone are pivotal to supporting the state's economy. In 2010-11, ports along the GBR recorded throughput (the sum of exports and imports) of 196.7 million tonnes, which was 78 per cent of Queensland's total port throughput in volume terms. Exports accounted for 87 per cent of GBR port throughput and were heavily concentrated in the coal mining sector. As at 2010-11, coal exports accounted for 81 per cent of all throughput volume of GBR ports. Over the last 10 years, coal exports have made a sizeable and consistent contribution to GBR port throughput accounting for between 78 and 80 per cent from the 2000-01 to 2010-11 financial years.[15]

Agriculture, tourism and construction also rely on the import and export capacity of ports adjacent to the GBR. Around a million Queenslanders also rely on regional ports for imports of household goods, cars and other consumables.

The growth of Queensland's economy, particularly in the resources sector, has seen an increase in port use and shipping over the last 10 years. In 2001 there were 3583 ship calls to ports within the GBR. These numbers reached their highest point to date in 2010 with 4487 ships calling at ports within the GBR.[15] Further detail on the ports in the GBR coastal zone is included in section 5.2.4.1.

### 2.3.5 Construction

Construction is a major industry for the LGAs in the GBR coastal zone, employing 28 000 persons in 2011. It contributed significantly to employment growth from 2001–2006 and 2006–2011. This likely reflects the need for workers required for the construction of major resource and infrastructure projects with workers drawn from both within and outside the region.

Residential building approvals grew by 6.9 per cent between 2005–06 and 2011–12. Mirroring this trend was the larger growth in non-residential building approvals by 47 per cent between 2005–06 and 2011–12. The largest growth occurred in Mackay and Gladstone for both residential and non-residential building approvals.

The construction of houses and other buildings to support the growing population living in the GBR coastal zone is also an important economic contributor. The majority of residential construction is currently occurring in Townsville, Mackay and Gladstone, where increased development of the resources industry has led to increased in-migration of workers needing accommodation.

## 2.4 Social values

Millions of people in Australia and around the world value the GBR simply because it exists, even if they may never have the opportunity to visit it or derive an income from it. Recreation is, however, an important value of the GBR. Recreational activities include boating, camping, diving, snorkelling, swimming, camping, bird and wildlife watching.

Previous studies have found that the Australian community attaches a high value to the continued conservation of the GBR Marine Park and that the Australian public values the existence of the GBR ecosystem and wants it protected. In 2003, approximately three-quarters of the Queensland coastal community thought that the GBR was under threat and that it was acceptable to lose some usage in the interests of achieving increased protection of the GBR.[16]

Ecosystem services that people obtain from the GBR coastal zone environment include:

- pollination
- fulfilment of people's cultural spiritual and intellectual needs
- regulation of climate
- insect pest control
- maintenance and provision of genetic resources
- maintenance and regeneration of habitat
- prevention of soil erosion
- maintenance of soil health
- maintenance of healthy waterways
- water filtration
- regulation of river flows and groundwater levels
- waste absorption and breakdown.

A number of these ecosystem systems and functions are provided by waterways and water quality. The waterways and water quality within the GBR catchment are significant environmental assets on which the community heavily relies for both commercial and non-commercial benefits. Studies indicate that the community is willing to invest heavily in the protection and enhancement of waterways and water quality in GBR catchments.[17]

The benefits of avoiding water quality-related incidents for the general public are significant. The Marsden Jacob Associates (2010)[17] report stated that there was evidence to suggest that residents highly value maintaining ecosystem function and services. It is expected that individuals would be willing to pay to maintain waterway health to retain the option of using them in the future. Conversely, failing to protect these ecosystem services could have costs.

Understanding of the relationship between water quality, tourism activity and economic benefits is poor. Water quality can affect coral cover and fish diversity and a study undertaken in Port Douglas indicated that recreational diving and snorkelling visitors would reduce annual visits to the GBR if there was a decrease in coral cover and fish diversity. The report estimated that tourism expenditure could drop by almost $140 million per annum.[17]

Beyond ecosystem services, the value of the GBR also stems from its tangible link with Australia's national heritage. Australia's national heritage comprises natural and cultural places that contribute to its national identity. Historic heritage includes places associated with the non-Indigenous cultural heritage of Australia encompassed in the country's history. Historic places tell us about national and social developments in Australia over the past few centuries, technical and creative achievements, and provide a tangible link to past events, processes and people.

Cultural values of the GBR include historic sites, such as over 30 historic shipwrecks, ruins on the islands, and operating lighthouses that are of cultural and historical significance.

## 2.5 Indigenous heritage values

### 2.5.1 Connectivity to country

Aboriginal and Torres Strait Islander people are inextricably linked to their land and sea country through their living culture and traditions, including their stories and song lines, sites of cultural significance and important saltwater ceremonies. Aboriginal people have a well-developed knowledge about the natural world.

Traditional knowledge is a critical component supporting the conservation and ecologically sustainable use of Queensland's biodiversity. The diversity of traditional knowledge means it can fulfil multiple purposes from the regulation of natural resources based on cultural practices and belief, to the maintenance of culturally and biologically significant sites. When combined with modern techniques, traditional knowledge can enhance the identification and preservation of sites that have high cultural, biological and/or ecological value, making traditional knowledge invaluable for protecting the GBR coastal zone.

The Queensland Government's GBR coastal zone strategic assessment relates to matters of land and coast as distinct from the GBRMPA's strategic assessment, which relates to the marine matters. This arbitrary distinction between the two programs has been problematic when attempting to address matters of Traditional Owners' involvement in the management of the reef. For many Aboriginal and Torres Strait Islander people there is a seamless flow between natural and cultural values and their land and sea estates.

There are both similarities and differences between the ways Aboriginal and Torres Strait Islander groups use the land and sea in their customary practices. Each group has their own distinctive culture and identity, and often within groups there are many more clans and kinship groups whose discrete characteristics further distinguish one from the other.

### 2.5.2 Heritage

Heritage is made up of tangible and intangible elements of all cultural practices, resources and knowledge developed, nurtured and defined by Aboriginal and Torres Strait Islander people. Traditional Owners express their cultural heritage through their relationships with country, people, beliefs, knowledge, law and lore, language, symbols, ways of living, sea, land and objects — all of which arise from their spirituality. Heritage values have been passed down through generations and to others as part of expressing their cultural and spiritual identity.

The EPBC Act defines 'Indigenous heritage value' as meaning 'a heritage value of the place that is of significance to Indigenous persons in accordance with their practices, observances, customs, traditions, beliefs or history.'

For Aboriginal and Torres Strait Islander people in the GBR region, there are a number of cultural sites that occur within GBR's land and sea country. These include sacred sites, ceremonial sites, burial grounds, rock art sites, middens, fish traps, cultural landscapes and story places. Today trade networks, beliefs, music, art, creation stories, traditional lore and customs maintain a living culture.

In addition, legally recognising the rights of Traditional Owners to access and use their traditional Country and resources is also an important aspect of Indigenous cultural heritage.

Table 2.5 1 describes Aboriginal and Torres Strait Islander heritage values at a broad level only. In doing so it provides a platform for identifying what and where the Program recognises various Indigenous heritage values.

Table 2.5-1 Indigenous heritage values

| Indigenous Heritage Value | Overview |
|---|---|
| Cultural Landscapes | This term is sometimes used to describe Traditional Owners' perceptions and relationships with their traditional land and sea country. |
| Sacred Sites | Places that have unassailable spiritual connections between Traditional Owners, ancestors and law/lore. |
| Sites of significance | These places are important to Indigenous people for social, spiritual, historical and commemorative reasons. |
| Law/lore | Traditional Owners entitlement to ancestral lands and waters derives from customary law/lore. Law/lore is the source of customary beliefs and practices, protocols and procedures as well as traditional interests and rights. Law/lore is also the source of all life forms and natural phenomenon that comprise their world. |
| Totems | Beings that shaped and gave meaning to the world. Ancestral and totemic tracks flow out over the seas embracing tidal areas, offshore reefs and islands, and form a crucial link with land. In the process of creation, they left behind essences of themselves in the landscape and in physical objects. In this respect, totems of ancestors may also be reflected in specific species of a certain region/ area. |
| Stories/Story-places | Cultural elements (stories of totemic beings for example) are reflected in the landscape as identifiable geographic forms, thus nature and culture are inseparable. |
| Song Lines | Songs used at ceremonies (as an example) with the purpose of nurturing the well being of particular places, species and habitats. |
| Languages | In some instances, languages are associated with specific territories. Indigenous languages are considered to be a key value that connects Indigenous people to their country. |
| Indigenous Structures | Structures may include Aboriginal built fences and stockyards, scarred trees and the remains of fringe camps (as examples). |
| Indigenous Technologies | Stone fish traps, stone cutting and/or grinding tools, fishbone tipped weapons, nets and baskets (as examples). |
| Tools and Archaeology | Tools and archaeology may be physical objects such as stone tools, spears, boomerangs, rock art and material deposited on land such as middens, or ancestral remains of Indigenous people. |

### 2.5.3 Contemporary indigenous use

Subsistence activities, hunting, fishing and gathering have a significant role in the cultural life and economy of Indigenous communities. In remote locations, Indigenous people continue to rely on marine resources for a substantial part of their diet. Seafood consumption by Torres Strait Islanders on the Island of Mer for example is among the highest in the world (Nietchmann 1989). This finding is consistent with numerous studies of the contribution of subsistence activities to Indigenous peoples' socio-economic welfare. Beyond subsistence fishing, marine resources within the GBR region also support cultural values.

Turtle and dugong hunting is also an important aspect of the Indigenous economy and cultural life in the GBRWHA and is based on collectively accumulated ecological knowledge, skills and continued cultural association with the species (Williams 1996). GBR Marine Park zoning plans require dugong and turtle hunting permits which are granted to Indigenous people for customary purposes. However permits may not be required under section 211 of the Native Title Act 1993 (Cth) in some areas where 'native title rights and interests exist.'

Little is known the status about the current status of Indigenous fishing and shell collecting in the GBRWHA in terms of effort, impact on the sustainability of resources and contribution to local and regional gross value of fisheries production (Altman, Arthur and Bek 1994; Smith 1987). It is also unclear how significant the contribution of subsistence fishing is to overall fisheries production.

A survey undertaken by the Australian Bureau of Statistics in 1994 indicated that 11 per cent of the 49500 Indigenous people involved in unpaid work engaged in hunting, fishing and gathering (Madden 1994). Some economic analyses of Indigenous fishing have been undertaken in the Torres Strait (Atlman et al. 1994), Cape York Peninsula (Asafu- Adjaye 1994),

Image courtsey of Tourism Queensland.

and in the Ingham area (Benzaken et al, in progress). These studies show that subsistence activities contribute a significant part of the household income. A study of subsistence activities on Cape York Peninsula indicates that as much as 80 per cent of protein is derived from fishing and hunting. This is a significant contribution to the diet, health and economy of people in remote communities where the availability of alternative food items is irregular and often of poorer quality. Some economic analyses of Indigenous fishing have been undertaken in the Torres Strait (Atlman et al. 1994), Cape York Peninsula (Asafu- Adjaye 1994), and in the Ingham area (Benzaken et al, in progress). These studies show that subsistence activities contribute a significant part of the household income.

Information on the level of subsistence fishing and hunting in urban areas is yet to be investigated although anecdotal evidence suggests that it may be substantial and linked to the importance of seafood in the diet of Indigenous peoples as well as being a culturally significant activity.

### 2.5.4 Indigenous Protected Areas and management

Traditional Use of Marine Resources Agreements (TUMRA) play an important role in enabling traditional Indigenous use of marine resources within their sea country. These agreements describe how Traditional Owner groups manage the natural resources (including protected species) and their role in compliance and monitoring activities relating to the condition of plants, animals and human activities within the GBR Marine Park.

A TUMRA is a formal agreement developed by Traditional Owner groups and accredited by the GBRMPA and the Queensland Government. The agreement describes how Traditional Owner groups work with the government to manage traditional use activities in their sea country (Dobbs 2007). TUMRAs are developed by a Steering Committee elected by the Traditional Owner group. The steering committee documents the desired role of their group in managing their sea country and the role they want the Australian and Queensland Governments to take. All members of the group must agree with the document before it can be accredited. For example, a TUMRA may describe how Traditional Owner groups wish to limit their take of turtle and dugong, their role in monitoring plants and animals, and their involvement in observing human activities in their sea country. The TUMRA implementation plan may also describe ways to educate the public about traditional connections to sea country, and to educate other members of a Traditional Owner group about managing their sea country (Great Barrier Reef Marine Park Authority 2009).

By working together to develop and implement a TUMRA, Traditional Owner groups are able to better achieve their aims for managing their sea country. TUMRAs are widely acknowledged as an important stepping-stone towards co-management on a regional scale. TUMRAs have the great advantage that they present an adaptive approach. For example, Robinson et al. (2006) reported that TUMRAs: 'are aimed at encouraging Traditional Owners to agree on how to implement sustainable levels of traditional use of marine resources, especially dugong and sea turtle harvesting. Even so, we show that there is potential for Indigenous and the GBRMPA's aspirations for co-operating in environmental management to converge if TUMRAs are approached in an adaptive manner, and if Indigenous cultural values for marine resource use can also be included in the TUMRA agreement.'

As the capacity of the Tradional Owners increases, their responsibilities can grow accordingly. In addition, TUMRAs present a process where relationships with the GBRMPA and the Queensland Government can be maintained and built upon through time, and differences can be negotiated.

An Indigenous Land Use Agreement (ILUA) is an agreement between a native title group and others about the use and management of their land and sea country. These agreements are flexible and can be negotiated to suit the circumstances of different Traditional Owner groups. Indigenous Land Use Agreements were first introduced after amendments to the Native Title Act in 1998 (National Native Title Tribunal 2009). As of August 2008, the Tribunal had more than 340 ILUAs registered nationally (National Native Title Tribunal 2009). When an ILUA is registered, it binds all native title holders and participating parties to the terms of the agreement.

An Indigenous Protected Area (IPA) is an area voluntarily declared as protected by the traditional custodians of the region. The concept was developed in the late 1990s through collaboration between the Australian Government and Indigenous landholders. Indigenous communities managing IPAs achieve conservation and sustainability goals for country, as well as maintaining their culture (Department of the Environment, Water, Heritage and the Arts 2010). The Australian Government and, in some instances, state or territory agencies provide funding and support (Smyth 2009).

More than 25 IPAs have been established on Australian land, making a significant contribution to terrestrial biodiversity conservation (Department of the Environment, Water, Heritage and the Arts 2010). Despite this, few marine IPAs have been declared. The first IPA to extend over a marine area was the Dhimurru IPA in Arnhem Land (Smyth 2009).

Two IPAs are currently located within the GBR coastal zone. Mandingalbay Yidinji IPA encompasses a small section of both the Wet Tropics and GBR WHAs in north Queensland, just east of Cairns across Trinity Inlet. It is made up of a number of protected areas that were joined up following recognition of native title over the Mandingalbay Yidinjii country in 2006. The Djunbunji Land and Sea Program through the Djunbunji Rangers manage this country on behalf of the Mandingalbay Yidinji people.

Girringun region IPA is a voluntary declaration by the Djiru, Bandjin, Gulnay, Girramay, Warrgamay, Warungnu, Gugu Badhun and Nywaigi (with the support of Jirrbal) Traditional Owners. The country within the Girringun region Indigenous Protected Area forms part of the Wet Tropics and GBR WHAs.

Management techniques such as dugong and turtle monitoring, removal of ghost nets and fisheries surveillance may be undertaken in IPAs (Smyth 2009). Like other protected areas, management tools for IPAs include a range of legislative and nonlegislative management techniques, with the greatest effort directed towards non-legislative tools such as education, monitoring, research and interpretation, rather than enforcement.

ILUAs, IPAs and TUMRAs may be just one part of a broader sea country plan. Sea country planning is the process whereby Traditional Owners and/or other local Indigenous people develop their goals and strategies to manage, conserve and use their coastal and marine environments and resources (Smyth 2007). A sea country plan combines the priorities and aspirations of Traditional Owners with others with an interest in their sea country, including government. The sea country planning process encourages people and organisations to work together towards sustainable management of marine environments (Department of the Environment, Water, Heritage and the Arts 2008).

Sea country plans can focus on specific areas, rather than being applied universally along a coastline. This enables them to be applied to aspirations of specific groups. However, sea country plans do not have any statutory authority unlike ILUAs, IPAs and TUMRAs. It is often quick and easy to implement some actions suggested in sea country plans, while other actions may require more lengthy discussion and development. Following the preparation of a sea country plan, the establishment of an IPA, TUMRA or ILUA may form the next step towards a robust sea country framework.

Using these management avenues, in conjunction with Traditional Owner knowledge and organised partnership projects, a range of activities are undertaken to promote connectivity with country to the conservation of biodiversity and MNES in the GBR. In the GBR coastal zone, Queensland’s Land and Sea Ranger Program fund land and sea Indigenous rangers. These rangers ensure the unique ecologies of Queensland’s natural environment, including the MNES and OUV of the GBRWHA are protected through activities such as:

- managing weeds, feral animals and other threats
- performing fuel reduction and ecological burning
- collecting data on protected species and habitats
- supporting disaster recovery efforts
- managing visitor activity
- recording traditional stories
- helping manage national parks.

An adaptive and flexible approach to partnerships is required to acknowledge the different levels of participation and knowledge among Traditional Owner groups in managing country. The concept of co-management has formed the platform for managing country in the region since the 1990s, and has helped form a number of ongoing partnerships between Traditional Owners, government authorities and other stakeholders.

### 2.5.5 Contemporary Aboriginal and Torres Strait Islander interests in the management of the Great Barrier Reef Area

Aboriginal and Torres Straits Islander groups identify themselves as Traditional Owners and custodians of marine estates and are keen to have their traditional claim to ownership of estates legally recognised. The recognition of sea rights is not only a matter of identity and compensation for past wrongs, but also an avenue to claim management responsibility for the protection of important sites and to develop an economic base from the use of marine and coastal resources (Bergin 1993).

Indigenous peoples have expressed strong views on the principles underlying the management of the environment which arise from differing views of nature and the place of humans. From an Indigenous perspective, coastal landscapes and seascapes are part of an integrated cultural domain comprising defined owned clan estates to which affiliated groups belong, and from which they get their identity and customary rights to own and exploit other resources. This contrasts with the European concept of coastal and marine systems as separate domains, the common property nature of marine resources and concepts of naturalness. These contrasting perspectives have been articulated around the concept of wilderness and wilderness management. Wilderness is perceived by Indigenous people as a negation of prior occupation and property rights and another form of dispossession even though there may be congruence between Indigenous aspirations and conservation goals.

Langton (1996) strongly argues that wilderness maintains the invisibility of Indigenous people and that the whole notion of protected area management must be reconsidered. She argues that ‘the modern supporters of this wilderness cult divide aborigines in two extremes – the noble savage in harmony with the environment and the modern aborigines who threaten extinction of rare and endangered species.'

Through the mechanisms described in section 2.5.2, the Queensland Government Program encourages participation of Aboriginal and Torres Strait Islander people in managing the GBR coastal zone, and recognises the special rights and interests of Traditional Owners. Their knowledge of biodiversity and the cultural values of the area are recognised and promoted through legislation and activities to conserve biodiversity and MNES within the GBR coastal zone.

Providing Traditional Owners with access to their land and sea country to manage their cultural heritage is critical to ensuring the well-being of Aboriginal and Torres Strait Islander communities in the region. Facilitating partnership programs to achieve this can also potentially enhance economic, social and environmental outcomes for Aboriginal and Torres Strait Islanders within the GBR coastal zone.

In the context of the strategic assessment, ongoing partnerships between Traditional Owner groups and governments provide an important contribution to the protection of MNES and OUV of the GBR. Many of the remote areas within the GBR coastal zone that are adjacent to the GBR, including shire councils, are managed by Aboriginal and Torres Strait Islander communities, including shire councils. Developing processes for ongoing negotiation and engagement with Aboriginal and Torres Strait Islander communities, shire councils and Traditional Owner groups is also important for recognising the cultural heritage values of the GBR and helping to protect MNES and OUV.

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# Chapter 3

## assessment approach

*Extract from Great Barrier Reef Coastal Zone Strategic Assessment terms of reference*

*2.1 Identification of MNES including OUV*

*………*

*The description must include the key terrestrial, coastal, and marine biodiversity and heritage values and supporting ecological processes considered critical to the functioning of MNES including OUV. This will be achieved in part through:*

*(a) an assessment of Queensland's processes for identifying areas of MNES including OUV*

*(b) an assessment of Queensland's processes to otherwise represent MNES including OUV as non-mapped descriptions of biophysical attributes.*

*The Strategic Assessment Report must also:*

*………*

*(c) provide sufficient information to allow an understanding of the connectivity between MNES including OUV*

*………*

*(f) describe the methodologies and data sources used for all of the above.*

*………*

*8 Independent review*

*The Program Report and Strategic Assessment Report will be the subject of independent review by a suitably qualified party, external to both the Queensland and Australian Governments.*

*9 Information sources*

*For information and data used in the assessment, the Strategic Assessment Report must state:*

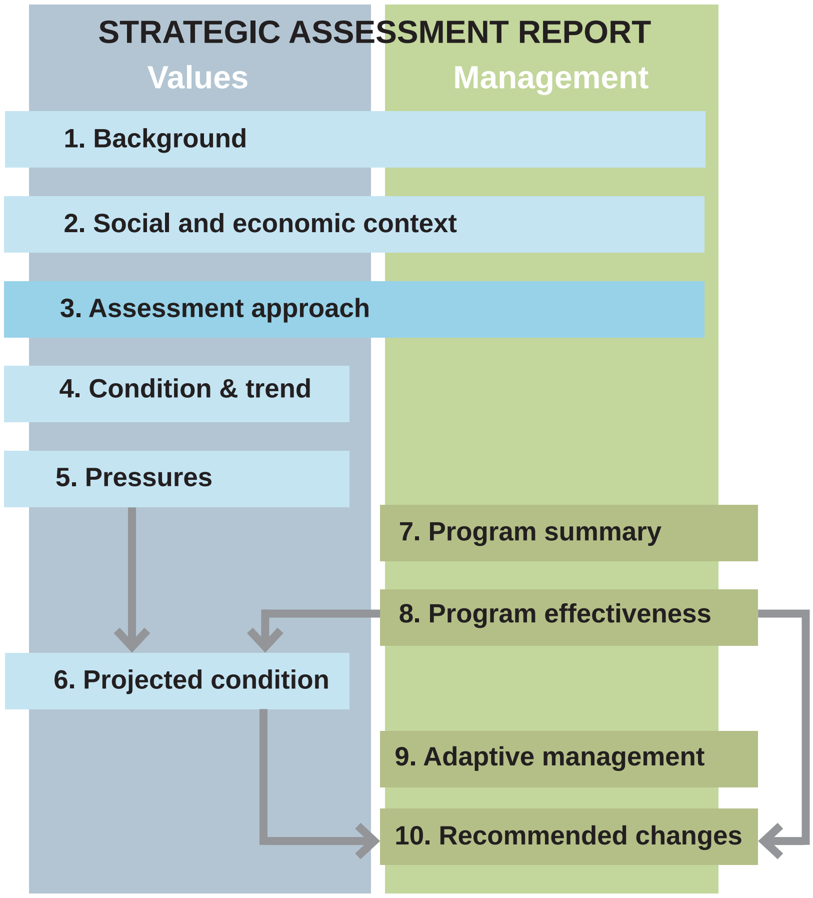
*(a) the source of the information*

*(b) how recent the information is*

*(c) the reliability and limitations of the information.*

*Wherever possible information underpinning the strategic assessment will be made publicly available.*

# 3. Assessment approach




CHAPTER 3 I assessment approach

## 3.1 Introduction

This chapter sets out the technical framework and methodologies used to identify MNES values in the GBR coastal zone as well as the general approach to the strategic assessment, the stakeholder input into its development, and the processes for scientific, peer and independent reviews.

The TOR setting out the requirements for this strategic assessment were finalised and released by the then Minister for Sustainability, Environment, Water, Population and Communities on 31 August 2012 (refer Appendix D). The TOR were finalised following a public consultation period between 18 February and 30 April 2012.

The following key principles have underpinned this strategic assessment:

1. Fulfil the TOR
2. Establish a system-wide, landscape scale understanding of the current extent, condition and trend for MNES based on the existing legacy and current activities and the pressures these create
3. Recognise impacts vary at different spatial and temporal scales
4. Utilise existing information where possible
5. Use information that is publicly available and peer reviewed
6. Include spatial presentations of risks and impacts wherever possible
7. Use demonstration cases to describe in more detail how the management systems identify, protect and manage MNES and OUV with reference to particular values, places or pressures
8. Choose these detailed demonstration cases based on clear and transparent criteria
9. Acknowledge and report confidence, uncertainties and gaps in information

## 3.2 The approach

### 3.2.1 Complex overlapping MNES

The comprehensive strategic assessment of the GBRWHA and adjacent coastal zone is the largest undertaken under the EPBC Act to date. The size and complexity of the GBR and adjacent coastal areas, and the fact that MNES within the strategic assessment area vary in scale from individual species to the entire GBRWHA, make it impossible to assess every impact on every value. The complexity means this strategic assessment differs from strategic assessments undertaken elsewhere. Specifically, this report assesses the effectiveness of a set of planning, development and NRM frameworks to protect MNES, rather than examining the potential impact from specific, regional-scale activities, such as expansion of an urban development within a metropolitan area.

There is spatial overlap between many of the individual MNES in the coastal zone, as outlined in Figure 3.2 1. For example, the basis for listing the GBR as a National Heritage place is its World Heritage values and, as a result these two occupy the same geographical area.

Where overlaps occur this strategic assessment groups MNES within the GBR coastal zone. The National Heritage places are included within the GBRWHA and Wet Tropics WHA assessment; they were both included on the National Heritage List on 21 May 2007.

In addition, all of the MNES do not occur in isolation, they are interconnected. For example, the GBR coastal zone species habitats, regional ecosystems and ecological processes are the basis of the GBR and Wet Tropics world heritage listings as well as supporting its listed threatened and migratory species and TECs.

While focused on the GBR coastal zone, this report does consider activities in the broader GBR catchment that impact MNES in coastal and marine areas. The primary catchment issues are activities that generate poor water quality that impacts on downstream values. Of particular importance are the impacts of rural diffuse pollution on reef ecosystems such as corals and seagrass.

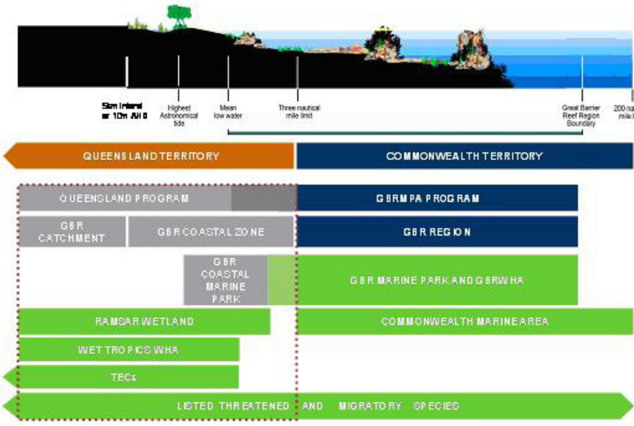



Figure 3.2-1 Overlapping matters of national environmental significance of relevance to the Great Barrier Reef

CHAPTER 3 I assessment approach

### 3.2.2 Multi-scale ssessment

Ecosystems are highly differentiated in space and time, and their sound management requires careful local planning and action. At the same time, local scale assessments rarely take into account broader considerations, such that environmental systems and processes operate across wider, often global, scales and resources often transfer across regions. The Millennium Ecosystem Assessment (MEA)[18] was a United Nations project designed to assess the consequences of ecosystem changes for human well-being. The project identified that multi-scale assessment would enable project findings to be of greater use across many levels of decision-making. This is highly relevant to the GBR coastal zone strategic assessment given the complexity and various scales of MNES considered.

A multi-scale assessment evaluates the scale dependence of various actions and policies. Often the beneficial impacts of a policy change at a national scale can obscure negative impacts at a local scale. Although differing impacts of change will always exist, more careful assessment of these scale-dependent impacts can enhance the net benefits of actions and policies.

The strategic assessment has a tiered or hierarchical approach, looking broadly at the existing pressures. This report is used to demonstrate effectiveness of the Program at the GBR coastal zone scale. Demonstration cases (and shorter case studies) are then used for specific locations or initiatives to demonstrate the effectiveness of the Program in protecting MNES at a regional and local scale.

Across the vastness of the GBR coastal zone, its differing ecosystems (marine, terrestrial, freshwater wetlands, lowlands and elevated areas, soil and climatic differences) and land use history, there is a large variation in the extent, condition and trend of all the MNES values.

This assessment considers MNES values on a habitat basis (for species), regional ecosystem basis for threatened ecological communities and a discrete spatial basis for the World Heritage and Ramsar areas. It is not possible to consider every species or ecological community individually. The Queensland Government regional ecosystem mapping forms the basis of many of the ecological protection mechanisms of the Program and informs the assessment for species habitat and ecological communities used here.

There is a clear difference between the northern (Cape York) and southern sections of the coastal zone, in relation to extent of development and the types of development pressures occurring. However, the north-south distinction has not been considered in the identification of MNES values, and assessment of their extent, condition and trend in chapter 4.

For the marine environment, this report relies heavily on the more qualitative statements of the MNES values extent, condition and trend. This information is drawn primarily from the Great Barrier Reef Outlook Report 2009 (the Outlook Report)[4], the national State of the Environment (SoE) 2011[19], the Queensland State of the Environment Report 2011[20] the GBRMPA for the GBR marine area. Because the focus of the GBR region strategic assessment is on the marine environment, in the interests of avoiding duplication, there is less emphasis on the marine environment in this report.

There are a number of standard terms regularly used in this report which indicate a hierarchy in relation to drivers, activities and their resulting pressures and impacts on MNES. Figure 3.2 2 explains these terms.

### 3.2.3 Strategic approach

This strategic assessment looks systemically at the effectiveness of Queensland Government's Program to manage impacts on MNES to ensure it identifies, assesses and manages impacts on MNES to the extent required by the EPBC Act. This provides an

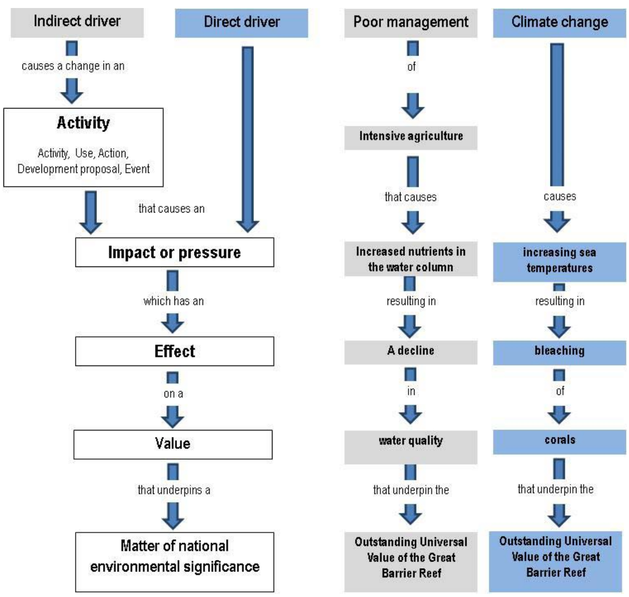



Figure 3.2-2 Example of terminology used in the strategic assessment

CHAPTER 3 I assessment approach

opportunity to ensure in the long-term that the Queensland Government's planning and development system directs development to the most appropriate locations to minimise impacts on MNES and support sustainable development.

The Queensland Government's Program applies an 'avoid or mitigate and offset' policy approach (see section 3.8) to achieve positive outcomes for managing impacts on MNES when considering future development. Programs and policies complement this by seeking to address legacy impacts arising from historical land clearing and ongoing land uses. This works to enhance MNES by rehabilitating degraded ecosystems or restoring cleared ecosystems. Figure 3.2 3 conceptualises the overall strategic assessment approach.

Assessment of the effectiveness of the Program at protecting and managing MNES has been appraised using demonstration cases. This is in alignment with the TOR for the strategic assessment.

Regional and value specific assessments are made by way of demonstration cases and shorter case studies. Together these examples demonstrate the effectiveness of the Program in protecting MNES at the strategic, regional and value specific scale.

The scale and complexity of the strategic assessment needs a logical sequence to show the identification and analysis of Program impacts. Figure 3.2 4 illustrates the steps followed in undertaking the strategic assessment, from establishing a strong foundation by being clear about the identification of values and pressures, to identifying the current state and trend of MNES, and how effective the Program is at protecting MNES. The assessment includes proposed improvements to the Program that are required to ensure negative trends in MNES values are reversed or stabilised. The structure of the strategic assessment report reflects this approach.

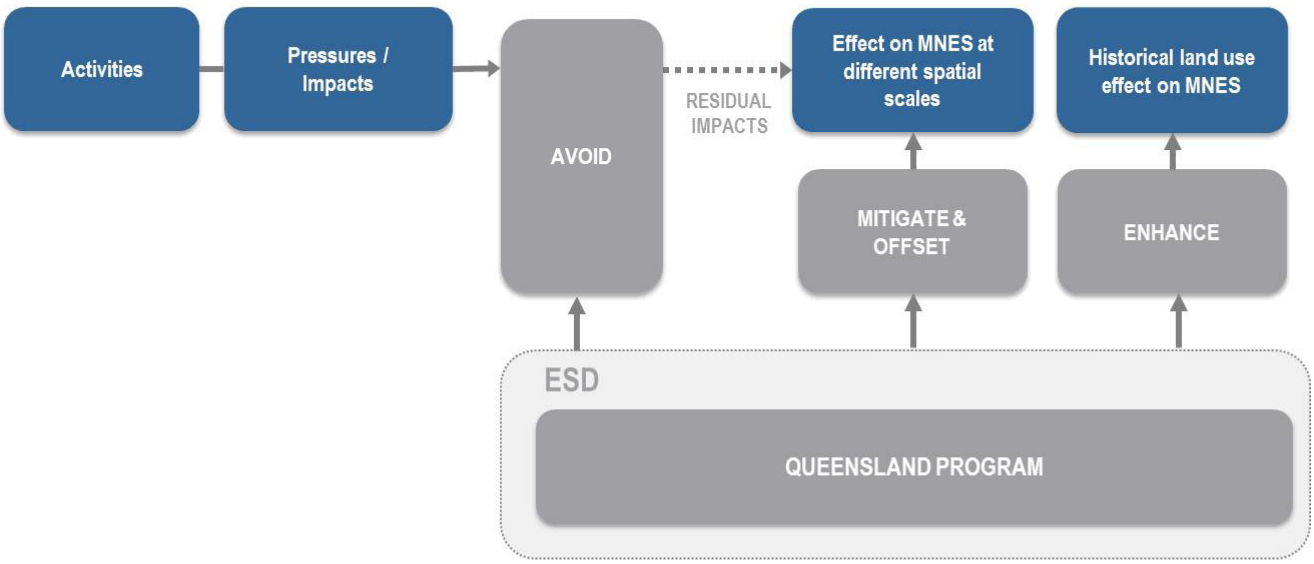



Figure 3.2-3 Overlap approach


Figure 3.2 4 Pathway to assessing impacts on MNES and the Program's effectiveness at protecting MNES

## 3.3 Identifying MNES

This report primarily focusses on the land component of the GBR coastal zone and only includes marine MNES where the MNES species also utilise terrestrial habitat. In general, the report uses two types of data spatially identify MNES values. Where there is a fixed boundary for a MNES, it is used. This applies to World and National Heritage areas, the GBR Marine Park, Commonwealth marine areas and Ramsar sites. Regional ecosystems (REs) and Australian and Queensland government species distribution data is used for identifying geographic areas of other MNES (threatened species, threatened ecological communities and migratory species).

### 3.3.1 Australian Government mapping

The Australian Government uses a predictive species and ecological communities distribution model. This model depicts where MNES species and ecological communities are known to occur, likely to occur or may occur. Queensland Government's planning and development assessment framework adopts a mapping system that identifies where matters of national and state environmental significance are most likely to be located.

To ensure that spatial information is readily available to assist the identification of MNES, the Australian Government has developed a Protected Matters Search Tool (PMST). The PMST generates reports that help determine whether MNES or other matters protected by the EPBC Act have the potential to occur in an area of interest. The PMST for threatened species uses a predictive approach that returns results for species that are either 'known' or 'likely' or 'may' occur in the area.

The Australian Government's species profile and threats database (SPRAT) provides information on what the species looks like, its population and distribution, habitat, movements, feeding, reproduction and taxonomic comments. The information has been compiled by summarising information from a range of sources and contributors.

Information on species distribution provided through this facility is indicative only and the Australian Government recommends seeking local knowledge and information where possible (http://www.environment.gov.au/epbc/pmst/).

This strategic assessment uses the Australian Government's mapping to identify the geographic extent of MNES with declared boundaries and uses Queensland Government mapping to identify the geographic extent of the following MNES:

- threatened ecological communities (TECs)
- key threatened species
- key migratory bird species.

### 3.3.2 Queensland Government's biodiversity mapping methodology

Assessing relative biodiversity significance plays a vital role in establishing conservation priorities. Assessing the value of an area is based on an extensive set of attributes such as relative size or condition, whether it is habitat for threatened species, or if it provides connectivity across the landscape. Analysing Queensland Government's biodiversity and land use data through geographic information systems (GIS) generates a valuable tool to enable rapid identification and analysis of MNES across the GBR coastal zone.

Being able to identify environmental values is dependent on the extent, quality and availability of relevant data, such as species distribution or the extent of ecological communities. Fortunately, Queensland has some of the best quality and most extensive biodiversity data within Australia. From vegetation communities, species habitat and aquatic ecosystems, the natural environment is well covered, as is the ability to assess the extent to which humans have had, or are continuing to have an impact on our environment. This, in turn, helps support information used to develop strong policy and planning for protection and conservation of high value biodiversity.

Mapping will continue to be an important input into planning through the life of Queensland Government's Program to assist in the avoidance of impacts where possible. Queensland Government is committed to working with the Australian Government to improve mapping to ensure accurate identification of all EPBC listed threatened species, ecological communities and listed migratory species relevant to Queensland.

#### 3.3.2.1 Regional ecosystem mapping

Mapping and classification of terrestrial and some estuarine ecosystems that support MNES values in Queensland is based on the digital RE mapping undertaken by Queensland Government's Queensland Herbarium. This is one of three Queensland Government foundation or primary datasets for assessing biodiversity values, the other two being the Queensland Wetlands Mapping and the Species Sightings Database (known as WildNet).

REs are vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The Queensland Herbarium completed RE surveying for more than 85 per cent of the state's vegetation, generally at a scale of 1:100 000. However, in the coastal zone south of Cape York Peninsula, the scale of the RE mapping is approximately 1:50 000 with a minimum polygon (or RE mapping unit) area of one hectare. This base mapping is revised using updated remotely sensed data approximately every three years. However, there is usually a lag between when the updated RE mapping is released by the Herbarium and its availability.

This mapping includes both remnant and non-remnant vegetation for both woody and non-woody REs. The surveying and mapping of vegetation communities and REs in Queensland provides information for regional NRM groups, non-government organisations, local, state and national governments and private industry for planning and management purposes.

The Queensland Herbarium assigns one of three conservation classes to remnant REs based on the remaining extent of an RE relative to its pre-clearing extent. The classes are:

- 'endangered' RE (less than 10 per cent of the pre-clearing extent remains, or there is between 10 to 30 per cent of the pre-clearing extent remaining but in total less than 10 000 hectares remains)
- 'of concern' REs (between 10 per cent and 30 per cent of the pre-clearing extent remains)
- 'least concern' (more than 30 per cent of the pre-clear extent remains).

TECs, one of the MNES categories, are associated with groups of REs and so can be accurately mapped using RE data. Species habitat maps with a reasonable degree of accuracy as it generally equates with REs. However, the RE – habitat relationship is not as strong as the RE – TEC relationship. The classification of an RE, together with information about land use where it is located (such as a grazing area or conservation area) is also used to assess the expected condition of these areas. The analysis of the pre-clearing extent of REs changes over time, particularly since general prohibition of broadscale clearing for agriculture in Queensland 2006, and can provide an indication of trend for MNES values.

#### 3.3.2.2 Queensland Wetlands Program

Queensland's wetlands have been mapped digitally by building on existing information, including water body mapping derived from satellite imagery, mapping of wetland type REs and a springs database. The Queensland and Australian governments jointly fund the Queensland Wetlands Program (QWP) which produced the mapping. The QWP published an updated version of the Queensland Wetlands Map in February 2012

The QWP classifies wetlands according to a range of criteria, including the type of ecological system (riverine, estuarine, etc.), their degree of water permanency, salinity and degree of modification. The result is a consistent wetland map at a scale of 1:100 000, with finer detail in some parts of Queensland where appropriate mapping data exists (mainly coastal regions). This includes in the coastal zone south of Cape York Peninsula, where the scale of the wetlands mapping is approximately 1:50 000 with a minimum polygon area (or wetland mapping unit) of one hectare. Queensland Government's wetlands mapping incorporates wetland areas within Ramsar sites, as well as those within areas in Directory of Important Wetlands in Australia.

QWP also uses aerial photography to classify wetlands by the degree of hydrological and ecological modification observed. Modification can include bunds, conversion of a natural wetland to a dammed body of water, drains or creating artificial wetlands. This data is consistent across Queensland and is an invaluable tool for determining wetland habitat condition.

QWP wetland mapping can be used for determining habitat for MNES species, including migratory breeding and roosting sites, as well as identifying aquatic habitats within Ramsar sites and WHAs. QWP wetland ecosystems can then be analysed for the level of modification of habitat and current protection status. Reviewing previous versions of QWP wetlands with current mapping to evaluate the changing modification of natural aquatic ecosystems is useful for identifying MNES trends.

#### 3.3.2.3 Species sightings data

Sightings records for plants and animals, including MNES such as migratory species and threatened species, are included in the Queensland Government's wildlife database, WildNet. The database stores a range of information including survey data, wildlife sightings, species lists, species descriptions and species status. The data can range from a number of sources, from expert surveys, historical museum data, to amateur enthusiasts and the public. The data repository, CoreVEG, managed by the Queensland Herbarium, is the source of most of the flora sightings records within WildNet.

This species data varies in quantity and quality between individual species. All sightings are verified; however, except for funded expert species surveys, they are mainly distributed to areas of human-wildlife interaction (e.g. urban areas, main highways). Many rare or reclusive species that exist within unpopulated areas have very few or no sightings records available. Also, the sightings may have been from past records where species habitat has now diminished and no longer exists, due to clearance for example. Data may also exist for species that, due to their nature, are free-roaming and utilise a variety of habitats (e.g. highly mobile species such as the red goshawk).

Queensland Government incorporates species data as well as peer reviewed habitat modelling into essential habitat mapping for threatened species.

#### 3.3.2.4 Essential habitat mapping

The three primary data sets (REs, Wetlands and Species Sightings) provide the basis for further analysis and assessment, generally using GIS supported methodologies, to establish derived products fit for specific purposes. The species 'essential habitat' mapping is one of these. The Queensland Government uses three methods to map essential habitat, being vegetation communities in which threatened species have been known to occur. Peer reviewed habitat models provide the best accuracy and reliability; where species habitats are known to equate with specific REs, RE mapping is combined with species sightings; where other methods are not available buffered species sightings are used.

The VM Act protects essential habitat to prevent loss of biodiversity. Queensland Government assesses applications to clear vegetation based on the presence of essential habitat. When essential habitat mapping is assessed for vegetation clearing purposes the mapping can be further evaluated to determine whether it contains essential habitat factors that confirm it is suitable for a certain species. These habitat factors include, but are not limited to:

- Vegetation – the species or types of vegetation that the species is associated with
- RE – the regional ecosystem(s) with which the species is most commonly associated
- land zone – the underlying geology associated with a regional ecosystem
- altitude – the range of altitudes at which the species is found
- soils – the type of soil on which a species is most commonly found
- position in landscape – a precise description of the landscape features the species is commonly associated with (e.g. creek bank, levees, lower slopes, hillsides and ridges).

At least three essential habitat factors are listed for each species, of which one or more may be categorised as mandatory.

Peer-reviewed modelling is the most accurate method of habitat mapping as it has been determined specifically by experts with key knowledge of the species' foraging, feeding, roosting and breeding habits. Habitat modelling is undertaken for individual species, generally species that are of iconic value or are key species as they share habitat with many other significant species. The mapping process includes peer review by other experts and refinement to where the species exists in the real-world environment. Modelled habitat for one species generally incorporates habitats for other species, for which data are often poor.

For example, the southern population of cassowary (*Casuarius casuarius*) occurs within the Wet Tropics in dense vine rainforests extending to the coast at Mission Beach and Daintree localities. The distribution of the cassowary is well known with peer-reviewed spatially defined areas for primary and secondary habitat as well as habitat for rehabilitation. The distribution covers over 700 000 hectares of a broad range of habitats and vegetation communities. At least 69 EPBC Act threatened species have been sighted within the cassowary habitat.

In the absence of either modelled habitat or habitat identified using the 'habitat factors' method, species habitat mapping is based on sightings data and a buffer of remnant vegetation surrounding it. To ensure greater accuracy only species sightings reliably recorded and sighted after 1950 (for flora) and 1970 (for fauna) are used. For species considered to be highly mobile, only known breeding and roosting sites are used.

#### 3.3.2.5 Queensland Land Use Mapping Project (QLUMP)

While not providing a basis for determining the geographic extent of MNES or other biodiversity values, land use mapping enhances our understanding of the likely condition and trend of natural values. Land use and land management practices have a profound impact on Queensland's natural resources, the environment and agricultural production. The availability of consistent and reliable spatial information on land uses is critical for sustainable natural resource management. Queensland Government provides excellent and consistent land use and cover mapping through QLUMP.

QLUMP maps incorporate patterns of land use and land use change across Queensland in accordance with the Australian Land Use and Management (ALUM) classification. Governments, the private sector, research agencies and community groups use the QLUMP data for natural resource assessment, monitoring and planning.

Land use and land cover information are both included within the QLUMP product. Land use describes the land is used for (e.g. grazing, irrigated cropping, mining, residential or conservation). Land cover describes the physical surface of the earth, (e.g. forest, pasture, water or urban).

The QLUMP mapping provides valuable trend information on human impacts in the last 10 years. To assess MNES condition, RE and wetlands mapping, together with species habitat mapping overlaid with QLUMP mapping is used. This approach is consistent with the Vegetation Assets, States, and Transitions (VAST) framework used for national vegetation condition assessment.

## 3.4 Methodology for selecting key MNES values

An objective of the GBR coastal zone strategic assessment is to assess the status of MNES species and TECs within the area. The large number of species and limited species data make it difficult to assess accurately the condition of each MNES species and TEC. A process to select a representative group, or 'key' MNES species and TECs, is required to best illustrate the extent, condition and trend of MNES species and TECs within the GBR coastal zone.

Queensland Government used the PMST to generate lists of threatened species, migratory species and TECs predicted to occur in the GBR coastal zone. The list includes 175 nationally threatened species, 81 migratory species and seven TECs (Appendix E and F).

Queensland Government refined the lists using species sightings records, habitat models and regional ecosystem mapping. The selected MNES species and ecological communities have been subject to an assessment of extent, condition and trend in chapter 4. From these lists the Queensland Government created a representative list for each of the MNES groupings and assessed their condition and trend based on habitat in the GBR coastal zone.

Identification of the key MNES species and ecological communities involved applying the following three processes:

**Selection of threatened species**

1. The Australian Government's mapping data (PMST) was used to identify EPBC threatened species predicted to occur within the GBR coastal zone – this step generated a list of 175 threatened species.
2. Thirteen marine species were removed as these are being addressed in the GBR Region Strategic Assessment. These include; MNES threatened species listed as 'marine' or 'marine-overfly' under the EPBC Act; Cetaceans; Sharks, and; Turtles – 162 species remained after this step was completed.
3. One hundred and twelve terrestrial species in the GBR region which are not regularly triggered for development assessments under the EPBC Act were removed. These species, though still regarded as important, were removed as their habitats are most likely not as threatened by development, or do not come in contact with development as much as species that are commonly triggered – this resulted in a list of 50 species.
4. Thirty-seven species were removed because species habitat mapping, sightings data and literature review (including the

Australian Government's habitat descriptions) showed they did not occur, or predominantly did not occur in the GBR coastal zone – This resulted in a list of 13 species.

5. Two species, the nothern quoll (Dasyurus hallucatus) and the spectacled flying fox (Pteropus conspicillatus) had no recent sightings or modelled habitat in the coastal zone and so were excluded.
6. This report assesses a final list of 11 'key species'.

### Selection of TECs

A similar process was used to identify TECs predominantly located in the GBR coastal zone:

1. The Australian Government's mapping data (PMST) was used to identify TECs predicted to occur within the GBR coastal zone were selected – this identified seven TECs.
2. The equivalent REs for each TEC were identified and mapped against the GBR coastal zone.
3. TECs that have most of their occurrence outside of the GBR coastal zone were removed.
4. Two 'key TECs' have the majority of their distribution in the GBR coastal zone. Four of the five excluded TECs had less than 1 per cent of their extent in the GBR coastal zone while the fifth had less than 5 per cent of its extent in the GBR coastal zone.

### Selection of migratory species

The following process identified migratory species that predominantly used the GBR coastal zone:

1. Migratory species predicted by the PMST mapping system to occur within the GBR coastal zone were selected.
2. Migratory species listed as 'marine' under the EPBC Act (cetaceans, sharks and turtles) were removed as these are assessed in the GBR Region Strategic Assessment.
3. A migratory species shortlist was developed identifying regionally important species and those that have commonly triggered the EPBC Act for past or current proposals in the GBR coastal zone. This refined the list to migratory birds.
4. The PMST mapping system was used to identify known breeding and roosting sites of 'key migratory birds' within the GBR coastal zone.

With the selection of known breeding and roosting sites of migratory bird species in the GBR coastal zone, the list of migratory species was refined from 81 to 38 species. Queensland Government assessed all migratory species habitat together for condition and trend using the same method for threatened species and TECs. Migratory habitats for the degree of modification of wetland habitats using QWP wetland mapping were assessed.

### Key MNES threatened species, Key TECs and Key migratory bird species

Table 3.5 1 and Table 3.5 2 list the key threatened species, key TECs and key migratory bird species. Analyses of extent, condition and trend of the key MNES species and TECs are included in chapter 4.

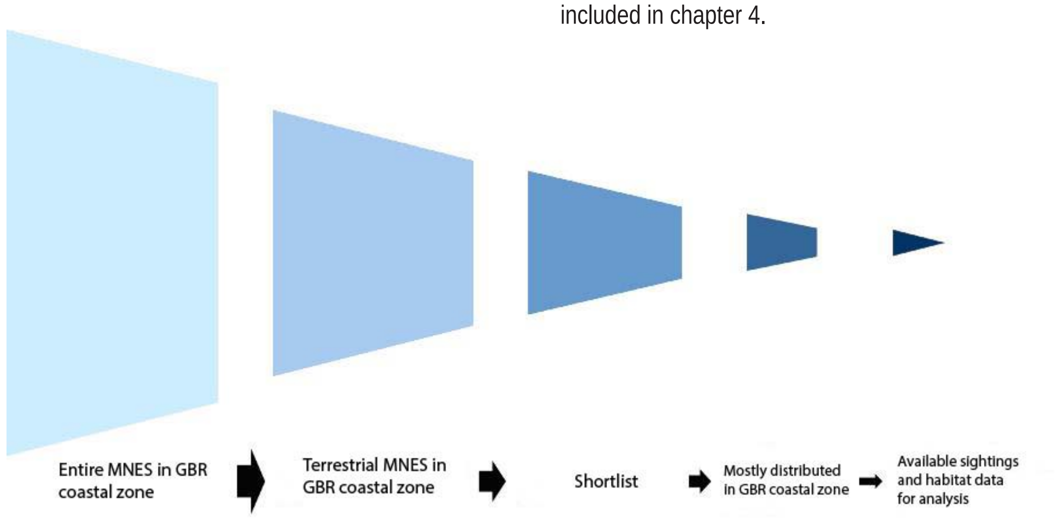



Figure 3.5-1 Identifying MNES 'key' species for analysis

Table 3.5-1 Key threatened species and ecological communities in the GBR coastal zone

| MNES | EPBC Status | NC Act Status | NRM Region |
|---|---|---|---|
| **Fauna** | | | |
| ***Mammals*** | | | |
| Bare-rumped sheathtail bat (*Saccolaimus saccolaimus nudicluniatus*) | Critically Endangered | Endangered | Cape York |
| Mahogany glider (*Petaurus gracilis*) | Endangered | Endangered | Wet Tropics |
| Proserpine rock wallaby (*Petrogale persephone*) | Endangered | Endangered | Mackay Whitsunday |
| False water rat (*Xeromys myoides*) | Vulnerable | Vulnerable | Mackay Whitsunday |
| ***Birds*** | | | |
| Yellow chat (*Epthianura crocea*) | Critically Endangered | Endangered | Fitzroy |
| Southern cassowary (*Casuarius casuarius johnsonii*) (northern and southern population) | Endangered | Endangered | ***North***<br>Cape York<br>***South***<br>Wet Tropics<br>Burdekin |
| **Flora** | | | |
| ***Flowering plants*** | | | |
| Australian arenga palm (*Arenga australasica*) | Vulnerable | Vulnerable | Cape York<br>Wet Tropics |
| Cardwell bearded orchid (*Calochilus psednus*) | Endangered | Endangered | Cape York<br>Wet Tropics |
| Cooktown orchid (*Dendrobium bigibbum)* | Vulnerable | Vulnerable | Cape York<br>Wet Tropics |
| *Quassia bidwillii* | Vulnerable | Vulnerable | Mackay Whitsunday<br>Fitzroy<br>Burdekin<br>Burnett Mary |
| ***Cycads*** | | | |
| *Cycas silvestris* | Vulnerable | Vulnerable | Cape York |
| **TEC** | | | |
| Broad leaf tea-tree (*Melaleuca viridiflora*) woodlands in high rainfall coastal north Queensland | Endangered | | Cape York Peninsula; Far North Queensland, North Queensland; Mackay, Isaac and Whitsunday; Central Queensland |
| Littoral Rainforest and Coastal Vine Thickets of Eastern Australia | Critically Endangered | | Cape York Peninsula; Far North Queensland, North Queensland; Mackay, Isaac and Whitsunday; Central Queensland |

Table 3.5-2 Key Migratory MNES that are represented by known breeding and roosting sites

| Scientific Name | Common Name |
|---|---|
| *Actitis hypoleucos* | Common Sandpiper |
| *Anous stolidus* | Common Noddy |
| *Arenaria interpres* | Ruddy Turnstone |
| *Calidris acuminata* | Sharp-tailed Sandpiper |
| *Calidris alba* | Sanderling |
| *Calidris canutus* | Red Knot, Knot |
| *Calidris ferruginea* | Curlew Sandpiper |
| *Calidris melanotos* | Pectoral Sandpiper |
| *Calidris ruficollis* | Red-necked Stint |
| *Calidris tenuirostris* | Great Knot |
| *Charadrius bicinctus* | Double-banded Plover |
| *Charadrius leschenaultii* | Greater Sand Plover, Large Sand Plover |
| *Charadrius mongolus* | Lesser Sand Plover, Mongolian Plover |
| *Charadrius veredus* | Oriental Plover, Oriental Dotterel |
| *Fregata ariel* | Lesser Frigatebird, Least Frigatebird |
| *Fregata minor* | Great Frigatebird, Greater Frigatebird |
| *Gallinago hardwickii* | Latham's Snipe, Japanese Snipe |
| *Heteroscelus brevipes* | Grey-tailed Tattler |
| *Heteroscelus incanus* | Wandering Tattler |
| *Limicola falcinellus* | Broad-billed Sandpiper |
| *Limosa lapponica* | Bar-tailed Godwit |
| *Limosa limosa* | Black-tailed Godwit |
| *Numenius madagascariensis* | Eastern Curlew |
| *Numenius minutus* | Little Curlew, Little Whimbrel |
| *Numenius phaeopus* | Whimbrel |
| *Pluvialis fulva* | Pacific Golden Plover |
| *Pluvialis squatarola* | Grey Plover |
| *Puffinus pacificus* | Wedge-tailed Shearwater |
| *Sterna anaethetus* | Bridled Tern |
| *Sterna bengalensis* | Lesser Crested Tern |
| *Sterna caspia* | Caspian Tern |
| *Sterna sumatrana* | Black-naped Tern |
| *Sula dactylatra* | Masked Booby |
| *Sula leucogaster* | Brown Booby |
| *Sula sula* | Red-footed Booby |
| *Tringa glareola* | Wood Sandpiper |
| *Tringa stagnatilis* | Marsh Sandpiper, Little Greenshank |
| *Xenus cinereus* | Terek Sandpiper |

### 3.4.1 Methodology for identfying key habitat

The majority of habitats for key TECs, threatened species and migratory species in the GBR coastal zone have been mapped based on REs associated with MNES sightings or habitat models. Cleared and non-vegetated areas (e.g. water) were not included as only vegetated RE communities were considered MNES habitat. As the habitat is based on remnant REs, non-remnant areas were not included in current version of RE mapping.

The mapped habitat for key migratory species is based solely on REs and wetlands in which sightings occurred, and identified breeding and roosting sites.

The pre-clearing and current extent of identified key habitat area was determined; this provided a pre and post development area of habitat for each TEC and species assessed. This method for habitat identification was preferred over modelled habitat as the extent of some threatened species is based on current habitat extent only (usually derived from recent RE mapping), meaning pre-cleared analysis cannot be determined.

SPRAT information listing REs identified the habitat of the key TECs. The SPRAT TEC table translates TECs descriptions into REs and lists them for each TEC. The same REs in the SPRAT TEC table were selected from the pre-clearing and current extent versions of the RE mapping and the area of RE for each was calculated. This showed the extent of habitat clearance since European settlement. These associated REs became the TEC habitat for analysis (Figure 3.5 2).

The REs' numeric and ecosystem description for the broad leaf tea-tree (Melaleuca viridiflora) woodlands in high rainfall coastal north Queensland community:

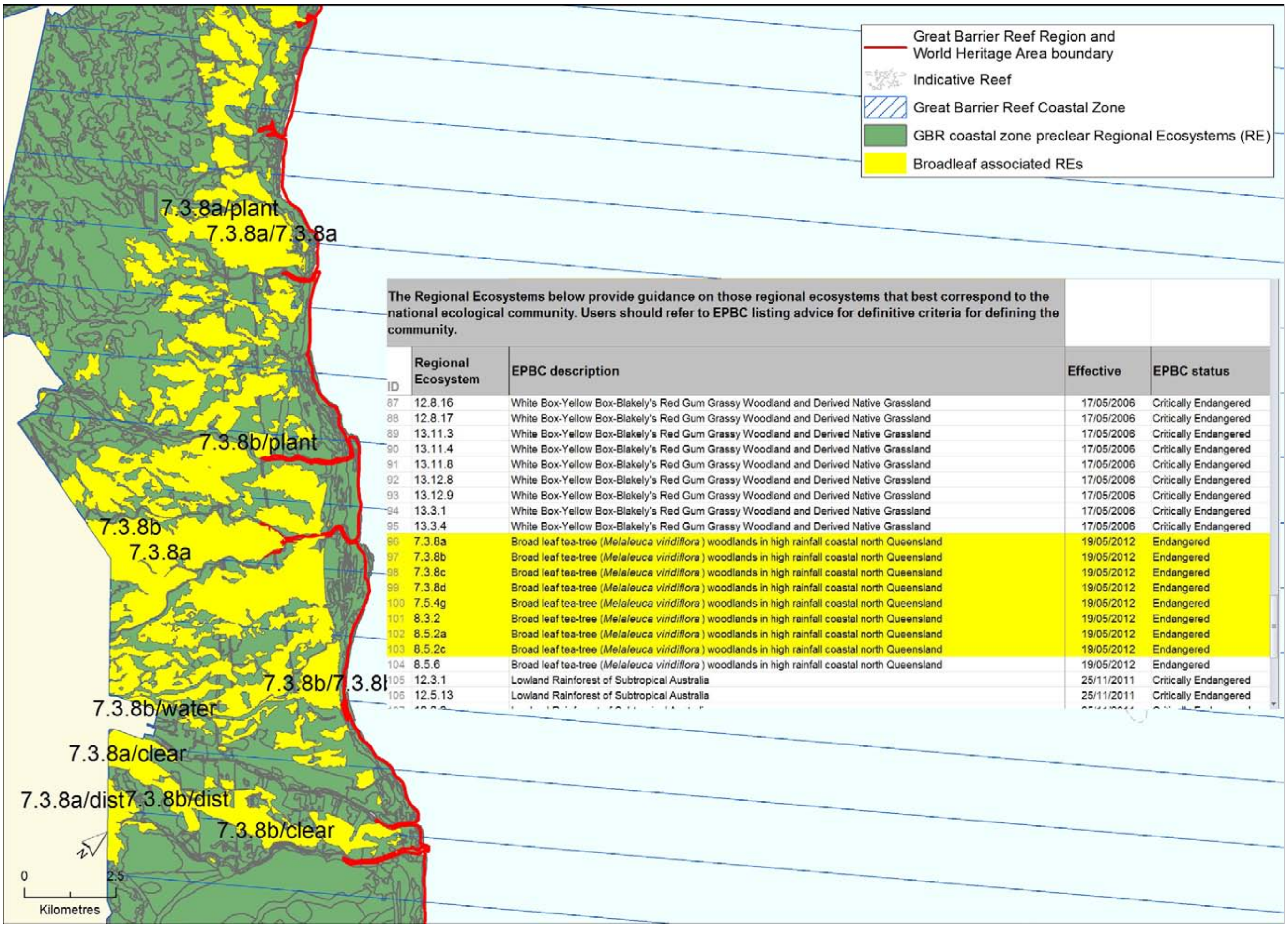
- 7.3.8a Melaleuca viridiflora open-forest to open-woodland, on poorly drained alluvial plains
- 7.3.8b Melaleuca viridiflora open-forest to open-woodland with eucalypt emergents (or sparse eucalypt overstorey) of species such as Corymbia clarksoniana, Eucalyptus platyphylla, Lophostemon suaveolens and E. drepanophylla on poorly drained alluvial plains
- 7.3.8c Melaleuca viridiflora and Lophostemon suaveolens

open forest to woodland, on poorly drained alluvial plains

- 7.3.8d Melaleuca viridiflora, Lophostemon suaveolens and Allocasuarina littoralis open-shrubland, on poorly drained alluvial plains
- 7.5.4g Melaleuca viridiflora woodland on laterite
- 8.3.2 Melaleuca viridiflora woodland on seasonally inundated alluvial plains with impeded drainage
- 8.5.2a Melaleuca viridiflora +/- Allocasuarina luehmannii woodland on Tertiary sand plains
- 8.5.2c Melaleuca viridiflora and M. nervosa woodland on Tertiary sand plains
- 8.5.6 Melaleuca viridiflora +/- Allocasuarina littoralis woodland on Tertiary sand plains

The REs that currently equate to the Littoral Rainforest and Coastal Vine Thickets of Eastern Australia community are:

- 3.2.1 Evergreen notophyll vine forest on coastal dunes and beach ridges
- 3.2.11 Low microphyll vine forest. Occurs on coastal dunes and beach ridges
- 3.2.12 Araucarian microphyll vine forest on coastal dunefields and beach ridges
- 3.2.13 Evergreen notophyll vine forest on beach ridges on the east coast
- 3.2.28 Evergreen notophyll vine forest on beach ridges on coral atolls, shingle cays and sand cays
- 3.2.29 Pisonia grandis low closed forest. Restricted to a few scattered sand cays




The Regional Ecosystems below provide guidance on those regional ecosystems that best correspond to the national ecological community. Users should refer to EPBC listing advice for definitive criteria for defining the community.

| ID | Regional Ecosystem | EPBC description | Effective | EPBC status |
|---|---|---|---|---|
| 87 | 12.8.16 | White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland | 17/05/2006 | Critically Endangered |
| 88 | 12.8.17 | White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland | 17/05/2006 | Critically Endangered |
| 89 | 13.11.3 | White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland | 17/05/2006 | Critically Endangered |
| 90 | 13.11.4 | White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland | 17/05/2006 | Critically Endangered |
| 91 | 13.11.8 | White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland | 17/05/2006 | Critically Endangered |
| 92 | 13.12.8 | White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland | 17/05/2006 | Critically Endangered |
| 93 | 13.12.9 | White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland | 17/05/2006 | Critically Endangered |
| 94 | 13.3.1 | White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland | 17/05/2006 | Critically Endangered |
| 95 | 13.3.4 | White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland | 17/05/2006 | Critically Endangered |
| 96 | 7.3.8a | Broad leaf tea-tree (*Melaleuca viridiflora* ) woodlands in high rainfall coastal north Queensland | 19/05/2012 | Endangered |
| 97 | 7.3.8b | Broad leaf tea-tree (*Melaleuca viridiflora* ) woodlands in high rainfall coastal north Queensland | 19/05/2012 | Endangered |
| 98 | 7.3.8c | Broad leaf tea-tree (*Melaleuca viridiflora* ) woodlands in high rainfall coastal north Queensland | 19/05/2012 | Endangered |
| 99 | 7.3.8d | Broad leaf tea-tree (*Melaleuca viridiflora* ) woodlands in high rainfall coastal north Queensland | 19/05/2012 | Endangered |
| 100 | 7.5.4g | Broad leaf tea-tree (*Melaleuca viridiflora* ) woodlands in high rainfall coastal north Queensland | 19/05/2012 | Endangered |
| 101 | 8.3.2 | Broad leaf tea-tree (*Melaleuca viridiflora* ) woodlands in high rainfall coastal north Queensland | 19/05/2012 | Endangered |
| 102 | 8.5.2a | Broad leaf tea-tree (*Melaleuca viridiflora* ) woodlands in high rainfall coastal north Queensland | 19/05/2012 | Endangered |
| 103 | 8.5.2c | Broad leaf tea-tree (*Melaleuca viridiflora* ) woodlands in high rainfall coastal north Queensland | 19/05/2012 | Endangered |
| 104 | 8.5.6 | Broad leaf tea-tree (*Melaleuca viridiflora* ) woodlands in high rainfall coastal north Queensland | 19/05/2012 | Endangered |
| 105 | 12.3.1 | Lowland Rainforest of Subtropical Australia | 25/11/2011 | Critically Endangered |
| 106 | 12.5.13 | Lowland Rainforest of Subtropical Australia | 25/11/2011 | Critically Endangered |

Figure 3.5 2 An example of determining key MNES TEC habitat (associated REs)

- 3.2.31 Premna serratifolia closed scrub. Restricted to coral atolls, shingle cays and sand cays
- 3.12.20 Evergreen notophyll vine forest dominated by Welchiodendron longivalve on headlands
- 7.2.1a-i Mesophyll vine forest on beach ridges and sand plains of beach origin
- 7.2.2a-h Notophyll to microphyll vine forest on beach ridges and sand plains of beach origin
- 7.2.5a Mesophyll/notophyll vine forest of Syzgium forte subsp. forte on beach ridges and sand plains of beach origin
- 7.2.6b Mosaic of clumps of notophyll vine forest, sclerophyll spp. shrublands and open woodlands, and bare sand blows, on aeolian dunes
- 7.11.3b Semi-deciduous mesophyll vine forest on metamorphics, of the moist and dry foothills and lowlands
- 7.12.11d Simple notophyll vine forest and notophyll semi-evergreen vine forest of rocky areas and talus, of moist granite and rhyolite foothills and uplands
- 8.2.2 Microphyll vine forest on coastal dunes
- 12.2.2 Microphyll/notophyll vine forest on beach ridges

The identification of habitats for key threatened species used a similar process to identifying TEC habitats, except the associated REs were derived from sighting areas and modelled habitat and then extended to the entire GBR coastal zone. Key species sighting areas are sightings records in the GBR coastal zone surrounded by a 1000 metre buffer to allow for the range of individual animals.

Key species modelled species habitat is the area determined by experts as a species primary habitat and included within essential habitat. Essential habitat is an area of vegetation in which an endangered, vulnerable, rare or near threatened species have been known to occur. Essential habitat was identified by using habitat factors, including, but not limited to:

- Vegetation – the species or types of vegetation with which the species is associated
- RE – the REs with which the species is most commonly associated
- land zone – the underlying geology associated with a RE
- altitude – the range of altitudes at which the species is found
- soils – the type of soil on which a species is most commonly found
- position in landscape – a precise description of the landscape features the species is commonly associated with (e.g. creek bank, levees, lower slopes, hillsides and ridges).

Associating REs with threatened species to identify habitat was the method preferred over including only REs that are within a sighting area. The process of identifying the habitat for the threatened species involved mapping the species sighting record and buffer area and modelled habitat over the pre-cleared RE mapping. The REs that intersected the species sighting record and modelled habitat were selected and the area calculated (see Figure 3.5 3). The same REs were then selected in the current extent RE mapping and the area calculated.

A similar technique was used to identify migratory species habitat, with additions (such as wetlands, which may be devoid of vegetation). Only migratory bird species were considered as the majority of the other migratory species are marine. The key migratory species habitat was defined by known breeding and roosting sites in the GBR coastal zone. Key migratory species habitat was also analysed against the QWP. The habitat type and modifications for all wetland types that crossed the key MNES migratory habitat were investigated. All known breeding and roosting sites for migratory species in the GBR coastal zone were analysed together and only REs that crossed the key migratory species habitat were included in the analysis (see Figure 3.5 4).

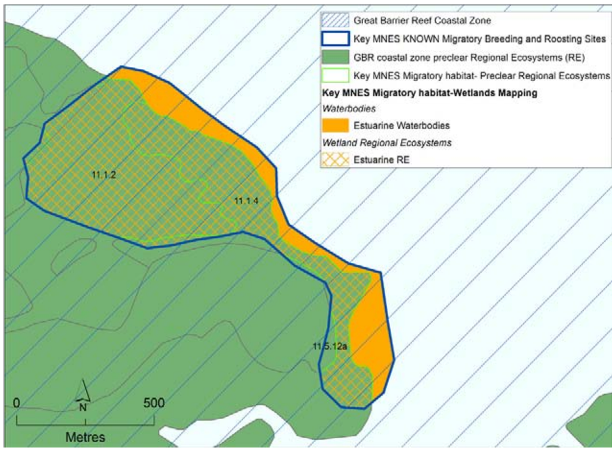



Figure 3.5 3 Determining key threatened species habitat (associated REs)

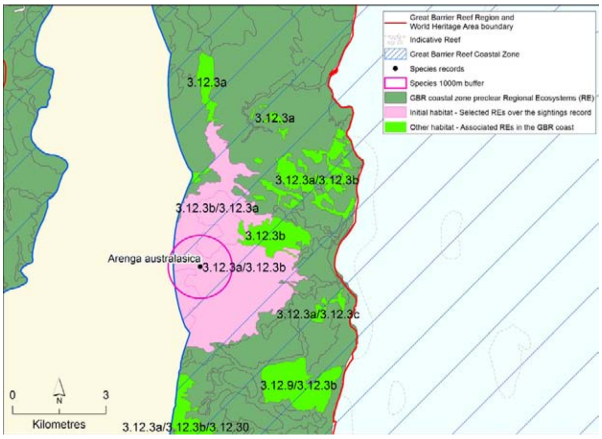



Figure 3.5 4 Determining key MNES migratory habitat (wetland and RE habitat)

## 3.5 Extent, condition and trend

Assessments of the extent, condition (or state) and trend of MNES are based primarily on the associated REs (for TECs), species habitat (for listed threatened species) or defined boundaries for specified areas (such as World Heritage and Ramsar areas).

### 3.5.1 Extent

The assessment of extent is based on an assessment of REs which establishes the conservation significance of REs based on area of their pre-clearing extent remaining. This is robust data and temporal snapshots dating from the early 1990s can be used to track changes in RE extent.

Similarly, the extent of habitat for listed threatened or migratory species can be tracked as this is generally tied to sightings data linked to RE data. The extent of the specified areas (WHA and Ramsar sites) is the simplest measure given the firm cadastral boundaries these areas have.

### 3.5.2 Condition

This *strategic assessment report* uses grading statements to standardise the assessments. There are four grades available for each assessment. For example, the condition of each MNES is graded by rating its condition against a standard set of grading statements. The most conservative grading statement was applied overall for each assessment.

Table 3.5-1 Specific MNES areas

| | | | Equivalent term in IUCN |
|---|---|---|---|
| | Very good condition | All elements necessary to maintain listing of an area are essentially intact, and their overall condition is stable or improving. Available evidence indicates only minor, if any, disturbance to ecological (and OUV where applicable) values | Good |
| | Good condition | Some loss or alteration of the elements necessary to maintain listing has occurred, but their overall condition is not causing persistent or substantial effects on ecological/OUV values | Good with concerns |
| | Poor condition | Loss or alteration of many elements necessary to maintain listing has occurred, which is leading to a significant reduction in ecological/OUV values | Significant concerns |
| | Very poor condition | Loss or alteration of a majority of elements necessary to listing has occurred and has caused a major loss of the ecological/OUV value | Critical |

Source: IUCN system for assessing Natural World Heritage sites

The grading statements for specific MNES areas in the coastal zone (including the GBRWHA) are consistent with those in the GBR regional strategic assessment (Table 3.5-1). The supporting evidence for those grading statements is contained in the GBR regional strategic assessment report.

Some MNES have relatively detailed information available, such as for Ramsar areas where ecological character descriptions (ECDs) have been completed (refer to the Bowling Green Bay demonstration case) or the Wet Tropics WHA where a management plan and conservation strategy have been prepared (refer to the Wet Tropics WHA demonstration case). However, there is limited direct information about the condition of most environments containing MNES values (particularly outside protected areas).

Data relating to the condition of TECs and the habitat for listed threatened or migratory species varies considerably. Unfortunately, no assessment technique is available to measure the condition of broadscale areas. As a result an assessment of the condition of MNES, TECs, threatened and migratory species habitat areas generally relies on a combination of indirect measures, particularly conservation status and land use classification as a proxy (Table 3.5-2).

Land use, specifically the current or potential intensity of that use, is considered to be a reasonable proxy for condition and long-term viability. For example, at the extremes, land in conservation areas is expected to remain intact and well managed for conservation outcomes, whereas an area of MNES located in an urban area is more likely to be managed to enhance its development potential. Land use has been categorised as conservation, minimal use, moderate use and intensive use (see Table 3.5-3.)

Table 3.5-2 Threatened and migratory species

| | | |
|---|---|---|
| (dark green) | Very good condition | Only a few, if any, species populations have declined as a result of human activities or declining environmental conditions |
| (light green) | Good condition | Populations of a number of significant species (but no species groups) have declined significantly as a result of human activities or declining environmental conditions |
| (orange) | Poor condition | Populations of many species or some species groups have declined significantly as a result of human activities or declining environmental conditions |
| (red) | Very poor condition | Populations of a large number of species have declined significantly |

Source: Australia SoE, adapted from *Outlook Report* [4]

Table 3.5-3 Threatened and migratory species habitat and threatened ecological communities

| | | | Condition indicator |
|---|---|---|---|
| (dark green) | Very good condition | Conservation areas | All habitat is protected and managed for conservation purposes to ensure structural and functional integrity. |
| (light green) | Good condition | Minimal use areas | All habitat is located in a minimal use area, suggesting minimal degradation but no persistent, substantial effects on populations of dependent species. |
| (orange) | Poor condition | Moderate use areas | All habitat is located in moderate use areas, suggesting land use may result in persistent, substantial effects on populations of some dependent species. |
| (red) | Very poor condition | Intensive use areas | All habitat is located in intensive use areas, suggesting widespread loss, degradation or alteration of habitat will occur leading to persistent, substantial effects on many populations of dependent species. |

Source: DEHP (2013)

Queensland Government manages conservation areas such as national parks, other protected areas under the NC Act, fish habitat reserves and high protection marine park zones areas primarily or substantially in a way to protect and enhance their natural values. These areas essentially remain intact and human activities result in minimal impacts. Additionally, it is assumed that land management practices in these areas ensure pest and fire management is undertaken with a view to protecting or enhancing natural values. On this basis land used for these purposes is assumed to be in very good condition and the trend is stable.

Minimal use areas are natural areas used for low impact activities. These areas include state forests and military training areas. In these areas, biodiversity values are often managed as well as conservation areas, but the intensity of use is likely to lead to a greater level of impact. In these areas pest and fire management is undertaken with a view to protecting assets as well as natural values. It is assumed that 'minimal use' areas are in good condition and the trend is stable.

In areas classified as containing moderate land use, such as grazing or agriculture, human activities may not be very intense, but because they are not managed primarily to protect biodiversity values it has been assumed that the condition of these areas is lower and will trend down over time. These uses pose greater threats, such as the loss of native grasses through grazing, erosion due to stock herding, limited management of environmental pests, and fire regimes suited to productive rather than ecological purposes. The condition of habitat is considered poorer in these areas because of the frequency of human activities in these areas and the susceptibility to further degradation. It is assumed that 'moderate use' areas are in poor condition and the trend is deteriorating.

Activities within an urban footprint, including port and industrial areas, are considered intensive uses. While MNES areas may remain in urban areas, they are more likely to be subject to a high level of pressures. One of the greatest threats to habitat condition within the urban footprint is fragmentation and expected loss of biodiversity. Some of these areas may remain intact but be very species poor due to having less interaction with similar habitats and loss of species from crossing between fragments (e.g. car strikes, domestic predators). Additionally, it is less likely that management will address pest and fire issues from an ecological perspective. In the long-term these areas are either cleared for development, or retained as low biodiversity value parklands or recreation areas for residents.

The condition of ecosystem processes was also determined in this assessment and the grading statements are provided in Table 3.5-4.

### 3.5.3 Trend and confidence

Queensland Government has also provided an assessment of the trend and the level of confidence for each grading statement

Table 3.5-4 Ecosystem processes

| | | |
|---|---|---|
| (green) | Very good condition | There are no significant changes in ecological processes as a result of human activities |
| (light green) | Good condition | There are some significant changes in ecological processes as a result of human activities in some areas, but not to the extent that they are significantly affecting ecosystem functions |
| (orange) | Poor condition | There are substantial changes in ecological processes as a result of human activities, and these are significantly affecting ecosystems in some areas |
| (red) | Very poor condition | There are substantial changes in ecological processes across a wide area as a result of human activities, and ecosystem functions are seriously affected in much of the area |

Source: Australia SoE, adapted from *Outlook Report*[4]

Table 3.5-5 Trend and confidence grading

| |
|---|
| **Trend** |
| Improving |
| Deteriorating |
| Stable |
| **Confidence** |
| Adequate high-quality evidence and high level of consensus |
| Limited evidence or limited consensus |
| Evidence and consensus too low to make an assessment |

(Table 3.5 5). Trend and confidence indicators were adapted from those used for the Australian State of the Environment Report. The trend assessment uses historical information to identify the recent trend. For key TECs and MNES species this relates to a combination of extent and condition. For the majority of species habitat in conservation areas and minimal use areas trend gradings are stable, and for moderate land use and intensive land use areas trend gradings are deteriorating.

Given the limitations of data used to establish MNES extent, and the proxy approach used to establish 'condition', trend data is indicative and likely to be unreliable at a broad scale. It is therefore important to ascribe an indicator of the level of confidence we have in the grading statements provided. The confidence indicator shows the strength of the evidence, with high confidence indicating adequate high-quality data and low confidence showing there was only limited data or consensus to make an assessment. If there was too little data to provide a score this information gap is indicated.[21] This strategic assessment indicates trend as either 'improving', 'stable' or 'deteriorating'. Each assessment applies the most conservative grading of trend and confidence.

## 3.6 Pressures and impacts

Pressures and impacts may be positive or negative. Applying a consistent grading system for individual impacts provides a basis for determining overall cumulative impacts from multiple activities (see Table 3.6 1).

Table 3.6 1 Grading statements for the effect of pressures and impacts on MNES

| | | |
|---|---|---|
| | Positive effect | There are positive effects of the impact that are more significant than any negative effects |
| | No effect | No interaction or the interaction is so insignificant that it can be considered negligible |
| | Very low effect | Any effects attributable to the impact are minor or localised, with no observable effects on the values |
| | Low effect | The effects of the impact are observable in some locations or to some species, but only to the extent that limited additional intervention would be required to maintain the values |
| | High effect | The effects of the impact are obvious in many locations or for many species to the extent that significant additional intervention would be required to maintain the values |
| | Very high effect | The effects of the impact are widespread, to the extent that the values are severely compromised |

For the purposes of the strategic assessment, cumulative impacts are the combined and incremental environmental effects from existing and proposed pressures on the GBR coastal zone and subsequently on the GBR, the interaction between those impacts, and the accumulation of past, present and potential future activities.

The extent and diverse coastal environment of the GBR presents many challenges in assessing the cumulative impacts within the 2300 kilometre long GBR coastal zone.

Queensland Government collects and interprets information regarding the impacts on the GBR, including MNES, at a broad scale. More detailed analysis on a regional and local scale provides an indicator of the drivers of cumulative impacts and progress with regard to reversing the decline in water quality and terrestrial habitats in the GBR coastal zone. Queensland Government bases these assessments on accurate quantitative data on vegetation and wetland extent, and species numbers and distribution that enable measurement of the state and trend of MNES.

A number of mechanisms are already in place to assess and monitor cumulative impacts, which range in scale and provide different functions to inform management. This strategic assessment report discusses cumulative impacts and the management of cumulative impacts in sections 5.5 and 5.6.

## 3.7 Program effectiveness

The ‘avoid, mitigate, offset’ approach is widely used to ensure no significant impacts on the environment result from future development decisions. The Queensland Government’s Program uses this approach to achieve positive outcomes for MNES, as outlined in Figure 3.7 1. Additionally the program contains components aimed at enhancing MNES.

### 3.7.1 Avoid

The first priority is avoiding impacts on MNES. The Queensland Government’s Program endeavours to avoid impacting MNES by:

- planning within areas designated for development
- locating development away from MNES areas
- constructing developments outside sensitive migration periods
- project design
- extending and effectively managing Queensland’s protected area estate.

### 3.7.2 Mitigate

Where development cannot avoid MNES, the next priority is to ensure impacts are minimised as far as possible through the design and construction of the project, through development of management plans or by timing of operations. Mitigation refers to measures applied to reduce the level of impact from a proposed development during its implementation. This primarily occurs through placing appropriate conditions on individual development approvals during the development assessment process. The Queensland Government has produced a range of plans, policies, programs and guides to reduce the level of impact from development.

### 3.7.3 Offset

Where impacts cannot be reasonably avoided and impacts are minimised as much as practicable, residual impacts must be offset to ensure that the value which is being impacted is no worse off. Environmental offsets are conservation activities which compensate environment harm caused by development when it cannot be avoided or mitigated. Offsets can take the form of positive management interventions such as restoration of degraded habitat, arrested degradation or averted risk, protecting areas where there is imminent or projected loss of biodiversity. Offsetting occurs through offsetting policies designed by the Queensland Government to counterbalance any residual loss of MNES values that cannot be avoided or mitigated. The Queensland Government’s offset policy provides the framework to ensure there is net gain of biodiversity and it is aligned with the Australian Government’s offset policy for MNES under the EPBC Act.

### 3.7.4 Enhance

Ongoing adaptive management is critical to provide positive long-term outcomes for MNES by maintaining and enhancing MNES values over time, in both current and future developments within the GBR coastal zone. Enhancing MNES includes rehabilitating degraded ecosystems or restoring cleared ecosystems. Queensland Government contributes significant resources to enhancing MNES impacted by past land clearing or current land use practices.

This hierarchy will effectively ensure that unacceptable impacts on MNES will not occur. With a more strategic approach to offsets, and continued efforts to enhance MNES through other supporting programs, a net gain can be achieved for MNES.


Figure 3.7 1 The avoid, mitigate, offset approach

### 3.7.5 Program effectiveness

Queensland Government developed a consistent framework to assess its Program effectiveness, based on the TOR endorsement criteria and other best practice management standards. Examining management responses using this method highlights the strengths and weaknesses in management efforts.

Queensland Government's has assessed its Program on its ability to:

- identify MNES
- assess impacts to MNES
- avoid, or mitigate and offset likely impacts on MNES
- enhance MNES impacted by past land clearing and current land use practices.

Program effectiveness is graded on a scale of four levels, very effective, effective, partially effective, and ineffective. Table 3.7-1 below outlines the definitions for the grading statements for Program effectiveness.

Table 3.7-1 Grading statements for Program effectiveness

| Program effectiveness | Definitions for grading statements |
|---|---|
| Demonstrated ability to identify MNES (including WHA OUVs) Demonstrated ability to identify MNES (including WHA OUVs) | Very effective: MNES are identified early and explicitly in the planning, development and management processes. Identification methods are scientifically proven and well documented. Mapping (where relevant) is regularly reviewed and updated.<br>Effective: MNES are identified through the planning, development and management system but not explicitly. Identification may not be explicitly documented. Mapping (where relevant) may be once off.<br>Partially effective: MNES are identified in only in some cases, but are not explicitly required to be considered in planning, development and management processes. There may be significant scientific uncertainty.<br>Ineffective: MNES are not identified, mapped or integrated into planning, development or management processes in any meaningful way. |
| Effectiveness in assessing impacts | Very effective: MNES values and potential significant impacts from a development proposal identified by an applicant from a comprehensive site survey and are transparently articulated and quantified in the assessment process.<br>Effective: The potential significant impacts on MNES values from a development proposal are generally described from a high quality trigger map and assessment is based on general guidance.<br>Partially effective: MNES values are not transparently identified or identified from poor quality data and assessment is based on assumptions about the extent of potential impact.<br>Ineffective: MNES values are not identified by any sound method and assessment of the significance of impact occurs from a desk-top analysis or not at all. |
| Effectiveness in avoiding impacts | Very effective: Planning, development and management processes effectively and explicitly ensure impacts on MNES are avoided. Mapping (where relevant) of areas of significance is integrated into planning in order to frontload avoidance mechanisms. Cumulative impacts considered upfront in planning and assessment.<br>Effective: Planning, development and management processes effectively ensure impacts are avoided. Mapping (where relevant) of areas of significance is integrated into some aspects of planning, but may not be explicit.<br>Partially effective: Planning, development and management processes avoid some impacts on MNES up front, but indirect and cumulative impacts are not well planned for or managed.<br>Ineffective: Direct, indirect and cumulative impacts on MNES are poorly avoided and mapping (where relevant) is not regularly used to avoid areas of significance. |

| Program effectiveness | Definitions for grading statements |
|---|---|
| Effectiveness in mitigating impacts | Very effective: Strong systems are in place to minimise the impacts on MNES. Rigorous, scientifically justified conditions applied to use or development.<br>Effective: Systems are largely in place to minimise the impacts on MNES. Some conditions may be applied to use or development in certain circumstances.<br>Partially effective: Some systems in place to minimise the impacts on MNES, but may be ad hoc.<br>Ineffective: Only minimal steps taken to minimise impacts on MNES or there are significant deficiencies in the process or lack of scientific knowledge on which to base measures. |
| Effectiveness in offsetting unavoidable impacts | Very effective: Offsets policies explicitly consider MNES and deliver the effective and strategic outcomes that result in a net improvement overall for MNES.<br>Effective: Offsets policies explicitly consider MNES and deliver 'like for like' outcomes that result in no net loss for MNES.<br>Partially effective: Offsets policies do not explicitly consider MNES, do deliver some tangible outcomes for MNES, but not a net improvement.<br>Ineffective: Offsets policies do not explicitly consider MNES and the outcomes are insufficient to offset the impacts. |
| Contribution to enhancement of MNES and management of existing pressures | Very effective: Legacy impacts well understood and strong measures are in place to recover or improve MNES. Significant resources applied to address key threats.<br>Effective: Legacy impacts well understood and some measures are in place to recover or improve MNES. Some resources applied to address the key threats.<br>Partially effective: Legacy impacts understood and measures are in place to recover or improve MNES. Resources applied not sufficient to address the key threats, and impacts are likely to persist.<br>Ineffective: Legacy impacts poorly understood. No measures in place to recover or improve MNES. |
| Demonstrated ability to adapt system over time to incorporate new knowledge | Very effective: Well-designed management systems implemented for effective delivery of planned management actions, including clear governance arrangements in place, appropriate stakeholder engagement, active adaptive management and adequate reporting against goals.<br>Effective: Well-designed management systems are in place, but not yet fully implemented.<br>Partially effective: Management systems provide some guidance, but are not consistently delivering around implementation of management actions, stakeholder engagement, adaptive management or reporting.<br>Ineffective: Adequate management systems are not in place. Lack of consistency and integration of management activities across jurisdictions is a problem. |
| Resourcing, monitoring and compliance | Very effective: Financial and staffing resources are largely adequate to address management issues. Biophysical and socioeconomic information is available to inform management decisions. Systems are in place for enforcement and compliance.<br>Effective: Financial and staffing resources are mostly adequate to address management issues, but may not be secure. Biophysical and socioeconomic information is available to inform decisions, although there may be deficiencies in some areas. Systems are in place for enforcement and compliance.<br>Partially effective: Financial and staffing resources are unable to address management issues in some important areas. Biophysical and socioeconomic information is available to inform management decisions, although there are significant deficiencies in some areas. There is limited enforcement or compliance.<br>Ineffective: Financial and staffing resources are unable to address management issues in many areas. Biophysical and socioeconomic information to support decisions is deficient in many areas. Enforcement and compliance mechanisms deficient in many areas. |

## 3.8 Projected condition and trend

Queensland Government has based the projected condition and trend of MNES on land use and its assumed management intent (i.e. level of protection). Clearly, areas containing MNES values face substantially less long-term risk of decline in condition where located in a conservation area. The reverse is likely to be true for MNES values located in areas identified for development. Using the conventionally accepted risk-based approach – likelihood versus consequence[22] – the following information has been synthesised to assess projected condition and trend over the 25-year life of the Queensland Government's Program:

- the existing extent, state/condition and trend for MNES
- an understanding of activities and pressures impacting on MNES, including risk to MNES
- the effectiveness of the Program, including forward commitments, to avoid future impacts and enhance MNES
- an assessment of resilience.

The projected risk of the activities and pressures is based on the likelihood and consequence of each threat (Table 3.8 1, Table 3.8 2 and Table 3.8 3).

Table 3.8-1 Gradings for likelihood

| Likelihood | Expected frequency of a given threat |
|---|---|
| Almost certain | Expected to occur more or less continuously throughout a year |
| Likely | Not expected to be continuous but expected to occur one or more times in a year |
| Possible | Not expected to occur annually but expected to occur within a 10 year period |
| Unlikely | Not expected to occur in a 10 year period but expected to occur in a 100 year period |
| Rare | Not expected to occur within the next 100 years |

Table 3.8-2 Gradings for consequence

| Consequence | Extent of the impact based on current management | |
|---|---|---|
| | Broad Scale | Local Scale |
| Catastrophic | Impact is clearly affecting, or would clearly affect, the nature of the ecosystem or heritage value over a wide area.<br><br>Recovery periods greater than 20 years likely. | Complete loss of values can be expected. Not reversible. |
| Major | Impact is, or would be, significant at a wider level.<br><br>Recovery periods of 10 - 20 years likely. | Impact is, or would be, extremely serious and possibly irreversible to a sensitive population or community.<br><br>Condition of an affected part of the ecosystem or heritage value possibly irretrievably compromised. |
| Moderate | Impact is, or would be, present at a wider level.<br><br>Recovery periods of 5 - 10 years likely. | Impact is, or would be, extremely serious and possibly irreversible over a small area.<br><br>Recovery periods of 10 - 20 years likely. |

| Consequence | Extent of the impact based on current management | |
|---|---|---|
| Minor | Impact is, or would be, not discernible at a wider level.<br><br>Impact would not impair the overall condition of the ecosystem or heritage value, sensitive population or community over a wider level. | Impact may be significant to a sensitive population or community at a local level but is likely to recover with management intervention.<br><br>Recovery periods of 5 - 10 years likely. |
| Insignificant | No impact or if impact is, or would be, present then only to the extent that it has no discernible effect on the overall condition of the ecosystem or heritage value. | No impact or if impact is, or would be, present then only to the extent that it has no discernible effect on the overall condition of the ecosystem or heritage value. |

Table 3.8-3 Grading for overall risk

| | |
|---|---|
| | Given current management arrangements, any threats considered likely or certain to occur are predicted to have insignificant consequences for the values. There may be minor consequences for the values for other less likely threats. |
| | Given current management arrangements, many of the threats considered likely or certain to occur are predicted to have minor consequences for the values, a few may have moderate consequences but none will have catastrophic consequences. Some unlikely threats may have major consequences for the values. |
| | Given current management arrangements, many of the likely or almost certain threats are predicted to have moderate or major consequences for the values. Unlikely events may have catastrophic consequences. |
| | Given current management arrangements, there are likely or almost certain threats that are predicted to have catastrophic consequences on the values. |

Table 3.8-4 Matrix for determining overall risk based on likelihood and consequence

| | Consequence | | | | |
|---|---|---|---|---|---|
| **Likelihood** | Insignificant | Minor | Moderate | Major | Catastrophic |
| Almost Certain | Low | Medium | High | Very High | Very High |
| Likely | Low | Medium | High | High | Very High |
| Possible | Low | Low | Medium | High | High |
| Unlikely | Low | Low | Low | Medium | High |
| Rare | Low | Low | Low | Low | Medium |

Source: Adapted from Outlook Report 2009[4]

The projected conditions of particular values depend not only on management, but also on the resilience of the species or ecosystem (i.e. how able it is to withstand and recover from impacts), and the response time after particular impacts. For example, some threatened species are expected to have slow response times to a decline in broadscale clearing compared with TECs. Coastal rainforest communities are predicted to return to structural maturity within two to three decades following management intervention.

For threatened species and ecological communities, the projected trend for the 25-year duration of the Program is based on the level of protection that the REs are expected to experience. This considers that an area of a RE within a national park, state forest or non-urban area will continue to be protected and its extent will remain stable. Areas in the urban footprint are considered to be declining.

For TECs, key species and migratory species, trend predictions are derived by looking at the percentage of each land use category of the remaining RE extent and assuming that certain land uses will have particular impacts on the RE's condition. For the purposes of this assessment Queensland Government has assumed that if over 75 per cent of the remaining REs are in a conservation area or minimal use area, the TEC or species is considered to be improving; if between 50 and 75 per cent is remaining it is considered to be stable; and if up to 50 per cent is remaining it is considered to be deteriorating. A grading statement for projected trend is presented in Table 3.8 5.

Table 3.8 5 Trend for key MNES species and ecological communities

| Trend | Percentage in conservation area and minimal use area | |
|---|---|---|
| Improving | > 75% | There is likely to be an overall improvement in habitats and continuing protection. Protection of the habitat can be assumed to be improving the structural and functional integrity of the habitat. |
| Stable | > 50% and < 75% | While there is likely to be future but minimal loss, degradation or alteration in these habitats, this is not persistent and there are likely to be no substantial effects on populations of dependent species. |
| Deteriorating | > 25% < 50% | RE loss, degradation or alteration will continue to occur in a number of areas leading to further persistent, substantial effects on populations of some dependent species |

## 3.9 Data used and knowledge gaps

The strategic assessment is based on the best available information, including existing reports, scientific data and expert opinion. All references are cited in the text and listed at the end of the report.

Queensland Government has used a number of sources to identify the extent, condition and trend in MNES in the GBR coastal zone and the values underpinning them, including the habitats of threatened species and ecological communities and the breeding and roosting sites of migratory species. These sources include:

- relevant legislation, including the EPBC Act, NC Act and VM Act
- statements of the OUV for the World Heritage properties
- Ramsar sites' Ecological Character Descriptions (ECD)
- Conservation assessments (Biodiversity Planning Assessments and Aquatic Conservation Assessments)
- Regional Ecosystems (RE) mapping which provides vegetation mapping for vegetation communities based on geology, landform and soil
- Queensland Wetland Mapping
- Queensland *State of the Environment Report 2011* [20]
- *Great Barrier Reef Outlook Report 2009* [4]
- *State of the Wet Tropics Report* [23]
- Back on Track list of priority species.

A number of Australian Government funded Sustainable Regional Development Program projects were undertaken during 2012–13 to fill significant knowledge gaps for matters relevant to the strategic assessment. Where relevant the outcomes of these projects are incorporated into the report and the reports cited. These projects are:

- *Improved dredge material management for the Great Barrier Reef Region:* To provide improved information on which to base dredge spoil management decisions for the five major ports in the GBRWHA.[24]
- *Environmental Best Practice Port Development:* An Analysis of International Approaches: To provide further understanding on international benchmarks in the environmental management of ports, and the potential application of those practices in Australia.[25]
- *Identification of impacts and proposed management strategies associated with offshore ship anchorages in the Great Barrier Reef World Heritage Area:* To identify environmental impacts of existing offshore anchoring for the five major GBR ports and the likely future impacts of increased shipping.[26]
- *Great Barrier Reef coastal ecosystems assessment framework:* To examine development impacts in selected basins within the GBR coastal zone to assess present and future development pressures and potential offset opportunities.[27]
- *Great Barrier Reef resilience decision framework:* To develop a resilience framework to inform decision making in the GBR coastal zone.[28]
- *Economic contribution of the Great Barrier Reef:* To update understanding of the Great Barrier Reef's economic contribution, including analysis of commercial and non-commercial uses and detailed regional-scale analysis.[5]
- *Geological and geomorphological features of outstanding universal value in the Great Barrier Reef World Heritage Area:* To identify geological and geomorphological features of OUV that may not have been previously identified and provide an overview of the pressures affecting values.[29]
- *Defining the aesthetic values of the Great Barrier Reef World Heritage Area:* To identify and map aesthetic values and analyse the sensitivity of those values to impacts.[30]
- I*ntegrated monitoring framework for the Great Barrier Reef World Heritage Area:* To establish a framework for a standardised and integrated ecological, social and economic monitoring program to address critical information needs, align existing monitoring programs and provide a baseline for assessing the condition of values and effects of pressures, as well as the impact on those values.[31] This project is funded through the National Environmental Research Program – Marine Biodiversity Hub.

Data sources and reliability for MNES values vary greatly. For a specified area with a fixed boundary, such as a WHA, the data is reliable and areas are easily mapped. For species, surrogate data is required to approximate its habitat. The reliability of habitat data varies considerably. TECs are often very broadly described, being ecosystems with similar characteristics. The RE associated with each TEC is used as surrogate data. REs are vegetation communities associated with certain landform, geology and soil and have been mapped across Queensland bioregions.[32]

The size and complexity of the GBR coastal zone, and the fact that MNES within this strategic assessment area vary in scale from individual species to the entire GBRWHA, make it impossible to undertake ecological studies on the impacts to, and values of, every MNES. Consequently this strategic assessment has leveraged the existing information available from published scientific, informally published, and government literature. A small number of targeted synthesis projects were funded by the Australian Government and coordinated by the GBRMPA to address select knowledge gaps. Results from these perojects have been used to support this strategic assessment as appropriate.

Queensland Government recognises there will be gaps in knowledge that cannot be filled as part of the strategic assessment; uncertainties and assumptions have been clearly documented. In the grading systems and assessment of Program effectiveness, the level of confidence in grades is clearly documented taking account of information available to support findings. Also, demonstration cases identify possible future data acquisitions and research priorities that may address identified knowledge gaps.

## 3.10 Stakeholder engagement

Stakeholder engagement is a central approach to the management of Queensland's natural assets and has been a constant theme throughout the GBR coastal zone strategic assessment, occurring from the development of the TOR up to the public consultation period for the draft reports. This draft report has been prepared to facilitate public consultation. The public comments from this process will inform the finalisation of this report and will be summarised into the final report at that time.

### 3.10.1 Preparing terms of reference

The draft TOR for this assessment were available for public comment from February to April 2012. A total of 377 submissions were received by the Queensland Government on the GBR coastal zone TOR. The following key issues were raised during the public consultation and were considered in finalising the TOR:

- defining the scope of management arrangements to be considered
- what methodologies will be used for the strategic assessment
- consistency between the Queensland and the GBRMPA TOR
- criteria for selecting demonstration cases
- how cumulative impacts would be considered
- independent assessment of management effectiveness
- explicit reference be made to the OUV of the GBRWHA

The submissions informed the final TOR, which were to:

- provide greater detail and clarity on the intent of the assessment
- require an independent review
- include criteria for choosing demonstration cases
- have more specific reference to OUV and ESD
- include recommendations for change to seek to achieve a net benefit for the MNES in the GBR coastal zone.

The final TOR were endorsed by the Australian Minister for Sustainability, Environment, Water, Population and Communities on 31 August 2012 (Appendix D).

### 3.10.2 Preparing the report

This *strategic assessment report* is in draft form. It has been prepared to enable public consultation and independent review. Outcomes and findings from those processes will inform the document for finalisation. This draft has been prepared in consultation with a range of stakeholders. The Queensland Stakeholder Reference Group was invited to provide high level contributions to the strategic assessment, the group includes representatives from:

- the conservation sector
- regional NRM bodies
- the property industry
- local government
- the resources industry
- Girringun Aboriginal Corporation
- the agricultural industry

In addition to Stakeholder Reference Group interactions, the Queensland Government has engaged with a number of other stakeholder groups during development of the strategic assessment documentation. Presentations regarding the strategic assessment have been provided at the Coast to Coast conference, Major Projects Conference and various Reef Advisory Committee meetings. Individual meetings have occurred with interested stakeholder groups as they have been requested.

Queensland Government officers participated in a number of stakeholder workshops led by the GBRMPA relating to the strategic assessment and taken into account comments received in preparing the strategic assessment documentation.

A number of stakeholders also assisted in peer reviewing different sections of the report, or particular demonstration cases, where they had a role or interest in management.

Additionally, targeted consultation has been undertaken during the development of the many components of the Queensland Program, both across and outside of Queensland Government. For example, consultation across government agencies and with relevant external stakeholders is routinely undertaken before legislative amendments are made, and during the development of statutory instruments.

The individual inputs associated with the strategic assessment are also subject to their own consultation processes:

- Great Barrier Reef Ports Strategy – presentations regarding the Great Barrier Reef Ports Strategy provided to the North Queensland Resource Supply Chain Committee, members of the Natural Resource Management group, and the Queensland Resources Council as well as public consultation.
- Queensland Ports Strategy – the results of public consultation on the Great Barrier Reef Ports Strategy have informed the draft Queensland Ports Strategy. In turn, the draft Queensland Ports Strategy will undergo public consultation concurrently with the strategic assessment.
- Offsets – targeted consultation has been undertaken with some industry groups, across Queensland Government agencies and with the Australian Government.
- Regional Plans – Regional Plan Advisory Committees have been formed and are regularly consulted during the review of existing and development of new regional plans. Community consultation is also undertaken during plan review and development.
- Coastal Management Plan – A reviewed coastal management plan has been prepared and was available for public review and comment between September and October 2013.
- The State Planning Policy - Was subject to public consultation early 2013 and is anticipated to be finalised by late 2013.
- Independent review.

As noted above, this draft report has been prepared to facilitate public consultation and independent review. The independent review is required by the terms of reference and has been commissioned by the Australian Government. This, together with reviews conducted as preparation of this report progressed, will provide for greater transparency and rigour in preparing the Program and strategic assessment reports.

Independent review was not complete by the time this draft was prepared for public consultation. Comments raised in the review process will be addressed at the same time the public consultation period is underway. All comments will be addressed in the final report.

### 3.10.3 Peer reviews

During document development a wide range of experts, both within and outside the Queensland Government, have peer reviewed different chapters of this report or particular demonstration cases. This includes Queensland Government scientists and policy and operational staff. External to government, peer review was provided by staff of regional NRM bodies, the GBRMPA officers and by members of relevant committees with expertise and knowledge in their field of management.

### 3.10.4 Independent scientific panel

To ensure a robust methodology, the Reef Water Quality Protection Plan Independent Science Panel (ISP) provided advice on the technical assessment framework that underpins both the Queensland and GBRMPA strategic assessments. The ISP includes:

- Dr Roger Shaw (Chair) with expertise in catchment processes
- Dr Peter Doherty (Australian Institute of Marine Science) with expertise in marine ecology
- Dr Eva Abal (University of Queensland) with expertise in marine health and modelling
- Dr Mike Grundy (CSIRO) with expertise in soils and landscape processes
- Mr Neil Byron with expertise in socio-economic research.

### 3.10.5 Independent review

The independent review of the full draft documentation for the GBR coastal zone strategic assessment was commissioned by the Australian Government and undertaken by Sinclair Knight Merz to ensure that it adequately addressed the TOR and is supported by rigorous evidence. The purpose of the independent review is to provide a rigorous independent assessment of the *Program Report, Strategic Assessment Report* and any relevant supporting documentation, ensuring that the documents transparently and accurately describe and demonstrate the Program. In doing so, the review will consider:

- The presentation, readability and accessibility of the *Program report and the Strategic assessment report*
- The Program's representation of potential impacts and the effectiveness of the Program in protecting MNES, including any proposed changes to the Program.

Review findings and actions taken to address the independent review findings will be included as an appendix in the final report.

### 3.10.6 Summary

A conceptual timeline (not to scale) of the various stakeholder engagement processes that have informed the delivery of the strategic assessment and program report drafts for consultation is provided in Figure 3.10 1. This timeline also identifies the tasks yet to be completed including the incorporation of review feedback and consultation to support finalisation of the strategic assessment and program reports.

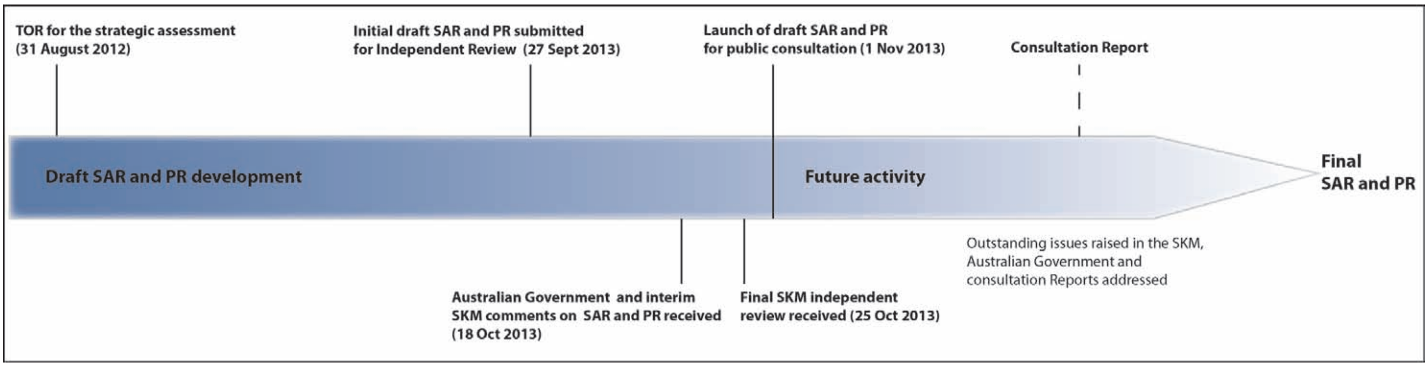



Figure 3.10 1 Conceptual timeline of stakeholder engagement process

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# Chapter 4

## values of the GBR coastal zone and their extent, condition and trend

***Extract from Great Barrier Reef Coastal Zone Strategic Assessment terms of reference***

***2 Matters of national environmental significance affected by the program***

*The scale and diversity of the geographic area requires that a tiered, or hierarchical approach be taken that looks at the existing and likely future risks and impacts to the Great Barrier Reef and adjacent coastal zone. It then needs to look in depth at specific locations and initiatives as a means of demonstrating the effectiveness of the Program in protecting matters of national environment significance (MNES), including outstanding universal value (OUV) at a local scale.*

***2.1 Identification of MNES including OUV***

*The Strategic Assessment Report must describe the extent of the following MNES within the strategic assessment area:*

- *World Heritage properties (sections 12 and 15A)*
- *National Heritage places (sections 15B and 15C)*
- *Wetlands of international importance (sections 16 and 17B)*
- *Listed threatened species and ecological communities (sections 18 and 18A)*
- *Listed migratory species (sections 20 and 20A)*
- *Commonwealth marine area (sections 23 and 24A)*
- *The Great Barrier Reef Marine Park (sections 24B and 24C)*

*The description must include the key terrestrial, coastal, and marine biodiversity and heritage values and supporting ecological processes considered critical to the functioning of MNES including OUV.*

*………*

*The Strategic Assessment Report must also:*

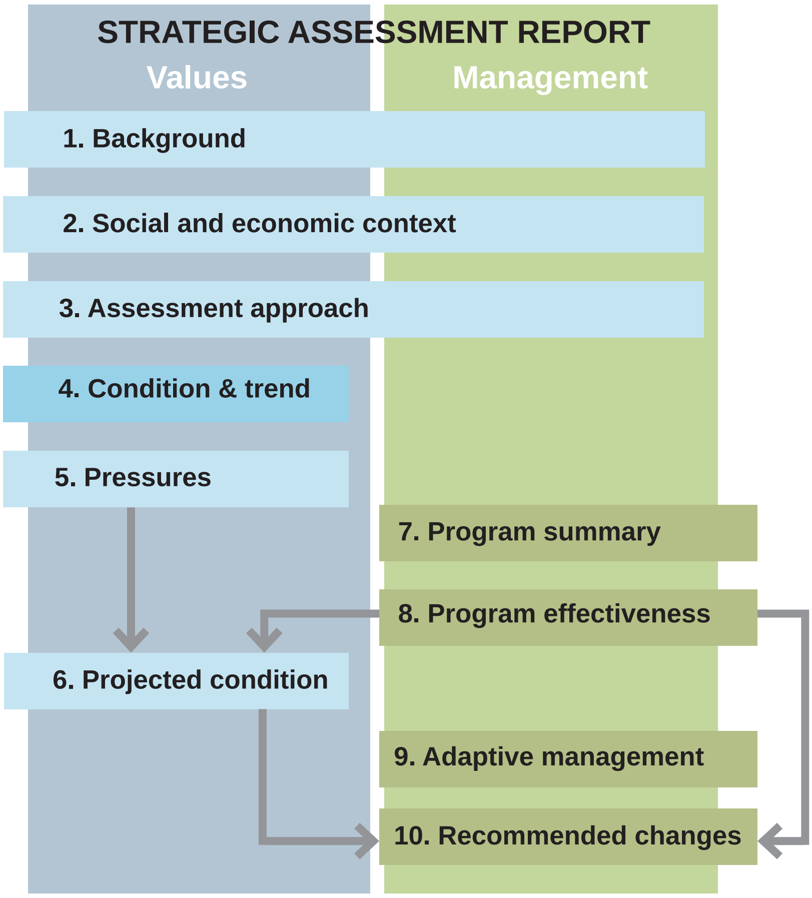
*(a) describe the current condition of MNES including the values described above, projected trends and existing threats from both within and outside the strategic assessment area*

*(b) for World Heritage values, describe the current condition of OUV against the retrospective statement of OUV which describes the state of the Great Barrier Reef World Heritage Area (GBRWHA) at the time of listing*

*………*

# 4. Values of the GBR coastal zone and their extent, condition and trend






## 4.1 Introduction

This chapter provides a description of the current extent, condition and trend for MNES within the GBR coastal zone, including those that make up the OUV of the GBR and the Wet Tropics WHAs.

Although marine MNES are not the focus of this report a short summary of marine MNES in the GBR coastal zone is provided, based on the GBR Region Strategic Assessment undertaken by the GBRMPA. Marine MNES that are captured more specifically in this assessment are those associated with spatially defined MNES areas, such as the two Ramsar Wetlands.

### 4.1.1 National context

Australia is recognised by Conservation International as one of only 17 of the world's mega diverse countries due to its rich biological diversity. Many of Australia's species are unique to this continent. However, the Australia *State of the Environment 2011 Report* found that there have been major declines in many components of biodiversity since European settlement. Data suggest that this decline continues across Australia.[19]

Australia's oceans and coastal marine ecosystems are considered to be in good condition compared with the marine environment of other nations. Australia's ecosystems have experienced only gradual decline, although there are localised coastal areas where conditions are already poor or very poor.[19] The major loss of biodiversity in Australia has been the effect of clearing for agriculture and the impacts of pests and altered fire regimes.

The dichotomy between the essentially intact northern section of the GBR coastal zone (Cape York Peninsula) and the populated and impacted area to the south of Cooktown, is a mirror of the Australian coastal zone as a whole. Most of the northern and western coast of Australia, like the northern GBR coast, is generally undeveloped and intact. The mid-east coast, south east coast and south west coast of Australia is similar to the southern GBR coast. In these areas there have been land use changes that have led to modification of coastal areas.

In broad terms, there is less than 10 per cent of remnant vegetation remaining in parts of Victoria and South Australia, through to 31 to 50 per cent remaining in large parts of the south western and north-eastern coastal areas, and 71 to 100 per cent remaining for most of northern and western coastal Australia.[19]

It is nationally recognised that past environmental management has led to a number of continued pressures on the environment. The major ongoing pressures on biodiversity, ecosystem processes and natural and cultural heritage along Australian coasts include[19]:

- rural and urban diffuse pollution
- point source pollution
- loss and fragmentation of habitats by urban development
- rapidly growing numbers of invasive species and pathogens
- changed fire regimes
- changed flows of rivers into estuaries and coastal environments
- disturbance of acid sulfate soils
- fishing and intertidal harvesting
- low levels of recognition of what is culturally significant
- decline in connections between Indigenous people and coastal places

Globally, the threat of rising sea levels as a result of climate change is one of the most concerning pressures on coastal communities, potentially affecting economic, social, cultural and environmental assets and processes. In Australia, a sea level rise of one metre during this century is plausible, potentially placing several hundred thousand homes at risk of inundation.[19] Rising sea levels will also result in greater wave action on the shore, leading to increased rates of coastal erosion, particularly during extreme weather events, which may become more intense. The capacity for coastal species to migrate inland to higher ground is limited in many parts of Australia by both the natural limits to the coastal plains and human-built structures. Direct impacts on cultural sites, including many of significance to Indigenous people, are also possible.

For coral reef systems including the GBR, higher water temperatures will result in more mass coral bleaching events and ocean acidification. These represent major threats to these ecosystems worldwide. It is not possible for individual jurisdictions to address the global cause of these future impacts. However, it is within the capacity of jurisdictions to introduce programs to improve the resilience of ecosystems to cope with these impacts.

### 4.1.2 GBR regional context

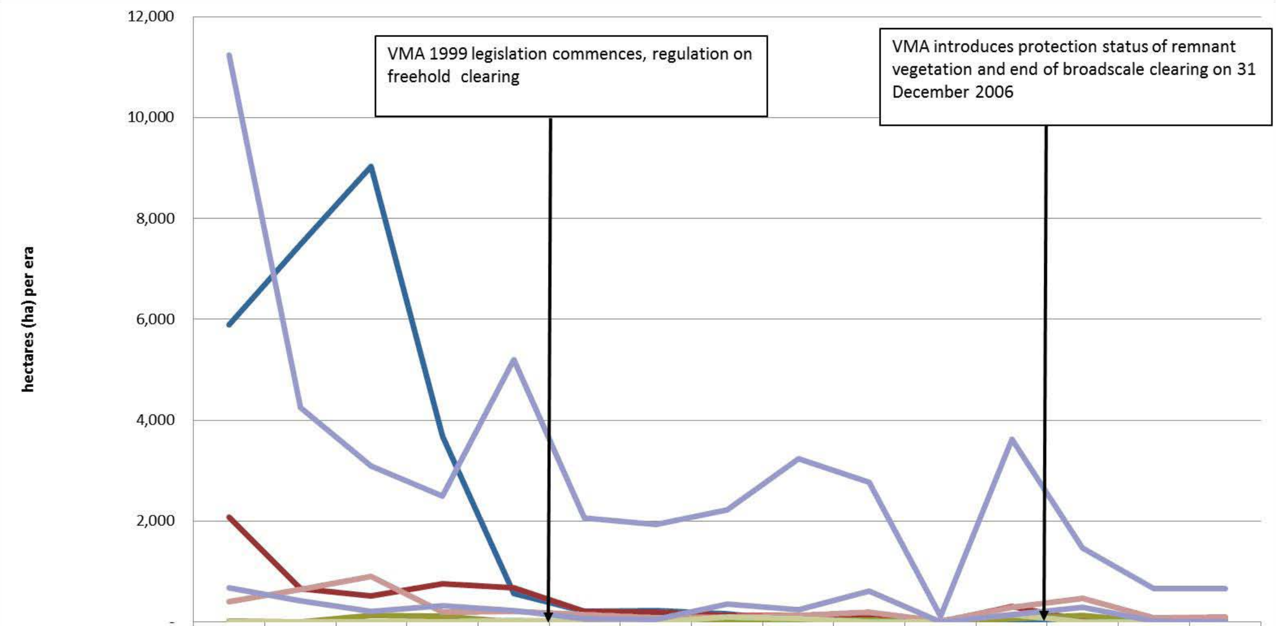
The current extent and condition of MNES in the GBR coastal zone primarily results from development activities undertaken since European settlement, together with the impact of extreme weather events. Over the past 150 years, European settlement has resulted in broadscale clearing of vegetation in the GBR catchment and the establishment of agricultural and urban areas, including industry and ports. By far the largest direct impact on MNES extent is a result of land clearing for agriculture. The largest indirect and ongoing impact arises from rural land management practices. Such practices create the rural diffuse pollution that is the primary contributor to poor and declining water quality in the GBR lagoon. Clearing for urban and similar development, by contrast, occupies a small footprint within the GBR coastal zone, and ongoing impacts, particularly in relation to poor water quality arising from point and diffuse urban pollution is relatively minor by comparison.

Despite the extent of clearing since European settlement, a relatively large proportion of the GBR coastal zone remains in a natural state, particularly in the northern part of the GBR catchment. The GBR coastal zone has an area of nearly 11 million hectares, with 2.8 million hectares (26 per cent) above AHD. Remnant REs (uncleared areas containing native vegetation communities) currently occupy approximately 74 per cent of this area. Relative to other populated coastal regions, MNES in the GBR coastal zone are extensive. For example, using remnant native vegetation as a surrogate, the southern Queensland coastal zone (outside the GBR coastal zone) retains only 40 per cent of its original vegetation.

The introduction of land clearing controls for agricultural and urban development in Queensland in 2000, which were extended to become a prohibition on clearing for agriculture in 2006, has been the single most important policy initiative to protect MNES areas in the GBR coastal zone. Clearing for other forms of development (urban, tourism, industry and ports) is permitted in some instances, but this represents a relatively small area impacted and these uses are subject to development control laws that require residual impacts to be offset.

The prohibition of clearing land for agriculture from 2006 has therefore become a marker or baseline from which to measure changes in the extent of MNES. At the time of writing, the most current MNES extent data available was derived from imagery acquired in 2009. As a result the assessment of change in the extent of MNES used in this strategic assessment is measured from the original 'pre-clearing' extent, the extent at 2006, and the extent at 2009.

Data for clearing rates of remnant vegetation has been acquired since 1988 (see Figure 4.1 1). Of particular note is the spike in clearing rates before the introduction of regulatory controls in 2000 for cropping and pasture purposes and the smaller spike when further regulations were introduced in 2006. The clearing of vegetation in the GBR coastal zone for cropping through the 1980s and 1990s was related to a rapid expansion of cane growing in response to the high price for sugar at that time. The moratorium on broadscale clearing of vegetation for agriculture resulted in the dip in clearing rates in 2005-2006 for pasture followed by some catch up clearing that occurred before clearing rates stabilised at about 660 hectares a year.




| | 88-91 | 91-95 | 95-97 | 97-99 | 99-00 | 00-01 | 01-02 | 02-03 | 03-04 | 04-05 | 05-06 | 06-07 | 07-08 | 08-09 | 09-10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Crop | 5,892 | 7,488 | 9,026 | 3,679 | 564 | 211 | 217 | 160 | 14 | 4 | 1 | 9 | 49 | - | 21 |
| Infrastructure | 2,074 | 666 | 512 | 759 | 668 | 210 | 191 | 123 | 127 | 76 | 7 | 301 | 25 | 13 | 45 |
| Mine | 16 | 3 | 131 | 116 | 6 | 1 | 1 | 15 | 24 | 37 | 1 | 65 | 132 | - | 27 |
| Pasture | 11,240 | 4,242 | 3,084 | 2,500 | 5,199 | 2,053 | 1,933 | 2,221 | 3,231 | 2,769 | 108 | 3,626 | 1,472 | 657 | 662 |
| Settlement | 400 | 636 | 901 | 186 | 204 | 145 | 72 | 101 | 124 | 196 | 12 | 296 | 473 | 86 | 92 |
| Thinning | - | - | - | - | 31 | - | 0 | 100 | 69 | - | 2 | 143 | - | - | - |
| Timber Plantation | 679 | 425 | 208 | 317 | 233 | 56 | 40 | 357 | 234 | 615 | 5 | 141 | 287 | 23 | 6 |

Figure 4.1 1 Vegetation clearing rates in the Great Barrier Reef coastal zone

Source: 33

### 4.1.3 The extent, condition and trend for MNES

The EPBC Act defines the MNES. This report specifically considers only the MNES values that are located in the GBR coastal zone, including:

- GBRWHA, National Heritage Area and Marine Park
- Wet Tropics WHA and National Heritage Area
- Bowling Green Bay Ramsar site
- Shoalwater and Corio Bays Ramsar site
- Threatened ecological communities
- Threatened species
- Migratory species

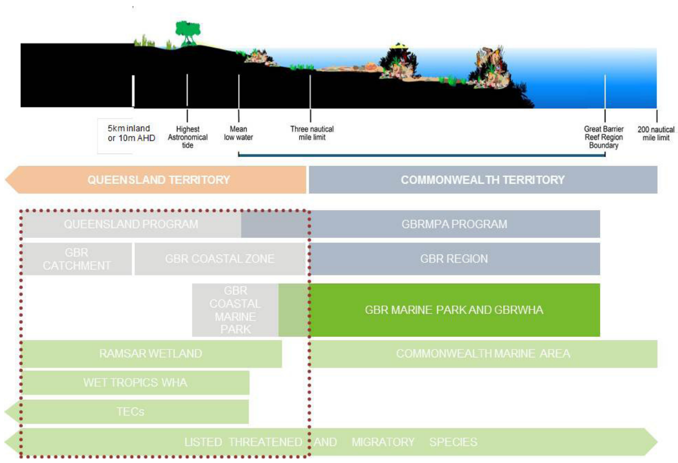
The strategic assessment process used here involves an assessment of the condition and trend of MNES with fixed boundaries (WHA and Ramsar sites) within the GBR coastal zone, and extent, condition and trend for key TECs and threatened and migratory species within the GBR coastal zone. With limited species data, it is difficult to assess accurately the condition of each MNES species. With this in mind, a representative MNES species list, or 'key' MNES species, are used in this assessment to give a summary of extent, condition and trend of MNES within the GBR coastal zone (see chapter 3 for methodology). The extent, condition and trend of two key TECs, 11 key threatened species and 38 key migratory species has been assessed.

Grading statements for the condition and trend of MNES are applied to the MNES in the GBR coastal zone. The grading statements are based on available data for the specific MNES values. The gradings used are those explained in chapter 3 of this report.

The extent, condition and trend of MNES also varies greatly across the vast longitudinal extent of the GBR coastal zone. For terrestrial areas in the Cape York Peninsula and in most conservation areas elsewhere in the coastal zone, the extent, condition and trend for MNES is generally very high and stable. In areas that are managed for less intensive uses, such as forestry and defence areas, the condition and trend for MNES is considered to be good and stable. For areas of more moderate land use such as grazing lands, the condition and trend for MNES is considered to be poor and declining. For those areas used for urban purposes the condition and trend for MNES is generally considered to be very poor and declining (and at risk of being lost). Queensland Government recognises that despite this general assessment there are examples of well-managed MNES areas within all land use categories.

In the marine environment the extent, condition and trend of MNES also varies significantly between marine areas adjacent to the Cape York Peninsula and areas to the south, with condition and trend generally worse and declining proceeding south. There is also a significant difference between inshore and offshore areas, with the latter generally maintaining a better condition than the former. However, there are protected areas such as fish habitat areas and highly protected zones in marine parks where direct pressures are less, which means improved resilience in these marine areas relative to other marine areas. Nevertheless, chronic pressure, like poor water quality, generally affects all marine areas regardless of an area's management purpose.

## 4.2 Great Barrier Reef World Heritage Area, National Heritage Area and Marine Park




The GBRWHA extends from the tip of Cape York to just south of Gladstone. The western edge of the area extends to the high water mark of the Queensland mainland. The eastern edge of the area extends beyond Queensland waters into Commonwealth marine waters (refer to Figure 1.4 1 in chapter 1) and includes all islands and cays. The GBR National Heritage Area aligns with the GBRWHA.

The GBR Marine Park is contained within the GBRWHA, but its boundary does not extend above the lowest astronomical tide. The Queensland Government and the GBRMPA jointly manage the area within Queensland coastal waters.

To ensure continuity of the joint management arrangements in the marine and estuary area the Queensland Government declared the GBR Coastal Marine Park in 2004 with complementary zoning, so in most areas the Marine Parks generally extend to the highest astronomical tide mark. The GBR

Coastal Marine Park protects habitats including mangrove wetlands, seagrass beds, mudflats, sandbanks, beaches, rocky outcrops and fringing reefs.

The world heritage properties listing criteria include six cultural heritage criteria and four natural heritage criteria. The GBRWHA was listed as meeting all four of the natural heritage criteria. The World Heritage Committee of UNESCO has endorsed a retrospective statement of the outstanding universal value (OUV) of the WHA.

The listing criteria and OUV statement are summarised below:

**Criterion vii:**

*Listing statement*

- Contains superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance.

*OUV statement*

- 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.

**Criterion viii:**

*Listing statement*

- Is an outstanding example 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.

*OUV statement*

- The GBR, extending 2000 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.

***Criterion ix***

*Listing statement*

- Is an outstanding example 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.

*OUV statement*

- 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 4000 species of molluscs, over 1500 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.

***Criterion x***

*Listing statement*

- Contains 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

*OUV statement*

- 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 general. 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.

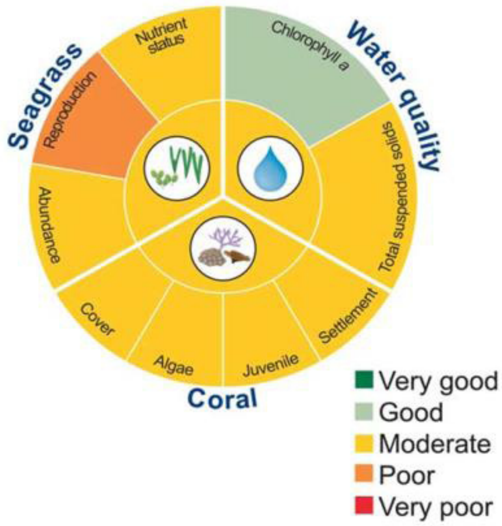
Additionally, world heritage properties must meet an 'integrity' test and be effectively managed. Both of these requirements have been met. The full OUV statement and more information about world heritage listing criteria can be obtained from the Australian Government's website of http://www.environment.gov.au/heritage/places/world/great-barrier-reef/values.html.

The values that underpin the GBRWHA and the GBRMPA are discussed fully in the GBR Region strategic assessment report. The GBRWHA values that are potentially impacted by activities in the GBR coastal zone considered in this strategic assessment are water quality, coral habitats, seagrass habitat, inter-tidal habitats (beaches, mangroves and saltmarsh) and the OUV of the GBRWHA.

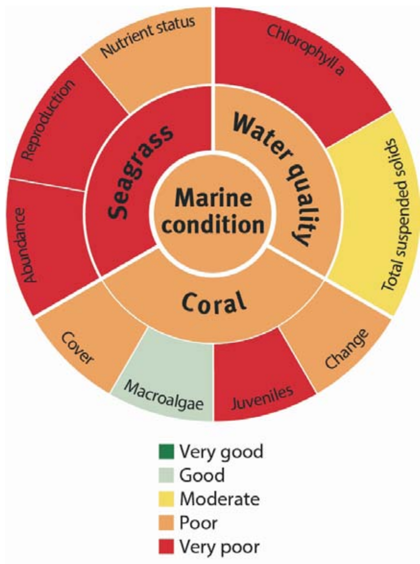
### 4.2.1 Condition and trend

The Great Barrier Reef First Report Card 2009 was published in 2011 and showed that the inshore GBRWHA was in moderate condition overall based on an integrated metric of water quality, seagrass and coral (Figure 4.2 1)[34]. The 2011 report card published in 2013 shows that the condition of the inshore WHA declined from moderate to poor condition for water quality and coral, and very poor for seagrass (Figure 4.2 1). This is as a result of extreme weather in 2010 and 2011 (including above average rainfall and the effects of Cyclone Yasi)[34]. Most NRM regions showed a similar trend, with moderate, poor or very poor for the integrated metrics of water quality, seagrass and coral (Figure 4.2 2).

Inshore coral reefs in southern areas have been particularly affected, as have populations of southern dugong and marine turtles. From the perspective of the GBR coastal zone, key indicators of the overall health of the GBR region relate more to inshore environments including inshore corals, seagrass, mangroves and other inter-tidal ecosystems. A summary of the condition and trend of the key elements of the GBRWHA, inshore coral habitats, seagrass habitats, intertidal habitats and water quality, relevant to the GBR coastal zone is provided below.

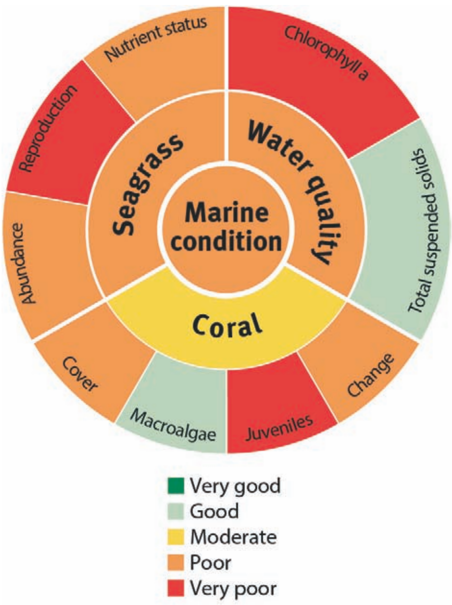


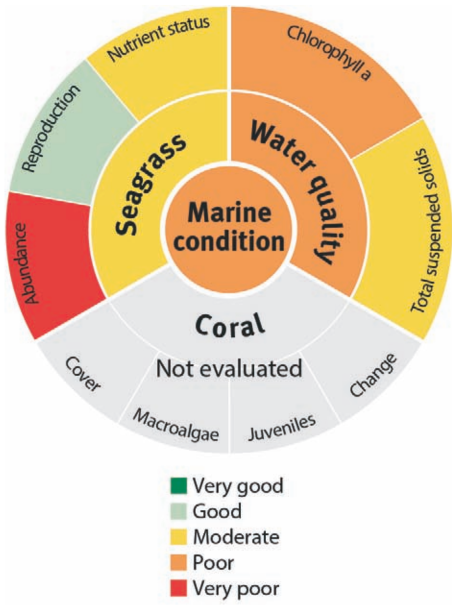

2009 marine condition {Department of the Premier and Cabinet (DPC), #180}.




2011 marine condition {Department of Premier and Cabinet (DPC), 2013 #59}

Figure 4.2 1 GBR ecosystem health (2009 and 2011)



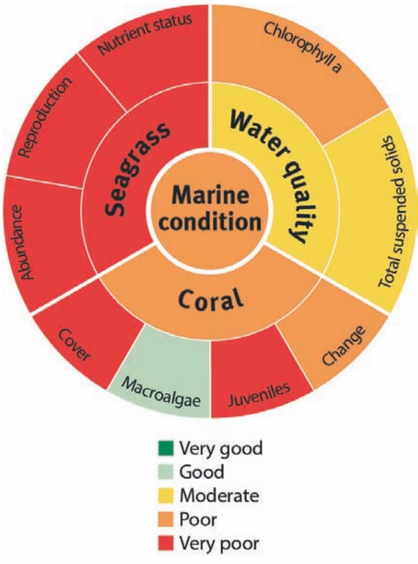




Wet Tropics:

The Wet Tropics' marine condition declined from moderate to poor. Inshore water quality and seagrass meadows were in poor condition and coral reefs were in moderate condition.

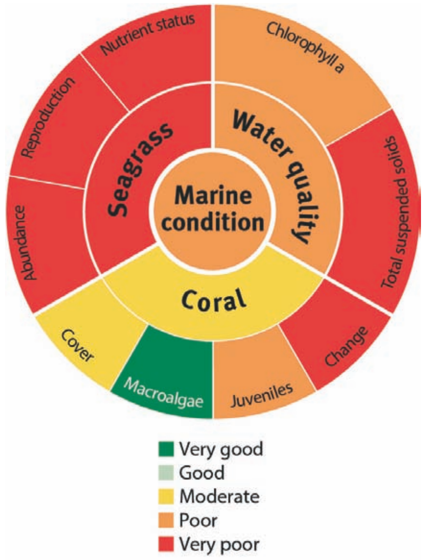
Cape York:

The marine condition off Cape York was poor. Inshore water quality was poor and the one southern seagrass bed monitored was in moderate condition.




Burdekin:

The Burdekin's marine condition remained poor. Inshore water quality was moderate overall, while inshore seagrass meadows declined from poor to very poor and coral reefs remained in poor condition.




Mackay Whitsundays:

The Mackay Whitsunday's marine condition declined from moderate to poor. Inshore water quality also declined from moderate to poor, inshore seagrass meadows declined from poor to very poor and coral reefs remained in moderate condition.

Figure 4.2 2 Condition of the inshore GBR (2011)

Source: [36]

#### 4.2.1.1 Water quality

Second only to the impacts of extreme weather events, deteriorating water quality is the most important factor in the decline of GBR ecosystems, particularly the loss of corals. It is the major catchments of the southern GBR, where agriculture and grazing land uses dominate, that generates the bulk of the sediments, nutrients and pesticides that are impacting on the GBR ecosystems. However, the second reef report card[36] shows encouraging results from changes to agricultural management practices. There was an estimated six per cent reduction in sediment load and a 15 per cent reduction in pesticide loads as a result of land management changes between 2009 and 2011.[36] The total nitrogen load reduced by seven per cent; however, dissolved nitrogen, the key pollutant of concern, reduced by 13 per cent. While these results are positive, it is expected that it will take more time for this to translate into measurable improvements to marine ecosystem health, particularly given the impacts of extreme weather events in recent years.

Table 4.2 1 Condition and trend in water quality within the GBRWHA

| Summary (water quality) | Condition and trend | Confidence |
|---|---|---|
| The 2011 reef report card showed water quality declined from moderate to poor condition as a result of extreme weather and above average rainfall. | X<br>Recent trend - Deteriorating | Adequate |

#### 4.2.1.2 Coral habitats

***Condition and trend***

The GBR region's coral reef ecosystems are the best known of all ecosystems within the WHA and provide the primary basis for its listing by the World Heritage Committee. North of Cooktown the extent of coral cover has been found to be stable. However, research has found that over approximately the last 27 years there has been a loss of coral cover of nearly 50 per cent across the GBR south of Cooktown.[37] The research shows that the primary causes of this serious decline are extreme weather events (which accounts for 48 per cent of the decline), predation by crown of thorn starfish (COTS) (42 per cent). Coral bleaching events are making a much smaller contribution to the overall loss, accounting for 10 per cent of the decline. Extreme weather events are natural occurrences. However, a reef ecosystem in otherwise good condition can be expected to recover from such events.

Nitrogen runoff from catchments between the Daintree and Burdekin Rivers during extreme and early wet seasons is associated with outbreaks of the coral eating COTS on the northern GBR that subsequently generate secondary outbreaks throughout the central GBR.[36] Estimates suggest COTS have affected more than 1000 of the approximately 3000 reefs within the GBR over the past 60 years.[36] The findings suggest that if the impacts of COTS were reduced following nitrogen load reduction in the Wet Tropics, coral cover is predicted to either recover or at least stabilise, strengthening the case for sustained action on water quality improvement.[36]

Coral bleaching occurs when seawater temperature exceeds the normal range for coral. A permanent increase in temperature, or long periods of higher than usual temperatures, can lead to bleaching events that kill coral. This impact can be expected to be greater when other pressures reduce the resilience of the GBR. Coral bleaching may become a greater threat to the reef as sea temperatures rise as a result of global warming (both natural and anthropogenic), together with associated effects of increased seawater acidification (which dissolves the calcium carbonate in reefs and the shells of some invertebrates) and sea level rise.

In the southern part of the GBR Queensland Government expects coral cover will continue to trend downwards for a significant period.

Table 4.2 2 Condition and trend of coral within the GBRWHA

| Summary (water quality) | Condition and trend | Confidence |
|---|---|---|
| The 2011 reef report card showed coral condition declined from moderate to poor condition. | X<br>Recent trend - Deteriorating | Adequate |

#### 4.2.1.3 Seagrass habitat

***Condition and trend***

In the GBR region, seagrass habitat is a significant component of estuarine and coastal ecosystems and provides nursery grounds for a wide range of species which are important for the health of coral and other offshore ecological communities. Some MNES threatened species, particularly the dugong are dependent on seagrass habitat for survival. Inshore and estuarine seagrass environments also provide an ecosystem service function through trapping sediments and absorbing nutrients.

Again, there is a difference between the extent and condition of seagrass in the northern GBR and that in the south. Seagrass ecosystems in the north are stable; and those in the south are deteriorating. The 2011 Reef Report Card indicates that seagrass has deteriorated from poor to very poor condition as a result of extreme weather events.

Water pollution derived from catchments is a major factor in the monitored decline in the condition of seagrass habitat. The downward trend is likely to continue until the positive impacts of the catchment management program (Reef Plan) flow through to the waters of the GBR lagoon.

Table 4.2 3 Condition and trend of seagrass within the GBRWHA

| Summary (water quality) | Condition and trend | Confidence |
|---|---|---|
| The 2011 reef report card showed Seagrass condition declined from poor to very poor condition as a result of extreme weather events. | X<br>Recent trend - Deteriorating | Adequate |

#### 4.2.1.4 Intertidal habitats

***Condition and trend***

Intertidal habitats consist of mangrove and saltmarsh ecosystems that are vital for many species of invertebrates and small fish and act as nursery grounds for many species that colonise other GBR ecosystems as they mature. They also provide important ecosystem services as sediment and nutrient traps, and protect terrestrial ecosystems and freshwater aquatic ecosystems from erosion and inundation.

These ecosystems essentially remain intact throughout the GBR coastal zone, but have been subject to very minor clearing and reclamation activities around development nodes south of Cooktown. However, this development is confined to areas of less than 0.5 per cent of the pre-clearing extent.[38]

Analysis of current RE data for the southern GBR coastal zone shows that 97 per cent (334 107 ha) of the pre-clearing extent (or pre European settlement extent) remains. All marine plants are protected under the Fisheries Act, which regulates the removal of marine plants. Based on this data it is considered that intertidal habitats are in good condition and the trend appears to be stable.

Table 4.2 4 Condition and trend of intertidal habitats within the GBRWHA

| Summary (water quality) | Condition and trend | Confidence |
|---|---|---|
| 97 per cent of the pre-clearing extent (or pre European settlement extent) remains | X<br>Recent trend - Stable | Adequate |

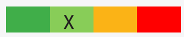
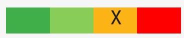
#### 4.2.1.5 Outstanding Universal Value fo the GBRWHA

Even though there is considerable urban and rural development adjoining the southern part of the GBRWHA, there is no doubt that the exceptional natural beauty and aesthetic importance of the WHA remains broadly intact. Hinchinbrook Island is part of Queensland's national park network and is managed for conservation purposes. The mangroves of the Hinchinbrook Channel, Missionary Bay and Rockingham Bay are mostly intact and in good condition. Ongoing ecological and biological processes are being impacted in the southern part of the GBRWHA. Poor water quality flows into the GBR lagoon from the major NRM regions of the Wet Tropics, Burdekin, Mackay-Whitsundays and Fitzroy, particularly during periods of high flows. The diversity of species remains across the GBRWHA; however, some habitats are being impacted by declining water quality and, to a lesser extent, direct loss from coastal development. The shallow and inshore marine waters are most affected by these impacts, along with corals.

Since the GBRWHA's listing in 1981, the condition of some features, such as humpback whales, has improved, while others have experienced serious declines, particularly coral cover. Inshore coral reefs in southern areas have been particularly affected, as have populations of southern dugong and marine turtles, and offshore and pelagic foraging seabirds. From the perspective of the coastal zone, key indicators of the overall health of the GBR region relate more to inshore environments including corals, seagrass, mangroves and other inter-tidal ecosystems.

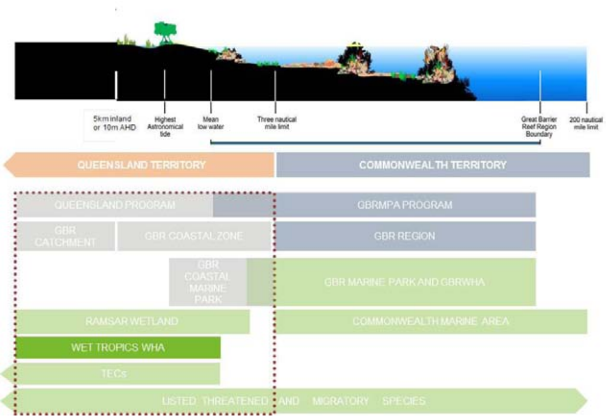
Assessment shows that many OUVs that make up the GBRWHA values remain in good condition and that the area retains a high degree of integrity (wholeness and intactness). A summary of the assessment of OUV is provided in Table 4.2 5, Further details of the assessment of the condition and trend of the OUV of the GBRWHA can be found in the GBR region strategic assessment report.

Table 4.2 1 Condition and trend in water quality within the GBRWHA

| Summary (OUV) | Condition and trend | Confidence |
|---|---|---|
| Many elements that make up the OUV of the GBRWHA remain in good condition and it retains a high degree of integrity (wholeness and intactness). However, some significant aspects (such as corals) are in serious, long-term decline. |   Recent trend - Deteriorating | Adequate |
| ***Criteria viii: Major stages of the Earth's evolutionary history*** | | |
| The Region remains a globally outstanding example of an ecosystem that has evolved over millennia, and almost all geomorphological evolutionary processes remain intact. Examples of all stages of reef development remain. Although reef health in southern areas has declined significantly, overall the condition of the reefs are considered to be stable. |   Recent trend - Stable | Adequate |
| ***Criterion ix: Ecological and biological processes*** | | |
| Many ecosystem processes remain in good condition however some, such as recruitment and reef building, are declining. Any processes associated with species groups that are in decline (for example corals and seagrasses) have likely also declined. In the southern inshore area there are particular concerns, principally associated with land-based activities in the catchment, about some processes, such as connectivity, nutrient cycling and sedimentation. Traditional Owners maintain their cultural practices and customs however Indigenous heritage values are under pressure especially in the southern two-thirds of the Region. The condition overall is considered to be deteriorating. |   Recent trend - Deteriorating | Adequate |
| ***Criterion vii: Natural beauty and phenomena*** | | |
| The significant loss of coral cover, especially in areas south of about Cooktown, has reduced underwater aesthetic value, as has increasing turbidity in inshore areas. The natural beauty of large areas remains intact, especially for offshore coral reefs in the far north and aerial vistas, as well as for neighbouring islands (many of which are national parks). While some of the natural phenomena remain intact, others are likely to have deteriorated, for example some turtle nesting locations and coral spawning. |   Recent trend - Deteriorating | Adequate |
| ***Criterion x: Habitats for conservation of biodiversity*** | | |
| There are significant concerns about some key habitats, particularly seagrass meadows and coral reefs, and some species such as dugongs, marine turtles and some dolphins. These concerns are significantly reduced in far northern areas, which remain relatively intact. Populations of humpback whales, loggerhead turtles and green turtles (southern stock) are recovering from historical declines. There have been no records of species extinction, though there is concern that the speartooth shark has not been recorded in or near the Region since 1982. The recent trend has seen the condition deteriorated. |   Recent trend - Deteriorating | Adequate |

Source: GBR Region Strategic Assessment Report[39]

## 4.3 Wet Tropics World Heritage Area




This World Heritage Area covers 894 420 hectares of Far North Queensland. The land is predominantly reserved as national park. The boundary of the Wet Tropics WHA is approximately 3000 kilometres long and extends 450 kilometres from just south of Cooktown to north of Townsville and is mostly contained within the Wet Tropics NRM region (Figure 4.3 1). The Wet Tropics National Heritage Area aligns with the Wet Tropics WHA.

The Wet Tropics of Queensland contains one of the most complete and diverse living records of the major stages in the evolution of land plants, from the very first land plants to higher plants (gymnosperms and angiosperms), as well as one of the most important living records of the history of marsupials and songbirds.

The Wet Tropics WHA was inscribed on the World Heritage List in 1988 as a property that fulfilled all four natural criteria for listing. The retrospective statement of OUV for the Wet Tropics WHA, adopted at the 36th meeting of the World Heritage Committee in St Petersberg in 2012 (see Appendix B), included the following criteria for the listing of the area and the OUV:

**Criterion (vii)**

*Listing statement*

- 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.

*OUV statement*

- The Wet Tropics contains one of the most complete and diverse living records of the major stages in the evolution of land plants, from the very first pteridophytes more than 200 million years ago to the evolution of seed-producing plants including the cone-bearing cycads and southern conifers (gymnosperms), followed by the flowering plants (angiosperms). As the Wet Tropics is the largest part of the entire Australasian region where rainforests have persisted continuously since Gondwanan times, its living flora, with the highest concentration of primitive, archaic and relict taxa known, is the closest modern-day counterpart for Gondwanan forests. In addition, all of Australia's unique marsupials and most of its other animals originated in rainforest ecosystems, and the Wet Tropics still contains many of their closest surviving members. This makes it one of the most important living records of the history of marsupials as well as of songbirds.

**Criterion (ix)**

*Listing statement*

- Be outstanding examples representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals.

*OUV statement*

- The Wet Tropics provides outstanding examples of significant ongoing ecological processes and biological evolution. As a centre of endemism for the region (second only to New Caledonia in the number of endemic genera per unit area), the Wet Tropics provides fundamental insights into evolutionary patterns both in isolation from and in interaction with other rainforests. Its tall, open forests on the drier western margins of the rainforest are also significant as part of an evolutionary continuum of rainforest and sclerophyll forests. Eucalypts, that now dominate the Australian landscape, are considered to have evolved from such rainforest stock and radiated into drier environments from the margins of closed forests.
- The area supports an exceptionally high level of diversity of both flora and fauna, with over 3,000 vascular plant species in 224 families, of which 576 species and 44 genera are endemic, including two endemic plant families. Vertebrate diversity and endemism are also very high, with 107 mammal species including 11 endemic species and two monotypic endemic genera. In terms of avifauna, there are 368 bird species, of which 11 species are endemic. For reptiles, there are 113 species of which 24 species are endemic, including three monotypic endemic genera. The diversity of amphibians includes 51 species of which 22 are endemic.

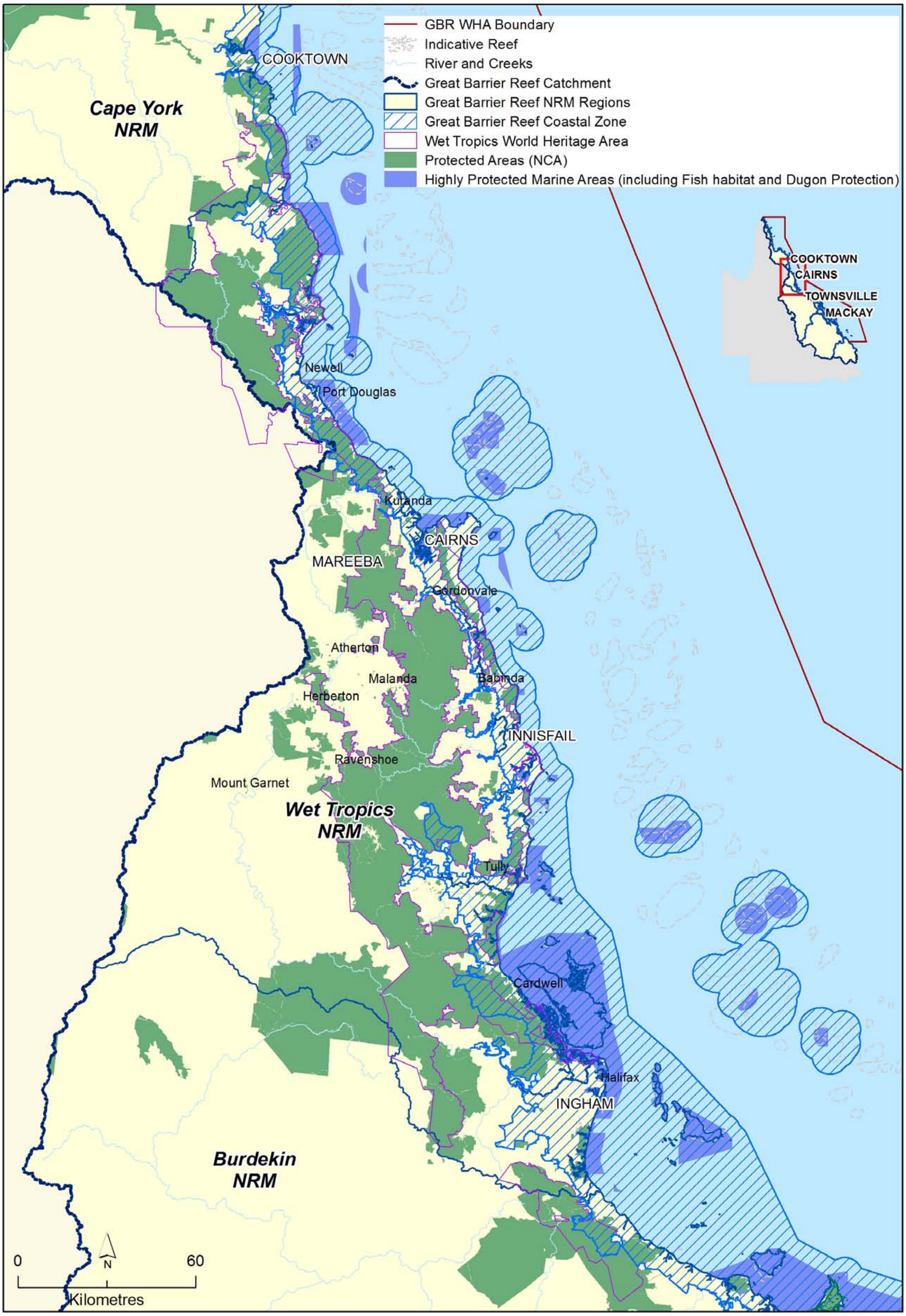



Figure 4.3 1 The Wet Tropics WHA and the Wet Tropics NRM region

**Criterion (x)**

*Listing statement*

- 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.

OUV *statement*

- The Wet Tropics holds a largely intact flora and fauna with hundreds of endemic species restricted to the property, of which many are classified as threatened. The majority of plant species have restricted distributions, and many monotypic plant genera and several species of marsupials, frogs and reptiles have very restricted distributions either as isolated or disjunct populations, reflecting the refugial nature of the rainforests found in several locations. The diversity of the plant communities and animal habitats of the Wet Tropics is recognised as being the most floristically and structurally diverse in Australia and is also outstanding on a global scale. Among many emblematic species occurring in the property is the flightless Australian cassowary, one of the largest birds in the world.
- In an Australian context, the Wet Tropics covers less than 0.2 per cent of Australia, but contains 30 per cent of the marsupial species, 60 per cent of bat species, 25 per cent of rodent species, 40 per cent of bird species, 30 per cent of frog species, 20 per cent of reptile species, 60 per cent of butterfly species, 65 per cent of fern species, 21 per cent of cycad species, 37 per cent of conifer species, 30 per cent of orchid species and 18 per cent of Australia's vascular plant species. It is therefore of great scientific interest and of fundamental importance to conservation.
- Although the Wet Tropics is predominantly wet tropical rainforest, it is fringed and in a few places dissected by sclerophyll forests, woodlands, swamps and mangrove forests, adding to its diversity.

Additionally, world heritage properties must meet an 'integrity' test and be effectively managed.

The Wet Tropics Management Authority (WTMA), under the Wet Tropics World Heritage Protection and Management Act 1993 (Wet Tropics WHPM Act), has responsibility for ensuring the area is appropriately managed. The authority was established to ensure Australia meets its obligation under the World Heritage Convention. The authority is committed to promoting and developing partnerships with people and stakeholders with rights, responsibilities and interests associated with the Area, including state and private landholders, community services infrastructure agencies and the tourism industry. The Wet Tropics WHPM Act recognises the important role that Aboriginal people can play in the management of natural and cultural heritage in the property. Activities and land use in the Wet Tropics WHA is controlled under the Wet Tropics WHPM Act and the Wet Tropics Management Plan 1998. Day to day management is undertaken by the Queensland Parks and Wildlife Service (QPWS) and other landholders.

### 4.3.1 Condition and trend

The most decisive step taken to protect the Wet Tropics WHA occurred on its declaration with the cessation of logging and prohibition of new mining and grazing activities. Since listing, the overall integrity of the Wet Tropics WHA has been maintained or improved. Significant improvements to the health or condition of the Wet Tropics WHA have been achieved through a wide range of management partnerships, research and innovative projects.[40]

The WTMA is required to report annually to both the Australian Government and the Queensland Government regarding the State of the Wet Tropics. Since 2008, the WTMA has adopted a theme-based approach for these reports. For example:

- Climate Change in the Wet Tropics – Impacts and Responses (2007–2008)
- Condition of the Wet Tropics WHA – a report card (2008–2009)
- Managing Tourism in the Wet Tropics (200–2010)
- New and Emerging Biosecurity Threats in the Wet Tropics (2010–2011)

It is intended that the report card theme used for the 2008-2009 State of the Wet Tropics report[40] will be revisited every four to five years as a basis for regular reporting on the condition and integrity of the OUV of the Wet Tropics WHA and also to provide key information to assist in the completion of the six-yearly UNESCO Periodic Reporting on the Wet Tropics WHA. This is a similar approach taken for the adjacent GBRWHA for which the GBR Outlook report is issued every five years.

The 2008–2009 Condition of the Wet Tropics Report found that the Wet Tropics WHA was in very good condition. Contemporary uses have relatively minor impacts and actions were being taken to further reduce these impacts.[40] However, the extent and condition of MNES values in adjacent areas were assessed as poor and in decline. Significant intervention is required to reduce the impacts of loss and fragmentation of remnant REs that resulted from past development.[40] Impacts on World Heritage values from activities occurring outside the area relate primarily to the minimal vegetated linkages between discrete patches of the WHA. While this is an issue of north-south connectivity, a larger concern is the limited east-west connectivity, between the coastal lowland and highland habitats.

Management of the Wet Tropics WHA and the impact of factors external to the area are discussed in detail in the Wet Tropics demonstration case (Appendix I). The demonstration case:

- evaluates the current extent, condition and trends of the OUV
- identifies threats, pressures and direct, indirect and cumulative impacts
- describes the statutory and policy framework for protecting and managing the WHA
- outlines measures being taken to protect OUV
- details information gaps and how they are being addressed
- describes the monitoring, evaluation and compliance arrangements.

A summary of the condition and trend of the terrestrial habitat and the species diversity in the Wet Tropics WHA is provided below.

#### 4.3.1.1 Terrestrial habitat

***Condition and trend***

The WTMA's State of Wet Tropics Report 2008–2009 notes that natural regenerative processes are gradually reinstating ecosystem composition, structure and function in previously logged forests. Many previously disturbed areas had significantly rehabilitated in the 20 years since World Heritage listing. The extent of cleared areas and vehicle tracks within the WHA had been significantly reduced which had also resulted in a reduction in the amount of internal habitat fragmentation. This had resulted in a general enhancement of the integrity of the area.[40]

The 2008–2009 report[40] also indicated that rates of habitat loss and degradation in the wider region were slowing but were yet to cease. The report credited this to the regulation of native vegetation through the introduction of the VM Act. Although the VM Act offers a greater level of protection, the condition of the REs had not improved and they remained highly fragmented with pressure on areas outside the WHA increasing.

#### 4.3.1.2 Species diversity

***Condition and trend***

Pressures on biodiversity are generally not geographically uniform. Analysis concluded the status and trends for biodiversity for the entire Wet Tropics area was 'good'. The State of the Wet Tropics Report 2008–2009 suggested there was a knowledge gap about the population distribution and behaviour of most rare and threatened species making monitoring and conservation difficult.[40] There had been a catastrophic decline in the region's frog populations with frog mortality and disappearance being linked to fungus and other amphibian diseases. The cassowary population was in decline due particularly to habitat fragmentation and vehicle collisions, with stress disease and dog attacks also contributing.[40] Pests, pathogens and disease and fire are major issues affecting the Wet Tropics WHA.

**Pests, pathogens and disease threats**

Two of the five major issues affecting the condition of the Wet Tropics WHA are invasive terrestrial species (such as weeds, feral animals, pathogens and disease) and invasive freshwater species (such as water weeds and pest fish). Climate change, another of the five major issues, will interact with and exacerbate the risks posed by weeds, pests and diseases.

In the last decade, the Wet Tropics has had numerous incursions of high risk environmental pests including diseases such as myrtle rust, feral animals such as tramp ants and Asian honey bees, and a range of weeds that have the potential to invade tropical ecosystems. The arrival of myrtle rust and its potential impact on Wet Tropics species and ecosystems, and the threatening advance of tramp ants such as the electric ant and yellow crazy ants into the WHA are of particular concern at this point in time.

**Fire**

Inappropriate fire regimes and fire regimes altered as a result of vegetation clearing and climate change and extreme weather events are a threat to the heath and resilience of the Wet Tropics. The WTMA 2008-09 Report identified a knowledge gap about what constitutes an appropriate fire regime in the Wet Tropics.[40] In response to this, and other issues, the Queensland Government has produced a specific Planned Burn Guidelines for the Wet Tropics Bioregion.[41] The guideline provides direction towards understanding the role, ecology and practice of Wet Tropics fire management. The guideline promotes the importance of fire management as a conservation tool to halt further loss or weakening of the integrity of lowland, highland and wetland fire-adapted communities and thereby maintaining the resilience and complexity of the wet tropics.

'Of concern' REs , including once widespread types that have been extensively developed for agriculture, as well as some open forest systems, are rapidly changing floristic composition and structure due to altered fire regimes.[40] Even with increased regulation of REs prior to the WTMA 2008–09 Report, it was reported that the condition of these REs had not greatly improved. The REs remain highly fragmented and pressure on the areas outside the Wet Tropics WHA is increasing, particularly on the coastal lowlands.[40]

The 2008–2009 report found that the long term persistence or regeneration of a number of the region's more restricted sclerophyll vegetation types is under threat due to the disruption of historical fire patterns. Inappropriate fire management and wildfires were reported to have adversely affected rainforest areas not adapted to burning, particularly hillside slopes and grassland communities like those on the hill slopes surrounding Cairns. These areas around Cairns have been affected by sugarcane burning practices. Power line corridors are also reported to act as conduits for fire into the interior of the forests.[40]

Pressures on biodiversity are generally not geographically uniform. Analysis concluded the status and trends of biodiversity for the entire Wet Tropics area was 'good'. The differences in condition and trend within conservation reserves and those outside are highlighted in Table 4.3 1. Summary of condition and trend of OUV of the Wet Tropics WHA is shown in Table 4.3 2.

Table 4.3-1 Condition and trend within and outside the Wet Tropics WHA

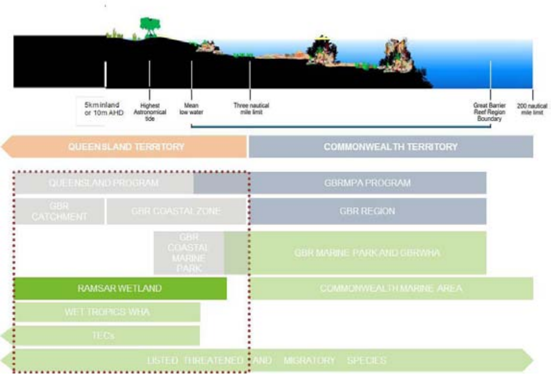
| Summary (OUV) | | Condition and trend | Confidence |
|---|---|---|---|
| ***Within conservation reserves*** | | | |
| Habitat (vegetation) extent and condition | The WHA has well protected upland forests that are separated from low land sections by agricultural and urban areas. | X<br>Recent trend - Stable | Adequate |
| MNES species diversity and distribution of species | Overall species are stable however cassowary populations in the lowland section suffered from a lack of food sources following recent cyclones which affected a large area of lowland habitat at Mission Beach. | X<br>Recent trend - Stable | Adequate |
| ***Outside conservation reserves*** | | | |
| Habitat (vegetation) extent and condition | Grazing tenures, infrastructure corridors have degraded the condition and connectivity of vegetation in some areas. | X<br>Recent trend - Stable | Adequate |
| MNES species diversity and distribution of species | Cassowaries and other species that utilise habitat outside of the WHA are at an increased risk from domestic/pest animal predation and vehicle strike. Invasive pest species more readily take hold in disturbed areas, particularly on the boundary of the WHA. | X<br>Recent trend - Stable | Adequate |

Source: [40]

Table 4.3-2 Condition and trend of OUV in the Wet Tropics WHA

| Summary (OUV) | Condition and trend | Confidence |
|---|---|---|
| The 2008/09 Report Card on the State of the Wet Tropics WHA indicated that natural regenerative processes are gradually reinstating ecosystem composition, structure and function in previously logged forests. Many disturbed areas have significantly rehabilitated in the twenty years since World Heritage listing. The extent of cleared areas and vehicle tracks within the Wet Tropics WHA has been significantly reduced which has also resulted in a reduction in the amount of internal habitat fragmentation. This has resulted in a general enhancement of the integrity of the Area. The rates of habitat loss and habitat degradation in the wider region are slowing but have not ceased.<br>The assessment tool provided by the World Heritage Centre for the WTMA to undertake the 2011 UNESCO Periodic Reporting concluded that<br>• no serious management needs have been identified for management of the property<br>• the integrity of the World Heritage property is intact<br>• the Area's OUV has been maintained. | X<br>Recent trend - Stable | Adequate |

## 4.4 Bowling Green Bay Ramsar site




The Bowling Green Bay Ramsar site was designated in 1993 under the Convention on Wetlands of International Importance especially as Waterfowl Habitat (known as the Ramsar Convention). The site is located 52 kilometres south-east of Townsville, covers over 47 000 hectares and includes Cape Bowling Green, parts of Cape Cleveland and the south-eastern portion of Cleveland Bay (Figure 4.4 1). The Bowling Green Bay Ramsar site is within the Burdekin NRM region.

The Bowling Green Bay Ramsar site has been assessed as meeting criteria 1 to 4 and 6 to 8 of the 2005 Ramsar nomination criteria: The nomination criteria and how the site meets the criteria is provided below:

- **Criterion 1:** A wetland should be considered internationally important if it contains a representative rare or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.

The Bowling Green Bay Ramsar site is in the north-east Coast Australian drainage division. It is representative of many coastal and seasonal wetlands in the area, but it is particularly significant for its diversity and extent of wetland types.

- **Criterion 2:** A wetland should be considered internationally important if it supports vulnerable, endangered or critically endangered species or threatened ecological communities.

The Bowling Green Bay Ramsar site provides feeding grounds for the nationally vulnerable Green Turtle. The site also supports Dugong, listed on the International Union for Conservation of Nature Red List of threatened species as vulnerable. Saltwater Crocodiles also inhabit the site.

- **Criterion 3:** A wetland should be considered internationally important if it supports populations of plant/ and or animal species important to maintaining the biological diversity of a particular biogeographic region.

Bowling Green Bay is particularly important for the abundance and diversity of bird species. The site regularly supports substantial numbers of all Australian waterbird groups, including post-breeding populations of Brolgas and Magpie Geese.

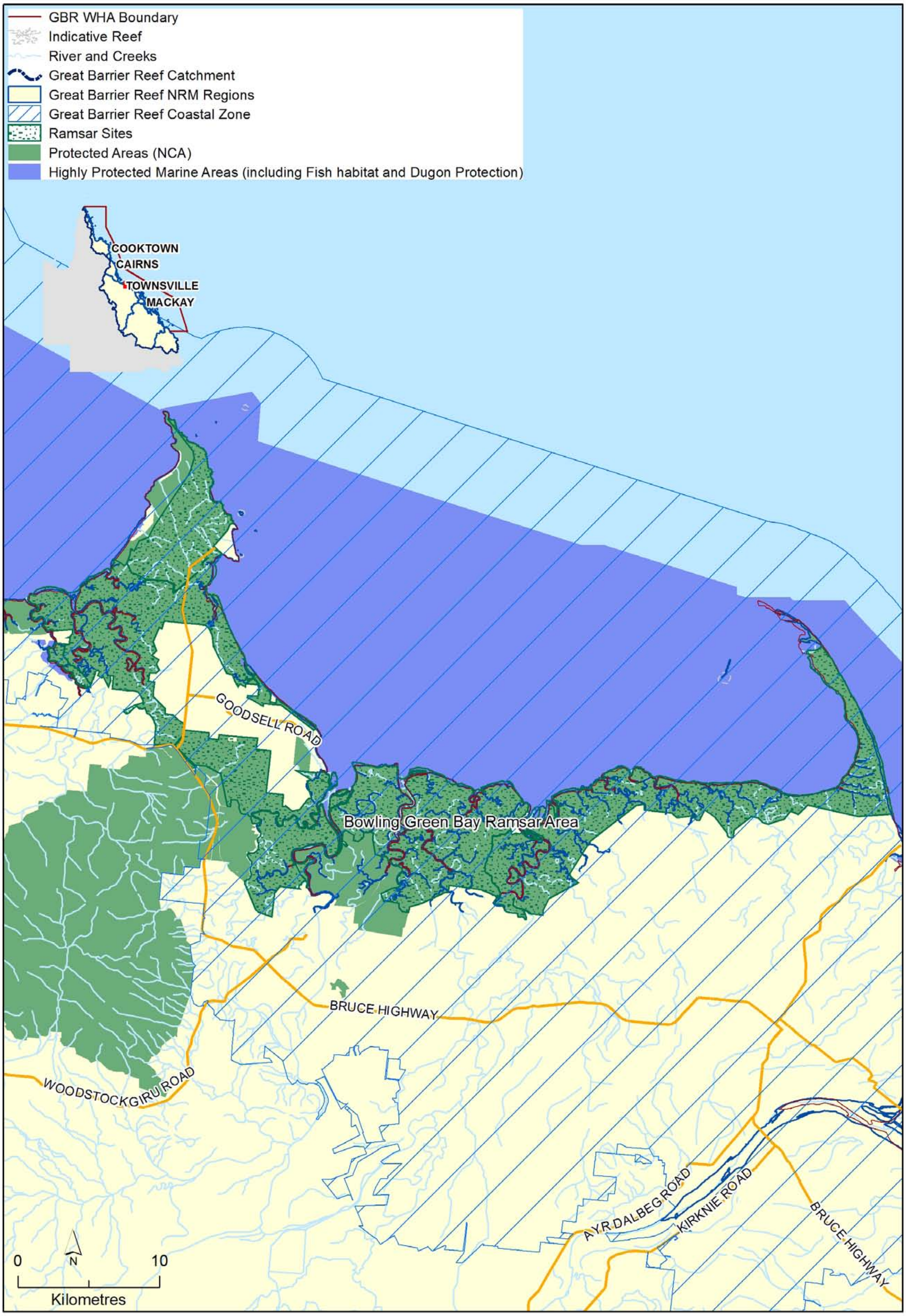



Figure 4.4 1 Bowling Green Bay Ramsar site

- **Criterion 4:** A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their lifecycles, or provides refuge during adverse conditions.

This Ramsar site is of special significance as breeding and feeding habitat for Brolgas and Magpie Geese.

- **Criterion 6:** A wetland should be considered internationally important if it regularly supports 1 per cent of the individuals in a population of one species or subspecies of waterbird.

The Bowling Green Bay Ramsar site is likely to seasonally support one per cent of the total population of the Brolgas.

- **Criteria 7:** A wetland should be considered internationally important if it supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity.
- **Criteria 8:** A wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.

The ECD for the Bowling Green Bay Ramsar site[42] describes the values of the site and adjacent marine areas that are part of the GBRWHA. The Bowling Green Bay Ramsar site is regionally unique and internationally important for the diversity and extent of marine, estuarine and freshwater wetland types it supports.

The site is internationally important for its migration pathways for marine turtles, shorebirds and terns and important for supporting several threatened species, including marine turtles, dugongs, inshore dolphins and waterbirds.[42]

The site is regionally significant for its diversity of wetland biota and food webs. It is important for endemic colonial waterbird species with perhaps some of the largest colonies of water birds in eastern Queensland. It provides important seasonal feeding habitat for regionally significant populations of brolgas and magpie geese. It supports high value fisheries with batfish aggregations and fish stocks of regional economic, recreational and indigenous significance. The site is important to local Indigenous communities and provides opportunities for scientific research, conservation and nature observation activities.

The site is locally and regionally important for nutrient assimilation and sediment stabilisation, receiving agricultural run-off from one of the largest agricultural catchments in Australia's eastern seaboard.

### 4.4.1 Condition and trend

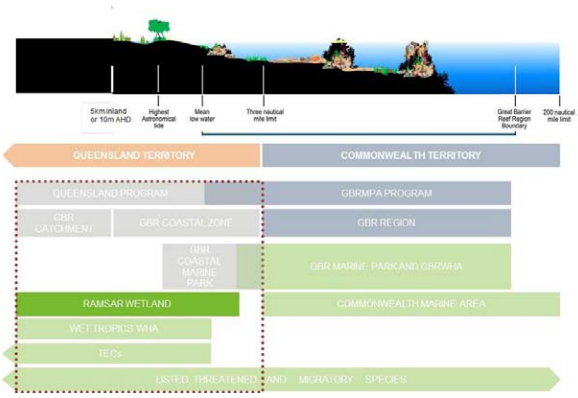
Bowling Green Bay Ramsar site is within terrestrial and marine protected areas. While subject to some external influences, such as water flow changes and (as with other marine waters) water quality, overall this area is considered to be in very good condition and stable.

Table 4.4 1 Condition and trend within the Bowling Green Bay Ramsar site

| | Summary | Condition and trend | Confidence |
|---|---|---|---|
| Habitat (vegetation) extent | No significant deterioration in the ecological character of the site outside the realms of natural variability. The site continues to meet all Ramsar nomination criteria. | X<br>Recent trend - Stable | Adequate |
| MNES species diversity and distribution of species | No significant deterioration in the ecological character of the site outside the realms of natural variability. The site continues to meet all Ramsar nomination criteria. | X<br>Recent trend - Stable | Adequate |

Source: [42]

## 4.5 Shoalwater and Corio Bays Area Ramsar site




The Shoalwater and Corio Bays Area was listed as a Ramsar site in 1996. The site is in the central Queensland coast bioregion and Australia's northeast coast drainage division and covers an area of 239 100 hectares along approximately 330 kilometres of coastline. This Ramsar site is divided into two discontinuous sections: the Shoalwater portion in the north, and the Corio Bay portion in the south. The boundary of the Shoalwater portion is approximately 85 kilometres north of Rockhampton and extends from Broome Head in the northwest, along the coast in a south-easterly direction around Cape Manifold, to the southern boundary of Shoalwater Bay Defence Training Area at Five Rocks Beach. The Corio Bay portion is located approximately 50 kilometres north of Rockhampton and includes the estuarine embayment of Corio Bay and the lower reaches of Waterpark Creek (Figure 4.5 1).

The Shoalwater and Corio Bay Ramsar site has been assessed as meeting criteria 1 to 8 of the 2005 Ramsar nomination criteria. The Shoalwater and Corio Bays Area Ramsar site is within the Fitzroy NRM region. The nomination criteria and how the site meets the criteria is provided following:

- **Criterion 1:** A wetland should be considered internationally important if it contains representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.

The Shoalwater and Corio Bays Area Ramsar site is in the north-east coast Australian drainage division. It contains the largest area in central east Queensland of representative coastal, subcoastal and aquatic landscapes and ecosystems in a relatively undisturbed state. The area represents one of a very few large estuarine systems that retains a relatively undisturbed catchment.

- **Criterion 2:** A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.

The Shoalwater and Corio Bays Area Ramsar site supports populations of the threatened Green Turtle, Flatback Turtle and Hawksbill Turtle and the endangered Loggerhead Turtle. The site also supports the EPBC Act listed Dugong.

- **Criterion 3:** A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.

The Shoalwater and Corio Bays Area contain a high diversity of freshwater, marine and estuarine fish species, with 445 species recorded. Eighteen species of mangroves occur in the area. There are at least 10 species of seagrass present, with seagrass beds extending to depths of 20 metres due to water clarity. The site is of special value as habitat for endemic fish species. The mangrove, tidal mudflats and saltflats are important habitats for local and migratory shorebirds, including 26 species protected under international migratory bird conservation agreements.

- **Criterion 4:** A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.

This Ramsar site provides nesting sites for turtles and critical feeding areas for turtles and dugongs. It also provides breeding sites for the beach stone-curlew.

- **Criterion 5:** A wetland should be considered internationally important if it regularly supports 20 000 or more waterbirds.

The Shoalwater and Corio Bays Area Ramsar site supports more than 20 000 waterbirds in summer

- **Criterion 6:** A wetland should be considered internationally important if it regularly supports 1 per cent of the individuals in a population of one species or subspecies of waterbird.

Six species of migratory shorebirds have been recorded in the Shoalwater and Corio Bays Area Ramsar site at numbers exceeding one per cent of their population in the East Asian Australasian Flyway, including the Eastern Curlew, Whimbrel and Great Knot.

- **Criteria 7:** A wetland should be considered internationally important if it supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity.

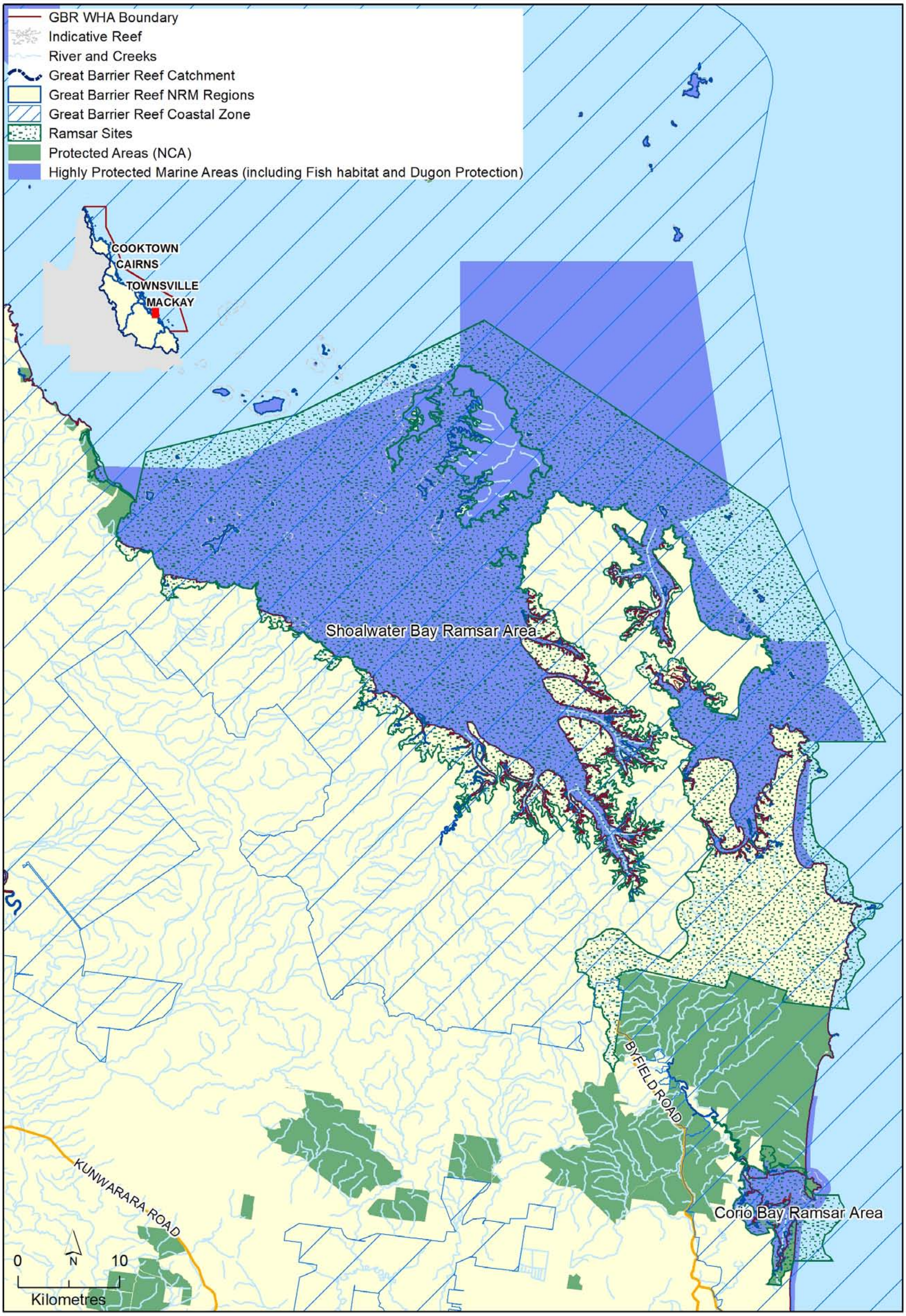



Figure 4.5 1 Shoalwater and Corio Bays Area Ramsar site

- **Criteria 8:** A wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.

The marine section of the Shoalwater component of the Ramsar site and the coastal waters outside of Corio Bay form part of the GBRWHA. Marine areas of the Ramsar site also form part of the GBR Marine Park and GBR Coast Marine Park. The Corio Bay Fish Habitat Areas have been declared under the Fisheries Act to provide long-term protection for fish habitats that are essential to sustaining fisheries. A terrestrial area within the Corio Bay component of the site forms part of Byfield National Park and is therefore protected under the NC Act. Japan-Australia, China-Australia and Republic of Korea-Australia Migratory Bird Agreements are applicable for the site (see section 4.7 for further details).

The Ramsar site and surrounding lands and waters supports a remarkably high level of biodiversity. The high biodiversity is due to the geomorphic diversity and the overlapping climatic zones which create an unusual mix of tropical, sub-tropical and temperate species with a marked rainfall gradient between east and west.

A total of 400 vertebrate fauna species have been recorded within or adjacent to the site, while at least 800 flora species have been recorded. The biodiversity of the Ramsar site also includes a number of species of conservation significance, listed as threatened on a national or international scale. Notably, the Ramsar site supports an abundance of waterbirds, providing important feeding, resting and breeding habitat for approximately:

- 77 waterbird species; representing approximately 73 per cent of the waterbird fauna known for the Central Queensland Coast bioregion (CQC bioregion: 105 species)
- 32 shorebird species; representing approximately 71 per cent of the shorebird species known for the Central Queensland Coast bioregion (CQC bioregion: 45 species).

The site also supports 22 frog species representing approximately 79 per cent of frog species known for the Central Queensland Coast bioregion (CQC bioregion: 28 species).

### 4.5.1 Condition and trend

The ECD for the site assessed that the site continues to meet the Ramsar nomination.[43]

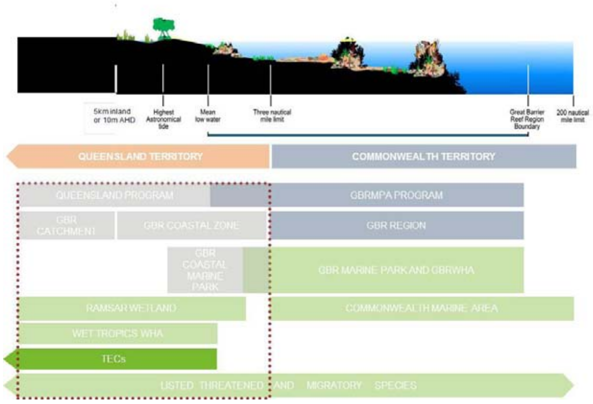
Table 4.5-1 Condition and trend within the Shoalwater and Corio Bay Ramsar site

| | Summary | Condition and trend | Confidence |
|---|---|---|---|
| Habitat (vegetation) extent | No significant deterioration in the ecological character of the site outside the realms of natural variability. The site continues to meet all Ramsar nomination criteria. | X<br>Recent trend - Stable | Adequate |
| Numbers and distribution of MNES species | No significant deterioration in the ecological character of the site outside the realms of natural variability. The site continues to meet all Ramsar nomination criteria. | X<br>Recent trend - Stable | Adequate |

Source: [43]

CHAPTER 4 I values of the GBR coastal zone and their extent, condition and trend

## 4.6 Nationally threatened ecological communities




Nationally threatened ecological communities (TECs) are listed under the EPBC Act as MNES. In Queensland, TECs are identified and mapped by their associated REs. Seven TECs are predicted to be found in the GBR coastal zone based on the Australian Government's PMST. However, Queensland mapping of associated REs identified only two TECs which have the majority of their extent within the GBR coastal zone. The other TECs extend beyond the GBR coastal zone with only a very small proportion of their extent (four with less than one per cent and one with less than five per cent) located in the GBR coastal zone (one per cent is beyond an acceptable degree of data reliability). The two TECs are:

- The broad leaf tea-tree (*Melaleuca viridiflora*) woodlands in the high rainfall coastal north Queensland ecological community occurs where broad leaf tea-tree is dominant in the canopy and a diversity of grasses, sedges and forbs (herbaceous flowering plant other than a grass) occupy the ground layer. The broad leaf tea-tree woodlands ecological community is restricted to the Wet Tropics and Central Mackay Coast bioregions in Queensland, occurring in the Mackay Whitsunday and Fitzroy NRM regions.[44]
- The littoral rainforest and coastal vine thickets of eastern Australia ecological community is a complex of rainforest and coastal vine thickets on the east coast of Australia influenced by its proximity to the sea. The canopy, which protects less tolerant species and propagules in the understorey from salt laden winds, can range from patchy to closed, and may include emergents as well as dead trees due to ongoing natural disturbance. The littoral rainforest and coastal vine thickets of eastern Australia ecological community occur in the Cape York, Wet Tropics, Mackay-Whitsunday, Fitzroy and Burnett-Mary NRM regions. While this ecological community has been significantly reduced and fragmented by sandmining, agriculture and coastal development in other parts of Australia[45], it remains relatively intact within the GBR coastal zone.

Table 4.6 1 describes the two TECs within the GBR coastal zone in the context of their presence across Queensland.

Table 4.6-1 Threatened ecological communities in the GBR coastal zone

| Threatened Ecological Community | EPBC Act Status | NRM Region | Total Area QLD (ha) | Total Area GBR coastal zone (ha) | % Total in GBR coastal zone |
|---|---|---|---|---|---|
| Broad leaf tea-tree woodlands in high rainfall coastal north Queensland | Endangered | Cape York<br>Wet Tropics<br>Burdekin<br>Mackay<br>Whitsunday<br>Fitzroy | 31 306 | 20 638 | **65.9%** |
| Littoral Rainforest and Coastal Vine Thickets of Eastern Australia | Critically Endangered | Cape York<br>Wet Tropics<br>Burdekin<br>Mackay<br>Whitsunday<br>Fitzroy<br>Burnett Mary | 72 853 | 55 973 | **76.8%** |

Source: [44,45]

## 4.6.1 Extent, condition and trend

### 4.6.1.1 TEC extent and trend

TEC extent is based on the remnant extent of their associated REs – this is a comparison between the pre-clearing and current extent. The Queensland Herbarium has prepared a pre-clearing map showing RE extent prior to European settlement, as well as a series of post-clearing maps showing remnant REs.[32] This shows the loss of extent in TECs that resulted from clearing for rural and urban land use since European settlement.

The measure of change in extent is based on two temporal points; pre-clear (pre-European) and current (2009). The latest RE mapping is based on data from 2009 drawn from Queensland's 'Statewide Landcover and Trees Study' Annual Reports.[33] Figure 4.6 1 shows clearing rates over time for TECs. The clearing rates have changed with increasing levels of protection of these TECs as a result of regulation of vegetation clearing over the past 25 years. The extent of TECs is now relatively stable after a long period of clearing. The level of protection from clearing is considered to be the best indicator of future trend for extent of TECs.

### 4.6.1.2 TEC condition and trend

TEC condition has been determined by considering the current land use classifications throughout their distribution in the GBR coastal zone. TEC occurring in conservation areas are considered to be in very good condition and will be enhanced or remain stable. TEC in minimal use areas are considered to be in good condition and stable. TEC in moderate areas are considered to be generally in poor condition and TEC in urban areas are considered to be in very poor condition with both likely to decrease over the life of the Queensland Government's Program.

A great proportion of REs associated with both TECs have been modified by land uses such as grazing, timber harvesting and, possibly, defence activities. While these REs associated with TECs remain remnant their vegetation structure and composition is predominantly altered but remains intact. The natural regenerative processes have been able to tolerate and endure past and current land uses and management practices.

<u>Broad leaf tea-tree (Melaleuca viridiflora) woodlands in high rainfall coastal north Queensland</u>

The area of current broad leaf tea-tree habitat is shown in Figure 4.6 2, while Figure 4.6 3 shows the extent, level of protection and condition of broad leaf tea-tree woodlands in the high rainfall coastal north Queensland ecological community (broad leaf tea-tree). The pre-cleared extent of this TEC in the GBR coastal zone was 70 800 hectares. By 2009, 31 300 hectares remained and currently, 20 600 hectares of broad leaf tea-tree communities remains within the GBR coastal zone. Approximately 25 per cent of the remaining area of this TEC occurs in national parks and state forests. A further 74 per cent occurs in non-urban areas and is protected under the VM Act. Less than two per cent occurs in urban areas.

The broad leaf tea-tree communities in national parks are expected to be in very good condition and improving. In areas of minimal land use it is expected to remain in good condition and stable. However, the approximately 60 per cent of this

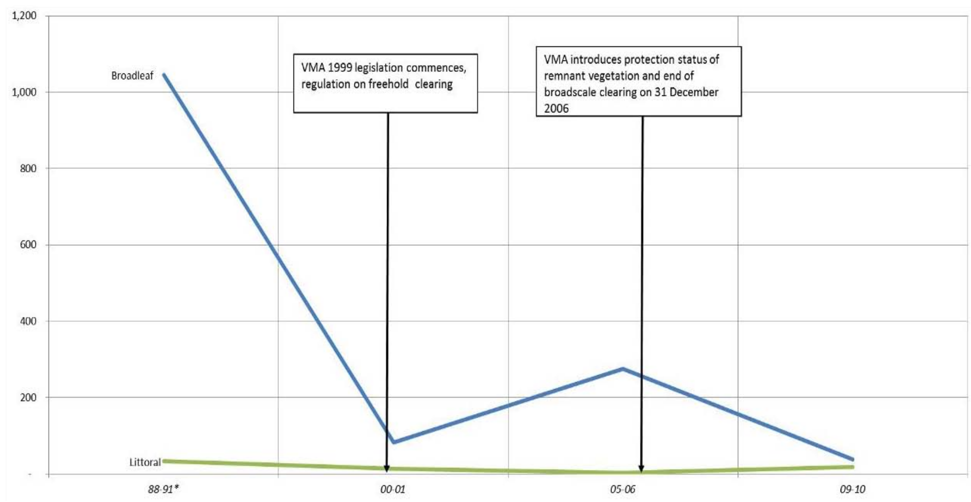



Figure 4.6-1 Vegetation clearing rates in key TECs 1988 - 2010

Source: [33]

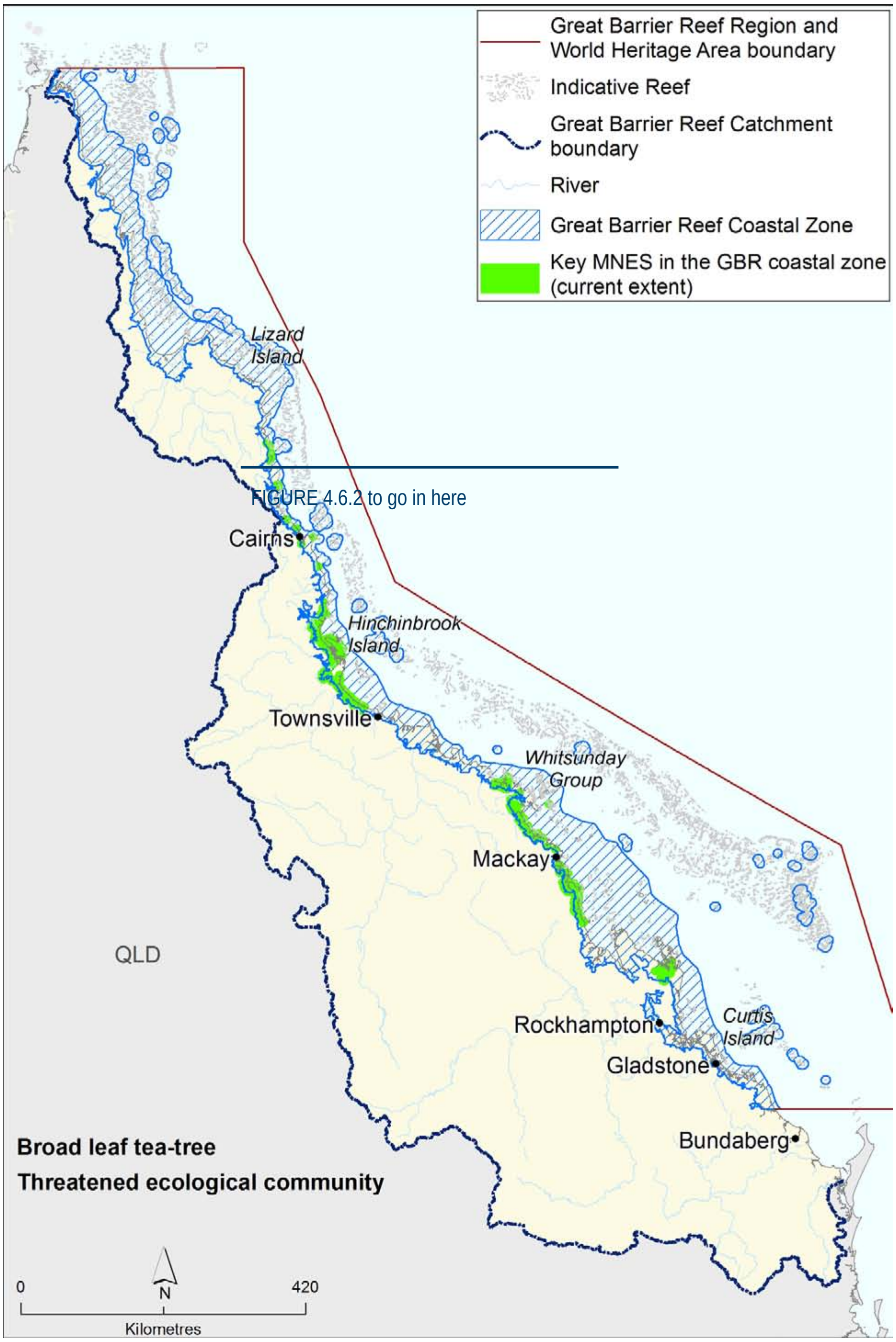



Figure 4.6 2 Current extent of broad leaf tea-tree (Melaleuca viridiflora) woodlands in the GBR coastal zone

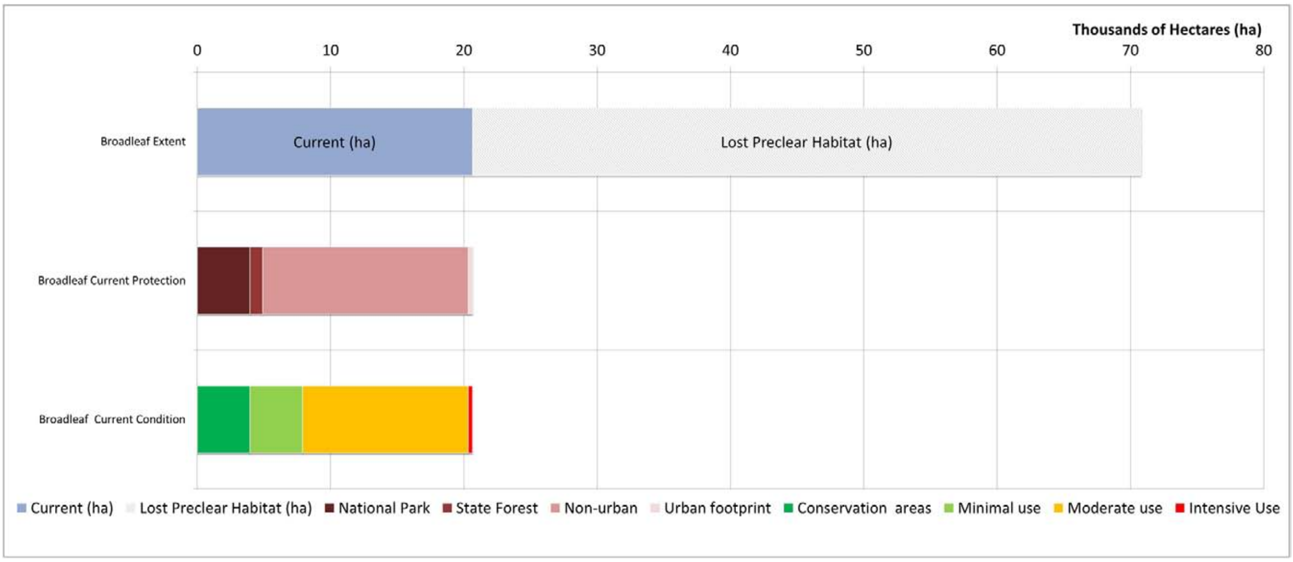



Figure 4.6 3 Extent, level of protection and condition of broad leaf tea-tree (Melaleuca viridiflora) woodlands in the high rainfall coastal north Queensland ecological community

community in areas of moderate land use are expected to be in poor condition and likely to decline. The small proportion of this community located in urban areas is considered to be in very poor condition and declining. Overall it is expected that the condition of this TEC will decline.

The extent of broad leaf tea-tree communities is expected to be largely stable during the life of the Program because of the level of protection provided by the VM Act in non-urban areas; however, for approximately 60 per cent of this community there is likely to be a continuing decline in ecological condition over time due to grazing, timber harvesting and other moderate impact activities.

Littoral Rainforest and Coastal Vine Thickets of Eastern Australia

The area of current littoral rainforest habitat is shown in Figure 4.6 4, while Figure 4.6 5 shows the extent, level of protection and condition of the littoral rainforest and coastal vine thickets of eastern Australia ecological community. There is 72 853 hectares of this community in Queensland with 77 per cent of its distribution in the GBR coastal zone. The pre-cleared extent of littoral rainforest community in the GBR coastal zone was 60 316 hectares, and of this 56 000 hectares remained in 2009. Almost 30 per cent of this TEC is located within national parks. Over 69 per cent is non-urban area protected by the VMA. The one per cent that occurs in urban areas is at risk of being cleared, although the rate of clearing remains low.

The 30 per cent of littoral rainforest in conservation areas is considered to be in very good condition. A further 64 per cent is in areas subject to minimal use and considered to be in good condition. Just five per cent is subject to intensive use and less than one per cent is in urban areas which are considered to be in very poor condition.

It can be assumed that overall the condition of the remaining REs associated with littoral forest will remain in very good condition given such a large proportion of the habitat is in conservation or minimal use areas. The modified proportion of the REs is still remnant and intact, however land use activities such as grazing, timber harvesting practices and urban development are leading to alteration of the structure and composition of the vegetation community. However, these impacts on a small proportion of this TEC are unlikely to substantially affect its condition overall.

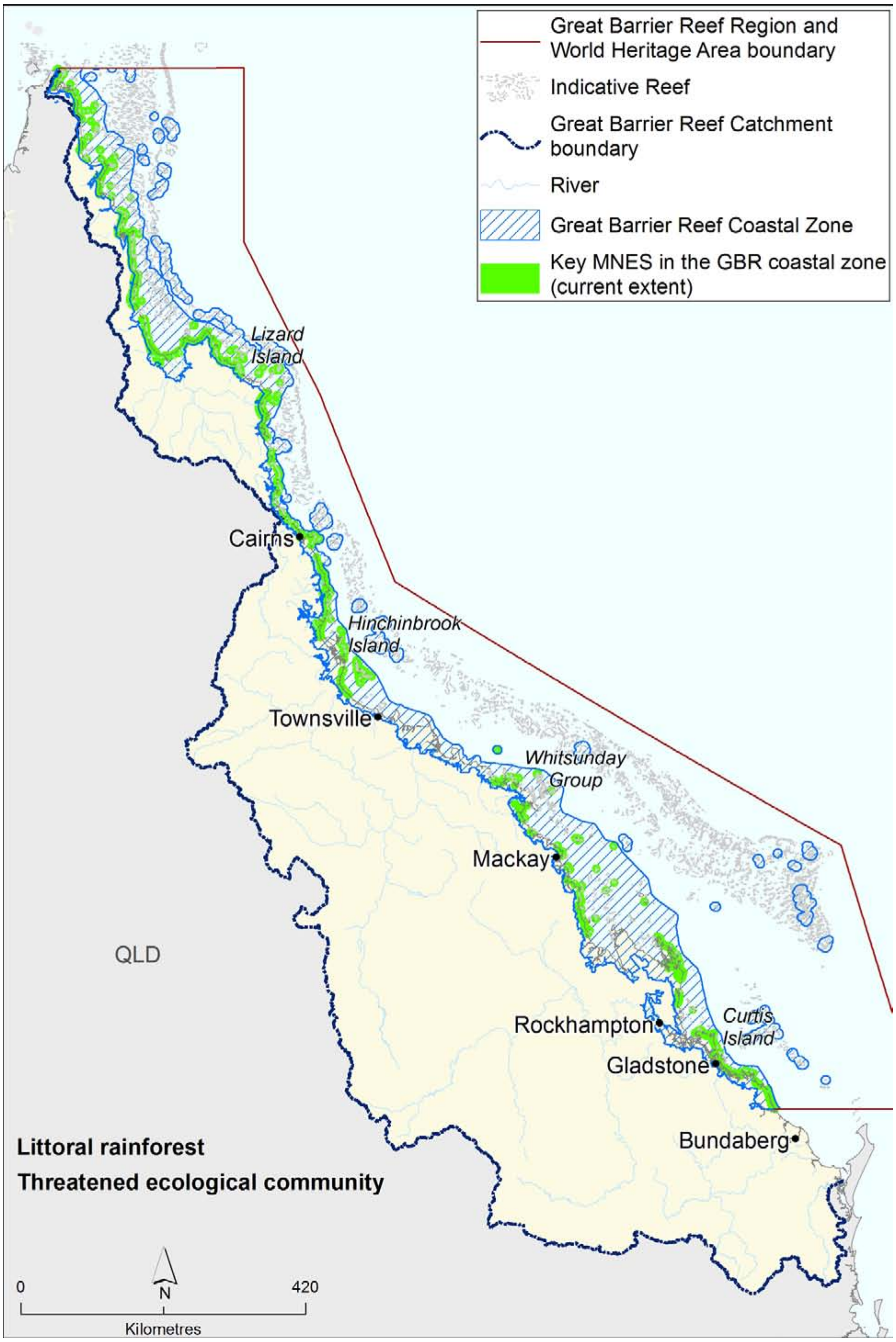



Figure 4.6 4 Current extent of littoral rainforest in the GBR coastal zone

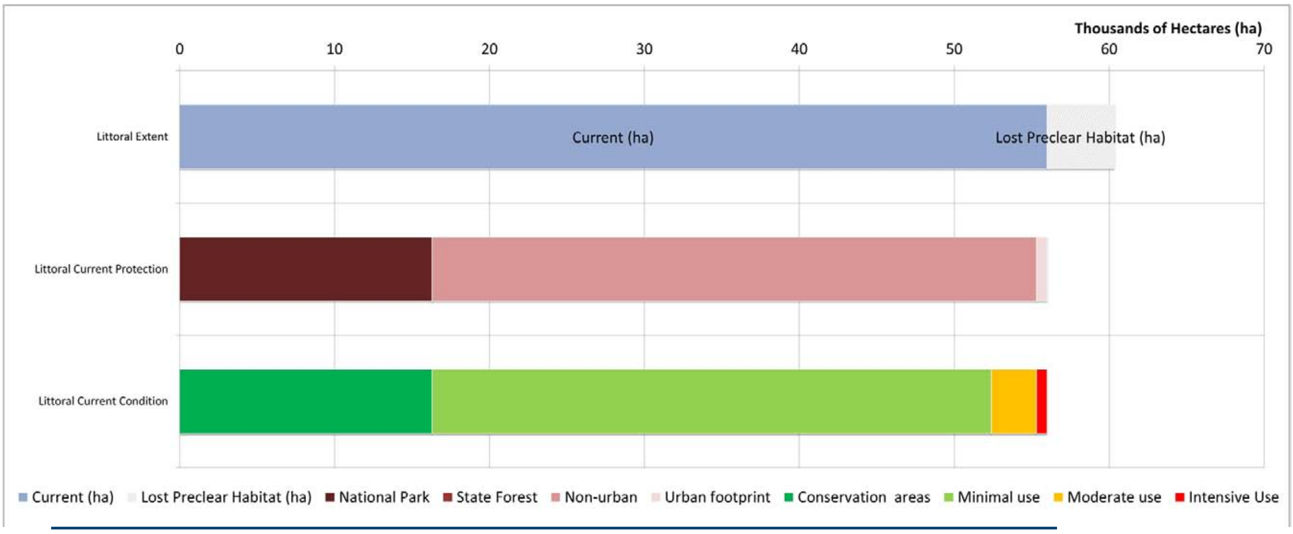


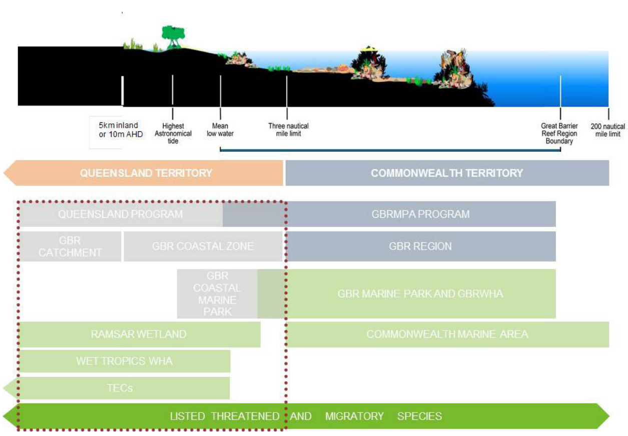

Figure 4.6 5 Extent, level of protection and condition of littoral rainforest and coastal vine thickets of eastern Australia ecological community

Table 4.6-2 Threatened ecological communities (TECs) – condition and trend

| MNES | Status (EPBC Act) | Summary of REs in GBR coastal zone | Summary | Condition and trend | Confidence |
|---|---|---|---|---|---|
| Broad leaf tea-tree woodlands in high rainfall coastal north Queensland | Endangered | 7 of 9 REs of this community are within the GBR coastal zone. A mixture of endangered, of concern and least concern REs. There are 31 306 hectares of this community in Queensland with 20 638 hectares or 66 % of its distribution in the GBR coastal zone. | There has been a significant historical loss of this TEC in the GBR coastal zone, Although present day clearing rates are approaching zero ha/annum, the remaining extent represents less than 40 % of the pre-cleared extent. Much of the remaining extent is not within conservation or minimum use areas. | X<br>Recent trend - Deteriorating | Adequate |
| Littoral Rainforest and Coastal Vine Thickets of Eastern Australia | Critically Endangered | 32 out of 35 REs of this community are within the GBR coastal zone. Most of these are of concern with some endangered and least concern. | While listed as critically endangered, within the GBR coastal zone a substantial proportion of the pre-cleared extent of this TEC remains (over 88 %) and the vast majority is located within conservation or minimal use areas (94 %). | X<br>Recent trend - Stable | Adequate |

Source: DEHP 2013

## 4.7 Threatened species




As described in Section 3.4, six key threatened fauna species and five key threatened flora species were identified as being located in the GBR coastal zone. There is sufficient data available to undertake analysis of the extent, condition and trend of these key species with a reasonable level of confidence. For some species records are not available for large parts of the GBR coastal zone which are relatively inaccessible – particularly north of Cairns. This assessment uses the habitat of these species in such cases. With regard to protection and management of these species for condition and trend analysis, land use is used to inform the assessment. This takes account of how different land use management regimes deal with threatening processes including land clearing and fire weed and pest management. These matters, and their influence on threatened species, are also addressed individually under chapter 5.

Key threatened species listed in Table 4.7 1 have been selected by refining the list of threatened species predicted to occur in the GBR coastal zone as described in chapter 3.

The key threatened species represents a range of MNES species that have the majority of their habitat within the GBR coastal zone. The extent, condition and trend for these species have been assessed using REs associated with the essential habitat of each key species and the dominant land use within these habitats.

Table 4.7 1 Key threatened species, status and NRM region

| MNES | EPBC Status | NC Act Status | NRM Region |
|---|---|---|---|
| **Fauna** | | | |
| Bare-rumped sheathtail bat (*Saccolaimus saccolaimus nudicluniatus*) | Critically Endangered | Endangered | Cape York<br>Wet Tropics<br>Burdekin |
| Mahogany glider (*Petaurus gracilis*) | Endangered | Endangered | Wet Tropics<br>Burdekin |
| Proserpine rock wallaby (*Petrogale persephone*) | Endangered | Endangered | Mackay Whitsunday |
| False water rat (*Xeromys myoides*) | Vulnerable | Vulnerable | Mackay Whitsunday |
| Yellow chat (*Epthianura crocea*) | Critically Endangered | Endangered | Fitzroy |
| Southern cassowary (*Casuarius casuarius johnsonii*) (northern and southern population) | Endangered | Endangered | **North**<br>Cape York<br>**South**<br>Wet Tropics<br>Burdekin |
| **Flora** | | | |
| Australian arenga palm (*Arenga australasica*) | Vulnerable | Vulnerable | Cape York<br>Wet Tropics |
| Cardwell bearded orchid (*Calochilus psednus*) | Endangered | Endangered | Cape York<br>Wet Tropics |

| MNES | EPBC Status | NC Act Status | NRM Region |
|---|---|---|---|
| Cooktown orchid (*Dendrobium bigibbum*) | Vulnerable | Vulnerable | Cape York<br>Wet Tropics |
| *Quassia bidwillii* | Vulnerable | Vulnerable | Mackay Whitsunday<br>Fitzroy<br>Burdekin<br>Burnett Mary |
| *Cycas silvestris* | Vulnerable | Vulnerable | Cape York |

### 4.7.1 Extent and condition of key species habitat

The associated REs for the key species habitat and the pre-cleared and current extent of these REs provides a snapshot of the extent of habitat clearing since European settlement.[32] The assessment of the condition of key species relies on analyses of the land uses where the REs associated with the species occur. Analyses of the extent and condition of the 11 key threatened species habitat are provided below. This takes account of the area of habitat that is conserved or used minimally to inform condition. As illustrated by Figure 4.7 1, clearing rates have slowed with increasing levels of protection offered by changes to the VM Act.

#### 4.7.1.1 Bare rumped sheathtail bat

Only anecdotal information is available about the bare-rumped sheathtail bat. This information is based on habitat around roosts or from deceased specimens. No information is available on foraging habitat shifts between the dry and wet seasons. There have only been two records in the last two decades both from north-eastern Queensland.

The habitat adjacent to the roost in the Jerona Fauna Sanctuary at Ayr in north Queensland was in poplar gum (*Eucalyptus platyphylla)* woodland, typical of the alluvial plains adjacent to the lower Burdekin and Houghton Rivers, near Townsville. Adjacent to this habitat were woodlands dominated by carbeen (*E. tessellaris*) and ghost gum (*E. papuana*).[46, 47] The specimen from Attack Creek, north of Coen, was collected in riverine vine forest with adjacent open forest/woodland.

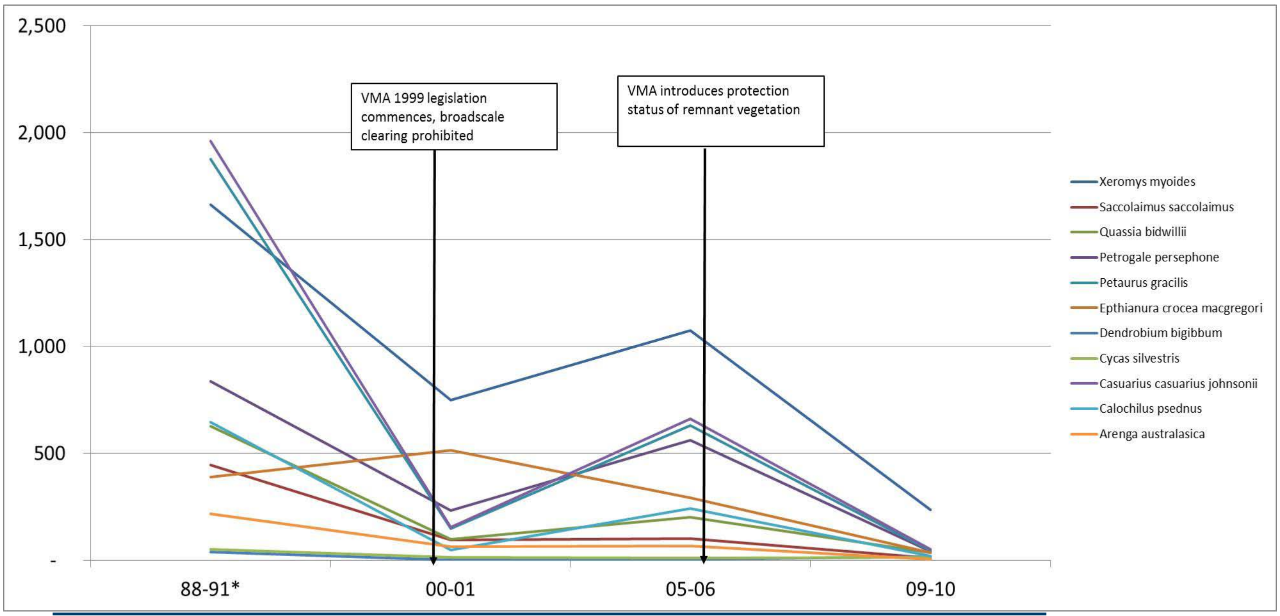



Figure 4.7 1 Vegetation clearing rates in key threatened species habitat 1988 to 2010

Source: [33]

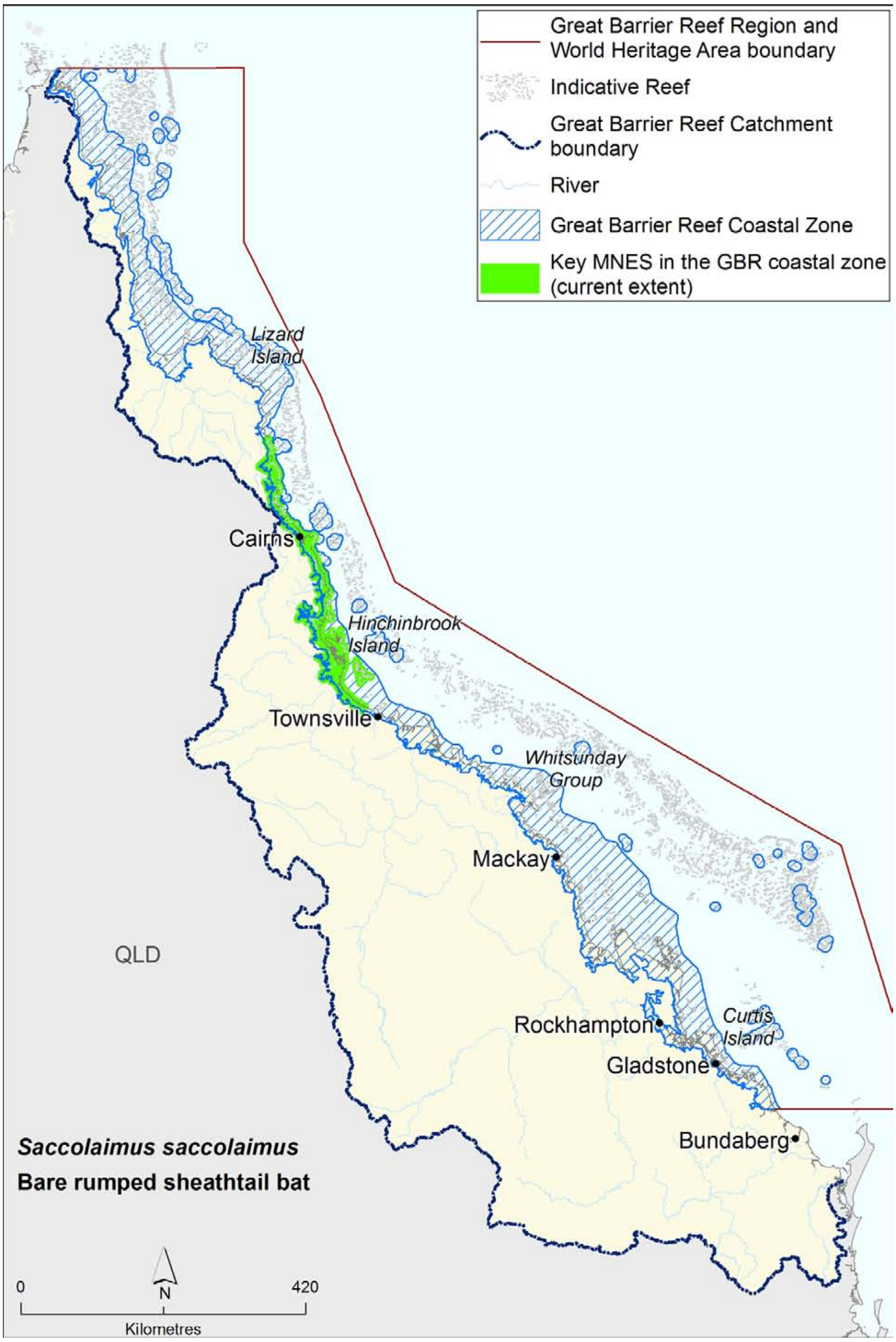



Figure 4.7 2 Current extent of bare-rumped sheathtail bat habitat in the GBR coastal zone

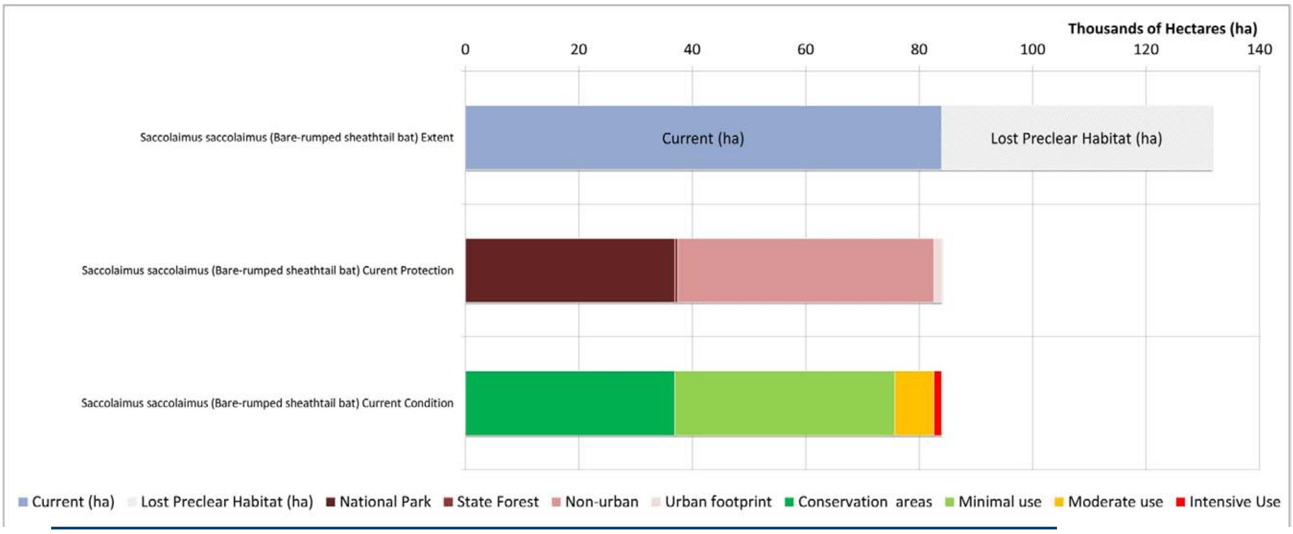



Figure 4.7 3 Extent, level of protection and condition of bare rumped sheathtail bat habitat

In either case it was not known if individuals foraged over some or all of the vegetation communities in the vicinity of the roost. The current extent of bare-rumped sheathtail bat habitat is shown in Figure 4.7 2. There has been a 36 per cent reduction in the extent of bare-rumped sheathtail bat habitat between the pre-cleared extent and the current extent (2009 data).

Most of the habitat associated with the bare-rumped sheathtail bat occurs within the GBR coastal zone. This habitat covers 84 000 hectares, of which 45 per cent is in national parks and state forests. A further 54 per cent is in non-urban areas protected under the VM Act and two per cent is in urban areas (see Figure 4.7 3).

The condition of the habitat associated with this species is considered to be very good to good with 44 per cent of the habitat in conservation areas and 46 per cent of the habitat in areas of minimal use. Eight per cent of bare-rumped sheathtail bat habitat is in areas subject to moderate use and two per cent is in areas subject to intensive use which are considered to be in poor to very poor condition. Given the paucity of sightings, the extent and condition of this species habitat may not be a reasonable indicator of the real situation. Overall, the bare-rumped sheathtail bat habitat condition should improve as 90 per cent is in conservation or mimimal use areas.

#### 4.7.1.2 Mahogany gliders

The population of the mahogany glider is small and restricted to the coastal southern Wet Tropics region of northern Queensland. They have been found in recent years in a narrow and highly fragmented band of lowland sclerophyll forest extending around 140 kilometres from Toomulla (north of Townsville) to Tully, and up to 40 kilometres inland.

In this area, the woodland vegetation is shaped and maintained by fire and dominated by bloodwoods (*Corymbia* and *Eucalyptus*) and acacia. An open vegetation structure needs to be maintained to facilitate gliding, therefore, gliders avoid rainforest.[48-50] While recent sightings are restricted in area, the habitat for the species is more extensive.

The current extent of mahogany glider habitat is shown in Figure 4.7 4. There has been a 35 per cent reduction in the extent of habitat between the pre-cleared extent and the current extent (2009 data).

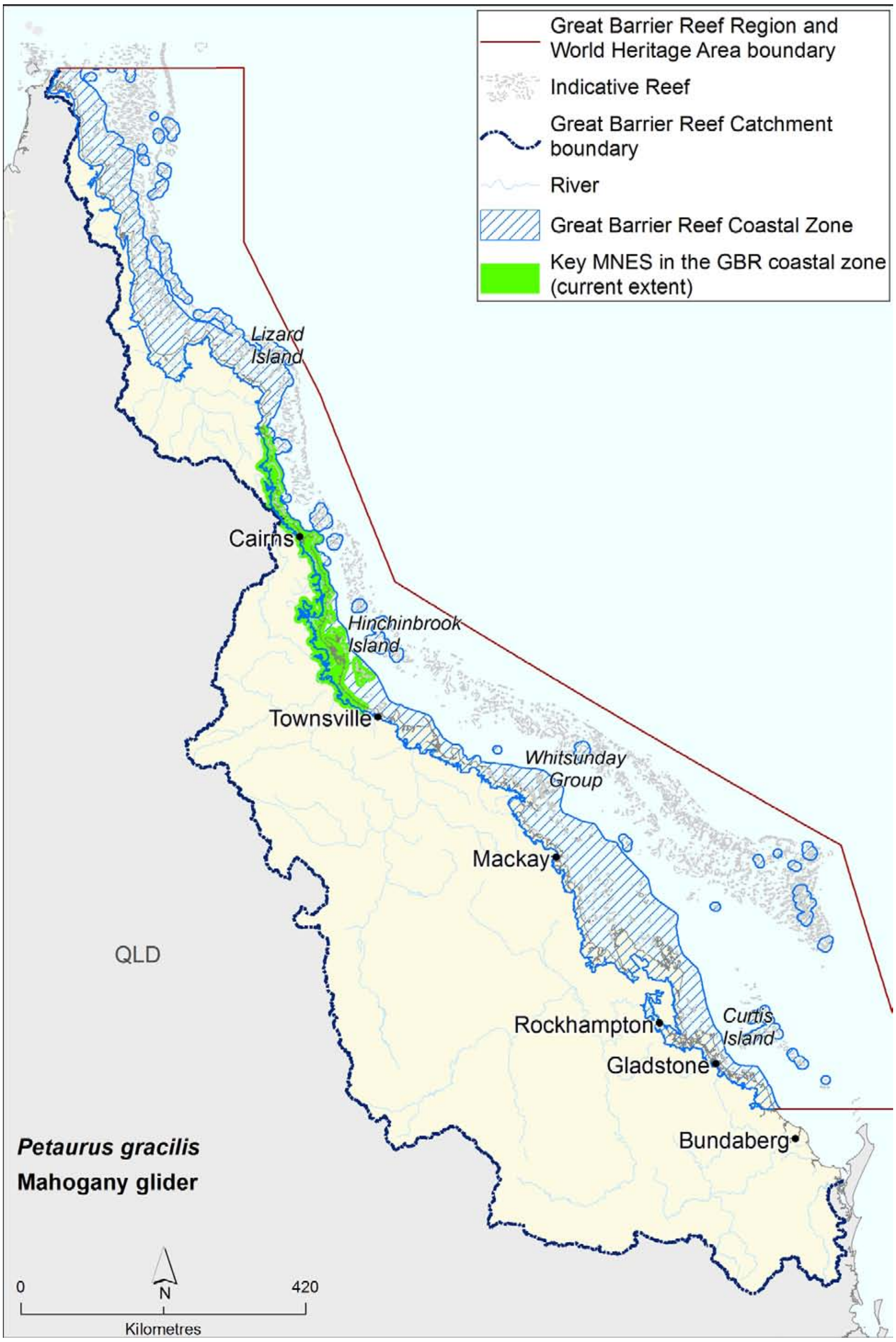



Figure 4.7 4 Current extent of mahogany glider habitat in the GBR coastal zone

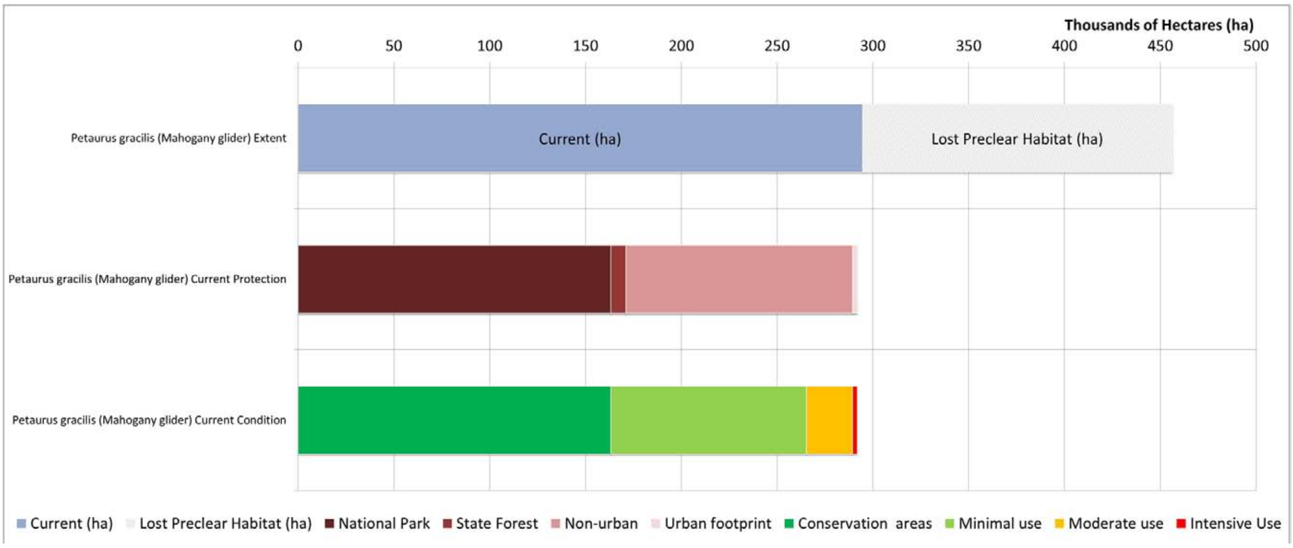



Figure 4.7 5 Extent, level of protection and condition of mahogany gliders habitat

Most of the habitat associated with the mahogany glider occurs within GBR coastal zone and covers 295 000 hectares, of which 58 per cent occurs in national parks and state forests. A further 40 per cent is in non-urban areas protected under the VM Act and one per cent is in urban areas (see Figure 4.7 5).

The condition of the habitat associated with this species is considered to be very good to good with 55 per cent of the habitat in conservation areas and 35 per cent of the habitat in areas of minimal use. Eight per cent of the mahogany glider habitat is in areas subject to moderate use and one per cent is in areas subject to intensive use which are considered to be in poor to very poor condition. Overall, the mahogany glider habitat condition should improve as 90 per cent is in conservation or mimimal use areas.

#### 4.7.1.3 Proserpine rock wallaby

The population of the Proserpine rock wallaby is small and spread across 24 small colonies. The Proserpine rock wallaby occurs near rocky outcrops, rock piles and ledges in and around Dryander National Park, Conway National Park, Gloucester Island National Park, the Clarke Range west of Proserpine, parts of the Conway Range and around the township of Airlie Beach.

In Gloucester Island National Park, the Proserpine rock wallaby prefers littoral (beachside) habitat. It uses rocky outcrops and rock piles covered with dry vine scrub, usually associated with beach scrub. At higher elevations, its habitat is rocky outcrops, rock piles and rocky creeks within an Acacia open forest.

Their habitat has been severely fragmented creating barriers to genetic flow. On Hayman Island, where the wallaby has been translocated, it occurs in association with boulder piles covered with vine thicket.[51-53]

The current extent of Proserpine rock wallaby habitat is shown in Figure 4.7 6. There has been a 33 per cent reduction in the extent of Proserpine rock wallaby habitat between the pre-cleared extent and the current extent (2009 data).

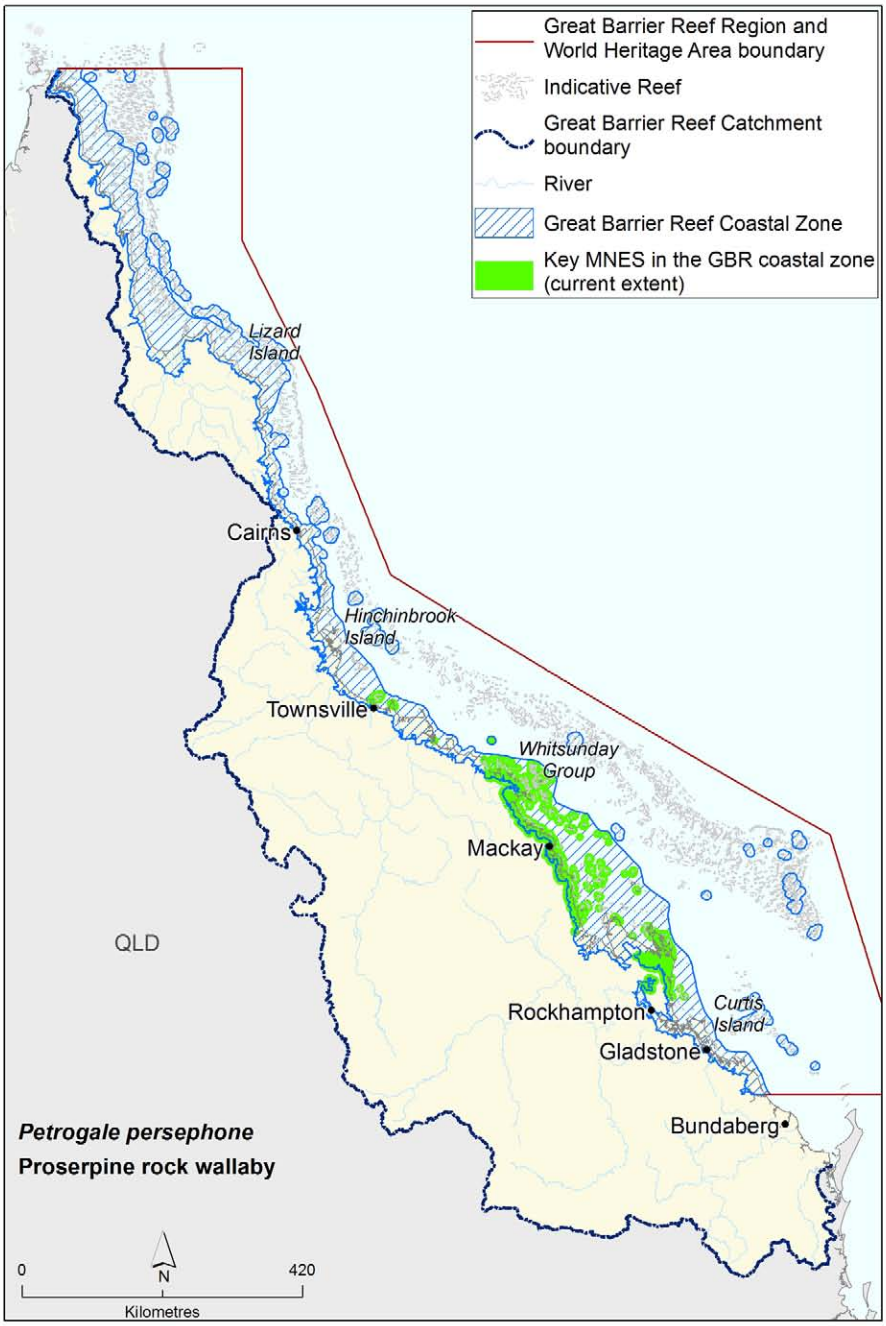



Figure 4.7 6 Current extent of Proserpine rock wallaby habitat in the GBR coastal zone

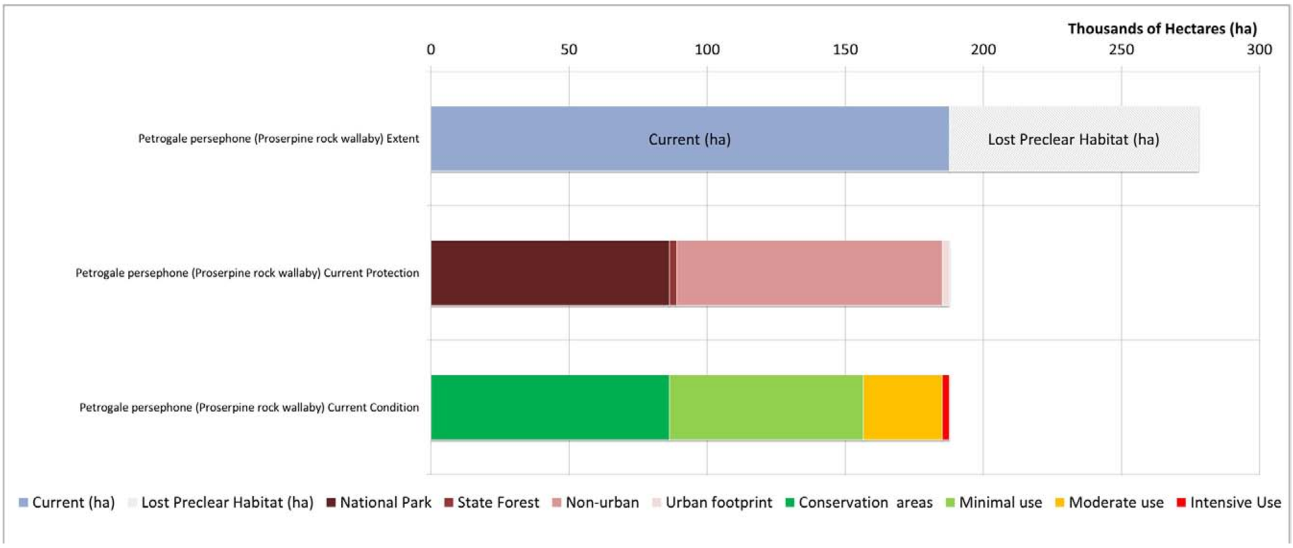



Figure 4.7 7 Extent, level of protection and condition of Proserpine rock wallaby habitat

Most of the habitat associated with the Proserpine rock wallaby occurs within GBR coastal zone and covers 188 000 hectares of which just under 50 per cent is located in conservation areas and just under 40 per cent being located in minimal use areas. Under 20 per cent of the habitat is located in moderate and intensive use areas. In non-urban the habitat is protected under the VM Act (see Figure 4.7 7).

The condition of the habitat associated with this species considered to be very good to good overall with 46 per cent of the habitat in conservation areas and 37 per cent of the habitat in areas of minimal use. Fifteen per cent of the habitat is in areas subject to moderate use and one per cent is in areas subject to intensive use which are considered to be in poor to very poor condition. Overall, the Proserpine rock wallaby habitat condition should improve given the high proportion in conservation or mimimal use areas.

#### 4.7.1.4 False water rat (water mouse)

The false water rat lives in mangrove communities, adjacent freshwater lagoons, swamps and sedged lakes close to coastal foredunes. In central Queensland, the species has only been captured within fringing mangroves in the high intertidal zone dominated by *Ceriops tagal* and/or *Bruguiera* spp. despite extensive searching in other mangrove habitats. This is possibly a reflection of the challenges presented to the species by a much higher tidal range in this area.[54]

The current extent of false water rat habitat is shown in Figure 4.7 8. There has been a 35 per cent reduction in the extent of false water rat habitat between the pre-cleared extent and the current extent (2009 data).

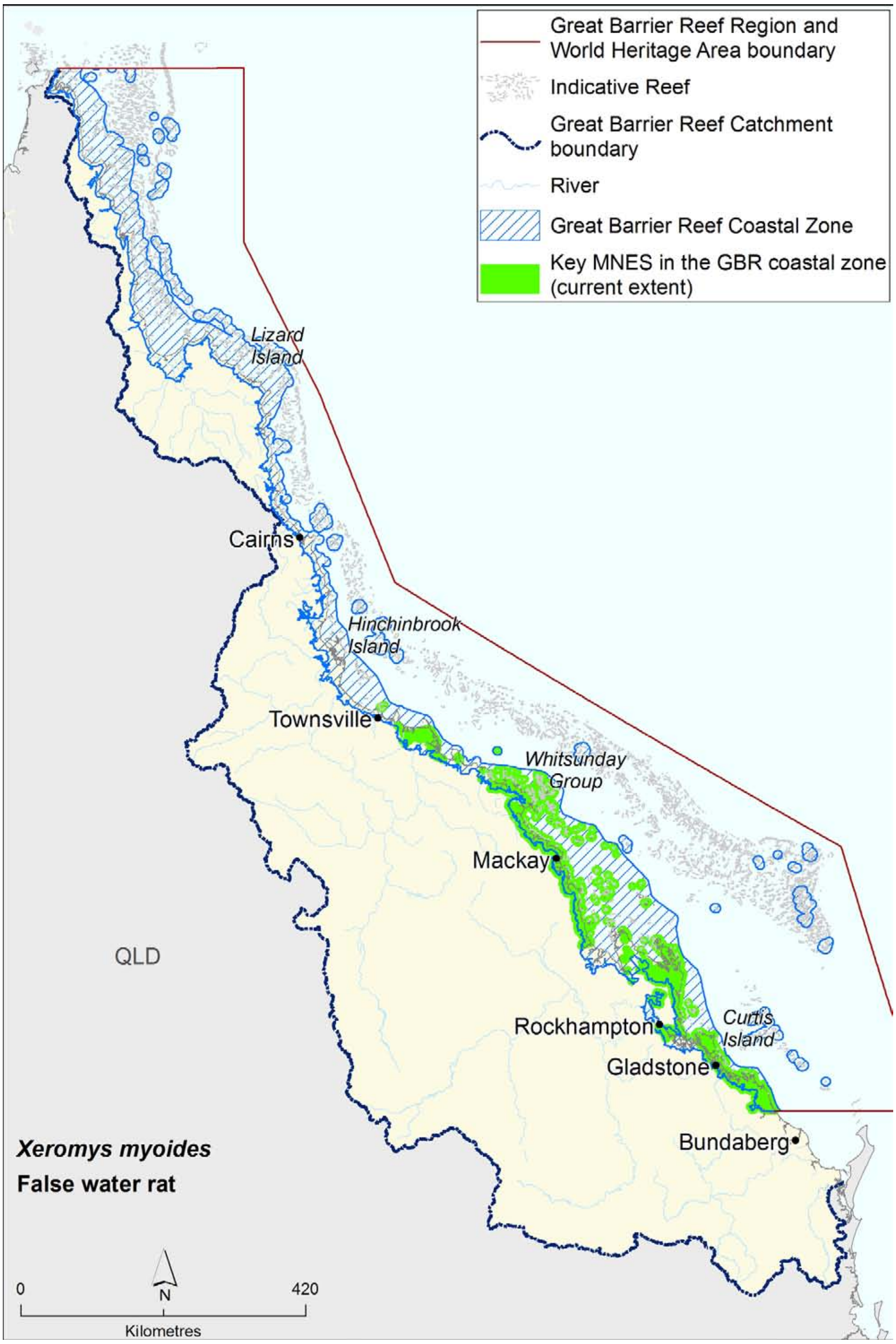



Figure 4.7 8 Current extent of false water rat habitat in the GBR coastal zone

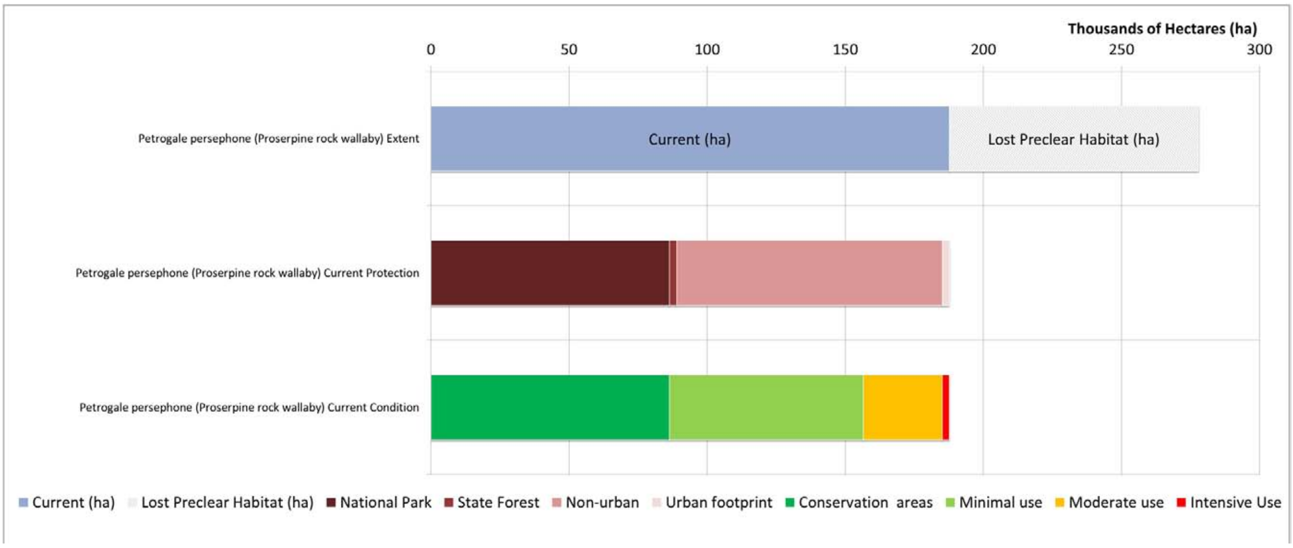



Figure 4.7 9 Extent, level of protection and condition of false water rat habitat

Most of the habitat associated with the false water rat occurs within GBR coastal zone and covers 379 000 hectares, of which 30 per cent is in national parks and state forests. Approximately 40 per cent is located in minimal use areas, and 30 per cent is located in moderate and intensive use areas. In non-urban areas this habitat is protected under the VM Act (see Figure 4.7 9).

The condition of the habitat associated with this species is considered to be good overall and the trend stable given the high proportion in conservation or mimimal use areas.

#### 4.7.1.5 Yellow chat

The false water rat lives in mangrove communities, adjacent The yellow chat is a small bird that lives in sedges, grassy swampland and saline herbland. The total population is estimated to be 250 from five locations. The Dawson subspecies is known only from Curtis Island, the Torilla Plain and Fitzroy River Delta in central Queensland. It eats mostly insects, and feeds in low vegetation or on the ground at the base of the shrubs.[55,56] The current extent of yellow chat habitat is shown in Figure 4.7 10. There has been a 37 per cent reduction in the extent of yellow chat habitat between the pre-cleared extent and the current extent (2009 data).

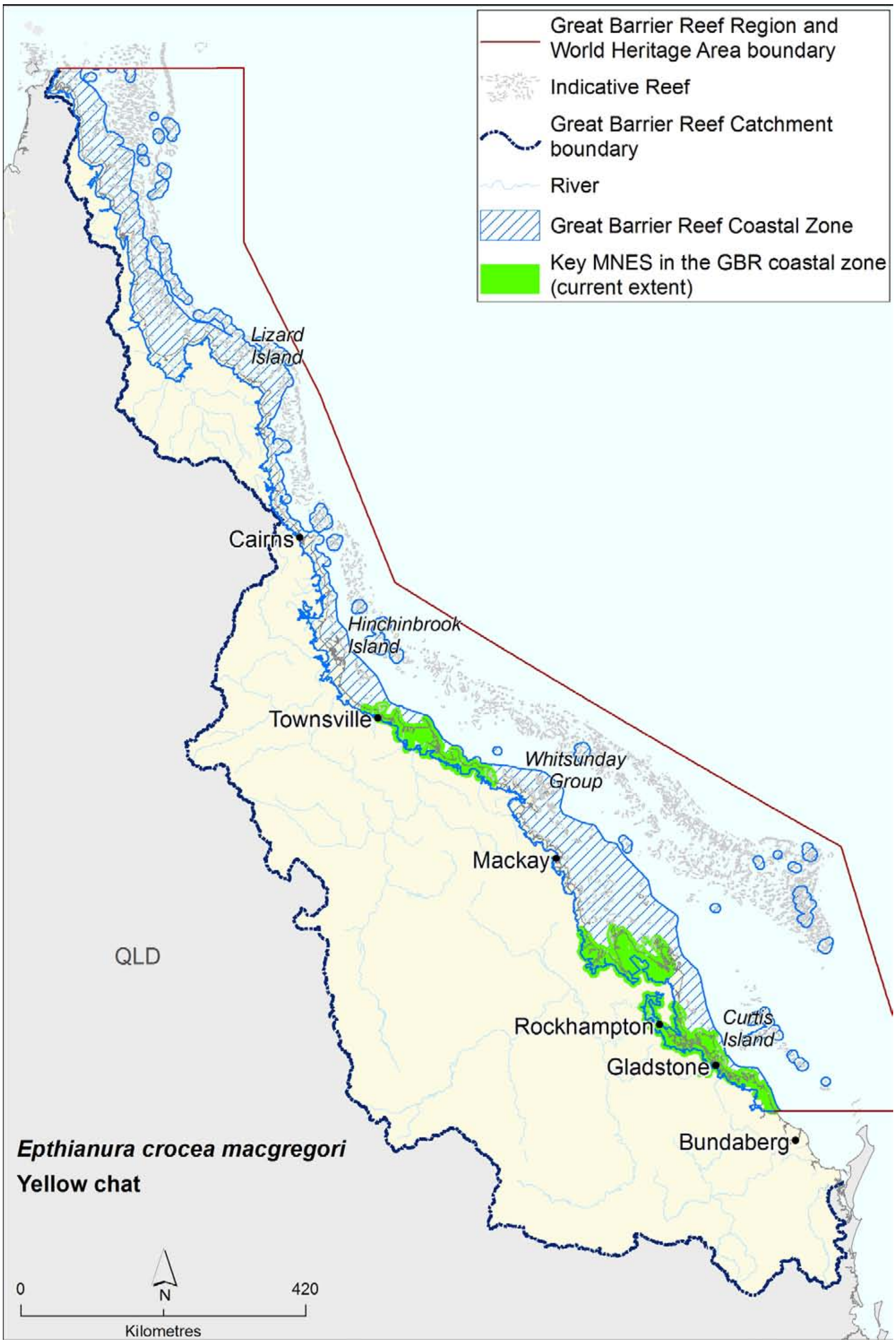



Figure 4.7 10 Current extent of yellow chat habitat in the GBR coastal zone

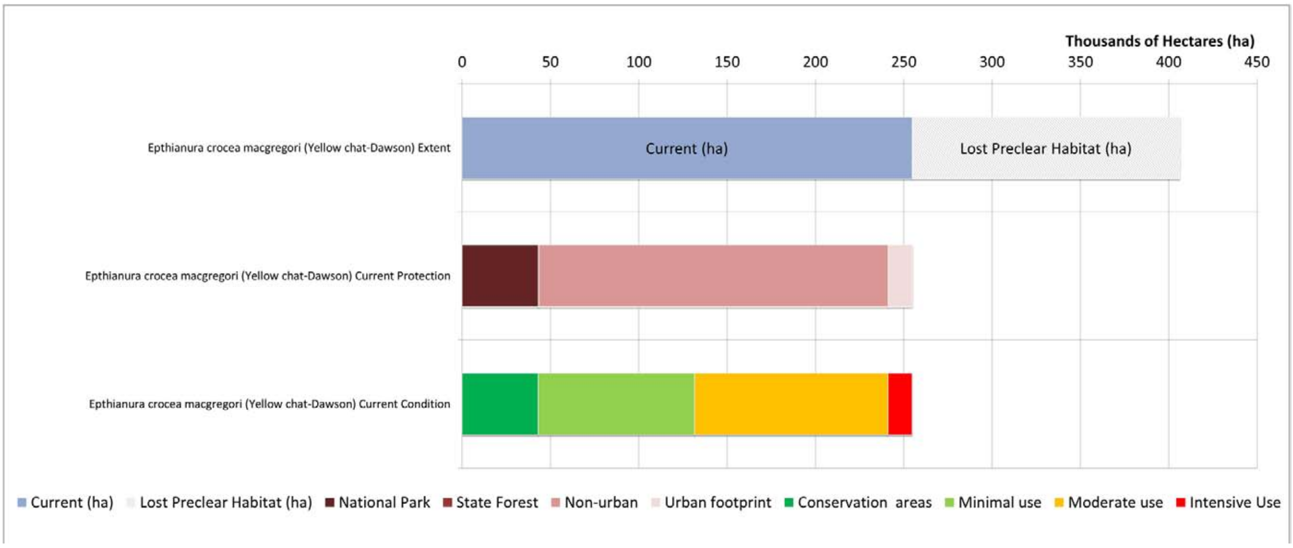



Figure 4.7 11 Extent, level of protection and condition of yellow chat habitat

All of the habitat associated with the yellow chat occurs within the GBR coastal zone and covers 255 000 hectares, of which 17 per cent is in national parks and state forests. A further 78 per cent is in non-urban areas protected under the VM Act and five per cent is in urban areas (see Figure 4.7 11).

The condition of the habitat associated with this species considered to be good with 17 per cent of the habitat in conservation areas and 35 per cent of the habitat in areas of minimal use. Forty-three per cent of the yellow chat habitat is in areas subject to moderate use and five per cent is in areas subject to intensive use which are considered to be in poor to very poor condition. Overall, the yellow chat habitat condition should remain stable as 52 per cent is in conservation or mimimal use areas.

Given the low estimated population, this species is likely to be at greater risk than the extent, condition and trend of its habitat indicates.

#### 4.7.1.6 Cassowary

The cassowary is a large flightless bird that lives in the rainforests, melaleuca swamps and mangrove forests of far north Queensland. It is an important seed disperser of rainforest plants, with the capacity to swallow and spread seeds that are too large for other animals. Cassowaries require a high diversity of native trees to provide a year-round supply of fleshy fruits. Cassowaries are usually solitary, and the size of their home ranges appears to vary between 0.52 square kilometres and 2.35 square kilometres. Cassowaries are now found in two populations, one on the Cape York peninsula and another in the Wet Tropics. The total population is estimated to be 2500 mature individuals. On Cape York, they now occur in the vine forests of the McIlwraith and Iron ranges and in the less extensive vine forests north of Shelburne Bay.

Cassowary habitat in the Wet Tropics has been greatly reduced by land clearing, so numbers have decreased. In the Wet Tropics cassowaries are distributed widely from Cooktown to Paluma Range. Approximately 89 per cent of their remaining essential habitat in the Wet Tropics lies within protected tenures.

Habitat loss from vegetation clearing is thought to have caused a loss of more than 30 per cent of the population in the last three generations (44 years). The creation of protected areas has preserved much of the remaining cassowary habitat, but a small ongoing population decline is still likely. This is largely due to the impacts, particularly on the southern population, of road kill, disease, and attacks by dogs and feral pigs.[56,57] The current extent of cassowary habitat is shown in Figure 4.7 12. There has been a 31 per cent reduction in the extent of cassowary habitat between the pre-cleared extent and the current extent (2009 data).

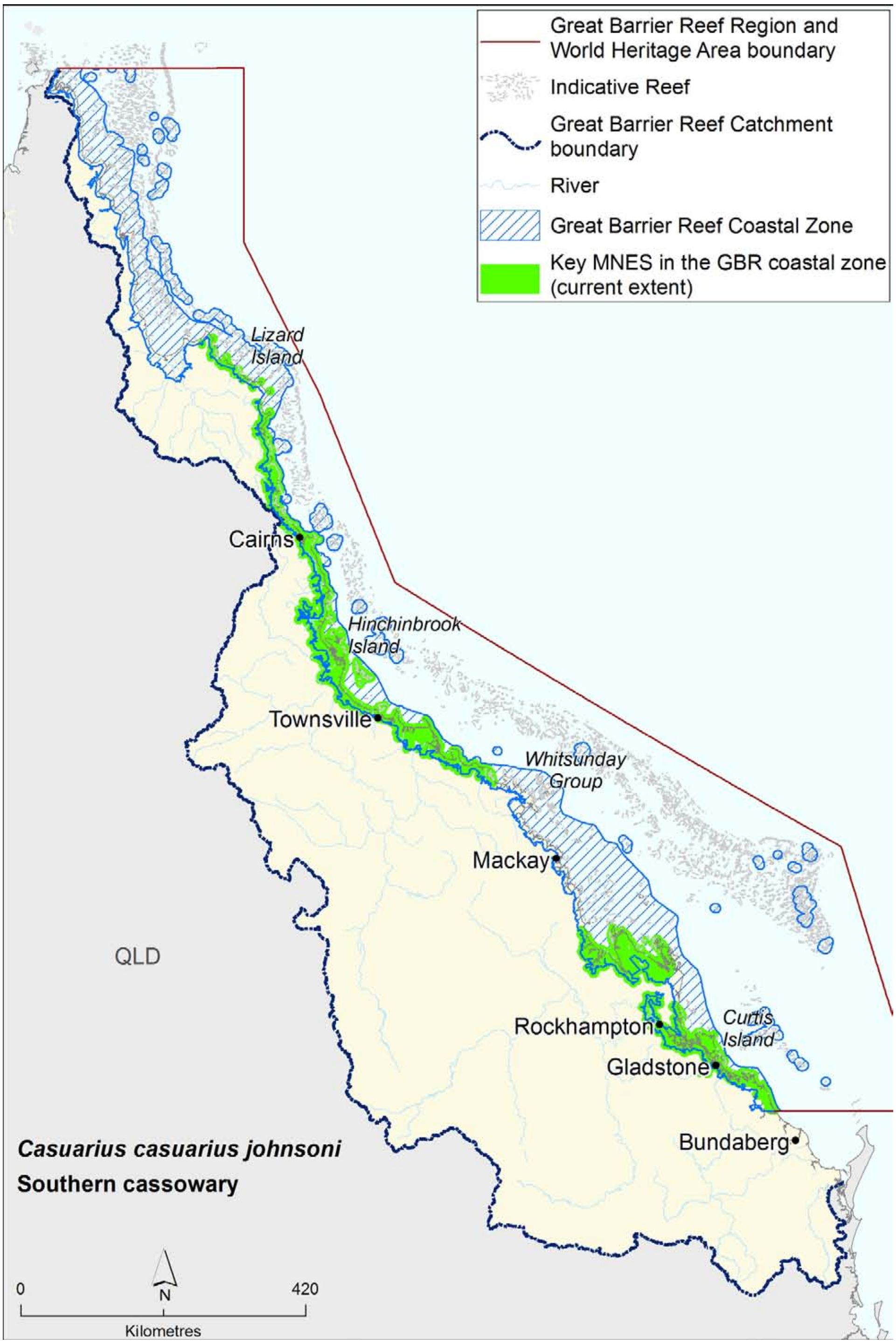



Figure 4.7 12 Current extent of cassowary habitat in the GBR coastal zone

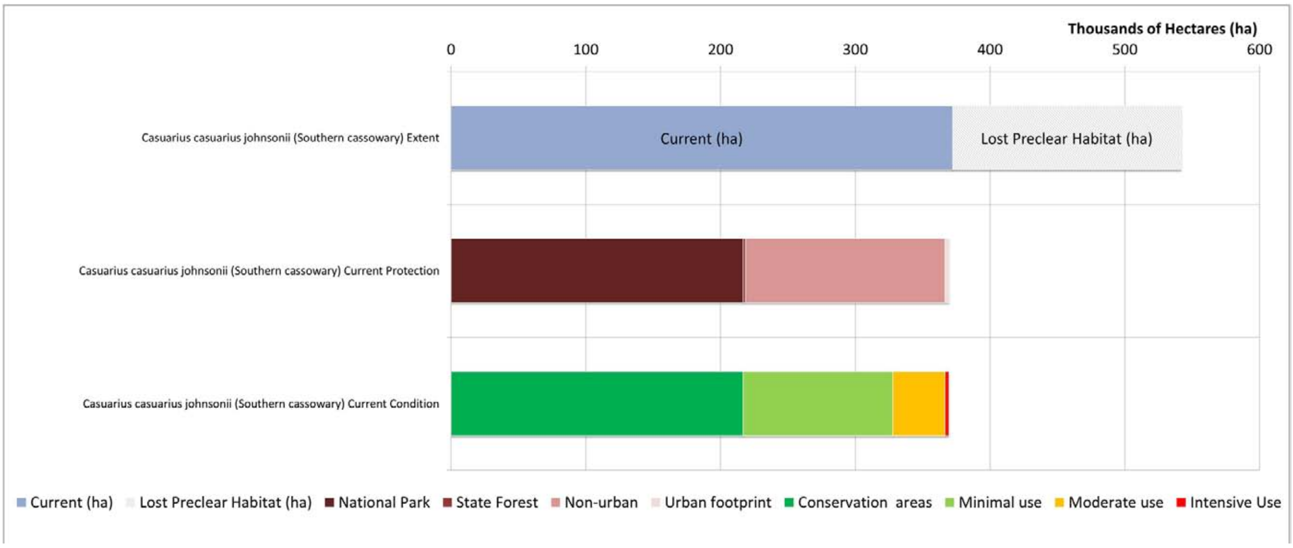



Figure 4.7 13 Extent, level of protection and condition of cassowary habitat

Most of the habitat associated with the cassowary occurs within GBR coastal zone and covers 372 000 hectares of which 58 per cent occurs in national parks and state forests. A further 40 per cent occurs in non-urban areas, generally protected under the VM and one per cent occurs in urban areas (see Figure 4.7 13).

The condition of the habitat associated with this species is considered to be very good with 58 per cent of the habitat in conservation areas and 30 per cent of the habitat in areas of minimal use. Ten per cent of the cassowary habitat is in areas subject to moderate use, and one per cent is in areas subject to intensive use which are considered to be in poor to very poor condition. Overall, the cassowary habitat condition is expected to improve as 88 per cent is in conservation or mimimal use areas.

#### 4.7.1.7 Australian arenga palm

The Australian arenga palm, also known as *Arenga australasica*, family Arecaceae, is a clump-forming palm usually with one to three dominant trunks, growing to 20 metres tall and 30 centimetres in diameter, and numerous immature suckers emerging from the base.[58] Clumps are often dense and wide-spreading.[59]

Australian arenga palm occurs in north-eastern Queensland from the Torres Strait to south of Innisfail in a series of highly disjunct populations, and is relatively uncommon on the mainland. On Cape York Peninsula, Landsberg (2004)[60] estimated the extent of occurrence as 46 700 square kilometres and identified 11 separate populations. It is very common on some coral cays and continental islands.[58,61] The current extent of Australian arenga palm habitat is shown in Figure 4.7 14. There has been a 23 per cent reduction in the extent of Australian arenga palm habitat between the pre-cleared extent and the current extent (2009 data).

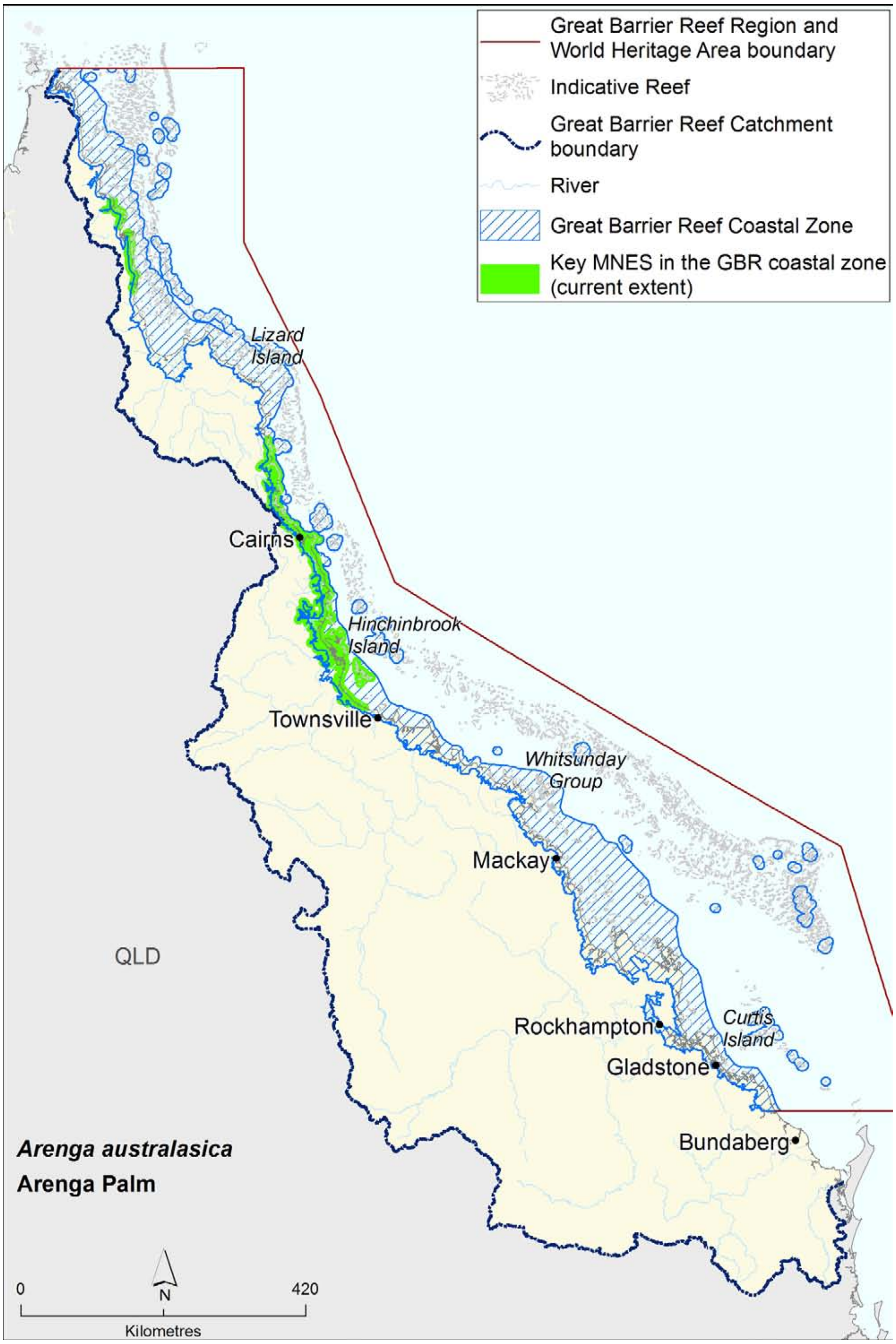



Figure 4.7 14 Current extent of Australian arenga palm habitat in the GBR coastal zone

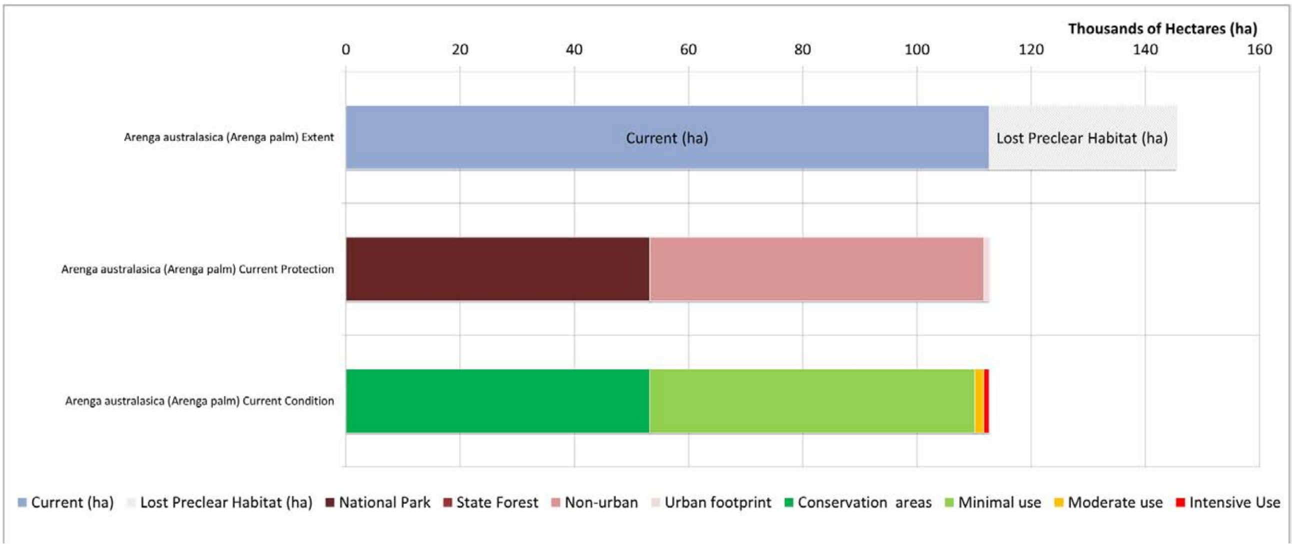



Figure 4.7 15 Extent, level of protection and condition of Australian arenga palm habitat

Most of the habitat associated with the Australian arenga palm occurs within GBR coastal zone and covers 113 000 hectares, of which 47 per cent occurs in national parks. A further 52 per cent occurs in non-urban areas protected under the VM Act and one per cent occurs in urban areas.

The condition of the habitat associated with this species is considered to be very good with 47 per cent of the habitat in conservation areas and 51 per cent of the habitat in areas of minimal use. One per cent of the Australian arenga palm habitat is in areas subject to moderate use and one per cent is in areas subject to intensive use which are considered to be in poor to very poor condition. Overall, the Australian arenga palm habitat condition should improve as 98 per cent is in conservation or minimal use areas.

#### 4.7.1.8 Cardwell bearded orchid

Cardwell bearded orchid also known as bearded orchid or *Calochilus psednus,* family Orchidaceae, is a terrestrial orchid with leaves 60–120 millimetres long and 3–5 millimetres wide, which are absent at flowering. The bearded orchid is known only from a small area south of Cardwell, in north-eastern Queensland, where it occurs in Melaleuca woodland with an understorey of dense sedges and scattered low shrubs. Soils are seasonally inundated sandy loams.[62] Total population numbers are unknown.[63] The current extent of Cardwell bearded orchid habitat is shown in Figure 4.7 16. There has been a 26 per cent reduction in the extent of Cardwell bearded orchid habitat between the pre-cleared extent and the current extent (2009 data).

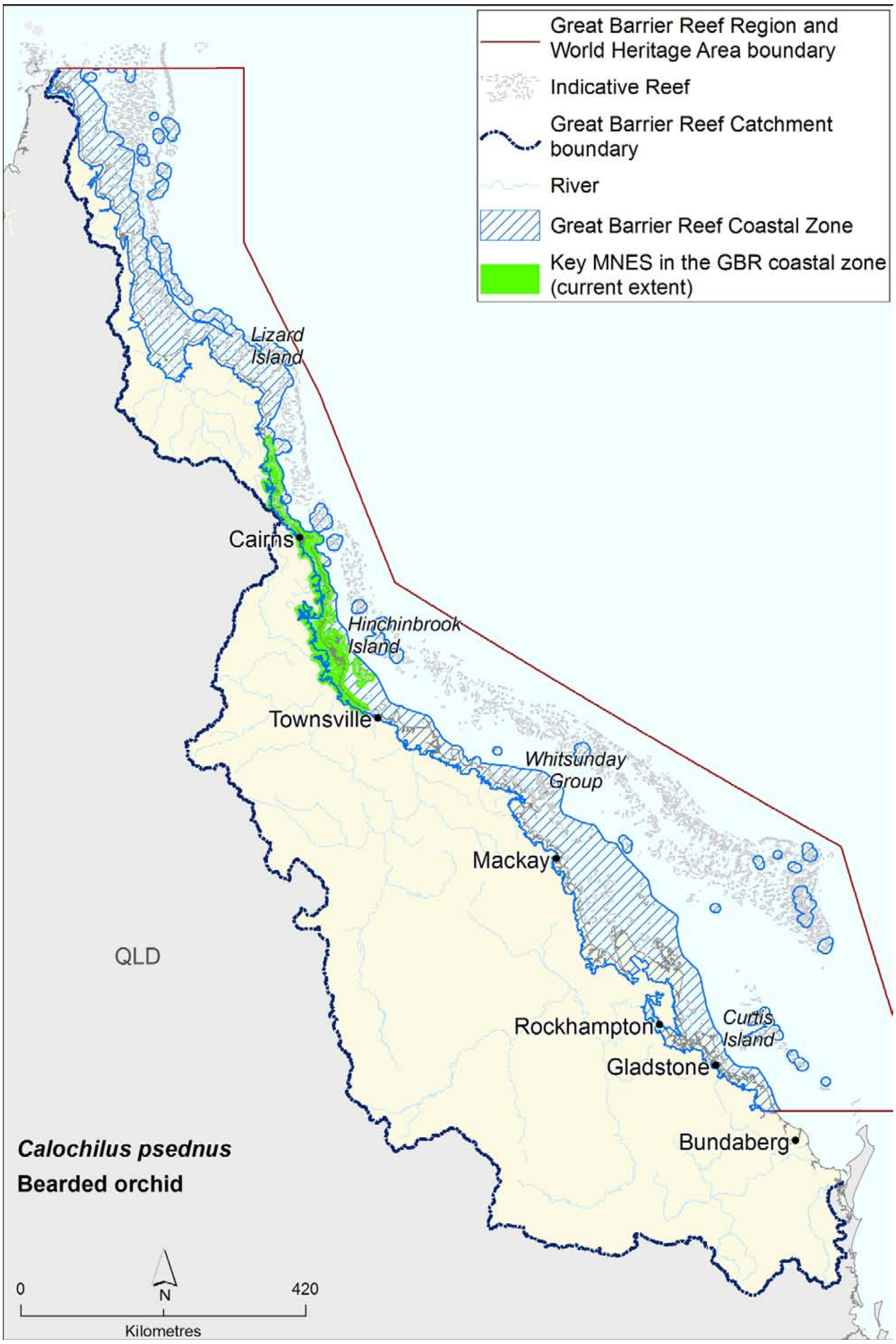



Figure 4.7 16 Current extent of Cardwell bearded orchid habitat in the GBR coastal zone

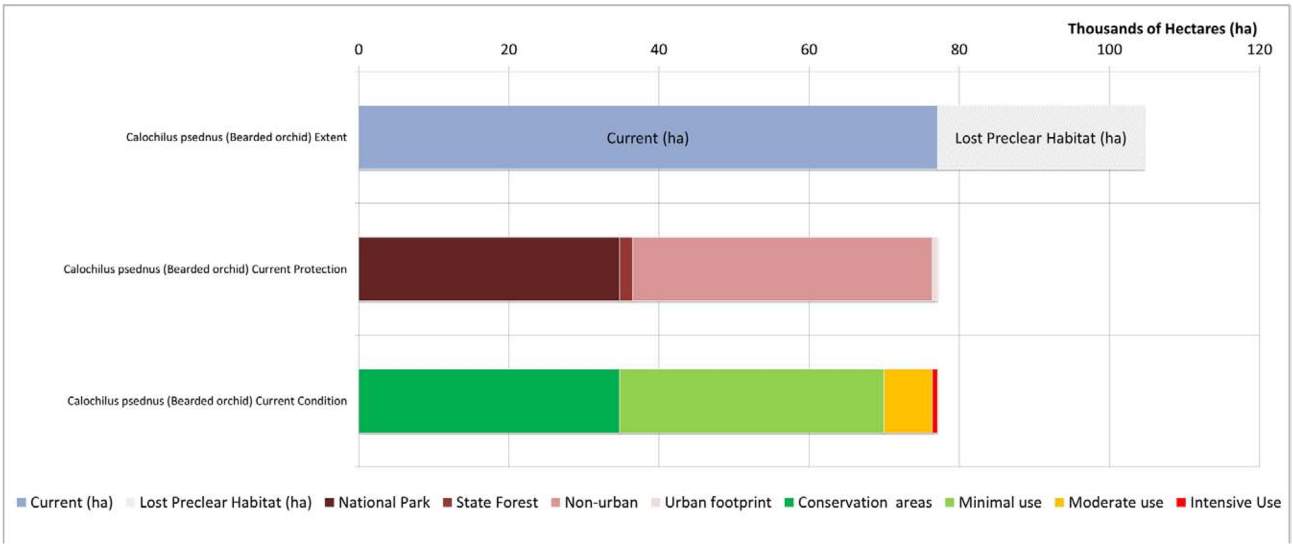



Figure 4.7 17 Extent, level of protection and condition of Cardwell bearded orchid habitat

All of the habitat associated with the Cardwell bearded orchid occurs within GBR coastal zone and covers 77 000 hectares of which 47 per cent occurs in national parks and state forests. A further 52 per cent occurs in non-urban areas protected under the VM Act and one per cent occurs in urban areas (see Figure 4.7 17).

The condition of the habitat associated with this species is considered to be very good with 45 per cent of the habitat in conservation areas and 46 per cent of the habitat in areas of minimal use. Eight per cent of the Cardwell bearded orchid habitat is in areas subject to moderate use and one per cent is in areas subject to intensive use which are considered to be in poor to very poor condition. Overall, the Cardwell bearded orchid habitat condition should improve as 91 per cent is in conservation or mimimal use areas.

#### 4.7.1.9 Cooktown orchid

Cooktown orchid, also known as mauve butterfly orchid or *Dendrobium bigibbum*, family Orchidaceae, is an epiphytic orchid with cylindrical pseudobulbs which are green or purplish and leafy in the upper third. The flowers are usually lilac-purple but can occasionally be white, bluish or pinkish and have a prominent white spot on the labellum (lip).

Cooktown orchid is known from Cape York Peninsula, northern Queensland, south to the Archer River.[64] This species occurs within the Cape York and Torres Strait NRM Region.

Cooktown orchid grows at altitudes between 0–400 metres above sea level.[64] It grows on trees and rocks with moderate light intensity in a range of habitats including coastal scrub, streambank vegetation, monsoon thickets, and gullies in open forest and woodland where fire cannot penetrate.[64-68] It rapidly recolonises disturbed sites.[64]

The current extent of Cooktown orchid habitat is shown in Figure 4.7 18.

There has been an approximately one per cent reduction in the extent of Cooktown orchid habitat between the pre-cleared extent and the current extent (2009 data).

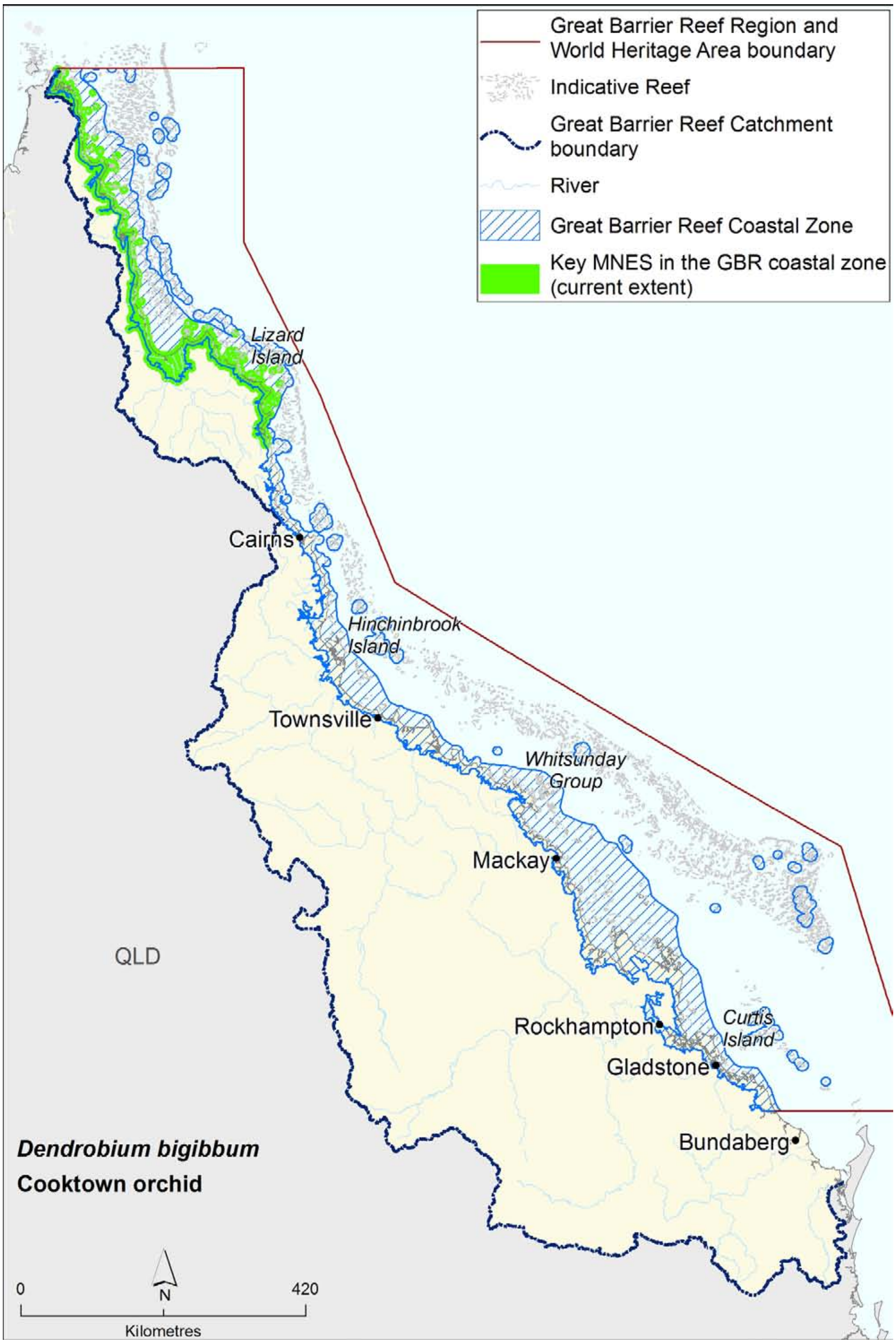



Figure 4.7 18 Current extent of Cooktown orchid habitat in the GBR coastal zone

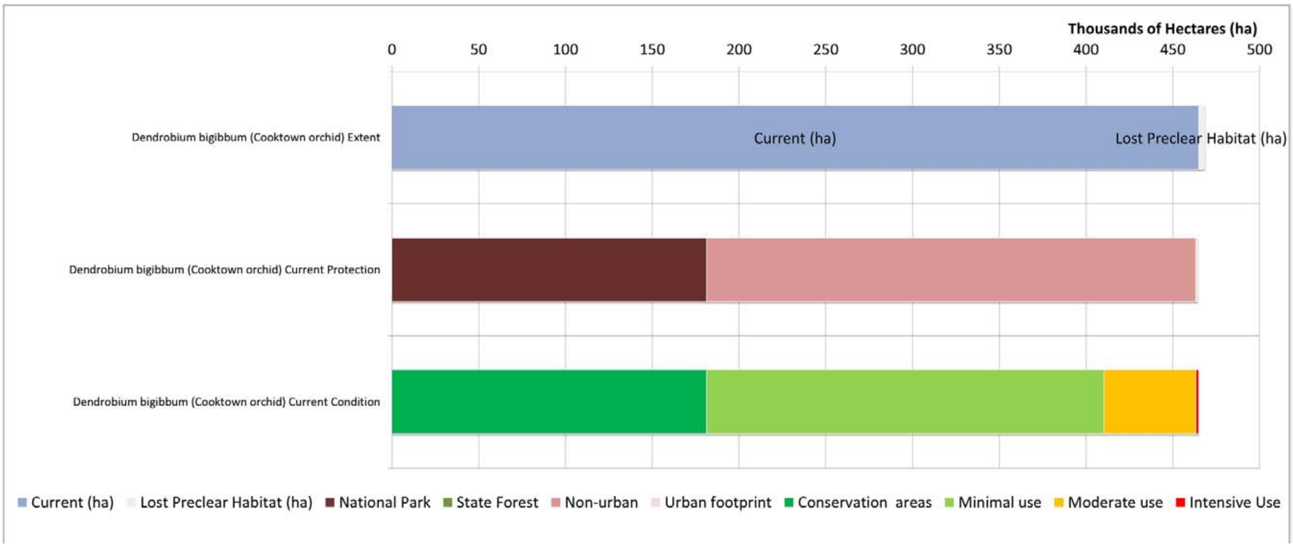



Figure 4.7 19 Extent, level of protection and condition of Cooktown orchid habitat

All of the habitat associated with the Cooktown orchid occurs within GBR coastal zone, extending over 465 000 hectares of which 99 per cent of the species habitat occurs in national parks or in non-urban areas protected under the VM Act (see Figure 4.7 19).

The condition of the habitat associated with this species is considered to be very good with 39 per cent of the habitat in conservation areas and 49 per cent of the habitat in areas of minimal use. Eleven per cent of the Cooktown orchid habitat is in areas subject to moderate use and none is in areas subject to intensive use which are considered to be in poor to very poor condition. Overall, the Cooktown orchid habitat condition should improve as 88 per cent is in conservation or mimimal use areas.

#### 4.7.1.10 *Quassia bidwillii*

*Quassia bidwillii*, family Simaroubaceae, commonly known as Quassia, is a small shrub or tree that grows to about six metres in height, with red fruit and red flowers from November to March. Quassia is endemic to Queensland and is currently known to occur in several localities between Scawfell Island, near Mackay, and Goomboorian, north of Gympie.[69]

Quassia has been confirmed as occurring in at least 40 known sites.[69] Quassia commonly occurs in lowland rainforest or on rainforest margins[70], but it can also be found in other forest types, such as open forest and woodland.[69] Quassia is commonly found in areas adjacent to both temporary and permanent watercourses[71] in locations up to 510 metres above sea-level. The current extent of quassia habitat is shown in Figure 4.7 20. There has been a 20 per cent reduction in the extent of quassia habitat between the pre-cleared extent and the current extent (2009 data).

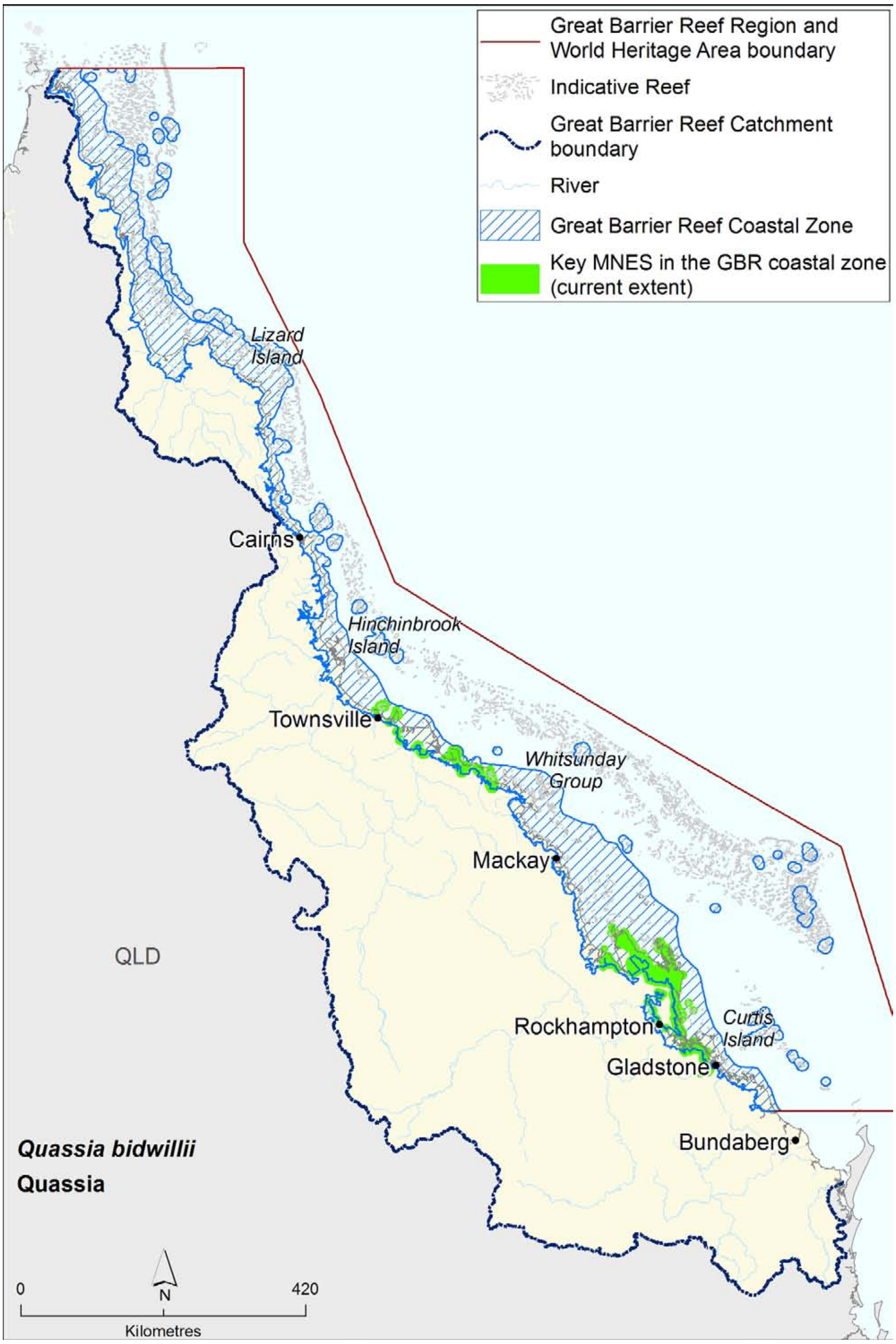



Figure 4.7 20 Current extent of quassia habitat in the GBR coastal zone

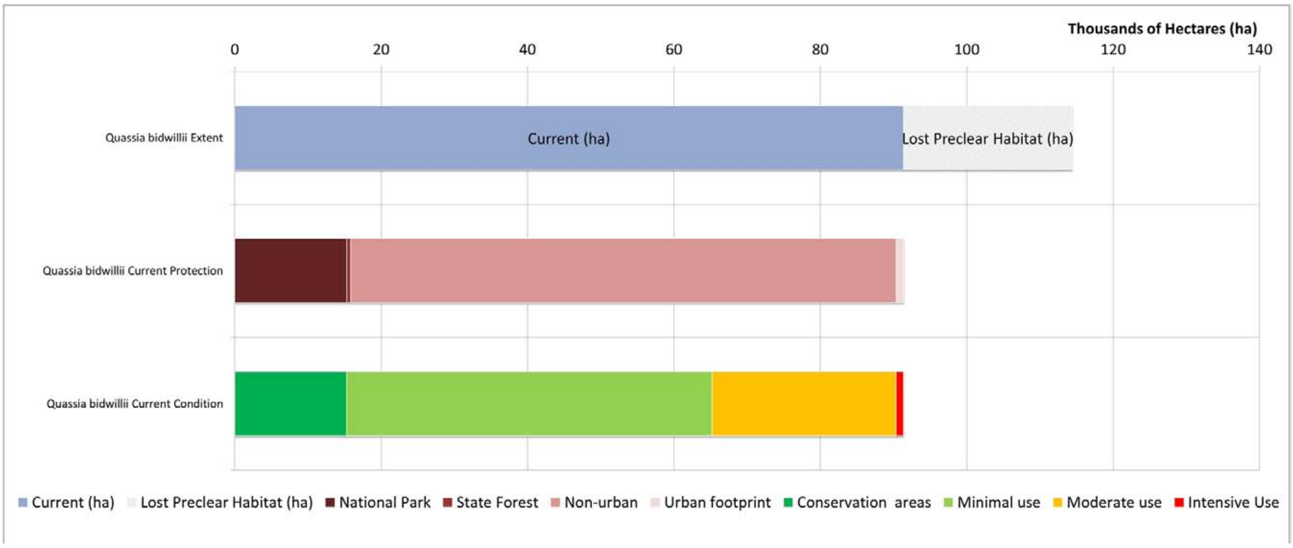



Figure 4.7 21 Extent, level of protection and condition of quassia habitat

Most of the habitat associated with quassia occurs within the GBR coastal zone and covers 91 000 hectares, of which 18 per cent occurs in national parks and state forests. A further 82 per cent occurs in non-urban areas protected under the VM Act, and one per cent occurs in urban areas (see Figure 4.7 21).

The condition of the habitat associated with this species is considered to be very good with 17 per cent of the habitat in conservation areas and 55 per cent of the habitat in areas of minimal use. Twenty-eight per cent of the quassia habitat is in areas subject to moderate use and one per cent is in areas subject to intensive use which are considered to be in poor to very poor condition. Overall, the quassia habitat condition should improve as 72 per cent is in conservation or mimimal use areas.

#### 4.7.1.11 *Cycas silvestris*

*Cycas silvestris* is restricted to coastal areas of north-east Cape York. Locations include near Temple Bay, north and south of the Olive River, and a disjunct population near the mouth of Nesbit River. *Cycas silvestris* grows on deep, white to grey sands of stabilised dunes from directly behind the beach to two kilometres inland. In nearly all instances plants occur within the canopy of dry rainforest with emergent hoop pine and occasionally in layered woodland of *Melaleuca spp*. The main potential threats to *Cycas silvestris* include inappropriate fire regimes which destroy surface seed and kill seedlings, failure of insect pollination, mutualism and illegal collection.[72] The current extent of *Cycas silvestris* habitat is shown in Figure 4.7 22. There has been a one per cent reduction in the extent of *Cycas silvestris* habitat between the pre-cleared extent and the current extent (2009 data).

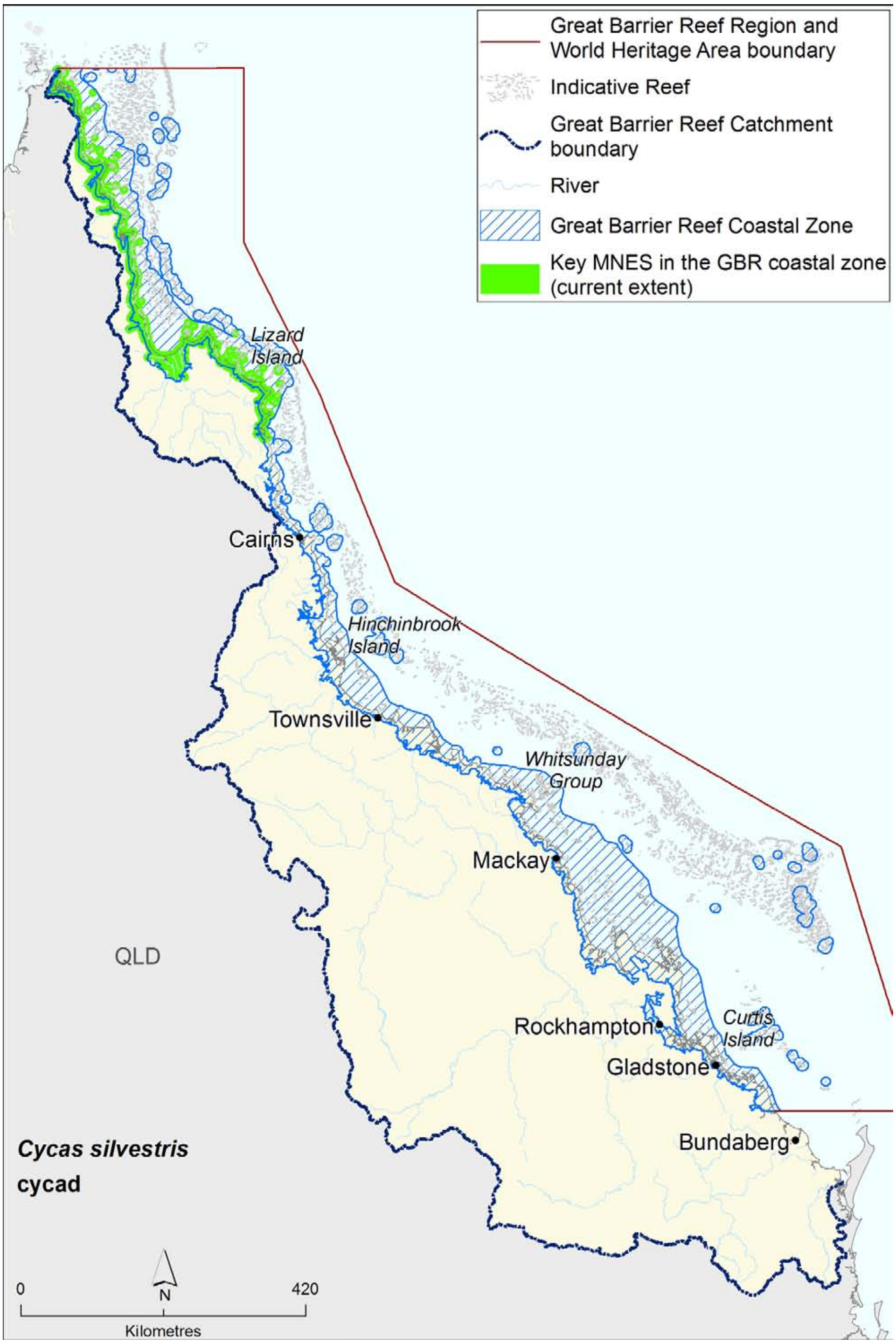



Figure 4.7 22 Current extent of *Cycas silvestris* habitat in the GBR coastal zone

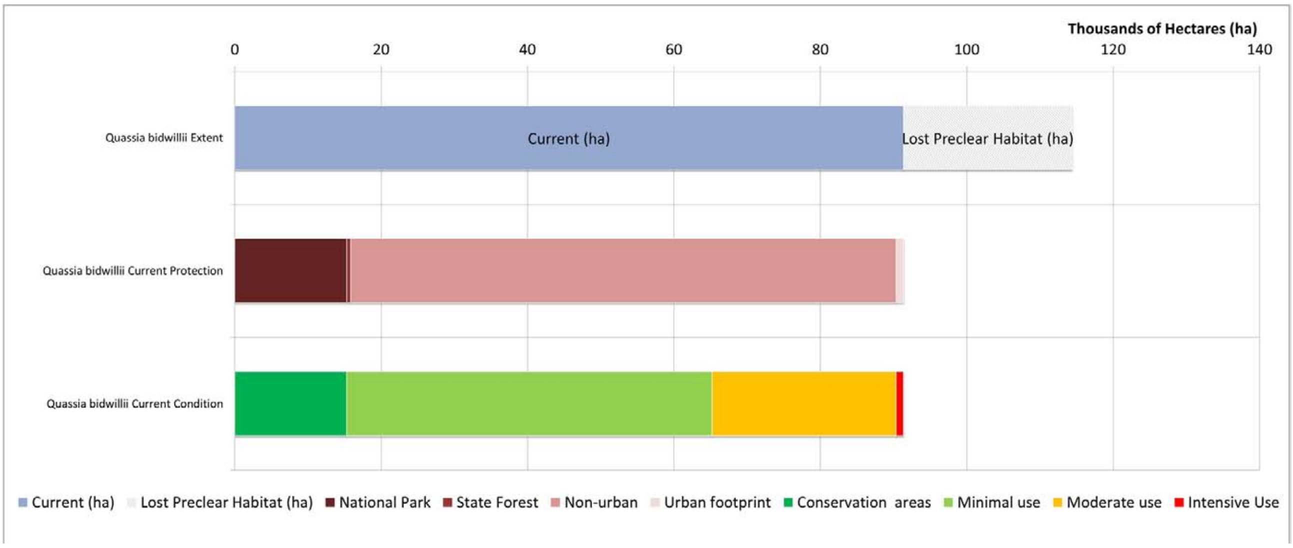



Figure 4.7 23 Extent, level of protection and condition of *Cycas silvestris* habitat

Most of the habitat associated with the *Cycas silvestris* occurs within the GBR coastal zone and covers 262 000 hectares, of which 24 per cent occurs in national parks and state forests. A further 76 per cent occurs in non-urban areas protected under the VM Act, and no habitat occurs in urban areas (see Figure 4.7 23).

The condition of the habitat associated with this species is considered to be very good with 24 per cent of the habitat in conservation areas and 73 per cent of the habitat in areas of minimal use. Three per cent of the *Cycas silvestris* habitat is in areas subject to moderate use and none is in areas subject to intensive use which are considered to be in poor to very poor condition. Overall, the condition of the *Cycas silvestris* habitat should improve as 97 per cent is in minimal use and conservation area.

### 4.7.2 Threatened species summary

A summary of the condition and recent trend of key MNES species habitat is provided in Table 4.7 2 and described in section 4.10. The recent trend for key MNES species relates to a combination of extent and condition. If half or more than half of a species' habitat is in conservation areas and minimal use areas, the area is graded as stable to improving. If more than half of the land use is for moderate land use and intensive land use areas, the habitat is graded as deteriorating in condition.

The extent of habitats of every one of the key species selected for the purpose of this report has declined since European settlement. It can be inferred from this that there has been an associated loss of species over time as a result of this habitat loss. The reduction in clearing rates, shown in Figure 4.7 1, correlates to elevated levels of protection over the last 25 years.

The clearing rates of REs associated with key species habitat is represented by the trend in vegetation clearing of the associated REs. Projecting these trends into the future is used in this strategic assessment to project the trend for the key species. Vegetation management laws will ensure clearing of the habitats of these species will be minimal and where it does occur the impacts will be offset. On this basis, where the habitat is protected by being located in a conservation or minimal use area or protected under vegetation management law, there is a higher probability that the extent of the associated key species will improve.

Table 4.7 2 Key threatened MNES species habitat extent, condition and trend

| MNES habitat | Status EPBC Act | Condition and trend | Confidence |
|---|---|---|---|
| ***Fauna*** | | | |
| Bare-rumped sheathtail bat (*Saccolaimus saccolaimus nudicluniatus*) | Critically Endangered | X Recent trend - Improving | Limited |
| Mahogany glider (*Petaurus gracilis*) | Endangered | X Recent trend - Improving | Adequate |
| Proserpine rock wallaby (*Petrogale persephone*) | Endangered | X Recent trend - Improving | Adequate |
| False water rat (*Xeromys myoides*) | Vulnerable | X Recent trend - Stable | Limited |
| Yellow chat (*Epthianura crocea*) | Critically endangered | X Recent trend - Stable | Limited |
| Southern cassowary (*Casuarius casuarius johnsonii*) | Endangered | X Recent trend - Improving | Adequate |
| ***Flora*** | | | |
| Australian arenga palm (*Arenga australasica*) | Vulnerable | X Recent trend - Improving | Limited |
| Cardwell bearded orchid (*Calochilus psednus*) | Endangered | X Recent trend - Improving | Limited |
| Cooktown orchid (*Dendrobium bigibbum*) | Vulnerable | X Recent trend - Improving | Limited |
| *Quassia bidwillii* | Vulnerable | X Recent trend - Improving | Limited |
| *Cycas silvestris* | Vulnerable | X Recent trend - Improving | Limited |

## 4.8 Migratory Species

The migratory species included in this strategic assessment are MNES that are listed under the following International Conventions and Agreements:

- **Japan-Australia Migratory Bird Agreement (JAMBA)** – an agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment. This Agreement considers that many species of birds migrate between Australia and Japan and live seasonally in the respective countries. Birds are regarded as an important element in the natural environment and play an essential role in enriching the natural environment. This role may be enhanced through cooperative conservation initiatives for the management and protection of the birds and their environments.
- **China-Australia Migratory Bird Agreement (CAMBA)** – an agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environments. This Agreement considers that birds are an important element in the natural environment and that they are also important natural resources of great value in carrying on scientific, cultural, artistic, recreational and economic activities. The Contracting Parties seek to cooperate in the protection of migratory birds and their environment.
- **Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA)** – an agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds. This Agreement relates to those species and subspecies of birds that migrate between the two countries. It considers that birds are not only an important element of the natural environment but also that they play an essential role in enriching the natural environment and that this role may be enhanced by proper management.
- **Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)** – the convention aims to conserve terrestrial, aquatic and avian migratory species throughout their range. It is an intergovernmental treaty, concerned with the conservation of wildlife and habitats on a global scale. Since the convention's entry into force, its membership has grown steadily to include over 100 Parties from Africa, Central and South America, Asia, Europe and Oceania. The convention lists migratory species threatened with extinction. Parties to the convention strive towards strictly protecting these animals, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them. Migratory species that need or would significantly benefit from international cooperation are also listed.

The 81 MNES migratory species in the GBR coastal zone are listed in Appendix F. In addition to birds, whales, dolphins, marine turtles and sharks, estuarine crocodiles are also listed as MNES migratory species.

The estuarine crocodile (*Crocodylus porosus*) is listed as vulnerable under the NC Act and a migratory species under the EPBC Act and is known to occur in Queensland between Gladstone and the Cape York Peninsula, and throughout the Gulf of Carpentaria. Although most commonly seen in tidal reaches of rivers, they also occur along beaches and offshore islands in the GBR and Torres Strait, and in freshwater lagoons, rivers, and swamps up to hundreds of kilometres inland from the coast. The condition and trend of the estuarine crocodile has been assessed in the GBR region strategic assessment as good and improving.

The key migratory species were defined by refining the EPBC Act list of migratory species that occur within the GBR coastal zone using the method described in chapter 3. Marine species which are not known to breed or roost within the GBR coastal zone were removed. The key migratory species which are known to breed and roost in the GBR coastal zone are listed in Table 4.8 1.

The habitats of species within known breeding and roosting sites were assessed for condition and trend using the QWP mapping. The habitats of the key migratory species were refined to areas where known breeding and roosting sites occur. This strategic assessment relies on the modelled habitat of all the migratory species derived from the wetland mapping to represent key migratory species habitat for all species. Therefore, there is a single result for extent and trend for key migratory species which applies to all key migratory species.

An assessment of a number of migratory birds was also undertaken in the GBRMPA's GBR Region strategic assessment and they were divided into three categories:

- inshore and coastal seabirds
- offshore and pelagic seabirds
- shorebirds

Generally, inshore and coastal foraging seabird species source food closer to their breeding colony compared with offshore and pelagic foragers. Colonies of inshore and coastal foraging seabirds are also smaller, more numerous and more widely distributed. Offshore and pelagic foraging seabirds usually have single clutches and much slower growing chicks with longer fledging periods than seabirds with other methods of foraging. These species nest in large colonies, often spread over multiple, closely-spaced islands that are close to abundant food and provide suitable nesting habitat. They feed on pelagic fish whose abundance and distribution are determined by oceanographic upwellings.

Shorebirds use a wide range of habitats within and adjacent to the GBR Region, including beaches, rocky shores, estuaries, intertidal flats, coral cays and reefs, freshwater wetlands, grasslands, pasture land and sewage treatment plants. The most crucial habitats for shorebirds are tidal flats.

Table 4.8-1 Key migratory MNES that are represented by known breeding and roosting sites

| Scientific Name | Common Name | Category in the GBR Region strategic assessment |
|---|---|---|
| *Actitis hypoleucos* | Common Sandpiper | Shorebird |
| *Anous stolidus* | Common Noddy | Offshore and pelagic seabird |
| *Arenaria interpres* | Ruddy Turnstone | Shorebird |
| *Calidris acuminata* | Sharp-tailed Sandpiper | Shorebird |
| *Calidris alba* | Sanderling | Shorebird |
| *Calidris canutus* | Red Knot, Knot | Shorebird |
| *Calidris ferruginea* | Curlew Sandpiper | Shorebird |
| *Calidris melanotos* | Pectoral Sandpiper | |
| *Calidris ruficollis* | Red-necked Stint | Shorebird |
| *Calidris tenuirostris* | Great Knot | Shorebird |
| *Charadrius bicinctus* | Double-banded Plover | |
| *Charadrius leschenaultii* | Greater Sand Plover, Large Sand Plover | Shorebird |
| *Charadrius mongolus* | Lesser Sand Plover, Mongolian Plover | Shorebird |
| *Charadrius veredus* | Oriental Plover, Oriental Dotterel | |
| *Fregata ariel* | Lesser Frigatebird, Least Frigatebird | Offshore and pelagic seabird |
| *Fregata minor* | Great Frigatebird, Greater Frigatebird | Offshore and pelagic seabird |
| *Gallinago hardwickii* | Latham's Snipe, Japanese Snipe | Shorebird |
| *Heteroscelus brevipes* | Grey-tailed Tattler | Shorebird |
| *Heteroscelus incanus* | Wandering Tattler | Shorebird |
| *Limicola falcinellus* | Broad-billed Sandpiper | |
| *Limosa lapponica* | Bar-tailed Godwit | Shorebird |
| *Limosa limosa* | Black-tailed Godwit | Shorebird |
| *Numenius madagascariensis* | Eastern Curlew | Shorebird |
| *Numenius minutus* | Little Curlew, Little Whimbrel | Shorebird |
| *Numenius phaeopus* | Whimbrel | Shorebird |
| *Pluvialis fulva* | Pacific Golden Plover | |
| *Pluvialis squatarola* | Grey Plover | Shorebird |
| *Puffinus pacificus* | Wedge-tailed Shearwater | Offshore and pelagic seabird |
| *Sterna anaethetus* | Bridled Tern | |
| *Sterna bengalensis* | Lesser Crested Tern | Inshore and coastal seabird |
| *Sterna caspia* | Caspian Tern | Inshore and coastal seabird |
| *Sterna sumatrana* | Black-naped Tern | Inshore and coastal seabird |
| *Sula dactylatra* | Masked Booby | Offshore and pelagic seabird |

| Scientific Name | Common Name | Category in the GBR Region strategic assessment |
|---|---|---|
| *Sula leucogaster* | Brown Booby | Offshore and pelagic seabird |
| *Sula sula* | Red-footed Booby | Offshore and pelagic seabird |
| *Tringa glareola* | Wood Sandpiper | Shorebird |
| *Tringa stagnatilis* | Marsh Sandpiper, Little Greenshank | Shorebird |
| *Xenus cinereus* | Terek Sandpiper | Shorebird |

### 4.8.1 Extent and condition of key migratory species habitat

The current extent of key migratory species habitat is shown in Figure 4.8 1.The extent, condition and trend for these species and their habitat is provided in Figure 4.8 2. There has been a 20 per cent reduction in the extent of key migratory species habitat between the pre-cleared extent and the current extent (2009 data).

Much of the Queensland habitat associated with the key migratory species occurs within the GBR coastal zone and covers 1800 hectares. Of this, 28 per cent occurs in national parks and 66 per cent in areas of minimal use. Overall, the condition of the habitat associated with migratory species is considered to be good and stable.

The extent, condition and trend in migratory species habitat in the GBR coastal zone is summarised in Table 4.8 2. Migratory species were also assessed in the GBR Region strategic assessment, including a number of species and species groups which are relevant to the GBR coastal zone. These are provided in Table 4.8 3.

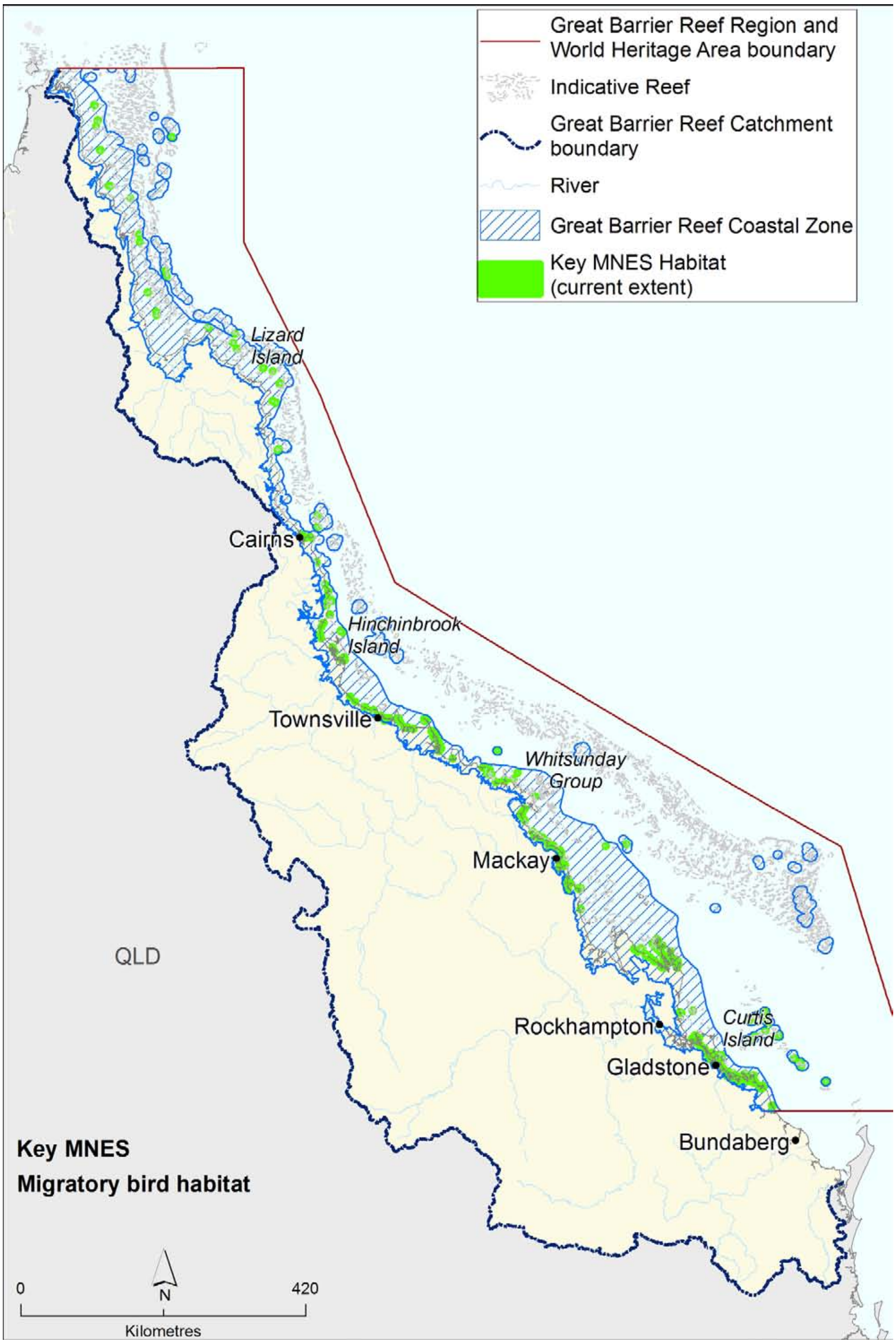



Figure 4.8 1 Current extent of migratory bird habitat in the GBR coastal zone

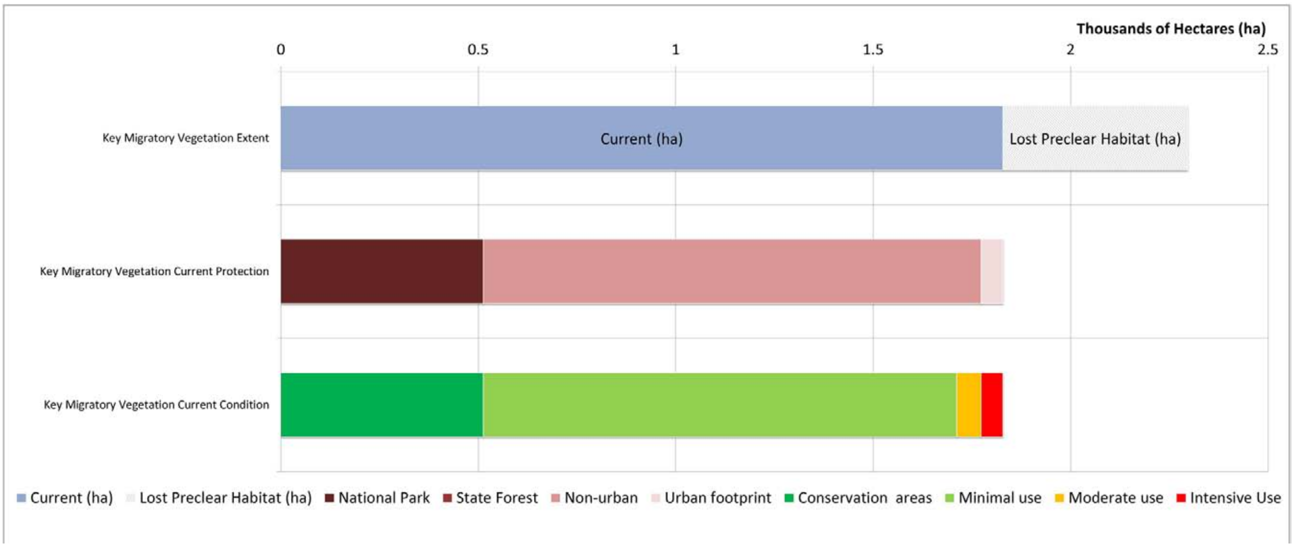



Figure 4.8 2 Extent, level of protection and condition of key migratory species habitat

Table 4.8 2 Migratory species habitat – extent, condition and trend

| MNES | Extent, condition and trend | Condition and trend | Confidence |
|---|---|---|---|
| GBR coastal zone migratory species habitat | Thirty eight species of migratory birds are known to breed and roost in the GBR coastal zone. There has been a 20 per cent historical reduction in the extent of key migratory species habitat. About 90% of current habitat is within conservation or minimal use areas. | X<br>Recent trend - Stable | Limited |

Table 4.8 3 Migratory species – extent, condition and trend

| MNES | Extent, condition and trend | Condition and trend | Confidence |
|---|---|---|---|
| Seabirds* | At least 20 species of seabirds breed annually on islands and cays in the GBRWHA. | X<br>Recent trend - Stable | Limited |
| Shorebirds* | There are no population estimates for the Region's shorebirds.<br>Australia-wide declines of between 70 and 80% have been recorded in the last 24 years.<br>Internationally significant numbers of shorebirds occur at a number of sites within the Region.<br>Changes to the coastline from population growth directly affect the habitats used by shorebirds. | X<br>Recent trend - Deteriorating | Limited |
| Estuarine Crocodile* | Estuarine crocodiles occur in most coastal waters in the GBR Region. The species is steadily recovering from previous population declines, with no recorded expansions in its range | X<br>Recent trend - Improving | Limited |

* Data from the GBR Region Strategic Assessment Report[39]

## 4.9 Environmental processes trend

Environmental processes can operate across a range of scales and include ecological, physical and chemical processes. They play a key role in influencing the extent, condition and biodiversity of ecosystems.[73] Identifying, understanding and mapping, where possible, the environmental processes underpinning MNES is crucial to future management and conservation.

Ecological processes include all those processes occurring between organisms; within and between populations and communities (including interactions with the non-living environment) that result in existing ecosystems and bring about changes in ecosystems over time.[74] Groups of ecological processes are sometimes referred to as ecosystem functions. In some cases it may be necessary to consider broader environmental processes that may be physical or chemical and not directly involve organisms.

To ensure adequate consideration of supporting environmental processes, MNES may need to be viewed in the context of a broader landscape, catchment or ecosystem. Ramsar sites are MNES where environmental processes are identified as part of the development of a site's ECD (see section 4.1.3). Also identified in the descriptions are the ecosystem components of a site where they include the physical, chemical and biological parts of a wetland (from large scale to very small scale, for example habitat, species and genes).[75-77] The key processes that have been identified for the Ramsar sites in the GBR coastal zone include hydrologic, geomorphologic, biological and climatic, as well as physico-chemical. Examples include surface water and groundwater flows, energy, sediment and nutrient cycling, decomposition, reproduction and migration.

Identification, understanding and mapping of these supporting environmental processes is often a key knowledge gap for many MNES. The main physical, chemical and ecological processes of the GBR ecosystem that the GBR coastal zone influences are primarily freshwater inflows, sediment transport, nutrient cycling and connectivity. Inflow of freshwater and sediments into the GBR lagoon are natural phenomena and these processes can transport nutrients to the GBR lagoon. Nutrients have a particularly important role in determining the health of the GBR. Nutrient levels and rates of nutrient cycling provide the basis for growth and production in aquatic environments.

Ecological connections are recognised as a fundamental component of the GBR environment. These connections may operate over short periods, from generation to generation, over seasons or cyclically. There are connections between estuarine and inshore habitats and those further offshore and north-south connections between habitats. Connectivity is important to every aspect of the GBR, including nutrient flows, species migration, larval dispersal and the maintenance of gene flow and genetic diversity.

### 4.9.1 Freshwater inflow

Freshwater inflows can have a variety of short and long term impacts for the GBR. While freshwater inflows are a natural occurrence, anthropogenic changes to catchments have altered the amount, the pattern and the quality of water inflows that reach the estuaries and marine environments associated with the GBR.[78]

Wet Tropics rivers (north from Ingham) have some flow most of the time and generally flood at least once per year. Dry Tropics rivers (south from Townsville) may have little or no flow much of the time and have significant floods once every two to three years (e.g. the Burdekin River) or longer (e.g. the Fitzroy River). The catchments in the Wet Tropics NRM region contribute a large proportion of the freshwater flowing into the GBR, both in total freshwater flow and in relation to their catchment size.

Patterns of freshwater flow into the GBR have changed as a result of river and land management practices. Although knowledge is increasing, the full extent of how natural environmental flows have altered and any subsequent effects on the GBR remain unknown.

In some GBR catchments, the creation of barriers to water flow and the rates of water extraction have significantly reduced the freshwater inflows (and the necessary nutrients) reaching the marine and estuarine environment. In other cases it is the frequency, timing or duration of freshwater inflows (particularly with flooding events) that has changed.[78] Marine and estuarine habitats have evolved in response to historical freshwater inflows, and the rapid rates of change in modern aquatic environments have disrupted biological balances and processes that rely on consistent and adequate freshwater inflows and associated nutrients.[79]

Between 2004 and 2007 the flow of freshwater into the GBR was significantly lower than the long-term average, principally because of drought throughout the catchment. Then in 2008 and early 2009 there was major flooding and exceptionally high rainfall in the central and northern parts of the GBR catchment, causing a large influx of freshwater into the GBR.

Flood plumes are conduits of sediment and contaminants to the GBR. Again, flood plumes are a natural phenomenon.[80] However, the anthropogenic changes of land use in the GBR catchments mean there are higher than previous levels of sediments within the flood plumes, and associated increases in contaminants. The sediment within flood plumes impacts aquatic flora and fauna. The nutrients carried by the flood plume may stimulate the growth of pelagic and benthic algae and phytoplankton, which can disrupt the natural trophic relationships (or 'food webs') of the marine community[80] and cause algal blooms. Additional impacts are introduced when contaminants present in the system due to human activity in the catchment (e.g. toxins, chemicals and heavy metals) are flushed into the marine environment.[79] These contaminants can have a range of impacts on growth and reproduction, and the general health and resilience of communities and environments.

Freshwater inflows into the GBR lagoon were assessed in the GBR Region strategic assessment; a summary of the current condition and past trend is provided in Table 4.9 1.

Table 4.9 1 Condition and trend of freshwater inflows into the GBR lagoon

| Summary | Current condition | Confidence |
|---|---|---|
| After a period of significantly lower than average freshwater flow, significant volumes of freshwater have entered the GBR Region in the last five years, including record flows for some rivers. This freshwater has reached beyond the coastal zone and had direct effects on marine species as well as delivering increased loads of sediments, nutrients and pesticides. | X<br>Recent trend – Deteriorating | Adequate |

Source: GBR Region Strategic Assessment Report[39]

### 4.9.2 Sedimentation

Over the past 150 years sediment inflow into the GBR has increased, primarily due to historical land management practices including extensive forest clearing, especially the clearing of lowland rainforests and wetlands for sugarcane and the clearing of dryland forest for cattle. The coastal zone is the part of the GBR most exposed to increased sedimentation, especially areas close to river mouths. The removal of riparian and terrestrial vegetation for cropping and grazing has resulted in the destabilisation of banks, increased susceptibility to gully erosion and increased land surface erosion through wind and rain.

The total annual average sediment load discharged into the GBR waters is estimated to have increased 3 to 5.5 fold since European settlement, the bulk coming from catchments that have large grazing areas.[36] The 2013 Scientific Consensus Statement concluded that at least 70 per cent of the total suspended solid load came from the Fitzroy and Burdekin NRM regions. Grazing lands contribute over three quarters of this load. The dominant sediment supply is from a combination of gully and stream bank erosion. Fine sediment is the fraction most likely to reach the GBR lagoon. The 2011 report card showed that the estimated annual sediment loads have reduced by six per cent as a result of land management changes since 2009.[36] The Burdekin NRM region is estimated to have reduced annual sediment loads by 10 per cent.

The 2013 Scientific Consensus Statement concluded that compared to diffuse sources, most contributions to suspended sediment from point sources such as intensive animal production, industrial processing, mining, rural and urban residences, ports and shipping are relatively small but could be significant locally, over short periods.

High sediment loads are particularly problematic for the GBR as there are a variety of physical and physicochemical impacts on freshwater, estuarine and marine environments. Sediments carry toxins, and can convey these contaminants from upstream freshwater reaches through to the marine environment. In any aquatic ecosystems, increased sediment loads can also block the passage of light, decrease water temperatures and reduce the levels of dissolved oxygen.[81-83]

There can also be physical impacts on aquatic flora and fauna when sediments clog and damage fish and invertebrate gills, or smother or obstruct photosynthesis in aquatic flora and fauna. This means sediment loads can influence the productivity and trophic relationships of aquatic communities.[79] Suspended sediments can also affect feeding success in visual predators, scavengers and grazers (for example fish or turtles).

Sedimentation in the GBR lagoon was assessed in the GBR Region strategic assessment; a summary of the current condition and past trend is provided in Table 4.9 2.

Table 4.9 2 Condition and trend of sedimentation in the GBR lagoon

| Summary | Current condition | Confidence |
|---|---|---|
| Exposure of the GBR to terrestrial sediments has increased, especially in the southern coastal zone, however land management improvements are starting to demonstrate a reduction in sediment loads. | X<br>Recent trend - Stable | Adequate |

Source: GBR Region Strategic Assessment Report[39]

### 4.9.3 Nutrient cycling

Modern and historical land use and management practices have negatively altered the optimal balance of nutrient inputs.[79] Increased nutrient levels support algal and plankton growth both in freshwater and marine environments. Unnaturally high levels of algae and plankton can block the passage of light through water which impacts on photosynthetic plants and animals. Additionally, high algae and plankton loads can smother benthic flora and fauna (including corals).[79]

Estimates suggest the total nutrient discharge into the GBR ecosystem has increased 2 to 6 fold for nitrogen and 2.5 to 9 fold for phosphorous since European settlement.[36]

Sources for nutrients entering the GBR system from the coastal zone include river discharges, urban runoff, dust from storms and wind and re-suspension of nearshore sediments. Of these, the single largest source is river discharges, largely driven by the application of fertilisers and the subsequent loss of dissolved inorganic nutrients into the water column. Nutrients are also transported as part of the sediment load bound to particulates.

The Fitzroy, Burdekin and Wet Tropics NRM regions contribute over 75 per cent of the modelled nitrogen load as a result of human activity.[36] Sediment erosion processes, particularly in grazing lands, are sources of particulate nitrogen; sugarcane and other cropping are sources of dissolved nitrogen. The 2013 Scientific Consensus Statement concluded that compared to diffuse sources, most contributions to nutrient loads from point sources such as intensive animal production, industrial processing, upstream mining, rural and urban residences, ports and shipping are relatively small but could be locally, over short periods, highly significant.

**Nutrients and blooms**

Excess nutrients can feed massive blooms of microscopic plants (phytoplankton) and algae in the water column (pelagic) and on the sediment surface (benthic) causing algal blooms and 'red tides' events. Excess nutrients can also fuel the growth of water weeds, causing the loss of habitat, oxygen and fish in waterways. Nutrients are also linked to COTS outbreaks, which have caused significant loss of coral cover over the last 27 years.

The 2011 Report Card shows that annual average load of nitrogen was reduced by seven per cent as a result of land management changes since 2009. Dissolved nitrogen, the key pollutant of concern because of its influence on COTS outbreaks, reduced by 15 per cent.

Nutrient cycling in the GBR lagoon was assessed in the GBR Region Strategic Assessment; a summary of the current condition and past trend is provided in Table 4.9 3.

Table 4.9-3 Condition and trend of nutrient cycling in the GBR lagoon

| Summary | Current condition | Confidence |
|---|---|---|
| Most southern inshore areas of the GBR Region are increasingly exposed to nutrients, which continue to enter the GBR at greatly enhanced levels. However, improved land management practices have resulted in reductions in annual average pollutant loads, suggesting the decline, while continuing, is likely to be halted. | X<br>Recent trend – Stable | Adequate |

Source: GBR Region Strategic Assessment Report[39]

**Outbreaks of crown-of-thorns starfish**

COTS outbreaks have been one of the major causes of coral death and reef damage on the GBR since surveys began in the 1960s. Nutrients may encourage planktonic algal blooms, which if coinciding with the spawning of COTS larvae, greatly increase the latter's chances of survival. A COTS outbreak is when they are at densities greater than about 30 starfish per hectare.

The general scientific view is that occasional outbreaks are to some extent natural, but that human impacts have increased their frequency and severity. Suggested impacts include improved survival of larvae due to increased nutrients and phytoplankton and reductions in predator populations.

Repeated damage from COTS continues. The current management regime aims to address the potential human contributions to outbreaks by reducing runoff, managing fishing, and to control outbreaks at specific locations that are important for site-dedicated tourism operators.

Source: [4]

### 4.9.4 Connectivity

Hydrological connectivity is an important requirement for maintaining the health and resilience of the GBR (see section 4.9.5). For many aquatic species, hydrological connectivity is the only physical means through which dispersal (and gene flow) and/or migration can take place.[84,85] In Queensland, particularly south of Cape York, numerous artificial barriers such as dams and weirs block the passage of aquatic fauna within and between rivers and the marine environment. These barriers have resulted in changes to aquatic populations and communities. Equally, hydrological connectivity is important for the dispersal of organic and inorganic matter, including nutrients and heavy metals. Disconnected pools and lagoons accumulate nutrients from terrestrial sources and decomposition and can become eutrophic and devoid of oxygen, which can result in fish kills. Maintaining hydrological connectivity avoids the impacts associated with the physical isolation of aquatic fauna communities and their habitats. The loss and modification of coastal wetlands and the deterioration of connecting waterbodies has reduced or destroyed connectivity between marine and adjacent freshwater.

The lifecycles of many fish, including barramundi, mangrove jack and freshwater sawfish, feature movement between marine habitats and adjacent aquatic floodplain habitats. The lifecycle of the red emperor fish shows the importance of the variety of coastal and marine ecosystems and their relationship to this commercially and recreationally important fish.

Connectivity in the GBR lagoon was assessed in the GBR Region strategic assessment, a summary of the current condition and past trend is provided in Table 4.9 4.

Table 4.9-4 Condition and trend of connectivity in the GBR lagoon

| Summary | Current condition | Confidence |
|---|---|---|
| Aquatic connections between freshwater and marine environments are still functioning well in northern areas. In contrast, aquatic connectivity has been substantially altered in the south. In southern coastal areas changes to hydrological flows and the construction of bunds, weirs and other structures have altered the functioning of the water bodies and decreased connectivity, except in flood events. In the southern upper catchment, the construction of dams is a major barrier. | X<br>Recent trend – Deteriorating | Limited |

Source: GBR Region Strategic Assessment Report[39]

### 4.9.5 Resilience

Ecosystem resilience refers to the capacity of an ecosystem to recover from disturbance or withstand ongoing pressures.[4] It measures how well an ecosystem can tolerate disturbance without collapsing into a different state that is controlled by a different set of processes. Resilience is not about a single ideal ecological state, but an ever-changing system of disturbance and recovery.

Given enough time, a resilient ecosystem will be able to recover from disturbances. Similarly, a resilient ecosystem may be able to absorb the stresses caused by disturbances with little or no sign of degradation. The MNES in the GBR coastal zone are facing some very serious pressures. An understanding of an ecosystem's resilience is an important part of predicting its likely condition.

An ecosystem's ability to absorb or recover from pressures and impacts, and its rate of recovery, depend on:

- the inherent biology and ecology of its component species or habitats
- the condition of these individual components
- the nature, severity and duration of the impacts
- the degree to which potential impacts have been removed or reduced.

If all of these factors are positive, populations of species or habitats can often absorb or recover from impacts, thereby allowing the ecosystem to continue to function.

A number of pressures and impacts affect ecosystems and these are discussed in chapter 5. These pressures and impacts can affect the ecosystem in many different ways, either individually or in combination, and at various temporal and spatial scales.

Impact frequency is also critical to resilience because an ecosystem will always require time to recover from an impact. If recovery takes too long, or disturbances are too frequent or continual, the system may not fully recover before the next disturbance, leading to gradual, long-term degradation.

### 4.9.6 Ecosystem services

Understanding ecosystem components and processes forms the basis for identifying what services and values may be provided by an ecosystem. Ecosystem services refer to the goods and services provided by ecosystems that benefit, sustain and support the environmental, social and economic well-being of people.[86] These services contribute to the economic, cultural and social values people place on the GBR coastal zone.

They include:

- provisioning services such as food and water,
- regulating services such as regulation of floods, drought, land degradation, and disease
- supporting services such as soil formation and nutrient cycling
- cultural services such as recreational, spiritual, religious, and other non-material benefits.[87]

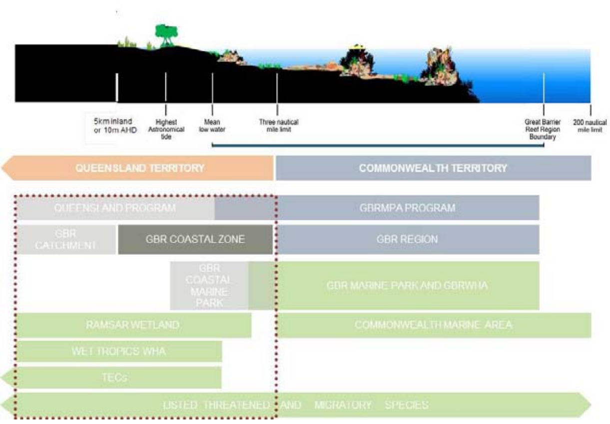
Table 4.9 5 outlines examples of the range of ecosystem services that could be delivered by the ecosystems within the GBR coastal zone.

Table 4.9-5 Ecosystem services

| Examples of ecosystem services | Examples of how the service is of benefit |
|---|---|
| ***Provisioning services – incorporates the products obtained from ecosystems*** | |
| Food | Production of fish |
| Fresh water | Water for humans, livestock, irrigated agriculture and industry |
| Fibre and fuel | Production of logs, fuel, wood and fodder |
| Biochemical products | Extraction of medicines and other material from biota |
| Genetic material | Genes for resistance to plant pathogens, medicines and tolerance of certain conditions e.g. salinity |
| ***Regulating services – benefits obtained from the regulation of ecosystem processes*** | |
| Maintenance of hydrological regimes | Storage and delivery of water as part of water supply systems |
| Support for food and fresh water services | |
| Erosion protection | Prevention of physical changes, such as coastal erosion |
| Pollution control | Retention, recovery and removal of excess nutrients and pollutants to support the reef |
| Climate regulation | Regulation of climatic variables and processes to support hospitable climatic conditions for living |
| Control of pests and diseases | Support of predators of agricultural pests |
| Hazard reduction | Flood control, coastal shoreline and river bank stabilisation and storm protection |
| ***Cultural services – benefits obtained through spiritual enrichment, recreation, education and aesthetics*** | |
| Recreation and tourism | Sports and activities<br>Picnics, outings, touring<br>Nature observation<br>Nature tourism<br>Fishing<br>Ecotourism |
| Spiritual and inspirational | Source of inspiration<br>Cultural heritage (historical and archaeological) spiritual and religious significance<br>Sense of place<br>Existence value<br>Appreciation of natural features |
| Scientific and educational | Educational activities and opportunities<br>Scientific reference area or site<br>Long-term monitoring site<br>Type and extant locality for taxon |
| ***Supporting services - services necessary for the production of other ecosystem services, note that these incorporate environmental processes*** | |
| Biodiversity | Support of the variety of all life forms including plants, animals and microorganisms, the genes they contain and the ecosystems of which they form a part |
| Soil formation | Sediment retention and accumulation of organic matter |
| Nutrient cycling | Storage, recycling, processing and acquisition of nutrients, carbon sequestration |

Source: [87,88]

## 4.10 Summary condition and trends of MNES values




The values of the MNES in the GBR coastal zones are summarised in Table 4.10 1. The values of the GBRWHA are also discussed in the GBR Region strategic assessment report. Some MNES are also values that underpin other MNES. For example a threatened species can be one of the values that underpin the GBRWHA, Wet Tropics WHA or a Ramsar site.

Table 4.10-1 Values in the GBR coastal zone (marine areas)

| Values and their elements that underpin matters of environmental significance | Matters of national environmental significance (MNES) | | | | | | |
|---|---|---|---|---|---|---|---|
| | GBR WHA | Wet Tropics WHA | Bowling Green Bay Ramsar site | Shoalwater and Corio Bays Ramsar site | Threatened ecological communities | Threatened species | Migratory species |
| ***Great Barrier Reef Inshore habitats*[1]** | | | | | | | |
| Islands | • | • | | | | | • |
| Beaches | • | • | • | • | | | • |
| Mangroves | • | • | • | • | | | • |
| Saltmarsh | • | • | • | • | | | • |
| Seagrass meadows | • | • | • | • | | | |
| Inshore coral reefs | • | | | • | | | |
| ***Ecosystem processes*** | | | | | | | |
| Freshwater inflow | • | • | | | | | |
| Sedimentation | • | • | • | • | | | • |
| Nutrient cycling | • | • | • | • | | | |
| Connectivity | • | • | • | • | • | • | • |

Refer to the GBR Region Strategic assessment report for an assessment of islands, beaches, mangroves, seagrass meadows and coral reefs.[39]

### 4.10.1 Overall condition and trend

Overall the GBR coastal zone retains a high proportion of naturally vegetated areas (74 per cent of the land area), and a significant portion of this is within conservation areas or minimal use areas, safeguarding its future condition. Despite this, there has been a significant loss of biodiversity within the GBR coastal zone as a result of past land clearing and there are continuing impacts on some values from ongoing land use.

The extent, condition and trend of MNES varies greatly across the vast longitudinal extent of the GBR coastal zone. Some ecosystem types have experienced greater loss than others, particularly freshwater aquatic ecosystems. There is also a significant dichotomy in the extent of clearing and ongoing impacts across the GBR coastal zone with the Cape York Peninsula to the north being essentially intact and the major impacts generally restricted to areas south of Cooktown.

The overall finding in this chapter is that the extent of terrestrial MNES habitats has declined in the past five years; however, it is now stable due to the end of broadscale clearing for agriculture under the VM Act. Overall, the condition of MNES habitat was found to be good. However, there are some areas of particular concern. These are the inshore marine ecosystems that are at most risk from the effects of poor water quality inflows from the GBR catchments.

The assessment identified evidence that a range of threats are continuing to affect inshore habitats along the coast and the species that use these habitats. The key impacts affecting habitats and species are extreme weather events, poor water quality from catchment runoff, and loss of habitats. These impacts are detailed in chapter 5.

Even in relation to the catchment water quality, land and NRM practices have improved over the last decade, due to programs under the Reef Water Quality Program and the Regional NRM program. Both these programs target the legacy issues associated with past land clearing and present day rural land management.

Table 4.10 2 presents outcomes from an assessment of the current condition and recent trend for habitats and species in the GBR coastal zone. Where the condition and trend differs between location, habitat and species, then the assessment is presented for all.

Table 4.10 2 Current condition and recent trend of MNES and values in the GBR coastal zone

| MNES/Value | Summary | Current condition and recent trend | Confidence |
|---|---|---|---|
| **GBRWHA Includes GBR NHA, GBR Marine Park and Commonwealth marine areas** | **Overall** | X<br>Deteriorating | |
| Water quality | The 2011 reef report card showed water quality declined from moderate to poor condition as a result of extreme weather and above average rainfall. | X<br>Deteriorating | Adequate |
| Coral | The 2011 reef report card showed coral condition declined from moderate to poor condition, primarily in the southern GBR. | X<br>Deteriorating | Adequate |
| Seagrass | The 2011 reef report card showed Seagrass condition in the southern GBR declined from poor to very poor condition as a result of extreme weather events. | X<br>Deteriorating | Adequate |
| Intertidal habitats | 97 per cent of the pre-clearing extent (or pre European settlement extent) remains | X<br>Stable | Adequate |

| MNES/Value | Summary | Current condition and recent trend | Confidence |
|---|---|---|---|
| OUV | Many elements that make up the OUV of the GBRWHA remain in good condition and it retains a high degree of integrity (wholeness and intactness). However, some significant aspects (such as corals) are in serious, long-term decline. | X Deteriorating | Adequate |
| **Wet Tropics WHA** | **Overall** | X Stable | |
| Habitat (vegetation) extent and condition in reserve areas | The WHA has well protected upland forests that are separated from low land sections by agricultural and urban areas. | X Stable | Adequate |
| MNES species diversity and distribution of species in reserve areas | Overall species are stable however cassowary populations in the lowland section suffered from a lack of food sources following recent cyclones which affected a large area of lowland habitat at Mission Beach. | X Stable | Adequate |
| Habitat (vegetation) extent and condition outside reserves | Grazing tenures, infrastructure corridors have degraded the condition and connectivity of vegetation in some areas. | X Deteriorating | Adequate |
| MNES species diversity and distribution of species outside reserves | Cassowaries and other species that utilise habitat outside of the WHA are at an increased risk from domestic/pest animal predation and vehicle strike. Invasive pest species more readily take hold in disturbed areas, particularly on the boundary of the WHA. | X Stable | Adequate |
| OUV | The 2008/09 Report Card on the State of the Wet Tropics WHA indicated that natural regenerative processes are gradually reinstating ecosystem composition, structure and function in previously logged forests.<br>Many disturbed areas have significantly rehabilitated in the twenty years since World Heritage listing. The rates of habitat loss and habitat degradation in the wider region are slowing but have not ceased. | X Stable | Adequate |
| **Ramsar sites** | **Overall** | X Stable | |
| Habitat (vegetation) extent | No significant deterioration in the ecological character of the site outside the realms of natural variability. The site continues to meet all Ramsar nomination criteria. | X Stable | Adequate |
| MNES species diversity and distribution of species | No significant deterioration in the ecological character of the site outside the realms of natural variability. The site continues to meet all Ramsar nomination criteria. | X Stable | Adequate |

| MNES/Value | Summary | Current condition and recent trend | Confidence |
|---|---|---|---|
| **Threatened Ecological Communities** | | | |
| Broad leaf tea-tree woodlands in high rainfall coastal north Queensland | There has been a significant historical loss of this TEC in the GBR coastal zone. Although present day clearing rates are approaching zero ha/annum, the remaining extent represents less than 40 % of the pre-cleared extent. Much of this area is outside of conservation/ minimum use areas. | X<br>Stable | Adequate |
| Littoral Rainforest and Coastal Vine Thickets of Eastern Australia | A substantial proportion of the pre-cleared extent of this TES remains (over 88 %) and the vast majority is located within conservation/ minimum use areas (94 %). | X<br>Stable | Adequate |
| **Threatened Species habitat** | **Overall** | X<br>Stable | |
| Bare-rumped sheathtail bat (*Saccolaimus saccolaimus nudicluniatus*) | Species records are extremely limited. This species appears to have an extensive spatial extent and occurs in a broad range of REs. The habitat for this species is assessed as secure. | X<br>Stable | Limited |
| Mahogany glider (*Petaurus gracilis*) | The population of the mahogany glider is small and restricted to a narrow coastal belt in the southern Wet Tropics region. Overall habitat condition should improve as 90 % is in now in conservation or minimal use areas. | X<br>Improving | Adequate |
| Proserpine rock wallaby (*Petrogale persephone*) | The population of the Proserpine rock wallaby is small and spread across 24 small colonies. The condition of the habitat associated with this species considered to be very good to good with 46% of the habitat in conservation areas and 37 % of the habitat in areas of minimal use. | X<br>Improving | Adequate |
| False water rat (*Xeromys myoides*) | Despite a 35 % historical reduction in the extent of false water rat habitat, the condition of the habitat associated with this species is considered to be very good to good with 29 % of the habitat in conservation areas and 41 % of the habitat in areas of minimal use. | X<br>Stable | Limited |
| Yellow chat (*Epthianura crocea*) | The total population of the Yellow chat is estimated to be only 250, known from five locations. There has been a 37 % historical reduction in the extent of its habitat. The condition of the habitat associated with this species considered to be good with 17 % in conservation areas and 35 % in areas of minimal use. | X<br>Deteriorating | Limited |
| Southern cassowary (*Casuarius casuarius johnsonii*) | Cassowaries are found in two populations, one in Cape York and another in the Wet Tropics. The total population is estimated to be 2500 mature birds. Cassowary habitat in the Wet Tropics has been greatly reduced by historical land clearing. The condition of the habitat associated with this species is considered to be very good with 88% in conservation or minimal use areas. | X<br>Improving | Limited |

| MNES/Value | Summary | Current condition and recent trend | Confidence |
|---|---|---|---|
| Australian arenga palm (*Arenga australasica*) | Australian arenga palm occurs in far north-eastern Queensland from the Torres Strait to south of Innisfail. Most of the habitat associated with this species occurs within GBR coastal zone. The condition of the habitat is considered to be very good with 98 % in conservation or minimal use areas. | X Improving | Limited |
| Cardwell bearded orchid (*Calochilus psednus*) | The Cardwell bearded orchid is known only from a small area south of Cardwell. Population numbers are unknown. About 75 % of the pre-cleared habitat extent remains. The condition of the habitat associated with this species is considered to be very good with over 90 % of the habitat in conservation or minimal use areas. | X Improving | Limited |
| Cooktown orchid (*Dendrobium bigibbum*) | Only 1 % of the Cooktown orchid habitat has been cleared with almost 80 % of the habitat in conservation or minimal use areas. | X Improving | Limited |
| *Quassia bidwillii* | There has been a 20 % reduction in the extent of quassia habitat from the pre-cleared extent. About 70 % of the habitat is located in conservation or minimal use areas. | X Improving | Limited |
| *Cycas silvestris* | Only 1 % of *Cycas silvestris* habitat has been cleared with about 95 % of the habitat located in conservation or minimal use areas. | X Improving | Limited |
| **Migratory Species** | | | |
| GBR coastal zone migratory species habitat | Thirty eight species of migratory birds are known to breed and roost in the GBR coastal zone. There has been a 20 % historical reduction in the extent of key migratory species habitat. About 90 % of current habitat is within conservation or minimal use areas. | X Improving | Limited |

Results for values and MNES marked (*) were assessed in the GBR region strategic assessment have been included in Table 4.10 3 for completeness, and a detailed analysis of the condition and trend is provided in the GBR Region strategic assessment report.

Table 4.10 3 Condition and trend of MNES and values in the GBR coastal zone assessed in the GBR region strategic assessment report

| MNES/Value | Summary | Condition and trend | Confidence |
|---|---|---|---|
| **Great Barrier Reef inshore habitats** | | | |
| Beaches and coastlines* | Beaches and coastlines are important habitats for migratory shore birds, seabirds and marine turtles.<br>In the remote north, they remain relatively undisturbed, except for marine debris.<br>Structures near urban centres and ports have extensively modified some coastline habitats and affected coastal processes locally. Artificial barriers to freshwater flow have disrupted sediment supply to some beaches and increased fine sediments have resulted in mangroves replacing beaches in local instances. | X Stable | Limited |

| MNES/Value | Summary | Condition and trend | Confidence |
|---|---|---|---|
| Inshore coral reefs* | The decline is most severe on southern inshore reefs. The two major drivers of loss are outbreaks of crown-of-thorns starfish and cyclones, others include catchment runoff and climate change. | X Deteriorating | Adequate |
| Islands* | There are about 1050 islands within the boundaries of the GBR Region, including continental islands, coral cays and mangrove islands. Most remain in good condition, but there is increasing pressure from recreational use, coastal development and climate change. There is limited monitoring on the condition of most islands. | X Stable | Limited |
| Mangroves* | The GBR Region includes an estimated 2070 km$^2$ of mangrove habitat. Mangroves are a dynamic habitat, with some localised declines and some expansions. The overall condition of mangrove habitats is relatively stable and abundance is being maintained.<br>The Region's mangrove forests are very diverse with at least 39 mangrove species and hybrids recorded. The highest diversity is in the far north. In contrast to international trends, the diversity and abundance of mangrove species along the GBR coast is being maintained. | X Stable | Adequate |
| Saltmarshes* | Saltmarshes occur discontinuously along the entire GBR coast. They have been significantly modified by coastal development, affecting more than 30% of the habitat in the catchment. The impact is highest in areas with grazing and cropping, urban growth or large communities. | X Deteriorating | Limited |
| Seagrass meadows* | Intertidal seagrass meadows are in poor condition with serious declines reported over the last four years, especially those in the paths of cyclones and exposed to flooding. Fewer impacts mean that northern area meadows are likely to be in very good condition.<br>The GBR is maintaining seagrass diversity; however, there have been recent severe declines in abundance and changes in community composition in the southern coastal zone. These are mainly due to cyclones and flood events, in addition to the longer term impacts of catchment runoff. | X Deteriorating | Limited |
| **Terrestrial habitats** | | | |
| Freshwater wetlands* | Freshwater wetlands across the catchment are relatively intact but many are functioning poorly due to a range of factors including loss of connectivity, sediment and nutrient overload, changes to groundwater and weed infestations. Losses of wetlands are often underestimated, especially for infrequently inundated wetlands on highly developed coastal floodplains. In some coastal floodplain basins, up to 80 % of freshwater wetlands have been lost. | X Deteriorating | Limited |
| **Species** | | | |
| Bony fish* | There are about 1600 species of bony fish in the GBR Region. Very little is known about most species. Long-term monitoring of targeted and non targeted coral reef fish populations does not indicate declines in the species monitored. Our understanding suggests that targeted fish species are under significantly more pressure in southern areas from the combined effects of fishing activities, severe weather events, reduced habitat and declining water quality. There is little evidence of declines in northern populations. | X Stable | Limited |

| MNES/Value | Summary | Condition and trend | Confidence |
|---|---|---|---|
| Seabirds* | At least 20 species of seabirds breed annually on islands and cays in the GBRWHA. | X<br>Stable | Limited |
| Shorebirds* | There are no population estimates for the Region's shorebirds. Australia-wide declines of between 70 and 80 % have been recorded in the last 24 years.<br>Internationally significant numbers of shorebirds occur at a number of sites within the GBR Region.<br>Changes to the coastline from population growth directly affect the habitats used by shorebirds. | X<br>Deteriorating | Limited |
| Dolphins* | The number of dolphin species in the GBR Region is estimated to be 17; there is limited information about most populations. Two listed inshore species, the Australian snubfin and Indo-Pacific humpback, are considered most at risk and likely to be in decline. The coastal Indo-Pacific humpback dolphin is also listed and considered at risk. | X<br>Deteriorating | Limited |
| Dugongs* | The northern population of dugong remains healthy. A substantial decline in dugongs in waters south of Cooktown since the 1960s has continued recently due to the effects of extreme weather events. | X<br>Deteriorating | Adequate |
| Estuarine Crocodile* | Estuarine crocodiles occur in most coastal waters in the GBR Region. The species is steadily recovering from previous population declines, with no recorded expansions in its range. | X<br>Improving | Limited |
| **Ecosystem processes** | | | |
| Freshwater inflow* | After a period of significantly lower than average freshwater flow, significant volumes of freshwater have entered the GBR Region in the last five years, including record flows for some rivers. This freshwater has reached beyond the coastal zone and has had direct effects on marine species as well as delivering increased loads of sediments, nutrients and pesticides. | X<br>Deteriorating | Adequate |
| Sedimentation* | Exposure of the GBR to terrestrial sediments has increased, especially in the southern coastal zone, however land management improvements are starting to demonstrate a reduction in sediment loads. However, there will be a time lag before the system can be considered stable. | X<br>Stable | Adequate |
| Nutrient cycling* | Most southern inshore areas of the GBR Region are increasingly exposed to nutrients, which continue to enter the GBR at greatly enhanced levels. However, improved land management practices have resulted in reductions in annual average pollutant loads, suggesting the decline is being halted. However, there will be a time lag before the system can be considered stable. | X<br>Stable | Adequate |
| Connectivity* | Aquatic connections between freshwater and marine environments are still functioning well in northern areas. In contrast, aquatic connectivity has been substantially altered in the south. In southern coastal areas changes to hydrological flows and the construction of bunds, weirs and other structures have altered the functioning of the water bodies and decreased connectivity, except in flood events. In the southern upper catchment, the construction of dams is a major barrier. | X<br>Deteriorating | Very limited |

* Data from the GBR Region Strategic Assessment Report[39]

The values that maintain the condition of MNES in the GBR coastal zone vary from good to very poor with the trend stable or declining – except for estuarine crocodiles, which is improving. While there is evidence that the extent, condition and trend of MNES is stable overall, the trend of these supporting values means there is no room for complacency.

Improving the resilience of MNES in the GBR coastal zone and region will require:

- continued efforts to improve the quality of freshwater inflows to the GBR lagoon
- NRM programs to improve habitat connectivity and manage pests and fire
- applying the 'avoid, mitigate and offset' policy to ensure development that impacts on MNES achieves a net gain in biodiversity conservation outcomes.

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# Chapter 5

## pressures and impacts on MNES

***Extract from Great Barrier Reef Coastal Zone Strategic Assessment terms of reference***

***2 Matters of national environmental significance affected by the program***

*The scale and diversity of the geographic area requires that a tiered, or hierarchical approach be taken that looks at the existing and likely future risks and impacts to the Great Barrier Reef and adjacent coastal zone. It then needs to look in depth at specific locations and initiatives as a means of demonstrating the effectiveness of the Program in protecting matters of national environment significance (MNES), including outstanding universal value (OUV) at a local scale.*

***2.1 Identification of MNES including OUV***

*………*

*The Strategic Assessment Report must also:*

*(a) describe the current condition of MNES including the values described above, projected trends and existing threats from both within and outside the strategic assessment area*

*(b) for World Heritage values, describe the current condition of OUV against the retrospective statement of OUV which describes the state of the Great Barrier Reef World Heritage Area (GBRWHA) at the time of listing*

*(c) provide sufficient information to allow an understanding of the connectivity between MNES including OUV*

*(d) identify any key information gaps and the further studies needed*

*(e) identify any proposals or processes to address critical information needs*

*………*

***2.2 Identification and analysis of the potential impacts***

*The Strategic Assessment Report must describe how potential future impacts of activities taken under the Program are identified and taken into account in relevant decision making processes, in the context of past and existing impacts as described in Section 2.1 above.*

*For illustrative purposes, the activities described in the Program may include the following:*

- *urban developments within an urban footprint in a region within a statutory regional plan;*
- *planned tourist developments consistent with a Statutory Regional Plan;*
- *planned urban development within an urban development area where it is consistent with an approved development scheme;*
- *planned industrial development within state development areas where it is consistent with an approved development scheme;*
- *proposed port developments within existing port limits where it is consistent with a port land use plan and the Queensland Government's strategy for port developments; and • aquaculture development (in aquaculture development areas).*

*In doing so, the Strategic Assessment Report must:*

*………*

*(b) identify the following areas and the activities that may occur within them:*

- *existing developed areas, including ports*
- *protected areas*
- *areas that may be subject to future development within the life of the Program*
- *areas, including protected areas, where certain types of development or activity may be specifically prohibited to avoid impacts on MNES, including OUV*
- *priority areas for conservation, that may be acquired as offsets, where development is restricted or excluded for the net benefit of ecological outcomes.*

*As part of this the Strategic Assessment Report will:*

- *describe the Queensland Government's strategy for port development and for managing the safety of vessel movements within port limits and compulsory port pilotage areas*
- *identify existing and planned urban and industrial areas having regard to local and regional planning instruments*
- *identify planned or potential state development areas and urban development areas*

*………*

*(e) identify and analyse the potential direct, indirect and cumulative impacts on relevant MNES and OUV arising from implementing the Program in general and more specifically in key demonstration areas*

*………*

*(g) consider and assess the effects of climate change and other long-term influences on the potential future impacts*

*(h) include an assessment of uncertainties and the confidence associated with the likelihood and consequence(s) of potential impacts, including reference to scientific and other information relied upon in identifying and assessing those impacts.*

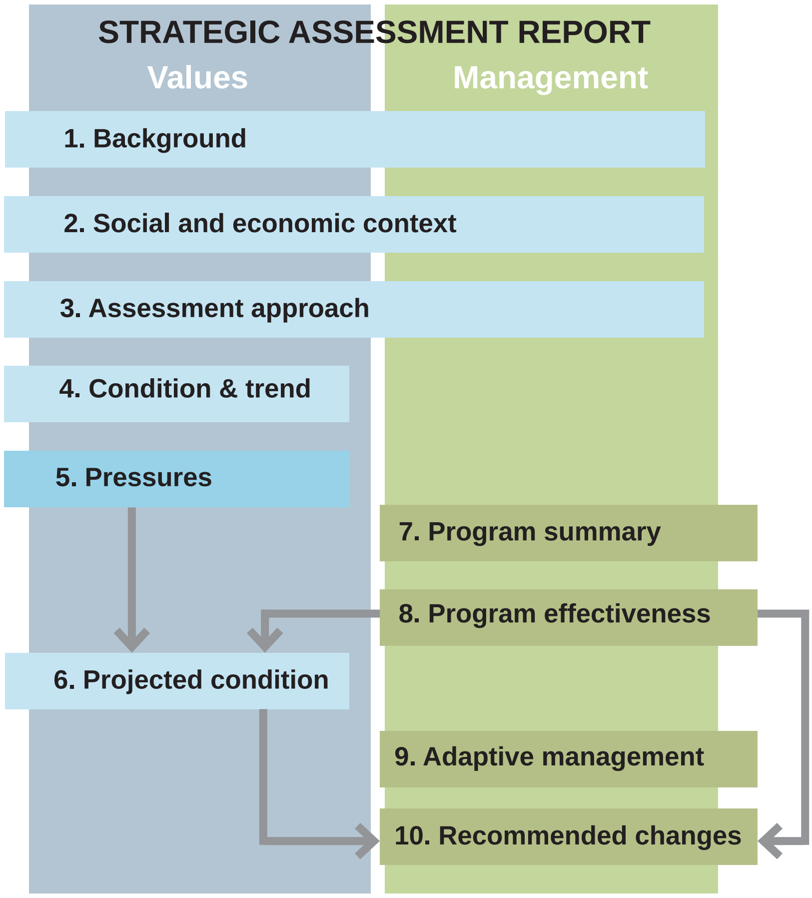
*2.3 Measures to avoid, mitigate and offset impacts*

*The Strategic Assessment Report must describe the avoidance, mitigation and offsetting measures that are proposed for future activities taken under the Program and analyse the effectiveness of these measures in protecting and enhancing MNES including OUV. This analysis may use demonstration cases to illustrate the application and effectiveness of particular measures and approaches and must include, but not be limited to:*

*………*

*(d) describing the extent to which cumulative impacts on MNES including OUV are considered and the methods used to determine cumulative impacts*

# 5. Pressures and impacts on MNES






## 5.1 Introduction

This chapter assesses the direct, indirect and cumulative impacts of the pressures on MNES, including the OUV of World Heritage Areas, in the GBR coastal zone and the activities that generate these pressures. These activities occur both within and outside the GBR coastal zone. Figure 5.1 1 below, illustrates the interrelationship between activities and pressures that can result in significant impacts on MNES.

The current extent and condition of MNES in the GBR coastal zone is primarily a result of past land clearing and the impact from extreme weather events (direct impacts). This has resulted in permanent loss of ecosystems (through the establishment of agricultural and urban areas) and temporary loss while ecosystems respond following an extreme weather event. Ongoing land management practices both within the coastal zone and in the middle and upper GBR catchments generate continuous indirect impacts through diffuse and point source rural and urban water pollution and the impacts of pests, diseases and changed fire regimes in REs. The sum of these, together with the projected future impacts associated with climate change (more intense extreme weather events, sea level rise and seawater temperature rise) are cumulative impacts.

There are several drivers that influence the capacity to build resilience in areas that contain MNES values. The drivers include climate change, economic growth, population growth and land management practices. Addressing the cause of climate change is beyond the scope of the Program and the strategic assessment as a global solution is required.

The Program focuses on management of coastal development and activities that occur within or directly affect the GBR coastal zone, which include:

- development and expansion of urban areas, tourism and recreational use
- development and expansion of industrial areas and ports (including dredging)
- management of agriculture practices and aquaculture development
- mining and quarrying
- land and natural resource management (pest and fire management and ecosystem rehabilitation).

### 5.1.1 Drivers of change

There are a range of factors that guide or influence human activities and natural processes, including social, environmental, economic, cultural and political factors. These factors can be termed drivers of change. Four main drivers influence the vast majority of impacts on MNES in the GBR coastal zone:

- climate variability and change
- economic growth
- population growth[20, 21]
- land and natural resource management.

While each driver may increase pressures on MNES, if well managed this may not eventuate, particularly if compared to the ongoing impacts of past land use. In this respect, land and natural resource management is critical as it can be the driver that remediates legacy impacts from past and ongoing land use.

Human activities and environmental factors cause pressures and impacts on the environment, such as extreme weather events, clearing of habitat, disturbance of species, decline in water quality due to urban and industrial development and land use, agriculture run-off, introduction of pest and weed species and disease and changes to naturally occurring fire regimes and the generation of pollutants. It is expected that many of these effects will be worsened by the impact of climate change in the coming decades. A summary of the main drivers of change to the environment in the GBR catchments is provided below.

### 5.1.2 Climate variability and change

While climate change cannot be addressed by the Program due to its global nature, it is important to recognise the increased pressures and consequential impacts of climate change to ensure they are accounted for when considering impacts of activities that can be managed under the Program.

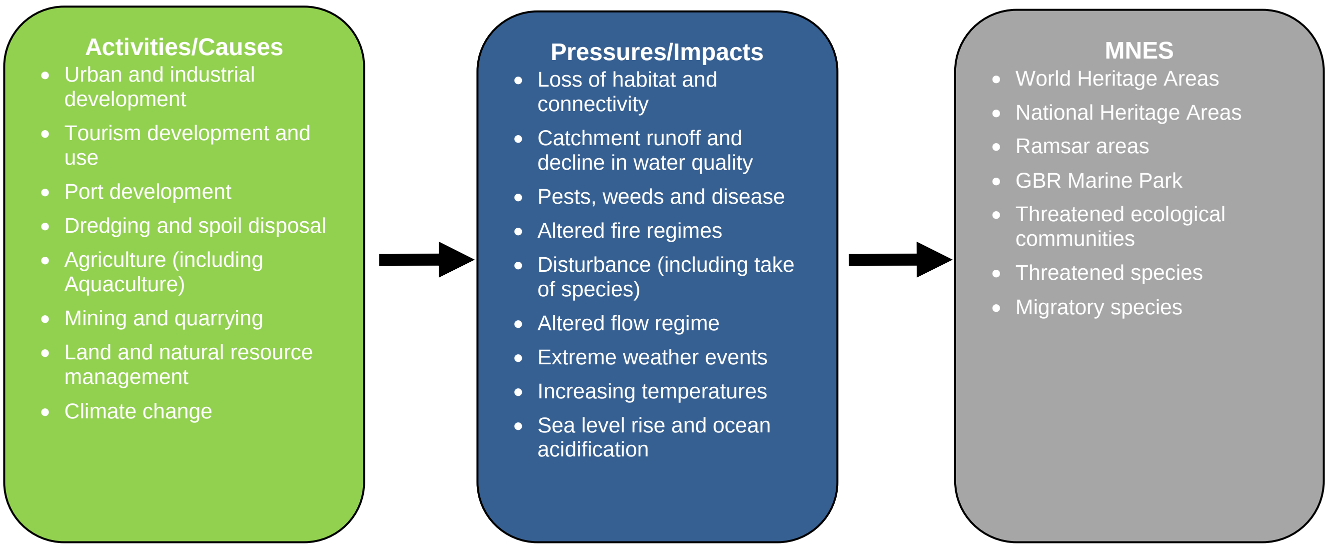



Figure 5.1-1 Interrelationship between activities, pressures and MNES

Queensland's climate is naturally variable, however evidence shows that temperatures are increasing and rainfall distribution patterns are changing.[89-91] Figure 5.1 2 shows how Queensland average temperatures have increased since the early 20th century. The black line indicates the 11-year running average and shows that the average temperature across Queensland has been increasing over the past 60 years. The annual average temperature anomaly is measured as the difference from the long-term climate average (1961–1990).

Climate variability and change will profoundly change Queensland's environment, potentially presenting widespread and significant impacts to ecosystems, native vegetation, water security, agricultural production and coastal communities.[19]

A changing climate has direct, indirect and ongoing effects on environmental values and services. Higher temperatures and changing, more variable rainfall regimes are expected to have significant effects on the natural processes that underpin the state and function of ecosystems, communities and species and the provisioning services they provide.

Future impacts of climate change on Australia are likely to include:

- projected increases in average surface temperature of 0.6–1.5 °C by 2030 and 2.2–5.0 °C by 2070
- projected increase in sea level by 0.8 metres by 2100
- less predictable rainfall patterns, with some areas experiencing decreased average annual rainfall and other areas becoming wetter
- more intense rainfall, with heavy rainfall over northern parts of Australia
- there may be fewer cyclones, but they are likely to be more intense (in the order of 10 per cent) and may therefore cause more damage. More cyclones may be experienced further south
- more frequent and longer duration heatwaves
- more frequent and longer duration droughts
- ocean acidification and warming.[89-91]

Data from tide gauges and satellites shows the global sea level has risen by almost 0.2 metres since 1870. The measurements show that the rate of sea level rise has accelerated due to rapid ice melt and thermal expansion of the upper ocean.[93] Although sea levels have been projected to rise by 0.8 metres by 2100, indications are that the rise could be greater, with a sea-level rise of 1.0 metres or more a possibility, depending on the stability of major ice sheets in Greenland and the Antarctic.[91]

While the scientific consensus supports projections of global temperature rise, the nature and scale of flow on impacts, particularly at local and regional scale (even at the GBR scale) is much less certain. Time lags between atmospheric temperature rise and associated impacts such as sea level rise or changes in

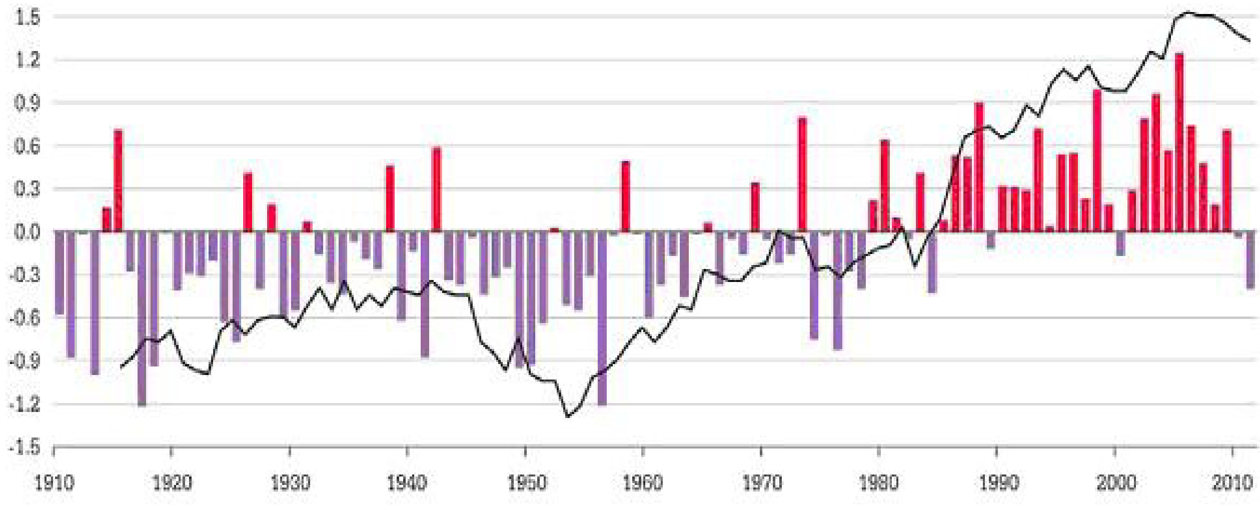



Figure 5.1-2 Annual average temperature anomaly for Queensland

Note: The black trend line indicates the 11 year running average and shows that the average temperature across Queensland has been increasing over the past 60 years. The annual average temperature anomaly is measured as the difference from the long-term (1961–1990) climate average.

Source: [92]

CHAPTER 5 I pressures and impacts on MNES rainfall patterns may mean significant effects won't be experienced for some decades yet. For example, significant sea level rise is not expected until 2030 to 2050. However, the impacts of climate change are overarching as every ecosystem and habitat is vulnerable. In particular near shore environments, such as beaches, mangroves, saltmarshes and seagrasses are likely to face inundation from sea-level rise and shoreline erosion, leading to loss of habitat.[20]

Findings from the Australian Academy of Sciences (2010)[94], the Climate Commission (2012)[91], and CSIRO (2012)[90], indicate stronger than expected and sooner than expected changes in climate. The potentially profound consequences of a changing climate make it a key driver of environmental change in Queensland.[89]

Adapting to the impacts of climate change will need to be considered through the Program components. For example, in advancing the purpose of the SP Act, decision making processes are required take account of short and long-term environmental effects of development at local, regional, State and wider levels, including, for example, the effects of development on climate change – refer to section 5(1)(a)(ii).

### 5.1.3 Economic growth

Queensland has a strong economy, based on increasing global demand for Queensland's natural resources. The corresponding growth of Queensland's, agricultural, energy, mining and transport industries, together with increasing use of natural resources, such as water, has put pressure on environmental values and ecosystem services. Economic growth has been dampened over the past three years by the impacts of the global financial crisis, widespread flooding and Cyclone Yasi in early 2011, and further flooding in 2013.

Many of north Queensland's industries are heavily reliant on the environment for their output, including agriculture, aquaculture, forestry, fisheries, mining, manufacturing, construction and tourism. Mining, cropping and grazing, along with associated infrastructure requirements such as ports, roads, processing plants and storage facilities, can directly and indirectly affect ecosystems by modifying land- and seascapes and generating pollution and waste. In contrast, other important industries that provide ongoing economic growth in Queensland, such as tourism, rely heavily on the maintenance of Queensland's environmental assets for their viability.

Queensland Government's Program contains components that aim to prevent impacts from economic growth, including the EP Act. These are discussed in chapter 7.

### 5.1.4 Population growth

The size, growth rate, distribution and migration patterns of Queensland's population are all important factors that drive land use change and natural resource demand, providing a challenge to the provision of socio-economic services that support high or improved living standards.[20]

The population of the GBR coastal zone is expected to grow at an average annual growth rate of nearly two per cent to approximately 1.4 million by 2031. This predicted growth is particularly evident in the cities of Gladstone, Mackay and Townsville and is in line with the growth rate for the state. A population decline is expected in some of the smaller, more remote coastal communities (see Appendix C). Both economic and lifestyle factors will drive this trend.

As human populations grow there is a need for more land for housing and related urban and industrial infrastructure. Historically, population growth has required increasing amounts of resources and generated larger amounts of waste and emissions which require disposal/treatment or are ultimately returned to the environment. Population growth may, therefore, increase the significance of urban development as an activity creating pressure on MNES in the GBR coastal zone.

However, this may only be an issue where a population is already large, such as a metropolitan area. While the urban development required to accommodate population growth in the GBR coastal zone will increase pressures on MNES, it will generally be localised and of marginal significance relative to other pressures. This is primarily because the population will grow from a relatively small base compared to the land area, and urban development is subject to significant regulation relative to other land use, particularly agriculture. Accommodating a significant increase in population in the major centres of the GBR coastal zone will not require a major new footprint. For example, the Far North Queensland Regional Plan forecast an additional population of about 70 000 for Cairns by 2031. Most of this additional population is planned to be accommodated in the Mount Peter area north of Gordonvale. The area is less than 2000 hectares and is currently used primarily for sugarcane production. A well planned and regulated urban development in this area can be expected to have a net positive impact on MNES over the previous land use in these circumstances.

The Program contains components, including the SP Act, that provide a strong framework for ensuring the planning for and development of urban areas and activities do not have a significant impact on MNES and other important natural values and resources. These are discussed in chapter 7.

### 5.1.5 Land and natural resource management

The way the impacts of past land clearing are managed is essential to improving the resilience of MNES and improving the natural environment's capacity to recover from natural events and the effects of climate change. Improving land and natural resource management can be a positive driver, reducing pressures and impacts and over time helping reverse the decline of MNES.

There has been a significant loss of terrestrial, fresh-water aquatic and estuarine ecosystems as a result of past land use decisions, particularly the development of agriculture. While this loss is accepted as the price paid for the economic development of Queensland, it means remaining REs, the home to threatened species and ecological communities are all the more important. The management of these areas (and adjacent areas to the extent activities impact on remnant areas) is a key priority. Maintaining the extent and condition of these remnant areas, enhancing them where possible and protecting the ecological links or connectivity between them are core concerns. Minimising habitat loss and changing land management practices to improve the quality of water running off agricultural areas, managing pests and fire, and the impacts of grazing in rangeland areas, are key means of protecting MNES. The Program includes components, such as the Reef Plan, that address these issues. These are discussed in chapter 7.

## 5.2 Activities

Within each NRM region the extent and condition of MNES varies, as does the nature of the pressures that activities exert on these values. Broadly, the activities can be categorised as:

- land management activities (or lack of management) conducted at various scales of intensity, such as horticulture, rangeland grazing, changed fire regimes and pest management, that occur broadly across catchments and exert pressure and broad-scale on-going impacts
- development in the GBR coastal zone, such as urban, industrial, tourism infrastructure, port and dredging activities; which can result in significant one off impacts at a localised scale
- disturbance activities, such as fishing, hunting, habitat disturbance and debris in the marine environment, all exert pressures on species and ecosystems.

The land use within the GBR catchment and NRM regions is shown in Figure 5.2 1.

### 5.2.1 Agriculture and aquaculture

#### 5.2.1.1 Agriculture

The agricultural sector is an important contributor to Queensland's economy, but it has also driven significant landscape change leading to both direct and indirect environmental impacts. The two primary impacts are the contribution agricultural land management makes to poor catchment water quality, and the impact of stock grazing in natural areas (rangeland grazing) on biodiversity extent and condition. Other impacts include changes to fire regimes to benefit agricultural activities rather than ecosystems, the introduction of exotic grasses favoured by stock and limited management effort directed at environmental pests.

Land clearing was once the major impact from agriculture development, however since 2000 the rate of clearing was reduced to protect at risk ecosystems and from 2006 clearing for agricultural development has been essentially prohibited under the VM Act. The vegetation management laws were extended in 2009 to protect native regrowth vegetation along watercourses in the priority Burdekin, Mackay-Whitsunday, and Wet Tropics NRM regions.

Broadscale agriculture contributes around 90 per cent of pollutants that have led to declining water quality in the GBR lagoon come from agricultural land uses, such as grazing and sugarcane.[95] Grazing cattle is most extensive in the larger catchments of the Fitzroy and Burdekin NRM regions. In the coastal floodplain catchments of the Wet Tropics and Mackay Whitsundays NRM regions, large areas are dominated by sugarcane and horticulture (Figure 5.2 1). The 2013 Scientific Consensus Statement prepared by over 40 leading scientists identified that the decline in water quality from catchment runoff is the major cause of the current poor state of many of the key ecosystems and that the three major risks are nitrogen, fine sediment, and pesticide discharge. It also identified that the major source of the key pollutants is broadscale agriculture and that other sources such as urban, ports and shipping are relatively small but may be locally and over short time periods highly significant. In terms of risks, the consensus statement noted that overall, nitrogen poses the greatest risk to coral because of its influence on crown of thorns starfish outbreaks, while sediment poses the greatest risk to seagrass.[36]

There is great potential for changes in agricultural land management practices which could significantly reduce pollutant loads and improve water quality. This has been the focus of The Reef Water Quality Protection Plan (Reef Plan) since 2003 and associated programs (see chapter 7).

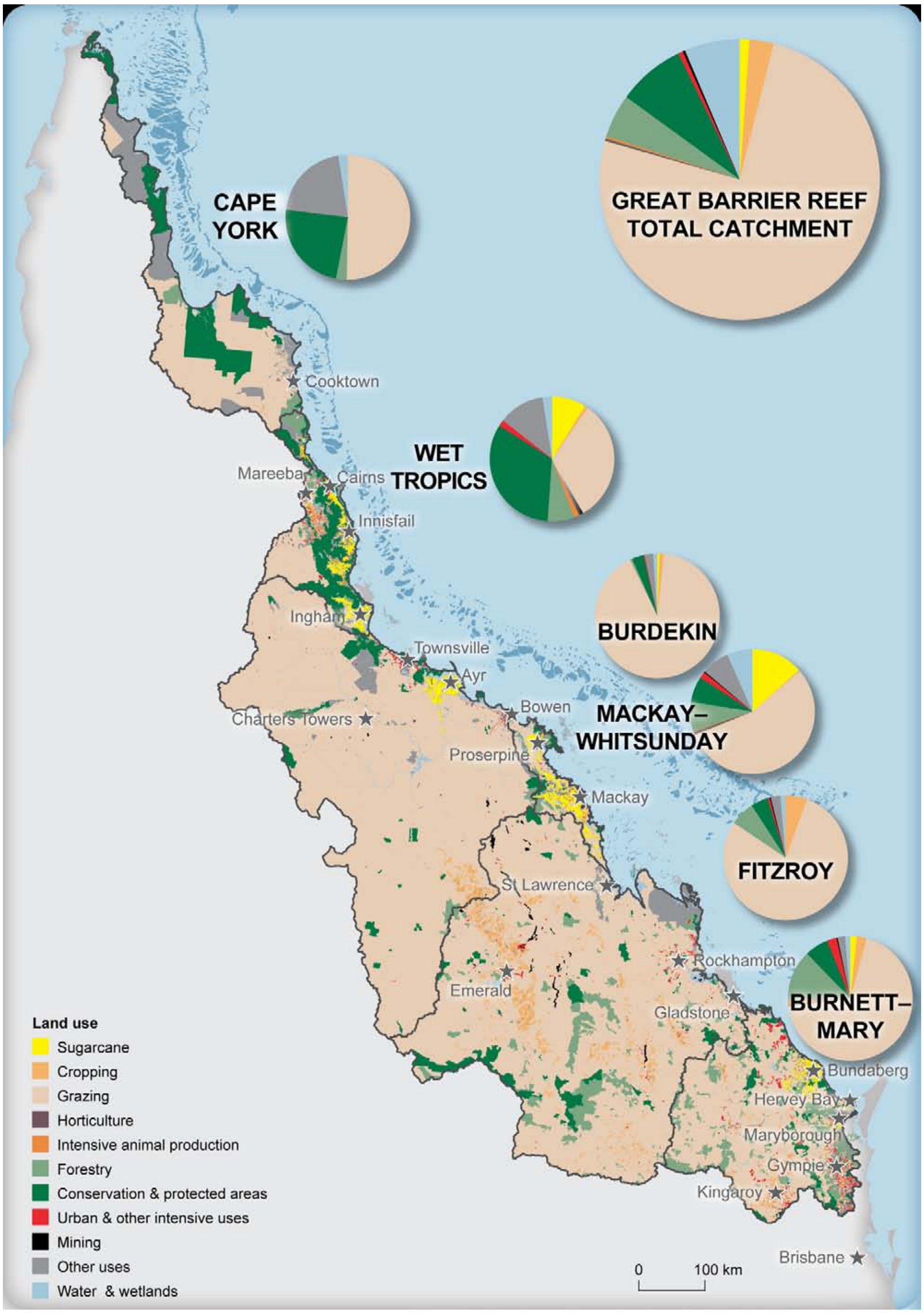



Figure 5.2-1 Land use in NRM regions (2012)
Source: [20]

#### 5.2.1.2 Aquaculture

Land-based aquaculture occurs in the GBR catchment, principally for prawns, barramundi, redclaw and freshwater fish. The potential impacts of land-based aquaculture facilities on the GBR environment include: increased loads of sediment and nutrients (nitrogen and phosphorus) in discharged wastewater; clearing, modification or removal of coastal habitat; modification of hydrologic processes; disturbance of ASS; introduced marine species; genetic pollution and disease introduction (endemic and introduced).

Most aquaculture in Queensland occupies land-based sites within the GBR coastal zone (Figure 5.2 2). In 2010–2011 over 90 per cent buy value of aquaculture production was from farmed prawns and barramundi.[96] This production was predominantly from ponds, a substantial proportion of which are located in the GBR coastal zone. There is only one sea cage authority in Queensland which is located in the Hinchinbrook Channel within the GBR Region, but at the time of writing it is non-operational.

The environmental impacts of aquaculture vary according to the species cultivated, the management practices used and location of the production system.[97] The industry is strongly regulated relative to other agricultural activities and effluent standards are required to meet license conditions which are set in accordance with the statutory Environment Protection (Water) Policy 2008. Effluent discharge quality is generally considered to be the major potential ongoing impact of aquaculture. There are also potential one-off impacts from new aquaculture development from clearing and draining of natural ecosystems.

***Best Management Practice***

A best management practice is a method or technique that has consistently shown results to improve the environment. Best management practices have been developed in aquaculture such as recommending low-phosphorus feed ingredients and in forestry to manage riparian buffer zones. In agriculture best management practice has been successfully used in the cotton and grains industry and is currently being developed for the cane and grazing industries adjacent to the Great Barrier Reef World Heritage Area.

### 5.2.2 Urban and industrial development

Urban development refers to the construction or expansion of a town or city including buildings, houses, roads, water and electricity supply. The five major population centres within the GBR coastal zone are Cairns, Townsville, Mackay, Rockhampton and Gladstone (Figure 5.2 1).

Increasing populations drive the growth of urban and industrial developments, which impacts the environment through land use change, the development of physical and social infrastructure, the consumption of water and energy and the generation of waste.

As outlined in section 5.1.4, the majority of the population (over 62 per cent) in the GBR coastal zone is in the larger urban centres of Cairns, Townsville, Mackay, and Rockhampton.[98] These urban centres account for less than one per cent of the total area of the GBR catchment. Urban centres in the GBR coastal zone are expected to grow by 22.1 per cent over the 10 years to 2021, with the majority of this growth in urban centres of Cairns, Townsville, Whitsundays, Mackay, Rockhampton and Gladstone.[98]

Urban development in coastal areas can lead to habitat loss or modification of natural processes that may lead to loss or damage of MNES values. Activities include clearing and filling, modifying water flow and changing aquatic connectivity between coastal and marine habitats.

However, while urban areas are considered intensive development, the ongoing impacts on some environmental values may not be significant. For example, sewage discharge from urban areas contributes less than four per cent of the total nitrogen load and less than one per cent of the total phosphorous load discharged annually into the GBR lagoon.[99]

For the majority of population centres that discharge sewage via waterways that lead to the GBR, the sewage is treated to tertiary standard which means it will not adversely impact MNES including OUV. There are a number of smaller communities along the coast that discharge secondary treated sewage to waterways that lead to the GBR Marine Park, or are serviced by septic systems. Both of these situations pose potential risk to the MNES or OUV, albeit very small relative to other sources of water pollution, such as rural diffuse sources. In these communities, it is not currently economically viable to upgrade to tertiary treatment plants and further development and expansion of these communities will exacerbate the impact.

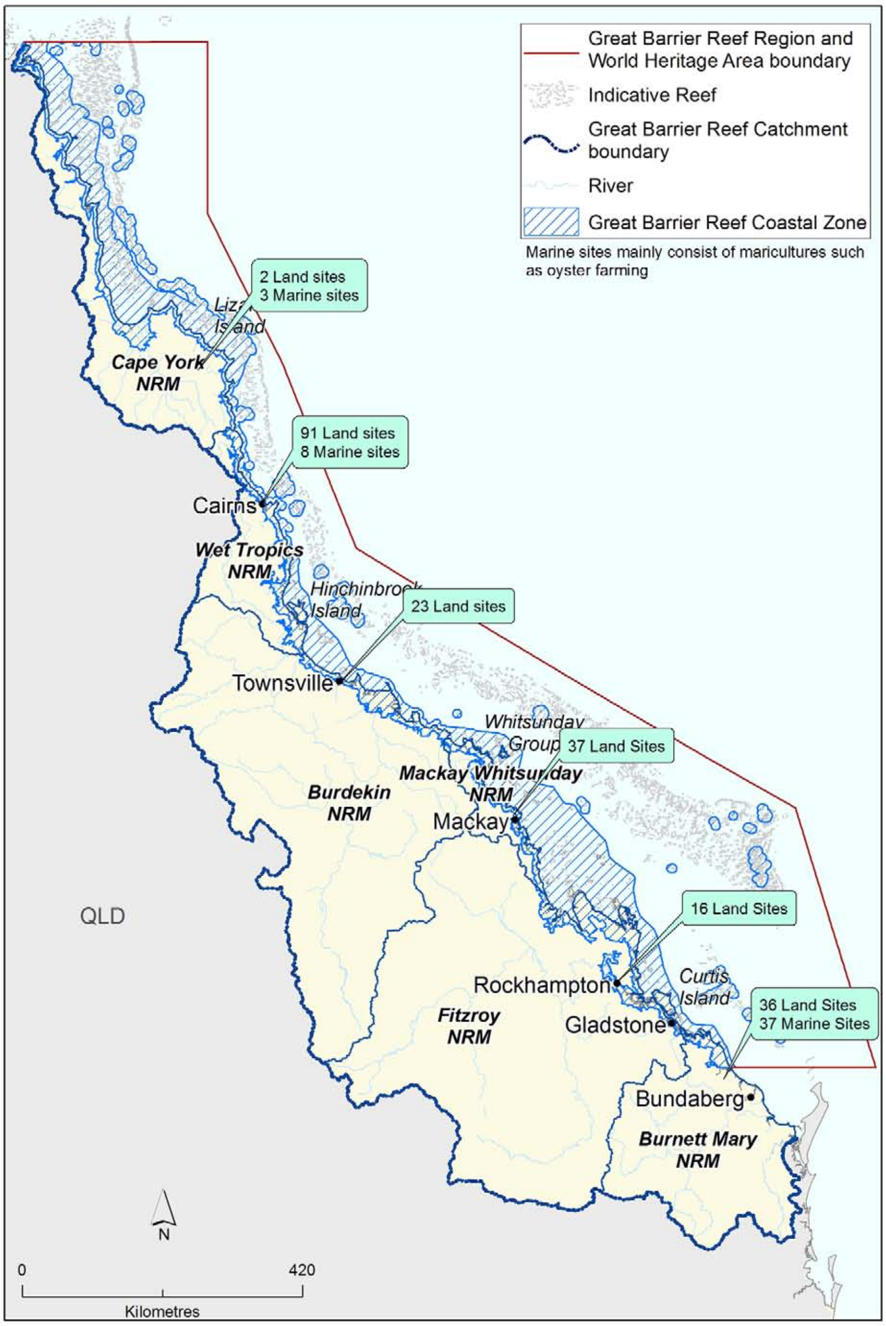



Figure 5.2 2 Aquaculture sites

Source: [38]

Other impacts from urban development include exposure of ASS, increased light pollution, atmospheric pollution, increased noise, and visual disturbance.The major direct impact/pressure from urban and industrial developments is the clearing of vegetation and the fragmentation of habitats.

Indirect impacts include the spread of pest and weed species and declines in water quality resulting from diffuse and point source pollution. The main consequential impacts related to urban and industrial development are altered flow regimes associated with water use infrastructure such as dams and weirs, the disturbance or accidental death of species due to vehicle collision and domestic animals (e.g. dogs and cats).

### 5.2.3 Tourism infastructure and recreational use

Tourists are drawn to Queensland's coastal areas as it offers a relaxed beachside lifestyle supported by clean beaches, open spaces, scenic landscapes and the opportunity for a range of recreational activities, such as boating, off road (four-wheel) driving, camping, fishing and swimming. Tourism is invariably supported by infrastructure, such as walking paths, amenities, shelters, barbeques, parks, playgrounds, hotels and motels, restaurants, swimming pools, shops and marine infrastructure.

Popular areas can suffer from the effects of over-use, leading to impacts such as disturbance to seabird nesting, vegetation trampling, weed spread and erosion. The potential impacts from recreation include, damage from trampling, horse riding, mountain biking and off road vehicles, as well as the potential spread of weeds and disease from one location to another.

The environmental pressure caused by tourism is related to the type and location of tourism infrastructure provided to service the activities of visitors as well as the potential number of visitors into previously natural or undeveloped areas. The direct major impacts / pressures from tourism infrastructure development may include vegetation clearing and habitat loss. Indirect impacts may include the introduction of pest and weed species, erosion and sedimentation, and declined water quality in runoff from tourism infrastructure development areas. Indirect may include disturbance, including light and noise or accidental death due to recreational activities, such as boat collision.

### 5.2.4 Port development and maritime infastructure

#### 5.2.4.1 Port development

International demand for Queensland's bulk commodity exports driven mainly by economic growth in rapidly developing countries like China and India, is expected to place continued demand on Queensland's export infrastructure supply chains, particularly the minerals, gas and coal/energy corridors. With growth in the mining and coal seam gas industry, there has been an increase in proposals to expand Queensland's long established major trading ports and to establish new trading ports. Excluding Brisbane and Weipa, all other Queensland major and medium-scale trading ports are located in the GBR coastal zone. Ports along the GBR coastal zone support almost 200 million tonnes throughput occurs at these ports annually.[15]

Coastal ecosystems in and adjacent to the GBR, form the critical connection between land and sea. Ports are located in inshore coastal areas where species such as migratory birds, dugongs and fish, and habitats such as seagrass are often found. Numerous vulnerable habitats and species are present within and adjacent to port areas.

Impacts to the environment from the installation and maintenance of port infrastructure and general port operations can include clearing, modifying and fragmenting coastal habitats, reclamation of marine areas, creation of artificial habitats, alteration of natural coastal processes, the risk of chemical and oil spills, marine debris, injury or death of marine wildlife, diminished aesthetic values for users and nearby communities and altered light regimes.

The direct impacts of port developments are generally localised and indirect impacts are mostly short-lived. The GBR coastal zone based activities associated with port developments include:

- terminals, loading and un-loading facilities
- trestle structures
- tug boat and shipping berths
- storage and waste facilities, cargo holding facilities, stockpiles
- land reclamation
- rail and road networks
- dredging and dredge spoil disposal.

### *Ports in the GBR Coastal Zone*

There are 12 ports in the GBR coastal zone (Figure 5.2 3).

1. Quintell Beach – located approximately 800 kilometres north of Cairns. Quintell Beach is a community port with a barge facility located on the east coast of northern Cape York. It services the needs of the Lockhart River community and remote grazing properties.
2. Cooktown – located approximately 330 kilometres north of Cairns. The Port of Cooktown is a declared Port servicing cruise vessels, however no commercial trade takes place.
3. Cape Flattery – located approximately 200 kilometres north of Cairns. Used for export of silica sand form the Cape Flattery silica mine. There is a single trestle jetty and conveyor running from the mine to an offshore berth and ship-loader.
4. Cairns – imports petroleum products and fertilizers, and exports raw sugar and molasses. It is a port of call for international and domestic cruise vessels and a base for patrol boats of the Royal Australian Navy. It is a distribution port for the many small communities to the north of Cairns and mining ventures in Papua New Guinea and Indonesia. Cairns is also home to a fleet of prawn trawlers with mooring facilities for 94 vessels.
5. Mourilyan – located at the mouth of the Moresby River 20 kilometres south of Innisfail. The port was established primarily for the export of raw sugar and molasses from the surrounding sugar mills and is serviced by a bulk sugar terminal which loads ships via a travelling rail-mounted gantry at 1900 tonnes per hour.
6. Lucinda – located 110 kilometres north of Townsville and 2.4 miles south of Hinchinbrook Island. The port is operated by the Lucinda Bulk Sugar Terminal. The jetty is 5.8 kilometres in length.
7. Port Alma – located approximately 60 kilometres from Rockhampton southern end of the Fitzroy River delta. Cargoes handled are class 1 explosives, ammonium nitrate, bulk tallow and military equipment for exercises held regularly at the Shoalwater Bay Military Training Area north of Rockhampton.
8. Townsville - is the principal port in north Queensland and services a large area that includes the mining community at Mount Isa and the Yabulu nickel refinery. The main imports are refined fuel products, nickel ore, motor vehicles, cement and general cargo. Exports include raw sugar, copper and zinc concentrates refined lead, copper, zinc and nickel, high analysis fertiliser in bulk, molasses, frozen beef, and live cattle. Townsville is also a regular port of call for cruise ships and naval vessels.
9. Abbot Point – located 25 kilometres north west of Bowen, the port is a bulk coal export facility whose annual capacity is currently 15 million tonnes per annum, although three expansion projects are proposed. The port has one off-shore berth serviced by a conveyor system 2.8 kilometres from the stockpiles and a ship loader with a loading rate of 4600 tonnes per hour.
10. Mackay – located approximately 950 kilometres north of Brisbane, Mackay services a large area that includes the mining communities of the Bowen Basin and four large sugar mills. The principal imports are refined fuel products, fertilisers and general cargo. Exports include raw sugar, refined sugar, ethanol, molasses and grain in bulk.
11. Hay Point – located approximately 40 kilometres south of Mackay it services Queensland coal mines in the Bowen Basin. There are two terminals at the port, Dalrymple Bay Coal Terminal and Hay Point Services Coal Terminal.
12. Gladstone – located approximately 520 kilometres north of Brisbane, just south of the Tropic of Capricorn. It is the principal port in central Queensland servicing a large area rich in natural resources, particularly coal. The principal imports include petroleum products, caustic soda and bauxite, which is refined and re-exported as alumina. Exports include coal, cement clinker, wheat, alumina and aluminium.

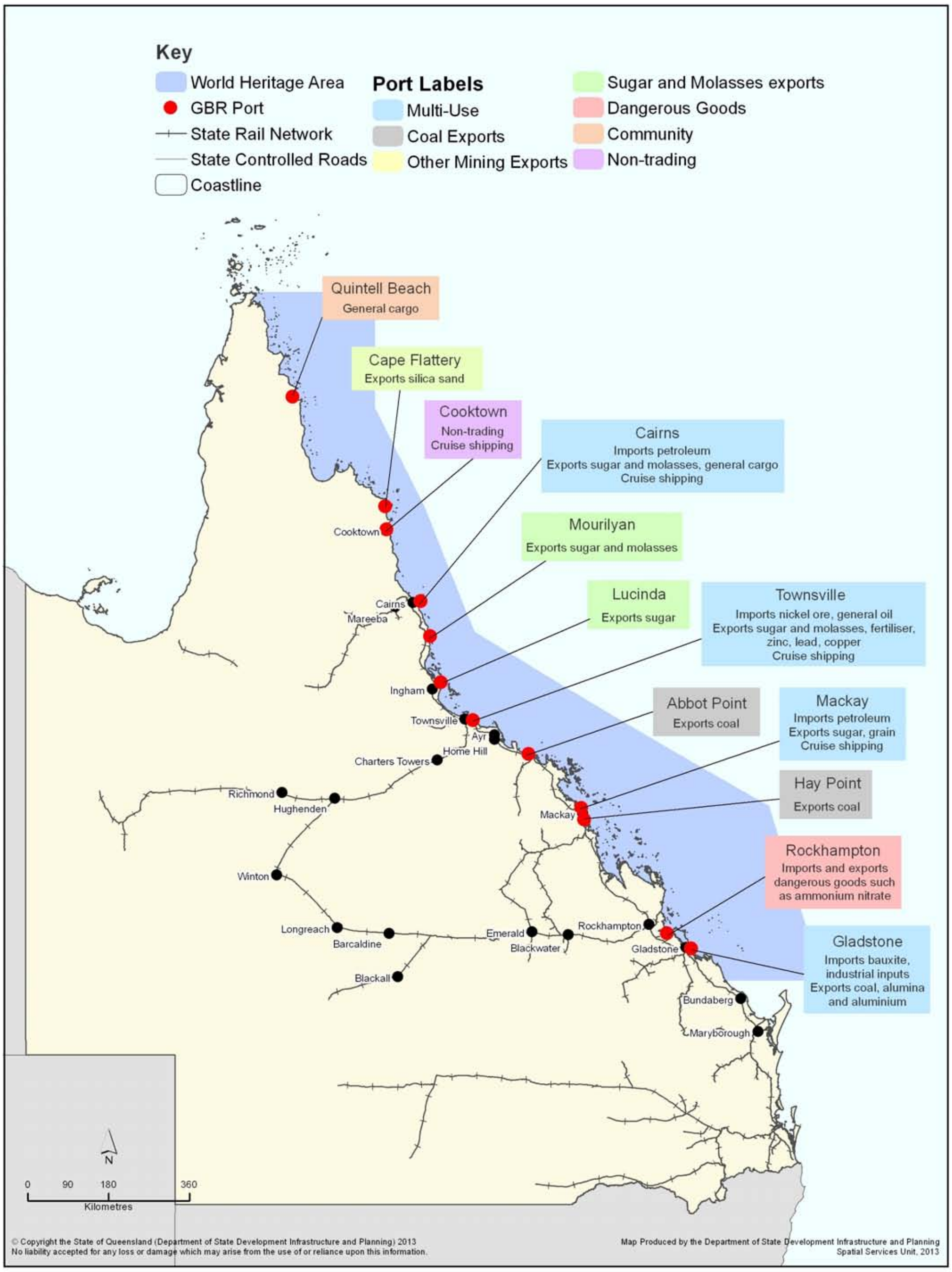



Figure 5.2-3 Major Ports in GBR coastal zone

Source: [15]

A recent literature review and analysis of relevant case studies, both national and international, was conducted by GHD (2013)[25] to investigate and identify best practice environmental management standards relevant to the planning, development and operation of seaports internationally.

The study found that best practice was primarily driven by three key factors:

- Strong regulation, policy environment and governance arrangements
- Consideration and avoidance of environmental impacts through rigorous site selection and master planning processes (incorporating strong stakeholder and community engagement processes)
- Adoption of a site specific and risk-based approach to selecting management options to avoid and mitigate environmental impacts.

Overall this study found that the ability to avoid environmental impacts is greatest at the site selection, master planning and design stages of a port, and hence it is critical that these processes consider environmental and social values along with operational requirements. Monitoring and auditing also enables the success or otherwise of actions to be captured and recognised and lessons shared to inform future projects.

#### 5.2.4.2 Marinas

Marinas can have a number of direct and indirect impacts on coastal areas. Marina development can lead to small scale, localised modification of the coastal environment, sedimentation, water quality issues and drainage impacts.[4]

The use of marinas by small vessels can lead to noise, vibration and risk of boat strike, sewage discharges and therefore further impacts to water quality[4] and the introduction of marine pests.

The development of 'dry land' marinas (marinas dredged from land above tidal water and connected to tidal water by canals) in particular, generate significant volumes of (usually) acid-sulfate generating spoil.

Marinas can also be beneficial and have a positive environmental impact as important habitat for marine species. Artificial marine structures, such as marinas, can provide substrate for settlement of marine invertebrates and flora. Such structures over time often develop into significant local marine communities supporting higher-level species such as fish.[100] However, there is also the potential for marinas to act as introduction nodes for marine pest species which could outcompete native species.

#### 5.2.4.3 Dredging and spoil disposal

Dredging and dredge material relocation (or spoil disposal) is an essential maintenance activity of many larger ports. Dredging is also often required for development or expansion of larger ports. Dredging occurs inshore and the disposal of dredge material is directed to the least environmentally impacting site, which may include on-shore treatment and disposal. Port expansion may also increase the need for dredging to maintain safe access channels for ships entering ports. An increase in the operational size of vessels may also drive the need for dredging to maintain safe access to ports.

Dredging and dredge material relocation can lead to seabed disturbance, transport or resuspension of contaminants, changes to hydrodynamics and coastal processes and degradation of water quality. As dredge material varies from clean to contaminating, depending on the surrounding environment. The degradation of water quality at dredge sites is mainly due to effects from increased turbidity in the water column[101] due to the removal and transportation of dredged material.

Injury or mortality to marine fauna can occur through collision with the dredge mechanism or dredge vessel, and there can also be removal of habitat.[101, 102]

It should be noted that under the *Environment Protection (Sea Dumping) Act 1981* (cth), dredged material that contains contaminants of certain types (such as heavy metals) or above specified proportions, must be disposed of on land.

Dredge material can be relocated either onshore or in the ocean. Either option for relocating dredged material presents potential adverse impacts. Disposed of dredge material onshore can impact surface and ground water, fauna and flora and release ASS.

The physical removal or burial of important feeding habitat can also lead to further indirect impacts on marine fauna, such as the translocation of species or altered recruitment patterns of benthic fauna.[4, 103] For example, seagrass meadows are important feeding grounds for dugong and marine turtle species. The removal or smothering of seagrasses can cause a reduction in the availability of feeding grounds or lead to species translocating to other feeding areas.[101]

While these impacts may be significant, they are usually localised and recovery of the disturbed area after cessation of activities is often expected depending on the intensity and duration of the dredging campaign.[4, 104] The 2013 Scientific Consensus Statement concluded that compared to diffuse sources, most contributions to suspended sediment from point sources such as ports and shipping are relatively small but could be locally, over short periods, highly significant.[36]

One of the recent Regional Development Projects completed by SKM (2013)[24] in support of the Strategic Assessment considered *Improved dredge material management for the Great Barrier Reef Region*. The project provides information regarding impacts associated with dredging and dredge plume migration. The study also developed a generalised framework for developing water quality monitoring programs for dredging projects and considered potential dredge material placement areas across the study sites. Findings reinforce the notion that plume distribution associated with dredging works is affected by currents the plume interacts with and the duration of any dredging campaign. Key aspects identified for further research include conducting dredging assessments at multiple spatial and temporal scales to fully understand potential impacts for design of appropriate management actions. It should be noted that the project has many limitations and the findings should be used cautiously. The project considered only hypothetical scenarios and requires validation to test findings and improve confidence.

#### 5.2.4.4 Shipping and anchorages

Threats associated with shipping operations include ship sourced pollution, noise, vibration and risk of boat strike, and the introduction of pest species. Marine traffic through the GBR and within port channels will create noise and vibration that may disturb marine animals (inshore dolphins and turtles), and creates a risk of boat strike. Ship sourced pollutants, particularly plastic waste, can impact birds and marine fauna through ingestion or entanglement. Ships may carry pest species in their ballast water or in fouling on their hulls that may lead to pest species introduction in port areas.[105] Australia is a signatory to an international convention aimed at reducing bio-threats from ballast water.

Shipping numbers are driven by: the level of demand for Queensland exports; the rate at which supply can meet that demand; and the rate at which Queensland purchases international commodities. Fluctuations in demand, competition between supply countries and production constraints mean that shipping number forecasts change regularly. Given the heavy concentration of coal exports in the throughput of ports in the GBR coastal zone, changes in demand and supply of coal are likely to have a continuing effect on future shipping numbers.

Ships can access ports directly or they may go to an anchorage prior to entering the port. Therefore, changes in shipping numbers can also have an impact on ship anchorage areas. Anchorage areas are managed by GBRMPA. An additional Regional Development Project completed by GHD (2013)[26] in support of the Strategic Assessment considered *Ship Anchorage Management in the Great Barrier Reef World Heritage Area*. The project provides information regarding impacts associated with ship anchorage across project prescribed areas. It also considers management strategies of relevance to controlling impacts from anchoring under future increased shipping pressures. Key aspects identified for further investigation include clarifying feasibility of altering existing anchorage management strategies taking account of the multi-jurisdictional environment that governs shipping within the GBR and its ports.

An environmental management strategy that could be used to avoid, mitigate, offset or adaptively manage identified impacts, particularly under future shipping demand while maintaining efficient port operation was also developed. The strategy has been designed to enable improved management of anchorages to protect and minimise identified impacts on environmental values during the next 25 years as shipping demand increases.

The environmental ship anchorage management strategy aims to be applicable to the current and future use of the port anchorages and underpins ongoing sustainable use of the anchorages in the WHA without putting at risk the values for which the area is recognised.

Overall, the likelihood of shipping related significant impacts on MNES is low, but the consequences could be very high, particularly from the introduction of pest species.

There are a number of initiatives that both the Queensland and Australian governments undertake aimed at reducing the effect of shipping on the marine environment, these are further discussed in the *GBR Region Strategic Assessment Report*.

### 5.2.5 Mining and quarrying

The Queensland mining industry is predominantly based on the extraction of extensive coal deposits and coal seam gas, and to a lesser extent the extraction of other valuable minerals including silica, magnesium and shale oil. The increasing world demand for mineral and energy resources has led to further emphasis on mineral and energy production in Queensland.

Very limited mining occurs within the GBR coastal zone and no mining occurs in the GBRWHA. Operations that do occur are limited to silica mining at Cape Flattery and magnesite mining north of Rockhampton. Small silica sand reserves near Mourilyan Harbour are being investigated for development. Extensive oil shale deposits are also known to occur in the coastal zone from south of Gladstone to north of Mackay however there is a moratorium in place until 2028 preventing any development of the McFarlane oil shale deposit near Proserpine.

There are no operating coal mines in or in close proximity to the GBR coastal zone and no major coal reserves. Small reserves in the Styx Coal Basin north of Rockhampton in Central Queensland and the Laura Basin north of Hopevale are the subject of small scale open cut and underground coal mine proposals. There is also a range of small quarry operations producing a diverse range of products for example black granite, marble, limestone, gypsum and dolomite. Salt harvesting through evaporation ponds have also operated for over 50 years at Bowen and south of Rockhampton.

Pressures that do arise from these activities may result from site development and the extraction, treatment and movement of raw materials.

While mining is prohibited in the GBRWHA and limited in the GBR coastal zone, resources mined inland (Figure 5.2 4) are exported through ports on the GBR coast. Mining can therefore have flow on pressures to the coast through associated infrastructure such as rail corridors, port development and through the generation of waste (or pollutants) that may be released into waterways and catchments that flow into the GBR. The direct major impacts / pressures from mining are the clearing of vegetation and any associated sediment laden runoff. Indirect impacts predominantly stem from a decline in water quality from flood emergency and general releases and runoff from mining operations.

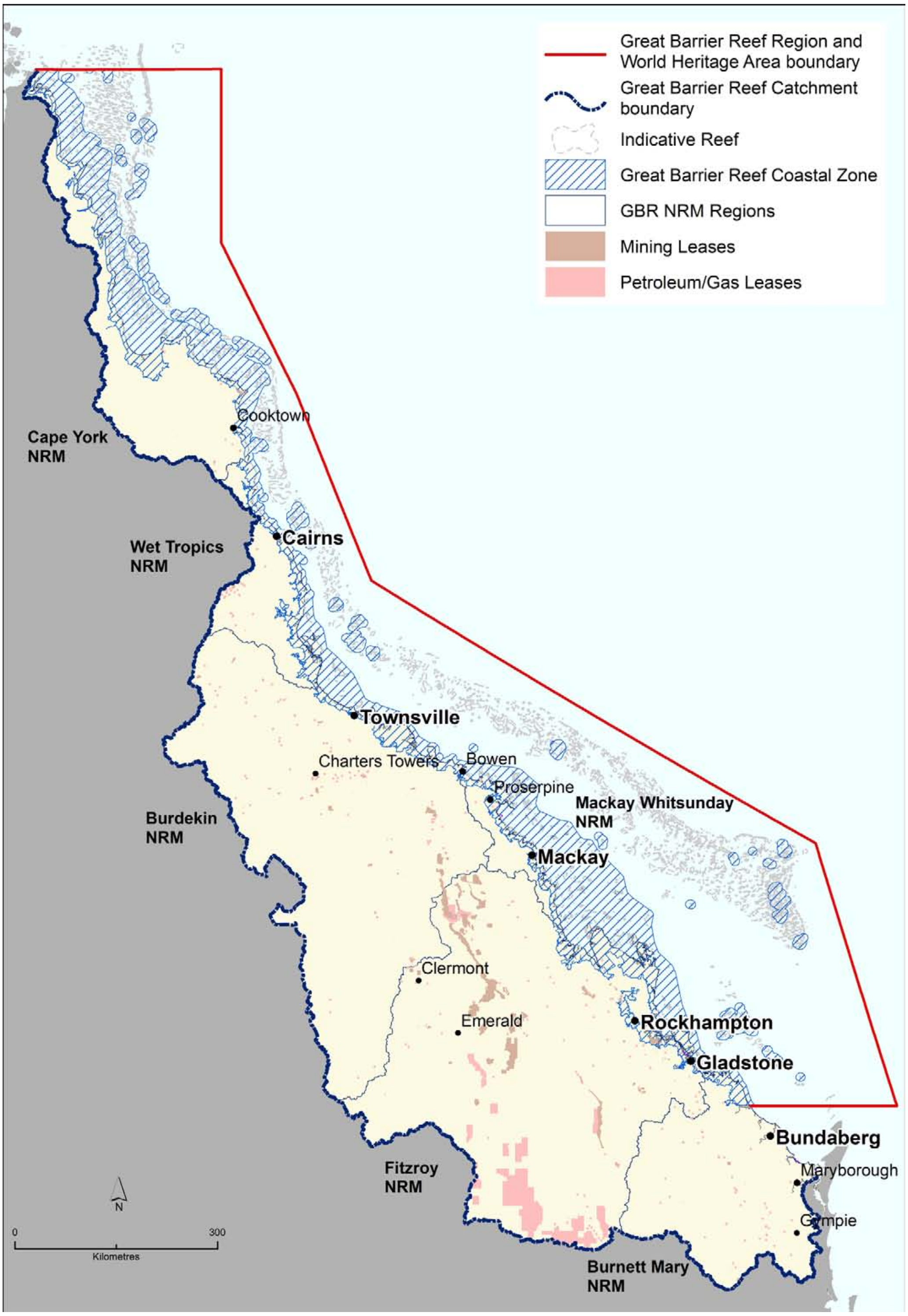



Figure 5.2 4 Mining in Great Barrier Reef catchments.

Source: DEHP, 2013

### 5.2.6 Land and natural resource management

By far the largest current non-natural impact on the GBR results from poor water quality from the GBR catchment. Because poor water quality primarily stems from agriculture, changing agricultural land management practices provides the best means to significantly reduce pollutant loads and improve water quality. Such changes could include changes in the ways in which soils are prepared, crops are treated and cattle are managed.[106] This has been the focus of The Reef Water Quality Protection Plan (Reef Plan) since 2003.

Reduced clearing alongside watercourses which flow into the GBR can also contribute to improved water quality. Vegetation management laws were extended in 2009 to prohibit the clearing of native regrowth vegetation alongside watercourses in the Burdekin, Mackay-Whitsunday and Wet Tropics NRM regions. A range of NRM programs (including the Australian Government Reef Rescue program and Queensland's Regional NRM Investment Program) also support revegetation and fencing of riparian areas to further reduce runoff.

Land and natural resource management practices have improved during the past few decades. Although better management of many agricultural systems has reduced their impacts on the environment, a number of issues around herbicide and nutrient as well as water and soil management remain.

The nature of widespread landscape scale pressures and resource constraints, present challenges to effectively managing more extensive land uses and pressures. The effectiveness of management of the environment varies with land use and the nature of the pressures on the environment. While management effectiveness has improved for most land uses, particularly those that are most intensive, it needs to improve further in many land use systems to protect and sustain their environmental values.

#### 5.2.6.1 Pests and fire management

Pest plants and animals and fire have direct impacts on the condition of MNES habitats and can also directly impact on specific species. Inadequate management of these pressures can lead to alterations to the mix of species in ecosystems through favouring some natural species over others, introduced species outcompeting and replacing native species and predation on native species. Introduced pests can significantly impact terrestrial and marine environments.

Eradication efforts are focused on newly introduced species such as the Asian green mussel (*Perna viridis*) which was found on the hull of a boat visiting Cairns Harbour in 2001 and a successful eradication program was undertaken. Where eradication is not possible management has focussed on limiting the impact of pests. The yellow crazy ant (*Anoplolepis gracilipes*) is an example. This species is widely regarded as an environmental pest and is included as one of the world's 100 worst invasive species. The pest ant has spread extensively since it was first discovered in Cairns in 2001 despite Biosecurity Queensland's ongoing treatment and surveillance activities. Eradication is now not considered possible.[107]

Fire is an integral component of the Australian landscape as many plant communities depend on fire for reproduction or have adaptations to cope with it. Indigenous communities influenced the nature of fire in Australia, burning areas in specific ways and at certain times of the year in order to make hunting, food gathering, and travelling the landscape easier. Over time, this type of burning created a mosaic of burnt patches and as plant communities responded the mix of plants shifted to the fire tolerant trees and shrubs present today.

Grazing has changed the approach to fire management. Overgrazing and associated changes to the burning regime have resulted in woody thickening which has negatively affected viability and biodiversity. In areas where fire has been excluded for some time, wildfires can be devastating and can burn over large areas.

Environmental impacts of these large wildfires include:

- major effects on smaller, less mobile animals and fire sensitive plant communities
- loss of habitat (thought to be a significant cause of species extinctions in Australia)
- disturbance of the ecosystem's natural balance, from which introduced plants (weeds) benefit.

The Queensland Government recently released Planned Burn Guidelines for specific bioregions to help land managers maintain healthy ecosystems and promote awareness of fire management issues.[41]

## 5.3 Pressures and impacts on MNES

The main pressures and impacts produced by development and non-development activities in the GBR coastal zone that have the potential to impact MNES, include the following:

- loss of habitat and connectivity between areas of vegetation
- rural and urban diffuse and point source pollution and associated decline in water quality
- pest and weed species (plants, animals and diseases)
- modified fire regimes leading to altered ecosystems
- disturbance of species, including fishing, hunting, vehicle / vessel strike, noise, light, etc.

- altered flow regime
- climate change, including sea level rise, sea temperature rise, increase in cyclones and other extreme weather events.[20, 34]

These pressures and impacts are discussed further in this chapter. Some of these pressures are acute, while others, such as water quality, are chronic long-term issues. The demonstration cases supporting this Strategic Assessment are included in chapter 7 and provide greater detail on activities and pressures on MNES.

### 5.3.1 Loss of habitat and connectivity

Development since European settlement has resulted in extensive landscape scale changes in ecosystem extent and condition in many GBR NRM regions. Only the Cape York NRM region remains essentially unaffected by the development that has taken place. Extensive portions of the other GBR catchments have been cleared for agriculture (primarily) and urban development (localised). The legacy of broadscale clearing, principally in the southern two thirds of the GBR catchments, has ongoing effects beyond the loss of ecosystems. For example the substantially cleared GBR catchment now contributes high levels of sediment and nutrient run-off to the GBR lagoon.

The 2009–2010 Statewide Landcover and Trees Study (SLATS) shows the average annual clearing rates of remnant vegetation in Queensland, from 1988 to 2010 (Figure 5.3 1). The graph reflects the effect of the 2006 amendment to the VM Act which ended broadscale clearing of remnant vegetation in Queensland. The majority of clearing of woody vegetation was undertaken for conversion to pasture for grazing purposes and this clearing has ongoing effects to the environment, species and habitats.

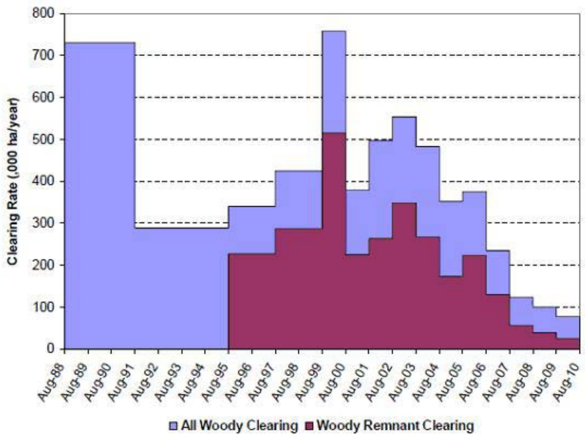



Figure 5.3.1 Average annual clearing rates for remnant vegetation from 1988 to 2010

Source: [108]

Habitat fragmentation is most commonly caused when native vegetation is cleared for activities such as agriculture, aquaculture, mining and urban and industrial development and associated infrastructure, such as roads, rail and power lines.

Riparian ecosystems provide refuge for plants and animals in times of environmental stress. They serve as important wildlife corridors for terrestrial species and are vital for the maintenance of healthy waterways and water quality entering the GBR.[109] Removal or clearing of riparian vegetation can have detrimental impacts on the ecosystems, including the water quality and the terrestrial and aquatic species that rely on these ecosystems.

Freshwater aquatic habitats can be lost or damaged through the construction of dams or weirs and other infrastructure across creeks and rivers.[110] Coastal reclamation refers to the process of creating new land where there was ocean, wetlands, or other water bodies by filling the area with 'land fill' or infrastructure such as groynes (which cause sand to accumulate) and jetties. Reclamation projects are generally for ports, but can also occur for public open space, housing or commercial and industrial developments. About one per cent of the coastline has been directly affected by reclamations, groynes and jetties. Coastal reclamation can affect the water quality of adjacent waters, alter ocean currents and result in the removal of coastal habitats. It can also impede natural drainage from the catchment, alter groundwater levels and potentially expose ASS.

Once habitat has been lost or fragmented, flora and fauna are more likely to suffer effects from other pressures such as altered hydrological regimes and connectivity, and pest and weed species.[110]

The main activities that have contributed to the loss of habitat and connectivity are:

- historical land clearing
- agriculture,
- urban, industrial and port expansion.

### 5.3.2 Decline in water quality

A scientific consensus statement was recently prepared by over 40 leading scientists and provides a synthesis of the latest scientific understanding of land use impacts on Great Barrier Reef water quality and ecosystem condition.[36]

The statement concluded that:

1. The decline of marine water quality associated with terrestrial runoff from the adjacent catchments is a major cause of the current poor state of many of the key marine ecosystems of the Great Barrier Reef.
2. The greatest water quality risks to the Great Barrier Reef are from nitrogen discharge, associated with crown-of-thorns starfish outbreaks and their destructive effects on coral reefs, and fine sediment discharge which reduces the light available to seagrass ecosystems and inshore coral reefs. Pesticides pose a risk to freshwater and some inshore and coastal habitats.
3. Recent extreme weather - heavy rainfall, floods and tropical cyclones - have severely impacted marine water quality and Great Barrier Reef ecosystems. Climate change is predicted to increase the intensity of extreme weather events.
4. The main source of excess nutrients, fine sediments and pesticides from Great Barrier Reef catchments is diffuse source pollution from agriculture.
5. Improved land and agricultural management practices are proven to reduce the runoff of suspended sediment, nutrients and pesticides at the paddock scale.

The Independent Science Panel (the panel) was established in 2009 to provide multidisciplinary scientific advice to the Australian and Queensland Governments on implementing Reef Plan. The panel also oversaw and reviewed the 2013 Scientific Consensus Statement.

***Independent Science Panel remarks***

In reviewing the evidence and conclusions of the Consensus Statement, the Panel noted:

1. There has been excellent progress over the past four years with greater scientific understanding and measurement of 'catchment to reef' processes and progress by the farming community towards land management practices that reduce pollutant loads to the Great Barrier Reef.
2. Water quality modelling, supported by appropriate validation, indicates that early adopters of best practice land management have reduced total pollutant loads - a significant step towards the goal of halting and reversing the decline in water quality to the reef.
3. The recent relative risk assessment is a major achievement allowing the development of cost-effective, regionally-specific management actions to improve water quality. The leading example is the recommendation to reduce nitrogen loads from northern rivers. This will reduce the frequency and severity of primary outbreaks of crown-of-thorns starfish arising from floods in this area, which propagate to many other reefs in the central Great Barrier Reef over 15 year cycles.
4. While current management interventions are starting to address water quality in the Great Barrier Reef, sustained and greater effort will be needed to achieve the ultimate goal of no detrimental impact on the health and resilience of the reef. In addition to continuous improvement, transformational changes in some farming technologies may be necessary to reach some targets.
5. Conditions in terrestrial catchments are most strongly connected with marine receiving waters during floods but the extreme rainfall causing major floods is often episodic and may be separated by decadal droughts. Consequently, there are inherent and complex lags in this system which must be recognised in performance evaluations of Reef Plan. This challenge is best met by investing in continued development of coupled catchment-reef models and the essential collection of adequate data to calibrate and validate the models.
6. The Consensus Statement has identified new knowledge needed to help achieve the ultimate goal of Reef Plan. These are outlined in the supporting chapters of the Consensus Statement and will assist with identifying future research priorities. Future efforts should focus on synthesising the knowledge gained and communicating the results to landholders and decision makers. The Consensus Statement provides an excellent platform for this work.

#### 5.3.2.1 Marine impacts

GBR marine ecosystems and their associated catchments are part of a dynamic, interconnected system. Activities within the catchments affect the condition of coral reefs and seagrass meadows, which have both declined severely in the period since 2008. Marine water quality continues to be negatively affected by the discharge of excess nutrients, fine sediments and pesticides from the adjacent catchments, and poor marine water quality is a major cause for the poor state of many of the key marine ecosystems (coral reefs, seagrass meadows, coastal wetlands and estuaries) of the GBR.

The consensus statement included the following summary of evidence:

- Great Barrier Reef-wide coral cover has declined by approximately 50 per cent since 1985, while coral cover on inshore reefs has declined by 34 per cent since 2005. Coral cover in the northern GBR has remained stable. Causes of coral loss vary from reef to reef, depending on exposure to tropical cyclones, outbreaks of crown-of-thorns starfish or coral disease, elevated temperatures causing coral bleaching and exposure to flood plumes.
- Evidence of the link between poor water quality, specifically nutrients, and crown-of-thorns starfish outbreaks has been greatly strengthened.
- Inshore seagrass meadows along the developed GBR coast (i.e. south of Cooktown) have declined over the past three to five years and are in poor condition.
- Suspended sediment discharges, especially after extreme weather events, negatively affect turbidity in inshore waters, reduce the light required by corals and seagrass meadows and increase the sedimentation of fine particles and organic rich flocs (muddy marine snow) that can smother marine organisms.
- Poor water quality, especially elevated concentrations of and different ratios of nutrients and high turbidity, has been shown to increase the likelihood of bleaching in corals.
- There is evidence of increases in seagrass leaf tissue nitrogen concentrations since 2005. Epiphyte loads that reduce light availability and impair seagrass growth have increased, possibly as a consequence of increased nutrient supply.
- Pesticides pose a low to moderate risk to inshore coral reefs at current levels, but the consequences of long-term exposure at concentrations below those known to affect coral is not understood.
- Many coastal and inshore seagrass meadows of the GBR are exposed to herbicide concentrations that adversely affect seagrass productivity. The contribution of herbicides to recent widespread seagrass losses is unknown.
- The interactions of poor water quality with other pressures such as climate change are largely unknown, but could increase the risk to GBR ecosystems.
- Significant new mangrove stands and landward range expansions in some areas of the GBR are correlated with increased sedimentation due to human activity. However, excessive sedimentation can reduce tree growth, bury seedlings and cause mortality. Increased productivity and growth in response to high nitrogen availability is offset by the increased probability of canopy loss and mortality during periods of drought or storm activity along gradients of increasing salinity. Remaining coastal wetlands are subject to sediment, nutrients and pesticides inputs from rainfall runoff and irrigation tailwater. These inputs and physical modifications to the wetlands contribute to loss of biodiversity and affect wetland structure and function, for example by facilitating weed growth, loss of connectivity between habitats, reduced oxygen levels and flow rate.

#### 5.3.2.2 Relative risks to water quality

A combination of qualitative and semi-quantitative assessments was used to estimate the relative risk of water quality constituents to GBR ecosystem health from major sources in the catchments, focusing on agricultural land uses (Figure 5.3 2 and Figure 5.3 3). Risk was defined as the area of coral reefs and seagrass meadows within a range of assessment classes (very low to very high relative risk) for several water quality variables in each natural resource management region.

The variables included:

- ecologically relevant thresholds for concentrations of total suspended solids and chlorophyll a from daily remote sensing observations
- the distribution of key pollutants including total suspended solids, dissolved inorganic nitrogen and photosystem II inhibiting herbicides in the marine environment during flood conditions (based on end-of-catchment loads and plume loading estimates)
- a factor related to water quality influences on crown-of-thorns starfish outbreaks was included for coral reefs.

The main finding was that increased loads of suspended sediments, nutrients (nitrogen and phosphorus) and pesticides all pose a high risk to some parts of the GBR. However, the risk differs between the individual pollutants, the source catchments and the distance from the coast.

The consensus statement included the following summary of evidence:

- Overall, nitrogen poses the greatest risk of pollution to coral reefs from catchments between the Daintree and Burdekin Rivers. Runoff from these rivers during extreme and early wet seasons is associated with outbreak cycles of the coral-eating crown-of-thorns starfish on the northern GBR shelf (15 to 17 degrees south) that subsequently generate secondary outbreaks throughout the central GBR. GBR-wide loss of coral cover due to crown-of-thorns starfish is estimated to be 1.4 per cent per year over the past 25 years, and a new outbreak is underway. It is estimated that crown-of-thorns starfish have affected more than 1000 of the approximately 3000 reefs within the GBR over the past 60 years.
- Of equal importance is the risk to seagrass from suspended sediments discharged from rivers in excess of natural erosion rates, especially the fine fractions (clays). Whether carried in flood plumes, or resuspended by waves, suspended solids create a turbid water column that reduces the light available to seagrass and corals. High turbidity affects approximately 200 inshore reefs and most seagrass areas. Seagrass loss severely impacts green turtle and dugong populations. On a regional basis, the Burdekin and Fitzroy regions present the greatest risk to the GBR in terms of sediment loads.
- At smaller scales, particularly in coastal seagrass habitats and freshwater and estuarine wetlands, pesticides can pose a high risk. Concentrations of a range of pesticides exceed water quality guidelines in many fresh and estuarine water bodies downstream of cropping lands. Based on a risk assessment of the six commonly used photosystem II inhibiting herbicides, the Mackay Whitsunday and Burdekin regions are considered to be at highest risk, followed by the Wet Tropics, Fitzroy and Burnett Mary regions. However, the risk of only a fraction of pesticides has been assessed, with only six of the 34 pesticides currently detected included in the assessment, and therefore the effect of pesticides is most likely to have been underestimated.
- The ranking of the relative risk of degraded water quality between the regions in the GBR is (from highest risk to lowest):
  - Wet Tropics
  - Fitzroy
  - Burdekin
  - Mackay Whitsunday
  - Burnett Mary
  - Cape York.
- Priority areas for managing degraded water quality in the GBR are Wet Tropics for nitrogen management; Mackay Whitsunday and the lower Burdekin for photosystem II inhibiting herbicide management; and Burdekin and Fitzroy for suspended sediment management.
- From a combined assessment of relative risk of water quality variables in the GBR (using the total area of habitat affected in the areas identified to be of highest relative risk) and end-of-catchment anthropogenic loads of nutrients, sediments and photosystem II inhibiting herbicides, the regional ranking of water quality risk to coral reefs is (from highest risk to lowest):
  - Wet Tropics
  - Fitzroy
  - Mackay Whitsunday
  - Burdekin
  - Cape York
  - Burnett Mary.
- The regional ranking of water quality risk to seagrass is (from highest risk to lowest):
  - Burdekin
  - Wet Tropics
  - Fitzroy
  - Mackay Whitsunday
  - Burnett Mary
  - Cape York.

- Importantly in the Mackay Whitsunday region, 40 per cent of the seagrass area is in the highest relative risk class compared to less than 10 per cent for all other regions. The highly valuable seagrass meadows in Hervey Bay, and the importance to associated dugong and turtle populations in the Burnett Mary region, were not included in the ranking analysis, as they are outside the GBR Marine Park boundaries.
- Both dissolved (inorganic and organic) and particulate forms of nutrients discharged into the GBR are important in driving ecological effects. Overall, increased nitrogen inputs are more important than phosphorus inputs. Dissolved inorganic forms of nitrogen and phosphorus are considered to be of greater concern than dissolved organic and particulate forms as they are immediately bioavailable for supporting algal growth. Particulate forms of nitrogen and phosphorus mostly become bioavailable, but over longer time frames. Most dissolved organic nitrogen typically has limited and delayed bioavailability.
- Little is known about the types and concentrations of contaminants bound to sediment discharged by rivers into the GBR and the risk that these pose to marine ecosystems.

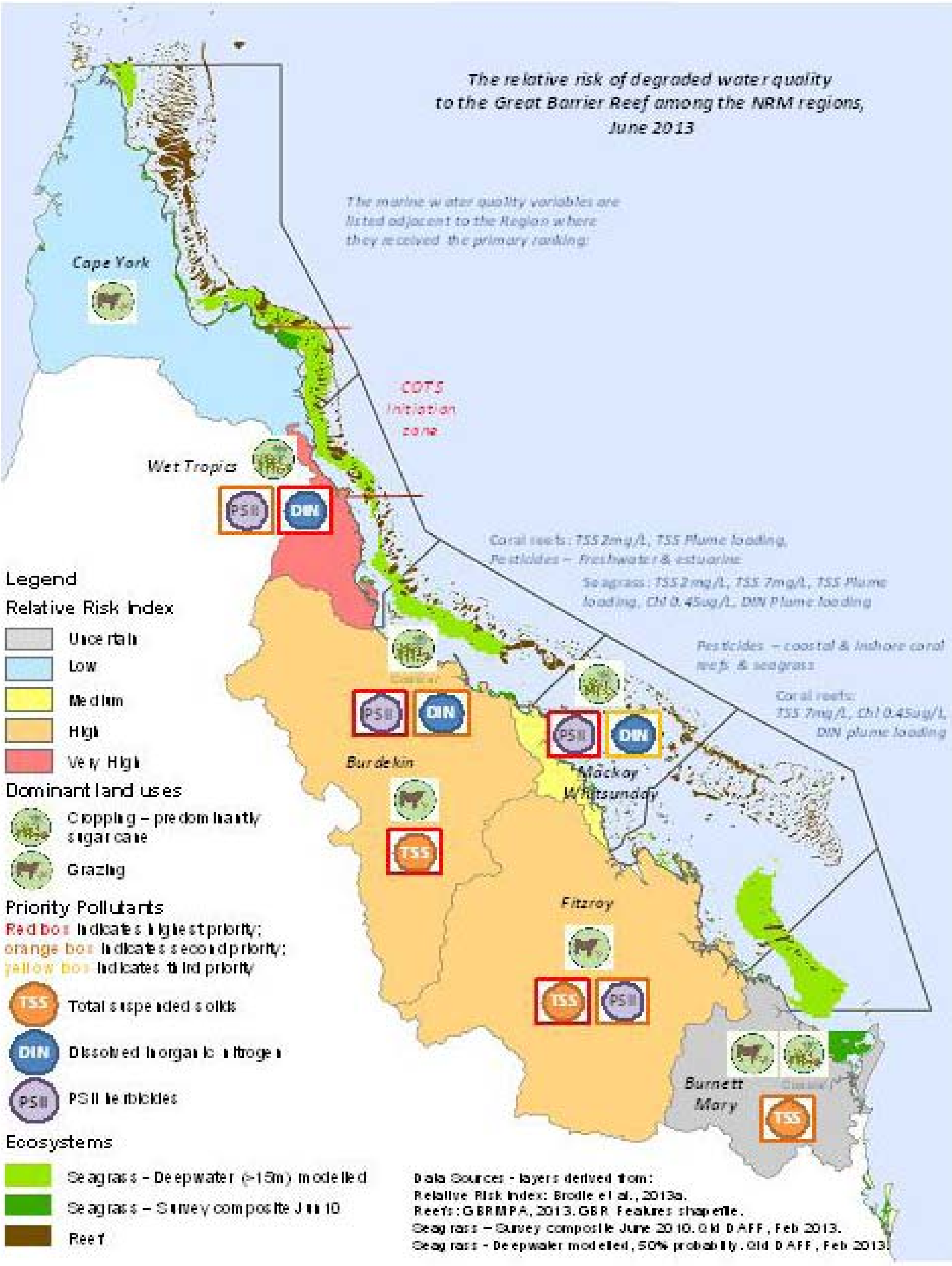



Figure 5.3-2 Overall relative risk ranking

Source: [36]

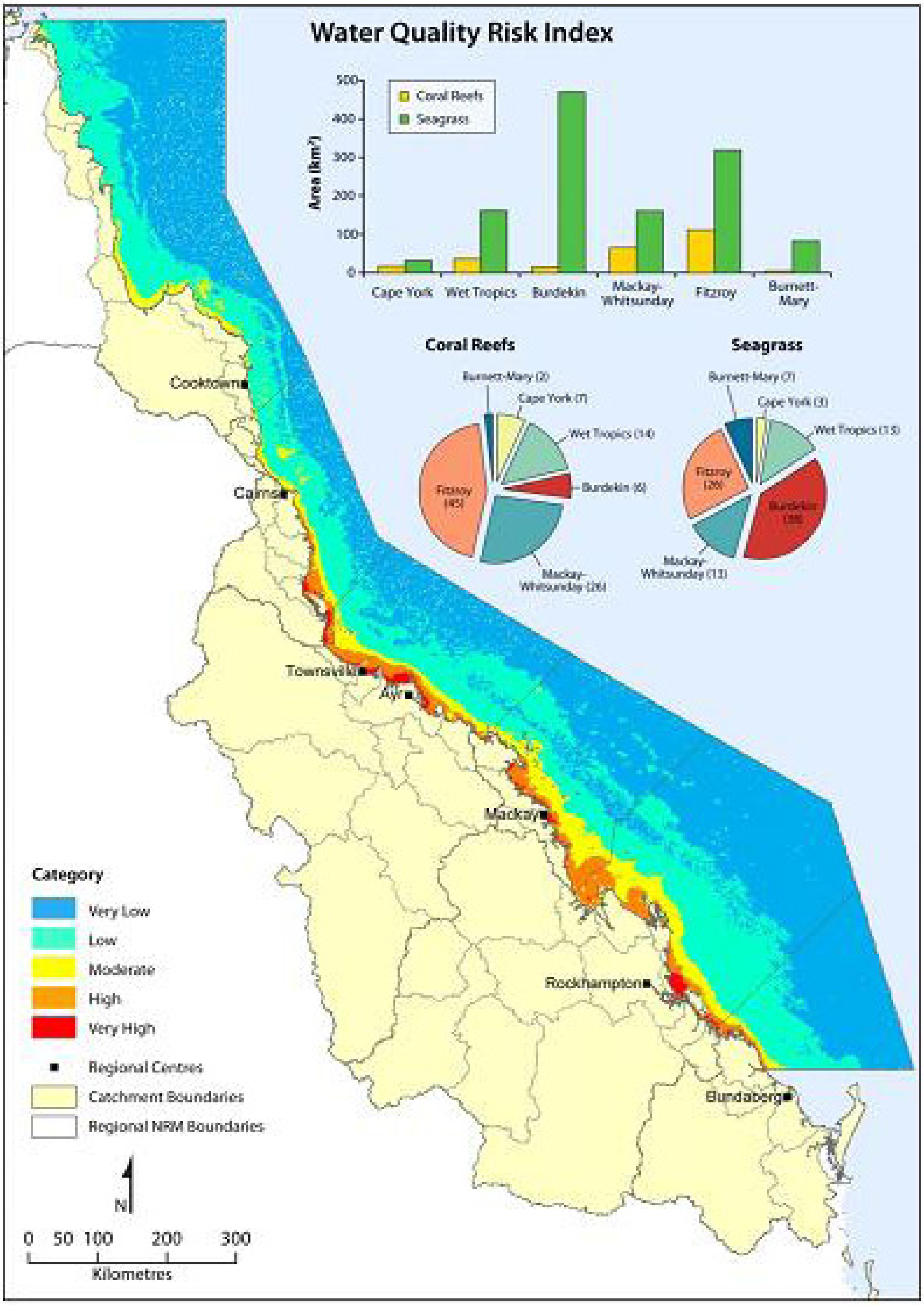



Figure 5.3-3 Relative risk from degraded water quality

Source: [36]

#### 5.3.2.3 Source of Pollutants

Estimates of river pollutant loads to the GBR lagoon have greatly improved since the last Consensus Statement in 2008.[95, 111] The results confirm that water discharged from the catchments into the lagoon continues to be of poor quality in many locations. Furthermore, enhanced modelling and monitoring of total suspended solids, nitrogen, phosphorus and photosystem II inhibiting herbicides, and provenance tracing of sediment, has significantly enhanced our knowledge of major sources and processes contributing to these river pollutant loads. The main land uses contributing pollutant loads are rangeland grazing for sediment, rangeland grazing and sugarcane for total nitrogen and total phosphorus, and sugarcane for photosystem II inhibiting herbicides. The Wet Tropics, Burdekin and Fitzroy regions contribute most to these river pollutant loads.

The consensus statement included the following summary of evidence:

- Compared to pre-European conditions, modelled mean-annual river loads to the GBR lagoon have increased 3.2 to 5.5-fold for total suspended solids, 2.0 to 5.7-fold for total nitrogen and 2.5 to 8.9-fold for total phosphorus. However large differences in changed loads exist between rivers due to human factors; e.g. there is almost no change in loading for most pollutants in northern Cape York rivers but much greater changes in rivers in the central and southern GBR. Mean-annual modelled loads of photosystem II inhibiting herbicides, namely ametryn, atrazine, diuron, hexazinone, tebuthiuron and simazine, are estimated to range between 16 000 and 17 000 kilogrammes per year. The total pesticide load to the GBR lagoon is likely to be considerably larger, given that another 28 pesticides have been detected in the rivers.
- The Fitzroy and Burdekin regions contribute at least 70 per cent to the modelled total suspended solids load to the GBR lagoon from human activity. Grazing lands contribute over three quarters of this load. The dominant sediment supply to many rivers is from a combination of gully and streambank erosion, and subsoil erosion from hillslope drilling, rather than broadscale hillslope sheetwash erosion. Fine sediment (less than 16 micrometres) material is the fraction most likely to reach the GBR lagoon, and is present at high proportions in monitored total suspended solids in the Burdekin, Fitzroy, Plane, Burnett, and Normanby catchments.
- The Fitzroy, Burdekin and Wet Tropics regions contribute over 75 per cent to the modelled total nitrogen load to the GBR lagoon from human activity. Particulate nitrogen comprises by far the largest proportion, followed by dissolved inorganic and dissolved organic nitrogen respectively. Sediment erosion processes, particularly in grazing lands, are sources of particulate nitrogen; sugarcane, other cropping and grazing are sources of dissolved inorganic nitrogen; and land use changes in filter and buffer capacity are the main sources of dissolved organic nitrogen.
- The Fitzroy and Burdekin regions contribute approximately 55 per cent to the modelled total phosphorus load to the GBR lagoon from human activity. Particulate phosphorus comprises by far the largest proportion, followed by dissolved inorganic and dissolved organic phosphorus respectively. Sediment erosion processes, particularly in grazing lands, are sources of particulate phosphorus; sources of dissolved inorganic phosphorus and dissolved organic phosphorus are unclear.
- Most particulate nitrogen and phosphorus is lost or mineralised from fine sediment following delivery to the GBR lagoon and could be readily available for uptake in marine ecosystems.
- The Wet Tropics, Burdekin and Mackay Whitsunday regions contribute over 85 per cent of the modelled total photosystem II inhibiting herbicides load to the Great Barrier Reef lagoon from human activity. Sugarcane contributes 94 per cent of this load. Groundwater potentially may be an important source of photosystem II inhibiting herbicides (as well as dissolved nutrients) to critical near-shore ecosystems of the GBR lagoon; however, insufficient information is available to evaluate the risks.
- The role of modified freshwater flow regimes in driving pollutant transport and affecting reef condition, through surface water diversion, dam construction and wetland drainage and deforestation, has not been fully analysed but is important.
- Compared to diffuse sources, most contributions to suspended sediment, nutrient and pesticide loads from point sources such as intensive animal production, manufacturing and industrial processing, mining, rural and urban residences, waste treatment and disposal, ports and shipping are relatively small but could be locally, and over short-time periods, highly significant. Point sources are the major sources of pollutants such as metals, industrial chemicals and pharmaceuticals. Whilst point sources are generally regulated activities, monitoring may not include this broad range of chemicals, and monitoring and permit information is not always available. In contrast to nutrients, sediments and pesticides, there is a lack of knowledge of the risks posed by these chemicals to GBR ecosystems.

The four main activities which contribute to the decline in catchment water quality, either entering or within the GBR are:

- diffuse runoff from agricultural lands, including sediments, nutrients and pesticides (broadscale major impact)
- diffuse runoff from urban and industrial areas (localised minor significance)
- point source discharges from urban and industrial areas (localised minor significance)
- dredging, dredge spoil disposal and reclamation (localised impacts of variable significance).

### 5.3.3 Pest and weed species (Animals, plants and diseases)

Pest and weed species (plants, animals and diseases) can cause significant ecological impacts in coastal ecosystems and habitats, and have contributed to national reductions in biodiversity and productivity.[21] Impacts from pest and weed species create pressures on natural ecosystems by out-competing or directly preying on native species, modifying habitats or affecting the health and resilience of native species.[112]

Each year Biosecurity Queensland produces a comprehensive series of pest distribution maps that show where over 100 weeds and pest animal species occur in Queensland. The data for the maps comes from an annual pest distribution survey. Information for each pest is gathered through regional workshops, where participants include local government, Biosecurity Queensland officers and others with knowledge of local pest locations. Species included in the survey each year are:

- Class 1 pest animals and plants
- most Class 2 pest animals and plants
- a selection of Class 3 emergent species and pest plants

Pest and weed species have been identified in each NRM region and have been prioritised for action. The primary activity (or lack of activity) that contributes to the impact of pests is land and natural resource management programs.

#### 5.3.3.1 Pests animals

Within the GBR coastal zone a number of pest species are widespread, including cane toads, cats, pigs, foxes, rabbits and wild dogs. There are also localised populations of feral horses, deer and Indian myna bird.

Pest animals are particularly active around urban or human settlement areas due to the abundance of food and other resources. Rats and dogs in coastal areas are known to cause significant impacts to seabird, turtle and cassowary populations[4] through direct predation of nesting areas and disturbance of habitat. Other pest animals such as foxes, feral pigs and cats have adverse ecological impacts due to competition for food, land degradation and direct predation.[113]

Other pressures such as a changing climate, habitat loss, fragmentation and degradation, and pollution can exacerbate the impacts of pest species. Equally, pest species can exacerbate other pressures, such as weed growth increasing the incidence of fires and the spread of disease.[20]

Pest species may also impact marine coastal regions, especially in marinas, ports and other developed coastal areas. Marine invasive species are normally translocated via the hulls of vessels or in ballast waters and they have the potential to significantly impact marine industries, commercial fisheries, aquaculture industries, marine ecosystems and biodiversity.[114] Marine invasive species adversely impact native species through direct competition for resources, predation, disease and competitive exclusion. Invasive marine species including the Asian green mussel and Asian bag mussel have been previously found in coastal ports, having been transported to the port on a vessel's hull.[4, 114]

An invasive species can also be a species occurring outside its normal distribution, often due to human activities or interference, which causes damage to and threatens valued environmental, agricultural or other social resources.[113] Traits of an invasive species that make them particularly threatening are few natural predators and high reproductive rates.[113]

#### 5.3.3.2 Plants

A large number of weed species have been observed in the GBR coastal zone. Most have localised distributions around population centres. However, seven species are widespread within the GBR coastal zone, including:

- Prickly pear (*Opuntia spp.*)
- Lantana (*Lantana camara*)
- Mexican poppy (*Argemone ochroleuca*)
- Noogoora burr (*Xanthium occidentale*)
- Parthenium (*Parthenium hysterophorus*)
- Rats tail grass (*Sporobolus spp.*)
- Rubber vine (*Cryptostegia grandiflora*)

Figure 5.3-4 Prickly pear (*Opuntia spp.*), Lantana (*Lantana camara)*, Noogoora burr (*Xanthium occidentale*), Rubber vine (*Cryptostegia grandiflora*) Source: [115]

Weeds are a particular problem in areas where they are easily transported and where no or poor weed control practices are in place. Invasive weeds have the potential for high economic and environmental impacts causing damage to landscapes and coastal areas, changing the balance of ecological communities and most often displacing native vegetation. Two highly invasive weeds that have particular impacts on coastal dune systems and displace native vegetation are bitou bush (*Chrysanthemoides monilifera ssp. rotundata*) and boneseed (*C. monilifera ssp. monilifera*).[21]

Invasive plants can drastically alter native species composition and ecosystem function. For example rubber vine invades riparian areas, reaching densities of up to 5000 plants to a hectare. It smothers native vegetation and, as a result, is likely to impact negatively on riverine species.[16]

Within the Wet Tropics WHA, the majority of weeds are associated with boundary edges and infrastructure corridor clearings such as powerline easements and road verges which act as conduits for weed dispersal. Weeds generally compete vigorously with native plants for light, water, nutrients and pollinators and often prevent native species regenerating in disturbed areas. Weeds can affect animal biodiversity by eliminating, reducing or increasing food supplies, habitat and nesting sites.[40]

A major environmental weed in the Wet Tropics WHA is the Pond apple (*Annona glabra*). It is a small tree that becomes quite dense and particularly prefers the silty alluvial soils of coastal flood plains. This weed is mainly dispersed by water, especially in floods. Pond apple competes with ferns, grasses, shrubs and sedges, and prevents regeneration of native species. Dense infestations can result in the replacement of rainforest native vegetation or mangroves with a monoculture of pond apple, impacting on the area's ecology.[117] Disturbed flood prone ecosystems are the most susceptible to pond apple invasion.[118]

#### 5.3.3.3 Diseases

Diseases can lead to significant ecological, social or economic harm. Some of the most recent diseases impacting Queensland include:

- Domestic and feral cats spread *Toxoplasmosis gondii* which has been documented to cause blindness and death in rock wallabies.[51]
- Hydatids, a type of cyst formed by tapeworm larvae, may also be contracted from dogs and has proven fatal for the Proserpine rock wallaby.[51]
- Myrtle rust is a serious fungal disease that was detected in Queensland in December 2010. It affects plants of the Myrtaceae family, the second largest plant family in Australia and is dominant in many of Australia's forests and woodlands (including the Wet Tropics WHA). The rust can cause deformed leaves, heavy defoliation of branches, dieback, stunted growth and even death.
- Turtle fibropapilloma disease, which causes tumours to grow on and inside turtles, has been previously considered a significant threat to marine turtles. However, long-term mark-recapture studies are showing good recovery of turtles following infection. Domestic and feral cats have been linked to the spread of this disease.
- Chytridiomycosis, an amphibian disease, continues to pose a significant risk to Queensland's frog populations (e.g. tinker and day-frogs).[119]

The main activities that have contributed to the pest and weed species are:

- urban and industrial development
- port development
- agriculture
- historical land clearing

### 5.3.4 Modified fire regimes

Modified fire regimes have been associated with changes to species and community abundance, diversity and distribution and have resulted in a loss of biodiversity.[120] Australia's terrestrial landscape has been shaped by climate and the fire management practices of Indigenous people over thousands of years. Since European settlement fire regimes have been significantly altered in many landscapes (i.e. season, frequency, intensity and extent). This has generally resulted in increased burning to protect life and assets, and the promotion of ecosystems more suitable for grazing cattle and sheep. However, in some areas, particularly conservation reserves, less frequent burning has occurred but fires have been of greater intensity.[121]

Optimal fire regimes vary. Some terrestrial species, communities and ecosystems are dependent on particular fire regimes, whilst others require absence of fire. Therefore fire can have both positive and negative impacts depending on whether an appropriate or inappropriate fire regime is applied to an area.[120]

The fire regimes that threaten most listed species and communities in Queensland are those that are too frequent or too intense. Generally, fires occurring late in the dry season are most problematic. Climate change may contribute to the frequency of fire occurrence.

The main activities that contribute to modified fire regimes include:

- land and natural resource management regimes, including rangeland (savannah) grazing management
- burning associated with agricultural practices.

### 5.3.5 Disturbance of species

Human-caused disturbance occurs when human activities result in behavioural or physical changes to wildlife or their habitats. Beaches are areas where humans, dogs, and off-road vehicles share the resources and space. Beaches are also important breeding and nesting habitats for migratory seabirds, shorebirds, waterfowl and marine turtles. Human activities can upset delicate balances in the lifecycles of birds and turtles, particularly during the short window of time when birds must find a mate, build a nest, incubate eggs, and raise young, or when turtles come ashore to lay eggs or when young turtles hatch and find their way to the sea.

Disturbance from port operations includes noise, dust and lighting. Noise will be generated during port construction (particularly pile driving and seismic activities). Ongoing noise will occur through the operation of the rail and conveyor system, port facilities, dredging and shipping. Noise is a particular concern for cetaceans including dolphins.

Coastal developments cause changes in light horizons, which increase mortality of marine turtle hatchlings. Hatchlings instinctively move toward the brightest light (which would naturally be the sun or the moon) leading them towards the ocean, however, artificial lights in urban environments, or camp sites can disorientate hatchlings often resulting in the hatchlings being eaten by predators or dying from exhaustion.

Barbed wire fences are generally associated with cattle grazing operations, constructed by either the grazier to contain cattle, or by adjacent landholders to restrict cattle from entering their land. Entanglement in barbed wire is a threat to wildlife generally[122] and has caused the death of mahogany gliders in the wet tropics. It is presumed that gliders become entangles in barbed wire while gliding. An entangled animal is likely to die from entanglement, dehydration, starvation or predation.

Roads fragment habitat, create barriers to species movement, produce edge effects, introduce exotic species and cause substantial mortality through direct strikes. Almost 4000 kilometres of highways, roads and tracks criss-cross the Wet Tropics WHA[123], which is home to the southern cassowary. During 2001–05, 28 cassowaries were killed on roads at Mission Beach – amounting to 76 per cent of the total cassowary deaths recorded at that location (QPWS unpublished data).

Given that cassowaries are long-lived, slow-reproducing animals with lengthy parental care and low juvenile survival, each road death of an adult bird may potentially influence population dynamics and the population's reproductive fitness.[126]

Collection or take of fauna and flora may further reduce the number of threatened species. Take can occur illegally or due to other extractive activities, including fisheries by-catch. Introduction of turtle exclusion devices on trawl nets has addressed impacts of by-catch on turtles. However, other risks to marine megafauna remain.

Dugongs are particularly at risk from boat strikes from recreational or small commercial vessels, as their feeding habitats are shallow inshore waters where seagrasses grow. Boat strike is more likely to occur in areas adjacent to population centres that may also be important foraging grounds for dugongs.[124]

Dugongs are also under threat from diminishing food sources. Seagrass meadows, are being detrimentally affected by pollution (including herbicide runoff, sewage, detergents, heavy metals, hypersaline water from desalination plants, and other waste products)[125], as well as algal blooms, high boat traffic and turbid waters. Dugongs are being forced to rely on smaller seagrass meadows for food and habitat. When the seagrass habitat becomes unsuitable for foraging, dugong populations are displaced and placed under greater threat. Other direct threats to dugongs include incidental mortality in gill fishing nets and shark nets.

The main activities that contribute to disturbance and mortality of species include:

- urban and industrial development
- port development and dredging
- tourism activities and development
- agriculture
- land management practices

### 5.3.6 Altered flow regime

Water resource development includes changing the natural flow regimes of waterways through the construction of dams or weirs, and through the take of water from river systems or overland flows. These activities are primarily undertaken for water supply purposes, to facilitate rural, urban, industrial and mining development, to generate electricity, or for flood control or mitigation purposes.[127]

Changing the natural flow regime of rivers and streams puts pressure on both coastal and terrestrial ecosystems. The scale of development varies considerably so impacts can be river basin wide or very localised. The result may be barriers and altered riverine and estuarine flow regimes that change the timing and magnitude of flows or prevent fish migration and disrupt natural breeding cycles.[127] As many as 78 GBR marine and estuarine fish species use the freshwater systems for part of their lifecycle and can be affected by changes in water flow and artificial barriers.

Natural flow regime is the key driver of river and wetland ecosystems.[128] Aquatic species have evolved life history strategies in direct response to the natural flow regimes and the maintenance of natural patterns of longitudinal and lateral connectivity is essential to the viability of many riverine species. The invasion and success of exotic and introduced species in rivers is facilitated by the alteration of flow regimes.[128]

Activities such as agriculture, urbanisation and industrial development can increase the magnitude and timing of freshwater flows into the GBR lagoon. For example, the smooth surfaces of roads and other urban infrastructure can increase the volume and speed of freshwater flow compared to natural vegetation and soil.

Large freshwater inflows can have negative effects, for example widespread damage to seagrass meadows or the loss of estuarine areas, largely salt and mud flats, is likely to have significant impacts on shorebirds, particularly through the disruption of tidal systems. However increased freshwater can also have positive effects, for example on breeding and recruitment of estuarine and marine fish of commercial and recreational value including barramundi and king threadfin. Generally, increased freshwater enhances estuarine productivity and connectivity, and improves fish recruitment and growth.

The main activities that drive the development of water resources and potentially alter flow regimes are:

- urban and industrial development
- agriculture

### 5.3.7 Climate variability and change

Extreme weather events can bring high winds and coastal storm surges, driving rain or no rain for long periods, sudden frosts and storms of hail. Droughts, floods and erosion from wind and debris are highly damaging to essential habitats and extended or abrupt temperature changes can be beyond the survival range for some plants and animals.

The *State of the climate*[90] provides an updated summary of long-term climate trends for Australia, including the following observations:

- Long-term global climate trends are occurring alongside natural weather variations. For example, recent Australian heavy rainfall and flooding can be explained largely by strong La Niña events.
- Extreme weather events, principally cyclones and flooding are natural and relatively common extreme weather events experienced in the GBR coastal zone. However, since 1993, the rates of sea level rise to the north and northwest of Australia have been 7 to 11 millimetres per year, two to three times the global average, and rates of sea-level rise on the central east and southern coasts of the continent are mostly similar to the global average. These variations are at least in part a result of natural variability of the climate system.
- It is likely (with more than 66 per cent probability) that there will be fewer tropical cyclones in the Australian region, on average, but the proportion of intense cyclones is expected to increase.
- Long-term warming trend indicates that each decade has been warmer than the previous decade since the 1950s.
- Sea-surface temperatures around Australia have increased faster than the global average and averaged over the decades since 1990 have increased for every decade.
- Australian annual average daily maximum temperatures have increased by 0.75 °C since 1910, with most of the warming trend occurring since 1970.
- Climate change will interact with most other pressures, increasing the risks posed by weeds, pests and diseases,

fire and habitat fragmentation.[118] The effects of climate change may manifest at an individual species level, community level or for whole ecosystems.[129] Changes in climate could potentially shift ecosystems beyond thresholds or tipping points such that an ecosystem no longer functions in the same way.

It has been predicted that the magnitude and rate of the change in climate may lead to changes in the abundance and distribution of species and even extinctions.[121] This could change the structure, composition and functioning of communities and ecosystems.[121] Bioclimatic models suggest climate change is likely to have catastrophic effects on many of the endemic vertebrate species occurring in the Wet Tropics WHA.[130] This modelling predicts approximately 50 species becoming globally extinct with only a moderate average temperature increase.

The Reef Plan 2013 Scientific Consensus Statement includes a summary of the effects of climate variability on the GBR.[36] It concluded that *recent extreme weather – heavy rainfall, floods and tropical cyclones – have severely impacted marine water quality and Great Barrier Reef ecosystems. Climate change is predicted to increase the intensity of extreme weather events.* It was supported by the following summary of evidence:

- In 2010, a historically strong La Niña weather pattern developed, replacing an El Niño pattern. Between 2009 and 2012, seven cyclones affected North Queensland which produced substantial physical damage to shallow water ecosystems and record flooding. Extreme rainfall in 2010–2011 and 2012–2013 resulted in extensive flood plumes along most of the coast and across much of the continental shelf in some regions.
- Recent loss of seagrass habitat as a result of severe weather events and degraded water quality has led to increased mortality of dugongs and green turtles.
- Reducing end-of-catchment loads of nutrients, sediments and pesticides will help enhance reef resilience in the face of continuing climate change pressures. For example, if the impacts of crown-of-thorns starfish were reduced following nitrogen load reduction from the Wet Tropics, coral cover is predicted to either recover or at least stabilise.

Cyclones, especially severe tropical cyclones such as Tropical Cyclone Yasi, place pressure on the terrestrial environment as well, by destroying large tracts of vegetation that form habitat and food sources for endangered native animals. The widespread rain following such a cyclone also causes further damage. Tropical Cyclone Yasi wreaked havoc on the food sources for the mahogany glider and the habitat of the endangered southern cassowary.[119]

Some species may respond better than others to climate change. The most vulnerable species will likely be those with a restricted geographic and climatic range that are unable to migrate successfully to suitable alternative habitat, or those that are already suffering depleted small populations as a consequence of the effects of other pressures.[121] It is expected that MNES in near shore environments (both marine-estuarine and terrestrial) with exposed, steep slopes located close to the coast (such as in the Wet Tropics WHA) are most vulnerable to impacts of climate change.

The ability of ecosystems and species to withstand, recover or adapt to effects of climate variability and change will greatly depend on their resilience.[120] Resilience is dependent on the cumulative effects from the many other pressures that activities may place on the environment. The Program recognises the impacts of climate change on MNES and seeks to strengthen the resilience of MNES by limiting loss of habitat and managing pressures impacting on their condition.

## 5.4 Relative significance of activities, pressures and impacts

Not all pressures on MNES are of equal significance and while some activities may cause significant impact at a localised scale they may have little or no broader impact. Some pressures have significant broadscale impacts but are naturally occurring (such as extreme weather events), or are induced by human activity occurring at a very broad, even global scale (such as human-induced climate change related pressures).

Both extreme weather events and the impacts of climate change are beyond the capacity of the Program to influence. However, maximising the resilience of MNES to these pressures by addressing other pressures that the Program can influence will help build resilience against the expected impacts of climate change and extreme weather events.

In a resource-constrained management environment it is necessary to prioritise addressing the impacts with activities that generate the maximum beneficial outcome for the effort expended. Table 5.4 1 provides an overall assessment of the relative significance each impact has on each MNES and Table 5.4 2 provide an overview of which activities are the most significant in generating these pressures. This approach aims to identify which activities are both significant in terms of the impacts they can have on MNES and for which the Program can effectively address. The assessment method and grading statements indicating the relative significance of pressures are fully described in chapter 3.

Table 5.4 1 Relative significance of pressures and impacts on MNES values

| Pressure/ impact | MNES values in GBR coastal zone | | | | | | |
|---|---|---|---|---|---|---|---|
| | GBR WHA | Wet Tropics WHA | Bowling Green Bay Ramsar site | Shoalwater Bay and Corio Bay Ramsar site | Threatened Species essential habitat | Migratory Species feeding, breeding, roosting habitat | Threatened Ecological Communities |
| Climate Change Extreme Weather | Very high effect | Very high effect | Very high effect | Very high effect | High effect | Very high effect | High effect |
| Loss of habitat and connectivity | High effect | Very Low effect | Low effect | Very low effect | High effect | Low effect | High effect |
| Decline in water quality | Very high effect | Low effect | Low effect | Very low effect | Low effect | Very Low effect | Very Low effect |
| Pest and weed species | Very high effect | High effect | High effect | Low effect | High effect | High effect | High effect |
| Modified fire regimes | No effect | Low effect | Very low effect | Very low effect | Very high effect | Low effect | Very high effect |
| Disturbance of species | High effect | Very low effect | Very low effect | Very low effect | Low effect | Very low effect | Very low effect |
| Altered flow regimes | Low effect | Low effect | High effect | Very low effect | Low effect | Low effect | Very Low effect |

Table 5.4 2 Effect of activities in generating significant pressures and impacts on MNES

| Activity | Pressure/impact | | | | | |
|---|---|---|---|---|---|---|
| | Loss of habitat | Decline in water quality | Pest and weed species | Modified fire regimes | Disturbance of species | Altered flow regimes |
| Urban and industrial development | Very high effect | High effect | High effect | No effect | High effect | High effect |
| Tourism development and use | Low effect | Low effect | Low effect | No effect | Low effect | Low effect |
| Port development and dredging | High effect | High effect | High effect | No effect | High effect | Very Low effect |
| Agriculture | Very high effect | Very high effect | Very high effect | Very high effect | High effect | High effect |
| Mining and quarrying | High effect | Low effect | Very Low effect | Low effect | Low effect | High effect |
| Natural resource management | Positive effect | Positive effect | Very high effect | Very hiigh effect | Low effect | Low effect |

The analysis recognises that the impacts of extreme weather and climate change and variability cause the most significant impacts on MNES values. However, to counteract such impacts the resilience of MNES needs to be strengthened by reducing the effect the other impacting pressures. The key pressures and impacts that need to be targeted to improve the resilience of MNES are:

- Loss of habitat and connectivity
- Decline in water quality
- Impact of pests and weeds
- Altered fire regimes.

In the analysis of which activities are generating these key pressures it is recognised that the impacts of some activities are broadscale, permanent and ongoing while others are localised and/or short lived. For example, agriculture has resulted in extensive and permanent loss of MNES habitat and ecosystems, as well as generating major ongoing impacts associated with declining water quality affecting waterways, wetlands and the GBR lagoon. However, the likelihood of future broadscale clearing for agriculture is small given Queensland's vegetation management regime, which is part of the Queensland Government's Program.

Overall, there are several activities that require management through the Program to ensure significant impacts on MNES do not, or do not continue, to occur. The activities that require management through the Program are:

- Agriculture

  - reverse the decline in water quality

- Urban, industrial and port coastal development

  - avoid or minimise or offset short and long-term significant impacts

- Land and natural resource management

  - pest and fire management, ecosystem rehabilitation; environmental water flow regimes

Figure 5.4 1 shows the main activities, pressures and impacts in the GBR coastal zone.

One of the challenges of the Program is to address the chronic issues associated with improving catchment water quality and addressing pest and fire threats within remnant areas containing MNES values. The enhancement components of the Program will be the more important with respect to ensuring the extent and condition of MNES in the GBR coastal zone is maintained over the life of the Program. The effectiveness of the Program is addressed in chapter 7.

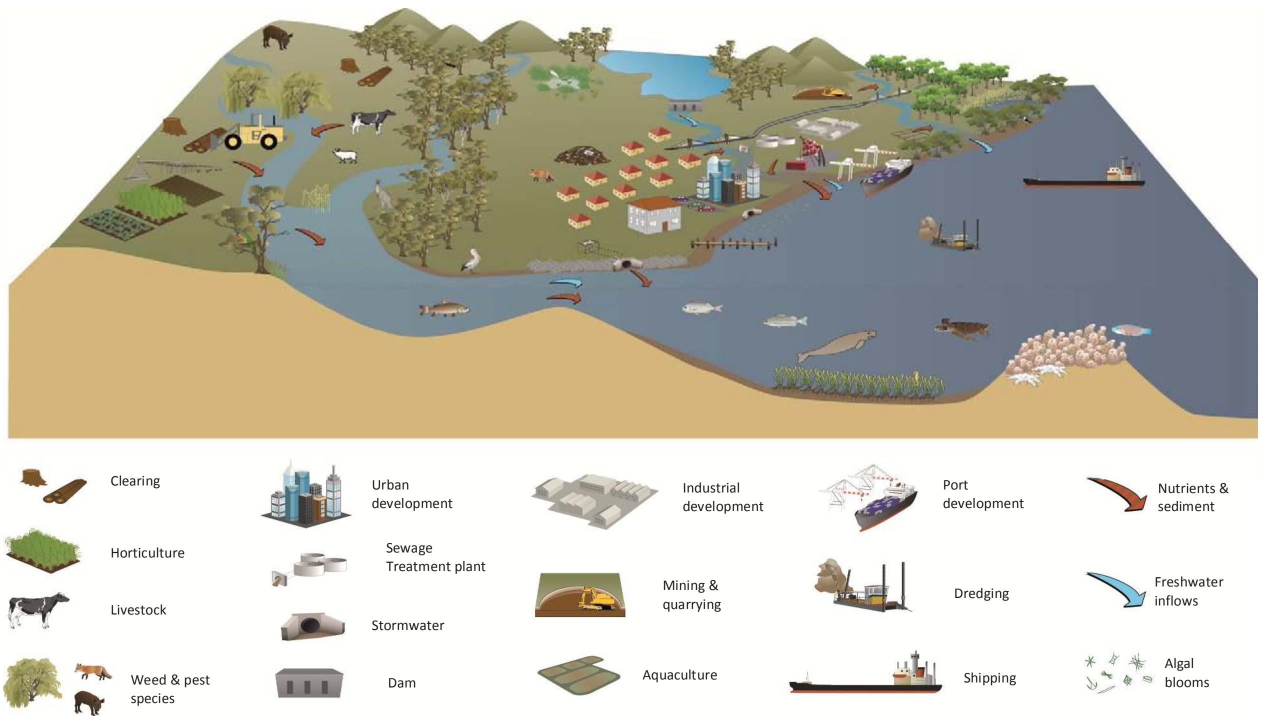



Figure 5.4 1 Activities, pressures and impacts in the GBR coastal zone

## 5.5 Cumulative impacts on MNES

Cumulative impacts are the combined and incremental environmental effects from existing and proposed pressures on the GBR coastal zone and subsequently on the GBR, the interaction between those impacts, and the accumulation of past, present and potential future activities. For the purposes of the strategic assessment, the assessment of cumulative impacts is taken to include all impacts on the GBR and adjacent coastal zone. This is broader than the sense in which cumulative impact assessments are applied in project-specific Environmental Impact Statements (EISs), which just refers to the assessment of the combined impacts of several planned developments.

The purpose or desired application of the assessment should determine the approach used. The assessment used in this report focuses primarily on providing direction for targeted management actions, to maximise effectiveness and efficiency of the Programs, rather than quantification or detailed description of the potential cumulative impacts.

Cumulative impacts in the GBR coastal zone are measured through numerous monitoring activities at a regional and local level. A cumulative impact assessment considers many potential, direct and indirect impacts, to provide an indication of the compounding effects over time of these impacts. The cumulative impacts of an activity (taking into account the effectiveness of the program component that governs it) can be viewed as the addition to the aggregate effects on a species, community or ecosystem from previous activities.

The methodology for assessing cumulative impacts is challenging and is still developing nationally and internationally. For instance, it may be difficult to assess cumulative impacts where there are a range of individual projects (either planned or completed) with uncertain impacts, or where future development is uncertain.[131]

The assessment of cumulative impacts provides a much needed context for environmental management. Considerable research has been devoted to establishing an acceptable methodology to identify pressures on the environment, the activities and events which contribute to cumulative impacts and an assessment of the multiplicity of resultant impacts. Some consistent themes raised include the scale and extent of potential impact; the subsequent need for a collaborative approach to assessment and management; and a clear understanding of how this information will be used to protect environmental values (Figure 5.5 1).

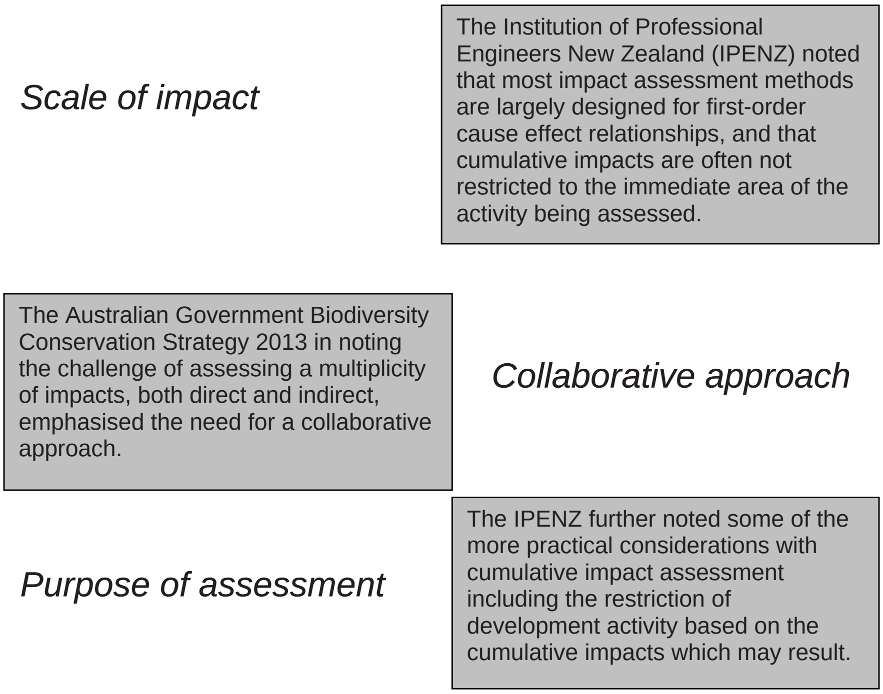



Figure 5.5-1 Key themes in approaching CIA methodology

A project was commissioned by SEWPaC to develop a framework to support decision making that would enhance the resilience of GBR ecosystems to ensure they have the capacity to deal with future impacts, including climate change. The framework was intended to be regionally scalable, facilitate analysis of cumulative impacts, allow scenario testing, and help identify management actions that can best maintain or improve the reef's resilience.

The Cumulative Impact and Structured Decision-Making (CISDM) framework represented is designed to assist GBR Marine Park managers and stakeholders in understanding the cumulative impacts of multiple stressors and incorporating this knowledge into management decisions. The overarching purpose of this framework is to provide a tool that can assist managers and policy-makers understand the risk that cumulative impacts pose to different ecosystems in the GBRWHA and identify management levers in a rigorous, defensible and transparent way.[28]

The framework uses a qualitative modelling approach to understand and predict cumulative impacts on ecosystems underpinning MNES including the OUV of the GBRWHA. These predictions are then used to inform a process of Structured Decision-Making (SDM).

Findings from the framework suggest that in complex systems, such as GBRWHA ecosystems, any given activity may lead to multiple pressures that may vary in their effects at different points in time. Similarly, a given type of pressure (e.g. turbidity) may be driven by multiple activities.[28] The CISDM framework provides a practical mechanism for model-based assessments of cumulative impacts to inform adaptive management plans.

Considerations in approaching cumulative impact assessment undertaken by the U.S. Environmental Protection Agency in 1999[132] noted the following:

- Level of assessment should be commensurate with the potential impacts, resources affected and project scale. Not all activities result in significant impacts.
- Recommendations to address cumulative impacts to either avoid, minimise, protect, restore and enhance the environment should not be confined to those directly attributable to a specific project but also to address activities outside the project. This is suggested through partnerships with Government agencies and industry whose activities over time have contributed to those broader impacts.
- Need to identify ecosystem components of concern and the scale of potential impacts, placing reasonable limits to the scope of the analysis.
- An assessment of activities undertaken outside the immediate impact zone of the project which may potentially affect the environmental resource of concern.

***Framework for Understanding Cumulative Impacts and Supporting Environmental Decisions: To Inform Resilience-Based Management of the Great Barrier Reef World Heritage Area.***

- Established qualitative and probabilistic models for seagrass and coral reef ecosystems to identify likely impacts of cumulative impact scenarios. The models were integrated with the process of structured decision making to produce an overall decision-framework.
- Developed a six-step framework to evaluate different cumulative impact scenarios, highlight environmental risks and identify effective management options.
- Regionally scalable models to allow scenario testing, and help identify management actions that can best maintain or improve the reef's resilience.
- The framework used quantitative data (for example on flood plumes) to identify spatial 'zones of influence' where impacts are expected to have a significant and observable pressure on Great Barrier Reef ecosystems, and where these impacts overlap.
- Identified climate change and storms are likely to be the key stressors affecting reef and seagrass ecosystems in the future. Sediment and nutrient load from agricultural runoff and to a lesser extent port development can exacerbate risks to these ecosystems. Strategic management of these stressors can assist in maintaining or improving the resilience of the ecosystems to future climate change.

### 5.5.1 Mechanism to assess cumulative impacts

A number of mechanisms are already in place to assess and monitor cumulative impacts, which range in scale and provide different functions to inform management. The following sections demonstrate firstly how the Program has established reporting mechanisms to inform cumulative impacts and secondly provides an assessment of actual site-specific cumulative impacts.

Direct mechanisms established to measure actual cumulative impacts are undertaken through the development assessment process for projects which are subject to environmental impact assessment and where a specific cumulative impact assessment process has been undertaken. Both mechanisms provide an understanding of how activities interact and combine to produce the final cumulative impacts on the receiving environment. While an agreed approach to cumulative impact assessment is not currently in place, both mechanisms provide valuable insight from different perspectives.

The need for a consistent and systematic approach to cumulative impact assessment in the GBRWHA has been identified as an area for further development by the Queensland Government and is noted in the *forward commitments* section of this report (chapter 10). It is the intention of the Queensland program to address this gap through establishing guidelines which can be agreed across each state and territory jurisdiction so as to ensure that the development assessment process does not commercially advantage any one jurisdiction.

Table 5.5 1 provides the mechanisms used to provide the actual cumulative impacts of site specific activities. Both mechanisms are valuable to inform the performance of management programs in place to improve the health of the GBR.

Table 5.5-1 Existing mechanisms to assess cumulative impacts in the GBR coastal zone

| Existing Mechanisms | Scale | Purpose |
|---|---|---|
| Cumulative impact assessment projects to inform planning (e.g. Abbot Point SDA) | Local level | Voluntary processes have been used to assess cumulative impacts of development in key locations where a number of developments are likely. |
| EIS process | Site specific | Assessment of cumulative impact of the project required as part of standard Terms of Reference for EIS. |

### 5.5.2 Monitoring of cumulative impacts

The extent and diverse coastal environment of the GBR presents many challenges in assessing the cumulative impacts within the 2300 kilometre long GBR coastal zone.

At a broad scale, information is collected and interpreted regarding the impacts on the GBR, including MNES over time. More detailed analysis on a regional and local scale provides an indicator of the drivers of cumulative impacts and progress with regard to reversing the decline in water quality and terrestrial habitats in the GBR coastal zone. These assessments are based on accurate quantitative data on vegetation and wetland extent, and species numbers and distribution that enable the state and trend of MNES to be measured.

In the absence of a landscape-scale cumulative impact assessment for MNES across the GBRWHA, Table 5.5 2 outlines the data and information currently collected and analysed to identify potential cumulative pressures. This information is used to inform management strategy development to address the findings of these data to avoid, mitigate and offset environmental impacts.

This information does not, however, provide an understanding of how activities interact and combine to produce the final cumulative impact or result in the receiving environment. Interpreting the following information for the purposes of building resilience of ecosystems in the GBR region has been identified as a gap in the Program and a recommended improvement in chapter 10.

Across the GBR annual monitoring and reporting of impacts provide a robust assessment of the result of cumulative impacts at a broad scale by regularly measuring changes over time provided in the reporting mechanisms and guidelines. This includes the Australian and Queensland *State of Environment* reports and the *GBR Outlook Report*, which all provide valuable high level information on the state and extent of values underpinning MNES in the GBR coastal zone. The *State of the Wet Tropics Report 2008 - 2009* provides a good understanding of the relationships between values, activities and pressures at a regional level. The ECDs for Ramsar sites provide an understanding of values, activities and pressures at a sub-regional level and relevant to the individual Ramsar site.

Information from annual Reef Plan report cards provides a valuable understanding of the resultant cumulative impacts from catchment runoff, as well as progress towards water quality improvement targets. The 2011 Report Card for example showed that land management and water quality improvement is on a positive trajectory and that land management practice changes are reducing pollutant loads entering the reef. The report cards also provide a summary of the cumulative impacts of extreme weather on the marine system. For example, the impacts of Cyclone Yasi in 2011 had a significant impact on the overall condition of the marine environment which declined from moderate to poor condition in 2010–2011.

Table 5.5-2 Existing mechanisms, including guidelines to inform cumulative impacts in the GBR coastal zone

| Existing Mechanisms | Scale | Purpose |
|---|---|---|
| State of Environment Reporting | State wide | Considers all pressures on Queensland's environment |
| State of the Wet Tropics reporting | Wet Tropics WHA | Provides a summary all impacts on the World Heritage Area, from both within and outside the area. The intent is to publish a report every four years. |
| Great Barrier Reef Outlook Report | Great Barrier Reef | Considers all the impacts on the Great Barrier Reef and their relative risks. Prepared by GBRMPA every four years in consultation with Queensland Government. |
| Reef Plan report cards | Great Barrier Reef and adjacent catchments | Considers the impact of land use on reef water quality. Provides an integrated metric on reef condition which combined multiple water quality indicators. |
| Water quality guidelines | Reef wide and catchment specific | Sets benchmarks for water quality that take into account all impacts. Marine guidelines are developed by GBRMPA, while freshwater guidelines are prepared by Queensland Government. |
| Recovery plans for threatened species | Species level | Documents all the impacts on a particular threatened species. |
| State Land and Trees Study (SLATS) | State wide | Monitors impacts of land use change on vegetation coverage. |
| Ecological Character Descriptions for Ramsar Wetlands | Wetland specific | Provides a summary of the pressures on the individual wetland. |

A site specific cumulative impact assessment was undertaken recently at the Port of Abbot Point. The study was a voluntary industry driven exercise to identify MNES and to establish cooperative management strategies in and around the Port.

The Abbot Point Cumulative Impact Assessment (CIA) provides a site specific cumulative impact assessment of concentrated activity around this multi-user port facility, as detailed in the Abbot Point CIA demonstration case (snapshot below). Queensland Government policy seeks to rationalise the use of port land and maximise its efficiency within existing designated port areas. The resultant preservation of coastal land in the GBR whilst still facilitating economic growth and financial benefit to Queensland will place greater pressure on existing port footprints. It is important to recognise the role of CIA in informing management strategies to promote environmental resilience in order to maximise environmental protection.

**OVERALL EFFECTIVENESS**

Partially effective

***DEMONSTRATION CASE SNAPSHOT:***

ABBOT POINT CUMULATIVE ENVIRONMENTAL IMPACT ASSESSMENT (CIA)

The developers of proposed new coal terminals at the Port of Abbot Point (North Queensland Bulk Ports Corporation as the port authority, BHP Billiton, GVK Hancock Coal and Adani) have undertaken a comprehensive investigation of environmental impacts from their port development projects.

The Abbot Point CIA looks at the impact of port development and shipping on the harbour focussing on matters of national environmental significance (MNES) that are protected under the Australian Government's Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The CIA will help ensure that the Port of Abbot Point is designed and developed in a manner consistent with environmental best practice and considerate of the OUV of the GBRWHA.

The CIA considered impacts on the marine environment, terrestrial environment, Kaili (Caley) Valley wetland and GBRWHA. Sixteen comprehensive studies were undertaken. The main findings noted the potential impacts to be threatened terrestrial species primarily associated with possible habitat loss and indirect edge effects leading to an increase in weeds, feral animals and fire. The report concludes that the marine environment and marine fauna are not likely to be significantly impacted by the Abbot Point development.

Where direct or indirect impacts cannot be minimised, offsets were recommended. The offsets address impacts on semi-evergreen vine thicket and migratory shorebirds. Cumulative impacts to prevent runoff and material mobilisation were also recommended to be coordinated and delivered thorough a dedicated Caley Valley Wetland Management Plan to be developed through the Joint Environmental Management Framework.

Based on the application of the recommended management measures, it was anticipated that a loss in the OUV or decline in integrity of the GBRWHA is unlikely to occur as a result of the Abbot Point development. A range of climate change measures were also identified which focussed on improving ecosystem resilience, ensuring port infrastructure is designed and built appropriately, minimising greenhouse gas emissions from construction and operation.

Routine shipping in the GBR did not present substantive risk to the environment with appropriate management strategies in place. Impacts from collisions, groundings and the introduction of marine pests could be significant if these events were to occur in sensitive areas or as a serious event. Key recommendations include the use of ship vetting and terminal questionnaires, and maintaining the use of the REEFVTS system which reflects a set of best practice shipping arrangements and set a new standard for shipping management across the reef.

This CIA highlights some systemic long-term and chronic impacts on MNES such as climate change, poor water quality and the impacts of previous broadscale clearing. The systemic threats to MNES are similar to those experienced nationwide and internationally. Climate change remains a dominant feature in the outlook for the GBR and will also put pressure on threatened and migratory species as home ranges contract and weather becomes more extreme.

The CIA confirms that ongoing development in Abbot Point can occur and sustain the biodiversity values for the Abbot Point area through the implementation of port wide requirements for monitoring and mitigation and a commitment to adaptive environmental management. It recommends that managing cumulative impacts from the multiple Abbot Point projects require a level of port-wide integration and cooperation between proponents.

This collaborative and proactive approach to measuring and addressing cumulative impacts is the first of its kind and provides an opportunity to raise the bar on environmental performance.

Source: NQBP. Further information can be found at: http://www.nqbp.com.au/abbot-point/ [133]

### 5.5.3 Regional scale assessments

On a regional scale, local profiles also provide an assessment of the impacts on MNES and OUV over time, outlining any changes which have occurred and the pressures experienced as a result. A regional analysis has been undertaken to provide an assessment of the cumulative impacts on MNES and OUV for each of the six NRM regions located in the GBR coastal zone: Cape York, Wet Tropics, Burdekin, Mackay Whitsunday, Fitzroy and Burnett Mary regions. The summaries found that potential cumulative impacts are much lower in the Cape York NRM region (north of Cairns) compared to the southern GBR NRM regions. The southern GBR has experienced significant land use change and development activity compared to the northern GBR. Inshore areas between Mackay and Gladstone and close to Townsville present the greatest potential threat to the health of the GBR.

The following NRM regional summaries are derived from the detailed analysis found in Appendix H.

***Cape York***

The main land uses in the Cape York NRM region are grazing and conservation management. Traditional Owner management and use is a major aspect of this region. Ninety eight per cent of the terrestrial GBR coastal zone in the Cape York NRM region in 2009 was essential habitat which increased by 289 hectares between 2006 to 2009. Eighty-four per cent of the GBR coastal zone was being used for conservation purposes. Freshwater wetlands condition and extent has remained at pre-European levels. The 2011 Reef Report Card indicated poor marine condition and water quality off Cape York. One southern seagrass bed monitored was reported to be in moderate condition. Both terrestrial areas and freshwater wetlands are assessed as being in a stable condition.

***Wet Tropics***

The main land uses in the Wet Tropics NRM region are grazing, grazing natural areas and cropping (sugar and bananas). Approximately 66 per cent of GBR coastal zone in the Wet Tropics NRM region in 2009 was essential habitat and is assessed to be in a stable condition. Approximately 60 per cent of the GBR coastal zone was being used for conservation purposes in 2009. There has been extensive clearing in the coastal floodplains, most of which has been for agricultural purposes. The condition of the freshwater wetlands is assessed as being in decline. The 2011 Reef Report Card indicated a decline in marine condition from moderate to poor. Coral reefs were found to be in moderate condition.

The primary pressures on this area include past land clearing, agricultural land management, invasive pest and weed species and altered fire regimes. The major impacts are on water quality on GBR MNES, declining MNES terrestrial condition and habitat fragmentation. A recent relative risk assessment of water quality impacts identified the Wet Tropics NRM region as the highest risk region because of the link between dissolved nitrogen runoff and crown of thorns starfish outbreaks. The initiation zone for outbreaks is adjacent to the Wet Tropics.

***Burdekin***

The Burdekin NRM region extends into marine waters including Magnetic Island and Palm Island. The primary land use is agriculture with grazing on natural pastures, accounting for 84 per cent of the regions land area. Intensive irrigated agriculture occurs also on the coastal floodplain, dominated by sugarcane and horticulture. Fifty-seven per cent of the coastal habitat was essential habitat which increased by 6372 hectares between 2006 and 2009 with 34 per cent used for conservation purposes. Twenty-seven per cent of land has been cleared for agricultural purposes. Both the terrestrial habitat and freshwater wetlands are assessed as being in decline.

Townsville is located in this region and is the state's second largest city with major commodity export ports located at Townsville and Abbot Point. Significant capital (1.8 million cubic metres over the next five years) and maintenance dredging (720 000 cubic metres depending on weather conditions) is planned to occur in these ports. A voluntary industry-led CIA was undertaken by proponents who share the Abbot Point port facility to demonstrate how cumulative impacts, pressures and resultant interactions, focussing on matters of national environmental significance in the GBR can be addressed.

The primary pressures in the Burdekin NRM region relate to water quality decline, invasive species and altered fire regimes. The marine condition in this region remained poor in 2011. Inshore water quality was moderate overall, while inshore seagrass meadows declined from poor to very poor and coral reefs remained in poor condition.

***Mackay Whitsunday***

This region includes the Pioneer, O'Connell and Proserpine Rivers which drains into the GBRWHA. Sixty-four per cent of the GBR coastal zone in the Mackay Whitsunday NRM region in 2009 was essential habitat which increased by 21 190 hectares between 2006 and 2009. Thirty-eight per cent of GBR coastal zone was being used for conservation purposes in 2009. The terrestrial area is considered to be stable. There has been extensive clearing in the coastal floodplains, 16 per cent of which was primarily cleared for agriculture, and a further 43 per cent uncleared but also used for agriculture purposes.

There are two ports in this area, Mackay Port and Hay Point Port are major export facilities. Capital dredging of 18 million cubic metres is planned between 2013 to 2017 at Hay Point and

600 000 cubic metres maintenance dredging over the same period. Maintenance dredging of 140 000 cubic metres at Mackay Port is expected to occur in 2013 and again in 2016.

The major pressures in this region are on water quality decline, pest and weed species and altered fire regimes. The marine condition declined from moderate to poor. Inshore water quality also declined from moderate to poor, inshore seagrass meadows declined from poor to very poor and coral reefs remained in moderate condition. The freshwater wetlands are assessed to be in decline.

***Fitzroy***

Seventy-three per cent of the GBR coastal zone in the Fitzroy NRM region was essential habitat which increased by 26 767 hectares between 2006 and 2009. Fifteen per cent of the GBR coastal zone was being used for conservation purposes. The Shoalwater Bay defence training area covers 26 per cent of the GBR coastal zone. The Fitzroy river delta contains a diverse array of wetlands, coastal ecosystems, islands and important marine areas for MNES species. Approximately two per cent has been cleared for agriculture and a further two per cent for urban areas.

The Gladstone Port is a major export facility in the region. Capital dredging of 9.65 million cubic metres for port expansion and maintenance dredging of 260 000 cubic metres per annum is underway and expected to continue over the next five years.

The primary pressures in the region include water quality decline, pest and weed species and altered fire regimes. The Queensland Government has committed to establish the Gladstone Healthy Harbour Partnership (GHHP) to establish best practice collaborative monitoring and management of the harbour. The marine condition declined from moderate to poor. Inshore water quality and inshore seagrass meadows also declined from moderate to poor and coral reefs remained in poor condition. Both the terrestrial area and freshwater wetlands are assessed to be in decline.

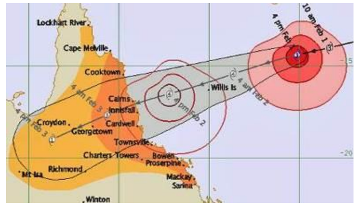
***Burnett Mary***

Sixty-five per cent of the GBR coastal zone in the Burnett Mary NRM region was essential habitat in 2009 which increased by 30 657 hectares between 2006 and 2009. Thirty-six per cent of the GBR coastal zone was being used for conservation purposes in 2009. Fifty-nine per cent of the aquatic area is being used for agricultural purposes. The dominant land use pressures are grazing, forestry and conservation. The marine condition remained poor. Inshore water quality remained moderate and the condition of seagrass declined from poor to very poor. The main impact in this region is water quality. Both the terrestrial and aquatic areas are assessed as being in decline.

# Cumulative impact summary

***Climate Change and legacy impacts of past agricultural activities are major contributors to cumulative impacts in the GBR.***

- The impact zone of Cyclone Yasi in 2011 resulted in significant declines in terrestrial and marine habitat condition.
- Legacy impacts of past agricultural practice have been a key factor in the declines experienced in the GBR regions.
- Significant improvements evidenced in water quality through the use of best practice technology in agriculture have been overshadowed by cyclone Yasi.




**Cyclone Yasi path**

### Cape York

**Essential habitat:** 98% of the GBR coastal zone

**Landuse:** Main land uses are gazing and conservation management
84% land use conservation purposes

**Condition:** Stable Condition
Poor marine condition
Poor water quality off Cape York
Moderate seagrass condition

**Impacts:** Primary pressures are water quality

### Wet Tropics

**Essential habitat:** 66% of the GBR coastal zone

**Landuse:** Main land uses are grazing and cropping
60% land use conservation purposes

**Condition:** Stable Terrestrial Condition
Declined Marine Condition
Declined MNES
Moderate Coral Reef Condition

**Impacts:** The primary pressures include past land clearing, agricultural land management, invasive pest and weed species and altered fire regimes. The major impacts are water quality, declining MNES terrestrial condition and habitat fragmentation.

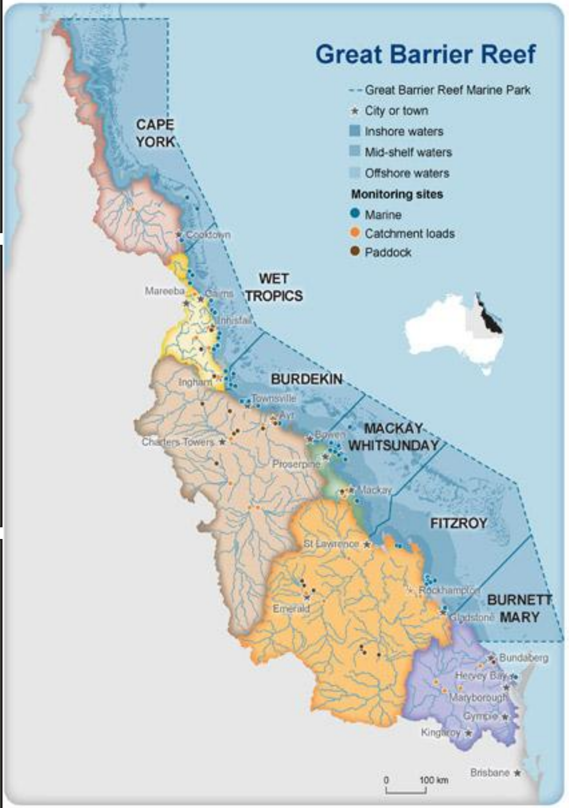
### Burdekin

**Essential habitat:** 57% of the GBR coastal zone

**Landuse:** Main land uses are agriculture and grazing
34% land use conservation purposes
Port development at Townsville and Abbot Point

**Condition:** Declined terrestrial habitat
Declined freshwater wetlands
Poor marine condition
Moderate inshore water quality
Declined sea grass
Poor coral reef condition

**Impacts:** Primary pressures are water quality, invasive species and altered fire regime




### Mackay / Whitsundays

**Essential habitat:** 65% of the GBR coastal zone

**Landuse:** Main land uses are agriculture
38% land use conservation purposes
Port development at Mackay and Hay Point

**Condition:** Stable terrestrial habitat
Declined marine condition from moderate to poor
Declined inshore water quality from moderate to poor
Declined inshore seagrass from poor to very poor
Coral reefs moderate condition
Declined freshwater wetlands

**Impacts:** Primary pressures are water quality, pest and weed species and altered fire regimes

### Fitzroy

**Essential habitat:** 73% of the GBR coastal zone

**Landuse:** Main land uses are
15% land use conservation purposes
Port development at Gladstone

**Condition:** Declined marine condition from moderate to poor
Declined inshore water quality from moderate to poor
Declined inshore seagrass from moderate to poor
Coral reefs poor condition
Declined terrestrial and freshwater wetlands

**Impacts:** Primary impacts on water quality, pest and weed species and altered fire regimes. Legacy impacts of land clearing in the Fitzroy River Delta for agriculture and urban areas.

### Burnett Mary

**Essential habitat:** 65% of the GBR coastal zone

**Landuse:** Main land uses are gazing, forestry and conservation
36% land use conservation purposes
59% of aquatic area used for aquacultural purposes

**Condition:** Poor marine condition
Moderate Inshore water quality condition
Declined seagrass from poor to very poor
Declined terrestrial and aquatic areas

**Impacts:** Legacy impacts of grazing impacting on water quality

### 5.5.4 Summary of cumulative impacts on MNES

The most significant cumulative impacts on the values of the GBRWHA are driven by extreme weather events including the recent cyclone Yasi in 2011, and poor catchment water quality resulting from past clearing and ongoing rural land management practices. The impacts of extreme weather events are projected to become more intense as a result of a changing climate.[36]

Climate change had the greatest impacts in the Wet Tropics WHA specifically to threatened and migratory species; and more generally in the Bowling Green Bay and Shoalwater and Corio Bay Ramsar areas. Land management practices in areas of, and between remnant habitat and ecological communities remain an ongoing threat for these MNES values. Past clearing has left a legacy of discontinuous patches of vegetation leaving these areas at much greater risk of pest invasion and changed fire regimes and reducing the resilience of species to adapt to changes or move away from threats.

Generally, the potential cumulative impacts are much lower in the Cape York NRM region (north of Cairns) compared to the southern GBR NRM regions where there has been significant land use change and development activity. In particular, inshore areas between Mackay and Gladstone and close to Townsville have the greatest potential cumulative impacts and present the greatest potential threat to the health of the GBR. Pressure from nutrient and pesticide runoff is considerable in close proximity to the Wet Tropics and Mackay Whitsundays NRM regions, and sediment runoff is considerable close to the Burdekin and Fitzroy NRM regions.

Significant improvements have been measured in water quality across the NRM regions, however, the impacts of Cyclone Yasi in 2011 has resulted in a decline in freshwater habitats south of Cape York and declines in terrestrial habitats in the Burdekin, Fitzroy and Burnett Mary NRM regions with varying degrees of stability in the remaining regions. Initiatives being implemented to improve water quality will take some time before the full extent of water quality improvements are observed in the GBR coastal zone.

High sediment and nutrient loads are projected to continue impacting biodiversity for many years. With continued pesticide use in the GBR catchment, it is almost certain that pesticides will continue to be a component of catchment runoff; however, continued uptake of improved management practices across the GBR regions will continue to improve the water quality of runoff.

The cumulative impacts of greatest concern in the GBR coastal zone include:

- **Decline in water quality leading to high levels of nutrients, sediments and pesticides**

The development activities in the GBR coastal zone and catchment are contributing to the cumulative impacts on the GBR. Parts of the inshore area south of Cairns the most affected.

The combined effects of increased nutrients and sediments have significantly affected key habitats such as coral reefs and seagrass meadows, as evidenced through the recent Reef Report Card findings and scientific consensus statement.

Targeted investment in addressing the decline in water quality is demonstrating results. However, there is likely to be a significant lag time before measurable water quality improvements are observed in the GBR coastal zone. The high sediment and nutrient loads are projected to continue impacting biodiversity for many years. With continued pesticide use in the GBR catchment, it is almost certain that pesticides will continue to be a component of catchment runoff.

- **Past and present catchment land management practices**

The cumulative impacts of past and present catchment land management practices, such as the clearing of vegetation (habitat), the introduction of pest species, changed fire regimes and agricultural practices present significant impacts on land based MNES in the GBR coastal zone.

## 5.6 Knowledge gaps

Given the scale of the GBR coastal zone and the number of MNES contained within it, there are a number of gaps in knowledge. A range of issues requiring additional information and analysis are listed below. Knowledge gaps that hinder effective evaluation of MNES condition and trends include:

- insufficient modelled habitat data for MNES species
- limited marine and estuarine habitat data and mapping
- condition measures for MNES species' habitat and WHA OUV
- long-term monitoring data to identify current status and changes over time for many MNES species' habitat and key attributes related to the OUV of World Heritage properties
- a lack of understanding of pressures and impacts, and links between pressure, state and trend for MNES, as well as relationships between pressures and impacts

- identification, understanding and mapping of environmental processes that underpin MNES
- identification, understanding and mapping of the ecosystem services in the GBR coastal zone
- a comprehensive inventory of natural and cultural heritage.

Further information on potential drivers, activities and pressures/impacts to MNES in the GBR coastal zone is needed to facilitate better management and positive outcomes for MNES, including:

#### Climate change and extreme weather

A better understanding of the likely long-term changes resulting from climate change impacts is required, including:

- adaptation and acclimatisation of species and habitats to climate change impacts.
- indicators of resilience to climate change impacts for a number of species.

#### Population growth

Into the future, much of the GBR catchment is expected to experience annual population growth rates of 1.6 per cent or higher, but there is very little information about:

- how an expanded urban footprint will affect the GBR coastal zone values.
- how increased national and global populations will affect the GBR coastal zone values – for example through increased shipping of export cargo through the GBR.

### Economic growth

There is little information to forecast with certainty the likely trends in economic activities and their potential impacts on the GBR coastal zone, including:

- new projects (for example coal mines, coal seam gas projects) and expanded ports and associated infrastructure
- agricultural intensification
- growth in tourism infrastructure
- expansion of aquaculture fisheries

#### Urban and industrial development

The major direct impact/pressure from urban and industrial developments is the clearing of vegetation and the fragmentation of habitats. Indirect impacts include the spread of pest and weed species and declines in water quality resulting from diffuse and point source pollution. A better understanding of the environmental impacts of urban and industrial coastal development is required to improve urban management, including:

- pollutants from urban and industrial developments to determine impacts attributed to these sources compared to pollutants from other sources.
- cumulative impacts of urban and industrial coastal developments on the GBR coastal zone.

#### Ports and shipping

Ports and associated infrastructure are of significant economic and social importance to Australia. They are an important gateway for industry, goods and services, and support the domestic, security and safety needs of the nation. A better understanding of the environmental impacts of port activities is required to improve port management, including:

- the direct and indirect impacts, dispersal and timeframes of recovery of intertidal and benthic communities.
- An analysis of the trade-offs and consequences of having fewer larger ports rather than more smaller ports in the GBR coastal zone is important to better inform management and address public perception issues.

#### Agriculture

The agricultural sector is an important contributor to Queensland's economy, but it has also driven significant landscape change leading to both direct and indirect environmental impacts. There is great potential for changes in agricultural land management practices which could significantly reduce pollutant loads and improve water quality. To facilitate changes in agricultural land management practices it is important to:

- understand how changes in land and natural resource management practices and water quality affecting MNES in the GBR coastal zone
- understand what pollutant load reductions will be required in order to meet the GBR water quality guidelines and what land management changes will achieve this (requires development of a receiving water model).
- better estimate time lags between on land agricultural practice change and water quality benefit to improve assessment of management effectiveness.
- quantify the filtering capacity of GBR coastal zone habitats such as floodplains, riparian areas, wetlands and mangroves of nutrients, pesticides and sediments.

### 5.6.1 Knowledge gaps regarding cumulative impact assessment

Assessment of cumulative impacts is an emerging field with regard to environmental management and protection of MNES, including OUV. As highlighted earlier, there is a need to improve our understanding of:

- the cause-effect relationships of multiple or compounding impacts on values underpinning MNES
- the cause-effect relationships of cumulative impacts within the GBR catchment and GBR coastal zone and the GBRWHA
- the multiple scales at which impacts and processes occur and interact with ecological and human systems
- how to facilitate the use of existing multiple information sources which monitor and evaluate cumulative impacts in an integrated manner to demonstrate a more comprehensive understanding of the interactions between pressures causing cumulative impacts.

Two examples of integrating data/information to better inform cumulative impacts and the interactions between pressures on the GBRWHA including MNES are:

- The eReefs project - a joint initiative of the Australian and Queensland Governments, private sector and government funded scientific organisations. It provides integrated and interactive information to enable accurate monitoring of management interventions, track rainfall and flooding impacts and assess cumulative threats in the GBR and identify gaps in current science and monitoring initiatives
- The GBR Coastal Ecosystems Assessment Framework - developed as a framework for assessing the importance of coastal ecosystems. It assesses the ecological functions, the risks of these functions and the cumulative impacts at work across the GBR catchment that are affecting the long-term health of the GBR in a holistic way.

# Chapter 6
## program summary

*Extract from Great Barrier Reef Coastal Zone Strategic Assessment terms of reference*

*1. Purpose and description of the Program*

*The Strategic Assessment Report must include an overview of the Program including its purpose and the area in which it will be implemented. For the purposes of the strategic assessment, the life of the Program is 25 years.*

*The Program Report will include:*

*1. the purpose of the Program*

*2. a description of the area to which the strategic assessment applies (the strategic assessment area)*

*3. the component legislation, plans, policies and other material that make up the Program, including program commitments*

*4. the likely activities that will occur under the Program*

*5. the state and regional context (environmental, social, and economic) in which the Program operates, including activities outside the strategic assessment area that may influence the Program*

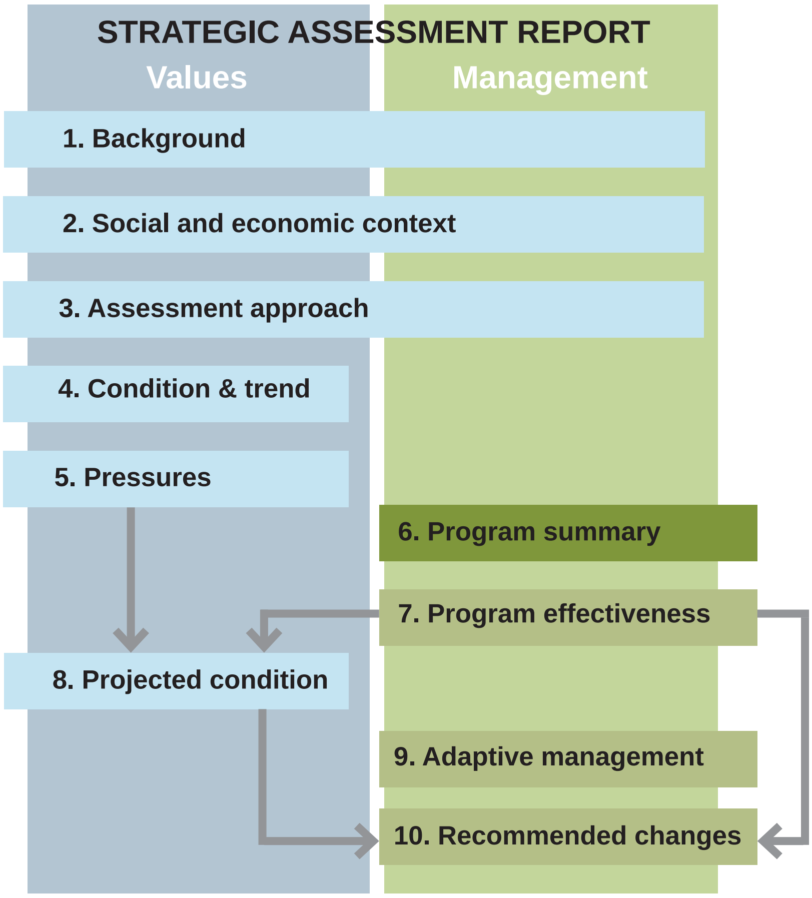
*6. other relevant national, state or regional planning or management frameworks that affect the Program*

*7. a description of how the Program identifies, protects and manages matters of national environment significance (MNES)*

*8. identification of how long the Program will be in effect and the process for review of the Program, including adaptive management*

*9. identification of the relevant authorities responsible for the implementation of the Program.*

# 6. Program summary




## 6.1 Introduction

The GBR coastal zone is a vast area where a range of activities are undertaken, including conservation, tourism, agriculture, recreation, urban development, mining, port development, fishing and shipping. These activities have been continually subject to an evolving range of Queensland Government regulatory tools including legislation and ongoing management programs.

Through its Program and supporting legislation and policies, the Queensland Government is committed to ensuring that planning, development and management in the GBR coastal zone is appropriate to ensure that MNES, including the GBR and Wet Tropics WHAs retain the values for which they were declared, and that they continue to be two of the best managed protected areas in the world for future generations.

The concept of ESD is embedded in the Queensland environmental regulation and management framework, and therefore, the Queensland Government's Program. The Queensland environmental regulation and management framework requires effective integration of economic, social and environmental considerations in the decision-making processes. The way in which the Program achieves the principles of ESD is addressed in section 9.1.

The proposed Program is a collection of commitments and outcomes that will be delivered for MNES within the GBR Coastal Zone over the next 25 years. The Queensland Government's proposed Program includes at its core a set of commitments articulating how the Queensland Government will deliver on the goal of protecting, managing and enhancing MNES in the GBR coastal zone (Figure 6.1 1). These commitments build upon the work done collaboratively between the Australian and Queensland governments to identify high environmental standards that must be met for the Australian Government to consider accreditation of state systems.

The proposed Program is a framework within which planning and development approval decisions are made. It is supported by a range of management tools designed to achieve the Program objectives and commitments (see Figure 6.1 2). This includes legislation, policies, plans and programs, both existing and new, as well as a range of forward commitments.

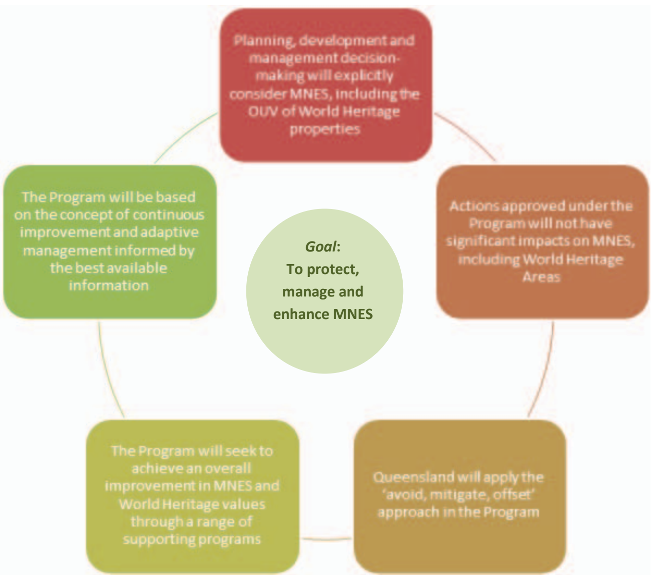



Fig 6.1-1 Program commitments


Fig 6.1-2 Snapshot of management tools that will support achievement of the Program objectives and commitments

The Queensland Government's Program is a combination of existing, strengthened and proposed new components. The Program is made up of the following three elements (Figure 6.1 3):

- **foundational management–** existing statutory and non-statutory policies, plans and programs
- **strengthening management –** proposed new management arrangements that strengthen the Program
- **forward commitments –** things that the Queensland Government commits to do as part of the Program, including monitoring and reporting. Forward commitments also include implementation of proposed strengthening management arrangements.

The *program report* outlines the package of foundational management measures that the Queensland Government has in place to protect MNES, including the OUV of the GBRWHA. It also describes a range of new measures designed to strengthen management to ensure coastal development occurs in a balanced way, taking into account world renowned environmental values. The *program report* also outlines how the Queensland Government will work with its partners to implement the outcomes of the strategic assessment.

This chapter provides a brief summary of the Queensland Government Program elements.

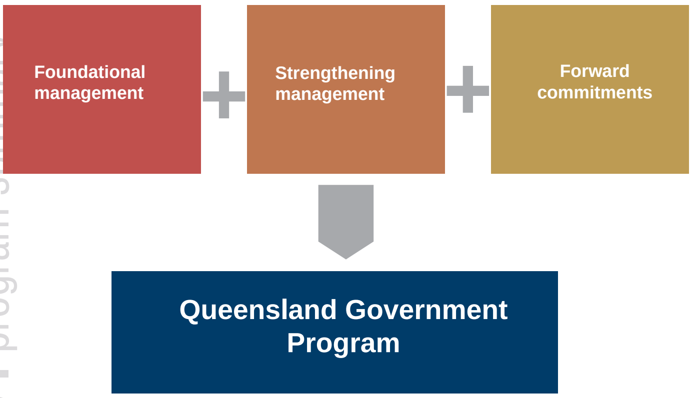



Fig 6.1-3 The Queensland Government Program

## 6.2 Foundational management

The Queensland Government's foundational management arrangements are extensive and include various legislation, as well as supporting policies, plans and programs. These policies and programs were not specifically established for MNES, but were designed to more broadly protect Queensland's environmental values. However, in doing so, they also protect values of national interest.

They are grouped for the purposes of this report to show how the Program overall identifies MNES, avoids, mitigates and offsets significant impacts and how the Program enhances and improves the condition of MNES. A summary snapshot is provided in Figure 6.2 1.


Fig 6.2-1 Snapshot of how the foundational management arrangements identify MNES, avoid, minimise or offset impacts and enhance the condition of MNES

The 'avoid, mitigate, offset' approach is central to Queensland Government's Program and is the basis for considering future coastal development. Other parts of the Program are designed to improve the condition or enhance MNES and address the legacy of past impacts. The first priority is avoiding impacts on MNES. This occurs by setting aside important areas in the protected area estate or using the planning system to identify areas for future development that are located away from high value areas important for MNES.

Where development cannot avoid MNES, the next priority is to ensure impacts are mitigated as far as possible through the design and construction of the project, through development of management plans or by timing of operations. Mitigation measures are routinely built into the conditions on project approvals.

Where impacts cannot be reasonably avoided and impacts are mitigated as much as practicable, residual impacts must be offset to ensure that the value which is being impacted is no worse off. This occurs through the Queensland Government's offsets policies and may take the form of positive management interventions such as restoration of degraded habitat or conversion of land to protected areas. A review of the Queensland Government's approach to offsets is seeking to ensure alignment with the Australian Government's offsets policy where possible and to deliver more strategic outcomes.

This hierarchy will effectively ensure that unacceptable impacts on MNES will not occur. With a more strategic approach to offsets, and continued efforts to enhance MNES through other supporting programs, a net gain can be achieved for MNES.

The Program is based around the well-established 'avoid, mitigate, offset' approach which is enshrined in a number of pieces of Queensland legislation. The first priority is to avoid impacts on MNES where possible. This occurs by identifying and considering MNES during planning investigations so that development can be located away from areas that are important for MNES. This routinely happens as part of planning investigations during the preparation of local government planning schemes, and development schemes for ports, state development areas and priority development areas. Sophisticated Queensland and Australian government mapping and decision support tools help identify important areas for MNES and inform planning processes. Impacts on MNES are also avoided through Queensland's protected area estate where little or no development is permitted.

Where impacts cannot be avoided, they must be mitigated or minimised as far as possible. This primarily occurs through the development assessment process where appropriate conditions are placed on individual development approvals.

In terms of mitigating impacts of future development, there are five key pieces of legislation in Queensland:

1. the SP Act provides the framework for the development assessment process in Queensland
2. the SDPWO Act provides the framework for development in SDAs and the EIS process for 'coordinated projects'
3. the EP Act provides for management of mining on land and other environmentally relevant activities
4. the TI Act outlines the process for port development
5. the ED Act outlines the process for PDAs for urban development.

Other than the TI Act and ED Act, these laws include environmental impact assessment mechanisms which have been accredited by the Australian Government through an 'assessment bilateral agreement' established under the EPBC Act. This bilateral agreement, which was last refreshed in 2012, recognises that EIS processes under the respective Acts meet the requirements of the EPBC Act in identifying and assessing the impacts on MNES from proposed major projects. In practical terms this means the proponent is only required to prepare a single EIS to address both Australian and Queensland legislative requirements. The agreement only deals with the assessment phase, not the decision-making phase. Each jurisdiction continues to make its own decision.

In addition to avoiding, mitigating and offsetting future impacts, the Program also aims to 'enhance' MNES through a range of supporting programs. This includes initiatives designed to address the legacy impacts of past activities and build resilience in MNES to cope with likely future impacts of climate change. Amongst these are the successful Reef Water Quality Protection Plan, Everyone's Environment Grants and the Queensland Natural Resource Management Investment program. These present the best opportunity to directly support MNES over the 25 year life of the Program.

## 6.3 Strengthening management

The assessment of Program effectiveness within the s*trategic assessment report* identifies opportunities where the Queensland Government can further strengthen its Program to better and more explicitly identify, assess, avoid, mitigate and offset impacts on MNES and enhance the condition of MNES over time. The *strategic assessment report* recommends improvements (see chapter 10) for elements of Queensland Government's Program identified as only partially effective. These recommendations led to the development of proposed strengthened management arrangements in the *program report.* Figure 6.3 1 shows the relationship between the *strategic assessment report* and the *program report* and how they have informed each other.

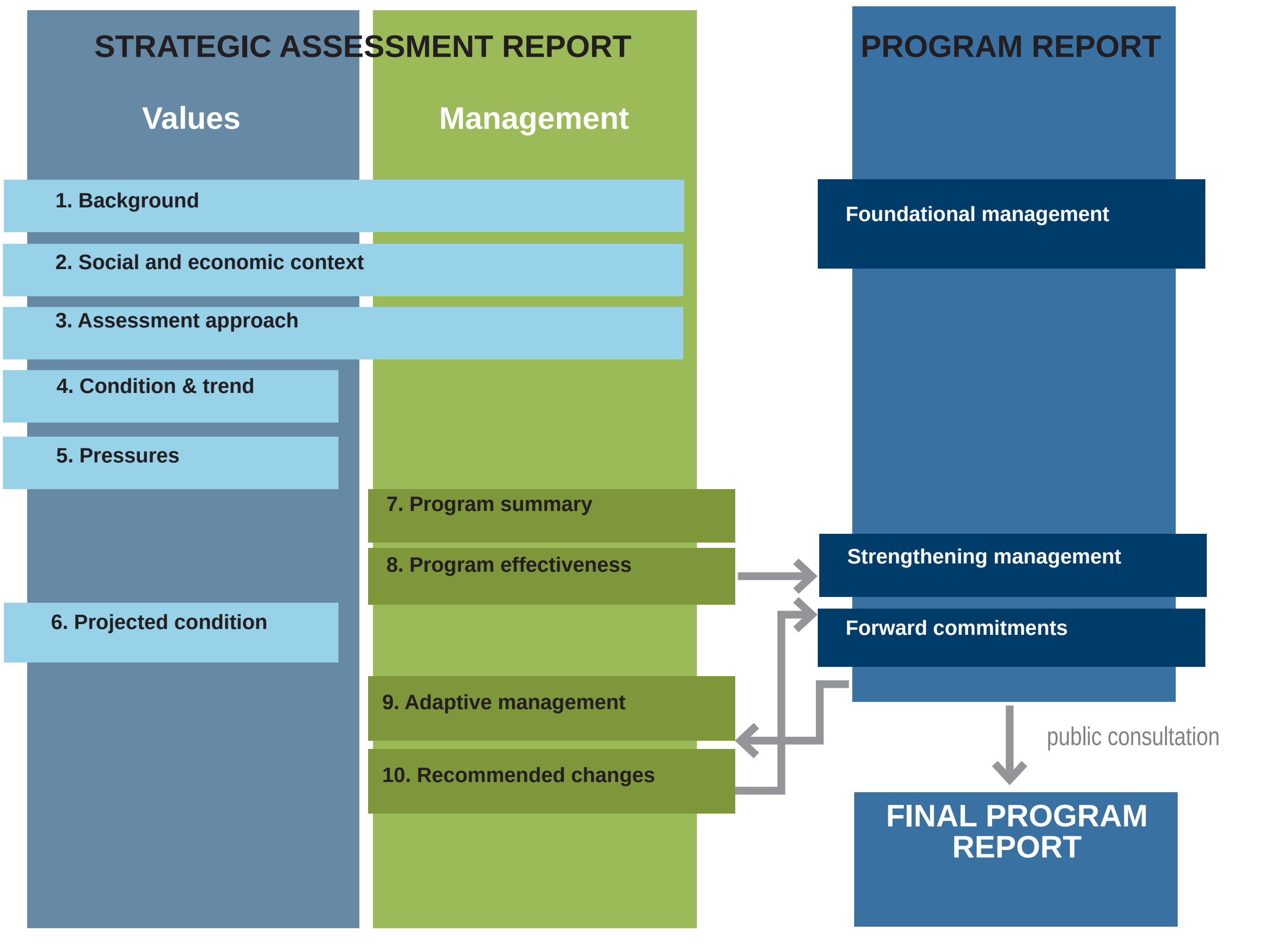



Figure 6.3 -1: Relationship between strategic assessment report and program report

Table 6.3 1 Summary of proposed measures to strengthen the Program

| Proposed measures to strengthen management | Rationale | MNES | | | | |
|---|---|---|---|---|---|---|
| | | GBR WHA/ MP / Comm'th marine | Wet Tropics | RAMSAR | Threatened and migratory | Threatened ecological communities |
| SM1: Queensland Ports Strategy | More efficient, consolidated use of existing port capacity. | • | | • | • | |
| SM2: Single State Planning Policy (SPP) | Through the SPP Queensland will include measures to protect the environmental values of the coastal zone and explicitely incorporate consideration of MNES. | | | | | |
| SM3: New approach to regional planning | A simplified approach to regional planning, focused on resolving competing interests. | • | • | • | • | • |
| SM4: Guideline for MNES in Queensland's Planning system | Will provide greater certainty and clarity of the consideration of MNES during decision making for state planning activities | • | • | • | • | • |
| SM5: Guideline for MNES in Queensland's state development assessment processes | Will provide certainty and clarity for the consideration of MNES during development assessment | • | • | • | • | • |
| SM6: Cumulative Impact Assessment Guideline | Will provide guidance on and identify matters that proponents should consider when assessing cumulative impacts on the Great Barrier Reef World Heritage Area. | • | • | • | • | • |
| SM7: Introduction of standard MNES conditions | Will ensure standard and agreed conditions are placed on approvals in relation to MNES where appropriate | • | • | • | • | • |
| SM8: One government offsets policy | More strategic use of offsets which will help deliver a net benefit overall and ensure that funds derived from the GBR region are used to tackle the most significant issues facing the GBR | • | • | • | • | • |
| SM9: Reef Plan 2013 | More targeted approach to water quality improvement to address key risks | • | | • | • | |
| SM10: Queensland Regional NRM Investment Program | A greater focus on on-ground activities that will improve water quality, address weeds and pests and encourage sustainable agriculture. | • | • | • | • | • |
| SM11: Integrated monitoring | Better integration of existing monitoring programs relevant to the GBRWHA. | • | | • | • | |
| SM12: Gladstone Healthy Harbour Partnership | Will deliver open, honest and accountable management, annual report cards on ecosystem health and management recommendations based on sound science, monitoring and stakeholder engagement | • | | | • | |

## 6.4 Forward commitments

As part of its proposed Program the Queensland Government is making a number of forward commitments to provide confidence that Queensland's system will continue to meet high standards and respond to key challenges. Many of the forward commitments demonstrate the Queensland Government's commitment to implementing the World Heritage Committee's recommendations regarding the GBRWHA. They also demonstrate the Queensland Government's desire to work collaboratively with the Australian Government in joint management of the GBR, and provide detail on forward commitments to implement the proposed strengthening management arrangements. Table 6.4 1 summarises the Queensland Government's forward commitments.

Table 4.9-3 Summary of Queensland Government's forward commitments

| | Forward commitment | Link to recommendations |
|---|---|---|
| ***Meeting international obligations*** | | |
| FC1 | Queensland will provide information to the Australian Government on proposed developments that may impact upon World Heritage properties to ensure Australia's international obligations continue to be met. | - |
| FC2 | Queensland will work with the Australian Government to develop and implement a Long Term Sustainability Plan for the Great Barrier Reef World Heritage Area by the end of 2014. | REC13 |
| FC3 | Queensland will work with the Australian Government to jointly develop an outcomes-based framework for the GBRWHA. | REC17 |
| FC4 | Queensland will continue to work with industry and other stakeholders in Gladstone Harbour to establish and implement the Gladstone Healthy Harbour Partnership which will inform future management decisions. | REC 18 and 19 |
| ***Managing coastal development*** | | |
| FC5 | Queensland is committed to working with the Australian Government to improve identification of MNES | REC2, 3 and 5 |
| FC6 | Queensland will continue to work with the Australian Government and other states and territories to achieve consistent national listing of threatened species. | - |
| FC7 | Queensland will complete regional plans in the GBR coastal zone where there is a gap and continue to update other regional plans to ensure they respond to the latest information and pressures. | REC8 |
| ***Implementing strengthened management measures*** | | |
| FC8 | Queensland will develop and implement the Queensland Ports Strategy which build on and further strengthen the government's commitment to consolidate existing port capacity and strengthen port-related management of the Great Barrier Reef coastal zone. | REC9 |
| FC9 | Queensland will work with the Australian Government and GBRMPA to develop guidelines proponents should consider when assessing cumulative impacts for EPBC Act approvals including those that impact on the Great Barrier Reef World Heritage Area. | REC6 |
| FC10 | Implement a new Queensland offsets policy that delivers more strategic outcomes and ensures funds derived from the GBR coastal zone are used to tackle the most significant issues facing the GBR and seek to align with the objectives of the Australian Government Offsets Policy and proposed Reef Trust where possible. | REC14 |
| FC11 | Queensland will also work with GBRMPA and seek to utilise the outcomes of recent research (coastal basin assessments) in implementing the new offsets policy, including the through development of a Direct Benefit Management Plan for the Great Barrier Reef. | REC14 |

| | Forward commitment | Link to recommendations |
|---|---|---|
| ***Enhancing MNES*** | | |
| FC12 | Queensland will continue to support the Reef Water Quality Protection Plan and the associated Paddock to Reef monitoring program to help achieve the long term goal of no detrimental impact from water entering the GBR. | REC15 |
| FC13 | At Reef Plan's next review (2018), consideration will be given to expanding its scope to other sources of pollutants other than broadscale land use. | REC16 |
| FC14 | Queensland will continue to support programs that improve the Wet Tropics WHA. | REC15 |
| FC15 | Queensland will continue to undertake broader activities to improve the character of wetlands through the Queensland Wetlands Program | REC15 |
| FC16 | Queensland will prioritise actions to recover species, taking into account national recovery plans, threat abatement plans and conservation advices | REC15 |
| ***Adaptive management*** | | |
| FC17 | Incorporate reporting into Queensland state of the environment reporting in relation to MNES condition and trend. | REC20 |
| FC18 | Work with the Australian Government to develop an integrated monitoring program that incorporates existing Queensland monitoring programs and provides improved information to underpin the long term sustainability plan. | REC19 |
| FC19 | Advise the Australian Government of any proposed changes to the Program and prepare an MNES Impact Statement where a significant change is considered. | REC18 |
| FC20 | Report annually to the Great Barrier Reef Ministerial Forum on implementation of the strategic assessment. | REC20 |
| FC20 | The Queensland Government will report annually to the Great Barrier Reef Ministerial Forum on implementation of the strategic assessment | REC21 |

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# Chapter 7

## program effectiveness

*Extract from Great Barrier Reef Coastal Zone Strategic Assessment terms of reference*

*2.3 Measures to avoid, mitigate and offset impacts*

*The Strategic Assessment Report must describe the avoidance, mitigation and offsetting measures that are proposed for future activities taken under the Program and analyse the effectiveness of these measures in protecting and enhancing MNES including OUV. This analysis may use demonstration cases to illustrate the application and effectiveness of particular measures and approaches and must include, but not be limited to:*

*(a) describing how impacts on MNES including OUV are avoided, including how alternative approaches are considered, including for restricted or no development*

*(b) describing, where impacts of development cannot be avoided, how impacts are mitigated and offset*

*(c) describing, where impacts of development cannot be avoided or mitigated, how impacts are offset, including through securing additional areas where development is restricted or excluded*

*(d) describing the extent to which cumulative impacts on MNES including OUV are considered and the methods used to determine cumulative impacts*

*………*

*2.4 Demonstration of the Program*

*The Strategic Assessment Report must include a detailed analysis of the Program, through the use of demonstration cases to test the effectiveness of the Program in identifying and protecting MNES, including OUV, at a local and/or regional scale.*

*Demonstration cases will relate to a regional or local plan under Queensland's planning legislation and a development area, such as a port, state development area or urban area. They could also include a transect approach to demonstration cases which extends from key coastal zones through the Great Barrier Reef marine environment.*

*The locations for the demonstration cases will be chosen by Queensland in consultation with the Australian Government. This should be based on the following criteria:*

*(a) there should be multiple impacts acting upon the region, locality or value*

*(b) demonstration cases may relate to a specific value, place or pressure/impact*

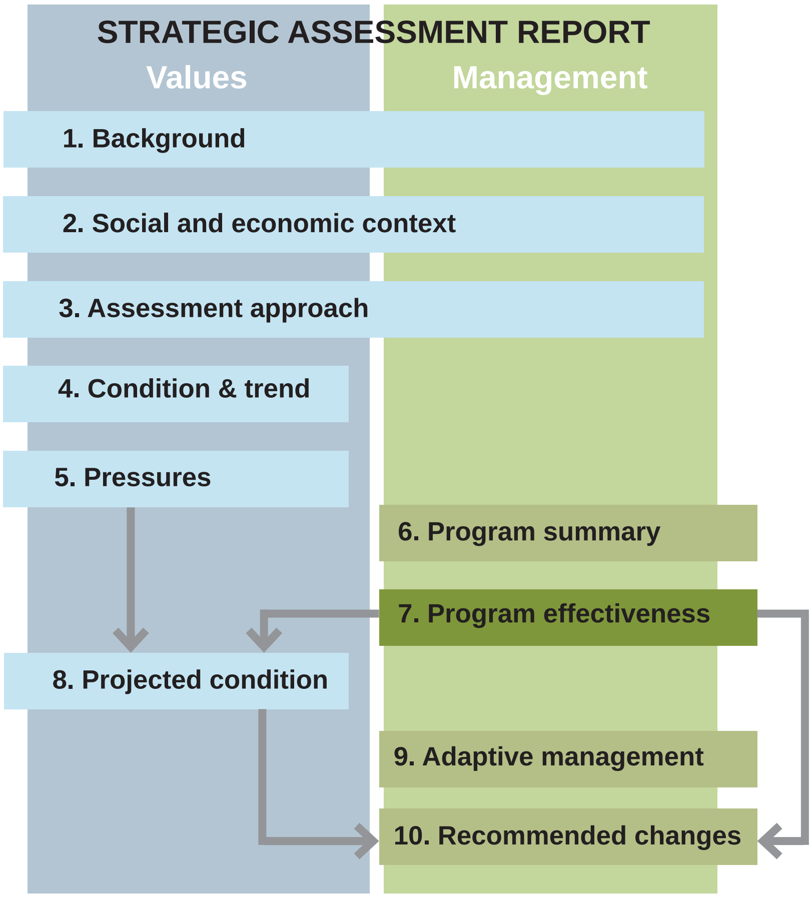
*(c) learning that could transfer to other areas*

*(d) there may be an urgent need to act on a particular issue or area*

*(e) there is an opportunity to build capacity for future management.*

*Queensland will work with GBRMPA to identify demonstration cases relevant to both strategic assessments.*

# 7. Program effectiveness




## 7.1 Introduction

This chapter provides an analysis of the effectiveness of Queensland's Government's Program focusing on its foundational arrangements. The analysis is based on how well the Program identifies MNES, how well impacts are avoided, mitigated or offset and how well the Program enhances MNES more broadly.

The findings from the analysis have helped inform recommended improvements to management which have led to the development of Queensland Government's strengthening management arrangements presented in chapter 10.

The analysis of Program effectiveness (see Figure 7.1 1) has been undertaken at a systems level rather than looking at the impact of every likely development or activity which may occur within the next 25 years. This is because it is impossible to predict given the extent and variety of activities and MNES that occur within the GBR coastal zone.

The grading statements that have been used in this chapter to summarise the effectiveness of the Program are defined in chapter 3.

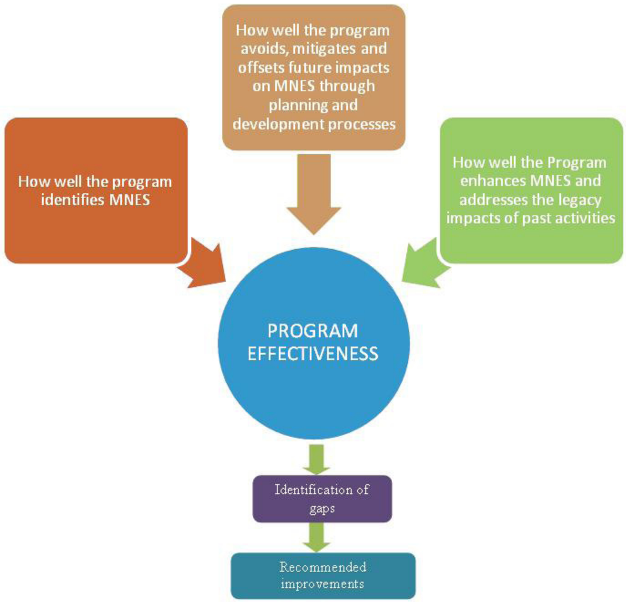



Figure 7.1-1 Broad components of assessing Program effectiveness

## 7.2 Structure of this chapter

This chapter is structured in the following way:

- Approach
- Overview of key findings
- How well the Program identifies MNES and OUV
- How well the Program avoids impacts on MNES – gaps and improvements
    - reef wide and regional analysis
    - protected areas
    - future priority conservation areas
    - state and regional planning and urban development
- How well the Program mitigates impacts on MNES
- How well the Program offsets residual impacts on MNES – gaps and improvements
- How well the Program considers cumulative impacts on MNES – gaps and improvements
- How well the Program enhances MNES – gaps and improvements
- How the Program accounts for impacts from outside the Program.

## 7.3 Approach

### 7.3.1 Approach to assessing Program effectiveness

As described in chapter 3 and chapter 6, the Queensland Government's Program uses the avoid, mitigate, offset approach to sustainably manage MNES. This is also the basis of the endorsement criteria for the Program as outlined in the TOR.

Program effectiveness is measured by the degree of effectiveness and the trend over time. A four level scale is used to grade effectiveness including: very effective, effective, partially effective and ineffective. Trend is measured on a three level scale including: improving, stable and declining. The the grading statements used to evaluate the Program are outlined in chapter 3 and are based closely on the endorsement criteria.

Demonstration cases and case studies are used to demonstrate the effectiveness of the Program in protecting MNES at different locations in the GBR coastal zone, regional and local scale.

### 7.3.2 Demonstration cases and case studies

The TOR for the strategic assessment provide for undertaking demonstration case studies to assess in finer detail the effectiveness of the Program to protect and manage the MNES, including OUV. Regional and value specific assessments were made by way of demonstration cases and smaller case studies. Together this approach explores the effectiveness of the Program in protecting MNES at the strategic, regional and value specific scale. Where joint management arrangements exist between the Queensland Government and the GBRMPA, demonstration cases have been prepared jointly.

Snapshots from the demonstration cases are presented in relevant locations in this chapter to provide an example of how particular Program components operate in different locations. The demonstration cases are provided in Appendix I. Small case studies have also been included in this chapter to provide further examples of the process where a particular Program component has not been presented in the demonstration cases.

Table 7.3 1 describes how demonstrations cases address the various TOR criteria. Table 7.3 2 then summarises the demonstration case snapshots and case studies presented in this chapter and the corresponding MNES and OUV, type of activity and Program component.

Table 7.3 -1 Meeting the selection criteria for demonstration cases

| TOR Criteria | Demonstration case |
|---|---|
| To test the effectiveness of the Queensland Government's Program in identifying and protecting MNES, including OUV, at a local and/or regional scale. | All the demonstration cases address effectiveness of management, covering a range of activities and pressures at multiple spatial scales. |
| Demonstration cases will relate to a regional or local plan under Queensland's planning legislation and a development area, such as a port, state development area or urban area. | The demonstration cases cover a range of activities including urban, tourist, industrial and port development and agriculture. |
| They could also include a transect approach to demonstration cases which extends from key coastal zones through the Great Barrier Reef marine environment | The Mackay transects contain demonstration cases which show connectivity across coastal and marine systems. |
| a) there should be multiple impacts acting upon the region, locality or value. | Demonstration cases represent a variety of spatial scales from region to locality and the multiple pressures acting at those spatial scales, for example the Mackay, Isaac and Whitsunday Regional Plan (region) and the Andergrove Urban Development Area (locality). |
| b) demonstration cases may relate to a specific value, place or pressure/impact. | Multiple pressures/impacts on MNES values including the Wet Tropics WHA and Bowling Green Bay Ramsar site are also explored in demonstration cases. |
| c) learning that could transfer to other areas. | All demonstration cases provide lessons and outcomes that can be transferred to other areas. |
| d) there may be an urgent need to act on a particular issue or area | The Mackay Water Quality Improvement and Abbot Point state development area demonstration cases were selected to highlight the urgent need to act. |
| e) Opportunity to build capacity for future management. | The outcomes of the demonstration cases will inform capacity building for future management. |

Table 7.3 2 Demonstration cases and relevant MNES and activity, and overall relevance to the Queensland Government's Program

| Demonstration case / Case Study | MNES and OUV | Type of activity | Relevance to Program | Program Component |
|---|---|---|---|---|
| Mackay, Isaac and Whitsunday Regional Plan | Threatened species<br>Threatened ecological communities<br>Migratory species | Urban development<br>Tourist development<br>Industrial development | Effectiveness of regional plans in urban development to avoid MNES | SP Act |
| Andergrove Urban Development Area | WHA/OUV/GBRMP<br>Threatened species<br>Threatened ecological communities | Urban development | Effectiveness of UDA in urban development to avoid and enhance MNES | ED Act |
| Wet Tropics Management Plan | Wet Tropics WHA/OUV<br>Threatened species | WHA management<br>Tourist development | Effectiveness of the Wet Tropics Management Plan in the management of the Wet Tropics WHA | Wet Tropics Act<br>Wet Tropics Conservation Strategy |
| Abbot Point State Development Area Land Use Plan and Cumulative Impact Assessment | WHA/OUV/ GBRMP<br>Threatened species | Port and industrial development<br>Shipping | Effectiveness of SDAs to avoid and protect MNES<br>Effectiveness of a Port LUP to avoid, mitigate and protect MNES<br>A demonstration of process to determine cumulative impacts. | SDPWO Act<br>TI Act |
| Ella Bay Resort Development EIS Process | Wet Tropics WHA/OUV<br>Threatened species | Residential development<br>Tourist development<br>WHA management | Effectiveness of the EIS process in mitigating impacts on MNES | SDPWO Act |
| Offsets in Gladstone Harbour | All | A range | Effectiveness of the Queensland Offset Policies in Gladstone Harbour | Queensland Government Environmental Offsets Policy |

| Demonstration case / Case Study | MNES and OUV | Type of activity | Relevance to Program | Program Component |
|---|---|---|---|---|
| Water Quality improvements in the Mackay Whitsundays Region<br>*Demonstration case prepared jointly with the GBRMPA* | All | All land use | Effectiveness of actions at reducing impacts on water quality and enhancing resilience of the GBR | EP Act Environmental Protection (Water) Policy 2009<br>Water Act<br>Reef Rescue Marine Monitoring and Reporting<br>Paddock to Reef Program<br>Mackay Whitsunday Water Quality Improvement Plan<br>Great Barrier Reef Water Quality Guidelines |
| Island management<br>*Demonstration case prepared jointly with the GBRMPA* | WHA/OUV/GBRMP<br>Threatened Species<br>Listed Migratory Species<br>Wetlands of International Importance | Recreational use<br>Tourism and commercial development<br>WHA management<br>Residential management | Effectiveness of island management to avoid, mitigate and protect MNES | Great Barrier Reef field management program.<br>Protected area estate<br>Great Barrier Reef Coast Marine Park Zoning<br>Traditional Use of Marine Resource Agreements |
| Bowling Green Bay RAMSAR site | Wetlands of international importance | Recreational use (national parks and marine park)<br>Agriculture<br>Urban development | Effectiveness of wetlands management<br>Downstream impacts | EP Act<br>Environmental Protection (Water) Policy<br>Water Act<br>GBR Wetlands state planning policy<br>Queensland Wetlands Program |
| Dugong<br>*Demonstration case prepared jointly with the GBRMPA* | Migratory species<br>WHA/OUV/GBRMP | All | Effectiveness of threatened species management | Back on Track program |
| ***Case studies*** | | | | |
| Cassowary | Threatened species<br>WHA | Management | Demonstrate the use of protected areas to avoid and protect a threatened species | NC Act - Conservation Areas |

| Demonstration case / Case Study | MNES and OUV | Type of activity | Relevance to Program | Program Component |
|---|---|---|---|---|
| Shipping | WHA/OUV/GBRMP<br>Threatened species<br>Migratory species | Port development shipping | Demonstrate the management of shipping in the GBRWHA | Marine Parks Act<br>TPC Act<br>North-east Shipping Management Plan |
| Mount Peter's master plan area | WHA/OUV | Management | Effectiveness of planning a large-scale urban area adjacent to a WHA. | SP Act |
| Weed and pest management in the Wet Tropics WHA | WHA/OUV<br>Threatened ecological communities<br>Threatened species<br>Migratory species | Management | Demonstrate the weed and pest management strategy in the Wet Tropics WHA as a tool to enhance MNES | Wet Tropics Act<br>Wet Tropics Conservation Strategy |
| Burnett Mary Region Healthy Habitats | Threatened ecological communities<br>Threatened species | Management | Demonstrate an NRM initiative to protect and enhance significant biodiversity assets | Regional NRM Plans and Funding |

## 7.4 Overview of key findings

There is a strong foundation of management in the Queensland Government Program, the highlights of which include:

- A large proportion (32 per cent) of the GBR coastal zone is within conservation areas. Eighty-nine per cent of the Wet Tropics WHA is contained in national parks, and large proportion of the Bowling Green Bay and Shoalwater/Corio Bay Ramsar wetlands are within terrestrial or marine protected areas (approximately 99 per cent and 80 per cent respectively). Ninety-six per cent of the area of the GBRWHA within the GBR coastal zone is within a marine protected area.
- A robust planning system which aims to avoid areas of high importance to MNES (although not explicitly in all cases). There is a specific planning framework for the Wet Tropics WHA.
- A sophisticated mapping system that helps identify TECs, essential habitat required to support terrestrial threatened species and key roosting and breeding sites for migratory species, provides an important tool for planning.
- A well established development assessment process that applies conditions to approvals to avoid, mitigate and offset impacts on MNES. The Queensland Government's process for assessing projects that require environmental impact statements has been accredited by the Australian Government under a bilateral agreement.
- Vegetation management laws that prevent broadscale clearing of remnant vegetation for agriculture and protects riparian vegetation in GBR catchments.
- The successful Reef Plan which is halting and reversing the decline in water quality from broadscale agriculture, with excellent results so far.

However, some of Queensland Government's foundational arrangements have been identified as only partially effective. Typically these components have been primarily designed to address environmental considerations of importance (to the state) across issues that include but are broader than MNES. Areas where alignment and transparency for the management of MNES can be improved include:

- **Planning for ports.** There are no specific restrictions on where port development can occur, although port land use plans do promote consolidated development.
- **A lack of explicit consideration of MNES.** Queensland Government's planning and development assessment is well advanced, but doesn't explicitly require impacts on MNES to be considered and avoided, mitigated or offset.
- **Queensland's approach to offsets.** A number of offsets policies are in place, but they are not well integrated and do not deliver strategic outcomes or a net benefit to MNES.
- **The lack of a clear framework for cumulative impacts.** While all EIS assessments are required to report on direct, indirect and cumulative impacts on MNES from the development, to date, there is no consistent method to determine the cumulative impacts of a development.

By looking in more depth at how management currently operates, the demonstration cases have also highlighted a number of strengths and weaknesses of the Program as shown in

Table 7.4 2.

Table 7.4 1 Summary of program effectiveness

| MNES | Summary | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Identify MNES | Asses impacts on MNES | Avoid (protected areas) | Avoid (coastal planning) | Mitigate | Offset | Consider cumulative impacts | Enhance MNES | Summary of key evidence |
| ***GBRWHA GBR Marine Park Commonwealth Marine area*** | Effective | Very effective | Very effective | Partially effective | Effective | Partially effective | Partially effective | Very effective | Management of the GBRWHA is partially effective. A number of values continue to decline as a result of the legacy of past management or from impacts outside the direct control of local management (e.g. climate change).<br>Major programs to improve water quality are helping to address one of the most significant pressures on the reef and will enhance the WHA over time and build resilience against climate change.<br>A large proportion of the GBR coastal zone is within conservation areas (over 30 % terrestrial and over 40 % marine). Proposed coastal development is expected to occur in just over 3 % of the GBR coastal zone. This will continue to have some flow on impacts on the GBR, but new arrangements to limit port development to existing ports will ensure that development and associated impacts such as dredging is constrained to a smaller footprint.<br>There is a well established development assessment process that applies conditions to approvals to mitigate impacts on MNES.<br>While all EIS projects are required to report on direct, indirect and cumulative impacts on MNES from the development, to date, there is no consistent method to determine the cumulative impacts of a development.<br>Marine offsets have only been partially effective, but a proposed new policy will contribute to improved outcomes. |

| MNES | Summary | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Identify MNES | Asses impacts on MNES | Avoid (protected areas) | Avoid (coastal planning) | Mitigate | Offset | Consider cumulative impacts | Enhance MNES | Summary of key evidence |
| ***Wet Tropics WHA*** | Very Effective | Very effective | Very effective | Effective | Effective | Partially effective | Partially effective | Effective | Management of the Wet Tropics WHA is effective. Separate legislation and a statutory authority overseeing protection and management ensure impacts are identified and managed. 89 % of the WHA is protected in conservation areas. The Wet Tropics Management Plan provides protection through regulation of activities with potential to impact on OUV and provides direction for management within the WHA, including areas outside national parks, and comprises a zoning scheme and permit system. There is a robust system of reporting on the condition of the WHA and the WTMA works closely with Queensland Government to manage impacts from outside the WHA through the FNQ Regional Plan 2009 – 2031.<br>The identification of strategic rehabilitation areas within and outside the WHA indicates a new approach to offsetting the impacts of development activity in the region.<br>The review of the Wet Tropics Plan and other Program components has enabled progress to be made toward the control of pest species.<br>The assessment tool provided by the World Heritage Centre for the WTMA to undertake the 2011 UNESCO Periodic Reporting concludes the following with respect to management effectiveness:<br>• No serious management needs have been identified for management of the property<br>• The integrity of the World Heritage property is intact<br>• The Area's OUV has been maintained. |

| MNES | Summary | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Identify MNES | Asses impacts on MNES | Avoid (protected areas) | Avoid (coastal planning) | Mitigate | Offset | Consider cumulative impacts | Enhance MNES | Summary of key evidence |
| ***Ramsar wetlands*** | Very Effective | Very effective | Very effective | Partially effective | Effective | Partially effective | Partially effective | Effective | The Ecological Character Descriptions for the Ramsar sites provide an excellent tool to identify values and assess impacts.<br>On-site impacts are effectively avoided through terrestrial and marine protected areas. Off-site cumulative impacts from development are not avoided as effectively, however there are some key measures in place (e.g. avoiding high impact earthworks that may impact on the site) and a requirement for EISs to consider downstream impacts.<br>There are a range of programs that are directly enhancing the condition of the wetlands, including water quality improvement programs. There has been significant investment in the Queensland Wetlands Program through the Queensland Regional NRM Investment Program. |
| ***Threatened ecological communities*** | Effective | Very effective | Very effective | Partially effective | Effective | Partially effective | Partially effective | Effective | Broadscale clearing for agriculture was ended in 2006 and riparian vegetation in priority GBR catchments has been protected since 2009.<br>The vegetation offsets policy is partially effective but will be significantly improved under the one government offsets policy which will deliver more strategic outcomes and net improvement for MNES.<br>Most of the area of Broadleaf tea-tree is located in moderate use areas and therefor its condition may decline.<br>The Littoral rainforest and coastal vine thicket TEC is considered to be in very good condition in conservation areas and in good condition in minimal use areas. Only five per cent is subject to intensive use and less than one per cent in urban areas. The trend for this TEC is considered stable. |

| MNES | Summary | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | Identify MNES | Asses impacts on MNES | Avoid (protected areas) | Avoid (coastal planning) | Mitigate | Offset | Consider cumulative impacts | Enhance MNES | Summary of key evidence |
| ***Threatened and migratory species*** | Effective | | Very effective | Partially effective | Effective | Partially effective | Partially effective | Effective | Queensland Government's mapping system provides an excellent tool which provides detail that supports the information provided by the Australian Governments Protected Matters Search Tool by identifying the critical habitat required to support threatened species and is based on a rigorous methodology built over the last 10 years. The mapping provides a useful decision support tool for planning and natural resource management programs and also identifies key roosting and breeding sites for migratory species.<br>The condition of habitat for key migratory species is expected to improve with 94 per cent of the area in conservation or minimal use areas. A total of six per cent of migratory species are in habitats subject to moderate or intensive use which are considered to be in poor to very poor condition.<br>The biodiversity offsets policy is partially effective, but will be significantly improved under the proposed new government offsets policy which will deliver more strategic outcomes and net improvement for MNES.<br>A well established development assessment process that applies conditions to approvals to mitigate impacts on MNES including threatened and migratory species.<br>Queensland Government's process for assessing projects that require environmental impact statements has been accredited by the Australian Government under a bilateral agreement. |

Table 7.4 2 Strengths and weaknesses of the Program, drawn from demonstration cases

| Management component | Strengths | Weaknesses |
|---|---|---|
| Identifying MNES | Consistent and rigorous mapping methodology for identifying MNES. | Planning processes are not explicitly required to identify MNES.<br>Flow-on consequences for avoiding and mitigating impacts if not adequately identified.<br>Reliance on mapping.<br>Not enough studies/research. |
| Assessing impacts on MNES | There is a rigorous and well established process in place supported by legislation for assessing projects that may impact on MNES. | There are no established standards or guidelines to help proponents and decision makers consider and address cumulative impacts.<br>There is currently significant duplication in assessment processes across jurisdictions. |
| Avoiding MNES | Draft Queensland Ports Strategy will concentrate port development to existing ports.<br>Protected areas provide a strong foundation for continued conservation of MNES.<br>The field management program is a major strength of the Program, not only in relation to compliance, but also the on ground activities that improve MNES.<br>Good on ground efforts on islands through the joint field management program which avoids impacts and improves values | Gaps remain in regional plans (North Queensland and Central Queensland).<br>Planning documents are not explicitly required to avoid impacts on MNES.<br>There is currently significant duplication in protected area management and permitting arrangements between GBRMPA and Queensland.<br>There are inadequate resources available to meet current and future demands.<br>Current penalties don't provide sufficient deterrent for repeat offenders.<br>Further work required to address biosecurity issues on islands and more strategically plan activities that will improve island natural integrity. |
| Mitigating MNES | Good capacity to mitigate impacts through conditions on development approvals, some of which exceed standards. | A range of different conditions have historically been applied to project approvals, although Queensland is beginning to use more standardised conditions. |
| Offsetting MNES | Some examples of more strategic approaches to offsets through the Coordinator-General. | The current approach to offsets, limits opportunities to deliver more holistic and strategic outcomes. |
| Enhancing MNES | Major programs to improve water quality backed by significant resources.<br>Excellent planning tools to prioritise on ground activities (eg Wet Tropics Conservation Strategy). | No explicit overall program to coordinate efforts to enhance MNES.<br>Research priorities are well understood for water quality, but there is a need to better prioritise research needs in other areas. |
| Monitoring and evaluation | Range of existing monitoring and reporting programs in place that are fit for purpose. | Monitoring could be more efficient and better integrated and should focus around an agreed outcomes framework.<br>Monitoring and reporting is not explicitly focused around MNES. |
| Governance | There are good examples of the Queensland Government responding to new information and adapting management.<br>There is a strong foundation of governance with the Great Barrier Reef Intergovernmental Agreement, Ministerial Forum and Reef Plan governance. | Governance arrangements are relatively strong across the management components but could be strengthened in some areas such as coastal management, port planning and monitoring. |

## 7.5 How well the Program identifies MNES and OUV

### 7.5.1 Mechanisms for identification of MNES and OUV

The Program uses a number of mechanisms to identify MNES, from landscape scale mapping to site based investigations for specific activities. The mechanism used depends on the MNES being considered (Figure 7.5 1). The more detailed methodologies for mapping are provided in chapter 3.

For MNES with fixed geographical boundaries, such as WHAs, the GBR Marine Park and Ramsar wetlands, the boundaries are used for planning or development purposes. For example, the Far North Queensland Regional Plan explicitly identifies the Wet Tropics WHA. These areas are often protected through conservation tenures. In Queensland these are primarily protected areas under the NC Act, or protective zoning regimes under a MP Act or Fisheries Act.

For MNES without fixed geographical boundaries, such as threatened species habitat, TECs and migratory species, identification requires tools appropriate to the scale and type of assessment. To determine if MNES may occur in any given site the Australian Government Protected Matters Search Tool (PMST) is used. If the PMST identifies potential for MNES to occur, proponents are required to undertake surveys to determine with greater accuracy the occurrence and extent of MNES in the proposed impact area and the likely impacts. The assessment of the proposed impact sets out the findings of these surveys.

Similar processes are used for planning activities. The Queensland Government uses a number of decision support tools to ensure MNES are appropriately considered through planning and development schemes. For SDAs and priority development areas PDAs, formerly known as urban development areas (UDAs), a range of studies are routinely undertaken to assess the environmental values of areas proposed for development. This includes use of the PMST and ecological surveys which determine the key environmental values of a particular site so that development schemes can be prepared that avoid these areas (for further information see demonstration cases on Abbot Point SDA and Andergrove UDA).

The Queensland Government also maps its own matters of state environmental significance (MSES). MSES is defined in the draft State Planning Policy and includes areas protected under state environmental legislation, and provides a trigger for further

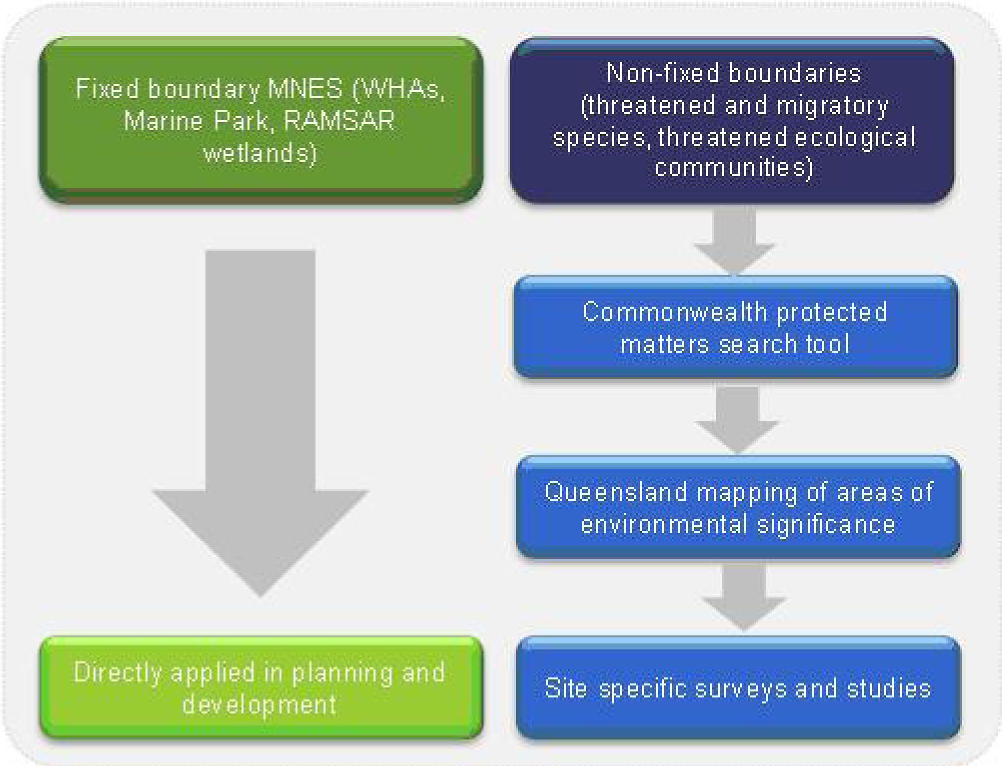



Figure 7.5 1 Mechanisms to identify MNES

assessment at site level when development is proposed. MSES mapping draws upon a range of datasets, such as species habitat models, species sightings data (to identify where threatened species may be found in the landscape) and precise regional ecosystem mapping (to identify regulated vegetation). Much of the mapping for MSES overlaps significantly with MNES.

Mapping will continue to be an important input into planning through the life of the Program to ensure impacts can be avoided from the outset. While mapping is a useful tool to inform planning, more detailed assessment of the environmental values of an area proposed for development will have to be undertaken. Information gained from these area or site assessments can be used to enhance the databases on which mapping systems are based.

### 7.5.2 Gaps and improvements

To improve the ability of the Program to identify MNES the Queensland Government is committed to working with the Australian Government to improve and align the resolution of mapping and to ensure that all EPBC Act listed threatened species, TECs and listed migratory species are accurately identified. While there are effective decision support tools such as the PMST and the use of processes for identifying MNES, the Program components differ in whether there are explicit requirements to identify MNES. These range from statutory mechanisms, to formal guidelines, to there being no specific requirements. A more explicit requirement to identify MNES throughout the Program would provide improved transparency and consistency in the identification of MNES.

To assist in the consistent identification of MNES the Queensland Government is proposing to develop a guideline for MNES in the Planning System in consultation with the Australian Government. The Guideline will be a tool for decision makers relevant to land use planning, including for PDAs, port development, SDAs and local planning schemes and assessment of development or project proposals. It will provide detail on how significant impacts should be avoided, mitigated and offset; and to outline the circumstances in which a planned development would be considered to have unacceptable or unsustainable impacts on MNES. It will provide specific details about the OUV of WHAs, drawing significantly from the Interim Guidelines for OUV recently published by the Australian Government.

This approach is consistent with the findings of the recent Independent Review of the Port of Gladstone, which found that while environmental management and governance within the Port of Gladstone is generally comprehensive, there is a need to incorporate World Heritage and other environmental protection considerations in a single, comprehensive and consultative port planning process.

### 7.5.3 Summary of effectiveness to identify MNES

| Management effectiveness component | Grading | Confidence | Trend | Summary of evidence |
|---|---|---|---|---|
| Demonstrated ability to identify MNES including OUV<br><br>MNES: All | Effective | Adequate |  | MNES must be explicitly identified and assessed through project by project assessment.<br>Sophisticated mapping of matters of state environmental significance currently informs coastal planning and there is a significant overlap with MNES. However, MNES will be more clearly and explicitly identified in future as part of the planning process (through the draft SPP and planning guidelines). |
| *Effective:* Assessment processes effectively ensure that MNES are identified | | | | |

## 7.6 How well the Program assesses impacts on MNES and OUV

### 7.6.1 Assessment of impacts

For projects which are likely to have significant environmental impacts, including on MNES, the preparation of an environmental impact statement (EIS) is usually required under either the EP Act (for mining and other environmentally relevant activities), the SP Act (for urban and other types of development), or under the SDPWO Act (where a development has been declared as requiring coordinated assessment or is within a SDA). An assessment bilateral agreement is in place with the Australian Government to ensures that EISs address both Queensland and Australian government assessment requirements with MNES addressed in a specific chapter of an EIS. This process leads to consideration of options to mitigate impacts that are identified through the assessment process and the application of conditions to ensure this occurs.

***OVERALL EFFECTIVENESS***

Very effective

***DEMONSTRATION CASE SNAPSHOT:***

ELLA BAY RESORT DEVELOPMENT EIS PROCESS

The Ella Bay Integrated Resort was declared a 'significant project' under the SDPWO Act, requiring the proponent of the development to prepare an EIS. The Ella Bay site is surrounded on three sides (north, west and part south) by the Ella Bay National Park. Most of the surrounding area is located in the Wet Tropics WHA. The site is separated from the GBRWHA to the east by a gazetted esplanade.

The EIS documentation indicated that the proposed Ella Bay development would be designed, constructed and managed to avoid (where possible) potential adverse impacts on tropical rainforest, swampland (Wet Tropics WHA) and coastal and aquatic (GBRWHA) ecosystems or on the geological and geomorphological characteristics of the region that underlie the ecological diversity of the Wet Tropics and the GBR. MNES were addressed in both the EIS and SEIS documentation. During the latter stages of the EIS process, additional work was undertaken to better understand, analyse and synthesise the potential impacts of the whole project on MNES. Where impacts on MNES including OUV cannot be avoided, the proponent committed to an environmental management regime and proposed a number of measures to minimise and mitigate potential impacts. An offsets proposal was also put forward by the proponent to address residual impacts.

### 7.6.2 Summary of effectiveness in assessing impacts

| Management effectiveness component | Grading | Confidence | Trend | Summary of evidence |
|---|---|---|---|---|
| Effectiveness in assessing impacts<br><br>MNES: All | Very effective | Adequate | ↗ | Impacts on MNES are assessed under an EIS process. A bilateral agreement between the Australian and Queensland governments ensures that MNES are considered. This bilateral agreement is continually being refined and improved. |
| *Very effective:* EIS processes effectively ensure that impacts on MNES are assessed | | | | |

### 7.6.3 How well the Program considers cumulative impacts

Cumulative impacts resulting from historical land uses, the growth of Queensland's communities and economy are monitored and managed at various scales through a variety of tools in the Program as shown in Table 7.6 1 below. The cumulative impacts of growth are controlled through planning, development assessment and natural resource management based activities.

#### Planning and development assessment

Where possible, the consolidation of land use and activities means that design and management approaches can be employed to address the cumulative impacts of development more effectively. In a broad sense, this enables Queensland Government to consolidate development in particular areas to lessen the footprint of specific types of development, which assists in minimising cumulative impacts. Examples of this include the establishment of urban areas to consolidate residential development, the establishment of strategic port land to contain port development, and declaring industrial areas and infrastructure corridors to manage the location of industrial activities.

Development assessment processes limit the nature and extent of development with potential to have significant impacts on the environment, either individually or cumulatively, through setting conditions and the mandatory application of standards or offsets. Such development may include environmentally relevant activities for which an environmental approval is required, and conditions set to assess and minimise the environmental impacts of those activities.

The cumulative impact assessment voluntarily undertaken by developers of proposed new coal terminals at the Port of Abbot Point is a good example of a process used to assess cumulative impacts.

#### Standards and guidelines

Approval conditions ensure adherence to state policies such as Environmental Protection Policies which contribute to addressing cumulative impacts by outlining standards for air, water and noise. For example, the *Environment Protection Regulations 2008 and Environmental Protection (Water) Policy 2009* (EPP Water) includes a framework that:

- identifies environmental values (EVs) for aquatic ecosystems and for human uses (e.g. water for drinking, farm supply, agriculture, industry and recreational use)
- determines water quality guidelines (WQGs) and water quality objectives (WQOs) to enhance or protect those environmental values.

EVs and WQOs that are adopted by the Queensland Government for particular waters are included in Schedule 1 of the EPP Water. The following waters have EVs and WQOs scheduled in the EPP Water:

- Mary River Basin/Great Sandy Region – including all waters of the Mary, Fraser Island, Burrum (part), and Noosa (part) basins, Hervey Bay and State coastal waters.
- Wet Tropics (north) and Trinity Inlet – including all waters of the Daintree and Mossman basins, Trinity Inlet, and State coastal waters.
- Fitzroy Basin – covering all waters of the Comet, Callide, Dawson, Fitzroy, Isaac (including Connors River catchment), Mackenzie and Nogoa Sub-basins.

In areas where no WQOs are scheduled, the Queensland Water Quality Guidelines 2009 apply as default objectives. The GBRMPA has also prepared Water Quality Guidelines for the GBR Marine Park[134] for maintaining the health and resilience of the GBR. These guidelines describe the concentrations of sediment, nutrients, and pesticides that are needed for the protection and maintenance of marine species and the GBR's ecosystem health. Areas that are not covered in the Water

Table 7.6 1 Example of elements of the Program that consider cumulative impacts at different scales

| GBR scale | Pressure or impact scale | MNES specific | Species scale | Project scale |
|---|---|---|---|---|
| State of the environment reporting<br><br>Annual Reef Plan report cards on marine health | Water quality monitoring programs and risk assessments | Adequate Wet Tropics report cards<br><br>Ecological character descriptions for Ramsar sites. | Back on Track prioritisation framework for threatened species | Cumulative impact analysis in individual Environmental Impact Statements<br><br>Cumulative Impact Assessments by multiple proponents (e.g. Abbot Point). |

Quality Guidelines for the Great Barrier Reef Marine Park default to the Queensland Water Quality Guidelines 2009 or the Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000.

The Queensland Government monitors ecosystem health in rivers, estuaries and coastal areas throughout the eastern coast of Queensland including the GBR coastal zone. In addition, the Queensland Government also regulates industries through licensing waste outputs into waterways.

### Reporting

Reef report cards measure marine health and exceedances from guidelines. For the Wet Tropics, annual report cards also track the key pressures and condition of the Wet Tropics WHA. Similarly, ECDs for Ramsar wetlands identify the character of the site and key threats.

### Species scale

At a species scale, the Back on Track program systematically considers the range of cumulative threats to individual threatened species and prioritises on-ground actions that will be most effective.

### NRM Programs

Regional NRM programs provide one of the best opportunities to reduce the cumulative impacts on MNES by managing some of the most chronic and systemic threats facing MNES. A range of programs are in place and are described in the following section on how well the program enhances MNES.

Whilst further progress needs to be made, the Queensland Government's Program has demonstrated some success in managing cumulative impacts. This has been demonstrated most clearly through improvements in water quality parameters reported through Reef Plan.

## 7.6.4 Gaps and improvements

There are significant challenges that need to be considered in further improving the way Queensland Government's Program manages cumulative impacts along the 2300 kilometre GBR coastal zone. The challenges primarily relate to the absence of an established consistent framework and methodology for assessing cumulative impacts on a site by site or project by project basis.

Currently the terms of reference for project-specific environmental assessments conducted under the SDPWO Act, EP Act and SP Act outline the requirement to address cumulative environmental impacts. Those projects which trigger the EPBC Act are then considered by the Australian Government under the EPBC Act. However, the absence of specific guidance on how this should be addressed by proponents results in discrepancies in the depth and scale of information provided for assessment. Similarly guidance is required for officers on how they should assess proposals to achieve consistency.

In working together to improve the consideration and assessment of cumulative impacts, the Australian and Queensland governments will need to consider approaches to address issues such as:

- the scale at which assessment should be conducted i.e. local, regional, catchment, GBR wide
- the knowledge base supporting determinations of interactions between potential impacts and the environment
- timeframes for defining periods over which cumulative impacts should be described and assessed
- identifying and evaluating the source, pathways of impacts and interactions between pressures
- determining legacy and current activity based and non-activity based impacts
- expected management outcomes and ensuring that management strategies contain sufficient flexibility to address the unknown
- how impacts from weather events and other events that are outside the ability of the Program to address should be considered
- how cooperative holistic approaches can be supported.

The GBR coastal zone is a large and diverse area. An agreed methodology is needed to measure and monitor cumulative impacts to ensure reliable, consistent and regular monitoring is undertaken. In the meantime, there are national and international guidelines which provide information on identifying, monitoring and reporting cumulative impacts at the local and regional scale, including Cumulative Impacts - *A good practice guide for the Australian coal mining industry*.[135]

The Queensland Government is commitment to working closely with the Australian Government to improve understanding of cumulative impacts and provide clearer guidance on how proponents and decision makers should address cumulative impacts (See chapter 10).

An innovative model for this kind of assessment has been piloted at Abbot Point through North Queensland Bulk Ports Corporation and private proponents, as described in the Abbot Point cumulative impact assessment (CIA) demonstration case in section 5.5. This CIA project is in line with the draft GBR Ports Strategy which identifies that 'environmental assessments of port development should have an increasing focus on cumulative impacts including shipping.'

### 7.6.5 Summary of effectiveness in considering cumulative impacts

| Management effectiveness component | Grading | Confidence | Trend | Summary of evidence |
|---|---|---|---|---|
| Effectiveness in considering cumulative impacts<br><br>MNES: All | Partially effective | Limited | | All EIS are required to report on cumulative impacts on MNES from the development.<br>To date, however, there is no consistent method to determine the cumulative impacts of a development. |
| *Partially effective:* Cumulative impacts are considered upfront in planning and assessment. There is no consistent method to determine the cumulative impacts of a development. | | | | |

***OVERALL EFFECTIVENESS***

Partially effective

***DEMONSTRATION CASE SNAPSHOT:***

ABBOT POINT CUMULATIVE ENVIRONMENTAL IMPACT ASSESSMENT (CIA)

The developers of proposed new coal terminals at the Port of Abbot Point have undertaken a comprehensive investigation of environmental impacts from their port development projects.

The CIA will help ensure that the Port of Abbot Point is designed and developed in a manner consistent with environmental best practice and considerate of the OUV of the GBRWHA.

North Queensland Bulk Ports Corporation, as the port authority, and BHP Billiton, GVK Hancock Coal and Adani, as the developers of future terminal projects at the port, have together produced a consolidated assessment report providing comprehensive information to inform individual approval decisions at the port.

The CIA considered impacts on the marine environment, terrestrial environment, Kaili (Caley) Valley wetland and GBRWHA.

The CIA identified conservation objectives and has informed the development of a proposed Joint Environmental Management Framework which will provide for coordinated and adaptive management of the port to mitigate impacts.

This collaborative and proactive approach to measuring and addressing cumulative impacts is the first of its kind and provides a performance model for addressing cumulative impacts across multiple proponents. The CIA also looked specifically at the impacts on the OUV of the GBR and provides a benchmark for future explicit consideration of World Heritage values.

Source: NQBP. Further information can be found at: http://www.nqbp.com.au/abbot-point/

## 7.7 How well the Program avoids impacts on MNES

The establishment of conservation areas, such as national parks, under the NC Act, provides one of the most important means by which impacts on MNES can be avoided. However, reserving land in national parks or other protected areas cannot provide the only means of protecting MNES values in a multiple use landscape.

In terms of managing future coastal development, Queensland Government's overall approach through its Program is to contain coastal development to key areas, such as urban localities, SDAs, PDAs and port areas. There are restrictions on what types of activities may occur outside these areas.

Constraining and encouraging development in certain well-defined nodes and avoiding areas of MNES provides a strategic basis for protecting MNES. This approach is supported by general consensus that nodal development has significantly less impact than linear or ribbon development which fragments the landscape.[136]

In general, the Queensland Government's Program considers environment impacts of development at three stages.

- The first is through a decision to designate an area for development; such as the **declaration** of a SDA, Port Area, PDA or an urban footprint. This is the preferred stage to identify MNES areas or values and ensure that future development avoids significant impacts on these values.
- The second is through a structure/master **planning** or development planning stage where areas within the 'declared' development area are zoned for future development or set aside to protect the environment.
- The third is through **development assessment**, where a specific proposal is assessed for its potential to have a significant impact on MNES. At any of these stages, if it is not feasible to avoid impacts on MNES, the 'minimise and offset impacts' policy can be applied.

### 7.7.1 Reef wide analysis

Only three per cent of the GBR coastal zone is currently developed or identified as likely to be developed in the near future. Over 30 per cent of the terrestrial GBR coastal zone is within a conservation area, which is significantly greater than the Queensland average of just over five per cent.[20] See Table 7.7 1 below.

Table 7.7 1 Area in Conservation Areas and areas identified for future development in the GBR coastal zone

| | | Terrestrial | Marine |
|---|---|---|---|
| ***Conservation areas*** | Protected areas (e.g. national parks)<br>Marine Parks<br>Conservation parks<br>Fish Habitat Areas<br>other protected areas | 31.9%<br><br><br>44.3% | 96% (of GBRWHA coastal zone in marine parks)<br>In no take zones of marine parks |
| ***Areas currently developed or identified for future development*** | Urban localities<br>Priority Development Areas<br>State Development Areas<br>Strategic port land | 3.0% | 0% |

Source: [20]

CHAPTER 7 I program effectiveness

### 7.7.2 Regional analysis

Figures 7.7 1 to Figure 7.7 6 show the conservation areas and areas currently developed or identified for future development within each NRM region. They also show the areas of significance for MNES where further investigation or studies may be necessary to determine the level of impact on MNES from potential development.

Table 7.7 2 details the proportion of conservation areas and areas currently developed or identified for future development in each NRM region within the GBR coastal zone. Cape York and the Wet Tropics have the greatest proportion of conservation area and the lowest proportion of area identified for future development. In contrast, the Burdekin and Fitzroy regions (particularly around Gladstone) have the highest amount of area designated for future development. Development in the Wet Tropics and Burnett Mary is lower relative to the other catchments south of Cape York. The areas of significance for MNES where further investigation may be necessary to determine the level of impact on MNES from potential development is also included in Table 7.7 2.

Table 7.7 2 Area in Conservation Areas and areas identified for future development in the NRM Regions

| NRM Region | Areas currently developed or identified for future development (%) | Conservation Areas (%) |
|---|---|---|
| ***Cape York*** | 0.1 | 46.4 |
| ***Wet Tropics*** | 2.7 | 42.3 |
| ***Burdekin*** | 8.1 | 21.3 |
| ***Mackay Whitsunday*** | 2.7 | 26.1 |
| ***Fitzroy*** | 3.4 | 13.4 |
| ***Burnett Mary*** | 0.7 | 30.9 |

Source: [20]

For many of the developed catchments, the legacy of past land use changes are having an ongoing impact on the GBRWHA. Other than in Cape York region, large areas of the other NRM regions have been cleared, mostly for agriculture. These areas are not designated for future coastal development, but they are not of high environmental value because of the modification that has taken place. However, best practice management of these areas is critical to the long-term health of the GBRWHA. The GBRMPA's Informing the Outlook Report[4] highlights areas of intensive agriculture in the lower floodplain as major contributors to the significant loss of forested floodplain and freshwater wetland ecosystems in the GBR coastal zone. Some cleared areas have been identified as critical for many ecological processes (e.g. groundwater recharge and discharge, water, nutrient and sediment cycling and regulation (see chapter 4), habitat and feeding areas, recruitment and nursery areas for ecologically important flora and fauna) and areas where future restoration work could be focused.

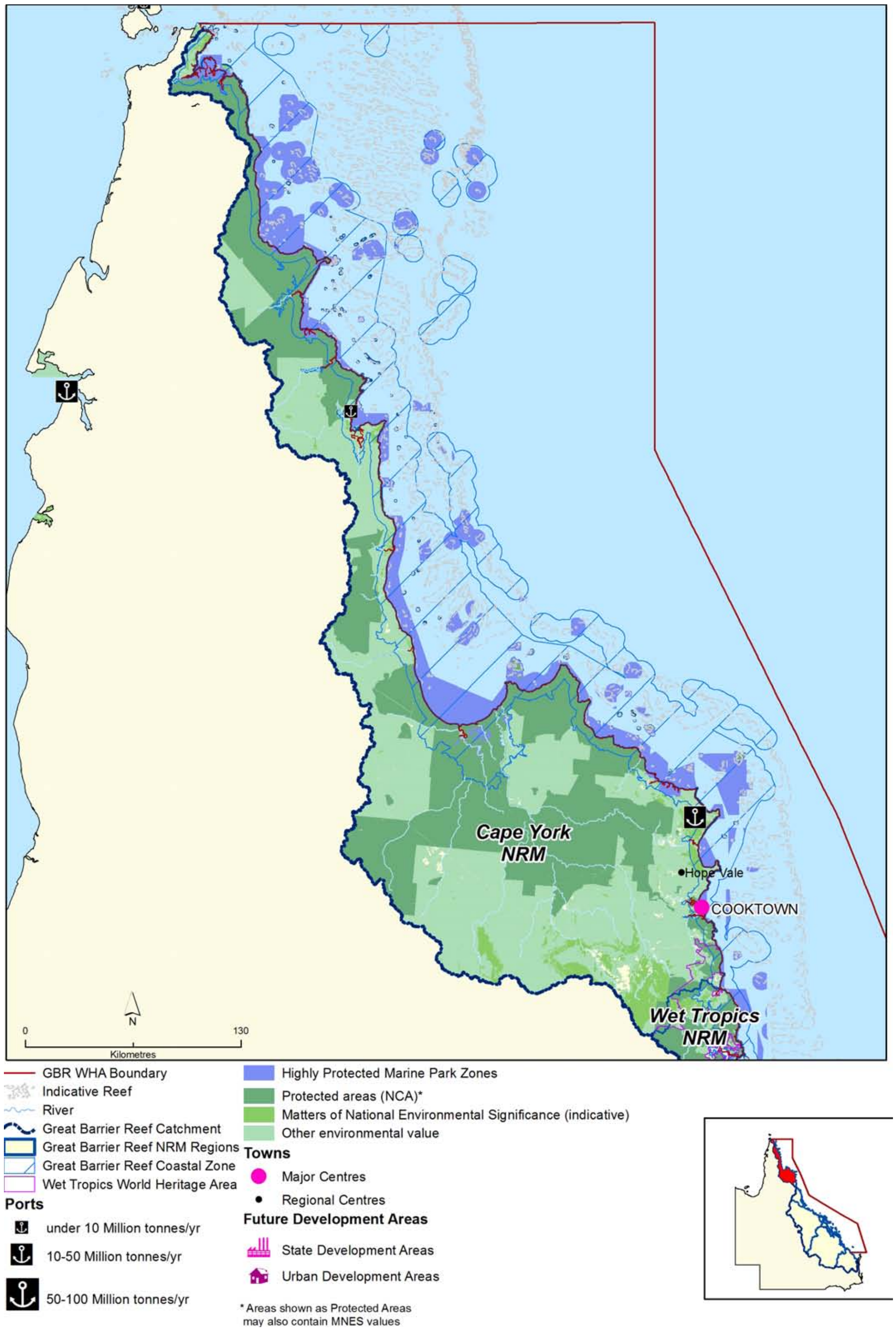



Figure 7.7 1 Conservation and future development areas within the Cape York NRM Region

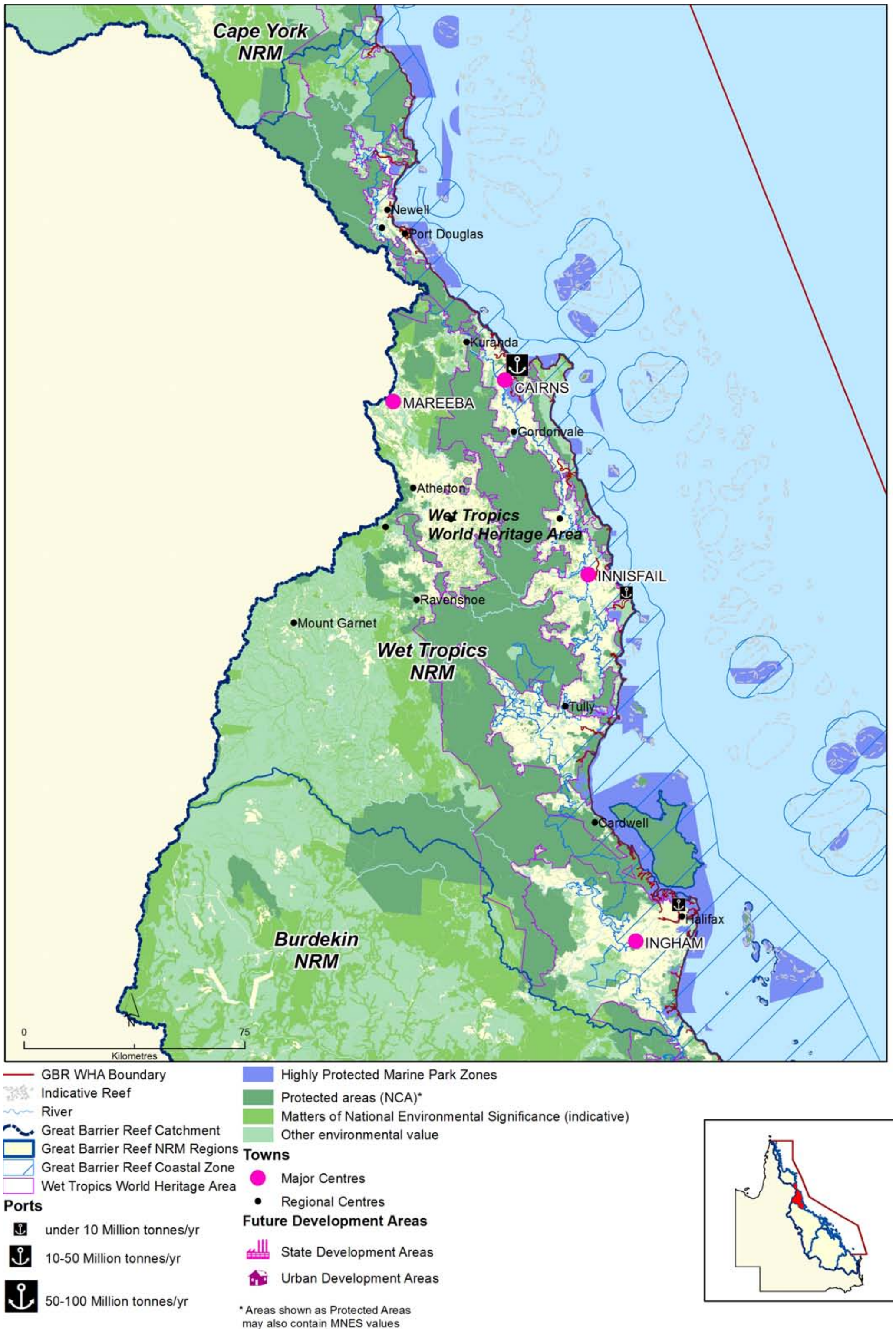



Figure 7.7 2 Conservation and future development areas within the Wet Tropics NRM Region

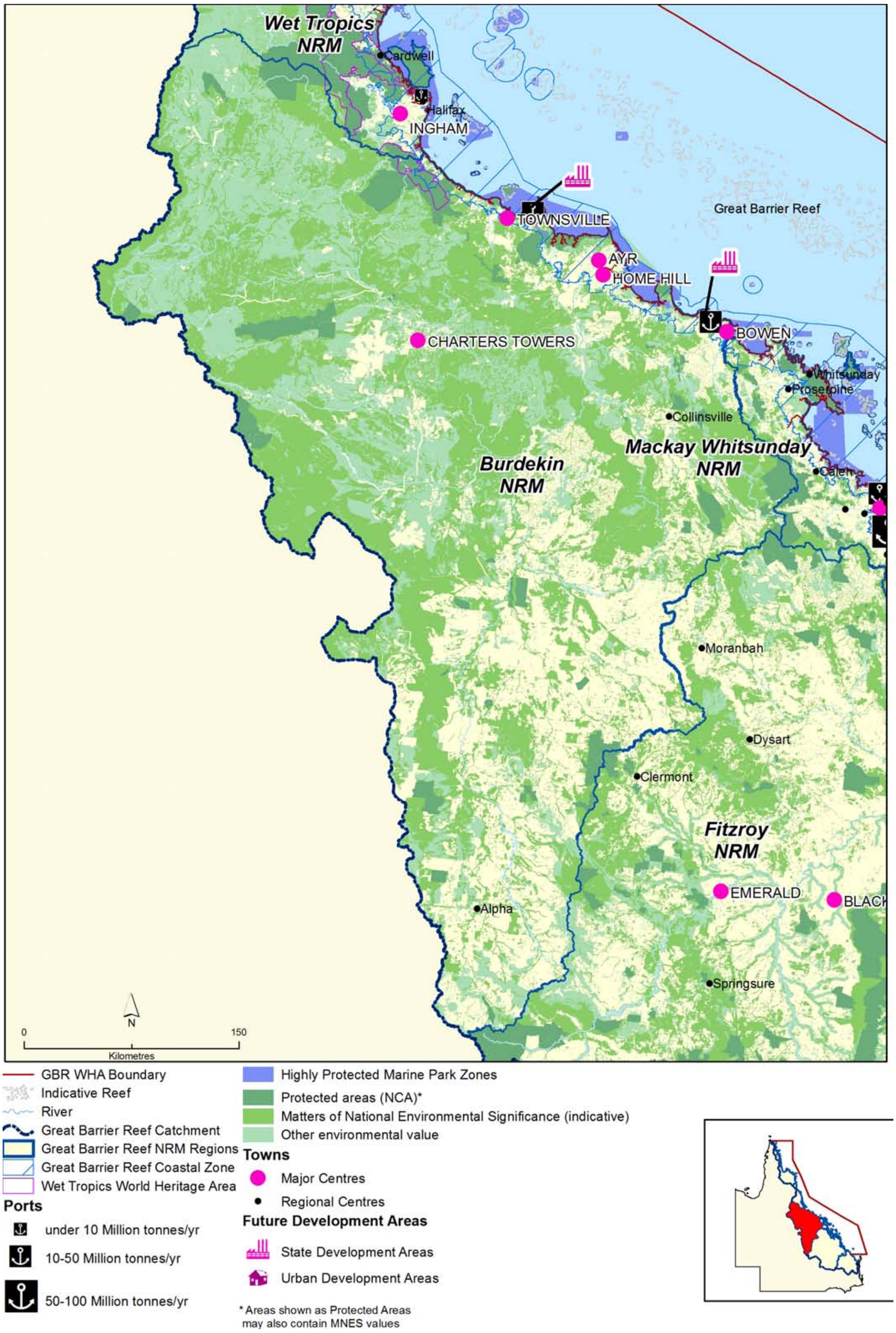



Figure 7.7-3 Conservation and future development areas within the Burdekin NRM Region

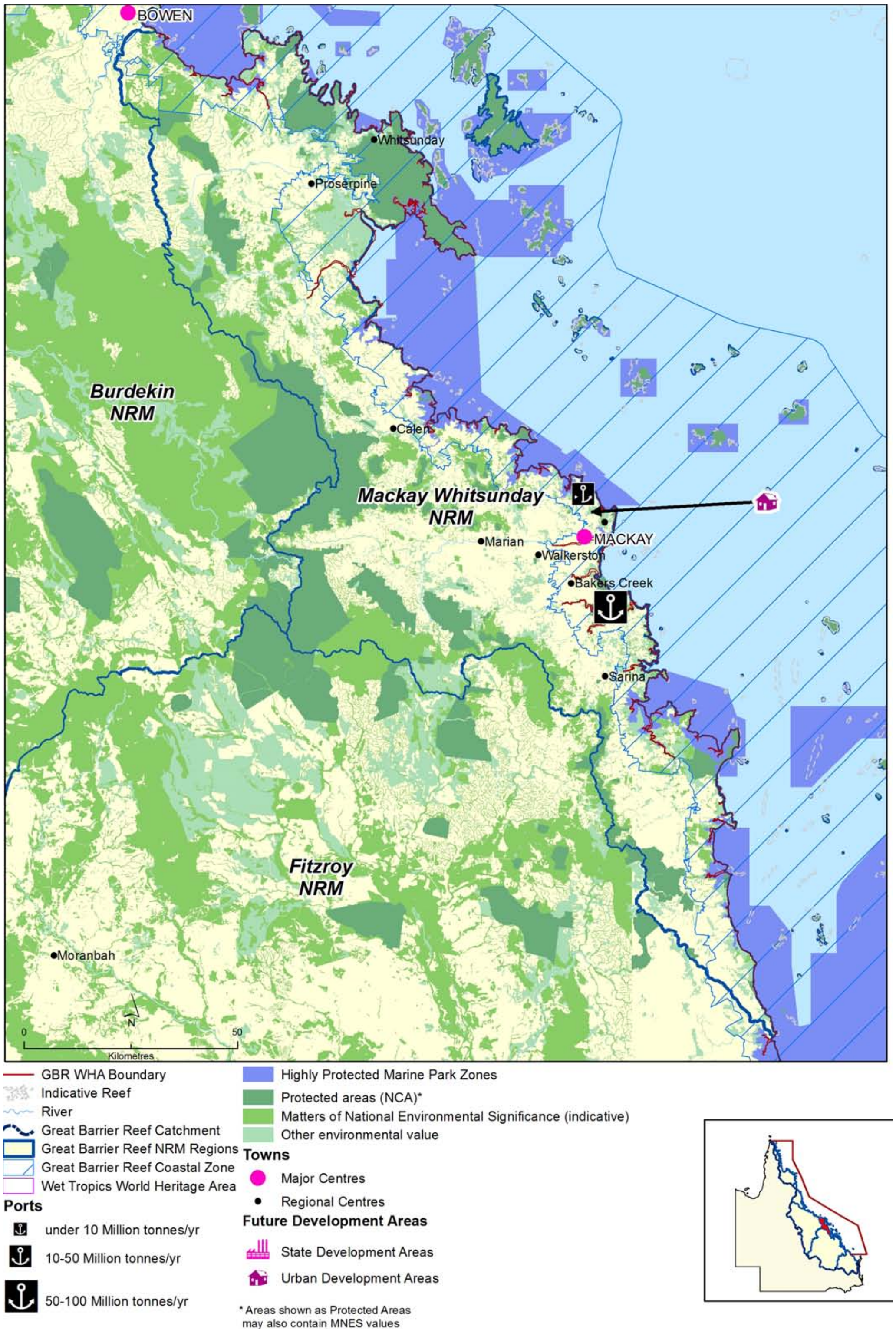



Figure 7.7 4 Conservation and future development areas within the Mackay Whitsunday NRM Region

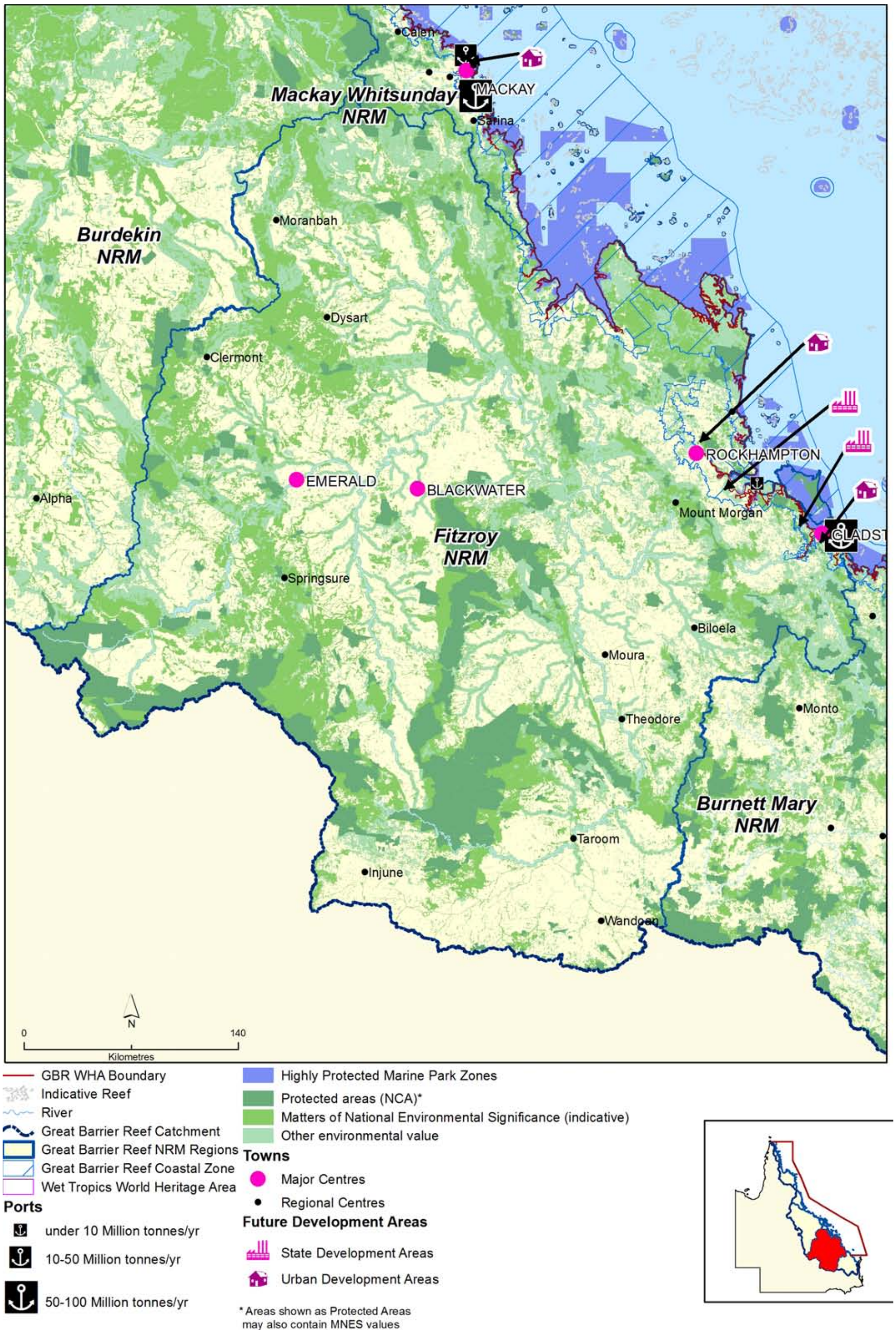



Figure 7.7 5 Conservation and future development areas within the Fitzroy NRM Region

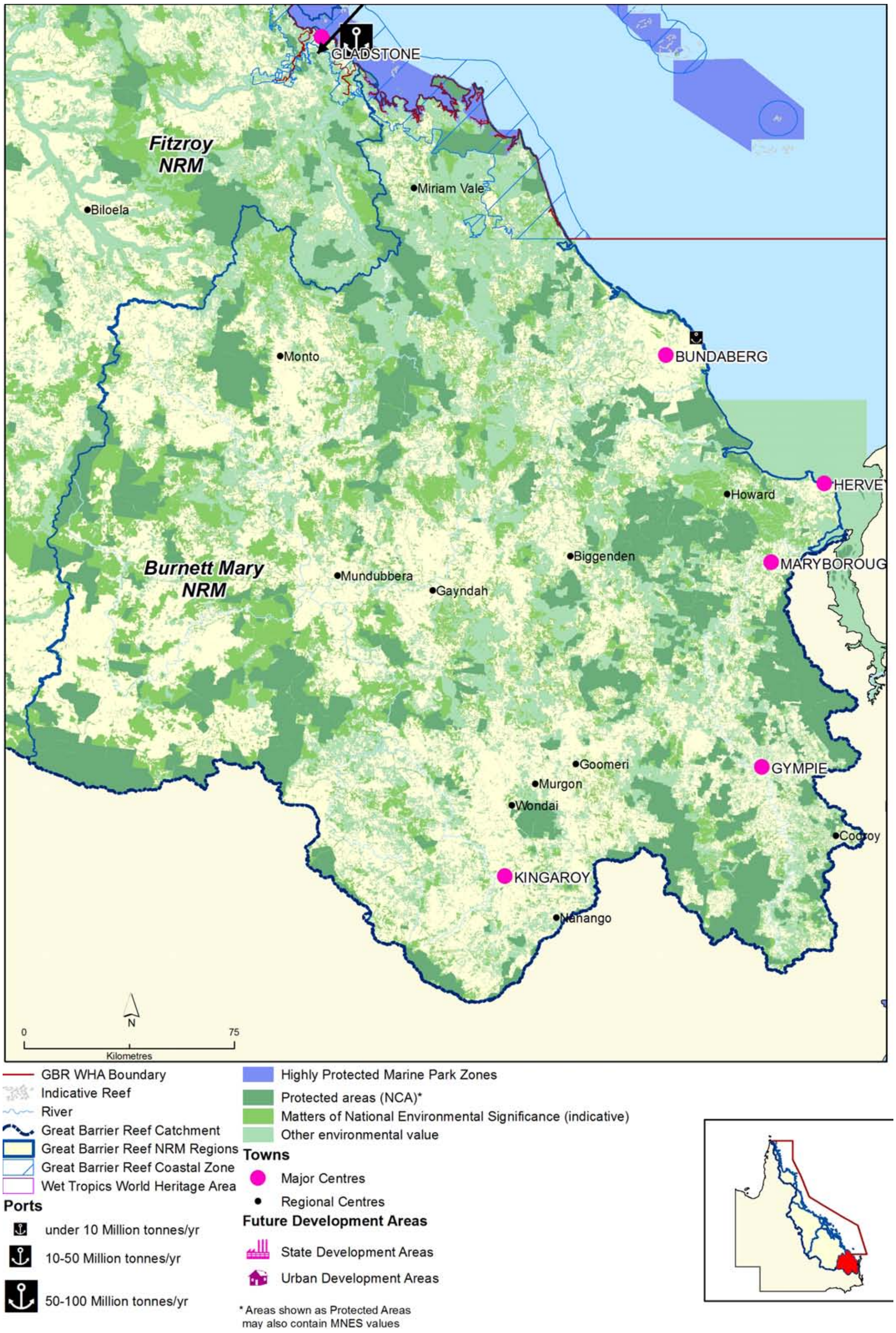



Figure 7.7 6 Conservation and future development areas within the Burnett Mary NRM Region

## 7.7.3 Avoiding impacts on MNES through conservation areas

In Queensland, protected areas are established under the NC Act, Fisheries Act and MP Act and include state lands managed by the QPWS. Protected areas, such as national parks are critical to the preservation of our environment and provide a broader whole-of-landscape and seascape approach to biodiversity conservation. They will continue to be extremely important for biodiversity conservation in the light of the emerging threats from global climate change as well as the continuing legacy of past land use changes.

### 7.7.3.1 Protected areas

Queensland's protected area estate in the GBR coastal zone provides an important basis for managing MNES. Protected areas, such as national parks and private conservation reserves (nature refuges), are declared under the NC Act on terrestrial areas and islands. A large proportion (32 per cent) of the GBR coastal zone is within terrestrial conservation areas. There are 84 national parks protected under the NC Act within the GBR terrestrial coastal zone, covering 18 per cent of the area.

Marine parks, including high protection zones, are established under the MP Act. Declared Fish habitat Areas (FHAs) are established under the Fisheries Act. Protected areas on state land and state marine parks are managed by the QPWS.

The majority of the Wet Tropics WHA and Ramsar wetlands are in protected areas. Protected areas also provide a stronghold for threatened species.

Eighty-nine per cent of the Wet Tropics WHA is contained in national parks, and large proportion of the Bowling Green Bay and Shoalwater/Corio Bay Ramsar wetlands are within terrestrial or marine protected areas. Ninety-six per cent of the area of the GBRWHA within the GBR coastal zone is within a state or Commonwealth marine protected area (all marine park zones included) (see Table 7.7 3).

Table 7.7 3 Examples of MNES and the proportion within terrestrial or marine protected areas

| Examples of MNES | Proportion in protected area (%) |
|---|---|
| Great Barrier Reef WHA (within the coastal zone) | 96 (in marine parks) |
| Wet Tropics WHA | 89 |
| Bowling Green Bay RAMSAR site | 99 |
| Shoalwater/Corio Bay Ramsar site | 80 |

Source: DEHP 2013

Other national parks provide an important stronghold for threatened species. For example, approximately 89 per cent of essential habitat for cassowary in the Wet Tropics lies within protected tenures (see cassowary case study below).

To achieve their purpose, protected areas require management. Key aspects of management of Queensland's national parks are focussed on management of key threatening processes of fire and pests as well as addressing sustainable use:

- **Fire –** The QPWS Fire Management System sets standards and operational aspects for planned burns and bushfire responses in protected areas, forests and other areas of land. The Fire Management System also encompasses fire management operational policies and procedures, environmental principles and an incident control system. The Queensland Government recently released Planned Burn Guidelines for specific bioregions to help land managers maintain healthy ecosystems and promote awareness of fire management issues.[41]
- **Pest management –** A statewide pest management system guides planning and on-ground activities and encourages an integrated approach to the management of pests. The operational policy titled 'Management of pests on QPWS managed areas' is prepared under the requirements of the LP Act.
- **Sustainable use –** A key goal of QPWS is managing the sustainable use of protected areas, while protecting their natural and cultural values. Permits and management strategies are used to regulate visitor use of protected areas.

## *Case study:*

CASSOWARY

The southern cassowary (*Casuarius casuarius johnsonii*) is listed as Endangered under the EPBC Act. The Wet Tropics population is also listed as Endangered in Queensland under the NC Act and it is ranked as a critical priority under the EHP Back on Track species prioritisation framework. The Cape York populations are listed as Vulnerable in Queensland (NC Act) and are ranked as a medium priority under the EHP Back on Track species prioritisation framework.

Like the emu and ostrich, the southern cassowary is a ratite – a large flightless bird with unusual feathers and other features that distinguish it from all other birds. A striking bird with glossy black plumage, the adult southern cassowary has a tall, brown casque (helmet) on top of its head, a vivid blue and purple neck, long drooping red wattles and amber eyes. Newly hatched chicks are striped dark brown and creamy white (Figure 7.7 7 - left). After three to six months the stripes fade and the plumage changes to brown. As the young mature, the plumage darkens, the wattles and casque develop and the skin colour on the neck and wattles brighten. The cassowary is mature by about three years of age (Figure 7.7 7- right).

Adult cassowaries can grow to an imposing two metres tall. In general the sexes are fairly similar in appearance, though females are slightly larger and can weigh up to 76 kilogrammes. Males can weigh up to 55 kilogrammes.


Figure 7.7 7 A cassowary chick (left) and an adult cassowary (right)

Source: [137]

The cassowary requires a high diversity of fruiting trees to be present within its habitat to ensure it has a year-round supply of fleshy fruits. Although occurring primarily in rainforest, it also uses woodlands, melaleuca swamps, mangroves and even beaches, both as intermittent food sources and as connecting habitat between more suitable sites. Cassowaries play an important role in maintaining the diversity of rainforest trees. They are one of only a few frugivores (fruit eaters) that can disperse large rainforest fruits and are the only long distance dispersal vector for large seeded fruits.

At the time of European settlement of Australia, the cassowary lived in tropical rainforests of north-east Queensland, from Paluma Range (north of Townsville) to the tip of Cape York. Its present distribution remains similar but is greatly reduced and fragmented by forest clearing. On Cape York, it now occurs in two separate populations: a southern population in the vine forests of the McIlwraith and Iron ranges and a northern population in the less extensive vine forests north of Shelburne Bay (Figure 7.7 8).

A number of factors affect cassowary survival. The major threats include the loss, fragmentation and modification of habitat, vehicle strikes, dog attacks, human interactions, pigs, disease and natural catastrophic events. Once common in far north Queensland the cassowary's traditional feeding grounds, particularly the coastal lowlands, have been seriously reduced by land clearing for farming, urban settlement and other development. Widespread clearing and fragmentation of rainforest habitat have reduced cassowary numbers until today; the cassowary is now threatened with extinction. Most of their lowland habitat has been cleared and urban development threatens the continued existence of local populations outside of protected areas.

In the Wet Tropics cassowaries are distributed widely from Cooktown to Paluma Range with approximately 89 per cent of remaining essential habitat in the Wet Tropics being within protected tenures.

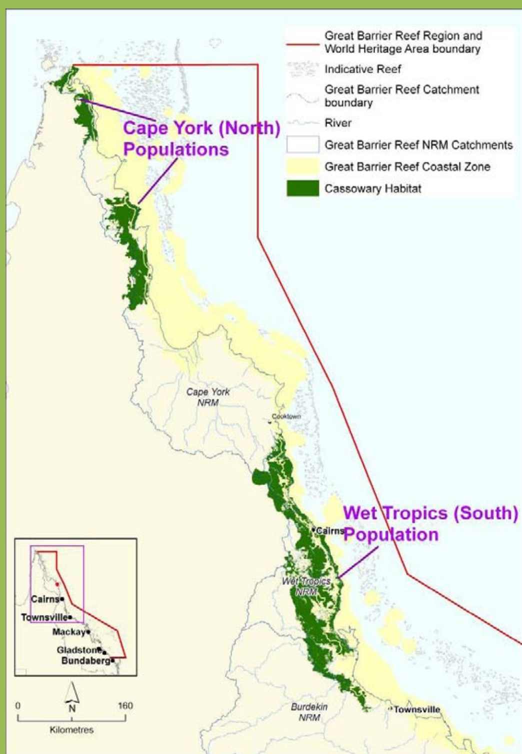



Figure 7.7 8 The cassowary distribution in Queensland

Source: [38]

7.7.3.2 Islands in the GBRWHA

The GBR coastal zone includes the islands of the GBR coastal waters. Seventy-seven islands have been declared national parks under the NC Act and 361 of the islands (45 per cent) contain areas that have been declared national parks.[138]

GBR islands provide valuable nesting sites for a variety of threatened species including turtles and migratory sea birds. Management plans for protected areas islands in the GBRWHA clearly articulate how a protected area will be managed to protect its natural and cultural values, support visitor use and manage other uses. They also include comprehensive listings of

***DEMONSTRATION CASE SNAPSHOT:***

ISLAND MANAGEMENT

***OVERALL EFFECTIVENESS***

Partially effective

Managing around 1050 islands in the GBRWHA is a complex task. The State of Queensland has jurisdiction over approximately 980 of these islands. About 330 of them are protected areas, national parks, and the tenure on the other 650 islands includes leasehold, freehold, Unallocated State Land, Commonwealth or Deed-of-Grant in Trust land.

The degree of active management for the 1050 islands in the GBRWHA varies widely. For around 700 islands (many of which have important values such as seabird rookeries) there are a range of 'managers' covering a variety of tenures (leasehold, freehold, Unallocated State Land, Commonwealth and Aboriginal Land).

The Queensland Government and the GBRMPA adopt risk-based approaches to the management of these islands. Key challenges in the management of islands include resource limitations, the remote locations of many islands and the aforementioned ecological and jurisdictional complexities. This led to the establishment of joint management arrangements and a formal partnership between the Australian and Queensland governments in the 1979 Emerald Agreement and the current Great Barrier Reef Intergovernmental Agreement 2009. Over the 30 year period, an extremely effective partnership between QPWS and other state and Australian government agencies has delivered day-to-day management as a Field Management Team.

Overall, management of islands was endorsed by the independent reviewers as mostly effective, with the exception that significant long term financial commitments from both the Queensland and Australian governments are required if priority actions to achieve agreed objectives are to be implemented.

The protection of natural, social, cultural and economic values of islands with national park or other conservation tenure requires:

- improved field management resources, personnel and fit-for-purpose vessels to deploy to all protected area islands at the frequency and duration for effective on-ground management
- a focus on biosecurity awareness and the prevention of pest invasions
- improved capacity for regional and site specific tourism and recreation planning (including infrastructure planning) to stay ahead of demand, and to sustain visitor enjoyment
- improved protection of high value island environments (such as marine turtle and bird nesting islands)
- improved understanding and resourcing for management of historic heritage
- a focussed program for Traditional Owner partnerships specifically related to protection and active management of Indigenous heritage
- a strong capacity for adaptive governance, which could include the capacity to use island condition and trend information to adjust on-ground actions and mitigate climate change impacts
- strengthening island condition and trend monitoring for adaptive management and reporting.

Many of the identified management improvements would also benefit non-protected area islands.

*Demonstration case jointly prepared with the GBRMPA* species, habitats and pressures. For example the Raine Island National Park (Scientific) Management Statement 2006–2016 provides a full description of the values and management intent for the island. The Island Management Demonstration Case highlights some of the work being done in island national parks to enhance MNES.

For islands that fall within the Queensland Government's jurisdiction but have not been declared as national parks or partial national parks the same management regime applies as to the mainland. Generally, their isolated nature means they are subject to fewer pressures than mainland areas and the pressures are mostly focused around tourism infrastructure. However, there are some islands close to mainland urban centres where there is more significant urban development (e.g. Magnetic Island).

#### 7.7.3.3 Other conservation areas

### *Nature refuges and state forests*

Landholders can protect native wildlife and wildlife habitat by having their property declared a nature refuge. Nature refuges can be declared over any land, state leasehold or freehold. They protect significant natural resources such as wildlife habitat and provide for controlled use of those natural resources, taking into account the landholder's interests. The property can still be used for agriculture, grazing, timber production and tourism, provided those activities are ecologically sustainable. A total of 39 nature refuges are in place, covering over 30 000 hectares – 1.1 per cent of the GBR coastal zone.

The number and area of nature refuges in Queensland has increased significantly over the last decade. The number of nature refuges containing threatened species and their habitat is a measure of the conservation value of nature refuges. Over 84 per cent of nature refuges record the presence of at least one species listed under the NC Act and over 81 per cent of nature refuges record at least one species listed under the EPBC Act.

There are a number of other areas where limited development occurs, including state forests. In recent years, a large area of state forests (185 966 hectares) has been converted to National Park.[108]

### *Indigenous protected areas and management*

There are other specific agreements in place to enable traditional Aboriginal and Torres Strait Islander heritage and cultural practices to continue within protected areas. These agreements are designed to recognise the traditional practices of Aboriginal and Torres Strait Islander people while allowing marine and terrestrial resources to be managed in a sustainable way. Three such agreements are TUMRA, ILUA and IPA.

TUMRAs play an important role in enabling traditional Indigenous use of marine resources within their sea country. These agreements describe how Traditional Owner groups manage the natural resources (including protected species) and their role in compliance and monitoring activities relating to the condition of plants, animals and human activities within the GBR Marine Park.

An ILUA is an agreement between a native title group and others, such as governments, about the use and management of land and waters. They were introduced following amendments to the *Native Title Act 1993.* ILUA are intended to be flexible, practical agreements that allow Traditional Owners to control and manage their use of their land and sea country. They may be negotiated over areas where native title has, or has not yet, been determined.

An IPA is an area of Indigenous owned land or sea country where Traditional Owners have entered into an agreement with the Australian Government to promote biodiversity and cultural resource conservation. There are currently two IPA located within the GBR coastal zone.

Mandingalbay Yidinji Indigenous Protected Area encompasses a small section of both the Wet Tropics and GBR WHAs in north Queensland, just east of Cairns across Trinity Inlet. It is made up of a number of protected areas that were joined up following recognition of native title over the Mandingalbay Yidinjii country in 2006. The Djunbunji Land and Sea Program through the Djunbunji Rangers manage this country on behalf of the Mandingalbay Yidinji people.

Girringun region Indigenous Protected Area is a voluntary declaration by the Djiru, Bandjin, Gulnay, Girramay, Warrgamay, Warungnu, Gugu Badhun and Nywaigi (with the support of Jirrbal) Traditional Owners. The Country within the Girringun region Indigenous Protected Area forms part of the Wet Tropics and GBR WHAs.

On Cape York Peninsula, Traditional Owners have entered into agreements with the Queensland Government to establish national parks on Aboriginal land under the NC Act. These include:

- Kutini-Payamu (Iron Range) National Park
- Lama Lama National Park
- Rinyirru (Lakefield) National Park

### *Case study:*

MANJAL JIMALJI TRAIL, DAINTREE NATIONAL PARK

The Daintree National Park in far north Queensland forms part of the Wet Tropics WHA. It is situated about 100 kilometres northwest of Cairns and is renowned for its stunning natural beauty and the many rare and threatened plant and animal species that can be found within its limits. The Wet Tropics has great cultural significance for the Aboriginal people who have traditional links with the area and its surrounds. The Daintree National Park itself is of great cultural significance to the Eastern Kuku Yalanji Aboriginal people who are the Traditional Owners of the national park. The Manjal Jimalji trail within the Daintree National Park recognises the Eastern Kuku Yalanji people's connection to this important cultural site and tells the story of fire creation.

In October 2007, the Eastern Kuku Yalanji people signed an ILUA with the State of Queensland and the WTMA. The ILUA forms part of 144 000 hectares of native title claim first lodged in 1994. The signatories to the Indigenous land use agreement consent to, among other things, the:

- declaration of certain land as freehold Aboriginal Land
- declaration of a new national park
- the surrender of any native title rights over the Cartaar Road opening area, and
- the creation of the South Arm Permit area which will include a reserve to be used for cultural and environmental purposes.

Manjal Jimalji is the Eastern Kuku Yalanji place name for what is known locally as Devil's Thumb. The trail begins in the Whyanbeel Valley at Little Falls Creek around 17 kilometres north of Mossman. It is a renowned bird watching trail where the range of bird life changes with altitude and can include metallic starlings, yellow-spotted honeyeaters, the endangered southern cassowary, fernwrens, grey-headed robins and chowchillas.

The Kuku Nyungkal and Jalunji-Warra ranger groups take a lead role in managing this country through conservation work. To date their work has resulted in the development of cultural management plans, cultural heritage surveys and the implementation of fire and pest management plans.[139]

In partnership with the Australian Government and the QPWS, the Eastern Kuku Jalunji-Warra and Kuku Nyungkal are hoping to develop a number of sustainable businesses. These include a health retreat, eco-cultural tourism, walking tours and cultural education to provide employment and economic opportunities for the local community.

Under these arrangements and organised partnership projects, there is a range of activities to promote the conservation of biodiversity. In the GBR coastal zone, Queensland's Land and Sea Ranger Program fund several land and sea rangers. These rangers ensure the unique ecology of Queensland's natural environment, including MNES values are protected through activities such as:

- managing weeds, feral animals and other threats
- performing fuel reduction and ecological burning
- collecting data on protected species and habitats
- supporting disaster recovery efforts
- managing visitor activity
- recording traditional stories
- helping manage national parks.

In acknowledging the different levels of participation and knowledge among Traditional Owner groups in managing country, an adaptive and flexible approach to partnerships is required. The concept of co-management has formed the platform for managing country in the region since the 1990s, and has helped form a number of ongoing partnerships between Traditional Owners, government authorities and other stakeholders.

#### 7.7.3.4 Marine Parks

The GBR Coast Marine Park was declared under Queensland law in 2004. It extends over Queensland's coastal waters the full length of the GBR Marine Park from just north of Baffle Creek (north of Bundaberg) to Cape York, generally congruent with the Commonwealth GBR Marine Park (see Figure 7.7 9). However, the boundary of the two marine parks differ in that the Queensland GBR Coast Marine Park extends to high water mark whereas the Commonwealth GBR Marine Park extends to the low water mark. The intertidal areas included in the GBR Coast Marine Park are crucial to the functioning of coastal ecosystems and the GBR. The Queensland GBR Coast Marine Park therefore protects intertidal areas and most estuaries and other tidal waterways. There are a number of areas excluded from the Queensland and Australian Government GBR marine parks. These are generally port areas.

The GBR Coast Marine Park complements the GBR Marine Park through adopting similar zone objectives, and entry and use provisions. A total of 39 per cent of the GBR Coast Marine Park is considered protected. Under the MP Act and relevant zoning plans, permits are required for a range of activities, including installation and operation of structures (including moorings), any work such as repairs to structures, dredging and dumping, waste discharge from a fixed structure anchoring and mooring for an extended period. The Queensland Government works closely with the GBRMPA to deliver joint permits for the GBR Marine Park and the GBR Coast Marine Park.

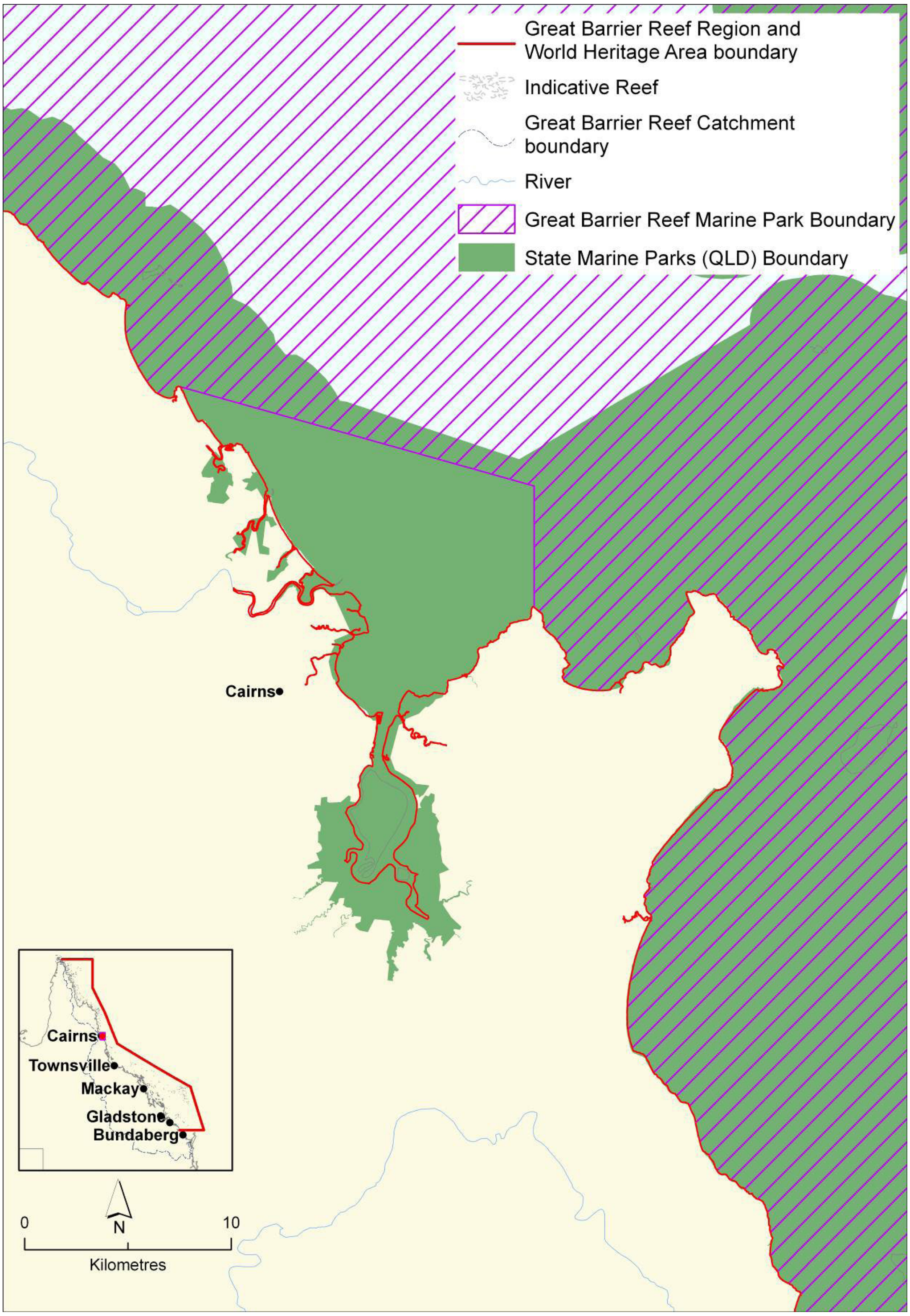



Figure 7.7 9 Map of a section of the Australian Government GBR Marine Park and Queensland GBR Coast Marine Park

### 7.7.3.5 Other marine conservation areas

#### *Fish habitat areas*

Declared fish habitat areas (FHAs) are areas protected from physical disturbance associated with coastal development and declared under the Fisheries Act. There are 41 declared FHAs covering more than 1.1 million hectares, eight per cent of the GBR coastal zone (Figure 7.7 10). They are part of Australia's Nationally Representative System of Marine Protected Areas, and fit within the International Union for the Conservation of Nature and Natural Resources (IUCN) Protected Area Management Category VI - 'Managed Resource Protected Area'.

The FHAs allow all legal forms of fishing – recreational, commercial and indigenous – and restrict the level of coastal development and its impacts on these key fish habitats. The key habitats support a diverse fish fauna that sees many species, such as prawns and gamefish, moving into offshore waters, while other species, such as barramundi and mangrove jack, move upstream to mature in freshwaters.

All development in a FHA, except self-assessable development, requires approval before activities start. A resource allocation authority (RAA) issued under the Fisheries Act is required, as well as a fisheries development approval under the SP Act. Development in a declared FHA is limited to key public infrastructure, such as boat ramps, although limited private structures, such as jetties, may also be approved. Building work in a declared FHA is self-assessable under the Fisheries Act, if the work is reasonably necessary for educational or research purposes relating to the declared FHA (Sustainable Planning Regulation 2003, schedule 3, part 2).

The declared FHA Network Strategy 2009-14 sets the direction for expansion and ongoing management of the network of FHAs. The 2012 Declared Fish Habitat Area Assessment Report[140] documented the overall good condition of the network, inclusive of key fish habitat diversity and fisheries-related activity.

#### *Marine plant protection*

Marine plants grow on or adjacent to tidal lands. They include mangroves, seagrass, saltcouch, algae, and samphire (succulent) vegetation.

All marine plants are protected under the Fisheries Act. The destruction, damage or disturbance of marine plants without prior approval from Fisheries Queensland is prohibited. Heavy penalties apply to any unauthorised disturbances that impact on marine plants.

Protection applies to all marine plants, no matter where they grow, including private, leasehold or public lands, and whether the marine plants are alive or dead. Coastal residents and landholders must apply for prior approval to undertake certain activities, such as building a jetty, that require them to cut, trim or remove mangroves or other marine plants.

#### *Dugong Protection Areas*

There are 15 dugong protection areas along the GBR coast, covering 5.7 per cent of the GBR coastal zone. Within these areas set fishing nets (i.e. stationary nets) are either prohibited or have restrictions placed on them.

The Dugong Protection Areas are declared under the Fisheries Act and the NC Act. Two types of protection areas have been established. Zone A has more stringent controls over netting practices. Foreshore set nets and offshore set and drift nets are prohibited in most Zone A protection areas. In Zone B mesh netting is permitted but with restrictions on the type, size and location of nets, and requirements for attendance at nets.

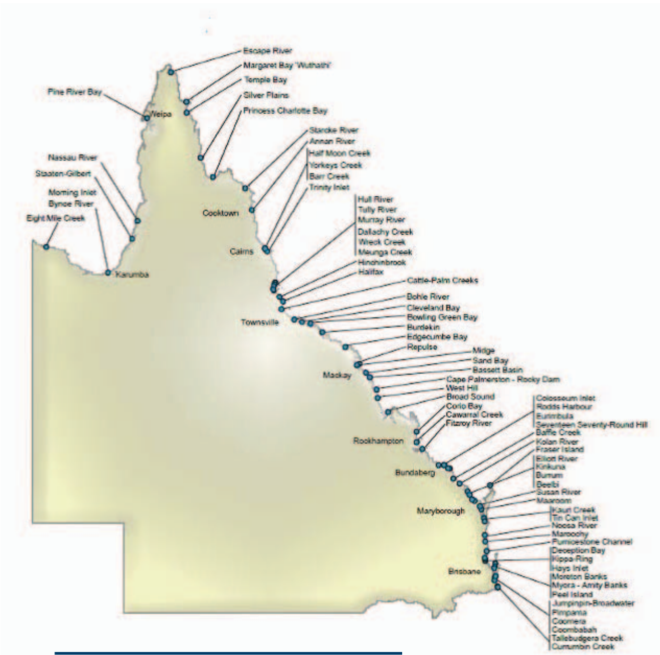



Figure 7.7 10 Fish Habitat Areas in Queensland.

Source: [140]

CHAPTER 7 I program effectiveness

#### 7.7.3.6 Identification of future priority conservation areas

The Queensland Government continues to add to its protected area estate over time and seeks to ensure a comprehensive, adequate and representative system that protects a range of ecosystems and species. As described above, the Queensland Government has identified areas of significant biodiversity value. This includes areas that would benefit from strategic rehabilitation or may be of high value and warrant incorporation into the protected area estate (including through nature refuges) at some time in the future.

Since the 1970s, the design intent for building Queensland's terrestrial network has been the systematic protection of a full range of biodiversity across the state, including not only the scenic and diverse areas near the coast, but also samples of deserts, woodlands and grasslands. This has been based on a bioregional approach, using REs as a finer-level representation of biodiversity to guide protected area selection. The bioregional approach is the basis of the 'comprehensive, adequate and representative' protected area network, which is a primary goal of the terrestrial National Reserve System.

Each RE has been assigned a conservation status which is based on its current remnant extent (how much of it remains from its pre-cleared extent) in a bioregion. The RE mapping is one of the consideration in selecting areas for additions to the Queensland National Park estate. As a result, the future acquisition of national parks will most likely incorporate TECs, the majority of which are listed as 'of concern' or 'endangered' REs under the VM Act.

Under a new approach to offsets, strategic investment corridors will also be identified for particular values, where offset delivery could be prioritised in order to benefit impacted matters and to provide strategic landscape scale benefits.

#### 7.7.3.7 Gaps and improvements

The remote locations and diverse ecological and jurisdictional complexities involved with conservation area management has led to the development of a risk-based approach, resulting in joint management approaches between the Australian and Queensland governments and Traditional Owners. Whilst this approach has resulted in an extremely effective partnership to deliver day-to-day management, a long term management commitment by both governments and assistance for Traditional Owners is required for agreed objectives to be implemented to improve the Program.

#### 7.7.3.8 Summary of effectiveness of avoiding impacts on MNES through conservation areas

| Management effectiveness component | Grading | Confidence | Trend | Summary of evidence |
|---|---|---|---|---|
| Effectiveness in avoiding impacts through conservation areas<br><br>MNES: All | Very effective | Appropriate |  | Management of protected areas is the cornerstone of protection for MNES. A large proportion of the GBR coastal zone is within conservation areas (31.9 % terrestial and 44.3 % marine). |
| *Very effective:* Planning, development and management processes effectively and explicitly ensure that impacts on MNES are avoided. | | | | |

### 7.7.4 Avoiding impacts on MNES through Queensland Government's planning system

Queensland Government's planning system provides for consideration of environmental values in the early stages of identifying locations for future urban or industrial areas. While not explicit, this includes consideration of MNES amongst the suite of environmental values that are considered in planning. The early consideration of MNES is the best means of avoiding and minimising impacts on MNES and minimises the requirement to address MNES issues when development proposals are put forward. The planning system has the capacity to provide a direct line of sight from the global level right down to the local level, by taking into account national and international matters and reflecting these in state planning instruments which in turn are then reflected at the local level (see Figure 7.7 11).

Through Queensland Government's Program, planning for different activities, including urban, port and industrial development are covered by different Program components. These include the SP Act and its mechanisms such as state planning policies, state planning regulatory provisions and Regional Plans, the SDPWO Act through SDAs, TI Act through Port Land Use Plans and the ED Act through PDAs.

#### 7.7.4.1 Queensland's state planning policy

Queensland Government's Program includes a number of planning and development laws and other instruments as outlined in the *program report.* These include a number of existing state planning policies (SPP) that guide development and include requirements to avoid impacts on a range of environmental values in Queensland.

The Queensland Government is simplifying and streamlining the planning and development framework of the SP Act by establishing a single SPP that considers the state's interests as a whole. This is expected to replace the many issue-specific planning policies and the Coastal Protection State Planning Regulatory Provision that have been prepared over a period of 20 years.

The single SPP is expected to set out the interests and policy provisions that local government must take into account when preparing or amending their local planning schemes or assessing certain types of development applications. Local government planning instruments must reflect relevant state interests and provide local context to those interests. This ensures that the state planning interests are frontloaded into local government planning activities. It is expected that the single SPP will commence in late 2013.

The draft State Planning Policy (draft SPP) was released in April 2013 for public consultation; the draft as released is currently being reviewed and is subject to change prior to finalisation. It included provisions for coastal environment protection, biodiversity conservation and water quality improvement. The draft SPP made specific reference to avoiding, mitigating and offsetting impacts on MNES, an approach that will help ensure that Australian Government environmental interests (MNES) are considered upfront in the local planning process, allowing early avoidance and mitigation of development impacts.

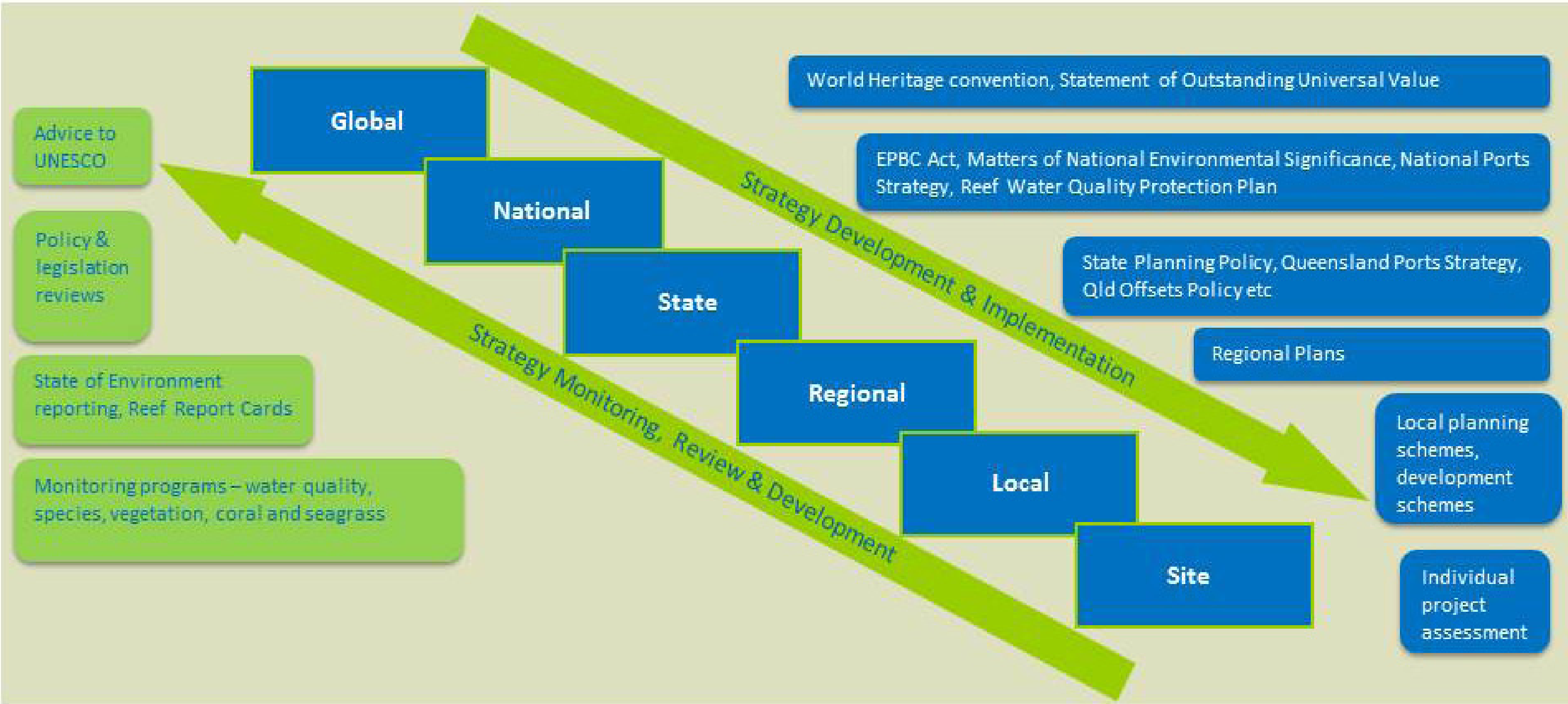



FIGURE 7.7-11 Line of sight in planning from the international to the local level

### 7.7.4.2 Regional plans and urban development

Regional plans seek to provide the strategic direction to achieve regional outcomes that align with the state's interest in planning and development. Regional plans prepared between 2008 and 2012 have included biodiversity conservation policies broadly similar to those in the draft SPP.

Historically, regional plans have identified future development and growth areas to ensure that future growth was accommodated within the most appropriate locations that will have the least environmental impact. There are currently three statutory regional plans for the catchments adjacent to the GBR, the Far North Queensland Regional Plan, the Mackay, Isaac and Whitsunday Regional Plan and the Wide Bay Burnett Regional Plan. The Mackay, Isaac, Whitsundays Regional Plan Demonstration Case provides an example of how MNES has been incorporated into a regional plan.

There are also non-statutory plans in place for central Queensland and north Queensland which will be replaced by statutory plans in due course. Examples of detailed structure planning for newly designated urban area are the Mount Peter (Cairns) case study and Andergrove (Mackay) master planning demonstration case.

A new generation of statutory regional plans are currently being prepared for Cape York and central Queensland. Further gaps in the regional planning program will be filled during the life of the Program (see chapter 10).

Certain types of urban development areas (priority development areas - PDA) are planned and developed under the ED Act. Each PDA requires a development scheme; a regulatory document that controls land use and infrastructure planning and development in the PDA. The development schemes ensure development is planned and managed appropriately and that environmental impacts are avoided and minimised. The PDA development schemes override local and other state government planning instruments related to the use of land. The Andergrove Urban Development Area Demonstration Case provides an example of this.

The Draft Coastal Management Plan 2013 under the *Coastal Protection and Management Act 1995* (Coastal Act) was recently released for public comment. The objective of the Coastal Act is to provide, conserve, rehabilitate and manage the coastal zone while having regard for the ecologically sustainable use of the Queensland coastal zone including the Great Barrier Reef area.

### 7.7.4.3 Gaps and improvements

The current suite of state planning policies do not explicitly consider or seek to avoid impacts on MNES specifically, although many of the existing planning policies protect environmental values that overlap significantly with MNES (e.g. wetlands). A guideline addressing the consideration of MNES in Queensland Government's planning system is required to provide greater certainty and clarity of the consideration of MNES during decision making for state planning activities.

### 7.7.4.4 Summary of effectiveness of avoiding impacts on MNES through conservation areas

| Management effectiveness component | Grading | Confidence | Trend | Summary of evidence |
|---|---|---|---|---|
| Effectiveness in avoiding impacts (urban development)<br><br>MNES: All | Partially effective | Adequate |  | State planning policies, regional planning and development schemes for urban development areas all specifically aim to avoid areas of state significance currently, but not MNES. (see *program report* – Strengthening Management section). |
| *Partially effective:* Planning policies do not explicitly consider MNES (including OUV), but do deliver some tangible outcomes for MNES. | | | | |

***DEMONSTRATION CASE SNAPSHOT:***

MACKAY, ISAAC, WHITSUNDAYS REGIONAL PLAN

***OVERALL EFFECTIVENESS***

Partially effective

The Mackay, Isaac, Whitsundays Regional Plan (MIW Regional Plan) was introduced in 2012 to help manage one of the GBR coast's fastest growing regions. The MIW Regional Plan is designed to balance a range of competing state interests and help manage and guide development in the region. Local governments must align their individual planning schemes with the intent/requirements of the MIW Regional Plan and all other relevant state planning instruments, unless the minister accepts the local government's justification for being inconsistent with an aspect of those instruments.

At the time the MIW Regional Plan commenced, Queensland Government identified and spatially represented areas of significant biodiversity value in Queensland that were of international, national, state or regional importance as of high ecological significance (HES). MNES were embedded within the HES mapping methodology, including threatened species, migratory species and TECs. This mapping was then used in association with the MIW Regional Plan to support local governments and development proponents to identify where the relevant policies of the regional plan were likely to apply. The maps identifying AES published in the 'MIW Regional Plan' document are provided as guidance to support local government decision-making and are not statutory in the context of the MIW Regional Plan for the purposes of the SP Act.

The regional planning process also involved identifying land with increasing levels of sensitivity based on the AES mapping methodology and planning for three regional land use categories. Despite the non-statutory effect of mapping associated with these three land use categories, the mapping is still being used because regional plan policies refer to these areas:

- Urban Footprint – land projected to meet the projected urban development needs to 2031
- Rural Living Area – areas suitable for rural residential development
- Regional Landscape and Rural Production Area – areas not planned for urban or rural residential development over the planning horizon due to values such as significant biodiversity or fauna habitat, cultural and landscape heritage values, natural economic resources (e.g. mineral and extractive resources) and good quality agricultural land.

Where the MIW Regional Plan has identified pressures and impacts on MNES (for example impacts of development on biodiversity or water quality and/or resource demands on the coastal zone), it provides principles, policies and programs for avoiding, mitigating and offsetting these impacts through desired regional outcomes (DROs). In relation to biodiversity, the policies within the MIW Regional Plan that apply to the protection of MNES include:

- development in non-urban areas maintains the integrity of areas with significant biodiversity values
- in urban areas, impacts from development on areas with significant biodiversity values where they cannot be avoided are offset in accordance with established policies, codes and frameworks
- the values of regional biodiversity networks are protected for the long term through improved ecological connectivity, enhanced habitat extent and condition, and rehabilitation of degraded areas.

## *Case study:*

MOUNT PETER'S MASTER PLAN AREA

The far north Queensland (FNQ) regional plan sets out a regional land use pattern based on a preferred pattern of development to achieve desired regional outcomes. The Mount Peter's master plan area (MPA) was identified as the area to receive the greatest amount of urban growth under the FNQ regional plan.

The MPA encompasses 3330 hectares, and is located in the Mulgrave River catchment in the Wet Tropics NRM region, between Edmonton and Gordonvale within the Cairns LGA. The MPA is bordered by the Wet Tropics WHA to the south and west. The main waterways that cross the MPA flow into the Cairns Trinity Inlet, which is part of the GBRWHA .[141]

Waterways and riparian corridors within the MPA provide important known and potential habitat for threatened wildlife species listed under the provisions of the Australian Government's EPBC Act and Queensland Government's NC Act. Downstream stretches of the MPA are subject to tidal influence and form part of the Queensland's Coastal Zone. The Trinity Inlet Fish Habitat Area adjoins the north-east section of the MPA.

The MPA is linked to the GBRWHA through the habitats that support the biodiversity for MNES and the processes that underpin MNES. Key aspects of the MPA are therefore:

- land use that impacts on in-stream quality: removal of habitat, modifying catchment physical, chemical and ecological processes
- in-stream habitat management: modifying natural systems, in-stream barriers and poor water quality.

One of the primary tools under the SP Act for managing urban development is local planning schemes, developed and administered by local government. Planning schemes include existing and future urban areas and local strategic outcomes to be achieved, and the measures to facilitate these outcomes. Local planning schemes also include priority infrastructure plans and may include structure plans for master planned areas. Other Program components relevant to the MPA are the Coastal Act, VM Act, Fisheries Act and the Water Act.

To manage urban drainage, including stormwater, the SP Act is supported by a number of legislative tools:

- Environmental Protection Act 1994 (EP Act)
- Environmental Protection (Water) Policy 2009
- SPP for Healthy Waters
- Guidelines.

The SPP for Healthy Waters specifically addresses urban stormwater runoff, waste water and waterway management. The policy ensures that the planning, design, construction and operation of development includes the management of stormwater to protect the environmental values specified in the Environmental Protection (Water) Policy 2009.[89]

**OVERALL EFFECTIVENESS**

Effective

***DEMONSTRATION CASE SNAPSHOT:***

ANDERGROVE URBAN DEVELOPMENT AREA

In 2010 the Mackay region was identified as one of the 10 largest growing local government areas in regional Queensland with a marked increase in one and two person households. In April 2010, the Queensland Government declared an urban development area (UDA) (now known as a priority development area (PDA)) in Andergrove, approximately five kilometres north of Mackay's CBD, five kilometres from the coast and within the GBR coastal zone. One of the main aims of the UDA was to act as a demonstration case for smaller lot housing to address diverse community needs whilst also providing housing for the increased population in the region.

Prior to declaration the Urban Land Development Authority (ULDA) undertook preliminary investigations to identify any constraints that may prevent development from occurring. The investigations included reviewing state and local constraints mapping and consultation with local government and state agencies. The investigations identified that the western and southern sections of the site were mapped as an area of HES supporting remnant vegetation and a seasonal wetland. The northern portion of the site was leased for cattle grazing but had previously been used for liquid waste disposal.

Once the ULDA was satisfied that any constraints could be addressed and the site could be redeveloped, declaration of the UDA occurred with an early development parcel, not contaminated or otherwise constrained by environmental values, being identified in the Andergrove Interim Land Use Plan (ILUP). An ILUP guides development for up to 12 months until a development scheme for the area comes into force.

Following declaration further studies were undertaken to gain a deeper understanding of the UDA's constraints and opportunities. One of the main studies undertaken for the Andergrove UDA was an ecological study which examined significant vegetation, the seasonal wetland, bushfire hazard, and flora and fauna on the site. The study found no MNES on the site although potential habitat resources for a number of threatened species listed under the EPBC Act were identified.

Through the development scheme the potential habitat resources were protected through the avoidance of remnant vegetation and the seasonal wetland by including the area within a bushland and open space zone. The zone fulfils a multi-functional role including maintaining the area's significant environmental values, passive community recreation and stormwater management.

Through the project it is anticipated that potential habitat resources for a number of threatened species listed under the EPBC Act will improve, which may promote the return of some of the threatened and migratory species that may have previously inhabited the site. In addition storm water management measures will result in an improved quality of water entering the wetland and ultimately the GBRWHA and GBR Marine Park.

***OVERALL EFFECTIVENESS***

Effective

***DEMONSTRATION CASE SNAPSHOT:***

WET TROPICS MANAGEMENT PLAN

Eighty-nine per cent of the Wet Tropics WHA is protected in national parks. The Wet Tropics Management Plan provides direction for management within the WHA, including areas outside national parks, and comprises:

- a zoning scheme
- a permit system
- principles and guidelines for deciding a permit application.

The principles and guidelines against which permit applications must be assessed recognise the most important consideration in deciding an application is the likely impact of the proposed activity on the Wet Tropics WHA's integrity, and that the WTMA must decide an application in a way that minimises the likely impact of the proposed activity on the Wet Tropics world heritage values.

While some of the pressures on the Wet Tropics WHA occur outside its boundary, the WTMA works with state and local governments to minimise the impacts on the integrity of the WHA. The preparation of the statutory FNQ Regional Plan 2009—2031 was a major step forward in strategic regional planning. It provides a robust basis for meeting the challenge of ecological sustainable development in the Wet Tropics bioregion. Not only does the FNQ Regional Plan recognise the Wet Tropics Management Plan as an 'aligned strategy', it also provides a sound planning and development assessment framework in relation to MNES outside of the Wet Tropics WHA. For example, the FNQ Regional Plan establishes policies for areas of HES, some of which are of strategic importance in maintaining the integrity of the Wet Tropics WHA.

The assessment tool provided by the World Heritage Centre for the WTMA to undertake the 2011 UNESCO Periodic Reporting concludes the following with respect to management effectiveness:

- no serious management needs have been identified for management of the property
- the integrity of the World Heritage property is intact
- the Area's OUV has been maintained.

### 7.7.5 Avoiding impact from urban developments in the Wet Tropics

Almost ninety per cent of the Wet Tropics WHA is national park, with some areas of state forest, state leasehold (for grazing), aboriginal freehold and a small part privately owned as freehold. Specific legislation has been made for this area and the Wet Tropics Management Authority (WTMA) was established in 1992 to plan for the management of this WHA. The *Wet Tropics Management Plan 1998* has a zoning scheme aimed at protecting most of the area while allowing for limited sustainable use (tourism facilities, roads and service infrastructure). The demonstration case snapshot below describes the management plan.

#### 7.7.5.1 Gaps and improvements

Existing legislation and management plans protecting the values of the Wet Tropics WHA are recognised to be effective and maintaining and protecting the integrity of this area and the OUV for which the area is recognised. Ongoing review and adaptive management will continue to apply to maintain relevance of protection measures and management actions. Alignment of management actions applicable to the WHA with pressures that occur outside its boundary will continue to be a focus.

#### 7.7.5.2 Summary of effectiveness in avoiding impacts from urban developments in the Wet Tropics WHA

| Management effectiveness component | Grading | Confidence | Trend | Summary of evidence |
|---|---|---|---|---|
| Effectiveness in avoiding impacts (urban development)<br><br>MNES: Wet Tropics WHA | Effective | Adequate | | The Wet Tropics Management Plan provides specific planning arrangements that avoid and minimise impacts from urban development within for the Wet Tropics WHA. |

*Effective:* Planning, development and management processes effectively ensure that impacts are avoided.

### 7.7.6 Planning for industrial development

Major state sponsored industrial development areas (SDA) are established under the SDPWO Act. SDAs are clearly defined areas of land to promote economic development in Queensland. They typically take the form of one of the following:

- Existing industrial hubs for large-scale, heavy industry – mainly located on the Queensland coast – in close proximity to ports, rail and major road networks
- multi-user infrastructure corridors – for the co-location of infrastructure such as rail lines, water and gas pipelines, and electricity transmission lines
- major public infrastructure sites – for example, the Queensland Children's Hospital.

There are four SDAs in the GBR coastal zone – Townsville, Abbot Point, Gladstone and the Stanwell to Gladstone Infrastructure Corridor.

The SDPWO Act provides the legislative framework for the declaration, development planning (development schemes) and assessment of development proposals within SDAs. The development scheme is a regulatory document controlling land use and infrastructure planning and development in the SDA. The development schemes ensure development is planned and managed appropriately and that environmental impacts are avoided and minimised. SDA development schemes override local and other state government planning instruments related to the use of land.

OVERALL EFFECTIVENESS

***DEMONSTRATION CASE SNAPSHOT:***

ABBOT POINT STATE DEVELOPMENT AREA

Partially effective

A high level concept study was undertaken to determine the area of land adjacent to the Port of Abbot Point that could be suitable for large scale industrial development. The Bowen and Abbot Point Industrial Land Concept Plan and Infrastructure Plan (the concept study)[142] involved land suitability assessments which were primarily based on desktop data analysis, and examined the environmental characteristics of the land to determine where industry would be best suited.

The land suitability assessment considered geology, topography, hydrology, vegetation communities, flora, fauna, fauna habitat areas, and the environmental and legislative policy framework in force at that time, including the EPBC Act.

The concept study concluded that the area provided an excellent opportunity for major industrial development in Queensland adjacent to an existing deep water port. It provided conceptual planning and siting principles for industrial development and infrastructure to service that development, which were used to inform a boundary of the proposed Abbot Point State Development Area (APSDA), and delineate precincts within the boundary. The proposed APSDA was divided into three draft land use precincts, including a buffer precinct, industrial precinct and transport precinct.

The APSDA was declared in June 2008 to facilitate port-related development. Following the declaration, Queensland's Coordinator-General undertook a range of studies to inform preparation of the development scheme for the area which would guide the location of future development. As part of this process MNES were identified and reviewed for the site.

The studies informed the identification of land use precincts to ensure that industry and infrastructure development are located in areas with low to little ecological significance. Only around 27 per cent of the SDA is designated for industrial development while the rest is allocated to environmental areas, buffers and infrastructure corridors. In particular, the Kaili (Caley) Valley wetland, while not a MNES on its own, represents important habitat for migratory species and has been designated in the development scheme as an environmental management precinct.

The APSDA is regulated and managed by a development scheme which controls strategic / operational land use planning and approval within the boundaries of the SDA. The scheme ensures development is well planned and managed, and ensures as far as possible that from the outset impacts on MNES are avoided through appropriate planning and the inclusion of specific objectives to protect environmental values and areas of HES within and adjacent to the Abbot Point SDA. The development scheme also includes an objective for development to consider the cumulative impacts from development.


Source: [143]

The Abbot Point SDA demonstration case shows an example where areas of MNES are identified, considered, and where appropriate avoided, upfront in planning.

The declaration of a new SDA requires a regulation amendment and approval by the Governor in Council. Currently, consideration of impacts on MNES is not a legislative requirement at the declaration stage. However, it is usually considered by the Coordinator-General as part of the scoping and background planning before declaration of the SDA. It is proposed that more explicit consideration of MNES be required as part of the new Guideline for MNES.

Outside of SDAs industrial development is generally restricted to industrial areas identified under local government planning schemes.

### 7.7.6.1 Gaps and improvements

Historically, development schemes for SDAs have considered MNES in a number of cases; however this consideration is not explicitly required. Mapping of areas of environmental significance has been incorporated into development schemes to avoid impacts on MNES. However, this could be made more explicit in the future. A guideline addressing the consideration of MNES is required to provide greater certainty and clarity of the consideration of MNES during decision-making for declaration of SDAs and planning for SDAs.

### 7.7.6.2 Summary of effectiveness in avoiding impacts from industrial developments

| Management effectiveness component | Grading | Confidence | Trend | Summary of evidence |
|---|---|---|---|---|
| Effectiveness in avoiding impacts (industrial development)<br><br>MNES: All | Partially effective | Limited |  | Historically, development schemes for SDAs have considered MNES in a number of cases; however this consideration is not explicitly required. Mapping of areas of significance has been incorporated into development schemes to avoid impacts on MNES, however, this could be made more explicit in future. |
| *Partially effective: Planning, development and management processes effectively ensure that impacts are identified and considered. Mapping (where relevant) of areas of significance is integrated into planning, but may not be explicit* | | | | |

### 7.7.7 Port planning

The designation of new or extended port areas under the TI Act does not specifically require consideration of environment impacts or involve a public process. However, the Queensland Government's aim is to ensure port development in the GBR coastal zone occurs in a balanced and incremental way to support economic development while maintaining the environmental value of the GBR. Through the TI Act the Program requires that all ports develop a comprehensive Port Land Use Plan (LUP) which includes measures to manage impacts on the environment including MNES. These plans are reviewed every eight years to ensure they remain contemporary.

Port boundaries in the GBRWHA

Since the World Heritage Listing of the GBR in 1981, port limits have undergone very few amendments. A listing of amendments and a comparison of maps illustrating port limits in 1993 compared to current boundaries indicates only minor amendments have taken place. In fact, in the case of Mackay and Innisfail (now Mourilyan), some port boundaries were actually reduced significantly. The only additional port since the World Heritage Listing was Abbot Point, established in 1982.

Other than minor changes to address the alignment of port limits for the ports of Mackay and Hay Point in 2007, there has not been any change to the port limits of any other Queensland port since 2005. The port limits for the Port of Rockhampton which includes Port Alma and Balaclava Island have not changed since 1994.

The LUP designates areas for environmental protection which typically exhibit recognised ecological and/or cultural heritage values that are to be protected, managed and enhanced. Any development or activity that conflicts with the conservation of these values is inappropriate in areas designated for environmental protection. LUPs are required to identify Desired Environmental Outcomes which provide the overarching vision and direction for future development.

A demonstration case of port land use planning, using the Port of Abbott Point LUP as the example, provides details of the considerations, including environmental, that port land use planning addresses. A snapshot is provided below.

Recognising the important role of ports and the contribution port planning makes to the management of impacts on MNES and OUV of the GBRWHA the Queensland Government released for public consultation the Great Barrier Reef Ports Strategy, outlining the government's vision for port development adjacent to the GBR: to develop an efficient Queensland port network that will grow Queensland's four pillar economy while protecting the GBR.

The Great Barrier Reef Ports Strategy and feedback received from public consultation has been used to inform the development of a Queensland wide ports strategy (the Queensland Ports Strategy) during 2013. The Queensland Ports Strategy will extend the principles enunciated in the Great Barrier Reef Ports Strategy to all Queensland ports. It will outline the Queensland Government's approach to future port development and planning including:

- establishing a master planning framework for Queensland ports, with consistent principles for environmental, social and economic planning
- supporting the efficient, commercial operation of ports including consideration of governance, investment models, and opportunities to streamline process
- providing for improved port and infrastructure corridor protection
- improving landside infrastructure planning for port supply chains.

The Draft Queensland Ports Strategy 2013 was released for public comment on 17 October 2013. When finalised it will be the Queensland Government's blueprint for managing and improving the efficiency and environmental management of the state's port network over the next decade. It is intended to strengthen the effectiveness of environmental management at ports.

Key actions will focus on the concentration of port development around long-established major ports in Queensland, and will provide guidance for port master planning through consistent principles for environmental, social and economic planning. Through such actions, ports will be better able to identify and manage potential environmental impacts in the GBR coastal zone including MNES and OUV. The Draft Strategy maintains the commitments of the Draft Great Barrier Reef Ports Strategy and also prohibits capital dredging for the development of deep water port facilities outside Queensland's long-established major port areas.

### 7.7.7.1 Gaps and improvements

As identified in the Independent Review of the Port of Gladstone, port planning is comprehensive, but doesn't necessarily take into account World Heritage values. Port planning does not currently require specific consideration of MNES (including OUV) and this could be made more explicit in the future. A guideline addressing the consideration of MNES and OUV including World Heritage values is required to provide greater certainty and clarity and ensure they are appropriately considered in port planning.

### 7.7.7.2 Summary of effectiveness in avoiding impacts from port developments

| Management effectiveness component | Grading | Confidence | Trend | Summary of evidence |
|---|---|---|---|---|
| Effectiveness in avoiding impacts (port development)<br><br>MNES: All | Partially effective | Limited |  | All ports are required to develop comprehenive Land Use Plans that can designate areas for envionmental protection. Guidance on how MNES, OUV and World Heritage values should be considered in port planning is limited.<br>The Queensland Government has commited to restrict any significant port development, within and adjoining the Great Barrier Reef World Heritage Area, to within existing port limits to 2022 |
| *Partially effective: Planning, development and management processes avoid some impacts on MNES up front, but indirect impacts are not well planned for or managed.* | | | | |

***DEMONSTRATION CASE SNAPSHOT:***

ABBOT POINT LAND USE PLAN

***OVERALL EFFECTIVENESS***

Partially effective

The TI Act facilitates the planning, construction and operation of State roads, railways and ports, in conjunction with the Transport Planning and Coordination Act 1994 (TPC Act). A port authority can be declared under the TI Act, with defined port limits able to be established by a regulation. The TI Act empowers port authorities to undertake a number of functions including land use planning and control of development on port land.

The TI Act requires that at least every eight years, a port authority must prepare a LUP to guide the development and management of Strategic Port Land which can include seabed and tidal areas.

Desired environmental outcomes (DEOs) are identified in the LUPs and structured around ecological processes, community wellbeing, and economic development - the three foundations of 'ecological sustainability.'

The Abbot Point state development area (APSDA) is divided into land use precincts, an Industry Precinct, an Infrastructure and Corridors Precinct and a Restricted Development Precinct. The Restricted Development Precinct provides physical separation of significant industrial and infrastructure activities within APSDA from sensitive land uses outside APSDA. It also allows for the utilisation of limited areas for uses which will have no adverse impact on premises located outside APSDA and are compatible with being in close proximity to industry. The minister approved the current Abbot Point LUP on 28 March 2011. The current ecological DEOs within the Abbot Point LUP are:

- Protection and enhancement of the natural port environment will be achieved through pursuing high standards of environmental performance and incorporating sustainable environmental management into all aspects of port planning, development and operations at the port.
- Development on port land will not adversely affect the values of identified areas with high conservation significance, including the GBRMP and adjacent Caley Valley Wetlands.
- Climate change assessment will form part of the design of projects on strategic port land, as appropriate.
- Development of port land will comply with air, water, waste and noise policies administered under the EP Act.

Apart from being addressed in the LUP, DEOs are also reflected through corporate planning programs, the port Environmental Management Plan, supporting development guidelines and other relevant processes and programs administered by NQBP.

## 7.8 How well the Program mitigates impacts on MNES

In situations where a proposed development cannot be sited to avoid impacts on MNES, the Program uses measures to mitigate potential impacts. In such instances the mitigation of impacts is considered on a case by case basis through design considerations and the condition of approvals. For example, impacts may be avoided by locating the development in a cleared or highly modified area under appropriate management to avoid adverse impacts on MNES. This requires detailed site surveys to determine the presence or absence of MNES and an assessment of whether the development may impact on MNES values beyond the development site. Design and siting of development, together with carefully managing the manner in which it operates can ensure that significant impacts can be minimised. For example, careful urban design and measures taken during construction can reduce or eliminate the impacts of stormwater flowing from urban areas into waterways that may contain MNES or flow into areas of MNES, such as the GBRWHA.

A range of plans, policies, programs and guides have been developed by the Queensland Government to reduce the level of impact from development.

### 7.8.1 Conditioning of approvals

There are five key pieces of Queensland legislation in Queensland which work towards mitigating impacts of future development:

1. the SP Act provides the framework for the development assessment process in Queensland
2. the SDPWO Act provides the framework for development in SDAs and the EIS process for ‘coordinated projects’
3. the EP Act provides for management of mining on land and other environmentally relevant activities
4. the TI Act outlines the process for port development
5. the ED Act outlines the process for PDAs for urban development.

Other than the TI Act and ED Act, these laws include environmental impact assessment mechanisms which have been accredited by the Australian Government through an ‘assessment bilateral agreement’ established under the EPBC Act. Further details on the role of the five key pieces of legislation and other legislation that mitigate impacts on MNES are provided in section 3.5 of the *program report*.

Under the accredited EIS process, impacts on MNES are specifically considered and conditions are recommended that address both direct and indirect impacts. In the case of ‘coordinated projects’, the Coordinator-General prepares an evaluation report that includes a specific chapter on MNES.

Conditions are regularly imposed on development approvals to mitigate impacts on MNES. For projects that are declared ‘coordinated’ projects under the SDPWO Act, conditions are set by the Queensland Coordinator-General. In other cases, the relevant state decision-making agency or local government apply conditions to the relevant approvals.

Conditions can cover a range of areas and may include:

- minimising water quality impacts from runoff
- treating wastewater on site
- managing pests and weeds
- establishing environmental management plans
- minimising the risk of ASS.

In highly sensitive areas such as the GBRWHA, more stringent conditions are often placed on development. For example, the water quality limits placed on discharges from the LNG plants into Gladstone Harbour were more stringent than those prescribed in the guidelines under the GBR Marine Park legislative framework. In addition, the Coordinator-General asked proponents to reduce the burden on the offshore environment by connecting to the mainland water and sewerage systems and facilitated the approvals for that connection in time to cater for all proponents.

A number of supporting tools are in place to inform conditioning, including information on appropriate fishway design to ensure connectivity between ecosystems, dredging guidelines to limit impacts and design guidelines for Water Sensitive Urban Design to minimise impacts on water quality. Detailed guidelines also support many existing SPPs which provide development assessment guidance for addressing potential environmental impacts of development.

The Ella Bay Resort Development Demonstration Case discusses the EIS process and conditions that can be applied to a development to mitigate impacts on MNES.

***DEMONSTRATION CASE SNAPSHOT:***

ELLA BAY RESORT DEVELOPMENT EIS PROCESS

***OVERALL EFFECTIVENESS***

Very effective

The Ella Bay Integrated Resort was declared a 'significant project' under the SDPWO Act, requiring the proponent of the development to prepare an EIS. The Ella Bay site is surrounded on three sides (north, west and part south) by the Ella Bay National Park. Most of the surrounding area is located in the Wet Tropics WHA. The site is separated from the GBRWHA to the east by a gazetted esplanade.

The EIS documentation indicated that the proposed Ella Bay development would be designed, constructed and managed to avoid (where possible) potential adverse impacts on tropical rainforest, swampland (Wet Tropics WHA) and coastal and aquatic (GBRWHA) ecosystems or on the geological and geomorphological characteristics of the region that underlie the ecological diversity of the two WHAs. MNES were addressed in both the EIS and supplementary EIS documentation. During the latter stages of the EIS process, additional work was undertaken to better understand, analyse and synthesise the potential impacts of the whole project on MNES. Where impacts on MNES including OUV cannot be avoided, the proponent committed to an environmental management regime and proposed a number of measures to minimise and mitigate potential impacts. An offsets proposal was also put forward by the proponent to address residual impacts.

As a result of the EIS process for the Ella Bay Integrated Resort project and evaluation by the Coordinator-General, the proponent is required to operate under a range of conditions and implement a variety of management strategies to mitigate potential construction and operational related impacts on fauna, flora and communities. These include an offsets strategy, Environment Management Plans, protected area management and species-specific management sub-plans. Management sub-plans have been developed for the cassowary, stream-dwelling rainforest frogs, spectacled flying-fox, marine turtles and significant flora. These sub-plans identify impacts of the development on these fauna and flora and provide a number of strategies to manage or mitigate these impacts.

The EIS process undertaken by the proponent and its evaluation by Queensland's Coordinator-General and the Australian Government Environment Minister has also provided several positive tangible outcomes for the Ella Bay property. These include an expected net increase in essential cassowary habitat of approximately 238 hectares, full fencing for each precinct and all internal roads, and dedicated facilities for research including a cassowary research station. It is considered that increases in cassowary habitat, the return of land to national park, offsets arrangement proposed by the proponent, and environmental management plans have the potential to improve the condition of MNES in the area. As a result of the EIS process it is expected that should the project proceed, the condition of MNES including OUV would be relatively similar to predevelopment condition. In some respects, it could be concluded the condition of MNES would have improved as a result of offsets arrangements, environmental management plans and strategies that the project proponent is required to undertake.

### 7.8.2 State Assessment and Referral Agency

The five core pieces of legislation apply to different types of development, but all work in a similar way to ensure development is appropriately planned, assessed and conditioned. The other pieces of Queensland Government legislation that apply in the GBR coastal zone sometimes overlap, but are integrated and coordinated to the extent possible. Combined, the suite of legislation provides full coverage of key management issues for the GBR coastal zone and leaves no significant gaps. In some cases, there may not be an explicit reference to MNES, but the administrative implementation of the legislation delivers this in practice.

On 1 July 2013, the Queensland Government launched the State Assessment and Referral Agency (SARA). This provides for a single agency lodgement and assessment point for development applications, where the state government has a jurisdiction (i.e. where a state agency is a concurrence agency). The new arrangements mean the chief executive of the SP Act (being the Director-General of the Department of State Development, Infrastructure and Planning (DSDIP)), will be the assessment manager or referral agency for these development applications and will coordinate Queensland Government input into the decision. This will deliver a more coordinated, whole-of-government approach to the state's assessment of development applications.

## 7.8.3 Specific measures to mitigate impacts on MNES

### 7.8.3.1 Fisheries management

During the last 30 years significant commercial fishing management changes in Queensland east coast waters have helped to ensure that fisheries remain ecologically sustainable. The management of fishing activity and shipping have made significant contributions toward the mitigation of impacts on MNES in the marine environment of the GBR coastal zone.

Management of fisheries in the GBRWHA is primarily the responsibility of the Queensland Government, however, the GBRMPA has a direct management role in administering the GBR Marine Park zoning plan, which prohibits fishing in certain sections of the GBR Marine Park.

Changes to the Fisheries Act have been made to ensure that fisheries remain ecologically sustainable. Some of those changes include: major reductions in fishing effort and fleet size, including a $9 million buyout of the East Coast net fishery; by-catch reduction devices and satellite vessel monitoring in the trawl fishery; and the establishment of FHAs and dugong protection areas.

Annual status reports are prepared for each fishery identifying interactions with protected species and any management changes. All of Queensland's fisheries have been assessed and endorsed by the Australian Government as part of an independent assessment of all export fisheries. More than 70 declared FHAs provide protection to key fish inshore and estuarine habitats within more than 1.1 million hectares.

### 7.8.3.2 Shipping management

Shipping management within the GBR Marine Park is primarily the responsibility of the Australian Maritime Safety Authority and the GBRMPA, who work in close collaboration with Maritime Safety Queensland, which is responsible for ship safety within port limits and in Queensland waters.

The introduction of the Great Barrier Reef and Torres Strait Vessel Traffic Service (REEFVTS) is also an effective tool to assist in the mitigation of impacts to MNES in the GBRWHA. This mandatory ship reporting system has attributed to significantly reducing the number of groundings in the Great Barrier Reef and Torres Strait – from one per year between 1997 and 2003 to only one incident between the years 2004 and 2009.

Other improvements to shipping management have included establishing designated shipping areas and defined traffic routes, limiting shipping to specific zones along the Reef as well as extending the compulsory pilotage area to include Torres Strait.

Shipping safety measures in the GBR are generally managed through the North East Shipping Management Group, of which the Queensland Government is a part. The group is developing the North East Shipping Management Plan which will set strategies for managing shipping in the GBR with the aim of reducing the risk of a shipping incident and pollution of the marine environment.

### 7.8.3.3 Protected area management

With careful management, people can enjoy national parks and forests without damaging them. A masterplan for Queensland's park system sets out how protected areas will be managed in Queensland for the next 20 years. Management plans or statements for each park, including any new protected areas, outline their management. The public is invited to provide input whenever a plan or statement is being prepared.

QPWS actively manages fire, pest plants and animals in parks and other areas gazetted under the NC Act in order to protect the biodiversity and natural processes in these areas. The Queensland Government also provides over $8 million a year for the joint field management program for the GBR Marine Park which includes compliance, management of visitor facilities and education. The Australian Government matches this funding, with QPWS delivering the activities. Pest management under the field management program successfully manages introduced species such as wild pigs which can prey on the nests, or young of many species.

### 7.8.4 Gaps and improvements

Projects that are conditioned by separate state agencies do not have an explicit requirement to address MNES. A guideline addressing the consideration of MNES would provide greater clarity of how MNES are considered during these assessments and clarify where relevant management controls are applied.

### 7.8.5 Summary of effectiveness in mitigating impacts

| Management effectiveness component | Grading | Confidence | Trend | Summary of evidence |
|---|---|---|---|---|
| Effectiveness in mitigating impacts<br><br>MNES: All | Effective | Adequate |  | Project by project assessment involves appropriate conditioning of approvals to mitigate impacts on MNES.<br>A range of fisheries management measures are in place to minimise the impacts on the GBRWHA. Interactions with threatened species are minimised through a range of by-catch reduction devices.<br>All Queensland export fisheries have been assessed and endorsed under the EPBC Act. |
| *Effective: Systems are in place to minimise the impacts on MNES (including OUV). Conditions may be applied to development in certain circumstances.* | | | | |

## 7.9 How well the Program offsets residual impacts

Environmental offsets compensate for unavoidable impacts on significant environmental values, such as highly valuable species and ecosystems and MNES. They are used when it is determined that a significant environmental impact of a development cannot be avoided or mitigated. Offsets can take the form of positive management interventions such as restoration of degraded habitat, arrested degradation or averted risk, or protecting areas and improving resilience where there is imminent or projected loss of biodiversity. A number of pieces of planning, development and management legislation include a mechanism through which impacts on environmentally significant areas can be offset, such as the SP Act and the SDPWO Act. Offsetting occurs through the overarching Queensland Government Environmental Offset Policy (QGEOP).

The QGEOP provides the principles for offsets and forms the foundation for development of detailed specific-issue offset policies. The QGEOP offset principles are as follows:

- Principle 1: Offsets will not replace or undermine existing environmental standards or regulatory requirements, or be used to allow development in areas otherwise prohibited through legislation or policy.
- Principle 2: Environmental impacts must first be avoided, then minimised, before considering the use of offsets for any remaining impact.
- Principle 3: Offsets must achieve an equivalent or better environmental outcome.
- Principle 4: Offsets must provide environmental values as similar as possible to those being lost.
- Principle 5: Offset provision should minimise the time-lag between the impact and delivery of the offset.
- Principle 6: Offsets must provide additional protection to environmental values at risk, or additional management actions to improve environmental values.
- Principle 7: Offsets must be legally secured for the duration of the offset requirement.

The four specific issue offset policies that Queensland has in place are implemented with the framework provided by the QGEOP (Figure 7.9 1). These are aligned with other offset tools including the Australian Government Offsets policy and local government planning schemes and laws.

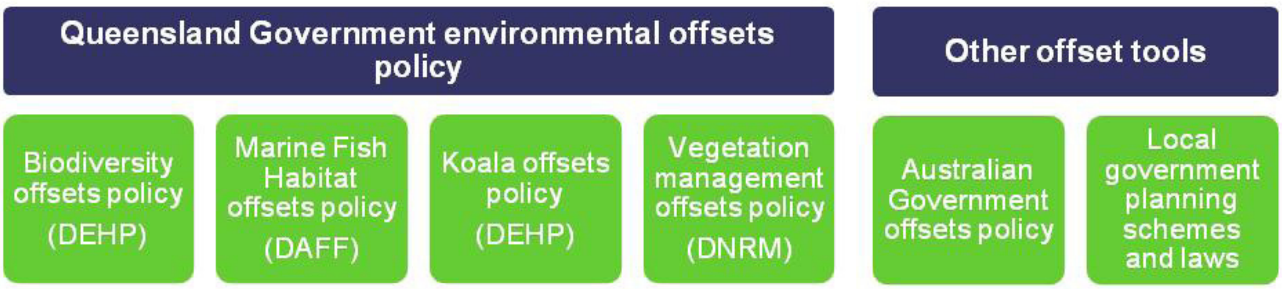



Figure 7.9 1 The Queensland Government Environmental offsets policy and the supporting specific issue policies

Strategic rehabilitation areas have been specifically identified in some regions. These areas have been identified as priority areas on the basis that they would provide improved essential habitat for connectivity of MNES. For example, the Wet Tropics Conservation Strategy identifies critical cassowary habitats within the Mission Beach area, and where linkages should be made to other coastal and mountain sections of the WHA. A number of rehabilitation projects have been undertaken to target restoration in these corridors.

### 7.9.1 Gaps and improvements

Queensland Government's existing specific issue offset policies have been developed separately over a number of years and are not well integrated. As our knowledge of issues impacting on the GBR coastal zone has improved it is important that offset policies are reviewed to ensure that they are targeted at the key issues impacting the GBR coastal zone and GBRWHA. The Queensland Government is currently reviewing its offsets framework to create a single, strategic policy focussed on delivering outcomes for impacted environmental matters which aligns with the Australian Government Offsets policy.

### 7.9.2 Summary of effectiveness in offsetting impacts

| Management effectiveness component | Grading | Confidence | Trend | Summary of evidence |
|---|---|---|---|---|
| Effectiveness in offsetting impacts<br><br>MNES: All | Partially effective | Limited | | A number of offsets policies are in place under the QGEOP, but they are not well integrated and may not deliver strategic outcomes in all instances. The different MNES are adequately captured in the existing policies, but not explicitly. It is expected that outcomes will be significantly improved under the proposed one-government offsets policy which will deliver more strategic offsets and a net improvement for MNES |
| *Partially effective: Offsets policies do not explicitly consider MNES (including OUV), but do deliver some tangible outcomes for MNES, but not a net improvement.* | | | | |

***DEMONSTRATION CASE SNAPSHOT:***

OFFSETS IN GLADSTONE HARBOUR

***OVERALL EFFECTIVENESS***

Partially effective

The Western Basin Dredging and Disposal Project is being undertaken by Gladstone Ports Corporation (GPC). It accommodates the long-term dredging and disposal of dredged spoil material that is required to provide safe and efficient access to the existing and proposed Gladstone Western Basin port facilities (in Port Curtis, from Auckland Point to The Narrows) particularly for the emerging liquefied natural gas industry in the Gladstone region. The SDPWO Act provides an assessment process for significant projects which includes preparation of an EIS against terms of reference. This EIS identifies and protects the environmental values underpinning MNES. Through this process, project proponents are required to consider avoiding or minimising impacts on MNES including OUV when preparing their EIS. Where they cannot avoid or mitigate impacts, offsets must be considered. The EIS process for the project collected the information deemed sufficient to assess impacts on MNES.

At the time that the Coordinator-General assessed the Western Basin project[144], offsets were only required under QGEOP and the fish habitat offset policy. The Coordinator-General's report on the Western Basin Dredging and Disposal Project referred to the draft Australian Government policy statement regarding the use of environmental offsets under the EPBC Act to provide guidance on projects that may trigger consideration of an offset by the Australian Government.

Through the EIS process, the Coordinator-General applied a strategic approach to offset identification. This approach enabled the identification of a practical offset arrangement that will protect a significant area of high value habitat over the long term. The Coordinator-General placed 143 conditions on the project after careful consideration of the likely impacts. The majority of these conditions related to avoiding and mitigating impacts. Five conditions related specifically to environmental offsets in the following areas:

- Marine habitat offset
- Commercial fisheries offset
- Recreational fishing and boating offset
- Marine and coastal biodiversity offset

The Coordinator-General's report on the Western Basin Dredging and Disposal Project also imposed a condition requiring additional offset measures for shorebirds and marine fauna protected under the EPBC Act to be included in the projects Flora and Fauna Management Plan (FFMP).

The main difference between conditions imposed by the Coordinator-General and the Australian Government relates to seagrass protection. The Coordinator-General felt the provision of a direct offset or land-based offset for seagrass was impracticable and directed a financial contribution be provided by GPC for habitat enhancement/restoration actions in the region or the wider bioregion. The Australian Government instead required offsets specifically for seagrass.

While the QGEOP provided useful guidance on the appropriate use of environmental offsets across marine and terrestrial environments, to ensure that the environmental benefits of offsets are maximised, the Queensland Government is undertaking a review of its offsets policy. A revised Queensland offsets policy will deliver more strategic outcomes and seek to align with the objectives of the Australian Government Offsets Policy where possible.

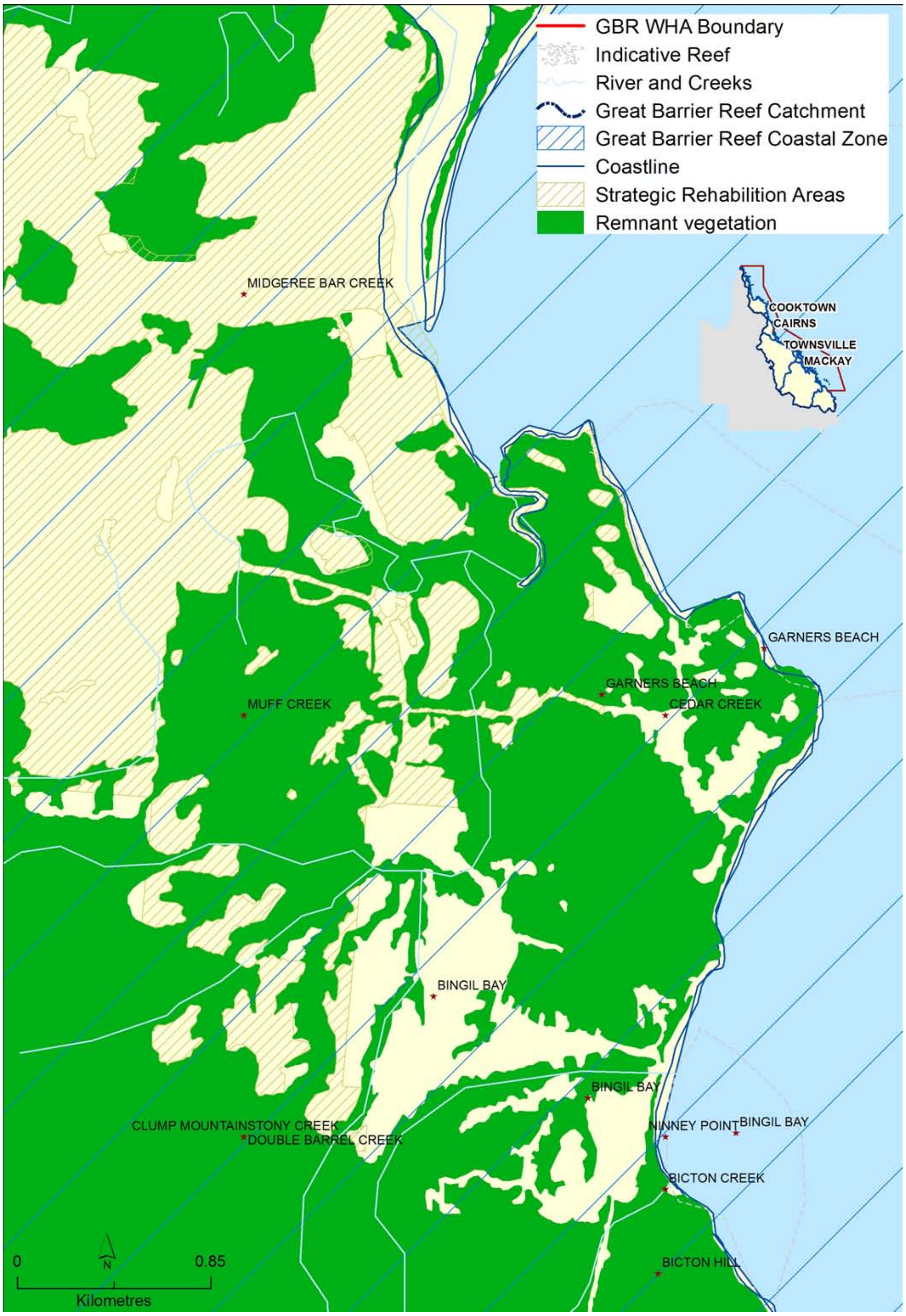



Figure 7.9 2 Strategic rehabilitation areas in the Wet Tropics NRM region.

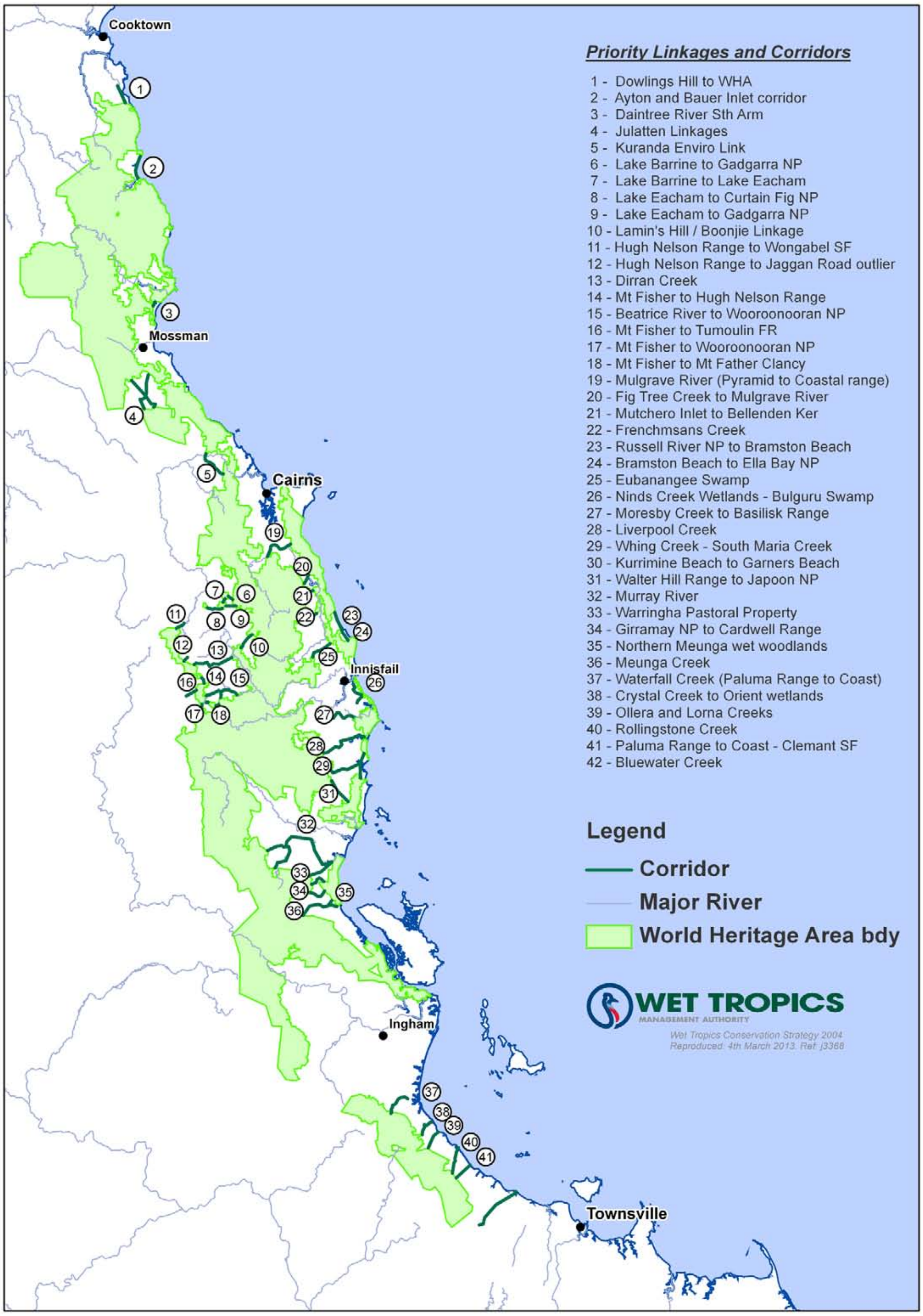



Figure 7.9 3 Rehabilitation priority areas for the Wet Tropics World Heritage Area.
Source: [123]

## 7.10 How well the Program enhances MNES

Over the 150 years since European settlement, significant changes have been made to Queensland's environment as a result of land clearing for agriculture and urban purposes. While it may not be possible to restore environmental values to their pre-European settlement condition, a large part of the Queensland Government's Program is aimed at improving the condition and trend of those values that have been significantly impacted from past activities. The revised offsets policy discussed in section 7.9 will improve Queensland's management of impacts on MNES.

There are a number of important supporting programs in place to enhance and improve MNES in the GBR coastal zone include:

- Everyone's environment grants
- Regional NRM Investment Program
- Reef Water Quality Protection Plan
- Gladstone Healthy Harbour Partnership
- Indigenous Land and Sea Rangers Program
- Wet Tropics Conservation Strategy
- Queensland Wetlands Program
- Queensland's Biodiversity Strategy
- Back on Track species prioritisation framework

NRM programs play an important role in addressing legacy impacts through a broad and long-term approach to finding and implementing solutions to address environmental and natural resource management threats. Currently, Queensland NRM funding is addressing biodiversity, wetlands, water quality, coastal risk, weeds and pest management, and sustainable agricultural practices.

Program components to enhance MNES are also targeted on the main pressures and impacts on MNES in the GBR coastal zone including loss of habitat extent and condition, decline in water quality and pest and weed species. Maintaining and enhancing the condition of MNES areas is critical to enable recovery of the ecological processes of these areas from extreme weather events and the consequences of climate change.

In their capacity as local government authorities, Aboriginal Shire Councils servicing remote areas of the GBR coastal zone do not just provide natural resource management services to their respective regions. These councils also form critical economic, educational and social hubs for their communities. All vary greatly with regard to the nature and scope of services and programs they offer, while providing expert knowledge in representing the interests and cultural heritage of their communities in partnership with Traditional Owners. Several regional NRM bodies have Traditional Owners and/or other representatives of Aboriginal and Torres Strait Islander people on their boards. As directors and/or members of regional NRM bodies, these officers provide a key link between Indigenous interests and matters relating to country and government natural resource management. Although limited, part of their role is to ensure consultation and engagement processes between Traditional Owner groups and government representatives is ongoing and meaningful.

The following sections describe how the Queensland Government's Program enhances MNES within the GBR coastal zone.

### 7.10.1 World Heritage Areas

#### 7.10.1.1 Great Barrier Reef World Heritage Area

The 2009 Great Barrier Reef Outlook Report[4] noted that the threat of climate change dominates most aspects of the GBR's outlook over the next few decades. Therefore measures to improve the resilience of the GBR to adapt to climate change by reducing other threats will be critical to its conservation. This is also acknowledged in the companion GBR Region strategic assessment.

One of the most significant and successful programs of work improving the resilience of the GBRWHA are the actions being taken to address poor water quality. The Queensland and Australian governments have been working together since 2003 to deliver actions to halt and reverse the decline in water quality through the Reef Water Quality Protection Plan (the Reef Plan) (see the Water Quality Demonstration Case). Reef Plan's purpose is to address runoff of pollutants (i.e. nutrients, pesticides and sediment) from broadscale agriculture (e.g. sugarcane, grazing and horticulture).

The Queensland Government contributes $35 million a year to GBR water quality initiatives, including extension and education. One of Queensland's major contributions to Reef Plan is the development of the sugarcane and grazing Best Management Practice (BMP) programs. Annual Reef Plan report cards are showing positive progress towards targets, with reductions in all key pollutants and significant uptake of improved practices by landholders.

Even if further coastal development, including agriculture, was to cease tomorrow, the GBR would still be faced with a significant legacy of poor water quality from changes in land use over the past 150 years. Improving water quality in the GBR relies on continued contributions and commitments from many different groups and individuals, ranging from the Australian and Queensland governments, industry organisations, NRM organisations and individual land managers. By working together to develop, prioritise and implement improved land management practices, the GBR has the best chance of long term survival. It is critical that across the GBR coastal zone this legacy is addressed by continuing the range of programs designed to improve land management and water quality flowing to the GBR. This will significantly improve and enhance the condition of the GBR, including its OUV.

In conjunction with improved resilience through water quality improvements associated with land use management, the control of pests, weeds and fire in all areas remains a challenge for land and resource managers. Impacts from these threatening processes place significant pressures on MNES. Management of these pressures is a primary responsibility of landholders and natural resource managers. The Queensland Government is responsible for state-owned land including national parks. Biosecurity Queensland is responsible for managing biosecurity risks to Queensland. The Australian Government is responsible for Commonwealth owned land and marine areas.

**OVERALL EFFECTIVENESS**

Effective

***DEMONSTRATION CASE SNAPSHOT:***

WATER QUALITY IMPROVEMENT IN MACKAY WHITSUNDAY REGION

Measures to improve water quality present one of the best opportunities to improve the condition of the GBRWHA and increase its resilience to other impacts such as climate change. A range of significant programs are in place to halt and reverse the decline in water quality. These are coordinated through the Reef Water Quality Protection Plan (the Reef Plan).

A key target of the Reef Plan is to achieve a 50 per cent reduction in nutrient loads entering the GBR by 2018 and ensure that by 2020 catchment runoff has no detrimental impact on the health and resilience of the GBR. Total fertiliser use on farming lands in the catchment has been reduced in recent years and recent monitoring and modelling show current initiatives are successfully reducing nutrient concentrations in catchment runoff. There was an estimated 7 per cent reduction in nitrogen, 6 per cent reduction in sediment load and a 15 per cent reduction in pesticide loads as a result of land management changes between 2009 and 2011.[36]

There is a range of programs to deliver against these targets. These include the Australian Government's Reef Rescue Program, which offers incentives to landholders to adopt improved practices, and the Queensland Government's water quality program which provides a regulatory framework for best practice and is currently transitioning to a co-management approach working with industry to develop best management practice programs.

Accelerated actions under the Reef Plan since 2009 are already showing reductions in pollutant loads which are expected to drive improvements in marine health over the longer term. Reef Plan has been shown to be an effective mechanism for coordinating and integrating actions across governments in close partnership with industry, regional NRM bodies and conservation groups. It is also an appropriate mechanism to ensure adaptive management based on sophisticated and integrated monitoring programs and water quality guidelines.

The report from the recent visit by UNESCO praised the efforts by government and partners on actions to improve water quality. This was also reflected by the World Heritage Committee which, at its 36th session in July 2012, 'welcomed the initial positive results of the Reef Plan and associated measures to address major long-term impacts on the property from poor water quality.' Efforts were further acknowledged at the 2013 meeting where the results of the second report card were praised.

*Demonstration case jointly prepared with the GBRMPA*

The Queensland Government also contributes significantly to a range of other management programs designed to improve the GBRWHA and enhance MNES, including:

- over $8 million a year for joint field management for the GBR Marine Park which includes compliance, management of visitor facilities and education
- over $21 million a year for fisheries management, and an additional $9 million to buy-out of the net fishery on the east coast of Queensland which will have financial benefits for the fishery, as well as conservation benefits for the GBR.

The Queensland Government also invests in a range of activities designed to restore coastal ecosystems and enhance MNES. The Everyone's Environment Grants provides $12 million statewide to community-based groups over three years to tackle environmental degradation. In the first round of grants, fourteen projects that will improve environmental degradation in the GBR coastal zone were successful. Funds granted for these projects totals $0.55 million. Other funds are also dedicated to the Queensland Wetlands Program ($0.5 million a year) which provides a number of tools to help restore the function of important wetlands adjacent to the GBR that support a healthy functioning reef ecosystem. Queensland also invests around $5 million a year to support on ground activities through its Queensland Regional NRM Investment program in the GBR coastal zone.

Queensland Government has also committed $1 million to control COTS outbreaks which cause serious degradation to corals. This commitment is independent of management objectives targeted at water quality improvements, which also have effect on reducing risk of impact from COTS. This control commitment is through the Skilling Queensland program, which provides a range of activities including job preparation, work placement and accredited training to assist local long-term unemployed jobseekers. Work placement participants assist in small scale control of the COTS infestation on selected and popular coral reefs.

#### 7.10.1.2 Gaps and improvements

Although management of the direct threats of climate change to the GBR are beyond the scope of the Queensland Program, there are significant opportunities to improving the GBR's resilience to climate impacts through commitments against improving water quality, reducing impacts from fire, weeds and pests including COTS. The success of all parallel programs in achieving the single resilience objective will require alignment of how each program is achieving its individual objectives to enable adaptive management to inform improvements in the Program as needed. Partial coordination across the programs focussed on water quality and land use management improvements currently occurs through measures such as the Reef Plan. Overarching coordination across the Queensland Program that also captures other threatening processes could be considered to support development, prioritisation and implementation of all resilience measures to ensure the GBR has the best chance of long-term survival.

#### 7.10.1.3 Summary of effectiveness of enhancing MNES in GBRWHA

| **Management effectiveness component** | **Grading** | **Confidence** | **Trend** | **Summary of evidence** |
|---|---|---|---|---|
| Contribution to enhancement of MNES including OUV and management of existing pressures<br><br>MNES: GBRWHA | Very effective | Limited | ↗ | Improving water quality is a major contributor to building GBR resilience and improving MNES and OUV and the Queensland Government invests heavily in this key area. The Queensland Government also contributes to a range of programs that will enhance the GBR World Heritage Area over time. |

*Very effective: Existing programs effectively and explicitly contribute to enhancement of MNES including OUV and management of existing pressures.*

#### 7.10.1.4 Wet Tropics World Heritage Area

The governance arrangements for the Wet Tropics provide an outstanding example of how to effectively manage a WHA. The Wet Tropics WHA has its own legislation, a statutory authority, the Wet Tropics Management Authority, and a statutory management plan (and permitting system) to oversee protection and management. There is periodic reporting on the values underpinning the OUV of the Wet Tropics WHA. Significant programs are also in place to enhance the Wet Tropics WHA.

Additional Program components relevant to the management of the Wet Tropics WHA include:

- Wet Tropics Conservation Strategy 2004
- State of the Wet Tropics annual reporting to the Queensland and Australian governments
- Wet Tropics Walking Strategy 2010 - 2014
- Wet Tropics Nature Based Tourism Strategy

One of the main pressures on the MNES in the GBR coastal zone is pest and weed species. The Wet Tropics Conservation Strategy includes measures targeting pest and weed species (see the Weed and pest management in the Wet Tropics WHA case study below). By targeting pest and weed species within the Wet Tropics WHA, MNES will also be protected and enhanced.

### *Case study:*

WEED AND PEST MANAGEMENT IN THE WET TROPICS WHA

The Wet Tropics Conservation Strategy[145] has developed management priorities to ensure the conservation, rehabilitation and transmission to future generations of the WHA, including the control of invasive species.

The Wet Tropics Conservation Strategy sets out a strategic approach to weed control, including prioritising the allocation of available resources to:

- prevent the introduction of new species of invasive weeds to the Wet Tropics region
- eradicate new and localised outbreaks of environmental weeds which can disrupt and transform ecosystems
- prioritise weed eradication in more pristine areas rather than in disturbed areas
- ensure weed eradication programs are achievable and incorporate long-term monitoring and rehabilitation
- provide educational materials about the identification, reporting and eradication of weeds for land managers and the public
- research the ecology and management of priority weeds in the Wet Tropics.

Historically, weed control has focused on established outbreaks of weeds which affect agricultural productivity. A recent initiative in the Wet Tropics WHA has focused on environmental weeds which are becoming established in the Wet Tropics and could potentially overrun intact ecosystems, but where eradication is still achievable. Targeting new incursions of miconia species, mikania vine, Koster's curse, Siam weed and limnocharis, the Australian and Queensland governments have provided $490 000 for the first year of eradication and guaranteed funding for five years.

The Wet Tropics Conservation Strategy also sets out a strategic approach to pest management of exotic and feral animals, including prioritising the allocation of available resources to:

- monitor outbreaks of feral deer and goats and support localised, integrated eradication programs across all tenures
- monitor, record and report the occurrence of foxes and rabbits within the WHA and surrounds and support integrated control programs
- eradicate feral cattle populations from the WHA where possible
- apply the management principles of the draft national threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs within the Wet Tropics region
- develop and implement integrated feral pig control programs involving targeted baiting programs (based on research into new bait technology), trapping and where appropriate, shooting
- protect critical populations of endangered species with pig exclusion fencing where appropriate and achievable
- target pig control programs during dry times when pigs are congregated and target areas are more readily accessible

#### 7.10.1.5 Gaps and improvements

The pest and weed program in place for the Wet Tropics WHA is considered to be effective. Legacy impacts are well understood. Maintaining currency of knowledge around emerging pest and weed threats and appropriate controls requires ongoing revision for improvement of the program. Specific issues in need of improvement include a comprehensive early warning system, contingency plans for weeds, pests and diseases, building regional capability and increased community awarenesss.

#### 7.10.1.6 Summary of effectiveness of enhancing MNES in Wet Tropics WHA

| Management effectiveness component | Grading | Confidence | Trend | Summary of evidence |
|---|---|---|---|---|
| Contribution to enhancement of MNES including OUV and management of existing pressures<br><br>MNES: Wet Tropics WHA | Effective | Adequate | | The Wet Tropics Conservation Strategy is designed to improve the OUV of the property by controlling targetting priority weeds and pests, installing animal overpasses and rehabilitating areas to improve connectivity. |
| *Effective: Legacy impacts are well understood and some measures are in place to recover or improve MNES (including OUV). Some resources are applied to address the key threats.* | | | | |

### 7.10.2 Ramsar wetlands

In 2003, the Australian and Queensland governments established the Queensland Wetlands Program to support projects that will result in long-term benefits to the sustainable use, management, conservation and protection of Queensland wetlands. Since then the Queensland Wetlands Program has supported more than 70 projects to help with all aspects of wetland management, from mapping and classification, through assessment to monitoring and communication of wetlands information.

A range of new mapping, information and decision-making tools and products have been developed under the Queensland Wetlands Program to enable local, state and national government agencies, landowners, regional natural resource management bodies and conservation groups to protect and manage wetlands into the future.

The tools include mapping of wetland extent, development of a framework for assessing wetland condition and a toolbox for identifying the policy and legislation relating to wetlands.

In addition, a range of guidelines have been delivered to assist with defining and delineating wetlands, buffer planning, rehabilitation and the management of wetlands in farming systems. Wetland management profiles and conceptual models further enhance knowledge and understanding of wetland systems.

The ability to update the wetlands mapping and the development of tools for monitoring risk and condition means Queensland is one of the few states with the ability to monitor wetland extent, risk and condition changes and assess the effectiveness of policies.

The Queensland Wetlands Program directly contributes to enhancement of Ramsar Wetlands, as well as other nationally important wetlands not listed under the EPBC Act, that also provide critical habitat for a range of migratory species. The Bowling Green Bay demonstration case outlines some of the programs in place to enhance Ramsar wetlands.

***DEMONSTRATION CASE SNAPSHOT:***

BOWLING GREEN BAY RAMSAR SITE

***OVERALL EFFECTIVENESS***

Effective

The Bowling Green Bay Ramsar site is one of two sites within the GBR coastal zone listed under the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention). An Ecological Character Description (ECD) has been prepared for the site which identifies the ecological character, as well as key threats to the site, knowledge gaps, monitoring needs and communication messages.

Ninety-nine per cent of the Ramsar site is within protected areas. A management plan is in place to guide ongoing management of the site including, for example, fire and visitor management. However, the site experiences a range of pressures from activities outside its boundaries. The main pressures have been identified as poor water quality from agricultural, urban and industrial development.

Reef Plan aims to halt and reverse the decline in water quality entering the GBR from broadscale agriculture and has the potential to contribute significant benefits to the site. Work has also been completed under the Environment Protection (Water) Policy to set water quality objectives and targets specific to the region. The Wetlands state planning policy also helps prevents high impact earthworks that would affect high value wetlands, including the Bowling Green Bay Ramsar site. Other programs, such as the Queensland Wetlands Program are significantly improving understanding of the site and the pressures on it and funding on-ground activities that aim to improve its function (e.g. through natural resource management programs).

The future condition of the site will be largely dependent on the effective management of key pressures in the surrounding catchment area, particularly where they relate to modification of surface water and groundwater hydrology and pollution. On site management will continue to focus on key issues such as pest and weed species, the impacts of recreational activities and altered fire regimes to ensure the ecological character of the site is maintained.

The ESD framework provides a comprehensive foundation for informing future management actions, site planning, research initiatives and stakeholder engagement. Rolling reviews will assist with evaluation and reporting of progress and inform an adaptive management approach to site management.

#### 7.10.2.1 Gaps and improvements

Pressures from outside the RAMSAR wetland boundaries including poor water quality and impacts from significant earthworks present a challenge to the ongoing protection of the these wetland areas. Developing a greater understanding of the impacts from human activities and the interactions of many naturally occurring processes would assist in revising the limits on acceptable change in relation to the ecological character of the site. Detailed studies of the flux and flow of pollutants such as nutrients and herbicides delivered through groundwater flows into the GBR coastal zone both annually and on a seasonal basis would assist in this endeavour.

A better understanding of the interactions, function and ecological values of critical ecosystems on the receiving environments when under stress would provide a greater context for understanding how to improve resilience. Other knowledge gaps include an understanding of oceanographic processes, invasive species, estimates of species which use the site, habitat types, cumulative impacts of toxins and the interaction between surface and ground water.

7.10.2.2 Summary of effectiveness of enhancing Ramsar wetlands

| Management effectiveness component | Grading | Confidence | Trend | Summary of evidence |
|---|---|---|---|---|
| Contribution to enhancement of MNES including OUV and management of existing pressures MNES: Ramsar wetlands | Effective | Adequate | Stable | The Queensland Wetlands Program is delivering a range of benefits to Ramsar wetlands and tools to assist in improving their condition over time. |
| *Effective: Legacy impacts are well understood and some measures are in place to recover or improve MNES (including OUV). Some resources are applied to address the key threats.* | | | | |

## 7.10.3 Threatened ecological communities and threatened/migratory species habitat

Past activities leading to the loss of vegetation, altered fire regimes and grazing have impacted TECs and species habitat. Broadscale clearing for agriculture ceased in Queensland at the end of 2006 under the VM Act, which has led to a significant reduction in clearing rates. Protection was further enhanced in 2009 through regulating the clearing of vegetation within 50 metres of watercourses in priority GBR catchments.

Queensland Government's vegetation management framework effectively provides protection for EPBC Act listed TECs and species habitats. In some cases however, a RE that forms part of a TEC or species habitat is actually listed as 'least concern' under the VM Act because it is regionally more abundant (i.e. more than 30 per cent of remnant remains). This listing provides a slightly lower level of protection than 'of concern' and 'endangered' REs under the VM Act. The VM Act protects only endangered REs in urban areas being developed for urban purposes. Queensland's NRM program is contributing to further improvements through habitat rehabilitation programs, as evidenced in the Burnett Mary Region Healthy Habitats Case Study, below.

## *Case study:*

BURNETT MARY REGION HEALTHY HABITATS

The Healthy Habitats is an initiative of the Burnett Mary Regional NRM Group to protect and enhance the region's significant biodiversity assets. Healthy Habitats is jointly funded by the Australian Government through the Caring for our Country and the complementary Queensland Regional NRM Investment program.

Healthy Habitats has three components:

- on-ground investment in terrestrial and coastal biodiversity priority areas
- priority species and ecosystems research and monitoring
- biodiversity education and awareness raising.

The object of these programs is to support a range of high priority activities and to improve the long term security of the region's significant biodiversity assets.

In partnership with catchment care groups, landholders and managers, Burnett Mary Regional NRM Group's Healthy Habitats team accomplished on-ground actions to assist in reducing critical threats within 21 243 hectares of native vegetation including habitat for threatened plants and animals.

Key recovery and conservation plan actions were carried out in a total of 1 040 hectares of TECs for Brigalow, Semi- Evergreen Vine Thicket, Littoral Rainforest Coastal Vine Thicket and Box Gum Grassy Woodland.

2 615 hectares of remnant vegetation within the Bulburin area have been enhanced through the implementation of feral animal control activities and improved fire management. The national park and adjoining private land serves as significant refugia for terrestrial biodiversity in the north of the Burnett Mary region and contains a high incidence of threatened species.

**OVERALL EFFECTIVENESS**

Effective

***DEMONSTRATION CASE SNAPSHOT:***

DUGONG MANAGEMENT

Dugongs have been a focus of management agencies for many decades, with high-level leadership from the former Great Barrier Reef Ministerial Council.

In the 1980s the GBRMPA's original zoning plan protected some important dugong habitats (seagrass meadows) in 'no-take' and 'no-go' zones. The level of spatial protection was increased significantly in response to the serious decline in dugongs in the GBRWHA south of Cooktown, and outside the GBRWHA in Hervey Bay in 1997. These emergency measures established 16 Dugong Protection Areas under Queensland fisheries legislation (which imposed spatial and gear restrictions and prohibited the use of some types of fishing nets). Soon after, additional measures to protect seagrass habitats from trawling were introduced, as well as netting restrictions and net attendance rules to reduce the incidental capture of dugong within the East Coast Inshore Fin Fish Fishery, and a review of the use of nets in the Queensland Shark Control Program. Other management arrangements were introduced with the Department of Defence for activities in the Shoalwater Bay Defence Training Area.

Dugong habitats were explicitly taken into consideration when the GBR Marine Park was re-zoned in 2004. In combination with other management measures such as improving water quality and fisheries management, approximately 96 per cent of high conservation value dugong habitats are highly protected. Furthermore, 24 per cent of known shallow water seagrass meadows are included in highly protected green zones that prohibit extractive activities. Major efforts to improve water quality through Reef Plan are expected to have positive outcomes for seagrass in the medium term.

Mapping and qualitative models have been used to aid understanding of cumulative impacts on dugongs. The condition for dugong populations is projected to decline to very poor in the southern GBRWHA, and to remain good in the north in the coming decades.

The most critical management action for dugongs is to ensure the health of seagrass meadows. The recovery, protection and increased resilience of seagrass habitats is fundamental to the recovery of dugong populations. It will be particularly important to continue long-term collaborative arrangements to halt and reverse the declines in water quality entering the GBR lagoon, such as those in place under Reef Plan.

Community action and compliance activities at a local and regional scale will continue to help to reduce and minimise mortality or ill-health of dugongs (for example, from entanglement and drowning in nets, vessel strike, marine debris, disease, noise or interference).

Additionally, avoiding entanglement and incidental drowning can be achieved by reviewing the Queensland Shark Control Program to meet bather protection objectives and achieve zero mortality for dugongs, and by adopting best-practice net fishing techniques and technology through regional co-management between government, fishers and the broader community.

TUMRAs are a valuable tool to facilitate sustainable traditional hunting without impacting on dugong populations.

Adaptive management requires monitoring, evaluation and review of the abundance and distribution of dugong and seagrass to allow better understanding of trends.

*Demonstration case jointly prepared with the GBRMPA*

## *Case study:*

REVEGETATION OF MAHOGANY GLIDER HABITAT

Traditional Owners of the Wet Tropics region possess a rich and complex knowledge of the region's natural environment. Their unique knowledge of Wet Tropics ecosystems has provided the basis for environmental management in the region for thousands of years, and forms a critical part of how Traditional Owners care for their country. Knowledge of species distribution, breeding patterns, food requirements and seasonal growth patterns strengthens the close kinship between people, country, and its flora and fauna.

The Queensland Government in cooperation with Terrain NRM, the WTMA, and Aboriginal communities, councils and representatives are working to optimise Indigenous intellectual property and knowledge in protecting the Wet Tropics region and WHA. In conjunction with scientific knowledge, Traditional Owner knowledge and input is being used to restore habitat of the critically endangered mahogany glider within the Wet Tropics region.

The mahogany glider (*Petaurus gracilis*) is a critically endangered glider thought to be extinct since the 1880s until a living specimen was found in 1989. The glider's greatest threat is from habitat loss through land clearing. As it is not dependent on rainforest and prefers woodland and swampy coastal plains, the glider's range falls outside the protection of the WHA. To protect the glider's remaining habitat, several government programs including buy back schemes and population identification and monitoring projects have been undertaken by various authorities including the Girringun Rangers.

As part of the joint Australian and Queensland governments' Recovery Plan for the Mahogany Glider Petaurus Gracilis, Traditional Owners of the Wet Tropics region are identified as key proponents of efforts to save this endangered species. Actions identified in the plan indicate that Traditional Owners and their representatives have a role to play in assessing habitats and corridors, engaging private landholders and implementing strategies to preserve or rehabilitate mahogany glider habitat. Traditional Owners also hold a key stake in promoting and facilitating broader community involvement in programs and activities to save the glider.

Projects from these arrangements are being delivered by Terrain NRM with the assistance of the Girringun Rangers run by the Girringun Aboriginal Corporation. Terrain's Caring for our Country funded Habitat Incentives Project is designed to increase the habitat for two hundred threatened species in the Wet Tropics region including the mahogany glider.

Working on country belonging to the Girramay people, the Girringun Rangers are helping revegetate mahogany glider habitat on part of the Girramay native title determination. Activities of this project include weed control and revegetating riparian areas along Meunga Creek. Many of the trees being planted on the site are also of cultural significance to the Girramay people and will be used as educational tools in the long-term.

#### 7.10.3.1 Gaps and improvements

As evidenced through the Mackay, Isaac and Whitsunday Regional Plan demonstration case, the methodology for mapping does not separate individual biodiversity values into separate mapping layers. Identifying these specific values on a particular site needs to be transparently facilitated through a more interactive mapping facility to assist in the planning process. It is anticipated that the implementation of a single SPP will clearly articulate the matters of state interests which will provide the necessary direction for local government to also consider MNES in the planning process.

TEC and species habitat areas are mostly protected from direct loss (clearing) through the VM Act or being located in conservation areas. However, all TECs and habitats face pressures from pests and altered fire regimes and those located in minimum use and moderate use areas face additional pressure from grazing and other activities. Improved land management practices to deal with these pressures are required to enhance these MNES values.

#### 7.10.3.2 Summary of effectiveness of enhancing threatened ecological communities and threatened/mirgatory species

| Management effectiveness component | Grading | Confidence | Trend | Summary of evidence |
|---|---|---|---|---|
| Contribution to enhancement threatened ecological communities and threatened/ migratory species | Effective | Adequate (TEC) Limited (Habitat) | Stable | Clearing of vegetation over the last 150 years has created a significant lasting impact on the extent of TECs and species habitat.<br>The VM Act halted broadscale clearing in Queensland in 2006. Clearing of regrowth in riparian areas in also prohibited in high priority catchments. |
| *Effective: Legacy impacts are well understood and some measures are in place to recover or improve MNES (including OUV). Some resources are applied to address the key threats.* | | | | |

## 7.11 How well the Queensland Government's Program deals with impacts from outside the Program

### 7.11.1 Likely impacts of climate change and severe weather events

One of the greatest influences on the future of a number of MNES, including the GBRWHA, is the likely impacts of climate change and severe weather events.

Whilst the Queensland Government's Program can put in place measures to improve the resilience of MNES so ecosystems and species have a better capacity to adapt to the likely changes from climate change, such as improving water quality and reducing other threats like pest species, addressing greenhouse gas emissions is outside the scope of the strategic assessment. Action on climate change mitigation is not within the scope of the Program, however given its pervasive nature each component of the Program addresses the expected impacts.

Similarly to climate change, severe weather events such as cyclones and flooding cannot be avoided through the Program. Management measures that improve the resilience of MNES and thereby its capacity to recover afford the best opportunities to address the impacts of severe weather events.

### 7.11.2 Shipping

Responsibility for shipping through the GBR is primarily the responsibility of the Australian Government, although the Queensland Government does have responsibility for managing ship movements within port limits. Maritime Safety Queensland (MSQ) works in partnership with the Australian Maritime Safety Authority (AMSA) and the GBRMPA to ensure shipping management is coordinated and integrated.

The North East Shipping Management Plan will set strategies, including additional or enhanced measures that may be needed in the future, for managing shipping in the GBR with the aim of reducing the risk of a shipping incident and subsequent pollution of the marine environment.

The shipping case study below shows that despite an increase in shipping traffic through the GBR, shipping incidents have not increased. This shows the effectiveness of the management measures in place.

*Case study:*

SHIPPING

Management of shipping in the GBR has significantly improved since the area was inscribed on the World Heritage list and subsequently designated as a Particularly Sensitive Sea Area by the International Maritime Organisation.

While shipping movements in the GBRWHA have increased over the past 25 years, the number of major shipping incidents occurring each year has not. The Queensland and Australian governments have a range of existing protections in place to manage the risk of ship movements, including compulsory pilotage (requiring a local pilot who understands local conditions, navigation and shipping routes) and vessel monitoring, which was extended to the southern boundary of the GBR after the grounding of the Shen Neng 1 in 2010.

These measures have significantly reduced groundings (Figure 7.11 1). The following graph showing the number of groundings from 1986 to 2009 illustrates the impact of the enhanced ship management measures that have been put in place since the 1990s

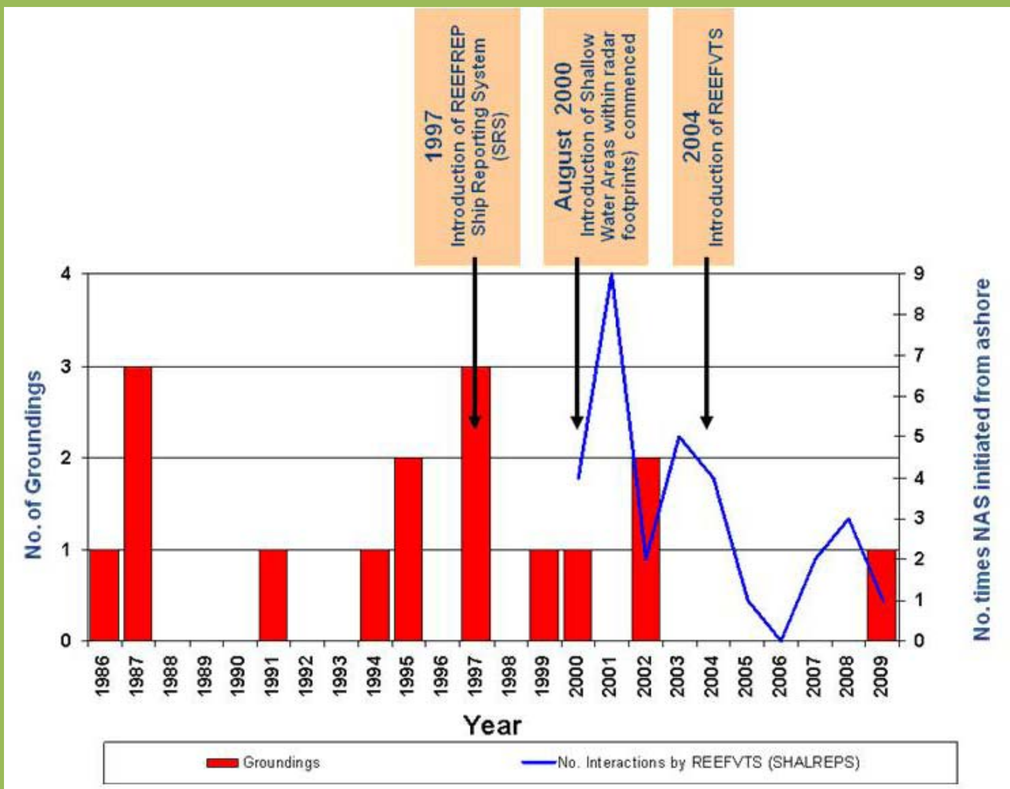



Figure 7.11 1 Ship groundings since 1996

Source: [146]

As shipping numbers increase over the next 25 years, it is expected that management will need to continue to adapt to manage emerging risks. To maintain preparedness, the North East Shipping Management Group is developing the North East Shipping Management Plan which is assessing whether the current safety and management measures will be effective in 10-20 years' time if shipping activity significantly increases.

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# Chapter 8

## projected condition

*Extract from Great Barrier Reef Coastal Zone Strategic Assessment terms of reference*

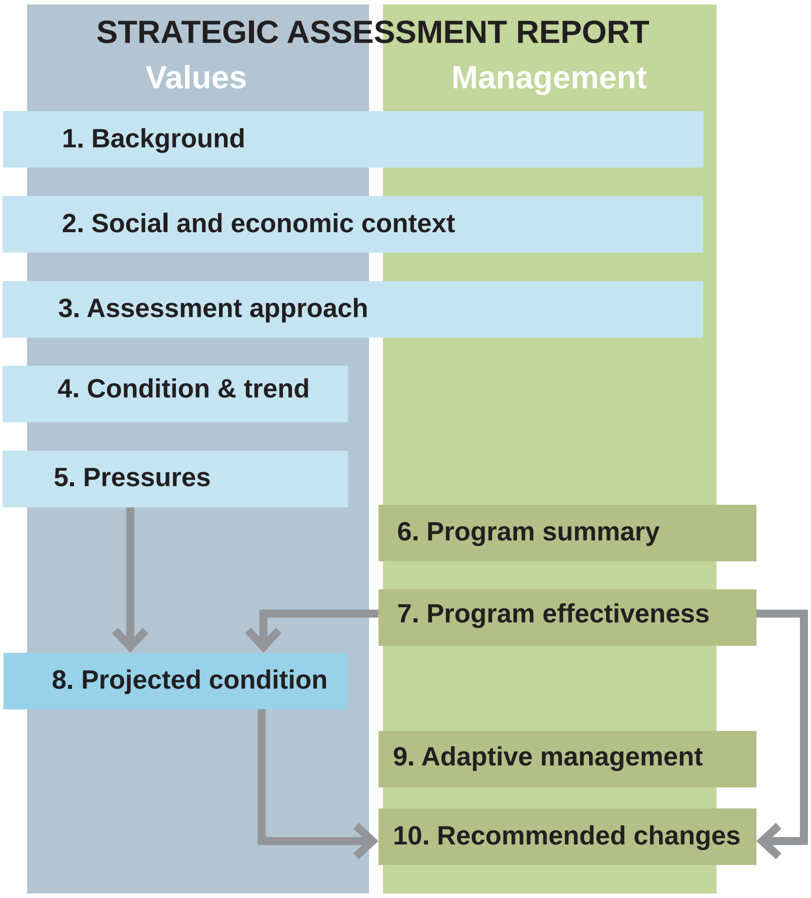
*2.5 Recommendations for changes to the Program*

*The Strategic Assessment Report must include an evaluation of the resulting projected condition of MNES including OUV within the strategic assessment area of the Program taking into account:*

*(a) the baseline scenario, i.e. the analysis of the current condition of MNES including OUV, projected trends and existing threats*

*………*

# 8. Projected condition




## 8.1 Introduction

This chapter provides an analysis of the projected condition of the GBR coastal zone's MNES over the 25 year timeframe for the Program, including proposed improvements and forward commitments. The projected condition of MNES draws upon on a synthesis of information including:

- the existing extent, condition (state) and trend for MNES
- an understanding of activities and pressures impacting on MNES, including risk to MNES
- the effectiveness of the Program, including forward commitments, to avoid future impacts and enhance MNES
- an assessment of resilience.

This is achieved by considering the findings from chapter 4 on condition and trend, chapter 5 on pressures and cumulative impacts, chapter 7 on Program effectiveness and the overall risk of the potential future impacts to MNES in the GBR coastal zone.

The Australian Standard procedure for risk assessment[147] has been used to assess the risks posed by pressures or impacts to MNES in the GBR coastal zone. Both the likelihood and consequence of each predicted impact has been ranked on a five-point scale (see section 3.8). An overall risk level for each pressure or impact was then determined, based on both its likelihood and consequence (Table 8.1 1).

Table 8.1 1 Potential impacts on MNES and risk assessment

| Potential impacts | Likelihood | Consequence | Summary | Risk |
|---|---|---|---|---|
| Loss of habitat and Connectivity | Possible | Moderate | Projected increases in urban and industrial development makes the likely clearing and modification of MNES areas possible at a local scale.<br>However, with the general prohibition on clearing of native vegetation for agriculture under the VM Act, 32 % of terrestrial MNES located in protected areas, the expected inclusion of MNES areas in Queensland's mapping and a better approach to vegetation offsets the likelihood of further loss of habitat is reduced | Medium |
| Decline in water quality | Posssible | Major | Ongoing improvements in land management are likely to reduce sediment and nutrient loads in catchment runoff in the future.<br>However, there is likely to be a significant lag time between land management and measurable water quality improvements | High |
| Pest and weed species and disease | Possible | Major | Limited resources available to NRM programs in the GBR coastal zone is likely to lead to an increase in pest and weed species occurrence and dispersal. | High |
| Inappropriate fire regimes | Likely | Moderate | Altered fire regimes have been associated with changes to species and community abundance, diversity and distribution and have resulted in a loss of biodiversity.<br>The impacts of climate effects may additionally contribute to this pressure. | High |
| Disturbance of species | Almost Certain | Minor | Increases in population, tourism and recreation use of the GBR coastal zone is likely to lead to an increase in disturbance of species | Medium |
| Altered flow regimes | Likely | Major | Artificial barriers in the catchment continue to affect freshwater and estuarine systems<br>Change the timing and magnitude of flows can prevent fish migration, disrupt natural breeding cycles and affect freshwater inflows into the GBR lagoon | High |

A summary of the current condition and recent trend of key MNES is presented in Table 8.1 2. The current condition across the key MNES are assessed as good to very good with one noted exception for the Broad leaf tea-tree woodlands. Despite the current condition, the recent trend for the GBRWHA has been deteriorating. This is also true for the Broad leaf tea-tree woodlands.

Table 8.1 2 Summary of current condition and recent trend of key MNES and values underpinning MNES

| MNES/value | Current condition | Recent trend |
|---|---|---|
| GBRWHA (OUV) | Good | Deteriorating |
| Wet Tropics WHA (OUV) | Good | Stable |
| Ramsar sites | Very good | Stable |
| TEC - Broad leaf tea-tree woodlands | Poor | Deteriorating |
| TEC - Littoral Rainforest | Good | Stable |
| Threatened species habitat | Good | Stable |
| GBR coastal zone migratory species habitat | Good | Improving |

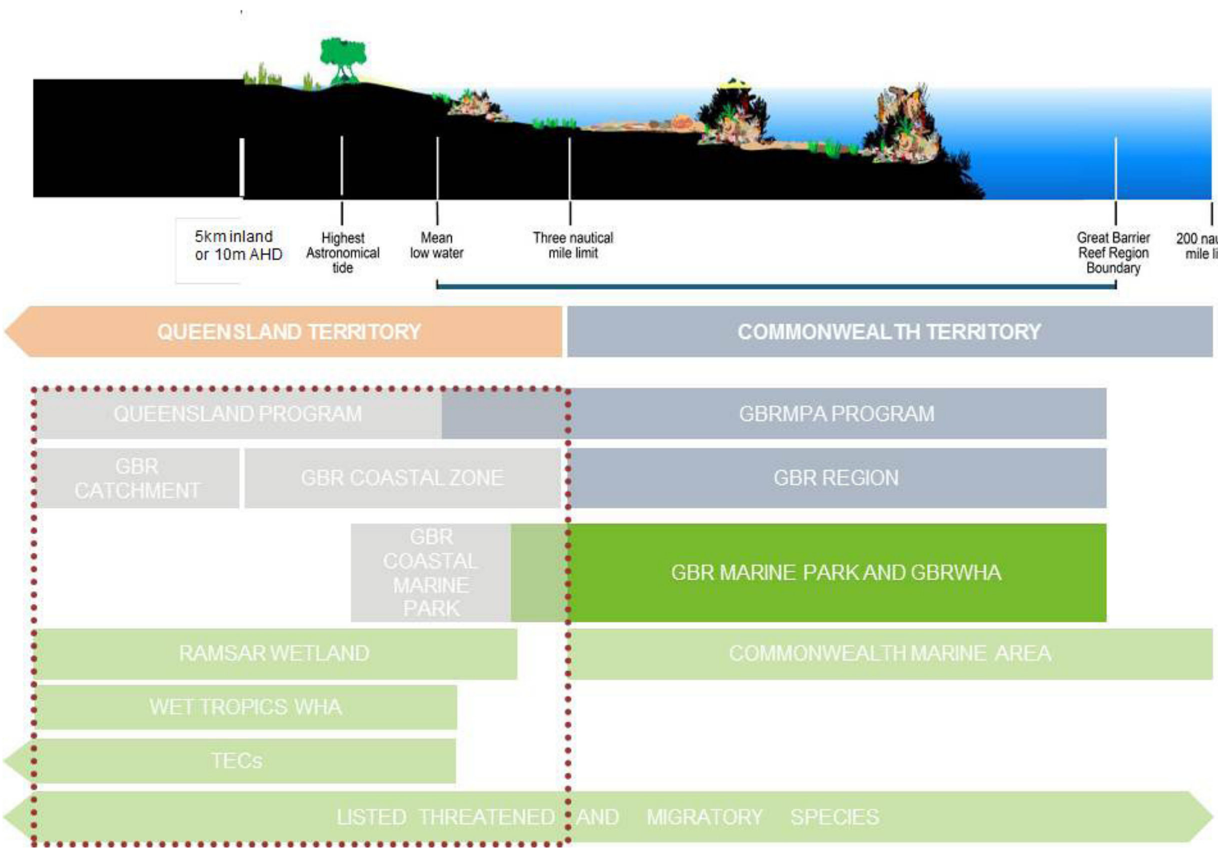
A summary of the current condition, trend, impacts and management effectiveness of each key MNES category follows. This information has been used to determine the projected condition.

Overall the projected trend for the GBR coastal zone is very positive. The analysis shows that the key MNES and values underpinning MNES are expected to improve into the future. In particular, the GBRWHA recent condition had been assessed as declining but is now expected to improve over time and into the future.

The exception to this clear upward trend is the Broad Leaf tea-tree woodland which has been in poor condition in recent times and was expected to continue to deteriorate. More recent assessments of the woodland indicate that despite the condition remaining poor, the future trend is expected to stabilise.

Future management of the GBR coastal zone will start to focus more specifically on cumulative pressures to maintain the health and resilience of the GBR. Water quality in particular has the potential to build resilience in the GBR coastal zone and minimise the cumulative impacts of past activities and inform future activities with regard to management strategies. Realising improvements in other MNES as a result of improved water quality will take more time.

## 8.2 Great Barrier Reef World Heritage Area and Marine Park




### 8.2.1 Condition and trend

As a result of historical (settlement) land clearing, wetland drainage and ongoing diffuse rural pollution (sediment, nutrients and pesticides) from agricultural and grazing land within the GBR catchments many ecosystems in the GBRWHA have experienced significant and ongoing decline.

On a regional scale, the marine environment adjacent to the Cape York NRM region is generally in better condition than those to the south, notwithstanding recent findings of anthropogenic derived sediment being observed in the marine environment. Nevertheless, the trend within marine and estuarine areas adjacent Cape York Peninsula is expected to remain stable for all MNES values. However, the situation is different south of Cooktown due to greater levels of historical land clearing and greater intensity of agriculture and grazing leading to poorer quality freshwater flows into the GBR lagoon.

There are early positive signs that NRM programs aimed at achieving best management practice in the agricultural and grazing sectors are slowing the decline in water quality entering the GBR lagoon. Unfortunately, these improvements have in the past two years been overwhelmed by extreme weather events and associated heavy rains that have flushed catchments that had previously experienced extended periods of below average rain, if not drought.

The assessment identified overwhelming evidence that a range of threats is continuing to affect inshore habitats along the coast and the species that use these habitats. Extreme weather events and poor water quality from catchment runoff are the prime reason for the continuing loss of habitats such as seagrass and inshore corals (Table 4.10 2). There have been declines recorded in dolphins, dugongs and shorebirds, although seabirds and estuarine crocodile populations are in good condition. Conversely, mangrove ecosystems may have benefited from increased sedimentation. The processes of sedimentation, nutrient cycling and connectivity are in poor condition and are continuing to deteriorate. In summary, while catchment NRM programs aimed at improving land management practices are showing signs of success, the trend continues to be one of deterioration.

Further vegetation clearing associated with urban development and industrial activities could create additional pressures and subsequent impacts.The Queensland Government Program and forward commitments will aim to concentrate development in the GBR coastal zone to promote sustainable development and limit possible impacts

The overall findings are that the extents of MNES habitats declined in the past, but however, they are now stable due to the end of broadscale clearing under the VM Act which came into effect in 1999. The overall condition of MNES habitat was found to be good. However, there are some areas of particular concern.

The assessment identified overwhelming evidence that a range of threats continue to affect inshore habitats along the coast and the species that use these habitats. The key impacts affecting habitats and species are extreme weather events, poor water quality from catchment runoff, and loss of habitats.

Land and natural resource management practices have improved during the past few decades. Although better management of many agricultural systems has reduced their impacts on the environment, a number of issues around nutrient and soil management remain. Improved management techniques currently being implemented in the GBR coastal zone have started to yield better water quality results. However, there will be a time lag to halt and subsequently reverse overall water quality results.

The northern inshore habitats of the GBR remain in good condition, whereas the southern inshore habitats have deteriorated – especially seagrass meadows and inshore coral reefs (Table 4.10 2). Populations of migratory species vary. There have been declines recorded in dolphins, dugongs and shorebirds, although seabirds and estuarine crocodile populations are in good condition. The processes of sedimentation, nutrient cycling and connectivity are in poor condition and are continuing to deteriorate.

### 8.2.2 Impacts

The most significant impacts on the GBR continue to be the likely impacts of climate effects and poor water quality. The impacts of poor water quality are more pronounced in the southern inshore area of the GBR, compared with the northern and offshore areas. Previous clearing and modification of the catchments has also had an impact on inshore functionality, particularly through changes to natural waterways. The impacts of urban, port and industrial development tend to be locally significant and do not pose a significant threat to the GBRWHA. Continued improvements expected with regard to those activities make it less likely that condition will decline (see section 5.4).

### 8.2.3 Management effectiveness

Project by project assessment involves appropriate conditioning of approvals to avoid, mitigate or offset impacts on MNES. Impacts are avoided, mitigated or offset through legislation, plans, policies and programs included in the Queensland Government's Program. The planning and development assessment and monitoring regime outlined in the Program, limit and minimise impacts on MNES, including OUV. Major project conditions restrict and control the nature and extent of development to ensure only sustainable development occurs with minimal impacts on the surrounding environment.

A number of offsets policies are in place under the Queensland Government Environmental Offsets Policy, but are not well integrated to ensure strategic outcomes. They deliver some tangible outcomes for MNES, but not a net improvement and therefore are assessed as partially effective.

Management plans are in place for protected areas to address ongoing cumulative impacts although further improvements could be made to identify and manage cumulative impacts from development activities. Proponents of major projects are required to identify and assesspotential cumulative impacts on MNES as part of the EIS process. To date, however, there is no consistent method to determine the cumulative impacts of a development proposal. Based on this, the Program's effectiveness in addressing cumulative impacts is assessed as partially effective.

Significant progress is being made to improve water quality through the Reef Plan. These actions will build the resilience of the GBR and improve the ability of MNES to deal with the likely impacts of climate change. The Queensland Government also contributes to a range of other programs that will improve MNES over time. Legacy impacts of past activities are well understood andmeasures are in place to improve MNES (including OUV).

The Queensland Government continues to work closely with the GBRMPA in areas of joint management of the GBR Marine Park, particularly in relation to field management (i.e. compliance and island management).

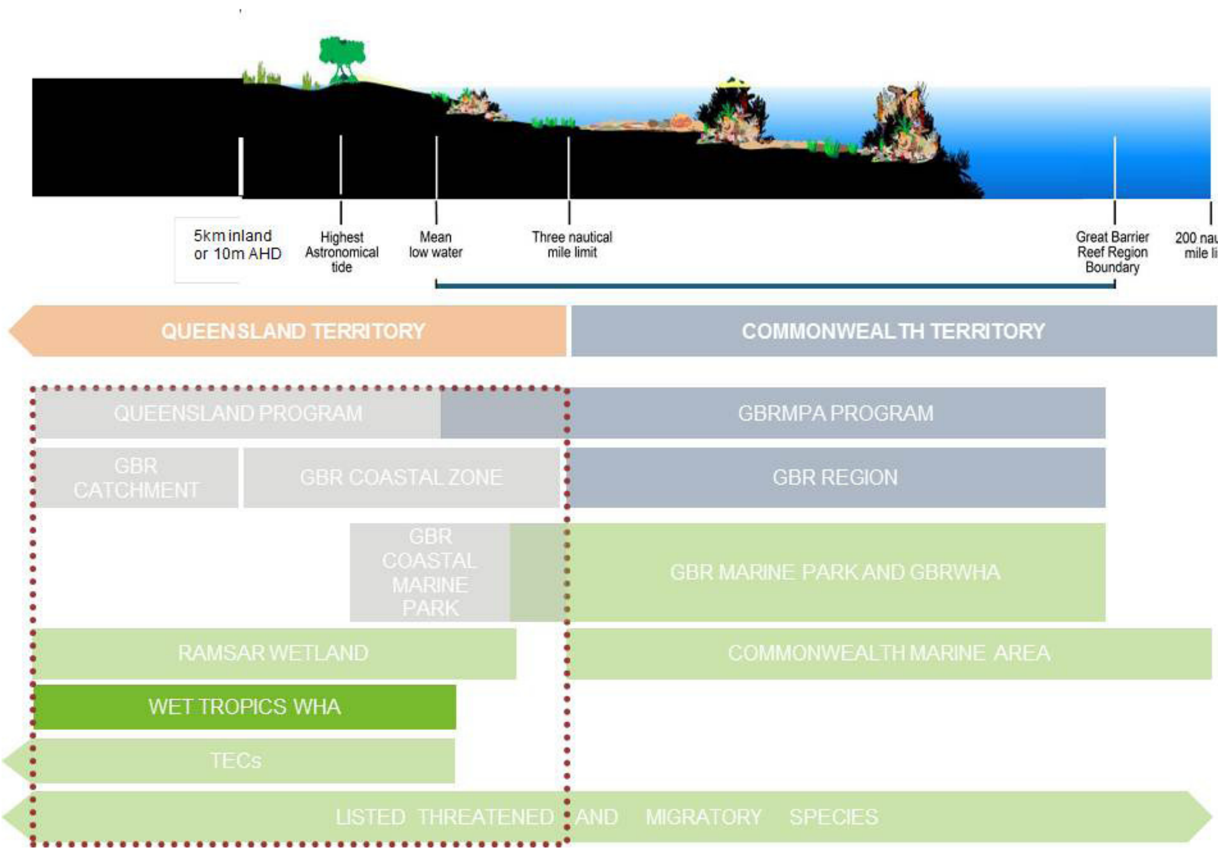
### 8.2.4 Projected condition

Some values of the GBRWHA are expected to improve in response to:

- significant investment in water quality improvement
- improved data that supports mapping of MNES areas.

The Commonwealth marine area is outside the GBR coastal zone, however, the values, pressures, impacts and projected condition of this MNES are the same as those for the GBRWHA.

## 8.3 Wet Tropics World Heritage Area




### 8.3.1 Condition and trend

The 2011 UNESCO Periodic Reporting concluded the following with respect to condition and trend of the Wet Tropics WHA:

- no serious management needs have been identified for management of the property;
- the integrity of the World Heritage property is intact
- the Area's OUV has been maintained.

The Wet Tropics WHA is in good condition. Pressures on biodiversity are generally not geographically uniform. Analysis of the condition indicators for the Wet Tropics report card suggests that, with respect to the status and trends of biodiversity, the overall assessment for the entire Wet Tropics WHA was 'good'. In areas outside the WHA, the condition is poor, with extensive areas historically cleared in the coastal floodplains, and increased risk of impacts from development, the spread of pests and weeds, and extreme weather events (see section 4.3.1).

### 8.3.2 Impacts

The Wet Tropics NRM region is the most populated of the NRM regions adjacent to the GBR and the population is growing. Tourism relies almost exclusively on marketing the natural values of the region, particularly the GBR and Wet Tropics WHAs. Despite the economic importance of industry, it relies on MNES values and is therefore careful to avoid or minimise its environmental impacts. As a result, these impacts are neglibile.

Vegetation loss stands at 22 per cent of the pre-clearing extent.[124] The topography and relative remoteness of this NRM region has helped protect the area, as has World Heritage designation in 1988 and resultant extensive conservation. The region is characterised by areas of coastal habitat separated from mountain habitat by a narrow coastal plain that has been intensively developed, mostly for growing sugarcane. This development has led to poor catchment water quality and limited habitat connectivity between coastal and mountain habitats.

The predicted future development in the Wet Tropics NRM region will include urban and tourism development. Development in the Wet Tropics NRM region has the potential to impact on the Wet Tropics WHA.

While there have been many major advances in conserving the WHA through research, technology, legislation and community participation and support, there remain some serious threats to the Wet Tropics WHA's OUV. Some major underlying and emerging threats are:

- The impacts of climate change on endemic and threatened species, particularly in montane rainforests.
- Major biosecurity issues due to the arrival of highly invasive weeds, feral animals and diseases. The arrival of myrtle rust and its potential impact on Wet Tropics species and ecosystems, and the threatening advance of tramp ants such as the electric ant and yellow crazy ants into the WHA are of particular concern.
- The significant damage and disturbance caused by three cyclones in recent decades crossing the WHA between Babinda and Cardwell (tropical cyclones Winifred [1986], Larry [2006]) and Yasi [2011]). This part of the Wet Tropics is home to threatened species such as the cassowary and mahogany glider. Forests damaged during these events will take decades to recover.
- Urban and rural development and associated activities which may result in loss of remnant vegetation and habitat, presents the possibility of fragmentation between sections of the WHA and a loss of connectivity essential for certain species.

### 8.3.3 Management effectiveness

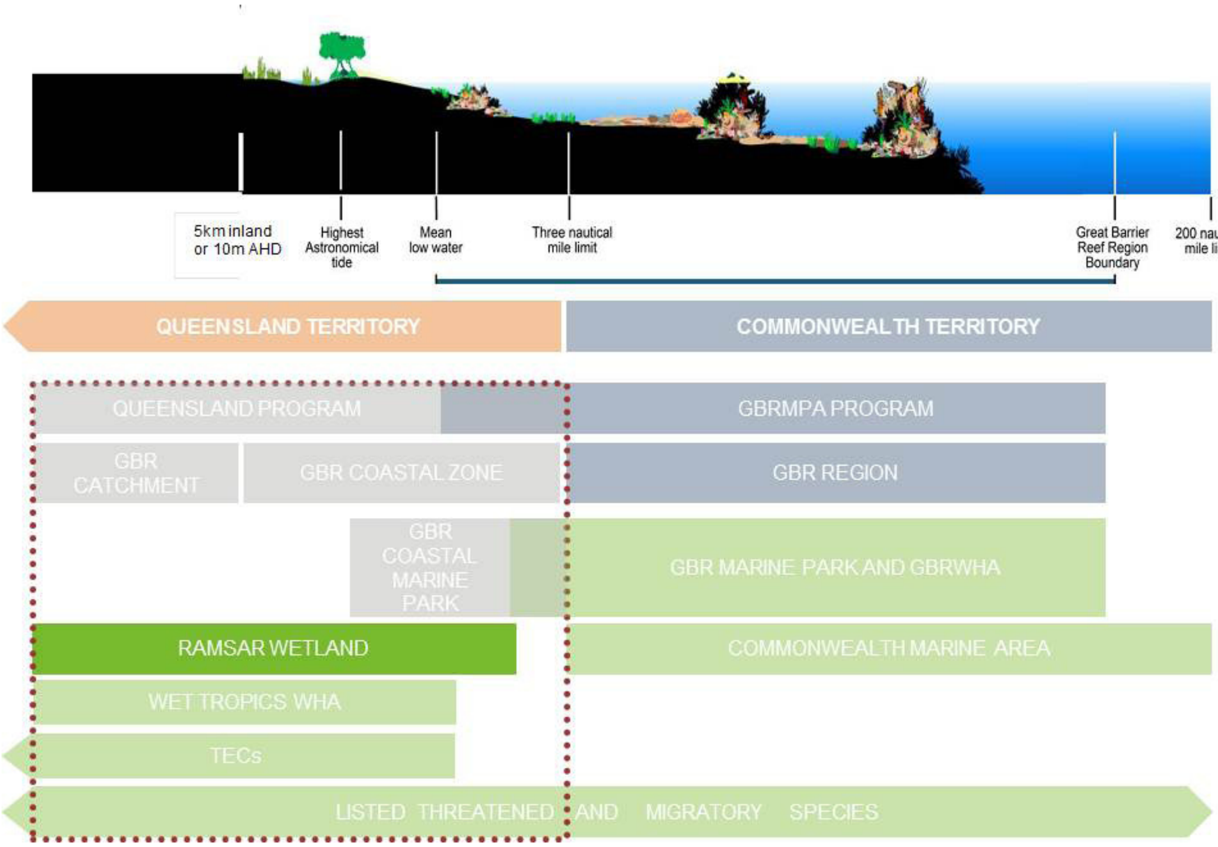
Management of the Wet Tropics WHA is effective. Separate legislation and a statutory authority (the WTMA) overseeing management in the Wet Tropics WHA ensure impacts are identified and managed. Seventy-nine per cent of the WHA is protected in national parks. The Wet Tropics Management Plan provides direction for management within the WHA, including areas outside national parks, and comprises a zoning scheme and permit system. There is a robust system of reporting on the condition of the WHA and the WTMA works closely with the Queensland Government to manage impacts from outside the WHA through the FNQ regional plan.

The contribution to the enhancement of MNES including OUV, and the management of existing impacts is assessed as effective. The Wet Tropics Conservation Strategy is designed to improve the OUV of the Wet Tropics WHA by controlling weeds and pests, installing animal overpasses and rehabilitating areas to improve connectivity.

### 8.3.4 Projected condition

Separate legislation and a statutory authority oversee the management of the Wet Tropics WHA. The condition is projected to remain very good and may further improve as a result of enhancement under the Wet Tropics Conservation Strategy.

## 8.4 Ramsar sites




### 8.4.1 Condition and trend – Bowling Green Bay Ramsar site

This Ramsar site is in very good condition and continues to demonstrate its ecological character. The draft ECD for the Bowling Green Bay Ramsar site assessed that the site continues to meet the Ramsar nomination criteria (see section 4.4.1).

### 8.4.2 Impacts – Bowling Green Bay Ramsar site

Land use within this Ramsar site catchment area is almost entirely agricultural and pastoral, with extensive agricultural lands associated with the Burdekin river irrigation area occurring further inland. Livestock (cattle) grazing is also carried out in portions of the site, mainly in the brackish and freshwater areas north-west of the Haughton River.

The northern seaward portion of the site abuts the GBR Marine Park. Several small townships (Cungulla and Hucks Landing) are encompassed by the site but do not form part of it. At the northern extremities of Capes Bowling Green and Cleveland, there are small lighthouse reserves (approximately 80 hectares and 3 hectares respectively) and a further 208 hectares has been excised at the western end of Bowling Green Bay for the Australian Institute of Marine Science.

Agricultural, urban and industrial developments in the catchment area external to the site, pose the most significant threats to the integrity of the area, particularly in the lowland areas. The potential impact posed by these is the result of cumulative impacts causing changes to water regimes and the chemistry of both surface and sub-surface waters. As already evident within the coastal region, this initiates rapid changes in biological communities and degrades the natural functioning of wetlands within the landscape and their value as habitat [148].

The predominant impact on the Bowling Green Bay Ramsar site is from extreme weather events. Other impacts to the Ramsar site come from activities outside its boundaries, including a decline in water quality, habitat fragmentation and pest and weed species (see section 5.4).

### 8.4.3 Management effectiveness – Bowling Green Bay Ramsar site

As 99 per cent of this Ramsar site is within a protected area, on-site impacts are effectively avoided through terrestrial and marine protected areas. Despite the lack of a general management plan, portions of this Ramsar site are subject to controlled burning practices to reduce the damaging effects of wildfire. Shallow seasonal wetlands are also subject to controlled grazing to maintain the wetlands for waterfowl by preventing the invasion of upland grasses into the swamps during the dry spring. Limited public access is available to the whole area for fishing and camping. Minor facilities are available at one location (Barramundi Creek) and proposed for another (Bald Rock at Cape Cleveland). The area is actively patrolled by two full time rangers of the QPWS who enforce regulations on the site.

Off-site cumulative impacts from development activity are not avoided as effectively, however there are some key measures in place (e.g. avoiding high impact earthworks). A range of programs are directly enhancing the condition of the wetlands, including water quality improvement programs. There has been significant investment in the Queensland Wetlands Program which provides supporting tools for management.

### 8.4.4 Condition and trend – Shoalwater and Corio Bays Ramsar site

The Shoalwater and Corio Bays Ramsar site encompasses coastal and sub-coastal ecosystems which are relatively undisturbed. This Ramsar site is in very good condition and continues to demonstrate its ecological character. The ECD for the site assessed that the site continues to meet the Ramsar nomination criteria, with no significant deterioration in the ecological character of the site outside the realms of natural variability [43] (see section 4.5.1).

### 8.4.5 Impacts – Shoalwater and Corio Bays Ramsar Site

The Shoalwater Bay area has been gazetted as a Defence Practice Area under the Defence Act 1903 (Cth). A Commission of Inquiry acknowledged that Defence use should be the primary use of the Area but recommended 'that conservation use of the area as a whole – land and sea – be elevated in importance and explicitly recognised as being a concurrent and equally significant use with Defence use of the area' [149]. Defence activities within the nominated area are localised and are appropriately managed under the Area's integrated management plan.

Deliberate burning by Indigenous people and pastoralists occurred historically as a fire control measure and has had some long-term impact on the area.

Commercial and recreational fishing is an important activity at both bays and minor tourism and other recreation activities also occur. Prohibition of trawling in much of the area and the current low level use for tourism and recreation mean these activities appear to pose little threat to the values of the area. Oyster banks in the area are licensed by the Queensland Department of Agriculture, Fisheries and Forestry (DAFF).

Around Shoalwater Bay commercial and recreational fishing, agricultural and pastoral activities, and recreation activities are limited. Around Corio Bay, state forest and national park dominate with limited urban land use, tourism, recreation and agriculture making up most of the remaining activities.

Future growth in marine-based tourism and increased recreational activities is predicted. There has been an increase in the use of the freshwater area by Indigenous people as they renew their cultural and spiritual links to the land.

Defence training activities pose localised disturbance in the Shoalwater Bay Training Area but are appropriately managed under the guidelines of the area's integrated strategic plan.

Threats posed by the use of fire as a management tool and feral pests (cat, fox, rabbit, cattle, horses, pigs and goats) and weeds (Lantana camara, Passiflora suberosa and Emilia sonchifolia) have been addressed through the implementation of the management plan for this Ramsar site. Illegal fishing practices (e.g. netting) pose a threat to dugongs, turtles and fish stocks (especially barramundi and salmon), and breaches are enforced under the Fisheries Act.

The predominant impact on the Shoalwater and Corio Bay Ramsar sites is from extreme weather events. Other impacts to the Ramsar site come from activities outside its boundaries, including a decline in water quality, changes in groundwater hydrology and pest and weed species (see section 5.4).

### 8.4.6 Management effectiveness – Shoalwater and Corio Bays Ramsar site

The Shoalwater Bay area has been listed on the Register of the National Estate since 1980[150.] Corio Bay is a gazetted FHA and has restrictions placed on it to protect its fish habitat values. The entire area is within the GBR Marine Park and managed within the provisions of its zoning plan. Conservation management of the marine areas are the responsibility of the GBRMPA, and Queensland Government DEHP and DAFF. On-site impacts are effectively avoided through terrestrial and marine protected areas, 80 per cent of the Ramsar site is within a protected area.

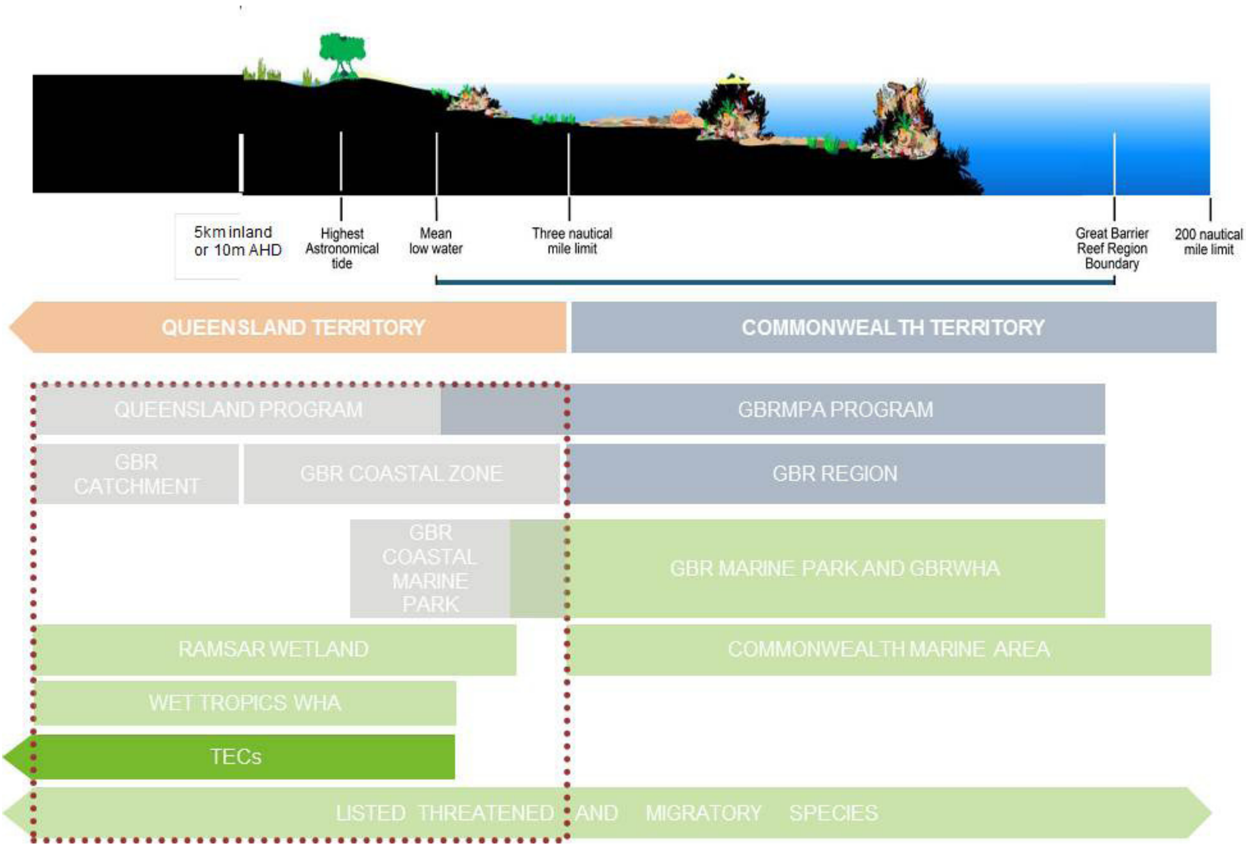
Access to the Shoalwater Bay Training Area is restricted and existing tourism and recreation use is at a low level. All tourism and recreational opportunities are marine-based and these are totally restricted when the area is in military use. Current levels of recreational fishing and tourism from the coast are not causing damage to the national estate values.

Although there are some key measures in place (e.g. avoiding high impact earthworks), off-site cumulative impacts from development are not as effectively avoided. There is however, a range of programs that are directly enhancing the condition of the wetlands, including water quality improvement programs. There has been significant investment in the Wetlands Program which provides supporting tools for management.

### 8.4.7 Projected condition

Significant impacts on the two Ramsar sites are effectively avoided through terrestrial and marine protected areas. Programs are also in place to directly enhance or mitigate impacts from outside the Ramsar sites, including water quality improvement programs. Both Ramsar sites are projected to remain in very good condition and programs to improve water quality will translate into improved condition.

## 8.5 Threatened ecological communities




### 8.5.1 Condition and trend

Terrestrial habitats in northern GBR catchments are generally in good condition, however in the southern GBR catchments these habitats have been substantially modified, especially wetlands and forests. TECs are made up of multiple REs which do not all share the same conservation status. For some ecological communities, there is a mixture of 'endangered' and 'least concern' REs as classified by the Queensland Herbarium. The TECs with a significant proportion of their extent within the GBR coastal zone are:

- broad leaf tea-tree woodlands in high rainfall coastal north Queensland
- littoral rainforest and coastal vine thickets of eastern Australia.

See section 4.6.1 for further detail.

The broad leaf tea-tree woodlands TEC is generally in poor condition and the trend is considered to be deteriorating, because a significant proportion of this TEC has been cleared and much of its remaining extent is located in areas of moderate use. The 'littoral rainforest' on the other hand retains much of its original extent and a significant proportion is located in conservation and minimum use areas.

### 8.5.2 Impacts

The landscape within which the broad leaf tea tree ecological community occurs is subject to a range of land uses including grazing. Some areas are subject to small-scale clearing for hobby-farms and fire breaks. The key threats impacting upon the ecological community are clearing and fragmentation, weed invasion, inappropriate grazing regimes, forestry practices, inappropriate fire regimes, and illegal wildlife harvesting. The main potential threats to the ecological community relate to myrtle rust and changes in hydrological regimes [151].

Generally, the littoral rainforest and coastal vine thickets of eastern Australia ecological community has been significantly reduced and fragmented by sandmining, agriculture and coastal development. However this TEC is less impacted in the GBR coastal zone. Presently, the main key threats to the ecological community include clearing, coastal development, visitor disturbance, weed invasion, animal grazing/browsing, fire and the effects of fragmentation [45]. In addition, natural disturbances, such as storms and cyclones can impact the ecological community, and are likely to increase in frequency and intensity with climate change.

The impacts on TECs have been significantly reduced since broadscale clearing ended in 2006. Since that time, vegetation across Queensland has increased. The main impact on TECs is loss of habitat and connectivity, altered fire regimes and the spread of weeds, as identified in section 5.4.

### 8.5.3 Management effectiveness

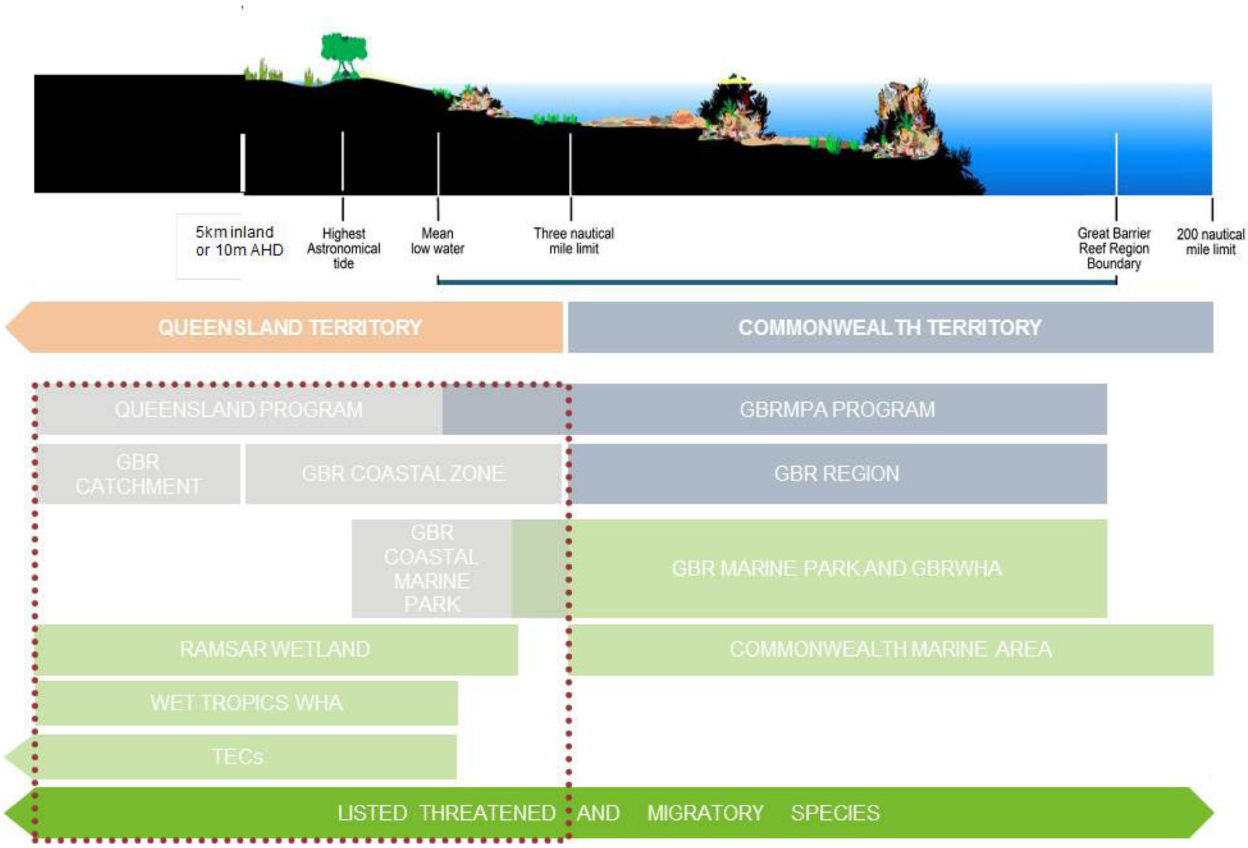
Management of protected areas and vegetation clearing under the VM Act is important in the protection of TECs. A large proportion of the GBR coastal zone is within conservation areas (over 30 per cent), with the VM Act providing important protection outside conservation areas. Very little of the remaining extent of the two TECs are located in urban or other intensive use areas.

Legacy impacts on TECs are well understood and some measures are in place to recover or improve MNES. The halting of broadscale clearing in Queensland under the VM Act in 2006 and the protection of riparian vegetation in priority GBR catchments under the VM Act in 2009 will further protect and improve TECs in the GBR coastal zone. The vegetation offsets policy is partially effective but will be significantly improved under the proposed new offsets policy which will deliver more strategic outcomes and net improvement for MNES.

### 8.5.4 Projected condition

The projected condition of the broad leaf tea tree TEC is expected to move from deteriorating to stable in response to the protection of native vegetation under the VM Act, while the projected condition of the littoral rainforest TEC is expected to move from stable to improve due to the extent of this TEC within protected and minimum use areas and the protection afforded by the VM Act.

## 8.6 Threatened and migratory species




### 8.6.1 Condition and trend

Based on habitat extent, the condition and trend for threatened and migratory species in the GBR coastal zone varies. However, taken together the general picture is that around 25 per cent of habitat for the key species assessed has been lost due to historical clearing, which is far less than for many habitat types in coastal Queensland. Additonally, of the remaining habitat extent, around 60 to 80 per cent is located in conservation or minimum use areas, thereby providing this habitat with a high degree of protection. For all key species the recent trend is considered to be stable or improving.

Populations of threatened and migratory species vary. There have been declines recorded for dolphins, dugongs and shorebirds. Estuarine crocodiles, seabirds and bony fish populations are in good condition and improving (see section 4.7). Species records indicate that populations of some species is very low (e.g. yellow chat, cassowary and bare-rumped sheathtail bat). Further, some species, such as the cassowary population around Mission Beach, are under pressure due to being in close proximity to urban areas and risking dog attacks, vehicle collision and habitat fragmentation. Some species have been affected by experiencing several extreme weather events over several consecutive years.

Beaches and coastlines, mangroves, saltmarsh and seagrass are important habitats for migratory shorebirds, seabirds and marine turtles. In the remote north, they remain relatively undisturbed, except for by marine debris. However, saltmarsh and seagrass have been assessed as in poor or very poor condition south of Cooktown due to sedimentation from freshwater inflows..

### 8.6.2 Impacts

The impacts vary across the different threatened and migratory species. For terrestrial threatened species, the major impacts are loss and fragmentation of habitat and pest species. Altered fire regimes are a major impact on threatened species' essential habitat (see section 5.4).

Other impacts that are specific to certain species or act on a local scale include:

- Roads and traffic: cassowaries are killed by vehicles on roads, major transport corridors disrupt mahogany glider movements – a number of road kills on the Bruce Highway have been recorded.
- Dog and cats attacks: urban development brings more domestic dogs and cats.
- Diseases: aspergillosis, avian tuberculosis, toxoplasmosis and hydatids.
- Natural catastrophic events: cyclones.
- Altered hydrology: this causes habitat degradation.

For marine species, the major impacts from activities in the GBR coastal zone are poor water quality which has flow on impacts on habitat (seagrass and coral cover). Further detail on other impacts on marine species is provided in the GBRMPA's *strategic assessment report*.

The impacts on terrestrial migratory species primarily relate to pests and predation from introduced animals and a decline in water quality. Altered fire regimes are a major impact on migratory species' feeding, breeding and roosting habitat (see section 5.4). Some structures near urban centres and ports have extensively modified coastline habitats in localised areas.

### 8.6.3 Management effectiveness

The effectiveness of the Program to enhance MNES and manage existing pressures on MNES, including threatened species, is assessed as effective.

The process for the listing of species under the NC Act ensures that conservation initiatives and land use requirements reflect current scientific knowledge. Queensland's Back on Track Prioritisation Framework provides an effective scientific mechanism for prioritising actions for threatened species and informs management and on-ground actions. Significant portions of habitat are within conservation areas. However, the Queensland Government Program relies on funding from NRM programs and other programs to deliver actions on the ground. The Queensland Regional NRM Investment Program directs funding to priority on-ground actions.

The biodiversity offsets policy is partially effective, but will be significantly improved under the one government offsets policy which will deliver more strategic outcomes and net improvement for MNES.

Queensland's mapping system enables identification of the essential habitat required to support terrestrial threatened species and key roosting and breeding sites for migratory species. This helps ensure that areas critical for MNES are avoided from the outset and no further habitat fragmentation occurs.

The draft State Planning Policy, released in April 2013, included proposed biodiversity policies to facilitate the protection of MNES. It also proposed requiring that when planning for development, significant and adverse environmental impacts are to be avoided, or minimised and offset.

### 8.6.4 Projected condition

Based on the remnant extent of habitat, the projected condition of most threatened and migratory species is expected to improve in response to:

- the extent of habitat in conservation and minimum use areas
- the protection of native vegetation under the VM Act
- a revised mapping product that will deliver more information about the actual MNES and state environmental values present at a search site
- a better approach to biodiversity offsets and prioritising actions for threatened species.

However, some species are expected to take longer (multiple decades) to respond to management programs or continue to decline because of slower growth rates or low population numbers.

## 8.7 Summary and conclusion

The resilience of the GBR ecosystems is challenged by a range of stressors acting over multiple temporal and spatial scales. Whether the GBR coastal zone ecosystems will be resilient enough to sustain important functions and biodiversity under current and predicted future threats and pressures is important for the health of the GBR.

The 2013 Scientific Consensus Statement investigated the resilience of the GBR coral reefs, finding that a reduction in water quality is considered likely to lower the GBR's resilience 36. However, there is strong evidence that recent improvements to water quality within the GBR catchment will contribute to enhancing the resilience of marine and coastal ecosystems to other disturbances.

Future management of the GBR will need to more thoroughly address cumulative pressures to maintain its health and resilience. Currently, water quality is being improved through targeted efforts from government and stakeholder involvement via the implementation of the Reef Plan and Reef Rescue initiative. Realising improvements in other MNES as a result of improved water quality will take longer.

A summary of the current and projected condition and trend of MNES in the GBR coastal zone is provided in Table 8.7 1. The two Ramsar sites (which are entirely in protected or minimal areas) are projected to be in very good condition. A number of values that underpin MNES are also projected to be in good condition, including the GBRWHA, Wet Tropics WHA, Littorial rainforest TEC and threatened species habitat.

The MNES in poor condition are likely to remain in poor condition, although with appropriate management intervention the deteriorating trend in some values is expected to be halted and reversed over the life of the Program.

Table 8.7 1 Summary of current and projected condition and trend of MNES and the values that underpin MNES

| MNES/value | Current condition | Trend | Projected condition | Projected trend |
|---|---|---|---|---|
| GBRWHA (OUV) | Good | Deteriorating | Good | Improving |
| Wet Tropics WHA (OUV) | Good | Stable | Good | Improving |
| Ramsar sites | Very good | Stable | Very good | Improving |
| TEC - Broad leaf tea-tree woodlands | Poor | Deteriorating | Poor | Stable |
| TEC - Littoral Rainforest | Good | Stable | Good | Improving |
| Threatened species habitat | Good | Stable | Good | Improving |
| GBR coastal zone migratory birds habitat | Good | Improving | Good | Improving |

# Chapter 9

## adaptive management

*Extract from Great Barrier Reef Coastal Zone Strategic Assessment terms of reference*

*2.2 Identification and analysis of the potential impacts*

*The Strategic Assessment Report must describe how potential future impacts of activities taken under the Program are identified and taken into account in relevant decision making processes, in the context of past and existing impacts as described in Section 2.1 above.*

*………*

*In doing so, the Strategic Assessment Report must:*

*………*

*(f) describe how social and economic impacts and issues are considered and assessed*

*………*

*2.3 Measures to avoid, mitigate and offset impacts*

*The Strategic Assessment Report must describe the avoidance, mitigation and offsetting measures that are proposed for future activities taken under the Program and analyse the effectiveness of these measures in protecting and enhancing MNES including OUV. This analysis may use demonstration cases to illustrate the application and effectiveness of particular measures and approaches and must include, but not be limited to:*

*………*

*(f) analysing resourcing, monitoring, evaluation and compliance regimes.*

*………*

*3 Promoting Ecologically Sustainable Development*

*The Strategic Assessment Report must describe how the principles of ecologically sustainable development have been applied in the Program.*

*4 Adaptive management: addressing uncertainty and managing risk*

*The Strategic Assessment Report must identify the key adaptive management measures addressing uncertainties and risks inherent in the decision making process. Uncertainties could include knowledge gaps in scientific understanding and the timing, effectiveness, or capacity to implement, maintain, operate and enforce management measures.*

*The Strategic Assessment Report must describe how the adaptive management strategies will be implemented under the Program to ensure MNES including OUV are effectively protected over the life of the Program. This includes:*

*(a) how the monitoring of MNES including OUV will occur, how the monitoring will be analysed throughout the life of the Program and how the results of the monitoring will influence the Program*

*(b) how new information relating to MNES, OUV or the Program is to be assessed and accounted for in management of the area affected by the Program.*

*5 Auditing and reporting*

*The Strategic Assessment Report must describe:*

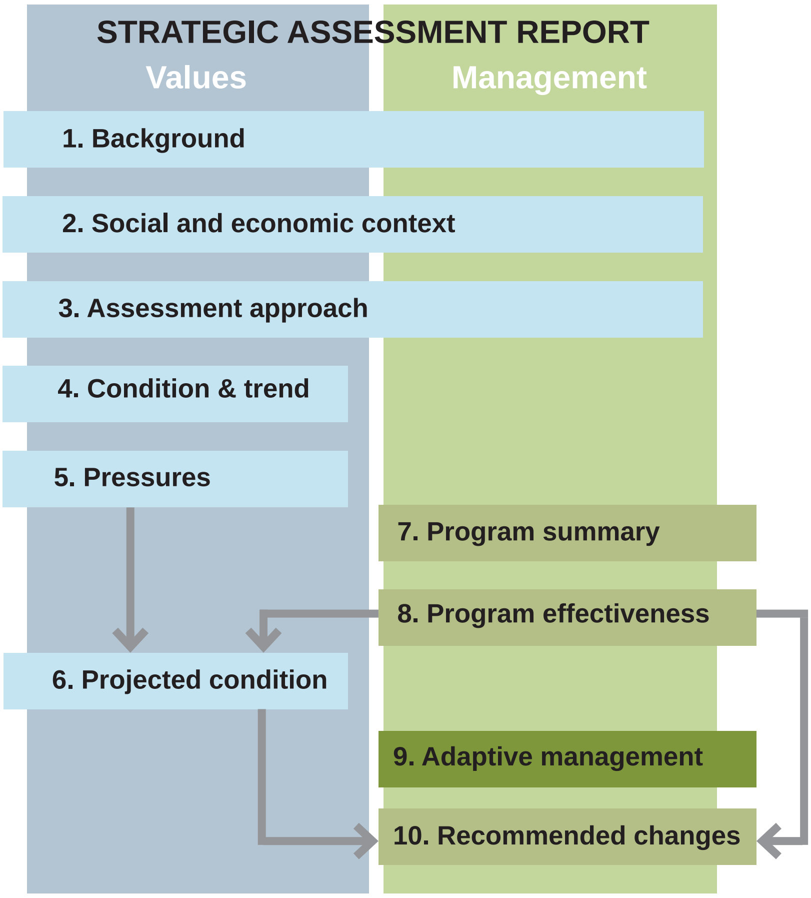
*(a) a monitoring, review and public reporting process to ensure implementation of the Program continues to adequately protect MNES including OUV*

*(b) the parties responsible for undertaking the monitoring, review, reporting and implementation of the activities arising.*

*6 Review, modification or abandonment*

*The Strategic Assessment Report must identify and analyse the likely circumstances and procedures that may result in the review, modification or abandonment of the Program. This is to include a discussion of how any commitments under the Program will continue to be met under these situations.*

# 9. Adaptive management






## 9.1 Introduction

Adaptive management involves continually monitoring a process to evaluate its effectiveness, and improving the process based on this evaluation. It requires transparent planning systems and implementation strategies, and a strong emphasis on monitoring and reviewing to ensure emerging information is reflected in future planning.

The Queensland Government is committed to the principles of adaptive management and the continuous improvement of the Queensland Government Program to protect MNES. To ensure ongoing protection and management within the GBR coastal zone, the Queensland Government will continue to base its management on using the best available information, with the capacity to make continual improvements as new information emerges.

The Program includes a regulatory framework which provides a wide range of monitoring, audit, compliance, and enforcement powers. Complementing the regulatory management framework are long-term monitoring and reporting programs reporting at different spatial scales – from those covering the entire GBR to those working at regional and/or value specific scales. Together these monitoring activities improve the effectiveness of the Program as a whole to improve outcomes for MNES. The monitoring program is enhanced further by ensuring that the findings of scientific and other research is considered when adapting Program components.

This chapter details how adaptive management has been applied in the Queensland Government Program. This includes the use of compliance, monitoring, auditing, review and reporting processes to inform and allow for the continued effectiveness of the Program. The information gathered from monitoring activity will then be used to update the Program components to better identify, protect and manage MNES.

The application of the principles of ESD in the development of the Queensland's Program is also outlined in this chapter. Information from the adaptive management process is also used to update the knowledge underpinning ESD within the Program.

## 9.2 Adaptive management

Adaptive management allows for best practice environmental management to be implemented as technologies develop over time. Adaptive management frameworks are widely used to address unknown and unintended impacts when making important management decisions. Figure 9.2 1 below illustrates the stages involved in adaptive management.

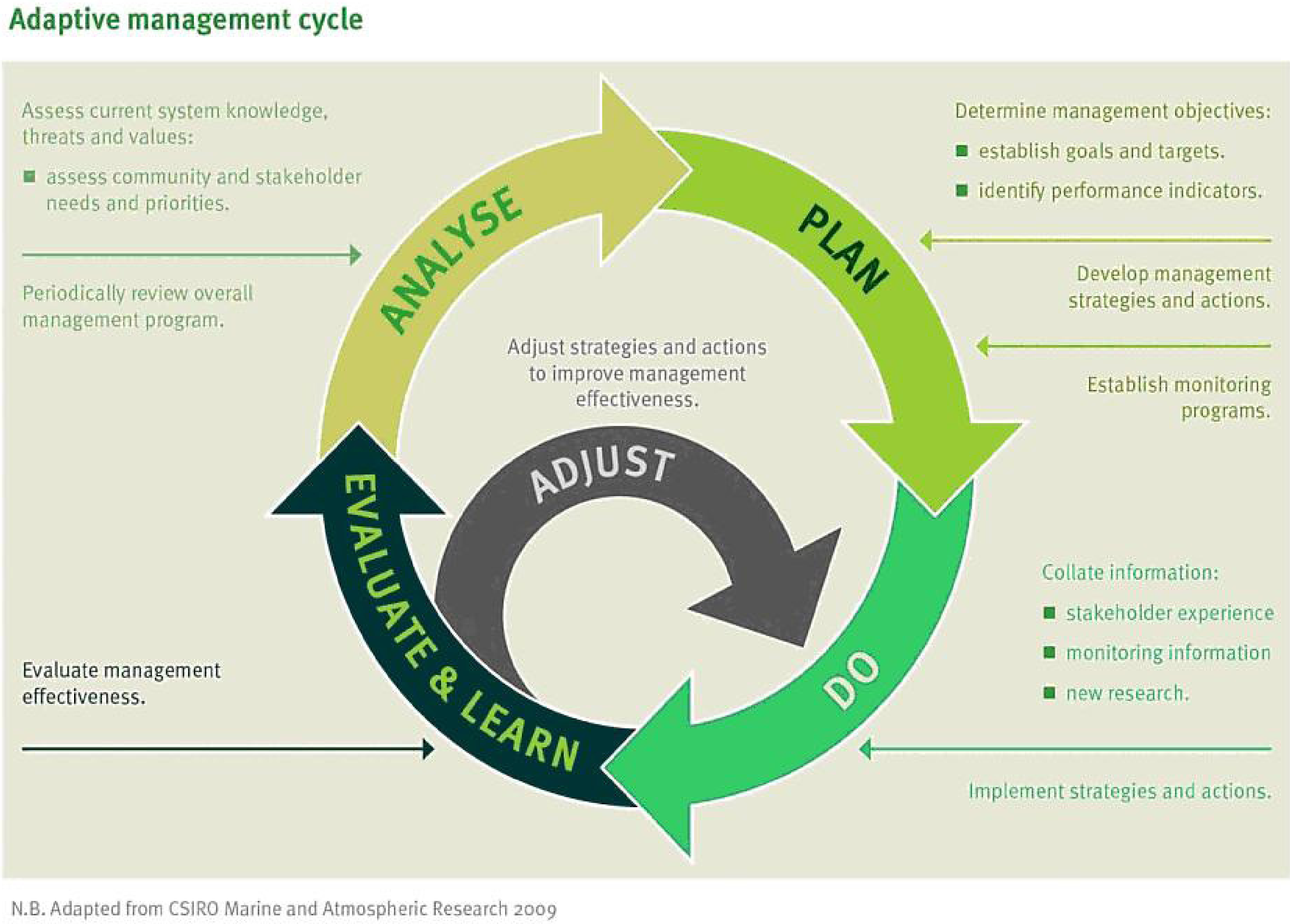



Figure 9.2 1 Adaptive management process applied by the Queensland Government

Source: State of Environment, 2012

The Queensland Government has a history of adaptive management in environmental management and has demonstrated the capacity to address emerging issues over the last three decades, for example the introduction during the 1990s of legislation to improve the ongoing protection of the environment (see section 1.5). Continued adaptive management will be underpinned by the best available information from a range of sources.

The 2009 Outlook Report identified a number of deficiencies in the management of coastal development. These concerns have been addressed through the evolution of Queensland's highly sophisticated planning system and more recently the draft Queensland Ports Strategy and State Planning Policy.

The management systems in place include mechanisms to ensure management adapts to new information. The effectiveness varies across the management components. For example, clearer mechanisms are in place for adaptive management of the Wet Tropics WHA compared to other MNES. Nevertheless, stakeholders are regularly engaged in management decisions as they relate to MNES. Public reporting mechanisms such as state of the environment reporting underpin management decisions. As with any adaptive management system, there are often delays between the collection of new information (e.g. recovery actions for threatened species) and implementation of new actions to improve the management effectiveness of the Queensland programs.

### 9.2.1 Summary of effectiveness

| Management effectiveness component | Grading | Confidence | Trend | Summary of evidence |
|---|---|---|---|---|
| Demonstrated ability to adapt system over time to incorporate new knowledge | Partially effective | Limited | Improving | There have been demonstrated examples of the Queensland Government responding to new information and adapting management. The forward commitments outlined in the strategic assessment provide further evidence of this. Governance arrangements are relatively strong across the management components but could be strengthened in some areas such as coastal management. |

*Partially effective: Management systems provide some guidance, but are not consistently delivering around implementation of management actions, stakeholder engagement, adaptive management or reporting.*

## 9.3 Ecologically sustainable development

Coastal development represents one of the most challenging areas in which to balance the principles of ESD. The GBR coastal zone includes a range of unique biodiversity values that need to be protected, and it is also a mixed use area where almost one million people live, many people visit and a range of economic activities occur. While much of the GBR coastline remains in excellent condition or is well protected, maintaining a balance between coastal development and environmental protection is a challenge.

Queenslanders expect governments to ensure that there is continuing economic, social and environmental well-being in the GBR coastal zone. The Queensland Government Program is designed to allow economic development to occur in a balanced and incremental way, whilst maintaining strong protection for the key values in the GBR coastal zone.

The endorsement criteria for an EPBC Act strategic assessment require the principles of ESD to be considered as part of the assessment process. The way in which the Queensland Government Program achieves the principles of ESD is outlined below:

**3A (a) decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations.**

The Program demonstrates the effective integration of economic, environmental and social considerations in an equitable manner for the short- and long-term by identifying a range of outcomes that provide for economic, social and environmental benefits.

The environmental benefits include a strong plan to concentrate development around key nodes and to avoid significant high value areas critical to MNES. The strategic assessment approach is considered to be far more effective in identifying, planning and supporting environmental outcomes than individual, project-by-project assessments.

The GBR coastal zone contains important supply chain links inland to Queensland's rich resource deposits. Efficient, well connected ports are vital to Queensland's export reliant economy, and to the Australian economy. The coal industry alone exported $31 billion through Queensland ports in 2011-12 . The liquefied natural gas industry is projected to export a further $3.2 billion [138] out of Queensland ports. Currently 34 000 people are directly employed by the coal industry, and the LNG industry is projected to support an additional 18 000 jobs by 2020 [138].

While Queensland major bulk commodity ports are located along the GBR coast, maintenance of a healthy and resilient GBRWHA will also underpin the tourism industry which generates over $5.7 billion per year to the Queensland economy and more than 54 000 jobs directly [138.]

Activities within the catchments adjacent to the GBR are also important to the Queensland economy, with the beef, sugarcane and horticulture industries contributing approximately $3.7 billion a year in gross value of production, and supporting significant regional employment [35].

Recreational fishing provides an important social and economic benefit to Queenslanders and helps support the tackle and boating industry. In addition, recreational fishing provides an economic stimulus to local businesses which benefit when recreational fishers visit their local area. An estimated 600 000 recreational fishing days occur in GBR coastal waters. In fishing regions adjacent to the GBR, coral trout, redthroat emperor, morwong and sweetlip form a key part of the harvest. More than 400 000 coral reef fin fish were caught by recreational fishers in the GBR coastal waters, with approximately half of these being released back into the water.

The Queensland Government Program provides an equitable approach to ensure sustainable development can occur, in balance with appropriate environmental protection.

**3A (b) if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation (the Precautionary Principle)**

The precautionary principle is enshrined in Queensland's planning system and provides guidance for all future land use planning decision-making (at state, regional and local levels) under the Queensland Government Program. In particular, applying the precautionary principle in decision-making processes, such as when preparing a planning instrument, is required in order to advance the purpose of the SP Act.

In application, the Program will ensure that where there is scientific uncertainty, the Queensland Government will seek to use the best available evidence to inform decision-making, including advice through public consultation. The Queensland Government is actively seeking to improve the consideration of cumulative impacts and will work closely with the GBRMPA and the Australian Government to develop a robust and consistent methodology.

Scientific knowledge of the key risks are presented in the State of the Environment Report every four years. The Queensland Government will seek to ensure that this reporting will specifically capture information on MNES in the future.

**3A (c) the principle of inter-generational equity – that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations**

The principle of intergenerational equity is enshrined in Queensland's planning system.

The Queensland Government Program will seek to manage impacts on MNES in the GBR coastal zone by having a strong hierarchy of identifying, avoiding, mitigating and offsetting likely impacts. A more strategic approach to offsets will ensure that there is net gain of MNES, that the values underpinning MNES are protected and enhanced for future generations, and that the services they provide will continue.

The Queensland Government will continue to invest in programs addressing the legacy of past land use, such as the Reef Water Quality Protection Plan, which presents one of the most valued opportunities to improve the condition of the GBR coastal zone for future generations.

#### 3A (d) the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making

Environmental considerations, including maintaining the OUV of the WHAs, are fundamentally integrated into Queensland's planning development and managementsystems. The availability of mapping in relation to environmental matters is a valuable tool that can be used and integrated into state and local decision-making. Forward commitments under the Queensland Government Program will require consideration of important biodiversity values by state and local government in planning activities, to support the protection of biological diversity and ensure the integrity of the GBR environment.

The Program will deliver substantial conservation outcomes, particularly by concentrating development around key nodes and offsetting unavoidable impacts in a way that will achieve net gain of MNES.

#### 3A (e) Improved valuation, pricing and incentive mechanisms should be promoted

The strategic assessment represents a significant positive incentive for development to occur in an ecologically sustainable manner. It identifies the environmental values that could be affected and the systems for managing potential impacts of certain proposed actions, and provides incentives for responsible development to occur in well planned areas where impacts can be avoided, minimised of offset. Improvements to the offsets policy, including strategic offsets and the more effective use of monetised offsets will deliver more strategic outcomes and will seek to achieve net gain of MNES.

## 9.4 Governance

Coastal management is a highly complex jurisdictional issue, with all levels of government involved, as well as a wide variety of stakeholders including industry, conservation groups and landcare, and regional NRM bodies. Stakeholders are regularly engaged in decision-making through a range of forums and there are arrangements between the Queensland and Australian governments which focus on various management areas.

The Great Barrier Reef Intergovernmental Agreement 2009 between the Australian and Queensland governments establishes the governance arrangements for the protection and management of the GBR. The Agreement provides an opportunity to ensure collaborative and complementary management arrangements for the GBR and facilitates ongoing joint adaptive management. Similarly, the intergovernmental agreement for the Wet Tropics WHA facilitates the same adaptive management for that area.

The complexity of management in the GBR coastal zone and the uniqueness of the collaborative arrangements established under the Intergovernmental Agreement were noted in a report by the House of Representatives Joint Standing Committee on Climate Change, Water, Environment and the Arts assessing Australia's preparedness to manage the coast in a changing climate [152]. Recommendations were made that these arrangements be investigated as a pilot for improved integrated coastal zone management in Australia.

As part of a project funded through the National Environmental Research Program, Dale et al. [31] undertook a preliminary risk assessment of the governance arrangements in place for the GBR. Broadly, Dale et al. [31] found that there are strong governance arrangements in place for fisheries management, water resource planning and research. There are also a number of areas where governance arrangements have stabilised in recent years including reef water quality and regional NRM programs. Some management areas are finely balanced on the divide between significant risk of failure or potential success, where the consequences of system failure are important but not catastrophic. This includes the reef protection regulations, agricultural property planning and Indigenous governance. Dale et al. [31] identified that there are some areas where there is a risk of governance failure and recommend there needs to be a clearer cumulative impact assessment, more streamlined and coordinated assessment processes, integrated monitoring programs, and a market framework for ecosystem services.

Building on the learnings from the Reef Plan, and as an outcome from the strategic assessment, the Queensland and Australian governments are scoping a GBR Long Term Sustainability Plan to guide joint management. This will ensure a coordinated approach to adaptive management, address some of the potential governance risks, and in part respond to the World Heritage Committee's recommendations for a sustainable development plan for the GBRWHA.

The Queensland Government agencies responsible for various aspects of the Program are provided in chapter 6 of the *program report.*

## 9.5 Compliance

Each piece of Queensland's legislation has built in compliance mechanisms. DEHP undertakes the majority of compliance activities in relation to environmental matters and uses a regulatory compliance program to achieve Queensland's legislated obligations. It is founded on a targeted and transparent approach to compliance, supported by a modern and strong enforcement program. DEHP carries out two main types of compliance activity to ensure risks are being managed appropriately:

- Reactive compliance: DEHP responds to reports about incidents that affect the environment and natural resources. These reports can come from members of the public, industry self-reporting or from monitoring programs. This responsive work drives remedial and/or enforcement action on a site-by-site basis.
- Proactive compliance: DEHP plans a variety of compliance activities throughout the year aimed at addressing risks before they become problems, many of which would be irreversible.

Major compliance incidents are those regarded as severe and become priority matters for the Queensland Government. The distribution of major incidents across the state varies according to the types of industries, their potential risks, and the environmental impacts of the activities that are undertaken.

As part of the strategic assessment, the Queensland Government will continue to engage in proactive compliance activities targeted towards addressing emerging, large scale, or ongoing environmental threats. These activities are:

- Regulating environmentally relevant activities – mining and energy development, waste, water, sewage, chemical storage, motor vehicle workshops, and oil and gas processes. Consequently, the major activities requiring environmental approvals are mining and energy extraction, transport and treatment of regulated waste, chemical storage, sewage treatment, and compost manufacturing and fuel burning activities.
- Annual Compliance Plans set out the proactive compliance activities in each of the areas that it regulates. The plans include programs linked to the key regulatory areas of coastal and inland waters, environmental management, Queensland heritage conservation, Indigenous heritage conservation, land management, estate management, vegetation management, wildlife and ecosystems, and water supply.
- Planned compliance inspections are conducted at a number of sites licensed under the EP Act. These comprise localities undertaking activities considered to be high risk, where the environmental significance demands particular attention and emerging problems or trends pose new risks which need to be managed. The public interest and concerns raised also demand focused attention. Inspections are concentrated on certain catchments, particular industrial estates' activities and certain licensable activities. For example, hazardous wastes activities such as recycling, storage, transport and disposal of regulated wastes around the Cairns, Gold Coast, Mackay, and Townville areas. During 2010-2011, the Queensland Government undertook 1131 planned inspections of licensed activities, focusing primarily on inspections of licensed sites posing the greatest environmental risk.
- Compliance under the Program is performed by a number of Queensland state agencies including:
- Department of Environment and Heritage Protection (DEHP)
- Department of State Development, Infrastructure and Planning (DSDIP)
- Department of Natural Resources and Mines (DNRM)
- Department of Agriculture, Fisheries and Forestry (DAFF).

A number of Program components have compliance requirements and these are outlined below.

### 9.5.1 Environmental Protection Act and Economic Development Act

The EP Act provides for compliance and enforcement penalties and is administered by DEHP.

In 2011–12, the department secured a range of penalties and more than $2.2 million in fines and costs. The department's Service Delivery Statement also included as a service standard the number of sites engaging in activities regulated under the EP Act inspected for compliance under the following levels:

- Level A (Basic inspections)
- Level B (Condition audit)
- Level C (Performance audit).

Table 9.4 1 below outlines the targets for planned compliance inspections of sites carrying out regulated activities and the number of planned compliance inspections achieved during 2011–12.

Table 9.5 1 DEHP inspections 2011-12

| Inspection level | 2011-12 target | 2011-12 achieved |
|---|---|---|
| Level A | 180 | 258 |
| Level B | 430 | 509 |
| Level C | 80 | 71 |

Source: DEHP

An example of prosecution in the GBR coastal zone is the Gladstone Magistrates Court's ruling against a large Australian chemical manufacturing company in November 2012. The company was operating near Gladstone and was penalised $432 000. The defendant was charged with four offences of contravening a condition of a development approval under section 435(2) of the EP Act, by allowing contaminated water and contaminated effluent to be discharged from the site. The company was ordered to allocate $250 000 of the fine to public-benefit projects in the Gladstone area. For further information, refer to the DEHP Prosecution Bulletin: www.ehp.qld.gov.au/management/pdf/prosecution-bulletin04-2012.pdf

The ED Act also provides for compliance and enforcement penalties and is administered by the Department of State Development, Infrastructure and Planning (DSDIP).

### 9.5.2 The Sustainable Planning Act

The SP Act provides for compliance and enforcement penalties and is administered by the DSDIP.

The SP Act prescribes maximum penalties for each offence. The SP Act also provides for some exemptions, including carrying out emergency development to prevent danger to life or to ensure the structural adequacy of a building. Enforcement mechanisms available under the SP Act include:

- show cause notices
- enforcement notices
- enforcement proceedings in the Magistrates Court and the Planning and Environment Court.

Monitoring and compliance mechanisms under the SP Act rely on the compliance and enforcement mechanisms under the assessor's authority as prescribed in the assessor's legislation. However, the SP Act sets out a number of offences, including:

- carrying out development without a compliance permit or development permit
- failure to comply with a development approval, compliance permit, compliance certificate or master plan
- carrying out prohibited development.

A show cause notice may be given where an assessing authority reasonably believes a person has committed or is committing a development offence. Generally a show cause notice should be given before issuing an enforcement notice, however the assessing authority may proceed directly to issuing an enforcement notice if it considers it appropriate – for example if urgent action is necessary to address a danger to public health or safety.

### 9.5.3 State Development And Public Works Organisation Act

The SDPWO Act provides for compliance and enforcement penalties and is administered by DSDIP.

Under the SDPWO Act, the Coordinator-General (CG) can impose conditions of approval on projects to ensure their impacts are properly managed. Any conditions or recommendations imposed by the CG under the SDPWO Act are legally enforceable and apply to anyone who undertakes the project, including the project proponent and their agents, contractors, subcontractors or licensees. The CG may also state conditions that must be attached to future approvals, such as an environmental authority or a mining or petroleum lease. Compliance with these 'stated conditions' is monitored and enforced by the relevant administering authority. The CG may nominate an administering authority to have jurisdiction of an imposed condition, such as DEHP.

Compliance with imposed conditions is monitored by the administering authority (DSDIP), however the CG remains responsible for the auditing and enforcement of the condition. On behalf of the CG, DSDIP's compliance unit:

- monitors and enforces project proponents' compliance with all imposed conditions of approval
- works collaboratively with administering authorities
- reviews and provides advice to the CG on third-party audit reports
- ensures non-compliance is addressed appropriately
- advises the CG on the conditioning of approvals, to ensure the conditions are effective and enforceable.

DSDIP uses a range of compliance measures to ensure project proponents comply with the CG's imposed conditions of approval for a project. Non-compliance with imposed conditions is addressed through:

- education
- remediation
- enforcement actions.

Additionally, project proponents are required to engage an independent and suitably qualified person/s to conduct a third-party audit of compliance with imposed conditions. The audit reports must be submitted to the CG for review. The frequency of project auditing varies, but they are generally conducted every 6 to 12 months during the conditioned audit period. The audit period can be for the life of the project.

### 9.5.4 Vegetation Management Act

The VM Act is administered by Department of Natural Resources and Mines (DNRM). It regulates the clearing of native vegetation in Queensland in conjunction with SP Act and includes compliance and enforcement mechanisms. These Acts in conjunction with the State Development and Assessment Provisions set down rules and regulations to guide what land clearing can occur, and how it must be done to meet the requirements of the law.

Compliance notices may be issued to landholders who have carried out, or are in the process of carrying out, vegetation clearing offences. The notice is aimed at restoring the vegetation to its previous condition through a series of management requirements. A compliance notice outlines the vegetation clearing offence and how it has been committed. It may also include conditions on how vegetation is to be restored.

Between the year 2000 and July 2009, there were approximately 77 cases, involving 25 000 hectares of illegally cleared vegetation, resulting in approximately $218 000 in fines. Since July 2009, 23 prosecutions have been finalised for offences totalling over 15 000 hectares of illegally cleared vegetation, resulting in approximately $1.3 million in fines.

### 9.5.5 Fisheries Act

The Department of Agriculture, Fisheries and Forestry (DAFF) Queensland Boating and Fisheries Patrol (QBFP) enforce Queensland's fisheries legislation through a fisheries compliance program. QBFP officers undertake around 49 000 patrol hours each year, of which about half is in the GBR coastal region. Operational capacity includes random and targeted patrols and inspections, surveillance services and specialist investigators. In 2011-12, there were 13 608 fisheries inspections in the GBR region, resulting in 245 Fisheries Infringement Notices and 18 prosecutions for alleged offences against the Fisheries Act. The majority of infringements were for regulated fish offences, including taking undersized fish or taking fish in excess of the possession limit. The overall compliance rate for 2011-12 in the GBR coastal region was 96 per cent.

### 9.5.6 Other Program components

There a number of other supporting Program components which include legislative mechanisms that help protect Queensland's environment and MNES, including the following, which are administered by DEHP, DNRM and NPRSR:

- *Coastal Protection and Management Act 1995*
- *Nature Conservation Act 1992*
- *Queensland Heritage Act 1992*
- *Water Act 2000*
- *Land Protection (Pest and Stock Route Management) Act 2002*
- *Land Act 1994*
- *Water Supply (Safety and Reliability) Act 2008*
- *Recreation Areas Management Act 2006.*

The Joint Field Management Program plans and executes field operations in the GBR marine parks and on island national parks within the GBRWHA. The field management program, jointly undertaken by the GBRMPA and QPWS plays a key role in compliance activities through a multi-agency approach which allows use of a broad range of legislative and compliance tools, with vessel and aerial surveillance activities by all agencies coordinated by the Field Management Compliance Unit.

### 9.5.7 Summary of effectiveness

As part of its commitment to transparency, DEHP publishes compliance and enforcement-related information. The compliance update e-newsletter is regularly sent to subscribers to increase their awareness of important compliance and enforcement information.

DEHP seeks to ensure voluntary compliance with its environmental legislation by working with industry and individuals to promote sustainable behaviours. However, DEHP will pursue enforcement action against those ignoring their legal obligations to the environment and other natural resources. The enforcement pyramid below (see Figure 9.4 1) demonstrates the path of escalation. The department has a strong record of enforcement and prosecution where there are significant breaches of legislation.

Compliance resourcing is strong: DEHP has approximately 180 environmental officers involved in frontline environmental compliance work, three times as many as four years ago. These officers comprise one part of the department's full contingent of approximately 380 authorised environmental officers, who are all able to identify and respond to instances of non-compliance across the state. In 2010-11, the Queensland Government invested $23.4 million into frontline environmental compliance services. This funding was used to recruit environmental officers, technical specialists, investigators, lawyers and other staff. In 2011-2012, this funding increased to $25.4 million, in recognition of the extra resources required to be committed to the expanding mining, coal seam gas and liquified natural gas sectors.


Figure 9.4 1 DEHP Enforcement Guidelines Source: adapted from a model provided by Ayers and Braithwaite

### 9.5.8 Summary of effectiveness

| Management effectiveness component | Grading | Confidence | Trend | Summary of evidence |
|---|---|---|---|---|
| Resourcing and compliance | Effective | Limited | Improving | Queensland has a strong compliance system in place supported by appropriate funding and staffing resources. There are demonstrated examples of effective enforcement and prosecutions. |
| Effective: Financial and staffing resources are mostly adequate to address management issues, but may not be secure. Biophysical and socioeconomic information is available to inform decisions, although there may be deficiencies in some areas. Systems are in place for enforcement and compliance. | | | | |

## 9.6 Monitoring

As detailed in the *program report*, the Queensland Government undertakes a broad range of long-term monitoring programs to underpin its adaptive management arrangements. These are summarised in Table 9.5 1.

Monitoring is performed by a number of state agencies including:

- Department of Environment and Heritage Protection (DEHP)
- Department of Science, Information Technology, Innovation and the Arts (DSITIA)
- Department of Natural Resources and Mines (DNRM)
- Department of Agriculture, Fisheries and Forestry (DAFF)
- Department of Transport and Main Roads (DTMR).

Table 9.6 1 Summary of Queensland Government monitoring programs

| Prpgram | Purpose of monitoring | Type of monitoring | Agency |
|---|---|---|---|
| **Waterway monitoring** | | | |
| Queensland Integrated Monitoring Framework | Improve the coordination and comprehensiveness of waterway monitoring programs and enhance how data is shared and used to improve water quality and ecosystem health. | The framework is implementing a range of projects designed to advance the integration of government monitoring activities in priority regions as well as addressing statewide issues | DNRM |
| Paddock to Reef Integrated Monitoring, Modelling and Reporting Program | Integrates information from across a range of scales to provide a link between management actions and water quality outcomes for the GBR | Measures status of land management, water quality and ecosystem health in paddock, catchment and marine areas | Joint program led by DPC with significant input from DEHP, funding from DNRM<br>Input also from regional NRM bodies, DAFF, CSIRO & other research providers |
| Regional waterway monitoring programs | Utilised in priority areas where there are significant policy issues and associated risks to waterways | Estuarine monitoring and water quality monitoring under the Reef Plan. | Undertaken by DSITIA for DNRM |
| Gladstone Healthy Harbour Partnership | Align activities in Gladstone Harbour to monitor and improve ecosystem health | Integrated Aquatic investigation program which monitors water quality and fish health | GHHP |
| Coastal Monitoring | To provide information on tides, waves, floods, storms and cyclones, and changes in sea level | Storm tide, wave height, sea surface temperature gauging | DEHP |
| Maritime safety monitoring | Ongoing monitoring of ship movements in the GBR and ports. Provides information on marine incidents | Ship movement monitoring within the GBR | DTMR |

| Prpgram | Purpose of monitoring | Type of monitoring | Agency |
|---|---|---|---|
| **Vegetation Monitoring** | | | |
| Regional Ecosystem Mapping | Mapping on the extent of vegetation used for a wide range of purposes by both government and non-government agencies. Central to Queensland's vegetation management framework | Fine scale maps showing the extent of 85% of the state's vegetation communities and contains information on the extent of vegetation pre and post-clearing | Undertaken by DSITIA for DEHP and DNRM |
| Statewide Land Cover and Tree Study (SLATS) | To inform vegetation management, planning and compliance, and for greenhouse gas inventory purposes | Vegetation monitoring initiative using satellite imagery over Queensland to estimate wooded vegetation cover and woody land cover change information. Provides the base data for RE mapping (see below) | Undertaken by DSITIA (with funding from DNRM) |
| BioCondition Assessment Manual | Vegetation condition assessed against benchmarks, and monitored as part of various land management regulatory processes and offset programs | Site based method assessing the condition of native vegetation. Outlines a framework for measuring how a terrestrial ecosystem is functioning for the maintenance of biodiversity values | DEHP |
| **Species Monitoring** | | | |
| Routine monitoring of threatened species | Species level monitoring and tracking of threatened species. | Methods currently vary, and include annual population census, tagging animals for recapture, and satellite tracking to find out more about movement patterns | Undertaken by DSITIA for DEHP |
| Strandnet | Strandings information on whales, seals, sealions, dugong and turtle | Records information on where sick, injured, dying and dead animals are found | DEHP |
| Fisheries monitoring | Outline information on the operation of the fishery, trends in catch and fishing effort, impacts on ecosystems and management regimes in place | Annual Fisheries status reporting.<br>Data regularly collected from fishery dependent and fishery independent sources including daily logbooks from fishing boats, regular recreational fisher surveys, long term biological monitoring to collect data for scientific assessment of key species | DAFF |

| Prpgram | Purpose of monitoring | Type of monitoring | Agency |
|---|---|---|---|
| **Land Monitoring** | | | |
| Queensland Land Use Mapping Program (QLUMP) | Ongoing monitoring of land use and land management practices that can affect water quality and catchment, soil erosion, acidification, nutrient decline and carbon losses | Ongoing provision of mapping | Undertaken by DSITIA (with funding from DNRM) |
| **Community Surveys** | | | |
| Queensland Parks and Wildlife surveys | Aim to understand the motivations, visitation patterns, annual visitor estimates, needs and values of the Queensland community in relation to national parks and the performance of the Queensland Parks and Wildlife Service | Survey | NPRSR |

Some of these comprehensive monitoring programs are delivered through the collaborative efforts of a number of state agencies (Table 9.5 1). A number of these are discussed below

## 9.6.1 Waterway monitoring

### 9.6.1.1 Queensland Integrated Waterway Monitoring Framework

The Queensland Integrated Waterway Monitoring Framework aims to improve the coordination and comprehensiveness of waterway monitoring programs and enhance how data is shared and used to improve water quality and ecosystem health. The framework is led by DNRM, together with DEHP, DSITIA, DAFF and also the GBRMPA. Key legislative and policy drivers for Queensland waterways monitoring include Australian and Queensland government legislation, government agreements and specific strategies to protect particular waterways such as the GBR catchments. The framework is implementing a range of projects to advance the integration of government monitoring activities in priority regions, as well as addressing statewide issues, such as information management and reporting.

There are six long-term Queensland waterway monitoring programs that form part of the integrated framework. These are:

- Surfacewater Water Quality Network
- Stream Gauging Station Network
- Stream and Estuary Assessment Program (SEAP)
- Environmental Flows Assessment Program (EFAP)
- Groundwater Water Levels Network
- Groundwater Water Quality Network.

Regional monitoring programs are supported in priority areas where there are significant policy issues and associated risks to waterways. These programs include the estuarine monitoring programs from the Fitzroy to Tin Can Bay and the Burnett–Mary.

Coordinated monitoring and evaluation of water quality in the GBR catchments and lagoon is crucial for measuring the success of other government driven management initiatives such as the Reef Plan.

### 9.6.1.2 Paddock to reef monitoring

The Paddock to Reef Integrated Monitoring, Modelling and Reporting Program (Paddock to Reef program) integrates information from across a range of scales to provide a link between management actions and water quality outcomes for the GBR. The Paddock to Reef program measures the status of land management, water quality and ecosystem health in paddock, catchment and marine areas. Progress towards the goals and targets of the Reef Plan are assessed through the program and form the basis of the Annual Reef Report Card.

The Paddock to Reef program is based on a philosophy of continuous improvement which will help improve data confidence over time. The design of the Paddock to Reef program as part of the Reef Plan will ensure alignment of monitoring and modelling at different scales and locations, improve paddock scale water quality monitoring to measure effectiveness of management practices and ensure the strategic location of monitoring sites in key areas.

The Paddock to Reef Program is led by DPC. DSITIA, DNRM, regional NRM bodies, DAFF, CSIRO and other research providers undertake components of the program. Funding for the paddock and marine components is through the Australian Government (via Reef Rescue). The Queensland Government provides funding through DNRM.

#### 9.6.1.3 Gladstone Healthy Harbour Partnership

The Queensland Government is committed to ensuring that the Gladstone region, at the southern end of the GBR, can continue its role as a key economic base with a sustainable and healthy environment. Gladstone comprises the single largest concentration of major industry and port facilities in Queensland.

On 4 May 2012, the Queensland Premier announced a partnership agreement would be established to ensure the ongoing monitoring and improvement of Gladstone Harbour and surrounding catchments. The GHHP includes representatives from national, state and local government, industry, research and community interests.

The purpose of the GHHP is to align activities, harness the co-investment potential, implement an adaptive management framework and deliver a shared vision for a healthy Gladstone Harbour. The GHHP will agree strategic directions and leverage the benefits of streamlined monitoring, targeted management and expert science advice and deliver a shared vision for a healthy Gladstone Harbour through adaptive management.

An independent science panel has been established to inform the decisions made by the GHHP. In turn, the partnership will be responsible for the Gladstone Healthy Harbour Report Card and any actions needed to address its findings.

#### Gladstone Integrated Aquatic Investigation Program

The Integrated Aquatic Investigation Program for Gladstone Harbour was an expanded integrated program aimed at applying further monitoring and research towards understanding the causes of the fish health issues reported in Gladstone Harbour in 2011.

Key elements of this program included:

- building on the existing monitoring effort by testing well-formed hypotheses and conceptual models about potential causal factors and to improve our understanding of aquatic ecosystems. This also included expanded fish health and water quality monitoring investigations.
- commissioning and reviewing scientific research to inform the above studies, and investigating the use of alternative testing methodologies where appropriate
- Ensuring collaboration and integration with existing institutional, industry and community based research and monitoring such as the Port Curtis Integrated Monitoring Program (PCIMP)

The program involved regular public reporting, including:

- regular progress reports at stakeholder meetings
- status updates/report cards published in brochure format
- publication of reports on the water quality and fish health investigation.

Formal program investigations were completed in September 2012 and the Gladstone Harbour Integrated Aquatic Investigation Program 2012 Report was released in January 2013 summarising the key findings to date and acknowledging that a wide range of fish, crustacean and mollusc species were still undergoing more detailed studies. These studies have now been finalised and two reports have been released. These are:

- An Analysis of Water Quality in Relation to Fish Health in Gladstone Harbour and Waterways September 2011–September 2012
- The Gladstone Harbour Fish Health Investigation 2011–2012.

Results of the fish health investigation indicated that flooding, combined with a significant introduction of fish from Lake Awoonga into Gladstone Harbour and adjacent waterways, stressed the ecosystem. While it is possible that dredging and associated turbidity put additional stress on the ecosystem, it was not the primary cause.

Reports from the investigation can be found at http://www.ehp.qld.gov.au/gladstone

### *Case study:*

GLADSTONE HARBOUR AQUATIC INVESTIGATION

After significant rainfall in the summer of 2010–2011, Gladstone Harbour experienced some abnormal occurrences associated with fish and health of the marine environment. In August 2011, concerns for human health and the health of fish in Gladstone waterways were raised with the Queensland Government.

In response an investigation program was set up, working closely with key interest groups to understand the extent and nature of the issue. The program aimed at identifying any specific causes for the fish and marine environment health issues and included extensive fish, water quality and sediment sampling and testing in and around Gladstone Harbour as well as interviews and testing of human health issues. Gladstone Harbour and surrounding areas were also closed to fishing for a three week period in response to the concerns about human health and the possible transfer of disease between fish and humans and entry into the food chain.

The initial government response was reviewed by the independent Gladstone Fish Health Scientific Advisory Panel, which acknowledged and supported ongoing investigation and noted the progress already made. After an extensive review of available data and literature, the panel released its final report in January 2012. The report confirmed there was no risk to human health but there was no conclusive view on the cause of the fish conditions observed in Gladstone Harbour. Further monitoring and research was recommended while noting that:

- identifying the cause(s) of the disease(s) and prevalence of parasites on fish in Gladstone Harbour was a complex and difficult task, further complicated by significant rainfall in the summer of 2010–2011 and the historical and ongoing industrial development of the harbour
- determining conclusively whether any environmental changes have anything to do with the reported fish health problems is a formidable and perhaps impossible undertaking
- the Queensland Government has already acted upon some of its recommendations including undertaking analysis of dissolved metals but notes that there is no evidence of metal impacts on fish.

Following the panel's recommendation for further research, the Queensland Government set up the 'Integrated Aquatic Investigation Program for Gladstone Harbour' to expand on the work already undertaken. As part of the program regular monitoring reports were published on DEHP and DAFFs' websites.

Formal program investigations were completed in September 2012 and the Gladstone Harbour Integrated Aquatic Investigation Program 2012 Report was released in January 2013 summarising the key findings to date and acknowledging that a wide range of fish, crustacean and mollusc species were still undergoing more detailed studies. These studies have now been finalised and two reports have been released. These are:

- An Analysis of Water Quality in Relation to Fish Health in Gladstone Harbour and Waterways September 2011 – September 2012
- The Gladstone Harbour Fish Health Investigation 2011–2012.

#### 9.6.1.4 Coastal monitoring

A network of 25 storm tide gauges along Queensland's coastline monitor flooding from the sea, usually associated with storm surge during tropical cyclones. The storm tide gauges record the rise and fall of the tide automatically at regular time intervals providing sea level information in near real time. This network is vital in helping communities to prepare for extreme events.

A number of Waverider buoys are used to measure the height of waves along the Queensland coast. Wave reports are generated 'on-line', describing wave conditions at various locations along the Queensland coast. Wave data are collected, stored and analysed to help short and long-term investigations of natural coastal processes, including accretion (deposition of sediments) and erosion (loss of sediments). Sea surface temperature is collected at the same time as wave height and direction. When a cyclone is approaching the coast, advice is provided to the State Counter Disaster Organisation on the potential impact of waves on coastal communities, while maritime organisations use wave data to plan port activities and to support navigational information.

#### 9.6.1.5 Maritime safety monitoring

The Department of Transport and Main Roads (DTMR) plans, manages and delivers Queensland's integrated transport system to achieve sustainable transport solutions for road, rail, air and sea. The department is committed to environmental management and improving its environmental performance including, atmosphere, land, water, noise and cultural heritage. Maritime Safety Queensland (MSQ) is a division of the DTMR responsible for waterways. MSQ is responsible for:

- improving maritime safety for shipping and small craft through regulation and education
- minimising vessel-sourced pollution and responding to marine pollution
- providing essential maritime services such as pilotage for regional ports and aids to navigation
- encouraging and supporting innovation in the maritime industry.

MSQ, in conjunction with the Australian Maritime Safety Authority (AMSA), operates the GBR and Torres Strait Vessel Traffic Service (REEFVTS) that tracks and monitors ship movements within areas of the GBR and Torres Strait.

Since 1997 Australia has had a mandatory ship reporting system (REEFREP) to improve navigational safety, reduce the risk of shipping incidents and minimise any resulting ship-sourced pollution in the GBR and the Torres Strait. Since this time Australia has improved the delivery of services in the region through a range of measures. These measures led to the introduction of REEFVTS in 2004.

After the Shen Neng 1 ran aground in the GBR in April 2010, the measures for mitigating risks associated with shipping activity in the GBR were reassessed. In December 2010 the International Maritime Organization (IMO) approved Australia's submission to extend the mandatory ship reporting requirements of REEFREP to the southern boundary of the GBR Marine Park effective from 1 July 2011.

MSQ also provides summary information of current shipping movements in Queensland ports. Information provided includes ships in a particular port and movements in the port from a day prior, to seven days ahead of a specified date. The monthly ship movement reports show the numbers and gross tonnage of ships that use Queensland ports, including arrivals and departures by port. The reports are available at the MSQ website http://www.msq.qld.gov.au/Shipping/Shipping-movements.aspx.

MSQ produces annual reports on marine incidents in accordance with Section 127 of the Transport Operations (Marine Safety) Act 1994. This provides a valuable summary of the more serious marine incidents in Queensland waters and a factual basis for informed consideration of how the safety risks associated with boating activities might be better managed in the future.

### 9.6.2 Vegetation monitoring

#### 9.6.2.1 Regional ecosystems mapping

Queensland is the only Australian jurisdiction to have a statewide, vegetation-mapping program at a regional scale. RE mapping provides the foundation for biodiversity conservation in Queensland. These are fine scale maps (1:100 000) showing the extent of 85 per cent of the state's vegetation communities [153], containing information on the extent of vegetation both pre- and post-clearing. This foundation information layer is used for a wide range of purposes by both government and non-government agencies and is central to Queensland's vegetation management framework.

#### 9.6.2.2 Statewide land-cover and tree study

The Statewide Land-cover and Tree Study (SLATS) is a major vegetation monitoring initiative. It uses satellite imagery over the entire state to estimate wooded vegetation cover and woody land cover change to inform vegetation management, planning and compliance and for greenhouse gas inventory purposes.

#### 9.6.2.3 The BioCondition assessment manual

Compared with vegetation extent, the assessment of vegetation condition is considerably less well documented in Queensland. BioCondition is a vegetation condition assessment tool to measure how well a terrestrial ecosystem is maintaining biodiversity values at a local or property scale. In BioCondition, vegetation condition is described in comparison to the same vegetation in its reference state. The assessment provides vegetation condition assessed against benchmarks, and monitored as part of various land management regulatory processes and offset programs. Benchmark documents have been developed and are available for a subset of REs. Where benchmarks are not available, the reference site manual describes a methodology to derive them. The BioCondition information is helpful to inform developmental approvals, incentive payments and market-based investments, as well as NRM programs.

### 9.6.3 Species monitoring

#### 9.6.3.1 Routine monitoring of threatened species

The Back on Track species prioritisation framework (Back on Track) is an initiative of the Queensland Government that:

- prioritises Queensland's native species to guide conservation management and recovery
- enables the strategic allocation of limited conservation resources for achieving greatest biodiversity outcomes
- increases the capacity of government, NRM bodies and communities to make informed decisions by making information widely accessible.

Back on Track actions for biodiversity documents identify research and monitoring actions to improve the recovery of priority species for conservation management. The monitoring methods vary, and include annual population census, tagging animals for recapture, and satellite tracking to find out more about movement patterns.

At a species level, there is routine monitoring of threatened species, including estuarine crocodiles and marine turtles.

***Case study:***

QUEENSLAND TURTLE CONSERVATION PROGRAM

Queensland's marine turtle conservation program has been running for more than 40 years. Over this time turtle populations have been monitored through annual censuses at key nesting beaches along Queensland's coast and by tagging turtles for recapture in later years. Turtles have also been fitted with satellite transmitters to learn more about local and regional movement patterns. At other times of the year, turtles have been captured and tagged at shallow water turtle feeding sites, where growth and survival data contribute to the understanding of these species and how they have been responding to management interventions.

Information from the work has provided a basis for strong management changes, such as the introduction of turtle exclusion devices that became compulsory in 2001 for the east coast trawl and northern prawn fisheries. Evidence generated by the research is used to change local management practices, such as avoiding street lighting near turtle nesting beaches and zoning plans for Queensland marine parks. A number of 'go slow' zones have been created to reduce the rate of boat strikes in key turtle habitats in marine parks.

This work contributes to a better understanding of the state of marine ecosystems. Turtles are indicators of water quality and respond to large scale events, such as floods, as well as localised impacts from changes in water quality. Following the flooding that occurred in 2011, surveys have confirmed that at least parts of Queensland's immature east coast turtle population was experiencing extreme stress and had poor body condition. Improvements in water quality and reduction of sediment run-off are central to improving the resilience of inshore marine habitats and MNES to future extreme weather events

#### 9.6.3.2 StrandNet

DEHP maintains StrandNet, a database of marine wildlife strandings and deaths. The primary focus of the database is to record information on where sick, injured, dying and dead marine cetaceans (whales and dolphins), pinnipeds (seals and sea lions), dugong and turtles have been found in Queensland and assess causes of injury and death, if possible. Incidental information on sharks, rays, seabirds and other marine animals is also recorded.

Data collected and collated in the strandings database is summarised in annual reports. The information published as at November 2012 data for dugongs and turtles in included in Table 9.5 2 and Table 9.5 3.

Table 9.6 2 Reported dugong strandings 2009-2012

| Year | 2012 | 2011 | 2010 | 2009 |
|---|---|---|---|---|
| All of Queensland | 51 total (including 4 released alive) | 186 | 79 | 56 |
| Hervey Bay, 25° | 6 | 20 | 8 | 11 |
| Gladstone, 23° | 9 | 12 | 3 | 1 |
| Mackay, 21° | 1 | 4 | 2 | 1 |
| Townsville, 19° | 5 | 54 | 19 | 11 |
| Cairns, 16° | 6 | 13 | 17 | 10 |
| Remainder of Qld | 24 | 83 | 30 | 22 |

Source: [154]

Table 9.6 3 Reported marine turtle strandings 2009-2012

| Year | 2012 | 2011 | 2010 | 2009 |
|---|---|---|---|---|
| All of Queensland | 1187 verified on StrandNet (including 211 released alive) 111 require verification | 1611 | 740 | 855 |
| Hervey Bay, 25° | 123 | 136 | 72 | 102 |
| Gladstone, 23° | 57 | 304 | 48 | 43 |
| Mackay, 21° | 23 | 79 | 14 | 19 |
| Townsville, 19° | 298 | 286 | 82 | 43 |
| Cairns, 16° | 74 | 43 | 17 | 11 |
| Remainder of Qld | 612 | 763 | 507 | 637 |

Source: [155]

#### 9.6.3.3 Fisheries monitoring

DAFF has a number of monitoring and management measures relevant to MNES. The measures outline information on the operation of the fishery, trends in catch and fishing effort, impacts on ecosystems and management regimes.

Science plays a key role in ensuring that harvesting of valuable fish from Queensland's ecosystems is sustainable. Relevant information about fish stocks and the fisheries they support is continuously collected to enhance their sustainability.

Data are regularly collected from fishery-dependent and fishery-independent sources including:

- daily logbook returns from all commercial fishing boats, documenting target and by-product species and species of conservation interest
- regular recreational fisher surveys
- a long-term biological monitoring program collecting fishery-dependent and independent data for scientific assessment of key species.

Annual fisheries status reports outline information on the operation of the fishery, trends in catch and fishing effort, impacts on ecosystems and management regimes.

An example of this is the Queensland logbook system. Since 1988, commercial fishers operating in Queensland's state-managed fisheries are required to complete daily catch and effort logbooks. The logbook collects details on where, when and how fishing took place, and what was caught. The Commercial Fisheries Information System (CFISH) is a database which stores the fishing information from the logbooks of all licensed operators. CFISH helps Fisheries Queensland assess the status of Queensland's fisheries resources. The information is also valuable in developing fisheries management plans and helping determine the effectiveness of measures already in place. Today CFISH represents one of the most comprehensive fisheries information systems in Australia. It continues to expand and improve thanks to the cooperation of fishers, researchers, managers and logbook section staff.

Further logbooks and reporting requirements exist for the various fisheries managed by Fisheries Queensland, reflecting the unique characteristics of each fishery. Fisheries Queensland has monitoring programs to collect biological information for a range of species. These programs involve either dedicated scientific surveys or the community collecting information from their fisheries. Of particular importance is the Species of Conservation Interest (SOCI) logbook which has been required by commercial fishers since 2005. The ability to report on a fleet-wide basis will greatly assist Fisheries Queensland in its efforts to comply with Australian Government requirements for the ecological sustainability of Queensland's fisheries.

### 9.6.4 Land monitoring

#### 9.6.4.1 Queensland land use mapping program

The DNRM's soil and land mapping, modelling and monitoring are critical to understanding land productivity and land degradation risk. The Queensland Land Use Mapping Program (QLUMP) provides for the ongoing monitoring of land use and land management practices that can affect water quality and catchment, soil erosion, acidification, nutrient decline and carbon losses.

It has also helped in assessing agricultural productivity and opportunities for diversification, conducting cost benefit-analyses for major natural resource investments and trade-offs from land use change, developing solutions for sustainable land management, and using integrated modelling to predict the behaviour of a catchment under different management options.

The DNRM also provides ASS maps and coastal hazard maps to inform land use planning and development decisions. Since 1995, the department has initiated a number of projects to identify the extent, location, and risk level of ASS in Queensland. The DNRM also has in place the Queensland Acid Sulfate Soils Investigation Team (QASSIT) which has advised on many coastal development proposals and provided technical advice on management of ASS for developments totalling in excess of $3 billion.

### 9.6.5 Integrated monitoring framework

As identified above, within the GBR coastal zone monitoring is undertaken by a wide range of agencies. In addition to Queensland Government monitoring programs, there are a number of other research and monitoring providers such as AIMS, CSIRO, the GBRMPA and universities, as well as community based monitoring programs. A recent review of existing monitoring programs in the GBRWHA, undertaken as part of the Integrated Monitoring Framework project, identified more than 65 privately and publicly funded monitoring programs that are relevant to MNES[31]. While some of these monitoring programs have been specifically designed to meaningfully inform management of MNES values (e.g. the Paddock to Reef Program), there is no overarching framework to ensure these various programs are aligned with each other so that their findings can be integrated to better inform management of the property.

There are gaps in existing monitoring both spatially and in regards to some of the identified monitoring priorities. For example, the far northern GBR is generally poorly covered by monitoring, as are deep water portions of seagrass meadows and deep water reefs. Furthermore, for many cause-effect interactions, only the cause or the effect is monitored; there are very few instances where both the pressure and the value are adequately monitored. Some values, such as coral reefs, are the focus of multiple monitoring programs with differing objectives. There is an opportunity to better draw together, evaluate, interpret and report the relevant results for these groups of programs and achieve efficiencies in monitoring and reporting.

Through the project, the monitoring needs for management, legacy of past monitoring programs and the capacity of existing monitoring programs are being brought together by a multi-disciplinary, multi-institutional, effort to provide a blueprint for an integrated approach to monitoring the GBR. The draft framework explicitly links management objectives, monitoring objectives and monitoring programs in a driver, pressure, state, impact and response framework to provide a solid foundation for considering an Integrated Monitoring Program for the GBRWHA.

### 6.11.1 Summary of effectiveness

| Management effectiveness component | Grading | Confidence | Trend | Summary of evidence |
|---|---|---|---|---|
| Monitoring | Effective | Adequate | Improving | A number of monitoring programs are in place to inform management. There is capacity to improve the integration of existing monitoring programs to improve efficiency and report against broader outcomes. |
| Effective: Existing monitoring programs and strategies are effective at informing management of MNES | | | | |

## 9.7 Reporting

The Queensland Government Program includes reporting mechanisms using the suite of monitoring data available. This includes:

- The state of the environment reports (SoE), required under the EP Act and Coastal Act every four years
- Annual Report Cards on reef water quality and marine health through the Reef Plan.
- As required by the EP and Coastal Acts, SoE reports must:
  - include an assessment of the condition of Queensland's major environmental and coastal resources
  - identify significant trends in environmental and coastal values
  - review significant programs, activities and achievements of persons and public authorities relating to the protection, restoration or enhancement of Queensland's environment and coastal zone
  - evaluate the efficiency and effectiveness of environmental and coastal management strategies implemented.

SoE reporting is an important part of the Queensland Program's integrated adaptive management framework. SoE reports provide assessments of Queensland's natural and cultural assets, outlining if the state of natural and cultural assets has remained the same, improved or deteriorated, since the previous report.

The findings reflect how well Queensland is responding to environmental challenges, both in reducing or eliminating pressures and the underlying driving forces that cause these pressures. Actions to achieve this include protecting the environment and preventing or limiting damaging activities; restoring and rehabilitating degraded natural assets; and changing behaviour and practices to reduce the demand or pressures placed on environmental resources.

Reporting on the state of the environment is important to provide objective measures of the effectiveness of the Queensland Program to protect and manage MNES. Additionally, SoE reporting assists strategic planning within the Queensland Program by identifying new and emerging issues requiring intervention.

Another reporting mechanism which is used to provide an indication of effectiveness of Queensland Program at protecting and managing MNES is the annual report cards as part of the Reef Plan. The annual report cards outline progress towards Reef Plan's goals and targets (Figure 9.6 2). Three report cards have been published to date and demonstrate good progress towards targets.

The Queensland Government also contributes and responds to the Great Barrier Reef Outlook Report prepared by the GBRMPA every five years. This report tool also provides an opportunity to assess the effectiveness of the Queensland Program and

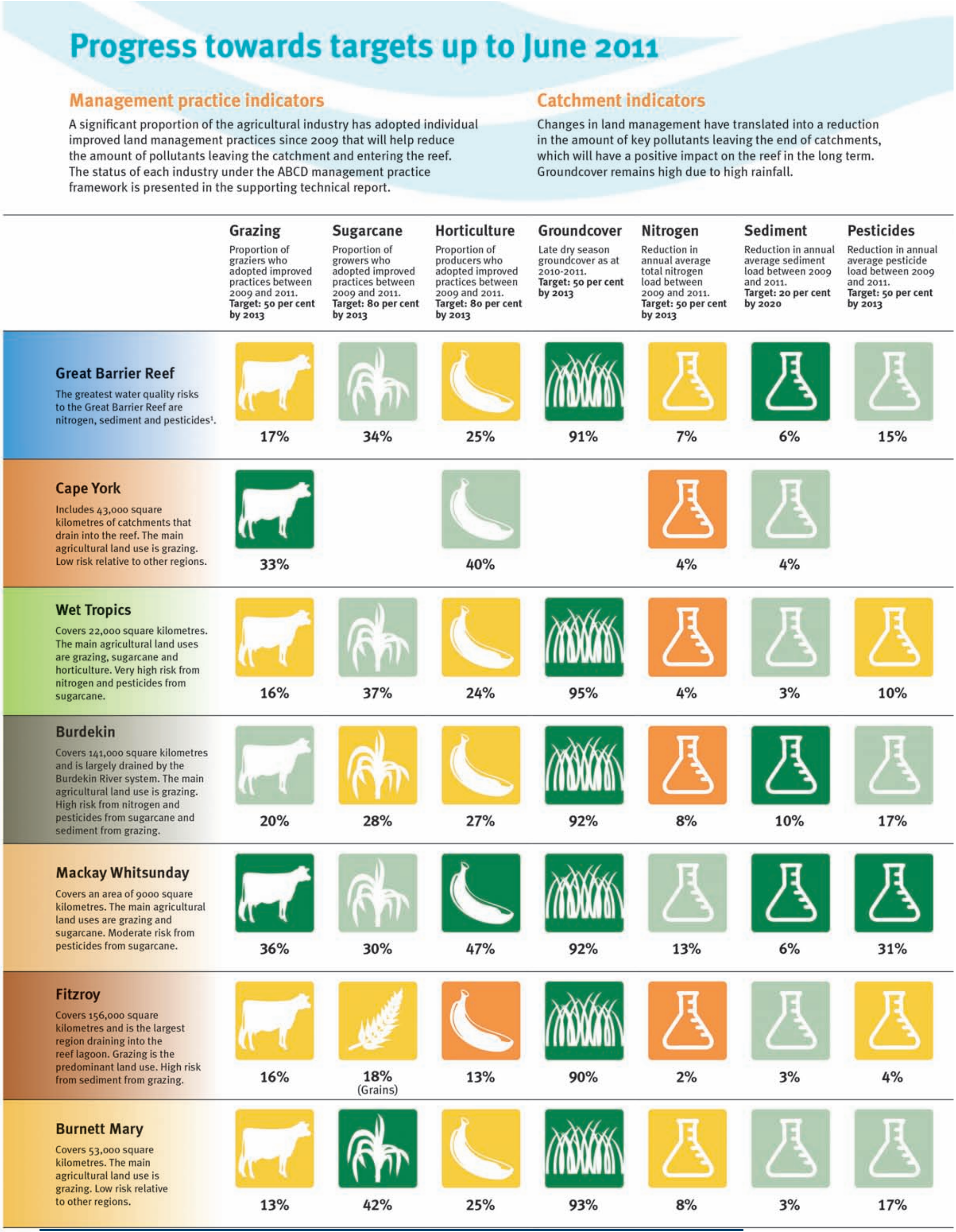



Figure 9.6 1 2011 Report Card results

Source: 36

address issues facing the GBR and refocus joint management between the governments.

## 9.8 Independent scientific input

Underpinning Queensland's environmental management systems is robust scientific knowledge and evidence gathering. Both short-term intensive studies to understand specific events or processes, as well as long-term continuous monitoring programs are needed to understand cumulative impacts occurring over timescales from years to decades. Using the best available science is important in the adaptive management process of the Queensland Program, by providing robust knowledge and information needed to refine the Program components to protect and manage MNES.

Scientific efforts relevant to the GBR coastal zone include data collected under the Reef Plan and GHHP.

A key feature of Reef Plan is the Independent Science Panel which provides independent scientific advice on water quality issues for the GBR. This includes advice on knowledge gaps, science priorities and delivery associated with the overall implementation of the Reef Plan. The panel:

- conducts scientific reviews of the Reef Plan activities and initiatives, including annual and other reports, and makes specific recommendations about the direction, content and details of future activities
- provides timely independent scientific advice and review to ensure Reef Plan implementation, monitoring and reporting.

As previously mentioned, in 2012 the Queensland Government established a partnership agreement to ensure the ongoing monitoring and improvement of Gladstone Harbour and surrounding catchments.

The GHHP includes representatives from government, industry, research, community and other interests. The purpose of the partnership is to align activities, harness co-investment potential, implement an adaptive management framework and deliver a shared vision for a healthy Gladstone Harbour.

The GHHP will focus on best practice collaborative monitoring and management of the harbour. It is envisaged that industry, the Australian Government, Queensland Government, local government, universities and research institutions will partner in investment to agree on the strategic directions and leverage the benefits of streamlined monitoring, targeted management and expert science advice.

An independent science panel will inform the decisions made by the GHPP. In turn, the GHHP will be responsible for the Gladstone Healthy Harbour Report Card and any actions needed to address its findings. By implementing collaborative actions, the GHHP will maintain and continuously improve harbour health.

A number of information gaps have been highlighted in this *strategic assessment report*. The forward commitments will address many of these during the life of the Program, improving certainty and directly contributing to improving the management of the GBR coastal zone.

A range of research and development programs are in place to increase knowledge of the GBR coastal zone ecosystem and ultimately significantly improve its management,these include:

- a water quality risk assessment, which will identify priority pollutants and areas
- the e-reefs project which will better link catchment runoff to marine ecosystem health through a receiving waters model
- an updated 2013 scientific consensus statement on water quality that will inform the next update of the Reef Plan
- conservation planning in the coastal zone, funded through the National Environmental Research Program (NERP).

## 9.9 The way forward

The Queensland Government recognises that continuous improvement in monitoring and reporting activities are required to provide the best environmental outcomes for the GBR. Adaptive management involves using compliance, monitoring and reporting outcomes to continually improve the Program. The process focuses on clear planning and implementation, with an emphasis on monitoring, reporting and reviewing to ensure that as new information emerges it is embedded in future planning.

The Program will evolve over its 25 year lifespan in accordance with adaptive management, as new information emerges and new procedures are introduced. The Queensland Government Program's regulatory framework, supported by compliance mechanisms and long-term monitoring and reporting programs, such as the SoE Report and Reef Plan Report Cards, will ensure the Program is adapted to reflect any changes and achieve improved outcomes for MNES.

The Queensland Government undertakes a statutory review process for all regulatory mechanisms as well as regular review of long-term plans and programs, such as the components of the Queensland Government Program. The statutory review is to ensure continuous improvement towards achieving the desired outcomes. Through the mechanisms detailed in this chapter the Queensland Government will continue to monitor and review the effectiveness of the Program in achieving its objectives to protect and manage MNES in the GBR coastal zone. Especially important is improving the baseline data used to develop management strategies and actions at the regional and reef-wide levels to provide for improved environmental outcomes.

The Queensland Government also recognises and supports industry initiatives such as the Abbot Point Cumulative Impact Assessment which can be used to inform monitoring and reporting programs being undertaken by the Government. Further information and analysis of the Abbot Point CIA is provided in the demonstration case at Appendix I.

The Queensland Government will continue to work with the GBRMPA and the Australian Government, through the joint field management program and other initiatives, in revising and/or establishing new activities to achieve shared agreed objectives for MNES in the GBR.

Implementation arrangements for the Program are outlined in the *program report* and include a commitment to report to the Great Barrier Reef Ministerial Forum annually on implementation of the Program. The Australian and Queensland governments are also working together to develop a Long Term Sustainability Plan for the Great Barrier Reef World Heritage Area. The plan will inform future development by drawing together the marine and coastal components of the comprehensive strategic assessment, providing an over-arching framework to guide the protection and management of the GBRWHA from 2015 to 2050. It will target the identified areas of action from the strategic assessments and seek to address gaps important for future management of the WHA.

Queensland Government expects that changes to the Program will be achievable under the endorsed Program and within the scope of the conditions provided under Section 146B of the EPBC Act. Other variations may require amendment of those conditions. This would occur pursuant to Section 143 of the EPBC Act. Changes will take into account the best available scientific information. The forward commitments and recommended improvements to the Program are discussed in chapter 10.

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# Chapter 10

## recommended changes and forward commitments

*Extract from Great Barrier Reef Coastal Zone Strategic Assessment terms of reference*

*2.5 Recommendations for changes to the Program*

*The Strategic Assessment Report must include an evaluation of the resulting projected condition of MNES including OUV within the strategic assessment area of the Program taking into account:*

*(a) the baseline scenario, i.e. the analysis of the current condition of MNES including OUV, projected trends and existing threats*

*(b) the likely net impacts on MNES including OUV from implementing the Program and the effects of any ongoing management and enhancement activities.*

*The Strategic Assessment Report must include recommendations for changes to the Program if the assessment identifies that MNES including OUV are not adequately protected by the Program. The Strategic Assessment Report may include recommendations to:*

*(a) modify the state's processes for identifying MNES including OUV either through mapping or non-mapped descriptions of biophysical and heritage attributes*

*(b) change the policy framework by which impacts on MNES including OUV are considered by the Program*

*(c) change the state's processes for declaring, planning and deciding development including how certain types of development or activity may be specifically prohibited to avoid impacts on MNES, including OUV*

*(d) change the state's processes for identifying, declaring and managing protected areas to protect and enhance MNES, including OUV*

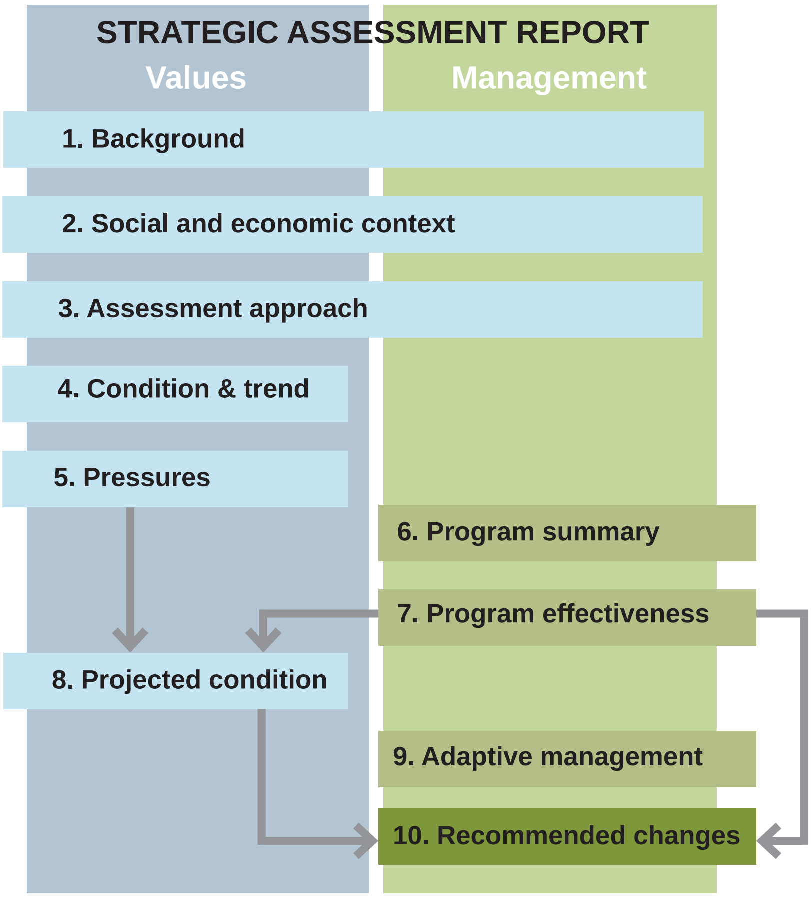
*(e) change to the state programs to avoid, mitigate and establish offsets1 for impacts on MNES, including OUV*

*(f) establish a program for further strategic assessments of specific areas and plans, policies or programs*

*(g) describe and analyse the circumstances where impacts on MNES and OUV are likely to be unacceptable and any process for resolving conflicts.*

*Recommendations for changes to the Program will seek to achieve a net benefit in terms of how the Program addresses impacts on MNES including the OUV of the GBRWHA.*

# 10. Recommended changes and forward commitments




CHAPTER 10 I recommended changes and forward commitments

## 10.1 Introduction

This chapter provides a description of the forward commitments and recommended improvements to the Queensland Government's management arrangements to better identify, protect and manage MNES in the GBR coastal zone, including the OUV of the GBRWHA. Recommendations are designed to strengthen the identification and protection of MNES and guide improvements to the management of impacts, including actions required to avoid, mitigate, offset and adaptively manage impacts on the MNES.

The accompanying *program report* is focussed on the Queensland Government's current management arrangements and has regard to these recommendations. It contains a description of the Queensland Government's existing foundational management arrangements, proposed measures to strengthen management and forward commitments. The recommended improvements have directly informed the Strengthening Management and Forward Commitments sections of the draft Program (see Figure 10 1). The public consultation process will help identify potential additional improvements to management arrangements.

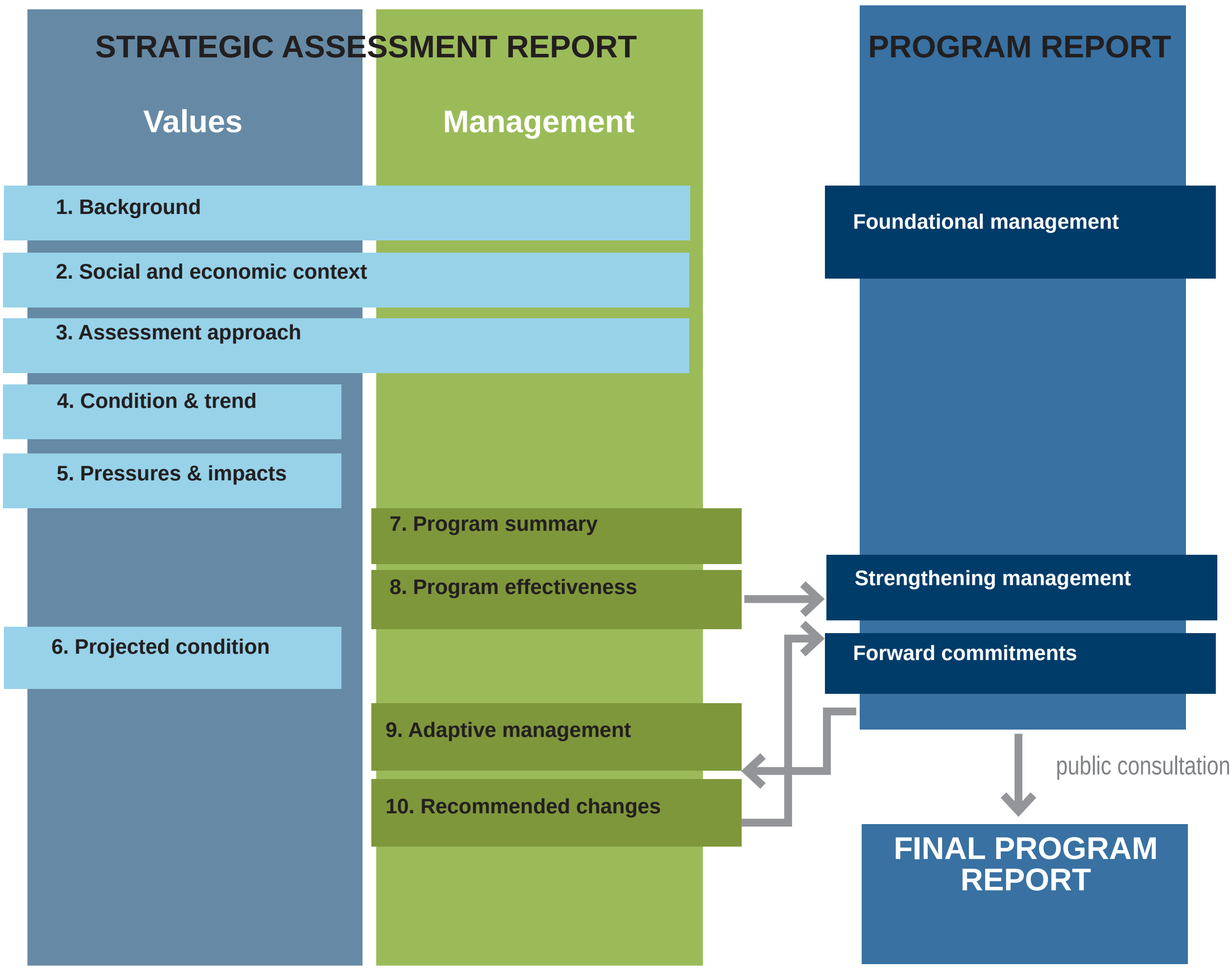



Figure 10.1 1 Relationship between Strategic Assessment Report and Program Report

## 10.2 How recommended improvements were identified

An assessment of Program effectiveness (chapter 7) has highlighted numerous strengths in the Queensland Government's Program and noted some existing and potential weaknesses which need to be addressed. In order to ensure that MNES, including the OUV of the Great Barrier Reef and Wet Tropics World Heritage Areas, are adequately identified, protected and managed, a number of improvements are recommended to the Program. The recommended improvements are designed to ensure activities that have the potential to impact upon MNES, proceed in a manner consistent with the principles of ecologically sustainable development.

The recommended improvements proposed for the Queensland Government's Program are based on the key findings of the strategic assessment. They include specific consideration of the outcomes from:

- an assessment of the current and projected condition and trend of key indicators of matters of national environmental significance (chapter 8, Table 8.7-1)
- an assessment of pressures and impacts on MNES and projected risks (chapter 5, Table 5.4-1)

- a review of the Program's management effectiveness (chapter 9 and Appendix G)
- an understanding of the application of the existing program provided through the demonstration cases (chapter 7 and Appendix I)
- the objectives of the adaptive management approach to the constantly evolving and dynamic environment of the Great Barrier Reef and adjacent coastal zone (chapter 9).

The preliminary results from regional sustainability projects, the recommendations of the World Heritage Committee and the findings of the GBRMPA's strategic assessment have all contributed the formulation of recommendations in this report.

## 10.3 Summary of findings from strategic assessment report

### 10.3.1 Condition and trend

A summary of current and projected condition and trend of MNES and the values that underpin MNES (Table 8.7-1) shows that current condition is good to very good with the corresponding recent trend data indicating either 'stable' or 'improving,' with the exception of the GBRWHA and the Broad leaf tea-tree woodlands which were both deteriorating. However, the projected condition and trend of MNES is very encouraging, with all showing an improving trend. This is a very strong positive outcome and reflects the effectiveness of the Queensland Program.

Historically, there has been a significant loss of terrestrial, fresh-water aquatic and estuarine ecosystems as a result of past land use decisions, particularly through the clearing of vegetation and the development of agriculture. At the scale of the GBR coastal zone, most areas of MNES, particularly species habitat and TECs are assessed to have experienced a significant reduction in extent with some now in poor condition. On a regional scale, the habitats and species within the Cape York NRM region, the Wet Tropics World Heritage Area, Ramsar wetlands and conservation reserves are in very good condition, but the condition and trend decline significantly outside these areas and progressing south.

The assessment identified overwhelming evidence that a range of threats is continuing to affect inshore habitats along the coast and the species that use these habitats. The key impacts affecting habitats and species are extreme weather events, climate change, poor water quality from catchment runoff from rural diffuse pollution, and loss of habitats.

Terrestrial habitats in northern catchments are generally in good condition, however, in southern catchments, where habitats have been substantially modified, the existing condition varies, especially for wetlands and forests. Populations of threatened terrestrial species range from poor to very poor condition and in most cases are declining. Populations of migratory species vary; for example, estuarine crocodile populations are in good condition and improving, but the processes of sedimentation, nutrient cycling and connectivity are in poor condition despite having started to stabilise in recent years as a result of management intervention.

Land and natural resource management practices have improved during the past few decades but resources remain suboptimal, particularly in relation to pest management and ecological fire management. Although better management of many agricultural systems has reduced their impacts on the environment, a number of issues around nutrient and soil management from past agricultural activities remain. For some species and habitats, their current condition is assessed as poor or very poor and declining. This is despite strong initiatives to address the factors affecting their populations.

### 10.3.2 Impacts

The most significant current impacts on the GBR coastal zone continue to be extreme weather events, the chronic long term impacts of poor water quality and the impact of pest and weed species. The impacts of poor water quality are more pronounced in the southern inshore area of the GBRWHA, compared with the northern and offshore areas. Previous clearing and modification of the catchments has also had an impact on inshore ecosystem functionality, particularly through changes to natural waterways.

Proposed coastal development is expected to occur in just over three per cent of the GBR coastal zone. Whilst the impacts of urban, port and industrial development may present as locally significant around population centres and ports, they are relatively small at the scale of the GBR coastal zone. The major source of impacts will continue to be climate change and catchment runoff. In particular, the impacts of climate change, particularly the intensification of extreme weather events, sea temperature increases, ocean acidification and sea level rise and catchment runoff from past agricultural activities, continue to dominate the outlook for the coastal zone.

### 10.3.2 Program effectiveness

The Queensland Government's foundational management tools vary in terms of their effectiveness. Table 10.3 1 summarises the key findings from the review of program effectiveness and highlights that some aspects of the program are effective or very effective, including the identification of MNES and the assessment of potential impacts, while other areas are only partially effective, including Queensland's approach to offsets.

Overall, there is a strong foundation of management in the Queensland Government's Program which is proving to be an effective protection mechanism in the GBR and adjacent coastal zone, the highlights of which include:

- Queensland's protected area estate, which is the cornerstone of protection for MNES. A large proportion of the GBR coastal zone is within conservation areas (over 30 per cent terrestrial and over 40 per cent marine). The majority of the Ramsar wetlands and Wet Tropics WHA is protected in national parks.
- A robust planning system which aims to avoid areas of high importance to MNES (although not explicitly in all cases). There is a specific planning framework for the Wet Tropics WHA.
- A sophisticated mapping system that helps identify areas of MNES including the essential habitat required to support terrestrial threatened species and key roosting and breeding sites for migratory species and is an important tool for planning.
- A well established development assessment process that applies conditions to approvals to identify, avoid, mitigate and offset impacts on MNES. Queensland's process for assessing major project and planning developments that require environmental impact statements has been accredited by the Australian Government under a bilateral agreement.
- A highly co-ordinated and well developed Field Management Program which has for more than three decades provided on-ground management, site management and planning and compliance for the GBR. This program has been jointly funded by both the Australian and Queensland governments since its inception.
- Vegetation management laws that generally prevent broadscale clearing of remnant vegetation for agriculture and protect riparian vegetation in GBR catchments.
- The very effective Reef Plan whose programs are demonstrating a clear trend toward halting and reversing the decline in water quality from broadscale agriculture.

Some of the Queensland Government's foundational arrangements have been assessed as partially effective with regard to managing cumulative impacts, applying offsets and some aspects of coastal planning noted in Table 10.3 1. Typically these components have been primarily designed to address environmental considerations of importance (to the state) across issues that include but are broader than MNES. Areas where alignment and transparency for the management of MNES can be improved include:

- A lack of explicit consideration of MNES. Queensland's planning and development assessment is well advanced, but doesn't explicitly require impacts on MNES or OUV to be identified, avoided, mitigated or offset.
- The lack of a framework to address cumulative impacts. While all EIS are required to report on expected direct, indirect and cumulative impacts on MNES from proposed development, to date, there is no consistent method to determine or manage the cumulative impacts of a development.
- Queensland's approach to offsets. A number of offsets policies are in place, but they are not well integrated and do not deliver strategic outcomes or a net benefit to MNES.
- Planning for ports. While significant port development, within and adjoining the Great Barrier Reef World Heritage Area, is restricted to within existing port limits to 2022, this commitment can be strengthened to promote more concentrated development.

Table 10.3 1 Summary of Program effectiveness

| MNES | Program effectiveness | | | | | | |
|---|---|---|---|---|---|---|---|
| | Identify MNES | Avoid (protected areas) | Avoid (coastal planning) | Mitigate | Offset | Consider cumulative impacts | Enhance MNES |
| GBRWHA<br>GBR Marine Park<br>Commonwealth marine | Effective | Very effective | Partially effective | Effective | Partially effective | Partially effective | Very effective |
| Wet Tropics WHA | Effective | Very effective | Effective | Effective | Partially effective | Partially effective | Effective |
| Ramsar wetlands | Effective | Very effective | Partially effective | Effective | Partially effective | Partially effective | Effective |
| Threatened ecological communities | Effective | Very effective | Partially effective | Effective | Partially effective | Partially effective | Effective |
| Threatened and migratory species | Effective | Very effective | Partially effective | Effective | Partially effective | Partially effective | Effective |

## 10.4 The need to strengthen Queensland Government's Program

The GBR is acknowledged as one of the best managed reefs in the world. In part, this is because the Queensland and Australian governments are constantly evolving management arrangements to respond to emerging trends and impacts. This practice is continuing. The Queensland Government is using improved planning systems, rigorous assessment processes and emerging science to strengthen its program of management to influence the resilience of the GBR coastal zone and hasten its recovery after extreme weather events. Similarly, improved management practices are being adopted to support the future growth of the coastal zone in a sustainable manner. This strategic assessment is a critical piece of work that will help inform the continued improvement of management strategies and ensure that both Queensland and national interests are explicitly considered in planning and development assessment.

This *strategic assessment report* has identified that the Great Barrier Reef and adjacent coastal zone will be subject to a range of cumulative impacts into the future. Without appropriate intervention, MNES values in the Great Barrier Reef coastal zone are likely to deteriorate further. However, with careful management and a more strategic approach that focuses on addressing the greatest risks and investing where the greatest environmental gains can be achieved, it is possible to improve the condition of the coastal zone, while facilitating economic growth.

The recommended improvements outlined in this chapter are specifically designed to address those aspects of the Program that have been assessed as only partially effective. They have been informed by both the broadscale analysis of management effectiveness, and by the findings of the demonstration cases.

## 10.5 Recommended improvements

The strategic assessment has provided valuable insight into the strengths and weaknesses of the Queensland Government's management arrangements and has informed a number of recommendations for improvement.

In order to accommodate future coastal development and deliver the outcomes detailed in the *program report*, future management will need to:

- avoid impacts from development activity through improved planning mechanisms to enhance the protection of coastal ecosystems
- identify potential cumulative impacts of development through establishing guidelines which will facilitate a consistent rigorous approach to the development assessment process
- concentrate development in the coastal zone to spatially minimise impacts and improve productivity and sustainable development
- offset unavoidable residual impacts to ensure no net loss of MNES, which includes the OUV of the GBRWHA
- focus efforts on actions that enhance MNES and build resilience, including improving water quality, rehabilitating critical habitat, re-establishing corridors and recovering threatened and migratory species.

Table 10.5 1 outlines the recommended improvements to the Program and has informed the Strengthening Management arrangements identified in the *program report*.

Table 10.5 1 Recommended improvements from the Strategic Assessment Report

| Management components | Strengths | Weaknesses | Recommended improvements |
|---|---|---|---|
| Identifying MNES | Consistent and rigorous mapping methodology for identifying MNES | Planning processes are not explicitly required to identify MNES<br>Flow-on consequences for avoiding and mitigating impacts if not adequately identified. | REC1: More explicitly incorporate consideration of MNES into the planning and development assessment system and provide clearer guidance on how MNES should be considered.<br>REC2: Ensure that mapping is readily available in order to inform local planning and is provided in such a way that the specific values at the site can be understood. |
| | | Reliance on mapping | REC3: Work closely with GBRMPA and the Australian Government to help identify values of the GBRWHA that are not easily mapped.<br>REC 4: Work with GBRMPA and Traditional Owners to undertake an assessment of the Indigenous heritage values of the Great Barrier Reef WHA. |
| | | Not enough studies/research | REC5: Seek to include additional information in the mapping system, particularly for:<br>• intertidal and inshore coastal ecosystems where information is currently limited,<br>• threatened ecological communities; and<br>• migratory species. |
| Assessing impacts on MNES | There is a rigorous and well established process in place supported by legislation for assessing projects that may impact on MNES | There are no established standards or guidelines to help proponents and decision makers consider and address cumulative impacts. | REC6: Work closely with the Department of the Environment and the GBRMPA to improve understanding of cumulative impacts within and adjacent to the Great Barrier Reef and provide clearer guidance on how proponents and decision makers should address cumulative impacts in impact assessments. |
| | | There is currently significant duplication in assessment processes across jurisdictions | REC7: Streamline assessment processes across jurisdictions and seek to have a more coordinated approach to community consultation. |

| Management components | Strengths | Weaknesses | Recommended improvements |
|---|---|---|---|
| Avoiding impacts on MNES | Draft Queensland Ports Strategy will concentrate port development to existing ports. | Gaps remain in regional plans (North Queensland and Central Queensland) | REC8: Commit to filling the remaining gaps in regional plans and establish a timetable for completion. |
| | | Planning documents are not explicitly required to avoid impacts on MNES. | See REC1.<br>REC9: Implement arrangements to concentrate port development around long-established major ports in Queensland, and encourage port master planning which includes community engagement. |
| | Protected areas provide a strong foundation for continued conservation of MNES. | There is currently significant duplication in protected area management and permitting arrangements between GBRMPA and Queensland | REC10: Improve alignment between Queensland and GBRMPA protected area and tourism management arrangements and pursue opportunities to streamline. |
| | The field management program is a major strength of the Program, not only in relation to compliance, but also the on ground activities that improve MNES. | There are inadequate resources available to meet current and future demands. Current penalties don't provide sufficient deterrent for repeat offenders. | REC 11: Improve compliance through increased coordination across jurisdictions to prevent repeat offending. |
| | Good on ground efforts on islands through the joint field management program which has improved values. | Further work required to address biosecurity issues on islands and more strategically plan activities that will improve island natural integrity. | REC12: Support a collaborative, Reef-wide management strategy for islands and contribute to its development and implementation. |
| Mitigating impacts on MNES | Good capacity to mitigate impacts through conditions on development approvals, in some cases which exceed standards. | A range of different conditions have historically been applied to project approvals, although Queensland is beginning to use more standardised conditions. | REC13: Work closely with the Australian Government to establish standard MNES conditions that should be applied to certain types of development that give confidence that impacts will be mitigated as far as possible. |
| Offsetting impacts on MNES | Some examples of more strategic approaches to offsets through the Coordinator-General. | The current approach to offsets, limits opportunities to deliver more holistic and strategic outcomes. | REC14: Review Queensland's approach to offsets to ensure more strategic outcomes that help deliver a net benefit overall. Seek to align a new offsets approach to the Commonwealth offsets policy where possible. |
| Enhancing MNES | Major programs to improve water quality backed by significant resources. Excellent planning tools to prioritise on ground activities (e.g. Wet Tropics Conservation Strategy). | No explicit overall program to coordinate efforts to enhance MNES. | REC15: Develop and implement the Long Term Sustainability Plan for the GBRWHA in cooperation with the Australian Government to better coordinate programs designed to manage and improve the condition of the reef.<br>REC16: Consider expanding the scope of Reef Plan to incorporate other sources of pollutants (e.g. urban, port) to provide a sound coordination mechanism. |

| Management components | Strengths | Weaknesses | Recommended improvements |
|---|---|---|---|
| | | Research priorities are well understood for water quality, but there is a need to better prioritise research needs in other areas. | REC17: Work with partners to identify critical research needs to inform management and support the Long Term Sustainability Plan for the GBRWHA. |
| Monitoring and evaluation | Range of existing monitoring and reporting programs in place that are fit for purpose | Monitoring could be more efficient and better integrated and should focus around an agreed outcomes framework. Monitoring and reporting is not explicitly focused around MNES. | REC18: Work with GBRMPA and the Australian Government to identify agreed outcomes for MNES that can be monitored over time to assess the effectiveness of management.<br>REC19: Work with GBRMPA to look for opportunities to integrate existing monitoring programs and focus on reporting against consistent outcomes.<br>REC20: More explicitly report on the condition and trend of MNES. |
| Governance | There are good examples of the Queensland Government responding to new information and adapting management.<br><br>There is a strong foundation of governance with the Great Barrier Reef Intergovernmental Agreement, Ministerial Forum and Reef Plan governance | Governance arrangements are relatively strong across the management components but could be strengthened in some areas such as coastal management, port planning and monitoring. | REC 21: Consider improved governance arrangements for the management and coordination of coastal development issues in the GBR coastal zone, using the Reef Plan governance framework as a benchmark. |

## 10.6 The GBRMPA's recommended improvements

As part of the complementary Great Barrier Reef Region strategic assessment, the GBRMPA has made a number of recommendations to improve management. Some of these overlap and are consistent with Queensland's recommendations, for example, development of an outcomes-based framework, the long term plan for the GBRWHA, integrated monitoring program and improved understanding of cumulative impacts. Both sets of recommendations are provided in Table 10.6-1 to demonstrate their alignment.

A number of the GBRMPA's recommendations relate to matters for which Queensland is directly responsible, or has joint responsibility for. This includes a range of recommendations on port management, fisheries management, water quality, coastal development and biodiversity management. Queensland has worked closely with the GBRMPA to consider the recommendations and try to identify consistent and collaborative recommended improvements.

Public consultation on both strategic assessments will provide further input into proposed and additional recommended improvements.

As part of Queensland Government's proposed Program a number of forward commitments are made to provide confidence that Queensland Government's system will continue to meet high standards and respond to key challenges. Many of the forward commitments demonstrate Queensland Government's commitment to implementing the World Heritage Committee's recommendations regarding the Great Barrier Reef World Heritage Area. They also demonstrate Queensland's desire to work collaboratively with the Australian Government in joint management of the Great Barrier Reef and detail forward commitments to implement the proposed strengthened management arrangements. The forward commitments are outlined in the accompanying *program report*.

Table 10.6-1: Alignment between Queensland Government's and the GBRMPA's recommended improvements

| Management component | Queensland Government recommended improvements | GBRMPA recommended improvements |
|---|---|---|
| Identifying MNES | REC1: More explicitly incorporate consideration of MNES into the planning and development assessment system and provide clearer guidance on how MNES should be considered. | REC1: Explicitly incorporate consideration of all values relevant to matters of national environmental significance, including elements of the property's outstanding universal value, into the Authority's programs, plans and policies. |
| | REC2: Ensure that mapping is readily available in order to inform local planning and is provided in such a way that the specific values at the site can be understood. | |
| | REC3: Work closely with GBRMPA and the Australian Government to help identify values of the GBRWHA that are not easily mapped. | REC3: Work closely with Australian and Queensland government agencies to help identify values of the Great Barrier Reef World Heritage Area that are not easily represented and measured such as aesthetic values.<br>REC6: Improve understanding of the role that the Great Barrier Reef plays in the life of the community. |
| | REC 4: Work with GBRMPA and Traditional Owners to undertake an assessment of the Indigenous heritage values of the Great Barrier Reef WHA. | REC4: Collaborate with Traditional Owners to undertake an assessment of the Indigenous heritage values of the Region. |
| | REC5: Seek to include additional information in the mapping system, particularly for:<br>• intertidal and inshore coastal ecosystems where information is currently limited,<br>• threatened ecological communities; and<br>• migratory species. | REC2: Improve spatial mapping capabilities to support planning and assessment decision making, including the range of values mapped and public availability.<br>REC5: Develop and implement knowledge management systems for Indigenous and historic heritage information, including a protocol for managing culturally sensitive information and improved information sharing arrangements. |
| Assessing impacts on MNES | REC6: Work closely with the Department of the Environment and GBRMPA to improve understanding of cumulative impacts within and adjacent to the Great Barrier Reef and provide clearer guidance on how proponents and decision makers should address cumulative impacts in impact assessments. | REC7: Work closely with Australian and Queensland government agencies to improve understanding and management of cumulative impacts from activities within and adjacent to the Region and provide clearer guidance on how proponents and decision makers should address cumulative impacts in assessments. |
| | REC7: Streamline assessment processes across jurisdictions and seek to have a more coordinated approach to community consultation. | REC8: Streamline assessment processes across jurisdictions and seek to have a more coordinated approach to community consultation. |
| Avoiding impacts on MNES | REC8: Commit to filling the remaining gaps in regional plans and establish a timetable for completion. | Not applicable to GBRMPA. |

| Management component | Queensland Government recommended improvements | GBRMPA recommended improvements |
|---|---|---|
| | REC9: Implement arrangements to concentrate port development around long-established major ports in Queensland, and encourage port master planning which includes community engagement. | REC11: Support development of a Queensland ports strategy that concentrates port development around long-established major ports in Queensland, and encourage port master planning. |
| | REC10: Improve alignment between Queensland and GBRMPA protected area and tourism management arrangements and pursue opportunities to streamline | REC9: Improve alignment between the Authority's and Queensland Government's protected area and tourism management arrangements and look for opportunities to streamline. |
| | REC 11: Improve compliance through increased coordination across jurisdictions to prevent repeat offending. | REC16: Improve compliance through more effective surveillance and compliance activities, access to latest technology, increased coordination across jurisdictions and strengthened powers to prevent repeat offending. |
| | REC12: Support a collaborative, Reef-wide management strategy for islands and contribute to its development and implementation. | REC17: Support a collaborative, Reef-wide management strategy for islands and contribute to its development and implementation. |
| | | REC10: Develop and implement plans of management in areas of the Great Barrier Reef Marine Park that have high growth for recreation and other uses. |
| | | REC12: Promote a strategic approach to the development and operation of marinas and other access infrastructure along the Great Barrier Reef coast. |
| | | REC13: Review and update the Great Barrier Reef Marine Park Heritage Strategy to guide management actions to strengthen recognition and protection of heritage values. |
| | | REC14: Promote, recognise and encourage stewardship and best practice efforts by community, industry and government. |
| | | REC15: Support increased investment in site infrastructure to protect matters of national environmental significance in the Great Barrier Reef Region. |
| Mitigating impacts on MNES | REC13: Work closely with the Australian Government to establish standard MNES conditions that should be applied to certain types of development that give confidence that impacts will be mitigated as far as possible. | REC18: Update and strengthen the Great Barrier Reef water quality guidelines to address a broader range of habitats and species and account for cumulative impacts.<br>REC19: Improve the effectiveness of the Authority's hydrodynamic guidelines as a decision making tool by requiring consideration of a greater range of environmental factors, and regularly reviewing them to reflect improvements in understanding.<br>REC20: Support research on critical ecosystem thresholds, with a focus on inshore biodiversity and associated ecosystems.<br>REC21: Improve understanding and the Authority's management of the impacts of noise on species, particularly at-risk and inshore species. |
| | | REC22: Reduce crown-of-thorns outbreaks by continuing to improve water quality and through a long-term control program. |

| Management component | Queensland Government recommended improvements | GBRMPA recommended improvements |
|---|---|---|
| Offsetting impacts on MNES | REC14: Review Queensland's approach to offsets to ensure more strategic outcomes that help deliver a net benefit overall. Seek to align a new offsets approach to the Commonwealth offsets policy and proposed Reef Trust where possible. | REC23: Develop a policy and supporting mechanisms to facilitate strategic and collaborative implementation of offsets across jurisdictions.<br>REC24: Inform implementation of Australian and Queensland government offsets policies and restoration programs by identifying actions that will maximise the delivery of environmental benefits to the Region. |
| Enhancing MNES | REC15: Develop and implement a Long Term Sustainability Plan for the GBRWHA in cooperation with the Australian Government to better coordinate programs designed to manage and improve the condition of the reef. | REC26: Develop and implement a long-term sustainability plan for the Great Barrier Reef World Heritage Area in cooperation with Australian and Queensland government agencies to better coordinate programs designed to manage and improve the condition of the Reef. |
| | REC16: Consider expanding the scope of Reef Plan to incorporate other sources of pollutants (e.g. urban, port) to provide a sound coordination mechanism | REC27: Strengthen engagement with all relevant partners to facilitate actions that maintain and enhance the condition of values and reduce impacts, particularly in relation to climate change, catchment run-off, degradation of coastal ecosystems and direct use. |
| | REC17: Work with partners to identify critical research needs to inform management and support the Long Term Sustainability Plan for the GBRWHA. | REC30: Improve alignment and coordination of strategic research priorities and strengthen partnerships between the Authority and research institutions to facilitate the delivery of critical research needs. |
| | | REC28: Develop a comprehensive management framework and an Indigenous heritage strategy for Traditional Owner use and management of the Great Barrier Reef. |
| | | REC29: Adopt regionally-based cooperative approaches to protect inshore biodiversity hotspots – supporting local actions and encouraging cooperation |
| Monitoring and evaluation | REC18: Work with GBRMPA and the Australian Government to identify agreed outcomes for MNES that can be monitored over time to assess the effectiveness of management. | REC25: Establish a management framework with clear outcomes and targets for the protection of values and the management of impacts, including cumulative impacts. |
| | REC19: Work with GBRMPA to look for opportunities to integrate existing monitoring programs and focus on reporting against consistent outcomes. | REC31: Implement an integrated monitoring, reporting and adaptive management program for the Great Barrier Reef World Heritage Area, including more explicit reporting on the condition and trend of matters of national environmental significance.<br>REC32: Maintain and improve monitoring, investigation and data management relating to critical species and habitats. |
| | REC20: More explicitly report on the condition and trend of MNES. | |
| Governance | REC 21: Consider improved governance arrangements for the management and coordination of coastal development issues in the GBR coastal zone, using the Reef Plan governance framework as a benchmark. | REC34: Contribute to the development of improved governance arrangements for the management and coordination of development activities that affect the Great Barrier Reef. |

| Management component | Queensland Government recommended improvements | GBRMPA recommended improvements |
| --- | --- | --- |
| Climate change | | REC35: Communicate the implications of climate change impacts for the Great Barrier Reef and the critical need to halt increasing concentrations of global greenhouse gases and restore them to levels that will support growth, recruitment and recovery processes of the Great Barrier Reef ecosystem. |
| | | REC36: Ensure the impacts of climate change and extreme weather are appropriately considered in the Authority's management decisions. |
| | | REC37: Encourage reduction of greenhouse gas emissions in the Great Barrier Reef Region in partnership with industry and communities. |
| | | REC38: Support initiatives to build the capacity of management agencies and Reef users to adapt and respond to climate change and extreme weather events. |

## 10.7 Forward commitments

The following summary of proposed forward commitments proposed is outlined in chapter 6 of the *program report* to provide confidence that the Queensland Government's system will continue to meet high standards and respond to key challenges. These commitments demonstrate how the Queensland Government will implement the World Heritage Committee's recommendations regarding the GBRWHA and the desire to work collaboratively with the Australian Government in the joint management of the GBR.

Table 10.7 1 Summary of forward commitments

| | Forward commitment | Link to recommendations |
|---|---|---|
| **Meeting international obligations** | | |
| FC1 | Queensland will provide information to the Australian Government on proposed developments that may impact upon World Heritage properties to ensure Australia's international obligations continue to be met. | - |
| FC2 | Queensland will work with the Australian Government to develop and implement a Long Term Sustainability Plan for the Great Barrier Reef World Heritage Area by the end of 2014. | REC13 |
| FC3 | Queensland will work with the Australian Government to jointly develop an outcomes-based framework for the GBRWHA. | REC17 |
| FC4 | Queensland will continue to work with industry and other stakeholders in Gladstone Harbour to establish and implement the Gladstone Healthy Harbour Partnership which will inform future management decisions. | REC 18 and 19 |
| **Managing coastal development** | | |
| FC5 | Queensland is committed to working with the Australian Government to improve mapping to ensure that all EPBC listed threatened species and ecological communities and listed migratory species relevant to Queensland are accurately identified. | REC2, 3 and 5 |
| FC6 | Queensland will continue to work with the Australian Government and other states and territories to achieve consistent national listing of threatened species. | - |
| FC7 | Queensland will complete regional plans in the GBR coastal zone where there is a gap and continue to update other regional plans to ensure they respond to the latest information and pressures. | REC8 |
| **Implementing strengthened management measures** | | |
| FC8 | Queensland will develop and implement the Queensland Ports Strategy which build on and further strengthen the government's commitment to consolidate existing port capacity and strengthen port-related management of the Great Barrier Reef coastal zone. | REC9 |
| FC9 | Queensland will work with the Australian Government and GBRMPA to develop guidelines proponents should consider when assessing cumulative impacts for EPBC Act approvals including those that impact on the Great Barrier Reef World Heritage Area. | REC6 |
| FC10 | Implement a new Queensland offsets policy that delivers more strategic outcomes and ensures funds derived from the GBR coastal zone are used to tackle the most significant issues facing the GBR and seek to align with the objectives of the Australian Government Offsets Policy and proposed Reef Trust where possible. | REC14 |

| | Forward commitment | Link to recommendations |
|---|---|---|
| FC11 | Queensland will also work with GBRMPA and seek to utilise the outcomes of recent research (coastal basin assessments) in implementing the new offsets policy, including the through development of a Direct Benefit Management Plan for the Great Barrier Reef. | REC14 |
| **Enhancing MNES** | | |
| FC12 | Queensland will continue to support the Reef Water Quality Protection Plan and the associated Paddock to Reef monitoring program to help achieve the long term goal of no detrimental impact from water entering the GBR. | REC15 |
| FC13 | At Reef Plan's next review (2018), consideration will be given to expanding its scope to other sources of pollutants other than broadscale land use. | REC16 |
| FC14 | Queensland will continue to support programs that improve the Wet Tropics WHA. | REC15 |
| FC15 | Queensland will continue to undertake broader activities to improve the character of wetlands through the Queensland Wetlands Program | REC15 |
| FC16 | Queensland will prioritise actions to recover species, taking into account national recovery plans, threat abatement plans and conservation advices | REC15 |
| **Adaptive management** | | |
| FC17 | Incorporate reporting into Queensland state of the environment reporting in relation to MNES condition and trend. | REC20 |
| FC18 | Work with the Australian Government to develop an integrated monitoring program that incorporates existing Queensland monitoring programs and provides improved information to underpin the long term sustainability plan | REC19 |
| FC19 | Advise the Australian Government of any proposed changes to the Program and prepare an MNES Impact Statement where a significant change is considered. | REC18 |
| FC20 | Report annually to the Great Barrier Reef Ministerial Forum on implementation of the strategic assessment. | REC20 |

# References

1. ABS, 2011, Population by Age and Sex Regions of Australia, 2011, Cat No. 3235.0. Sourced from the Office of the Government Statistician Queensland Regional Database.
2. Access Economics, 2012, Economic Contribution of the Great Barrier Reef Marine Park 2006 – 07. . Townsville, Australia.
3. Department of Sustainability, Environment, Water, Population and Communities (SEWPaC), 2012, Draft Framework of Standards for Accreditation of Environmental Approvals under the Environment Protection and Biodiversity Conservation Act 1999, July 2012, http://www.environment.gov.au/epbc/publications/accreditation-standards-framework.html.
4. Great Barrier Reef Marine Park Authority (GBRMPA), 2009, Great Barrier Reef Outlook Report 2009. Australian Government.
5. Deloitte Access Economics, 2013, Economic contribution of the Great Barrier Reef, Great Barrier Reef Marine Park Authority, Townsville. http://www.environment.gov.au/sustainability/regional-development/gbr/publications/gbr-economic-contribution.html. Townsville, Australia.
6. ABS, 2008-09, Land Account. Cat no. 4609.0.55.001.
7. Tourism Queensland, 2012, Tourism Facts and Figures. Tourism Queensland.
8. ABS, 2005-06, Agricultural Commodities, Australia 2005-06 cat. No 7125.
9. Ports Australia, 2012, Trade statistics for 2011/2012., < http://www.portsaustralia.com.au/tradestats/ Last accessed November 2012>.
10. Oxford Economics, 2009, Valuing the effects of Great Barrier Reef bleaching. Great Barrier Reef Foundation. Newstead, Queensland. www.barrierreef.org/Portals/0/Oxford_report/GBRF_OxfordReport_Final_WEB.pdf.
11. Australian Government, 1980, Offshore constitutional settlement. Selected statements and document 1978 – 1979. Attorney-General's Department, Canberra. http://www.law.uq.edu.au/documents/maslu/offshore-constitutional-settlement-selected-documents-full.pdf.
12. Department of Environment and Resource Management (DERM), 2011, Queensland Regional Natural Resource Management Framework. Queensland Department of Environment and Resource Management, Brisbane, Australia.
13. Queensland Government, 2013, Agriculture. , <http://www.business.qld.gov.au/industry/agriculture Accessed January 2013>.
14. Department of Agriculture Fisheries and Forestry (DAFF), 2012, Queensland AgTrends 2012-13: Forecasts and trends in Queensland agricultural, fisheries and forestry production.
15. Department of State Development Infrastructure and Planning (DSDIP), 2012, Great Barrier Reef Ports Strategy 2012-2022, October 2012, <http://dsdip.qld.gov.au/resources/plan/great-barrier-reef-ports-strategy.pdf Last accessed January 2013>.
16. Hand, T., 2003, An economic and social evaluation of implementating the representative areas program by rezoning the Great Barrier Reef Marine Park. Report on the revised zoning plan. Great Barrier Reef Marine Park Authority and PDP Australia Pty Ltd.
17. Marsden Jacob Associates, 2010, The economic and social impacts of protecting environmental values in Great Barrier Reef catchment waterways and the reef lagoon. A report prepared by Marsden Jacob Associates for the Department of Environment and Resource Management.
18. Millennium Ecosystem Assessment (MEA), 2003, Ecosystems and Human Well-being. . Island Press.
19. Department of Sustainability Environment Water Population and Communities (SEWPaC), 2011, Australia State of the Environment 2011. Independent report to the Australian Government Minister for Sustainability, Environment, Water and Population and Communities. . Canberra, Australia.
20. Department of Environment and Heritage Protection (DEHP), 2012, State of the Environment Queensland 2011 Report. Brisbane. Australia.
21. Department of Sustainability Environment Water Population and Communities (SEWPaC), 2011, Approved Conservation Advice for Coolibah – Black Box Weedlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions ecological community, <  http://www.environment.gov.au/biodiversity/threatened/communities/pubs/66-conservation-advice.pdf; Last accessed 30 January 2013>.
22. Australian Standard, 2004, Risk Management AS/NZS 4360:2004.
23. Wet Tropics Management Authority (WTMA), 2012, Wet Tropics Management Authority Annual Report and state of the Wet Tropics Report 2011-2012, <http://www.wettropics.gov.au/site/user-assets/docs/wtma_annrep_2011-2012_a4qld.pdf;  Last accessed, 21 January 2013>.
24. SKM, 2013, Improved dredge material management for the Great Barrier Reef Region, Great Barrier Reef Marine Park Authority. Townsville, Australia.
25. GHD, 2013, Environmental Best Practice Port Development: An Analysis of International Approaches. Report prepared

for the Department of Sustainability, Environment, Water, Population and Communities, Canberra, Australia.

26. GHD, 2013, Ship anchorage management in the Great Barrier Reef World Heritage Area: Great Barrier Reef Marine Park Authority, Townsville. Brisbane, Australia.
27. Great Barrier Reef Marine Park Authority (GBRMPA), 2012, Coastal Ecosystems Assessment Framework 2012. Townsville, Australia.
28. Anthony, K. R., Dambacher, J. M., Walshe, T.and Beeden, R., 2013, A Framework for Understanding Cumulative Impacts and Supporting Environmental Decisions: To Inform Resilience-Based Management of the Great Barrier Reef World Heritage Area. Great Barrier Reef Marine Park Authority, Townsville, Australia.
29. Whiteway, T., Smithers, S., Potter, A.and Brooke, B., 2013, Geological and Geomorphological features of Outstanding Universal Value in the Great Barrier Reef World Heritage Area. Report prepared for SEWPaC. Coastal Marine and Climate Change Group, Geoscience Australia and School of Earth and Environmental Sciences, James Cook University, Townsville, Australia.
30. Context Pty Ltd, 2013, Defining the aesthetic values of the Great Barrier Reef: Final Report. Report prepared for SEWPaC.
31. Dale, A., in prep., Governance, planning and the effective application of emerging ecosystem service markets to secure climate change adaptation and landscape resilience in far north Queensland: Project 12.4.
32. Nelder, V. J., Wilson, B. A., Thompson, E. J.and Dillewaard, H. A., 2005, Methodology for Survey and Mapping of Regional Ecosystems and Communities in Queensland. Version 3.1.Queensland Herbarium. . Environmental Protection Agency Brisbane, Australia.
33. Department of Environment and Resource Management (DERM), 2011, Landcover change in Queensland 2008–09: a Statewide Landcover and Trees Study (SLATS) Report Department of Environment and Resource Management, Brisbane, Australia.
34. Department of Premier and Cabinet (DPC), 2011, Reef Water Quality Protection Plan (Reef Plan) 2009 -First Report Card. Queensland Government, Brisbane, Australia.
35. Department of the Premier and Cabinet (DPC), 2009, Reef Water Quality Protection Plan (Reef Plan) 2010 - Second Report Card. Department of the Premier and Cabinet, Brisbane, Australia.
36. Department of Premier and Cabinet (DPC), 2013, Reef Water Quality Protection Plan (Reef Plan) 2010 - Second Report Card, (report card yet to be released). Queensland Government, Brisbane, Australia.
37. De'ath, G., Kathatrina, E., Sweatman, H.and Puotinen, M., 2012, The 27–year decline of coral cover on the Great Barrier Reef and its causes. Proceedings of the National Academy of Sciences 109.44, 17995-17999.
38. Department of Environment and Heritage Protection (DEHP), 2013, Gladstone Harbour Integrated Aquatic Investigation Program 2012 Report. Brisbane. Australia.
39. Great Barrier Reef Marine Park Authority (GBRMPA), in prep, Great Barrier Reef Region Strategic Assessment Report.
40. Wet Tropics Management Authority (WTMA), 2009, Annual Report & State of the Wet Tropics Report 2008-2009, <http://www.wettropics.gov.au/site/user-assets/docs/2009_sowt_report.pdf; Last accessed 11 October 2013>.
41. Department of National Parks Recreation Sport and Racing (DNPRSR), 2013, Planned Burn Guidelines Wet Tropics Bioregion of Queensland., Brisbane, Australia.
42. Kelly, K. E.and Lee Long, W. J., 2011, Ecological Character Description for the Bowling Green Ramsar site, Report produced by URS Australia Pty Limited for the Department of Sustainability, Environment, Water, Population and Communities, Australian Government, Canberra.
43. BMT WBM, 2010, Shoalwater and Corio Bays Ramsar site Ecological Character Description.
44. Department of Sustainability Environment Water Population and Communities (SEWPaC), 2013, Broad leaf tea-tree (Melaleuca viridiflora) woodlands in high rainfall coastal north Queensland in Community and Species Profile and Threats Database, <http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=122&status=Endangered; Last accessed 20 February 2013>.
45. Department of Sustainability Environment Water Population and Communities (SEWPaC), 2013, Littoral Rainforest and Coastal Vine Thickets of Eastern Australia in Community and Species Profile and Threats Database, <http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=76&status=Critically+Endangered. Last accessed 20 February 2013>.
46. Department of Sustainability Environment Water Population and Communities (SEWPaC), 2013, Saccolaimus saccolaimus nudicluniatus in Species Profile and Threats Database, < http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=66889; Last accessed January 2013>.

47. Schultz, M.and Thomson, B., 2007, Recovery plan for the Bare-rumped Sheathtail Bat Saccolaimus saccolaimus nudicluniatus 2007-2011. Report to Department of the Environment and Heritage, Canberra. , <http://www.environment.gov.au/biodiversity/threatened/publications/s-nudicluniatus.html.>.

48. Queensland Parks and Wildlife Service (QPWS), 2000, Bowling Green Bay National Park Management Plan 2000

49. Queensland Parks and Wildlife Service (QPWS), 2001, Parks, forests and wildlife services performance review. QPWS/EPA Annual Report 2000/01. Queensland Government, Brisbane, Australia.

50. Department of Sustainability Environment Water Population and Communities (SEWPaC), 2013, Petaurus gracilis in Species Profile and Threats Database, Department of Sustainability, Environment, Water, Population and Communities, Canberra. http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=26775 Accessed January 2013.

51. Department of Environment and Resource Management (DERM), 2010, National recovery plan for the Proserpine rock-wallaby Petrogale persephone: Report to Department of Sustainability, Environment, Water, Population and Communities, Canberra. . Queensland Department of Environment and Resource Management, Brisbane, Australia.

52. Department of Sustainability Environment Water Population and Communities (SEWPaC), 2013, Petrogale persephone in Species Profile and Threats Database, < http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=226; Last accessed January 2013>.

53. Nolan, B.and Johnson, P., 2001, Recovery plan for the Proserpine rock-wallaby Petrogale persephone 2000–2004. Report to Environment Australia, Canberra. . Queensland Parks and Wildlife Service., Brisbane, Australia.

54. Department of Sustainability Environment Water Population and Communities (SEWPaC), 2013, Xeromys myoides in Species Profile and Threats Database <http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=66; Last accessed January 2013>.

55. Department of Sustainability Environment Water Population and Communities (SEWPaC), 2013, Epthianura crocea macgregori in Species Profile and Threats Database, <http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=67090; Last accessed January 2013>.

56. Garnett, S., Szabo, J.and Dutson, G., 2011, The Action Plan for Australian Birds 2010. CSIRO Publishing.

57. Department of Sustainability Environment Water Population and Communities (SEWPaC), 2013, Casuarius casuarius johnsonii in Species Profile and Threats Database, <http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=25986; Last accessed January 2013>.

58. Jones, D. L., 1984, Palms in Australia. . Reed Books. .

59. Jones, D. L., 1996, Palms in Australia; third edition. . Reed New Holland.

60. Landsberg, L.and Clarkson, J., 2004, Threatened plants of Cape York Peninsula, Tropical Savannahs., CRC.

61. Tucker, R., 1988, Palms of Subequatorial Queensland. . Palms and Cycad Societies of Australia.

62. Jones, D. L.and Lavarack, P. S., 1989, A new species of Calochilus (Orchidaceae) from North-eastern Queensland Proceedings of the Royal Society of Queensland 100, 100–103.

63. Department of the Environment Water Heritage and the Arts (DEWHA), 2008, Approved Conservation Advice for Calochilus psednus (Bearded Orchid). Released 2008.

64. Jones, D. L., 2006, A complete guide to native orchids of Australia, including the island territories., New Holland Australia.

65. Nicholls, W. H., 1969, Orchids of Australia. Nelson.

66. Lavarack, P. S.and Gray, B., 1985, Tropical Orchids of Australia. Nelson.

67. Dockrill, A. W., 1992, Australian Indigenous Orchids, revised edition, SGAP NSW Region.

68. Lavarack, B., Harris, W.and Stocker, G., 2000, Dendrobium and its relatives. Kangaroo Press.

69. Queensland Department of Natural Resources (QDNR), 2001, Updated map prepared from information supplied by the Queensland Herbarium, Queensland Government, Brisbane, Queensland.

70. Hewson, H. J., 1985, In Flora of Australia, Australian Government Publishing Service, 188-196.

71. Belleng Pty Ltd., 2004, Proposed Residential Development Lot 3 RP35335 Doolong Road South, Hervey Bay, Preliminary Information (Part 1) for Environmental Assessment & Approval under Chapter 4 of the Environment Protection and Biodiversity Conservation Act 1999.

72. Department of Sustainability Environment Water Population and Communities (SEWPaC), 2013, Cycas silvestris in Species Profile and Threats Database., <http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=55778; Last accessed March 2013>.

73. Plant, R., Taylor, C., Hamstead, M.and Prior, T., 2012, Recognising the broader benefits of aquatic systems in water planning: an ecosystem services approach: Waterlines Report Series No. 87, <http://www.nwc.gov.au/__data/assets/pdf_file/0010/23221/Recognising-the-broader-benefits-of-aquatic-systems.pdf; Last accessed 25 October 2013>.

74. Australian Heritage Commission, 2002, Australian Natural Heritage Charter for conservation of places of natural heritage significance. Second Edition. . Australian Heritage Commission, Canberra, Australia.

75. Millennium Ecosystem Assessment (MEA), 2005, Ecosystem Services and Human Well-Being: Wetlands & Water: Synthesis. 2005. Millennium Ecosystem Assessment report to the Ramsar Convention. World Resources Institute, Washington D.C., USA.

76. Ramsar Convention, 2005, Resolution IX.1 Annex A. A Conceptual Framework for the wise use of wetlands and the maintenance of their ecological character. , <http://www.ramsar.org/cda/en/ramsar-documents-resol-resolution-ix-1-annex-a/main/ramsar/1-31-107%5E23536_4000_0__ ; Last accessed 22 October 2013>.

77. Department of the Environment Water Heritage and the Arts (DEWHA), 2008, National Framework and Guidance for Describing the Ecological Character of Australia's Ramsar Wetlands. Module 2 of Australian National Guidelines for Ramsar Wetlands – Implementing the Ramsar Convention in Australia.

78. Scheltinga, D. M., Fearon, R., Bell, A.and Heydon, L., 2006, Assessment of Information Needs for Freshwater Flows into Australian Estuaries Fisheries Research and Development Corporation (FRDC) and Land & Water Australia (LWA).

79. Kelley, R., Barnett, B., Bainbridge, Z., Brodie, J.and Pearson, R., 2006, Nutrients, Catchments and Reefs – a guide to nutrients in your landscape: Catchment to Reef Program.

80. Connolly, N., Kelley, R., Pearson, R.and Prior, T., 2005, Catchment to reef – an interpretive poster and booklet: A publication from the Catchment to Reef Program, a joint initiative of Rainforest CRC and CRC Reef Research Centre.

81. Pawert, M., Müller, E.and Triebskorn, R., 1998, Ultrastructural changes in fish gills as biomarker to assess small stream pollution. Tissue and Cell 30, 617-626.

82. Allan, J. D., 2004, Landscapes and riverscapes: the influence of land use on stream ecosystems. Annual Review of Ecology, Evolution and Systematics 35, 257-284.

83. Camargo, M. M. P.and Martinez, C. B. R., 2007, Histopathology of gills, kidney and liver of a Neotropical fish caged in an urban stream. Neotropical Ichthyology 5, 327-336.

84. Allendorf, F. W., 1983, In Genetics and conservation: A refeence for managing wild animal and plant populations (eds C.M. Schonewald-Cox, S.M. Chambers, B. MacBryde, & W.L. Thomas), Benjamin Cummins, 51-65.

85. Hughes, J. M., 2007, Constraints on recovery: using molecular methods to study connectivity of aquatic biota in rivers and streams. Freshwater Biology 52, 616-631.

86. University of the Sunshine Coast, 2009, Assessing the impacts of climate change on ecosystem services in south-east Queensland, report for SEQ Catchments.

87. Millennium Ecosystem Assessment (MEA), 2005, Ecosystems and human well-being: current state and trends. . Millennium Ecosystem Assessment. Island Press.

88. Department of the Environment Water Heritage and the Arts (DEWHA), 2008, Assessment of Australia's Terrestrial Biodiversity 2008: Report prepared by the Biodiversity Assessment Working Group of the National Land and Water Resources Audit for the Australian Government., Canberra, Australia.

89. Department of Environment and Resource Management (DERM), 2010, Climate change in Queensland: what the science is telling us. Office of Climate Change, Queensland Government, Brisbane, Australia.

90. Commonwealth Scientific and Industrial Research Organisation (CSIRO), 2012, The Implications of Climate Change for Biodiversity Conservation and the National Reserve System: Final Synthesis: A report prepared for the Department of Sustainability, Environment, Water, Population and Communities, and the Department of Climate Change and Energy Efficiency. CSIRO Climate Adaptation Flagship, Canberra, Australia.

91. Climate Commision, 2012, http://climatecommission.gov.au/basics/.

92. Steffen, W., Hughes, L., Sahajwalla, V.and Hueston, G., 2012, The Critical Decade: Queensland climate impacts and opportunities, <http://climatecommission.gov.au/wp-content/uploads/Queensland-report_web_final-Dec.pdf: Last accessed 25th October 2013>.

93. Church, J., A,and White, N. J., 2011, Sea-level rise from the late 19th to the early 21st Century. Surveys in Geophysics 10.

94. Australian Academy of Science, 2010, The Science of Climate Change Questions and Answers <http://www.science.org.au/reports/climatechange2010.pdf; Last

accessed 22 January 2013>.

95. Brodie, J., Binney, J. et al., 2008, Scientific consensus statement on water quality in the Great Barrier Reef, <http://www.reefplan.qld.gov.au/about/assets/scientific-consensus-statement-on-water-quality-in-the-gbr.pdf; Last accessed 21 January 2013>.

96. Lobegeiger, R., 2012, Ross Report to farmers: Aquaculture production survey Queensland 2010–11 <http://www.daff.qld.gov.au/documents/Fisheries_Aquaculture/Report-to-farmers-10-11.pdf>.

97. Preston, N. P., Macleod, I., Rothlisberg, P. C.and Long, B., 1997, In 2, Vol. Proceedings, CSIRO, Melbourne, (eds D.A. Hancock, D.C. Smith, A. Grant, & J.P. Beumer), 471-477.

98. Department of State Development Infrastructure and Planning (DSDIP), 2012, Great Barrier Reef Coastal Zone: Economic Report. Queensland Government, Brisbane, Australia.

99. Great Barrier Reef Marine Park Authority (GBRMPA), 2012, Climate change adaptation: Outcomes from the Great Barrier Reef Climate Change Action Plan 2007-2012. Townsville, Australia.

100. Vance, R. R., 1988, Ecological succession and the climax community on a marine subtidal rock wall. Marine Ecology Progress Series 48, 125-136.

101. Erftemeijer, P. L. A.and Lewis, R. R. R., 2006, Environmental impacts of dredging on seagrasses: A review. Marine Pollution Bulletin 52, 1553-1572.

102. Great Barrier Reef Marine Park Authority (GBRMPA), 2013, Dredging and spoil disposal in the Marine Park, <http://www.gbrmpa.gov.au/about-us/consultation/legislative-requirements-for-permits/dredging-and-spoil-disposal-in-the-marine-park; Last accessed 13 February 2013>.

103. Knott, A. K., Aulbury, J. P., Brown, T. H.and Johnston, E. L., 2009, Contemporary ecological threats from historical pollution sources: impacts of large-scale resuspension of contaminated sediments on sessile invertebrate recruitment. Journal of Applied Ecology 46, 770-781.

104. 104 Cruz-Motta, J. J.and Collins, J., 2004, Impacts of dredged material disposal on a tropical soft-bottom benthic assemblage. Marine Pollution Bulletin 48, 270-280.

105. Fitzroy Basin Association (FBA), 2012, Fitzroy River Estuary Development Proposals – A review of Issues April 2012, prepared by Ebernard Consulting, <http://www.protectkeppelbay.org/Welcome_files/Final-Fitzroy-Ports-synthesis-report-270412.pdf; Last accessed 21 January 2013>.

106. Commonwealth Scientific and Industrial Research Organisation (CSIRO), 2010, Baseline pollutants loads to the Great Barrier Reef: Water for a Healthy Country Flagship Report. Canberra, Australia.

107. Csurhes, S.and Hankamer, C., 2012, Pest animal risk assessment: Yellow Crazy Ant (Anoplolepis gracilipes). 1 - 27 DEEDI, Biosecurity QLD.

108. Queensland Department of Science Information Technology Innovation and the Arts (DSITIA), 2012, Land use summary 1999–2009: Great Barrier Reef catchments. Queensland Government, Brisbane, Australia.

109. Far North Queensland Natural Resource Management (FNQ NRM) Ltd and Rainforest Cooperative Research Centre, 2004, Sustaining the Wet Tropics: A Regional Plan for Natural Resource Management 2004–2008, <http://www.terrain.org.au/images/stories/publications/nrm-plans/V4-Region-Plan-for-NRM.pdf; Last accessed viewed 21 January 2013>.

110. Fahrig, L., 2003, Effects of Habitat Fragmentation on Biodiversity. Annual Review of Ecology, Evolution, and Systematics 34, 487-515.

111. Kroon, F., Turner, R.and Smith R, W. M., Hunter H, Bartley R, Wilkinson S, Lewis S, Watres D, Carroll C, 2013, 2013 Scientific Consensus Statement: Chapter 4 – Sources of sediment, nutrients, pesticides and other pollutants in the Great Barrier Reef catchment. Queensland Government, Brisbane, Australia.

112. Department of Primary Industries and Fisheries (DPIF), 2008, Queensland Biosecurity Strategy 2009-14. Queensland Government.

113. Reddiex, B.and Forsyth, D. M., 2004, Review of existing Red Fox, Feral Cat, Feral rabbit and Feral Goat control in Austrlia. II. Information Gaps <http://www.environment.gov.au/biodiversity/invasive/publications/information-gaps/introduction.html; Last accessed 24 October 2013>.

114. Commonwealth Department of Agriculture Fisheries and Forestry, 2013, The marine pest threat, <http://www.marinepests.gov.au/marine_pests; Last accessed 24 October 2013>.

115. Department of Agriculture Fisheries and Forestry (DAFF), 2013, Weeds, pest animals and ants, <http://www.daff.qld.gov.au/plants/weeds-pest-animals-ants/weeds; Last accessed 24 October 2013>.

116. Department of Natural Resources and Mines (DNRM), 1996, Rubber Vine (Cryptostegia grandiflora) in Queensland Pest Status Review Series – Land Protection Branch., Brisbane, Australia.

117. Australian Government and Queensland Department of

Natural Resources Mines and Water (DRNM), 2006, Pond apple Annonna glabra Annonaceae management, <http://www.weeds.org.au/WoNS/pondapple/docs/pond_apple_MM.pdf; Last accessed 21 January 2013>.

118. Wet Tropics Management Authority (WTMA), 2008, Climate Change in the Wet Tropics Impacts and Responses State of the Wet Tropics Report 2007-2008, <http://www.wettropics.gov.au/site/user-assets/docs/2008sowt_report_climatechange.pdf; Last accessed 21 January 2013>.

119. Department of Environment and Heritage Protection (DEHP), 2012, State of the Environment Queensland 2011 Report - Chapter 3: Pressures, <http://www.ehp.qld.gov.au/state-of-the-environment/report-2011/index.html; Last accessed 16 October 2013>.

120. Williams, K. J., Dunlop, M. et al., 2012, Queensland's biodiversity under climate change: impacts and adaptation – synthesis report. A Report Prepared for the Queensland Government, Brisbane. . CSIRO Climate Adaptation Flagship, Canberra.

121. Dunlop, M., Hilbert, D. W. et al., 2012, Implications for policymakers: Climate change, biodiversity conservation and the National Reserve System', A report prepared for the Department of Sustainability, Environment, Water, Population and Communities, and the Department of Climate Change and Energy Efficiency. . CSIRO Climate Adaptation Flagship, Canberra.

122. Booth, C., 2007, Barbed Wire Action Plan, <http://www.wildlifefriendlyfencing.com/view.pdf>.

123. Wet Tropics Management Authority (WTMA), 2004, Wet Tropics Conservation Strategy: the conservation, rehabilitation and transmission to future generations of the Wet Tropics World Heritage Area. Cairns, Australia.

124. Great Barrier Reef Marine Park Authority (GBRMPA), 2012, Informing the outlook for the Great Barrier Reef coastal ecosystems. Townsville, Australia.

125. Marsh, H., Penrose, H., Eros, C.and Hugues, J., 2002, Dugong Status Report and Action Plans for Countries and Territories., United Nations Environment Programme, Nairobi.

126. Bentrupperbaümer, J., 1998, Reciprocal ecosystem impact and behavioural interactions between cassowaries, Casuarius casuarius and humans (Homo sapiens) Ph.D. Thesis thesis.

127. Poff, N. L., Allan, J. D. et al., 1997, The natural flow regime. BioScience 47, 769-784.

128. Bunn, S., E,and Arthington, A., H,, 2002, Basic Principles and Ecological Consequences of Altered Flow Regimes for Aquatic Biodiversity. Environmental Management 30, 492-507.

129. Steffen, W., Burbridge, A. et al., 2009, Australia's biodiversity and climate change.

130. Rainforest CRC, 2003, Global Warming in the Wet Tropics. Issues in Tropical Forest Landscapes. Issue 2.

131. Productivity Commission, 2013, Major Project Development Assessment Processes, Draft Research Report, <http://www.pc.gov.au/__data/assets/pdf_file/0005/125429/major-projects-draft.pdf>.

132. United States Environmental Protection Agency, 1999, Consideration Of Cumulative Impacts In EPA Review of NEPA Documents, EPA 315-R-99_002, <http://www.epa.gov/compliance/resources/policies/nepa/cumulative.pdf; Last accessed 24 October 2013>.

133. North Queensland Bulk Ports Corporation (NQBP), 2013, Aboot Point Port, <http://www.nqbp.com.au/abbot-point/; Last accessed 24 October 2013>.

134. Great Barrier Reef Marine Park Authority (GBRMPA), 2010, Water quality guidelines for the Great Barrier Reef Marine Park – revised edition 2010. Townsville, Australia.

135. Franks, D. M., Brereton, D., Moran, C. J., Sarker, T.and Cohen, T., 2010, Cumulative impacts - A good practice guide for the Australian coal mining industry. Australian Coal Association Research Program. . Centre for Social Responsibility in Mining & Centre for Water in the Minerals Industry, Sustainable Minerals Institute, The University of Queensland, Brisbane, Australia.

136. Department of Environment and Resource Management (DERM), 2012, Queensland Coastal Plan. Brisbane, Australia.

137. Department of Environment and Heritage Protection (DEHP), 2013, Cassowary, <http://www.ehp.qld.gov.au/wildlife/threatened-species/endangered/endangered-animals/cassowary.html; Last accessed 24 October 2013>.

138. Queensland Resources Council (QRC), 2009, State of the Sector Report: December Quarter 09 – Edition 4, Volume 1, No. 4, <https://www.qrc.org.au/_dbase_upl/SOSDec09_web2.pdf; Last accessed 24 October 2013>.

139. Commonwealth Government Department of Sustainability Environment Water Population and Communities (SEWPaC), 2013, Eastern Kuku Yalanji: Wet Tropics, Queensland Declared an Indigenous Protected Area in May 2013, <http://www.environment.gov.au/indigenous/ipa/pubs/fs-eky.pdf; Last accessed 24 June 2013>.

140. Department of Agriculture Fisheries and Forestry (DAFF), 2012, The 2012 Declared Fish Habitat Area Assessment

Report. Fisheries Queensland.

141. Cairns Regional Council, 2010, Mount Peter Structure Plan: Summary Report, <http://www.cairns.qld.gov.au/__data/assets/pdf_file/0003/69105/1-Final-Summary-Report-for-Mount-Peter-Master-Planning-Area.pdf; Last accessed 24 October 2013>.

142. Worley Parsons, unpublished, Bowen and Abbot Point Industrial Land Concept Plan and Infrastructure Plan. Prepared for the Queensland Government Coordinator-General, 2007., Brisbane, Australia.

143. North Queensland Bulk Ports Corporation (NQBP), 2013, Abbot Point Cumulative Impact Assessment Report.

144. Queensland Department of State Development Infrastructure and Planning (DSDIP), 2010, Western Basin dredging and Disposal Project: Coordinator-General's report for an environmental impact statement, <http://www.dsdip.qld.gov.au/resources/project/port-of-gladstone-western-basin-dredging-disposal-project/wbdp-cg-report-22-july-10.pdf; Last accessed 17 October 2013>.

145. Wet Tropics Management Authority (WTMA), 2003, State of the Wet Tropics Report 2002-2003 Annual Report, <http://www.wettropics.gov.au/site/user-assets/docs/2003a_report.pdf;  Last accessed 15 October 2013>.

146. Australian Maritime Safety Authority (AMSA), 2010, Improving safe navigation in the Great Barrier Reef, <http://www.amsa.gov.au/navigation/services/gbr-and-torres-strait-vts/documents/AMSA-report-of-safe-navigation-in-the-GBR.pdf; Last accessed 25 October 2013>.

147. Australian Standard, 2013, Australian Standard procedure for risk assessment AS/NZS 4360:2004

148. Blackman, J. G.and Brooke, G., 1994, In Rural Queensland - A Sustainable Future, Royal Society of Queensland. Proceedings of a Symposium 1989.

149. Australian Government, 1994, Commonwealth commission of inquiry, Shoalwater Bay, Capricornia Coast, Queensland - Final report. Australian Government Publishing Service, Canberra, Australia.

150. Australian Heritage Commission, 1980, Shoalwater Bay Area. Register of the National Estate.

151. Department of Sustainability Environment Water Population and Communities (SEWPaC), 2013, Lowland Rainforest of Subtropical Australia in Community and Species Profile and Threats Database, Department of Sustainability, Environment, Water, Population and Communities, Canberra. http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=101&status=Critically+Endangered. Accessed 20/02/2013.

152. Australian Government, 2010, Managing our coastal zone in a changing climate: the time to act is now. Australian Government Response to House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts House of Representatives Committee Report.

153. Department of Environment and Heritage Protection (DEHP), 2010, State of the Environment Queensland 2011 Report – Chapter 6 Responses, <http://www.ehp.qld.gov.au/state-of-the-environment/report-2011/pdf/responses.pdf; Last accessed 25 October 2013>.

154. Biddle, T. M., Boyle, M.,and Limpus, C. J., 2011, Marine wildlife stranding and mortality database annual report 2009 and 2010. Dugong. Conservation Technical and Data Report 2010 2, 1to59.

155. Biddle, T. M.and Limpus, C. J., 2011, Marine wildlife stranding and mortality database annual reports 2005–2010. Marine Turtles. Conservation Technical and Data Report 2010 1, 1-124.


# Appendices

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