An analysis of key governance domains affecting environment outcomes and their social and economic consequences in the Great Barrier Reef: Core data tables

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Please note that this document is an updated version of the 2016 document with the score index in Table 1 on p. 3 reversed to reinforce the notion of risk.

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TABLE OF CONTENTS

TABLE OF FIGURES

OVERVIEW

The intended outcomes of governance for the Great Barrier Reef (GBR) are made clear in the Reef Long Term Sustainability Plan (LTSP). At its broadest level, the vision for future outcomes in the GBR under the LTSP is *"to ensure the Great Barrier Reef continues to improve on its Outstanding Universal Value every decade between now and 2050 to be a natural wonder for each successive generation to come*" (Commonwealth of Australia, 2015). The Plan goes on to outline a range of quite specific water quality and reef health targets that it intends to achieve by 2050. This vision and associated outcomes are broadly agreed across the Australian and Queensland Governments and among key sectors with GBR interests. These outcomes are also implicitly supported internationally through recent decisions regarding the future status of the GBR taken by the United Nations Educations, Sciences and Cultural Organization (UNESCO, 2015).

This document consists of a number of rapid assessment tables that examine the risk of systemic failure of key governance domains and subdomains that majorly influence outcomes in the GBR. In doing so, we apply the Governance Systems Analysis (GSA) framework tested in Dale et al. (2013). Table 3 provides a description and summary of the results of all the rapid assessments contained in this document. The rapid assessment tables below are organised based on their alignment with the overarching governance themes of Economic Development, Social Development, and Environmental Management. Within all themes, some governance domains are broken down into more distinct subdomains. Most rapid assessment tables in this document describe and assess the governance systems within domains and subdomains in the Environmental Management Theme.

Each rapid assessment table consists of a short description of the domain or subdomain, followed by the identification and explanation of the key structural and functional components of each. Based on this, the likelihood and consequences of each domain's or subdomain's governance system failing are identified. Each table also consequently contains a score for the likelihood of systemic failure and the consequence of systemic failure. Finally, a cumulative risk rating is then derived from the multiplication of each of the aforementioned scores. The rapid assessment tables conclude with the identification of possible or suggested areas for governance reform.

The standardised scores described in Table 1 and Table 2 are used throughout this document to indicate the likelihood and consequences of systemic failure of the governance system. The use of standard criteria enables benchmarking of the target governance system over time and

repeatability of the assessment/s. The multiplication of the likelihood and consequence scores provides an indication of the risk of failure of the governance system being analysed.

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Table 1. Scoring system for likelihood of system failure

Indicative score	Description
1	The governance system is **highly functional**. The governance system is in excellent overall health and will not fail to deliver its intended system outcomes.
2	The governance system is **functional**. The governance system is in good overall health and is not likely to fail to deliver its intended system outcomes.
3	The governance system is **somewhat functional**. The governance system is on a knife's edge and could fail or succeed to deliver its intended outcomes.
4	The governance system is **poorly functioning**. The governance system is in poor overall health and is likely to fail to deliver its intended system outcomes.
5	The governance system is **dysfunctional**. The governance system is currently unable to deliver its intended outcomes.

Table 2. Scoring system for consequences of system failure

Indicative score	Description
1	Failure of the domain or sub-domain will have **no consequence** for overall system outcomes
2	Failure of the domain or sub-domain will have **limited consequences** for overall system outcomes
3	Failure of the domain or sub-domain will have **consequences of concern** for overall system outcomes
4	Failure of the domain or sub-domain will have **significant consequences** for overall system outcomes
5	Failure of the sub-domain will have **catastrophic consequences** for overall system outcomes

Table 3. Colour code for combined ratings

Combined rating	Colour code
1-5	
6-10	
11-15	
16-20	
21-25	

Table 4. Outputs from a rapid risk analysis of the coastal governance system as it relates to the Great Barrier Reef

Subdomain	Subdomain descriptor	L*	C*	R*	Rating justification
ECONOMIC THEME					
ECONOMIC AND INFRASTRUCTURE POLICY DOMAIN					
Australia's economic policy	Like most nations, Australia has a macro-economic policy based on continuous economic growth. This does not fully recognise limits to the productivity of natural systems or the value of ecosystem services.	3	4	12	Even under continuous growth models, given a strong regulatory framework for environmental management, progressive threats to coastal/reef ecosystems will be slow to build. The system is in-part self-regulated by natural economic cycles.
Australia's infrastructure planning	Australia currently has a strong national and state focus on infrastructure development. In the GBR, shared infrastructure priorities currently include coastal and inland highways and priority ports. Frameworks for enhancing private sector investment in infrastructure are also emerging.	3	2	6	A new focus on infrastructure development can be expected in GBR catchments. Environmental regulation will guide developments away from critical coastal ecosystems, but subdomain capacities for innovative environmental solutions are marginal. Limited areal extent of development will minimise consequences.
Northern Australian development	Australia's national and state approaches to facilitating northern development have experienced a revival since 2013 with the release of bipartisan policy commitments. While it is assumed environmental impacts will be managed under current systems, constraints on the expansion of agriculture are not envisaged in GBR catchments.	4	4	16	Australian and State policies on northern development make reference to ensuring environmental standards, and all new development will operate under existing planning/impact assessment systems. This does not recognise cumulative impacts. Without these reforms, expansions in agriculture/aquaculture could have major consequences for water quality, particularly in the northern GBR.
LAND USE PLANNING AND IMPACT ASSESSMENT DOMAIN					
Regional land use planning	Regional land use planning in Queensland previously operated under the Queensland *Planning for Queensland's Development Act 2014.* The Act is currently being reformed to better resolve economic and environmental conflict, but the primary focus is to set a broad regional vision and to deliver clear local land use plans/urban footprints to facilitate investment.	4	4	16	Regional land use plans are variable across the GBR coast. There is a weak focus on plan development, and plans to date have not built strong mobilising frameworks and Treasury support for implementing agreed regional strategies. New reforms are currently seeking to secure economic, social and environmental outcomes rather than to just facilitate economic development as it primary goal.
Local government planning	Corporate and Community Plans (*Qld Local Government Act*) and Local Planning Schemes (under the soon to be reformed *Planning for Queensland's Development Act 2014*) have been important drivers of land use in the GBR.	3	4	12	Council land use planning systems are stable and have a long heritage. Community Plans are in their infancy and are no longer required, reducing local ownership. The quality of planning depends on the capacity and stability of GBR Councils.
Major development project assessment	This domain represents and forms the Australian (*Environment and Biodiversity Conservation Act*) and State Government (*State Development and Public Works Organisation Act*) Ministerial call-in powers for significant infrastructure and development projects.	4	4	16	There is tension between State/Commonwealth systems for approving major projects, with both based on different purposes. Improvements are being negotiated but failures in this subdomain could lead to cumulative coastal impacts *and* may threaten the attraction of economic capital into reef catchments. Commonwealth third party appeal rights are under review and may be reduced.
Ecosystem service delivery (offsets)	An emerging but fragmented market for ecosystem services is evolving, initially via voluntary markets, Australia's Direct Action Policy (carbon) and regulated offsets under several pieces of State and Commonwealth legislation. The regulated carbon offsets market is potentially a major strategic opportunity for the repair of GBR catchments in the shorter term.	4	5	20	A coherent market framework for ecosystem services across GBR catchments could deliver substantive rehabilitation of coastal ecosystems/land use practices. The over-arching policy framework for potentially harnessing these markets is weak. This subdomain has potentially major positive consequences in the GBR if developed in a strategic fashion. Alternatively, it represents a lost opportunity.

Subdomain	Subdomain descriptor	L*	C*	R*	Rating justification
AGRICULTURAL DEVELOPMENT DOMAIN					
Property planning and management	Property-scale planning and management or best management programs, if driven by well-supported property owners and managers, are one of the keys to delivering landscape outcomes in the GBR based on agreed regional goals.	4	4	16	There is no one clear framework for property management planning and no consistent approach that enables a strong link between on-ground action and regional landscape priorities. There are potentially significant consequences from failure as land area affected covers much of the GBR catchment.
Support for farms/small businesses	There remains no clear framework for support for farms/small businesses as it relates to the health of the GBR coastal zone. A range of fragmented government, commercial, industry and not-for-profit services exist.	3	3	9	A policy shift to market-based farm support and extension services two decades ago has not been replaced by commercial services, though a reasonable range of services exist. The consequences of system failure are important but not highly significant due to their implications for extensive pollution across the GBR
TOURISM DEVELOPMENT DOMAIN					
Tourism industry	Tourism contributes significantly to the GBR economy. The GBR is described as Queensland's 'greatest natural tourism advantage' and is actively promoted to visitors by Tourism and Events Queensland, Tourism Australia, and a plethora of tourism activity/business operators.	3	4	12	The GBR tourism industry is well governed but potentially negative international press about declining health of the GBR could have big impacts on the industry. The consequences of any failure of the governance of the industry would be highly significant because of the regional economy's high dependence on GBR tourism.
SOCIAL DEVELOPMENT THEME					
EDUCATION SYSTEM DOMAIN					
School-based education	The Australian education system is funded by Australian and Queensland governments and monitored via bilateral policy frameworks. Schools work to a national curriculum alongside university and vocational development.	3	4	12	The Australian school-based educational system does not adequately provide the necessary skills in civics and critical analysis of major dilemmas facing society. Society-wide awareness and preparedness for action, however, is significant to long-term health of the coastal zone affecting the GBR.
ENVIRONMENTAL MANAGEMENT THEME					
CLIMATE CHANGE MANAGEMENT DOMAIN					
Greenhouse gas emission management	Via the UN Framework Convention on Climate Change, slow progress is being made towards a global system for reducing greenhouse gases. Australia's current focus is on incentive approaches without a regulated foundation.	4	5	20	The current international system is still represents a far from cohesive framework for global action. The consequence of failure could be catastrophic via increased coral bleaching, sea level rise, increased cyclonic intensity and ocean acidification.
FISHERIES DOMAIN					
Commercial fisheries subdomain	Commercial fisheries are managed both by Australian (export requirements using national sustainability guidelines) and Queensland Governments (applying input and output controls as part of a formal plan).	3	4	12	Subdomain governance is quite mature though there would be major adverse consequences if governance deteriorated. More than 30% of the Marine Park is free from fishing and more than 60% is free from specific types of fishing (e.g. trawling).
Aquaculture	Queensland's aquaculture industry is small comparative to other Australian states, and consists predominantly of land-based barramundi and prawn farming in the GBR coastal zone. The regulatory controls and approvals for the aquaculture industry are particularly complex compared to other states.	3	4	12	Governance arrangements are fragmented and poorly integrated. However, as the subdomain has been highly regulated, failure of the governance system is unlikely to be devastating to the GBR, but will have major economic implications for the aquaculture industry and local communities. It is a significant subdomain, however, as poor development could have major implications for the health of the GBR.
Recreational fishing	Recreational fisheries in the GBR are managed through the State (by regulation), and in part through the GBR Marine Park Zoning Plan.	2	4	8	Strong policy/regulatory foundations and community support for recreational fishing suggests governance in this subdomain is not likely to fail. Any failure in the system would have significant ecological and social impacts on GBR values.

Subdomain	Subdomain descriptor	L*	C*	R*	Rating justification
WATER AND VEGETATION DOMAIN					
Water allocation/ management subdomain	Water allocation plays out at the Queensland scale. The State controls the allocation of water assets and the Australian Government provides overarching leadership on water issues of national significance.	2	3	6	Queensland has been progressive in water governance, planning and management, though the State is reviewing its regulatory framework. Poor management is unlikely but systemic failure could lead to reductions in water quality, environmental degradation, and economic losses in areas reliant on water.
Water quality planning and management	Environmental flows under the *Qld Water Act* have water quality implications, but point source discharge is managed via the State's *Environmental Protection Act.* Diffuse agricultural sources are regulated under the reef-specific regulations, while the Commonwealth invests in regional approaches to Water Quality Improvement Plans. The Australian Government's Reef Rescue Program delivers significant incentives.	2	4	8	Water allocation and the management of point source pollution are mature areas of regulation which are now being complemented with the new reef regulations and Water Quality Improvement Plans. More effort is needed to continue to invest in delivery aspects of water quality improvement. Failure of this system would have significant implications for reef health and the economic viability of agriculture.
Pesticide regulation/ management	The Australian Pest and Veterinary Medicine Authority (APVMA) manages the registration of pesticides for use and Australia is a signatory to international conventions.	3	4	12	This subdomain, while mature is not water quality focussed, and failure would have major consequences because of known impacts of excess chemicals on reef health. GBRMPA has developed water quality guidelines for several pesticides in the GBR.
Vegetation planning and management subdomain	Broad-scale vegetation management (and carbon emissions from tree clearing) across the GBR landscape is broadly managed through the lens of the Qld *Vegetation Management Act.* Policy uncertainty exists in the further protection of carbon emission and high value vegetation in GBR catchments.	4	4	16	Lack of bipartisan commitment to a form and approach to vegetation management in high value ecosystems and reef catchments could see this once stable subdomain become fragile. The subdomain has significant implications for ecological health, short term sediment movement and carbon emissions within GBR catchments.
COASTAL PLANNING, SHIPPING AND INFRASTRUCTURE DOMAIN					
Coastal planning	The *Coastal Management Act* in Queensland was intended to reduce development pressure on the coast. Regional Coastal Plans were recently withdrawn and the coastal plan provisions codified at State level. New coastal planning legislation is however, being drafted.	4	3	12	Regional Coastal Management Plans have had limited impact on controlling the drivers or impacts of coastal zone growth. There is no clear framework for implementation of non-regulatory identified actions. Consequent risks could have implications for land use, ecosystem heath and the quality to catchment discharge.
Coastal infrastructure planning	The *Queensland Coastal Plan* previously described acceptable forms of maritime infrastructure in coastal areas, and specified that structures can only be erected on State land where there is a public need to do. Most reef relevant coastal infrastructure is assessed via the *GBR Marine Park Act*.	3	3	9	Strategic planning for coastal infrastructure has become a priority for government in recent years given the increase in resources sector activity, however many of the mechanisms to support such planning are in their infancy. There is a strong project-based regulatory culture. Managing cumulative impact is a risk facing the system.
Ports Planning	The *Queensland Sustainable Ports Development Bill* is aligned with the National Ports Strategy and requires master plans for Priority Port Development Areas (PPDAs). The *Queensland Ports Strategy* declares Gladstone, Hay Point/Mackay, Abbot Point, and Townsville as PPDAs.	3	3	9	A new focus on a higher level strategy on port location and master planning could mean a more stable approach to managing development impacts. Port plans are undertaken in a well-defined and structured way but fail to consider cumulative impacts. More can be done exploring innovative solutions to managing dredge spoil.
Other coastal infrastructure management	Many local coastal infrastructure facilities (e.g. groynes, jetties, marinas, canals) are owned and managed by Councils and/or private operators. Approval and management is well regulated.	2	2	4	This subdomain is well regulated/monitored, generally at local scale. The consequences of system failure are localised. Assets installed prior to modern legislation can leave legacy impacts on the function of coastal ecosystems.
Sewage treatment	Following significant State, Federal and Council investment over the last decade, most major sewage systems have been upgraded to tertiary level. Withdrawal of State subsidies is affecting upgrades.	3	3	9	Upgrades of infrastructure and progressive asset management and innovation are continuously improving. System failure can have consequences for nutrient pollution locally, especially when combined with rapid population growth.

Subdomain	Subdomain descriptor	L*	C*	R*	Rating justification
Maritime safety	Shipping in the GBR is managed under the UN Convention of the Laws of the Sea and roles and responsibilities are clear. The GBR is classified as one of the few Particularly Sensitive Sea Areas worldwide.	2	3	6	The GBR shipping management system is efficient with continuous monitoring. However, most shipping incidents in the last two decades have been human error and while unlikely, the consequences can be locally catastrophic.
LARGE PELAGIC SPECIES DOMAIN					
International whaling	Whaling is managed under two multinational instruments that address whaling in national and international waters. There is an international moratorium in place on commercial whaling.	1	4	4	Whaling has been banned in Australian waters since the 1960s and humpback populations have recovered by 50%. Interactions with humans (i.e. entanglement in shark nets) are becoming frequent. While the governance system has stabilised, systemic failure could result in quick returns to unsustainable populations.
Turtle/ dugong management	The six species of marine turtles in the GBR are all listed as threatened and are protected under Australian and Queensland legislation. Recovery plans and a Biodiversity Conservation Strategy have been developed for the GBR.	4	4	16	Globally significant breeding sites exist in the GBR for 4 turtle species. Some species are in recovery, though a decline in seagrass and extreme weather have seen unprecedented dugong deaths. Lack of international action remains a concern.
REEF MANAGEMENT DOMAIN					
Long Term Sustainability Plan	The Australian and Queensland Governments have agreed to a strong bilateral approach to halt and reverse the decline of water quality in the reef lagoon under the bilaterally agreed LTSP and the Reef Water Quality Plan.	4	4	16	Reef Planning has a strong (but embryonic) framework for intergovernmental/actor partnerships. It is being revitalised via new implementation arrangements, inclusive of a wider range of threats. There is less focus on strategy/delivery and this could undermine the achievement of LTSP targets. Ongoing decline in water quality, however, would have big impacts on GBR resilience.
Reef Trust	In 2013 the Australian Department of the Environment proposed a $40 million Reef Trust as part of their emerging LTSP. The Reef Trust is intended to provide and grow the availability funds for projects that will improve the water quality and coastal habitats in the GBR.	4	4	16	The successful establishment of Reef Trust could bring substantial resources to cohesive on ground works in GBR catchments. The current model, however, is in its infancy and is far from a bilateral approach. Failure of the model would represent a loss of future opportunity, significantly impacting on Plan target achievement.
GBR Marine Park	The *GBR Marine Park Act* underpins planning/regulation of the World Heritage Area, regulating reef tourism, some fishing and other uses. While significantly affected by coastal and climate-related subdomains, it has limited influence on them; a task now falling to the *LTSP Subdomain*.	2	4	8	This subdomain has been stable, with several progressive advances over recent decades, including tourism regulation, green zones traditional owner agreements. Overuse of GBR assets is not the risk once posed. However, this subdomain has limited influence over bigger subdomains that impact upon it (e.g. coastal/climate).
Reef regulation	The *Qld Reef Protection* Act, focussed on sugar farming communities, is now shifting towards industry-based best-practice management.	3	3	9	The formation of the *Reef Protection Act* led to conflict between industry and conservation sectors. Failure of the legislation would likely have few consequences because of existing frameworks for improvement of industry practices.
INDIGENOUS PEOPLE AND COUNTRY DOMAIN					
Traditional sea country management	Traditional lore governs use by indigenous communities of coastal resources of GBR significance (e.g. dugong/turtles). Traditional Use and Management Resource Agreements (TUMRAs) have been developed and many traditional owner groups drive their own approach to country-based planning.	4	3	12	Traditional owner institutions related to land and sea management can be limited in their capacity to effectively manage key resources such as turtle and dugong. Fragmentation in Government support limits management capacities with implications for catchments and some iconic reef species.
COMMUNITY-BASED NRM AND CATCHMENT MANAGEMENT DOMAIN					
Regional NRM planning and delivery	Queensland's Regional NRM planning framework results in the development of regional NRM plans in all major reef catchments, coordinated and reviewed by regional NRM bodies, with significant investment from Commonwealth and State governments to effect plan delivery.	3	4	12	Regional NRM planning has been embryonic, but has delivered significant benefits, resulting in the development and coordinated implementation of a $200M Reef Rescue Program. Early progress is showing reasonable movement towards improved land management, though its influence may be beginning to decline.

Subdomain	Subdomain descriptor	L*	C*	R*	Rating justification
River and drainage management	Three State Acts govern the management of floodplains across the coastal zone. Core objectives relate to economic development/public safety.	4	4	16	There is no clear legislative and management vision for sustainable river /floodplain management of at the GBR scale. Capacities of local River Trusts are limited and subdomain failure contributes to reef pollution.
Voluntary community action	Voluntary community action operates from very local scales to whole catchments and the entire Reef. These groups receive investment through many sources.	3	3	9	The voluntary action sector has continued to grow in size/breadth. Group burnout and effort fragmentation remain governance issues. The sector, however, will remain an important and complementary subdomain.
Landscape rehabilitation delivery	Technical capacities for large-scale restoration of catchments, rivers and estuaries largely reside within the voluntary sector (Landcare groups), Councils (work crews) and the private sector.	3	4	12	Lack of market-driven landscape restoration has restricted subdomain development. Training systems are deficient and emerging delivery capacities often suffer limited financial viability, limiting opportunities for wide-scale system repair.
Estuarine management	The estuarine zone does not have a clear policy framework, but benefits from several specific legislative protections. This subdomain represents a spatial hole in Queensland's formal marine resource management policy framework.	3	4	12	Without a strong coordinative policy/delivery framework, this subdomain runs a risk of failure. As the estuarine zone is an intermediator between catchment and reef systems, the consequences of system failure would be quite significant.
BIOSECURITY DOMAIN					
Terrestrial biosecurity management	Biosecurity arrangements in the GBR cover both marine and terrestrial pests, but focus on terrestrial environments. Commonwealth programs and State regulations set the foundation for pest/weed planning and management.	3	4	12	Australia's biosecurity system has longstanding and continuously improving institutional arrangements, but significant risks of new and serious incursions of terrestrial pests remain, with major catchment-scale implications
Marine biosecurity	There are more than 250 invasive marine species in Australian waters. While many have had a minimal impact on the quality of marine habitats, a small number have had a particularly devastating impact in specific locations, including the Asian Green Mussel and Crown of Thorns starfish in the GBR.	2	4	8	The subdomain is well designed and integrated with other subdomains. Australia's marine biosecurity system appears under-resourced compared to the risks and the vulnerable environmental, economic and social assets. Failure consequences can be regionally significant and potentially catastrophic (e.g. Crown of Thorns).
ENVIRONMENTAL RESEARCH AND DEVELOPMENT DOMAIN					
Reef/coastal research and development	The GBR coast has a strong, well-funded framework for research on key issues (e.g. water quality) via universities and CSIRO. New institutions for research brokerage have emerged in recent years.	2	3	6	This subdomain has been well funded on key issues such as water quality. Resulting knowledge is well integrated with management, including monitoring of reef health. Consequences of system failure would be important in managing GBR ecosystems.

- L = Likelihood rating; C = Consequence rating; R = Combined rating (Likelihood x Consequence).

ECONOMIC DEVELOPMENT THEME

ECONOMIC POLICY DOMAIN

Table 5. Australia's economic policy subdomain

<table>
<tr><td>Australia’s economic policy</td><td colspan="2">Subdomain descriptor: Australia has one of the largest free-market capitalist economies in the world, with a national aspiration for continuous economic growth. Australia’s economy is relatively strong comparative other international economies and was one of few to avoid a recession in the Global Financial Crisis in 2009. The primary economic drivers in Queensland are the mining, agriculture, construction, service and manufacturing industries. The current economic framework does not fully recognise limits to the productivity of natural systems, nor does it systematically apportion costs to maintain ecosystem services.</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
The Australian Government sets the overarching economic policy for the nation with a clear vision for economic growth, though with limited integration of environmental considerations within that frame (Australian Government, 2014).
Investment in economic strategy is generally high, but focusses entirely on facilitating economic growth.
Current economic policy focuses on natural resource development within a defined regulatory framework with some tax resources hypothecated to the environment (Australian Government, 2014).
Australia uses a national financial accounts system to monitor economic activities and to guide the budget. While this system is rigorous and well developed to monitor monetary transactions, it does not acknowledge the economic benefits of environmental values.</td><td>Functional considerations:
There is capacity in the system to set higher level visions and objectives for the Australian economy, however there is a lack of connectivity with the nation’s environment management theme.
The capacity of economic monitoring frameworks to consider environmental values needs greater development.
Environment management domains have a weak role in negotiations at the national scale relative to economic portfolios (Australian Government, 2014).
There is a strong connection between national accounts and vision/strategy development of macro-economic policy but environmental matters are poorly represented (Australian Government, 2014).</td></tr>
<tr><td>Considerations for likelihood of system failure</td><td colspan="2">While securing a healthy natural resource base is crucial for economic stability, this goal is weakly addressed through Australia’s economic policy framework: environmental health and impacts are poorly considered in economic decision-making and feedback mechanisms.
With a focus on economic growth, this subdomain is likely to continue to undervalue the socio-economic importance of reef-based ecosystems.
The existence of a relatively strong but quite disconnected environmental policy and regulatory framework does however, manage the greater impacts from a disconnected economic policy agenda.</td></tr>
</table>

	• In the shorter term, an economic policy domain focussed on economic growth, if environmental impacts remain well managed, is not likely to have extreme impacts on the reef in the short to medium term. • As the potential natural resource limits to economic growth are reached and in the absence of a mechanism to rate the impact of consumption on ecosystem services, system failure is more likely in the longer term. • There are some significant risks that the Australian economy may become insufficiently diversified, leading to a stronger emphasis on extractive industries, high emissions and agriculture in reef catchments. • In the medium term, decline in expansion of the mining sector may reduce the impact of growth on reef ecosystems (Hyam, 2013). • Although there is also some consideration of the economic value of the GBR in relation to the tourism and shipping industry in economic policy settings, there is little recognition or consideration of the economic value of ecosystem services that deliver environmental outcomes in the GBR, increasing the likelihood of system failure in the medium to long term. • Failure to safeguard the natural resource base within the economic system will have an impact on the Australian economy in the long term.	
Likelihood rating	Preliminary Rating **3**	Final Rating **3**
Considerations for consequences of system failure	• In the short to medium term the impacts of system failure are not likely to be substantive, as impacts will be slow onset and locally variable. Even under continuous economic growth models, progressive threats to coastal and reef ecosystems will be slow to build. • The ability to address environmental concerns within the economic policy domain is very significant if core economic reforms recognising environmental assets are eventually institutionalised. • The major impacts of the economic policy domain can be self-regulated by natural economic cycles, reducing pressure on reef ecosystems. A perverse outcome from this, however, would be a decrease in the capacity of the nation to afford reasonable reef protection mechanisms.	
Consequence rating	Preliminary Rating **4**	Final Rating **4**
Combined risk rating	Preliminary Rating **12**	Final Rating **12**
Priorities for reform	• Greater diversification of the Australian economy to reduce the nation's economic reliance on finite extractive resources. • A clearer national focus on defining the limits of resource use for those natural resources contributing to reef health. • Economic tools will eventually be needed to ensure consumption contributes to the payment of ecosystem services. • Need for recognition of environmental values in the national accounts and economic decision-making.	

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Hyam, R. (2013). Australian mining production expected to soar 41 percent in the next five years. Retrieved from http://www.abc.net.au/news/2013-11-11/mining-production-surge-forecast-to-offset-falling-investment/5082052

Table 6. Australia's infrastructure planning subdomain

<table>
<tr><td>Australia’s infrastructure planning</td><td colspan="2">Subdomain descriptor: Australia currently has a strong national and state focus on infrastructure development. At the national level, this overarching process is guided by Infrastructure Australia, focussing major Australian Government budgetary commitments. These commitments’ however, are generally levered through State-level Infrastructure Planning processes. Queensland is currently developing its own State Infrastructure Plan, and this in turn will influence State budgetary commitments to infrastructure. In the context of the GBR, shared infrastructure priorities currently include coastal and inland highways and priority ports but have little relationship to environmentally-oriented land use planning. Improved frameworks for enhancing private sector investment in infrastructure are also emerging.</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
Both the Australian and Queensland Governments have processes for planning and prioritising infrastructure, but this poorly accounts for environmental considerations.
Infrastructure strategy development tends to be focussed on standard rather than innovative strategy solutions with lower costs or environmental impacts.
Major infrastructure is generally well delivered via Queensland Government agencies or Public-Private Partnerships, but often with limited strategic environmental assessment or cohesive impact assessment requirements.
The impact of major infrastructure is well monitored and reported in the justification of expenditure, but there is virtually no environmental components to this form of monitoring and evaluation.</td><td>Functional considerations:
Australia’s infrastructure planning and delivery is well developed at national, state and local scales, but has limited capacity for integration of environmental innovation and impact reductions.
The infrastructure planning and delivery sector is generally poorly connected to environmental innovation systems and sectors.
There is a limited use of strong environmental and social knowledge within this subdomain, limiting the emergence of win-win outcomes in the development of major infrastructure.</td></tr>
<tr><td>Considerations for likelihood of system failure</td><td colspan="2">Australia’s environmental regulatory system will in general guide new infrastructure project development away from environmentally sensitive features and locations in GBR catchments.
Highly innovative solutions to new infrastructure development and revitalisation are not likely within this subdomain.
The quality of environmental design and impact avoidance in the development and operation of major infrastructure is generally limited.
Increasing pressure for infrastructure development in Queensland is likely to increase the risks associated with this subdomain.</td></tr>
</table>

Likelihood rating	Preliminary Rating **NA**	Final Rating **3**
Considerations for consequences of system failure	• In the context of the size of the GBR coast, major new infrastructure developments are not likely to have serious consequences for the GBR. • New pressures for infrastructure development and consequent impacts are likely to continue to place new (but previously low) development pressures in northern GBR catchments. • Ports specific pressures are considered in Ports planning subdomain.	
Consequence rating	Preliminary Rating **NA**	Final Rating **2**
Combined risk rating	Preliminary Rating **NA**	Final Rating **6**
Priorities for reform	• Need greater integration of environmental knowledge and planning capacities to ensure more innovation in infrastructure solutions and improved management of environmental impact from infrastructure.	
References:		

Table 7. Northern Australian development subdomain

<table>
<tr><td>Northern Australian development</td><td colspan="2">Subdomain descriptor: Australia's national and state approaches to facilitating northern development have been long standing, but have experienced a revival since 2013 with the release of significant bipartisan policy commitments on the notion of northern development. The Australian government has recently released a Whitepaper on Developing Northern Australia (Department of the Prime Minister and Cabinet [DPM&C], 2015) which envisages expanded water and agricultural development in the north, including GBR catchments. While it is assumed environmental impacts will be managed under current systems, constraints on the expansion or environmental performance of agriculture/aquaculture are not broadly envisaged in GBR Catchments. Until recently, Queensland Government policy also envisaged doubling agricultural productivity across the State (Queensland Department of Agriculture, Fisheries and Forestry [QDAFF], 2013).</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
The Australian Government sets the clear overarching economic vision and strategy for Northern Australia, though with limited integration of environmental considerations within that frame.
Current Queensland Government specific vision on agricultural development is less ambitious.
Environmental services are marginally recognised as an economic opportunity, and there is some recognition of environmental limits and requirements on development.
Implementation of major and smaller-scale projects will progress through current planning and impact assessment systems, but cumulative impacts bear little consideration.
No frameworks for monitoring the long term economic, environmental and social health of northern Australia are proposed.</td><td>Functional considerations:
As a core economic strategy, there are few key connections to social and environmental policy agenda.
Capacities of Governments to effectively implement Whitepaper strategies are limited and fragmented across multiple agencies.
Capacities for enhancing environmental management outcomes from increased development have not been enhanced.
Environmental and social knowledge has been recognised as important, and it's intended to be integrated through the emerging Northern Australian Collaborative Research Centre (CRC) proposal and National Environmental Sciences Program (NESP) hubs.</td></tr>
<tr><td>Considerations for likelihood of system failure</td><td colspan="2">Multiple constraints on northern development may see modest expansions of agriculture in GBR catchments.
New agricultural and other developments still need to meet Australian planning and environmental regulations.
New innovations in agriculture and supply chains may mean breakthroughs in increased agricultural production.</td></tr>
</table>

Likelihood rating	Preliminary Rating **NA**	Final Rating **4**
Considerations for consequences of system failure	• If a major expansion of agricultural development were to occur in the GBR, then this could have considerable consequences for the achievement of current reef water quality. • Current planning and impact assessment processes are not cohesive enough to consider the cumulative impact of agricultural and aquacultural development in GBR catchments. • Agricultural expansion in northern GBR catchments could have particularly big consequences in relatively healthy reef areas.	
Consequence rating	Preliminary Rating **NA**	Final Rating **4**
Combined risk rating	Preliminary Rating **NA**	Final Rating **16**
Priorities for reform	• Increase the quality of strategic regional land use planning in agricultural development in GBR catchments to guide development to the best possible locations. • Ensure best practice agricultural and aquacultural development standards and continuous improvement are a requirement of industry expansion in GBR catchments. • Explore the opportunities for best practice aquacultural development (with systems repair work) to replace less viable agricultural operations.	

References:

Department of the Prime Minister and Cabinet. (2015). *White paper on the development of northern Australia*. Canberra: Department of Prime Minister and Cabinet. Retrieved from http://northernaustralia.dpmc.gov.au/

Queensland Department of Agriculture, Fisheries and Forestry (2013). *Queensland's agriculture strategy: A 2040 vision to double agriculture, fisheries and forestry.* QDAFF, Brisbane. Retrieved from http://www.burdekin.qld.gov.au/wp/media/downloads/2014/07/Queenslands-Agriculture-Strategy.pdf

LAND USE PLANNING AND IMPACT ASSESSMENT DOMAIN

Table 8. Regional land use planning subdomain

<table>
<tr><td>Regional land use planning</td><td colspan="2">Subdomain descriptor: Until recently, regional land use planning in Queensland operated under the Queensland Sustainable Planning Act 2009. The Sustainable Planning Act 2009 was, until recently, been Queensland's principal planning legislation and it set out the regulatory framework through which planning was coordinated at the local, regional and state level (Environmental Defenders Office [EDO], 2012). In 2014, the Planning and Development Act replaced the Sustainable Planning Act 2009 as part of State Government's planning reforms (Department of State Development Infrastructure and Planning [DSDIP], 2014a), simplifying and streamlining the core regulatory provisions and guidelines for development in Queensland (DSDIP, 2014b). The Regional Planning Interests Act 2014 is another legislative instrument introduced as part of those reforms, and this aimed to resolve competing land use issues in regional areas (DSDIP, 2014a). This entire framework is now being reviewed again, and will likely enhance the role of regional land use planning in resolving environment, social and economic conflicts.</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
Regional land use plans are statutory instruments created by the State to articulate the visions and objectives for specific regions.
Regional Plans in GBR catchments currently do not have strong statutory power, following the repeal of the State Planning Regulatory Provisions in 2012.
The Sustainable Planning Act 2009, originally required all Local Government planning schemes to be aligned with the visions and objectives contained within regional plans (DSDIP, 2014c).
Development assessment at the local scale is informed by the State's overarching vision and objectives for the region, including State Planning Policies (SPPs) and regional land use plans.
Queensland's regional plans are currently able to be reviewed by the State every 5 years.
Regional plans in Queensland can be regulatory or voluntary, meaning some regions rely much more on suasive instruments to achieve desired regional outcomes.
Monitoring frameworks for statutory regional planning are</td><td>Functional considerations:
Structured negotiation between all stakeholders in regional plans are piecemeal and currently do not have a clear impact on planning.
The State has capacity to support regional planning, but, regional/local institutions are often better placed to inform planning at regional scale.
There is a high capacity in research institutions to support regional planning, and adequate levels of social, environmental and economic data to inform decision-making, but this is poorly linked to planning outcomes.
Local government tends to be responsible for implementing regional land use controls via planning schemes, however their capacity depends on available resources.
Generally State and Local government data sets inform semi-regular updates and improvement in planning.
Connectivity between the research sector and State agencies is fragmented, with limited involvement in the review and</td></tr>
</table>

	currently non-adaptive and generally weak.	efficiency of land use planning arrangements.
Considerations for likelihood of system failure	• The regulatory framework for land use planning in Queensland is mature and highly integrated but currently undergoing major reform. • There is a considerable disconnect between regional planning, local planning and cohesive coastal planning and GBR management. • Current regional planning arrangements are far from adaptive and are not based on the achievement of clear GBR outcomes. • The review of the *Planning for Queensland's Development Act 2014*, intended to improve environmental outcomes from the planning process, but it is still unclear how these changes will affect the regional planning process and GBR outcomes.	
Likelihood rating	Preliminary Rating **4**	Final Rating **4**
Considerations for consequences of system failure	• Regional land use plans are not in place across the Reef coast and effect land use outcomes to varying extents. • While there is a strong focus on plan development, plans to date have not built strong mobilising frameworks and Treasury support for the implementation of agreed strategies to affect GBR outcomes. • The new Queensland Government aims to revitalise regional statutory planning, and with a stronger environmental management focus. • Coastal development is considered as one of the most significant risks to maintaining the resilience of reef ecosystems (GBRMPA, 2014).	
Consequence rating	Preliminary Rating **4**	Final Rating **4**
Combined risk rating	Preliminary Rating **16**	Final Rating **16**
Priorities for reform	• Need for greater Federal, State and regional consensus on regional land use planning with a stronger focus on reef protection and equally creating security for economic investment. • Regional land use planning needs to be more actively implemented and adaptively managed based on evidence and wider engagement.	

References:

Department of State Development Infrastructure and Planning. (2014a). *RegionsQ Framework*. Brisbane: Department of State Development, Infrastructure, and Planning.

Department of State Development Infrastructure and Planning. (2014b). *New Planning for Qld's Development Act - Where we are at?* Brisbane: Queensland Government.

Department of State Development Infrastructure and Planning. (2014c). *Local government planning schemes*. Retrieved from http://www.dsdip.qld.gov.au/local-area-planning/local-government-planning-schemes.html

Environmental Defenders Office. (2012). *Introduction to Sustainable Planning Act 2009 (Qld).* Brisbane: Environmental Defenders Office Queensland.

Great Barrier Reef Marine Park Authority. (2014). *Great Barrier Reef Outlook Report 2014*. Townsville: Great Barrier Reef Marine Park Authority.

Table 9. Local government planning subdomain

<table>
<tr><td>Local government planning</td><td colspan="2">Subdomain descriptor: Corporate Plans (Local Government Act 2009) and Local Government Planning Schemes are important drivers of land use and management in Queensland. The Queensland Planning and Development Act 2014 ceded the power of managing localised land use and development from the State to local governments (Councils) in (England, 2011). The system contains provisions and statutory requirements for local government planning schemes and their preparation, how development applications must be processed (Integrated Development Assessment System), definitions of key terms such as ‘development’, and appeals to the Planning and Environment Court (Department of State Development Infrastructure and Planning [DSDIP], 2014a; Environmental Defenders Office [EDO], 2012). Planning schemes are used by development assessment planners in local councils to make decisions surrounding whether developments proposed in their city/region are desired, undesired, or need to meet a set of conditions to be considered appropriate. Proposed developments that meet the conditions already recognised as desirable in the planning scheme are likely to be approved, while others may require greater consideration or conditioning. As of 2013, development applications previously made under the Sustainable Planning Act 2009 that require State agency referrals are now lodged and assessed through the State Assessment and Referral Agency (SARA). New additional reforms to the current system have been described in Table 7.</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
Local Governments establish visions and objectives for the future of their local government area and must align their visions/objectives and subsequent strategies with higher level aspirations contained within regional plans and State Planning Policies (DSDIP, 2012).
Community planning is no-longer mandatory in Queensland, though Corporate Planning remains important in this subdomain.
SARA approval coordination is aligned with regional plans and Local Government schemes.
There is a high reliance on demographic modelling, mapping, and scenario testing to inform strategy development.
The quality of monitoring frameworks varies across local governments depending on available resources/political will.
Planning schemes are reviewed every 10 years to ensure their ongoing relevancy and consistency</td><td>Functional considerations:
Vision-based bargaining and negotiation frameworks are varied in quality/application across the State, with most local government’s undertaking a basic consultation and engagement.
Plan consultation is variable, but tends to be piecemeal.
There is a high level of connectivity between planning schemes and other planning policies in Queensland, largely because the regulatory nature of planning schemes seeks a high degree of consistency with other State and Australian Government policies.
Local government planning capacity is often limited and tends to focus on the vision/objective setting and strategy development, rather than implementation or monitoring. This has led to the monitoring systems often being weak and fragmented.</td></tr>
</table>

	with Queensland Planning Provisions (QPPs) (DSDIP, 2014a).	
Considerations for likelihood of system failure	• The legislative foundations for local government corporate planning are strong, but practices are variable. A general retreat from Community Planning has perhaps weakened community engagement opportunities. • The regulatory framework for local land use planning in Queensland is currently undergoing major reform involving numerous policy instruments at the local, regional and state scales. • The *Planning and Development Act 2014* intended to reform the planning process by increasing 'certainty, clarity and confidence' in the planning process (DSDIP, 2014b). It is still unclear how these changes will affect local planning processes and a review is also under way. • Local government land use planning frameworks are relatively mature and are strictly regulated through planning legislation. • Local land use planning frameworks are highly integrated with policies and legislation at other scales in Queensland. • Council land use planning systems are very stable in that they have a long heritage, but Community Plans are only in their infancy and no longer required to drive community input into planning. • The quality of local government planning depends strongly on the (variable) capacity and stability of Councils. The regulatory framework for land use planning in Queensland is mature and highly integrated with numerous policy instruments at the local, regional and state scales. • Current SARA coordination parameters are fairly rigorous but under-resourced, and requirements for referrals have been criticised for being too onerous for developers and referral agencies.	
Likelihood rating	Preliminary Rating **3**	Final Rating **3**
Considerations for consequences of system failure	• Coastal development is considered as one of the most significant risks to maintaining the resilience of reef ecosystems (GBRMPA, 2014).	
Consequence rating	Preliminary Rating **4**	Final Rating **4**
Combined risk rating	Preliminary Rating **12**	Final Rating **12**
Priorities for reform	• There is a need for greater Federal, State and regional consensus on regional land use planning to lead local planning with a stronger focus on reef protection and creating security for economic investment. • Local use planning needs to be more actively implemented and adaptively managed based on scientific evidence and engagement. • Increasing the capacity of Local Governments to undertake land use planning that are currently poorly equipped to deliver a comprehensive planning scheme or balance the social, environmental, and economic needs and aspirations of their communities. • The SARA process could be further streamlined to increase its efficiency in delivering timely assessments of development applications.	

References:

Department of State Development Infrastructure and Planning. (2012). Planning schemes. Retrieved from http://www.dsdip.qld.gov.au/integrated-planning-act/planning-schemes.html

Department of State Development Infrastructure and Planning. (2014a). Local government planning schemes. Retrieved from http://www.dsdip.qld.gov.au/local-area-planning/local-government-planning-schemes.html

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Table 10. Major development project assessment subdomain

Major development project assessment	**Subdomain descriptor:** Major development projects have the potential to significantly impact on coastal ecosystems and the Great Barrier Reef environment (GBRMPA, 2014). These projects are assessed via Australian (*Environment and Biodiversity Conservation Act*) and Queensland Government (*State Development Act*) ministerial call-in powers for significant projects.	
Governance health analysis	**Structural considerations:** • The vision for the subdomain is divided between environment protection (Australian Government) and economic development (Queensland Government). • A lack of shared frameworks for vision and target setting, decision making and monitoring has led to IUCN concern, and two separate but linked strategic assessment processes under the *Environment Protection and Biodiversity Conservation Act*. • Strategic vision setting for the operation of this subdomain is limited because as key legislative frameworks are now becoming anachronistic as new bilateral reform negotiations emerge. • There is no shared vision or clear framework for development in the coastal zone or for cumulative impact assessment of development projects (Department of Environment and Heritage Protection [DEHP], 2013). • Major projects often have strong strategy development component and implementation frame through their private or government proponents. • Both Queensland and Australian Government project assessment requirements are relatively clear, though negotiation frameworks for offsetting require greater clarity and consistency. • Major project monitoring and compliance systems are quite weak, and often not well engaged with affected communities (DEHP, 2013; Grech et al., 2013).	**Functional considerations:** • There is current disharmony between major project assessment by the Australian and Queensland Governments, which seek different outcomes. This is being resolved through bilateral approvals negotiations. • The Commonwealth is currently looking to diminish third party appeal rights with respect to *EPBC Act* decision making (Dale, 2015). • Expectations about major project assessments is increasingly being clarified and negotiated. • There can be poor alignment of assessment timelines set by the Australian and Queensland Governments, leading to reduced investor confidence. • Regular staffing turnover can cause capacity problems with alignment of Australian and Queensland Government visions for project assessment. • Capacity of participating sectors can often be weak at implementation scales (e.g. rural sector, environment sector, etc.). • Local government capacities to manage local impacts can be weak. • Social impacts of developments are under-assessed in project development and assessment (Dale et al., 2002). • The research sector is not engaged in a structured way with arrangements for major project monitoring and review. • An understanding of impacts is generally based on incomplete knowledge of environmental values and without contextual links to wider pressures or trends.

	• There is no research and development framework or shared strategy development for continuous improvement in this sub-domain (Zafrin & Rosier, 2011).	
Considerations for likelihood of system failure	• Currently extensive development of major projects on the Queensland coastline is affecting the coastal region while high commodity prices continue, although the Queensland and Australian Governments are looking to considerably rationalise governance processes in this domain. • The system is having difficulty effectively negotiating through environmental, social and economic conflicts, reducing support for environmental outcomes. • Currently there is much strategic tension between the Australian and Queensland Government systems, and better alignment required between Australian and Queensland Government Strategic Assessments. • There are currently poor project monitoring frameworks with limited research relationships and this poses a high risk for system failure (Grech et al., 2013).	
Likelihood rating	Preliminary Rating **4**	Final Rating **4**
Considerations for consequences of system failure	• Failures in the assessment of major projects could have significant regionalised consequences for estuarine and seagrass ecosystems. • Major uncertainties in current assessment frameworks for major projects could significantly discourage economic investment, with consequent economic and social impacts in the GBR region. • Proposed reductions in third party appeal mechanisms under the EPBC could significantly undermine accountability in this subdomain.	
Consequence rating	Preliminary Rating **4**	Final Rating **4**
Combined risk rating	Preliminary Rating **16**	Final Rating **16**
Priorities for reform	• Explore the potential of a combined framework for further developing strategic and project assessment in reef catchments and consider economic, social and environmental outcomes from a variety of development scenarios. • The Australian Government could consider greater regionalisation of its assessment capacities for major projects and place more focus on securing successful devolution of the assessment process within agreed standards • A stronger framework for cumulative impact assessment should be developed jointly by the Commonwealth/Queensland Governments in their Strategic Assessment processes. • Standing and jointly agreed capacity should be developed for a reef-wide approach to independent monitoring and engagement around major projects, with strong regionalised nodes.	

References:

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Table 11. Ecosystem service delivery (Offsets) subdomain

<table>
<tr><td>Ecosystem service delivery (Offsets)</td><td colspan="2">Subdomain descriptor: An emerging but fragmented market for ecosystem services is evolving, initially via the voluntary market, but also including regulated offsets under several pieces of Commonwealth and State legislation. A regulated national carbon offsets market is emerging though the nation's Emissions Reduction Fund. Regulated environmental offsets are used in Australia to counterbalance the loss of environmental value during development. Nationally, offsets may be required under the Environmental Protection and Biodiversity Conservation Act 1999 and are administered through the Reef Trust (Department of Environment and Heritage Protection [DEHP], 2013). In Queensland regulated environmental offsets are administered as per the Queensland Government Environmental Offsets Policy (DEHP, 2013; Environmental Protection Agency [EPA], 2008). This happens in accordance with the Planning For Queensland's Development Act, Marine Parks Act 2004, Nature Conservation Act 1992, Environmental Protection Act 1994, and the State Development and Public Works Act 1971 (DEHP, 2013; EPA, 2008). An Environmental Offsets Bill was expected to be in place by mid-2014 to provide a single environmental offsets framework for Queensland (DEHP, 2014).</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
International voluntary markets for environmental offsets are emerging without a clear unifying vision.
New opportunities under the Commonwealth Emissions reduction fund are also emerging but without a clear Reef specific vision (Losee, 2015).
There is little alignment between the Australian Government and State Government visions and objectives for ecosystem service delivery and offset management.
The Queensland Government Environmental Offsets Policy is aligned with Federal and Local Government policies, programs and management strategies.
Reef Trust is emerging to coordinate the delivery of national offsets.
Regional NRMs have helped to facilitate offset development in the field. Some landholders and organisations choose to participate voluntarily in offset programs for biodiversity and carbon.
Only a limited number of organisations or landholders voluntarily engage in non-mandated offsets, while private developers</td><td>Functional considerations:
The State and Australian Governments have significant capacity to set visions and objectives, and develop strategies to promote and regulate offsets, however their capacity to implement such strategies is limited by the lack of a cohesive framework.
The existing regulatory framework is somewhat fragmented; however the Environmental Offsets Bill may improve the framework.
There is increasing engagement of landholders in offsets with the introduction of the Australian Government's Emissions Reduction Fund.
The research sector is generally involved in this domain. They provide the Australian and State Governments with data to support the development of offset strategies.
There is a low level of connectivity between the research sector and landholders/implementers, though there is a moderately strong connection between researchers/decision-makers</td></tr>
</table>

	may be legislatively required to offset clearing or development. • Monitoring and evaluative frameworks were developed in Queensland as part of the 2008 *Queensland Government Environmental Offsets Policy,* and were first applied in 2013, but is yet to deliver its results (DEHP, 2013).	• Capacity to monitor the success of offsets and their success is currently weak.
Considerations for likelihood of system failure	• The current framework for ecosystem service delivery and offsets is relatively under-developed and still evolving, representing and significant lost opportunity for economic development and environmental outcomes within GBR catchments. • Currently the existing framework and offset arrangements are not particularly cohesive and lack clarity. This is, however, improving through policy and the development of the Reef Trust. • Queensland is on the cusp of exploring strategic new approaches to the application of the ERF to landscape scale change in the GBR.	
Likelihood rating	Preliminary Rating **4**	Final Rating **4**
Considerations for consequences of system failure	• A coherent market framework for ecosystem services could deliver substantive reconstruction of the World Heritage Area and coastal ecosystems and reduce pollutant runoff. • The subdomain has much potential for major positive consequences if developed well and will be a serious lost opportunity if not.	
Consequence rating	Preliminary Rating **5**	Final Rating **5**
Combined risk rating	Preliminary Rating **20**	Final Rating **20**
Priorities for reform	• Development of a clear and cohesive framework for ecosystems services environmental offsets, with an enhanced Reef Trust framework delivering substantially through a strong focus on strategic subsidiarity. • Policy leadership and integration of the existing/emerging framework (the revised Queensland Government Environmental Offsets Policy is yet to be released) with other similar frameworks such as the Emissions Reduction Fund and secondary markets still currently evolving. • Further development of the strategic approach to the application of the ERF in GBR catchments as proposed by Losee (2015).	

References:

Department of Environment and Heritage Protection. (2013). Queensland Government environmental offsets framework: Discussion paper. Brisbane: Department of Environment and Heritage Protection.

Department of Environment and Heritage Protection. (2014). Environmental Offsets Bill. Retrieved from https://www.ehp.qld.gov.au/management/environmental-offsets/offsets-bill.html

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AGRICULTURAL DEVELOPMENT DOMAIN

Table 12. Property planning and management subdomain

<table>
<tr><td>Property planning and management</td><td colspan="2">Subdomain descriptor: Property-scale planning (PMP) and property or best management programs (BMP), if driven by well-supported property owners and managers, are one of the keys to delivering landscape outcomes based and agreed regional goals. In Queensland, landholder led property planning is supported in an ad hoc way by the Australian Government, State Government, industry groups and non-government resource management groups. The Great Barrier Reef Amendment Act 2009, Water Act 2000, Vegetation Management Act 1999, Land Act 1994, and the Environmental Protection Act 1994 all contain some regulatory requirements for landholders to have property plans that contain commitment towards sustainable land management practices (Queensland Farmers Federation [QFF], 2013) although implementation of these measures is varied. Property management plans can take many forms. Generally they are based on an assessment of current and future desired land management practices and spatial analysis to identify priorities for property management reform.</td></tr>
<tr><td>Governance Health analysis</td><td>Structural considerations:
There is no one clear vision or framework for property management planning and existing approaches are highly fragmented and varied in their rigour, resourcing and use of science.
The Reef Rescue program provided some leadership in the GBR catchments for property planning. Reef Rescue used a collaborative and partnership-based framework for implementation that encourages landholders to take up BMPs and undertake property-scale planning (Department of Agriculture, 2013)
In PMP, landholders set their own visions and objectives for their land, however they are required to fit within existing higher-level regulatory frameworks created by the State or Australian Governments. Bargaining and negotiation frameworks are fragmented, and tend to be industry-led (Vella & Dale, 2013).
The Queensland Government is pushing towards industry-led best management practices that focus on key areas of concern such as the GBR (Future Beef, 2014; QFF, 2013).
Although there are some regulatory requirements surrounding property-</td><td>Functional considerations:
There is no broad collaborative framework at reef level re the design and integration of PMP policy. With the exception of the Reef Regulations and Reef Rescue (Vella & Dale, 2013),
Collaborative frameworks are informal and exist between landholders and industry.
Connectivity between industry groups/landholders is strong.
Connectivity between landholders and regional NRM groups is varied.
The capacity of landholders to create and implement property planning is varied and dependent on the availability of support services.
There is generally some limited capacity in the industry and government sectors to support property planning.
Many landholders undertake property planning voluntarily in order to increase the profitability or ensure ongoing viability (Dawson et al., 1983; Vella & Dale, 2013),
Landholder participation in property planning is varied (Richards & Aitken, 2004).
Retention of property-level data is varied, and tends to be anecdotal,</td></tr>
</table>

	scale planning, suasive instruments are used to reinforce property-scale planning and engage landholders. • Informally, property-scale plans are reviewed by landholders to ensure they remain relevant. • Modelling, mapping and data from the ongoing monitoring of land management and management outcomes at the property scale are drawn on to inform decision-making and strategy development across multiple scales, however this is the exception, not the rule. • Monitoring and reporting on individual properties occurs in the GBR catchments through the Paddock to Reef program, which involves landholders self-monitoring and reporting the condition of their land and their land practices.	rather than written (Kanowski et al., 2008). • Connectivity between the research sector and landholders is weak, with research outputs generally not tailored towards end-users. • There is, however, substantial research and spatial data available in suitable delivery formats for effective property-scale planning.
Considerations for likelihood of system failure	• There is no consistent approach that enables a strong link between on-ground action and regional landscape priorities. • Although the current approach requires high levels of partnership and collaboration between landholders, industry, NRM bodies and state agencies, these relationships are not consistent across the landscape. • Uptake of voluntary property planning has been piecemeal and fragmented across the GBR catchments. • In GBR catchments the reef regulation and Reef Rescue/ Reef Programs have provided leadership for PMP/MP, and has developed partnerships between landholders and other institutions in the catchments.	
Likelihood rating	Preliminary Rating **4**	Final Rating **4**
Considerations for consequences of system failure	• Property-scale planning, BMP and adaptive management should be seen as a keystone foundation for reef governance. • There are potentially significant consequences from failure as it could lead to flow on effects that would impact the whole GBR catchment and a result of continuing environmental degradation and declines in water quality, which would be of major significance to the health of the GBR.	
Consequence rating	Preliminary Rating **4**	Final Rating **4**
Combined risk rating	Preliminary Rating **16**	Final Rating **16**
Priorities for reform	• Establishing a clear, cohesive and collaborative policy framework for property planning linked to emerging investment, regulation, regional NRM planning and the effective operation ecosystem service markets.	

References:

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Dawson, N., Berndt, R., & Venz, B. (1983). *Land use planning - Queensland canelands.* Paper presented at the Australasian society of sugar cane technologists, Brisbane.

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Table 13. Support for farms and small businesses subdomain

<table>
<tr><td>Support for farms and small businesses</td><td colspan="2">Subdomain descriptor: There is no clear framework for supporting farms and small businesses as they relate to the health of the GBR coastal zone. A range of fragmented government, commercial, industry and not-for-profit services exist. Support initiatives range from extension service organisations, funding for improved land management practices on farms, disaster recovery funding, business advice, and education programs for small business owners. The Queensland Government provides some small business assistance (mostly small financial grants/packages), advice on planning matters, and support to establish partnerships (Queensland Government, 2013). There are a number of local government and non-government, economic development organisations in the GBR catchments. They provide training and business support to local businesses (Queensland Government, 2013). The Queensland Government provides farmers with up to $650,000 financial support following natural disasters through the Exceptional Disaster Assistance Scheme (AgForce, 2014). Farmers are also provided with financial incentives to make changes to their land management practices through programs such as Reef Rescue (AgForce, 2013). Existing farm support initiatives are largely focussed on building the capacity of landholders to manage their land sustainably using financial incentives</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
There is currently not a clear policy framework for providing support to small businesses or farms.
Alignment of farm support initiatives is poor and it is administered in an ad hoc way through a number of different and fragmented organisations, government agencies and programs.
There is an over-reliance on financial support mechanisms for farms, whereas small business support required is often largely technical/professional in nature.
Brokerage frameworks to guide the delivery of support services regionally are generally weak and poorly engaged with on-ground stakeholders and collaborative frameworks across the range of support services are unclear.
No monitoring, evaluation or review frameworks exist in this subdomain.</td><td>Functional considerations:
Industry, NRM and landholder sectors are engaged in the implementation of this subdomain, but are poorly engaged in other phases such as vision and objective setting, or strategy development.
Connectivity between stakeholders delivering services within regions is often limited and relies on the strength of personal relationships.
Capacity to develop support initiatives for the sustainability of farms and small businesses is inconsistent and dependent on economic factors.
Despite administrative and business support services in the GBR catchments existing, a lack of financial and human resources limits their capacity.
The research sector is not well engaged in this subdomain.</td></tr>
</table>

Considerations for likelihood of system failure	• Many farms and businesses in the GBR region are considered 'small' (employing 20 people or less) and are highly vulnerable to economic fluctuations and natural disasters (King, 2014). • A policy shift to market-based farm support and extension services some two decades ago has not been adequately replaced by commercial services and services addressing intangible issues. • While services exist, the current framework for farm and small business support is fragmented, and lacks a cohesive regional strategy or vision.	
Likelihood rating	Preliminary Rating **3**	Final Rating **3**
Considerations for consequences of system failure	• The consequences of system failure in this subdomain are important due to their implications for extensive pollution and inappropriate land uses across the GBR.	
Consequence rating	Preliminary Rating **3**	Final Rating **3**
Combined risk rating	Preliminary Rating **9**	Final Rating **9**
Priorities for reform	• A strong focus in the integration of regional service delivery and linkages to adaptive property-scale planning and management.	

References:

AgForce. (2013). Reef rescue: Grazing and grains reef rescue partners. Retrieved from http://www.agforceqld.org.au/index.php?tgtPage=industry&page_id=270

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TOURISM DEVELOPMENT DOMAIN

Table 14. Tourism industry subdomain

<table>
<tr><td>Tourism industry</td><td colspan="2">Subdomain descriptor: Tourism is a key economic driver in Australia and contributes approximately $34 billion to the nation's economy (Tourism Australia, 2015). International visitor numbers have more than doubled in since 1992, with the majority of visitors in 2014 travelling from New Zealand, China, the United Kingdom, the United States, and Singapore (Australian Government, 2015). Nature and cultural and heritage-based attractions play a particularly important role attracting visitors from around the world. In fact, 75% of international visitors in 2013-14 participated in outdoor or nature-based activities while they were in Australia (Australian Government, 2015). The Great Barrier Reef is described as Queensland's 'greatest natural tourism advantage' and is actively promoted to visitors by Tourism and Events Queensland, Tourism Australia, and a plethora of tourism activity/business operators (Australian Government, 2015; Tourism and Events Queensland, 2014). The Australian Marine Parks Tourism Organisation deals specifically with GBR tourism. The Queensland Government and the GBRMPA manage the interface between the tourism sector in the GBR through appropriate advisory arrangements (GBRMPA, 2015; Tourism and Events Queensland, 2014).</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
Tourism Australia (with the Australian Government) set the overarching vision for the sector with clear objectives, though limited mention of nature-based attractions, including the GBR (Australian Government, 2015).
Tourism and Events Queensland provide leadership and regularly review visions and set of objectives for tourism surrounding the GBR (Tourism and Events Queensland, 2015).
Tourism operators using the GBR are required to pay a $6/person levy that goes towards environmental management costs of the GBR (GBRMPA, 2015).
Implementation of strategies is currently the responsibility of individual tourism operators.
Tourism operators, and the GBRMPA monitor visitor numbers and their impact on the Great Barrier Reef as well as participate actively in GBR research and monitoring programs (GBRMPA, 2015).</td><td>Functional considerations:
There is significant capacity in the system to set higher and lower level visions and objectives for tourism in Australia and Queensland.
The capacity of individual tourism operators to participate in strategy development and implementation of strategies is varied depending on their access to financial, technical and information resources.
Connectivity between industry groups, tourism operators, and Federal/State policy-makers is strong.
There is a strong research capacity to support the tourism sector in Australia and the GBR more specifically, however, the connection between on-ground managers and the research sector is inconsistent.
Tourism industry monitoring arrangements are formalised across scales and feed into decision-making.</td></tr>
</table>

Considerations for likelihood of system failure	• Governance of the tourism sector is quite strong, and hence the industry should be quite resilient in the face of uncertainty in the environmental health of the GBR. • The GBR has recently been under scrutiny by the United Nations for declining environmental quality (Whiting, 2014). Ongoing degradation is likely to have significant negative implications for the Tourism sector and could trigger system failure. • The tourism sector around the GBR has experienced a downturn in visitor numbers and expenditure since 2008 as a result of the Global Financial Crisis (Deloitte Access Economics, 2013).	
Likelihood rating	Preliminary Rating **NA**	Final Rating **3**
Considerations for consequences of system failure	• Reliance on the GBR for eco-tourism helps drive Commonwealth, State and community support for maintaining GBR health. • Failure of the tourism sector in the GBR would have very significant social/economic consequences for GBR regions/ communities.	
Consequence rating	Preliminary Rating **NA**	Final Rating **4**
Combined risk rating	Preliminary Rating **NA**	Final Rating **12**
Priorities for reform	• Greater recognition by Federal and State decision-makers of the connectivity between the tourism and environmental management subdomains.	

References:

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Tourism and Events Queensland. (2014). *The Great Barrier Reef: A tourism story*. Brisbane: Tourism and Events Queensland.

Tourism and Events Queensland. (2015). *Strategic plan 2015-2019*. Brisbane: Tourism and Events Queensland.

Whiting, F. (2014). *Grief on the Great Barrier Reef*. Retrieved from http://www.couriermail.com.au/news/queensland/grief-on-the-great-barrier-reef/story-fnihsrf2-1226815375424

SOCIAL DEVELOPMENT THEME

EDUCATION DOMAIN

Table 15. National school-based education system subdomain

National school-based education system	**Domain descriptor:** The Australian school-based education system consists of 13 years of schooling with attendance required from age 6 until age 16. Education is a State/Territory responsibility in Australia, however the education system is funded by both State and Australian governments and monitored via Council of Australian Governments (COAG) policy frameworks (Australian Trade Commission [ATC], 2014). A national curriculum is currently being developed and rolled out in schools. As part of the national curriculum The Commonwealth Government provides national policy direction and policy priority setting, while the State/Territory Governments are responsible for delivering school-based education (ATC, 2014). The education system is also focussed on university/vocational development.	
Governance health analysis	**Structural considerations:** • Historically the Australian education system has been fragmented, with 7 different education systems with varied visions, objectives, strategies, and sets of educational standards. However the Australian Government through the National Curriculum has established national vision and objectives for education strategy and this is being progressively implemented around Australia (COAG, 2013). • Alignment of visions and objectives between the State/Territory and Australian Governments are improving through the rollout of the national curriculum. • The GBRMPA have developed science teaching units for all grade levels that are linked to the national curriculum, increasing the dissemination of knowledge of the reef to younger generations and increasing their participation in management and policy. • GBRMPA's Reef Guardians Schools program is designed to engage the education system in the management and protection of the Reef through collaborative community projects, science teaching units, and general education and awareness of the reef (GBRMPA, 2014).	**Functional considerations:** • Vision and objective setting for the school-based education system in Australia are disjointed and lack key connections between the State/Territory and Australian Governments, with few negotiation frameworks to mediate the diverse stakeholder perspectives. • There is a high level of capacity to set higher level visions and objectives, however the lack of connectivity between key players limits the efficacy of decision-makers across scales to develop common visions and objectives. • The capacity of individual schools to implement strategies is highly varied, with some lacking critical financial, human and infrastructure resources. • Resource capacity tends to be higher in private/independent schools and schools in large metropolitan areas, and lower in public and rural schools. • Local stakeholders are often poorly connected to school decision-making processes • There is some engagement of the education research sector in strategy development, but limited with regard to other research sectors. • Student benchmarking in 2007 shows low levels of knowledge about the greenhouse effect and climate change

	• Monitoring occurs annually and involves testing the skill levels of students in specific year groups. • Current monitoring frameworks (NAPLAN testing) are contested by stakeholders. • There has been little long-term monitoring of the education system nationally prior to the introduction of the NAPLAN framework.	among high school students in a regional Queensland city, indicating the education curriculum is falling short of educating students on issues of climate change relevant to the GBR (Boon, 2009).
Considerations for likelihood of system failure	• In recent years there has been a measured decline in the education results (particularly literacy and numeracy) of the Australian school-based education system compared with the scores of other OECD nations (O'Farrell, 2013). This has in part led to the heavy emphasis of basic skills of reading, writing and arithmetic in the national curriculum that is currently being rolled out. • The reef guardian program has been moderately successful in engaging school-aged children in education and management activities in the GBR catchments. The program links the national curriculum. • The national curriculum will include Geography from 2015, which may have a positive effect on student awareness of the GBR, and increase their interest in career paths relevant to GBR research or management.	
Likelihood rating	Preliminary Rating **3**	Final Rating **3**
Considerations for consequences of system failure	• The Australian school-based educational system does not adequately provide the necessary skills in civics and critical analysis of major natural resource dilemmas facing society. • Failure of the education system is likely to reduce long-term policy and research capacity of institutions to support management of the GBR. • Society-wide awareness and preparedness for action is critical to long-term health of the coastal zone and reef.	
Consequence rating	Preliminary Rating **4**	Final Rating **4**
Combined risk rating	Preliminary Rating **12**	Final Rating **12**
Priorities for reform	• Continue to increase equity in education resources across government and non-government schools. • Build a stronger focus on building civic and critical thinking skills to aid future policy and research capacities for GBR benefit.	

References:

Australian Trade Commission. (2014). Schools in Australia. Retrieved from http://www.studyinaustralia.gov.au/global/australian-education/schools

Boon, H. (2009). Climate change? When? Where. *The Australian Educational Researcher, 36*(3), 43-65.

Council of Australian Governments. (2013). Schools and education: Reform agenda. Retrieved from https://www.coag.gov.au/schools_and_education

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ENVIRONMENTAL MANAGEMENT THEME

CLIMATE CHANGE MANAGEMENT DOMAIN

Table 16. Greenhouse gas emission management subdomain

<table>
<tr><td>Greenhouse gas emission management</td><td colspan="2">Domain descriptor: International commitment to greenhouse gas emission management is varied and there has been slow progress towards a global system for reducing greenhouse gases. In 2013 Australia published a report on the amount of greenhouse gasses emitted by different sectors in Australia annually between 1990 and 2010 as part of the nation's commitments to the Kyoto Protocol and the United Nations Convention on Climate Change (Department of Environment [DoE], 2013a). Policy and strategy for greenhouse gas emission management in Australia, however, has recently experienced several significant paradigm shifts. The most notable has been a significant shift away from an Emission's Trading Scheme towards a taxpayer funded incentives scheme (Direct Action). Retention of the foundations of Australia's Carbon Farming Initiative through the Emissions reduction fund and secondary market will present options for landscape scale abatement as the wider international framework matures.</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
Responsibility for vision and objective setting on Greenhouse Gas Abatement (GGA) has tended to be left to one level of government (Federal) without a high priority being placed on climate change.
In the past, some states and the previous Australian Governments took leadership in setting a vision, targets and strategies for greenhouse gas emission management. This occurred without a clear multi-partisan framework for bargaining and negotiation over vision and objective setting leading to high levels of stakeholder contestation over emissions reduction strategies reinforced by political partisanship.
A number of corporate organisations have set their own more aggressive targets, usually for social-responsibility reasons.
A strong research sector provides the Australian Government with predictions of the impacts of climate change and data to support the development of strategies.</td><td>Functional considerations:
There is a strong capacity across all tiers of government to set visions and objectives for greenhouse gas emissions.
Australian Government research and development capacity is weakening due to skills losses and reduced Government funding for climate research.
Although there are strong networks for climate change research in Australia and internationally, the connectivity between them and decision-makers in Australia has declined.
The capacity of stakeholders to implement policy objectives is varied depending on their access to financial, technical and information resources.
In the GBR catchments, uptake of the CFI/ERF has been limited, with only a handful of private landholders participating.
Implementation of emissions management is the responsibility of landholders and individual organisations, however, their level of engagement with management</td></tr>
</table>

	• The Emissions Reduction Fund and emerging secondary markets provides financial incentives to encourage rural landholders to store/reduce greenhouse gases on their land for abatement (Department of Climate Change and Energy Efficiency [DCCEE], 2012a; Losee, 2015). There are concerns that the carbon price value is too low to engage landholders to fund abatement broadly across the land sector on the scale needed to address greenhouse gas pollution. • Greenhouse gas emissions are monitored by the Australian Government and reported in the National Greenhouse Accounts (DoE, 2013b), however they have only been used in a limited way to inform vision setting and strategy.	activities is highly varied (DCCEE, 2012a).
Considerations for likelihood of system failure	• Continuous adjustments in international and national policies provide little certainty about GGA market based arrangements, potentially resulting in limited achievement of substantive targets. The current international system is still far from cohesive international action. • At a national level, dismantling of public-funded climate change research institutions, repeal of cap and trade based arrangements for managing greenhouse gas emissions, and plans for new voluntarily measures for emissions reduction add further uncertainty (DCCEE, 2012b; 2012c; DoE, 2013; White, 2014). • The international price for carbon carries the risk that landholders will not participate on the scale needed to address GBR landscape problems. • The lack of uptake of the CFI in the GBR catchments indicates a need for greater incentives and suasive instruments.	
Likelihood rating	Preliminary Rating **4**	Final Rating **4**
Considerations for consequences of system failure	• There is currently a high level of uncertainty surrounding the future and direction of the national greenhouse gas abatement framework and policies relating to greenhouse gas emissions management. • The consequence of failure of these policy systems could be catastrophic via increased coral bleaching, sea level rise, increased cyclonic intensity and ocean acidification.	
Consequence rating	Preliminary Rating **5**	Final Rating **5**
Combined risk rating	Preliminary Rating **20**	Final Rating **20**

Priorities for reform	• Agreed international frameworks for GGA leading to long term and stable market based mechanisms. • Continued strengthening of the potential policy frameworks that would allow international and national market-based mechanisms to invest in landscape scale adjustment in GBR catchments.

References:

Department of Climate Change and Energy Efficiency. (2012a). Australian National Greenhouse Accounts: National Inventory Report 2010 (Vol. 1). Canberra: Department of Climate Change and Energy Efficiency.

Department of Climate Change and Energy Efficiency. (2012b). Carbon Farming Initiative. Retrieved from http://www.climatechange.gov.au/cfi

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FISHERIES DOMAIN

Table 17. Commercial fisheries management subdomain

<table>
<tr><td>Commercial fisheries management</td><td colspan="2">Domain descriptor: Commercial fisheries are managed both by Australian (export requirements using national sustainability guidelines) and State Governments (input and output controls as part of a formal plan). The Australian Fishing Zone extends from 12 to 200 nautical miles from the Australian coastline and establishes Australia's sovereign rights to explore, exploit, and manage coastal and marine resources. Management of the Australian Fishing Zone and commercial fishing within it involves regulation of boat licensing, strict compliance and enforcement of species harvest limits, and the ongoing monitoring of Australian fisheries' conditions (Department of Agriculture, Fisheries, and Forestry [DAFF], 2007; 2014,). In 2004, the Great Barrier Reef Marine Park Zoning Plan came into Effect, increasing the 'no take' areas from 4.5% to 33%, significantly decreasing the impact of commercial fishing on the GBR (Sutton & Tobin, 2009). There have also recently been State-based coastal fishery buy-backs as part of the Reef Long Term Sustainability Plan (LTSP).</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
The Australian Fisheries Management Authority (AFMA) is responsible for day-to-day management of the Australian Fishing Zone (Department of Agriculture, 2014a; 2014b).
'Offshore constitutional settlement arrangements' between the State/Territory and Commonwealth Governments set out the division of powers between the State and Australian Governments in managing coastal waters, including shipping, mineral exploration, fisheries, and crime at sea (Department of Agriculture, 2014a).
Fishery-specific management plans generated for individual fisheries (e.g. the GBR) by the relevant State/Territory management agency also guide local management and implementation. These management plans are reviewed every five years (Department of Agriculture, 2014a).
These arrangements enable the Queensland and Australian Governments to negotiate the management visions, objectives and strategies for the 10 major fisheries in the GBR (GBRMPA, 2014).</td><td>Functional considerations:
Management of Australian fisheries is generally collaborative with a high degree of connectivity and alignment between the multiple stakeholder groups (Department of Agriculture, 2014a). This is especially true in the GBR, where stakeholder engagement is critical in development of strategies, implementation, and the ongoing monitoring of the fisheries' and reef's condition.
The public and industry sectors were comprehensively consulted during the development of the Great Barrier Reef Marine Park Zoning Plan.
There is not a particularly strong capacity among peak fishing industry groups around sustainability issues.
The recreational fishing sector is quite strong in the GBR.
Implementation capacity is high in the State, however monitoring arrangements capacity could be developed further.
There is a strong research capacity to support fisheries management in Australia and the GBR more specifically, however, there is</td></tr>
</table>

	• There has been significant investment in strategy development for Australian fisheries, which are focussed towards the sustainable use and management of fisheries. However, nationally there is a strong emphasis on the economic importance of fisheries, rather than their environmental significance. • In the GBR, the *Great Barrier Reef Marine Park Zoning Plan* strategically prioritised the environmental protection of the lagoon's biodiversity over the economic benefits of fisheries. The Zoning Plan includes representative areas of the 70 major GBR bioregions (Sutton & Tobin, 2009). • There is a strong reliance on regulatory instruments, and limited use of suasive instruments, except in the GBR catchments where GBRMPA and the State use a number of suasive instruments to ensure ongoing awareness and compliance to regulatory controls.	generally a poor connection between on-ground managers and the research sector. • The capacity of fisheries monitoring and research systems are mature. • Scenario analysis tools provide decision-makers with greater information to support strategy development and priority setting.
Considerations for likelihood of system failure	• Management arrangements for commercial fisheries have evolved over the past 30 years in Australia, and are generally strong, however this varies for different fisheries. • There are currently high levels of involvement from multiple sectors – including industry, government, NGOs and the community. • There is strong support for the ongoing management of ecologically and economically significant fisheries such as those in the GBR Marine Park.	
Likelihood rating	Preliminary Rating **2**	Final Rating **3**
Considerations for consequences of system failure	• Governance arrangements in this domain are quite mature and functional, but there would be major adverse consequences if governance deteriorated. • More than 30% of the Marine Park is free from fishing and more than 60% free from specific types of fishing (e.g. trawling) (GBRMPA, 2014).	

Consequence rating	Preliminary Rating **4**	Final Rating **4**
Combined risk rating	Preliminary Rating **8**	Final Rating **12**
Priorities for reform	• Continuous improvements in the management of individual fisheries. • Stronger comanagement approaches could be developed with respect to any further development of the proposed Coral Sea Marine Protected Area and its linkages to management of reef ecosystems.	

References:

Department of Agriculture Fisheries and Forestry. (2007). Commonwealth Fisheries Harvest Strategy: Policy and Guidelines. Canberra: Australian Government.

Department of Agriculture. (2014a). Managing Australian fisheries. Retrieved from http://www.daff.gov.au/fisheries/domestic/state-fisheries

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Department of Agriculture, Fisheries, and Forestry. (2014). Basic fisheries management methods. Retrieved from http://www.daff.qld.gov.au/fisheries/commercial-fisheries/queenslands-commercial-fisheries/basic-fisheries-management-methods

Great Barrier Reef Marine Park Authority. (2014). About the Reef: Commercial Fishing. Retrieved from http://www.gbrmpa.gov.au/about-the-reef/Managing-multiple-uses/fishing

Sutton, S., & Tobin, R. (2009). Recreational fishers' attitudes towards the 2004 rezoning of the Great Barrier Reef Marine Park. *Environmental Conservation, 36*(3), 245-252. doi: 10.1017/S0376892909990270

Table 18. Aquaculture management subdomain

<table>
<tr><td>Aquaculture management</td><td colspan="2">Subdomain descriptor: Queensland's aquaculture industry is somewhat small comparative to other Australian states, and consists predominantly of land-based barramundi and prawn farming in the GBR coastal zone (Department of Agriculture, Fisheries and Forestry [DAFF], 2012; Queensland Competition Authority [QCA], 2014). Other species also cultured in Queensland include (but are not limited to) oysters, eels, golden perch, Murray cod, jade perch, redclaw crayfish, etc (DAFF, 2012). Aquaculture production represents 31% of Queensland's total fisheries production (DAFF, 2012). The regulatory controls and approvals for the aquaculture industry are particularly complex compared to other states (DAFF, 2012; QCA, 2014). They include development approval from local councils, Resource Allocation Authority and a general fisheries permit from the Department of Agriculture, Fisheries, and Forestry, environmental impact statements (where necessary), a permit from the Department of National Parks, Recreation, Sport, and Racing if activities occur in the GBR Marine Park, and an Environmental Authority and Environmentally Relevant Activity permit from the Department of Environment and Heritage Protection (QCA, 2014). At the Commonwealth scale, approvals may also be necessary as part of the Environment Protection and Biodiversity Conservation Act 1999, from GBRMPA for works in the GBR Marine Park (as per the Great Barrier Reef Marine Park Act 1975) (QCA, 2014).</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
There is currently no overarching vision or set of objectives for the management of aquaculture nationally or in Queensland.
Regulatory frameworks for aquaculture in Queensland are complex, highly fragmented and are poorly aligned across scales (Queensland Aquaculture Industries Federation [QAIF], 2012; QCA, 2014).
Aquaculture businesses currently pay a levy to support aquaculture research and development and ongoing improvement of industry activities (QCA, 2014).
Bargaining and negotiation frameworks are weak at best.
Strategy development is ad hoc and poorly aligned with other sectors.
Implementation of strategies is largely the responsibility of private operators, while regulatory compliance is managed predominantly by State Government Departments (DAFF, 2012).
Monitoring of aquaculture sector is based on compliance with environmental regulatory instruments (QCA, 2014).</td><td>Functional considerations:
There is a moderate degree of capacity in the aquaculture sector and government agencies across scales to set clear visions and objectives.
There is a high degree of connectivity between the industry and research sectors (QCA, 2014). Connectivity is also high between industry stakeholders (QAIF, 2012).
Connectivity between State and Australian Government decision-makers and the industry sector remains fragmented (QCA, 2014).
The research capacity for aquaculture related projects is particularly high in research institutions based in North Queensland (QAIF, 2012).
There is a strong body of literature/data to support decision-making for aquaculture (QCA, 2014).
Strategy development capacity across the subdomain is constrained by regulatory requirements (QCA, 2014).
Monitoring capacity exists at the operator scale, but is poorly integrated or coordinated at the State level.</td></tr>
</table>

	• Monitoring data is currently not used to support decision-making or strategy development.	
Considerations for likelihood of system failure	• Structural reforms of the subdomain are likely following the review of regulatory arrangements by the Queensland Competition Authority (QCA, 2014) and a current Federal Parliamentary inquiry. • There has been limited recent investment and expansion of existing projects in the Queensland aquaculture sector, likely because of regulatory risks and costs (QCA, 2014), despite the sector potentially being able to replace high nutrient industries in key locations. • As the subdomain has been highly regulated, failure of the governance system is unlikely to be devastating to the GBR. • Cyclones, erosion and inundation are the primary risks to coastal aquaculture projects in northern areas of Queensland (QCA, 2014).	
Likelihood rating	Preliminary Rating **NA**	Final Rating **3**
Considerations for consequences of system failure	• The governance arrangements in this subdomain are particularly fragmented and poorly integrated • Poor aquaculture development could have significant implications for the GBR, however, failure to address existing inefficiencies will perpetuate existing systemic constraints and limit the economic and social expansion of the sector. • There are very few locations suitable for new non-terrestrial aquaculture along the Queensland Coastline due to regulatory constraints, sufficient water supply (fresh and salt water), electricity access, and expanses of flat impermeable land (QCA, 2014).	
Consequence rating	Preliminary Rating **NA**	Final Rating **4**
Combined risk rating	Preliminary Rating **NA**	Final Rating **12**
Priorities for reform	• Development of a single regulatory instrument for the control and management of fisheries and aquaculture in Queensland to streamline existing permits, approvals, and regulatory requirements.	

References:

Department of Agriculture, Fisheries and Forestry. (2012). Aquaculture Industry profile. Retrieved from http://www.daff.qld.gov.au/fisheries/aquaculture/overview/industry-profile

Queensland Aquaculture Industries Federation Inc. (2012). The further development of the aquaculture industry in Queensland. Retrieved from http://www.aquaculturequeensland.com/about/industry-strategy.html

Queensland Competition Authority. (2014). Aquaculture Regulation in Queensland. Brisbane: Queensland Competition Authority.

Table 19. Recreational fishing subdomain

<table>
<tr><td>Recreational fishing</td><td colspan="2">Subdomain descriptor: Recreational fishing is a popular tourist and leisure activity managed largely by State Governments (enforces regulation compliance through inspection and surveillance) (State of Queensland, 2015). However, the Federal Government provides overarching vision for recreational fishing in the form of the ‘Recreational fishing in Australia – 2011 and beyond: a national industry development strategy’ (Commonwealth of Australia, 2011). Recreational fishing in the Great Barrier Reef Marine Park and Queensland is monitored and enforced by the Queensland Boating and Fisheries Patrol (part of Fisheries Queensland) under the Queensland Fisheries Act 1994 (State of Queensland, 2015). The introduction of the Great Barrier Reef Marine Park Zoning Plan in 2004 led to restrictions regarding where specific types of recreational fishing could occur in the Marine Park (Sutton & Tobin, 2009).</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
The overarching vision for the management of recreational fishing and fisheries in Australia is clearly set out by the Australian Government’s Department of Agriculture and Water Resources (Commonwealth of Australia, 2011)
Strategic overview and planning is well developed and planned in both the coastal zone and GBR.
Fisheries science fundamentally informs policy development.
Fishing regulations and associated compliance activities are the primary management strategy.
The regulatory framework for recreational fishing is somewhat ambiguous but professionally managed (MRAG, 2014).
Regulations are supplemented with restocking programs in some areas.
Implementation of strategies is largely the responsibility of individuals and regulatory compliance is enforced predominantly by State Government Departments (State of Qld, 2015).
Monitoring of the recreational fishing sector is undertaken by Fisheries Queensland and within the Great Barrier Reef Marine Park by the Great Barrier Reef Marine Park Authority (GBRMPA, 2014).
Monitoring data is currently used to support decision-making surrounding fisheries zones in the Great Barrier Reef Marine Park and the update of policy and regulatory strategy (GBRMPA, 2014).</td><td>Functional considerations:
Connectivity between State and Australian Government decision-makers remains fragmented (MRAG, 2014).
There is reasonably strong connectivity between government policy and the recreational fishing sector.
Bargaining and negotiation frameworks are increasing in strength due to high levels of investment in consultation across sectors (MRAG, 2014).
Strategy development is strongly aligned with the commercial fisheries sector (Department of Agriculture, 2014).
Both government and community sectors have reasonable capacities but compliance capacities may be under-developed.
Implementation capacity is moderately high in the Great Barrier Reef Marine Park, but more varied and inconsistent elsewhere in Queensland (GBRMPA, 2014; State of Queensland, 2015).
The research capacity for fisheries related projects is particularly high with five fisheries specific research centres based in Queensland (Department of Agriculture and Fisheries, 2012).
There is a strong body of literature/data to support decision-making for fisheries (Department of Agriculture and Fisheries, 2012).</td></tr>
</table>

Considerations for likelihood of system failure	• The policy and regulatory system is reasonably mature, stable and adaptive, with strong community/government relations. • There is strong support for the ongoing management of ecologically, socially and economically significant fisheries such as those in the Great Barrier Reef Marine Park (Sutton & Tobin, 2009). • Strong science foundations enable quite adaptive management. • The fisheries sector was reviewed in 2014, leading to systemic reforms and increased consultation (MRAG, 2014).	
Likelihood rating	Preliminary Rating **NA**	Final Rating **2**
Considerations for consequences of system failure	• Because the key ecological role of fish species targeted by the recreational fishery, system failure could have significant consequences. • Recreational fisheries are highly valued by the community.	
Consequence rating	Preliminary Rating **NA**	Final Rating **4**
Combined risk rating	Preliminary Rating **NA**	Final Rating **8**
Priorities for reform	• The exploration of additional non-regulatory mechanisms to supplement improved fisheries management (e.g. systems repair, increased educational and communication efforts, etc.).	

References:

Commonwealth of Australia. (2011). Recreational fishing in Australia - 2011 and beyond: a national industry development strategy. Canberra: Recreational Fishing Advisory Committee.

Department of Agriculture. (2014). Managing Australian Fisheries. Retrieved from http://www.daff.gov.au/fisheries/domestic/state-fisheries

Department of Agriculture and Fisheries. (2012). Fisheries research centres. Retrieved from https://www.daf.qld.gov.au/fisheries/research/research-centres

Great Barrier Reef Marine Park Authority. (2014). About the reef: Commercial fishing. Retrieved from http://www.gbrmpa.gov.au/about-the-reef/Managing-multiple-uses/fishing

MRAG. (2014). Taking stock: Modernising fisheries management in Queensland. Brisbane: MRAG Asia Pacific.

State of Queensland. (2015). Managing fisheries compliance in Queensland. Brisbane: Department of Agriculture and Fisheries.

Sutton, S., & Tobin, R. (2009). Recreational fishers' attitudes towards the 2004 rezoning of the Great Barrier Reef Marine Park. *Environmental Conservation, 36*(3), 245-252.

WATER AND VEGETATION DOMAIN

Table 20. Water allocation planning and management subdomain

<table>
<tr><td>Water allocation planning and management</td><td colspan="2">Domain descriptor: Water allocation planning and management plays out at the State level (Department of the Environment [DoE], 2013). State governments control water assets and the Australian Government provides overarching leadership on water issues of national significance. Queensland accounts for 20% of Australia's water use, the majority from surface water supplies (National Water Commission, 2011).</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
The Australian Government provides the overarching vision and objectives to guide State/Territory management strategies and plans, which are then implemented at the local and regional scales (National Water Commission, 2010).
Water planning and management for supply (water use and flows) occurs separately. The State owns and manages water assets.
The Queensland Water Plan and subsidiary catchment level water plans provide direction for water allocation and management strategies and development of water infrastructure to meet supply and demand for water by current and future populations (National Water Commission, 2011).
Under the Queensland Water Act, allocation arrangements established at catchment scale are implemented and monitored through Resource Operating Plans (ROPS).</td><td>Functional considerations:
The National Water Agreement increased connectivity between pre-existing arrangements for water planning and management (DoE, 2013).
There is a high level of connectivity between State and local Government decision makers, who are largely responsible for planning and managing water supplies.
Strong frameworks exist for the negotiation and bargaining of visions/objectives and strategies across scales.
There is an abundance of hydrological, social, economic and environmental data available to decision-makers to inform planning and management, however there is greater biophysical data than social data (National Water Commission, 2010).
Research brokerage arrangements are strong
Monitoring arrangements are formalised across scales and inform decision-making.</td></tr>
<tr><td>Considerations for likelihood of system failure</td><td colspan="2">The legislative arrangements for water planning and management in Queensland are comprehensive and mature, though some problematic allocation decisions were emerging across Queensland up to 2015.
Some recent legislative amendments are yet to be bedded down, so will need to be reassessed once operating effectively.</td></tr>
<tr><td>Likelihood rating</td><td>Preliminary Rating
1</td><td>Final Rating
2</td></tr>
<tr><td>Considerations for consequences of system failure</td><td colspan="2">Queensland has been progressive in water governance, planning and management since the original Water Act 2000 was passed.
Poor management would contribute to ecosystem failure and could lead to reductions in water quality, environmental degradation, and economic losses in areas reliant on water-based eco-tourism.
Because of the limited impact of consumptive use in high flows, however, consequences for the GBR are not as major as other domains.</td></tr>
</table>

Consequence rating	Preliminary Rating **3**	Final Rating **3**
Combined risk rating	Preliminary Rating **3**	Final Rating **6**
Priorities for reform	• The Australian Government needs to maintain a strategic and active interest in maintaining standards in water allocation systems. • Reporting systems need to have greater consideration of social and economic issues surrounding water allocation. • Current reforms need to achieve continuous improvements in the allocation of water flows but greater social/economic flexibility. • Local area approaches to crisis management and adaptive management as water allocation need to be increased over time.	

References:

Department of the Environment. (2013). NWI Policy Guidelines for Water Planning and Management. Retrieved from http://www.environment.gov.au/topics/water/australian-government-water-leadership/national-water-initiative/guidelines-water

National Water Commission. (2010). *Australian environmental water management report*. Canberra: National Water Commission.

National Water Commission. (2011). *National water planning report card 2011*. Canberra: National Water Commission.

Table 21. Water quality planning and management subdomain

<table>
<tr><td>Water quality planning and management</td><td colspan="2">Domain descriptor: Water quality (combined with environmental flows) at the catchment scale that is required to maintain catchment, reef and World Heritage value. As mentioned in Table 15, flows as they related to water quality are determined through the National COAG Agreement on Water Reform and the Queensland Water Act 2000 (Department of the Environment [DoE], 2013). Point source discharge is managed via the State's Environmental Protection Act. Diffuse sources in agriculture are regulated under the reef-specific regulations, while the Commonwealth invests in regional approaches to Water Quality Improvement Plans (WQIPs). The Australian Government's Reef Program delivers significant incentives in the context of WQIPs.</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
Water planning and management for quality and supply (water use and flows) issues occur separately.
The Australian Government provides the overarching vision and objectives to guide State/Territory management strategies and plans for both water quality and quantity), which are then implemented at the local and regional scales (DoE, 2013).
Property-scale water resource planning is progressed in the context of the Reef Protection Act.
Solid works programs for implementation and delivery exist through the Australian Government's Reef Rescue Program.
Water quality monitoring in Queensland is relatively rigorous, however monitoring is largely limited to biophysical traits of waterways (National Water Commission, 2010).
Benchmarking is used to monitor and compare the health of water ways against their respective Water Quality Improvement Plans.</td><td>Functional considerations:
The capacity for strategy development and implementation is greatest at the river catchment scale, however capacity across catchments is highly varied depending on financial and human resource availability
Connectivity between State Government decision makers, and community/industry groups (largely responsible for the implementation of catchment-level water management plans) is varied.
Strong frameworks exist for the negotiation and bargaining of visions/objectives and strategies across scales.
There is a high level of connectivity between resource planners/managers and research institutions, leading to strong brokerage arrangements.
Monitoring arrangements are collaborative across scales and feed into decision-making.
There is an abundance of hydrological, social, economic and environmental data available to decision-makers to inform water quality management, however there is greater biophysical data than social data (National Water Commission, 2010).</td></tr>
<tr><td>Considerations for likelihood of system failure</td><td colspan="2">There is currently a water resource plan and WQIPs in place for nearly all the major reef catchments in the state, however the content and focus on implementation is varied in quality and effort.
There is strong community support for most existing water quality and water resource plans because they were developed using strong community input (National Water Commission, 2011).</td></tr>
</table>

Likelihood rating	Preliminary Rating **NA**	Final Rating **2**
Considerations for consequences of system failure	• COAG Agreement has historically provided a durable and stable policy framework delivering significant improvements in water governance. • Queensland has been progressive in water governance (quality and quantity), planning and management. • Poor management would ensue systemic failure and could lead to reductions in water quality, environmental degradation, and economic losses in areas reliant on water-based eco-tourism.	
Consequence rating	Preliminary Rating **-**	Final Rating **4**
Combined risk rating	Preliminary Rating **-**	Final Rating **8**
Priorities for reform	• Greater bilateral commitment and consensus on continuous improvement in the development and implementation of WQIPs. • Strong continuous improvement in the delivery of, and continued investment in, the delivery of Federal and State investments. • Integration between Reef Program investment systems and emerging offset management frameworks delivered through the Reef Trust.	

References:

Department of the Environment. (2013). NWI Policy Guidelines for Water Planning and Management. Retrieved from http://www.environment.gov.au/topics/water/australian-government-water-leadership/national-water-initiative/guidelines-water

National Water Commission. (2010). *Australian environmental water management report*. Canberra: National Water Commission.

National Water Commission. (2011). *National water planning report card 2011*. Canberra: National Water Commission.

Table 22. Pesticide regulation and management subdomain

<table>
<tr><td>Pesticide regulation and management</td><td colspan="2">Subdomain descriptor: Australia is a signatory to a number of international conventions, including the Rotterdam Convention and the Stockholm Convention (Department of Agriculture, 2014a; Department of the Environment [DoE], 2014). The Australian Pest and Veterinary Medicine Authority (APVMA) is an independent statutory body established in 1993 to manage the registration of pesticides for use. The APVMA act as an industry regulator by determining the suitability of chemicals for use in Australia, and the safety of their use around people, animals, crops, etc. (APVMA, 2014a). As part of the National Registration Scheme, the APVMA are required to assess and register chemicals for use in Australia (APVMA, 2014a; 2014b).</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
GBRMPA has developed specific water quality guidelines for a number of pesticides being found in the GBR.
In delivery terms, the State and Territory Governments are responsible for the control and implementation of management strategies after the chemicals are sold (APVMA, 2014b; Department of Agriculture, 2014b).
Some industries such as the Australian Cotton industry have developed a set of collaboratively developed Best Management Practices (BMPs) for pesticide use, however this is yet to occur in all other industries.
There is an equal reliance on suasive and market instruments, encouraging participation and alignment of implementation with the overarching visions and objectives for pesticide use.
Reef Rescue used a similarly collaborative approach to establish BMPs for land management to reduce pesticide use in the agriculture sector in GBR catchments (Queensland Government, 2014; Radcliffe, 2002).
Reasonably effective monitoring, evaluation and review frameworks are in place at national scale, but tend to be weaker at State and regional scales.</td><td>Functional considerations:
There is a high level of alignment between the State/Territory and Australian Government vision and objectives, and these are generally complementary to the visions and objectives of local landholders.
The industry sector is highly engaged in both the strategy development and implementation phases.
Bargaining and negotiation frameworks for the use of, and reduction in, pesticides are scale specific and varied in their quality.
There is a limited connection between monitoring frameworks and evaluative/review mechanisms.
There is some fragmentation between the different monitoring agencies and issues surrounding the accountability of these agencies and landholders.
There is a strong Commonwealth and State/Territory Government capacity to regulate pesticides
Connectivity between the research sector and on-ground managers is generally poor but variable across the country.
Social and economic considerations often poorly integrated in research and assessment processes.</td></tr>
</table>

Considerations for likelihood of system failure	• Overall framework for pesticide management is quite strong, well engaged, evidence-based and stable. • Currently, there is limited availability of detailed and region-specific data regarding the use of different pesticides. • There are currently no national strategies to reduce pesticide use across Australia, however in Queensland Reef Plan and the Reef Rescue program aim to reduce use of pesticides in the GBR catchments	
Likelihood rating	Preliminary Rating **2**	Final Rating **3**
Considerations for consequences of system failure	• This subdomain is quite mature, connected and strongly regulated, though it would have major adverse consequences if it were not.	
Consequence rating	Preliminary Rating **4**	Final Rating **4**
Combined risk rating	Preliminary Rating **8**	Final Rating **12**
Priorities for reform	• A more comprehensive and cohesive reporting system is necessary to ensure greater knowledge of the use and long-term impacts of pesticide use nationally and in different reef regions. • A stronger proactive focus is required in identifying alternative management solutions in advance of regulatory change (i.e. greater integration of social/economic knowledge).	

References:

Australian Pesticides and Veterinary Medicines Authority. (2014a). About the APVMA. Retrieved from http://www.apvma.gov.au/about/index.php

Australian Pesticides and Veterinary Medicines Authority. (2014b). The National Registration Scheme for Agriculture and Veterinary Chemicals. Retrieved from http://www.apvma.gov.au/about/nrs/

Department of Agriculture. (2014a). Rotterdam Convention. Retrieved from http://www.daff.gov.au/agriculture-food/ag-vet-chemicals/international/rotterdam

Department of Agriculture. (2014b). Agriculture and Veterinary Chemicals: Regulation. Retrieved from http://www.daff.gov.au/agriculture-food/ag-vet-chemicals/regulation

Department of the Environment. (2014). Stockholm Convention on Persistent Organic Pollutants. Retrieved from http://www.environment.gov.au/topics/environment-protection/chemicals-management/pops

Queensland Government. (2014). About Reef Plan. Retrieved from http://www.reefplan.qld.gov.au/about.aspx

Radcliffe, J. (2002). Pesticide Use in Australia: A Review. Parkville, Victoria: Australian Academy of Technological Sciences and Engineering.

Table 23. Vegetation planning and management subdomain

<table>
<tr><td>Vegetation planning and management</td><td colspan="2">Subdomain descriptor: Broad-scale vegetation management (and carbon emissions from tree clearing) across the Queensland landscape is broadly managed through the lens of the Queensland Vegetation Management Act 1999. In 2009, the Act was modified to further protect high value regrowth and riparian lands within GBR catchments. Soon after, however, these protections were removed by the new Coalition government and also enabled the consideration of permits for clearing for high value agriculture. A new Labor government has committed to restore the legislation to its 2009 form (Queensland Labor 2015), and is currently embarking on engagement based approach to determining the most appropriate approach. This has been a contentious policy area over many years, but it is also worth noting the legislative focus does not ensure either the ecological health or reduce the erosive of key vegetation communities.</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
The strategic and legislative framework for vegetation physical vegetation protection in GBR catchments is quite sound.
There are no clear visions, objectives and strategies for the protection of ecological health of vegetation communities.
There is not a clear program of research and development specifically targeted to the development and operation of the Vegetation Management Act.
Core strategies of regulatory protection and compliance are in place, though compliance systems may not be entirely effective.
Strategies and implementation arrangements associated with engagement, extension and incentives have generally been under-developed.
Implementation is focussed on ongoing mapping refinement and permitting/compliance activities.
Satellite-based monitoring systems are strong and improving.</td><td>Functional considerations:
No bipartisan position exists on the protection and management of high value vegetation communities.
There is no well engaged mechanism in place for continuous improvement in regard to the scope and operation of the legislation.
There are currently opportunities but limited sectoral linkages between vegetation management and carbon and ecosystem service markets (Losee, 2015).
Departmental compliance capacities have tended to be limited and poorly integrated.
Capacity of all key sectors to participate in policy reform is quite strong at State level, but limited at the regional scale.
Strong ecological knowledge exists in the Queensland Herbarium (but is poorly linked to decision making).
The interplay between socio-economic and biophysical aspects of decision making tend to be poorly defined.
There is generally a strong body of research and data to support decision-making.</td></tr>
<tr><td>Considerations for likelihood of system failure</td><td colspan="2">Lack of bipartisan commitment to a form and approach to vegetation management in high value ecosystems and reef catchments could see the traditional success of this subdomain become fragile.
Improved open-ness and public access to satellite imagery may see improvements in policy debate and monitoring.
Government supported efforts are in place to seek a more lasting agreement about continuous improvement in the operation of the Act.
A legislative focus on tree protection versus the ecological health of vulnerable communities may eventually contribute to policy failure.</td></tr>
</table>

Likelihood rating	Preliminary Rating **NA**	Final Rating **4**
Considerations for consequences of system failure	• Failure in this subdomain could have significant consequences for the ecological health of catchment ecosystems linked to reef health. • Failure in this subdomain could have short term impacts of sediment movement in GBR catchments. • Increased land clearing in Queensland has the potential to significant contribute to the State greenhouse gas emissions. • Increased erosive potential under tree thickening in some circumstances needs further policy considerations.	
Consequence rating	Preliminary Rating **NA**	Final Rating **4**
Combined risk rating	Preliminary Rating **NA**	Final Rating **16**
Priorities for reform	• Agreed approaches to achieving a stable long term solution to the protection of important vegetation communities in GBR catchments. • Improved connectivity between vegetation management science, policy, permitting and compliance activities. • Strategies developed to maximise potential linkages between vegetation management and emerging carbon and ecosystem service markets.	

References:

Losee, S. (2015). Review of land sector opportunities for the Queensland Government to participate in the Emissions Reduction Fund. *Prepared for:* Department of Environment and Heritage Protection, July 29, 2015. Brisbane: Scott Losee Consulting.

Queensland Labor (2015). *Saving the Barrier Reef: Labor's plan to protect a natural wonder.* Brisbane: Queensland Labor.

COASTAL PLANNING, SHIPPING, AND INFRASTRUCTURE DOMAIN

Table 24. Coastal planning subdomain

<table>
<tr><td>Coastal planning</td><td colspan="2">Subdomain descriptor: Queensland's coastline is widely recognised as a valuable natural, economic and social resource, however the coastline is also in high demand for development (Department of Environment and Heritage Protection [DEHP], 2013; Department of State Development, Infrastructure, and Planning [DSDIP], 2013). The Queensland Government introduced the Coastal Protection and Management Act 1995 to reduce coastal degradation and ease development pressure through zoning of areas for conservation, creation of coastal plans, and developing management districts (DEHP, 2013). However, following a change in State Government in 2012, regional Coastal Plans were withdrawn and the coastal plan provisions codified at State level through the Coastal Protection State Planning Regulatory Provision under the Sustainable Planning Act 2009 (DSDIP, 2013). The Queensland Coastal Management Plan was replaced by the Queensland Coastal Plan as part of State reforms to coastal management in 2012 (DSDIP, 2013). As of 2013, development applications made under that require State agency referrals are now lodged and assessed through the State Assessment and Referral Agency (SARA). The sensitive nature of coastal areas and development on them means that they are likely to trigger multiple referrals now streamlined under SARA, and the new State government is now reconsidering reintroducing coastal planning.</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
The Queensland State Government is responsible for all elements of coastal planning in Queensland.
Although there is some alignment of Local/State/Territory and Australian Government visions and objectives for coastal management, strategy development and implementation remain fragmented nationally and at the State level.
Coastal planning has been highly contentious in Queensland, with a policy pendulum between pro-development and pro-protection.
Regulatory instruments are the primary mechanism for coastal planning and management in Queensland, with limited use of suasive instruments, and no use of market-based instruments.
SARA is aligned with Local Government planning schemes and State planning legislation.
The Queensland Coastal Plan was originally introduced to link and align with Queensland's planning</td><td>Functional considerations:
Although the State has capacity to set visions and objectives, and develop strategies, their capacity to implement strategies is limited due to the lack of connectivity with key local and regional stakeholders.
Limited consultation was done on the Queensland Coastal Plan before it was axed, and fresh policy engagement is now re-emerging.
The current alignment of visions, objectives, strategies and on-ground activities between community coastal groups and the State is varied and fragmented.
Despite capacity to do monitoring and evaluation of coastal processes, application has been limited.
There is significant biophysical data available to inform coastal planning (e.g. via long term NCCARF funding) however social and economic research capacity requires further development.
There once was a high reliance on modelling, mapping and scientific</td></tr>
</table>

	legislation and was previously integrated well with other planning/management policies affecting the GBR. • Implementation of the *Queensland Coastal Plan* was very limited • Monitoring the impacts of coastal development is the responsibility of the Department of Environment and Heritage Protection, however there has been little (if any) cohesive monitoring since the *Queensland Coastal Plan* was implemented.	information in the development of the coastal planning framework. This work has more recently been aligned towards disaster preparedness planning.
Considerations for likelihood of system failure	• A strongly pro-development focus has weakened the prior integrity of Queensland's coastal planning framework. • New coastal planning policies are still developing and evolving, but arrangements under the *Planning for Queensland's Development Act 2014,* remain in place at present (DSDIP, 2014). • Queensland's coastal planning and management processes have recently been internationally criticised due to the Great Barrier Reef's rapidly declining health, despite more than two decades of management.	
Likelihood rating	Preliminary Rating **4**	Final Rating **4**
Considerations for consequences of system failure	• Regional Coastal Management Plans have generally had limited impact on either controlling the drivers/impacts of growth in the coastal zone. • There is no clear framework for implementation of non-regulatory identified actions, potentially leading to ecosystem decline. • Consequent risks could have broad-scale implications for land use.	
Consequence rating	Preliminary Rating **4**	Final Rating **3**
Combined risk rating	Preliminary Rating **16**	Final Rating **12**
Priorities for reform	• Despite new planning reforms coming in place, a higher level vision for coastal planning and development in reef catchments is needed with Federal/State support, including a stronger framework for estuarine management outside of designated ports: one that is able to be effectively implemented at regional and planning scheme scales.	

References:

Department of Environment and Heritage Protection. (2013). State policy for coastal management: Queensland coastal plan. Brisbane: DEHP.

Department of State Development, Infrastructure, and Planning. (2013). Coastal Protection State Planning Regulatory Provision: Protecting the coastal environment. Brisbane: Department of State Development, Infrastructure, and Planning.

Department of State Development, Infrastructure, and Planning. (2014). New planning for Queensland's Development Act - Where we are at? Brisbane: Queensland Government.

Gold Coast City Council. (2013). Who manages our coast? Gold Coast: Griffith University Centre for Coastal Management.

Table 25. Coastal infrastructure planning subdomain

<table>
<tr><td>Coastal infrastructure planning</td><td colspan="2">Subdomain descriptor: The Queensland Coastal Plan previously described acceptable and unacceptable forms of maritime infrastructure in coastal areas, and specified that structures could only be erected on State land where there is a public need to do so (Department of Environment and Heritage Protection [DEHP], 2013. There were however, still many exclusions (e.g. ports). As a result, development of maritime facilities is ad hoc rather than planned regionally. In accordance with the Great Barrier Reef Marine Park Zoning Plan, a person proposing to engage in coastal infrastructure development (e.g. pontoons, wharves, etc.) within or partly within the Marine Park that is not allowed ‘as of right’ or under an accredited arrangement, must apply for a permission under the Great Barrier Reef Marine Park Act 1975. Decision-makers approving infrastructure to be built on coastal land must also have regard to management policies such as the Water Act 2000, Vegetation Management Act 1999, Marine Parks Act 2004, Environmental Protection Act 1994 (DEHP, 2013). In this subdomain, we refer to middle range coastal infrastructure not inclusive of ports and major projects.</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
The State Government visions and objectives for coastal infrastructure were previously articulated in the Queensland Coastal Plan (DEHP, 2013), but this policy clarity is currently being reworked. The Federal government’s position on the strategic location of infrastructure remains ill-defined.
Cohesive lower level regulatory and suasive instruments are used to ensure all coastal infrastructure meets rigorous standards.
Project approval implementation is structured and occurs via GBRMPA, Local and State Government departments (DEHP, 2013).
Legislation in Queensland is reviewed irregularly. Recent planning instruments described above are yet to be reviewed.
GBRMPA runs a strong monitoring framework for coastal infrastructure in the GBR marine park, including jetties, pontoons, and other infrastructure.</td><td>Functional considerations:
Industry sector is consulted during the policy and regulatory strategy development phase.
Project-based infrastructure decision making frameworks are moderately stable and support collaboration between government and landholders/ commercial managers of infrastructure implementation.
Engagement of the research and community sectors is weak in this subdomain, but science significantly informs GBRMPA’s regulatory decision-making processes.
Capacity to implement effective coastal infrastructure approval and management strategies tend to be high in GBRMPA and reasonable in State and local government and the industry sectors.
Science links to regulatory approval decision making tends to be robust.</td></tr>
</table>

Considerations for likelihood of system failure	• Coastal planning has sought to maintain nodal development along the coast but project-led development continues to be the norm, encouraging fragmented infrastructure planning and impacts. • Strategic planning for coastal infrastructure in Queensland has become a priority for government in recent years, however many of the mechanisms to support such planning are still in their infancy. • GBRMPA's regulatory approval frameworks are rigorous. • EIAs that influence coastal planning decisions may down play the impacts of proposed development (Grech et al., 2013).	
Likelihood rating	Preliminary Rating **3**	Final Rating **3**
Considerations for consequences of system failure	• System failure can have significant localised consequences for water quality and coastal habitat quality locally or across the regions within the GBR, especially when combined with rapid population growth.	
Consequence rating	Preliminary Rating **3**	Final Rating **3**
Combined risk rating	Preliminary Rating **9**	Final Rating **9**
Priorities for reform	• A stronger focus on coastal and regional planning to ensure individual development approvals don't have a cumulative impact. • Greater support is required for applicants to prepare for and to navigate the decision-making processes. • Continuous improvement in best practice development assessment, including social impact assessment (GBRMPA, 2014),	

References:

Department of Environment and Heritage Protection. (2013). State policy for coastal management: Queensland coastal plan. Brisbane: Department of Environment and Heritage Protection.

Department of State Development, Infrastructure, and Planning. (2013). Queensland Ports Strategy: Draft for Consultation. Brisbane: Department of State Development Infrastructure and Planning.

Great Barrier Reef Marine Park Authority (2014). Draft social, economic and cultural heritage assessment guidelines. Townsville, GBRMPA.

Grech, A., Bos, M., Brodie, J., Coles, R., Dale, A., Gilbert, R., . . . Smith, A. (2013). Guiding principles for the improved governance of port and shipping impacts in the Great Barrier Reef. *Marine Pollution Bulletin, 75*, 8-20. doi: 10.1016/j.marpolbul.2013.07.013

Table 26. Ports planning subdomain

<table>
<tr><td>Ports planning</td><td colspan="2">Subdomain descriptor: The Queensland Ports Strategy is aligned with the National Ports Strategy and requires master plans for Priority Port Development Areas (PPDAs) (Department of State Development, Infrastructure, and Planning [DSDIP], 2013), now codified under the Sustainable Ports Development Bill. The Qld Ports Strategy declares that Brisbane, Gladstone, Hay Point/Mackay, Abbot Point, and Townsville are PPDAs. State Government owned corporations manage the ports in Gladstone, Townsville, Abbot Point, and Mackay (DSDIP, 2013). The GBRMPA are responsible for assessing and regulating permits for activities associated with ports in the Marine Park (Grech et al., 2013). This includes sea dumping and dredging activities in accordance with the Marine Park Act 1975 and the Sea Dumping Act 1981 (DSDIP, 2013). Capital dredging can no longer be dumped at sea, but more focus on innovative solutions is required.</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
There is not a clearly agreed vision and purpose amongst State and Commonwealth decision-makers with respect to cohesive GBR port planning (Grech et al., 2013).
Current ports decision-making and strategy development is poorly coordinated and aligned across scales (Grech et al., 2013).
Via Priority Port Master Plans, stable regulatory and suasive instruments are used for port planning and development decision making, with collaboration between government, landholders, and the managers of ports and other infrastructure for the implementation of strategies.
Legislation in Queensland is reviewed irregularly and recent planning instruments described above are yet to be reviewed.
GBRMPA has strict monitoring frameworks for ports and their associated activities (e.g. dredging or dumping) in the GBR. Such activities require permits, and approvals to be undertaken.</td><td>Functional considerations:
Master planning approaches present a new opportunity for effective and engaged ports planning.
There is significant capacity in the State Government to plan for and assess the impacts of ports (Grech et al., 2013).
Capacity to implement strategies tends to be greater in the Port Authority, local government/industry sectors.
Communities are generally consulted during the policy and regulatory strategy development phase.
Engagement of the research and community sectors in ports planning is weak in this subdomain, but science significantly informs GBRMPA's regulatory decision-making processes.
There is currently a limited focus on brokering new innovations in development and maintenance of ports.</td></tr>
</table>

<table>
<tr><td>Considerations for likelihood of system failure</td><td colspan="2">• Currently, the Queensland Government are progressing and implementing the Sustainable Ports Development Bill 2015.
• Although the Queensland Ports Strategy identifies the need for an integrated approach to port planning, it does not explain how the process will be integrated (Grech et al., 2013).
• Engagement and evidence building mechanisms for very effective ports planning are not well institutionalised at port level.</td></tr>
<tr><td>Likelihood rating</td><td>Preliminary Rating
-</td><td>Final Rating
3</td></tr>
<tr><td>Considerations for consequences of system failure</td><td colspan="2">• Port development impacts generally remain localised, however, while, Ports plans are undertaken in a structured way but generally fail to consider cumulative impacts (Grech et al., 2013).
• The Townsville port is located outside of the GBR Marine Park and therefore there are no requirements for a GBRMPA permit for the dredge spoil grounds, despite being close to the GBR (Grech et al., 2013).</td></tr>
<tr><td>Consequence rating</td><td>Preliminary Rating
-</td><td>Final Rating
3</td></tr>
<tr><td>Combined risk rating</td><td>Preliminary Rating
-</td><td>Final Rating
9</td></tr>
<tr><td>Priorities for reform</td><td colspan="2">• Taking a more coordinated, integrated and strategic approach to port planning across the state to avoid cumulative impact.
• Continuous improvements in ports planning/operational monitoring.</td></tr>
<tr><td colspan="3">References:
Department of State Development, Infrastructure, and Planning. (2013). Queensland ports strategy: Draft for consultation. Brisbane: Department of State Development Infrastructure and Planning.
Grech, A., Bos, M., Brodie, J., Coles, R., Dale, A., Gilbert, R., . . . Smith, A. (2013). Guiding principles for the improved governance of port and shipping impacts in the Great Barrier Reef. Marine Pollution Bulletin, 75, 8-20. doi: 10.1016/j.marpolbul.2013.07.013</td></tr>
</table>

Table 27. Other coastal infrastructure management subdomain

<table>
<tr><td>Other coastal infrastructure managemen</td><td colspan="2">Subdomain descriptor: Many localised coastal infrastructure facilities (e.g. groynes, jetties, marinas, pontoons, jetties and canals) are owned and managed by Councils and/or private operators. Coastal infrastructure may be held under lease, reserved for relevant infrastructure purposes or held as freehold land (Department of Environment and Heritage Protection [DEHP], 2013). As mentioned before, approval and management was well regulated in Queensland through the Queensland Coastal Plan (DEHP, 2013; Department of State Development, Infrastructure, and Planning [DSDIP], 2013). Under the Queensland Coastal Plan coastal infrastructure previously had to be managed without having an adverse impact on the ecological processes and values of that area (DEHP, 2013). The Queensland Coastal Plan contained provisions for the creation of localised management plans for coastal infrastructure (DEHP, 2013). Local government authorities administered local management plans in accordance with requirements of Queensland legislation (DEHP, 2013).</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
There is strong alignment across national, state and local management policies and plans.
The Queensland State Government is responsible for setting the visions, objectives, and developing strategies for the management of coastal infrastructure, but work with GBRMPA to manage potential impacts in the Marine Park.
Although the visions, objectives and strategies between the State and Australian Governments are highly aligned, alignment between State and Australian Government implementation agencies can have limitations (Grech et al., 2013).
Current monitoring frameworks are weak as they are unable to show changes to the quality of the areas surrounding coastal infrastructure, due to a lack of consistent data (Grech et al., 2013).</td><td>Functional considerations:
Collaborative and bargaining and negotiation frameworks are stable and well developed.
Connectivity is high between the three tiers of government, leading to a relatively high level of alignment of visions, objectives and strategies.
The industry sector is consulted on strategy development and implementation of management strategies
Engagement of the research and community sectors is weak in this subdomain.
Capacity to set visions and objectives for coastal infrastructure management are moderately high, however the implementation capacity requires further development.</td></tr>
<tr><td>Considerations for likelihood of system failure</td><td colspan="2">This subdomain is well regulated and monitored, generally at local scale, and aligned with State and National policies.
Uncertainty created under the demise of the Queensland Coastal Management Act may be resolved through new emerging legislation.</td></tr>
<tr><td>Likelihood rating</td><td>Preliminary Rating
2</td><td>Final Rating
2</td></tr>
</table>

Considerations for consequences of system failure	• The consequences of system failure are localised and not significant. • Issues arise with some existing infrastructure previously approved. • Many assets installed prior to modern legislation leave a legacy of impacts on the health and function of coastal ecosystems.	
Consequence rating	Preliminary Rating **2**	Final Rating **2**
Combined risk rating	Preliminary Rating **4**	Final Rating **4**
Priorities for reform	• Greater engagement of the community and research sectors in the continued improvement in the operation of this subdomain. • Increasing the connectivity and alignment of strategy development and implementers related to activities in this subdomain.	

References:

Department of Environment and Heritage Protection. (2013). *State policy for coastal management: Queensland Coastal Plan*. Brisbane: Department of Environment and Heritage Protection.

Department of State Development, Infrastructure, and Planning. (2013). Queensland ports strategy: Draft for consultation. Brisbane: Department of State Development Infrastructure and Planning.

Grech, A., Bos, M., Brodie, J., Coles, R., Dale, A., Gilbert, R., . . . Smith, A. (2013). Guiding principles for the improved governance of port and shipping impacts in the Great Barrier Reef. *Marine Pollution Bulletin, 75*, 8-20. doi: 10.1016/j.marpolbul.2013.07.013

Table 28. Sewage treatment subdomain

<table>
<tr><td>Sewage treatment</td><td colspan="2">Subdomain descriptor: Following significant State, Australian and Local Government investment over the last decade, most major metropolitan sewage systems in the GBR have been upgraded to tertiary level, however, the withdrawal of State subsidies is affecting further upgrades. Local governments are responsible for the collection and treatment of sewage in Qld and sewage collection and management is generally done on a catchment basis. The infrastructure to support sewage treatment includes treatment plants, pipes (for transporting sewage), and sewage pumping stations (Queensland Water Supply Regulator [QWSR], 2010). Sewage treatment operations are regulated in accordance with the Environmental Protection Act 1994, and the Plumbing and Drainage Act 2002 and conditioned appropriately during the development assessment process under planning legislation (QWSR, 2010). The Queensland Department of Environment and Heritage Protection administer these regulations.</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
There is significant alignment of visions, objectives and strategies between Local, State and Australian Governments.
A knowledge management framework has been developed to support sewage infrastructure planning and management in Queensland (QWSR, 2010). This framework draws on multiple sources of knowledge and data.
Local monitoring of the sewage infrastructure network is extensive and regular, however monitoring of the impacts of sewage treatment outputs is less rigorously and frequently monitored.
Diffuse septic systems across GBR catchment need further attention.</td><td>Functional considerations:
The State has capacity to set visions, objectives and strategies, whereas their implementation capacity is limited to regulating local councils and companies contracted to implement management strategies.
There is a strong level of connectivity in local planning about sewage management.
Industry stakeholders are consulted following the development of local visions, objectives and strategies for the sewage network but are generally not engaged on an ongoing basis in review.
The local planning process used is evidence based, with sufficient data available to support decision-making in all steps of the planning process.</td></tr>
<tr><td>Considerations for likelihood of system failure</td><td colspan="2">Current arrangements are mature, well regulated and highly localised.
Upgrades of infrastructure and progressive asset management and innovation are continuously improving.
Resources for a full upgrade across the State have become more limited in recent years due to changes in State level commitments.</td></tr>
<tr><td>Likelihood rating</td><td>Preliminary Rating
3</td><td>Final Rating
3</td></tr>
</table>

Considerations for consequences of system failure	• System failure can have significant local consequences for nutrient pollution locally or for particular regions within the GBR, especially when combined with rapid population growth. • The consequence of the cumulative impact of diffuse septic systems needs further consideration.	
Consequence rating	Preliminary Rating **3**	Final Rating **3**
Combined risk rating	Preliminary Rating **9**	Final Rating **9**
Priorities for reform	• There is an opportunity for combined Federal, State and Local investment to finalise tertiary treatment arrangement across the GBR. • Opportunities exist to continue to explore more efficient and sustainable treatment options into the future. • Exploration of the cumulative impact of diffuse septic systems needs some consideration.	

References:

Queensland Water Supply Regulator. (2010). *Planning guidelines for water supply and sewerage*. Brisbane: Department of Energy and Water Supply.

Table 29. Maritime safety subdomain

<table>
<tr><td>Maritime safety</td><td colspan="2">Subdomain descriptor: The Australian Maritime Safety Authority (AMSA) is a Commonwealth statutory body established in 1990 to encourage and support maritime safety and environmental protection and is the national regulator for maritime safety in Australia (AMSA, 2014). The States share responsibility for maritime safety regulation with the Commonwealth, while implementation is largely the responsibility of the States. Australia is also a member of the International Maritime Organization (AMSA, 2014; International Maritime Organization [IMO], 2014). Shipping in the GBR is managed under the UN Convention of the Laws of the Sea. The GBR is classified as one of the few Particularly Sensitive Sea Areas worldwide.</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
AMSA set the visions and national objectives for maritime safety in the National System for Domestic Vessel Safety. The State implements the objectives and strategies set out by AMSA (AMSA, 2014).
The regulatory frameworks and strategies for maritime safety across the country are highly aligned and provide mechanisms for negotiation over objectives and strategies.
Decision-makers rely predominantly on regulatory instruments, however there is some application of suasive instruments such as education campaigns to increase public awareness.
Collective monitoring frameworks are strong and draw on multiple data sets, which are regularly updated and contributed to by a number of different institutions, to inform strategy development.
Modelling and scenario testing are widely and appropriately used to support decision-making.
Marine safety programs and policies in Queensland are comprehensively reviewed annually (Maritime Safety Queensland, 2014).</td><td>Functional considerations:
Marine Safety is highly collaborative, involving partnerships between AMSA (the Commonwealth) and the State Governments to develop and implement strategies.
The industry sector is highly engaged in the development and implementation of strategies for maritime safety.
There is a high level of connectivity of existing visions, objectives, strategies and implementation activities across the international, Australian and State/Territory scales (AMSA, 2014).
The State and Australian Governments have significant capacity to implement maritime safety regulations, which is further bolstered by the significant capacity of industry and community stakeholders to contribute towards developing and implementing strategies.
Knowledge foundations in this sector are well institutionalised and effective.</td></tr>
</table>

Considerations for likelihood of system failure	• There are strong regulatory objectives and controls for marine safety nationally and within the States and Northern Territory. Although the National System is relatively new, it appears stable and highly cohesive. • Monitoring and review systems are well developed and the GBR shipping management system is efficient with continuous monitoring. • Safety and spill prevention remains a unifying objective.	
Likelihood rating	Preliminary Rating **2**	Final Rating **2**
Considerations for consequences of system failure	• Most shipping incidents in the last two decades have been due human error and the consequences can be locally catastrophic. • A failure of this system could lead to an increase in shipping accidents and potentially significant regionalised environmental damage.	
Consequence rating	Preliminary Rating **3**	Final Rating **3**
Combined risk rating	Preliminary Rating **6**	Final Rating **6**
Priorities for reform	• Continuous improvement to maintain integrity of the system. • Some regionally specific systems improvements are needed (e.g. within the Torres Strait).	

References:

Australian Maritime Safety Authority. (2014). National system for domestic commercial vessel safety. Retrieved from https://www.amsa.gov.au/domestic/index.asp

International Maritime Organization. (2014). Introduction to IMO. Retrieved from http://www.imo.org/About/Pages/Default.aspx

Maritime Safety Queensland. (2014). Maritime safety Queensland. Retrieved from http://www.msq.qld.gov.au/About-us.aspx

Transport Safety Victoria. (2014). Maritime safety. Retrieved from http://www.transportsafety.vic.gov.au/maritime-safety

LARGE PELAGIC SPECIES DOMAIN

Table 30. International and national whaling subdomain

<table>
<tr><td>International and national whaling</td><td colspan="2">Subdomain descriptor: Whaling is managed under two multinational instruments that address issues in national and international waters, including the International Convention for the Regulation of Whaling (1946), and the moratorium on commercial whaling (1982). The International Whaling Commission (IWC) is the primary international intergovernmental body that administers these instruments to protect thirteen species of ‘great whales’ internationally (IWC, 2014a). The IWC are responsible for setting international catch limits for whaling (IWC, 2014a). It recognises three kinds of whaling: commercial, indigenous, and special permit whaling (IWC, 2014b). Australia is a member country of the IWC, and subsequently is expected to adhere to the commercial whaling moratorium that has been in place since 1982 (Department of the Environment, 2013; IWC, 2014b).</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
There is a strong vision and set of objectives internationally regarding the protection and management of at risk whale populations, however they are not universally shared, with several nations choosing to continue whaling despite the IWC’s moratorium on whaling.
Japan and Iceland have both had ‘special permits’ from the IWC to undertake whaling for scientific purposes (IWC, 2014b).
Norway and Iceland also participate in commercial whaling in objection or reservation to the moratorium (IWC, 2014b).
Subsistence whaling is allowed by the IWC in Denmark, the Russian Federation, St Vincent and the Grenadines, and the USA by traditional groups (IWC, 2014b).
There is a good level of alignment of strategies and implementation across all global scales.
Collaborative implementation and monitoring alliances are also strong. A number of countries align their conservation initiatives and contribute data to a central information bank to monitor declining populations (IWC, 2014a).</td><td>Functional considerations:
International negotiation frameworks are structured/ stable (IWC, 2014c).
There is some collaboration on strategy development and implementation between nations and the IWC, however there are a select number of nations that reject the IWC and its strategies.
There is a high level of capacity internationally and nationally and to set higher level aspirational targets
There is generally a high level of capacity to implement the IWC strategies internationally.
Traditional knowledge is acknowledged and applied to support sustainable Indigenous subsistence whaling (IWC, 2014c).
The research sector is moderately well engaged with the IWC to support decision-making and monitoring efforts.</td></tr>
</table>

<table>
<tr><td>Considerations for likelihood of system failure</td><td colspan="2">• Currently, despite a moratorium on commercial whaling, several countries (Norway and Iceland) choose to allow commercial whaling to continue in objection or under reservation to the moratorium. There is general support internationally, however, for the IWC and the moratorium on commercial whaling.
• Whaling has been banned in Australian waters since the 1960s and the humpback population has recovered to 50% of the estimated pre-whaling population.
• Australia recently won an International Court of Justice case against Japan, requiring Japan to cease its whaling activities in the Antarctic, ruling that Japan's 'research' whaling activities were not in line with international law or conventions.
• Whale interactions with humans, and especially entanglement in shark nets, are becoming more frequent, and many populations continue to be considered endangered or at risk. This might present new priorities.
• Tourism industry and community commitment to ethical management of whales for economic and scientific purposes is very high.</td></tr>
<tr><td>Likelihood rating</td><td>Preliminary Rating
1</td><td>Final Rating
1</td></tr>
<tr><td>Considerations for consequences of system failure</td><td colspan="2">• While the governance system is stable, the consequences of any significant failure could rapidly escalate for this high value GBR asset.</td></tr>
<tr><td>Consequence rating</td><td>Preliminary Rating
4</td><td>Final Rating
4</td></tr>
<tr><td>Combined risk rating</td><td>Preliminary Rating
4</td><td>Final Rating
4</td></tr>
<tr><td>Priorities for reform</td><td colspan="2">• Australia should continue to play a high profile role in ensuring IWC processes negotiate long term international management frameworks.</td></tr>
<tr><td colspan="3">References:
Department of the Environment. (2014). International Whaling Commission. Retrieved from http://www.environment.gov.au/topics/marine/marine-species/cetaceans/international/international-whaling-commission
International Whaling Commission. (2014a). Conservation and management. Retrieved from http://iwc.int/conservation
International Whaling Commission. (2014b). Whaling. Retrieved from http://iwc.int/whaling
International Whaling Commission. (2014c). Aboriginal subsistence whaling. Retrieved from http://iwc.int/aboriginal</td></tr>
</table>

Table 31. Turtle/dugong management subdomain

<table>
<tr><td>Turtle/dugong management</td><td colspan="2">Subdomain descriptor: Australia is one of 30 signatories to the Indian Ocean - South-East Asian (IOSEA) Marine Turtle Memorandum of Understanding, which is focused on the conservation and management of turtles and their habitat (National Oceanic and Atmospheric Administration [NOAA], 2014). Lush seagrass beds in the GBR attract both turtles and dugongs to the lagoon (Department of the Environment [DoE], 2013). The green, leatherback, hawksbill, loggerhead, flatback, and olive-ridley turtle species all come to the GBR and its coastal areas to breed. All of these species of marine turtles are listed as threatened and are protected under international conventions and Australian and Queensland legislation. A recovery plan and Biodiversity Conservation Strategy has been developed for the GBR. Turtles are protected under the Queensland Nature Conservation Act 1992 (Northern Australian Indigenous Land and Sea Management Alliance [NAILSMA], 2006) and dugong are managed as a fishery in the Torres Strait under the Torres Strait Fisheries Act 1984, and harvesters are limited to traditional methods of hunting. Several initiatives were established in the mid 2000s to reduce the impact of marine pollution on turtle and dugong in Northern Australia, including the Carpentaria Ghost Nets program, and the Threat Abatement Plan for Marine Debris (NAILSMA, 2006). An Australian/State Government Taskforce developed a national approach to turtle and dugong management in 2004-2005, and acknowledged the cultural importance of dugong and turtles to traditional owners.</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
The Australian Government articulated higher-level aspirational visions/objectives in 2003, while the State's visions and objectives were formally stated in 1994 (NAILSMA, 2006).
There is some alignment of visions and objectives about turtle and dugong management across the system.
Local communities are also developing and implementing their own dugong and turtle management plans with the support of State and Australian Government, NRM, industry, research, and economic development institutions (NAILSMA, 2006; 2008).
Research and development are highly linked to the operation of the system via Charles Darwin Uni and NAILSMA (NAILSMA, 2008).
Strategy development for turtle and dugong management has been ad hoc in the past, however there is</td><td>Functional considerations:
Collaborative policy frameworks are moderately strong, with a reliance on the strength of personal relationships within institutions to drive partnerships.
Delivery arrangements are somewhat fragmented, with some highly collaborative and inclusive, and others less so.
Although all institutions and groups in the system have capacity to set visions/ objectives and develop strategies, implementation capacity is primarily essential but limited at the local scale.
Implementation capacity is increasing at the local scale due to focussed investment in training/resource provision in indigenous communities (NAILSMA, 2008).
The research sector is engaged and informs higher-level decision-making, and biophysical data is available. However, significant gaps remain regarding the distribution,</td></tr>
</table>

	an emerging degree of alignment/integration and more long-term planning emerging out of existing institutional partnerships (NAILSMA, 2008). • Implementation activities are often limited in their duration due to the remoteness of dugong and turtle breeding sites (NAILSMA, 2008). • Monitoring frameworks are currently weak and fragmented, limited by a lack of investment.	mortality and size of dugong and turtle populations (NAILSMA, 2008). • There is good use and merging of traditional and scientific knowledge and data sets to inform strategy development and implementation (Nursey-Bray, 2009).
Considerations for likelihood of system failure	• While there are strong policy visions, strategy, implementation and monitoring frameworks generally remain weak, while turtle and dugong numbers remain of serious concern in the southern GBR. • Although there are some international conventions/treaties, a lack of international action remains a serious concern.	
Likelihood rating	Preliminary Rating **4**	Final Rating **4**
Considerations for consequences of system failure	• Globally significant breeding islands exist in the GBR for 4 species of turtle, so consequences of system failure would be global. • Some species have shown signs of recovery in recent years, although a decline in seagrass health and recent extreme weather has seen unprecedented deaths. • Turtles and dugong are culturally significant species to traditional owners in the GBR and their loss will have significant ramifications on the wellbeing of the region's indigenous communities.	
Consequence rating	Preliminary Rating **4**	Final Rating **4**
Combined risk rating	Preliminary Rating **16**	Final Rating **16**
Priorities for reform	• Improved international frameworks for turtle and dugong protection are essential. • Investment in strong and durable and evidence based frameworks for turtle and dugong management are essential in the northern region while stock remain relatively healthy. • An absolute focus in improving coastal water quality and reducing additional development risks are essential in the south.	

References:

Department of the Environment. (2013). Dugong dugon: Species profile and threats profile. Retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=28

Great Barrier Reef Marine Park Authority. (2012). Traditional use of marine resources agreements. Retrieved from http://www.gbrmpa.gov.au/our-partners/traditional-owners/traditional-use-of-marine-resources-agreements

National Oceanic and Atmospheric Administration. (2014). Indian Ocean - South-East Asian (IOSEA) Marine Turtle Memorandum of Understanding. Retrieved from http://www.nmfs.noaa.gov/pr/species/turtles/iosea.htm

Northern Australian Indigenous Land and Sea Management Alliance. (2006). Dugong and marine turtle knowledge handbook: Indigenous and scientific knowledge of dugong and marine turtles in Northern Australia. Darwin: Northern Australian Indigenous Land and Sea Management Alliance.

Northern Australian Indigenous Land and Sea Management Alliance. (2008). Performance Story Report: Evaluation of Investment in the Dugong and Marine Turtle Project. Darwin: NAILSMA.

Nursey-Bray, M. (2009). A Guugu Yimmithir Bam Wii: Ngawiya and Girrbithi: Hunting, planning and management along the Great Barrier Reef Australia. *Geoforum, 40*, 442-453.

REEF MANAGEMENT DOMAIN

Table 32. Long term sustainability and Reef Plan subdomain

<table>
<tr><td>Long term sustainability and Reef Plan</td><td colspan="2">Subdomain descriptor: The Australian and Queensland Governments have a bilateral approach to halt and reverse the decline of water quality in the reef lagoon. The first Reef Water Quality Protection Plan (Reef Plan) was published in 2003 as a framework to guide improvements to land management practices to reduce sediment, nutrients, and pesticides being washed into the GBR lagoon and subsequently improve water quality in the GBR. In this, the Australian and Queensland Government set out their vision, and short and long-term objectives to improve the water quality of the GBR lagoon in Reef Plan (Queensland Government, 2014). The Reef Water Quality Protection Plan was updated in 2009 and 2013. Reef Plan is largely delivered through regional NRM planning processes, and the development and implementation of Water Quality Improvement Plans in GBR catchments (Waterhouse et al., 2010). The framework though has now been expanded towards a longer Term approach to GBR sustainability (the Reef Long Term Sustainability Plan, and new governance arrangements are unfolding to implement this with a continuing water quality focus.</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
The LTSP shows a strong alignment with other GBR and NRM policies across multiple scales such as Reef Rescue (Commonwealth), and the Qld Water Quality Program (State) (Queensland Government, 2014).
The LTSP involves a combination of market and suasive instruments, which are administered through subsidiary programs such as the Paddock to Reef Program (Queensland Government, 2013).
There is a clear and common vision for the GBR shared by stakeholders and decision-makers (Peterson et al., 2009).
An independent ‘Science Panel’ provides multidisciplinary scientific advice to support implementation of reef planning (Queensland Government, 2013), however the LTSP still draws largely on biophysical data, and fails to acknowledge the social and economic dimensions of the GBR in more than a desultory way.
Major new monitoring frameworks are being established by GBRMPA and integrated in Outlook reporting cycles (Waterhouse et al., 2010).</td><td>Functional considerations:
The research sector is highly engaged in the strategy development and implementation phases of Reef Planning (Brodie, 2014).
Connectivity between Government authorities and local management groups within catchments is varied.
On-ground activities are not always well aligned between individual landholders or community groups.
Implementation is primarily at the property-scale and market-based instruments provide a significant incentive for landholders to engage with Reef Plan (Queensland Government, 2013).
There is capacity in the system to set high levels aspirational and condition targets for the GBR through Reef Plan.
The industry and community sectors have some capacity to implement and monitor the outcomes of Plan strategies.</td></tr>
</table>

	• Implementation under the LTSP and Reef WQ Plan has largely been devolved to non-government institutions (Peterson et al., 2009; Fabricius et al., 2011). • Modelling and scenario testing methods are used at the paddock, catchment and marine scales to inform local and regional management decisions (Queensland Government, 2014). • Progress towards targets is measured collaboratively through the Paddock to Reef Monitoring Program. The results of which are then reported in annual Reef Plan Report Cards (Fabricius et al., 2011) • The LTSP is to be reviewed every 5 years (Queensland Government, 2014).	• The research sector is engaged with the GBR, and Reef Plan. They generate significant data on the biophysical traits and quality of the GBR, to support continuous improvement of Reef Plan and other related strategies (Fabricius et al., 2011). • The research sector provides regular scientific updates to both decision-makers and the community, allowing more iterative and informed decision-making (Fabricius et al., 2011).
Considerations for likelihood of system failure	• Current arrangements under the LTSP and Reef WQ Plan are encouraging but not yet integrated, comprehensive and mature. • While there is a strong bilateral approach on policy targets, clear consensus and cooperation of strategy development, implementation and delivery are far from being resolved and may undermine targets. • To date, implementation arrangements under Reef WQ Plan have been widely taken up and supported by the research sector, communities, NGOs, industry groups and government agencies.	
Likelihood rating	Preliminary Rating **4**	Final Rating **4**
Considerations for consequences of system failure	• Reef Planning has a strong (but embryonic) framework for intergovernmental and stakeholder partnerships. • The consequence of serious decline in water quality would, however, have significant impacts on resilience.	
Consequence rating	Preliminary Rating **4**	Final Rating **4**
Combined risk rating	Preliminary Rating **16**	Final Rating **16**
Priorities for reform	• Far greater integration of LTSP governance and committee structures. Strengthening and supporting stakeholder delivery partnerships. • Full development of an agreed policy approach to alignment and coordination of implementation activities at the local scale. • Further development of cohesive monitoring of LTSP outcomes and a more adaptive approach to planning and effort alignment.	

References:

Brodie, J. (2014). Dredging the GBR: Use and misuse of science. *Estuarine Coastal Shelf Science, 142*, 1-3. doi: 10.1016/j.ecss.2014.01.010

Fabricius, K., Brodie, J., Waterhouse, J., & Yorkston, H. (2011). Science-based management is evolving along the Great Barrier Reef of Australia. In C. Wilkinson & J. Brodie (Eds.), *Catchment Management and Coral Reef Conservation* (pp. 102-105). Townsville, Queensland: Global Coral Reef Monitoring Network and Reef and Rainforest Research Centre

Peterson, A., Walker, M., Maher, M., Hoverman, S., & Eberhard, R. (2009). New regionalism and planning for water quality improvement in the Great Barrier Reef, Australia. *Geographical Research, 48*(3), 297-313. doi: 10.1111.j.1745-5871.2009.00634.x

Queensland Government. (2013). *Reef water quality protection plan 2013*. Brisbane: Reef Water Quality Protection Plan Secretariat.

Queensland Government. (2014). About reef plan. Retrieved from http://www.reefplan.qld.gov.au/about.aspx

Waterhouse, J., Grundy, M., Gordon, I., Brodie, J., Eberhard, R., & Yorkston, H. (2010). Managing the catchments of the Great Barrier Reef. In R. Ferrier & A. Jenkins (Eds.), *Handbook of catchment management* (pp. 350-375). Oxford, UK: Wiley-Blackwell.

Table 33. Reef Trust subdomain

<table>
<tr><td>Reef Trust</td><td colspan="2">Subdomain descriptor: In 2013 the Australian Department of the Environment proposed a $40 million Reef Trust as part of their Reef 2050 Plan (Department of the Environment [DoE], 2014a). The Reef Trust is intended to provide funds for projects that will improve the water quality and coastal habitats in the GBR (DoE, 2014a). The Trust commenced operations in 2014-2015 and is coordinated by the Australian Department of the Environment and the Queensland Department of Heritage Protection (DoE, 2014b). The initial funding was be provided to landholders to reduce run off into the GBR, to the existing Australian Government Reef Programme to control crown-of-thorns starfish, and to develop a National Turtle and Dugong Protection Plan (DoE, 2014a; 2014b). It is envisaged as the major funds delivery mechanism for Commonwealth GBR water quality funding.</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
While visions of Australian and Queensland decision-makers are aligned and articulated in the LTSP (DoE, 2014a), there is no bilateral commitment to Reef Trust.
The objectives and focus of the Reef Trust framework are still in their infancy and require further strengthening and development.
Reef Trust does deliver through some existing collaboration frameworks (DoE, 2014b).
While arrangements for Reef Trust strategy development are clear, implementation arrangements remain underdeveloped/ unclear.
Reef Trust will be regularly reviewed and monitored on an ongoing basis (DoE, 2014b).</td><td>Functional considerations:
Stakeholders were invited to comment on a discussion paper regarding the design and implementation of the Reef Trust in a 1-month period in early to mid-2014 (DoE, 2014a).
Capacity of Reef Trust to develop genuine bilateral approaches is low with clear Commonwealth and State commitment.
Capacity to develop and implement strategies is particularly high in industry, and government sectors. The capacity of individual landholders is variable.
Reef Trust is drawing on existing connections from programs such as Reef Rescue in supporting some delivery.
GBRMPA and the Australian Institute of Marine Science will provide the State and Australian Government with scientific knowledge and strategic input (DoE, 2014b).</td></tr>
</table>

Considerations for likelihood of system failure	• The arrangements for Reef Trust are in their infancy and still being developed and clarified (DoE, 2014b). • The Reef Trust is being partially funded by funds redirected from the existing and relatively successful Reef Rescue program (Moore, 2013). • While remaining as a Departmentally-focussed Commonwealth entity without bilateral support, the chances of success in Reef Trust raising and delivering funds effectively would be reasonably low.	
Likelihood rating	Preliminary Rating **-**	Final Rating **4**
Considerations for consequences of system failure	• The Reef Trust does presents a significant opportunity to increasingly focus on the mobilisation of a wider range of efforts to secure improved reef outcomes, hence the consequences of system failure could be high,	
Consequence rating	Preliminary Rating **-**	Final Rating **4**
Combined risk rating	Preliminary Rating **-**	Final Rating **16**
Priorities for reform	• Further development of a bilaterally agreed and innovative non-government approach to the further development of Reef Trust. • Further clarification of bilaterally agreed delivery arrangements, with a particular focus on cohesive alignment of reef wide and regional efforts. • Strengthening of delivery frameworks, particularly at regional scale.	

References:

Department of the Environment. (2014a). The Reef 2050 plan. Retrieved from http://www.environment.gov.au/marine/gbr/reef2050

Department of the Environment. (2014b). Reef Trust discussion paper. Canberra: Department of the Environment.

Moore, T. (2013). Great Barrier Reef trust promised by Coalition. Retrieved from http://www.brisbanetimes.com.au/queensland/great-barrier-reef-trust-promised-by-coalition-20130902-2szqc.html

Table 34. Management of the GBR Marine Park subdomain

<table>
<tr><td>Management of the GBR Marine Park</td><td colspan="2">Subdomain descriptor: The Great Barrier Reef Marine Park Act 1975 underpins core planning and regulation of the World Heritage Area, delivering regulation of reef tourism, some fishing and other uses. The GBR Marine Park Act 1975 provides a management framework that includes zoning regulations, management plans, prohibitions on certain activities (e.g. mining), and enforcement mechanisms. Management of the GBR is overseen by the GBRMPA who are a statutory body and have enforcement powers in the GBR. The on-the-ground management responsibilities are shared by the Queensland and Commonwealth Governments in accordance with the GBR Intergovernmental Agreement (GBRMPA, 2014a).</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
The State and Australian Governments have a number of Acts, policies, plans, strategies, and programs for the management of the GBR, implementation is fragmented (Brodie, 2014). In the past the complexity of management arrangements in the GBR has been a problem for identifying management roles and responsibilities, for accountability and for the day-to-day management of the reef.
Visions and objectives for the GBR are set out in various documents (Strategic Plan) and shared by stakeholders and decision-makers, indicating well designed collaborative frameworks for setting visions and objectives but their recognition in decision making arrangements is inconsistent across sectoral arrangements.
Implementation mechanisms include suasive, regulatory and market-based instruments, however the success of these instruments to deliver desired outcomes is varied and their application is inconsistent across industries and sectors impacting on the GBR.
Monitoring and compliance frameworks are collaborative and comprehensive across biophysical dimensions of reef management, and while social and economic frameworks are being developed, frameworks and research into</td><td>Functional considerations:
Vision, strategies and implementation arrangements are aligned across scales, and have a high local ‘buy in’.
Management strategies are fragmented and poorly integrated across the boundaries of the GBR WHA and the GBR Marine Park because the Australian Government is responsible for the Marine Park, while the State Government is responsible for adjacent catchments (Brodie & Waterhouse, 2012).
Governance distortions are increasingly occurring in major project approvals due to increasing centralisation of Federal decisions and poor links between social, economic and environmental decision making (see Dale, 2014).
Lower scale connectivity between Government authorities and local management groups and across sectors/reef management issues is varied.
Commonwealth and State Government agencies have a high ability to develop and implement management strategies, but because they are operating in a financially constrained environment their capacity for action is constrained.
Both strategy development and implementation are collaborative, drawing on the capacity of specific institutions – e.g. Fisheries Queensland manages fisheries, while GBRMPA and the Queensland</td></tr>
</table>

	planning and governance dimensions are limited.	Parks and Wildlife Service manage the Marine Park (GBRMPA, 2014a). • The research sector is highly engaged with the GBR, and generates significant data on the biophysical trends. Although there is significantly less social and economic data relating to the GBR available, the capacity of research institutions to examine the social and economic aspects of the GBR is increasing. • Connectivity between research, management, and monitoring activities in the non-WHAs that affect the Marine Park is poor (Brodie & Waterhouse, 2012). • Despite the GBR being threatened by climate change, coastal development and agricultural pollution is the only threat receiving major investment and research attention (Brodie, 2014). • Scientific interest and application in the GBR is high and research brokerage arrangements are strong. While this has led to an improved scientific understanding of the GBR, leading to enhanced strategy development, it has not produced a similar level of understanding of the social, economic and governance dimensions needed for effective management. In particular, performance data and evaluative information to support adaptive improvement of policies, strategies and management arrangements require improvement.
Considerations for likelihood of system failure	• GBR focussed management strategies are mature and although they continue to evolve, they are cohesive and comprehensive. • Subdomain has been stable and has made several progressive advances, including tourism regulation, green zones, and agreements with traditional owners. • Despite more than 30 years of management activities in the GBR, the GBR has continued to degrade and decline in health (Brodie & Waterhouse, 2012), suggesting that while reef management is strong, there is insufficient linkage between other key domains (e.g. climate change and catchment management domains).	

	• A 2013 IUCN and UNESCO report warned that new port infrastructure and coastal development will cause the GBR to decline further, and the GBR will be put on the 'List of World Heritage in danger' if action is not taken by the Australian and State Governments (UNESCO, 2013).	
Likelihood rating	Preliminary Rating **2**	Final Rating **2**
Considerations for consequences of system failure	• Given actual strength of the current system, the culture of more effective reef management could withstand some level of governance failure. • Failure to this subdomain to achieve major reforms in other risky domains could have major consequences for reef outcomes and economic consequences for GBR coastal communities.	
Consequence rating	Preliminary Rating **3**	Final Rating **4**
Combined risk rating	Preliminary Rating **6**	Final Rating **8**
Priorities for reform	• This subdomain needs to be empowered to more significantly influence other themes and domains that present significant risks to the reef (e.g. climate change/coastal and catchment management domains). • Major reform in needed in the capacity of this subdomain to more effectively link with the Major Projects Approval Domain, ensuring effective and more facilitated integration of social, economic and environmental aspects of major decisions.	

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United Nations Educational Scientific and Cultural Organization. (2013). Convention Concerning the Protection of the World Cultural and Natural Heritage. Phnom Penh, Cambodia: United Nations Educational Scientific and Cultural Organization: World Heritage Committee.

Table 35. Reef regulation subdomain

<table>
<tr><td>Reef regulation</td><td colspan="2">Subdomain descriptor: The Great Barrier Reef Protection Amendment Act 2009 sets out amendments to the Chemical Usage (Agricultural and Veterinary) Control Act 1988, the Environment Protection Act 1994, and the Sustainable Planning Act 2009. The purpose of these amendments was to bring those Acts into line with other government policies and legislation regarding the regulation and management of the GBR (Queensland Government, 2009). The Qld Great Barrier Reef Protection Amendment Act 2009, however, focussed on regulating sugar (Wet Tropics) and pastoral (Burdekin) farming practices affecting water quality in the GBR through the development and monitoring of Environmental Risk Management Plans (ERMPs). The Act sets out regulations for fertiliser management on sugarcane crops, erosion management in grazing (managing pasture cover), and risk management planning in sugarcane cultivation and grazing (Brodie et al., 2012; World Wide Fund for Nature, 2009). Following a change of government after its introduction, the implementation of the Act was refocussed on the extension on industry-based Best Management Practice (BMP) programs. A new State Labor government is again considering review of the Act, with a stronger focus on achieving improved water quality outcomes.</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
The original Act, while inclusive of clear objectives, was introduced by the State Government in response to concerns raised by the conservation sector with limited agreement with industry and other sectors.
The Great Barrier Reef Protection Amendment Act 2009 is aligned to existing Australian and State Government reef regulations and programs (Vella & Dale, 2013).
Strong bargaining and negotiation frameworks between local landholders and the State Government were not used well in the development of the legislation.
In the implementation phase, stronger collaborative frameworks for strategy development and implementation did focus on improving farm practices through voluntary commitment to BMPs.
Monitoring supported by the Paddock to Reef program informs the implementation of the Act though practice uptake, is sound, and relies on collaboration between Government agencies, landholders, regional NRM bodies, industry stakeholders and researchers.</td><td>Functional considerations:
There was limited structured engagement during both legislative development and the development of amendments.
In developing strategic approaches to implementation, connectivity between State decision-makers and local stakeholders was variable.
The State and local stakeholders have significant capacity to develop local visions, objectives, and strategies to reduce the impact of farming on the reef.
Implementation capacity is limited at the local scale because of Departmental resource limits.
There are insufficient links between State decision making and the application of reef sciences to adequately inform the operation of the Act.
The Paddock to Reef program was developed collaboratively, but is largely focussed on monitoring implementation of BMPs versus water quality outcomes secured by the Act.</td></tr>
</table>

<table>
<tr><td>Considerations for likelihood of system failure</td><td colspan="2">• This subdomain is fragmented due to the lack of higher level collaborative frameworks for vision and objective setting, and strategy development.
• The original legislation and development of regulation led to conflict between industry and conservation sectors, due to lack of consultation and collaboration in developing legislation and amendments. Act amendments under the Coalition may have equally diminished the potential effectiveness of the legislation.
• Monitoring frameworks are moderately strong, but could be further developed with respect to focussing on the achievement of water quality outcomes to better support decision-makers.
• Ultimately a strong regulatory foundation will be required, but an opportunity exists the see this collaboratively developed to ensure it is focussed on situations where significant water quality impacts apply.</td></tr>
<tr><td>Likelihood rating</td><td>Preliminary Rating
3</td><td>Final Rating
3</td></tr>
<tr><td>Considerations for consequences of system failure</td><td colspan="2">• Failure of the legislation would be unlikely to have major consequences because of existing frameworks for improvement of industry practices.</td></tr>
<tr><td>Consequence rating</td><td>Preliminary Rating
3</td><td>Final Rating
3</td></tr>
<tr><td>Combined risk rating</td><td>Preliminary Rating
9</td><td>Final Rating
9</td></tr>
<tr><td>Priorities for reform</td><td colspan="2">• This legislation and associated regulations would significantly benefit from far greater partnership development at the strategic level in review and delivery at the State and regional scales.
• Attention in implementation of the Act should be more strongly focussed in known regional and localised pollution hotpots.
• Strong and integrative water quality monitoring systems are needed across reef catchments to inform implementation/review.</td></tr>
<tr><td colspan="3">References:
Brodie, J., Kroon, F., Schaffelke, B., Wolanski, E., Lewis, S., Devlin, M., . . . Davis, A. (2012). Terrestrial pollutant runoff to the Great Barrier Reef: An update of issues, priorities and management responses. Marine Pollution Bulletin, 65, 81-100 doi: 10.1016/j.marpolbul.2011.12.012
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</table>

INDIGENOUS PEOPLE AND COUNTRY DOMAIN

Table 36. Traditional sea country management subdomain

<table>
<tr><td>Traditional sea country management</td><td colspan="2">Subdomain descriptor: Traditional owners across the GBR hold significant rights and responsibilities for managing sea country resources and cultural interests both within Reef catchments and sea country. There have been considerable structured approaches to the negotiation of Indigenous interests in sea country since the mid-1990s. Traditional lore governs use by indigenous communities of coastal resources of GBR significance (e.g. dugong and turtles). Traditional Use and Management Resource Agreements (TUMRAs) have been developed as part of the Indigenous Land and Sea Country Partnerships Program. TUMRAs set out partnership arrangements between traditional owners and the Australian and Queensland Governments to manage traditional use activities in sea country (GRBMPA, 2012). Currently there are five TUMRAs in place in the GBR Catchment, with strong support from indigenous communities (GBRMPA, 2012). In 2008 the Australian Government also established the Reef Rescue Indigenous Land and Sea Country Partnerships Program as part of the nation-wide Caring for Our Country (CfoC) NRM Program (GBRMPA, 2010). The purpose of the Indigenous Land and Sea Country Partnerships Program was to support traditional owner groups to plan for, manage and monitor their traditional lands (GBRMPA, 2010). Under the Indigenous Land and Sea Country Partnerships Program traditional owner groups have been able to apply for grants of $5,000 to $200,000 (GBRMPA, 2012). Despite these developments, traditional owners continue to be marginalised in wider GBR planning and delivery processes, so they are now using National Environmental Sciences Program (NESP) funding to explore a stronger Indigenous component emerges within the Long Term Sustainability plan.</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
Through Sea Forum in the mid 1990’s traditional owners had a strong GBR-wide vision of sea country management. New frameworks for bargaining and negotiation over management arrangements between traditional owner groups with shared interests over land/sea country.
The Australian Government appears to set the higher-level visions and objectives for traditional sea country management, while traditional owners are responsible for developing their own visions, objectives and strategies for the management of the lands they are affiliated with through their traditional lores and customs.
There is no strong program to research supporting traditional</td><td>Functional considerations:
While engagement across traditional owners exists in the GBR, efforts remain fragmented compared Sea Forum times in the mid-1990s.
Initial Sea Forum efforts found it difficult to mobilise effective State/ GBRMPA commitment to a new approach.
There is, however, a moderately strong collaborative framework between traditional owners and the GBRMPA to develop and implement plans for sea country that intersects with the GBR Marine Park.
While traditional owners are regrouping on sea country management issues at the GBR scale, there is still no structured capacity for them to help develop policy and structure negotiations.
The local capacity of traditional owner groups for sea country</td></tr>
</table>

	owner led management of sea country across the GBR. • Traditional governance systems require that only those with an affiliation to an area of land/sea can speak for and manage it, which is also supported by the TUMRAs. • Although the Australian Government funds the *Indigenous Land and Sea Country Partnerships Program,* the GBRMPA administer it (GBRMPA, 2010; 2012). • The *Land and Sea Country Partnerships Program* is focussed on building local capacity to undertake management activities, but poorly integrated with other efforts. • There are not strong monitoring and evaluation frameworks in place across Australian and State governments with respect to building the strength of traditional owner groups to effectively manage sea country interests.	management is highly varied, but limited by social/economic issues. • Although the connectivity between regional NRM groups and traditional owners provides some stability and support to traditional-owner groups, many still lack the capacity to garner resources. • Funding arrangements under CfoC were project or time frame specific, including funding for TUMRAs, providing sufficient funds to 'get started' but required traditional owners to source additional funds from elsewhere beyond the initial projects (Robins and Kanowski, 2011). • Traditional owners retain strong traditional knowledge in sea country management, but aspire to better protection and use of this knowledge. • Science supporting traditional owners in sea country management exists, but is not well connected to traditional owner decision making.
Considerations for likelihood of system failure	• Traditional owners continue to manage sea country resources on a daily basis across the GBR. While some areas of tension exist (e.g. with respect to dugong and turtle management, these are not considered to be leading to significant detrimental GBR environmental outcomes. • The main issue of concern is that lack of coordinated support for traditional owners in sea country management continues to erode cultural values in the reef and effective social outcomes. This has possibly become a more significant problem given recent major funding reforms (particularly funding centralisation) in Indigenous affairs. • Despite emerging investment in traditional-owner driven planning for country, there remain significant capacity limitations surrounding funding and business processes within key traditional owner groups.	
Likelihood rating	Preliminary Rating **3**	Final Rating **4**

Considerations for consequences of system failure	• Without some radical improvements in this subdomain, institutions related to land and sea management will continue to struggle to operate. • Cultural values in the reef could be severely hampered by other domains impacting on traditional owner interests, further limiting their capacity to effectively manage key resources such as turtle and dugong. • Failures in this subdomain are likely to have localised or species specific impacts rather than being detrimental to the whole GBR.	
Consequence rating	Preliminary Rating **3**	Final Rating **3**
Combined risk rating	Preliminary Rating **9**	Final Rating **12**
Priorities for reform	• Higher level strategic agreement between State and Australian governments and traditional owners about the vision/objectives for this subdomain are needed to deliver consistent approaches across the GBR. • Coordinated and whole of government support to increase the capacity and profile of traditional owners in catchment-based and sea country management, including wider recognition/valuing of the cultural values of the GBR in it promotion and management.	

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COMMUNITY BASED NRM AND CATCHMENT MANAGEMENT DOMAIN

Table 37. Regional NRM planning and delivery subdomain

<table>
<tr><td>Regional NRM planning and delivery</td><td colspan="2">Subdomain descriptor: The National Landcare Program is the national NRM funding program that articulates the Australian Government's broad national visions and objectives for NRM, which then affects how funding is distributed to projects and NRM groups at the regional and local scales (Department of Agriculture, Fisheries and Forestry [DAFF] & Department of Sustainability, Environment, Water, Population and Communities [SEWPAC], 2013). In Queensland, Q2 Coasts to Country is the primary State Government investment program (Department of Environment and Resource Management [DERM], 2011). Regional NRM in Queensland is operationalised by 13 community based NRM groups who are responsible for planning for, managing and monitoring NRM in their regions (DERM, 2011). All major reef catchments have a NRM plan and operate Water Quality Improvement Plans (WQIPs). Reef catchments include Cape York, Wet Tropics, Burdekin, Mackay Whitsundays, Fitzroy, and Burnett Mary. The implementation of the regional NRM plans and WQIPs are coordinated, and reviewed by regional NRM bodies, largely funded by State or Commonwealth funding/grant programs.</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
Vision for overall regional NRM agenda is focussed on programs delivery rather than policy targets (Dale, et al., in press)
The Australian Government currently sets higher-level visions, objectives and priorities for NRM. However a lack of a strong bargaining and negotiation framework means that there is a disconnect between the Australian Government visions/objectives and regional/local visions/objectives.
This subdomain only operates on one central national strategy – the delivery of a centralised competitive grant round suggesting limited strategy development capacity.
There is no framework for bilateral policy and priority agreement with State and Local Government regarding the subdomain (Dale, et al., in press).
Diminished and unclear investment in regional NRM bodies and removal of designation arrangements weakens regional strategy planning.
Singularised (grants) strategy has been developed in significant</td><td>Functional considerations:
Due to resource availability and political priority setting, regional NRM body strategy development capacities are varied. Some of the regions are currently delivering their second or third generation NRM plans, while others are still yet to deliver a NRM plan at all (Dale et al., 2013).
There is a high level of community engagement in NRM, however this tends to be weaker in vision/objective setting and strategy development. There is a greater level of collaboration for implementation activities, with many community groups taking responsibility for on-ground works in their catchments (DERM, 2011).
A national shift to annual competitive grants rounds have fractured long term partnerships required for effective local/regional NRM (Robins & Kanowski, 2011).
Public sector (Commonwealth and State) capacity for informed/independent national policy development appears to be declining.</td></tr>
</table>

	isolation from other national NRM governance domains. • There are few cohesive State/regional systems for NRM research synthesis (e.g. RRRC). • Regional NRM bodies are highly reliant on suasive instruments for strategy implementation due to the limited resources available and the non-statutory nature of most NRM plans in Queensland. • Some strong implementation frameworks emerged under Caring for our Country's IPA, WOC, and Reef Rescue sub programs (Department of Agriculture [DA], 2013; Department of Sustainability, Environment, Water, Populations and Communities [SEWPAC], 2012). • Monitoring and review frameworks appear chronically limited by a lack of resources and capacity and an outputs focus, leading to piecemeal, irregular and fragmented reviews of NRM planning outcomes. • MERI framework is focussed solely on project scale monitoring and delivers only national output reporting (Department of Environment, Water, Heritage, and Arts [DEWHA], 2009) • The Reef to Paddock monitoring program in the GBR catchments is gathering significant data on the biophysical environment and changes within it (Carroll et al., 2012). However, the Paddock to Reef to monitoring program is limited by available performance information (DA, 2013). • National resource condition monitoring/reporting systems do not influence strategy/resource allocation (DEWHA, 2009), though in the Reef the Science Consensus statement and Outlook reports do influence policy and investment.	• Variable but real capacities exist in councils, Landcare, farming, Indigenous, and other organisations. • There is a clear disconnect between the research sector and end-users in the NRM sector – particularly regional bodies and landholders. • There is a bias in the availability of data to support decision-making, with significant amounts of biophysical data available compared with limited social and economic data. • Limited structured use of social sciences, resource condition data, and trend data across the domain. • Despite improving capacities, regional NRM bodies are not funded as regional strategists/integrators • There are limited cohesive monitoring and evaluation capacities at all scales. • NRM arrangements and outcomes are currently monitored using MERI and SoE reporting, however these processes are limited (DAFF & SEWPAC, 2013). • While the biophysical quality of the GBR is well monitored, monitoring of performance, and the social and economic factors is generally limited.

Considerations for likelihood of system failure	• Current regional NRM arrangements are the result of several successive Government-driven NRM policy approaches and investment programs. • NRM arrangements in Queensland are currently somewhat integrated and aligned with local and national scales of planning and management. • NRM planning and delivery arrangements in Queensland are relatively mature though currently weakening. Some regions show less capacity than others in their NRM planning (Dale et al., 2013). • Recent government policy shifts have led to a lack of mandate for regional NRM planning, limiting funding certainty and an increase in competition between groups that traditionally worked collaboratively.	
Likelihood rating	Preliminary Rating **3**	Final Rating **3**
Considerations for consequences of system failure	• Regional NRM planning has been embryonic, but has delivered some significant benefits, resulting in the development and coordinated implementation of the current $200M Reef Rescue Program. • Early progress is showing reasonable movement towards improved land management, so subdomain failure will have GBR-wide consequences.	
Consequence rating	Preliminary Rating **4**	Final Rating **4**
Combined risk rating	Preliminary Rating **12**	Final Rating **12**
Priorities for reform	• Develop a revised bi- or tri-lateral framework for inter-government agreement in a way that is mindful of distributional equity. • Ensure policy design linked to long-term resource condition monitoring • Build stronger high-level policy rather than program objectives delivered against State/regional priorities and coordinated delivery. • Enhance place-based (especially regional) approaches to knowledge brokerage and research delivery. • Support performance benchmarking and continuous improvement in regional NRMs and potential expansion to other subdomain partners.	

References:

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Table 38. Floodplain, river and drainage management subdomain

<table>
<tr><td>Floodplain, river and drainage management</td><td colspan="2">Subdomain descriptor: Three State Acts govern the management of floodplains across the coastal zone, including the River Improvement Trust Act 1940, the Water Act 2000, and the Planning for Queensland's Development Act 2014 (currently in review). The primary objectives of these Acts relate to economic development/public safety. The Water Act 2000 is primarily focussed on protecting the provision of sufficient water flows needed to maintain the health of rivers in Queensland. However the Water Act 2000 contains provisions regarding the management of water in floodplain areas and flood mitigation measures. The Queensland Department of Natural Resources and Mines administer the River Improvement Trust Act 1940, which establishes a framework for the protection, and management of riverbanks and floodplains, while also providing for flood mitigation actions (Ryan et al., 2002). The River Improvement Trust Act 1940 allows for the constitution of trusts to manage 'trust areas' to improve the quality of the river bed and its banks (Ryan et al., 2002). Queensland's planning legislation itself does not require councils to undertake flood mapping or consider flood risks in decision-making on development (Queensland Floods Commission of Inquiry, 2012). However, a Queensland State Planning Policy sits under the legislation and requires local government development assessment officers to consider the risks and likelihood of flooding in development assessment (Department of Local Government and Planning & Department of Emergency Services, 2003). The flood considerations described in the State Planning Policy are only applicable to assessable development.</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
There is a weak planning and regulatory foundation for floodplain management in Queensland at State, regional and catchment scales.
There is no well-resourced frameworks for strong collaborative vision and objective setting or strategy development exists.
There are limited and poorly resourced strategic management framework for regional approaches to river planning and planning for rivers is localised and works often occur on a piecemeal basis.
Overall monitoring frameworks for success in this subdomain are weak.
The Planning for Queensland's Development Act, the Water Act 2000 and River Improvement Trust Act 1940 are reviewed irregularly by the Queensland Government.</td><td>Functional considerations:
The State's vision and objectives for river and drainage management is highly fragmented and disconnected across several pieces of legislation. The framework for river management lacks clarity and ties between regulations are weak and not cohesive.
There is a reasonable skill-based capacity to implement floodplain management at the regional and local scales in River Trusts, voluntary community catchment groups and NRM groups. However, a lack of financial resources remains a significant limitation to implement activities.
There are sufficient levels of biophysical and scientific data to support decision-making.</td></tr>
</table>

Considerations for likelihood of system failure	• There is currently no clear legislative and management vision for sustainable floodplain and river and management of at the GBR scale. • River trusts, some council planning and NRM activities do keep the system functioning to some limited degree.	
Likelihood rating	Preliminary Rating **4**	Final Rating **4**
Considerations for consequences of system failure	• Capacities of local River Trusts are generally limited and subdomain failure significantly contributes to biophysical health of catchments and reef pollution across the GBR. • Failure in this subdomain also presents significant economic risks to infrastructure and enterprise due to increased flood risk.	
Consequence rating	Preliminary Rating **4**	Final Rating **4**
Combined risk rating	Preliminary Rating **16**	Final Rating **16**
Priorities for reform	• A strong legislative foundation for integrated floodplain planning and management, including integration with NRM plans. • Building the capacity of Councils and local river trusts to better engage and manage their floodplains. • Establishing a clear and more cohesive framework for floodplain and river catchment management science across Queensland.	

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Table 39. Voluntary community action subdomain

Voluntary community action	**Subdomain descriptor:** Voluntary community action operates from very local scales to whole catchments and the entire Reef. Voluntary community action tends to be focussed on a specific issue or location (e.g. conservation of a specific species or management of a specific river). These groups receive investment through many sources.	
Governance health analysis	**Structural considerations:** • The new Federal National Landcare Program is the national policy framework for supporting regional and local volunteerism. • Limited cross-over of visions, objectives and strategies between voluntary groups across Australia • In GBR catchments there is some alignment in the focus of the visions and objectives of Landcare and catchment management groups towards improved catchment and reef health via NRM plans. • GBR Reef Guardians Program provides some limited recognition and support for the voluntary sector in reef catchments. • Voluntary groups generally have few legislative responsibilities except those tied to their funding. • Voluntary groups in the GBR are often funded to be involved in the implementation of government programs (e.g. Reef Rescue), and participate in on-the-ground rehabilitation and land management works, such as riparian tree planting, water quality management, and noxious weed management (Department of Agriculture, 2013; Reef Catchments, 2014). Such programs provide greater coordination of voluntary group actions and can encourage collaboration between groups with similar goals, leading to more strategic actions and outcomes. • Monitoring frameworks regarding the benefits of voluntary action are weak, with little funding available or impetus to undertake monitoring, leading to a mostly anecdotal evidence bank, rather than a	**Functional considerations:** • Implementation of a cohesive national and regional framework for supporting volunteerism has declined through the previous Caring for Our Country Program and is now under review. • Connectivity between voluntary groups is generally weak but variable. • State level peak capacity is represented by Landcare Australia and the Qld Water and Land Carers (QWALC) at the State level. • The capacity of voluntary community groups is highly varied, with some being highly organised and well-skilled (technically/ professionally), and others lack the skills and experience required. • There is no shared framework between voluntary groups for decision-making, collaboration or monitoring and evaluation • Voluntary community groups tend to have an older demographic, leading to a progressive decline in their capacity to undertake implementation activities and function as their membership declines over time. • Funding is a significant constraint on the capacity of many voluntary groups. • Voluntary community groups often have significant knowledge of their local area, and the condition, and history of that area, however this is rarely documented or retained in the long-term. • Research into the health and operation of this sector in limited, but some engagement exists in local biophysical issues of importance.

	systematically documented monitoring process. • There is a current Senate Inquiry into Landcare may review policy arrangements for cohesive support.	
Considerations for likelihood of system failure	• Volunteerism remains relatively strong across the Reef, but there is an attrition of volunteers due to the aging demographic and lower-participation levels of younger generations in voluntary groups. • The voluntary action sector has continued to grow in size/breadth. Group burnout and effort fragmentation remain issues for governance. • Currently, there is a high degree of fragmentation of efforts of voluntary groups in GBR catchments as a result of the National Landcare Program.	
Likelihood rating	Preliminary Rating **3**	Final Rating **3**
Considerations for consequences of system failure	• The sector, however, will remain an important and complementary subdomain in the GBR over time may increasingly be replaced by more market-based approaches to the delivery of ecosystem service outcomes. A strong volunteer sector is, however, crucial in ensuring community engagement and building local motivation and skills.	
Consequence rating	Preliminary Rating **3**	Final Rating **3**
Combined risk rating	Preliminary Rating **9**	Final Rating **9**
Priorities for reform	• Re-invigorate the national policy and delivery framework for community based natural resource management consistent with Curtis et al. (2014) and Dale et al. (in press).	

References:

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Department of Agriculture. (2013). Reef Rescue: Overview. Retrieved from http://www.nrm.gov.au/funding/reef-rescue/

Reef Catchments. (2014). Community volunteering. Retrieved from http://reefcatchments.com.au/community/volunteering/

Table 40. Landscape rehabilitation delivery subdomain

<table>
<tr><td>Landscape rehabilitation delivery</td><td colspan="2">Subdomain descriptor: A technically informed, cost effective and professionally capable sector of private and not for profit service delivery agents will be essential to achieving the major rehabilitation of landscape assets in the GBR. Critical capacities will include: improved farming system establishment; improved floodplain river and draining management, improved biosecurity management, soil erosion works and vegetation restoration and rehabilitation (including wetlands). Technical capacities for large-scale restoration of catchments, rivers and estuaries largely do reside within the voluntary sector (Landcare and community groups), Councils (work crews) and, to a limited extent, the private sector. Landcare and community groups generally focus their landscape rehabilitation activities in specific catchments, while councils coordinate work crews to undertake rehabilitation works across their city boundaries (Landcare, 2012; Reef Catchments, 2014). The private sector may be legislatively required to undertake landscape rehabilitation following development or resource extraction, however compliance is varied.</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
Voluntary groups and government agencies often have common but separate visions/objectives for landscape rehabilitation. There is not, however, a wider sector vision or profession association.
Bargaining and negotiation between policy and delivery occurs largely through fee-for-service arrangements, rather than structured policy frameworks
Cooperative effort towards establishment of this sector was curtailed under CfoC and delays in the roll out of the CFI.
Coordination of use of this sector, post-CfoC, is relatively fragmented, and there is little coordination across of service purchase.
There is currently no monitoring framework for reviewing the growth and efficacy of this landscape rehabilitation sector.</td><td>Functional considerations:
Connectivity between delivery groups across the GBR and catchments is generally poor.
Capacity of those participating sectors is variable; however technical capacity is generally high, while business capacity to garner funds is often poor.
Skill availability is diverse and patchy across the various sub-sectors and groups, because training is limited in its availability and scope
Although delivery capacity is often strong, monitoring capacity tends to be relatively weak, because of funding limitations and a lack of impetus from groups that would rather invest in more action than monitoring of completed works.
There is limited data retention on the success of works, with knowledge often held anecdotally by individuals involved in rehabilitation, rather than recorded for long-term synthesis (Kanowski, et al., 2008)</td></tr>
</table>

Considerations for likelihood of system failure	• Lack of a cohesive higher level strategic framework for the development of, and investment in this sector has restricted its development. • The subdomain grew substantially under the pre-CfoC regional arrangements for CBNRM and may grow further under the Australian government's Emission Reduction Fund and secondary market. • Training systems in this sector are also deficient and emerging delivery capacities often suffer from limited financial viability.	
Likelihood rating	Preliminary Rating **3**	Final Rating **3**
Considerations for consequences of system failure	• If this sector continues to stall under the new National Landcare Program and emerging ERF framework, this will delay significant opportunities to make major and rapid progress on the restoration of southern reef catchments via wide-scale systems repair.	
Consequence rating	Preliminary Rating **4**	Final Rating **4**
Combined risk rating	Preliminary Rating **12**	Final Rating **12**
Priorities for reform	• Establishment of a more structured national training system to build the capacity of emerging delivery agents in this sector. • Stable and structured delivery contracts to be regionally integrated and to establish monitoring programs following rehabilitation works.	

References:

Kanowski, J., Catterall, C., & Harrison, D. (2008). Monitoring the outcomes of reforestation for biodiversity conservation. In N. Stork & S. Turton (Eds.), *Living in a dynamic tropical forest landscape* (pp. 526-536). Oxford: Wiley-Blackwell

Landcare. (2012). Landcare: About. Retrieved from http://www.landcareonline.com.au/?page_id=56

Reef Catchments. (2014). Community volunteering. Retrieved from http://reefcatchments.com.au/community/volunteering/

Table 41. Estuarine management subdomain

<table>
<tr><td>Estuarine management</td><td colspan="2">Subdomain descriptor: The estuarine zone (the near coastal zone exclusive of formal ports) does not have a clear policy and management framework, but instead benefits from a number of quite specific legislative protections. This subdomain is raised more because it represents a spatial hole in Queensland's formal marine and natural resource management policy and planning framework.</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
There is a lack of a clear policy and planning framework (exclusive of ports) specifically and spatially focussed in the estuarine zone.
There is a reasonable research capacity in relation to the estuarine zone, but not a clear estuarine research and development frame.
Strategies for estuarine zone management are isolated regulatory mechanisms (e.g. mangrove protections, project assessment frameworks, fishing controls).
There is a lack of non-regulatory strategies aimed at directly improving the health of the estuarine zone.
Much of the diffuse pollution reduction effort has to date been focussed on reef vs estuarine health.
Compliance efforts relating to mangrove protection and fishing effort control have been reasonable.
There is no extensive framework for monitoring estuarine health.</td><td>Functional considerations:
A lack of spatially focussed attention on the estuarine zone means governance subdomains (e.g. catchment management) are not well connected.
Policy and planning capacities for estuarine management are generally weak or fragmented.
Isolated regulatory capacities are generally strong (e.g. mangrove protection.
Community-based capacities focussed on estuarine management are only just emerging or are weak.
National research capacities with respect to the estuarine zone are quite strong, but, since the collapse of the Coastal CRC, are poorly linked.</td></tr>
<tr><td>Considerations for likelihood of system failure</td><td colspan="2">Without a strong coordinative policy, planning and delivery framework, this subdomain does run a significant risk of failure.
Strong but isolated regulatory efforts (e.g. mangrove protection, fisheries management, etc.) do however, mitigate against this risk.</td></tr>
<tr><td>Likelihood rating</td><td>Preliminary Rating
3</td><td>Final Rating
3</td></tr>
<tr><td>Considerations for consequences of system failure</td><td colspan="2">As the estuarine zone is a critically important intermediator between catchment and reef systems, the consequences of failure in this system would be quite significant.
More scientific and practical knowledge of the critical importance of the zone is, however, required.</td></tr>
</table>

Consequence rating	Preliminary Rating **4**	Final Rating **4**
Combined risk rating	Preliminary Rating **12**	Final Rating **12**
Priorities for reform	• Greater coordination of research and development effort with respect to monitoring the health of the estuarine zone and better understanding its relevance to the health of the GBR. • Designing in catchment-based pollution reduction efforts, improve the focus on explicit links between catchment repair and estuarine health.	
References:		

BIOSECURITY DOMAIN

Table 42. Terrestrial biosecurity (weed and pest) subdomain

<table>
<tr><td>Biosecurity (weed and pest) management</td><td colspan="2">Subdomain descriptor: Biosecurity issues are managed at the international, national and State scales. Biosecurity Queensland is the primary regulatory body in Queensland for terrestrial disease, pest and weed management. Key international agreements include the International Plant Protection Convention, the UN Convention on Biodiversity. There are three relevant national pieces of legislation, including the Biological Control Act 1984, the Quarantine Act 1908 and the Environment Protection and Biodiversity Conservation Act 1999. Four different national institutions address key biosecurity agenda and a new DAFF Biosecurity Service Group integrates these function (Goldson et al., 2010). Australian Government programs and State Government regulations establish the foundation for pest planning and management (Department of Agriculture, 2013; Department of Agriculture, Fisheries and Forestry [DAFF], 2011). There are a number of Australian Government initiatives/programs focussed on terrestrial weed and pest management such as national weed eradication programs (Department of Agriculture, 2010). Biosecurity Queensland was established in 2007 (replacing multiple agencies) to streamline pest and weed management in Queensland (DAFF, 2011). Several quarantine boarders exist in Queensland and are managed by Biosecurity Queensland to limit the spread of invasive weeds (DAFF, 2011).</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
There is a moderately high degree of alignment between Australian and State Government biosecurity policies and arrangements, with responsibilities and defined roles.
The decision-making framework for biosecurity in Australia and Queensland is clear.
Regulatory foundations of implementation tend to be under—resourced, with weak compliance. Major new pests can be an exception to this general problem.
Monitoring and evaluation frameworks tend to focus on a limited number of biosecurity issues, while ignoring others.
National, State and regional monitoring is generally irregular and poorly linked to further decision-making in most situations.</td><td>Functional considerations:
Collaborative frameworks for decision-making at higher levels are stable.
Bargaining and negotiation frameworks at regional scale tend to be fragmented and focused on higher-level strategy development, meaning they are poorly engaged with lower level stakeholders.
There is a moderate level of capacity in landholders and local catchment groups to set visions/objectives and strategies to address biosecurity threats.
Landholders are disengaged with higher-level vision/ objective setting, and tend to be consulted rather engaged in strategy development.
Implementation tends to occur based on property-boundaries, rather than a collaborative, catchment or regional approaches.
Managers on private properties and State lands are disconnected, with poor alignment and timing of delivery strategies.</td></tr>
</table>

		• There is some engagement from the research sector in vision/objective setting, strategy development, and monitoring, but a disconnect between the research sector and local implementation. • There is significant biophysical data to support decision-making regarding biosecurity.
Considerations for likelihood of system failure	• National and State level biosecurity arrangements in Australia and Queensland are mature and stable, but new incursion can significant stretch resources and capacities. • Australia's biosecurity system has longstanding and continuously improving institutional arrangements, but significant risks of new and serious incursions of marine terrestrial pests remain. • Regional and local planning and delivery systems need attention.	
Likelihood rating	Preliminary Rating **3**	Final Rating **3**
Considerations for consequences of system failure	• Failure consequences can be locally and regionally significant and potentially significantly contribute to declining reef health (e.g. pigs).	
Consequence rating	Preliminary Rating **3**	Final Rating **4**
Combined risk rating	Preliminary Rating **9**	Final Rating **12**
Priorities for reform	• Through regional NRM planning and delivery and improved Council-based approaches to natural asset-based approaches to biosecurity management, improve local biosecurity outcomes.	

References:

Department of Agriculture. (2010). Animal and plant health: Pests, diseases, and weeds. Retrieved from http://www.daff.gov.au/animal-plant-health/pests-diseases-weeds/weeds

Department of Agriculture. (2013). About our biosecurity system. Retrieved from http://www.daff.gov.au/ba/about

Department of Agriculture, Fisheries and Forestry. (2011). About the work of Biosecurity Queensland. Retrieved from http://www.daff.qld.gov.au/biosecurity/about-biosecurity/the-work-of-biosecurity-queensland

Goldson, S.L., Frampton, E.R. & Ridley, G.S. (2010). The effects of legislation and policy in New Zealand and Australia on biosecurity and anthopod biological control research and development. *Biological Control 52*(3), 241-244.

Table 43. Marine biosecurity subdomain

<table>
<tr><td>Marine biosecurity</td><td colspan="2">Domain descriptor: There are more than 250 invasive marine species currently in Australian waters (Department of Agriculture, 2014). Although many of these species have had a minimal impact on the quality of marine habitats and biodiversity, a small number have had a particularly devastating impact in specific locations, including the Asian Green Mussel and Crown of Thorns starfish in the GBR (CSIRO, 2013). Such pests are largely introduced to Queensland's waters by shipping activities in ballast water or as biofoul (CSIRO, 2013; Department of Agriculture, 2014). The primary strategy for addressing marine pests is the National System for the Prevention and Management of Marine Pest Incursions, which is implemented by the Australian and state/territory governments, marine industries and marine scientists (Australian Government, 2014). Under the national system, national control plans have been developed for six invasive marine species (Australian Government, 2014). In addition to the national system, the Reef Rescue program also involves monitoring of some invasive marine species and their impacts on the GBR Marine Park (Department of Agriculture, 2013).</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
The decision-making framework for marine biosecurity in Australia and Queensland is highly aligned and coordinated across the country (Australian Government, 2013). Localised marine biosecurity measures are less clearly defined.
Suasive and regulatory instruments are used to encourage and enforce compliance with existing strategies (Australian Government, 2014; CSIRO, 2013).
Implementation and cohesive responses to emerging threats are limited by the availability of appropriate facilities (CSIRO, 2013).
The monitoring frameworks are well developed, however the regularity of monitoring is unclear (Australian Government, 2013).
Monitoring/reporting systems do not always influence strategy/resource allocation effectively</td><td>Functional considerations:
While connectivity is high amongst State, Territory, and Australian Government decision-makers and regulators, the connectivity between industry, research and government requires development (CSIRO, 2013).
Bargaining and negotiation frameworks exist but are not strong at local scale.
System capacity and coordination is limited by a lack of leadership beyond the regulatory framework (CSIRO, 2013).
Capacity to address emerging marine pests is limited by a lack of sufficient infrastructure and facilities, e.g. vessel cleaning (CSIRO, 2013).
The research capacity of the system is particularly high in research institutions based in North Queensland and national priorities for marine biodiversity have been identified (CSIRO, 2013).
There is currently insufficient information regarding Australian ecosystem functionality and species to apply technologies used elsewhere in the world for marine pest surveillance (CSIRO, 2013).</td></tr>
</table>

		• Monitoring capacity is high and there is sufficient connectivity to support monitoring and evaluation activities (Australian Government, 2014).
Considerations for likelihood of system failure	• The subdomain is well designed and integrated with other subdomains. • Australia's marine biosecurity system appears severely under-resourced compared to the risks and the environmental, economic and social assets that are vulnerable to the risks (CSIRO, 2013).	
Likelihood rating	Preliminary Rating **-**	Final Rating **2**
Considerations for consequences of system failure	• Failure consequences can be locally and regionally significant and can contribute to declining reef health (e.g. Crown of Thorns starfish). • National and State level marine biosecurity arrangements in Australia and Queensland are mature and stable, but new incursion can significant stretch resources and capacities. • Australia's biosecurity system has longstanding and continuously improving institutional arrangements, but significant risks of new and serious incursions of marine and terrestrial pests remain. • Regional and local planning and delivery systems need attention.	
Consequence rating	Preliminary Rating **-**	Final Rating **4**
Combined risk rating	Preliminary Rating **-**	Final Rating **8**
Priorities for reform	• Greater coordination between stakeholder sectors, governments and researchers to improve effectiveness and efficiency. • Strengthen existing bargaining and negotiation frameworks • Improved linkages between monitoring and evaluative mechanisms with decision-making structures.	

References:

Australian Government. (2014). The national system for the prevention and management of marine pest incursions. Retrieved from http://www.marinepests.gov.au/national-system/how-it-works/Pages/default.aspx

CSIRO. (2013). *Marine biosecurity workshop 2013: Workshop summary*. Hobart: CSIRO: Food Health and Life Science Industries.

Department of Agriculture. (2013). Reef rescue: Overview. Retrieved from http://www.nrm.gov.au/funding/reef-rescue/

Department of Agriculture. (2014). Marine pests. Retrieved from http://www.daff.gov.au/animal-plant-health/pests-diseases-weeds/marine-pests

ENVIRONMENTAL RESEARCH AND DEVELOPMENT DOMAIN

Table 44. Reef and coastal research and development domain

<table>
<tr><td>Reef and coastal research and development</td><td colspan="2">Subdomain descriptor: The GBR coast has a strong, well-funded framework for research on key issues (e.g. water quality) via universities and CSIRO. New institutions for research brokerage have emerged in recent years and have continued to evolve and inform policy/decision-making for the GBR. There are a number of research institutions and centres both within and external to North Queensland undertaking research on the GBR, including James Cook University, CSIRO, University of Queensland, Griffith University, Queensland University of Technology, Reef and Rainforest Research Centre, and NERP Great Barrier Reef Hub. In respect to regional scale NRM planning, new Knowledge Clusters were created as part of the Clean Energy Futures Plan (Stream 2 funding) to support regional NRM planning. The Wet Tropics Cluster is supported by a research partnership between James Cook University (leader) and the CSIRO (Department of the Environment, 2012). Several research consultancies also operate in the GBR and are contracted by strategic organisations to provide additional data or research support. Funding for research is sourced predominantly from Australian Government funds that are mostly government priority driven (e.g. water quality).</td></tr>
<tr><td>Governance health analysis</td><td>Structural considerations:
Despite a lack of alignment in the past, there is an increasingly aligned set of visions, objectives, and strategies for reef and coastal research and development for the GBR because of the CEF. These arrangements are still developing and will continue to emerge as the CEF funding is rolled out.
Many of the collaborative frameworks tend to be funded through integrated Commonwealth funding programs (e.g. the NERP and the GBRF), but their success relies on the interpersonal relationships of researchers within different institutions.
Brokerage arrangements are increasing in their strength with the introduction of a knowledge broker as part of the CEF, however as these arrangements are still emerging, there remains a disconnect between end users and the research sector.
At the project scale, poor institutional cultures supporting end user partnerships limit the successful uptake of research (see Babacan et al. 2012).</td><td>Functional considerations:
Structured collaborative frameworks are moderately stable and exist between key research institutions in the GBR catchments.
Research sector engagement with the planning and management sector and connectivity to the management sector is increasing in its strength, but there remain many gaps, requiring further development.
Although in the past the research sector has been somewhat fragmented, there has been increasing collaboration through the CEF knowledge cluster, MTSRF and NERP programs.
There is significant capacity in the research sector to provide information and analysis to support the development of visions, objectives and strategies for the management of the GBR catchments, with research on the GBR emerging from UQ, GU, QUT, Charles Darwin University, CSIRO, RIRDC, and numerous private consultancies.
Although research on the reef in the past has focused on the biophysical</td></tr>
</table>

	• There is no framework for monitoring and review of the health of this subdomain, though this has been recognised by the Qld Government GBR Taskforce.	characteristics, there is a growing body of research examining the social issues of the GBR catchments, and improving the capacity of decision-makers to consider more than the biophysical features of the GBR.
Considerations for likelihood of system failure	• This subdomain has been well funded on key issues such as water quality (i.e. a strong funding bias towards biophysical research). • The resulting knowledge is well integrated at the strategic level with management decision-making, including monitoring of reef health.	
Likelihood rating	Preliminary Rating **2**	Final Rating **2**
Considerations for consequences of system failure	• The consequence of system failure would be important in managing the condition of GBR ecosystems as knowledge is the key to adaptive management within the GBR. • Existing high levels of knowledge ensure effective management could continue for some time if there was a system failure in this domain.	
Consequence rating	Preliminary Rating **3**	Final Rating **3**
Combined risk rating	Preliminary Rating **6**	Final Rating **6**
Priorities for reform	• Integrative research planning and brokerage frameworks are needed to underpin new investment in GBR research (Department of Innovation, Industry, Science, and Research, 2010). • A strong cross-reef science strategy/communication approach is needed to prevent the emergence of denialism about GBR science.	

References:

Babacan, H., Dale, A., Andrews, P., Beazley, L., Horstman, M., Campbell, A., et al. (2012). *Science engagement and tropical Australia: Building a prosperous and sustainable future for the north.* Inspiring Australia Report, Kingston, ACT.

Department of Innovation, Industry, Science, and Research. (2010). *Inspiring Australia: A national strategy for engagement with the sciences*. Canberra: DIISR.

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