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Monitoring and adaptively reducing system-wide governance risks facing the GBR

Allan Dale, Karen Vella, Robert Pressey, Jon Brodie,
Margaret Gooch, Ruth Potts and Rachel Eberhard

JAMES COOK UNIVERSITY
AUSTRALIA

Monitoring and adaptively reducing system-wide governance risks facing the GBR

Allan P. Dale [1], Karen Vella[2], Robert L. Pressey[3], Jon Brodie[4], Margaret Gooch[5], Ruth Potts[2] and Rachel Eberhard[2]

[1] The Cairns Institute, James Cook University (JCU), PO Box 6811, Cairns, Queensland, 4870, Australia
[2] School of Civil Engineering and Built Environment, Science and Engineering Faculty, QUT, Brisbane, Queensland, 4000, Australia
[3] Australian Research Council Centre of Excellence for Coral Reef Studies, JCU, Townsville, Queensland, 4811, Australia
[4] Centre for Tropical Water and Aquatic Ecosystem Research, JCU, Townsville, Queensland, 4811, Australia
[5] Great Barrier Reef Marine Park Authority, PO Box 1379, Townsville, Queensland, 4810, Australia

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Cover photograph: JCU Image Library.

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ACRONYMS

CRN..... Collaborative Research Network
DOE..... Department of the Environment
GBR..... Great Barrier Reef
GBRMPA..... Great Barrier Reef Marine Park Authority
GSA..... Governance Systems Analysis
LTSP ..... Long Term Sustainability Plan
NESP..... National Environmental Science Programme
NRM ..... Natural Resource Management
RRRC ..... Reef and Rainforest Research Centre Limited
TWQ ..... Tropical Water Quality
UNESCO ..... United Nations Educational, Scientific and Cultural Organization

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SCIENCE SYNTHESIS STATEMENT

- This research, with government and stakeholder involvement, deeply analysed the **entire system of governance** effecting water quality outcomes in the Great Barrier Reef (GBR).
- While people often think of governance of the GBR **as one big system**, in reality, at least **40 discrete governance subsystems** influence GBR water quality outcomes.
- The ***Reef 2050 Long Term Sustainability Plan (Reef 2050 Plan)*** is the most important of these subsystems as it has the potential to **integrate effort in all other governance subsystems affecting the GBR**.
- The *Reef 2050 Plan* governance subsystem has only just been established, but several current weaknesses could significantly reduce its effectiveness.
- While the *Reef 2050 Plan* governance subsystem sets clear water quality targets for the GBR, there is a real risk of **"implementation failure"** as strong catchment-based and on-ground delivery subsystems have not been agreed and secured *between* governments *and* with regional stakeholders.
- There are also 5 non-GBR related governance subsystems that could **neutralise or reverse the outcomes** being achieved through the *Reef 2050 Plan* governance subsystem (e.g. Northern Development, Climate Change).
- If the Commonwealth, State and GBRMPA apply the Governance Systems Analysis approach developed here to benchmark the health of GBR governance and to facilitate cross-jurisdictional and partnership-based agreement about an adaptive governance reform program, these major risks could be managed effectively.

EXECUTIVE SUMMARY

The state and trend of the GBR's ecological health remains problematic, resulting in the United Nations Educational, Scientific and Cultural Organization (UNESCO) raising concerns regarding GBR governance (UNESCO, 2015). While UNESCO's concerns triggered separate strategic assessments by the Australian and Queensland governments, independent and integrated reviews of the key risks within the overall system of governance influencing GBR outcomes is missing. Consequently, this project applied Governance Systems Analysis (GSA); a novel analytical framework that identifies, benchmarks and enables monitoring of the integrity of those governance themes, domains and subdomains most likely to influence environmental and socio-economic outcomes in the GBR. Indeed, while many people often think of governance of the GBR as one big system, in reality, at least 40 discrete governance subdomains influence GBR water quality outcomes.

This report introduces and overviews two key outcomes from the research.

Research Outcome 1: The application of GSA identified and benchmarked governance subdomains that present high, medium, or low risk to achieving water quality outcomes in the GBR. This enabled us to determine that three "whole of system" governance problems currently have the potential to significantly undermine the achievement of GBR outcomes. First, we focussed attention on the integrative importance of the Reef 2050 *Long Term Sustainability Plan (LTSP) Subdomain.* Sponsored by the Australian and Queensland governments, this subdomain represents the primary institutional arrangements for coordinated GBR planning and delivery, but due to its recent emergence, it faces several internal governance challenges. Second, we found a major risk of implementation failure in the achievement of GBR water quality actions due to a lack of system-wide focus on building strong and stable delivery systems at catchment scale. Finally, we concluded that the *LTSP Subdomain* currently has too limited a mandate/capacity to influence several high-risk subdomains not aimed at GBR management (e.g., the *Greenhouse Gas Emission Management Subdomain*). This wider benchmark analysis enabled exploration of governance system reforms to address environmental trends in the GBR *and* to reflect on the possible application of GSA in other complex land and sea-scapes across the globe.

Research Outcome 2: Because of the identified lack of system-wide focus on building strong and stable water quality delivery systems at catchment scale, we identified and focussed on implementation failure (primarily at catchment scale) as a major systemic risk within the overall GBR governance system with regard to water quality outcomes. Consequently, we consider that the Australian, state (Queensland) and local governments need to develop a shared vision and agreed design principles for sound catchment scale governance and decision-making. While we also consider that there is substantive international recognition of the need for integrated governance approaches to achieve effective landscape and water quality outcomes at catchment scale, we suggest that few studies have explored specific design principles that need to be applied to different/discrete subdomains of governance within catchments. We have teased out what these design principles might look like for the GBR. The lessons emerging and the design principles established potentially have wide application in forested and agricultural landscapes across the globe.

1.0 INTRODUCTION

With the establishment of institutional structures for implementing and reviewing the new Reef 2050 Long Term Sustainability Plan (Commonwealth of Australia, 2015) in June 2015, this project was timed to establish the basis for regularly monitoring the health/impact of the wider governance system affecting social, economic and environmental outcomes in the GBR. Our focus has been on:

- ensuring key GBR stakeholders have a strong understanding of the method developed;
- developing the first full benchmark of the health of the existing governance system and exploring priorities for governance system reform for further development and refinement;
- exploring the willingness of all parties and mechanisms for institutionalising this approach within the longer term LTSP implementation/review mechanisms;
- working internally in the Great Barrier Reef Marine Park Authority (GBRMPA) to determine the best way to integrate such an approach with GBRMPA's five year Outlook reporting system. It is currently intended that the trialled reporting framework be directly integrated into Outlook reporting and mid-term LTSP review processes; and finally
- the research team publishing two international and quality journal articles that describe the method and its implications for long term GBR governance.

To achieve this, we have engaged closely with:

- both Australian and Queensland governments, internally within GBRMPA, and with the new governance/decision-making structures charged with implementing and reviewing the LTSP, particularly the Queensland GBR Water Quality Science Taskforce; and
- a much wider range of end users involved in GBR governance, including, but not limited to, agricultural industries, local government, regional NRMs, Traditional Owners, the conservation sector, the Landcare and catchment management sector and River Improvement Trusts.

This engagement has specifically included the following activities:

- A major round of structured stakeholder interviews to raise awareness and understanding of the GSA method and to review emerging findings (June to November 2015); and
- Structured discussions (sponsored by GBRMPA) with the new commonwealth and state institutional arrangements established for implementing/reviewing the LTSP, exploring opportunities for institutionalising the emerging monitoring approach (November to December 2015).

2.0 METHODOLOGY

The Governance Systems Analysis (GSA) framework, designed for analysing systemic risk within complex governance systems, was first proposed and developed by Dale et al. (2013) via National Environment Research Program funding. GSA applies normative criteria about desirable governance characteristics to analyse the key structural elements (i.e., from vision setting to monitoring and evaluation) and functional aspects (i.e., actor capacities, connectivity between actors, and the use of various knowledges) of governance systems. Additional evaluative criteria based on key operational principles (e.g., accountability) needed for building strong governance systems are also used to help describe the integrity of the system (i.e., the ability of the system to deliver on its intended outcomes). To establish a system-wide benchmark and to underpin the development of our two broad research outcomes, we applied GSA by following the steps outlined in Table 1 between June 2015 and March 2016; a process involving dialogue among GBR researchers and practitioners. Our small, multi-disciplinary research team also comprised GBR-specific knowledge and experience in ecological health, marine and terrestrial planning and governance analysis.

Table 1: **Steps in governance risk assessment applied in this study**

Step	Task	Key Research Methods Applied
1	Determine the key domains and subdomains affecting GBR outcomes	A detailed legislative and literature review and targeted discussions with GBR policy-makers, managers and governance experts to identify and describe some 15 governance domains and 40 subdomains of significance in the GBR. We focussed on subdomains substantively influencing GBR outcomes and targeted participants across Australian, state and local governments and across industry, conservation and Indigenous sectors.
2	Analysis of key domains and subdomains of governance	A literature review and targeted individual discussions (10) and focus groups (5) involving some 60 GBR policy makers, managers and governance experts to understand key subdomains and participant perceptions of how well the overall governance system was working. Structural aspects of our analysis addressed decision-making processes (from goal-setting, strategy development, implementation to monitoring and evaluation). Functional aspects addressed: (i) the decision-making capacities of all actors with a stake in each subdomain; (ii) the strength of connectivity among actors; and (iii) the way various knowledges are applied. This enabled consideration of different structures in subdomains and how they functioned across multiple scales.
3	Likelihood and consequence analysis of key subdomains	The application of standardised criteria for rating risks and consequences of the potential failure of all identified subdomains (see Table 2). The use of a standardised rating approach enabled benchmarking of the GBR governance system and set the foundations for repeatability over time. To analyse our Step 2 results, we also referred to several key evaluative criteria, including the sustainability, equity, accountability, adequacy, effectiveness, efficiency and adaptability of key aspects of each GBR governance subdomain. This analysis enabled us to assess all subdomains and explore the risk of their failure affecting overall GBR outcomes. For each subdomain, we rated the likelihood and GBR consequences of potential governance failure. Combined ratings were developed by multiplying likelihood and consequence ratings, enabling us to rank/cluster different subdomains and to prioritise reform options.

4	Assessment of potential governance system reforms	Where specific governance strengths and weaknesses were identified in key governance domains and subdomains, the research team, synthesised, considered and explored potential reforms and generic lessons for the application of GSA to other complex governance systems across the globe. GBR reform options were also explored within our targeted discussions and focus groups. In relation to the risk of "implementation failure" we specifically focussed on the development of design principles for 10 priority subdomains of importance to the delivery of water quality outcomes at the catchment scale across the GBR.
5	Design, implement and adaptively monitor reform	The results developed present a reliable benchmark of the integrity of the GBR governance system. Regular monitoring of changes in this risk is now both possible and desirable, and has been discussed and is being further developed with GBRMPA, Queensland and Commonwealth governments.

Table 2 below outlines the standardised criteria applied in rating risks and consequences of the potential failure of all identified subdomains.

Table 2: Rating scale for likelihood and consequences of systemic subdomain failure and combined ratings (likelihood x consequence)

Decision Rules - Likelihood	Failure of sub-domain will have no consequence for GBR outcomes (1)	Failure of sub-domain will have limited consequences for GBR outcomes (2)	Failure of sub-domain will have consequences of concern for GBR outcomes (3)	Failure of sub-domain will have significant consequences for GBR outcomes (4)	Failure of sub-domain will have catastrophic consequences for GBR outcomes (5)
Governance system dysfunctional and will fail to deliver intended outcomes (5)	5	10	15	20	25
Governance system in poor health and likely to fail to deliver intended outcomes (4)	4	8	12	16	20
Governance system on a knife's edge and could fail to deliver intended outcomes (3)	3	6	9	12	15
Governance system in good health and unlikely to fail to deliver intended outcomes (2)	2	4	6	8	10
Governance system in excellent health and will deliver its intended outcomes (1)	1	2	3	4	5
Risk Rating					

Decision Rules - Consequence

Full methodological detail behind this overall approach of evaluating all 40 identified governance subdomains can be found in Dale et al. (2013). The detailed results from this analysis are fully collated and synthesised into tables viewable at (http://researchonline.jcu.edu.au/43934/).

3.0 DISCUSSION

3.1 Risk Analysis of the GBR Governance System

This component of the work first identified some 40 governance subdomains that significantly influence outcomes in the GBR and classified them as high, low and medium risk. Combined ratings (likelihood x consequence) showing the relative risk profile of all governance subdomains. High risk represents combined ratings of 15 and above, medium risk represents combined ratings from 10 to 14 and low risk represents combined ratings below 10). In brief, these findings included (as summarised in Figure 1):

3.1.1 High risk subdomains requiring transformational change

Analysis identified 11 high risk (scoring 15 and above) subdomains of governance requiring transformational change to address declining water quality and ecological health outcomes in the GBR. Of most significance is the need for successful implementation of global action with respect to avoiding or sequestering greenhouse gas emissions in the *Greenhouse Gas Emissions Management Subdomain*. Action in this subdomain has routinely been isolated from GBR-specific governance, despite the potential for most GBR-related governance subdomains to be overwhelmed by far bigger risks emerging from the potential failure in international and national action on emissions. Secondly, there are various economic development subdomains that present significant risks. These include the *Northern Australian Development, Major Development Project Assessment,* and *Regional Land Use Planning* subdomains*.* Plans to increase agriculture in northern Australia, if not well managed, could over-ride gains made in improving water quality in the GBR catchment. Current weaknesses in the *Major Projects Subdomain* present a high risk to GBR health and creates uncertainty for economic investors. Problems in this subdomain also arise from weaknesses in the *Regional Land Use Planning Subdomain, which* could better guide major project siting to avoid cumulative impacts.

Another area that presents major risks but also opportunities for GBR governance is the lack of (but potential emergence) of a sound framework for the delivery of ecosystem services across GBR catchments (the *Ecosystem Services Subdomain*). Current landscape-scale investment in ecosystem-service management is based on a model requiring sustained government investment. Political uncertainty over strategies to protect high-value regrowth and riparian zones in GBR catchments also underpins medium-term risks in the *Vegetation Planning and Management Subdomain*. Poorly developed policy and bilateral effort presents risks in the *Property Planning and Management Subdomain*. Despite dugong populations being secure in the northern GBR, strategies for the protection and management of turtles and dugong (in the *Turtle/ Dugong Management Subdomain*) require reform internationally and particularly in the southern GBR, where declining populations remain a serious concern.

With pressure emerging from UNESCO, the Australian and Queensland governments have made strong efforts to establish new institutional frameworks for cohesive shared action in managing the future of the GBR (the *LTSP Subdomain*) and to significantly grow and deliver the resources required to achieve outcomes (through the *Reef Trust Subdomain*). While new, both of these subdomains face challenges becoming established, hence their high risk rating.

3.1.2 Medium risk subdomains requiring continued effort

Analysis identified 13 medium risk (scoring 10 to 14) subdomains, balanced on the divide between failure and success, and for which the consequences of system failure are important, but not catastrophic. These subdomains represent existing and new priorities for reform and include: (i) *Australia's Economic Framework;* (ii) *Local Government Planning;* (iii) *Tourism Development;* (iv) *National School-Based Education;* (v) *Commercial Fisheries Management;* (vi) *Aquaculture;* (vii) *Coastal Planning;* (viii) *Traditional Sea Country Management;* (ix) *Regional NRM Planning and Delivery;* (x) *Landscape Rehabilitation Delivery;* (xi) *Estuarine Management;* (xii) *Pesticide Management; and* (xiii) *Terrestrial Biosecurity (Weed and Pest).* Though many of these subdomains are improving, reference back to a trial benchmark established in Dale et al. (2013) suggests some are in decline and need renewed reform. One example is the *Regional NRM Planning and Delivery Subdomain*, which has been affected by increasing centralism in government policy and program delivery in community based NRM. Consequently, this research project has contributed to a proposed international paper exploring the key principles for reform of this subdomain, both in the national Australian and in other international contexts (Dale et al., n.d. c).

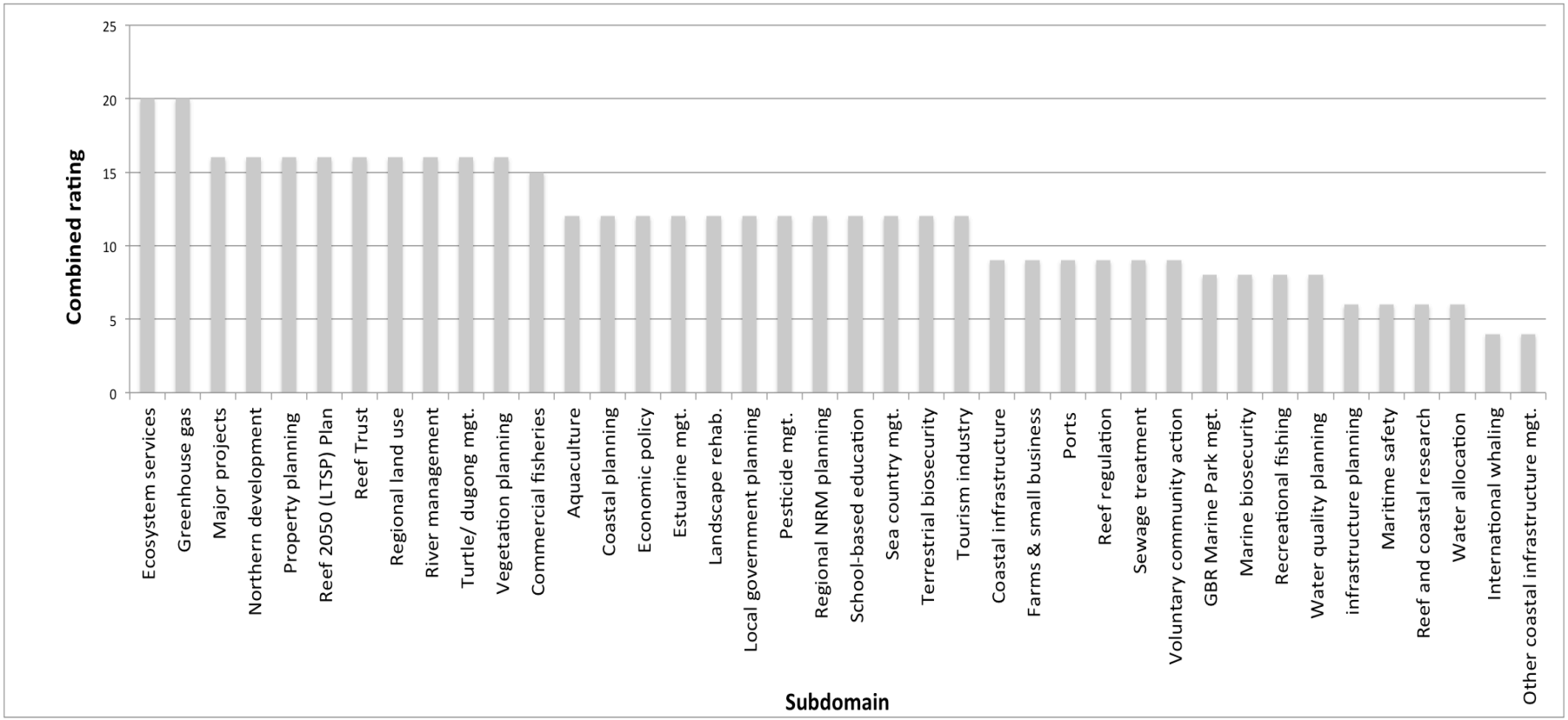

Figure 1: Combined ratings (likelihood x consequence) showing the relative risk profile of all subdomains

Note: High risk (ratings 15 and above), medium risk (ratings from 10 to 14) and low risk (ratings below 10).

3.1.3 Low risk subdomains requiring continuous improvement

There is a final cluster of subdomains that represent a low risk of governance failure. These 16 subdomains, however, need continuous refinement to avoid complacency and include: (i) *Australia's Infrastructure Planning*; (ii) *Other Coastal Infrastructure Management*; (iii) *Ports*; (iv) *Reef Regulation*; (v) *Sewage Treatment*; (vi) *Farm and Small Business Support*; (vii) *Voluntary Community Action;* (viii) *Marine Biosecurity*; (ix) *Recreational Fishing;* (x) *Water Quality Planning;* (xi) *Infrastructure Planning*; (xii) *Maritime Safety*; *(xiii) Reef and Coastal Research and Development (xiv) Water Allocation Planning and Management;* (xv) *International Whaling;* and (xvi) *Great Barrier Reef Marine Park Management*. It is important to remember, however, that increased risks of failure within important subdomains can emerge rapidly with changes in leadership, oversight or legislation.

3.1.4 A synthesis of overall system risks

From this risk based assessment, we were able to identify three thematic implications for the overall governance system. These include:

1. Governance of the LTSP Subdomain as the key integrative subdomain

The first key lesson is that the *LTSP Subdomain* is the one keystone arrangement with integrative potential to influence the entire GBR governance system. Despite the importance of this subdomain, it suffers its own weaknesses that need early attention. The subdomain did not exist in 2013 and evolved from previous bilateral and partnership arrangements focussed initially on strategising and coordinating efforts to achieve GBR water-quality targets. The formation of these new arrangements, with strong coordinated government efforts, engagement systems and knowledge integration platforms, is a significant and bold governance innovation. Due to its infancy, however, and the consequence of failure, we identify several characteristics that need bilateral strengthening:

- *Strategy Development:* A stronger focus on cohesive approaches to major strategy development to achieve LTSP targets;
- *Lack of Trilateralism:* A need for formal trilateralism between Australian, state and local governments involved in the GBR;
- *From Consultation to Partnership:* A move from a consultative to a more partnership-oriented approach to GBR policy development and implementation agenda;
- *Internal Institutional Overlaps:* The need for early, continuous effort to integrate commonwealth and state efforts and approaches within this complex system;
- *Science Priority Setting:* The need for stronger, more cohesive science priority setting, strategy development and effort/ investment alignment processes;
- *Monitoring and Reporting:* While early integration of monitoring/reporting shows promise, it needs adequate resourcing/influence within commonwealth and state budget cycles, perhaps on the current five year Outlook reporting basis; and
- The *Reef Trust Subdomain*: A need to reform several functional issues likely to limit success of the Reef Trust concept, including the lack of bilateral agreement with Queensland about focus/delivery and a lack of institutional flexibility (from within a government agency) to pursue/manage innovation.

2. Reforming key delivery systems at catchment scale

We identified a cluster of subdomains key to ensuring the quality delivery of planning and management actions for improving water quality and ecological health in GBR catchments. These subdomains, however, are not being cohesively strengthened as critical LTSP delivery mechanisms. When looking across all GBR subdomains, a consistent structural and functional problem becomes clear in that there is poor integration between policy-oriented subdomains (particularly the *LTSP Subdomain*) and delivery-oriented subdomains at regional or catchment scale. As in other governance systems, this risks systemic implementation failure. Catchment-based delivery mechanisms are essential to the success of regulatory, incentive or education-based strategies. The most important delivery subdomains that we consider need to be operating in a stronger policy context include the:

- *Pastoral and Agricultural Farming Systems Subdomain*;
- *River Improvement and Drainage Management Subdomain;*
- *Conservation Estate Planning and Best Management Subdomain;*
- *Water Allocation and Management Subdomain;*
- *Urban Water Management Subdomain;*
- *Port and Estuarine Management Subdomain;*
- *Indigenous Country Based Planning Subdomain*;
- *Regional and Local Land Use Planning Subdomain;*
- *Integrated Regulatory Frameworks Subdomain;* and the
- *Regional NRM Planning and Delivery Subdomain*.

Effective delivery of some $230 million of Commonwealth and State investment in water quality improvement over the next four financial years will experience deep inefficiencies without strong, adaptive bilateral agreement between the commonwealth and Queensland governments about the core design principles and reform partnerships needed to secure the delivery systems essential to achieving agreed water quality improvement targets.

3. Dealing with significant non-GBR governance domains and subdomains

We consider at least five non-GBR related governance subdomains could potentially overwhelm other subdomains specifically focussed on GBR outcomes:

- *Greenhouse Gas Emission Management*: This subdomain is significant in that there is currently no assurance that the unfolding global approach to managing emissions will curb global temperature rises and ocean acidification to levels that will prevent continuing declines in the ecological health of the GBR, regardless of other initiatives;
- *Ecosystem Service Policy and Delivery*: This subdomain is significant in that economic policy surrounding ecosystem services is so poorly developed that resourcing available to improve water quality leading into the GBR will not be adequate to improve ecosystem outcomes;
- *Northern Australian Development*: LTSP targets hope to reduce nitrogen runoff into the GBR by some 80% and sediment by 50% but assume no increase in the area or type of agriculture. Perversely, and at the same time, Australian and Queensland government policy is equally seeking to expand agricultural production in northern Queensland, including within GBR catchments;
- *Major Development Project Assessment*: The framework for major project assessment in GBR catchments remains poorly coordinated between Australian and Queensland governments, potentially leading to big environmental impacts for the

GBR *and* investment certainty for project investors. There is no focus on cumulative impact or consideration of the impact of the carbon emissions of major developments, including coal mines in GBR catchments; and

- *Vegetation Planning and Management*: Conflict over vegetation clearing laws in Queensland has vacillated between protection and development of native vegetation and regrowth in GBR catchments. While these areas are critical to maintaining GBR water quality, policy uncertainty remains, also resulting in significant social and economic impact for farmers in GBR catchments.

This situation suggests our current system of GBR-focussed governance (substantively integrated by the *LTSP Subdomain*) could be on course to failure. The *LTSP Subdomain* is currently too embryonic and limited in its powers to proactively address these conflicts. This highlights the problems facing the governance of complex globalised and high-stakes systems where politics and campaigns can drive a partial response that really needs a more considered focus. For the LTMP to have the desired effect, efforts need to be directed globally and locally to address the governance gaps in decision-making affecting the GBR. The GSA supports this policy reform prioritisation and decision-making to occur.

3.2 Overcoming Implementation Risk in GBR Catchments

Within the broader GBR governance system, there is a common failure in refining local implementation or delivery of Australian and Queensland government GBR actions. This is a significant finding as delivery actions for improving water quality in the GBR are almost universally taken within catchments (from water-shed to paddock levels). Combined deficiencies in delivery action of several key governance subdomains collectively mean that, no matter how good planning is at the wider GBR scale, water quality problems may remain intractable. We have identified 10 critical catchment-focussed subdomains key to ensuring the quality delivery of planning and management actions for improving water quality and ecological health in GBR catchments (see Figure 2). These subdomains, however, are not being cohesively strengthened as primary LTSP implementation or delivery mechanisms. When looking across all GBR subdomains, a consistent structural/functional problem emerges in that there is poor integration between policy-oriented subdomains (particularly the *LTSP Subdomain*) and delivery-oriented subdomains at regional/catchment scale.

Catchment-based delivery mechanisms are essential to the success of either regulatory, incentive or education-based delivery strategies for improving water quality outcomes. Securing effective delivery and achievement of LTSP targets will require strong, adaptive trilateral agreement (between national, state and local governments) about the core design principles and reform partnerships needed to secure the delivery systems that can be confidently deployed to secure agreed water quality targets. Consequently, we analysed the historical development, current delivery dilemmas and potential reform solutions associated with each of the identified priority delivery system-focussed subdomains. Figure 2 overviews these subdomains in a catchment context. Our summary of the resultant core design principles established are also outlined in Table 3.

Table 3: Design principles for the 10 key catchment scale subdomains related implementing water quality outcomes in the GBR

Design principles for subdomains related to governance of property management planning and best management practice	
Design principles	At the catchment scale, a flexible, continuously monitored accord could be developed between state and national governments, industry bodies (by sector), processors, markets, NRM bodies and the conservation sector regarding the development of a clear vision of the role of PMP/BMP approaches to: • Facilitate a focus on continuous improvements in profitability and stewardship at the farm scale; • Enable agreement about the key NRM practices that help farmers to meet their varied regulatory and market obligations, strive towards local best practice, and explore and experiment with innovative practices; • Secure agreement (most effective at the state level) about the role of PMPs/BMPs to be a single point of interface between the farm and government for regulation and compliance; • Provide an entry point for coordinated regional and catchment extension services and an agreed framework for the investment of national or state grants and tenders seeking practice change; • Guide research priorities and action plans for practice improvement; • Enable monitoring and reporting on continuous improvements in practice uptake across catchments and industries; and • Develop and provide the knowledge required for continuous improvements in estimating the net nutrient, sediment and pesticide reductions achieved through practice changes within catchments.
Design principles for river improvement and drainage management governance subdomains	
Design Principles	Encourage support for the development of a legislative and technically robust delivery framework that facilitates: • Integrated floodplain and river planning and works-program development to achieve both flood mitigation *and* catchment system repair; • Explicit links between floodplain-based land use planning, regional land use plans and local government planning schemes; • Stronger community engagement in the planning and delivery of stable long-term works programs; • A stronger, technically informed delivery capability (both with the required hard and soft engineering skills), perhaps in local councils; • A blended, long-term national and state (bilaterally agreed) investment, but also an enhanced capacity for local authorities to raise rates and maintain river and floodplain assets; and • Stronger strategic linkages back to integrated regional or catchment management strategies and water allocation and quality plans.

Design principles for conservation estate planning and best management subdomains	
Design Principles	Encourage support for approaches to conservation estate management that: • Prioritize the strategic use of an expanded conservation estate to deliver significant water quality benefits within catchments; • Establish and continuously improve best management practices for reducing sediment pollution loads emerging from the estate; • Establish strong power-sharing approaches with traditional owners and/or local landholding communities; and • Work effectively in a collaborative landscape-scale approach with both neighboring properties and the wider catchment community.
Design principles for water allocation and management subdomains	
Design Principles	Encourage support for the development of a legislative and technically robust framework for planning and allocation of flows that: • Engages catchment communities well in determining the economic, social, cultural and environmental values of water; • Employs sound science and decision-support in informing the negotiation of water allocation between competing values; • Has strong implementation mechanisms to manage the release and management of water for consumptive use; • Has regularized and engaged monitoring and review processes, leading to adaptive management of the resource; • Better integrates water quality and quantity issues.
Design principles for urban water management governance subdomains	
Design Principles	Encouraging national, state and local governments, catchment groups, industry, the community and research sector to form stable, long-term partnerships aimed at developing catchment-wide approaches to improving urban water quality. This could include higher level legislative or policy approaches for delivering of improved capacity in local government. Best practice frameworks for water sensitive urban planning and urban landscape management and urban design should be developed at the core of these partnerships, including a focus on: • Integrating water quality considerations in land use planning; • Best practice design in urban stormwater management (e.g. landscape softening, detention systems, trash removal); • Implementation of best practice measures through urban planning processes to reduce urban impacts on coastal sediment stores and toxicants stored in the coastal zone; • Education campaigns delivering reduced urban pollution; • Preservation and restoration of waterways and wetlands.

Design principles for port/estuarine governance subdomains	
Design Principles	Explore ways to better support the role of port authorities in facilitating and overseeing the adaptive development and implementation of their environmental management plans to result in continuously improving estuarine conditions in port areas via innovative/catchment solutions. Integrate and better align the governance and management of non-port estuarine areas with port-related planning and management, and other catchment scale planning and implementation subdomains.
Design principles for indigenous land and sea country management subdomains	
Design Principles	It must be recognized that indigenous people have a foundational interest in and significant ownership and control of the effective planning, management and delivery of catchment and estuarine management, requiring explicit recognition and support. This means: • Ensuring foundational legal and negotiation frameworks are in place for resolving and enhancing indigenous ownership and rights to land and sea country resources within catchments; • Recognizing and supporting the development of strong indigenous land and sea institutions to progress indigenous aspirations in country; • Explicitly empowering the involvement of indigenous land and sea institutions in all catchment scale planning and allocation processes; • Better facilitating the active involvement of indigenous institutions within the delivery mechanisms for catchment protection and repair.
Design principles for land use and infrastructure planning subdomains	
Design Principles	Foster the establishment of: • Stronger trilateral approaches to long-term and adaptive regional land use and infrastructure planning; • Effective environmental impact assessment systems embedded within a strong regional land use planning context; • Brokerage arrangements to support major project assessment processes to deliver environmental *and* economic outcomes; and • A focus on lifting the land use planning capacity and building the consistency of approaches across the multiple local governments with responsibility for GBR catchments. •
Design principles for regulatory integration governance subdomains	
Design Principles	In partnership with appropriate research providers, industry and environmental interests, establish a regional and catchment scale partnership process to explore alternative models for better implementing and integrating complex, fragmented legislation. These models would:

	• Enable the integrated expression of multiple legislative regulations at the farm/property scale, perhaps via property plan approaches; • Focus strongly on education, negotiation of outcomes and the strategic use of incentives and market-based instruments; and • Allow more strategic use of compliance-related resources.
Design principles for integrated regional NRM subdomains	
Design Principles	Encourage national, state and local government agreement on key approaches and reforms to regional/integrated NRM approaches that can: • Focus the policy logic behind integrative regionalism as a key mechanism for catchment scale strategy development, effort alignment, delivery reform and monitoring; • Drive genuine long-term trilateralism in the management and maintenance of stable catchment scale governance; • Establish and revitalize the bilateral accreditation of regional NRM plans and subsequent Water Quality Improvement Plans; • Explicitly focus on long-term, joint investment against priority actions to secure catchment water quality targets; • Commit to stable long-term catchment-based water quality improvement planning and monitoring partnerships; and • Establish regional coordination mechanisms to facilitate the alignment of local, state and national government targets and activities to achieve them.

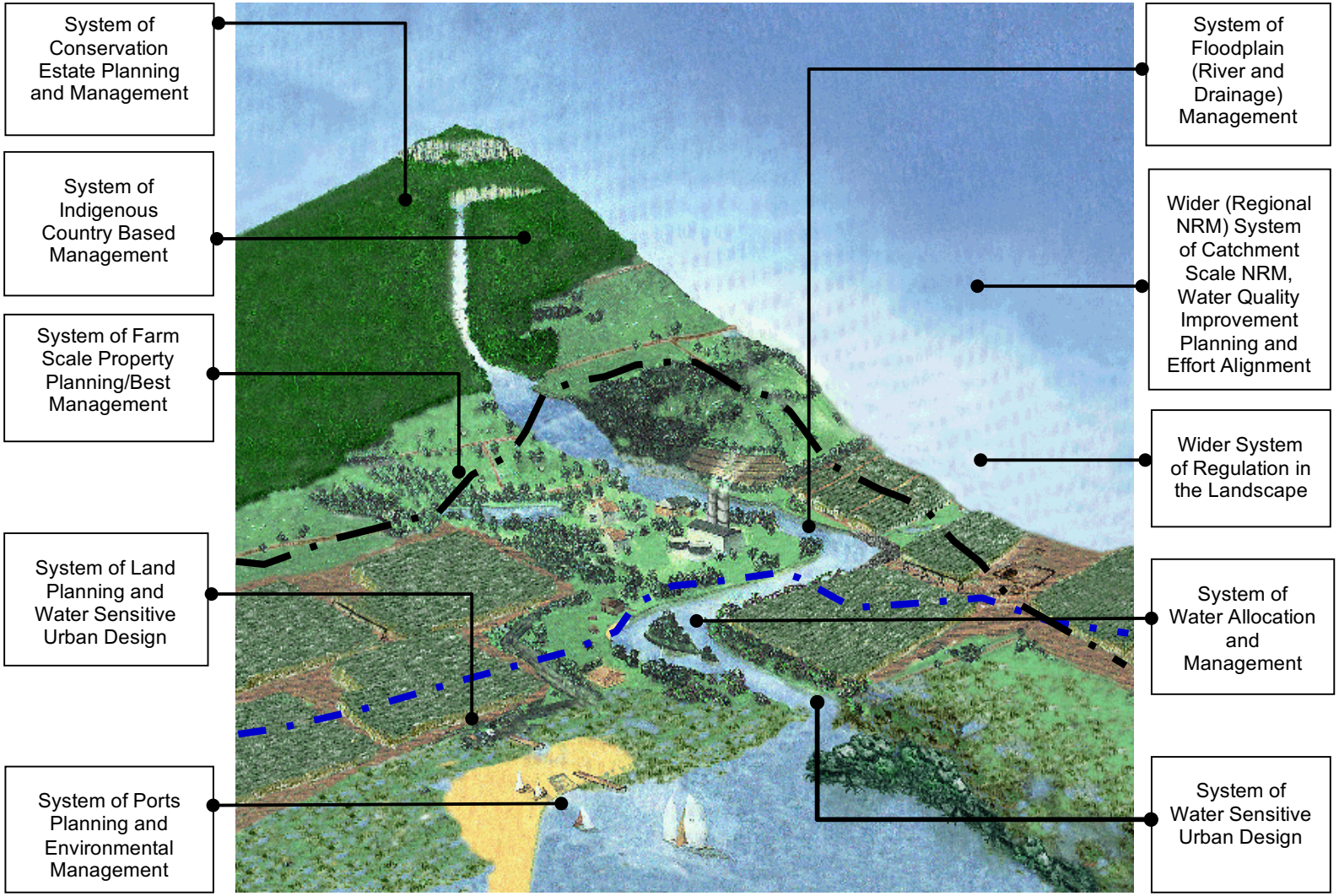

Figure 2: Simplified diagram (adapted from Vella, Bellamy & McDonald, 1999) of different systems, which when, combined, represent the key governance subdomains influencing water quality outcomes at the catchment scale in typical GBR catchments.

4.0 RECOMMENDATIONS, CONCLUSIONS & OUTCOMES

Given the summary results presented above, we consider two clear broad research conclusions and recommendations emerge from this project.

4.1 Overall risks in the governance system affecting GBR outcomes

We first identified high, medium and low risk subdomains of governance most significantly affecting social, economic and environmental outcomes within the GBR. From this assessment, we prioritised three system-wide reforms that need to be pursued including:

- Reform and continuous improvement in the governance of the *LTSP Subdomain*;
- Reforming key delivery systems at catchment scale; and
- Dealing with significant non-GBR governance domains and subdomains.

Progressing reform in these three areas will require a strong bilateral commitment between the Australian and Queensland governments to, based on this first benchmark approach, jointly monitor and adaptively negotiate reforms and improvements to the overarching system of governance affecting the GBR outcomes. This approach should:

- Build directly upon the benchmarking methodology established in this project;
- Be institutionalised to directly inform LTSP long-term Outlook reporting cycles;
- Fully involve all key GBR partners and stakeholders in the benchmarking process and reform prioritisation arrangements;
- Commencing by the mid-term LTSP review in 2016, result in regular bilateral review and agreement about an annual program of systemic governance reform; and
- Involve the application of this benchmarking and prioritisation approach through third-party facilitated negotiations about reform in systemic governance;

4.2 Design principles for catchment scale governance in the GBR

Secondly, we sought to showcase the importance of catchment scale governance in securing water quality improvements within important GBR coastal and inshore coral reef ecosystems. We focus on these issues because of an increasingly clear recognition of the "implementation dilemma" now emerging internationally in the environmental governance literature. We would contend that implementation of LTSP water quality improvement targets will remain unachievable if there is not a substantive focus on integrated reform of the key delivery-focussed governance subdomains that deliver coordinative and on ground actions within GBR catchments. This means serious negotiation between the Australian, Queensland and local governments about the key principles for redesign and reform on the 10 identified governance subdomains of most significance in delivering LTSP targets in GBR catchments. This agreement will then need to underpin a cohesive/durable and actively implemented and monitored package of system reforms.

Despite the importance of the catchment scale, we find that, throughout the international literature about natural resource governance, discussion tends to focus on the integrative concept of "whole of catchment management", rather than dropping into detail about desirable design principles for other critical catchment-focussed governance subdomains. We consider the concept of breaking down our understanding of the governance of

catchments into their component subdomains is a critically important new development in governance analysis, while retaining a strategic overview of integration of subdomain efforts across catchments also remains important. In the Australian and GBR context, *it is the Regional NRM Subdomain* that could be identified as being the most critical integrative subdomain in maintaining both a holistic and synoptic view of catchment governance.

While the design principles outlined here were crafted with GBR experience and reform in mind, we have also crafted them with the view that they could be readily adapted to the specific governance context of any catchment in either developed or developing nations. We hope that, in the context of building strong national, state/provincial and regional governance systems aimed at delivering catchment-focussed NRM outcomes in the GBR and internationally, this paper will provide a ready point of reference about both the diversity of subdomains required for effective delivery in catchments, and a more nuanced understanding of the design principles for the successful operation of these subdomains.

4.3 Direct Research Outcomes

In addition to the above broad conclusions and recommendations emerging from the research, the project has delivered the following key outcomes of significance to the long term governance of the GBR. Linked to original proposal outcomes, these include:

1. Directly influencing management in the GBR catchments by identifying short to medium term governance reform priorities in Queensland's GBR Taskforce, influencing State action/ investment in improving Reef water quality;

- At the time of the commencement of the project, lead researcher Allan Dale was appointed to the Queensland Government's Water Quality Science Taskforce. The research findings and approach helped raised the profile of governance issues within the report and were directly fed into the Taskforce process. Consequently, the research has directly influenced key recommendations related to governance and the expenditure of the now remaining $90 million. These recommendations are not finalized and will be released in the final Taskforce report before June this year.

2. Secure stakeholder willingness and agreed approaches to implementing the proposed method for long term benchmarking and monitoring of the health of the wider system of Reef governance and its constituent governance activities;

- In the context of both the project itself and the integration of governance issues within the GBR Water Quality Science Taskforce, preliminary discussion has been held with both the Queensland and Australian Governments about regularizing the benchmarking system established through this research, but will need to be progressed further once the Taskforce recommendations are completed. GBRMPA is particularly working closely with the researchers to see the system established as a standing component within regularized Outlook reporting systems.

3. Develop a discussion/options paper on short to medium term governance system reforms and a basis consensus-building about institutionalizing a long term monitoring approach;

- A priority paper for international publication (Dale n.d. a) has been circulated within GBRMPA and has been used as the basis for discussions about the integration of reporting about governance benchmarking within Outlook within that organization.

4. Establish a first cut, updateable, web-enabled data base describing the governance health of all key Reef governance activities, enabling regular update and adaptive monitoring;
- We have now published the first web-based data base representing the first full set of foundation synthesized data concerning our assessments of all 40 identified governance subdomains affecting GBR outcomes. This is available at http://researchonline.jcu.edu.au/43934/ and has been structured to enable regularized update and revision for all future benchmarking activities.
5. Provide data-based evidence concerning priority governance activities needed to underpin implementation of the LTSP and consequent management action to deliver reduced nutrient, sediment and pesticide pollution and to increase the biological health of Reef catchments, improving Reef resilience; and
- This web-enabled data set (see above) provided the evidence base from which we were able to draw out conclusions in our three key proposed publications arising from this research: Dale (n.d. a; b; and c). All three publications are on track for publication and/or review during 2016.
6. Provide evidence that Australia is taking an academically-robust, international leadership in benchmarking the performance of, and continuous improvement in, Reef governance.
- If Australian and Queensland governments commit to the emerging research and Taskforce recommendations proposed with respect to governance benchmarking and adaptive management, then Australia will have achieved a world first in facilitating innovative and continuous governance improvement in complex natural resource management system such as the GBR.

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