

FINAL REPORT

# Great Barrier Reef Water Science Taskforce

May 2016

*Clean water for a healthy reef*



**May 2016**

**The work of the Taskforce has called substantially on a wide body of research and evaluation that is summarised in the appendices.**

**The Taskforce acknowledges that Aboriginal and Torres Strait Islander peoples are the Traditional Owners of the Great Barrier Reef area and have a continuing connection to their land and sea country.**

Prepared by: The Great Barrier Reef Water Science Taskforce, and the Office of the Great Barrier Reef, Department of Environment and Heritage Protection

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## Preface and Acknowledgements

The Great Barrier Reef Water Science Taskforce was established in May 2015 to provide advice to the Queensland Government on how to achieve ambitious water quality targets and priorities for investing \$90 million over five years.

The key objective for the Taskforce was to provide advice to the Queensland Government on how to help ensure that clean water flows from the rivers to the sea to protect the Great Barrier Reef (the Reef) for future generations.

### This Final Report describes:

- Where are we now?
- Where do we want to be?
- How are we going to get there?

Firstly, we report on our key conclusions and recommendations.

The Report concludes with priorities for investment and a proposed implementation pathway.

**We would like to acknowledge and thank** the many people that have contributed to our process and the development of this Final Report, including:

- Our Taskforce members
- Our Peer Review Group members
- All stakeholders and community members who have provided feedback and suggestions during the consultation process
- The staff in the Department of Environment and Heritage Protection (particularly within the Office of the Great Barrier Reef), other Queensland Government agencies and the Australian Government and Great Barrier Reef Marine Park Authority, for their support, input and feedback.

The Great Barrier Reef is precious to all Queenslanders and we have been privileged to be able to provide advice on the steps that should be taken to protect and conserve it for future generations.

There are some bold recommendations in this report that will require more innovative approaches and thinking. We encourage the Queensland Government to keep pushing the boundaries for the benefit of the Great Barrier Reef.






Dr Geoff Garrett AO



**Queensland Chief Scientist, Chair of the Taskforce**





Claire Andersen, Rachel D'Arcy, Ben Hammill, Jenny Riches



**Taskforce Secretariat**

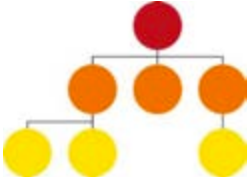
Principle		Taskforce conclusions	No.	Taskforce recommendations
The Reef water quality targets are critical to building Reef health.	<b>Targets:</b> 	The water quality targets are ambitious and important. Accelerating progress towards the targets is necessary.	1.	<b>1. REVIEW TARGETS IN 2016, FEEDING INTO THE REVIEW OF THE REEF WATER QUALITY PROTECTION PLAN.</b> 1.1. Review and refine the water quality targets, including targets for nutrients, sediment, pesticides, land management practice change and catchment health indicators. 1.2. Establish regional (and basin scale) targets for priority pollutants linked to Reef health.
A mix of tools are needed along the pathway to change	<b>Communication, collaboration and stakeholder engagement:</b> 	Strong leadership and two-way communication are essential for improving water quality for the benefit of a healthy Reef.	2.	<b>2. SUBSTANTIALLY IMPROVE COMMUNICATION AND INFORMATION TO BUILD UNDERSTANDING OF THE PRESSURES ON THE REEF AND TO SUPPORT MANAGEMENT PRACTICE AND SOCIAL CHANGE.</b> 2.1. Develop a collaborative communication approach with stakeholders to ensure everyone in the community understands how they can be part of the solution and contribute to improving Reef health. 2.2. Establish consistent communication and messaging on Reef matters including across governments and with partners, with well-defined roles and responsibilities, including through a single website. 2.3. Undertake an annual science synthesis workshop to generate new knowledge, better communicate science and inform policy, management practices and research priorities.
	<b>Extension and education:</b> 	Agricultural extension, particularly when aligned with other mechanisms such as incentives, is fundamental for improved long-term land management.	3.	<b>3. INVEST IN MORE EFFECTIVE, TARGETED AND COORDINATED EXTENSION TO SUPPORT LARGE SCALE LAND MANAGEMENT PRACTICE CHANGE.</b> 3.1. Restore the long-term government commitment to both resource and rebuild capacity in extension services across the Reef. 3.2. Formalise extension networks and define leadership and roles and responsibilities across local delivery organisations (government, private and farmer-to-farmer), for a whole-of-farm business approach which incorporates Reef health outcomes. 3.3. Support ongoing training programs and career development for accredited extension advisers. 3.4. Make greater use of smarter and more innovative extension approaches including facilitated peer-to-peer learning, demonstration projects and new technologies (for example phone apps). 3.5. Partner with the agricultural industry to develop a large-scale behaviour change program (already underway with the cane industry) to encourage farmers to adopt specific actions, by better understanding their motivations and the associated benefits.
	<b>Incentives:</b>	In order to make the significant changes needed to improve Reef health outcomes, incentives (for example grants) and market approaches (for example tenders) should be considered to	4.	<b>4. ESTABLISH GREATER USE OF INCENTIVES AND MARKET APPROACHES TO SUPPORT WATER QUALITY IMPROVEMENTS.</b> 4.1. Targeted use of market approaches such as tenders/reverse auctions (for example for purchasing nitrogen reduction) should be used where practical. 4.2. Develop new incentives to accelerate adoption of improved management

Principle		Taskforce conclusions	No.	Taskforce recommendations
		<p>complement and integrate with regulation, extension and education.</p>		<p>practices and/or support land use change (for example incentives for practice change, acquiring areas, and stewardship payments for restoration).</p> <p>4.3. Explore innovative approaches to support existing tools and manage risk (for example yield insurance, concessional farming loans).</p> <p>4.4. Water quality trading approaches may be viable in some settings in the future but will require a staged pathway of regulation and detailed farm level information to support implementation.</p>
	<p><b>Regulations:</b></p> 	<p>A staged regulatory pathway supported by extension, incentives, compliance, modelling and monitoring is needed to meet Reef outcomes.</p> <p>Regulations should apply to agricultural, urban and industrial activities within Reef catchments to meet minimum standards.</p> <p>Regulation of both future development and the intensification of existing development is important to ensure continuous improvement in water quality.</p> <p>Any regulatory regime needs to be clear, tailored to individual needs, easily measured and developed consultatively.</p>	<p><b>5.</b></p>	<p><b>5. IMPLEMENT STAGED REGULATIONS TO REDUCE WATER POLLUTION THROUGHOUT THE REEF REGIONS.</b></p> <p>5.1. Set and progressively reduce catchment pollution load limits in legislation to provide a regulatory framework to help drive load reductions to meet water quality targets.</p> <p>5.2. Incentives to continuously improve practices should be complemented by staged regulations that should:</p> <ul style="list-style-type: none"> <li>• improve existing minimum regulated standards (for example for urban, stormwater and point source) over time</li> <li>• establish minimum standards across all agricultural industries to address sediment and nutrient pollution</li> <li>• mandate the provision of farm level yield data, nutrient and other relevant data across all agricultural industries</li> <li>• consider progression to other approaches, including farm-based caps, if other stages are not successful within 5 years.</li> </ul> <p>5.3. Minimum standards must be set in consultation with affected industries and have explicit regard to the cost and benefits of those standards.</p> <p>5.4. Extend regulations to protect riparian areas and natural wetlands to all Reef regions, taking into consideration any impact this may have on landholders' ability to trade in ecosystem services.</p> <p>5.5. Establish regulations to ensure no net decline in water quality from intensification and expansion in the agricultural sector.</p> <p>5.6. Establish a water quality offset framework that can apply across industries (urban, ports, agriculture).</p> <p>5.7. Seek continuous improvement in regulations and compliance capacity for point source pollution, stormwater, and erosion and sediment control in urban and industrial areas.</p> <p>5.8. Improve management of irrigation to maximise water use efficiency and to minimise pollutant losses and associated impacts on water quality.</p>



Principle		Taskforce conclusions	No.	Taskforce recommendations
	<p><b>Knowledge, science and innovation:</b></p> 	<p>Improved alignment of research and innovation with the key challenges would enhance our ability to deliver substantial water quality improvements.</p> <p>Achieving the targets will not be possible with the adoption of current best practices alone and will require innovative approaches.</p>	6.	<p><b>6. BETTER ALIGN SCIENCE AND FUND DEVELOPMENT OF NEW IDEAS AND SOLUTIONS.</b></p> <p>6.1. Encourage the research community, governments and industry to work together to align current and future investment with the existing Reef Plan Research Development and Innovation Strategy.</p> <p>6.2. Establish an Innovation Fund that builds on existing activities to support the development, scaling up and roll-out of promising new technologies and approaches.</p> <p>6.3. Establish a Reef innovation network to drive boundary crossing collaboration among stakeholders, researchers and innovators from diverse backgrounds to explore new solutions to improve Reef water quality.</p>
	<p><b>Monitoring, modelling, evaluation and reporting:</b></p> 	<p>Current investment in monitoring and modelling is not enough to adequately measure Reef-wide water quality status and trends for both catchment and marine systems.</p> <p>Monitoring is also essential for supporting communities and properly evaluating and reporting on outcomes of investment and optimising program delivery.</p> <p>Regular and clear reporting on progress is vital and should be part of the broader reporting for the Reef 2050 Plan and Reef Water Quality Protection Plan (for example through Reef Outlook reporting and annual Reef report cards).</p>	7.	<p><b>7. FUND ADDITIONAL LONG-TERM AND FINER-SCALE CATCHMENT MONITORING, MODELLING AND REPORTING FOR IMPROVED DECISION MAKING AND ADAPTIVE MANAGEMENT.</b></p> <p>7.1 Fund high priority catchment monitoring and evaluation gaps to enable better understanding of current adoption of management practices across the industries and progress to water quality targets.</p> <p>7.2 As part of the proposed two major integrated projects, provide funding for finer-scale paddock and catchment monitoring, modelling and evaluation. This will provide timely feedback to farmers and support, encourage and embed improved practices. Explore more affordable monitoring technologies to expand this approach.</p> <p>7.3 Ensure monitoring and modelling of land management and water quality feeds into regular, integrated reporting across the Queensland and Australian governments which can provide ‘what if’ scenarios to assist decision-making and adaptive management.</p> <p>7.4 Continue co-funding Reef monitoring programs from the catchment to the Reef with the Australian Government to properly evaluate and report on outcomes of investment, and better align program delivery.</p> <p>7.5 Ensure public availability of information and improve communication and visualisation of monitoring results.</p>

Principle		Taskforce conclusions	No.	Taskforce recommendations
<p>Demonstration of all the recommendations in high risk areas through integrated projects</p>	<p><b>Two major integrated projects:</b></p> 	<p>Major integrated projects are needed in a small number of hot spots that integrate and evaluate the combined effectiveness of a range of tools and innovative approaches. Once up-scaled they will deliver accelerated progress to the targets and inform ongoing investment across the Reef catchments.</p>	<p><b>8.</b></p>	<p><b>8. IMPLEMENT TWO, WELL FACILITATED MAJOR INTEGRATED PROJECTS (MIPS) IN POLLUTANT ‘HOT SPOT’ AREAS TO EVALUATE THE MOST EFFECTIVE COMBINATION OF TOOLS TO INFORM THE DESIGN OF FUTURE PROGRAMS.</b></p> <p>8.1. One major project should engage with cane growers in the Wet Tropics (for example in the Tully, Johnstone and/or Herbert) to focus on reducing nutrient and pesticide loss.</p> <p>8.2. The other major project should engage with graziers in the Burdekin (for example in the Bowen-Broken-Bogie and Upper Burdekin) to focus on reducing sediment and particulate nutrient run-off.</p> <p>8.3. Local stakeholders and landholders must be actively involved in the design of the projects and the interventions being tested, which should be adapted over time as needed.</p> <p>8.4. Use the opportunity to identify and trial mechanisms for reform in the governance arrangements for delivering water quality outcomes.</p> <p>8.5. Monitoring and evaluation of the biophysical, social and economic outcomes of the interventions, delivery mechanisms and governance arrangements must be a major component of the projects so that learnings can be transferred to different locations and scales.</p> <p>8.6. Consider ongoing support to maintain and extend the successful outcomes of the MIPS approaches and tools.</p>
<p>Smart delivery and sustained investment will be critical to success</p>	<p><b>Investment planning:</b></p> 	<p>Reaching the targets is likely to require funds well beyond those currently allocated by both governments.</p> <p>Long-term continuity and strategic leveraging of government investment, for example through public-private partnerships and innovative funding vehicles, will be required.</p> <p>Clear regional investment planning will be necessary to maximise catchment and local scale investment alignment and implementation effectiveness.</p>	<p><b>9.</b></p>	<p><b>9. DEVELOP A STRATEGIC INVESTMENT PLAN AND ESTABLISH REEF-FRIENDLY PUBLIC-PRIVATE PARTNERSHIPS.</b></p> <p>9.1. Develop a combined investment plan for the \$90 million and the existing \$35 million per year Queensland Government funding (that is, \$230 million over the next four years).</p> <p>9.2. Develop multi-year joint investment plans with the Australian Government to pool resources, agree delivery mechanisms and provide greater certainty of funding and clearly address shared policy issues and priorities.</p> <p>9.3. Work with the Australian Government to transition the Reef Trust to an independent entity, better placed to attract private sector investment and philanthropic funding.</p> <p>9.4. Develop plans to:</p> <ul style="list-style-type: none"> <li>• leverage corporate and philanthropic funds through public-private partnerships</li> <li>• support conservation financing mechanisms (for example reduced interest rates for best management practice accredited farmers, green bonds).</li> <li>• encourage and support innovative catchment scale on-ground delivery partnerships to leverage collaboration, skills and energy from private and community enterprises.</li> </ul>

Principle		Taskforce conclusions	No.	Taskforce recommendations
	<p data-bbox="389 97 533 121"><b>Governance:</b></p> 	<p data-bbox="766 97 1153 384">Reef-wide, water quality governance arrangements from policy to on-ground delivery are currently complex and poorly aligned. Improved alignment, simplification and coordination of effort across the system is needed to improve water quality outcomes.</p> <p data-bbox="766 408 1153 536">This is an essential element to get right, across the wide range of organisations involved in the Reef space.</p> <p data-bbox="766 560 1153 743">Key issues that need to be resolved in order to improve governance include agreement on objectives, alignment of programs, clarity of roles and responsibilities, and accountabilities.</p>	<p data-bbox="1180 97 1223 121"><b>10.</b></p>	<p data-bbox="1258 97 2136 185"><b>10. SIMPLIFY AND STRENGTHEN GOVERNANCE AND CLARIFY ROLES AND RESPONSIBILITIES WITHIN AND BETWEEN THE QUEENSLAND AND AUSTRALIAN GOVERNMENTS.</b></p> <p data-bbox="1258 193 2136 344">10.1. Implement a simplified and more effective governance structure across Queensland and Australian governments to deliver better joint arrangements in funding and decision-making, and more efficient delivery arrangements and trial them through the major integrated projects.</p> <p data-bbox="1258 352 2136 544">10.2. Reach agreement on critical delivery systems operating within catchments and undertake progressive reform to improve coordination between partners including local, Queensland and Australian governments, regional NRM bodies, industry bodies, River Improvement Trusts, Drainage Boards and Traditional Owners to ensure more efficient and informed delivery.</p> <p data-bbox="1258 552 2136 679">10.3. Monitor and report on the effectiveness of the governance system affecting Reef water quality outcomes, resolving agreement on objectives, alignment of programs, clarity of roles and responsibilities and accountabilities.</p> <p data-bbox="1258 687 2136 775">10.4. Work across the Queensland Government to ensure the existing \$35 million per year investment has a direct Reef water quality benefit to respond to the Queensland Audit Office recommendations.</p>



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# INTRODUCTION AND BACKGROUND

## 1. An overview of the Great Barrier Reef

- **Covering an area of 344, 000 square kilometres, the Great Barrier Reef (the Reef) is the world’s largest coral reef system**, as large as Germany and larger than Great Britain, Malaysia or Italy, comprising approximately 3000 reefs and extending 2300 km along the Queensland coast.
- **The Reef was listed on the World Heritage Register in 1981** on the basis of its **Outstanding Universal Value**, particularly its “exceptional natural beauty and aesthetic importance”, and as an outstanding example “representing significant ongoing ecological and biological processes”.
- **While the corals that build reefs are the most visible natural ‘value’ in the Reef ecosystem**, it is the **Reef ecosystem as a whole** (including seagrasses, mangroves, sandy and muddy communities, coastal wetlands, islands and continental slope depths) that is important. It is the broader ecosystem that was recognised in the World Heritage Area listing.
- The breathtaking array of marine creatures includes 600 types of soft and hard corals, more than 100 species of jellyfish, 3000 varieties of molluscs, 500 species of worms, 1625 types of fish, 133 varieties of sharks and rays, and more than 30 species of whales and dolphins.
- **The Reef contains the greatest species diversity of any World Heritage Area on the planet**, including:
  - 56% of the world’s hard coral species
  - 33% of the world’s soft coral and sea fan species
  - 6 of the world’s 7 species of marine turtles
  - 54% of the world’s mangrove diversity
  - 23% of the world’s seagrass diversity
  - 13% of the world’s species of starfish, sea urchins and cucumbers
  - seabird breeding colonies on islands of world significance
  - one of the world’s most important populations of dugongs.
- **Traditional owners have cared for the Reef for thousands of years and have a special connection with it.**

- **The contribution of the Reef to the Queensland and Australian economy is estimated to be close to \$6 billion a year**, generating over 69,000 jobs across the tourism, recreation, commercial fishing, scientific research and management industries.
- **Agriculture is a dominant land use in the catchments adjacent to the Reef**, employing over 35,000 people and contributing approximately \$3.7 billion annually in gross value of production.
- For decades the Reef has been regarded as the best managed coral reef in the world, as a result of many years of joint management by the Australian and Queensland governments and collaboration across a full range of stakeholders.
- The **Reef 2050 Long Term Sustainability Plan (Reef 2050 Plan)** released by the Australian and Queensland governments in 2015 provides a 35 year blueprint for its management. Improving water quality is an important priority in that plan.



Further information: As part of the work of the Taskforce, a comprehensive ‘**Current Situation Analysis**’ was prepared, which provides further background information.

It can be found online at [www.gbr.qld.gov.au](http://www.gbr.qld.gov.au)

## 2. The problem

- **The Reef is facing a number of serious challenges.**
- Every five years, the **Great Barrier Reef Marine Park Authority** provides an assessment of the outlook for the Reef. The most recent **Outlook Report (2014)** concluded that: **'Even with the recent management initiatives to reduce threats and improve resilience, the overall outlook for the Great Barrier is poor, has worsened since 2009 and is expected to further deteriorate in the future. Greater reductions of threats at all levels, Reef-wide, regional and local, are required to prevent the projected declines in the Reef and to improve its capacity to recover.'**
- The 2014 Great Barrier Reef Outlook Report stated the **highest risks to the health and resilience of the Reef are:**
  - 1) **climate change** (that is, stronger storms, flooding, thermal stress)
  - 2) **land-based run-off** (with the greatest impact on the in-shore areas)
  - 3) **coastal land-use change**
  - 4) **aspects of direct use** (such as fishing, shipping and port activities).
- The ecosystem and species making up the natural value of the Reef are dynamic and go through cycles of disturbance and recovery. However, over the past decades there have been signs of significant declines in their condition.
- Significant, **widespread losses of seagrass** have occurred in areas directly affected by cyclones and river floods; seagrass abundance south of Cooktown has declined since 2009. Some recovery has been observed but appears to be patchy and site-dependent.
- The Reef region supports globally significant populations of dugongs. The dugong population was one of the reasons the Reef was listed on the World Heritage Register. The **dugong population south of Cooktown has drastically declined** from 1962 levels.
- From 1985 to 2012 **coral cover on the mid-shelf and off shore reefs on the Reef declined by almost 50%. The main reasons for this decline have been identified as outbreaks of crown-of-thorns starfish, cyclones, and thermal stress leading to coral bleaching.**
- From 2012 to 2015 coral cover has shown some recovery on reefs south of Cooktown, but declined further north. Coral reefs in the GBR remain under pressure.
- Crown-of-thorns starfish have caused widespread damage to parts of the Reef over the past five decades, due to population outbreaks which have occurred at regular intervals. Crown-of-thorns starfish (COTS) feed on corals

such as staghorns and plate corals. A current COTS outbreak is underway between Lizard Island and Cairns and is expected to move south over the next few years.



Photo: Crown-of-thorns starfish.



## 2016 coral bleaching event

- **In early 2016, the central to northern sections of the Reef experienced very significant coral bleaching**, which was a consequence of stress due to higher than average water temperatures.
- Further south, mid-shelf and outer reefs generally displayed minor to moderate bleaching. In past events (1998 and 2002), the central to southern areas experienced serious mass coral bleaching.
- **There is already significant mortality of corals across many severely bleached sites. However, the full ecological consequences of this mass bleaching event will not be known for some time.**
- See Great Barrier Reef Marine Park Authority website for further details and updates on the coral bleaching event: <http://www.gbrmpa.gov.au/media-room/coral-bleaching>



Photo: Bleached branching corals 2016. Source Chris Jones



## Climate change and ecosystem resilience

- Climate change is the single biggest threat to the Reef.
- The climate change risks of most concern are ocean warming and acidification, and the increased intensity of storm events.
- **At the same time, changes to the drought-flood cycle** due to climate change are likely to exacerbate the loss of sediments and nutrients from catchments that experience loss of vegetation (due to more extreme droughts) and greater scouring (due to more intense floods).
- **While efforts to reduce global climate change are underway, the focus must be on reducing all pressures to improve the Reef's resilience.**
- **This will give the Reef a greater capacity to bounce back from climate change related disturbances and survive well into the future.**
- The Taskforce recognises that the Queensland Government will need to consider how it can best meet international agreements around climate change. It is understood that Queensland is working on mitigation and adaptation strategies and that this will complement the work of the Taskforce.
- **Failure to deliver meaningful action on climate change could impact the effectiveness of investment in water quality improvement. Dual action on climate change and water quality improvement will be critical for the long-term health of the Reef.**

**The Taskforce recognises that to protect and maintain the health of the Great Barrier Reef in the long term, two things should be done:**

1. **Reduce emissions** to keep average global surface temperature increases to below 2.0°C\*, and hopefully 1.5°C over the long term. This means adopting a pathway to reduce greenhouse gas emissions over the next few decades consistent with international agreements to which Australia has committed to.
2. **Build resilience** by reducing all other stressors as much as possible, including poor water quality, crown-of-thorns starfish and other direct impacts like fishing.

*\* Above the Pre-industrial Period (that is, from about 1750 as per IPCC 2014 and the Paris COP21 Agreement 2015).*



### Factors affecting the health of corals include:

- **Water temperature:** Coral reefs are found in water that ranges from 18°C to 33°C. Generally, temperatures rising 1-2°C above the long-term summer maxima for 4-6 weeks will cause coral to bleach, with longer periods or higher temperatures leading increasingly to coral mortality.
- **Acidity:** Increasing atmospheric concentrations of carbon dioxide from the burning of fossil fuels is acidifying Reef waters, leading to a reduced ability by corals and other Reef organisms to produce their skeletons and shells. Being more brittle, storms may have greater impacts on corals which can lead to prolonged and cumulative damage to corals.
- **Increased nutrient levels in the water column:** Corals generally do best in waters that have lower concentrations of inorganic nutrients. Increasing concentrations of nutrients can change the competition between seaweeds (macroalgae) and corals, such that seaweeds may dominate previously coral dominated reefs after disturbances such as bleaching, storms and crown-of-thorns starfish outbreaks. Increasing nutrients may stimulate phytoplankton concentrations in the water column, leading to increased survival rates of crown-of-thorns starfish larvae as these food sources become more abundant. Increased survival rates of young starfish can lead to serious outbreaks of the adult starfish that eat corals.
- **Sediment:** Reduces the light available for seagrass and other organisms such as corals to photosynthesise, and may lead to smothering of these and other organisms that are not used to environments dominated by these types of sediments.
- **Pesticides:** Pesticides pose a risk particularly to coastal seagrass, wetland habitats and coral growth.
- **Extreme weather events:** Heavy rainfall, floods and tropical cyclones cause direct damage to the Reef in addition to transporting catchment-sourced nutrients, pesticides and sediments to the Reef. More intense droughts and floods due to climate change have potential to increase run-off and scouring – leading to even greater decreases in water quality.

### Role of coastal ecosystems and wetlands

- Wetlands and coastal ecosystems provide connectivity to the Reef for many species and also filter catchment run-off.
- Wetlands in Reef catchments provide a vital role in protecting shores from wave action and storms, reducing the impacts of floods, retaining sediment, absorbing pollutants and providing nurseries for fish and other freshwater and marine species.
- Many wetlands and coastal ecosystems have been extensively modified or lost over the last 100 years and their restoration and rehabilitation in strategic locations is expected to contribute to water quality improvement, but by how much, is still somewhat unclear.
- Wetlands and coastal ecosystems are valuable in their own right, providing habitat for important species.

## The impact of catchment run-off on reef water quality

- **Agricultural land uses are the main source of nitrogen, sediment and pesticides to the Reef and its ecosystems.**
- Other land uses, such as industrial, mining, port development, dredging and urban development contribute relatively small loads of pollutants to the Reef but can be locally significant. These industries are generally more heavily regulated than agriculture.
- **One of the most manageable impacts on the Reef is human-induced run-off of pollutants in rivers flowing to the Reef.**

## The highest risk pollutants

- Understanding of the highest risk pollutants to ecosystems in the Reef and the contributions from each land use has improved significantly.
- The 2013 **Scientific Consensus Statement** on land use impacts on Reef water quality and ecosystem condition was prepared by an independent panel of 40 leading scientists. It identified **the greatest water quality risks to the Reef to be from increased discharge of nutrients and fine sediments**, while **pesticides posed significant risk for coastal and freshwater ecosystems**:
  - **Excess nutrients** in the marine environment are linked to **outbreaks of destructive coral eating crown-of-thorns starfish**, excessive algal growth as well as increased susceptibility of corals to disease.
  - **Fine sediment** discharges **reduce light** available to seagrass ecosystems and inshore coral reefs.
  - **Pesticides** (specifically photosystem II {PSII} herbicides) **inhibit primary production, seagrass and coral growth** and at high concentrations, can lead to mortality.

## Sources of nitrogen, pesticides and sediment

- The dominant sources of **nitrogen** and **pesticides** are from agricultural fertiliser and pesticide use in intensive cropping, predominantly **sugarcane farms**, where large amounts of nitrogen fertiliser are used to maximise crop production.
- Grazing lands contribute the most **sediment** (and associated particulate nutrients) delivered to the Reef. Efforts to reduce erosion and sediment run-off will also help in reducing particulate nutrient loads.



**Priority Reef regions arising from poor water quality:**

Our current understanding of the high risk pollutants and areas (based on information available from the Water Quality Relative Risk Assessment prepared in 2013 (Brodie *et al.* 2013)) is as follows (refer to Table 1):

- The **Wet Tropics and Burdekin regions** are the priority for reducing **nutrient run-off**.
- The **Burdekin and Fitzroy regions** are the priority for reducing **sediment run-off**.
- The **Lower Burdekin and Mackay Whitsunday regions** are the priority regions for reducing **pesticide run-off**.
- Within each region (see Figure 1), there are individual catchments that are high priorities for the different pollutants (for example Normanby and Mary Rivers for sediment run-off).

**Table 1:** Water quality relative risk assessment

Water Quality Risk Assessment	
Highest risk nutrient areas	Wet Tropics Burdekin
Highest risk sediment areas	Burdekin Fitzroy
Highest risk pesticide areas	Lower Burdekin Mackay Whitsunday



**Figure 1:** Map of the Great Barrier Reef and catchments, with NRM regions shown.



### 3. Our task

- **The Great Barrier Reef Water Science Taskforce was established in May 2015 to provide the Queensland Government with the best possible advice on how it can meet its ambitious long-term water quality targets.**
- The Queensland Government has committed an additional \$100 million over five years to support priority actions across the Reef, \$10 million of which was allocated to the establishment of three net-free fishing zones.
- **The Taskforce is making recommendations to the government on how to best invest the remaining \$90 million for maximum water quality impact.**
- In providing advice on investment priorities for the \$90 million, existing Queensland Government investment and future Australian Government investment have also been considered.
- **The purpose of this Report is to detail findings of the Taskforce** in terms of identifying where we are now, where we want to be and how to get there. This has resulted in a range of conclusions and recommendations.
- Development of the Report has included extensive consultation (see Section 8).

***The key objective for the Taskforce is to provide advice to the Queensland Government on how to help ensure that clean water flows from the rivers to the sea to protect the Reef for future generations.***

#### **Terms of Reference (Extract):**

*The Great Barrier Reef Water Science Taskforce will provide advice and recommendations to the Minister for Environment and Heritage Protection and Minister for National Parks and the Great Barrier Reef and the Queensland Government more broadly on:*

- *the best approach to meeting the government's water quality targets, including the effectiveness and cost of robust regulations, incentives, Best Management Practice Programs, market-based trading mechanisms and other policy instruments, or a combination thereof.*
- *priority areas for investment for the additional \$100 million including:*
  - *upgrades to, and extension of the water quality monitoring network, scientific research where critical to support the recommended approach to meeting the targets, and/or facilitating the effective translation of current research into practice improvement*
  - *promoting environmentally sustainable industry practices especially to support primary producers in Reef catchments to reduce fertiliser and sediment run-off (including consideration of a potential net benefit policy)*
- *opportunities to align different sources of funding (for example from the Australian Government) and leverage Queensland Government investment effectively.*
- *opportunities to maximise and align other sources of funding such as private/philanthropic and various science funds (for example the Advance Queensland Initiative and National Environmental Science Programme).*
- *ensuring outcomes can be effectively monitored and reported over time, including providing advice on the adequacy of existing monitoring and reporting activities.*



## 4. Water Quality Targets

### Reef Water Quality Protection Plan

- In 2003, the **Reef Water Quality Protection Plan** committed the Queensland and Australian governments to halting and reversing the decline in water quality entering the Reef within 10 years. An additional goal was added in 2009, which was to ensure that by 2020 the quality of water entering the Reef from adjacent catchments has no detrimental impact on Reef health and resilience. This was refined in 2013 to ensure that by 2020 the quality of water entering the Reef from broad scale land use has no detrimental impact on the Reef health and resilience.
- Pollutant load reduction targets for water quality improvement in the Reef have been used in the Reef Water Quality Protection Plan since 2009 to help guide water quality improvement programs. The evolution of water quality targets is shown in Table 2 below.
- Since this plan was prepared, further scientific studies have recommended revised targets such as a 50-80% reduction in dissolved inorganic nitrogen in the Burdekin and Wet Tropics catchments may be required to meet the Great Barrier Reef Water Quality Guidelines (that identify the water quality thresholds that need to be met to ensure the health of coral and seagrass).

### Reef 2050 Plan

- As a result, the Queensland Government committed to more ambitious **targets, which were adopted in the Reef 2050 Plan**. The Taskforce has been tasked with addressing these targets, which are:
  - **Reduce nitrogen run-off by up to 80% in key catchments such as the Wet Tropics and the Burdekin by 2025.**
  - **Reduce total suspended sediment run-off by up to 50% in key catchments such as the Wet Tropics and the Burdekin by 2025.**
- These targets have been informed by the best available science, (for example Wooldridge *et al.* (2006) and Brodie *et al.* (2014)), but there are still knowledge gaps. Further work is required to determine basin-specific targets that ensure water quality on the Reef does not exceed ecological thresholds.
- The Reef 2050 Plan, with a wider focus than just water quality, is the overarching framework for protecting and managing the Reef from 2015 to 2050. The Reef 2050 Plan was developed jointly by the Queensland and Australian governments and the Great Barrier Reef Marine Park Authority in close consultation with stakeholders.
- The responsibility for implementation of the Reef 2050 Plan is shared between the Australian and Queensland governments.

### Refinement of targets

- A planned review of the Reef Water Quality Protection Plan targets in 2016 will be a timely opportunity to refine the targets and better define them at regional and basin scale. It will also ensure they are appropriately nested within and help deliver on the Reef 2050 Plan.
- Experience from other regions such as Moreton Bay suggests that being able to clearly identify contributions to the total pollutant load from various sources is very useful in mobilising action. In South East Queensland, a simple nutrient and sediment budget (i.e. proportion of nutrient and sediment from different sources and how it moves through the system) was prepared to inform discussions with stakeholders. A similar approach could be taken in the Reef utilising the existing catchment modelling. Contributions to targets by different industries and regions could then be identified.



**Table 2: History and evolution of the Reef water quality targets since 2009**

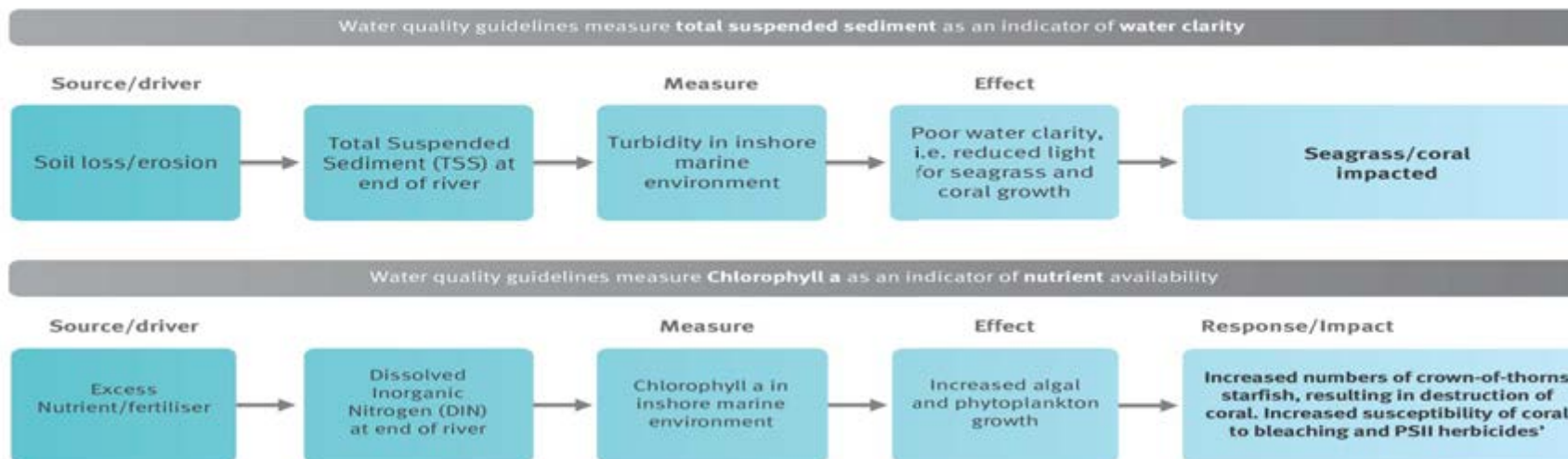
Plan	Nutrient target	Sediment target	Pesticides target	Basis of targets (best available at time)
<b>2003</b> Reef Water Quality Protection Plan <i>Goal: Halting and reversing the decline in water quality entering the Reef within 10 years</i>	No specific nitrogen reduction target	No specific sediment reduction target	No specific pesticide reduction target	Available data and expert opinion
<b>2009</b> Reef Water Quality Protection Plan <b>Goals:</b> <ul style="list-style-type: none"> <li><b>2013:</b> Halt and reverse the decline in water quality entering the Reef by 2013.</li> <li><b>2020:</b> To ensure that by 2020 the quality of water entering the Reef from adjacent catchments has no detrimental impact on the health and resilience of the Great Barrier Reef.</li> </ul>	<b>By 2013</b> there will be a minimum 50% reduction in total nitrogen and phosphorus loads at the end of catchments.	<b>By 2020</b> there will be a minimum 20% reduction in sediment load at the end of catchments.	<b>By 2013</b> there will be a minimum 50% reduction in pesticides at the end of catchments.	Stretch targets based on initial Water Quality Improvement Plans, available data and expert opinion.
<b>2013</b> Reef Water Quality Protection Plan <i>Goal: To ensure that by 2020 the quality of water entering the reef from broadscale land use has no detrimental impact on the health and resilience of the Great Barrier Reef.</i>	<b>By 2018</b> at least a 50% reduction in anthropogenic end-of-catchment dissolved inorganic nitrogen loads in priority areas.  <b>By 2018</b> at least a 20% reduction in anthropogenic end-of-catchment loads particulate nutrients in priority areas.	<b>By 2020</b> there will be a minimum 20% reduction in sediment load at the end of catchments.  <b>By 2018</b> at least a 20% reduction in anthropogenic end-of-catchment loads of sediments in priority areas.	<b>By 2018</b> at least a 60% reduction in end-of-catchment pesticide loads in priority areas.	Source Catchments modelling of best practice.  Nitrogen target changed to Dissolved Inorganic Nitrogen (DIN). The phosphorus target was removed.
<b>2015</b> Queensland Government commitment targets	<b>By 2025 reduce nitrogen run-off by up to 80% in key catchments such as the Wet Tropics and the Burdekin.</b>	<b>By 2025 reduce total suspended sediment run-off by up to 50% in key catchments such as the Burdekin.</b>		Ecologically based targets are available in some regions (e.g. Wet Tropics, Burnett Mary)
<b>2015</b> Reef 2050 Long-Term Sustainability Plan <b>2050 outcome:</b> Reef water quality sustains the Outstanding Universal Value, builds resilience and improves ecosystem health over each successive decade.	<b>By 2018</b> , at least a 50% reduction in anthropogenic end-of-catchment dissolved inorganic nitrogen loads in priority areas, on the way to achieving up to an 80% reduction in nitrogen <b>by 2025</b> .  <b>By 2018</b> , at least a 20% reduction in anthropogenic end-of-catchment loads of particulate nutrients in priority areas.	<b>By 2018</b> , at least a 20% reduction in anthropogenic end-of-catchment loads of sediments in priority areas, on the way to achieving up to a 50% reduction <b>by 2025</b> .	<b>By 2018</b> , at least a 60% reduction in end-of-catchment pesticide loads in priority areas	Combines Reef Water Quality Protection Plan 2013 targets and Queensland Government election commitment targets
<b>2016</b> Reef Water Quality Protection Plan: Mid-term Review	Targets to be determined	Targets to be determined	Targets to be determined	Available data and expert opinion, eReefs modelling

## How the targets are derived

- Water quality targets should be based on critical threshold levels for different water quality parameters to ensure that the marine ecosystem is adequately protected.
- There are a range of policies in place that help set the relevant water quality thresholds from the national level to the local level including the Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000, the Water Quality Guidelines for the Great Barrier Reef Marine Park 2010 and the *Queensland Environment Protection (Water) Policy (2009)*.
- Under these policies, water quality objectives are identified for different waterways and long-term goals are established for water quality that will help protect and maintain the freshwater and marine ecosystem.
- A water quality *guideline* is a numerical limit or descriptive statement that defines desirable conditions to support or maintain designated environmental

values. Water quality *objectives* take this a step further. They are the specific water quality targets agreed between stakeholders, or set by local jurisdictions, that become the indicators of management performance (Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000).

- Water quality objectives are based on local, regional or national water quality guidelines depending on information available – the more locally relevant the better.
- Empirical studies and, catchment and marine modelling are then needed to estimate the end of river loads needed to achieve those water quality objectives (Figure 2). This also takes into consideration the impact of climate variability and flood cycles.

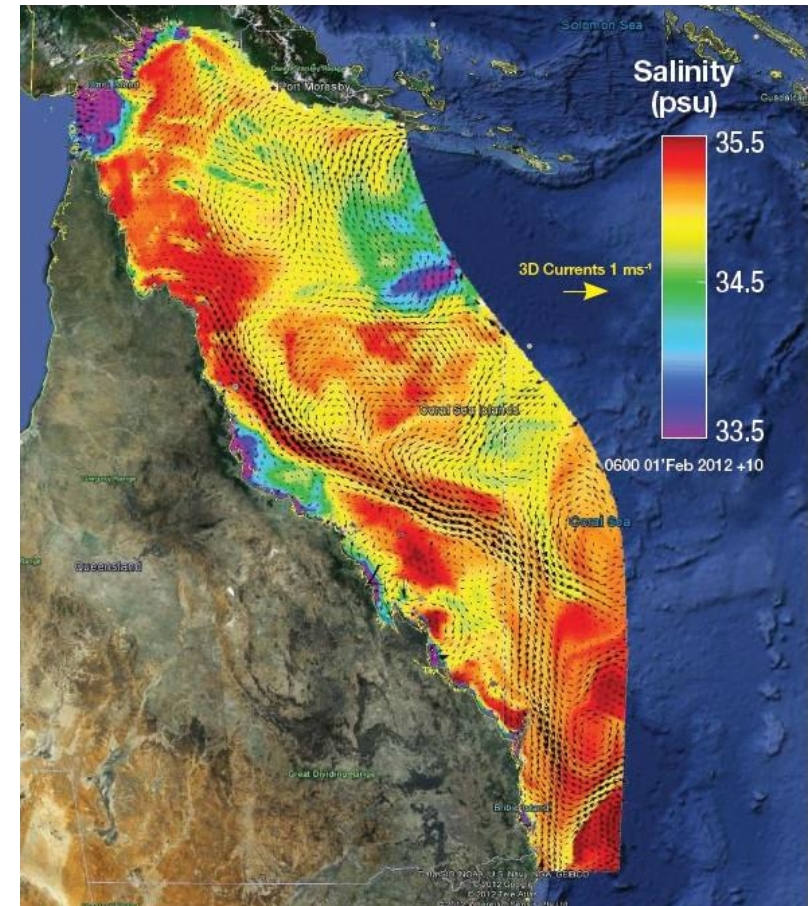


**Figure 2:** The impacts of excess nutrient and sediment



## eReefs

- Due to the long-term nature of ecosystem responses, monitoring information alone does not give timely feedback on the effectiveness of management changes and improvements. It is also clouded by normal climate variation and natural complexity.
- **Marine water quality modelling** assesses how the marine environment responds to changes in end-of-catchment loads and helps evaluate if progress toward catchment targets is producing the expected outcomes for the Reef.
- The eReefs project will provide marine water quality modelling tools to cover the catchment to Reef continuum, helping to predict how water and pollutants move and affect the Reef. It will support near real-time water quality information in a manner similar to how meteorological modelling is used to help predict the weather.
- The project is developing the capability and tools to undertake integrated modelling, and improve the type and delivery of water quality information to end-users. The project commenced in 2012 and is now in phase 2. Early scenario results from the modelling are expected in 2016.
- The project is managed by the Great Barrier Reef Foundation with work undertaken by CSIRO, the Australian Institute of Marine Science, the Bureau of Meteorology and the Queensland Department of Science, Information Technology and Innovation.
- The project is partly funded out of the \$90 million funding allocation for water quality from the Queensland Government. The \$2 million allocation builds on a \$12 million investment from the Queensland and Australian governments and the private sector in the eReefs project, as well as historical investments by the Queensland Government.
- **The review of the water quality targets in 2016 will incorporate new information and modelling from the eReefs project.**
- **Currently, funding for eReefs is terminating in 2017. Continuity of funding and maintaining the skills and capabilities that have been built will be important.**



Source: eReefs: Modelled salinity concentrations.

## WHERE ARE WE NOW?

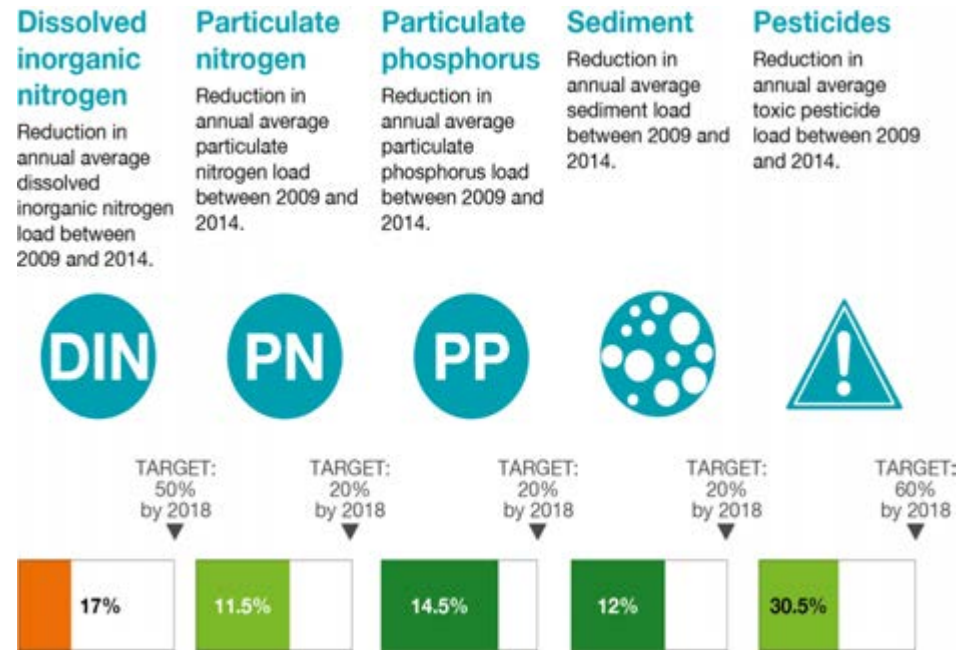
### 5. Progress to date

- **Progress has been made to improve water quality in Reef catchments.**
- Some considerable changes have been made across many sectors (including local government, urban development, agriculture, tourism, resources and ports), and there is a strong commitment in these industries to improving sustainability not only to ensure the prosperity of these sectors and industries into the future, but also to protect the Reef.
- **However, the resulting changes have not been rapid or widespread enough to improve or even maintain water quality on the Reef.**

#### Great Barrier Reef Report Card 2014 (released 2015)

- The Reef Report Card reports on progress towards targets in the Reef Water Quality Protection Plan 2013. This includes targets for:
  - land management practices for the main agricultural industries
  - catchment pollutant loads
  - catchment indicators - ground cover, wetlands and riparian extent.
- The Reef Report Card shows modelled long term average loads of five different pollutants (dissolved inorganic nitrogen (DIN); particulate nitrogen (PN), particulate phosphorus (PP), sediment and pesticides).
- As shown by the **Reef Report Card**, modelled long term average loads of **dissolved inorganic nitrogen have reduced by 17% and sediment by 12% compared to a 2009 baseline** (Figure 3).
- **Despite significant investment and goodwill from all parties, and improvements in some areas of marine condition, not enough has been achieved to prevent the further decline of the Reef.**
- **An accelerated uptake of improved practices is urgently needed to spur progress towards the targets.**
- The target for adoption of best practice land management is 90% of the land area by 2018 (Figure 4). The Reef Report Card 2014 shows the area of land managed under best management practice systems for each industry across the Reef was:
  - **sugarcane** - approximately 13% for nutrients, 30% for pesticides and 23% for soil
  - **grazing erosion** - approximately 28% for pastures, 47% for stream banks and 24% for gullies.

- While the measured progress towards water quality targets in many areas is still not fast enough or sufficient, considerable investment provides a strong foundation for further improvements.
- Further details on the Reef Report Card 2014 can be found at: <http://www.reefplan.qld.gov.au/measuring-success/report-cards/2014/>



**Figure 3:** Reef Report Card 2014: Catchment load results: results are an estimate of the annual average reduction in human-caused (anthropogenic) pollutant loads at the end of catchments.

Red = very poor; Orange = poor; Yellow = moderate; Light green = good; Dark green = very good. (see <http://www.reefplan.qld.gov.au/about/assets/gbr-report-card-2014-management-practice-results.pdf> for more details).



## Sugarcane

Area of sugarcane lands managed using best management practice systems as at June 2014.



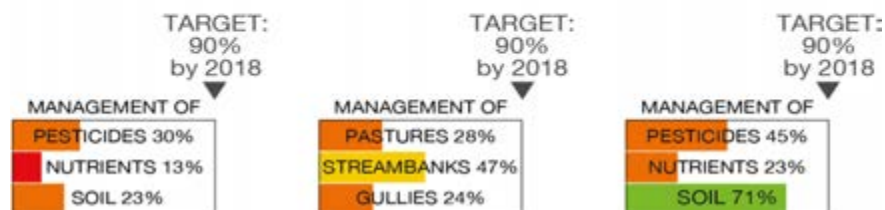
## Grazing

Area of grazing lands managed using best management practice systems as at June 2014.



## Horticulture

Area of horticulture lands managed using best management practice systems as at June 2014.



**Figure 4:** Reef Report Card 2014 management practices results for Sugarcane, Grazing and Horticulture.

Red = very poor; Orange = poor; Yellow = moderate; Light green = good; Dark green = very good.

- Farmers on around 50% of the cane land area and graziers on 10% of the grazing land area within Reef catchments have participated in the industry Best Management Practice (BMP) process. However, less than 5% of both cane farmers and graziers have so far been formally BMP accredited (refer to Table 3).
- There are approximately 3800 sugarcane growers managing 4032 square kilometres of land across the Reef catchment (Report Card 2014).
- There are approximately 8500 graziers managing 322,891 square kilometres of land across the Reef catchment (Report Card 2014).
- Farmers across approximately 50% of cane land area (around one third of farmers) have participated in the voluntary, industry-led Smartcane BMP program (commenced in 2013). Participants assess their practices against industry standards and identify opportunities for improvement not just in water quality but also in other topics like farm business management and workplace health and safety.

- While the number of growers participating is substantial since the program commenced in 2013 with 1287 cane growers participating, as of mid-April 2016, 86 are accredited. Updates on accreditation figures are available at: <https://www.smartcane.com.au/LatestNews/LatestNews.aspx>.
- Similarly, for the Grazing BMP (commenced in 2013), as of mid-April, 1371 have participated, with only 27 farms accredited. However, in 2015-16 alone almost 32,000 square kilometres were added by Grazing BMP participants (around 10% of the area within GBR catchments under grazing).
- There have been some real achievements in improved practices that make up best management practice. For example, green trash blanketing has now become the norm in all regions except the Burdekin, helping to reduce sediment run-off from participating cane farms.
- Despite some levels of practice change, adoption of the highest priority practices, such as those related to nitrogen application rates, has been slow.
- The Reef Report Card 2014 concluded that accelerated improvements in land management will be needed to increase progress towards the Reef Water Quality Protection Plan targets.
- Programs like Reef Rescue, which ran from 2009 to 2013 (and continued afterwards as the 'Reef Programme'), provided support for land management improvement and leveraged significant private investment from farmers and graziers. While regarded as highly successful by many stakeholders, **the changes have not come fast enough and are not sufficiently widespread to make a significant difference to end of catchment pollutant loads.**

**Table 3:** Rates of BMP adoption in Great Barrier Reef catchments (as at April 2016)

Rates of Adoption of BMP	Cane	Grazing
<b>Total number of farmers and graziers</b>	3777	8545
<b>Number of farmers who have participated in BMP</b>	1287 (34%)	1371 (16%)
<b>Area of land covered by BMP</b>	Approximately 50%	Approximately 10%
<b>Number of farmers who are BMP accredited</b>	86 (2.3%)	27 (0.3%)

## 6. Queensland Audit Office feedback

- In 2015 the Queensland Audit Office undertook an audit of Reef water quality programs and found:
  - while there was the Reef Water Quality Protection Plan, there was no cohesive State-based Reef program to support its achievement
  - Queensland's response had lacked urgency and purpose, characterised by disparate projects with no central authority and no clear accountability for their delivery or for achievement
  - results indicated that the right balance had not been achieved between industry led, voluntary approaches and regulatory enforcement
  - the fragmented program response was mirrored by fragmented governance arrangements. One consequence of this was that there was no strong accountability for program expenditures.
- **The Queensland Government has not yet formally responded to the audit.**
- In reaction to the audit, the Queensland Government, through the Minister for the Great Barrier Reef, announced in May 2015:
  - that the functions of the Reef Secretariat would be expanded and transferred from the Department of the Premier and Cabinet into the Department of Environment and Heritage Protection as an Office of the Great Barrier Reef to coordinate, monitor and assist in delivering the State's contribution to the Reef Water Quality Protection Plan and the Reef 2050 Plan
  - the establishment of the Taskforce and an interdepartmental committee.
- The Queensland Audit Office noted that, in principle, if implemented effectively, these changes should address the governance issues identified.
- The findings of the Queensland Audit Office along with the Queensland Government's actions have been considered by the Taskforce in their deliberations.
- **Many of the recommendations in this report complement the Queensland Audit Office conclusions and will help address their recommendations to the Queensland Government.**



## 7. Change needed

- The Taskforce considered the **2025 water quality targets aspirational** in the prescribed timeframe and available resources.
- **Transformational change is needed over the next 5-10 years if the targets have any chance of being achieved.**
- Transformational change for Reef water quality outcomes will occur when there is a fundamental shift in the way the land is managed. For example, alternative crops, calculating fertiliser based on zonal or 'management unit yield potential', better fertilisers that improve nitrogen use efficiency and repurposing or land use conversion of some areas.
- **The challenge is to lead and manage a much needed and significant practice and management change program across such a vast scale.** A program of this scale is likely to require significantly more investment than currently available. **Leadership, clearly defined accountabilities and adequate resourcing are key.**
- The scale of landscape alteration has exacerbated the problem, and it is questionable whether there is adequate protection of landscapes (for example, riparian and wetland areas) from future loss.
- Figure 5 shows progress to date, the poor outcome of continued business-as-usual as per current investment, and an indicative steep trajectory that will be needed to meet water quality targets.
- Like any major change program, care must be taken to ensure that changes are locked in for the long term to avoid having to invest multiple times to achieve the same gains.





## Nitrogen and Sediment load reductions required to meet 2025 targets

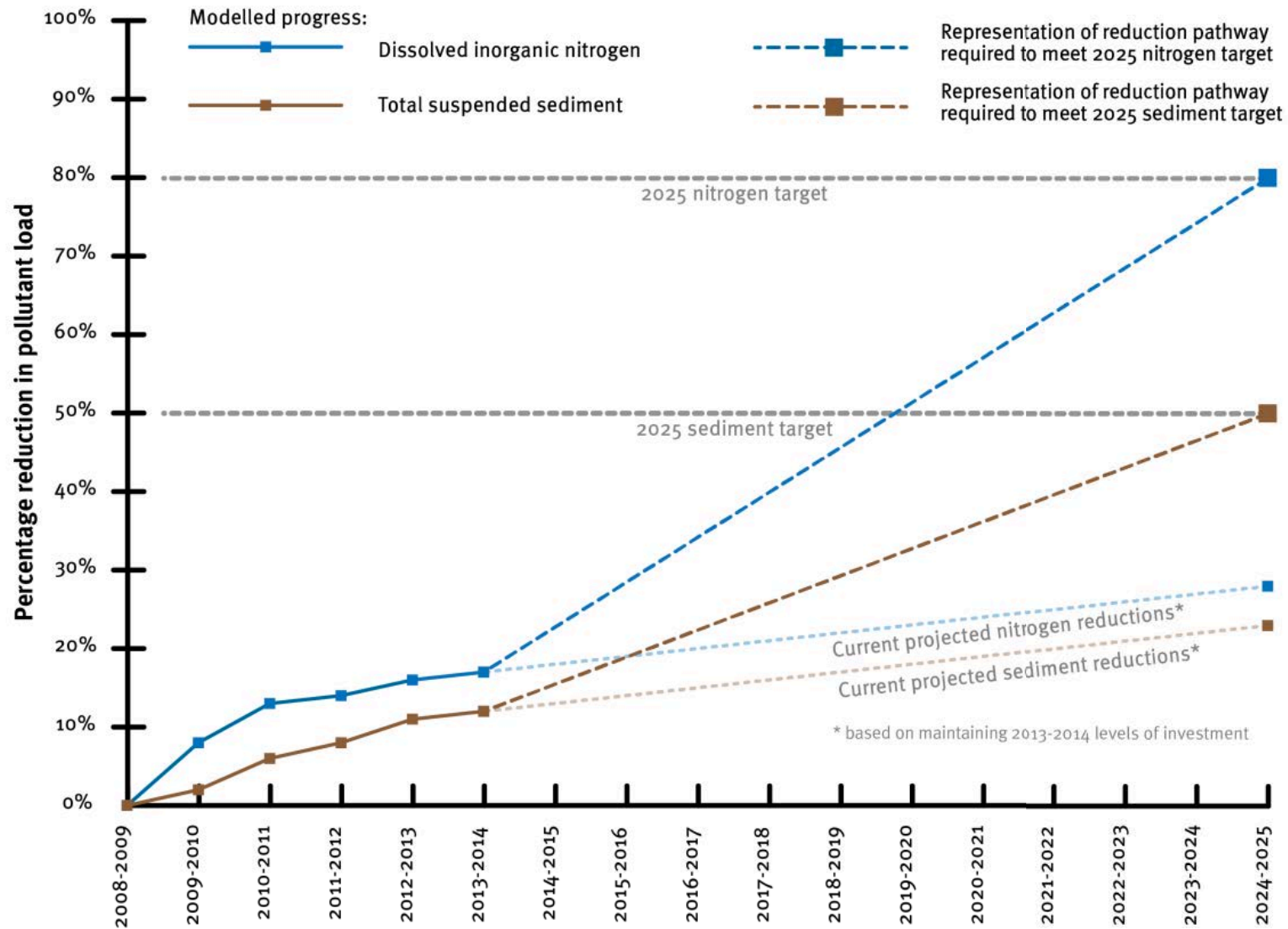


Figure 5: Nitrogen and sediment load reductions required to meet 2025 targets



## 8. Stakeholder consultation and feedback

### Taskforce – general consultation

- In developing both the Interim Report and this Final Report, the Taskforce has sought to understand the breadth of issues that concern the community and stakeholders across the Reef with respect to water quality.
- Taskforce members engaged with multiple stakeholders to gather their views on what has worked well and what hasn't in recent years, about potential investment priorities and the best ways to meet the targets.
- Initial points of feedback included:
  - Stakeholders involved in the Reef want to be engaged and recognised for their efforts.
  - There is a need for a clear narrative about the water quality linkages from the paddock - to the river – and to the Reef.
  - The need to pursue the most effective interventions for nutrient and sediment reduction considering the cost, likelihood of achievement and the ecological and potential economic benefits.
  - The need for improved monitoring and evaluation to better measure outcomes and communicate these to landholders and the community.
  - The currently complex and fragmented governance system needs to be greatly simplified to improve accountability and delivery of outcomes.
  - Land managers have different priorities, so a range of methods must be used to accelerate effective changes to land management practices based on different costs and benefits.

### Interim Report – consultation process

- The **Taskforce released its Interim Report for public consultation in December 2015**. The Interim Report set out the initial recommendations to the Queensland Government on how to deliver substantial Reef water quality improvements.
- **Consultation was undertaken on the Interim Report to seek the views of key stakeholders and interested members of the public regarding the development of the final recommendations.**
- The Interim Report was made available on the Queensland Government Great Barrier Reef Living Wonder website ([www.gbr.qld.gov.au/](http://www.gbr.qld.gov.au/)).
- Respondents were invited to make a submission via an online survey which was linked on the website, or to submit more detailed comments via email.

- A total of 103 public consultation submissions were received, with responses from individuals (67) and organisations (36), both within and outside of the Reef catchment areas.

### Interim Report - feedback

- **The Interim Report was well supported in principle by the majority of respondents**, both through survey responses and written comments. Additionally, the Interim Report's approach of collaborative problem-solving and endorsing the use of a combination of management tools was overwhelmingly supported by respondents.
- The recommendations listed in the Interim Report were largely supported, with **over 75% of total survey respondents in agreement with the 10 recommendations**.
- Survey respondents were asked to nominate their **top three priorities for investment** of \$90 million over four years. The most supported areas identified for investment were:
  - monitoring, modelling and reporting
  - more effective, targeted and coordinated extension
  - incentive and market approaches
  - staged introduction of outcomes-based regulation
- Whilst the two major integrated projects received the lowest support as an investment priority, over 60% of survey respondents agreed with the recommendation to implement these integrated projects.

Further information: The **Taskforce Consultation Report** is available on the Queensland Government Great Barrier Reef website at [www.gbr.qld.gov.au/taskforce/interim-report/](http://www.gbr.qld.gov.au/taskforce/interim-report/).

## 9. Funding

### Queensland and Australian government investment

#### History of funding

- There has been considerable investment relating to Reef water quality since the launch of the first Reef Water Quality Protection Plan in 2003.
- **In 2009**, investment was significantly increased, with the Australian Government committing \$200 million over five years and the Queensland Government committing \$175 million over five years.
- **In 2013**, both governments committed to continuing that investment over the following five years. This included Queensland Government continuing its \$35 million annual investment in water quality programs, which is allocated across a range of Departments and programs. Some of these programs are due to expire in coming years.
- **In 2014**, the Australian Government announced \$140 million to Reef Trust, on top of its existing commitment of \$160 million over five years for the Reef Programme. Of this, \$69.1 million has been allocated already to water quality since 2014 (pers comms, R Parry). Allocations of future funding from Reef Trust are subject to scientific advice and decisions of government (which may include activities broader than water quality).
- **In 2015**, the Queensland Government announced an additional \$100 million (\$10 million of which has supported a net fishing buyout and \$90million to water quality programs). Table 4 summarises these major funding announcements by both governments.

#### Funding for broader Reef 2050 implementation

- The Reef 2050 Plan was released in 2015 and is the Australian and Queensland governments' 30 year blueprint for managing the Great Barrier Reef. This includes actions around water quality, biodiversity, ecosystem health and heritage.
- A Reef 2050 Investment Baseline was completed in 2015, which estimated current levels of funding allocated to Reef management (eg marine park management, biodiversity protection etc). The total reef investment for 2014/15 from the Australian and Queensland governments was estimated to be \$215 million in the Reef 2050 Investment Baseline. Projections on future funding in the Investment Baseline estimated that \$2 billion would be invested in reef management over the next decade.

#### Latest commitments

- The Australian Government recently announced an additional \$171 million towards Reef 2050 and Reef Trust from 2016-17. The priority areas for investment for this have not yet been identified and will be done in consultation with independent experts. These priorities will be broader than just water quality (eg biodiversity, Reef 2050 action implementation).
- Table 5 shows a summary breakdown of Australian and Queensland government funding. It also displays the funds allocated to Reef water quality work by research institutions, universities and not-for-profit organisations since 2013-14. More comprehensive figures covering all aspects of Reef management are provided for 2014-15 as presented in the Reef 2050 Investment Baseline.
- These figures do not capture cash or in-kind investment by the private sector, community groups or volunteers.

**Table 4:** Major Reef funding commitments by Australian and Queensland governments (note: colours coincide with Table 5)

	2009-2013	2014-2018	Announcements post 2014
<b>Queensland major funding commitments</b>	\$175M	\$175M	+\$100M <i>(over five years)</i>
<b>Australian Government major funding commitments</b>	\$200M	\$300M <i>(over six years to 2019)</i>	+\$171M <i>(over 6 years, noting not all will be towards water quality)</i>
<b>Total</b>	\$375M	\$475M	

## Local government investment

- Local governments in the Great Barrier Reef catchment play an important role in protecting the Reef, with their efforts acknowledged through the Reef Guardian Council program. Significant efforts by local government have been expended over many years in reducing and preventing pollution, particularly from point sources, from damaging the Reef.
- **The local governments in the Reef catchments make large investments in activities that affect Reef health including on-ground activities, urban water quality and point source pollution management**, such as upgrades to sewage treatment plants and water treatment plants. Some of these upgrades were co-funded with the Queensland Government. With thirty-six major sewage treatment plants in the Reef catchment, upgrades of plants and the resulting improvements in quality of discharges have had a significant local impact.
- The Reef 2050 Investment Baseline found that in 2014-15, **15 of the 27 councils had collectively invested up to \$228.9 million in activities relevant to Reef health, including improved water quality**. As well as upgrades to their sewage and water treatment infrastructure, work included rehabilitating waterways and coastal areas, managing vegetation and pests, sustainable agriculture initiatives and local community education.
- While not all these activities were undertaken with improved water quality as a primary goal, the final outcomes have been very positive.
- **Ongoing investment and commitment by local governments will be critical to delivering a healthy Reef.**

## Investment from other parties

- There is also considerable cash and in-kind investment made in Reef water quality initiatives by individual landholders (including mills), NRM body staff, volunteers, the resources sector, universities and research institutions. For example, **under the first Reef Rescue program, up to \$1.80 was invested by landholders for every \$1 provided by the Australian Government** (totalling \$157 million of industry investment over five years).
- Research institutions also contribute significant funds of their own (on top of Australian Government funding) to reef water quality research (see Table 5).
- The challenges facing innovative financing mechanisms mean these have not been particularly explored to date (for example green bonds, concessional loans and reduced council rates for best practice).

## Recipients of funding for Reef water quality improvement

- As has been previously indicated, the funding environment (both allocation and spending) is complex and fragmented. It has been difficult to quantitatively define, in detail, all sources and recipients of funds when it comes to specific water quality improvements for the Great Barrier Reef. Table 5 provides the best available analysis at this time.
- Further work is needed, for example by skilled auditing personnel, to properly understand the respective ins and outs of respective Queensland and Australian governments funding in regard to prevailing Reef water quality activities.
- Illustratively, considering the financial year 2014-15 as an example, (see Table 5):
  - Of the \$35 million spent by the Queensland Government, approximately \$6.6 million was spent with the regional NRM bodies and a further \$2.5 million with the regional report card partnerships. \$4.6 million was also spent with industry groups and research partners. The remainder was used to fund various departmental-led programs.
  - Of the funding by the Australian Government for water quality related programs, approximately \$23.2 million was allocated to the Regional NRM bodies, \$13.4 million to GBRMPA, \$1.8 million to the Reef and Rainforest Research Centre, \$3.1 million with the GBR Foundation and \$1.1 million to the Regional Report Card Partnerships. \$6.3 million was co-invested with the Queensland Government on various initiatives including water quality monitoring.

## Investment planning

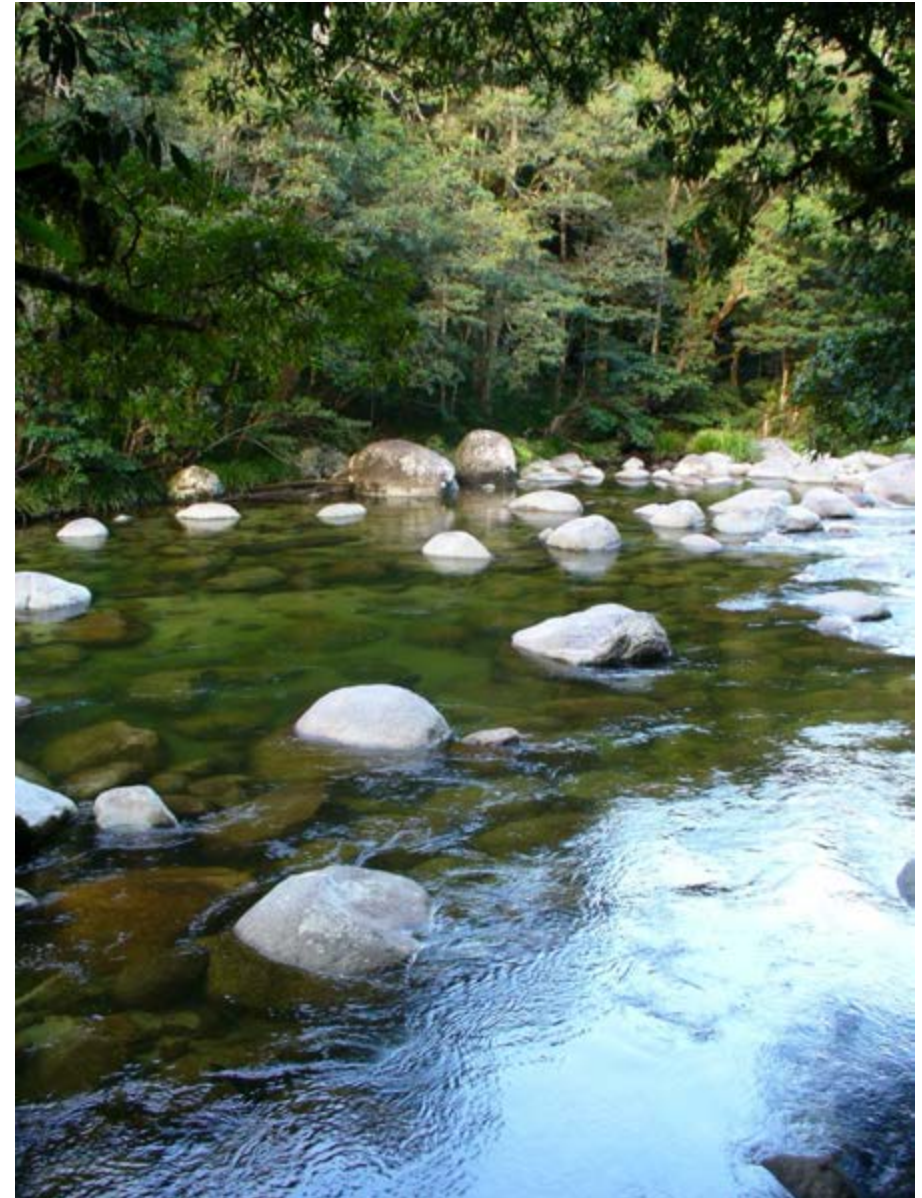
- An investment baseline developed in 2015 for the Reef 2050 Plan identifies the range of other investments made to support broader Reef management.
- While the **Reef Water Quality Protection Plan Investment Strategy** outlines the range of water quality investments by different funders, **in practice many of the funding decisions were already made prior to the strategy being developed** (so are not directly aligned to its objectives). It is also not updated regularly enough to influence decision-makers on investment priorities.
- As mentioned above, **the various funding programs currently appear fragmented**, with limited detailed supporting documentation to show how different programs contribute to achieving the water quality targets. Additionally, it is **unclear how different funding programs mesh together** – for example, who funds what in the research and development space, and who provides funding for which region. In many cases, it is up to the NRM bodies to identify different funding sources and tailor projects to those, based on their Water Quality Improvement Plans.



- **Clearer identification of the linkages** between initiatives/programs and activities needed to achieve the targets, the outcomes that they are expected to achieve, the priority areas for investment and better communication between funders will provide more rapid progress towards meeting the targets with existing and new investment.

#### **Future investment needed**

- Investment needed to achieve the targets in the timescale proposed is likely to be well beyond the funds currently allocated by the Queensland and Australia governments.
- **Additional investment will be critical and leveraging the Queensland Government funding should be a priority, including through public-private partnerships, philanthropy and innovative funding vehicles.**
- There are many other government programs that contribute to Reef outcomes. There is a **lack of integration of these potential investments towards Reef outcomes.**
- See also Section 12



**Table 5: Investment in Reef Initiatives 2003-04 to 2021-22**

Strategic planning documents		Reef Water Quality Protection Plan 2003						Reef Water Quality Protection Plan 2009						Reef Water Quality Protection Plan 2013		Reef Water Quality Protection Plan 2017					
		Reef 2050 Long Term Sustainability Plan																			
Funding Source	Program / Initiative / Organisation	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	
<b>Water Quality Initiatives</b>																					
Qld Govt	Reef Plan Funding (inc. \$6 million/year NRM program)	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	14.7	12.2	12.2	12.2	
	Reef Protection program (regulations, science extension and compliance)							10.0	10.0	10.0#											
	EHP Reef Water Quality Program (science, BMP and extension)										10.0	10.0	10.0	10.0	10.0	10.0	10.0	%	%	%	
	Water Quality (\$100 million commitment)													12.0	22.0	22.0	22.0	22.0#			
<b>Queensland Govt Sub-Total</b>		<b>25.0</b>	<b>25.0</b>	<b>25.0</b>	<b>25.0</b>	<b>25.0</b>	<b>25.0</b>	<b>35.0</b>	<b>35.0</b>	<b>25.0</b>	<b>35.0</b>	<b>35.0</b>	<b>35.0</b>	<b>47.0</b>	<b>57.0</b>	<b>57.0</b>	<b>46.7</b>				
Aust Govt	Reef Rescue						29.8	39.6	34.1	45.1	53.9										
	Commonwealth Environmental Research Facilities			0.5^	2.3	2.4	2.3	2.4#													
	National Environmental Research Program (NERP) <sup>1</sup>								0.4^	1	1	1	1.0#								
	National Environmental Science Program (NESP) <sup>2</sup>												2.2	5.6	5.4	5.4	5.4				
	Reef Programme and other Reef activities (160M/ 5 yrs)													47.9	45.2	43.2	15.9	12.1			
<b>Australian Government Sub-Total</b>					<b>2.3</b>	<b>2.4</b>	<b>32.1</b>	<b>39.6</b>	<b>34.1</b>	<b>46.1</b>	<b>54.9</b>	<b>48.9</b>	<b>48.4</b>	<b>48.8</b>	<b>21.3</b>	<b>17.5</b>	<b>5.4</b>				
<b>Combined Australian and Queensland government spending on water quality</b>		<b>25.0</b>	<b>25.0</b>	<b>25.0</b>	<b>27.3</b>	<b>27.4</b>	<b>57.1</b>	<b>74.6</b>	<b>69.1</b>	<b>71.1</b>	<b>89.9</b>	<b>83.9</b>	<b>83.4</b>	<b>95.8</b>	<b>78.3</b>	<b>74.5</b>	<b>52.1</b>				

Broader Reef Initiatives (including some water quality improvement activities)										
Qld Govt	Queensland Parks and Wildlife Service Joint Field Management		8.0							
	Maritime Safety Queensland Reef Management		28.0							
Aust Govt	Reef Trust (including new 2016 Federal Budget announcements)	Reef Trust and Reef 2050 funding includes water quality and broader initiatives. Future allocations will be confirmed subject to science advice and government decisions.	11.1	15.9	34.1	39.4	39.5	40.0	15.0	15.0
	Reef 2050 Plan (new 2016 Federal Budget announcements)				8.9	8.9	8.9	8.9	32.7	32.7
	Great Barrier Reef Marine Park Authority		30							
	Australian Maritime Safety Authority Reef Management		31.8							
	Australian Institute of Marine Science (AIMS)		15.1							
	ARC Centre of Excellence for Coral Reef Studies		2							
Research Institutions spend on Reef Water Quality (from base funding)										
Research <sup>3</sup>	ARC Centre of Excellence for Coral Reef Studies <sup>4</sup>		**	**	**	**	**	**	**	**
	AIMS <sup>5</sup>		1.9	2.4	%	%	%	%	%	
	CSIRO		5.3	4.5	3	2.4	2.4	2.4	2.4	
	Great Barrier Reef Foundation <sup>6</sup>		2.4	2.1	2	1.5	%	%	%	
	Griffith University <sup>7</sup>		0.6	0.8	%	%	%	%	%	
	James Cook University <sup>8</sup>		0.2	0.2	0.2	0.2	%	%	%	
	The University of Queensland <sup>8</sup>		0.7	0.7	0.5	0.3	0.2	0.6	0.1	
	Reef and Rainforest Research Centre		0.1	0.3	**	**	**	**	**	



**Explanatory notes:**

Estimates of total reef investment across all governments (Local, State And Commonwealth) and private and philanthropic are outlined in the Reef 2050 Investment Baseline for the 2014/15 year. It was estimated at **\$485M**.

Colour coding relates to major government funding commitments as indicated in Table 4.

Blank cells in this table indicate information is not available or has not been provided

*Italics* indicates future funding that has not yet been confirmed

% indicates periods where funding will occur but the amount is still to be determined

^ indicates transition funding periods

# indicates year when program / initiative terminated or is planned to terminate

\*\* Indicates activities supported by non-dedicated resources

<sup>1</sup> The National Environmental Research Program Tropical Ecosystems Hub was provided with a total of \$3.86 million over four years for research into water quality of the Great Barrier Reef. Figures reflect the average allocation to research over the four years

<sup>2</sup> Figures reflect total Australian Government funding committed to the National Environmental Science Programme Tropical Water Quality Hub. Funding includes knowledge brokering, communication and administrative activities that support the delivery of research.

<sup>3</sup> Research institution figures include water quality related research, however institutions often also fund broader Reef research

<sup>4</sup> The ARC Centre of Excellence for Coral Reef Studies spends only a very modest amount on catchment related research.

<sup>5</sup> Includes ARC, JCU, corporate and AIMS base funding.

<sup>6</sup> Resilient Reefs and corporate funding

<sup>7</sup> Includes Griffith University base funding plus Queensland Government Smart Futures Fund and Australian Government Natural Resource Managers Climate Change Impacts and Adaptation Grant in 2013-14 and 2014-15.

<sup>8</sup> Contribution from TropWater

<sup>9</sup> Includes The University of Queensland base funding, plus private/non profit from 2013-18, plus ARC 2013-17, plus CSIRO 2013-16, plus corporate funding in 2013-14.

## 10. Coordination and governance

- **The Taskforce observed that Reef-wide, water quality governance arrangements - under the Reef 2050 Plan framework (from policy to delivery levels) are fragmented and complex with relatively poor coordination across the system.** For example:
  - Multiple committees provide advice to different decision makers (Figure 6).
  - There are challenges with different science prioritisation and procurement arrangements and stakeholder advisory arrangements.
  - Three levels of government have their own strategic and sometimes competing agendas.
  - Multiple funders, delivery agents and a lack of agreed policy around the most appropriate delivery architecture.
- More strategy development effort is needed at the Reef-wide level, but for those Reef-wide strategies for water quality that do exist, the Queensland and Australian Governments have not reached agreement about key catchment-scale delivery mechanisms and the nature of durable support required. This risks implementation failure for Reef-wide water quality governance.
- For example, the Reef Water Quality Protection Plan includes a range of actions and strategies at the Reef-wide level, but relies on support from regional NRM bodies to plan, coordinate and deliver at the local level in keeping with its principles.
- Regional Water Quality Improvement Plans (WQIPs) are the fundamental basis for sound investment in water quality improvement but resources need to be sustained to provide the basis for implementation and adaptive management. WQIPs are in place for the Wet Tropics, Burdekin, Mackay-Whitsunday and Burnett-Mary with WQIPs also under development in the Fitzroy/Capricorn Coast region and eastern Cape York.
- Some broader policies (for example the Developing Northern Australia policy, vegetation management and urban development) also have the potential to undo some of the positive changes made to land management and water quality outcomes. A more coordinated approach to water quality, water flow, catchment management, vegetation management and agricultural expansion is needed. Indeed, there are multiple regulatory and planning frameworks that impact on water quality that are at times inconsistent in their outcomes.
- Alignment and accountability is needed across the various governments and institutions working on Reef and catchment management. Of particular importance is the strengthening of bilateral implementation frameworks between the Australian and Queensland governments.
- Finally, there is no agreed mechanism between the Australian and Queensland Governments to benchmark the health of the wider governance system and to agree and implement continuous system improvements.

## Governance model for Reef 2050, Reef Water Quality Protection Plan and Great Barrier Reef Water Science Taskforce

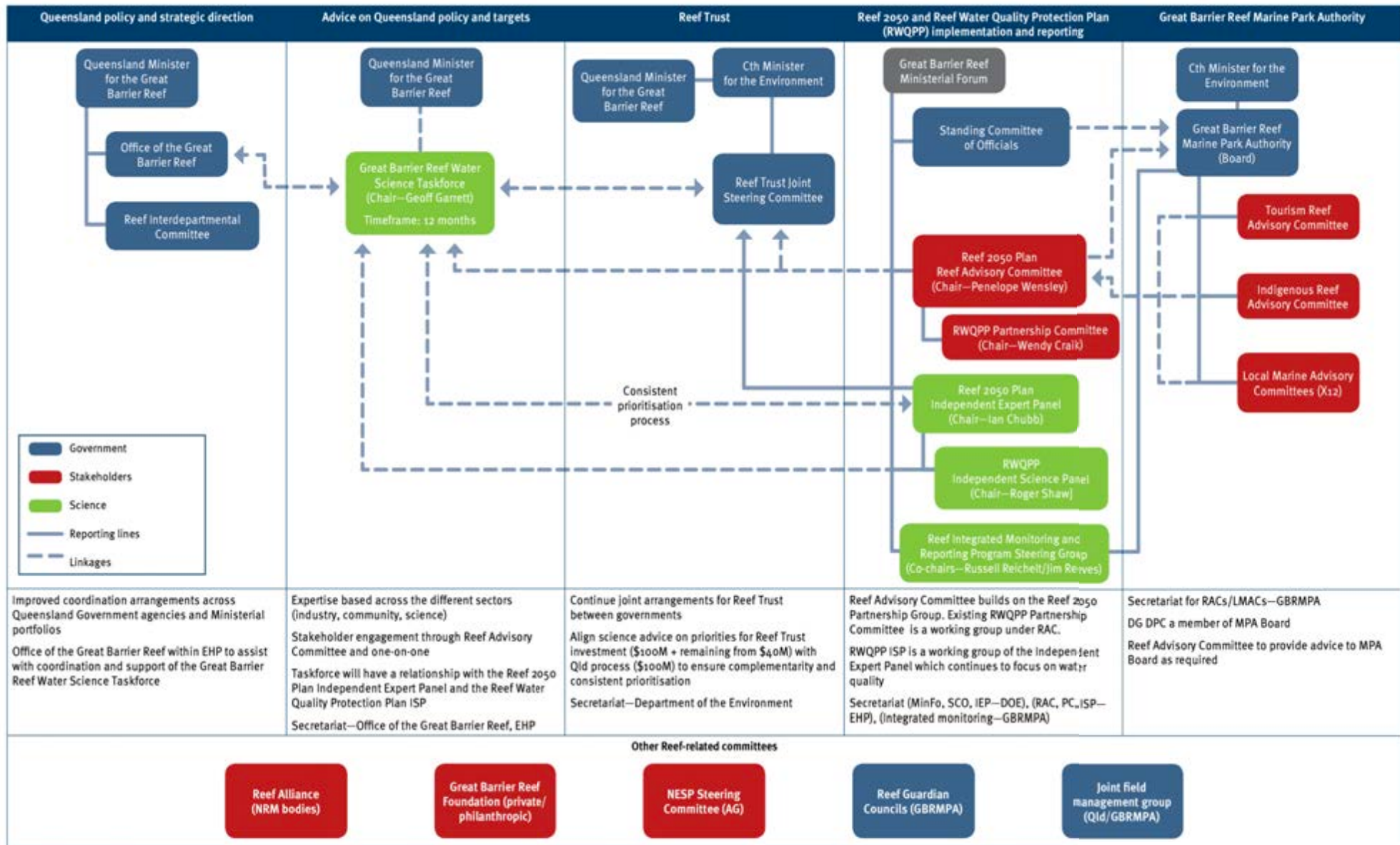


Figure 6: Current Governance arrangements for Reef management



## 11. Key Barriers

- There are a number of delivery issues that are barriers to effective program delivery (Figure 7):
  - **System complexity** – governance structures and program delivery continue to be highly complex and interwoven, making engagement difficult.
  - **Poor communication and engagement** – many individual landholders don't see a direct relationship between their land management practices and the health of the Reef. There has been no consistent narrative and poor engagement with landholders regarding the scientific evidence for this link and the need for change. There has also been a lack of communication with the landholders in regard to feedback from projects that have happened on their land.
  - **Fragmentation of policies and delivery efforts** – poor coordination of multiple authorities has resulted in fragmented programs, funding and policies, contributing to confusion and ineffectiveness.
- Efforts have previously been spread too thinly and across too many areas, reducing effectiveness and impact, and there has been a failure to coordinate efforts at larger scales.
- Despite significant effort since 2003:
  - application rates of fertilisers remain well above what is deemed industry best practice, resulting in excess nutrients leaving the property (see examples in Figures 8 and 9)
  - best management practice for water quality is only used by a small proportion of the agricultural and grazing industry (for example 13% in nutrient management in cane and 28% for pasture management in grazing, as referenced earlier in Figure 4).

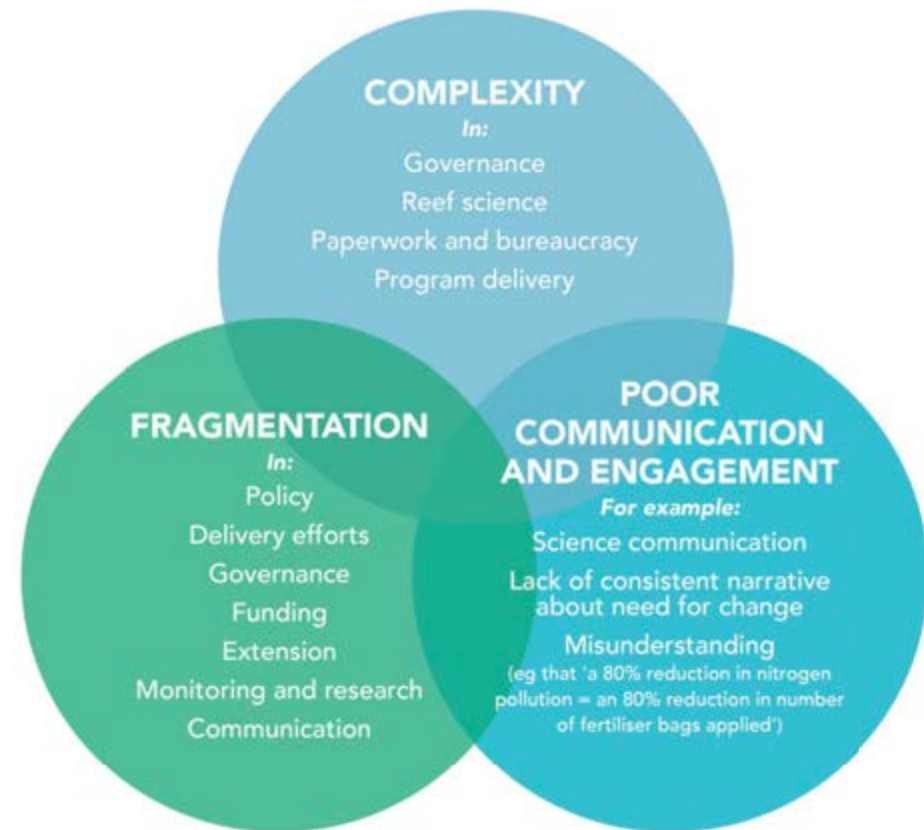


Figure 7: Barriers to effective program delivery

## Current nitrogen application rates and costs to cane farmers of over applying

- Figure 8 and 9 on the following pages highlight that **despite the Six Easy Steps program being in place for more than ten years, the large majority of farmers are still applying well over the recommended amount of nitrogen required for their crop.**
- **Not only does this impact the Reef, it also impacts farmers' bottom lines.**
- On a per hectare basis, if a grower applied 40 - 50kg N/ha over and above the Six Easy Steps guideline (which is a common incidence), they would be **spending about \$70/ha more than would be required for plant care and first ratoon crops and around \$130/ha more for second ratoon crops.** For a farm on the lower productivity soils following the Six Easy Steps guidelines **could represent a 10-15% cost saving.**
- Work funded by the Queensland Government has also shown that rates above the nominal Six Easy Steps rate often result in depressed sugar content and additional harvesting costs.
- Despite around half of the cane farming area participating in the industry BMP program, **application rates remain well above the industry standard** (Six Easy Steps).
- On-ground research projects working with farmers in the Burdekin have clearly demonstrated that lowering fertiliser application to rates that align with Six Easy Steps can produce the same yield and save farmers money on fertiliser inputs. The results of these projects will be communicated more broadly to encourage more landholders to better tailor their application rates to crop needs – with corresponding environmental and economic benefits.

The **Six Easy Steps program** is an integrated nutrient management tool that enables the adoption of best practice nutrient management on farm (and is part of the broader SmartCane BMP program).

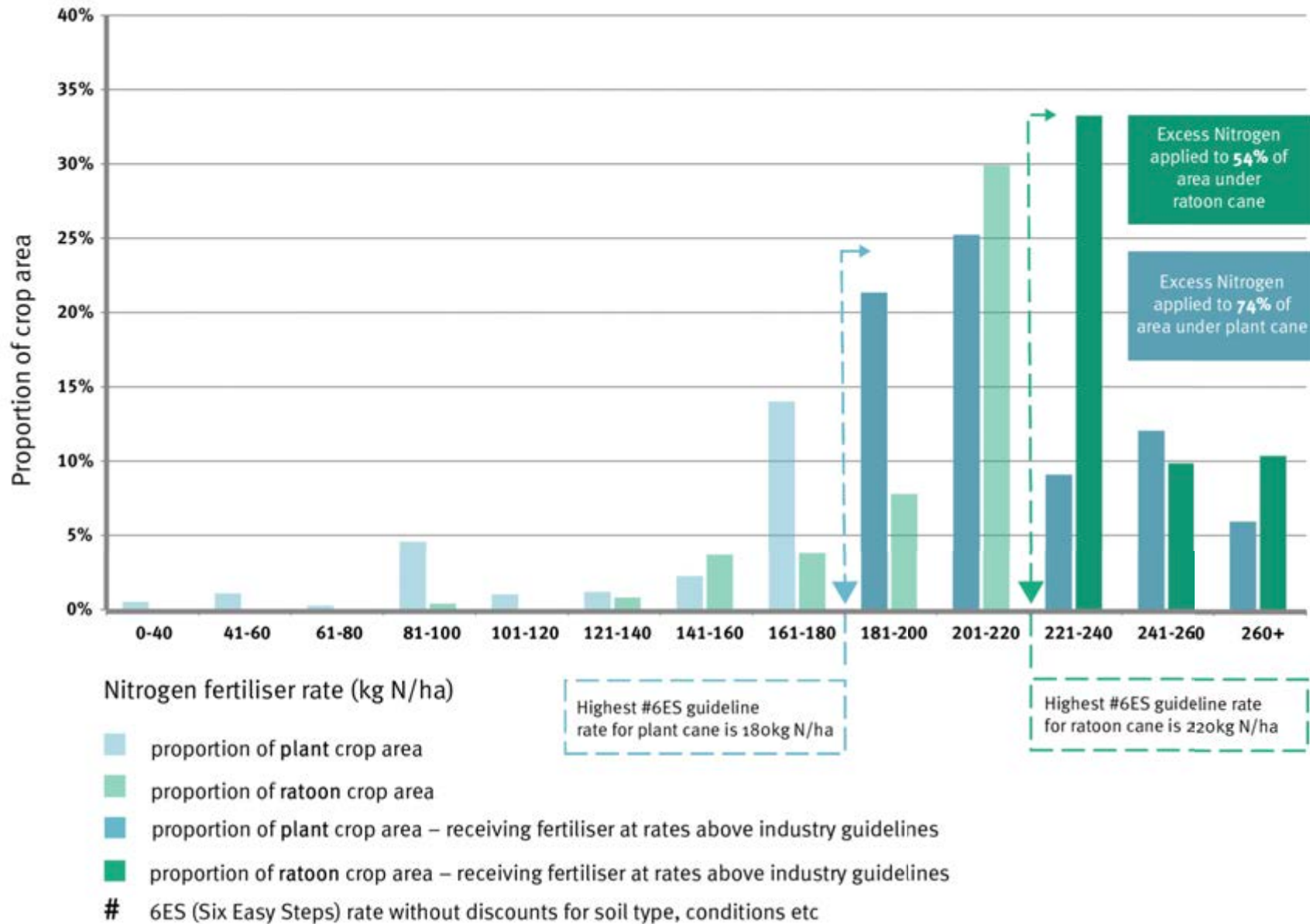
The program is aimed at promoting the concept of sustainable nutrient management. This means **that it recognises both the need for profitable cane production and the need to achieve this in an environmental responsibility manner.**

The program is being delivered to industry through grower-oriented courses and consists of the following units:

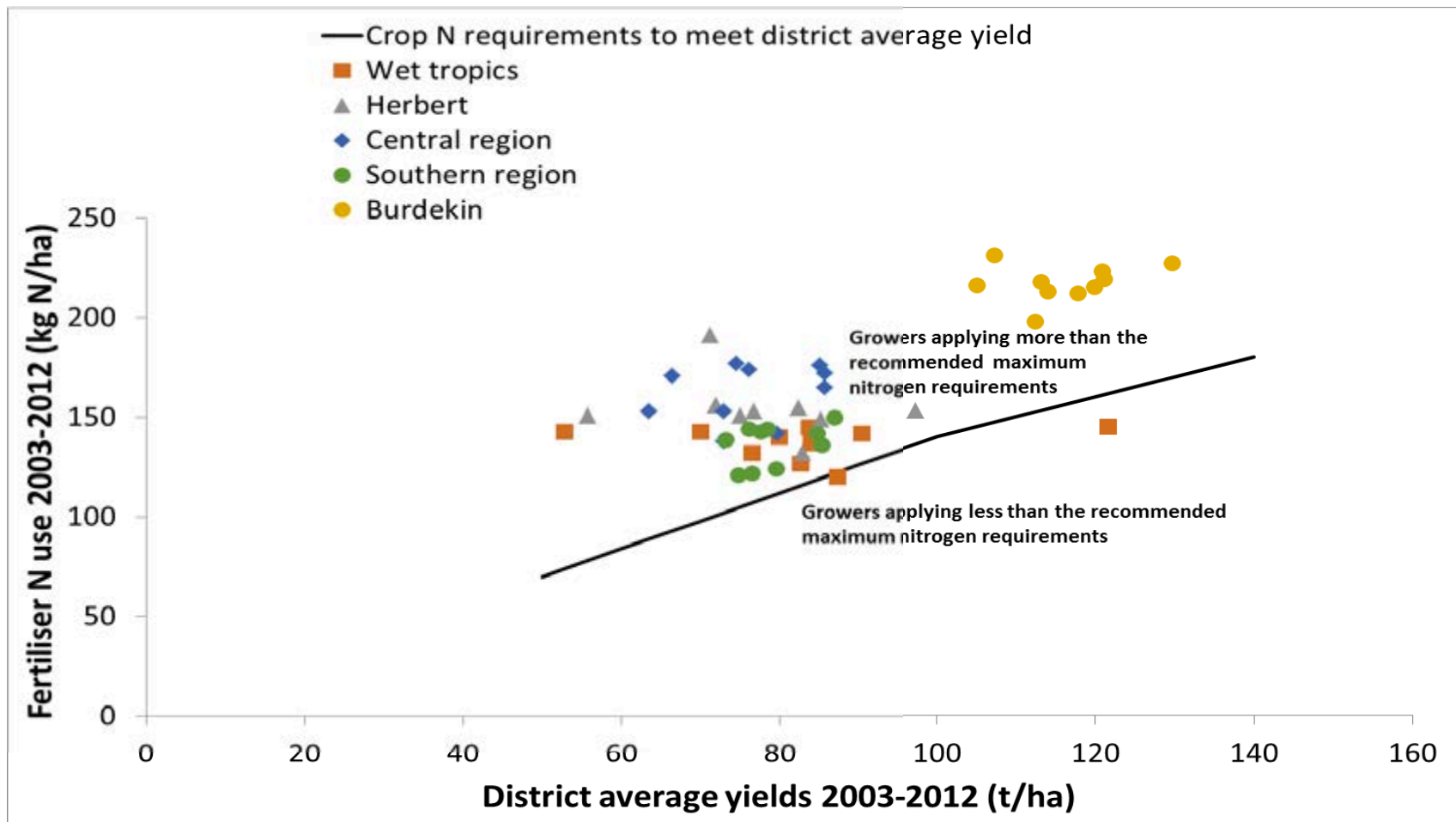
1. Knowing and understanding our soils.
2. Understanding and managing nutrient processes and losses.
3. Soil testing regularly.
4. Adopting soil-specific fertiliser recommendations.
5. Using leaf analysis as a check on the adequacy of fertiliser inputs.
6. Keeping good records/modifying nutrient inputs when and where necessary.

Ultimately the program provides growers the required skills to develop nutrient management plans for their farms.

## Farms receiving fertiliser nitrogen at rates above industry guidelines: Example: Sugarcane farms in the Burdekin region 2014-15



**Figure 8:** Sugarcane farms in the Burdekin region receiving nitrogen fertiliser at rates above industry guidelines; 2014-15



**Figure 9:** Relationship between district average cane yield (t/ha) and district average Nitrogen (N) fertiliser use (kg N/ha) for the major cane growing regions in Queensland 2003-2013 (Source: Bell, M.J. 2014. *A Review of Nitrogen Use Efficiency in Sugarcane*. Sugar Research Australia. Funded by the Australian Government).

- The black line represents the expected crop nitrogen requirement to achieve the district average yield, which is derived by multiplying the district average yield (t/ha) by the Six Easy Steps N multiplier (1.4 kg N/t cane up to 100 t/h and then an additional 1.0 kg N/t cane for additional yields above 100t/ha). This rate does not include any discounts for soil N mineralisation during the season. Each dot for each region represents annual average cane yield (t/ha) averaged across all soil types and crop classes, and this is plotted against fertiliser use (kg N/ha) at the same scale.
- **This data suggests that all districts are over-applying fertiliser for their crops' needs.**
- **Some of the districts are applying a lot more fertiliser than required on a year-in year-out basis.**



## 12. Costings work

### Costs and effectiveness of meeting the Reef 2050 water quality targets

- The Taskforce was asked to provide advice on the best approach to meeting the government's water quality targets.
- To support the Taskforce in recommending priority actions for investing an additional \$90 million over five years, **two projects were commissioned** to understand the costs and effectiveness (i.e. water quality benefits) of various interventions (e.g. like practice change, systems repair etc) for a range of industries across Reef catchments. These studies were:
  1. a project to estimate the **costs and effectiveness of reducing nutrient and sediment pollution for a number of improved cane and grazing land management practices**; and
  2. a more extensive exercise to **determine the total costs and effectiveness of a broader range of policy solutions to achieve the water quality targets**.

#### Project 1

- The initial study (*Marginal Abatement Cost Curves for Sugar Cane and Grazing in the Great Barrier Reef Catchments*) investigated the costs and water quality benefits of a mix of a small number of tools (including extension, incentives and regulation) for improved land management to reduce sediment and nutrient loads. It used a bio-economic modelling approach. **The project looked at the marginal costs (that is, the cost of delivering additional units of nutrient and sediment reduction) of each intervention, not the total costs of achieving the targets.** The study focussed on grazing in the Burdekin and Fitzroy catchments and sugarcane in the Wet Tropics and Burdekin catchments.
- The results of this study were included in the Taskforce Interim Report released in December 2015 and can be found at: <http://www.gbr.qld.gov.au/documents/marginal-abatement-cost-curves-technical-report.pdf>.
- **In summary, the project showed that for grazing, the most cost-effective interventions will be in the eastern parts of the Reef region in higher productivity landscapes; and for cane, the most cost effective improvements will result from moving growers from C-class (average) to B class (best practice).**

#### Project 2

- A further study (*Costs of achieving the water quality targets for the Great Barrier Reef*) is being undertaken by a consortium of economic and water quality experts to inform the **investment that may be required to achieve**

**the Reef 2050 Plan water quality targets** (up to 80% nutrient and 50% sediment reduction by 2025).

- This work will seek to highlight the most cost effective combination of investments for achieving the targets at a regional scale and **aims to be completed by July 2016**.
- The study also uses a bio-economic modelling approach to assess the costs and water quality benefits for an expanded and combined set of policy solutions for a range of industries across the Reef catchments. This project is leading edge and has never been done at this scale.
- The policy solutions being assessed include improved land management practice change for cane and grazing (building on the work already undertaken in the initial commissioned study), improved cane irrigation practices, and the use of constructed wetlands/pollutant traps in cane growing areas. Other solutions being assessed include reduced gully erosion, remediating streambanks, voluntary changes in land use to less polluting activities, and improved urban stormwater management.
- **It is expected that the funding required will be well beyond what is currently allocated.** It is also expected that a renewed focus on innovation, new technologies and different ways of thinking will be needed to achieve the targets.
- The bio-economic modelling tool being developed as part of study should also allow decision makers to select a particular management practice to gauge costs and water quality benefits and will help target investment to the most cost effective activities. This tool should be useful well into the future and could be adapted and built upon over time.
- **The Taskforce recognises that assessing the costs and effectiveness of the combined solutions is challenging, given the innovative nature of the work undertaken.**
- As such, while the best available information is being used, there are a range of uncertainties and assumptions underpinning the costings work, with caution required in applying any results. These assumptions and uncertainties will be outlined in the costings report.
- **Once completed and peer reviewed, the costs of achieving the water quality targets for the Great Barrier Reef report will be available on the Queensland Government Great Barrier Reef Living Wonder website [www.gbr.qld.gov.au](http://www.gbr.qld.gov.au) by July 2016.**

## WHERE DO WE WANT TO BE?

### 13. A vision for the future

- **The Taskforce’s vision for the Reef’s future is that it will be healthy and resilient, and will continue to support an iconic and diverse ecosystem, while supporting world class tourism, viable industries and sustainable communities.**
- **The Taskforce acknowledges that climate change will increase the ‘surprises’ that will challenge the implementation of the Reef 2050 Plan.** Some of the potential impacts include increased mass coral bleaching events that will detrimentally impact corals and other organisms, sea level rise which will modify nesting for birds and turtles, as well as changes to the flood-drought cycle – which has potential to influence water quality by exacerbating the loss of nutrients and sediments through loss of vegetation and increased flood scouring.
- **Thus, the emphasis on water quality in the short term is even more critical to build Reef resilience.**
- To achieve this future of a healthy and resilient Reef, there must be programs where everyone is doing their bit to look after the Reef – farmers, graziers, developers, resources sector, community members and tourism operators.
- The community must be part of the solution – owning the challenge and delivering the solutions.
- Good stewardship is good for the Reef and good for the economy long term.
- The desired future articulated in the Reef Water Quality Protection Plan continues to be relevant and important as we move forward (Figure 10).
- **However, the desired future must be broadened to include all parts of the community.**

#### Principles for the Future

- Everyone must be part of the solution.
- Tailored local solutions.
- A focus on innovation.
- Transparency – in decision-making, delivery and reporting.
- Clear communication.
- Alignment between programs, and clear accountability for actions.
- Cost-effective allocation of resources.

- Leveraging private investment.
- Adaptive management informed by science and experience.
- Monitoring and evaluation to determine the effectiveness of outcomes from investment is crucial.



**Figure 10:** The desired future for the Reef as articulated in the Reef Water Quality Protection Plan 2013, strongly endorsed by the Taskforce.

## HOW ARE WE GOING TO GET THERE?

- There has been considerable work done to address water quality issues in the Reef, dating back well before the release of the first Reef Water Quality Protection Plan in 2003. As a result, we have some very useful indicators as to what does and what does not work, and what needs to be explored further. This provides an invaluable framework on which to develop more tailored, integrated actions and responses to water quality challenges.
- Looking ahead, **the Reef 2050 Plan provides an overall agenda for the protection and management of the Reef from 2015 to 2050 with land based run-off (and resultant poor water quality) identified as one of the major threats to the Reef.**
- The planned review of the Reef Water Quality Protection Plan will provide a timely opportunity to:
  - Update the Reef Water Quality Protection Plan by June 2017 so that it reflects the scope of the Reef 2050 Plan including urban, ports and dredging and provides the implementation path for the water quality theme of the Reef 2050 Plan.
  - Refine the targets based on multiple lines of evidence including ongoing monitoring, Source Catchments modelling, eReefs receiving water modelling and outcomes from relevant research.
  - Reflect new initiatives and incorporate the work of this Taskforce.



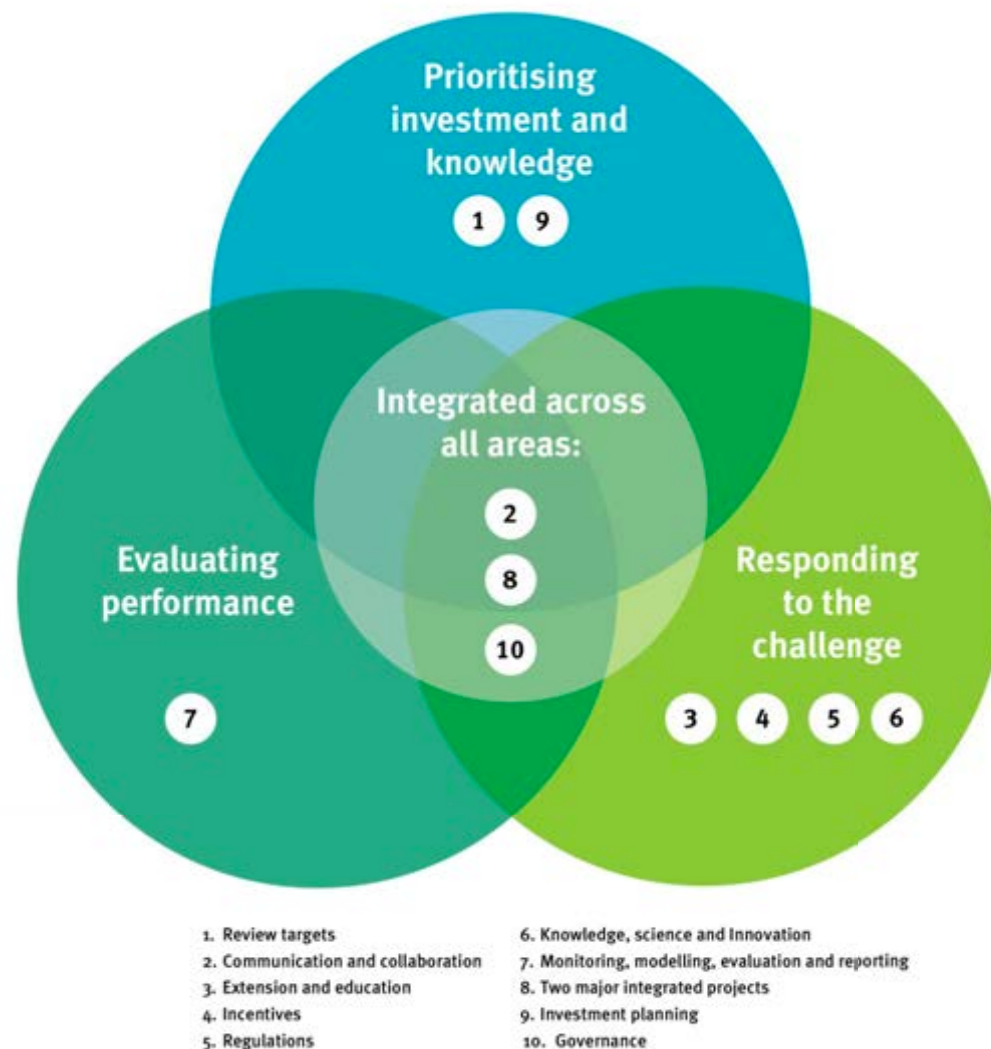


## 14. A mix of tools

### **PRINCIPLE:**

**A mix of tools are needed, not just one, along the pathway to change.**

- Many of the right tools/approaches are available and have been usefully applied in the past such as extension, industry led BMP programs, grants, incentives and monitoring programs. However, often there has been poor alignment of programs and approaches, and often these tools have been used in isolation so we are not getting maximum benefits.
- **The Taskforce has made ten key recommendations to help accelerate progress towards the water quality targets.**
- These recommendations combine a mix of tools and interventions. The recommendations complement the three priority work areas of the Reef Water Quality Protection Plan as outlined in Figure 11.

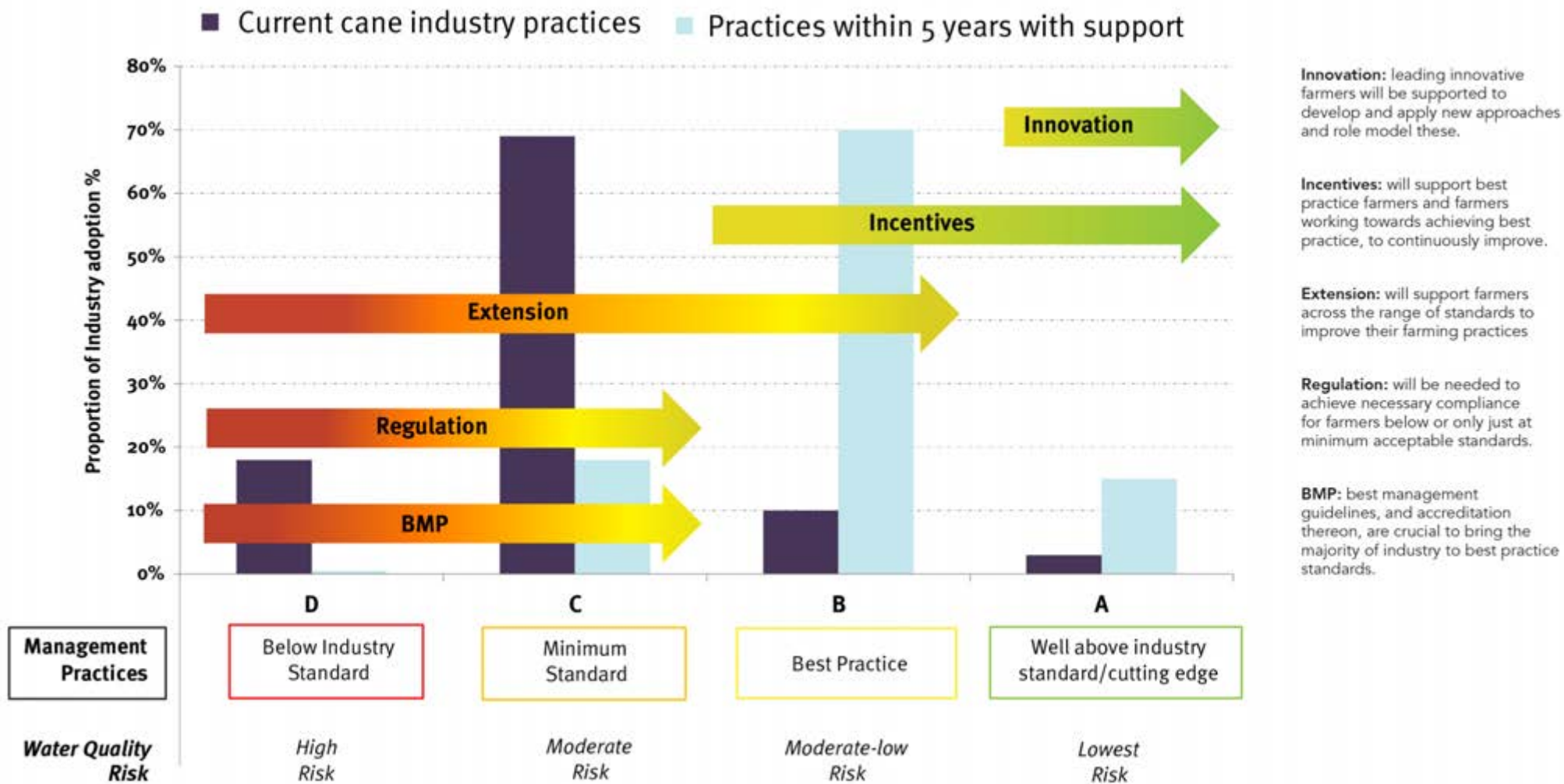


**Figure 11:** Recommendations aligned with the Reef Water Quality Protection Plan 2013: priority work areas



## A combination of actions

- To form a cohesive, fully integrated program, accelerated efforts must package:
  - communication, collaboration and engagement.
  - extension efforts.
  - incentives and market approaches.
  - outcomes-focussed regulation.
  - support for innovative approaches, research and development and monitoring and evaluation.
- It is often the interaction of these tools that provides the greatest benefits.
- **Different tools should be targeted at different parts of the problem.**
- For example, **regulations and BMP** should aim to achieve a minimum standard, or better, across industry. That is, moving from high risk to moderate to moderate-low risk practice.
- **Incentives and on-ground projects** should assist landholders to move beyond minimum standards. This means moving from industry standard to above industry standard, or from moderate to moderate-low risk.
- **Innovation funding** should help support those trialling new but not yet validated practices. That is, moving from moderate-low to low risk practice and identifying new practices.
- Note that the terms ABCD are commonly used for farming practice standards, where A equates to low risk practices, B equates to moderate-low risk or best practice standard, C equates to moderate risk or minimum standard, and D equates to the poorest level of farming practice, and high risk with regard to environmental risk. This framework has now been refined and gradually replaced with the Reef Plan Paddock to Reef Sugarcane Water Quality Risk Framework:
  - **Lowest risk** (Well above industry standard/cutting edge) – “A”
  - **Moderate-low risk** (Best practice) – “B”
  - **Moderate risk** (Minimum standard) – “C”
  - **High risk** (Below industry standard) – “D”
- Communication and extension must encompass all parts of the spectrum of change.
- Systems must be in place to ensure that changes achieved are locked in for the long term and built upon using a continuous improvement cycle to avoid having to invest multiple times to achieve the same gains.
- The proposed major integrated projects will pilot the best mix of tools in two regions and evaluate their effectiveness in reducing sediment and nutrient loads to the Reef.
- The suite of tools recommended for nutrients and sediments are summarised in the Figure 12 and in two conceptual diagrams (Figures 13 and 14).



**Innovation:** leading innovative farmers will be supported to develop and apply new approaches and role model these.

**Incentives:** will support best practice farmers and farmers working towards achieving best practice, to continuously improve.

**Extension:** will support farmers across the range of standards to improve their farming practices

**Regulation:** will be needed to achieve necessary compliance for farmers below or only just at minimum acceptable standards.

**BMP:** best management guidelines, and accreditation thereon, are crucial to bring the majority of industry to best practice standards.

Figure 12: Mix of tools

Figure 13: Nutrient Pollutant Reduction: summary of on-ground agricultural management responses

Note: 1 Links to recommendations

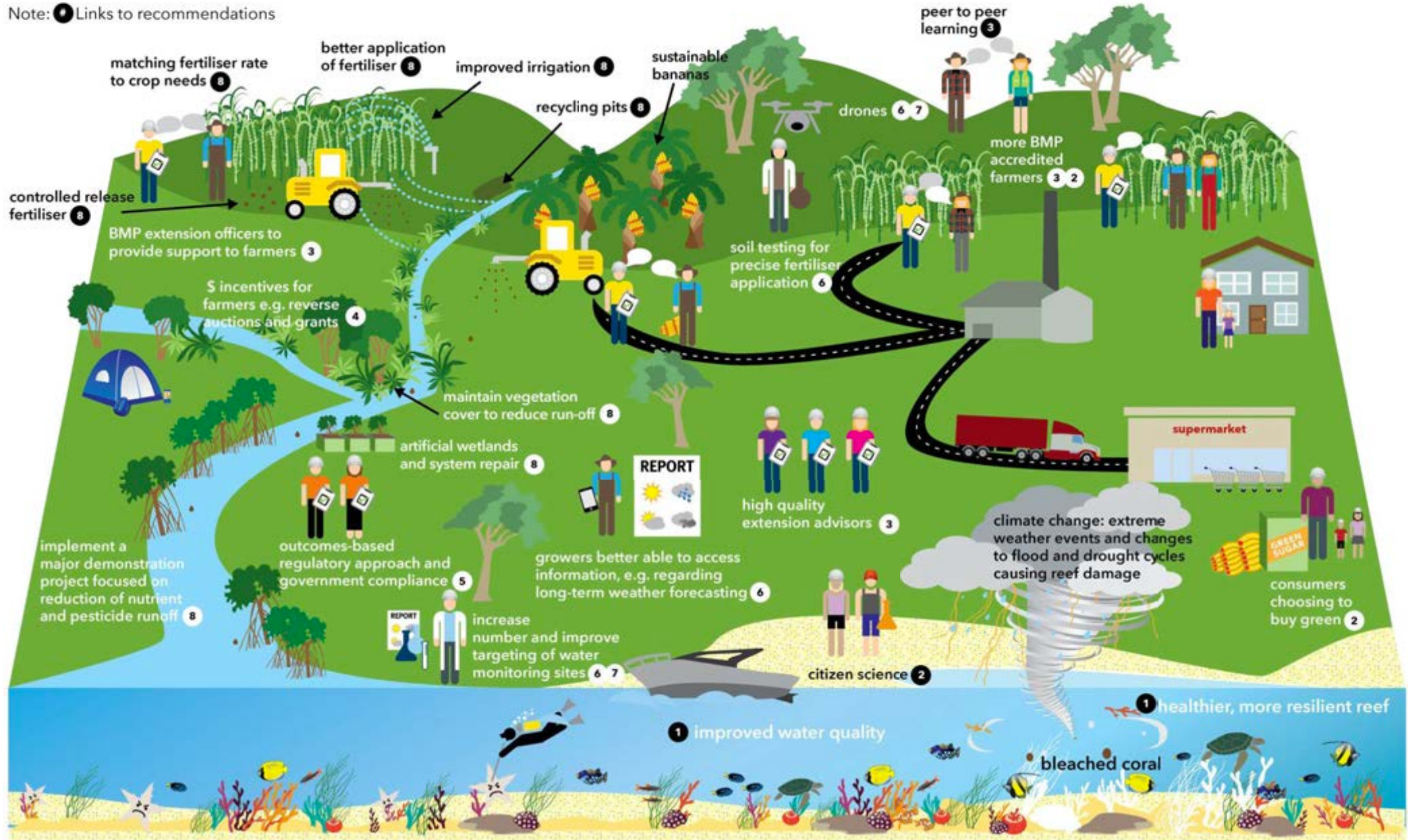

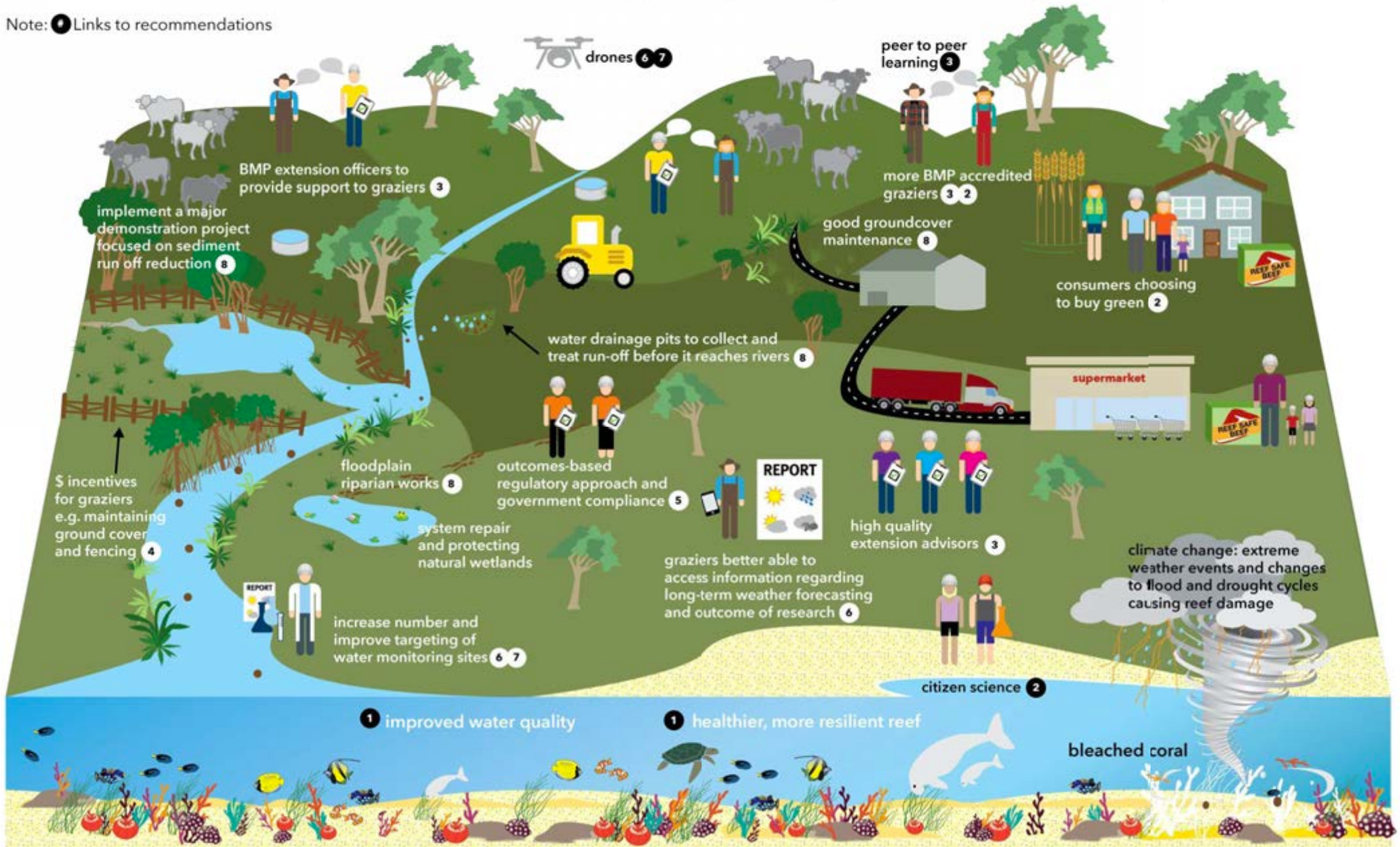




Figure 14: Sediment Pollutant Reduction: summary of on-ground agricultural management responses

Note:  Links to recommendations





## 15. Recommendation 1 – Targets

- A Reef-wide target of “up to” 80% reduction in nutrients does not take account of regional differences and may be beyond what the Reef needs for some basins.
- More locally relevant targets will allow better targeting of effort and resources to address the key ‘hotspots’, resulting in greater impact for reduced costs – a win-win situation for the Reef.
- Individual targets need to be developed for each of the 35 catchments that drain into the Reef lagoon that reflect each basin’s different water quality challenges.
- These basin targets can then be cascaded down and could be converted to tonnes of sediment and nutrients to be reduced by each industry within each sub-catchment.
- The basin targets established in the various WQIPs are a valuable starting point for this work and underpin the economic modelling work on possible costs.
- A planned review of Reef Water Quality Protection Plan targets by June 2017 will be a timely opportunity to refine the targets and better define them at regional and potentially, basin scale. The review will also ensure they are appropriately ‘nested’ within, and help deliver on, the Reef 2050 Plan.
- This review of targets by June 2017 will utilise new information and modelling including the eReefs project.

### Feedback from Consultation

- There was strong support for refining the targets as part of the Reef Water Quality Protection Plan review, with the achievability of targets flagged as a key issue.
- Better targeting of sub-catchments/basins that contribute most to pollutant run-off was highlighted by stakeholders as critical, as was the need for effective reporting against targets.

## Conclusion 1:

**The water quality targets are ambitious and important. Accelerating progress towards the targets is necessary.**

### Recommendation 1: Targets

1. Review targets in 2016, feeding into the review of the Reef Water Quality Protection Plan
  - 1.1. Review and refine the water quality targets, including targets for nutrients, sediment, pesticides, land management practice change and catchment health indicators.
  - 1.2. Establish regional (and basin scale) targets for priority pollutants linked to Reef health.

**Recommended investment \$0 million (covered by existing Queensland Government \$35 million per annum water quality funding)**

Linked Recommendations									
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
					√	√	√		

## 16. Recommendation 2 – Communication, collaboration and stakeholder engagement

- Communication, collaboration and engagement will be key to success.
- There is a need for improved engagement and communication across programs and with landholders. Ongoing, two-way communication is critical. This communication will also support the increased extension effort recommended by the Taskforce, including peer-to-peer learning through the provision of property specific and relevant local regional information (facilitated through extension and education activities).
- Other opportunities for improved communication and stakeholder engagement include better and more modern communication tools building on some of the systems in place like the Queensland Globe and FORAGE.
- An overarching **collaborative communication approach to encourage community social change** in actions to improve Reef health should be developed. It will have a strong regional focus and involve working with local organisations to develop locally relevant messages and identify the most effective existing and new communication channels to ensure community involvement in the solution.
- There is a need for lessons learnt from successful programs and advice from community champions and early adopters to be promoted.
- The development of an ‘information/knowledge website hub’ where users can interact about water quality issues with links to a range of related information to improve the currently fragmented set of communication products is recommended and will help support communications activities.
- There have been calls for some time to establish a science synthesis process to ensure the science communication is comprehensive and relevant to management and captures the complex interactions of Reef ecosystems.
- An annual science synthesis workshop would integrate information across disciplines and with stakeholders to generate communication and extension products to facilitate adaptive management of the Reef catchment and marine resources. It would draw upon advice from other groups (for example the sediment working group).
- Opportunities should be explored to utilise Indigenous rangers in communicating the importance of water quality to traditional owners and protecting the Great Barrier Reef.

### Feedback from Consultation

- There was very strong support for the communication recommendation in the Interim Report. In particular, there was a desire for everyone living in Reef catchments to recognise their role in improving the quality of water entering

the Reef. All sources of water pollution (including urban and industrial uses) must also be addressed.

### Conclusion 2:

**Strong leadership and two-way communication are essential for improving water quality for the benefit of a healthy Reef**

### Recommendation 2: Communication

2. Substantially improve communication and information to build understanding of the pressures on the Reef and to support management practice and social change.
  - 2.1. Develop a collaborative communication approach with stakeholders to ensure everyone in the community understands how they can be part of the solution and contribute to improving Reef health.
  - 2.2. Establish consistent communication and messaging on Reef matters including across governments and with partners, with well-defined roles and responsibilities, including through a single website.
  - 2.3. Undertake an annual science synthesis workshop to generate new knowledge, better communicate science and inform policy, management practices and research priorities.

### Recommended investment \$5 million over four years

Related Recommendations									
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
		✓		✓	✓		✓		✓

## 17. Recommendation 3 – Extension and education

- **Currently farmers are getting information, advice and signals from multiple sources which can be conflicting** (Figure 15). This includes advice from the Department of Agriculture and Fisheries, NRM bodies, productivity boards, sugar mills, industry bodies such as Sugar Research Australia, fertiliser sellers, BMP advisors and others.
- Agricultural stakeholders frequently note the desirability of having greater access to more effective extension services. There are insufficient extension advisors to achieve this currently within government, NRM bodies or industry. The situation is exacerbated by inadequate funding and poor coordination across local delivery organisations.
- **A variety of extension tools are needed, recognising that every farm is different and many best management practices need to be tailored to individual circumstances.** Traditional approaches such as field days, one-on-one and peer-to-peer learning can be effective, particularly when combined with on-farm trials. However, approaches such as the ‘nudge’ of behavioural economics and other methods and alternative delivery pathways should be incorporated within the extension portfolio to complement established techniques.
- Continuous improvement needs to be built into all extension programs, and follow-up contact built into the core extension program. Extension programs need to consider staff turn-over rate and how to best minimise its impact on the program outcomes, possibly through borrowing the approach used by schools, where teaching ‘teams’ have replaced single class teachers. Local delivery organisations need agreed approaches for integrated and coordinated effort.
- Advice on water quality and sustainability benefits will have more impact if it is seen as part of a ‘whole of farm’ integrated management package with profitability linked to improved water quality. Targeted information that clearly identifies the key issues and how farmers can respond on their individual properties is needed. This needs to link to scientific data on what is occurring on properties (for example, groundcover, local water quality information).
- Awareness of the need to give farming families the opportunity to participate in education and extension programs is important, and thus programs need to be made more family inclusive, increasing participation and access by all members of farming communities, not just the household head.
- The Taskforce supports an increase in targeted extension services across the Reef catchments, in conjunction with action to address the current and forecast shortage of extension advisors. This should be done by improving training and career opportunities for extension advisors. The extension

program should also have a strong monitoring and evaluation program so information can be captured on what works and what doesn’t work.

- There are numerous informal networks amongst extension advisors. However, if these were strengthened and given focus, their potential to share lessons learned and ‘jumpstart’ change across the different regions would be increased. The emphasis here would be on minimal bureaucracy and maximum impact.
- Better access to specialist extension advice across the regions and the various industries should result in improved farmer and grazier knowledge and practices, and would also be beneficial to junior level advisors in building their capabilities, skills and careers.
- Support for extension training programs undertaken by higher education institutions would assist in increasing the numbers of new extension officers available to work across Queensland and thus help to address the problem of a shortage of extension advisors.
- New graduate extension officers would benefit from mentoring from more experienced extension advisors and also good support networks if they are going to be able to connect well with landholders and farmers and build solid and productive relationships based on trust.
- Funding bodies and providers of extension programs will need to adjust their programs with long-term contracts to enable extension advisors to remain within the industry as they build their knowledge and networks and relationships with farmers.

### Behaviour change programs

- Complementary to the expanded extension presence will be a behaviour change program, which will be based on learnings from the successful Triple P Program, a behavior change program for parenting developed through The University of Queensland. In developing the behaviour change program, the learnings of other successful campaigns will be considered (for example, that of the 140L water campaign in South East Queensland during the Millennium Drought to reduce household water use, which has had enduring benefits even after the drought had broken).
- **The key to large scale and widespread practice change will be landholder engagement and understanding the drivers, motivations and also obstacles to change.** Water quality improvements alongside on-farm profitability and productivity must drive the agenda.
- Work is already underway to develop a behaviour change program in consultation with industry. The first stage will be scoping the behaviour change program.

- The initial focus is the sugarcane industry and undertaking research to understand the motivations for change and the benefits and barriers of specific actions.
- Programs for other industries would be informed by the learnings from this pilot.
- Learnings from the behaviour change program will be incorporated into the major integrated projects to support management improvements and evaluate the success of various interventions.
- A group of behavior change experts, social scientists and psychologists have recently formed an informal network to share information on new projects as work on this new area emerges.

### Farmers motivated after agriculture innovation bus tour

A group of 60 forward-thinking north Queensland farmers investigated innovative farming techniques during a four day, 1600km journey of discovery through the region on a cross-regional bus tour held in April 2016, organised by regional NRM groups.

The tour of the Great Barrier Reef catchment area left participating farmers feeling motivated to try new and improved farming techniques in their operations. The group which came from a diverse range of agricultural industry areas traveled the Wet Tropics, Dry Tropics and Mackay Whitsunday regions to learn from other farmers about the techniques they're using to improve their land management practices and save money.

One of the highlights was the visit to the Australian Institute of Marine Science (AIMS) where participants heard firsthand information about the state of the Reef from coral ecologists and saw the SeaSim marine aquarium research facility to understand the impacts of water quality on lagoon and Reef health.

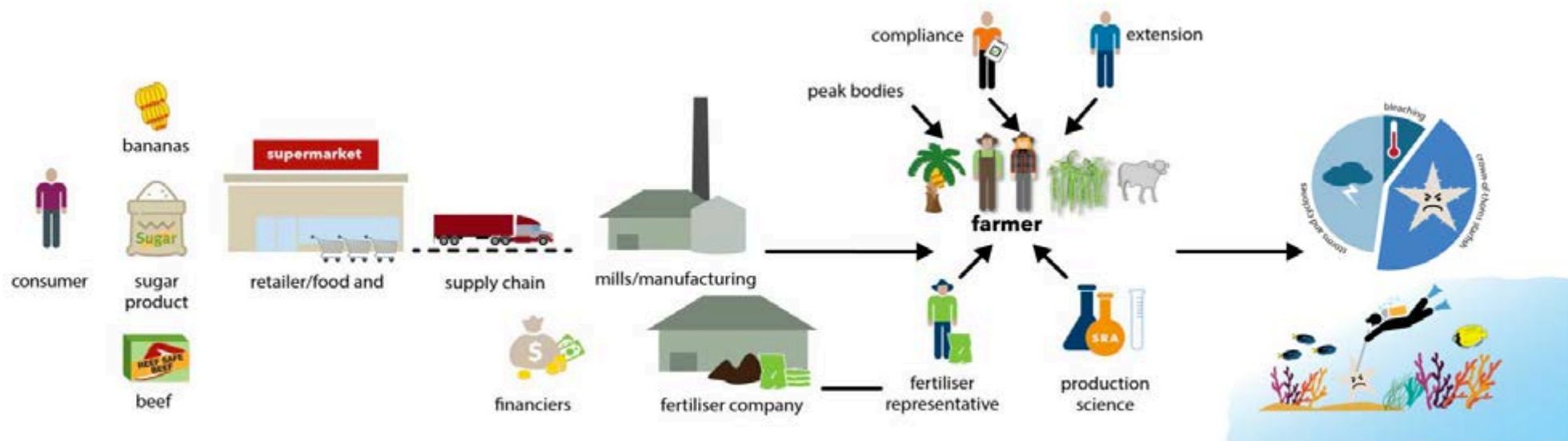


Figure 15: Sources of different messages to farmers



## Feedback from Consultation

- There was strong support for more effective, targeted and coordinated extension. Stakeholders have advised the Taskforce that they want extension services which cover the whole agribusiness, which align with regulatory requirements and which provide the latest knowledge about best practice. They also would like information on incentives programs.
- Stakeholders are concerned about the shortage of extension advisors (especially experienced advisors). Both government and non-government agencies and organisations are concerned about the existing advisors and their lack of employment security and their high turnover. Many extension advisors, including those employed by state government, are employed on short-term temporary contracts. This has a significant negative impact on career stability and results in the loss of experienced advisors across the sector.

### **Conclusion 3:**

**Agricultural extension, particularly when aligned with other mechanisms such as incentives, is fundamental for improved long-term land management.**

### **Recommendation 3: Extension**

3. Invest in more effective, targeted and coordinated extension to support large scale land management practice change.
  - 3.1. Restore the long-term government commitment to both resource and rebuild capacity in extension services across the Reef.

- 3.2. Formalise extension networks and define leadership and roles and responsibilities across local delivery organisations (government, private and farmer-to-farmer), for a whole-of-farm business approach which incorporates Reef health outcomes.
- 3.3. Support ongoing training programs and career development for accredited extension advisors.
- 3.4. Make greater use of smarter and more innovative extension approaches including facilitated peer-to-peer learning, demonstration projects and new technologies (for example phone apps).
- 3.5. Partner with the agricultural industry to develop a large scale behaviour change program (already underway with the cane industry) to encourage farmers to adopt specific actions, by better understanding their motivations and the associated benefits.

**Recommended investment \$15 million over four years**

Related Recommendations									
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
	√		√	√		√	√		

## 18. Recommendation 4 – Incentives

- Incentives are policies or initiatives used to affect change in actions or decisions. They are considered key tools in gaining greater adoption of sustainable land management to achieve the water quality targets.
- Using market-based approaches is one way of providing incentives. Market-based approaches encourage behaviour change through market signals such as changing the price of undertaking an action (for example grants), rather than through explicit directives such as regulation.
- Market-based approaches have the potential to provide incentives to improve the condition of the environment at a lower cost than many traditional approaches.

### Market-based approaches

- Market-based approaches include grants, subsidies and tenders (that have been used previously in Reef catchments) as well as stewardship payments, stamp duty relaxation and insurance schemes.
- Examples include:
  - reverse auctions (where individuals submit bids for funds to achieve a level of pollution reduction, and the most cost effective bids are funded)
  - grants for equipment (for example for global positioning system trackers in tractors) and changes in land management (for example to move to new row spacing)
  - stewardship payments to provide financial support for landholders to improve land condition (for example through payments to temporarily destock grazing land to reduce gully erosion) or to voluntarily convert unproductive land to a more sustainable land use (including by restoring wetland or natural ecosystem functions where this will be beneficial)
  - concessional loans to implement improved management practices for improved property value (for example loans to implement precision agriculture which requires capital expenditure up front). This could be done in partnership with the banking sector
  - an insurance mechanism to underwrite the risks of a practice change, where the science and economic analysis suggest that the change is a win-win for the environment and farmer's profitability is an option (for example crop insurance could cover yield or revenue loss associated with reduced nutrient application)

- stamp duty relaxation for best practice growers who want to expand their farms by buying neighbouring properties in poorer condition and committing to moving the new properties to best practice
- taxes or levies (for example on fertiliser). However, these are considered unlikely to succeed because of the legal difficulties in establishment, and the need for the tax to be very high to impact grower behaviour

### Using market approaches to achieve ecosystem repair

- The degradation or loss of riparian areas, wetlands and other natural ecosystems can be symptomatic of 'market failure'. The services that these areas provide (for example as fish nurseries or ameliorating poor water quality) are not fully recognised by the 'market' and as they are essentially a 'public good', no one is held responsible for the true cost of their loss. This means that reversing the degradation is unlikely unless there is targeted intervention or incentives.
- Providing targeted incentives for achieving ecosystem restoration and repair is considered particularly important recognising that best management practice alone will not meet the water quality targets. The restoration and rehabilitation of riparian areas, wetlands and flood plain ecosystems in strategic locations is expected to contribute to better outcomes for water quality and overall Reef health.

### Stewardship payments (payments for ecosystem services)

- Stewardship payments are payments made to a landholder for carrying out 'stewardship services' on their land to maintain or improve natural resource values and outcomes (for example for fencing off areas or restoring areas of land).
- These payments are based on the concept of the landholder providing a public service with the fee paid reflecting this. Their main benefit is that they can address more than one problem at a time (for example biodiversity and water quality outcomes) as well as maintaining existing environmental values (for example retention of native vegetation).
- The type and extent of stewardship payments is usually governed by a voluntary management agreement. Payments are generally ongoing (for example on an annual basis) and are offered for services above the expected minimum standard and are tailored to the situation.

### **Temporary retirement - compensation**

- Temporarily retiring marginal land from production is likely to be successful in reducing nutrient and sediment loads. Programs where farmers are offered financial assistance in exchange for signing a contract to set aside land from production and payments continue for as long as the land remains out of production may be appropriate. For example, to reduce sediment erosion and remediate gullies, some grazing properties require strategic de-stocking to enable groundcover to be restored to improve soil health and pasture resilience, and to make properties more sustainable overall.
- The form of compensation and criteria adopted needs careful consideration. Where farmers are expected to provide an ongoing management role, lump sum payments are unlikely to provide an ongoing incentive.

### **Voluntary land use change**

- In some situations, voluntary land use change is desirable followed by restoration to natural systems, and/or a lower impact alternative use. This may be associated with re-configuration of the land, with productive areas on-sold or placed under a protective covenant.
- Alternative land use options would need to be identified as part of the process of supporting land use change through incentives. This should use the outcomes of scoping work already underway as part of the National Environment Science Program Tropical Water Quality Hub.
- There may also be opportunities to link changes in use to more flexible arrangements for managing urban water quality (for example for sewage treatment and stormwater).

### **Trading systems**

- In some cases, water quality trading schemes may be an appropriate tool to reduce pollution. While some national and international trading schemes have shown financial and environmental benefits, the low number of successful schemes overall demonstrates the challenges in successfully applying the concept, particularly to diffuse source pollution (that is, pollution that doesn't come out of a single pipe).
- To successfully implement a trading scheme, significantly better information would be needed to establish, measure and monitor a cap and individual allocations. It would also require the support of a strong regulatory framework. The Taskforce proposes a staged approach to regulations for nutrient management, which would over time provide individual discharge permits based on an estimation tool - effectively providing a cap. A trading scheme could be considered building on such a permitting system.

### **Trialling a mix of initiatives**

- Defining and implementing a preferred program of incentives will require significant resources to be effective. The Taskforce recognises that there may not be sufficient resources to do this across all Reef catchments in the short term. Because of this, the application of incentives should initially be quite focussed and the effectiveness of particular approaches tested before being rolled out more widely.

### **Feedback from Consultation**

- There was strong support for the use of incentives and market based approaches. Concern was raised about certain types of instruments. These included concessional loans which reportedly have had low uptake by landholders in previous programs, and land 'buy-back' due to the high costs and potential flow-on effects for local industry. Changes from the Interim Report respond to these concerns.
- Respondents to the Interim Report had suggestions about how such approaches should be applied. This included tailoring them to the personal circumstances of landholders, targeting good performers, and directing subsidies or rebates to fund technological improvement. A number of respondents also suggested that the use of incentives must be integrated with extension and regulations as part of a comprehensive package, which the Taskforce agrees with.

### **Conclusion 4:**

**In order to make the significant changes needed to improve Reef health outcomes, incentives (for example grants) and market approaches (for example tenders) should be considered to complement and integrate with regulation, extension and education.**

### **Recommendation 4: Incentives**

4. Establish greater use of incentives and market approaches to support water quality improvements.
  - 4.1. Targeted use of market approaches such as tenders/reverse auctions (for example for purchasing nitrogen reduction) should be used where practical.
  - 4.2. Develop new incentives to accelerate improved management practices and/ or support land use change (for example incentives for practice change,

acquiring areas and stewardship payments for restoration).

- 4.3. Explore innovative approaches to support existing tools and manage risk (for example yield insurance, concessional farming loans).
- 4.4. Water quality trading approaches may be viable in some settings in the future but will require a staged pathway of regulation and detailed farm level information to support implementation.

**Recommended investment - \$0 million**

(Note: Incentives to be provided as part of the two major integrated projects)

Related Recommendations									
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
		v		v			v		





## 19. Recommendation 5 – Regulations

- The Taskforce considers regulation to be an important part of the mix of policy instruments to accelerate progress towards meeting the Reef water quality targets.
- Regulatory approaches need to be outcome focussed, clear, tailored to individual needs, easily measured and developed consultatively with industry. Additionally, they should target practices of greatest risk, have a negligible impact on those undertaking appropriate practices, and be coupled with supporting mechanisms such as improved extension, incentives and targeted compliance.
- The government should continue to collaborate with industry and progress to using co-regulatory approaches that recognise industry best practices and best management practice (BMP) programs in alignment with the Reef water quality management practice frameworks.

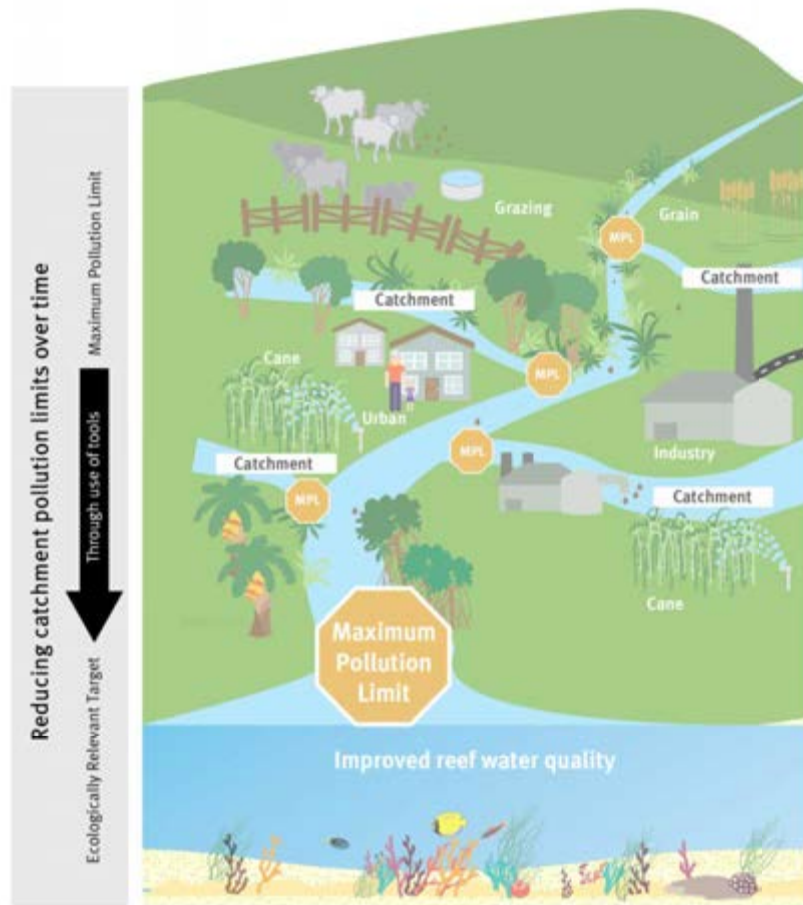
### Current regulatory approaches

- The main response for mitigating agricultural impacts, particularly from cane and grazing, but also for cropping, grains, bananas and horticulture, has been encouraging farmers to voluntarily adopt best management practices.
- From 2009, the *Environmental Protection Act 1994* and the *Chemical Usage (Agricultural and Veterinary) Control Act 1988* regulated the application of nitrogen, phosphorus and chemical (pesticide) application, and also required an Environmental Risk Management Plan for certain cane and grazing activities in the Wet Tropics, Burdekin and Mackay Whitsundays catchments.
- In 2012, the previous Queensland Government moved away from a regulatory approach and encouraged cane growers and graziers to meet the regulatory standards voluntarily through the cane and grazing BMP programs. The regulatory standards are reflected in these programs.
- The current government has, however, re-established a compliance program for the application of nitrogen, phosphorus and chemicals (pesticides) against the previous regulatory standards, with an initial focus in the Wet Tropics and Burdekin catchments.
- Point-source industrial activities (such as sewage treatment plants, aquaculture facilities, mining, dredging and quarrying) must meet water quality discharge requirements through a licence (environmental authority) under the *Environmental Protection Act 1994*. Urban development is required to be consistent with State and local planning instruments under the *Sustainable Planning Act 2009*, and other regulation dependent on the nature of the development.

- Statutory provisions also already exist to protect wetlands and riparian vegetation, but this is limited to certain wetlands and vegetation in priority Reef catchments.
- Targets for reducing catchment pollution loads are outlined in the Reef Water Quality Protection Plan and the Reef 2050 Plan but are currently non-statutory.

### Set and progressively reduce catchment pollution load limits

- The Taskforce advocates the establishment in legislation of sustainable catchment load limits for dissolved inorganic nitrogen and suspended sediment. This would provide a strong strategic driver for focused effort and momentum towards meeting the 2025 water quality targets in the Reef 2050 Plan.
- Catchment pollutant load limits should define the maximum nutrient or sediment load limit, usually expressed as tonnes per year at a defined point in the catchment. The catchment pollution loads should be determined using best available science generated through monitoring and modelling and set as maximum loads (see Figure 16). This should be used as part of the decision making for approving new development within the Reef catchments to ensure that any new nutrient and sediment discharge is only allowed where the load limits are not exceeded.
- A sustainable catchment load target will then be determined for each catchment using the ecologically relevant targets that are to be determined as part of the Reef Water Quality Protection Plan review. This should also be prescribed in legislation to present a clear pathway for meeting the targets for each catchment and to guide regulatory, policy and investment decisions.
- Once the load limits are set, a nutrient or sediment budget should be determined to outline the contribution to the load from each sector. This will further guide regulatory and investment decisions as well as help to communicate to each sector what their contribution to the solution will be.
- It is recognised that setting and progressively reducing catchment pollution limits will take a number of years.

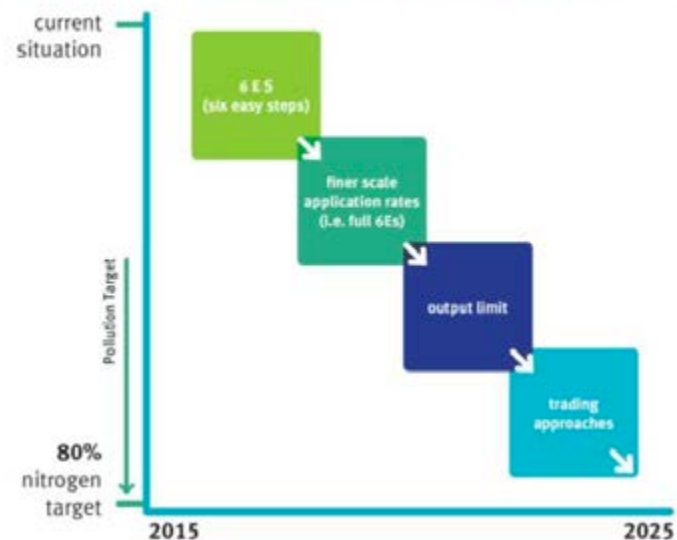


**Figure 16:** Catchment pollution load limits. A maximum pollution limit would be set at the end of catchments based on best available science, with targets then determined for each basin. Once the load limits are set, a nutrient or sediment budget should be determined to outline the contribution to the load from each sector.

**Establish minimum standards across all agricultural industries in consultation with affected industries having explicit regard to the costs and benefits of those standards**

- As cane and grazing produce comparatively more pollution loads than other types of agricultural production (in terms of total loads), the Taskforce recommends the existing minimum regulatory standards for these industries continuously improve. This includes progressing from existing standards (e.g. 6 easy steps), to more tailored and finer scale application standards (e.g. block yield / full 6 easy steps) and eventually to an output standard (e.g. amount of nutrients leaving a farm) to help establish a pathway to trading mechanisms (refer to Figure 17).
- Other land uses also contribute to nitrogen and sediment pollution and effort will be needed from these sectors to help reach the targets. Minimum regulatory standards should therefore also be established for other agricultural land uses (for example cropping, grains, bananas and horticulture) within Reef catchments. These standards should seek to achieve both positive water quality outcomes and maintain profitability for farmers.

**Evolution of farm minimum standards: farm scale**



**Figure 17:** Evolution of farm minimum standards showing suggested progression of minimum standards over time

## **Mandate the provision of farm level yield data, nutrient and other data across all agricultural industries**

- In order for both industry and government to make good decisions about regulation, extension and investment programs and support more property specific nutrient application, data is needed. **At a minimum, for the cane industry, nutrient use, cane yield, soil tests and fertiliser sales data should be mandated. Similar data should also be required from other sectors.**
- The requirement to provide the data should be targeted at the most efficient source to minimise the burden on industry. For example, yield data is collected by sugar mills so the requirement to provide this data should be upon the mills rather than the growers.
- The data must also be easily accessible to growers to empower them to improve nutrient use efficiency and farm productivity outcomes. An effective data management system must be in place before the requirements commence and this system should be accessible by growers to help inform their on farm decisions.
- The data should also be used to develop tools to support grower decision-making.

## **Staged regulatory approach for sugarcane production**

- A staged approach is recommended for improved nitrogen use efficiency in sugar cane production in all Reef catchments to reduce farm scale excess nitrogen loss.
- A significant proportion of cane land is recognised as not being managed to industry standards. While approximately 50% of land under cane is registered against the industry BMP less than 5% is currently accredited as meeting the standard. The Taskforce has concluded that much can be gained by increasing the uptake of existing BMP standards by growers and supports industry's efforts to achieve this.
- On-farm nitrogen trials, across many seasons, supported by government and industry, shows that reducing historically higher nitrogen rates to rates aligned with the Six Easy Steps (6ES) guidelines can maintain productivity, achieve significant savings associated with less fertiliser use, and reduce off farm nitrogen loss (see earlier Figures 8 and 9).
- **Stage 1** of a regulatory approach involves continuing to support the more rapid uptake of the BMP programs and enforcing the current regulated standards for nutrient and pesticide application, particularly for growers who are not proactively engaged in the BMP program.

- The existing regulatory arrangements for cane should be reviewed to empower all growers to meet the industry standard. Consideration should be given to removing the Environmental Risk Management Plan provisions and recognising BMP accreditation in legislation as part of a co-regulatory approach. Stakeholders view the Environmental Risk Management Plan provisions as burdensome and inefficient in meeting government and industry objectives.
- The regulated standard should also be expanded to growers in all Reef catchments to ensure minimum requirements are applied equitably.
- Implementing the revised arrangements must be supported by increased extension effort, working with growers to address practice adoption barriers, and targeted compliance. This is considered critical for success. However, as evidence indicates that the current minimum standards are profitable to growers, financial support or incentives should not be provided to meet them.
- **Stage 2** would require further improvements to nutrient use efficiency, using refined application rates based on property level yield information rather than district average yields.
- Emerging scientific research is highlighting the benefits of basing application rates within a property on specific information (for example yield history, crop age, time of harvest, weather, and soils). This approach continues to be successfully trialed by a number of initiatives including the Game Changer program being facilitated by Reef Catchments, Project Catalyst and research funded in partnership between government and Sugar Research Australia.
- Stage 2 would initially be implemented in 'hot spot' areas as identified through the mandated provision of yield and nutrient use data and water quality monitoring results.
- Incentives could support the cost of more refined nutrient application under Stage 2 to ease any financial burden on farmers. Adoption should also be supported with extension and compliance effort.

## **Consider progression to other regulatory approaches, including farm-based caps, if other stages are not successful within five years**

- Where adequate progress has not been made in reducing off farm nutrient losses through the staged approach for sugarcane production within five years, the Taskforce recommends the government consider the introduction of measures to cap nutrient use at the farm level.
- The Taskforce has considered a market based cap and trade scheme for nutrient outputs. It concluded that such approaches are not feasible in the

short-to-medium term due to the insufficiency of data and the necessary tools to set up a trading scheme.

- However, the recommendations about catchment pollution load limits and the collection of data and development of farm based tools would provide the underpinning for a cap and trade scheme for the future.
- To advance to a cap and trade scheme it would be necessary to allocate an amount of nutrient output for each source (i.e. farm and point source), within the context of the catchment pollution load limits. This would require the development of sophisticated tools, including a farm nutrient budgeting tool.
- The Major Integrated Project in the Wet Tropics could help inform a nutrient budgeting approach, as the project will support finer scale sub-catchment monitoring of nutrient loads.

### **Staged regulatory approach for grazing land management**

- A significant proportion of grazing land is not recognised as being managed to industry standards. Approximately 10% of grazing land is registered against the industry BMP but less than 1% of farms are accredited. The Taskforce recommends that best management practice requirements for minimising sediment loss be translated into a minimum regulatory standard for grazing land management across all Reef catchments, implemented through a staged approach.
- The existing Environmental Risk Management Plan provisions should be reviewed with consideration given to removing them and recognising BMP accreditation in legislation as part of a co-regulatory approach. As with the cane industry, stakeholders view the Environmental Risk Management Plan provisions as burdensome and inefficient in meeting government and industry objectives.
- **Stage 1** would introduce the minimum standard supported by appropriate extension (including tools for forage budgeting and determining carrying capacity for a range of climatic conditions) as well as working with growers to address practice adoption barriers. The revised arrangements should also be extended to all Reef catchments.
- Once graziers have had sufficient time to adapt their practices, any necessary compliance would be undertaken in Stage 2.
- Incentives could be provided to support the cost of meeting the minimum standard where there is minimal or no private benefit, including restoring areas of the property that may not provide a return on investment for the grazier.

### **Improve existing minimum regulatory standards and compliance capacity for point source pollution and stormwater, erosion and sediment control in urban and industrial areas, in consultation with affected industries having explicit regard to the costs and benefits of those standards**

- Point source pollution and urban water quality impacts on the Great Barrier Reef as a whole are considered minor in comparison to diffuse sourced pollution from agriculture. However localised impacts (particularly on inshore areas), and over short-term periods, can be significant.
- While regulatory controls are in place for urban and stormwater pollution under the Sustainable Planning Framework, these should be reviewed to ensure they meet current best practice water quality management, while having regard to the costs and benefits to industry from any changes to regulatory requirements.
- Emissions from point sources are regulated under the Environmental Protection Act. While emission standards (such as meeting the water quality objectives) have improved over time, emitters with older approvals may not be meeting these improved standards. There is an opportunity to work with industry to make improvements for water quality outcomes, while having regard to the costs and benefits to industry of meeting those outcomes.
- In support of the Reef 2050 Plan, operating licenses (“Environmental Authorities”) for point source nutrient and sediment contributors (such as sewage treatment plants, aquaculture facilities, mining, dredging and quarrying) should be reviewed by 2020 to ensure they meet modern water quality standards. However, this is a lower priority action given it is likely to result in a relatively low contribution to pollution reduction.
- Urban run-off from improperly installed or maintained erosion and sediment controls from construction sites (including roads) has been identified as a high impact source of suspended sediment, nitrogen and other pollutants. While regulatory controls are in place, there are concerns about the capacity of both industry and local government to ensure compliance with the regulatory requirements. Building capacity and capability to support implementation and on-going compliance with regulations is considered essential.
- The Reef 2050 Plan identifies the capacity building of local government as a specific action to improve water quality management in urban areas. In response, the Queensland Government has launched a suite of on-line tools and guidelines as well as a series of ‘capacity-building’ workshops aimed at local government and the construction industry.



- This should include on-going support to strengthen capacity to undertake industry compliance and education programs as well as consistent enforcement action to address poor practices.

### **Extend regulations to protect riparian areas and natural wetlands to all Reef regions taking into consideration impacts on landholders' ability to trade in ecosystem services**

- Requirements under the *Vegetation Management Act 1999* protect a 50m riparian buffer in the Wet Tropics, Burdekin and Mackay Whitsunday catchments. The Queensland Government is proposing to extend these protections to the Cape York, Fitzroy and Burnett Mary catchments. Any proposal to extend these regulations should be based on good functional mapping, avoiding regulatory duplication, and avoiding removing the rights of landholders to trade ecosystem services (for example carbon under the Emissions Reduction Fund). Requirements related to the development of streambanks in the *Water Act 2000* and development in Wetland Protection Areas in the Reef catchments under the *Sustainable Planning Act 2009* should be strengthened and extended to all Reef catchments.

### **Establish regulations to ensure no net decline in water quality from intensification and expansion in the agricultural sector**

- The regulatory focus must also ensure that intensification and expansion in the agricultural sector doesn't undo water quality outcomes associated with addressing the legacy of past developments. For example, impacts can increase where other high nitrogen dependent crops (for example rice, corn) are grown in the cane growing areas off-season or where new areas are opened up following access to irrigation water. Access to irrigation water is a key driver for agricultural intensification.
- Regulatory options under the Sustainable Planning Framework, the Environmental Protection Framework or through a combination of both should be explored to mitigate these impacts. Additionally, when sustainable catchment load limits are established these should be linked into land use approvals to ensure these limits are not exceeded by new and intensified agricultural development.

### **Establish a water quality offset framework that can apply across industries**

- An environmental offsets framework has been established in Queensland to deal with significant residual impacts from prescribed activities on matters of

environmental significance. This framework, however, doesn't directly address water quality impacts.

- The Taskforce recommends that the Queensland Government establish a water quality offset framework that is applicable to all nitrogen and sediment sources (agricultural industries, point sources such as sewage treatment plants, urban development, etc.) as a measure to manage water quality impacts for new or expanded development in the context of the new catchment load limits.
- The framework should allow for expanded or new development only if any additional nitrogen or sediment pollution is offset subject to maintaining catchment load limits. An offset is an action taken outside a development site that reduces the impact of pollution from that development on the environment.

### **Improve the management of irrigation to maximise water use efficiency and to minimize pollutant losses and associated impacts on water quality**

- Another factor which can influence nitrogen run-off is irrigation practice. The way a crop is irrigated, including timing, whether low pressure irrigation systems are used, and whether run-off waters are captured in a properly designed recycling pit, can lead to surplus nitrogen run-off.
- The government should review water allocation and irrigation practices in the Reef catchments to ensure that water use efficiency measures to minimise run-off and therefore nutrient losses are considered.

### **Feedback from consultation**

- Regulations were the fourth most popular choice for preferred Taskforce investment priorities. The majority of feedback was either supportive or neutral on the use of regulation. However, there was also some counter feedback including that additional regulation was unnecessary or not preferred, and any regulatory approach must be based more precisely on the science.
- Numerous submissions regarding the Interim Report supported land managers meeting best practice management standards. However, there were strong concerns about any moves to regulate best management practice, in particular, due to the belief that this would undermine existing best management practice programs. A blanket, one size fits all approach was not supported and there was limited support for nutrient and sediment discharge permits or a cap and trade scheme. There were some concerns

that urban impacts were not adequately represented in the Interim Report recommendations.

- Each regulatory response will need to be carefully tailored to address the concerns raised.

### **Conclusion 5**

**A staged regulatory pathway supported by extension, incentives, compliance, modelling and monitoring is needed to meet Reef outcomes.**

**Regulations should apply to agricultural, urban and industrial activities within Reef catchments to meet minimum standards.**

**Regulation of both future development and the intensification of existing development is important to ensure continuous improvement in water quality.**

**Any regulatory regime needs to be clear, tailored to individual needs, easily measured and developed consultatively.**

### **Recommendation 5**

5. Implement staged regulations to reduce water pollution throughout the Reef regions.
  - 5.1. Set and progressively reduce catchment pollution load limits in legislation to provide a regulatory framework to help drive load reductions to meet water quality targets.
  - 5.2. Incentives to continuously improve practices should be complemented by staged regulations that should:
    - improve existing minimum regulated standards (for example for urban, stormwater and point source) over time
    - establish minimum standards across all agricultural industries to address sediment and nutrient pollution
    - mandate the provision of farm level yield data, nutrient and other relevant data across all agricultural industries

- consider progression to other approaches, including farm-based caps, if other stages are not successful within 5 years

- 5.3. Minimum standards must be set in consultation with affected industries and have explicit regard to the cost and benefits of those standards.
- 5.4. Extend regulations to protect riparian areas and natural wetlands to all Reef regions, taking into consideration any impact this may have on landholders' ability to trade in ecosystem services.
- 5.5. Establish regulations to ensure no net decline in water quality from intensification and expansion in the agricultural sector.
- 5.6. Establish a water quality offset framework that can apply across industries (urban, ports, agriculture).
- 5.7. Seek continuous improvement in regulations and compliance capacity for point source pollution and stormwater and erosion and sediment control in urban and industrial areas.
- 5.8. Improve management of irrigation to maximise water use efficiency and to minimise pollutant losses and associated impacts on water quality.

### **Recommended investment \$15 million over four years #**

# Note: It is preferable that funding for compliance and regulation be base funded, as with other compliance activities for other industries. However, it is recognised that in the short term this may require a funding boost through part of the \$90 million. Priority should be given to finding alternative funding sources within 2 years. This may then free up funding for other priority investments (for example incentives in other areas outside the 2 major integrated projects).

Related Recommendations									
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
		√	√			√	√		

## 20. Recommendation 6 – Knowledge, science and innovation

- Much has been achieved recently in identifying sources of pollutants. The focus now needs to shift to identifying, evaluating – and implementing – a broader range of solutions for transformational change. This requires a strong scientific knowledge and solutions platform, together with a greater focus on innovation and problem-solving.

### Knowledge and Science

- **Ongoing reef related research and development is critical if we are to identify new technologies and the next generation of innovative practices that will support progress towards meeting the water quality targets.**
- Reef research supplies valuable information for decision-makers.
- While significant funding is already allocated to Reef research, it is **not always answering the most critical questions** and providing the tools needed for a major change program. Further, these programs and their funding are not always aligned to an overarching priorities program/investment framework.
- For example, while a Reef Water Quality Protection Plan Research, Development and Innovation Strategy 2013-2018, has been developed collaboratively by government and stakeholders, its priorities do not routinely inform Reef related Research and Development (R&D) programs.
- There are a range of Reef R&D programs and institutions that can be more closely aligned with key Reef water quality priorities. For example:
  - the National Environmental Science Programme (NESP)
  - the Queensland Government Reef Water Quality Science Program
  - AIMS
  - Universities (for example Griffith University, James Cook University, The University of Queensland – both core funding and ARC grants)
  - CSIRO
  - the Advance Queensland set of initiatives
  - the emerging Cooperative Research Centre for Northern Australia.

- **There is a need to ensure greater alignment of research to priority needs. The Queensland Government should work closely with the Australian Government to develop a unified R&D strategy and seek to ensure that investments are made accordingly.**
- **Research should be more priority focussed, integrated and coupled with two way communication to improve its translation into water quality improvement.**
- **More R&D funding through the \$90 million is not the answer.** Instead it would be better to use existing funding to get matched funding from bigger research programs/providers.
- Existing funding from the Australian and Queensland governments should continue to further develop the knowledge and solutions base (for example NESP and the Queensland Government's Water Quality Science program). However, **the \$90 million should be invested in applying already available knowledge.**
- **Better alignment and communication** within and between scientific disciplines, including the social sciences, **will also be needed to ensure maximum impact.** One approach, as discussed in the communications section, is holding an annual synthesis workshop including researchers, policy makers and stakeholders to support adaptive management and provide ideas on addressing the difficult issues and inform research priorities.

### Innovation

- Current management initiatives are not providing the rate of change needed to meet the Reef water quality targets and ultimately to ensure the Reef's long-term survival. Actions that are currently making a difference need to be maintained in parallel with a greater focus on innovation.
- Innovation – or “ideas successfully applied” – is needed not just in agriculture but across all industries in the Reef to deliver major change, along with maintaining current actions that are delivering positive outcomes.
- **Individuals and organisations with a history in successful innovations but not necessarily in the Reef should be engaged and encouraged to bring a fresh approach to Reef issues.**

**Innovation is needed in at least the following five areas:**

#### ***Next generation sustainable land management practices***

- Evidence suggests that even the adoption of current best farming practices for cane and grazing across the entire Reef catchment would still not be

sufficient to meet current water quality targets in the prescribed timeframe and secure the long-term future of the Reef.

- A greater focus on innovative approaches will be required to identify and embed the next generation of sustainable land management practices and drive major transformational change.
- Recent initiatives such as the Australian Government's Game Changer Programme and Project Catalyst (primarily funded by the Coca-Cola Foundation) have provided avenues for innovative practices in cane to be explored. Practices being trialled through these programs include:
  - electrical conductivity soil mapping as a surrogate for soil texture to apply herbicides and nutrients at variable rates across paddocks according to soil texture.
  - enhanced efficiency fertiliser.
  - potential improvements to soil health using different strategies involving crop husbandry.
  - variable rate nutrient application based on block or management zones and guided by age of the crop ratoon, historical yields and soil constraints.
  - low cost alternative irrigation, and sub-surface irrigation.
  - precision Agriculture GPS steered two row harvester.
  - conversion of green fallow into soybeans.
- Examples of approaches that also show promise include the use of zip-line banana harvesting systems to reduce erosion from steeper blocks, more intensive grazing systems, such as cell grazing and holistic management, and enhanced efficiency fertilisers, particularly when combined with lower nitrogen application rates. Enhanced efficiency fertilisers have the ability to slow the release of nutrients for uptake or to alter the conversion of nutrients to other forms that may be less susceptible to losses. These fertilisers should lead to nitrogen use efficiency which in turn should result in reduced levels of nitrogen at the end of catchments.
- Greater use of technologies (e.g. remote sensing, drones and satellite imagery) to support management change should be explored. An example of this is Digital Homestead, an initiative focussed on reducing labour and input costs, improving land management and boosting profitability in the grazing sector, with cattle location tracked, trends in cattle condition analysed, water levels in tanks and dams monitored, all from on-farm sensors.

### **Monitoring**

- Innovation should also be explored in terms of monitoring and evaluation with greater use of technologies like remote sensing technology, drones and satellite imagery where they can provide greater coverage at lower cost than current approaches.
- Working with the private sector may help identify and deliver cheaper monitoring alternatives on a mass scale, such as nutrient sensors, test kits and mobile phone applications, enabling stakeholders to receive personalised feedback reflecting their efforts. Processes like the Advance Queensland Small Business Innovation Research Initiative, which seeks innovative ideas from the market, should be utilised.

### **Treatment**

- There are novel remediation initiatives emerging which could help to treat sediment and nutrient run-off and protect the Reef from other recognised threats. Work is needed to investigate the likely impacts and benefits and ensure these are 'no regrets' actions. Possible examples include:
  - Denitrifying bioreactors are a treatment approach where solid carbon substrates (for example, cane trash) are laid down into the flow path of contaminated water. These substrates act as a carbon and energy source to support the conversion of nitrate to nitrogen gases.
  - James Cook University are exploring the use of algae as a filtering and water purification mechanism in reducing dissolved inorganic nitrogen from cane farm irrigation tail water.
  - Floating wetlands which treat suspended sediment and nutrients are a prospect which has largely been used to date in waste water treatment and could be considered in remediating agricultural run-off in irrigated systems.

### **Restoration**

- Riparian restoration, streambank management and wetland restoration can all deliver water quality benefits to the Reef. Restricting livestock movement through virtual fencing is one example of a management action that could aid riparian and streambank restoration at potentially less cost than conventional fencing and with greater flexibility.

### **Policy and funding mechanisms**

- There are more innovative approaches to policy emerging that may provide greater funding opportunities and maximise existing private and public



investment. For example, more flexible arrangements for urban sewage treatment and stormwater infrastructure could provide funds to treat upstream sources of nutrients and sediment instead of major investments in infrastructure upgrades to meet licence conditions.

- More innovative public and private partnerships should also be considered. For example, working with philanthropic organisations on a case by case basis and co-investing through initiatives such as the Ian Potter Foundation, the Paddy Pallin Foundation, or the Coles Nurture Fund which is providing \$50 million over five years to Australian farmers to develop new market-leading products, technologies, systems and processes. The corporate sector should also be engaged in terms of technology advancements (for example through international companies like GE, Microsoft, Facebook and Google).
- Similarly, greater innovation to leverage outcomes from other programs (for example like the Rural Water Use Efficiency program) to maximise water quality benefits would be beneficial.
- Novel funding mechanisms could also be considered such as green bonds and recognition of natural capital in banking.

#### ***Harnessing new ideas***

- To help harness new ideas and facilitate, cross boundary interaction and out-of-the-box thinking, a range of activities should be progressed. This could include, for example, accessing pre-existing networks for complex problem solving (such as the well-regarded 'Innocentive' process) or running special purpose hackathons (eg like a 'ReefHack'), that could bring together, from around the world, interested individuals for a focussed brainstorming event.



Photos: Floating wetlands in New Zealand (top photo) and South East Queensland (bottom photo). (Source: Spel Environmental, 2016)

## Proposed Innovation Fund

- **Significant, designated funding is required to provide the resources needed to develop, trial and implement innovative Reef practices.**
- The Taskforce is proposing a **specific Innovation Fund** that can support these types of innovative projects. A portfolio of investments should be developed, focussed on the priority areas of agricultural practices, monitoring, treatment and restoration.
- There also needs to be support for the identification of the next generation of practice improvements with farmers, and support for building the knowledge required to use innovation effectively.
- Options should be explored to match Queensland Government funding with other private sources, working with Reef Trust, the Great Barrier Reef Foundation, WWF and others. The Innovation Fund should also seek to build upon existing programs like Project Catalyst where appropriate.

## Feedback from Consultation

- Feedback was generally supportive of the need for innovation to make the improvements needed in water quality. Over-reliance on unproven and often unidentified innovative practices to achieve important outcomes was emphasised as a risk. Risk will feature in the roll-out of any innovation programs; this needs to be recognised and managed.
- Farmer led innovation was highlighted as an effective means in bringing together the scientific approach with the farmer's practical and context knowledge to find solutions. Also raised was the need for ways to attract investors to the topic of improved water quality in an agricultural setting.

## Conclusion 6:

**Improved alignment of research and innovation with the key challenges would enhance our ability to deliver substantial water quality improvements.**

**Achieving the targets will not be possible with the adoption of current best practices alone, and will require innovative approaches.**

## Recommendation 6: Knowledge, science and innovation

6. Better align science and fund development of new ideas and solutions.
  - 6.1. Encourage the research community, governments and industry to work together to align current and future investment with the existing Reef Plan Research Development and Innovation Strategy.
  - 6.2. Establish an Innovation Fund that builds on existing activities to support the development, scaling up and roll-out of promising new technologies and approaches.
  - 6.3. Establish a Reef innovation network to drive boundary crossing collaboration among stakeholders, researchers and innovators from diverse backgrounds to explore new solutions to improve Reef water quality.

### Recommended investment \$9 million over four years

Related Recommendations									
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
		√				√	√		√

## 21. Recommendation 7 – Monitoring, modelling, evaluation and reporting

- Reef-wide monitoring and evaluation for the Reef Water Quality Protection Plan is provided by the successful Paddock to Reef Program. It uses multiple lines of evidence to evaluate progress towards the water quality and catchment targets. The program includes monitoring and modelling at the paddock scale, catchment scale and in the marine environment, with both the Australian and Queensland Governments funding different program components (Figure 18).
- Approximately \$7.3 million per year is provided for the Paddock to Reef program (2013-18), with:
  - Australian Government funding of approximately \$3.66 million per year directed predominantly in paddock and marine areas
  - Queensland Government funding of approximately \$4 million per year directed to catchment monitoring, modelling and mapping activities.
- It includes paddock trials, management practice reporting, freshwater monitoring, catchment indicators assessment, catchment modelling, inshore marine monitoring, and remote sensing.
- Although the basis of the Paddock to Reef Program is sound, current monitoring and modelling investment is not sufficient to adequately test the effectiveness of a significant major change program at the scale needed for the proposed major projects, or to evaluate practice and actions as part of these projects to inform future program design. **It is also evident that overall funding in these areas has reduced over the past three years.**
- To improve evaluation and better understand the water quality outcomes from management practice adoption, **there is a need to increase monitoring and modelling coverage across Reef regions, at the appropriate scale.** This should include nested monitoring so we can track improvements from paddock/plot to sub-catchment to end-of-catchment to marine system in the long term.
- **Monitoring data and modelled scenarios should be presented to farmers and graziers in a user friendly, understandable way to demonstrate the impact of their changes and trials.** Positive examples of this include the Burdekin trials being run by BIFFMAC and funded by EHP which provided data directly back to farmers.
- There are a number of high priority gaps in the existing Reef catchment monitoring and evaluation program which need to be addressed with

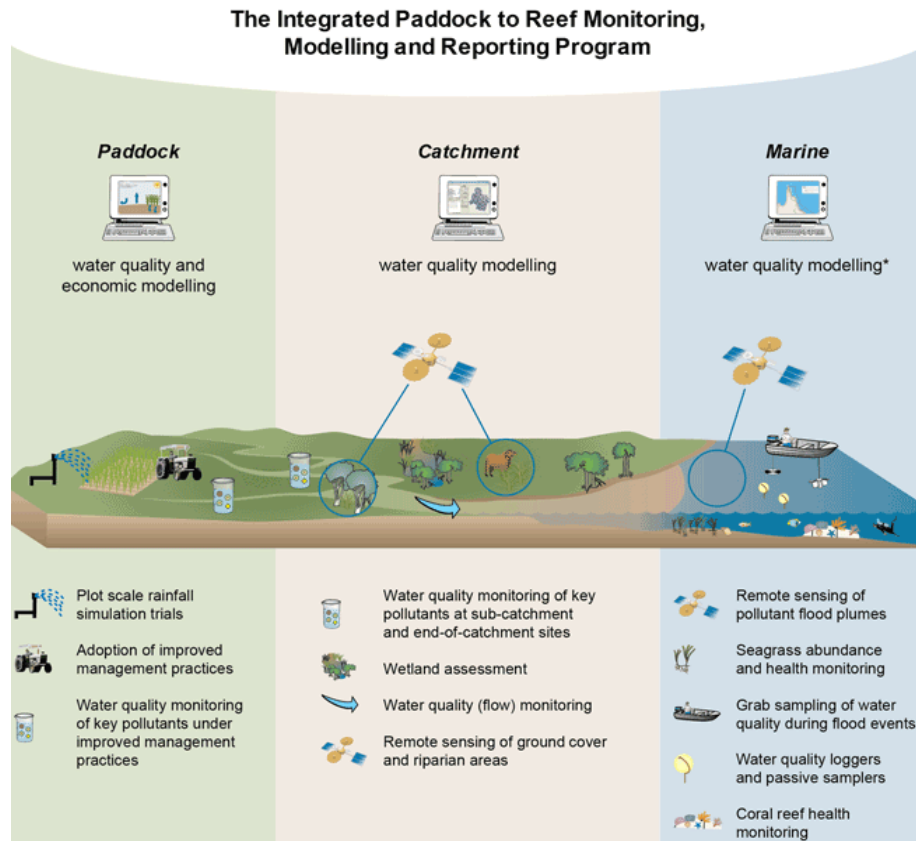
additional funding to provide more effective evaluation of management programs and better target and refine these programs over time. Specifically, there are limited monitoring sites in the Cape York and smaller coastal catchments, and there is insufficient sub regional or fine scale monitoring. Sub-regional monitoring is particularly important for providing specific water quality information to landholders, to help inform their practices. “What gets measured gets done” as the old adage says.

- There is also a need to better understand and document current management practice adoption across the industries and use this information to better target programs to specific needs, building upon the existing practice adoption program under the Paddock to Reef Program. Further, this information could also be better used in terms of how it translates to on-ground change, and most importantly, water quality outcomes.
- There are opportunities to develop and capitalise on citizen science and the public involvement in monitoring conditions in catchments and on the Reef for primarily educational purposes but also, potentially, feeding into data accumulation exercises.





Monitoring and modelling from the paddock to the reef allows us to measure and report on progress towards the Reef Plan goal and targets.



**Figure 18:** Components of the integrated Paddock to Reef Monitoring, Modelling and Reporting Program.

- The Great Barrier Reef Marine Park Authority is coordinating the development of an Integrated Monitoring and Reporting Program as part of the Reef 2050 Plan, covering the seven overarching themes – ecosystem health, water quality, biodiversity, heritage, community benefits, economic benefits and governance. \$8 million from the Australian Government has been allocated to fund the program’s establishment for the Great Barrier Reef World Heritage Area component of the Program and its integration with monitoring and modelling in the catchment as part of the existing Paddock to Reef Program. This may require expanding the Great Barrier Reef Report Card and filling critical information gaps in the Paddock to Reef Program.

- There are also a range of regional waterway health report card programs in place (Fitzroy, Gladstone and Mackay Whitsundays) and under development (Wet Tropics). These bring together the range of monitoring available in each region (freshwater, estuarine, inshore and offshore marine) and consider the impact of all sources of pollutants (urban, industrial, agricultural, ports) on waterway health and beneficial uses. Importantly they engage all partners in identifying opportunities to improve waterway health and management across sectors.
- In making enhancements to the monitoring and modelling program, there is a need to address issues highlighted in the Queensland Audit Office recommendations:
  - “Catchment monitoring is expanded to aid in determining the effectiveness of practice management change and enhance the confidence in modelled outcomes.”
  - “A rigorous verification process is applied to data on land management practice change to improve confidence in validation of the accuracy of inputs into catchment modelling.”

### Why use modelling to measure pollutant load reductions?

- Monitored pollutant loads leaving catchments vary significantly from year to year mainly due to differences in annual rainfall and run-off. To quantify changes in water quality due to land management change using monitoring data generally requires very long data sets to accommodate for the climate variability and time lags.
- Research suggests **time lags to monitor the improvements from land management practice change could range from years for pesticides up to decades for nutrients and sediments.** Therefore, modelling is required to estimate the potential long-term annual pollutant load reductions resulting from the adoption of improved land management practices.
- Modelling can account for the climate variability and provide an estimate of the likely effect that land management changes will have on water quality in the future. The models use measured changes in on-ground management and well-documented and accepted methods. Modelling is needed to fill the gaps, allowing comparisons of trends against Reef Water Quality Protection targets.



- Currently, funding for eReefs is terminating in 2017. Continuity of funding - and maintaining the skills and capabilities that have been developed – will be critical given the aforementioned time lags and a variable climate.
- **Long-term water quality monitoring data is critical to validate and improve the models, continuously improving confidence in the estimates of water quality over time.** Models also identify where more or better data are needed in the future.

## Reporting

- The various monitoring and modelling activities inform a range of reporting products. In relation to the water quality targets, the key reporting product is the Reef Water Quality Protection Plan annual Great Barrier Reef Report Card produced through the Paddock to Reef Program. It reports on practice adoption, catchment indicators, progress towards pollutant load reduction targets and inshore marine health. This information also feeds into five yearly Outlook Reports prepared by the Great Barrier Reef Marine Park Authority.
- Regional report cards also report on water quality at a finer spatial scale and in some cases report on progress towards objectives and targets under regional Water Quality Improvement Plans as well as community and beneficial uses.
- The nested approach to reporting is summarised in Figure 19.

## Feedback from Consultation

- There was very strong support for increased monitoring and reporting as part of the Taskforce's recommendations. Respondents would like to see more monitoring directly related to landholder actions.
- Some feedback has suggested that consideration be given to reporting bi-annually to provide more capacity to utilise the tools developed for other purposes.
- Full funding of monitoring and reporting was highlighted as a need to adequately report against all reef targets, including management practice and wetland targets.
- Strong support for finer scale (end of farm) monitoring, in a bid to engage producers and identify nutrient, pesticide and sediment losses so that delivery of extension, incentives and BMP programs can be better targeted at pollutant hot spots and evaluate management actions.



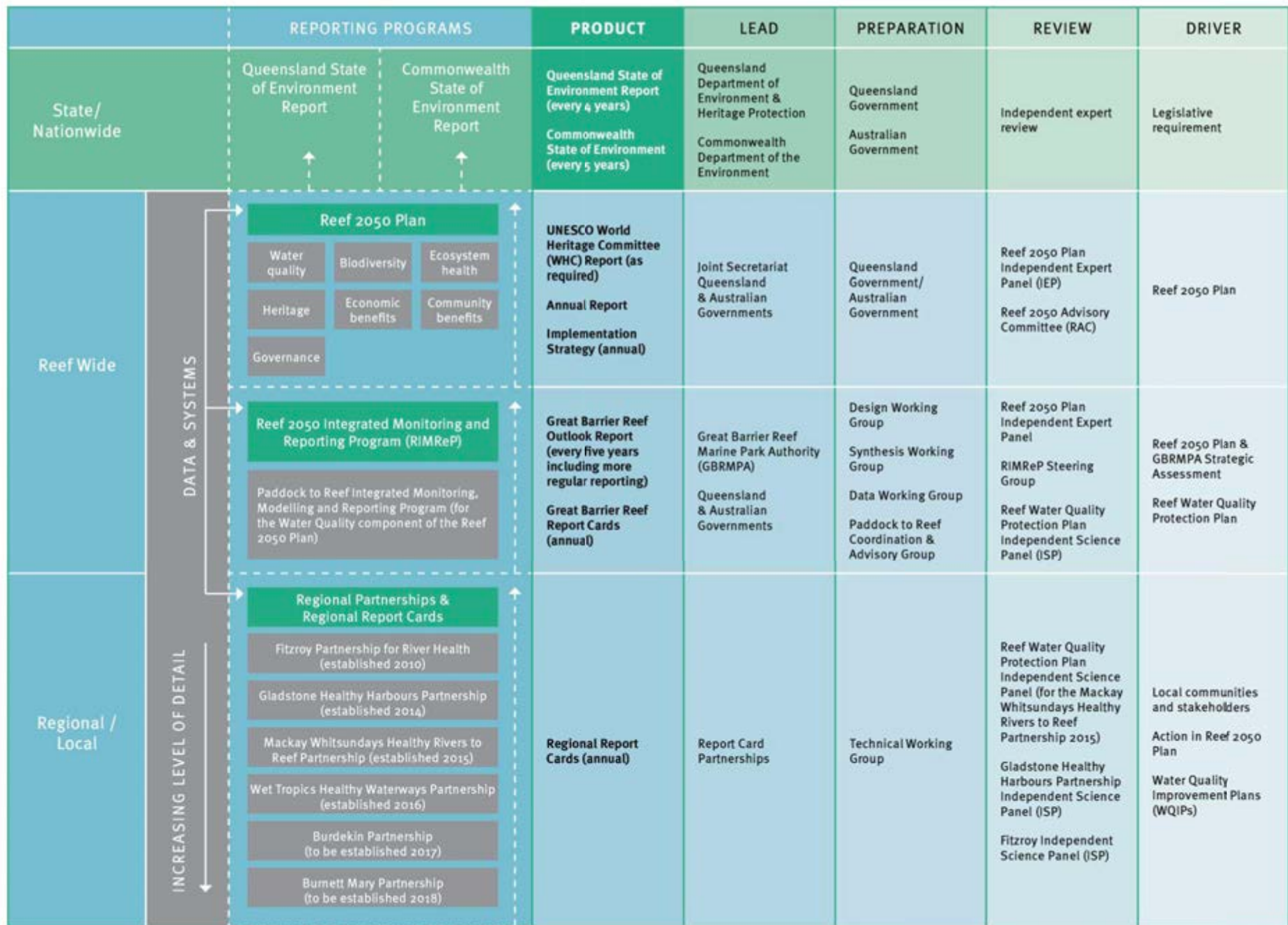


Figure 19: Nested approach to reporting

**Conclusion 7:**

**Current investment in monitoring and modelling is not enough to adequately measure Reef-wide water quality status and trends for both catchment and marine systems.**

**Monitoring is also essential for supporting communities and properly evaluating and reporting on outcomes of investment and optimising program delivery.**

**Regular and clear reporting on progress is vital and should be part of the broader reporting for the Reef 2050 Plan and Reef Water Quality Protection Plan (for example through Reef Outlook reporting and annual Reef report cards).**

**Recommendation 7: Monitoring, modelling and reporting**

- 7. Fund additional long-term and finer scale catchment monitoring, modelling and reporting for improved decision- making and adaptive management.
  - 7.1. Fund high priority catchment monitoring and evaluation gaps to enable better understanding of current adoption of management practices across the industries and progress to water quality targets.
  - 7.2. As part of the proposed two major integrated projects, provide funding for finer-scale paddock and catchment monitoring, modelling and evaluation. This will provide timely feedback to farmers and support, encourage and embed improved practices. Explore more affordable monitoring technologies to expand this approach.
  - 7.3. Ensure monitoring and modelling of land management and water quality feeds into regular, integrated reporting across Queensland and the Australian governments which can provide ‘what if’ scenarios to assist decision-making and adaptive management.
  - 7.4. Continue co-funding Reef monitoring programs from the catchment to the Reef with the Australian Government to properly evaluate and report on

outcomes of investment, and better align program delivery.

- 7.5. Ensure public availability of information and improve communication and visualisation of monitoring results.

**Recommended investment \$9 million over four years, plus \$2 million existing commitment to eReefs.**

Related Recommendations									
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
	√	√		√			√		





## 22. Recommendation 8 – Two major integrated projects

- Transformational change will only come from implementing new innovations, coupled with better integration of existing tools and timely feedback of results to stakeholders on changes to nutrient and sediment loads.
- Two major integrated demonstration projects – learning by doing, and at scale – are proposed to test the notion that, to get greater traction, we need to work more closely with the people that, will be most affected by potential management practice and land use changes - the landholders, local stakeholders, and their communities. **Importantly, the projects will help in understanding the change needed within a complex system of interactive pressures, variables and approaches.**
- This approach provides an opportunity to focus interventions and management effort into a scale that can be fully evaluated.
- These two major integrated projects will take account of the social and economic factors as well as the environmental factors that influence change.
- This integrated, intensive and comprehensive approach will require significant resources. That is why the approach will initially be limited to two locations to test whether it is effective and suitable for broader application across other Reef catchments. This will involve evaluating and communicating its cost-effectiveness, including the environmental, economic and social benefits, and corresponding costs of tools and interventions.
- The integrated projects will target **locations recognised as hot spots** in terms of their contributions to sediment and nutrient loads respectively to ensure that reductions in diffuse pollutants can be measured within relatively short time frames.
- Opportunities for evaluating and trialling catchment scale governance reforms should also be facilitated within these major projects.

### Project locations

- **One project would focus on sediment reduction in the Burdekin (in the Bowen-Broken-Bogie and / or Upper Burdekin) and a second project would focus on nutrients and pesticides reduction in the Wet Tropics (in the Tully and / or Johnstone), based on the risk as illustrated in Table 1.**

### Use a mix of tools

- **The projects will use a suite of tools (as per the other recommendations of the Taskforce) tailored to optimise uptake and outcomes**, including:
  - **significantly improved communication, collaboration and extension** targeted to individuals and supportive of peer-to-peer learning. The increased extension effort will include additional full time extension officers and/or agronomists being made available specifically to support project participants.
  - **fine-scale and nested monitoring** within the catchments to demonstrate the effect of system restoration and land practice changes to the stakeholders to enable adaptive management.
  - **trial and promotion of innovative practices** such as enhanced efficiency fertilisers coupled with techniques for gully prevention and remediation.
  - improved and new **user friendly and farm specific tools** and technological applications. This includes building on systems already in place for grazing such as Forage and VegMachine, as well as new tools and apps to support farmers to match fertiliser application rates to yield to promote outcome-focussed innovative approaches to farm management.
  - prioritisation of locations in the landscape for interventions and encourage **improved land management** building on Water Quality Improvement Plans, the Walking the Landscape approach for system understanding, and BMP programs to identify costs and benefits of different actions,
  - **stewardship payments or other incentives to achieve practice change above the minimum standard** and voluntary changes in the use of marginal land to support less polluting uses or restoration and rehabilitation of ecosystems, wetlands and other areas critical for effective landscape function.



## Feedback from Consultation

- Feedback regarding the Interim Report about the two major integrated projects was somewhat mixed, but still supportive. This may have been due to some ambiguity about what the major projects would achieve as well as concerns about the risks associated with significant investment being concentrated into two catchments.
- A number of respondents were strongly supportive of the proposal and supported the emphasis on evaluation and the opportunity to further road test specific interventions and mitigation techniques.

## Conclusion 8:

**Major integrated projects are needed in a small number of hot spots that integrate and evaluate the combined effectiveness of a range of tools and innovative approaches. Once up-scaled they will deliver accelerated progress to the targets and inform ongoing investment across the Reef catchments.**

## Recommendation 8: Major Integrated Projects

8. Implement two, well facilitated major integrated projects (MIPS) in pollutant 'hot spot' areas to evaluate the most effective combination of tools to inform the design of future programs.
  - 8.1. One major project should engage with cane growers in the Wet Tropics (for example in the Tully, Johnstone and/or Herbert) to focus on reducing nutrient and pesticide loss.
  - 8.2. The other major project should engage with graziers in the Burdekin (for example in the Bowen-Broken-Bogie

and/or Upper Burdekin) to focus on reducing sediment and particulate nutrient run-off.

- 8.3. Local stakeholders and landholders must be actively involved in the design of the projects and the interventions being tested, which should be adapted over time as needed.
- 8.4. Use the opportunity to identify and trial mechanisms for reform in the governance arrangements for delivering water quality outcomes.
- 8.5. Monitoring and evaluation of the biophysical, social and economic outcomes of the interventions, delivery mechanisms and governance arrangements must be a major component of the projects so that learnings can be transferred to different locations and scales.
- 8.6. Consider ongoing support to maintain and extend the successful outcomes of the MIPS approaches and tools.

### Recommended investment \$33.5 Million over four years

Related Recommendations									
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
	√	√	√	√	√	√			√

## 23. Recommendation 9 – Investment planning

- **Reaching the targets will be challenging even with the additional funding and is likely to require funds well beyond those allocated by the Queensland and Australian governments.**
- **Every dollar must be used wisely and be effectively targeted.**
- Existing funding (\$35 million per year from the Queensland Government) should be used more effectively and in a more coordinated way and better aligned to outcomes (as the Queensland Audit Office also recommended). This should include:
  - continuing to support industry led BMP programs, provided that the environmental standards are appropriate and widely adopted throughout industry leading to actual on-ground land management changes
  - introducing more contemporary, outcomes focussed regulations including amending the existing 'Reef Protection regulations' which are supported through existing funding
  - continuing a small research fund to get matched funding into highest priority areas
  - better aligning the work of River Improvement Trusts and Rural Water Use Efficiency schemes to water quality.
- **Reduce fragmentation of existing funding:**
  - the \$35 million per year is made up of multiple short-term funding programs as well as some base funded programs. **This should be consolidated into a single funding program, which isn't reliant on cobbling together base and limited life funding. That is, implement the Queensland Audit Office recommendations regarding single point of funding allocation.**
- Explore as an urgent priority, potential integration and/or ensure maximum alignment with Reef Trust funding and projects.
- Also consider how to leverage other sources of funding (for example through public-private partnerships) and consider more innovative financing mechanisms.
- It is often not recognised that a significant amounts of non-Commonwealth and state investment is aligned into reef water quality efforts at catchment and local scale (for example via landholders, industries, mills, Councils and

local philanthropy and volunteerism). Investment planning also requires improved regional arrangements to target and maximize these efforts.

- To ensure a coordinated approach to investment, a single investment plan for the \$90 million, combined with Queensland's existing \$35 million per year investment, should be developed, taking into account Australian Government funding allocations, to ensure that funding is tied to outcomes and performance measures.

### Public-Private Partnerships

- Both the Queensland and Australian governments are actively working to attract broader sources of funding:
  - Reef Trust's "Partnerships for the Reef" has been released to bring together both government and non-government investment in the Great Barrier Reef.
  - The Reef Trust Innovative Financial Mechanism Panel has been established by the Australian Government to look at the potential for conservation financing mechanisms to provide an additional funding stream for the Reef.
- Certain banks have indicated their willingness to consider providing accredited farmers with interest rate reductions. Some local governments are also considering reductions in rates based on improved farming practices.
- These types of approaches should continue to be explored, supported and promoted.

### In-kind Contributions

- Construction, mining and infrastructure companies may wish instead of making cash contributions to make in-kind contributions which will significantly benefit the management of the Great Barrier Reef (for example labour and equipment to remediate gullies).

### Feedback from Consultation

- There was general support in the Interim Report feedback for more strategic and coordinated investment in Reef water quality. There was support for reducing fragmentation, improved communication and coordination of government investment at all levels.
- The importance of a range of approaches to enhancing government investment through leverage and public-private partnerships and the need for

Reef Trust to be enhanced by becoming an independent entity were flagged as key issues.

- It was highlighted that more long-term core government funding is needed – with continuity within programs as well as total government package for impact. Greater investment from the private sector is largely dependent on continuity of government funds.

**Conclusion 9:**

**Reaching the targets is likely to require funds well beyond those currently allocated by both governments.**

**Long-term continuity and strategic leveraging of government investment, for example, through public-private partnerships and innovative funding vehicles, will be required.**

**Clear regional investment planning will be necessary to maximise catchment and local scale investment alignment and implementation effectiveness.**

**Recommendation 9: Investment Planning**

9. Develop a strategic investment plan and establish Reef-friendly public-private partnerships.
  - 9.1. Develop a combined investment plan for the \$90 million and the existing \$35 million per year Queensland Government funding (That is, \$230M over the next four years).
  - 9.2. Develop multi-year joint investment plans with the Australian Government to pool resources, agree delivery mechanisms and provide greater certainty of

funding and clearly address shared policy issues and priorities.

- 9.3. Work with the Australian Government to transition the Reef Trust to an independent entity, better placed to attract private sector investment and philanthropic funding.
- 9.4. Develop plans to:
  - leverage corporate and philanthropic funds through public-private partnerships
  - support conservation financing mechanisms (for example reduced interest rates for best management practice accredited farmers, green bonds)
  - encourage and support innovative catchment scale and on-ground delivery partnerships to leverage collaboration, skills and energy from private and community enterprises.

**Recommended investment \$0.5 million over four years**

Related Recommendations									
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
									√

## 24. Recommendation 10 – Governance

- **Simplifying and strengthening complex governance arrangements and clarifying roles and responsibilities is critical to the efficient delivery of the Taskforce’s Plan.**
- Improved alignment and integration of Reef water quality programs, investment, delivery systems and communication will ensure all levels of government are combining their efforts.
- Establishing a stronger program design, and implementation with clear accountability for actions across governments, agencies and delivery organisations, clearly defining ‘who has to do what, by when’ is necessary, and will result in reduced implementation costs. Program decisions should be based on the best available knowledge including from Traditional Owners.
- Ensuring the Queensland Government’s additional \$90 million and existing \$35 million per annum for improved Reef water quality outcomes works in collaboration with current programs and initiatives and builds on existing investment is critical.
- **To reduce fragmentation the Queensland and Australian governments should:**
  - **pool their funding** (in a Reef Trust more independent of government or other similar vehicle) to facilitate leveraging from private and philanthropic investments, locally and internationally
  - bilaterally agree and **invest in the continuous improvement** of catchment scale delivery mechanisms required to deliver results
  - **pilot catchment scale decision making** for better informed investments through the major integrated projects with partners, local, Queensland and Australian governments
  - **ensure continued alignment between strategies and programs** (for example Reef 2050 Plan, Reef Water Quality Protection Plan, Reef Trust, and Queensland funding programs)
  - **unify communication/messaging** to demonstrate interactions across organisations and responsibilities (for example a single website portal servicing both the Australian and Queensland entities regarding the Reef)
  - ensure other policy and program areas in both governments do not negatively impact on Reef water quality outcomes (for example climate change and northern development policies).
- It is recognised that existing governance structures are embedded in Reef 2050 Plan and the Reef Water Quality Protection Plan. The Taskforce has considered some ‘blue sky’ thinking about a potential longer term, simplified approach to governance, building upon other similar examples like the Murray Darling Basin which requires multi-jurisdictional arrangements (Figure 20).
- Over the short term, there may be opportunities to draw from other successful approaches, like that applied to the joint Queensland Parks and Wildlife Service and GBRMPA Field Management program, which is co-funded by both governments, and delivers compliance and marine park management. In this case, a joint team has been established, with a five year agreed strategy and annual business plans approved across governments. This type of approach could be successfully applied to water quality programs equally.
- Benchmarking how effective these arrangements are and regularly reviewing the governance system will be important to ensure it is properly functioning.

### Feedback from Consultation

- There was strong support for simplified governance in the Reef water quality space. Cooperation among all levels of government, non-government organisations, industry groups and community groups is needed.
- Longer term programs (that is, beyond political cycles of three and four years) were suggested as was applying learnings from past programs such as Reef Rescue, Reef Programme, Paddock to Reef.



## **Conclusion 10:**

**Reef-wide, water quality governance arrangements from policy to on-ground delivery are currently complex and poorly aligned. Improved alignment, simplification and coordination of effort across the system is needed to improve water quality outcomes.**

**This is an essential element to get right, across the wide range of organisations involved in the Reef space.**

**Key issues that need to be resolved in order to improve governance include agreement on objectives, alignment of programs, clarity of roles and responsibilities and accountabilities.**

## **Recommendation 10: Governance**

10. Simplify and strengthen governance and clarify roles and responsibilities within and between the Queensland and Australian governments.
  - 10.1. Implement a simplified and more effective governance structure across Queensland and Australian governments to deliver better joint arrangements in funding and decision-making, and more efficient delivery arrangements and trial through the major integrated projects.
  - 10.2. Reach agreement on critical delivery systems operating within catchments, and undertake progressive reform to improve coordination between partners including local, Queensland and Australian

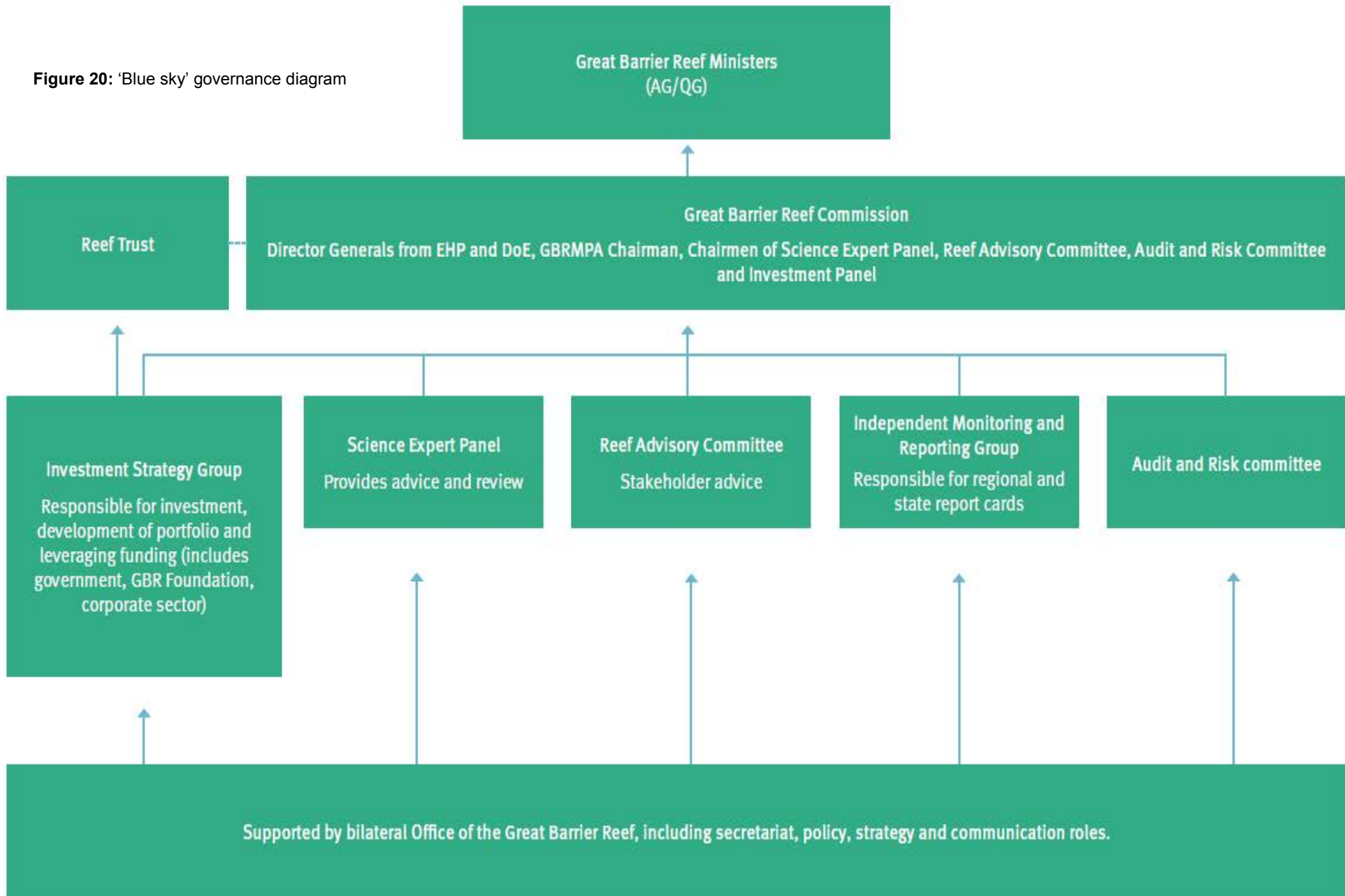
governments, regional NRM bodies, industry bodies, River Improvement Trusts and Drainage Boards and Traditional Owners to ensure more efficient and informed delivery.

- 10.3. Monitor and report on the effectiveness of the governance system affecting Reef water quality outcomes, resolving agreement on objectives, alignment of programs, clarity of roles and responsibilities, and accountabilities.
- 10.4. Work across the Queensland Government to ensure the existing \$35 million per year investment has a direct Reef water quality benefit to respond to the Queensland Audit Office recommendations.

**Recommended investment: \$0.5 million over four years** (a modest investment is needed for monitoring and reporting the effectiveness of governance arrangements. The key to this recommendation is commitment to act by senior decision makers in the Australian and Queensland governments)

Related Recommendations									
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
							v	v	

Figure 20: 'Blue sky' governance diagram













## 25. Summary of priorities for the \$90 million

- The Taskforce has made recommendations of the investment priorities for the \$90 million based on an understanding of the existing investment and programs, and the need to demonstrate accelerated progress towards targets. These recommendations include potential funding across different areas of investment.
- The Taskforce recognises that the investment needed to achieve the targets in the prescribed timeframe is likely to be well beyond the funds currently allocated by both governments.
- The Taskforce has made specific proposals for funding each of its recommendations. These are outlined in Table 6.
- The main areas for investment are the two major integrated projects, monitoring, extension, incentives and regulations.
- It is strongly preferable that funding for compliance and regulation should be base funded, as with other compliance activities for other industries. However, it is recognised that in the short term this may require a funding boost through part of the \$90 million. Priority should be given to finding alternative funding sources within 2 years. This will then free up funding for other priority investments.

### Priorities for existing funding

- The Taskforce strongly recommends using the Queensland Government's existing \$35 million per year funding more effectively and in a more coordinated way (as the Queensland Audit Office also recommended), and specifically:
  - Continue to support industry-led BMPs, provided that the environmental standards are appropriate and widely adopted throughout industry, leading to actual on-ground land management changes.
  - Establish more contemporary, outcomes-focused regulations (replacing the existing Reef Protection regulations) which are supported through existing funding.
  - Continue a small research fund to get matched funding into highest priority areas.
  - Better align the work of River Improvement Trusts and Rural Water Use Efficiency schemes to water quality.
- Reduce fragmentation of existing funding:
  - The \$35 million per year is made up of multiple, short-term funding programs as well as some base funded programs. This should be consolidated into a single funding program, which isn't reliant on cobbling together base and limited-life funding. This will address the Queensland Audit Office recommendations regarding a single point of funding allocation.
- Actively explore potential integration and/or ensure maximum alignment with Reef Trust funding and projects.

**Table 6:** Recommended priorities for investment of the \$90M

Recommendation	Area of Investment	Recommendation 8 Investment*	Reef wide funding	Total Investment	Comments
Recommendation 1	Targets 	\$0	\$0	\$0	Funding to be sourced from the existing \$35M/yr Queensland Government investment into Reef water quality.
Recommendation 2	Communication, collaboration and stakeholder engagement 	\$1M	\$5M	\$6M	Includes annual science synthesis workshop and products
Recommendation 3	Extension and education 	\$3.5M	\$15M	\$18.5M	Includes behaviour change program.
Recommendation 4	Incentives 	\$20M	\$0	\$20M	
Recommendation 5	Regulations 	-	\$15M	\$15M	Preferable that investment be base funded. However, it is recognised that in the short term this may require a funding boost through part of the \$90M.
Recommendation 6	Knowledge, science and innovation 	-	\$9M	\$9M	
Recommendation 7	Monitoring, modelling, evaluation and reporting 	\$9M	\$11M	\$20M	Includes \$2M to eReefs.
Recommendation 8	Two Major Integrated Projects 	*See total at base of column			Some Reef wide funding for Recommendations 5 and 6 may be invested in the Two Major Integrated Projects
Recommendation 9	Investment planning 	\$0	\$0.5M	\$0.5M	
Recommendation 10	Governance 	\$0	\$0.5M	\$0.5M	
<i>Already Committed</i>	<i>Taskforce Support</i>			\$0.5M	
	<b>TOTAL</b>	<b>\$33.5M</b>	<b>\$56M</b>	<b>\$90.0M</b>	



## NEXT STEPS

### 26. Implementation of Taskforce Recommendations

- It is for the Minister for the Great Barrier Reef and the Queensland Government to determine to what extent the recommendations of the Taskforce are adopted and implemented. The Taskforce envisages that providing implementation oversight for adopted recommendations would be the responsibility of the Office of the Great Barrier Reef (OGBR) within the Department of the Environment and Heritage Protection.
- All adopted recommendations require a work plan that is congruent with the Reef 2050 Plan and other existing Reef work plans and programs, has clear accountability for actions (including specific responsibilities) with clear outcomes based on performance objectives. Implementation oversight needs to be with the Office of the Great Barrier Reef and adequate resources prioritised.
- The opportunities to integrate or build upon existing programs, plans or funding mechanisms such as Reef Trust and the Reef 2050 Plan is a high priority through the program design process.
- The data and outcomes of funded projects should be made publicly available. In addition, this data should be used to evaluate the effectiveness of the funded projects.
- A proposed implementation pathway (Table 7) for the recommendations of the Taskforce is provided below. It identifies the critical initial actions and investments in year 1 and future years.

#### Delivery arrangements

- Where applicable, for recommendations with allocated funding, the government should develop programs and seek partnership arrangements to effectively implement the new programs. Partner and delivery organisations are likely to include:
  - Great Barrier Reef Foundation (GBRF)
  - Regional NRM bodies
  - Universities (e.g. James Cook University (JCU))
  - Industry bodies
  - Local governments
  - Stakeholder and Traditional Owner groups
  - Government agencies (e.g. Department of Agriculture and Fisheries (DAF))

- Relevant non-government organisations.
- Likely delivery agents and mechanisms for each of the recommendations are outlined in the implementation path.
- Efforts will be made to engage with Traditional Owners regarding the rehabilitation and protection of Reef catchments, with their cultural and ecological knowledge and connections valued by the Taskforce.

#### Formal and informal review processes

- The Taskforce acknowledges that a number of its recommendations are challenging and there are risks that projects may fail to yield desired results. Where this is the case, there must be opportunities to revise and adapt projects on a 'continuous improvement' basis. Some flexibility will be required to ensure that implementers are able to respond to emerging issues. Additionally, new technologies and knowledge may necessitate alterations to planned focus areas and funding requirements.
- To assist with continuous improvement, the implementation of the recommendations should include formal and informal review processes. A formal review should be undertaken and a publically available report prepared to outline the outcomes of any program implemented at the end of the current four-year funding period.
- The Taskforce members are unanimous in their offer to reconvene after 12 months to review, and comment on, progress. This will be for the Queensland Government to determine.



**Table 7:** Proposed implementation pathway for the Taskforce recommendations

Recommendation	\$	Work packages	Recommended Delivery lead	Recommended Mechanism	16-17 Year 1	17-18 Year 2	18-19 Year 3	19-20 Year 4
1. Targets	\$0	<ul style="list-style-type: none"> <li>eReefs scenarios</li> <li>Technical work to translate eReefs outputs to sustainable catchment loads for 35 basins</li> <li>Review by Reef Independent Science Panel</li> <li>Incorporation into new Reef Water Quality Protection Plan</li> </ul>	GBRF JCU ISP OGBR	Existing contract Contract Meeting Reef Plan review				
2. Communications	\$5M	<ul style="list-style-type: none"> <li>Communication campaign designed</li> <li>Comms campaign commences across industries (e.g. community service announcements, events)</li> <li>Agreed single communications strategy with Australian Government (including websites)</li> <li>Evaluation / social surveys</li> <li>Changes to communications campaign implemented</li> <li>Annual science policy synthesis workshop and product development</li> </ul>	OGBR " OGBR/DOE OGBR OGBR ISP	Internal " " " "				
3. Extension	\$15M (\$12M extension, \$3M behaviour change)	<ul style="list-style-type: none"> <li>Continue BMP program</li> <li>Behaviour change program commence and piloted in cane industry</li> <li>10 new extension officers trained</li> <li>Extension coordination network established</li> <li>18 new extension officers trained and coordination network operational</li> <li>Behaviour change program expanded</li> <li>New approaches and technologies for extension underway</li> </ul>	EHP/DAF/Industry Canegrowers/ experts DAF coordination; private /industry service providers Industry/experts DAF	Contract Contract MOU with DAF Contract MOU with DAF				
4. Incentives	\$0	<ul style="list-style-type: none"> <li>To be utilised in two major integrated projects (see 8)</li> </ul>	-	-				
5. Regulation	\$15M	<ul style="list-style-type: none"> <li>Establish and progressively reduce catchment and sub-catchment pollution load limits to provide a regulatory framework for driving reductions to meet water quality targets</li> <li>Improve existing minimum regulated standards (e.g. for urban, stormwater and point source) over time.</li> <li>Establish minimum standards across all agricultural industries to address sediment and nutrient pollution.</li> <li>Mandate the provision of farm level yield data,</li> </ul>	Internal govt delivery for regulations and compliance and policy development	Internal govt agreement				



8. Two major integrated projects	\$33.5M (\$1M comms, \$3.5M extension, \$9M monitoring, \$20M incentives)	<ul style="list-style-type: none"> <li>• Scoping with regional delivery organisations to identify tools from ground up</li> <li>• Engagement with landholders</li> <li>• Social / economic surveys</li> <li>• Provision of grants and extension services</li> <li>• Systems repair</li> <li>• Trial new governance approaches</li> <li>• Evaluation – repeat surveys</li> </ul>	Consortium of regional delivery agents  OGBR oversight	Contract	
9. Investment planning	\$0.5M	<ul style="list-style-type: none"> <li>• Update Qld Investment Plan to incorporate new investment (\$90M and \$35M)</li> <li>• Develop combined investment plan with Australian Government</li> <li>• Work with Commonwealth to explore options to pool funds through Reef Trust</li> <li>• Develop at least 1 new public/private partnership annually</li> <li>• Develop options for conservation financing</li> </ul>	OGBR	OGBR	
10. Governance	\$0.5M	<ul style="list-style-type: none"> <li>• Annual “governance health check”</li> <li>• Forum with Australian Government to identify critical delivery systems and opportunities for streamlining governance</li> <li>• Ensure Queensland existing \$35M annual investment is directly linked to water quality</li> <li>• Review and evaluate program (year 4) to ensure lessons learned are captured</li> </ul>	OGBR working with Australian Government	OGBR	



## Glossary of terms

**Adaptive management:** a systematic process for continually improving management policies and practices by learning from the outcomes of implemented actions.

**Best management practices:** are defined in Reef Water Quality Protection Plan - Water Quality Risk Frameworks for each major agricultural industry. These frameworks identify the management practices with greatest potential influence on off-farm water quality, and articulate a reasonable best practice level which can be expected to result in a moderate-low water quality risk. The levels described for each practice, where relevant, are:

- **Lowest risk** (Well above industry standard/cutting edge) – “A”
- **Moderate-low risk** (Best practice) – “B”
- **Moderate risk** (Minimum standard) – “C”
- **High risk** (Below industry standard) – “D”

The practice frameworks are used to measure progress against the Reef Water Quality Protection Plan management practice adoption targets and a range of investments in farm management change. Practices were initially classified as A, B, C or D (i.e., the ‘ABCD framework’). The ABCD framework was updated in 2013 with the water quality risk frameworks, but is still commonly referred to.

**Behaviour change:** a coordinated set of activities designed to bring about change to specific target behaviour/s of individuals.

**Catchment:** an area of land where water collects when it rains, often bounded by hills. As the water flows over the landscape it finds its way into streams and down into the soil, eventually feeding to a river, ocean or body of water. A catchment is the standard functioning unit of the landscape (also called catchment basin).

**Catchment Source model:** Catchment water quality model developed through eWater.

**Chlorophyll a:** a green pigment in green plants and cyanobacteria that absorbs light during photosynthesis. Generally, Chlorophyll a indicates the presence of plants such as phytoplankton driven by the availability of nutrients.

**Co-regulatory Approach:** situations where industry develops and administers its own arrangements, but government provides legislative backing to enable the arrangements to be enforced.

**Crown-of-Thorns Starfish (COTS):** the crown-of-thorns starfish (*Acanthaster planci*) is native to coral reefs in the Indo-Pacific region. On healthy coral reefs, the coral-eating starfish plays an important role, as it tends to feed on the fastest growing corals such as staghorn and plate corals, allowing slower growing coral species to form colonies. This helps increase coral diversity. However, outbreaks of the starfish can lead to the complete loss of coral and one of the most significant threats to the Great Barrier Reef.

**Ecosystem goods and services:** substances or processes derived from ecosystems that provide benefit to humans, such as the regulation of atmospheric gas content, maintenance of soil fertility, food production, regulation of water flows, water filtration, pest control and waste disposal. Ecosystem services also include social and cultural services, such as the opportunity for people to experience nature.

**DIN:** Dissolved inorganic nitrogen. See “nutrients”

**Ecologically relevant targets:** define pollutant load reductions that would be required to meet the Great Barrier Reef Water Quality Guidelines, which are set at a standard considered to be suitable to maintain ecosystem health.

**Ecological Thresholds:** the point at which there is an abrupt change in an ecosystem caused by a relatively small change or disturbance in external conditions.

**Ecosystem repair:** a term used to describe wetland, riparian and mangrove protection and restoration, as well as on-ground projects to improve the quality of water entering the Great Barrier Reef from highly developed areas of the catchment.

**Emissions reduction fund (ERF):** an Australian Government initiative which offers incentives to seek out actions that are in the interest of business as they reduce costs and in the interest of the environment as they reduce emissions. The objective of the ERF is to help achieve Australia's 2020 emission reduction target of five percent below 2000 levels by 2020.

**Gully erosion:** is the removal of soil along drainage lines by surface water run-off or where run-off concentrates. Gully erosion happens when run-off concentrates and flows strongly enough to detach and move soil particles. Splashback at the base of the gully head erodes the subsoil and the gully eats its way up the slope. In cultivation or pastures, advanced rill erosion can develop into gully erosion.

**Groundcover:** comprises organic material such as grasses, low shrubs and leaf litter. Maintaining ground cover minimises run-off and loss of nutrients and soil.

**Marginal Cost Abatement:** the expense associated with eliminating a unit of pollution.

**Nested:** in general, something that is nested is fully contained within something else of the same kind. For example, a table within a table is a nested table.

**Nutrients** (including total nitrogen and total phosphorous): nutrients such as nitrogen and phosphorus can be derived from both natural and modified landscapes and can be present in various forms in run-off and or leaching from different land uses. Currently the Queensland Government's target for nitrogen does not specify the form of nitrogen. Both dissolved and particulate forms of nutrients are important in driving ecological effects. The scientific consensus is that increased nitrogen inputs have more impact on water quality than phosphorus. Dissolved, inorganic forms of nitrogen (DIN) and phosphorus are currently considered to be of greater concern than particulate or dissolved organic forms as they readily support algal and plankton growth.

**Outcome based standards:** standards can be used to meet performance requirements in two ways. Prescriptive standards specify exactly what actions must be taken to meet the desired level of performance. Outcomes based standards, while specifying the desired level of performance, allow discretion as to how the performance level is to be achieved.

**Pesticides:** collectively refers to herbicides, insecticides and fungicides. This includes PSII herbicides, which act to inhibit photosynthesis.

**Plant cane:** a stalk of sugarcane of the first growth from the cutting.

**Point source:** pollution that comes from a single point (e.g. from a sewerage treatment plant, aquaculture facility etc.)

**Program logic:** identifies the links between resources, activities, outputs, impact and outcomes of policies and programs.

**Ratoon cane:** cane which grows from the stools left in the ground after a crop has been harvested.

**Riparian:** riparian forest and ground cover is the vegetation beside waterways which can help reduce pollutant flow to waterways and stabilise stream banks.

**Total suspended sediment:** sediments can be derived from both natural and modified landscapes through erosion and can be present in various forms in water. Total suspended sediment is an indicator of particulate matter in water. The finer, mud-sized fraction (<63 µm) are a primary concern for the Great Barrier Reef.

**Stream bank erosion:** is a natural geomorphic process which occurs in all water channels as adjustments of channel size and shape are made to convey the discharge and sediment supplied from the stream catchment. However, human influence through catchment development, stream regulation, removal of large wood, and clearing of riparian vegetation, can greatly increase the rate of bank erosion, sometimes to unacceptable levels. Bank erosion includes two main groups of processes:

- Hydraulic processes at or below the water surface entrain sediment and directly contribute to erosion, particularly of non-cohesive banks, by processes of bank undercutting, bed degradation, and basal cleanout.
- Gravitational mass failure processes detach sediment primarily from cohesive banks and make it available for fluvial transport.

**Water quality:** refers to the chemical, physical, biological and radiological characteristics of water. It is a measure of the condition of water relative to the requirements of one or more biotic species and/or to any human need or purpose.

**Water quality objectives:** are numerical concentration limits that have been established to support and protect the designated uses of water at a specified site. It is based on scientific criteria or water quality guidelines, but may be modified by other inputs such as social or political constraints.

## APPENDICES

### Appendix A – Taskforce Membership

The Great Barrier Reef Water Science Taskforce was made up of a group of experts from a range of fields, appointed by the Minister for the Environment and Heritage Protection and Minister for National Parks and the Great Barrier Reef. Members of the Taskforce included:

- Dr Geoff Garrett, AO FTSE, Queensland Chief Scientist (Chair)
- Steve Banney, Consultant, Grazing land management (Grazing industry)
- Dr Rebecca Bartley, Research Scientist, CSIRO (Sediment movement)
- Professor Susanne Becken, Director of Griffith Institute for Tourism, Professor of Sustainable Tourism, Griffith University (Tourism industry)
- Professor Mike Bell, Chair in Tropical Agronomy, Gatton Campus, The University of Queensland (Cane industry)
- Jon Black, Director-General, Department of Environment and Heritage Protection (Queensland Government) (up until Nov 2015)
- Colin Creighton, Principal Research Scientist, TropWATER, James Cook University and Director, Greening Australia (Natural resource management)
- Professor Allan Dale, Professor of Tropical Regional Development, Cairns Institute, James Cook University (Regional community expert)
- Dr Rob Fearon, Director, Innovation Partnerships, qldwater, Manager Queensland Water Regional Alliances Program (Local government)
- Professor Ove Hoegh-Guldberg, Director of the Global Change Institute, Professor of Marine Science, The University of Queensland (Tropical marine science)
- Euan Morton, Principal, Synergies Economic Consulting (Economics)
- Dr Steve Morton, Honorary Fellow, CSIRO Ecosystem Sciences (Conservation planning)
- Dr Chris Rawlings, Director, Queensland Energy Resources (Resources industry)
- Jim Reeves, Director-General, Department of Environment and Heritage Protection (Queensland Government) (from March 2016)
- Dr Russell Reichelt, Chairman and Chief Executive, Great Barrier Reef Marine Park Authority (GBRMPA)
- Dr Britta Schaffelke, Research Program Leader - Australian Institute of Marine Science (Water quality and research)
- Dr Roger Shaw, Independent consultant, Chair of the Reef Water Quality Protection Plan Independent Science Panel (Reef water quality science)
- Di Tarte, Independent Chair of the Mackay Whitsunday Healthy Rivers to Reef Partnership (Community engagement and partnerships)
- Jane Waterhouse, Research Fellow, Catchment to Reef Processes, James Cook University (Water quality improvement planning)
- Brad Webb, Director of BM Webb Group (Ports industry)
- Dr Stuart Whitten, CSIRO Group Leader - Economics, Productivity and Sustainability Land and Water (Economics).
- Malcolm Thompson, Ami McGrath and Kevin Gale (observers for Australian Government)

#### Taskforce Secretariat:

- Claire Andersen, Director, Reef Coordination and Partnerships, Office of the Great Barrier Reef
- Rachel D'Arcy, Manager, Reef Coordination and Partnerships, Office of the Great Barrier Reef
- Ben Hammill, Principal Project Officer, Reef Coordination and Partnerships, Office of the Great Barrier Reef
- Jenny Riches, Principal Project Officer, Office of the Queensland Chief Scientist



## Appendix B – Review Group membership

The Review Group was established to provide feedback and peer review on the work and draft recommendations of the Taskforce. Review Group members were:

- Professor Paul Greenfield, AO FTSE, (Chair of Review Group), International Water Centre (Chair)
- Associate Professor Dr Eva Abal, Program Director, UQ Water, Global Change Institute, The University of Queensland
- Dr Andrew Ash, Former Director, Climate Adaptation Flagship, CSIRO
- John Bennett, Chief Scientific Officer, Reef Water Quality, Department of Environment and Heritage Protection
- Jim Binney, Principal, Mainstream Economics and Policy
- Dr Graham Bonnett, Research Director for the Integrated Agricultural Systems Program of CSIRO's Agriculture Flagship.
- Greg Bourne, Chairman, Australian Renewable Energy Agency (ARENA) (up until January 2016)
- Jon Brodie, Research Scientist, Centre for Tropical Water and Aquatic Ecosystem Research, James Cook University
- Professor Stuart Bunn, Director, Australian Rivers Institute, Griffith University
- Dr Peter Doherty, AIMS Fellow (post retirement), Australian Institute of Marine Science (AIMS)
- Mike Grundy, Research Director, Sustaining Soil and Landscapes, Agriculture Flagship, CSIRO
- Lyall Hinrichsen, Executive Director, Land and Mines Policy, Department of Natural Resources and Mines
- Professor Terry Hughes, Director, ARC Centre of Excellence for Coral Reef Studies
- Dr Paul Lawrence, Director, Landscape Sciences, Science Division, Department of Science, Information Technology and Innovation
- Malcolm Letts, Executive Director, Regions and Industry Development, Department of Agriculture and Fisheries
- Tony McAlister, Group Manager - Water Quality, Water Technology
- Sheriden Morris, Managing Director, Reef and Rainforest Research Centre Ltd
- Professor Peter Mumby, ARC Australian Laureate Fellowship, School of Biological Sciences, The University of Queensland
- Professor Jon Olley, Professor of Water Science, Australian Rivers Institute
- Dr Ian Poiner, Chair - Integrated Marine Observing System Advisory Board, Chair - Gladstone Healthy Harbour Partnership Independent Science Panel
- Professor Hugh Possingham, Director ARC Centre of Excellence for Environmental Decisions, The University of Queensland
- Professor Bob Pressey, ARC Centre of Excellence for Coral Reef Studies, James Cook University
- Carole Sweatman, CEO, Terrain NRM Ltd
- Dr Rob Vertessy, FTSE, Former Director of Meteorology and CEO, Bureau of Meteorology

## Appendix C – Key References

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## Appendix D – Supporting Taskforce reports

Supporting Taskforce reports provide detail on the conclusions and recommendations of the Taskforce, and can be found at: [www.gbr.qld.gov.au](http://www.gbr.qld.gov.au)

Documents and resources available:

- Current situation analysis <http://www.gbr.qld.gov.au/documents/taskforce-situation-analysis-july2015.pdf>
- Terms of reference <http://www.gbr.qld.gov.au/documents/gbr-taskforce-tor.pdf>
- Taskforce Interim Report, Animation on the Interim Report and Public Consultation Report <http://www.gbr.qld.gov.au/taskforce/interim-report/>
- Taskforce Communiques <http://www.gbr.qld.gov.au/taskforce/>