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TERRAIN NATURAL RESOURCE MANAGEMENT

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

Wet Tropics Regional Water Quality Strategy 2025–2035

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Part A: Purpose and Context of the Wet Tropics Regional Water Quality Strategy

1. Introduction

1.1. Background

The Wet Tropics Natural Resource Management (NRM) Region (herein referred to as the Wet Tropics Region or the 'Region') in northeastern Queensland spans approximately 22,000 km² and contains a variety of landscapes and ecosystems. The Region has a population of around 250,000 residents primarily concentrated in Cairns, Innisfail, Tully and Ingham and many smaller population centres along the coast and in the Atherton Tablelands. There are eight major drainage basins—the Daintree, Mossman, Barron, Mulgrave-Russell, Johnstone, Tully, Murray and Herbert.

The Region contains outstanding natural assets, including parts of the Great Barrier Reef (GBR) World Heritage Area and the Wet Tropics World Heritage Area. Its economy is driven by marine and terrestrial tourism, fisheries, aquaculture, and agriculture, with grazing and sugarcane the dominant land uses, with smaller areas of cropping, bananas, horticulture, dairy and urban areas.

The **Wet Tropics Regional Reef Water Quality Strategy 2025 to 2035** (the Strategy) is a key component of the Australian Government funded Wet Tropics Region Landscape Repair Program. The Landscape Repair Program is a major initiative focusing on reducing fine sediment export to help improve the quality of water flowing from the basins in the Wet Tropics Region to the GBR, while also delivering multiple additional benefits for the local environment and local communities. Whilst funded as part of this program, the Strategy is not limited to addressing sediment, and the scope of the Strategy extends beyond a focus on just priority pollutants in the Region to address regional priorities for land-based water quality management and improvement.

The Strategy provides a 10-year road map to guide and support Terrain NRM, stakeholders and potential investors in prioritising resources and investment into activities to reduce the risk of land-based pollutants delivered from the Wet Tropics Region to the GBR. It identifies outcomes, objectives, management strategies and actions and where appropriate, priorities for water quality improvement in each of the basins within the Region, relevant to the current understanding of local water quality impacts, drivers and management options. It also identifies capacity and capability requirements for delivery and implementation of the regional water quality priorities, including recommended approaches for community, stakeholder and Traditional Owner engagement, processes to review and evaluate the effectiveness of the Strategy, potential risks and constraints to implementation, and strategic opportunities to collaborate and align with related initiatives.

The Strategy is a dynamic resource that will be updated at least twice (mid-point and endpoint reviews) to 2035 to contextualise and inform the development of regional water quality projects and programs. Program-specific implementation and action plans will be developed in alignment with the regional priorities when funding opportunities arise, according to investors' objectives and priorities. The Strategy is linked to the objectives of the Reef 2050 Catchment Water Quality Strategy[1] (Reef 2050 CWQS) and the intent is that potential investors, including but not limited to the Australian and Queensland governments, will be able to align programs and projects with the priorities identified within the Strategy.

[1] https://www.reefplan.qld.gov.au/__data/assets/pdf_file/0031/427837/reef-2050-catchment-water-quality-strategy.pdf

1.2. Scope

The geographic scope of the Strategy is the Wet Tropics Region and the adjacent marine areas of the GBR World Heritage Area (WHA). The ecosystems being considered include freshwater wetlands (with a focus on floodplain wetlands), coastal and marine ecosystems including coral reefs and seagrass. There is insufficient data to inform the assessment of Region-wide ecosystem condition and pollutant exposure to other marine ecosystems and species such as mangroves, soft bottom communities, most plankton communities and fish. The main land uses being considered in the Strategy are sugarcane, bananas, horticulture, grazing and urban. While other land uses including forestry and conservation areas may be important in some locations, there is typically limited opportunity for pollutant load reductions in these areas.

The pollutants of primary concern in the Wet Tropics Region are dissolved nutrients (primarily nitrogen), fine sediment, particulate nutrients (nitrogen and phosphorus), and pesticides. Other pollutants such as trace metals may be relevant at local scales. The nutrient and sediment targets defined in the Reef 2050 Catchment Water Quality Strategy (CWQS; Australian and Queensland governments, 2026) are basin-specific loads-based targets (currently under review), and the pesticide target for all basins is based on the concentrations required to protect 99 percent of aquatic species at the river mouth.

The development of regionally specific targets is also outside of the scope of the Strategy. The Reef 2050 WQIP defined additional targets for a range of indicators related to catchment condition and human dimensions. The Reef 2050 CWQS has revised this approach slightly, focusing targets on water quality improvement measures (i.e. loads of sediment and nutrients and risk of pesticides), with catchment and marine condition measures presented as indicators – e.g. 'No loss of the extent of natural wetlands (lakes, swamps and estuarine wetlands)', 'Improved wetland condition', 'Improved coral condition', 'Improved seagrass condition'. The previous riparian vegetation target is now expressed as an indicator 'Loss of woody vegetation in riparian areas is decreased', and a new groundcover indicator is recommended - 'Adequate ground cover (≥70%) in the late dry season'. Determination of adequate cover varies across the GBR catchments and definition of these levels is outside of scope of the Strategy. The Reef 2050 CWQS also addresses urban land use management through an indicator – 'Increased reduction of pollutants from urban water management'.

The previous Human dimensions and Management Practice Adoption targets are now also expressed as indicators, with changes to the wording of those as well – 'Increase in capability, opportunity, and motivation for stewardship to achieve water quality outcomes among agricultural landholders and Reef communities' and 'Increase in agricultural land management practice change' (respectively). The decision to move away from a Management Practice Adoption Target was informed by a recent review of these targets (DPI, 2025), conducted with input from industry, NRM, and conservation stakeholders, which emphasised the complexity of setting realistic and relevant adoption targets across diverse regions. It recommended discontinuing the GBR-wide voluntary land management targets in favour of more context-specific approaches, including consideration of local environmental and social factors. Rather, the review identifies and outlines *Potential Adoption* opportunity for specific priority management practices that may accelerate progress toward water quality targets in priority catchments. This is highlighted for incorporation into future agricultural program design and delivery which is beyond the scope of this Strategy.

Other areas out of scope for the Strategy include analysis of the costs of implementing the strategies and actions. This will be addressed through respective funding bids and programs, and regional priorities that are not directly related to water quality benefits for the Region. These priorities are addressed through other regional planning processes, such as the Wet Tropics NRM Plan.

1.3. Policy and program alignment

The Strategy sits within a much larger framework of policies and programs for water quality improvement in the GBR, and potential additional benefits, including the GBR-wide Reef 2050 Long

Term Sustainability Plan (Reef 2050 Plan), Reef 2050 WQIP/CWQS, Reef 2050 Wetlands Strategy (DESI 2023a) and Reef 2050 Indigenous Implementation Plan (see Figure 1). The six Regional Reef Water Quality Strategies are nested under the Reef 2050 CWQS, the Vision of which is: *'A healthy catchment for a healthy Reef and healthy people'.*

At the Regional level, the Strategy will also need to link and align with plans and initiatives where water quality is one of several themes or program areas within a broader scope, such as the Wet Tropics NRM Plan – the *Wet Tropics Plan for People and Country*, and Traditional Owner Strategic Plans. Similarly, integration with Catchment Action Plans already in development will be essential (e.g. the Russell River Catchment Sustainability Plan and Herbert Catchment Action Plan), following the principles of the Whole-of-System Values Based Framework (WoSVBF; see Section 1.4) and encompassing a wider range of ecosystem services.

The high-level priorities set out in this Strategy then feed into the more detailed levels of planning and implementation, including those specific to programs such as the Reef Trust Landscape Repair Program and Reefwise Farming and the Herbert Integrated Project. They also guide the complementary activities of agricultural industries, Landcare groups, Traditional Owners, local governments and River Improvement Trusts, ensuring alignment and coherence across the broader network of organisations contributing to GBR water quality outcomes.

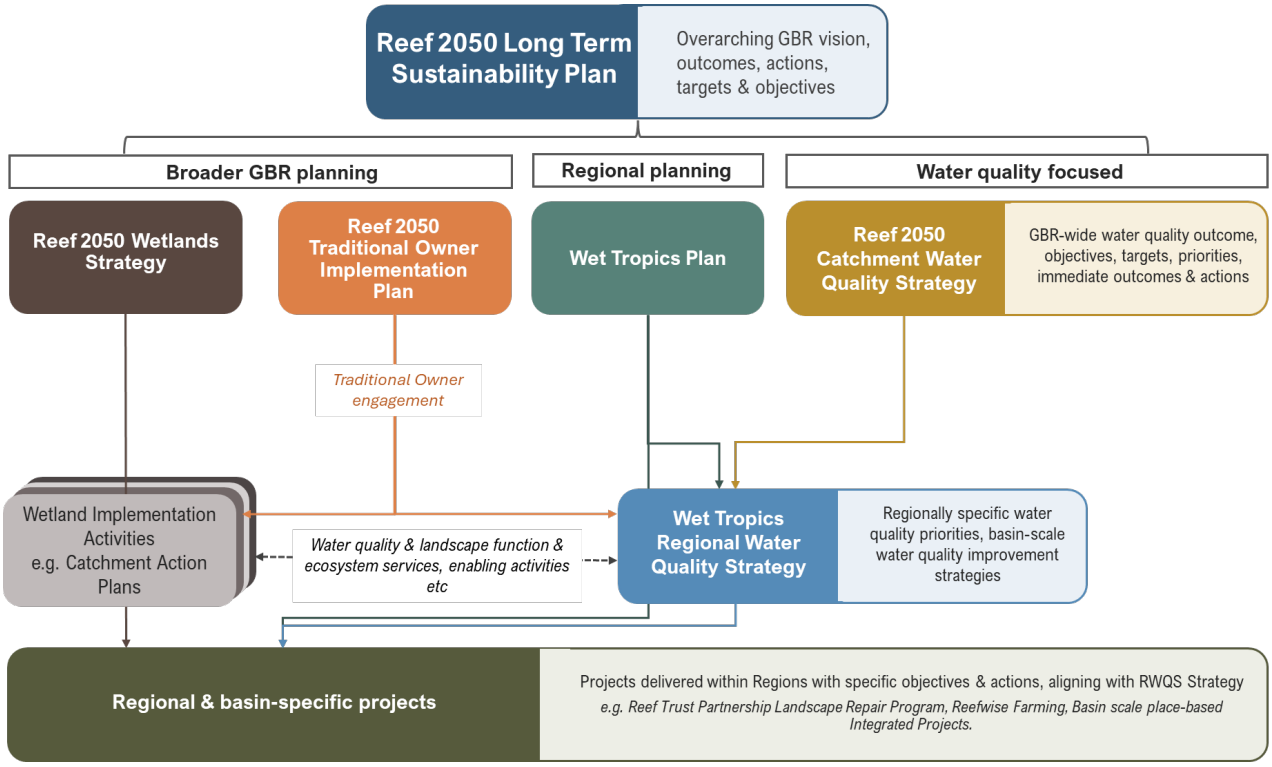


Figure 1. *Example of how the Wet Tropics Regional Water Quality Strategy sits in the GBR planning and policy frameworks.*

1.4. Guiding principles

The Strategy seeks to drive a holistic approach to water quality improvement in the Region, recognising the complexity of the interactions between biophysical, social and economic drivers, and the opportunities for potential co-benefits. The WoSVBF developed by the Queensland government as part of the Queensland Wetlands Program (DESI, 2022), aims to guide such holistic approaches for catchment management. However, adopting a full whole-of-system approach is beyond the scope of the Strategy, as it would require considering the full suite of direct and indirect drivers and pressures influencing catchment systems – including elements not directly related to water quality. Instead, the Strategy draws on key WoSVBF principles to guide the strategic development of water quality focused management options. These include:

- Consider system connections when developing and implementing management interventions, including connections between the biophysical environment, the beneficiaries of the services provided by that ecosystem and their values.
- Use a values-based, holistic management approach to achieve outcomes that consider the biophysical environment alongside social, economic and cultural outcomes.
- Engagement - involve all relevant groups (including Traditional Owners) of the system to ensure their needs and values have been considered and incorporated into the design of management interventions, including knowledge sharing.
- Foster integration - break down silos between groups, stakeholders, and sectors to foster collaboration and coordinated action.
- Make decisions based on the best available knowledge at several scales; that is, at the site, catchment, and system-scales (e.g. how can the knowledge about the broader system be used to inform site-specific management interventions?).
- Select management interventions for the appropriate spatial and temporal scales.
- Incorporate adaptive management by embracing flexibility and continuous learning, allowing strategies to evolve based on new information and changing conditions.

The Strategy guides regional water quality management for 10 years, through to 2035. The importance of long-term funding has been reinforced in multiple evaluations of previous GBR water quality investment programs. Documented benefits of long-term planning and associated investments include positive and ongoing stakeholder engagement, greater consistency and integration among program elements and improved implementation through continuous learning and adaptation of program design. Limitations or challenges associated with short-term planning are particularly evident in maintaining capacity and a skilled workforce, landholder engagement and delivering strategic outcomes.

Five major themes were identified for the Strategy as part of the stakeholder consultation workshops conducted in the first phase of the Strategy development in 2024: agricultural, non-agricultural, natural systems, integrated management, and sustainable communities. These themes guided regional priorities and strategies, with the Agricultural (e.g. sugarcane, bananas, horticulture, grazing) and Non-agricultural (e.g. urban, industrial areas, mining) themes related to sustainable land use and associated management options. These are complemented by actions related to Natural Systems which recognise the importance of landscape condition that influence water quality outcomes and includes options for smaller scale system repair or larger scale engineering solutions. The Integrated Management and Sustainable Communities themes have been used to identify actions required to support delivery and implementation of regional priorities. While these themes provided an initial focus for grouping actions, the structure of the Strategy has been adjusted to align with the Reef 2050 CWQS as described in Section 1.3. Integration across themes and with other policies and programs will be essential for successful implementation of the Strategy. This is in keeping with the principles of the WoSVBF described above.

While the Strategy guides regional investment priorities for water quality improvement, the delivery of these priorities is not necessarily resourced. In addition, there is no central coordinating body to ensure that there is cooperation between relevant programs or investments. Therefore, actions that foster collaboration between delivery partners and support maintenance of stakeholder networks are a key component of the Strategy.

1.5. Approach to developing the Strategy

The Strategy has been developed with a strong underpinning of scientific evidence, management experience and consultation with stakeholders and technical experience. The major steps of development are illustrated in Figure 2.

Figure 2. *Major steps involved in the development of the Wet Tropics Regional Water Quality Strategy.*

For the Phase 1 stakeholder consultation, workshops were held within each Wet Tropics basin. For the basins with an extensive lower and upper catchment area with different landscapes and industries, workshops were held in both locations. These included the Herbert, Johnstone and Barron basins. A total of 11 workshops were held, involving 77 organisations and 146 participants.

Invitations targeted key stakeholders across the local industries, conservation and other key organisations involved in water quality and natural resource management in the basin. The workshops were not 'closed' events but participation was sought from individuals who had local knowledge of specific issues. Frequently these included stakeholders who had also been engaged in the NRM Plan review processes held in 2019.

In preparation for the catchment consultation, invitees/participants were provided with information about an extensive range of projects that had previously been implemented in the basin - generally projects within the last five or so years. They were also provided with the list of priorities that had been raised/identified in the Wet Tropics NRM Plan review process for the area. This was aimed at demonstrating that information from past projects and input about priorities raised during the Wet Tropics NRM Plan review was being used to support the development of the Strategy, and to serve as a prompt/conversation starter for participants.

The feedback from these workshops is reflected in the Strategy and is summarised in Appendix 1. It provided a strong foundation for the local and regional priorities, strategies and actions identified for the Region.

1.6. Document structure and navigation

This document is structured into three Parts to help readers navigate the Strategy and its development that spans across multiple scales (regional, basin and sub-basin) and management dimensions (Figure 3). The structure maps out the *Why*, *What* and *How* of the Strategy:

Part A – Purpose and Context of the Wet Tropics Regional Water Quality Strategy
Part A (Sections 1 and 2) explains why the Regional Water Quality Strategy is needed. It outlines the purpose, scope, guiding principles, and policy alignment, and provides the regional context, including a summary of the evidence that has informed the Strategy development.

Part B – Regional Strategic Framework and Basin Application
Part B (Sections 3 and 4) forms the core of the Regional Water Quality Strategy and Basin Water Quality Improvement Strategies. It introduces the Regional Water Quality Strategy Framework in Section 3 and explains how the framework was used to guide the integration of regional- and basin-

level assessments and supporting evidence to develop a portfolio of prioritised and targeted Action and Delivery Strategies for each basin, to collectively contribute to the achievement of the Wet Tropics' Regional Objectives and Outcome.

The Basin Water Quality Improvement Strategies in Section 4 are designed specifically for each of the eight Wet Tropics' basins and identify what actions are required, where they should be applied, and the scale and intensity of management needed across three Strategic Action Areas:

I. Sustainable land use and management
II. Natural Systems Repair
III. Actions to support scaled delivery

Part C – Regional Implementation
Part C (Section 5) focuses on how the Strategy will be delivered and sustained over time at a regional scale. It sets out the enabling conditions required to support basin-level delivery, including investment priorities, governance and coordination, Traditional Owner engagement, regional capacity, knowledge sharing, science and innovation, and monitoring, evaluation and adaptive management.

Together, these three Parts provide a clear line of sight from regional objectives, through basin-scale strategic action, to coordinated regional implementation, ensuring that basin-level efforts collectively contribute to achieving the Wet Tropics' Regional Water Quality Outcomes.

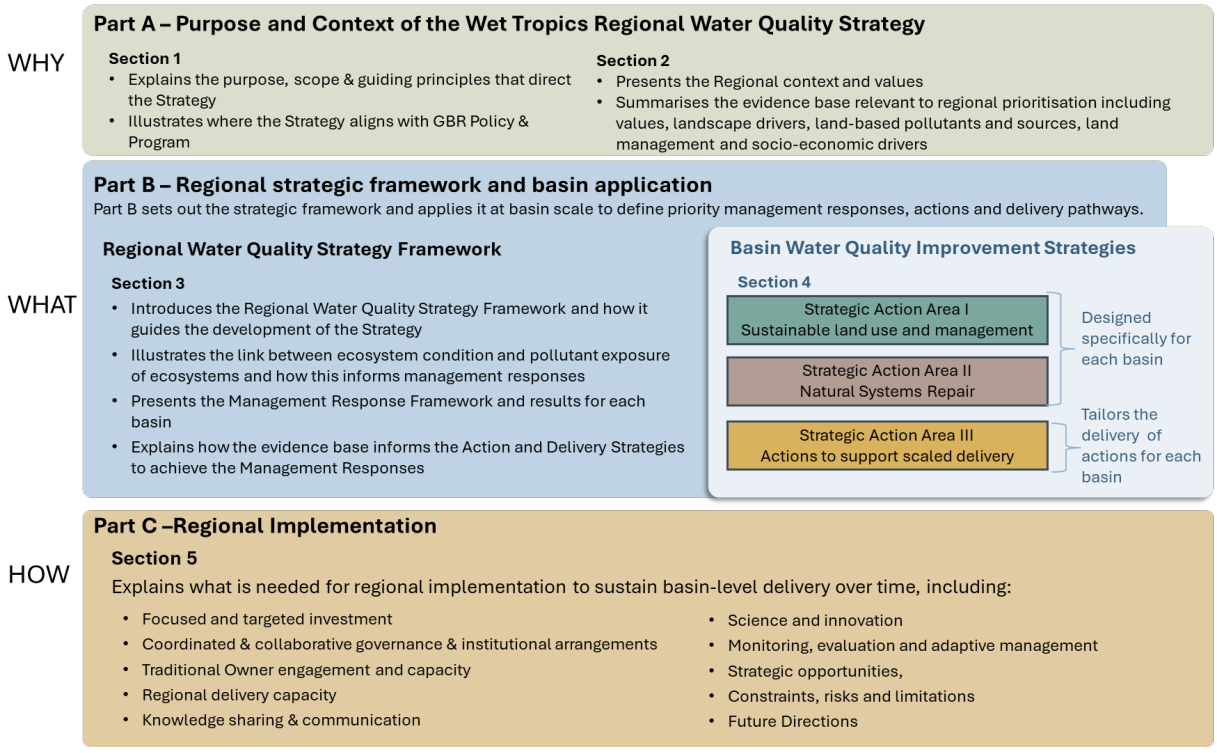


Figure 3. *Overview of the document structure showing how Parts A, B and C align across regional and basin scales.*

2. The Wet Tropics Region

A comprehensive understanding of the environmental, social, and economic drivers of water quality and the condition of ecosystems in the Wet Tropics Region is essential to underpin the Strategy. A comprehensive synthesis of supporting evidence (the 'Synthesis Report'; Sambrook et al., 2026) provides the detailed evidence base, drawing on a comprehensive review of scientific research, assessments of past initiatives and documentation of current programs. The below summary provides contextual insights; the full Synthesis Report should be consulted for detailed information (including referenced materials).

2.1. Geographic scope and characteristics

The Wet Tropics Region extends from the town of Bloomfield in the north, south to Ingham and west to Mount Garnet, and includes the Atherton Tablelands (Figure 4). The Region covers 5% of the total GBR catchment area and is the wettest of the six NRM regions, characterised by high rainfall and temperatures during the summer wet season, and major events such as rain depressions, monsoons and cyclones. As a result, the Region contributes 33% of the river discharge flowing to the GBR. The region contains unique, diverse and highly valuable terrestrial and aquatic environments including the Wet Tropics and GBR World Heritage Areas.

The population of the Wet Tropics Region is over 250,000 people, including more than 20,000 local Indigenous Aboriginal people, in several urban and rural centres. The main industries include marine and terrestrial tourism, commercial and recreational fisheries, aquaculture and agriculture. Livelihoods and lifestyles are closely linked to the climate, with some shifts across the dominant sectors in recent years, including an overall decrease in agriculture. The main agricultural land uses are grazing (31% of catchment area) and sugarcane (8.3%), followed by irrigated and dryland cropping (0.7%), banana farming (0.5%), horticulture (0.4%) and dairy (0.3%). Urban areas account for 1.9% of the Wet Tropics Region (DESI, 2023b; ABGC, 2025[2]). Each of the eight major river basins (Figure 4) exhibits distinct characteristics, varying in size, climate conditions, the intensity and distribution of land uses and landscape drivers. Land use change is also occurring in response to multiple drivers. Notably, the banana industry has been heavily affected by Panama Disease, leading to significant declines in banana production area in several basins since 2021; for example, in the Tully and Murray basins the area has reduced by approximately half (ABGC, 2025).

2.2. Values at risk

The Wet Tropics Region spans 510 km of coastline and is a high value area with diverse terrestrial, freshwater, coastal and marine assets. It includes 2,427 km² of coral reefs with 9% of the GBR's inshore coral reefs, 4,872 km² of seagrass meadows, 345 km² of mangroves, 43 km² of salt flats and saltmarshes, and 1,257 km² of wetlands (Figure 4). These ecosystems underpin interconnected ecological, social, economic, and cultural values, including Indigenous heritage. Around 35% of the Region is within the Wet Tropics WHA which provides some protection to the Region's waterways. However, many freshwater ecosystems in coastal areas and developed landscapes, such as agricultural and urban areas, are moderately to highly disturbed. This is particularly evident in the central basins between Cairns and Ingham. Climate change further compounds these pressures with major flooding events in 2024 and 2025 having significant impacts on the Region.

The Region has one Dugong Protection Area—Hinchinbrook Channel, and 13 Fish Habitat Areas—Trinity Inlet, Half Moon Creek, Yorkeys Creek, Barr Creek, Hull River, Tully River, Murray River, Dallachy Creek, Wreck Creek, Meunga Creek, Hinchinbrook Channel, and Cattle-Palm Creek. These high value areas support many species, some of which are listed as threatened or vulnerable under either the Australian *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* and/or Queensland *Nature Conservation Act 1992*, and have significant cultural values. Species of conservation concern that use Wet Tropics ecosystems include dugong, humpback whales, six species of marine turtle, two seabird species, and beach stone curlews. The Region is also home to other species that are considered rare in the GBR, such as the Irrawaddy and Indo-Pacific humpback dolphins.

[2] The area of banana production is updated with data supplied by the Australian Banana Growers' Council (2025) due to significant changes in some basins in recent years.

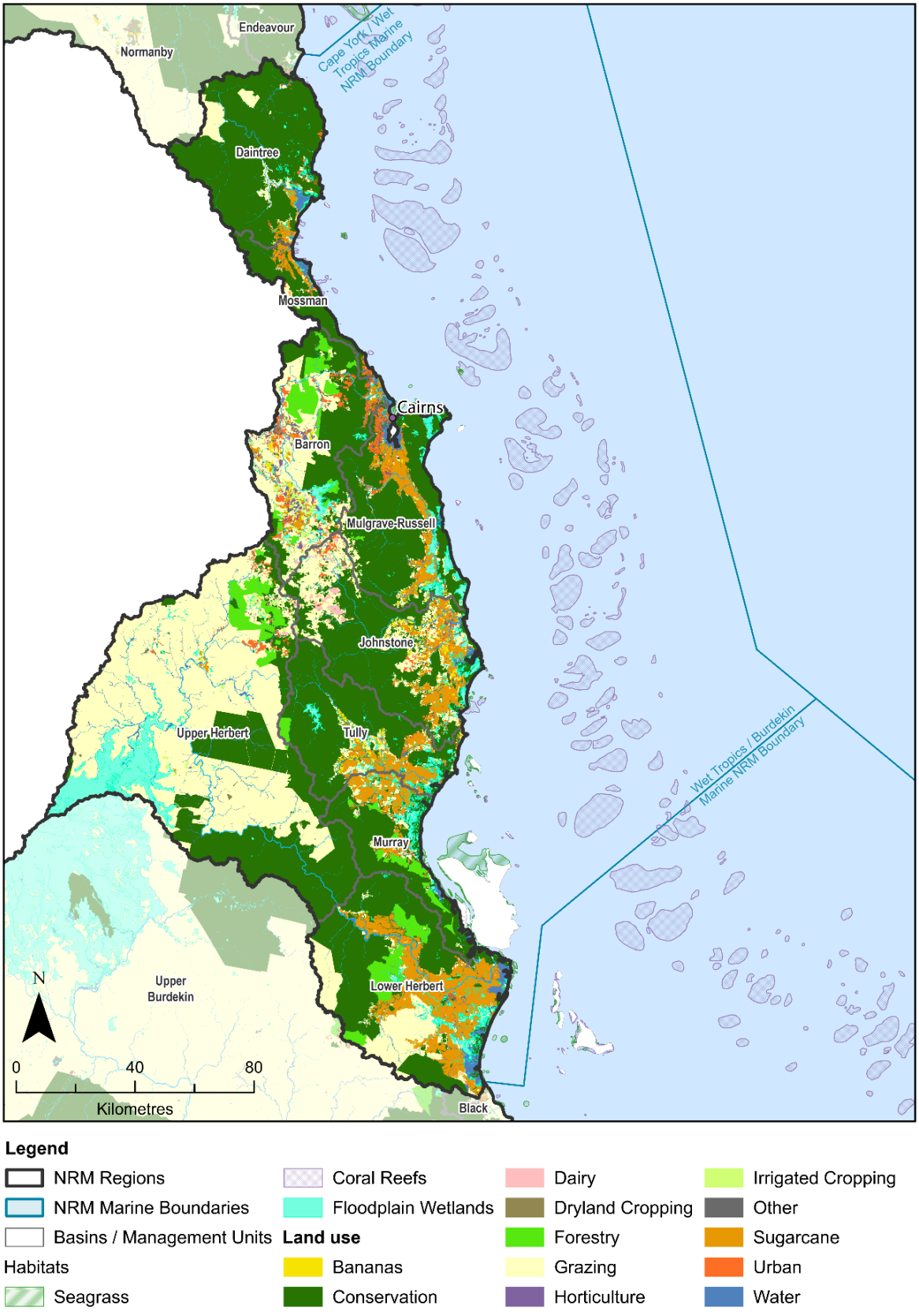


Figure 4. *Land use and aquatic ecosystems in the Wet Tropics NRM region. Data Sources: Land use data (DESI 2023b); Wetlands data based on 2019 extent data from* Wetland*Info version 6 (DESI 2023c); Reefs and Marine Waterbodies GBRMPA (2025); Seagrass McKenzie et al. (2022).*

While human-induced climate change is the greatest overall threat to the GBR, poor water quality—particularly elevated levels of fine sediments, nutrients and pesticides—continues to have detrimental impacts and exacerbate climate-related impacts. The effects of land-based runoff and increased pollutant loads are most pronounced in estuarine, coastal and inshore environments but can be evident more than 100 km alongshore from river mouths. Good water quality is critical for ecosystem resilience and recovery from disturbances such as coral bleaching and extreme weather events.

However, the Region has experienced substantial historical ecosystem losses, with approximately 30% of the Region's natural wetland extent lost or modified since European settlement, particularly vegetated freshwater swamps (less than half remaining natural and unmodified). Remaining wetlands are under pressure from invasive weeds and many are in poor condition. Marine ecosystems within the inshore areas, and to a lesser extent mid-shelf areas, are particularly vulnerable to influences from land-based runoff.

The Region's ecosystems provide significant ecological services, including coastal protection, carbon sequestration, and support for tourism and commercial and recreational fisheries. For Traditional Owners, the Region's waterways hold deep cultural significance and are integral to continuing spiritual relationships with Country, traditional management practices, and community wellbeing.

2.3. Traditional Owners, cultural values, stewardship and aspirations for water quality and Custodianship

The Wet Tropics Region is the current home of at least 20 First Nations groups encompassing around 120 clans and 8 languages, with many groups having maintained an unbroken connection to their Country for many thousands of years (Great Barrier Reef Marine Park Authority, 2024; Terrain NRM, 2024) (Figure 5).

For First Nations Peoples, freshwater movements play a crucial role in sharing stories, facilitating the flow of culture, connecting Country and people, and providing critical habitat for resources traditionally harvested for generations. Freshwater systems are part of First Nations' cultural identity, and there is a continuing obligation to care for waterways and remain connected to traditional management regimes. Cultural freshwater flows are essential for First Nations peoples to continue their spiritual relationship with Country and are vitally important for overall health and wellbeing (Connected Land & Sea, 2025).

A core guiding principle of Traditional Owners' beliefs is the interconnectedness of land and sea, freshwater and saltwater, rainforest and reef. Terrestrial and marine estates are not divided as contemporary management regimes currently dictate, but are treated as a whole to be nurtured, cared for and protected as a single, living, culturally animated entity (Connected Land & Sea, 2025).

Many Traditional Owner groups along the Wet Tropics basins have aspirations to become more involved in caring for their Country through initiatives such as establishing their own Ranger services. The Jabalbina Yalanji Rangers are now involved in managing much of the Daintree and Mossman basins and surrounding areas within and to the north of, the Eastern Kuku Yalanji Indigenous Protected Area (IPA). The Dawul Wuru Yirrganydji Rangers are involved in managing the lower coastal areas of the Mossman basin (Terrain NRM, 2024)[3].

Traditional Owners in the Wet Tropics Region have expressed several aspirations that are applicable to the development of a Wet Tropics Water Quality Strategy and associated projects:

- **Cultural recognition and knowledge integration:** Traditional Owners seek recognition and respect as traditional knowledge holders. Protecting sacred sites, nurturing cultural practices, languages, knowledges, customs and lore, and building cultural awareness in the wider community are important aspirations.

[3] https://www.wettropicsplan.org.au

- **Environmental stewardship**: Traditional Owners aspire to be more involved in the design, planning, delivery, and outcomes of research activities on Country to support healthy Country.
- **Economic opportunities:** There is interest in eco and cultural tourism opportunities, carbon and green economy initiatives, and fee-for-service models. Traditional Owner groups seek more funding, delivery opportunities, and infrastructure support (boats, vehicles, and equipment) to support their involvement.
- **Workforce development:** Limitations around staffing and infrastructure capacity are commonly identified as constraints to involvement and participation. While there is broad interest in the expansion of Ranger and junior Ranger programs, there is also a clear desire to expand learning opportunities and career pathways beyond Ranger roles (e.g. scientific research, decision-making positions).
- **Governance and decision-making**: Traditional Owners want to be part of decision-making and management of Country. To support this, assistance is needed to help develop business plans, Country-based plans, strategic plans and creation of IPAs on Country.

Figure 5. *Traditional Owners in the Wet Tropics NRM Region (Source: Terrain NRM, 2024).*

Specific water quality project interests include the removal of unwanted and introduced species from waterways, restoring connectivity by removing barriers to fish movement, establishing complementary

water quality monitoring programs, developing Country-based or water quality plans specific to areas of cultural authority, and cross-regional knowledge exchange about water quality initiatives. Several groups have expressed interest in learning from the Mamu Water Quality project and the Yirrganydji water quality plan (Connected Land & Sea, 2025).

Traditional Owner groups have identified the need for improved support across the Wet Tropics, particularly regarding opportunities to get involved in water quality projects. This includes the potential for a facilitator position within a government or natural resource management organization who could support Traditional Owner groups to engage more effectively with opportunities, disseminate information about water quality work and potential funding, and assist with applications for funding and delivery of programs (Connected Land & Sea, 2025).

2.4. Landscape drivers

The basins of the Wet Tropics Region are highly diverse, with northern areas of the Region remaining more natural, whereas areas further south have typically experienced higher levels of development and altered land use. Such alterations have had profound impacts on water quality, demonstrated by the significantly higher pollutant loads entering the GBR since European settlement. Several landscape drivers can influence the quantity and type of pollutants entering waterways. These include vegetation clearing particularly from riparian zones, the loss and/or modification of floodplain wetlands, the condition of groundcover, and the presence and extent of gully networks. Each of these drivers can influence the generation, mobilisation, and transport of pollutants through various pathways into waterways. When combined with climatic factors, such as intense rainfall events, these factors lead to pulse events where pollutants are rapidly mobilised and transported downstream. Understanding the distribution, extent and impact of these drivers is essential for effective water quality management, allowing for targeted interventions that address the underlying causes of degraded water quality. Table 1 presents the most recent data available for these landscape drivers for the eight basins of the Region and the two management units of the Herbert Basin (i.e. Upper and Lower). The implications of the status of these drivers are discussed in more depth in the Basin Water Quality Improvement Strategies in Section 4. For more information on the methods used to examine the landscape drivers, refer to Waterhouse et al. (2025).

Table 1. *Landscape drivers that can influence water quality in the Wet Tropics NRM region. For more information on methods and data sources, refer to Waterhouse et al.,2025.*

Basin	**Annual average rainfall (mm)**	**Mean late dry season groundcover (%)** [1987–2022]	**Historical and recent native vegetation clearing**				**Freshwater floodplain wetland modification and/or loss by 2017 as a percentage of historical extent**	**Gullies** **Average Annual Sediment Supply (AASS)**: Total eroded soil mass – both fine and coarse sediment; **Gully length:** Extent of gully network	
			Vegetation type	**Remnant vegetation in 2018 (ha)**	**Cleared by 2018 (%)**	**Recent native vegetation clearing (ha)** [2019–2022]			
Daintree	2,521	87%	All woody vegetation	197,220	6%	21	24%	AASS (tonnes per year)	128
			Floodplain vegetation	6,729	52%	2			
			Stream & river riparian areas	43,738	5%	5		Gully length (km)	5.1
			Freshwater floodplain wetland riparian areas	3,702	34%	0		Erosion rate (tonnes per km per year)	25
Mossman	2,109	81%	All woody vegetation	37,145	22%	38	97%	AASS (tonnes per year)	19
			Floodplain vegetation	1,149	85%	25			
			Stream & river riparian areas	7,668	16%	11		Gully length (km)	0.9
			Freshwater floodplain wetland riparian areas	10	88%	0		Erosion rate (tonnes per km per year)	21
Barron	1,442	85%	All woody vegetation	136,636	36%	899	87%	AASS (tonnes per year)	7,494
			Floodplain vegetation	6,777	56%	68			
			Stream & river riparian areas	33,031	22%	98		Gully length (km)	272
			Freshwater floodplain wetland riparian areas	230	82%	7		Erosion rate (tonnes per km per year)	28
Mulgrave-Russell	3,239	76%	All woody vegetation	144,062	27%	129	45%	AASS (tonnes per year)	469
			Floodplain vegetation	11,921	72%	70			

Basin	Annual average rainfall (mm)	Mean late dry season groundcover (%) [1987–2022]	Historical and recent native vegetation clearing				Freshwater floodplain wetland modification and/or loss by 2017 as a percentage of historical extent	Gullies **Average Annual Sediment Supply (AASS)**: Total eroded soil mass – both fine and coarse sediment; **Gully length:** Extent of gully network	
			Vegetation type	**Remnant vegetation in 2018 (ha)**	**Cleared by 2018 (%)**	**Recent native vegetation clearing (ha)** [2019–2022]			
			Stream & river riparian areas	30,225	21%	21		Gully length (km)	18
			Freshwater floodplain wetland riparian areas	11,467	27%	2		Erosion rate (tonnes per km per year)	26
Johnstone	3,152	75%	All woody vegetation	127,811	45%	325	78%	AASS (tonnes per year)	1,520
			Floodplain vegetation	5,765	85%	90			
			Stream & river riparian areas	29,135	40%	67		Gully length (km)	76
			Freshwater floodplain wetland riparian areas	3,106	55%	9		Erosion rate (tonnes per km per year)	20
Tully	2,763	82%	All woody vegetation	123,594	25%	70	65%	AASS (tonnes per year)	776
			Floodplain vegetation	10,143	77%	31			
			Stream & river riparian areas	27,188	20%	13		Gully length (km)	31
			Freshwater floodplain wetland riparian areas	6,669	48%	11		Erosion rate (tonnes per km per year)	26
Murray	2,164	84%	All woody vegetation	74,445	33%	258	62%	AASS (tonnes per year)	362
			Floodplain vegetation	13,052	71%	225			
			Stream & river riparian areas	15,700	23%	42		Gully length (km)	14
			Freshwater floodplain wetland riparian areas	5,940	48%	38		Erosion rate (tonnes per km per year)	26
	1,222	87%	All woody vegetation	Upper: 632,723	Upper: 6%	Upper: 1,281	Upper: 25%	AASS	

Basin	**Annual average rainfall (mm)**	**Mean late dry season groundcover (%)** [1987–2022]	**Historical and recent native vegetation clearing**				**Freshwater floodplain wetland modification and/or loss by 2017 as a percentage of historical extent**	**Gullies** **Average Annual Sediment Supply (AASS)**: Total eroded soil mass – both fine and coarse sediment; **Gully length:** Extent of gully network	
			Vegetation type	**Remnant vegetation in 2018 (ha)**	**Cleared by 2018 (%)**	**Recent native vegetation clearing (ha)** [2019–2022]			
Herbert				Lower: 207,076	Lower: 34%	Lower: 1,672	Lower: 73%	(tonnes per year)	Upper: 75,178 Lower: 8,211
			Floodplain vegetation	Upper: 52,465 Lower: 37,035	Upper: 8% Lower: 72%	Upper: 80 Lower: 979			
			Stream & river riparian areas	Upper: 113,870 Lower: 41,853	Upper: 4% Lower: 21%	Upper: 77 Lower: 116		Gully length (km)	Upper: 2,739 Lower: 276
			Freshwater floodplain wetland riparian areas	Upper: 6,105 Lower: 6,531	Upper: 16% Lower: 65%	Upper: 7 Lower: 57		Erosion rate (tonnes per km per year)	Upper: 28 Lower: 30

2.5. Primary pollutants of concern

The primary pollutants of concern from land-based runoff in the Wet Tropics Region are nutrients including dissolved inorganic nitrogen (DIN) and particulate nitrogen (PN) and particulate phosphorus (PP), fine sediments and pesticides. Current evidence indicates that pollutant loads have increased substantially since pre-European settlement, for example, with DIN loads increasing by 1.2 to 5.2 times (varying by basin) and fine sediments by 1.6 to 3.0 times across the Region. Pesticides are anthropogenic chemicals used commonly in pest management in agricultural and non-agricultural systems, including herbicides, insecticides, fungicides (plus others).

It is acknowledged that while nutrients, sediments and pesticides are well documented and routinely monitored in the GBR, many other pollutants can enter waterways and potentially affect a range of ecosystems (Chariton & Hejl, 2024). These include metals, persistent organic pollutants, PFAS, plastics, pharmaceuticals, veterinary chemicals, personal care products and sunscreens. Evidence for these pollutants in the GBR is far more limited (Chariton & Hejl, 2024), and they are therefore outside the scope of this Strategy. There is some documented evidence of acid sulfate soil impacts in parts of the region, particularly in Trinity Inlet (e.g. Cook et al. 2000), and this is noted where it is currently recognised as an issue. However, the problem may be more widespread than captured here and may warrant further investigation in some locations when planning beyond the basin scale.The modelled total annual average end-of-catchment DIN load from the Region is 4,367 tonnes. This is the highest regional DIN load across the GBR catchment area, over twofold higher than the second largest contributor, the Burdekin Region. The Region's modelled total annual average end-of-catchment fine sediment load is 1,195 kilotonnes per year, making it the third largest contributing GBR region.

The ecological risk of pesticides at the end-of-catchments ranges from Good to Moderate in most Wet Tropics' basins and catchments, with the Murray River consistently showing the highest catchment risk. Pesticide risk can reach High to Very High levels during temporal peaks at the start of each wet season, and in localised areas close to pesticide sources, for example, Catherina Creek a sub-catchment of the Herbert Basin has recorded Very High pesticide risk levels (see Sambrook et al., 2026). Two pesticides are the dominant contributors to pesticide risk – diuron (a PSII herbicide) and imidacloprid (an insecticide).

Regional pollutant sources

The primary anthropogenic sources of DIN in the Region are sugarcane areas (46% of total export), followed by bananas (15%), and grazing (9.4%), though these proportions vary significantly between basins and may shift with changes in land use[4]. The Herbert Basin generates the second highest annual average DIN load across the entire GBR catchment, with sugarcane dominating the DIN export in the Lower Herbert (exporting 85% of the Herbert basin DIN load), and the Johnstone is the third highest. DIN loss pathways also vary by basin, with seepage via subsurface loss pathways dominant in intensive agricultural areas (e.g. the Johnstone and Herbert basins) and diffuse dissolved sources via surface runoff more significant in forested catchments (e.g. the Daintree).

Although the Wet Tropics Region is relatively small contributor to total GBR fine sediment loads compared to the Burdekin Region (16% compared to 45% of the GBR total), specific basins export substantial annual average loads. Hillslope erosion is the primary erosion pathway in the Wet Tropics (54%), followed by streambank erosion (44%) and only small contributions from gully erosion (2.0%), primarily in the Upper Herbert. Conservation land dominates total fine sediment contributions in four of the eight basins (Daintree, Mossman, Mulgrave-Russell and Murray), while intensive agriculture contributes disproportionately high loads relative to land area, and in terms of anthropogenic loads.

[4] These proportions are based on the modelled annual average loads based on 2021 land use data and 2023 management practice adoption.

Pesticide risk across the Region is highest in basins with higher proportions of sugarcane and bananas, and lower in basins with higher proportions of conservation area. The relationship between the land use proportions within a catchment and pesticide risk varies depending on land use types, with higher proportions of intensive cropping land uses within a catchment (including sugarcane, bananas, horticulture, dryland and irrigated cropping) having a higher risk of pesticides in waterways. Other land uses such as grazing and urban also use pesticides, but with a comparatively lower risk of runoff to receiving waterways. Conversely, conservation land uses within a catchment act as sources of dilution (i.e. runoff from areas where no or minimal volumes of pesticides are applied) and are therefore, also important influences on the pesticide risk at the end-of-catchment.

Impact of pollutants on ecosystem health

There is strong evidence of the impacts of land-based runoff on GBR ecosystems, recently synthesised in the *2022 Scientific Consensus Statement for Land-based impacts on Great Barrier Reef water quality and ecosystem condition* (Waterhouse et al., 2024). Relevant key findings are summarised here and described further in the Synthesis Report (Sambrook et al., 2026). DIN poses risks to marine ecosystems by promoting algal growth that can outcompete corals and affect recruitment processes. Fine sediments reduce water clarity and light availability essential for photosynthesis in seagrasses and corals, while also causing physical smothering effects. The highest risk pesticides detected are primarily herbicides, including photosystem II herbicides like diuron that can directly impact photosynthetic organisms, and insecticides like imidacloprid that can directly impact aquatic insects and crustaceans. These pollutants often act synergistically, with multiple stressors combining to create cumulative impacts that exceed the effects of individual pollutants, particularly under climate stress conditions such as marine heatwaves.

The effects of land-based pollutants are most pronounced in estuarine, coastal, and inshore environments, with impacts evident more than 100 km alongshore from river mouths. Ecosystems closest to the mainland face the greatest risk from chronic poor water quality, threatening critical ecosystem services and diminishing tourism, aesthetic, spiritual, and recreational values. Current ecosystem condition assessments in the Wet Tropics Region reveal variable trends. Inshore seagrass meadows in the southern Wet Tropics are in 'poor' condition, while northern areas maintain 'good' condition. Coral communities across the Region are in 'moderate' condition, with evidence of persistent macroalgal growth linked to elevated nutrient levels.

Freshwater floodplain wetlands are classified as 'moderate' condition overall, but connectivity remains 'poor', limiting ecosystem resilience and recovery capacity. Estuarine systems generally maintain 'good' condition, except for the Barron estuary, which is classified as 'moderate' due to historical habitat loss and urban development impacts. The cumulative effects of multiple pollutants, combined with climate pressures including recent major flooding and cyclone events, continue to challenge ecosystem health and resilience across the Region. These impacts are compounded by historical losses of natural filtering systems, including extensive wetland loss and riparian vegetation clearing, which has reduced the landscape's capacity to naturally process pollutants before they reach marine environments.

2.6. Land management and socio-economic drivers

Landholder adoption of improved land management practices is influenced by factors operating across multiple scales - from broader systemic forces through to individual decision-making. At the macro level, governance systems, policy and legislation, economic conditions, and cultural norms all shape the enabling environment for practice change. At the meso level, industry bodies, R&D agencies, and community networks also play important roles. These broader forces direct and constrain what occurs at the individual level, ultimately affecting the efficiency and effectiveness of adoption efforts.

For the sugarcane industry, mill operations and supply chain arrangements can influence grower decisions, with unplanned mill downtimes, late-season harvest timing, cane supply arrangements and scheduling constraints disrupting optimal planting and fertiliser application timing. In this way, mill performance acts as a systemic external driver that can limit the adoption of best management

practice and constrain regional water quality improvement efforts. Periods of broader uncertainty can also influence decision making such as rising diesel prices, increasing input costs, and the threat of competing imports, as growers may not have the mental or financial capacity to focus on change during these times and are instead operate within their current means. Similarly, the significant impacts of Panama Disease on the banana industry are influencing production decisions and management priorities, inevitably affecting growers' capacity to implement or maintain practices linked to improved water quality.

While external factors set the context, this Strategy focuses on individual-level drivers because it is at this scale that programs can be designed and targeted to support targeted adoption. At the micro scale, adoption can be understood through three interconnected domains that can enable or act as barriers to adoption:

- Capability – whether land managers are aware of the practices and have the knowledge and skills to implement it
- Opportunity – whether they have access to necessary resources, equipment, and supportive social networks
- Motivation – whether they believe the practice is worthwhile and are driven to act

Research tools such as ADOPT, the Behaviour Change Wheel and Community-Based Social Marketing can help identify how these factors play out for specific practices and audiences, recognising that relative influences vary considerably across contexts. Local studies, including work by the Behavioural Insights team through the Paddock to Reef Human Dimensions program (Kanakis et al., 2024), have explored landholder perceptions to better understand these barriers and enablers in the Region.

2.7. Regional capacity and delivery approaches

Stakeholder consultation highlighted both the strengths and gaps in regional capacity and delivery approaches. While the Region has strong foundations, capacity remains variable across the Region. Key strengths include high levels of organisational expertise, tailored communication, and effective knowledge transfer through extension, mentoring, and peer-to-peer education. Collaboration is reinforced by engaged landholders, active Landcare groups, shared catchment plans, and NRM knowledge platforms, with practical support from contractors and nurseries. However, several challenges remain. For example, retaining extension staff is difficult, agency collaboration is limited, and siloed systems undermine resource sharing. Extreme weather events often exceed local capacity, while short-term funding cycles, restrictive models, and limited support for professional development or invasive species management continue to constrain innovation and on-ground outcomes.

Delivery approaches across the Region are diverse and underpinned by strong partnerships between industry, landholders, Traditional Owners, and local government. Peer-to-peer and local knowledge sharing is highly effective when supported with adequate resources, and engagement with Traditional Owners is both recognised and valued. Small communities also play a vital role, often collaborating across multiple projects and drawing on active Landcare groups and volunteer bases to sustain delivery. Despite these strengths, several challenges remain. Organisations need to better respond to regional and local engagement needs and professional development opportunities are limited. There is a need for greater incorporation of traditional knowledge in land management and there is a perception that focusing too narrowly on water quality targets risks overlooking broader cultural and environmental values and potential co-benefits. Regional delivery offers clear opportunities to broaden environmental benefits by embedding biodiversity and climate change outcomes into water quality projects, while volunteer contributions in landscape care, wildlife support, and fire management add significant value. Locally led, place-based initiatives and partnerships with Traditional Owners are seen as more relevant and sustainable, reinforcing the importance of community leadership. At the same time, capacity-building for communities and organisations is critical to sustaining long-term outcomes, yet declining volunteer capacity and chronic underfunding pose risks to project continuity and effectiveness.

Part B: Regional strategic framework and basin application

3. Development of the Wet Tropics Regional Water Quality Strategy

3.1. Regional Water Quality Strategy Framework

3.1.1. Framework overview and purpose

The Regional Water Quality Strategy framework (Figure 6) has been developed to align with the Reef 2050 CWQS and the supporting GBR-wide Spatial Management Prioritisation (SMP; *Decision framework for management options to maintain and improve water quality in the Great Barrier Reef catchment area*). The purpose of the Strategy framework ('the Framework') is to provide a systematic and consistent approach for developing Basin-level Water Quality Improvement Strategies that have a clear pathway for achieving the GBR-wide Outcomes and Vision.

The hierarchical structure of the Framework aligns with and reinforces the Reef 2050 CWQS Vision, Outcomes and Priority Areas while tailoring the region-specific strategies to reflect local priorities, values, and implementation capacity. This approach ensures that the regional strategies are locally relevant and contribute effectively and collectively to the broader Vision of the Reef 2050 CWQS.

The Strategy framework is guided by the Reef 2050 CWQS framework, incorporating the following key elements to reflect regional priorities, operational contexts and implementation needs:

- Definition of a single Regional Outcome Statement and three regional-scale Objectives that capture all elements of the Reef 2050 CWQS's Vision and Outcomes (with a shift in emphasis to reflect regional needs).
- Elements of the Reef 2050 CWQS Priority Areas are incorporated into three 'Strategic Action Areas' to garner clear lines of sight across the spatial scales of the Framework and between the objectives and the actions needed to achieve those objectives.
- The introduction of scaled and categorised basin-scale Management Responses, adopted from the GBR Spatial Management Prioritisation (Waterhouse et al. 2025) to address regionally specific landscape characteristics and ecosystem condition, pollutant exposure and local drivers.
- Definition of specific 'Action Strategies' and 'Delivery Strategies' for each Strategic Action Area to respond to regional- and basin-specific priorities and drivers within the scope of the Management Response. This introduces a level of detail beyond the current Reef 2050 CWQS, tailored specifically for the Region, its land uses, pollutant sources, water quality drivers and ecosystem conditions.
- Identification of Implementation requirements including 'Policy Instruments' (some of which are outside the scope of the Strategy's and 'Strategies to support implementation', both of which align with the Reef 2050 CWQS Enablers.
- Identification of key prerequisites for implementation that are relevant within and across all scales.

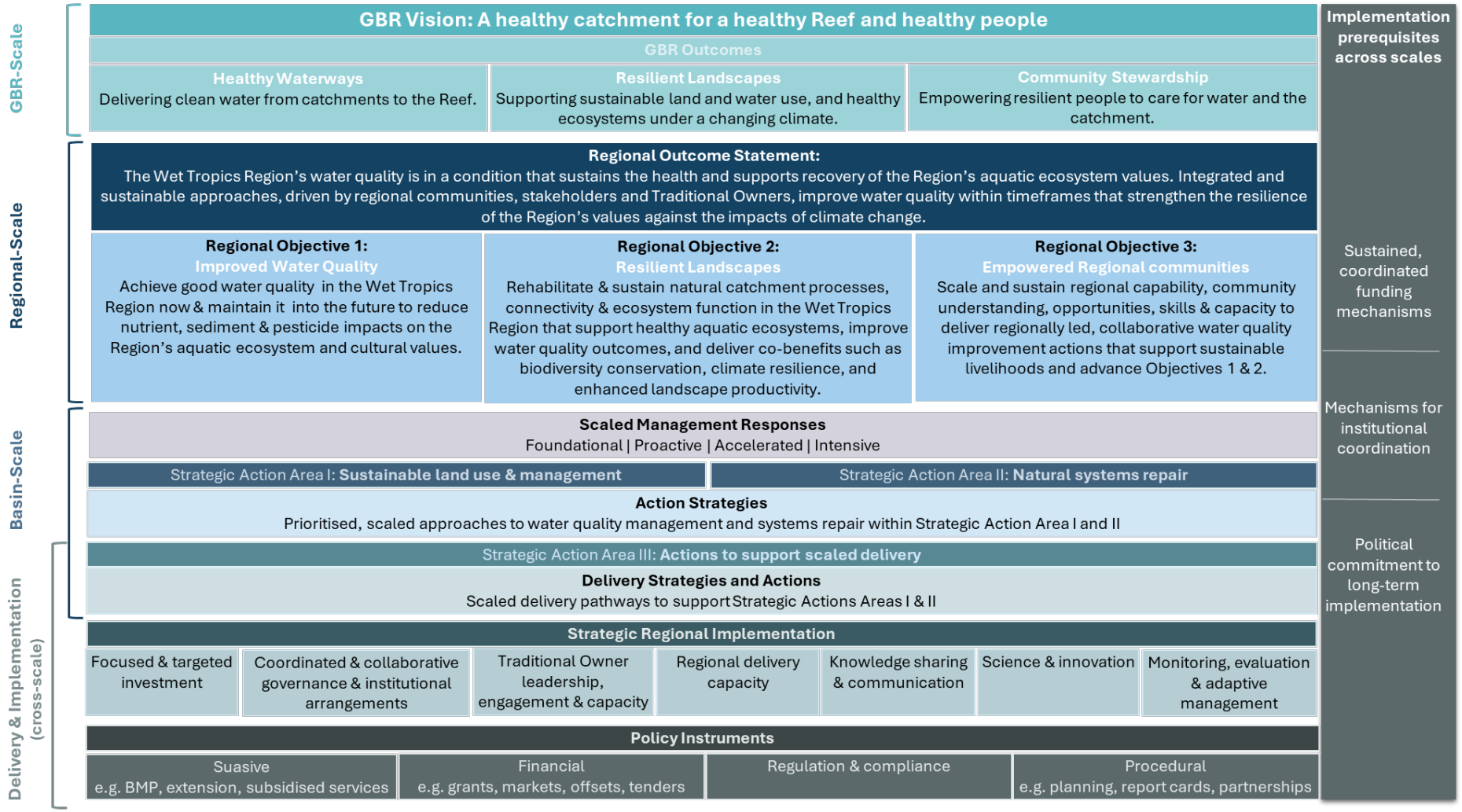


Figure 6. *Wet Tropics Regional Water Quality Strategy Framework.*

3.1.2. Framework structure and spatial scaling

The Framework operates across three distinct scales, creating a clear line of sight between the ***Why***, ***What*** and ***How*** of water quality management, from GBR- to regional- to basin-level scales. This logical flow shows how the actions that are implemented at the basin scale will lead to the outcome desired at the regional scale, which in turn support achievement of the outcomes at the GBR scale.

GBR scale

At the top level, the framework is anchored by the Reef 2050 CWQS Vision and three interconnected Outcomes:

GBR Vision: 'A healthy catchment for a healthy Reef and healthy people'

GBR Outcomes:

1. Healthy Waterways – delivering clean water from catchments to the Reef.
2. Resilient Landscapes - supporting sustainable land and water use, and healthy ecosystems under a changing climate.
3. Community Stewardship – empowering resilient people to care for water and the catchment.

Regional scale

The Regional Outcome Statement captures the elements of the Reef 2050 CWQS Outcomes and Objectives and translates them into a regionally specific aspiration. This includes improved water quality, sustainable land and water use, ecosystem function and climate resilience, connection to Country, and thriving communities and regional economies.

Regional Outcome Statement

> The Wet Tropics Region's water quality is in a condition that sustains the health and supports recovery of the Region's aquatic ecosystem values. Integrated and sustainable approaches, driven by regional communities, stakeholders and Traditional Owners improve water quality within timeframes that strengthen the resilience of the Region's values against the impacts of climate change.

The Regional Outcome is supported by three Regional Objectives that capture elements of all Reef 2050 CWQS Objectives while being tailored to regional priorities:

1. **Improved Water Quality** - Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment & pesticide impacts on the region's aquatic ecosystem and cultural values.
2. **Resilient Landscapes** - Restore and sustain natural catchment processes, connectivity & ecosystem function in the Wet Tropics Region that support healthy aquatic ecosystems, improve water quality outcomes, and deliver co-benefits such as biodiversity conservation, climate resilience, and enhanced landscape productivity.
3. **Empowered Regional communities -** Scale and sustain regional capability, community understanding, opportunities, skills and capacity to deliver regionally led, collaborative water quality improvement actions that support sustainable livelihoods and advance Objectives 1 and 2.

Basin scale

The basin level translates the Regional Objectives into implementation strategies and actions.

Scaled Management Responses identify the scale, intensity and urgency of the management response required to address each pollutant within each basin, based on ecosystem condition and pollutant exposure assessments. The Management Responses follow the four-scale Water Quality Management Response Decision Support Framework (Figure 9) developed by Waterhouse et al. (2025):

1. **Foundational Response** (minimal likelihood of pollutant exposure) – aims to maintain and protect ecosystems from water quality pressures into the future.
2. **Proactive Response** (low likelihood of pollutant exposure) – aims to prevent emerging pollutant issues before they become greater problems in the future.
3. **Accelerated Response** (moderate likelihood of pollutant exposure) – aims to actively reduce pollutant exposure with targeted actions.
4. **Intensive Response** (high likelihood of pollutant exposure) – aims to expedite reductions in pollutant exposure, recognising the large-scale, multi-land use interventions required.

Strategic Action Areas are the three main management approaches implemented together to achieve the Regional Objectives and Outcome, and include:

I. Sustainable land use & management
II. Natural Systems Repair
III. Actions to support scaled delivery.

These action areas capture elements of the Reef 2050 CWQS Priority Areas - Improve the quality of water flowing to the Reef, Repair nature and landscapes to protect the Reef, Support sustainable practices across the Reef catchment, Strengthen capacity to Care for Country, Grow strong communities and regional economies while protecting the Reef, Enhance and share knowledge that drives action. Aspects of these Priority Areas are also addressed through Delivery and Implementation (see below).

Action and Delivery Strategies represent the most specific level of the hierarchy, translating the basin-scale management responses into actions. 'Action Strategies' provide basin-specific, prioritised and scaled management options for sustainable land use and systems repair within Strategic Action Areas I and II, tailored to the basin's pollutant sources and water quality drivers. 'Delivery Strategies' within Strategic Action Area III provide scaled delivery pathways to support Strategic Action Areas I and II, reflecting the management response levels while also recognising that successful implementation depends on understanding and designing programs that meet and build on the capacity, opportunities, and motivations of the land managers being engaged (noting that the Strategic Action Area III is not specific to the basin scale, but the on-ground delivery/ implementation is). The language used to describe the strategies and actions gives direction towards the level of investment and effort that should be aimed for and includes examples of what management actions (both the management response and delivery method) might be implemented. Subsequent implementation plans or work plans would specify further detail.

Delivery and Implementation (cross-scale)

Several strategies are identified to support implementation of the Framework at the regional and basin scale.

Strategic regional implementation captures elements of the Reef 2050 CWQS Priority Areas (Support sustainable practices across the Reef catchment, Strengthen capacity to Care for Country, Grow strong communities and regional economies while protecting the Reef and Enhance and share knowledge that drives action), covering the key enabling activities:

- Focused and targeted investment
- Coordinated and collaborative governance and institutional arrangements
- Traditional Owner leadership, engagement and capacity
- Regional delivery capacity
- Knowledge sharing and communication
- Science and innovation
- Monitoring, evaluation and adaptive management

Policy Instruments can significantly influence achievement of the Regional Outcome and Objectives. These include:

- Suasive instruments (extension), for example, industry Best Management Practice programs, extension programs, subsidised private services
- Financial instruments, for example grants, market, offsets and tenders.
- Regulation and compliance
- Procedural instruments, such as planning, report cards and partnerships

While many of these instruments fall outside the direct scope of the Strategy, their influence remains critical - the Delivery Strategies and actions draw from these instruments, as well as their effects on the broader policy environment, enabling conditions and the effectiveness of regional implementation.

Implementation prerequisites are relevant within and across all scales of the Framework, and recognise the critical factors required to successfully translate the Framework from strategic intent into on-ground outcomes. Key prerequisites include:

1. Sustained, coordinated funding mechanisms that match with the identified management response requirements.
2. Mechanisms for institutional coordination to facilitate cross-jurisdictional collaboration and investment alignment.
3. Political commitment to long-term implementation.

3.2. Applying the framework to derive regional priorities and basin-scale Water Quality Improvement Strategies

The Regional Water Quality Strategy Framework guides how regional- and basin-level assessments and supporting evidence are integrated to develop a portfolio of prioritised and targeted Action and Delivery Strategies for each basin, collectively contributing to the achievement of the Regional Objectives and Outcomes.

The assessments and supporting evidence are brought together in a hierarchical, stepwise approach (Figure 7 and Box 1)**. Steps 1 and 2** first establish regional priorities and Management Response needs by identifying ecosystem values, condition, and pollutant exposure across the Region. **Steps 3–5** then translate this evidence, together with additional basin-specific information, into more directive basin-scale decisions about where management effort should be focused, which actions are most appropriate, the intensity at which they should be applied, and how delivery should be scaled and tailored to reflect the local context. Each of these steps are described below.

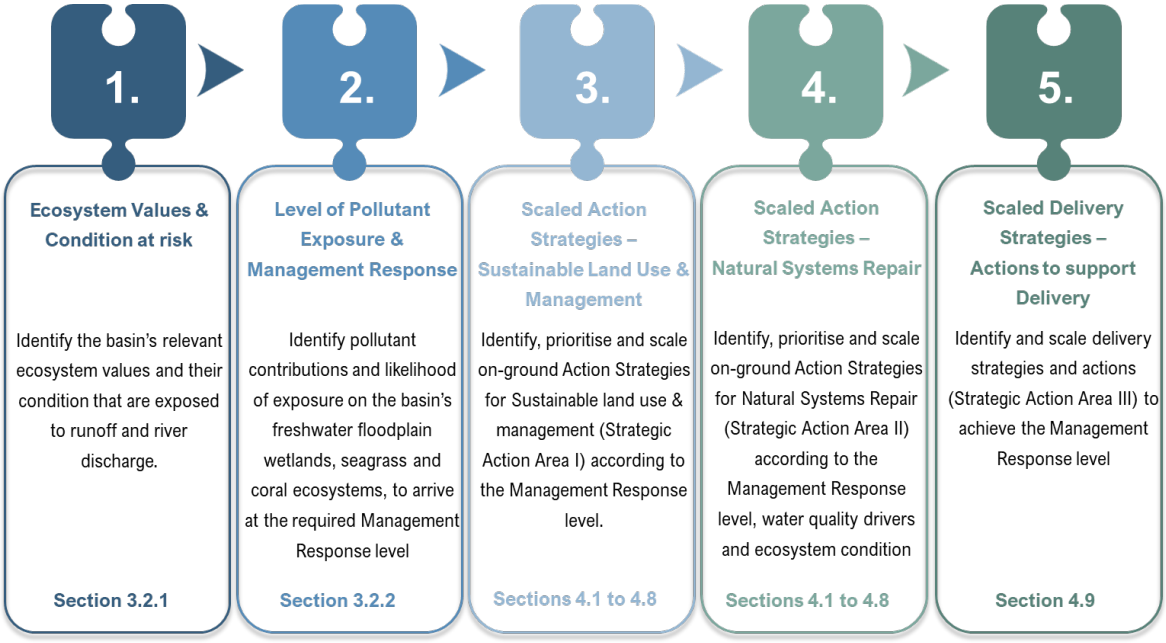


Figure 7. *Major steps involved in tailoring the framework to each Wet Tropics basin.*

Box 1: Underpinning evidence of the Regional Water Quality Strategy to identify priorities, strategies & actions

At the regional scale, ecosystem condition, pollutant exposure, modelled loads and pesticide risk inform basin-level Management Responses and regional priorities. At the basin scale, this information is combined with land use contributions, biophysical drivers, and social and economic considerations to identify focus areas, select appropriate Action Strategies, and design Delivery Strategies that are locally relevant and proportionate to risk.

This structured progression ensures that basin-level strategies are both **evidence-led and context-specific**, while remaining aligned with Regional Objectives and priorities.

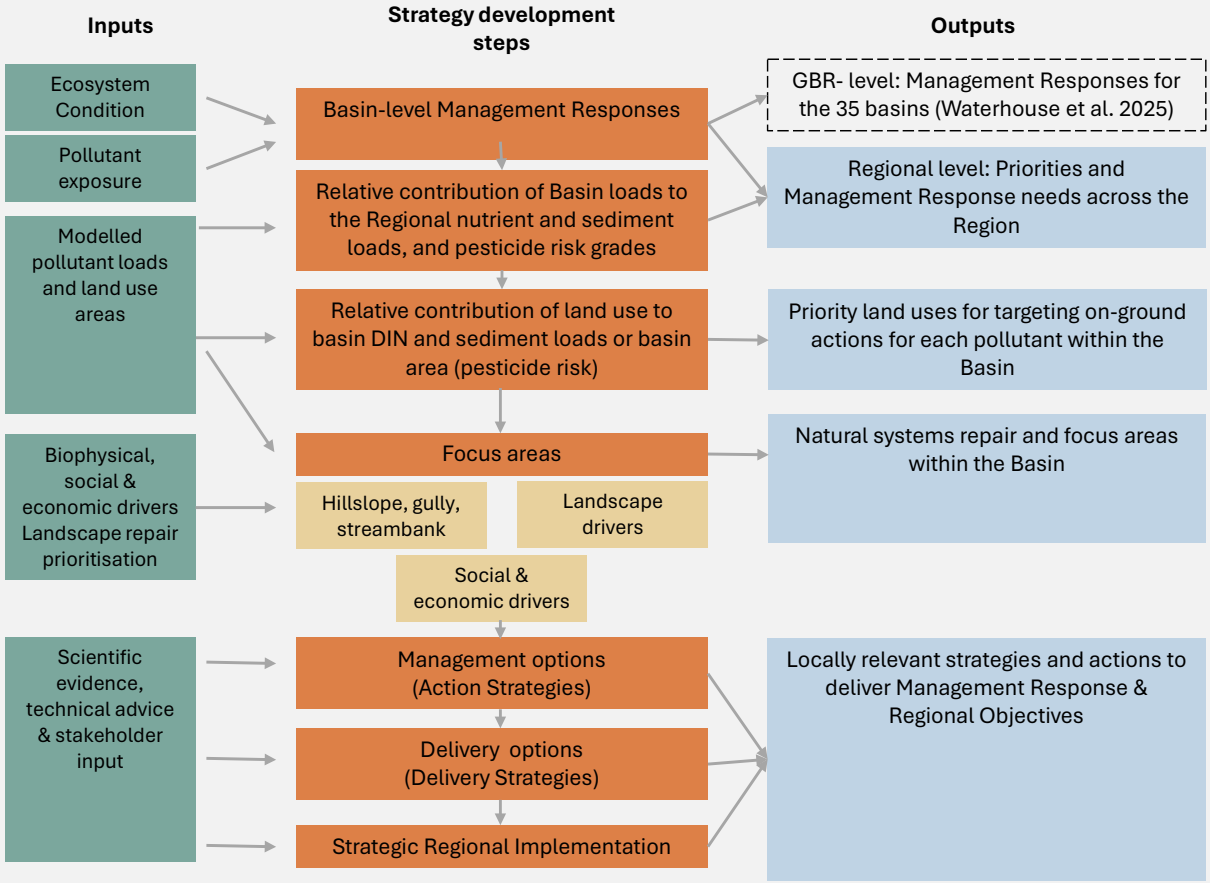


Figure 8. *Illustration of how multiple evidence streams are integrated to inform prioritisation and decision-making at different spatial scales.*

3.2.1. Regional ecosystem values, condition and exposure to river discharge

Step 1 of the Strategy development establishes the ecosystem context of pollutant exposure. This involves identifying the Region's aquatic ecosystem values, determining which values are most vulnerable to and likely to be exposed to land-based runoff (sediment, nutrients and pesticides), and assessing their current condition. This step focuses the exposure assessment on key organisms and ecosystems, while also recognising broader regional values that may be indirectly affected.

Environmental values are defined by the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (*EPP 2019*; State of Queensland, 2023) as '*the qualities that make water suitable for supporting aquatic ecosystems and human uses. These qualities need to be protected from the effects of habitat alteration, waste releases, contaminated runoff and changed flows to ensure healthy aquatic ecosystems and waterways that are safe for community use.*' The environmental values for surface and

coastal waters of the Wet Tropics Region are detailed in the *EPP 2019* Schedule 1 documents (basins 108 – 116; State of Queensland, 2020a-f).

Of the environmental values identified under the *EPP (2019)*, aquatic ecosystems in Wet Tropics Region are to be 'enhanced or protected', with the designated levels of protection ranging between high ecological value, slightly disturbed and moderately disturbed waters (State of Queensland, 2020a-f). Aquatic ecosystems as an environmental value are defined as '*the intrinsic value of aquatic ecosystems, habitat and wildlife in waterways and riparian areas, for example, biodiversity, ecological interactions, plants, animals, key species (such as turtles, platypus, seagrass and dugongs) and their habitat, food and drinking water.'* The environmental values for wetlands to be enhanced or protected under the *EPP (2019)* are *'the qualities of a wetland that support and maintain the biodiversity of the wetland'.* In maintaining the health or improving the condition of aquatic ecosystem values, other values identified through the *EPP (2019)* will also be enhanced or protected, for example production of aquatic foods, aquaculture, agricultural purposes, cultural and spiritual values, and recreational use.

Other aquatic ecosystem values and ecologically important habitat protection areas are also identified for the Wet Tropics Region, as described in more detail in the accompanying Synthesis Report (Section 2). These include species of conservation concern (e.g. dugong, humpback whales, six species of marine turtle, two seabird species, and beach stone curlews), species that are considered rare in the GBR (e.g. Irrawaddy and Indo-Pacific humpback dolphins), connectivity/ fish passages in and between aquatic ecosystems, Dugong Protection Areas and Fish Habitat Areas.

The ecosystem values vulnerable to exposure from land-based runoff and critical for Reef ecosystem health more broadly include wetlands, estuaries, inshore coral reefs and seagrass. In focusing on these values, higher order interactions with other valued species (e.g. fish and species of conservation interest) will also be enhanced and protected from land-based runoff.

Table 2 provides a regional overview of freshwater floodplain wetlands, estuary, seagrass and inshore coral condition, and the spatial area and extent of ecosystems exposed to river discharge. This includes nearby zoned Dugong Protection and Fish Habitat Areas and wetlands critical for conserving fish, prawn and dugong populations, which are particularly dependent on seagrass ecosystems. The datasets in Table 2 are used to inform the Management Response Framework in Section 3.2.2 and target actions and interventions to protect and assist ecosystem recovery under Strategic Action Area II.

Table 2. *Ecosystem assessments (condition and connectivity) and areas potentially exposed to nutrients, sediment and pesticides for basins within the Wet Tropics NRM Region. Gradings are based on the grading systems used from the sources of the data. MU = Management Unit as defined in the Paddock to Reef program.*

Basin	MU	Ecosystem Assessments				Potentially exposed ecosystem and habitat areas									
		Freshwater floodplain wetlands (condition) [A] [2017—2024][1] (Poor, Moderate or Good)	Estuary condition (Habitat & Hydrology) [B] [2022–23 data] (Very Poor, Poor, Moderate, Good, Very Good)	Seagrass condition [C] [2022–23] (Poor, Moderate or Good)	Coral condition [D] [2022–23] (Poor, Moderate or Good)	Natural & slightly modified freshwater floodplain wetlands extent (ha) [A] [2019]	Fish Habitat Areas	Dugong Protection Areas	Annual long term median river discharge (ML) [E] [1990/91 to 2019/20]	Modelled maximum river footprint area (km²) [2011–2022]	Area of habitat within maximum river footprint extent		Modelled area regularly influenced by river discharge (km²)	Area of habitat regularly exposed to river discharge	
											Seagrass (ha)	Coral reef (ha)		Seagrass (ha)	Coral reef (ha)
Daintree		No data*	Moderate	Moderate	Moderate	1,351			2,300,000	17,710	175,784	234,963	493	47	1,333
Mossman		No data*	Good	Good	Moderate	4			648,000	5,491	2,408	74,426	225	3	1,174
Barron		No data*	Moderate	Good	Moderate	150	Trinity Inlet, Half Moon Ck, Yorkeys Ck, Barr Ck		865,000	8,467	8,335	107,258	234	3,425	10
Mulgrave-Russell		Moderate	Moderate (Trinity Inlet) Good	Moderate	Moderate	7,470			4,120,000	13,734	9,819	172,564	595	334	194
Johnstone		Poor	Moderate	Moderate	Moderate	1,510			4,720,000	18,740	50,693	243,019	971	626	2,183
Tully		Moderate	No data	Poor	Moderate	3,729	Hull R, Tully R,		3,330,000	16,466	18,556	196,147	1,928	9,698	3,579
Murray		Poor	Good (Hinchinbrook Channel)	Poor	Moderate	3,326	Murray R, Dallachy Ck, Wreck Ck, Meunga Ck	Hinchin-brook Channel	1,510,000	3,891	14,518	15,795	837	12,355	838
Herbert	**Whole basin**		Good (Hinchinbrook Channel)	Poor	Moderate		Hinchin-brook Channel, Halifax, Cattle-Palm Ck	Hinchin-brook Channel	4,440,000	54,452	225,639	593,923	3,100	15,622	3,861
	Upper	Moderate				1,954									
	Lower	Poor				5,305									

[A] Waterhouse et al., 2025; [B] Wet Tropics Waterways (2024); [C] McKenzie et al.,2024; [D] Thompson et al.,2024; [E] Puignou-Lopez et al.,2025

* Low confidence due to insufficient data or observations – requires validation or investigation. [1] Wetland condition assessed on an annual basis for a subset of aggregations, and for other aggregations every four years on a rotational basis. Results presented for most recent data.

3.2.2. Pollutant exposure and basin-specific Management Responses

Step 2 of the Strategy development establishes the context of pollutant exposure and sources for each basin to provide a clear basis for identifying where management effort needs to be focused. This assessment identifies each basin's contribution to regional nutrient and sediment loads, pesticide risk gradings, the dominant land use sources and the likelihood of pollutant exposure to freshwater floodplain wetlands, seagrass and coral ecosystems (Table 3 - Table 5). These results are then interpreted through a structured Management Response decision framework to determine the appropriate level of management response required for each pollutant, in each basin.

Management responses are applied at two spatial scales: whole-of-basin responses, which address pollutant loads discharging to marine ecosystems, and smaller scale responses, which address localised risks to freshwater floodplain wetlands. The likelihood of pollutant exposure at these scales is graded (Minimal–High) using two parallel assessments presented in Waterhouse et al. (2025) and adopted here:

i. the marine exposure assessment describes the likelihood of exposure of vulnerable inshore ecosystems to land-based pollutants—sediment and pesticides for coral reefs and seagrass, and dissolved inorganic nitrogen (DIN) for coral reefs.
ii. the freshwater floodplain wetland hazard assessment estimates potential exposure from surrounding and upstream land uses for wetland aggregations,

Together, these assessments derive a management response for each pollutant at the whole-of-basin scale and smaller scales (catchment or sub-catchment scales), providing a clear basis for prioritising management effort and scaling investment across the Region:

Pollutants	**Marine ecosystems Basin scale**	**Freshwater floodplain wetlands Smaller scale (catchment and sub-catchment)**
DIN/ nutrients	Management response level for DIN based on likelihood of inshore coral reef exposure	Management response level for nutrients based on likelihood of wetland exposure
Fine sediment	Management response level for fine sediment based on likelihood of seagrass and inshore coral reef exposure	Management response level for fine sediment based on likelihood of wetland exposure
Pesticides	Management response level for pesticides based on likelihood of seagrass and inshore coral reef exposure	Management response level for pesticides based on likelihood of wetland exposure

The Management Response levels are defined using the Management Response Decision Support Framework (the Management Response Framework; Figure 9), developed as part of the GBR Spatial Management Prioritisation assessment (Waterhouse et al. 2025). The basis of the Management Response Framework is to integrate two types of management goals: stressor-focused goals aimed at reducing pollutant pressures affecting aquatic ecosystems, and outcome-focused goals aimed at maintaining or improving ecosystem condition through comprehensive interventions– highlighting the importance of protecting ecosystems currently in good condition while taking action to reduce stressors causing poor ecosystem condition (Waterhouse et al. 2025). The Management Response Framework assigns an appropriate management response level based on the pollutant exposure levels, with additional actions informed by ecosystem condition

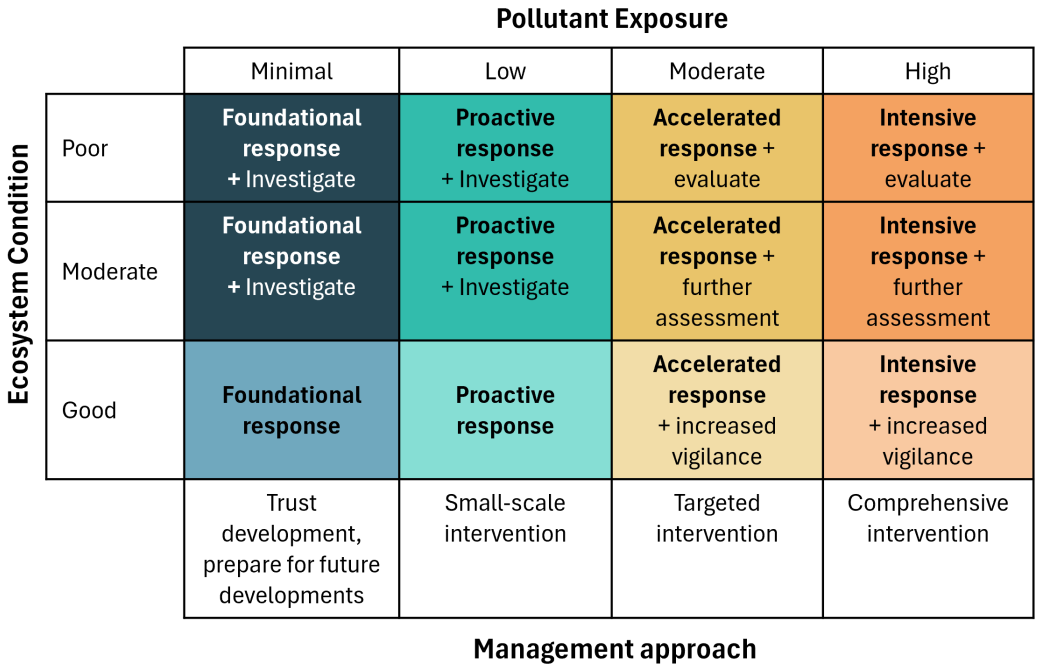


Figure 9. *Water Quality Management Response Decision Support Framework (adopted from Waterhouse et al., 2025).*

The Management Response levels are structured in a nested design beginning with the ***Foundational*** response, which applies across all GBR catchments as a minimum. As pollutant exposure increases, the responses build in scale, intensity and urgency. These response levels guide the scaling and prioritisation of Action and Delivery Strategies across the three Strategic Action Areas to achieve the Regional Objectives.

The language used to describe each Management Response level reflects this scaled approach to management intervention, which is carried through to describe the Action and Delivery Strategies:

- ***Foundational Response*** **– Minimal likelihood of pollutant exposure**: This is the minimum level of water quality management required broadly across the whole Region (and GBR catchment area). This response recognises the minimum standards (defined in policy and legislation) that should be implemented everywhere. It is an opportunity to actively maintain ecosystem values and services not impacted by water quality pressures and that are ecologically critical for other connected habitats, establish/strengthen engagement, communications, stakeholder relationships, and identify and prepare for future developments.
- ***Proactive Response*** **– Low likelihood of pollutant exposure**: The Strategy aims to support preventative actions to address emerging issues before they become significant problems, maintaining good water quality for ecosystem protection into the future. The focus is on smaller, local-scale activities within areas where there is opportunity to pre-emptively address emerging pollutant issues for the longer-term protection of ecosystem condition. These management responses typically have smaller investment costs and the potential for establishing/strengthening practices and processes with water quality benefits for now and for the long term.
- ***Accelerated Response*** **– Moderate likelihood of pollutant exposure**: The Strategy requires a targeted response that is smaller in scale than the Intensive response, generally at a sub-catchment scale, targeting and tailoring actions where they will have the greatest impact (recognising that many of these basins have already been a focus of investment). This approach focuses on the main sources of pollutants to address issues before they become of greater concern for exposed ecosystems. Additional actions for other pollutant sources provide a diversity of management options within the basin, to pre-emptively address emerging

pollutant issues. Management responses of this nature have the potential for faster environmental gains (now and for the longer term) with smaller investments.

- ***Intensive Response* – High likelihood of pollutant exposure**: The Strategy calls for a comprehensive management response that is generally large-scale and implemented across multiple land uses (recognising that many of these basins have already been a focus of investment in the past). The aim is to achieve widespread and fast uptake of interventions to reduce pollutant runoff rapidly and significantly. In these cases, the dominant contributing sources of the pollutants become the primary focus for targeting management, while the management of other sources and catchment processes are encouraged and supported to achieve further reductions toward ecologically relevant water quality targets.

Within each management response level, there are additional actions that are triggered according to the ecosystem condition (denoted by a + sign in Figure 9). These actions vary depending on the level of pollutant exposure and are used to inform the Natural Systems Repair Action Strategies (Strategic Action Area II). They are described in Waterhouse et al. (2025) as follows:

- **Good condition** ecosystems: Require routine and ongoing monitoring of ecosystem condition and water quality drivers, with reactive monitoring of large-scale disturbance events. Under Moderate and High pollutant exposure, additional responses are required for **increased vigilance** of changes in ecosystem condition to ensure condition does not decline.
- **Moderate condition** ecosystems: Under Minimal or Low pollutant exposure an **investigation** would be triggered to determine the other pressures driving the Moderate condition (assuming it is not related to nutrient, sediment or pesticide impacts) and to inform relevant managers of the need to act. Under Moderate or High pollutant exposure, a Moderate condition ecosystem would trigger **further assessment** to understand additional pressures on the ecosystem, to identify trends in ecosystem condition and to understand the role of pollutant impacts on the ecosystem's state to avoid further declines. **Tailored communications** on these ecosystems, drivers and pressure under threat should be developed and disseminated.
- **Poor condition** ecosystems: Under Minimal or Low pollutant exposure an **immediate investigation** would be triggered to determine the drivers of the condition and inform relevant managers of the need to act. Under Moderate or High pollutant exposure, a Poor condition ecosystem would trigger an **evaluation** of the ecosystem's ecological, social and cultural values, other potential drivers of the poor condition and the ecosystem's potential for recovery. Depending on the outcome of the evaluation, other intervention options may need to be considered. **Tailored communications** on these ecosystems under threat should be developed and disseminated.

Table 3. Nutrients - *Scale of the management responses required for anthropogenic nutrients (including DIN) for basins in the Wet Tropics NRM Region. Pollutant sources indicate the extent of anthropogenic DIN loads transported from the catchment and the dominant land uses contributing to the load - see the Basin Water Quality Improvement Strategy tables in Section 4 for more detail on the recommended management actions for each land use. Basin-scale Management Response levels are determined by the likelihood of coral exposure to DIN in the marine exposure assessment. Smaller scale (e.g. catchment) Management Response levels represent localised variations to the basin-level marine-driven management response and are determined from the likelihood of freshwater floodplain wetland exposure to nutrient hazards (DIN plus other nutrients). (+) Additional management requirements are highlighted – e.g. where data validation is required or additional actions for ecosystems based on their condition. Data were collated from Waterhouse et al.,2025, noting that the pollutant loads presented here are an updated version (DETSI, 2026) of the pollutant load information presented in Waterhouse et al. (2025). *wetland aggregations have not been monitored and therefore a survey to assess wetland condition is required.*

Basin	Management Unit	Pollutant sources		Basin-scale		Smaller-scale (e.g. catchment)	
		Anthropogenic modelled annual average DIN load (tonnes) (% of total Regional anthropogenic load)	Dominant pollutant source for targeted management (ranked)	Marine Exposure Likelihood of coral exposure	Management Response level	Freshwater floodplain wetlands Hazard assessment	Management Response level
Daintree		63 (2.2%)	Sugarcane	Moderate	**Accelerated** + further assessment	Minimal	Foundational
Mossman		45 (1.5%)	Sugarcane	Moderate	**Accelerated** + further assessment	Minimal	Foundational
Barron		83 (2.8%)	Sewage Treatment Plant, Urban, Bananas, Other, Horticulture,	Moderate	**Accelerated** + further assessment	High	**Intensive** + survey*
Mulgrave-Russell		401 (14%)	Sugarcane, Bananas, Urban, Sewage Treatment Plants	Moderate	**Accelerated** + further assessment	Low	**Proactive** + investigate
Johnstone		716 (24%)	Bananas, Sugarcane, Urban, Dairy	Moderate	**Accelerated** + further assessment	High	**Intensive** + evaluate
Tully		472 (16%)	Sugarcane, Bananas	High	**Intensive** + further assessment	High	**Intensive** + further assessment
Murray		227 (7.7%)	Sugarcane, Bananas	Moderate	**Accelerated** + further assessment	High	**Intensive** + evaluate
Herbert			Sugarcane	High	**Intensive** + further assessment		
	Upper	91 (3.1%)	Grazing			High	**Intensive** + further assessment
	Lower	850 (29%)	Sugarcane			High	**Intensive** + evaluate

Table 4. Fine Sediment *– Scale of the management responses required for anthropogenic fine sediment for the basins in the Wet Tropics NRM region. Pollutant sources indicate the extent of anthropogenic fine sediment loads transported from the catchment and the dominant land uses contributing to the load - see the Basin Water Quality Improvement Strategy tables in Section 4 for more detail on the recommended management actions for each land use. Basin-scale Management Response levels are determined by the likelihood of seagrass and coral exposure to fine sediment in the marine exposure assessment. Smaller scale (e.g. catchment or sub-catchment) Management Response levels represent localised variations to the basin-level marine-driven management response and are determined from the likelihood of freshwater floodplain wetland exposure to sediment hazards. Data were collated from Waterhouse et al.,2025, noting that the pollutant loads presented here are an updated version (DETSI, 2026) of the pollutant load information presented in Waterhouse et al. (2025). *wetland aggregations have not been monitored and therefore a survey to assess wetland condition is required.*

Basin	Management Unit	Pollutant sources		Basin-scale		Smaller-scale (e.g. catchment)	
		Anthropogenic modelled annual average fine sediment load (kilotonnes) (% of total Regional anthropogenic load)	Dominant pollutant source for targeted management (ranked)	Marine Exposure Likelihood of seagrass and coral exposure	Management Response level	Freshwater floodplain wetlands Hazard assessment	Management Response level
Daintree		44 (7.0%)	Streambank in various land uses, Grazing	Minimal	**Foundational** + investigate	Minimal	**Foundational**
Mossman		6 (0.9%)	Minimal anthropogenic sources (some Sugarcane & Urban)	Minimal	**Foundational** + investigate	Minimal	**Foundational**
Barron		57 (9.1%)	Streambank in various land uses, Grazing	Moderate	**Accelerated** + further assessment	High	**Intensive** + survey*
Mulgrave-Russell		50 (7.9%)	Streambank in various land uses, Sugarcane, Grazing	Low	**Proactive** + investigate	Low	**Proactive** + investigate
Johnstone		225 (36%)	Streambank in various land uses, Grazing	Moderate	**Accelerated** + further assessment	High	**Intensive** + evaluate
Tully		51 (8.2%)	Streambank in various land uses, Sugarcane	Moderate	**Accelerated** + evaluate	High	**Intensive** + further assessment
Murray		15 (2.4%)	Streambank in various land uses, Sugarcane	Minimal	**Foundational** + investigate	High	**Intensive** + evaluate
Herbert			Grazing, Streambank in various land uses, Sugarcane	High	**Intensive** + evaluate		
	Upper	104 (17%)				High	**Intensive** + further assessment
	Lower	75 (12%)				High	**Intensive** + evaluate

Table 5. Pesticides *– Scale of the management responses required for pesticides for the basins in the Wet Tropics NRM Region plus (+) additional actions based on ecosystem conditions. Pollutant sources indicate the level of pesticide risk estimated at the catchment and basin scales and the land uses within the basin that have a higher potential for pesticide risk to aquatic ecosystems - see the basin strategy tables for more detail on the recommended management responses. Basin-scale Management Response levels are determined by the end-of-catchment and basin pesticide risk levels. Smaller scale (e.g. catchment or sub-catchment) Management Response levels represent localised variations to the basin-level marine-driven management response and are determined from the likelihood of freshwater floodplain wetland exposure to pesticide hazards. Data were collated from Waterhouse et al.,2025.*wetland aggregations have not been monitored and therefore a survey to assess wetland condition is required.*

Basin	Management Unit	Pollutant sources			Basin-scale		Smaller-scale (e.g. catchment)	
		Catchment-level pesticide risk metric Very Low – Very High (% species protected) [A]	**Basin-level pesticide risk** Very Good – Very Poor [B]	**Land use with a higher potential for pesticide risk (ranked by land-use area)**	**Marine Exposure** **Likelihood of seagrass and coral exposure**	**Management Response level**	**Freshwater floodplain wetlands** **Hazard assessment**	**Management Response level**
Daintree		Very Low (99.9 to 99.2%)	Very Good	Sugarcane, horticulture, dryland and irrigated cropping	Minimal	**Foundational** + investigate	Minimal	Foundational
Mossman		Low to Moderate (96.8 to 94.8%)	Poor	Sugarcane, horticulture, bananas, irrigated cropping and dryland cropping	Low	**Proactive** + investigate	High	**Intensive** + survey*
Barron		Very Low (99.5 to 99.4%)	Very Good	Irrigated cropping, horticulture, sugarcane, bananas	Minimal	**Foundational** + investigate	High	**Intensive** + survey*
Mulgrave-Russell		Mulgrave: Low to Moderate (98.5 to 94%) Russell: Low to Moderate (97.9 to 93.3%)	Moderate	Sugarcane, bananas, Horticulture	Moderate	**Accelerated** + further assessment	High	**Intensive** + further assessment
Johnstone		Low (98.3 to 95.1%)	Moderate	Sugarcane, bananas, horticulture, irrigated and dryland Cropping	Moderate	**Accelerated** + further assessment	High	**Intensive** + evaluate
Tully		Low to Moderate (96.9 to 91.1%)	Moderate	Sugarcane, bananas, horticulture	Moderate	**Accelerated** + evaluate	High	**Intensive** + further assessment
Murray		High (89.6 to 81.0%)	Very Good	Sugarcane, bananas, horticulture	High	**Intensive** + evaluate		**Intensive** + evaluate
Herbert		Low to Moderate (97.5 to 94.0%)	Moderate	Sugarcane, dryland and Irrigated Cropping, horticulture	Moderate	**Accelerated** + evaluate		
	Upper			Irrigated and dryland cropping, sugarcane, horticulture			Moderate	**Accelerated** + further assessment
	Lower			Sugarcane, horticulture, irrigated cropping,			High	**Intensive** + evaluate

[A] Water Quality and Investigations (2024); [B] Reef Water Quality Report Card 2021 and 2022 (Australian and Queensland governments, 2024).

Table 6 provides a cross-basin comparison of the management response levels required for DIN and other nutrients, fine sediment and pesticides across the Wet Tropics Region. Management responses are presented at both the basin scale, reflecting exposure of marine ecosystems (coral reefs and seagrass), and the sub-basin scale, reflecting exposure of freshwater floodplain wetlands. In a number of basins, freshwater wetland hazard assessments trigger higher Management Responses than the basin's marine exposure assessment, highlighting the importance of localised, wetland-focused management alongside basin-scale management for marine protection.

The focus of DIN management in the Wet Tropics Region is actively reducing the Moderate and High DIN exposure that is occurring on marine and freshwater floodplain wetland ecosystems from key sources—primarily sugarcane and bananas, as well as urban areas and sewage treatment plants in some basins. At the basin scale, this requires an Intensive management response in the Tully and Herbert basins, where DIN exposure to coral reefs is High. All other basins—including Daintree, Mossman, Barron, Mulgrave-Russell, Johnstone and Murray—require an Accelerated management response to reduce Moderate DIN exposure. Within basins, the freshwater floodplain wetland hazard assessment indicates that Intensive nutrient management is required in areas surrounding and upstream of freshwater floodplain wetlands for most basins, including Barron, Johnstone, Tully, Murray and the Upper and Lower Herbert, reflecting high nutrient hazards. While the wetland hazard assessment indicates Foundational Management response for Daintree and Mossman, and Proactive for Mulgrave-Russell, the basin-scale responses are higher and therefore take precedence.

The focus of sediment management in the Wet Tropics Region is to actively reduce the Moderate and High sediment exposure to marine and freshwater floodplain wetland ecosystems, while also ensuring the Low and Minimal exposure is maintained in other areas; primarily through targeting grazing and streambank sources, as well as sugarcane in several basins. This requires an Intensive management response in the Herbert Basin to address High sediment exposure, and Accelerated management in the Barron, Johnstone and Tully basins to address Moderate exposure. Proactive management is required in the Mulgrave-Russell Basin to prevent escalation of Low sediment exposure. Maintaining Minimal exposure in the Daintree, Mossman and Murray basins will be supported through Foundational management responses. Within basins, Intensive management is required in areas surrounding and upstream of freshwater floodplain wetlands in the Barron, Johnstone, Tully, Murray and Herbert (Upper and Lower) basins. Proactive management of sediment is required in the Mulgrave-Russell, and Foundational management in the Daintree and Mossman basins for areas surrounding and upstream of freshwater floodplain wetlands.

The focus of pesticide management in the Wet Tropics Region is to actively reduce the Moderate and High pesticide exposure to marine and freshwater floodplain wetland ecosystems, while also ensuring the Low and Minimal exposure is maintained in other areas; primarily through targeting sugarcane and banana sources, with secondary targeting of horticulture, dryland and irrigated cropping and non-agricultural sources. At the basin level (for addressing marine exposure), this requires an Intensive management response in the Murray Basin for addressing high pesticide exposure, and Accelerated management in the Mulgrave-Russell, Johnstone, Tully, Herbert for Moderate exposure. Proactive management is required in the Mossman to ensure future land use in the basin does not increase pesticide exposure. Maintaining Minimal pesticide exposure at the end-of-catchment in the Daintree and Barron Basins will be supported through Foundational management responses. At the sub-basin scale, Intensive management is required in areas surrounding and upstream of freshwater floodplain wetlands in the Mossman, Barron, Mulgrave-Russell, Johnstone, Tully, Murray, Herbert (Lower) basins. Proactive management of pesticides in the Herbert (Upper), and Foundational management in the Daintree Basin, is also required in areas surrounding and upstream of freshwater floodplain wetlands.

Table 6. *Comparison of basin-scale and smaller scale water quality management response levels for DIN and other nutrients, fine sediment, and pesticides across the Wet Tropics Region. *Basin-scale management response (i.e. Marine exposure assessment) is based only on DIN exposure, smaller scale (i.e. the Freshwater wetland hazard assessment) is based on DIN plus other nutrients.*

	DIN & other nutrients*	Fine sediment	Pesticides
Basin-scale Management response (based on Marine exposure assessment)			
Foundational	-	Daintree, Mossman, Murray	Daintree, Barron
Proactive	-	Mulgrave-Russell	Mossman
Accelerated	Daintree, Mossman, Barron, Mulgrave-Russell, Johnstone, Murray	Barron, Johnstone, Tully	Mulgrave-Russell, Johnstone, Tully, Herbert
Intensive	Tully, Herbert	Herbert	Murray
Smaller scale Management response (based on Freshwater wetland hazard assessment)			
Foundational	Daintree, Mossman	Daintree, Mossman	Daintree
Proactive	Mulgrave-Russell	Mulgrave-Russell	-
Accelerated	-	-	Herbert (Upper)
Intensive	Barron, Johnstone, Tully, Murray, Herbert (Upper & Lower)	Barron, Johnstone, Tully, Murray, Herbert (Upper & Lower)	Mossman, Barron, Mulgrave-Russell, Johnstone, Tully, Murray, Herbert (Lower)

3.2.3. Identifying and prioritising Action and Delivery strategies for each pollutant

Building on the pollutant-specific Management Response levels derived in Steps 1 and 2, the next phase of Strategy development focuses on translating these responses into basin-level Action and Delivery Strategies. This phase moves from regional assessment to basin-specific actions, specifying what and where to target actions on the ground and how to effectively deliver those actions in line with the target audience.

Action Strategies define the priority on-ground actions required to reduce pollutant runoff where the greatest gains can be achieved, to maintain minimal pollutant exposure where exposure is currently low, or where interventions may be needed to assist natural systems repair or recovery. Delivery Strategies provide the enabling framework for program delivery, guiding the design of coordinated and targeted programs that are scaled to the Management Response level and tailored to local socio-economic contexts, including the capacity, opportunity and motivation of land managers and other stakeholders.

This translation from Management Response to action and delivery occurs through the next three linked steps of the Strategy development:

- Step 3 - Identifying, prioritising and scaling on-ground Action Strategies for Sustainable land use & management (Strategic Action Area I) according to the Management Response level.
- Step 4 - Identifying, prioritising and scaling on-ground Action Strategies for Natural Systems Repair (Strategic Action Area II) according to the Management Response level, water quality drivers and ecosystem condition.
- Step 5 - Identifying and scaling delivery strategies and actions (Strategic Action Area III) to achieve the Management Response level.

Systems logic underpinning the development of Action and Delivery Strategies

The Action and Delivery Strategies are developed using a systems thinking approach that examines the complex and interconnected ecological, biophysical, social and management components within each basin. This approach helps to identify the most effective intervention points where targeted actions can deliver the greatest impact toward achieving Regional Objectives and fulfilling the Management Response requirements within each Strategic Action Area.

Underpinning the development of the Action and Delivery Strategies is a clear and structured systems logic (Figure 10). The logic operates in two connected parts, the upper section depicts the key system components and causal relationships that drive pollutant exposure and impact on aquatic ecosystems. Starting from the top, the condition of aquatic ecosystem values is driven by exposure to land-based pollutants. This exposure is influenced by two interconnected components: the dominant pollutant sources and pathways (specific to each pollutant), and the system drivers of pollutant runoff and transport (such as climate, land use and socio-economic factors). These two components also represent key leverage points where management interventions can be targeted. The bottom section of the logic demonstrates how management responses connect to these leverage points through the three Strategic Action Areas. The Action Areas work together to address the basin-specific drivers and pollutant sources, informing the areas of focus for the Basin-level Water Quality Improvement Strategies. At the base of the systems logic is Strategic Regional Implementation, which connects the basin-level strategies to the broader regional delivery system. While the Basin-level Water Quality Improvement Strategies identify what needs to occur within each basin, the Strategic Regional Implementation identifies the regional systems that turn the Action and Delivery Strategies into coordinated, long-term action. Successful implementation influences the pollutant sources, drivers and ultimately the condition of ecosystems – achieving the Wet Tropics Regional Outcome.

While the systems logic is presented in a linear flow, it is important to acknowledge that in practice, interactions and feedback loops exist within the system. These complexities should be identified and considered as funding opportunities arise for specific project or programs, depending on the funding objectives.

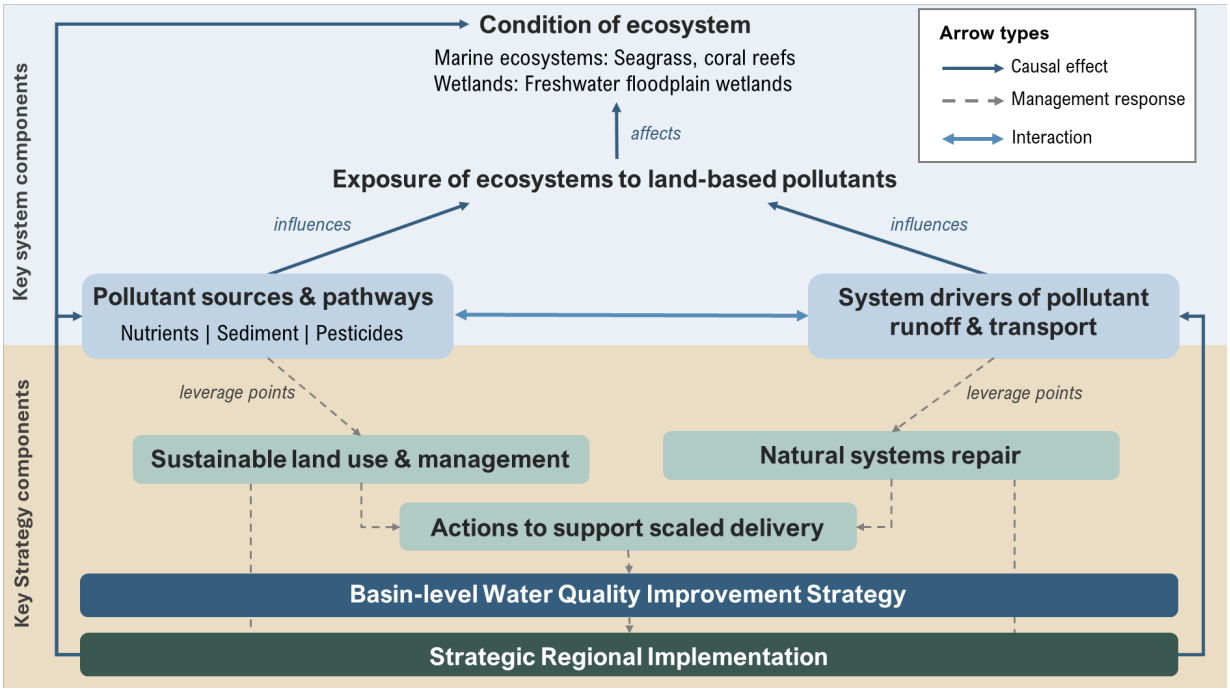


***Figure 10**. Systems logic framework for developing Basin-level Water Quality Improvement Strategies. Solid upward arrows indicate causal relationships between key system components where land-based pollutants drive ecosystem impacts on marine environments (seagrass, corals). Dotted downward arrows show how this understanding informs the development of the Strategy through three strategic action areas. The framework identifies key leverage points (pollutant sources/pathways and system drivers) where interventions can be targeted to improve water quality outcomes for the GBR.*

The system components and their relationships are described quantitatively and qualitatively through data and information specific to each basin (detailed in the accompanying Synthesis Report). This evidence base is used to tailor the Action and Delivery Strategies for each basin to achieve the Regional Objectives. The tailored Action and Delivery Strategies are also scaled to align with the management response level for each pollutant.

Development of Action and Delivery Strategies

The Action Strategies for **Strategic Action Area I: Sustainable Land Use and Management**, aim to reduce the initial source of pollutants across a range of land uses, such as by reducing fertiliser inputs, minimising soil erosion and optimising pesticide application. It is essential to acknowledge the challenge of bridging the gap between current management practice adoption and what ecosystems require. In many basins, even accelerated uptake of recommended practices may be insufficient to meet ecosystem needs—particularly where ecosystems are affected by multiple stressors. Even under a 'best-case' scenario of widespread adoption, the water quality benefits from land management alone may not fully achieve the pollutant reductions needed to maintain or restore ecosystem health. This Strategy explicitly addresses these challenges by:

- Providing multiple pathways to reduce pollutants at their source, through a prioritised suite of Action Strategies targeting the dominant pollutant sources. These strategies are ranked according to each land use's relative contribution to pollutant loads and primary loss pathways (for sediment), generally identifying the top three or four priority sources.
- Complementing sustainable land use strategies with Natural Systems Repair strategies, tailored to local drivers of pollutant exposure and ecosystem condition (e.g. streambank erosion, wetland condition, fish passage barriers).
- Aligning Action Strategies with targeted delivery tools that help to identify and respond to the enablers and barriers to increased and accelerated adoption. This includes identifying capability, opportunity, and motivation constraints to inform the design of support systems that enable sustained, long-term practice change – see Section 4.9.

There are several important caveats to how pollutant sources are ranked:

- DIN and sediment rankings reflect the total annual load based on 'manageable' contributions (i.e. excludes conservation areas).
- DIN load from grazing is primarily linked with sediment erosion and therefore was treated as a co-benefit of sediment reduction actions, for this reason grazing sources of DIN are acknowledged but ranked lower in the table.
- Data is unavailable to determine quantified land use contributions to pesticide risk, rather the land use's relative potential for pesticide risk is noted (i.e. Higher or Lower potential for pesticide risk[5]) along with the proportion of the basin the land use occupies.

In addition to ranking land uses by their relative contribution to pollutant loads or risk, the Action Strategies use scaled delivery language that reflects the required intensity and urgency of effort. Land uses with higher contributions and higher pollutant exposure levels are paired with stronger language (e.g. *"rapidly maximise and sustain"* or *"actively encourage and support"*) to signal the need for accelerated, well-resourced and coordinated action. Lower-contributing sources and lower exposure levels use lighter-touch phrasing (e.g. *"encourage adoption"*) to indicate proportionate effort and investment. This approach guides delivery partners on where to prioritise resources while still promoting broad uptake of sustainable practices across all land uses. This is described further in Section 4.9.

[5] Sugarcane, bananas, horticulture, dryland and irrigated cropping have a higher potential for pesticide risk, forestry, urban, grazing (open grazing and forested grazing) and dairy have a lower potential for pesticide risk (see Synthesis Report for further information – Sambrook et al., 2026).

The Action Strategies operate in addition to regulated minimum standards for land management. Minimum standards for managing nutrients and sediments in agriculture are regulated under the Reef Protection Regulations, while pesticide use is regulated by the *Chemical Usage (Agricultural and Veterinary) Control Act 1988*, which mandates adherence to label instructions. Achieving the water quality improvements necessary for ecosystem protection in the Wet Tropics basins will require adoption of *improved practices* that go beyond these minimum standards to deliver stronger water quality outcomes. The Paddock to Reef (P2R) Water Quality Risk Frameworks, developed in 2016 for key agricultural industries, provide consistent, risk-based guidance of management practices across the GBR catchment. These frameworks underpinned progress reporting toward the previous land management targets of the Reef 2050 WQIP (i.e. 90% best practice adoption), which have recently been reviewed to assess their applicability at regional and catchment scales (see DPI, 2025).

As noted in Section 1.2, the Review of Land Management Targets (DPI, 2025) recommended discontinuing the GBR-wide voluntary land management targets in favour of more context-specific approaches, including consideration of local environmental and social factors. In the Wet Tropics region, the Review focused on sugarcane (divided into north and south, DIN and pesticides), bananas (DIN and sediment), and grazing (sediment). The consultation process used ADOPT (Adoption and Diffusion Outcome Prediction Tool; https://adopt.csiro.au/) to assess and predict the likely peak adoption levels of specific agricultural management practices with defined target populations. The Review offers key insights into factors affecting current adoption trajectories and opportunities to increase adoption towards a best-case scenario, providing specific guidance for water quality improvement planning and program design. Following local stakeholder testing, the Review outcomes were integrated into the recommended priority actions for the Wet Tropics Region for sugarcane, banana and grazing land uses in the Action Strategies. For all other land uses, action examples from the scientific literature and stakeholder engagement are provided. It is acknowledged that different actions suit some contexts better than others, and therefore the actions provided are not prescriptive – more specific lists of actions for particular basins were identified through stakeholder consultation and are included Appendix 1.

The Action Strategies for **Strategic Action Area II: Natural Systems Repair** are needed to strengthen natural catchment processes, support recovery of ecosystem function and condition, and to help close the gap between water quality improvements achieved by sustainable management practices and what is required to sustain aquatic ecosystem health. These strategies were developed using multiple lines of evidence that identify the key landscape-scale drivers of degraded water quality and ecosystem condition, including primary sediment loss pathways and the loss or degradation of critical natural systems such as gullies, streambanks, riparian zones and wetlands (Table 1). The resulting Action Strategies target rehabilitation of natural catchment processes and functions, which can help to capture and break down pollutants in runoff, and recovery of ecosystem condition and connectivity (e.g. wetlands, seagrass, fish barriers). Examples include large-scale gully or streambank remediation, landscape revegetation or hydrological modifications to restore connectivity.

The formulation of these Action Strategies were informed by basin-specific water quality biophysical drivers (including primary loss pathways and load contributions - Table 1 - Table 5), ecosystem condition information (for freshwater floodplain wetlands, seagrass and coral), actions in the Gully and Streambank Toolbox, guidance from the Queensland River Rehabilitation Management (QRRM) Guideline and Queensland Wetlands Program and the 2022 Scientific Consensus Statement. Relative contributions of different erosion pathways to sediment loads (where available) informed the rehabilitation priorities associated with sediment reduction, with the acknowledgement that some natural systems deliver multiple benefits across water quality, biodiversity and landscape resilience, not just sediment reduction.

Ecosystem condition Action Strategies were further shaped by the Management Response Decision Support Framework (Figure 9), which links management responses to ecosystem condition grades – e.g. under higher pollutant exposure scenarios, the framework calls for progressively more targeted

investigation, evaluation and intervention, including assessment of ecological, social and cultural values, recovery potential and the role of land-based runoff in driving ecosystem decline.

The Action Strategies include a combination of smaller scale system repair actions and larger scale engineering solutions. Systems repair is defined in the Whole-of-System Values-Based Framework as "*improving processes or components of an ecosystem to a desired state that will deliver agreed ecosystem services and values, primarily through natural means*"[6]. Systems repair management options are relatively low risk compared to engineered solutions and may be adopted in instances where the ecosystem may be able to repair itself or do so with minimal engineering. In many cases systems repair requires reinstating or improving vegetation cover (e.g. through natural regeneration or active revegetation), removing some of the pressures on the system or changing minor hydrological flows (e.g. barrier removal). Larger scale engineering solutions may include gully and streambank reshaping and revegetation, bank stabilisation using rock chutes, pile fields and rock capping.

As with Strategic Action Area I, the language used in the Action Strategies reflects the relative scale, urgency and intensity of response required. This communicates where coordinated, targeted and well-resourced natural systems repair is most critical, while still promoting broad protection and maintenance of natural functions across the Region.

The strategies presented are not prescriptive. They provide examples of priority actions and hotspot areas where known, while allowing flexibility to tailor interventions based on local conditions, landholder contexts, technical feasibility and evolving evidence. More detailed technical guidance is provided in referenced tools and guidelines, including gully and streambank repair toolboxes, riparian management frameworks and wetland and catchment rehabilitation strategies.

The **Delivery Strategies** identified in **Strategic Action Area III** are required to support the delivery of the Action Strategies. Management actions that relate to practice change vary in their likelihood of adoption, depending on the enablers and barriers to uptake. These enablers and barriers typically centre around motivations, capability and opportunity factors (e.g. Michie et al., 2011; Murray-Prior et al., 2024; DPI, 2025). Further detail of Delivery Strategies is described in Section 4.9.

Strategies to support implementation

Underpinning the delivery of each Strategic Action Area are the broader Strategies to support regional implementation (Section 5) - including science and innovation, monitoring and evaluation, knowledge sharing and communication, and coordinated governance arrangements. These strategies create the enabling environment for effective delivery of actions at the regional scale. For example, investment in capacity building can equip delivery providers (such as extension officers, NRM bodies, and industry groups) with the skills and resources to support land managers in adopting targeted management responses. Similarly, stronger coordination and collaborative governance arrangements help align effort across multiple programs and funding sources, reducing duplication and ensuring that on-ground delivery is coherent and responsive to regional priorities.

Performance measures are also part of the implementation and include measurable indicators that track progress towards the objectives and assess whether outcomes are being achieved (see Section 5.7.1). Indicators that are already measured through existing programs are included where possible. Refer to Identifying performance measures for monitoring and evaluating the effectiveness of actions.

[6] https://wetlandinfo.des.qld.gov.au/wetlands/management/rehabilitation/rehab-process/step-4/systems-repair.html

4. Basin Water Quality Improvement Strategies

The Basin Water Quality Improvement Strategies outline, prioritise, and scale the Action and Delivery strategies for each basin across the three Strategic Action Areas:

1. Basin-specific Sustainable Land Use and Management (Strategic Action Area I): On-ground Action Strategies for each pollutant, tailored to each basin, and scaled and prioritised according to the Management Response level and pollutant sources.
2. Basin-specific Natural Systems Repair (Strategic Action Area II): On-ground Action Strategies tailored to each basin, and scaled according to the Management Response level, water quality drivers, and ecosystem condition.
3. Cross-basin Actions to Support Scaled Delivery (Strategic Action Area III): High-level strategies required to enable delivery of Actions I and II. These typically vary by land use rather than by basin (Section 4.9).

4.1. Daintree Basin Water Quality Improvement Strategy

4.1.1. Basin context

The Daintree is the most northerly basin in the Wet Tropics Region and covers a land area of 2,105 km^2. There are two major waterways, the Daintree River in the south and Bloomfield River in the north, as well as several smaller waterways flowing from the mountain ranges to the coast. The Daintree has an average rainfall of 2,521 mm per year and a long-term median river discharge of 1,918 gigalitres per year. The highland area is predominantly conservation lands (86% of the catchment area) and is included in the Wet Tropics World Heritage Area. Development is primarily along the lowland coastal areas, with pockets of grazing to the northwest. Grazing lands cover 8.0% of the area, followed by sugarcane (1.8%) and urban areas (1.1%).

Historical vegetation clearing on floodplains, along with freshwater floodplain wetland loss and/or modification are two landscape disturbance factors that may be influencing water quality in the Daintree. By 2018, 52% of the native vegetation from floodplains, and 34% of the freshwater floodplain wetland riparian vegetation had been cleared, however recent clearing has been minimal. By 2017, almost a quarter (24%) of the catchment's natural freshwater floodplain wetlands had been lost and/or modified.

In terms of pollutants, the modelled total annual average loads coming from the Daintree are 388 tonnes of DIN and 112 kilotonnes of fine sediments. The Daintree is the ninth largest exporter of DIN to the GBR, contributing 4.2% of the total load. Conservation areas (75%) are the dominant source of DIN, followed by sugarcane and grazing areas. Conservation areas are also the main source of fine sediments (47%), followed by streambank (33%) and grazing (13%) areas, primarily reaching waterways through hillslope erosion (87%). The pesticide risk is Very Low.

The condition of freshwater floodplain wetland condition is not monitored. Based on the 1,351 hectares of natural and slightly modified freshwater floodplain wetlands included in the hazard assessment, no mapped wetlands are currently exposed to High or Very High nutrient or sediment or Moderate, High or Very High pesticide hazards.

In 2022–23, coral reefs and seagrass meadows adjacent to the Daintree basin were in Moderate condition, however, these have declined to Poor condition following Cyclone Jasper and associated flooding in 2023. The marine DIN exposure score is Moderate, reflecting the anthropogenic DIN load and close proximity of coral reefs to the coast. Sediment exposure is Minimal, reflecting the low anthropogenic fine sediment load. Pesticide exposure is Minimal.

4.1.2. Overall management response and focus areas

Based on the likelihood of pollutant exposure and ecosystem condition, a targeted management response is required across the Daintree basin, involving sustainable land use and natural systems repair. At the basin scale, this includes **Accelerated management of nutrients** in targeted sub-catchment areas, supported by foundational nutrient management in all remaining areas. In addition, Broadscale, **Foundational management of sediment and pesticides is required** to maintain Minimal exposure into the future.

As monitored wetland condition data are not available for the Daintree basin, further assessment is required to determine current condition, validation of pesticide hazards and appropriate management needs for freshwater floodplain wetlands. In addition, investigation and development of interventions for seagrass and coral ecosystems may be required following impacts from Cyclone Jasper.

Stakeholder consultation emphasised the importance of restoring waterways, wetlands, and coastal areas to improve biodiversity and water quality, including opportunities for Blue Carbon. Strong calls were made for better land stewardship through cost-effective pest and weed management, soil health

programs, and feral pig control. There was recognition of the need to expand ecosystem services and green industry opportunities, and planning scheme reviews to align land use with productivity.

The Mossman Sugar Mill was closed in 2024 with no economically viable alternatives identified at this stage. Whilst the Department of Primary Industries funded a transition program that explored many alternatives, the substantial establishment and set-up costs and delay in return on investment have meant there is no singular outstanding opportunity. For example, a large proportion of the land in the Mossman district is classified as Good Quality Agricultural Land (GQAL) and as an example, to change activity from farming to other uses such as planting trees for carbon sequestration is deemed a 'material change of use' and requires an extensive application process through Local and State governments. These costs are prohibitive for many landholders who now have little or no income. Current planning requirements also preclude engaging in environmental markets that may provide alternative income streams. In addition, there is a significant extent of this current GQAL at risk of inundation from predicted climate change impacts, potentially limiting future agricultural uses.

4.1.3. Daintree sustainable land use and management

Table 7. Daintree *Sustainable land use & management Action and Delivery Strategies required to achieve Regional Objective 1. The* ***Basin-scale Strategic management response*** *aligns to the recommended Management Response for nutrients, fine sediment, and pesticides (Section 3.2.2). The* ***Action Strategies*** *are scaled according to the Management Response for each pollutant and ranked according to the pollutant's* ***Dominant land use sources*** *- the relative contributions of the basin's agricultural and non-agricultural land uses: DIN and fine sediment action strategies are ranked by the relative total annual loads of the top 'manageable' land use contributions (i.e. excludes conservation areas), and pesticide action strategies are ranked by the basin's highest land use areas and their potential (higher vs lower) for pesticide risk– see Section 3.2. Specific stakeholder feedback is described in further detail in Appendix 1. Strategies to support scaled delivery (Action Area III) are explained further in Section* 4.9.

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
DAINTREE **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards.** See specific stakeholder feedback for Daintree basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Nutrients **Actively reduce *Moderate* DIN exposure on marine ecosystems through an *Accelerated* management response in targeted sub-catchments, including maintaining *Minimal* nutrient exposure in wetland hazard exposed areas through a *Foundational* management response.** *Primary focus is reducing DIN exported from sugarcane. Additional reductions could also be achieved through targeted interventions in urban areas including the Daintree township. Increasing adoption of soil erosion management practices in grazing lands may also reduce DIN further. Foundational management of nutrients in all other areas to prevent future sources of nutrients, including*	**Sugarcane** 3,800 ha (16% of total annual average DIN load)	Increase and sustain adoption levels of improved practices that reduce DIN export from sugarcane areas including farm nutrient management planning that includes accounting for nitrogen derived from legume rotation crops or mill mud application, and using Enhanced Efficiency Fertilisers at reduced application rates (where suitable), with complementary practices such improving drainage and use of soil ameliorants to address yield constraints. Note that if there is a transition of sugarcane to other crops as a result of the mill closure, it is highly likely these other crops will still require agronomic management and support.	Deliver coordinated and integrated programs that accelerate sustained adoption of target basin-scale management responses, tailored to local socio-economic and cultural contexts, land use types, and land managers' capacity, opportunities, and motivations, including: • Capacity, skills and expertise
	Urban + STP 2,352 ha (1.3% of total annual average DIN load)	Encourage and support adoption of improved practices that reduce DIN export in stormwater runoff through strategically located stormwater treatment interventions including treatment trains (e.g. constructed wetlands, biofilters, vegetated swales, riparian vegetation restoration). Identify and manage potential risks from nutrient discharge in unsewered areas.	

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
DAINTREE **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards.** See specific stakeholder feedback for Daintree basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
land use areas upstream and surrounding wetlands.	**Grazing** 16,879 ha (6.7% of total annual average DIN load) [B]	Encourage and support adoption of improved practices that reduce DIN export through reducing sediment runoff in grazing. *[This action is a co-benefit of sediment erosion management actions – refer below]*	• Social norms and trust development • Decision support • Incentives and markets • Technology and equipment *See example interventions in Section 4.9 of the Strategy*
Sediment **Maintain *Minimal* fine sediment exposure on marine and freshwater floodplain wetland ecosystems through a *Foundational* management response across all land uses within the basin that maintains minimum standards and fosters awareness and uptake of improved practices for the future.** *Primary focus is on fostering sustainable practices in riparian zones, grazing and sugarcane, including land use areas upstream and surrounding wetlands.*	**Streambank** (33% of total annual average sediment load)	Encourage adoption of improved managementpractices in riparian zones that stabilise and protect frontage country including riparian fencing/excluding cattle from streambank access, managing weeds and pests including feral animals, and revegetation in riparian zones. *[These actions are complementary to Natural Systems Repair actions]*	
	Grazing 16,879 ha (13% of total annual average sediment load)	Encourage adoption of improved practices to reduce sediment erosion including matching stocking rates to carrying capacity and complementary practices such as managing linear features and frontage country (Streambank).	
	Sugarcane 3,800 ha (3.5% of total annual average sediment load)	Encourage adoption of improved practices that reduce sediment erosion in sugarcane, including using fallow crops and trash blanketing, minimal/zero tillage, controlled traffic practices, maintaining vegetated spoon drains, buffers and strategically located sediment traps. Note that if there is a transition of sugarcane to other crops as a result of the mill closure, it is highly likely these other crops will still require agronomic management and support.	

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
DAINTREE **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards.** See specific stakeholder feedback for Daintree basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Pesticides **Maintain Minimal fine sediment exposure on marine and freshwater floodplain wetland ecosystems through a Foundational management response across all land uses within the basin that maintains minimum standards and fosters awareness and uptake of improved practices for the future.** *Primary focus is on fostering sustainable practices in sugarcane, grazing and urban areas. Validate the wetland pesticide hazard assessment and where required, implement appropriate management for wetlands in hazard exposed areas.*	**Sugarcane** 3,800 ha (1.8% of basin area and a higher potential for pesticide risk)	Encourage adoption of practices that minimise pesticide risk from sugarcane including following label conditions, reducing overall pesticide application rates (within label recommendations), adopting banded spraying, switching to lower risk products, optimising application timing relative to rainfall, managing point sources and adopting integrated pest management holistically across the basin. Note that if there is a transition of sugarcane to other crops as a result of the mill closure, it is highly likely these other crops will still require agronomic management and support.	
	Horticulture, dryland and irrigated cropping 232 ha (<1% of basin area and a higher potential for pesticide risk)	Encourage adoption of improved practices that minimise pesticide risk from horticulture, irrigated and dryland cropping, including following label conditions, reducing overall pesticide application rates (within label recommendations), product selection, timing of application, precision technologies and integrated pest management.	
	Grazing 16,879 ha (8% of basin area and lower potential for pesticide risk)	Encourage adoption of improved practices that minimise pesticide risk from grazing land uses including following label conditions, product selection, rate, timing of application, and improved wastewater treatment processes.	

[A] Loads are presented as the Total Annual Average, not the Anthropogenic Load. Data is unavailable to determine quantified land use contributions to pesticide risk, rather the land use's relative potential for pesticide risk is noted along with the proportion of the basin the land use occupies.

[B] DIN load from grazing is primarily linked with sediment erosion and therefore is treated as a co-benefit of sediment reduction actions. For this reason, grazing sources of DIN are acknowledged but ranked lower in the table.

4.1.4. Daintree natural systems repair

Table 8. Daintree *Natural Systems Repair Action and Delivery Strategies required to achieve Regional Objective 2. The* ***Basin-scale Strategic management response*** *aligns to the recommended pollutant Management Response levels and ecosystem condition assessments. The* ***Action Strategies*** *target natural system drivers of water quality risks (streambank and gully erosion[1], vegetation and wetland loss[2]) and the condition of ecosystems[3] (freshwater floodplain wetlands, seagrass, coral, and ecosystem connectivity). [1]Streambank and gully action strategies are ranked and scaled based on their contributions to the basin's sediment load. [2] Vegetation loss and wetland loss/or modification action strategies are scaled based on % losses and identified hotspot areas. [3] Ecosystem condition action strategies are based on ecosystem condition ratings – poor, moderate or good. Specific stakeholder feedback is described in further detail in Appendix 1. Strategies to support scaled delivery (Action Area III) are explained further in Section* 4.9.

Regional objective: *Rehabilitate and sustain natural catchment processes, connectivity and ecosystem function in the Region that support healthy aquatic ecosystems, improve water quality outcomes, and deliver co-benefits such as biodiversity conservation, climate resilience, and enhanced landscape productivity.*			
DAINTREE **Basin-scale strategic management response**	**Natural Systems**	**Action Strategy** See specific stakeholder feedback for Daintree basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Actively rehabilitate natural systems in targeted and strategic locations to improve natural system processes for water quality outcomes and improve ecosystem condition.	**Streambank rehabilitation** (33% sediment load contribution)	Rehabilitate, protect and maintain streambanks in prioritised locations, including areas damaged by Cyclone Jasper in 2023, through revegetation of riparian areas and where required, structural and engineered interventions for bank stabilisation. *Potential focus areas: Lower Daintree River and surrounding areas* *[These actions are complementary to Sustainable Land use and Management actions for sediment reduction]* For guidance, refer to the Queensland River Rehabilitation Management (QRRM) Guideline[A].	Deliver coordinated and targeted natural systems and ecosystem rehabilitation programs that accelerates lasting restoration outcomes, tailored to local ecological, and the capacity, opportunities, and motivation of diverse stakeholder groups (including landholders and land managers, community groups, and government agencies), including: • Capacity, skills and expertise • Incentives and markets • Decision support • Technology and equipment *See example interventions in Section 4.9.*
	Native vegetation clearing (6%), **Riparian vegetation clearing** (5%), and **Natural freshwater floodplain wetland modification and/or loss** (24%)	Actively protect and maintain natural vegetation and wetland areas and prevent loss and/or modification through promoting awareness of regulatory standards for vegetation clearing and other co-benefits. Establish and maintain buffer zones and undertake weed control in riparian areas of waterways and wetlands areas. Implement feral animal control in strategic locations. Support actions and encourage incentives (e.g. environmental markets) to increase revegetation and wetland rehabilitation at strategic	

Regional objective: *Rehabilitate and sustain natural catchment processes, connectivity and ecosystem function in the Region that support healthy aquatic ecosystems, improve water quality outcomes, and deliver co-benefits such as biodiversity conservation, climate resilience, and enhanced landscape productivity.*			
DAINTREE **Basin-scale strategic management response**	**Natural Systems**	**Action Strategy** See specific stakeholder feedback for Daintree basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
		locations in the landscape that improve connectivity, water quality and ecosystem service functions. Maintenance of rehabilitation activities is essential. For guidance, refer to the goals, objectives and activities in the Reef 2050 Wetlands Strategy[B] (particularly *Theme 3: On-ground activities to protect, manage, rehabilitate and restore wetlands*) and Queensland River Rehabilitation Management (QRRM) Guideline.	
	Wetlands (*no monitored wetland aggregations*) *Minimal exposure from nutrients, sediments and pesticides*	Survey wetland condition and validate wetland pesticide hazard assessments and where required, apply appropriate management response. This may include coordinating interventions and activities to enhance wetland values, condition, and water quality improvement and ecosystem service functions, for example: • Interventions that improve hydrological integrity, manage pest species and safeguard native vegetation, strengthen riparian buffers and minimise pollutant inflows to wetlands (see actions for DIN, fine sediment and pesticides), supported by site-based planning. • Assessing the feasibility of using constructed wetlands or treatment systems (such as recycle pits, swales, wetlands, vegetated drains, sediment basins and bioreactors) to improve water quality while maintaining natural wetland values across a range of land use activities. *Potential focus areas: Lower Daintree River* For guidance, refer to the goals, objectives and activities in the Reef 2050 Wetlands Strategy [B]	
	Marine ecosystems – seagrass *(*Moderate) and coral (Moderate)	Further investigate and develop interventions for seagrass and coral ecosystems following Cyclone Jasper and associated flooding in 2023,	

Regional objective: *Rehabilitate and sustain natural catchment processes, connectivity and ecosystem function in the Region that support healthy aquatic ecosystems, improve water quality outcomes, and deliver co-benefits such as biodiversity conservation, climate resilience, and enhanced landscape productivity.*			
DAINTREE **Basin-scale strategic management response**	**Natural Systems**	**Action Strategy** See specific stakeholder feedback for Daintree basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
		including seagrass habitats at Low Isles and inshore coral reefs in coastal areas including Snapper Island.	
	Connectivity (Fish barrier score is Good and overall habitat and hydrology score is Moderate) [C]	Support interventions to enhance hydrological connectivity and improve habitat linkage such as removing barriers to fish passage, and restoration and rehabilitation activities. Maintain areas where activities have already been completed. Evaluate the need for additional intervention options to support habitat function, taking into account proximity to high value areas. For guidance, refer to the goals, objectives and activities in the Reef 2050 Wetlands Strategy[B] (particularly *Theme 3: On-ground activities to protect, manage, rehabilitate and restore wetlands*).	

[A] Department of Environment and Science (2022); [B] Department of Environment, Science and Innovation (2023a); [C] Wet Tropics Waterways (2024)

4.2. Mossman Basin Water Quality Improvement Strategy

4.2.1. Basin context

The Mossman is the smallest basin in the Wet Tropics Region covering 477 km^2 and occupying a narrow stretch along the coast. The Mossman River is the major system in this basin with its headwaters rising on the Mount Carbine Tableland in the Great Dividing Range. The Mossman has an average rainfall of 2,109 mm per year and a long-term median river discharge of 605 gigalitres per year. Most of the catchment area is in conservation areas (73%), but there are areas of development along the narrow coastal plain. Sugarcane (9.3% of the catchment area) and grazing (5.5%) are the main agricultural land uses, and urban areas cover 5.3% of the basin, including the townships of Mossman and Port Douglas.

Historical native vegetation clearing and the loss and/or modification of natural freshwater floodplain wetlands are two landscape disturbance factors that may be influencing water quality in the Mossman. On floodplains, 85% of the native vegetation had been cleared by 2018, and 88% had been cleared from the riparian areas of freshwater floodplain wetlands. In addition, 97% of the Mossman's natural freshwater floodplain wetlands had been lost and/or modified by 2017, with only 3 hectares of natural unmodified wetlands remaining.

In terms of pollutants, the modelled total annual average loads from the Mossman are 74 tonnes of DIN and 15 kilotonnes of fine sediments. Sugarcane is the dominant source of DIN (50%) and urban areas and sewage treatment plants (STPs) account for around 11% of the remaining DIN exports. Fine sediment and particulate nutrient loads are relatively low compared to other Wet Tropics basins. The end-of-catchment pesticide risk ranges between Low and Moderate, with diuron and imidacloprid the largest contributors to the risk.

The condition of freshwater floodplain wetland condition is not monitored. Based on the 4 hectares of natural and slightly modified freshwater floodplain wetlands included in the hazard assessment, no mapped wetlands exposed to High or Very High nutrient or sediment hazards. However, half of the assessed freshwater floodplain wetlands are exposed to Moderate, High, or Very High pesticide hazard.

In 2022–23, coral reefs adjacent to the Mossman catchment were in Moderate condition and seagrass meadows are in Good condition however, these have declined in condition following Cyclone Jasper and associated flooding in 2023. The marine DIN exposure score is Moderate, which is a reflection of the anthropogenic DIN load and close proximity of coral reefs to the coast. Sediment exposure is Minimal due to the low anthropogenic fine sediment load. Pesticide exposure is Low.

4.2.2. Overall management response and focus areas

Based on the likelihood of pollutant exposure and ecosystem condition, a targeted management response is required across the Mossman basin, involving sustainable land use and natural systems repair. At the basin scale, this includes **Accelerated nutrient management** in targeted sub-catchment areas, along with localised **Proactive management of pesticides** to address emerging risks. This is supported by Foundational management of nutrient and pesticides in all remaining areas and broadscale **Foundational management of sediment** across the basin to maintain minimal sediment exposure levels.

As monitored wetland condition data are not available for the Mossman basin, further assessment is required to determine current condition, validation of pesticide hazards and appropriate management needs for freshwater floodplain wetlands. In response to the impacts from Cyclone Jasper and the associated flooding, investigation and development of interventions for seagrass and coral ecosystems may be required.

Stakeholder consultation emphasised the importance of restoring waterways, wetlands, and coastal areas to improve biodiversity and water quality, including opportunities for Blue Carbon. Agricultural transition and diversification were highlighted as priorities, with support for alternative cropping, demonstration sites, income diversification, and upskilling agronomy services to meet new demands. Finally, there was recognition of the need to expand ecosystem services and green industry opportunities, including workshops, innovative models such as oyster reefs, and planning scheme reviews to align land use with productivity.

The Mossman Sugar Mill was closed in 2024 with no economically viable alternatives identified at this stage. Whilst the Department of Primary Industries funded a transition program that explored many alternatives, the substantial establishment and set-up costs and delay in return on investment have meant there is no singular outstanding opportunity. For example, a large proportion of the land in the Mossman district is classified as Good Quality Agricultural Land (GQAL) and as an example, to change activity from farming to other uses such as planting trees for carbon sequestration is deemed a 'material change of use' and requires an extensive application process through Local and State governments. These costs are prohibitive for many landholders who now have little or no income. Current planning requirements also preclude engaging in environmental markets that may provide alternative income streams. In addition, there is a significant extent of this current GQAL at risk of inundation from predicted climate change impacts, potentially limiting future agricultural uses.

4.2.3. Mossman sustainable land use and management

***Table 9**. Mossman Sustainable land use & management Action and Delivery Strategies required to achieve Regional Objective 1. The Basin-scale Strategic management response aligns to the recommended Management Response for nutrients, fine sediment, and pesticides (Section 3.2.2). The Action Strategies are scaled according to the Management Response for each pollutant and ranked according to the pollutant's Dominant land use sources - the relative contributions of the basin's agricultural and non-agricultural land uses: DIN and fine sediment action strategies are ranked by the relative total annual loads of the top 'manageable' land use contributions (i.e. excludes conservation areas), and pesticide action strategies are ranked by the basin's highest land use areas and their potential (higher vs lower) for pesticide risk– see Section 3.2. Specific stakeholder feedback is described in further detail in Appendix 1. Strategies to support scaled delivery (Action Area III) are explained further in Section 4.9.*

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
MOSSMAN **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards.** See specific stakeholder feedback for Mossman basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Nutrients **Actively reduce *Moderate* DIN exposure on marine ecosystems through an *Accelerated* management response in targeted sub-catchments, including maintaining *Minimal* nutrient exposure in wetland hazard exposed areas through a *Foundational* management response.** *Primary focus is reducing DIN exported from sugarcane. Additional reductions could also be achieved through targeted interventions in urban areas including the townships of Mossman, Port Douglas and Cairns northern beaches, and point source loads. Increasing adoption of soil erosion management practices in grazing lands may also reduce DIN further. Foundational management of nutrients in all other areas to prevent future sources of nutrients, including land use areas upstream and surrounding wetlands.*	**Sugarcane** 4,436 ha (50% of total annual average DIN load)	Increase and sustain adoption levels of improved practices that reduce DIN export from sugarcane areas including farm nutrient management planning that includes accounting for nitrogen derived from legume rotation crops or mill mud application, and using Enhanced Efficiency Fertilisers at reduced application rates (where suitable), with complementary practices such improving drainage and use of soil ameliorants to address yield constraints. Note that if there is a transition of sugarcane to other crops as a result of the mill closure, it is highly likely these other crops will still require agronomic management and support.	Deliver coordinated and integrated programs that accelerate sustained adoption of target basin-scale management responses, tailored to local socio-economic and cultural contexts, land use types, and land managers' capacity, opportunities, and motivations, including: • Capacity, skills and expertise
	Urban + STP 2,550 ha (11% of total annual average DIN load)	Encourage and support adoption of improved practices that reduce DIN export in stormwater runoff and point source discharges through strategically located stormwater treatment interventions including treatment trains (e.g. constructed wetlands, biofilters, vegetated swales, riparian vegetation restoration) and by improving treatment efficiency and encourage wastewater reuse where appropriate. Identify and manage potential risks from nutrient discharge in unsewered areas.	

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
MOSSMAN **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards.** See specific stakeholder feedback for Mossman basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
	Grazing 2,645 ha (5.5% of total annual average DIN load)[B]	Encourage and support adoption of improved practices that reduce DIN export through reducing sediment runoff in grazing. *[This action is a co-benefit of sediment erosion management actions – refer below]*	• Social norms and trust development • Decision support • Incentives and markets • Technology and equipment *See example interventions in Section 4.9.*
Sediment **Maintain *Minimal* fine sediment exposure on marine and freshwater floodplain wetland ecosystems through a *Foundational* management response across all land uses within the basin that maintains minimum standards and fosters awareness and uptake of improved practices for the future.** *Primary focus is on fostering sustainable practices in sugarcane, grazing and urban areas, including land use areas upstream and surrounding wetlands.*	**Sugarcane** 4,436 ha (19% of total annual average sediment load)	Encourage adoption of improved practices that reduce sediment erosion in sugarcane, including using fallow crops and trash blanketing, minimal/zero tillage, controlled traffic practices, maintaining vegetated spoon drains, and buffers and strategically located sediment traps. Note that if there is a transition of sugarcane to other crops as a result of the mill closure, it is highly likely these other crops will still require agronomic management and support.	
	Grazing 2,645 ha (4.7% of total annual average sediment load)	Encourage adoption of improved practices to reduce sediment erosion including matching stocking rates to carrying capacity and complementary practices such as managing linear features and frontage country.	
	Urban 2,550 ha (4.0% of total annual average DIN load)	Encourage adoption of actions to address emerging sediment issues in stormwater runoff through erosion and sediment control (particularly in developing areas), strategically located stormwater treatment interventions including treatment trains (e.g. constructed wetlands, biofilters, vegetated swales, riparian vegetation restoration), riparian vegetation restoration (see also *Natural Systems Repair actions*), and improved practices for road construction.	

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
MOSSMAN **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards.** See specific stakeholder feedback for Mossman basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Pesticides **Actively reduce pesticide exposure on freshwater floodplain wetlands through an Intensive management response in wetland hazard exposed areas, while applying a *Proactive* management response in localised areas to address emerging pesticide issues in the basin.** *Focus is on land use areas upstream and surrounding wetlands, and fostering sustainable practices more broadly in irrigated cropping, horticulture, sugarcane, bananas, and non-agricultural areas (urban and forestry). Validate the wetland pesticide hazard assessment and where required, implement appropriate management for wetlands in hazard exposed areas.*	**Sugarcane** 4,436 ha (9.3% of basin area and a higher potential for pesticide risk)	Encourage and support adoption of practices that minimise pesticide risk from sugarcane including following label conditions, reducing overall pesticide application rates (within label recommendations), adopting banded spraying, switching to lower risk products, optimising application timing relative to rainfall, managing point sources and adopting integrated pest management holistically across the basin. Note that if there is a transition of sugarcane to other crops as a result of the mill closure, it is highly likely these other crops will still require agronomic management and support.	
	Horticulture, bananas, irrigated cropping and dryland cropping 86 ha (<1% of basin area and a higher potential for pesticide risk)	Encourage adoption of improved practices that minimise pesticide risk from horticulture, bananas, irrigated and dryland cropping, including integrated pest and disease management approaches, including adherence to label requirements, reduction of overall pesticide application rates within label recommendations, careful product selection, optimised timing of applications, use of precision application technologies, and effective resistance management strategies.	
	Non-agriculture (urban and forestry) 2,585 ha (5.4% of basin area and lower potential for pesticide risk)	Encourage adoption of improved practices that minimise pesticide risk from non-agricultural land uses including following label conditions, product selection, rate, timing of application, and improved wastewater treatment processes.	

[A] Loads are presented as the Total Annual Average, not the Anthropogenic Load. Data is unavailable to determine quantified land use contributions to pesticide risk, rather the land use's relative potential for pesticide risk is noted along with the proportion of the basin the land use occupies.

[B] DIN load from grazing is primarily linked with sediment erosion and therefore is treated as a co-benefit of sediment reduction actions. For this reason, grazing sources of DIN are acknowledged but ranked lower in the table.

4.2.4. Mossman natural systems repair

***Table 10**. **Mossman** Natural Systems Repair Action and Delivery Strategies required to achieve Regional Objective 2. The **Basin-scale Strategic management response** aligns to the recommended pollutant Management Response levels and ecosystem condition assessments. The **Action Strategies** target natural system drivers of water quality risks (streambank and gully erosion[1], vegetation and wetland loss[2]) and the condition of ecosystems[3] (freshwater floodplain wetlands, seagrass, coral, and ecosystem connectivity). [1]Streambank and gully action strategies are ranked and scaled based on their contributions to the basin's sediment load. [2] Vegetation loss and wetland loss/or modification action strategies are scaled based on % losses and identified hotspot areas. [3] Ecosystem condition action strategies are based on ecosystem condition ratings – poor, moderate or good. Specific stakeholder feedback is described in further detail in Appendix 1. Strategies to support scaled delivery (Action Area III) are explained further in Section 4.9.*

Regional objective: *Rehabilitate and sustain natural catchment processes, connectivity and ecosystem function in the Region that support healthy aquatic ecosystems, improve water quality outcomes, and deliver co-benefits such as biodiversity conservation, climate resilience, and enhanced landscape productivity.*			
MOSSMAN **Basin-scale strategic management response**	**Natural Systems**	**Action Strategy** See specific stakeholder feedback for Mossman basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Actively rehabilitate natural systems in targeted and strategic locations to improve natural system processes for water quality outcomes and improve ecosystem condition.	**Streambank rehabilitation** (33% sediment load contribution)	Rehabilitate, protect and maintain streambanks in prioritised locations, including areas damaged by Cyclone Jasper in 2023, through revegetation of riparian areas and where required, structural and engineered interventions. *[These actions are complementary to Sustainable Land use and Management actions for sediment reduction]* For guidance, refer to the Queensland River Rehabilitation Management (QRRM) Guideline[A].	Deliver coordinated and targeted natural systems and ecosystem rehabilitation programs that accelerates lasting restoration outcomes, tailored to local ecological contexts, and the capacity, opportunities, and motivation of diverse stakeholder groups (including landholders and land managers, community groups, and government agencies), including: • Capacity, skills and expertise • Incentives and markets • Decision support • Technology and equipment
	Native vegetation clearing (22%), **Riparian vegetation clearing** (16%), and **Natural freshwater floodplain wetland modification and/or loss** (97%)	Protect and maintain natural vegetation and wetland areas and prevent loss and/or modification through promoting awareness of regulatory standards for vegetation clearing and other co-benefits. Establish and maintain buffer zones and undertake weed control in riparian areas of waterways and wetlands areas. Implement feral animal control in strategic locations. Support actions and encourage incentives (e.g. environmental markets) to increase revegetation and wetland rehabilitation at strategic locations in the landscape that improve connectivity, water quality and ecosystem service functions. Maintenance of rehabilitation activities is essential.	

Regional objective: *Rehabilitate and sustain natural catchment processes, connectivity and ecosystem function in the Region that support healthy aquatic ecosystems, improve water quality outcomes, and deliver co-benefits such as biodiversity conservation, climate resilience, and enhanced landscape productivity.*			
MOSSMAN **Basin-scale strategic management response**	**Natural Systems**	**Action Strategy** See specific stakeholder feedback for Mossman basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
		For guidance, refer to the goals, objectives and activities in the Reef 2050 Wetlands Strategy[B] (particularly *Theme 3: On-ground activities to protect, manage, rehabilitate and restore wetlands*) and Queensland River Rehabilitation Management (QRRM) Guideline.	*See example interventions in Section 4.9 of the Strategy.*
	Wetlands *3% (3 ha) remaining of natural unmodified freshwater floodplain wetlands* *(with no wetland aggregations currently monitored)* *Minimal exposure from nutrients, sediments and High exposure from pesticides*	Survey wetland condition and validate wetland pesticide hazard assessments and where required, apply appropriate management response. This may include coordinating interventions and activities to enhance wetland values, condition, and water quality improvement and ecosystem service functions, for example: • Interventions that improve hydrological integrity, manage pest species and safeguard native vegetation, strengthen riparian buffers and minimise pollutant inflows to wetlands (see actions for DIN, fine sediment and pesticides), supported by site-based planning. For guidance, refer to the goals, objectives and activities in the Reef 2050 Wetlands Strategy[B]	
	Marine ecosystems – seagrass *(*Good) and coral (Moderate)	Further investigate and develop interventions for seagrass and coral ecosystems following declines in condition from Cyclone Jasper and associated flooding in 2023, including seagrass habitats at Low Isles and inshore coral reefs in coastal areas including Snapper Island.	
	Connectivity	Support interventions to enhance hydrological connectivity and improve habitat linkage such as removing barriers to fish passage, and restoration and rehabilitation activities. Maintain areas where activities have already been completed. Evaluate the need for additional intervention options to support habitat function, taking into account proximity to high value areas. For guidance, refer to the goals, objectives and activities in the Reef 2050 Wetlands Strategy[B] (particularly *Theme 3: On-ground activities to protect, manage, rehabilitate and restore wetlands*).	

[A] Department of Environment and Science (2022); [B] Department of Environment, Science and Innovation (2023a).

4.3. Barron Basin Water Quality Improvement Strategy

4.3.1. Basin context

The Barron is in the central section of the Wet Tropics Region and covers 2,188 km^2. The basin has an average rainfall of 1,442 mm and a long-term median river discharge of 622 gigalitres per year. Most of the basin's land area is inland, and there is only a small coastal fringe. It is divided into two main areas, the upper reaches in the Atherton Tablelands above the Barron Falls, and the lower reaches in the narrow coastal plain. The lower reaches of the Barron River consist principally of urban and agricultural areas including grazing (31% of the catchment area), urban (6.1%), sugarcane (3.9%), irrigated cropping (3.4%) and horticulture (3.0%). The basin also contains smaller areas used for bananas, dairy farming and dryland cropping.

Native vegetation clearing and the loss and/or modification of natural freshwater floodplain wetlands are two landscape disturbance factors that may be influencing water quality in the Barron. By 2018, 36% of the Barron's native vegetation had been cleared, with higher vegetation clearing on floodplains (56%), and freshwater floodplain wetland riparian areas (82% cleared). By 2017, 87% of the original natural freshwater floodplain wetlands had been lost and/or modified.

In terms of pollutants, the modelled total annual average loads from the Barron are 117 tonnes of DIN and 141 kilotonnes of fine sediments. Urban areas and sewage treatment plants (STPs) contribute 42% of the DIN load, followed by conservation areas (13%) with diffuse dissolved and point source the main loss pathways. Streambank and grazing areas are the main sources of fine sediments (74%), with horticulture, forestry, and irrigated cropping contributing to a lesser extent. Streambank erosion is the dominant transport pathway (54%) followed by hillslope erosion (44%). The end-of-catchment pesticide risk is Very Low.

The condition of freshwater floodplain wetlands is not monitored. Based on the 150 hectares of natural and slightly modified freshwater floodplain wetlands included in the hazard assessment, 32% are exposed to High or Very High nutrient hazard, 33% are exposed to High or Very High sediment hazard, and 48% are exposed to Moderate, High, or Very High pesticide hazard.

In 2022–23, coral reefs adjacent to the Barron basin were in Moderate condition and seagrass meadows were in Good condition. The marine DIN exposure score is Moderate, reflecting the anthropogenic DIN load and northern extent of the river footprint. Sediment exposure is also Moderate, reflecting the anthropogenic fine sediment load and relatively large area of seagrass meadows in the higher exposure categories. Pesticide exposure is Minimal.

4.3.2. Overall management response and focus areas

Based on the likelihood of pollutant exposure and ecosystem condition, a coordinated management response is required across the Barron basin. At the basin scale, this includes **Accelerated management of nutrients and sediment** in targeted sub-catchment areas, supported by Foundational nutrient and sediment management in all remaining areas, and broadscale **Foundational management of pesticides** across the basin to maintain Minimal pesticide exposure into the future.

As monitored wetland condition data are not available for the Barron basin, further assessment is required to determine current condition, validation of nutrient sediment and pesticide hazards and, where required, appropriate management needs for freshwater floodplain wetlands in hazard exposed areas. In response to the impacts from Cyclone Jasper and the associated flooding, investigation and development of interventions for seagrass and coral ecosystems may be required.

In the Lower Barron, stakeholder consultation stressed the need to address streambank erosion, sediment impacts on cultural values, and water quality issues from residential land uses, while controlling feral cattle and pigs in sensitive areas. Improving fish habitat connectivity and protecting mangroves were highlighted as key ecosystem priorities. Strong calls were made for better governance

through improved coordination, enforcement, and Indigenous-led catchment management. Planning feedback emphasised integrated, landscape-scale approaches that respect community values, incorporate climate adaptation, and treat Trinity Catchment independently. Infrastructure upgrades, particularly sewage pump stations, were identified as essential to safeguard water quality.

In the Upper Barron, stakeholder consultation highlighted the need to build local research and education capacity, including graduate programs, certified courses, and employment pathways to reduce reliance on volunteers. Extension services were identified as critical, with calls to expand support for beef producers, small growers, and graziers, alongside improved access to soil conservation expertise. Farming practices should shift focus toward soil health, regenerative systems, and integrated pest management, supported by stronger monitoring and new market opportunities. Catchment planning feedback emphasised better coordination, hydrological mapping, and development of a whole-of-catchment plan for the Barron. Integrating carbon opportunities into farming and planning was seen as a priority, while restoration and regulation efforts should expand waterway rehabilitation and strengthen enforcement to protect catchment health.

4.3.3. Barron sustainable land use and management

Table 11. Barron *Sustainable land use & management Action and Delivery Strategies required to achieve Regional Objective 1. The* ***Basin-scale Strategic management response*** *aligns to the recommended Management Response for nutrients, fine sediment, and pesticides (Section 3.2.2). The* ***Action Strategies*** *are scaled according to the Management Response for each pollutant and ranked according to the pollutant's* ***Dominant land use sources*** *- the relative contributions of the basin's agricultural and non-agricultural land uses: DIN and fine sediment action strategies are ranked by the relative total annual loads of the top 'manageable' land use contributions (i.e. excludes conservation areas), and pesticide action strategies are ranked by the basin's highest land use areas and their potential (higher vs lower) for pesticide risk– see Section 3.2. Specific stakeholder feedback is described in further detail in Appendix 1. Strategies to support scaled delivery (Action Area III) are explained further in Section 4.9.*

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
BARRON **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards.** See specific stakeholder feedback for Barron basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Nutrients **Actively reduce *Moderate* DIN exposure on marine ecosystems through an *Accelerated* management response in targeted sub-catchments, including Intensive management of nutrients in wetland hazard exposed areas.** *Primary focus is reducing DIN exported in point source and from urban areas including Cairns and northern beaches, Kuranda and towns in the Atherton Tablelands including Atherton, Mareeba and Malanda. Additional reductions could also be achieved through targeted interventions in bananas, horticulture and sugarcane. Management includes a focus on nutrients in land use areas upstream and surrounding wetlands.*	**Urban + STP** 13,457 ha (42% of total annual average DIN load)	Increase and sustain adoption levels of improved practices that reduce DIN export in point source discharge and stormwater runoff through sewage treatment plant (STP) upgrades, increasing reuse and efficiencies in sewage system management, and strategically located stormwater treatment interventions including maintenance and enhancement of natural assets to mitigate runoff, and treatment trains (e.g. constructed wetlands, biofilters, vegetated swales, riparian vegetation restoration). Identify and manage potential risks from nutrient discharge in unsewered areas.	Deliver coordinated and integrated programs that accelerate sustained adoption of target basin-scale management responses, tailored to local socio-economic and cultural contexts, land use types, and land managers' capacity, opportunities, and motivations, including: • Capacity, skills and expertise
	Bananas 1,960 ha (9.7% of total annual average DIN load)*	Encourage and support the adoption of best-practice management to reduce DIN export from banana production by developing and implementing Nutrient Management Plans that align fertiliser application with crop demand (informed and adjusted with soil and leaf testing), improving application efficiency through targeted placement, optimising the timing of nutrient inputs via fertigation, maintaining inter-row groundcover, and upgrading on-farm infrastructure to support improved practice nutrient application.	

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
BARRON **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards.** See specific stakeholder feedback for Barron basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Foundational management of nutrients in all other areas to prevent future sources of nutrients.	**Horticulture** 6,503 ha (6.8% of total annual average DIN load)	Encourage and support adoption levels of improved practices that reduce DIN export from horticulture areas including nutrient budgeting and recording supported by leaf, sap and soil testing, and selection of fertiliser application methods in accordance with local weather conditions.	• Social norms and trust development • Decision support • Incentives and markets • Technology and equipment *See example interventions in Section 4.9.*
	Sugarcane 8,489 ha (3.6% of total annual average DIN load)	Encourage adoption levels of improved practices that reduce DIN export from sugarcane areas including farm nutrient management planning that includes accounting for nitrogen derived from legume rotation crops or mill mud application, and using Enhanced Efficiency Fertilisers at reduced application rates (where suitable), with complementary practices such improving drainage and use of soil ameliorants to address yield constraints.	
Sediment **Actively reduce *Moderate* sediment exposure on marine ecosystems through an *Accelerated* management response in targeted sub-catchments, including Intensive management of sediment in wetland hazard exposed areas.** *Primary focus is on managing riparian zones. Additional reductions could also be achieved through grazing, and smaller reductions through horticulture and irrigated cropping. Management includes a focus on areas upstream and surrounding wetlands.*	**Streambank** (54% of total annual average sediment load)	Increase and sustain adoption of improved management practices in riparian zones that stabilise and protect frontage country including riparian fencing/excluding cattle from streambank access, managing weeds and pests including feral animals, and revegetation in riparian zones. *[These actions are complementary to Natural Systems Repair actions]*	
	Grazing 68,074 ha (20% of total annual average sediment load)	Encourage and support adoption of improved practices to reduce sediment erosion including matching stocking rates to carrying capacity and complementary practices such as managing linear features and managing frontage country (see Streambank).	

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
BARRON **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards.** See specific stakeholder feedback for Barron basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Foundational management of sediments in all other areas to prevent future sources of sediments.	**Horticulture and irrigated cropping** 13,837 ha (6.5% of total annual average sediment load)	Encourage adoption of practices that reduce sediment erosion in horticulture areas including improving fallow and inter-row management to retain groundcover, managing headlands and drainage to minimise runoff and erosion, and installation of strategically located sediment traps.	
Pesticides **Actively reduce pesticide exposure on freshwater floodplain wetlands through an Intensive management response in wetland hazard exposed areas, while maintaining minimal pesticide exposure on marine ecosystems through a *Foundational* management response.** *Focus is on land use areas upstream and surrounding wetlands, and fostering sustainable practices more broadly in areas irrigated cropping, horticulture, sugarcane, bananas, and non-agricultural areas (urban and forestry).*	**Irrigated cropping and Horticulture** 13,837 ha (6.3% of basin area and a higher potential for pesticide risk)	Encourage adoption of improved practices that minimise pesticide risk from horticulture and irrigated cropping, including following label conditions, reducing overall pesticide application rates (within label recommendations), product selection, timing of application, precision technologies and integrated pest management.	
	Sugarcane 8,489 ha (3.9% of basin area and a higher potential for pesticide risk)	Encourage adoption of practices that minimise pesticide risk from sugarcane including following label conditions, reducing overall pesticide application rates (within label recommendations), adopting banded spraying, switching to lower risk products, optimising application timing relative to rainfall, managing point sources and adopting integrated pest management holistically across the basin.	
	Bananas 1,960 ha* (1.1% of basin area and a higher potential for pesticide risk)	Encourage adoption of improved practices to minimise pesticide risks from banana production through the implementation of integrated pest and disease management approaches, including adherence to label requirements, reduction of overall pesticide application rates within label	

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
BARRON **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards.** See specific stakeholder feedback for Barron basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
		recommendations, careful product selection, optimised timing of applications, use of precision application technologies, and effective resistance management strategies.	
	Non-agriculture (urban and forestry) 7,554 ha (4% of basin area and lower potential for pesticide risk)	Encourage adoption of improved practices that minimise pesticide risk from non-agricultural land uses including following label conditions, product selection, rate, timing of application, and improved wastewater treatment processes.	

[A] Loads are presented as the Total Annual Average, not the Anthropogenic Load. Data is unavailable to determine quantified land use contributions to pesticide risk, rather the land use's relative potential for pesticide risk is noted along with the proportion of the basin the land use occupies. *It should be noted that banana production area in the basin has decreased since 2021 (Australian Banana Growers' Council, 2025), and as a result there is lower confidence in the modelled load estimates.

4.3.4. Barron natural systems repair

***Table 12**. **Barron** Natural Systems Repair Action and Delivery Strategies required to achieve Regional Objective 2. The **Basin-scale Strategic management response** aligns to the recommended pollutant Management Response levels and ecosystem condition assessments. The **Action Strategies** target natural system drivers of water quality risks (streambank and gully erosion[1], vegetation and wetland loss[2]) and the condition of ecosystems[3] (freshwater floodplain wetlands, seagrass, coral, and ecosystem connectivity). [1]Streambank and gully action strategies are ranked and scaled based on their contributions to the basin's sediment load. [2] Vegetation loss and wetland loss/or modification action strategies are scaled based on % losses and identified hotspot areas. [3] Ecosystem condition action strategies are based on ecosystem condition ratings – poor, moderate or good. Specific stakeholder feedback is described in further detail in Appendix 1. Strategies to support scaled delivery (Action Area III) are explained further in Section 4.9.*

Regional objective: *Rehabilitate and sustain natural catchment processes, connectivity and ecosystem function in the Region that support healthy aquatic ecosystems, improve water quality outcomes, and deliver co-benefits such as biodiversity conservation, climate resilience, and enhanced landscape productivity.*			
BARRON **Basin-scale strategic management response**	**Natural Systems**	**Action Strategy** See specific stakeholder feedback for Barron basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Actively repair and rehabilitate natural systems in targeted and strategic locations to improve natural system processes for water quality outcomes and improve ecosystem condition.	**Streambank rehabilitation** (54% sediment load contribution)	Rehabilitate, protect and maintain streambanks in priority locations through revegetation of riparian areas, and structural and engineered interventions for bank stabilisation, such as rock protection or rock armouring, timber pile fields, log fillets and rock groynes. *[These actions are complementary to Sustainable Land use and Management actions for sediment reduction]* For guidance, refer to the Queensland River Rehabilitation Management (QRRM) Guideline[A]	Deliver coordinated and targeted natural systems and ecosystem rehabilitation programs that accelerates lasting restoration outcomes, tailored to local ecological contexts, and the capacity, opportunities, and motivation of diverse stakeholder groups (including landholders and land managers, community groups, and government agencies), including: • Capacity, skills and expertise • Incentives and markets • Decision support
	Native vegetation clearing (36%), **Riparian vegetation clearing** (22%), and **Natural freshwater floodplain wetland modification and/or loss** (87%)	Actively reduce wetland loss and/or modification and vegetation clearing through promoting awareness of regulatory standards for vegetation clearing and other co-benefits. Establish and maintain buffer zones and undertake weed control in riparian areas of waterways and wetlands areas. Implement feral animal control in strategic locations. Support actions and encourage incentives (e.g. environmental markets) to increase revegetation and wetland rehabilitation at strategic locations in the landscape that improve connectivity, water quality and ecosystem service functions. Maintenance of rehabilitation activities is essential. For guidance, refer to the goals, objectives and activities in the Reef 2050 Wetlands Strategy[B] (particularly *Theme 3: On-ground activities to protect, manage, rehabilitate and restore wetlands*) and Queensland River Rehabilitation Management (QRRM) Guideline[A].	

Regional objective: *Rehabilitate and sustain natural catchment processes, connectivity and ecosystem function in the Region that support healthy aquatic ecosystems, improve water quality outcomes, and deliver co-benefits such as biodiversity conservation, climate resilience, and enhanced landscape productivity.*			
BARRON **Basin-scale strategic management response**	**Natural Systems**	**Action Strategy** See specific stakeholder feedback for Barron basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
	Wetlands (*no monitored wetland aggregations*) *High exposure from nutrients, sediments and pesticides*	Survey wetland condition and where required, apply appropriate management response. This may include coordinating interventions and activities to enhance wetland values, condition, and water quality improvement and ecosystem service functions, for example: • Interventions that improve hydrological integrity, manage pest species and safeguard native vegetation, strengthen riparian buffers and minimise pollutant inflows to wetlands (see actions for DIN, fine sediment and pesticides), supported by site-based planning. • Assessing the feasibility of using constructed wetlands or treatment systems (such as recycle pits, swales, wetlands, vegetated drains, sediment basins and bioreactors) to improve water quality while maintaining natural wetland values across a range of land use activities. For guidance, refer to the goals, objectives and activities in the Reef 2050 Wetlands Strategy [B]	• Technology and equipment *See example interventions in Section 4.9.*
	Marine ecosystems – seagrass *(*Moderate) and coral (Moderate)	Further assess seagrass and coral condition to understand the role of pollutant impacts and actively manage other drivers of their condition. Prioritise monitoring and assessment of seagrass habitats in identified pollutant exposure hotspots, including Trinity Bay and Yule Point.	
	Connectivity	Support interventions to enhance hydrological connectivity and improve habitat linkage such as removing barriers to fish passage, and restoration and rehabilitation activities. Maintain areas where activities have already been completed. Evaluate the need for additional intervention options to support habitat function, taking into account proximity to high value areas such as the Trinity Inlet, Half Moon Creek, Yorkeys Creek, Barr Creek Fish Habitat Areas. For guidance, refer to the goals, objectives and activities in the Reef 2050 Wetlands Strategy[B] (particularly *Theme 3: On-ground activities to protect, manage, rehabilitate and restore wetlands*).	

[A] Department of Environment and Science (2022); [B] Department of Environment, Science and Innovation (2023a).

4.4. Mulgrave-Russell Basin Water Quality Improvement Strategy

4.4.1. Basin context

The Mulgrave-Russell is located along the coastal plain south of Cairns and covers 1,975 km^2. The catchment is divided into two major sub-catchments that join together very close to the coast, the Mulgrave River in the north and the Russell River in the south. There are also several smaller creeks that flow into Trinity Inlet or directly to the coast. The basin has an average rainfall of 3,239 mm per year, the highest across the GBR basins, and the third highest long-term median river discharge of 4,223 gigalitres per year. Most of the catchment is in conservation areas (71%), with the floodplains dominated by sugarcane (12% of the catchment area). The city of Cairns which is the largest population centre in the Wet Tropics Region is found in the northern part of the Mulgrave-Russell. While the catchments have many similarities and are combined for reporting purposes in the Paddock to Reef program, they are typically considered individually for management and program delivery.

Historical native vegetation clearing on floodplains and the loss and/or modification of natural freshwater floodplain wetlands are two landscape disturbance factors that may be influencing water quality in the Mulgrave-Russell. By 2018, 72% of the Mulgrave-Russell's floodplain vegetation had been cleared, and 45% of its natural freshwater floodplain wetlands had been lost and/or modified by 2017. In addition, the long-term mean late dry season groundcover (1987 to 2022) is 76% and fluctuates around the optimal 70–75% threshold for erosion protection.

In terms of pollutants, the modelled total annual average loads from the Mulgrave-Russell are 605 tonnes of DIN and 92 kilotonnes of fine sediments. It is the sixth largest exporter of DIN to the GBR, contributing 6.5% of the total load, and the dominant anthropogenic sources are sugarcane (50%) and bananas (10%). Conservation (34%), streambank (33%), sugarcane (15%) and grazing (7.6%) areas are the main sources of fine sediments, most of which is transported via hillslope erosion (66%) and streambank erosion (33%). Pesticide risk is Low to Moderate, and diuron is the biggest contributor to the risk.

Freshwater floodplain wetlands are in Moderate condition and face pressures including native vegetation clearing which has altered surface water flow, sediment inputs, and pest species. Based on the 7,470 hectares of natural and slightly modified freshwater floodplain wetlands included in the hazard assessment, less than 1% are exposed to High or Very High nutrient or sediment hazard. However, 25% are the area is exposed to Moderate, High, or Very High pesticide hazard.

In 2022–23, coral reefs and seagrass meadows adjacent to the Mulgrave-Russell catchment were in Moderate condition however, these have declined in condition following the flood events of 2025. The marine DIN exposure score is Moderate, which reflects the anthropogenic DIN load and proximity of coral reefs to the coast. Sediment exposure is Low, reflecting the relatively low anthropogenic fine sediment load. Pesticide exposure is Moderate.

4.4.2. Overall management response and focus areas

Based on the likelihood of pollutant exposure and ecosystem condition, a coordinated management response is required across the Mulgrave-Russell basin, involving sustainable land use and natural systems repair. At the basin scale, this includes **Accelerated management of nutrients and pesticides** across multiple land uses in targeted sub-catchment areas, in addition to localised **Proactive management of sediments** where emerging risks occur. Broadscale Foundational management of all pollutants is required in all remaining areas of the basin.

Complementary to the basin-wide response, freshwater floodplain wetland hazard-exposed areas require intensive management of pesticides, proactive management of sediment and validation of the proactive management response for nutrients. As freshwater wetlands are in Moderate condition, further assess the influence of pollutants and other pressures on wetlands, and implement

interventions to prevent further decline and enhance wetland values, condition, water quality and ecosystem services.

Following declines in seagrass and coral condition from the 2025 flooding, an evaluation of the need and feasibility of intervention options to support ecosystem recovery or rehabilitation is required, particularly in the Frankland Island Group and High Island.

In the Mulgrave catchment, stakeholder consultation emphasised the need to maintain industry viability, expand agronomic expertise and equipment access, and improve soil health practices while supporting succession planning. Sediment sources, erosion, sand extraction and pest and feral animal control were identified as key water quality issues, alongside the need for stronger disaster resilience and proactive management. Restoration priorities included wetland remediation, mapping of riparian areas, and revegetation to mitigate erosion. Stakeholders emphasised the need for integrated, whole-of-catchment planning to balance water extraction, environmental needs, and cultural perspectives, supported by hydrology studies, review of environmental flow standards, and monitoring. Finally, innovation and long-term stewardship were seen as critical, with support for ecosystem service education, green industry models, ongoing funding, and demonstration sites to drive diversification.

In the Russell catchment, whole-of-farm planning and drainage management were seen as critical needs, including improved soil health practices such as the use of lime as a soil ameliorant and long-term maintenance of vegetated drains. Stakeholders highlighted the importance of strengthening aquatic ecosystem health through an integrated whole of system approach, incorporating Traditional Owner knowledge and continuing and expanding local-scale water quality monitoring. Restoration priorities included revegetation of riparian areas, wetland reinstatement and vegetation of existing drainage networks. The need for stronger collaboration among delivery partners, growers and industry bodies, more efficient use of resources including better access to shared equipment. Other issues included integrated pig management, invasive species control including tilapia, sewage treatment plant upgrades and managing sand buildup in coastal areas.

A *Russell River Catchment and Seascape Sustainability Plan – Building community and environmental resilience through a whole-of-system, values-based approach* has been developed through a collaboration between the Queensland Government Wetlands Program, Jaragun EcoServices and multiple government and non-government contributors. It serves as a comprehensive demonstration of integrated catchment planning, using a Whole-of-System, Values-Based Framework, which is the underpinning framework of the Reef 2050 Wetland Strategy. The Russell Plan aims to sustain the biodiversity, economic, cultural, and social values of the Russell River catchment, its coastline, islands, offshore reefs, and ecosystems. It aligns and integrates with the Reef 2050 CWQS, GBR-wide SMP and this Strategy. The Russell Plan is part of a series of four nested documents and has been designed to be updated as new knowledge emerges, priorities evolve, and funding becomes available. The documents include the Russell Plan, and:

- The Technical Report, which synthesises available scientific, traditional ecological knowledge and anecdotal evidence for the catchment.
- Detailed ecosystem services tables outlining necessary actions to reduce pressures on the catchment's systems and processes.
- Future investment strategy that outlines how the actions highlighted in the ecosystem services tables will be funded and implemented.

4.4.3. Mulgrave-Russell sustainable land use and management

Table 13. Mulgrave-Russell *Sustainable land use & management Action and Delivery Strategies required to achieve Regional Objective 1. The* ***Basin-scale Strategic management response*** *aligns to the recommended Management Response for nutrients, fine sediment, and pesticides (Section 3.2.2). The* ***Action Strategies*** *are scaled according to the Management Response for each pollutant and ranked according to the pollutant's* ***Dominant land use sources*** *- the relative contributions of the basin's agricultural and non-agricultural land uses: DIN and fine sediment action strategies are ranked by the relative total annual loads of the top 'manageable' land use contributions (i.e. excludes conservation areas), and pesticide action strategies are ranked by the basin's highest land use areas and their potential (higher vs lower) for pesticide risk– see Section 3.2. Specific stakeholder feedback is described in further detail in Appendix 1. Strategies to support scaled delivery (Action Area III) are explained further in Section 4.9.*

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
MULGRAVE-RUSSELL **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load / or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards and should be coordinated with the Russell Plan's Investment Priorities.** See specific stakeholder feedback for Mulgrave-Russell basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Nutrients **Actively reduce *Moderate* DIN exposure on marine ecosystems through an *Accelerated* management response in targeted sub-catchments, including management of nutrients in wetland hazard exposed areas.** *Primary focus is reducing DIN exported from sugarcane and bananas. Additional reductions could also be achieved through targeted interventions in urban areas such as Cairns and Babinda and point source loads. Increasing adoption of soil erosion management practices in grazing lands may also reduce DIN further. Validate the wetland nutrient hazard assessment and where required, implement appropriate management for wetlands in hazard exposed areas.*	**Sugarcane** 23,177 ha (50% of total annual average DIN load)	Increase and sustain adoption levels of improved practices that reduce DIN export from sugarcane areas including farm nutrient management planning that includes accounting for nitrogen derived from legume rotation crops or mill mud application, and using Enhanced Efficiency Fertilisers at reduced application rates (where suitable), with complementary practices such improving drainage and use of soil ameliorants (e.g. lime) to address yield constraints.	Deliver coordinated and integrated programs that accelerate sustained adoption of target basin-scale management responses, tailored to local socio-economic and cultural contexts, land use types, and land managers' capacity, opportunities, and motivations, including: • Capacity, skills and expertise
	Bananas 807 ha (10% of total annual average DIN load)*	Increase and sustain the adoption of best-practice management to reduce DIN export from banana production by developing and implementing Nutrient Management Plans that align fertiliser application with crop demand (informed and adjusted with soil and leaf testing), improving application efficiency through targeted placement, optimising the timing of nutrient inputs via fertigation, maintaining inter-row groundcover, and upgrading on-farm infrastructure to support improved practice nutrient application.	
	Urban + STP 6,883 ha	Encourage and support adoption of actions to reduce DIN in point source discharge and stormwater runoff through sewage treatment plant (STP) upgrades, increased reuse and	

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
MULGRAVE-RUSSELL **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load / or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards and should be coordinated with the Russell Plan's Investment Priorities.** See specific stakeholder feedback for Mulgrave-Russell basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Foundational management of nutrients in all other areas to prevent future sources of nutrients.	(5.8% of total annual average DIN load)	efficiencies in sewage system management where appropriate, and strategically located stormwater treatment interventions including maintenance and enhancement of natural assets to mitigate runoff, and treatment trains (e.g. constructed wetlands, biofilters, vegetated swales, riparian vegetation restoration). Identify and manage potential risks from nutrient discharge in unsewered areas.	• Social norms and trust development • Decision support • Incentives and markets • Technology and equipment *See example interventions in Section 4.9.*
	Grazing 11,128 ha (5.5% of total annual average DIN load)[B]	Encourage and support adoption of improved practices that reduce DIN export through reducing sediment runoff in grazing. *[This action is a co-benefit of sediment erosion management actions – refer below]*	
Sediment **Proactively manage local sediment sources to prevent emerging exposure risks to marine ecosystems, including *Proactive* management of sediment in wetland hazard exposed areas.** *Focus is on managing riparian zones with supplementary actions in sugarcane and grazing, and land use areas upstream and surrounding wetlands.*	**Streambank** (33% of total annual average sediment load)	Encourage and support adoption of improved management practices in riparian zones that stabilise and protect frontage country including riparian fencing/excluding cattle from streambank access, managing weeds and pests including feral animals, and revegetation in riparian zones. *[These actions are complementary to Natural Systems Repair actions]*	
	Sugarcane 23,177 ha (15% of total annual average sediment load)	Encourage adoption of improved practices that reduce sediment erosion in sugarcane, including using fallow crops and trash blanketing, minimal/zero tillage, controlled traffic practices, installing vegetated spoon drains, revegetation of drains and buffers and strategically located sediment traps.	

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
MULGRAVE-RUSSELL **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load / or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards and should be coordinated with the Russell Plan's Investment Priorities.** See specific stakeholder feedback for Mulgrave-Russell basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Foundational management of sediments in all other areas to prevent future sources of sediments.	**Grazing** 11,128 ha (7.6% of total annual average sediment load)	Encourage adoption of improved practices to reduce sediment erosion including matching stocking rates to carrying capacity and complementary practices such as managing linear features and frontage country (see Streambank).	
Pesticides **Actively reduce *Moderate* pesticide exposure to marine ecosystems through an *Accelerated* management response in targeted sub-catchments, including *Intensive* management of pesticides in wetland hazard exposed areas.** *Focus is primarily on sugarcane. Additional reductions could also be achieved through bananas, horticulture, and non-agricultural areas. Management includes a focus on pesticides in land use areas upstream and surrounding wetlands.* *Foundational management of pesticides in all other areas to prevent future sources of pesticides.*	**Sugarcane** 23,177 ha (11.7% of basin area and a higher potential for pesticide risk)	Increase and sustain adoption of practices that minimise pesticide risk from sugarcane including following label conditions, reducing overall pesticide application rates (within label recommendations), adopting banded spraying, switching to lower risk products, optimising application timing relative to rainfall, managing point sources and adopting integrated pest management holistically across the basin.	
	Bananas 807 ha (< 1% of basin area and a higher potential for pesticide risk)	Encourage and support the adoption of improved practices to minimise pesticide risks from banana production through the implementation of integrated pest and disease management approaches, including adherence to label requirements, reduction of overall pesticide application rates within label recommendations, careful product selection, optimised timing of applications, use of precision application technologies, and effective resistance management strategies.	
	Horticulture 484 ha (<1% of basin area and a higher potential for pesticide risk)	Encourage adoption of improved practices that minimise pesticide risk from horticulture, including following label conditions, reducing overall pesticide application rates (within label recommendations), product selection, timing of application, precision technologies and integrated pest management.	

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
MULGRAVE-RUSSELL **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load / or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards and should be coordinated with the Russell Plan's Investment Priorities.** See specific stakeholder feedback for Mulgrave-Russell basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
	Non-agriculture (urban and forestry) 7,554 ha (4% of basin area and lower potential for pesticide risk)	Encourage adoption of improved practices that minimise pesticide risk from non-agricultural land uses including following label conditions, product selection, rate, timing of application, and improved wastewater treatment processes.	

[A] Loads are presented as the Total Annual Average, not the Anthropogenic Load. Data is unavailable to determine quantified land use contributions to pesticide risk, rather the land use's relative potential for pesticide risk is noted along with the proportion of the basin the land use occupies. *It should be noted that banana production area in the basin has decreased since 2021 (Australian Banana Growers' Council, 2025), and as a result the modelled load estimates may represent an overestimate.

[B] DIN load from grazing is primarily linked with sediment erosion and therefore is treated as a co-benefit of sediment reduction actions. For this reason, grazing sources of DIN are acknowledged but ranked lower in the table.

4.4.4. Mulgrave-Russell natural systems repair

***Table 14**. Mulgrave-Russell Natural Systems Repair Action and Delivery Strategies required to achieve Regional Objective 2. The **Basin-scale Strategic management response** aligns to the recommended pollutant Management Response levels and ecosystem condition assessments. The **Action Strategies** target natural system drivers of water quality risks (streambank and gully erosion[1], vegetation and wetland loss[2]) and the condition of ecosystems[3] (freshwater floodplain wetlands, seagrass, coral, and ecosystem connectivity). [1]Streambank and gully action strategies are ranked and scaled based on their contributions to the basin's sediment load. [2] Vegetation loss and wetland loss/or modification action strategies are scaled based on % losses and identified hotspot areas. [3] Ecosystem condition action strategies are based on ecosystem condition ratings – poor, moderate or good. Specific stakeholder feedback is described in further detail in Appendix 1. Strategies to support scaled delivery (Action Area III) are explained further in Section 4.9.*

Regional objective: *Rehabilitate and sustain natural catchment processes, connectivity and ecosystem function in the Region that support healthy aquatic ecosystems, improve water quality outcomes, and deliver co-benefits such as biodiversity conservation, climate resilience, and enhanced landscape productivity.*			
MULGRAVE-RUSSELL **Basin-scale strategic management response**	**Natural Systems**	**Action Strategy** **Action strategies should be coordinated with the Russell Plan's Investment Priorities.** See specific stakeholder feedback for Mulgrave-Russell basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Actively repair and rehabilitate natural systems in targeted and strategic locations to improve natural system processes for water quality outcomes and improve ecosystem condition.	**Streambank rehabilitation** (33% sediment load contribution)	Rehabilitate, protect and repair streambanks in priority locations through revegetation of riparian areas and installing structural and engineered interventions for bank stabilisation and reshaping such as bank battering, rock protection or rock armouring, and timber pile fields. *[These actions are complementary to Sustainable Land use and Management actions for sediment reduction]* For guidance, refer to the Queensland River Rehabilitation Management (QRRM) Guideline[A].	Deliver coordinated and targeted natural systems and ecosystem rehabilitation programs that accelerates lasting restoration outcomes, tailored to local ecological, and the capacity, opportunities, and motivation of diverse stakeholder groups (including landholders and land managers, community groups, and government agencies), including: • Capacity, skills and expertise • Incentives and markets • Decision support • Technology and equipment *See example interventions in Section 4.9.*
	Native vegetation clearing (27%), **Riparian vegetation clearing** (21%), and **Natural freshwater floodplain wetland modification and/or loss** (45%)	Actively reduce wetland loss and/or modification and vegetation clearing through promoting awareness of regulatory standards for vegetation clearing and other co-benefits. Establish and maintain buffer zones and undertake weed control in riparian areas of waterways and wetlands areas. Improving soil condition, including remediation of acid sulfate soils and aluminium toxicity. Support actions and encourage incentives (e.g. environmental markets) to increase revegetation and wetland rehabilitation at strategic	

Regional objective: *Rehabilitate and sustain natural catchment processes, connectivity and ecosystem function in the Region that support healthy aquatic ecosystems, improve water quality outcomes, and deliver co-benefits such as biodiversity conservation, climate resilience, and enhanced landscape productivity.*			
MULGRAVE-RUSSELL **Basin-scale strategic management response**	**Natural Systems**	**Action Strategy** **Action strategies should be coordinated with the Russell Plan's Investment Priorities.** See specific stakeholder feedback for Mulgrave-Russell basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
		locations in the landscape that improve connectivity, water quality and ecosystem service functions. Maintenance of rehabilitation activities is essential. For guidance, refer to the goals, objectives and activities in the Reef 2050 Wetlands Strategy[B] (particularly *Theme 3: On-ground activities to protect, manage, rehabilitate and restore wetlands*) and Queensland River Rehabilitation Management (QRRM) Guideline.	
	Wetlands (Monitored freshwater floodplain wetland aggregations in Poor condition) *High exposure from nutrients, sediments and pesticides*	Further assess wetland condition to understand the role of pollutant impacts and actively manage other drivers of wetland condition. Coordinate interventions and activities to enhance wetland values, condition, and water quality improvement and ecosystem service functions, such as: • Interventions that improve hydrological integrity, manage pest species and safeguard native vegetation, strengthen riparian buffers and minimise pollutant inflows to wetlands (see actions for DIN, fine sediment and pesticides). • Assess the feasibility of using constructed wetlands or treatment systems to improve water quality while maintaining natural wetland values across a range of land use activities. • Extend area of intertidal wetland ecosystem types. For guidance, refer to the goals, objectives and activities in the Reef 2050 Wetlands Strategy[B]	
	Marine ecosystems – seagrass *(*Moderate) and coral (Moderate)	Evaluate seagrass and coral ecological, social and cultural values, following declines in condition from the 2025 flooding, and the ecosystem's potential for recovery.	

Regional objective: *Rehabilitate and sustain natural catchment processes, connectivity and ecosystem function in the Region that support healthy aquatic ecosystems, improve water quality outcomes, and deliver co-benefits such as biodiversity conservation, climate resilience, and enhanced landscape productivity.*			
MULGRAVE-RUSSELL **Basin-scale strategic management response**	**Natural Systems**	**Action Strategy** **Action strategies should be coordinated with the Russell Plan's Investment Priorities.** See specific stakeholder feedback for Mulgrave-Russell basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
		Further investigate and develop interventions for seagrass and coral ecosystems in the Frankland Island Group and High Island.	
	Connectivity	Support interventions to enhance hydrological connectivity and improve habitat linkage such as removing barriers to fish passage, and restoration and rehabilitation activities. Maintain areas where activities have already been completed. Rehabilitating keystone freshwater, estuarine and marine species that provide multiple ecosystem services (e.g., macrophyte beds) and evaluate the need for additional intervention options to support habitat function, taking into account proximity to high value areas. For guidance, refer to the goals, objectives and activities in the Reef 2050 Wetlands Strategy[B] (particularly Theme 3: On-ground activities to protect, manage, rehabilitate and restore wetlands).	

[A] Department of Environment and Science (2022); [B] Department of Environment, Science and Innovation (2023a).

4.5. Johnstone Basin Water Quality Improvement Strategy

4.5.1. Basin context

The Johnstone is in the central section of the Wet Tropics region. It covers 2,317 km^2 and has an average annual rainfall of 3,152 mm, one of the highest in the GBR catchment area, and the highest long-term median river discharge of 4,797 gigalitres per year. The two biggest sub-catchments are the North Johnstone and South Johnstone rivers. More than half of the basin is in conservation areas (56%), but there are also large areas of agriculture towards the northwest of the basin and along the coastal floodplains. Industries include grazing (23%), sugarcane (11%), bananas (2.1%) and dairy farming (1.9%). Urban centres such as Innisfail and South Johnstone account for 2.9% of the land area.

High rates of historical native vegetation clearing, the extensive loss and/or modification of natural freshwater floodplain wetlands, and fluctuating levels of groundcover are three landscape disturbance factors that may be influencing water quality in the Johnstone. Around 85% of the Johnstone's floodplain native vegetation has been cleared, likely impacting the landscape's natural filtering capacity. In addition, 78% of the estimated historical freshwater floodplain wetland extent had been lost and/or modified. Of the original 6,774 hectares of freshwater floodplain wetlands, only 1,494 hectares of natural unmodified wetlands remained in 2017. The long-term mean late dry season groundcover (1987 to 2022) is 75% (the lowest in the Wet Tropics region) and fluctuates around the optimal 70–75% threshold for erosion protection.

In terms of pollutants, the modelled total annual average loads from the Johnstone are among the highest in the GBR catchment area. It is the third largest exporter of DIN at 954 tonnes (10% of the GBR's total DIN load) and fourth largest exporter of fine sediments (336 kilotonnes). Bananas (34%)[7] and sugarcane (33%) are the dominant sources of DIN, and seepage is the main loss pathway (64%). Streambank and grazing areas are the main sources of fine sediments (69%), with smaller contributions from sugarcane areas (4.9%). Pesticide risk is Low, and diuron and imidacloprid are the largest contributors to the risk.

The Johnstone's freshwater floodplain wetlands are in Poor condition. Pressures include vegetation modification and clearing, drainage modifications, transport infrastructure, pest species, reduced landscape connectivity, nutrient and sediment inputs. Based on the 1,510 hectares of natural and slightly modified freshwater floodplain wetlands included in the hazard assessment, around 35% and 38% are exposed to High or Very High nutrient or sediment hazard respectively. Over half (54%, 811 hectares) are exposed to Moderate, High or Very High pesticide hazard.

In 2022–23, coral reefs adjacent to the Johnstone were in Moderate condition however these have declined in condition following the flood events of 2025, and seagrass meadows remain in Poor condition. The marine exposure scores for DIN and fine sediment are both Moderate, which reflects the anthropogenic loads, as well as the proximity of coral reefs to the coast. Pesticide exposure is Moderate.

4.5.2. Overall management response and focus areas

Based on the likelihood of pollutant exposure and ecosystem condition, a coordinated management response is required across the Johnstone basin, involving sustainable land use and natural systems repair. At the basin scale, this includes **Accelerated management of nutrients, sediment and pesticides** across multiple land uses in targeted sub-catchment areas, supported by broadscale Foundational management of all pollutants in remaining areas of the basin to maintain Minimal future exposure.

[7] It should be noted that banana production area in the basin has decreased since 2021 (Australian Banana Growers' Council, 2025), and as a result there is lower confidence in the modelled load estimates.

Complementary to this basin-wide response, freshwater floodplain wetlands in hazard-exposed areas require Intensive management for all pollutants due to heightened local exposure risks. As wetlands are in **Poor condition**, an evaluation of the drivers of condition is required and to determine the need and feasibility of intervention options to support ecosystem recovery or rehabilitation. Following declines in seagrass and coral condition from the 2025 flooding, evaluate the need and feasibility of intervention options to support ecosystem recovery or rehabilitation, particularly in the Frankland Islands and High Island.

In the Lower Johnstone, stakeholder consultation emphasised the need to strengthen industry capacity and extension services, including tailored programs for banana growers, improved soil conservation expertise, and better access to equipment and contractors. Long-term funding mechanisms and streamlined governance were highlighted as essential, alongside improved coordination between agencies. Farming practices and biosecurity concerns were raised, with calls to prevent pest and disease spread, encourage whole-of-farm planning, and implement stronger pig and cattle management. Wetland and water quality priorities included recognition and incentives for farmers, enhanced understanding of wetland values, improved connectivity, and expanded monitoring. Collaboration and enforcement were also identified as critical, with requests for knowledge-sharing platforms, stronger integration with local groups, and more consistent regulation enforcement.

In the Upper Johnstone, stakeholder consultation emphasised the need to plan for rapid development and urbanisation impacts on hydrology and water quality, including construction-related pressures. Water quality concerns from residential land use and agricultural changes were highlighted, alongside calls for stronger weed management planning. Improved data collection, assessments of existing information, and expanded local-scale and groundwater monitoring were identified as essential to refine priorities. Farmer engagement was seen as critical, with requests for greater awareness programs and expanded extension services to support sustainable practices. Finally, biodiversity areas that deliver co-benefits for water quality and ecosystem health were recognised as important to protect and support.

4.5.3. Johnstone sustainable land use and management

Table 15. Johnstone *Sustainable land use & management Action and Delivery Strategies required to achieve Regional Objective 1. The* ***Basin-scale Strategic management response*** *aligns to the recommended Management Response for nutrients, fine sediment, and pesticides (Section 3.2.2). The* ***Action Strategies*** *are scaled according to the Management Response for each pollutant and ranked according to the pollutant's* ***Dominant land use sources*** *- the relative contributions of the basin's agricultural and non-agricultural land uses: DIN and fine sediment action strategies are ranked by the relative total annual loads of the top 'manageable' land use contributions (i.e. excludes conservation areas), and pesticide action strategies are ranked by the basin's highest land use areas and their potential (higher vs lower) for pesticide risk– see Section 3.2. Specific stakeholder feedback is described in further detail in Appendix 1. Strategies to support scaled delivery (Action Area III) are explained further in Section 4.9.*

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
JOHNSTONE **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards.** See specific stakeholder feedback for Johnstone basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Nutrients **Actively reduce *Moderate* DIN exposure on marine ecosystems through an *Accelerated* management response in targeted sub-catchments, including Intensive management of nutrients in wetland hazard exposed areas.** *Primary focus is reducing DIN exported from sugarcane and bananas. Additional reductions could also be achieved through targeted interventions in urban areas including Innisfail and point source loads. Increasing adoption of soil erosion management practices in grazing lands may also reduce DIN further. Management includes a focus on nutrients from land use areas upstream and surrounding wetlands.* *Foundational management of nutrients in all other areas to prevent future sources of nutrients.*	Bananas 4,877 ha (34% of total annual average DIN load)*	Increase and sustain the adoption of best-practice management to reduce DIN export from banana production by developing and implementing Nutrient Management Plans that align fertiliser application with crop demand (informed and adjusted with soil and leaf testing), improving application efficiency through targeted placement, optimising the timing of nutrient inputs via fertigation, maintaining inter-row groundcover, and upgrading on-farm infrastructure to support improved practice nutrient application.	Deliver coordinated and integrated programs that accelerate sustained adoption of target basin-scale management responses, tailored to local socio-economic and cultural contexts, land use types, and land managers' capacity, opportunities, and motivations, including: • Capacity, skills and expertise • Social norms and trust development
	Sugarcane 24,340 ha (33% of total annual average DIN load)	Increase and sustain adoption levels of improved practices that reduce DIN export from sugarcane areas including farm nutrient management planning that includes accounting for nitrogen derived from legume rotation crops or mill mud application, and using Enhanced Efficiency Fertilisers at reduced application rates (where suitable), with complementary practices such improving drainage and use of soil ameliorants to address yield constraints.	
	Urban and STPs 6,610 ha (1.9% of total annual average DIN load)	Encourage and support adoption of actions to reduce DIN in point source discharge and stormwater runoff through sewage treatment plant (STP) upgrades, increased efficiencies in sewage system management and reuse where appropriate and strategically located stormwater treatment interventions including maintenance and enhancement of natural assets to mitigate	

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
JOHNSTONE **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards.** See specific stakeholder feedback for Johnstone basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
		runoff, and treatment trains (e.g. constructed wetlands, biofilters, vegetated swales, riparian vegetation restoration). Identify and manage potential risks from nutrient discharge in unsewered areas.	• Decision support • Incentives and markets • Technology and equipment *See example interventions in Section 4.9.*
	Grazing 52,411 ha (12% of total annual average DIN load)[B]	Encourage and support adoption of improved practices that reduce DIN export through reducing sediment runoff in grazing. *[This action is a co-benefit of sediment erosion management actions – refer below]*	
Sediment **Actively reduce *Moderate* sediment exposure on marine ecosystems through an Accelerated management response in targeted sub-catchments, including *Intensive* management of sediment in wetland hazard exposed areas.** *Primary focus is on managing riparian zones and grazing. Additional reductions could also be achieved through reduction in hillslope erosion in sugarcane and bananas. Management includes a focus on land use areas upstream and surrounding wetlands.* *Foundational management of sediments in all other areas to prevent future sources of sediments.*	**Streambank** (44% of total annual average sediment load)	Increase and sustain adoption of improved management practices in riparian zones that stabilise and protect frontage country including riparian fencing/excluding cattle from streambank access, managing weeds and pests including feral animals, and revegetation in riparian zones. *[These actions are complementary to Natural Systems Repair actions]*	
	Grazing 52,411 ha (25% of total annual average sediment load)	Increase and sustain adoption of improved practices to reduce sediment erosion including matching stocking rates to carrying capacity and complementary practices such as managing linear features and frontage country (see Streambank).	
	Sugarcane 24,340 ha (4.9% of total annual average sediment load)	Encourage and support adoption of improved practices that reduce sediment erosion in sugarcane, including using fallow crops and trash blanketing, minimal/zero tillage, controlled traffic practices, installing vegetated spoon drains, revegetation of drains and buffers and strategically located sediment traps.	
	Horticulture 1,207 ha	Encourage adoption of practices that reduce sediment erosion in horticulture areas including improving fallow and inter-row	

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
JOHNSTONE **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards.** See specific stakeholder feedback for Johnstone basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
	(2.4% of total annual average sediment load)	management to retain groundcover, managing headlands and drainage to minimise runoff and erosion, and installation of strategically located sediment traps.	
	Dairy 4,302 ha (2.3% of total annual average sediment load)	Encourage the adoption of off streaming watering, fencing and revegetation of riparian areas, installation of creek crossings incorporating pipes and concrete, and maintaining ground cover through the use of reduced tillage technology at critical times of the year.	
	Bananas 4,877 ha (1.1% of total annual average sediment load)*	Encourage and support the adoption of best-practice measures to reduce sediment erosion in banana production through improved farm and paddock design, including the development and implementation of a Soil Conservation Farm Plan. Paddocks are designed and prepared using practices such as optimised planting direction, contour alignment, stabilised headlands, laser levelling and regrading/earthworks, supported by upgraded sediment-control infrastructure including appropriately designed drains, banks, vegetated waterways and sediment traps. High levels of groundcover are maintained to minimise erosion risk.	
Pesticides **Actively reduce *Moderate* pesticide exposure on marine ecosystems through an *Accelerated* management response in targeted sub-catchments, including Intensive management of pesticides in wetland hazard exposed areas.**	**Sugarcane** 24,340 ha (10.5% of basin area and a higher potential for pesticide risk)	Increase and sustain adoption of practices that that minimise pesticide risk from sugarcane including following label conditions, reducing overall pesticide application rates (within label recommendations), adopting banded spraying, switching to lower risk products, optimising application timing relative to rainfall, managing point sources and adopting integrated pest management holistically across the basin.	

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
JOHNSTONE **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards.** See specific stakeholder feedback for Johnstone basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Focus is primarily on sugarcane. Additional reductions could also be achieved through dryland and irrigated cropping, horticulture, grazing and non-agricultural areas. Management includes a focus on pesticides in land use areas upstream and surrounding wetlands (with validation required in the Upper Herbert). *Foundational management of pesticides in all other areas to prevent future sources of pesticides.*	**Bananas** 4,877 ha (2.2% of basin area and a higher potential for pesticide risk)	Encourage and support the adoption of improved practices to minimise pesticide risks from banana production through the implementation of integrated pest and disease management approaches, including adherence to label requirements, reduction of overall pesticide application rates within label recommendations, careful product selection, optimised timing of applications, use of precision application technologies, and effective resistance management strategies.	
	Horticulture, irrigated and dryland cropping 2,356 ha (1% of basin area and a higher potential for pesticide risk)	Encourage adoption of improved practices that minimise pesticide risk from horticulture, irrigated and dryland cropping including following label conditions, reducing overall pesticide application rates (within label recommendations), product selection, timing of application, precision technologies and integrated pest management.	
	Grazing 52,411 ha (24% of basin area and lower potential for pesticide risk)	Encourage adoption of improved practices that minimise pesticide risk from grazing including following label conditions, product selection, rate, and timing of application.	

[A] Loads are presented as the Total Annual Average, not the Anthropogenic Load. Data is unavailable to determine quantified land use contributions to pesticide risk, rather the land use's relative potential for pesticide risk is noted along with the proportion of the basin the land use occupies. *It should be noted that banana production area in the basin has decreased since 2021 (Australian Banana Growers' Council, 2025), and as a result there is lower confidence in the modelled load estimates.

[B] DIN load from grazing is primarily linked with sediment erosion and therefore is treated as a co-benefit of sediment reduction actions. For this reason, grazing sources of DIN are acknowledged but ranked lower in the table.

4.5.4. Johnstone natural systems repair

Table 16. Johnstone *Natural Systems Repair Action and Delivery Strategies required to achieve Regional Objective 2. The* ***Basin-scale Strategic management response*** *aligns to the recommended pollutant Management Response levels and ecosystem condition assessments. The* ***Action Strategies*** *target natural system drivers of water quality risks (streambank and gully erosion[1], vegetation and wetland loss[2]) and the condition of ecosystems[3] (freshwater floodplain wetlands, seagrass, coral, and ecosystem connectivity). [1]Streambank and gully action strategies are ranked and scaled based on their contributions to the basin's sediment load. [2] Vegetation loss and wetland loss/or modification action strategies are scaled based on % losses and identified hotspot areas. [3] Ecosystem condition action strategies are based on ecosystem condition ratings – poor, moderate or good. Specific stakeholder feedback is described in further detail in Appendix 1. Strategies to support scaled delivery (Action Area III) are explained further in Section 4.9.*

Regional objective: *Rehabilitate and sustain natural catchment processes, connectivity and ecosystem function in the Region that support healthy aquatic ecosystems, improve water quality outcomes, and deliver co-benefits such as biodiversity conservation, climate resilience, and enhanced landscape productivity.*			
JOHNSTONE **Basin-scale strategic management response**	**Natural Systems**	**Action Strategy** See specific stakeholder feedback for Johnstone basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Actively repair and rehabilitate natural systems in targeted and strategic locations to improve natural system processes for water quality outcomes and improve ecosystem condition.	**Streambank rehabilitation** (44% sediment load contribution)	Rehabilitate, protect and maintain streambanks in priority locations through revegetation of riparian areas and installing structural and engineered interventions for bank stabilisation and reshaping such as bank battering, rock protection or rock armouring, timber pile fields and in-channel benches. *[These actions are complementary to Sustainable Land use and Management actions for sediment reduction]* For guidance, refer to the Queensland River Rehabilitation Management (QRRM) Guideline[A].	Deliver coordinated and targeted natural systems and ecosystem rehabilitation programs that accelerates lasting restoration outcomes, tailored to local ecological, and the capacity, opportunities, and motivation of diverse stakeholder groups (including landholders and land managers, community groups, and government agencies), including: • Capacity, skills and expertise • Incentives and markets • Decision support • Technology and equipment *See example interventions in Section 4.9 of the Strategy.*
	Native vegetation clearing (45%), **Riparian vegetation clearing** (40%), and **Natural freshwater floodplain wetland modification and/or loss** (78%)	Actively reduce wetland loss and/or modification and vegetation clearing through promoting awareness of regulatory standards for vegetation clearing and other co-benefits. Establish and maintain buffer zones and undertake weed control in riparian areas of waterways and wetlands areas. Implement feral animal control in strategic locations. Support actions and encourage incentives (e.g. environmental markets) to increase revegetation and wetland rehabilitation at strategic locations in the landscape that improve connectivity, water quality and ecosystem service functions.	

Regional objective: *Rehabilitate and sustain natural catchment processes, connectivity and ecosystem function in the Region that support healthy aquatic ecosystems, improve water quality outcomes, and deliver co-benefits such as biodiversity conservation, climate resilience, and enhanced landscape productivity.*			
JOHNSTONE **Basin-scale strategic management response**	**Natural Systems**	**Action Strategy** See specific stakeholder feedback for Johnstone basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
		Maintenance of rehabilitation activities is essential. For guidance, refer to the goals, objectives and activities in the Reef 2050 Wetlands Strategy[B] (particularly *Theme 3: On-ground activities to protect, manage, rehabilitate and restore wetlands*) and Queensland River Rehabilitation Management (QRRM) Guideline[A].	
	Wetlands (Monitored freshwater floodplain wetland aggregations in Poor condition) *High exposure from nutrients, sediments and pesticides*	Evaluate drivers of poor wetland condition and the need and potential for intervention options to assist ecosystem recovery/rehabilitation. Coordinate interventions and activities to enhance wetland values, condition, and water quality improvement and ecosystem service functions, such as: • Interventions that improve hydrological integrity, manage pest species and safeguard native vegetation, strengthen riparian buffers and minimise pollutant inflows to wetlands (see actions for DIN, fine sediment and pesticides). • Assess the feasibility of using constructed wetlands or treatment systems to improve water quality while maintaining natural wetland values across a range of land use activities. • Extend area of intertidal wetland ecosystem types. For guidance, refer to the goals, objectives and activities in the Reef 2050 Wetlands Strategy [B]	
	Marine ecosystems – seagrass *(*Moderate) and coral (Moderate)	Further investigate and develop interventions for seagrass and coral ecosystems following declines in condition from the 2025 flooding, including seagrass habitats and inshore coral reefs in the Barnard Islands, Frankland Islands and High Island.	
	Connectivity	Support interventions to enhance hydrological connectivity and improve habitat linkage such as removing barriers to fish passage, and restoration and rehabilitation activities. Maintain areas where activities have already been completed.	

Regional objective: *Rehabilitate and sustain natural catchment processes, connectivity and ecosystem function in the Region that support healthy aquatic ecosystems, improve water quality outcomes, and deliver co-benefits such as biodiversity conservation, climate resilience, and enhanced landscape productivity.*			
JOHNSTONE **Basin-scale strategic management response**	**Natural Systems**	**Action Strategy** See specific stakeholder feedback for Johnstone basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
		Rehabilitating keystone freshwater, estuarine and marine species that provide multiple ecosystem services (e.g., macrophyte beds) and evaluate the need for additional intervention options to support habitat function, taking into account proximity to high value areas. For guidance, refer to the goals, objectives and activities in the Reef 2050 Wetlands Strategy[B] (particularly *Theme 3: On-ground activities to protect, manage, rehabilitate and restore wetlands*).	

[A] Department of Environment and Science (2022); [B] Department of Environment, Science and Innovation (2023a).

4.6. Tully Basin Water Quality Improvement Strategy

4.6.1. Basin context

The Tully is in the southern section of the Wet Tropics Region and covers an area of 1,668 km^2. Most of the catchment is drained by the Tully River, with the remaining area captured by the Hull River and several smaller coastal creeks. The basin has an average rainfall of 2,763 mm and a long-term median river discharge of 3,393 gigalitres per year. Land use in the Tully is dominated by conservation areas (73%), but the lowland floodplains have intensive agricultural use, principally sugarcane (12%), grazing (6.8%) and bananas (1.1%).

High rates of historical native vegetation clearing and the extensive loss and/or modification of natural freshwater floodplain wetlands are two landscape disturbance factors that may be influencing water quality in the Tully. By 2018, 77% of floodplain vegetation and 48% of freshwater floodplain wetland riparian vegetation had been cleared. Of the 10,411 hectares of natural freshwater floodplain wetlands estimated to be present before clearing started, only 35% (3,665 hectares) remained in 2017.

In terms of pollutants, the modelled total annual average loads from the Tully are 731 tonnes of DIN, making it the fourth largest exporter of DIN in the GBR catchment area, and 105 kilotonnes of fine sediments. Sugarcane (35%) and bananas (32%)[8] are the main contributors to the DIN load. Pesticide risk ranges from Low to Moderate depending on the sampling year (2015 to 2023), and diuron and imidacloprid are the largest contributors of the risk.

Freshwater floodplain wetlands are in Moderate condition in the Tully. They face pressures including pest species, sediment inputs, vegetation clearing, loss of regional ecosystems, drainage modifications, and reduced landscape connectivity. Based on the 3,729 hectares of natural and slightly modified freshwater floodplain wetlands, 51% are exposed to High or Very High nutrient hazard, 52% to High or Very High sediment Hazard, and 88% are exposure to Moderate, High or Very High pesticide hazard.

In 2022–23, coral reefs adjacent to the Tully basin were in Moderate condition however, these have declined in condition following the flood events of 2025, and seagrass meadows remain in Poor condition. The marine DIN exposure score is High, ranking second among all GBR catchments reflecting the significant anthropogenic DIN load, high frequency of river discharge and relatively large area of coral reefs in the highest exposure categories. Sediment exposure is Moderate, ranking fifth among all GBR catchments. Pesticide exposure is Moderate.

4.6.2. Overall management response and focus areas

Based on the likelihood of pollutant exposure and ecosystem condition, a comprehensive multi-pollutant management response is required across the Tully basin, involving sustainable land use and natural systems repair. At the basin scale, this includes large-scale **Intensive management of nutrients**, and **Accelerated sediment and pesticide management** in targeted sub-catchment areas. Complementary to the basin-wide management response, freshwater floodplain wetland hazard exposed areas require Intensive management for all pollutants due to more localised exposure risks. All remaining areas should be managed through a broadscale Foundational response to maintain low future exposure risks.

As freshwater wetlands are in Moderate condition, further assess the influence of pollutants and other pressures on wetlands, and implement interventions to prevent further decline and enhance wetland values, condition, water quality and ecosystem services. Following declines in seagrass and coral condition from the 2025 flooding, an evaluation of the need and feasibility of intervention options to support ecosystem recovery or rehabilitation is required, particularly in the Family Island Group.

[8] *It should be noted that banana production area in the basin has decreased since 2021 (Australian Banana Growers' Council, 2025), and as a result there is lower confidence in the modelled load estimates.

In the Tully and Murray basins, stakeholder consultation emphasised the need for updated BMP standards for the banana and sugarcane industries, and proactive management of land use changes driven by Panama disease in banana crops, with targeted extension support for new landholders. Strengthening grower support, including improved access to local extension services, addressing industry capacity gaps, and delivering timely support to boost adoption of improved practices was highlighted. A combined approach of education and incentive programs was identified, with calls to reward good practice, continuing and expanding local-scale water quality monitoring, while improving the presentation of data to make it more accessible and useful for growers, and enhancing knowledge of natural systems repair options.

4.6.3. Tully sustainable land use and management

Table 17. Tully *Sustainable land use & management Action and Delivery Strategies required to achieve Regional Objective 1. The* ***Basin-scale Strategic management response*** *aligns to the recommended Management Response for nutrients, fine sediment, and pesticides (Section 3.2.2). The* ***Action Strategies*** *are scaled according to the Management Response for each pollutant and ranked according to the pollutant's* ***Dominant land use sources*** *- the relative contributions of the basin's agricultural and non-agricultural land uses: DIN and fine sediment action strategies are ranked by the relative total annual loads of the top 'manageable' land use contributions (i.e. excludes conservation areas), and pesticide action strategies are ranked by the basin's highest land use areas and their potential (higher vs lower) for pesticide risk– see Section 3.2. Specific stakeholder feedback is described in further detail in Appendix 1. Strategies to support scaled delivery (Action Area III) are explained further in Section 4.9.*

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
TULLY **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards.** See specific stakeholder feedback for Tully basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Nutrients **Expedite reductions in *High* DIN exposure on marine ecosystems and in wetland hazard exposed areas through an *Intensive*, large-scale management response.** *Primary focus is reducing DIN exported from sugarcane and bananas. Additional reductions could also be achieved through targeted interventions in urban areas including Tully and Mission Beach and point source loads. Increasing adoption of soil erosion management practices in grazing lands may also reduce DIN further. Management includes a focus on DIN plus other nutrients from land use areas upstream and surrounding wetlands.* *Foundational management of nutrients in all other areas to prevent future sources of nutrients.*	**Sugarcane** 20,148 ha (35% of total annual average DIN load)	Rapidly maximise and sustain widespread adoption of practices that reduce DIN runoff in sugarcane including farm nutrient management planning that includes accounting for nitrogen derived from legume rotation crops or mill mud application, reducing nitrogen rates on late harvested or poor performing ratoons, and using Enhanced Efficiency Fertiliser products on late harvested cane, along with complementary practices to manage Ratoon Stunting Disease and use of soil ameliorants to address soil constraints.	Deliver coordinated and integrated programs that accelerate sustained adoption of target basin-scale management responses, tailored to local socio-economic and cultural contexts, land use types, and land managers' capacity, opportunities, and motivations, including: • Capacity, skills and expertise
	Bananas 1,898 ha (32% of total annual average DIN load)*	Rapidly maximise and sustain the adoption of best-practice management to reduce DIN export from banana production by developing and implementing Nutrient Management Plans that align fertiliser application with crop demand (informed and adjusted with soil and leaf testing), improving application efficiency through targeted placement, optimising the timing of nutrient inputs via fertigation, maintaining inter-row groundcover, and upgrading on-farm infrastructure to support improved practice nutrient application.	
	Urban + STP 1,973 ha	Encourage and support adoption of actions to reduce DIN in point source discharge and stormwater runoff through sewage treatment plant (STP) upgrades, increased efficiencies	

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
TULLY **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards.** See specific stakeholder feedback for Tully basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
	(0.7% of total annual average DIN load)	in sewage system management and reuse where appropriate, and strategically located stormwater treatment interventions including maintenance and enhancement of natural assets to mitigate runoff, and treatment trains (e.g. constructed wetlands, biofilters, vegetated swales, riparian vegetation restoration). Identify and manage potential risks from nutrient discharge in unsewered areas.	• Social norms and trust development • Decision support • Incentives and markets • Technology and equipment *See example interventions in Section 4.9*
	Grazing 11,348 ha (4.8% of total annual average DIN load)[B]	Encourage and support adoption of improved practices that reduce DIN export through reducing sediment runoff in grazing. *[This action is a co-benefit of sediment erosion management actions – refer below]*	
Sediment **Actively reduce *Moderate* sediment exposure on marine ecosystems through an *Accelerated* management response in targeted sub-catchments, including Intensive management of sediment in wetland hazard exposed areas.** *Primary focus is on managing riparian zones. Additional reductions could be achieved through reducing sediment export from grazing, sugarcane and bananas. Management includes a focus on land use areas upstream and surrounding wetlands.*	**Streambank** (48% of total annual average sediment load)	Increase and sustain adoption of improved management practices in riparian zones that stabilise and protect frontage country including riparian fencing/excluding cattle from streambank access, managing weeds and pests including feral animals, and revegetation in riparian zones. *[These actions are complementary to Natural Systems Repair actions]*	
	Sugarcane 20,148 ha (8.6% of total annual average sediment load)	Encourage adoption of improved practices that reduce sediment erosion in sugarcane, including using fallow crops and trash blanketing, minimal/zero tillage, controlled traffic practices, installing vegetated spoon drains, revegetation of drains and buffers and strategically located sediment traps.	
	Grazing 11,348 ha	Encourage and support adoption of improved practices to reduce sediment erosion in grazing, including matching stocking rates to carrying capacity and complementary	

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
TULLY **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards.** See specific stakeholder feedback for Tully basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Foundational management of sediments in all other areas to prevent future sources of sediments.	(5.8% of total annual average sediment load)	practices such as managing linear features and frontage country (see Streambank).	
	Horticulture 384 ha (2.4% of total annual average sediment load)	Encourage adoption of improved practices that reduce sediment erosion in horticulture, including improving fallow and inter-row management to retain groundcover, managing headlands and drainage to minimise runoff and erosion, and installation of strategically located sediment traps.	
	Bananas 1,898 ha (1.7% of total annual average sediment load)*	Encourage and support the adoption of best-practice measures to reduce sediment erosion in banana production through improved farm and paddock design, including the development and implementation of a Soil Conservation Farm Plan. Paddocks are designed and prepared using practices such as optimised planting direction, contour alignment, stabilised headlands, laser levelling and regrading/earthworks, supported by upgraded sediment-control infrastructure including appropriately designed drains, banks, vegetated waterways and sediment traps. High levels of groundcover are maintained to minimise erosion risk.	
Pesticides **Actively reduce *Moderate* pesticide exposure on marine ecosystems through an *Accelerated* management response in targeted sub-catchments, including Intensive management of pesticides in wetland hazard exposed areas.**	**Sugarcane** 20,148 ha (12% of basin area and a higher potential for pesticide risk)	Increase and sustain adoption of practices that minimise pesticide risk from sugarcane including following label conditions, reducing overall pesticide application rates (within label recommendations), adopting precision technologies (e.g. Dual Herbicide Sprayer), switching to lower risk products, optimising application timing relative to rainfall, managing point sources and adopting integrated pest management holistically across the basin.	

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
TULLY **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards.** See specific stakeholder feedback for Tully basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Focus is primarily on sugarcane. Additional reductions could also be achieved through bananas, horticulture and non-agricultural areas. Management includes a focus on pesticides in land use areas upstream and surrounding wetlands. *Foundational management of pesticides in all other areas to prevent future sources of pesticides.*	**Bananas** 1,898 ha (2.4% of basin area and a higher potential for pesticide risk)	Encourage and support the adoption of improved practices to minimise pesticide risks from banana production through the implementation of integrated pest and disease management approaches, including adherence to label requirements, reduction of overall pesticide application rates within label recommendations, careful product selection, optimised timing of applications, use of precision application technologies, and effective resistance management strategies.	
	Horticulture 384 ha (<1% of basin area and a higher potential for pesticide risk)	Encourage adoption of improved practices that minimise pesticide risk from horticulture, including following label conditions, reducing overall pesticide application rates (within label recommendations), product selection, timing of application, precision technologies and integrated pest management.	
	Non-agriculture (urban and forestry) 4,857 ha (3% of basin area and lower potential for pesticide risk)	Encourage adoption of improved practices that minimise pesticide risk from non-agricultural land uses including following label conditions, product selection, rate, timing of application, and improved wastewater treatment processes.	

[A] Loads are presented as the Total Annual Average, not the Anthropogenic Load. Data is unavailable to determine quantified land use contributions to pesticide risk, rather the land use's relative potential for pesticide risk is noted along with the proportion of the basin the land use occupies. *It should be noted that banana production area in the basin has decreased since 2021 (Australian Banana Growers' Council, 2025), and as a result the modelled load estimates may represent an overestimate.

[B] DIN load from grazing is primarily linked with sediment erosion and therefore is treated as a co-benefit of sediment reduction actions. For this reason, grazing sources of DIN are acknowledged but ranked lower in the table.

4.6.4. Tully natural systems repair

***Table 18**. **Tully** Natural Systems Repair Action and Delivery Strategies required to achieve Regional Objective 2. The **Basin-scale Strategic management response** aligns to the recommended pollutant Management Response levels and ecosystem condition assessments. The **Action Strategies** target natural system drivers of water quality risks (streambank and gully erosion[1], vegetation and wetland loss[2]) and the condition of ecosystems[3] (freshwater floodplain wetlands, seagrass, coral, and ecosystem connectivity). [1]Streambank and gully action strategies are ranked and scaled based on their contributions to the basin's sediment load. [2] Vegetation loss and wetland loss/or modification action strategies are scaled based on % losses and identified hotspot areas. [3] Ecosystem condition action strategies are based on ecosystem condition ratings – poor, moderate or good. Specific stakeholder feedback is described in further detail in Appendix 1. Strategies to support scaled delivery (Action Area III) are explained further in Section 4.9.*

Regional objective: *Rehabilitate and sustain natural catchment processes, connectivity and ecosystem function in the Region that support healthy aquatic ecosystems, improve water quality outcomes, and deliver co-benefits such as biodiversity conservation, climate resilience, and enhanced landscape productivity.*			
TULLY **Basin-scale strategic management response**	**Natural Systems**	**Action Strategy** See specific stakeholder feedback for Tully basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Actively repair and rehabilitate natural systems in targeted and strategic locations to improve natural system processes for water quality outcomes and improve ecosystem condition.	**Streambank rehabilitation** (48% sediment load contribution)	Actively rehabilitate, protect and maintain streambanks in priority locations through revegetation of riparian areas and installing structural and engineered interventions, for bank stabilisation and reshaping such as bank battering, rock protection or rock armouring and timber pile fields. *[These actions are complementary to Sustainable Land use and Management actions for sediment reduction]* For guidance, refer to the Queensland River Rehabilitation Management (QRRM) Guideline[A].	Deliver coordinated and targeted natural systems and ecosystem rehabilitation programs that accelerates lasting restoration outcomes, tailored to local ecological, and the capacity, opportunities, and motivation of diverse stakeholder groups (including landholders and land managers, community groups, and government agencies), including: • Capacity, skills and expertise • Incentives and markets • Decision support • Technology and equipment *See example interventions in Section 4.9.*
	Native vegetation clearing (25%), **Riparian vegetation clearing** (20%), and **Natural freshwater floodplain wetland**	Actively reduce wetland loss and/or modification and vegetation clearing through promoting awareness of regulatory standards for vegetation clearing and other co-benefits. Establish and maintain buffer zones and undertake weed control in riparian areas of waterways and wetlands areas. Implement feral animal control in strategic locations.	

Regional objective: *Rehabilitate and sustain natural catchment processes, connectivity and ecosystem function in the Region that support healthy aquatic ecosystems, improve water quality outcomes, and deliver co-benefits such as biodiversity conservation, climate resilience, and enhanced landscape productivity.*			
TULLY **Basin-scale strategic management response**	**Natural Systems**	**Action Strategy** See specific stakeholder feedback for Tully basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
	modification and/or loss (65%)	Support actions and encourage incentives (e.g. environmental markets) to increase revegetation and wetland rehabilitation at strategic locations in the landscape that improve connectivity, water quality and ecosystem service functions. Maintenance of rehabilitation activities is essential. For guidance, refer to the goals, objectives and activities in the Reef 2050 Wetlands Strategy[B] (particularly *Theme 3: On-ground activities to protect, manage, rehabilitate and restore wetlands*) and Queensland River Rehabilitation Management (QRRM) Guideline[A].	
	Wetlands (Monitored freshwater floodplain wetland aggregations in Moderate condition) *High exposure from nutrients, sediments and pesticides*	Further assess wetland condition to understand the role of pollutant impacts and actively manage other drivers of wetland condition. Coordinate interventions and activities to enhance wetland values, condition, and water quality improvement and ecosystem service functions, such as: • Interventions that improve hydrological integrity, manage pest species and safeguard native vegetation, strengthen riparian buffers and minimise pollutant inflows to wetlands (see actions for DIN, fine sediment and pesticides). • Assess the feasibility of using constructed wetlands or treatment systems to improve water quality while maintaining natural wetland values across a range of land use activities. For guidance, refer to the goals, objectives and activities in the Reef 2050 Wetlands Strategy[B]	
	Marine ecosystems – seagrass *(*Poor) and coral (Moderate)	Evaluate seagrass and coral ecological, social and cultural values, other potential drivers of the Poor condition and the ecosystem's potential for recovery.	

Regional objective: *Rehabilitate and sustain natural catchment processes, connectivity and ecosystem function in the Region that support healthy aquatic ecosystems, improve water quality outcomes, and deliver co-benefits such as biodiversity conservation, climate resilience, and enhanced landscape productivity.*			
TULLY **Basin-scale strategic management response**	**Natural Systems**	**Action Strategy** See specific stakeholder feedback for Tully basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
		Further investigate and develop interventions for seagrass and coral ecosystems following declines in condition from the 2025 flooding, including seagrass habitats and inshore coral reefs in the Family Island Group. Other intervention options may need to be considered to assist ecosystem recovery/rehabilitation taking into account proximity to high value areas such as the Tully River and Hull River Fish Habitat Areas).	
	Connectivity	Support interventions to enhance hydrological connectivity and improve habitat linkage such as removing barriers to fish passage, and restoration and rehabilitation activities. Maintain areas where activities have already been completed. Evaluate the need for additional intervention options to support habitat function, taking into account proximity to high value areas such as the Hull and Tully Murray River Fish Habitat Areas. For guidance, refer to the goals, objectives and activities in the Reef 2050 Wetlands Strategy[B] (particularly *Theme 3: On-ground activities to protect, manage, rehabilitate and restore wetlands*).	

[A] Department of Environment and Science (2022); [B] Department of Environment, Science and Innovation (2023a).

4.7. Murray Basin Water Quality Improvement Strategy

4.7.1. Basin context

The Murray basin is located in the southern part of the Wet Tropics Region and covers an area of 1,125 km^2. The major waterway is the Murray River, which captures the northern part of the catchment area. Further south, several smaller creeks drain into Hinchinbrook Channel. The Murray has an average rainfall of 2,164 mm and a long-term median river discharge of 1,484 gigalitres per year. Land use is dominated by conservation areas that cover 62% of the land area, but the floodplain is most developed for agriculture, including sugarcane (17%), forestry (9.1%) and grazing (6.5%), with smaller areas of bananas, horticulture, dryland and irrigated cropping (<1.0%).

High rates of historical native vegetation clearing and the extensive loss and/or modification of natural freshwater floodplain wetlands are two landscape disturbance factors that may be influencing water quality in the Murray. By 2018, 71% of the Murray's floodplain vegetation and 48% of its freshwater floodplain wetland riparian areas had been cleared, with vegetation clearing continuing in recent years, particularly on floodplains. Of the original 8,606 hectares of freshwater floodplain wetlands, only 3,280 hectares of natural unmodified wetlands remained in 2017.

In terms of pollutants, the modelled total annual average loads from the Murray are 335 tonnes of DIN and 34 kilotonnes of fine sediments. It is the tenth largest exporter of DIN to the GBR, contributing 3.6% of the total DIN load, most of which comes from sugarcane areas (60%), followed by conservation areas (20%) and bananas (8.3%)[9]. Conservation areas (43%), streambank areas (25%), and sugarcane (16%) are the primary sources of fine sediments, and hillslope erosion (74%) and streambank erosion (25%) are the dominant transport pathways. Pesticide risk is consistently high in the Murray and diuron and imidacloprid are the largest contributors of the risk.

Freshwater floodplain wetlands in the Murray are in Poor condition. They face a suite of pressures including altered water flows from vegetation modification and clearing, drainage and hydrological modifications, pest species and sediment input. Of the 3,326 hectares of natural and slightly modified freshwater floodplain wetlands included in the hazard assessment, 60% are exposed to High or Very High nutrient hazard, 63% are exposed to High or Very High sediment hazard, and 79% are exposed to Moderate, High, or Very High pesticide hazard.

In 2022–23, coral reefs adjacent to the Murray basin were in Moderate condition however, these have declined in condition following the flood events of 2025, and seagrass meadows remain in Poor condition. The marine DIN exposure score is Moderate, reflecting the anthropogenic DIN load and proximity of coral reefs to the coast. Sediment exposure is Minimal, reflecting the low anthropogenic fine sediment load. Pesticide exposure is High.

4.7.2. Overall management response and focus areas

Based on the likelihood of pollutant exposure and ecosystem condition, a comprehensive multi-pollutant management response is required across the Murray basin, involving sustainable land use and natural systems repair. At the basin scale, this includes large-scale **Intensive management of pesticides**, **Accelerated nutrient management** in targeted sub-catchment areas, and **Foundational management of sediments** to maintain Minimal exposure into the future. Complementary to the basin-wide management response, freshwater floodplain wetland hazard exposed areas require Intensive management for all nutrients and pesticides due to more localised exposure risks, and validation of the intensive management response for sediments. All remaining areas should be managed through a broadscale Foundational response to maintain low future exposure risks.

[9] It should be noted that banana production area in the basin has decreased since 2021 (Australian Banana Growers' Council, 2025), and as a result there is lower confidence in the modelled load estimates.

As freshwater floodplain wetlands are in **Poor condition**, evaluate the drivers of condition and determine the need and feasibility of intervention options to support ecosystem recovery or rehabilitation. Following declines in seagrass and coral condition from the 2025 flooding, an evaluation of the need and feasibility of intervention options to support ecosystem recovery or rehabilitation is required, particularly in the Family Island Group and ecosystems within proximity to high value areas (such as Fish Habitat and Dugong Protection Areas).

In the Tully and Murray basins, stakeholder consultation emphasised the need for updated BMP standards for the banana and sugarcane industries, and proactive management of land use changes driven by Panama disease in banana crops, with targeted extension support for new landholders. Strengthening grower support, including improved access to local extension services, addressing industry capacity gaps, and delivering timely support to boost adoption of improved practices was highlighted. A combined approach of education and incentive programs was identified, with calls to reward good practice, continuing and expanding local-scale water quality monitoring, while improving the presentation of data to make it more accessible and useful for growers, and enhancing knowledge of natural systems repair options.

4.7.3. Murray sustainable land use and management

Table 19. Murray *Sustainable land use & management Action and Delivery Strategies required to achieve Regional Objective 1. The* ***Basin-scale Strategic management response*** *aligns to the recommended Management Response for nutrients, fine sediment, and pesticides (Section 3.2.2). The* ***Action Strategies*** *are scaled according to the Management Response for each pollutant and ranked according to the pollutant's* ***Dominant land use sources*** *- the relative contributions of the basin's agricultural and non-agricultural land uses: DIN and fine sediment action strategies are ranked by the relative total annual loads of the top 'manageable' land use contributions (i.e. excludes conservation areas), and pesticide action strategies are ranked by the basin's highest land use areas and their potential (higher vs lower) for pesticide risk– see Section 3.2. Specific stakeholder feedback is described in further detail in Appendix 1. Strategies to support scaled delivery (Action Area III) are explained further in Section 4.9.*

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
MURRAY **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards.** See specific stakeholder feedback for Murray basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Nutrients **Actively reduce *Moderate* DIN exposure on marine ecosystems through an *Accelerated* management response in targeted sub-catchments, including *Intensive* management of nutrients in wetland hazard exposed areas.** *Primary focus is reducing DIN exported from sugarcane and bananas. Increasing adoption of soil erosion management practices in grazing lands may also reduce DIN further. Management includes a focus on reducing nutrient export from land use areas upstream and surrounding wetlands.* *Foundational management of nutrients in all other areas to prevent future sources of nutrients.*	**Sugarcane** 18,881 ha (60% of total annual average DIN load)	Increase and sustain adoption of practices that reduce DIN runoff in sugarcane including farm nutrient management planning that includes accounting for nitrogen derived from legume rotation crops or mill mud application, reducing nitrogen rates on late harvested or poor performing ratoons, and using Enhanced Efficiency Fertiliser products on late harvested cane, along with complementary practices to manage Ratoon Stunting Disease and use of soil ameliorants to address soil constraints.	Deliver coordinated and integrated programs that accelerate sustained adoption of target basin-scale management responses, tailored to local socio-economic and cultural contexts, land use types, and land managers' capacity, opportunities, and motivations, including: • Capacity, skills and expertise
	Bananas 206 ha (8.3% of total annual average DIN load)*	Encourage and support the adoption of best-practice management to reduce DIN export from banana production by developing and implementing Nutrient Management Plans that align fertiliser application with crop demand (informed and adjusted with soil and leaf testing), improving application efficiency through targeted placement, optimising the timing of nutrient inputs via fertigation, maintaining inter-row groundcover, and upgrading on-farm infrastructure to support improved practice nutrient application.	
	Grazing 7,296 ha	Encourage adoption of improved practices that reduce DIN export through reducing sediment runoff in grazing.	

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
MURRAY **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards.** See specific stakeholder feedback for Murray basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
	(4.3% of total annual average DIN load)[B]	*[This action is a co-benefit of sediment erosion management actions – refer below]*	• Social norms and trust development • Decision support • Incentives and markets • Technology and equipment *See example interventions in Section 4.9.*
Sediment **Maintain *Minimal* sediment exposure on marine ecosystems through a *Foundational* management response across all land uses within the basin that maintains minimum standards and fosters awareness and uptake of improved practices for the future. Management actions should include a focus on reducing sediment exposure on wetlands.** *Primary focus is on fostering sustainable practices in riparian zones, sugarcane, grazing, and bananas. Validate the wetland sediment hazard assessment and where required, implement sustainable land management in hazard exposed areas.*	**Streambank** (25% of total annual average sediment load)	Encourage adoption of improved managementpractices in riparian zones that stabilise and protect frontage country including riparian fencing/excluding cattle from streambank access, managing weeds and pests including feral animals, and revegetation in riparian zone. *[These actions are complementary to Natural Systems Repair actions]*	
	Sugarcane 18,881 ha (16% of total annual average sediment load)	Encourage adoption of improved practices that reduce sediment erosion in sugarcane, including use of fallow crops and trash blanketing, minimal/zero tillage, controlled traffic practices, installing vegetated spoon drains, revegetation of drains and buffers and strategically located sediment traps.	
	Horticulture 365 ha (5.8% of total annual average sediment load)	Encourage adoption of improved practices that reduce sediment erosion in horticulture, including improving fallow and inter-row management to retain groundcover, managing headlands and drainage to minimise runoff and erosion, and installation of strategically located sediment traps.	
	Grazing 7,296 ha (3.5% of total annual average sediment load)	Encourage adoption of improved practices to reduce sediment erosion in grazing, including matching stocking rates to carrying capacity and complementary practices such as managing linear features and frontage country (see Streambank).	
Pesticides	**Sugarcane** 18,881 ha	Increase and sustain adoption of practices that minimise pesticide risk from sugarcane including following label conditions, reducing overall pesticide application rates (within	

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
MURRAY **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards.** See specific stakeholder feedback for Murray basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Expedite reductions in *High* pesticide exposure on marine ecosystems and wetland hazard exposed areas through an *Intensive*, large-scale management response. *Focus is primarily on sugarcane. Additional reductions could also be achieved through bananas and horticulture. Management includes a focus on pesticides in land use areas upstream and surrounding wetlands.* *Foundational management of pesticides in all other areas to prevent future sources of pesticides.*	(16.8% of basin area and a higher potential for pesticide risk)	label recommendations), adopting precision technologies (e.g. Dual Herbicide Sprayer), switching to lower risk products, optimising application timing relative to rainfall, managing point sources and adopting integrated pest management holistically across the basin.	
	Bananas 206 ha (<1% of basin area and a higher potential for pesticide risk)*	Encourage and support the adoption of improved practices to minimise pesticide risks from banana production through the implementation of integrated pest and disease management approaches, including adherence to label requirements, reduction of overall pesticide application rates within label recommendations, careful product selection, optimised timing of applications, use of precision application technologies, and effective resistance management strategies.	
	Horticulture 365 ha (<1% of basin area and a higher potential for pesticide risk)	Encourage adoption of improved practices that minimise pesticide risk from horticulture, including following label conditions, reducing overall pesticide application rates (within label recommendations), product selection, timing of application, precision technologies and integrated pest management.	

[A] Loads are presented as the Total Annual Average, not the Anthropogenic Load. Data is unavailable to determine quantified land use contributions to pesticide risk, rather the land use's relative potential for pesticide risk is noted along with the proportion of the basin the land use occupies. *It should be noted that banana production area in the basin has decreased since 2021 (Australian Banana Growers' Council, 2025), and as a result there is lower confidence in the modelled DIN and fine sediment load estimates.

[B] DIN load from grazing is primarily linked with sediment erosion and therefore is treated as a co-benefit of sediment reduction actions. For this reason, grazing sources of DIN are acknowledged but ranked lower in the table.

4.7.4. Murray natural systems repair

Table 20. Murray *Natural Systems Repair Action and Delivery Strategies required to achieve Regional Objective 2. The* ***Basin-scale Strategic management response*** *aligns to the recommended pollutant Management Response levels and ecosystem condition assessments. The* ***Action Strategies*** *target natural system drivers of water quality risks (streambank and gully erosion[1], vegetation and wetland loss[2]) and the condition of ecosystems[3] (freshwater floodplain wetlands, seagrass, coral, and ecosystem connectivity). [1]Streambank and gully action strategies are ranked and scaled based on their contributions to the basin's sediment load. [2] Vegetation loss and wetland loss/or modification action strategies are scaled based on % losses and identified hotspot areas. [3] Ecosystem condition action strategies are based on ecosystem condition ratings – poor, moderate or good. Specific stakeholder feedback is described in further detail in Appendix 1. Strategies to support scaled delivery (Action Area III) are explained further in Section 4.9.*

Regional objective: *Rehabilitate and sustain natural catchment processes, connectivity and ecosystem function in the Region that support healthy aquatic ecosystems, improve water quality outcomes, and deliver co-benefits such as biodiversity conservation, climate resilience, and enhanced landscape productivity.*			
MURRAY **Basin-scale strategic management response**	**Natural Systems**	**Action Strategy** See specific stakeholder feedback for Murray basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Actively repair and rehabilitate natural systems in targeted and strategic locations to improve natural system processes for water quality outcomes and improve ecosystem condition.	**Streambank rehabilitation** (25% sediment load contribution)	Actively rehabilitate, protect and maintain streambanks in priority locations through revegetation of riparian areas and installing structural and engineered interventions, for bank stabilisation and reshaping such as bank battering and timber pile fields. *[These actions are complementary to Sustainable Land use and Management actions for sediment reduction]* For guidance, refer to the Queensland River Rehabilitation Management (QRRM) Guideline[A].	Deliver coordinated and targeted natural systems and ecosystem rehabilitation programs that accelerates lasting restoration outcomes, tailored to local ecological contexts, and the capacity, opportunities, and motivation of diverse stakeholder groups (including landholders and land managers, community groups, and government agencies), including: • Capacity, skills and expertise • Incentives and markets • Decision support • Technology and equipment *See example interventions in Section 4.9.*
	Native vegetation clearing (33%), **Riparian vegetation clearing** (23%), and **Natural freshwater floodplain wetland modification and/or loss** (62%)	Actively reduce wetland loss and/or modification and vegetation clearing through promoting awareness of regulatory standards for vegetation clearing and other co-benefits. Establish and maintain buffer zones and undertake weed control in riparian areas of waterways and wetlands areas. Implement feral animal control in strategic locations. Support actions and encourage incentives (e.g. environmental markets) to increase revegetation and wetland rehabilitation at strategic locations in the landscape that improve connectivity, water quality and ecosystem service functions. Maintenance of any rehabilitation activities is essential.	

Regional objective: *Rehabilitate and sustain natural catchment processes, connectivity and ecosystem function in the Region that support healthy aquatic ecosystems, improve water quality outcomes, and deliver co-benefits such as biodiversity conservation, climate resilience, and enhanced landscape productivity.*			
MURRAY **Basin-scale strategic management response**	**Natural Systems**	**Action Strategy** See specific stakeholder feedback for Murray basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
		For guidance, refer to the goals, objectives and activities in the Reef 2050 Wetlands Strategy[B] (particularly *Theme 3: On-ground activities to protect, manage, rehabilitate and restore wetlands*) and Queensland River Rehabilitation Management (QRRM) Guideline[A].	
	Wetlands Extensive historic wetland loss/modification (Monitored freshwater floodplain wetland aggregations in Moderate condition) *High exposure from nutrients, sediments and pesticides*	Further assess wetland condition to understand the role of pollutant impacts and actively manage other drivers of wetland condition. Coordinate interventions and activities to enhance wetland values, condition, and water quality improvement and ecosystem service functions, such as: • Interventions that improve hydrological integrity, manage pest species and safeguard native vegetation, strengthen riparian buffers and minimise pollutant inflows to wetlands (see actions for DIN, fine sediment and pesticides). • Assess the feasibility of using constructed wetlands or treatment systems to improve water quality while maintaining natural wetland values across a range of land use activities. For guidance, refer to the goals, objectives and activities in the Reef 2050 Wetlands Strategy [B]	
	Marine ecosystems – seagrass *(*Poor) and coral (Moderate)	Evaluate seagrass and coral ecological, social and cultural values, other potential drivers of the Poor condition and the ecosystem's potential for recovery. Further investigate and develop interventions for seagrass and coral ecosystems following declines in condition from the 2025 flooding in pollutant hotspots, including seagrass habitats and inshore coral reefs in the Family Island Group. Other intervention options may need to be considered to assist ecosystem recovery/rehabilitation, taking into account proximity to high value areas such as the Murray River, Dallachy Creek, Wreck Creek	

Regional objective: *Rehabilitate and sustain natural catchment processes, connectivity and ecosystem function in the Region that support healthy aquatic ecosystems, improve water quality outcomes, and deliver co-benefits such as biodiversity conservation, climate resilience, and enhanced landscape productivity.*			
MURRAY **Basin-scale strategic management response**	**Natural Systems**	**Action Strategy** See specific stakeholder feedback for Murray basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
		and Meunga Creek Fish Habitat Areas and Hinchinbrook Channel Dugong Protection Area and other identified ecosystem values.	
	Connectivity Poor freshwater wetland connectivity, freshwater ecosystem fragmentation due to barriers.	Support interventions to enhance landscape vegetation and hydrological connectivity and improve habitat linkage such as removing barriers to fish passage, and restoration and rehabilitation activities. Maintain areas where activities have already been completed. Evaluate the need for additional intervention options to support habitat function, taking into account proximity to high value areas such as the Murray River, Dallachy Creek, Wreck Creek and Meunga Creek Fish Habitat Areas. For guidance, refer to the goals, objectives and activities in the Reef 2050 Wetlands Strategy[B] (particularly *Theme 3: On-ground activities to protect, manage, rehabilitate and restore wetlands*).	

[A] Department of Environment and Science (2022); [B] Department of Environment, Science and Innovation (2023a).

4.8. Herbert Basin Water Quality Improvement Strategy

4.8.1. Basin context

The Herbert catchment is the largest basin in the Wet Tropics Region with a land area of 9,852 km^2. The Herbert River drains the majority of the basin, with several smaller coastal creeks capturing the southern section of the floodplain. The Herbert has an average rainfall of 1,222 mm and a long-term median river discharge of 3,880 gigalitres per year. The upper area of the basin is mostly grazing (50% of the catchment area), the central area is primarily conservation lands (32% of the catchment area), with more intensive areas of agriculture established on the lower floodplain, mainly sugarcane (7.8%).

High rates of historical native vegetation clearing, the extensive loss and/or modification of natural freshwater floodplain wetlands, and gully erosion are three landscape disturbance factors that may be influencing water quality in the Herbert. By 2018, the Herbert had around half of the basin's native vegetation from floodplains (53%) and floodplain wetland riparian areas (51%) had been cleared, and clearing continued between 2019 and 2022, particularly in the Lower Herbert. The loss and/or modification of freshwater floodplain wetlands in the Herbert has been significant. Of the original 20,732 hectares of freshwater floodplain wetlands, only 6,644 hectares of natural unmodified wetlands remained in 2017, with the Lower Herbert particularly impacted. The Herbert has a large total gully Average Annual Sediment Supply (83,389 tonnes per year) and gully length (3,015 km), though gully erosion rates (supply/length) remain relatively low.

In terms of pollutants, the modelled total annual average loads from the Herbert are among the highest in the GBR catchment area. It is the second largest exporter of DIN contributing 13% of the total GBR DIN load (1,163 tonnes), and sugarcane areas are the dominant source (71%). The Herbert is also the third largest exporter of fine sediments to the GBR (modelled total annual average load of 361 kilotonnes). Grazing and streambank areas (74%) are the primary sources of fine sediments, with hillslope erosion (47%) and streambank erosion (47%), the dominant transport pathways. Pesticide risk ranges from Low to Moderate. Imidacloprid and diuron are the biggest contributors to this risk.

Freshwater floodplain wetlands in the Upper Herbert are in Moderate condition, while those in the Lower Herbert are in Poor condition. Pressures include native vegetation modification and clearing, pest species, soil disturbance, and connectivity. Based on the 1,954 hectares of natural and slightly modified freshwater floodplain wetlands included in the hazard assessment for the Upper Herbert, 55% are exposed to High or Very High nutrient hazard, 95% are exposed to High or Very High sediment hazard, and 18% are exposure to Moderate, High or Very High pesticide hazard. Of the 5,305 hectares included in the assessment for the Lower Herbert, 91% are exposure to High or Very High nutrient hazard, 96% to High or Very High sediment hazard, and 85% to Moderate, High or Very High pesticide hazard.

In 2022–23, coral reefs adjacent to the Herbert basin were in Moderate condition however these have declined in condition following the flood events of 2025, and seagrass meadows remain in Poor condition. The marine DIN exposure score is High, ranking third among all GBR catchments, reflecting the significant anthropogenic DIN load and large extent of the river footprint. Sediment exposure is also High, ranking fourth across the GBR, reflecting the relatively high anthropogenic fine sediment load and large river footprint. Pesticide exposure is Moderate.

4.8.2. Overall management response and focus areas

Based on the likelihood of pollutant exposure and ecosystem condition, a comprehensive multi-pollutant management response is required across the Herbert basin, involving sustainable land use and natural systems repair. At the basin scale, this includes large-scale **Intensive management of nutrients and sediment**, and **Accelerated pesticide management** in targeted sub-catchment areas. Complementary to the basin-wide management response, freshwater floodplain wetland hazard exposed areas require Intensive management for all pollutants in the Lower Herbert management unit,

Intensive sediment management in the Upper Herbert and validation of the intensive nutrient management and Accelerated pesticide management responses. All remaining areas should be managed through a broadscale Foundational response to maintain low future exposure risks.

As freshwater floodplain wetlands are in Poor condition in the Lower Herbert, evaluate the drivers of condition and determine the need and feasibility of intervention options to support ecosystem recovery or rehabilitation. Following declines in seagrass and coral condition from the 2025 flooding, an evaluation of the need and feasibility of intervention options to support ecosystem recovery or rehabilitation is required, particularly in the Hinchinbrook Channel, Lucinda and Hinchinbrook Island and the northern Palm Islands (e.g. Pelorus) and ecosystems within proximity to high value areas (such as Fish Habitat and Dugong Protection Areas).

In the Lower Herbert catchment, stakeholder consultation emphasised the need to strengthen grower engagement and support through peer-to-peer learning, mentoring, and better extension services, while ensuring BMP initiatives address productivity constraints. There was strong support for integrated catchment approaches, improved riparian and wetland management, and erosion control measures. Building local skills and capacity—including Traditional Owner involvement and youth pathways —was highlighted as essential. In the Upper Herbert, stakeholder consultation highlighted the importance of strengthening sustainable land and farm management through whole-of-farm planning, regenerative grazing tailored to local conditions and improved practice road maintenance. Improved vegetation and weed control were seen as critical, with calls for stronger coordination and better mechanisms to manage groundcover and timber thickening specifically. Restoration and rehabilitation efforts were also prioritised, including wetland restoration, mine site recovery, and practical tools to support landscape restoration.

The Herbert Integrated Project (HIP), funded by DETSI (Office of the Great Barrier Reef and World Heritage), is a major initiative for the Herbert basin. The main components of the initiative include the development of the Herbert Catchment Action Plan and several projects associated with it including Whole of Farm Planning, Feral Pig Management, Circular Economy, Natural Capital, Upper Herbert grazing management (woody weeds/thickening) and Water Quality Communications. The HIP is adopting the ‘place-based’ approach with a strong focus on stakeholder involvement and consultation in all stages from design to delivery.

4.8.3. Herbert sustainable land use and management

Table 21. Herbert *Sustainable land use & management Action and Delivery Strategies required to achieve Regional Objective 1. The* ***Basin-scale Strategic management response*** *aligns to the recommended Management Response for nutrients, fine sediment, and pesticides (Section 3.2.2). The* ***Action Strategies*** *are scaled according to the Management Response for each pollutant and ranked according to the pollutant's* ***Dominant land use sources*** *- the relative contributions of the basin's agricultural and non-agricultural land uses: DIN and fine sediment action strategies are ranked by the relative total annual loads of the top 'manageable' land use contributions (i.e. excludes conservation areas), and pesticide action strategies are ranked by the basin's highest land use areas and their potential (higher vs lower) for pesticide risk– see Section 3.2. Specific stakeholder feedback is described in further detail in Appendix 1. Strategies to support scaled delivery (Action Area III) are explained further in Section 4.9.*

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
HERBERT **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards.** See specific stakeholder feedback for Herbert basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Nutrients **Expedite reductions in *High* DIN exposure on marine ecosystems and wetland hazard exposed areas through an *Intensive*, large-scale management response.** *Action is required across multiple agricultural land uses, primarily focused on DIN reduction in sugarcane. Additional reductions could also be achieved through targeted interventions in urban areas including Ingham and point source loads. Increasing adoption of soil erosion management practices in grazing lands may also reduce DIN further. Management includes a focus on DIN plus other nutrients in land use areas upstream and surrounding wetlands (with validation required in the Upper Herbert).* *Foundational management of nutrients in all other areas to prevent future sources of nutrients.*	**Sugarcane** 76,479 ha (71% of total annual average DIN load)	Rapidly maximise and sustain widespread adoption of practices that reduce DIN runoff in sugarcane including farm nutrient management planning that includes accounting for nitrogen derived from legume rotation crops or mill mud application, reducing nitrogen rates on late harvested or poor performing ratoons, and using Enhanced Efficiency Fertiliser products on late harvested cane, along with complementary practices to manage Ratoon Stunting Disease and use of soil ameliorants to address soil constraints. *Focus areas: Lower Herbert*	Deliver coordinated and integrated programs that accelerate sustained adoption of target basin-scale management responses, tailored to local socio-economic and cultural contexts, land use types, and land managers' capacity, opportunities, and motivations, including: • Capacity, skills and expertise • Social norms and trust development • Decision support • Incentives and markets • Technology and equipment
	Urban + STP 6,690 ha (1.4% of total annual average DIN load)	Encourage and support adoption of actions to reduce DIN in point source discharge and stormwater runoff through sewage treatment plant (STP) upgrades, increased reuse and efficiencies in sewage system management, and strategically located stormwater treatment interventions including maintenance and enhancement of natural assets to mitigate runoff, and treatment trains (e.g. constructed wetlands, biofilters, vegetated swales, riparian vegetation restoration). Identify and manage potential risks from nutrient discharge in unsewered areas.	

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
HERBERT **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards.** See specific stakeholder feedback for Herbert basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
	Grazing 496,307 ha (15% of total annual average DIN load)	Encourage and support adoption of improved practices that reduce DIN export through reducing sediment runoff in grazing. *[This action is a co-benefit of sediment erosion management actions – refer below]*	*See example interventions in* Section 4.9.
Sediment **Expedite reductions in High sediment exposure on marine ecosystems and wetland hazard exposed areas through an *Intensive*, large-scale management response.** *Action is required across multiple agricultural land uses, primarily focused on reducing sediment erosion in grazing and streambanks, particularly in the Upper Herbert. Additional reductions could also be achieved through management of hillslope and to a lesser extent streambank erosion in sugarcane and irrigated cropping in the Lower Herbert. Management includes a focus on sediment in land use areas upstream and surrounding wetlands.* *Foundational management of sediments in all other areas to prevent future sources of sediment.*	**Streambank** (47% of total annual average sediment load)	Rapidly maximise and sustain widespread adoption of improved management practices in riparian zones that stabilise and protect frontage country including riparian fencing/excluding cattle from streambank access, managing weeds and pests including feral animals, and revegetation in riparian zones. *[These actions are complementary to Natural Systems Repair actions]*	
	Grazing 496,307 ha (27% of total annual average sediment load)	Rapidly maximise and sustain widespread adoption of improved practices to reduce sediment erosion including matching stocking rates to carrying capacity and complementary practices such as wet season spelling (particularly in the Upper Herbert) and managing linear features and frontage country (see Streambank).	
	Sugarcane 76,479 ha (4.5% of total annual average sediment load)	Encourage and support adoption of improved practices that reduce sediment erosion in sugarcane, including use of fallow crops and trash blanketing, minimal/ zero tillage, controlled traffic practices, installing vegetated spoon drains, revegetation of drains and buffers and strategically located sediment traps.	
	Irrigated cropping 4,149 ha	Encourage adoption of practices that reduce sediment erosion in irrigated cropping including improving fallow and	

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
HERBERT **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards.** See specific stakeholder feedback for Herbert basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
	(0.5% of total annual average sediment load)	inter-row management to retain groundcover, managing headlands and drainage to minimise runoff and erosion, and installation of strategically located sediment traps.	
Pesticides **Actively reduce Moderate pesticide exposure on marine ecosystems through an Accelerated management response in targeted sub-catchments, including Intensive management of pesticides in wetland hazard exposed areas in the Lower Herbert** *Focus is primarily on sugarcane. Additional reductions could also be achieved through dryland and irrigated cropping, horticulture, grazing and non-agricultural areas. Management includes a focus on pesticides in land use areas upstream and surrounding wetlands (with validation required in the Upper Herbert).* *Foundational management of pesticides in all other areas to prevent future sources of pesticides.*	**Sugarcane** 76,479 ha (7.8% of basin area and a higher potential for pesticide risk)	Rapidly maximise and sustain widespread adoption of practices that minimise pesticide risk from sugarcane including following label conditions, reducing overall pesticide application rates (within label recommendations), adopting precision technologies (e.g. Dual Herbicide Sprayer), switching to lower risk products, optimising application timing relative to rainfall, managing point sources and adopting integrated pest management holistically across the basin. *Focus areas: Lower Herbert*	
	Dryland and irrigated cropping, and horticulture 5,602 ha (<1% of basin area and a higher potential for pesticide risk)	Encourage and support adoption of improved practices that minimise pesticide risk from dryland and irrigated cropping and horticulture including following label conditions, product selection, rate, timing of application, precision technologies and integrated pest management.	
	Grazing 541,703 ha (50% of basin area and a lower potential for pesticide risk)	Encourage adoption of improved practices that minimise pesticide risk from grazing including following label conditions, product selection, rate, timing of application, precision technologies and integrated pest management.	
	Non-agricultural areas (urban and forestry) 6,690 ha	Encourage adoption of improved practices that minimise pesticide risk from non-agricultural land uses including	

Regional Objective: *Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystems.*			
HERBERT **Basin-scale strategic management response**	**Dominant land use sources** Land use area (Contribution to total basin load or pesticide risk) [A]	**Action Strategy** **Action Strategies are in addition to the adoption of Minimum Standards.** See specific stakeholder feedback for Herbert basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
	(5% of basin area and lower potential for pesticide risk)	following label conditions, product selection, rate, timing of application, and improved wastewater treatment processes.	

[A] Loads are presented as the Total Annual Average, not the Anthropogenic Load. Data is unavailable to determine quantified land use contributions to pesticide risk, rather the land use's relative potential for pesticide risk is noted along with the proportion of the basin the land use occupies.

[B] DIN load from grazing is primarily linked with sediment erosion and therefore is treated as a co-benefit of sediment reduction actions. For this reason, grazing sources of DIN are acknowledged but ranked lower in the table.

4.8.4. Herbert natural systems repair

***Table 22**. **Herbert** Natural Systems Repair Action and Delivery Strategies required to achieve Regional Objective 2. The **Basin-scale Strategic management response** aligns to the recommended pollutant Management Response levels and ecosystem condition assessments. The **Action Strategies** target natural system drivers of water quality risks (streambank and gully erosion[1], vegetation and wetland loss[2]) and the condition of ecosystems[3] (freshwater floodplain wetlands, seagrass, coral, and ecosystem connectivity). [1]Streambank and gully action strategies are ranked and scaled based on their contributions to the basin's sediment load. [2] Vegetation loss and wetland loss/or modification action strategies are scaled based on % losses and identified hotspot areas. [3] Ecosystem condition action strategies are based on ecosystem condition ratings – poor, moderate or good. Specific stakeholder feedback is described in further detail in Appendix 1. Strategies to support scaled delivery (Action Area III) are explained further in Section 4.9.*

Regional objective: *Rehabilitate and sustain natural catchment processes, connectivity and ecosystem function in the Region that support healthy aquatic ecosystems, improve water quality outcomes, and deliver co-benefits such as biodiversity conservation, climate resilience, and enhanced landscape productivity.*			
HERBERT **Basin-scale strategic management response**	**Natural Systems (for repair)**	**Action Strategy** See specific stakeholder feedback for Herbert basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
Expedite widespread repair and rehabilitation of natural systems to improve natural system processes for water quality outcomes and improve ecosystem condition.	**Streambank rehabilitation** (47% sediment load contribution)	Rehabilitate, protect and maintain streambanks in priority locations through revegetation of riparian areas and structural and engineered interventions for bank stabilisation and reshaping such as rock protection or rock armouring, timber pile fields and in-channel benches. *[These actions are complementary to Sustainable Land use and Management actions for sediment reduction]* For guidance, refer to the Queensland River Rehabilitation Management (QRRM) Guideline[A].	Deliver coordinated and targeted natural systems and ecosystem rehabilitation programs that accelerates lasting restoration outcomes, tailored to local ecological contexts, and the capacity, opportunities, and motivation of diverse stakeholder groups (including landholders and land managers, community groups, and government agencies), including: • Capacity, skills and expertise • Incentives and markets • Decision support • Technology and equipment
	Gully rehabilitation (5.4% sediment load contribution)	Remediate and maintain gullies in priority locations through revegetation of gullied area and stock exclusion with fencing as required, installation of temporary structures such as stick traps, porous check dams, contour banks and engineered check dams, and at larger scales, mechanical gully reshaping, earth works, rock capping and revegetation.For guidance, refer to the Gully and Stream Bank Toolbox[B].	
	Native vegetation clearing (6% in Upper Herbert and 34% in Lower Herbert), **Riparian vegetation clearing** (10%), and	Actively manage woody weeds and associated woody vegetation thickening in the Upper Herbert. Actively reduce wetland loss and/or modification and vegetation clearing through promoting awareness of regulatory standards for vegetation clearing and other co-benefits.	

Regional objective: *Rehabilitate and sustain natural catchment processes, connectivity and ecosystem function in the Region that support healthy aquatic ecosystems, improve water quality outcomes, and deliver co-benefits such as biodiversity conservation, climate resilience, and enhanced landscape productivity.*			
HERBERT **Basin-scale strategic management response**	**Natural Systems (for repair)**	**Action Strategy** See specific stakeholder feedback for Herbert basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
	Natural freshwater floodplain wetland modification and/or loss (68%)	Establish and maintain buffer zones and undertake weed control in riparian areas of waterways and wetlands areas. Implement feral animal control in strategic locations. Support actions and encourage incentives (e.g. environmental markets) to increase revegetation and wetland rehabilitation at strategic locations in the landscape that improve connectivity, water quality and ecosystem service functions. Maintenance of rehabilitation activities is essential. For guidance, refer to the goals, objectives and activities in the Reef 2050 Wetlands Strategy[C] (particularly *Theme 3: On-ground activities to protect, manage, rehabilitate and restore wetlands*) and Queensland River Rehabilitation Management (QRRM) Guideline.	*See example interventions in Section 4.9 of the Strategy.*
	Wetlands **Upper Herbert** (Moderate Condition): Intensive management response for sediment. **Lower Herbert** (Poor condition): Intensive management response for nutrients, sediments and pesticides.	Validate wetland nutrient and pesticide hazard assessments in the Upper Herbert and, where required, implement targeted management in wetland hazard-exposed areas. Further assess wetland condition to clarify the role of pollutant pressures and other drivers. In the Lower Herbert, evaluate the ecological, social and cultural values of wetlands, assess additional drivers of poor condition and determine recovery potential. Where appropriate, coordinate targeted interventions to enhance wetland values, condition and water quality functions, including improving hydrological integrity, managing pest species, safeguarding native vegetation, strengthening riparian buffers and minimising pollutant inflows to wetlands. Assess the feasibility of constructed wetlands or treatment systems to improve water quality while maintaining natural wetland values. For guidance, refer to the goals, objectives and activities in the Reef 2050 Wetlands Strategy [C]	

Regional objective: *Rehabilitate and sustain natural catchment processes, connectivity and ecosystem function in the Region that support healthy aquatic ecosystems, improve water quality outcomes, and deliver co-benefits such as biodiversity conservation, climate resilience, and enhanced landscape productivity.*			
HERBERT **Basin-scale strategic management response**	**Natural Systems (for repair)**	**Action Strategy** See specific stakeholder feedback for Herbert basin actions in Appendix 1.	**Delivery Strategy** (linked to Strategic Action Area III – Section 4.9)
	Marine ecosystems – seagrass (Poor) and coral (Moderate)	Evaluate seagrass ecological, social and cultural values, other potential drivers of the poor condition and the ecosystem's potential for recovery. Prioritise further investigation and development of targeted interventions in identified pollutant hotspots, including inshore and deep seagrass habitats in the Hinchinbrook Channel, Lucinda and Hinchinbrook Island and coral reefs following further declines in condition in the northern Palm Islands (e.g. Pelorus) from the 2025 flooding. Evaluate the need for additional intervention options to support habitat function, taking into account proximity to high value areas such as the Hinchinbrook Channel, Halifax, and Cattle-Palm Creek Fish Habitat Areas, Hinchinbrook Channel Dugong Protection Area and other identified ecosystem values.	
	Connectivity	Support interventions to enhance hydrological connectivity and improve habitat linkage such as removing barriers to fish passage, and restoration and rehabilitation activities. Maintain areas where activities have already been completed. Evaluate the need for additional intervention options to support habitat function, taking into account proximity to high value areas such as the Hinchinbrook Channel, Halifax, and Cattle-Palm Creek Fish Habitat Areas. For guidance, refer to the goals, objectives and activities in the Reef 2050 Wetlands Strategy[C] (particularly *Theme 3: On-ground activities to protect, manage, rehabilitate and restore wetlands*).	

[A] Department of Environment and Science (2022); [B] Wilkinson et al. (2022); [C] Department of Environment, Science and Innovation (2023a).

4.9. Actions to support scaled delivery (Strategic Action Area III)

Substantial effort has already been undertaken to improve management practices for water quality outcomes in the Wet Tropics region. However, achieving widespread adoption of management responses requires more than identifying the right management response (as described in Strategic Areas I and II), it requires designing programs and initiatives that account for the socio-economic context, and the capacity, opportunity and motivation of the land managers being engaged. A synthesis of evidence conducted for the 2022 Scientific Consensus Statement found that factors influencing uptake of management practices operate at multiple levels, from macro (governance, policy, economics) through to meso (industry, community) and micro (individual landholders and relationships), and that context and the processes used to engage with land managers (including the economic and operational conditions land managers are facing at the time of engagement) are critical considerations for program design (Murray-Prior et al., 2024).

A range of policy instruments can be used to support adoption, including suasive approaches (e.g., capacity and skills and decision support tools), financial mechanisms (e.g., incentives and markets), regulatory tools[10] (e.g., compliance requirements), and procedural instruments (e.g., planning frameworks, partnerships). This aligns with established behavioural science frameworks, including the COM-B model (Michie et al., 2011) as well as past research in agricultural land management practice adoption (DPI, 2025; Coggan et al., 2021).

The choice of instrument - and the intensity of investment - should be tailored to both the target management response level (Foundational, Proactive, Accelerated, or Intensive) and the identified barriers and enablers (i.e., capacities, opportunities and motivations) within the target audience. In essence, delivery methods should be chosen to meet and build on identified barriers and enablers, while the level of effort and investment should align with the intensity of the management response being sought.

4.9.1. Coordinated and targeted program design and delivery

The following section describes a range of delivery strategies and actions that can be used to build coordinated and targeted programs that support Strategic Action Areas I and II. These include strategies relating to: capacity, skills and expertise; social norms and trust development; decision support; incentives and markets; and technology and equipment.

While these strategies and actions are presented generically, their selection and intensity should be tailored to both the management response level and the barriers preventing adoption within the target audience. This approach draws on the Behaviour Change Wheel (Michie et al., 2011), which uses the COM-B model to match delivery strategies to diagnosed barriers. The COM-B model identifies three components that can enable or be a barrier to adoption:

- Capability – the physical and psychological ability to perform the behaviour, including having the necessary knowledge, skills, and confidence.
- Opportunity – the physical and social environment that enables the behaviour, including access to resources, infrastructure, time, and supportive social norms.
- Motivation – the reflective and automatic mechanisms that activate or inhibit behaviour, including beliefs about consequences, intentions, goals, habits, and emotional responses.

[10] Regulatory instruments are not covered in this Strategy. However, regulation plays an important role in establishing minimum standards, and providing a baseline from which voluntary programs can encourage further improvement. The interaction between regulatory and non-regulatory instruments should be considered in program design.

Importantly, these three components are not static attributes, they can shift significantly in response to the current economic and operational conditions. For example, rising input costs (e.g., diesel, fertiliser, climate impacts, market volatility, or compounding biosecurity pressures) can both limit landholders psychological capability and/or constrain their financial opportunity to engage with further change.

Program design needs to be responsive to these conditions, including careful consideration of the prevailing context, reducing the cognitive burden of participation, and ensuring delivery mechanisms account for the real-world pressures land managers are navigating.

It is important to note that this framework provides general guidance only and should be used in conjunction with local knowledge and direct engagement with target land managers wherever possible.

If direct engagement with the target audience to assess their current capabilities, opportunities and motivations in relation to the target management action is not feasible, program designers can draw on existing research and monitoring. The social monitoring program, coordinated through the Office of the Great Barrier Reef and World Heritage (DETSI), collects data through standardised surveys administered to landholders participating in state and federally funded water quality improvement projects. From 2019 to 2024 the survey was referred to as the 'social monitoring survey'. In 2022-23, following a rigorous review process, the survey was updated to the Perceptions of Practices (or PoP) Survey. Both the historical social monitoring survey and the updated Perceptions of Practices survey (Paddock to Reef program) measure components of capacity, opportunity, and motivations of landholders engaged in water quality programs to adopt targeted practices as described in the Water Quality Risk Frameworks. Detailed reports on the outcomes of the social monitoring program are provided directly to the delivery providers to support their program implementation and to track progress towards outcomes. In addition to the PoP surveys (Office of the Great Barrier Reef, DETSI) a biennial survey that benchmarks the broader regional agricultural community, including both program participants and non-participants, using constructs aligned with the Perceptions of Practices survey is conducted. This survey seeks to provide the additional understanding of the capabilities, motivations and opportunities of producers not actively engaged in Reef water quality funded programs. These surveys are administered across the six GBR catchment areas. The surveys target producers in commodities subject to Reef Water Quality regulations, including grazing, sugarcane, grains, bananas and horticulture. The first wave of this quantitative research was conducted in 2023, with the second wave undertaken in 2025 to identify changes over time (MCR, 2023, 2025).

The social monitoring program is ongoing, with surveys conducted periodically to track changes over time. Delivery providers designing or refining their programs should refer to the latest available report cards for the Paddock to Reef program (www.reportcard.reefplan.qld.gov.au/), or ideally conduct their own research into their target audience.

For the urban sector, very little is known about the factors influencing adoption of improved practices (Murray-Prior et al., 2024). Direct engagement with urban land managers and stakeholders will be essential to inform program design in this context.

4.9.2. Delivery Strategy Design Process

There are several factors that need to be considered for selection of Delivery Strategies and program design. A process to design an effective, evidence-based delivery program is proposed in Figure 11. Table 23 provides an example of the application of the design process showing how to integrate Management Response Categories with COM-B Diagnostic Assessment to inform the selection of Delivery Strategies.

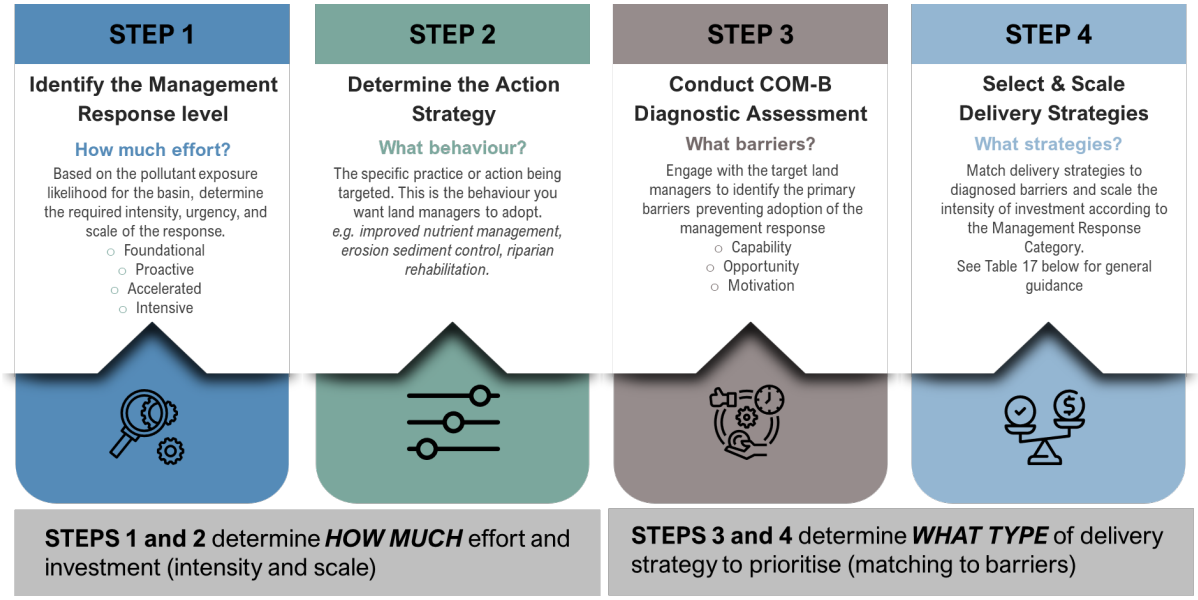


Figure 11. *Proposed process for designing an effective, evidence-based delivery program.*

Table 23. *Scaled Delivery Strategy selection.*

Response Category	Strategic Intent & Scale	COM-B Focus	Typical Pathways	Delivery Strategy Mix & Intensity
FOUNDATIONAL *Minimal pollutant exposure*	Maintain baseline regional capability and readiness to protect water quality and ecosystem health. Scale: Region-wide minimum standards	Identify primary barrier: *Typically limited to:* • Lack of awareness • Limited engagement/ relationships	Minimum practice support, baseline skills development, community awareness, relationship building (if needed).	Lower intensity, 1–2 strategies: • Basic education & awareness • + Social norms & trust (if needed)
PROACTIVE *Low pollutant exposure*	Build localised capacity and early action pathways to prevent emerging risks. Scale: Local-scale, preventative	Identify primary barrier: *May include:* • Skills gaps (Capability) • Limited peer support (Social opportunity) • Uncertainty about options (Motivation)	Targeted extension, early-adopter support, local pilot projects, peer networks, localised coordination.	Low–medium intensity; 2–3 strategies: • Capacity, skills & expertise • Social norms & trust
ACCELERATED *Moderate pollutant exposure*	Rapidly scale coordinated delivery to reduce pollutant exposure and improve ecosystem condition. Scale: Sub-catchment targeted	Diagnose primary barrier: *Often includes:* • Technical skills gaps (Capability) • Resource/cost constraints (Physical opportunity) • Economic concerns (Motivation) • Negative norms or low trust (Social opportunity)	Regional partnerships, coordinated program delivery, industry-led initiatives, workforce strengthening, targeted incentives.	Medium intensity; 3-5 integrated strategies: • Skills: Capacity + Decision support • Economic: Incentives + Decision support • Social: Social norms + Capacity
INTENSIVE *High pollutant exposure*	Mobilise large-scale, cross-sector delivery capability for urgent and sustained improvements. Scale: Large-scale, multiple land use	Address ALL barriers: *Address all barriers across:* • Capability (knowledge, skills, confidence) • Physical opportunity (resources, infrastructure) • Social opportunity (norms, trust) • Motivation (economic, habits, risk aversion)	Whole-of-system coordination, large-scale deployment, multi-sector governance, intensive investment, real-time adaptive management. Maximum intensity; sustained, multi-year engagement.	Deploy ALL strategies: • Capacity, skills & expertise • Social norms & trust • Decision support • Incentives & markets • Technology & equipment

A more detailed list of delivery strategies, along with recommended actions and examples of initiatives, is provided below with specific examples added from local stakeholder workshops. These should be further developed at a basin or catchment scale, such as through the development of Catchment Action Plans, adopting a comprehensive co-design process involving landholders, stakeholders, technical experts, decision makers and Traditional Owners. See also Appendix 2 for a Diagnostic Tool for guiding the selection and design of targeted, evidence-based delivery strategies.

Delivery Strategy: Support for Strategic Action Area I – Sustainable land use & management

Deliver coordinated and targeted programs that foster sustained adoption of management responses, tailored to local socio-economic contexts, land use types, and land managers' (both agricultural and non-agricultural) capacity, opportunities, and motivation.

Supported by Regional Implementation Strategies (Section 5).

The intent is for investors and delivery providers to scale implementation effort based on pollutant Management Response levels, with highest intensity for Intensive and Accelerated responses. The mix of Delivery Strategy actions (i.e., knowledge, capacity, social norms, decision tools, incentives) is tailored based on local socio-economic contexts and land manager characteristics (capacity, opportunities, motivation) – as described Figure 7 above with more detailed guidance in Appendix 2.

Capacity, skills and expertise

- ► Build, sustain and strengthen technical and practical capability for land managers and technical advisors to implement management responses through targeted skills programs, intensive one-on-one mentoring, peer learning networks, and sustained practice-change support systems.

Example cross-basin actions:

- Deliver sustained mentoring and peer coaching programs that support land managers through initial implementation, refinement, and long-term maintenance of practice changes.
- Provide tailored training and skill development through one-on-one, peer-group, technical and agronomic support.
- Build technical and geospatial capability through digital literacy training and support for spatial data platforms.
- Re-engage landholders with industry BMP programs, promoting BMP as an ongoing process and exploring pathways beyond minimum requirements.

Examples of high priority actions in each basin from stakeholder consultation (refer also to Appendix 1):

Mossman-Daintree:

- Involve growers in high-level transition planning to address issues such as the sugar mill closure.
- Facilitate knowledge exchange between local growers and experienced farmers from other industries on crop transition.

Upper Barron:

- Support small crop growers and graziers new to the Region or industry through targeted extension.

Mulgrave:

- Promote the development and adoption of property-specific management plans through access to extension services (*also Lower Herbert*).
- Promote the use of lime and mill mud for soil health by educating growers on the benefits and addressing barriers to uptake, including availability and cost.

- Improve mill mud application with operator precision equipment training, and better logistics, including access to challenging terrain (*also Russell*).

Russell:

- Improve mill mud application with operator precision equipment training, and better logistics, including access to challenging terrain *(also Mulgrave).*

Tully Murray:

- Provide targeted extension to new banana grower profiles who lack experience and/or local knowledge.

Herbert:

- Promote the development and adoption of property-specific management plans through access to extension services (*also Mulgrave*).
- Create a one-stop 'how to' guide for restoration of a degraded/poor condition paddock *(Upper Herbert).*
- Whole-of-farm planning (*Lower Herbert*).

Examples of initiatives:

- BMP Programs (e.g., SmartCane BMP, Hort360) and other sustainable best practice grower incentive models as they are developed.
- Herbert Integrated Project (DETSI Place-based Project)
- Reef Trust Reefwise Farming
- Future Farming

Social norms and trust development

► Accelerate positive stewardship norm shifts for management responses and build trust between land managers, delivery organisations, and scientists through peer-to-peer networks, visible recognition of good practice, programs that empower individuals as change leaders, and collaborative partnerships where all stakeholders co-create solutions together.

Example actions:

- Improve grower recognition by finding genuine and impactful ways to reward good practice that recognise that people are often driven by social appreciation rather than certificates.
- Facilitate peer-to-peer networks, producer groups and locally based forums to support learning and social reinforcement targeting specific groups where appropriate (e.g. younger grower groups, progressive growers).
- Promote inclusive and equitable engagement, recognising diverse roles in decision-making and stewardship.
- Support stewardship leaders to influence their peers and the broader community to adopt improved practices, recognising progressive land managers.
- Foster trust through collaborative monitoring and trials where land managers, scientists, and delivery staff co-design and evaluate solutions together.
- Support multi-topic field days, sports days, and informal gatherings for landholders build trust and visibility, even if not directly linked to pollutant outcomes.
- Encourage long-term projects and provide specific support for legacy work (refer also to Section 5).
- Review previous initiatives that were well supported by land managers such as Project Catalyst grower forums and Reef Guardian Farmers.

Examples of initiatives:

- Herbert Water Quality Monitoring Program

- Herbert Integrated Project (DETSI Place-based Project)
- Russell Mulgrave Coastal Restoration Projects (Reef Trust)

Decision support

► Encourage and support the development and use of place-based decision-support systems, monitoring and modelling that enable land managers and partners to select the most effective management responses in priority sub-catchments.

Example actions:

- Expand the availability and usability of existing nutrient, pesticide and water management tools. For example, provide growers with clear guidance on pesticide product selection, application and timing, including information on the risks, efficacy and implications of alternative products.
- Continue to develop easy to use tools that provide information directly relevant to landholders in decision making, including understanding the economic aspects of management practices. For example, support for property-level economic and environmental analysis to inform investment.
- Establish central data and spatial resources among extension staff, technical experts, delivery providers and stakeholders to improve accessibility and coordination.
- Support enterprise and property planning that links environmental outcomes with business goals.
- Support succession and legacy planning that maintains environmental stewardship across transitions.
- Integrate behavioural insights and adoption research into tool design and deployment.
- Ensure that information that supports property planning is readily accessible including hydrological mapping, soil and EM mapping.

Examples of initiatives:

- Queensland Globe for spatial mapping data
- Pesticide Decision Support Tool and Pesticide Projector (DPI, Truii)
- Facilitated stakeholder workshops / discussions using GIS
- Paddock to Reef decision support tools, e.g. Projector Tool
- SIX EASY STEPS™ nutrient management program
- Natural Capital Project
- FORAGE Long Paddock for seasonal climate and pasture condition information
- Grower – advisor management recording and reporting tools, such as Agtrix

Incentives and markets

► Encourage and support the growth of innovative incentive mechanisms and environmental markets that reduce barriers, improve co-benefits and support sustainable livelihoods.

Example actions:

- Build economic awareness and provide analysis to support informed decisions on practice adoption.
- Explore and trial innovative financing models, including alternative finance and natural-capital accounting frameworks.
- Provide flexible funding incentives (e.g. grants, rebates) to support uptake of improved practices and efficient equipment (Lower Herbert – priority for efficient machinery such as minimum till, GPS-controlled).
- Support participation in emerging environmental markets, incentive programs and payment for ecosystem services schemes.

High priority action for the Mossman-Daintree basins (refer also to Appendix 1):

- Incentivise novel practices and support innovative growers during economic transition.

Examples of initiatives:

- Reef Credits Scheme including DIN, Gully and Wastewater Methods
- Cassowary Credits Scheme
- Australian Carbon Unit Scheme
- GRASS (Grazing Resilience and Sustainable Solutions)
- Natural capital – as part of the Herbert Integrated Project (Alluvium)
- Emerging initiatives including Regen Farmers Mutual

Technology and equipment

► Improve access to precision technologies, equipment and monitoring tools that support efficient, scalable implementation of Accelerated and Intensive actions.

Example actions:

- Increase availability and access to shared farming equipment (e.g. direct drills, mud spreaders) to encourage better management practices.
- Support the provision of precision equipment such as bean planters, mud spreaders and bed renovators.
- Address growing demand for mill mud and appropriate application, driven by increased ploughout-replant cycles.
- Provide shared-cost incentives to support technology transition.
- Facilitate co-investment in infrastructure upgrades, e.g. local mills, STPs, stormwater management systems.
- Encourage trials of emerging technologies in local areas including nature-based solutions across all land uses.
- Address the challenges small-scale farmers face due to limited access to equipment compared to larger growers.

High priority action for the Mulgrave catchment:

- Support adoption of existing precision application, variable-rate and monitoring technologies, e.g. precision equipment for lime and mill mud application such as bean planters, mud spreaders and bed renovators and laser levelling to support improved drainage management.

Examples of existing initiatives:

- Autoweed (James Cook University)
- Data 161

Delivery Strategy: Support for Strategic Action Area II

Deliver coordinated and targeted natural systems repair and ecosystem rehabilitation programs that achieve lasting restoration outcomes, tailored to local ecological contexts, and the capacity, opportunities, and motivation of diverse stakeholder groups (including landholders and land managers, community groups, non-government and government agencies).

Supported by Regional Implementation Strategies (Section 5).

Design and tailor a selection of actions appropriate for the basin and pollutant management response level. Level of effort should be most intensive for Accelerated and Intensive Management responses.

Capacity, skills and expertise

► Build capacity, and enable access technical support, for effective restoration activities. Facilitate incorporation of Traditional Owner Knowledge in local natural system repair actions including cultural fire management

Example actions:

- Provide technical training to build capacity in restoration techniques (e.g., site assessment, erosion control, revegetation, wetland construction, maintenance, monitoring).
- Build local capacity in restoration techniques through contractor and worker training, with a focus on innovative approaches suited to local conditions.
- Build local capacity for land restoration by providing certified courses and supporting existing organisations.
- Facilitate incorporation of Traditional Owner Knowledge in local natural system repair actions, including support for Traditional Owner teams and local employment opportunities.
- Reduce reliance on volunteers in systems repair activities by building the local skills base and expanding employment.
- Improve landholder education on natural ecosystem management to facilitate integration of natural systems repair and BMP actions.

Examples of existing initiatives:

- Reef Assist (DETSI)

Decision support

► Encourage and support the development and use of place-based decision-support systems, monitoring and modelling that enable land managers and partners to select the most effective natural systems repair and ecosystem rehabilitation approach in priority sub-catchments.

Example actions:

- Provide digital-literacy training and support for spatial and data platforms.
- Establish central data and spatial resources to improve accessibility and coordination.
- Support facilitated stakeholder workshops / discussions using GIS.
- Support property-level economic and environmental analysis to inform investment.
- Support enterprise and property planning that links environmental outcomes with business goals.
- Ensure that information that supports property planning is readily accessible including hydrological mapping, soil and EM mapping.
- Support succession and legacy planning that maintains environmental stewardship across transitions
- Integrate behavioural insights and adoption research into tool design and deployment.

High priority action for the Upper Barron catchment (refer also to Appendix 1):

- Conduct thorough hydrological mapping to inform land use and development planning in the catchment.

Examples of initiatives:

- LiDAR
- Gully and Streambank Toolbox
- Natural Capital Project
- Wetland*Info*

Technology and equipment

► Improve access to specialised restoration technologies, monitoring tools, and equipment that enable efficient, effective ecosystem rehabilitation at scale.

Example actions:

- Facilitate shared access to specialised restoration equipment.
- Support community groups with tool libraries and shared resources.

- Enable access to monitoring technologies to track restoration success.
- Encourage trials of emerging technologies.

Examples of initiatives:

- Reef Assist (DETSI)
- Great Barrier Reef Urban Technology and Innovation Fund

Incentives and markets

► Support diverse funding mechanisms and market opportunities that enable restoration activities across different land tenure and stakeholder groups.

Example actions:

- Provide grants and subsidies for restoration activities.
- Support participation in biodiversity and carbon credit schemes linked to restoration.
- Facilitate cost-sharing arrangements between councils, land managers, and community groups.
- Develop restoration stewardship payments for ongoing maintenance.
- Link restoration activities to emerging nature-positive market opportunities.

Examples of initiatives:

- Landscape Repair Program (DCCEEW)
- Streambank Remediation Program (DETSI)
- Reef Credits
- Upper Cattle Creek and Palm Creek cost sharing arrangements for aquatic weed control

Part C: Regional Implementation

5. Strategic Regional Implementation

Effective implementation of the Strategy requires several actions to be undertaken at the regional scale. It is important to note that these actions are not currently resourced and will depend heavily on alignment with existing initiatives, projects and programs. This emphasises the need to build on and improve what is already in place, leveraging partnerships and collaborating with ongoing programs to ensure that delivery is both practical and achievable within the Region.

5.1. Focused and targeted investment

- **Build on the Basin Water Quality Improvement Strategies by developing smaller scale implementation plans** that direct resources to the highest-impact actions. These plans should be guided by basin-specific management responses, targeted to high-impact sub-catchments, and informed by relevant social information.
- **Target basin-specific priorities** based on the dominant pollutant sources and loss pathways in each basin.
- **Focus on high-impact sub-catchments** where localised water quality issues may be significantly worse than end-of-catchment monitoring suggests.
- **Address urban water quality issues** through improved stormwater management, wastewater treatment, and urban planning.

The Strategy identifies Regional and basin scale priorities for each basin based on a diverse and comprehensive information base. It is essential that management and investment decisions continue to be underpinned by the best available science and local knowledge, adopting an adaptive management approach to decision making. The Basin Water Quality Improvement Strategies in Section 4 highlight these characteristics in each basin but are presently described at the basin scale.

Place-based collaborative approaches rely on implementation of management actions that are fit-for-purpose and tailored to the characteristics of the local landscape, with finer scale information, e.g. sub catchments. This requires reliable information at smaller scales about water quality drivers, pollutant 'hot spots', socio-economic contexts and potential limitations or constraints to local implementation. The Walking the Landscape process established through the Queensland Wetlands Program has been implemented in all of the Wet Tropics basins (to varying levels of detail) and provides a critical resource for guiding management priorities at finer scales. Local monitoring at finer scales can also guide local management priorities, taking into account contributions from all land uses, including urban areas.

The establishment of finer scale priorities within basins must be resourced with support for continuous improvement of knowledge and information.

Recommended actions:

- Develop a collaborative implementation plan based on target-basin specific priorities, using co-design approaches with regional partners and communities to identity and build on co-benefits.
- Ensure that information related to spatial prioritisation is readily available to delivery partners and kept up to date with the best available information on pollutant impacts, sources and transport pathways.
- Identify the co-benefits of management actions, which could be leveraged to drive adoption while delivering simultaneous economic, environmental or community benefits – helping to maintain sustained, long-term change.
- Align and coordinate delivery across all programs, regions and partners to ensure integrated implementation.

- Apply cost-effectiveness analysis (including accounting for natural capital and ecosystem service benefits) to prioritise investments in high-impact areas, filling knowledge gaps where required.
- Align public and private investment frameworks with land management actions that deliver both water quality and broader environmental benefits (e.g., biodiversity, carbon, climate resilience).

Examples of initiatives:

- Reef 2050 Wetlands Strategy (DETSI)
- Reef Trust Programs (DCCEEW)

5.2. Coordinated and collaborative governance and institutional arrangements

5.2.1. Enhanced coordination and collaboration

- Establish a strong, **region-wide coordination framework with clear governance** that aligns partners, programs, governance arrangements and community groups to support large-scale, collaborative delivery.
- Adopt **integrated, whole-of-catchment and landscape-scale planning** that respects community values, addresses patchiness across regions, and ensures cohesive, long-term management beyond GBR-specific initiatives. This includes using approaches like *Walking the Landscape* to integrate hydrology, ecology, and cultural values into planning.
- **Embed climate adaptation strategies** into catchment planning and implementation to strengthen resilience and sustainability across diverse land uses and communities.
- **Resource cross-regional coordination to ensure consistent implementation of Strategies across the GBR.** Provide sustained funding to support governance mechanisms that align Strategy delivery across the Region and with other GBR NRM regions, enabling transparency, consistency, and shared accountability.

Recommended actions:

- Coordinate extension networks to facilitate strategic, tailored, and repetitive support with consistent messaging from staff, specialists, and peers for landholders.
- Conduct a review of organisations working on water quality and use this to build cross-sector partnerships (e.g. between Councils and NRM delivery partners) that align planning, funding and monitoring efforts at basin scale and identify opportunities to maximise impacts, reduce duplication and promote larger and long-term benefits.
- Enhance coordination among agencies and working groups (e.g. WTMA, NRMs, River Improvement Trust) for efficient decision-making and project delivery by improving communication and sharing opportunities among stakeholders.
- Promote longer-term project timelines and investment models to support trust, learning and continuity.
- Identifying opportunities to coordinate and integrate actions and initiatives to maximise impacts, reduce duplication and promote larger and long-term benefits.
- Explore mechanisms to support ongoing maintenance of natural system repair woks, including resolution of issues of ownership and liability for on-going maintenance and restoration works.
- Develop specific catchment management plans such as the Catchment Action Plans developed under the Reef 2050 Wetlands Strategy.
- Strengthen coordination between regulatory agencies and program delivery to ensure consistent enforcement and clear expectations for landholders.

- Ensure programs build on from established industry standards (e.g. Smartcane BMP) to provide consistency and avoid shifting benchmarks.

Examples of initiatives:

- Reef 2050 Wetlands Strategy, Whole of System Values Based Framework and Catchment Action Plans
- Wet Tropics Healthy Waters Partnership and Regional Report Card initiative
- Regional Paddock to Reef Forums
- Indigenous-led catchment management plan for Trinity Inlet led by Gimuy Walubara Yidinji in partnership with CSIRO, and ongoing monitoring on water quality conducted by JCU and Gimuy.
- Reef Guardian Councils

5.2.2. Fit for purpose governance

► **Facilitate alignment of project governance with the overarching Strategy.** Establish processes to ensure that individual project and program governance structures formally recognise the Strategy and contribute to its objectives through aligned planning, reporting, and adaptive delivery.

The Strategy adopts a hierarchical approach, recognising that implementation of priorities will occur progressively through a diversity of funding sources. As these opportunities emerge, the development of detailed design and implementation plans will be essential to ensure alignment with the Regional outcomes and objectives. To maintain consistency within the Region and across the GBR's NRM regions, **adequate resourcing for coordination, governance, and collaboration for the Strategies** is critical. This includes mechanisms that support cross-regional alignment and transparent decision-making. While individual projects and programs will manage their own governance arrangements, it is important that these efforts are strategically aligned and acknowledge the Strategy's role and contribute meaningfully to the delivery of the Reef 2050 WQIP. For successful implementation of this strategy to achieve the objectives and outcomes, there is a critical need for Federal, State and other funding programs to also be aligned to the strategy through coordinated and collaborative systems.

Effective delivery of water quality outcomes will require robust governance, and sustained resourcing across all levels of implementation. This includes aligning strategic objectives and actions across government agencies, regional bodies, industry stakeholders, and Traditional Owners. Clear governance structures must define roles, responsibilities, and accountability mechanisms, ensuring decision-making is inclusive and transparent. Long-term, flexible funding is essential to support program continuity, adaptive management, monitoring, and the capacity of regional partners. Coordinated effort and resourcing across sectors will maximise the efficiency of interventions and amplify collective impact toward GBR water quality targets.

Recommended actions:

- Address policy and regulatory barriers to implementation including streamlining approval processes for riverine and in-stream works and better integration between government agencies.
- Build adaptive, outcome-focused governance systems that respond to changing conditions.
- Ensure transparency in funding and delivery through agreed plans that clearly identify roles, responsibilities and funding sources. These plans should include provisions for long-term maintenance and ongoing monitoring and evaluation to secure enduring outcomes.
- Provide flexibility in program design and funding arrangements.

5.3. Traditional Owner leadership, engagement and capacity

- **Strengthen Traditional Owner leadership, engagement and capacity** in the Region by supporting and securing traditional knowledge and aspirations, fostering meaningful engagement and partnerships, and expanding on existing initiatives.
- Country education and employment opportunities to deliver culturally grounded, inclusive, and sustainable outcomes.
- Ensure early, continuous, and adequately resourced engagement that empowers Traditional Owners to lead planning and decision-making, fosters collaboration across groups and generations, and builds lasting relationships for culturally respectful and sustainable management of Country and water.
- Embed cultural values and heritage in all water and land management by ensuring access to clean water, protection of cultural sites with thorough assessments, empowering Traditional Owners to lead and participate in planning, works, and monitoring, and supporting traditional practices and knowledge-sharing that sustain Country and enhance landscape health.

Traditional Owner groups in the Wet Tropics Region have expressed aspirations to become more involved in caring for their Country through initiatives such as establishing Ranger services. Their water quality project interests include removing unwanted species from waterways, restoring connectivity by removing barriers to fish movement, establishing complementary water quality monitoring programs, and developing Country-based or water quality plans specific to areas of cultural authority.

Recommended actions:

- Incorporate Traditional Owner knowledge and aspirations in water quality planning and implementation, including local management actions, recognising the deep cultural connections to waterways and the desire of Traditional Owners to be more involved in caring for Country.
- Support Traditional Owners to build local land managers understanding and awareness of the values and role of wetlands in the landscape, and potential management options.
- Provide training support for Traditional Owners to lead and participate in rehabilitation activities.
- Increase direct engagement with Traditional Owners and stakeholders to ensure knowledge is contextually meaningful and empowers informed decision-making.
- Support Traditional Owners to protect and retain traditional knowledge, including through increased capacity to record, manage and securely store this information. This could include expanded cultural mapping to register sites and an audit of Traditional Owner's values and priorities for the catchment.
- Improve understanding of how to engage with the appropriate Traditional Owner groups at a place-based level.
- Expand on-Country education and employment opportunities for Traditional Owners.
- Collaborate and find opportunities for indigenous-led catchment management, integrating cultural significance and Traditional Owner knowledge into water quality initiatives.
- Support Traditional Owner groups in their existing water quality initiatives. For example, water quality testing, revegetation, or weed management; as well as maintain partnerships with other stakeholders including local government.

Examples of initiatives:

- Reef Assist (DETSI)
- Reef Trust Reef Coastal Restoration projects

5.4. Regional delivery capacity

► **Build and sustain the specialist technical, cultural and delivery capability** required by expanding training, mentoring, extension and institutional capacity.

Recommended actions:

- Build on existing regional delivery capacity by investing in local organisations to retain skilled personnel, strengthen local and technical knowledge, and support integration of works across programs to achieve cumulative catchment-scale outcomes.
- Develop local capacity and attract new recruits through graduate programs and high school pathways. For example, establish a work experience/cadetship for local youth with TropWATER in the Lower Herbert and/or high school education to address local skill shortages in the Upper Barron catchment areas.
- Create incentives and support services for technical experts including private extension specialists to stay in the Region (across all land uses) to support the development of trust through strong relationships and help bridge the gap between policy and on-the-ground experience.
- Address the decline in the availability of on-ground delivery capacity in the sugarcane industry across service providers including contractors, machinery operators and mill operations. This was noted for the Tully, Murray and Lower Johnstone specifically.
- Increase regional capacity regarding soil conservation expertise and improve localised access, with a dedicated soil health program. Provide ongoing professional development and certification pathways for delivery staff.

Examples of initiatives:

- Queensland Reef Water Quality Program extension programs
- The Enhanced Extension Coordination in GBR project
- QFF Agricultural extension work placement program
- DPI A84 Integrated Engagement and Capacity Building Project
- Reefwise Farming project
- Grower Shed Meetings
- FEAT workshops (SRA, DPI etc.)

5.5. Knowledge sharing & communication

► **Strengthen community understanding and shared awareness among diverse stakeholders (e.g. industry, Councils, River Improvement Trusts, community groups, land managers)** of locally specific water quality issues, natural systems processes and the co-benefits of practice change and natural systems repair through clear, accessible and evidence-based communication.

► **Continue to build long-term trust through adaptive communication and ongoing evaluation of communication impact.**

► ***(Linked to)* Strengthen extension and support services** that build trust, recognise local knowledge, and provide practical assistance to landholders.

Recommended actions:

- Develop and implement an integrated Communication and Engagement Strategy that establishes clear and consistent communication across programs, industries and delivery partners supports awareness, understanding, and informed participation.
- Develop communication products that address grower concerns by recognising the impacts of all land uses on water quality, promoting balanced accountability, and fostering trust through

fair, inclusive engagement that counters negative perceptions of agriculture and encourages adoption of better practices.
- Communicate water-quality science and the link to local land management and ecosystem health to landholders and the broader community (especially in urban areas).
- Create the link between public health and waterway health to facilitate meaningful connections and greater engagement.
- Shift communication focus from water quality to soil health, regenerative farming, production systems, and local-scale indicators.
- Support trusted messengers and local champions and proactively address misinformation.
- Support communication products that showcase positive stories and progress, related to the 'social norms' of sustainable farming practices and stewardship, and help to improve trust in the scientific information.
- Tailor communication for diverse stakeholders, translating technical findings (including water quality monitoring) into accessible materials, and using culturally appropriate, values-based messaging.
- Increase knowledge and awareness of the benefits, co-benefits, costs and risks of practice change through on-farm demonstrations, long-term trial sites, case studies, monitoring and evaluation.
- Deliver targeted workshops to engage and educate resellers.
- Provide opportunities for communication and engagement between extension officers, practitioners, and growers to improve landscape-level understanding.
- Embed feedback mechanisms to evaluate communication efforts and continuously adapt strategies to stakeholder needs and effectiveness over time.

Examples of initiatives:

- Wet Tropics Waterways and Regional Report Card

5.6. Science and innovation

- **Foster stronger research-practice partnerships** with sustained investment in collaborative research programs where scientists and practitioners identify priorities, co-develop solutions, and rapidly test and scale innovations together.
- **Continue to invest in innovative technologies, methods and interventions** that can achieve land management improvements and water quality outcomes more efficiently.
- **Improve understanding of ecological and social drivers** to identify management levers and opportunities for intervention.
- **Support applied research at local scales to enable management solutions that are effective under local conditions.**

Recommended Actions:

- Establish formal research-practice partnerships with defined roles and shared priorities
- Invest in trials and demonstrations of innovative technologies and methods. For example, establish demonstration sites for new crops (e.g. kava, bana grass, sun hemp, sorghum) to educate growers and help with uptake).
- Establish and maintain demonstration and trial sites to validate evidence of the effectiveness and profitability of actions at a local level, and demonstrate science understanding and local application.
- Share outcomes demonstrated through case studies and transparent monitoring and evaluation data.
- Develop programs that share research and solutions across regions, and create pathways to scale successful innovations into mainstream delivery.

- Support research into key knowledge gaps such as:
  - Pollutant loss pathways, particularly through groundwater.
  - Cost-effectiveness (particularly the economic outcomes) of management actions at smaller scales, and in local settings.
  - Modelling capability to calculate fine sediment and particulate nutrient load reductions from natural systems repair activities – streambank, gullies, wetlands.
  - Effectiveness of streambank rehabilitation actions under different hydrological and landscape conditions in the region.
  - Water quality conditions in urban areas and baseline monitoring across more areas and including other pollutants.
  - Improved understanding of nutrient speciation and identification of management practices best suited to specific nutrient forms, e.g. nitrate from agriculture versus ammonium and nitrite from urban areas, to support more targeted and effective management.
  - Transformation of particulate nutrients and potential focus areas and validation of the assumption that focus areas are the same as fine sediments.
  - Evaluate and validate co-benefits across different land uses and bioregions to strengthen the evidence base.
  - Emerging risks and opportunities to inform climate resilience and future management approaches.
  - Regenerative grazing practices that maintain productivity and cost-effectiveness and generate potential carbon and biodiversity co-benefits. Identified priority for the Upper Herbert catchment.
  - Alternative pesticide methods.
  - Effects of rapid development and land subdivisions on regional hydrology and water quality.
  - Establishment and maintenance costs for ecosystem services - currently a lack of understanding and different costings in across multiple sources.
  - Management of wetland systems under local conditions for improved outcomes.
  - Options for improved connectivity and importance of fish habitat, and links to water quality conditions.
  - Options for nature-based solutions including aquaculture facilities in the treatment of land-based runoff.
- The following areas were identified for further investigation as part of the GBR SMP:
  - Further validation of the wetland hazard assessment:
    - Daintree – pesticides
    - Mossman – pesticides
    - Barron – nutrients, sediment and pesticides
    - Murray – sediment
    - Upper Herbert – nutrients and pesticides
  - Investigation of wetland condition:
    - Barron, Mossman and Daintree

Examples of initiatives:

- Supporting applied research for Landscape Repair Program
- Investigations associated with the Herbert Integrated Project

5.7. Monitoring, evaluation and adaptive management

- **Collaborate with existing monitoring and evaluation programs** including the Regional Report Card Partnership and Paddock to Reef program to support evaluation of the Strategy.
- **Strengthen integrated monitoring and adaptive management systems** to track progress, demonstrate effectiveness, and inform adaptive management of land and water quality outcomes through establishment of a regional coordination role that consolidates ecological, biophysical, and management indicators—such as pollutant loads, pesticide risk, and ecosystem condition—across catchment, estuarine, and marine environments.
- **Prioritise spatially representative reporting** to detect change, identify hotspots, and assess management effectiveness in the Region. This data should directly inform adaptive planning cycles and guide investment in management practice adoption and rehabilitation of natural systems.

Recommended actions:

- Foster collaboration between groups to increase local-scale water quality monitoring and understand issues in the catchment, including further development of complementary Traditional Owner-led programs. This would enable extended monitoring at on-farm, sub-catchment and end-of-catchment scales.
- Reinstate former monitoring sites and establish new instream monitoring locations (including groundwater) to inform management practices. Continue to develop and improve presentation of water quality data. This was noted a priority action for the Mulgrave and Tully Murray catchments.
- Improve baseline information for water quality conditions across larger areas, with expansion to existing monitoring programs to include a range of 'other pollutants' particularly in urban areas where baseline data is limited.
- Build local capacity for monitoring, including citizen-science programs, to enhance engagement and data quality.
- Share monitoring and evaluation results and case studies widely among government, industry and community partners, for example, through the Queensland Government Data Portal.
- Ensure timely and equitable access to all relevant datasets to support informed decision-making, enable adaptive management and maintain transparency in the prioritisation and delivery of program outcomes.Continue to build long-term trust through adaptive and ongoing monitoring and evaluation.
- Embed feedback mechanisms to evaluate efforts and continuously adapt strategies to stakeholder needs and effectiveness over time.

Examples of initiatives:

- Paddock to Reef Integrated Monitoring, Modelling and Reporting Program (Paddock to Reef program)
- Urban Water Stewardship Framework
- Wet Tropics Waterways and Regional Report Card
- Various Traditional Owner led monitoring projects

5.7.1. Measuring success

As the Strategy itself is not specifically resourced, information from existing monitoring and evaluation programs and frameworks for related programs, plans and strategies will be required to measure progress towards the regional objectives and outcomes. Therefore, a collaborative approach to monitoring and evaluation will be essential. There are several relevant monitoring and evaluation activities that are already in place that could be used to measure the success of the Strategy. It is not within the scope of the Strategy to present the detail of these monitoring programs, however, relevant indicators and tools are presented below and identified in the basin strategies.

Of greatest relevance, the Paddock to Reef Integrated Monitoring Modelling and Reporting program (Paddock to Reef program) is the most comprehensive program in place across the GBR for measuring and reporting water quality and management outcomes across the catchment to reef landscape. The scope is represented in Figure 12. All program components are actively represented in the Wet Tropics region, and therefore provide a strong foundation for measuring the success of the Strategy.

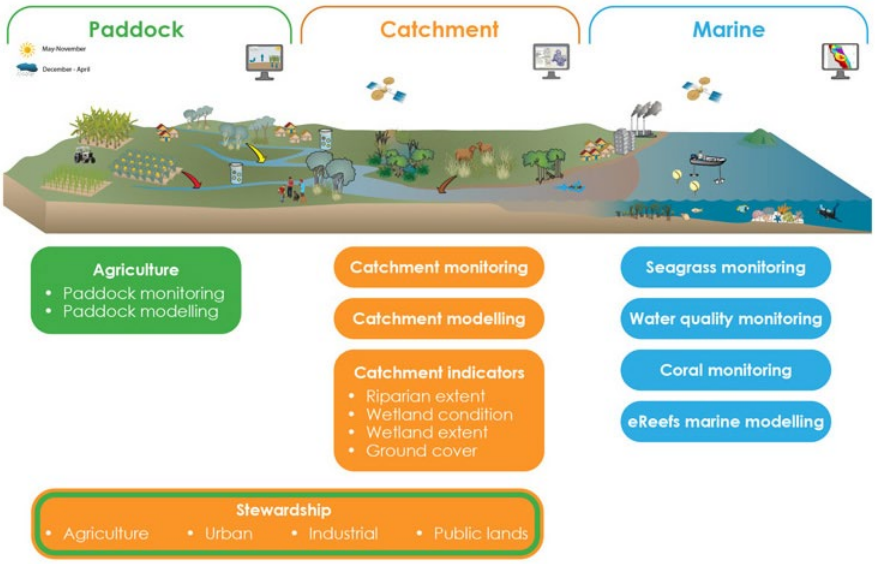


***Figure 12**. The scope and main components of the Paddock to Reef program.*

There are also other well-established monitoring programs that collect and/or collate information in the Region relevant to the Strategy. Many of these are presented in the Regional Report Card led by the Wet Tropics Waterways, and were used in the Synthesis Report (Sambrook et al., 2026).

Table 24 summarises examples of the key indicators and potential information sources that could be considered for the Strategy. This does not include detailed indicators that would be required to demonstrate success of individual actions or projects, such as analysis of LiDAR imagery to evaluate streambank rehabilitation works. These indicators are defined in detailed monitoring and evaluation programs for individual projects and programs and are outside the scope of this Strategy.

***Table 24.** Examples of measures of success for the outcomes and objectives of the Wet Tropics Regional Water Quality Strategy.*

Objectives	Relevant indicators	Information source	Reporting tool (where relevant)	Frequency
Strategy Objective 1: Achieve good water quality in the Wet Tropics Region now and maintain it into the future to reduce nutrient, sediment and pesticide impacts on the Region's aquatic ecosystem and cultural values.				
Strategy Objective 2: Rehabilitate and sustain natural catchment processes, connectivity and ecosystem function in the Wet Tropics Region that support healthy aquatic ecosystems, improve water quality outcomes, and deliver co-benefits such as biodiversity conservation, climate resilience, and enhanced landscape productivity.				
Ecosystem condition				
Catchment (freshwater floodplain wetlands)	Freshwater floodplain wetland condition	P2R Wetland Condition Monitoring	Reef Report Card	Annual
Marine (coral reefs, seagrass)	Coral & seagrass condition	MMP	Reef Report Card and Regional Report Card	Annual
Water quality measures				

Objectives	Relevant indicators	Information source	Reporting tool (where relevant)	Frequency
Catchment water quality	Water quality parameter concentrations	P2R Catchment Loads Monitoring Program Wet Tropics Waterways Partnership	Regional Report Card	Annual (check)
Estuarine	Water quality parameter concentrations	Wet Tropics Waterways Partnership	Regional Report Card	Annual
End of catchment pollutant loads	Fine sediment, particulate nutrient and DIN loads	P2R Catchment Modelling	Reef Report Card	Annual
Pesticide risk	End-of-catchment Pesticide Risk Metric	GBR Catchment Loads Monitoring Program	Reef Report Card Regional Report Card	Annual
Marine water quality & pollutant exposure	Water quality parameter concentrations & modelled exposure	MMP, eReefs modelling Marine exposure assessment	Reef Report Card Regional Report Card GBR Spatial Management Prioritisation	Annual 5 yearly
Biophysical drivers				
River discharge, rainfall & climate		MMP (& sources within)		Annual
Freshwater floodplain wetland extent & loss	Current extent, historical & recent loss	Wetland*Info*	Reef Report Card	Every 5 years
Riparian vegetation loss & remaining extent	Current extent, historical & recent loss	P2R (SLATS)	Reef Report Card	Every 5 years
Groundcover	Annual late dry season cover of grazing land compared to long term median (1988–2023)	P2R (SLATS)	Reef Report Card	Annual
Vegetation clearing	Current & historical rates	SLATS		Every 5 years
Landscape connectivity	Fish Barriers (check)	Wet Tropics Waterways Partnership	Regional Report Card	Annual
Management adoption				
Agricultural management practice improvements receiving funding	Adoption of priority management practices	P2R Management Practice Adoption / Review of Land Management Targets	P2R Projector Tool – P2R	Before and after Project delivery
Level of practice applied to urban water management related activities	Infrastructure management and maintenance	Urban Water Stewardship Framework	Regional Report Cards	Biennial
Water quality benefits				
Agricultural management practice	Reduction in the loads of fine sediment, particulate	P2R program	P2R Project Tool LCAT Reef Report Card	Before and after Project delivery

Objectives	Relevant indicators	Information source	Reporting tool (where relevant)	Frequency
improvements receiving funding	nutrients & DIN delivered to the GBR			
Systems repair	Reduction in the loads of fine sediment, particulate nutrients & DIN delivered to the GBR	Gully and Streambank Toolbox, P2R	VegCAT StreambankCAT GCAT LCAT	Before and after Project delivery
Strategy Objective 3: Build a lasting legacy of enhanced community understanding, opportunities, skills & capacity to deliver regionally led, collaborative water quality improvement actions that support sustainable livelihoods and advance Objectives 1 & 2.				
Increased capacity, opportunity and motivation of agricultural land managers to adopt targeted management responses	Knowledge Confidence Expectations Additionality Group Norms Motivations Barriers Aspirations	Within Program - P2R Perceptions of Practices	P2R Projector Tool – P2R	Before and after Project delivery
		Outside of Program Delivery – Social Monitoring	DETSI Social Monitoring Benchmark Research Report	Biennial
Increased capacity, opportunity and motivation of non-agricultural land managers to adopt Reef stewardship actions	Knowledge Confidence Response Efficacy Motivation Social Capital Reef connection	PROTECT Stewardship Framework & Toolkit	PROTECT Platform	After project delivery
People and communities to take individual and collective action to maintain the health and resilience of the Great Barrier Reef (Reef 2050 Objective) (Community Stewardship)	Reef 2050 Stewardship Indicators	SELTMP	Regional Report Cards	Biennial
Level of practice applied to urban water management related activities	Policy, planning and governance Social Approaches MERI	Urban Water Stewardship Framework	Regional Report Cards	Biennial

5.8. Strategic opportunities

- **Link the Reef 2050 Wetlands Strategy with Catchment Action Plans** to facilitate a whole-of-systems approach to management, ensuring that guidance provided in the Strategy is reflected in the Plans—and vice versa—to maximise investment efficiencies, enhance co-benefits, ensure consistency, and strengthen collaboration.
- **Accelerate progress toward Reef 2050 water quality targets by integrating co-benefits and expanding ecosystem market mechanisms** to help ensure that investment delivers not only measurable water quality improvements but also broader ecological and economic gains, fostering sustained landholder engagement. Policy integration and coordination and alignment of the diversity of programs and projects in the Region will be essential for supporting efficient and enduring change.

- ► **Harness emerging agricultural technologies (AgTech)** (e.g. including automated weed detection, AI-enabled mapping, remote sensing, precision spray systems, and digital decision-support tools) to accelerate adoption, improve precision, and reduce pollutant runoff across agricultural and peri-urban landscapes.
- ► Create long-term education, training, and employment pathways that **empower Traditional Owners and Indigenous groups** to lead planning, management, monitoring, and on-ground works—embedding cultural values, Traditional Ecological Knowledge, scientific knowledge, and holistic stewardship in sustainable outcomes for Country.
- ► Strengthen **continuity and community-led capacity**, diversify farming through innovative and environmentally sensitive industries, and build resilience to secure long-term viability of agriculture and catchments.

Example actions:

- Prioritise and implement practices with demonstrated water quality outcomes and proven co-benefits (e.g. soil health, biodiversity, carbon reduction, on-farm productivity).
- Broadly communicate the co-benefits of improved practices, including better soil health, increased infiltration, enhanced biodiversity, reduced input costs and greater efficiency.
- Where appropriate, utilise and align with existing legislative frameworks to build partnership projects that clearly define roles and responsibilities for natural system repair works and their ongoing maintenance.
- Expand participation in ecosystem market mechanisms such as Reef Credits, and the Australian Carbon Credit Unit scheme, providing long-term financial incentives to land managers for nutrient and sediment reduction.
- Support targeted research to evaluate and validate co-benefits across different land uses and bioregions to strengthen the evidence base.
- Align public and private investment frameworks with land management actions that deliver both primary and secondary environmental benefits. Undertake audit of what is being done in the Region regarding circular economy.
- Promote place-based, integrated programs that reflect community values and deliver whole-of-system outcomes.
- Utilise and invest in community expertise, recognising hidden skills within landholders and groups.
- Build on existing regional delivery capacity by investing in local organisations to retain skilled personnel, create pathways for young people, and strengthen local and technical knowledge. This long-term capability will support integrated program delivery and generate cumulative outcomes over time.
- Support Indigenous leadership and empowerment in the Region through involvement in decision making roles (e.g. Program Steering Committees), and provision of support for individual Traditional Owner groups.
- Strengthen peer-to-peer approaches and revisit Walking the Landscape processes to engage landholders and integrate shared values.
- Position the Region to establish governance arrangements that coordinate knowledge and align stakeholder efforts. Investigate alternative cropping options (e.g., bana grass, kava, sunhemp) to support transition from cane and diversify farm income.
- Explore environmentally sensitive industries and green models (e.g., oyster reefs, Blue Carbon markets) that deliver co-benefits for livelihoods and ecosystems.
- Build disaster resilience in catchments and farms, with strong recovery support systems.

Refer to specific opportunities for Traditional Owner engagement below.

Co-benefits and holistic management

There is still a substantial need and local interest in the Region to continue to deliver water quality benefits. Within this context, there is also increasing recognition of the barriers and limitations to

adoption and implementation of management options, and greater interest in actively seeking and supporting co-benefits associated with these options.

Co-benefits occur where a specific management practice implemented to improve water quality for the GBR has additional positive on-farm secondary impacts such as improving economic and production outcomes, reducing carbon emissions, increasing biodiversity or improving soil health. The co-benefits of land management practices for water quality improvement vary spatially with bioregions, land use and landscape connectivity and the specific co-benefit being sought such as biodiversity, soil carbon and productivity.

Potential co-benefits of land management practices (within the P2R Water Quality Risk Frameworks) have been identified for the major land uses in the GBR catchment area. For example, in sugarcane systems, improved nitrogen management (type, timing, and quantity applied) can reduce nitrous oxide and greenhouse gas emissions. The use of break-crops, rotations, controlled traffic farming, and trash blanketing, has demonstrated benefits for soil health. Reduced grazing pressure can lead to increased vegetation cover, particularly of perennial grasses, which improves water infiltration and reduces runoff, and can lead to improved soil carbon and biodiversity. For bananas and horticulture, maintaining ground cover, inter-row, and headland management, can also support biodiversity outcomes by providing habitat or, for example, reducing pollutant runoff into aquatic ecosystems. However, there are few studies that specifically evaluate these co-benefits in the GBR and the Wet Tropics Region specifically. Furthermore, whole of life cycle analysis is required for optimising the outcomes of co-benefits, supported by alignment of on-ground and management investment frameworks (Star et al., 2024).

Specific examples identified by stakeholders:

- Promote regenerative grazing and sustainable banana farming practices that reduce sediment and nutrient losses while maintaining productivity and cost-effectiveness.
- Reinstate wetlands and waterways to support aquatic and terrestrial biodiversity.
- Control invasive species such as tilapia, while exploring beneficial uses (e.g., fertiliser).
- Support growers to diversify income streams and promote sustainable use of farmland for long-term resilience.
- Explore opportunities in Blue Carbon and other alternative markets, alongside trials of environmentally sensitive crops and industries.

Environmental markets

Emerging ecosystem markets have a role in encouraging and supporting investment with benefits including carbon, biodiversity and water quality. For example, Reef Credits are a market-based incentive mechanism to deliver water quality benefits for the GBR. Farmers and landholders can earn an additional, regular income through generating and selling Reef Credits by taking actions on their land to reduce nutrient or sediment run-off flowing to the GBR. Current methods including the DIN Method for reducing DIN losses from sugarcane, Gully Method and Wastewater Method for algal bioremediation. For corporates like global bank, HSBC, who have already purchased Reef Credits, and private investors and philanthropic organisations, it's a unique opportunity to invest in work that directly protects the GBR, while meeting their own individual policy, investment or corporate responsibility charters. The Reef Credit Scheme is managed by an independent, not-for-profit company, Eco-Markets Australia[11].

One the primary aims of establishing ecosystem service payments for water quality improvement is to have an ongoing funding stream that could support land managers to sustain, and further improve, their practices. Project agreements are for between 10 and 25 years, depending on the practice or land management change. For example, fallow practices, which reduce nitrogen loads, would be eligible for

[11] https://eco-markets.org.au/reef-credits/

Reef Credits for over 10 years. Reef Credits created from gully projects would operate over a 25-year period. A method for wetlands is currently in development.

Traditional Owner engagement

Early and culturally appropriate engagement with Traditional Owners must be promoted as a foundational action for effective waterway management. The Strategy should embed the principles of Free, Prior and Informed Consent (FPIC) to ensure that Traditional Owner engagement is respectful, transparent, and equitable.

Traditional Owners bring significant expertise to project design and monitoring, with established programs such as the Girringun and Mamu Rangers' water quality monitoring initiatives, and Madjandji and Wanjuru-Yidinji ecosystem rehabilitation activities, providing strong examples of leadership and capability. These successful initiatives highlight the importance of partnering with Traditional Owners to achieve meaningful and enduring outcomes.

5.9. Constraints, risks and limitations

Despite significant investment and multiple projects across the region, progress toward the Reef 2050 Plan Water Quality Targets has been relatively slow. The region has achieved a 29.2% reduction in DIN (toward the 60% target), 15.1% reduction in fine sediments (toward the 25% target), 13.9% reduction in particulate nitrogen (toward the 25% target), and 22.9% reduction in particulate phosphorus (toward the 30% target). Recent progress (2020-2022) has been particularly slow, with DIN reduction classified as 'Very Poor' (0.7%) and fine sediment reduction as 'Poor' (0.9%). This presents a significant challenge for sustaining stakeholder interest and engagement and puts greater emphasis on the future design and implementation of regional water quality initiatives.

Key challenges and risks have been identified throughout the Strategy and include:

- **Adoption barriers** including financial constraints and costs of some management actions, distrust of government agencies and scientific information, conflicting advice, and complexity of funding applications all hinder adoption of improved practices.
- **Regional capacity to support program delivery**, particularly with regard to extension staff with specialist expertise relevant to the adoption of practices with water quality benefits.
- Inadequate funding or commitment to **maintenance of Natural System Repair** activities.
- **Gaps in technical capacity** in some locations and specialist areas including irrigation management.
- **Economic considerations** such as the perceived economic risks of practice change, particularly in the context of other market pressures and uncertainties, limit willingness to change.
- **Legacy issues** associated with extensive historical land modification has created ongoing sources of pollution (e.g. gullies) that require substantial resources to address.
- **Short-term funding cycles**, start/stop nature of program funding and program fragmentation leads to discontinuity in engagement, risks to maintaining regional capacity, the inability to maximise benefits of legacy work and disrupted motivation to participate across the full range of participants including landholders, delivery providers and scientists.
- **Complex approval processes** for some restoration activities leading to lengthy delays, increases in project costs and potential barriers for landholder engagement.
- **Time lags** between management actions and measurable water quality improvements which makes it difficult to demonstrate local benefits to landholders, decision makers and investors in the shorter-term to secure confidence in ongoing programs.
- Insufficient processes and planning in place to **prevent disadoption** of management practices - due to several factors but may be economic or personal situation or other social factors.
- **Increasing climate variability** including more variable and intense rainfall patterns affect both the implementation of management practices and their effectiveness.

The following **emerging issues** were also identified through stakeholder consultation and may have implications for future program design:

- **Planning for the risk of removal of the use of the residual pesticide Paraquat in the sugarcane industry** which may lead to a shift in greater use of alternative, higher risk residual pesticides**.** Understanding soil type variation is essential for residuals as they can impact sugarcane growth if not applied correctly and influence nutrient use efficiency*. Implement a more targeted extension and education campaign on residual management and targeted application. Assess human health issues including chemical contamination in bores and rainwater tanks to prioritise and facilitate local stewardship.*
- **Development Approval process for large scale systems repair activities**, creating barriers for landholder interest –risk of long-term commitment with maintenance requirements (maintenance of works is attached to the land through the Development Approval – so people don't want to commit).
- **Expansion of wind farms and associated infrastructure** concern over the impacts of clearing for construction of wind farms and extent of dirt roads including the contribution of sediment from these developments located in the upper catchments and potential opportunities for offsets.
- The **banana industry continues to face significant challenges due to Panama Disease,** which is driving shifts in land use with potential consequences for water quality. Many growers are moving from bananas to cane, though this transition is constrained by limited mill and contractor capacity, while others are diversifying into alternative crops or cattle, though this remains a minority trend. ABGC representatives noted that around a quarter of banana growers are new landowners of Indian heritage, often purchasing smaller, lower-quality properties. While relatively inexperienced, these growers are actively engaging with extension services and eager to learn. This highlights the diversity within the industry, ranging from large, well-resourced landholders to new entrants, and underscores the need for tailored extension approaches that reflect the varied practices and capacities across grower groups.
- **Capacity constraints are emerging in the sugarcane industry**, particularly around harvesting, where most growers rely on a small pool of contractors. With only a small number of local contractors available in most areas there are concerns about potential shortages in the short to mid-term. Addressing contractor capacity will be critical to sustaining industry resilience.
- **Rapid population expansion the southern Atherton Tablelands** which has been identified as a stable refuge under climate change, with high rainfall and fertile soils attracting increased interest from farming companies. Stakeholders emphasised the need for councils to adopt stronger, landscape-informed planning approaches that integrate ecological knowledge and regional values, ensuring land use decisions are sustainable and appropriate for long-term resilience.

Supporting growers in the Mossman Daintree region following closure of the Mossman sugarcane mill requires a strong focus on income diversification, sustainable land use, and building economic resilience. Growers should be actively involved in high-level transition planning, particularly around issues such as the sugar mill closure, while being incentivised to adopt novel practices and innovative approaches during this period of change. Practical initiatives such as field days and demonstration sites for new crops—including kava, bana grass, sun hemp, and sorghum—will help build confidence and uptake, supported by training and upskilling of agronomy service providers to meet emerging demands. At the same time, opportunities to explore green industry models, such as artificial oyster reefs, and alternative markets like Blue Carbon, can provide new income streams and environmental co-benefits. Crop diversification trials, such as the current investigation into bana grass for biochar, highlight the potential to reduce nutrient loads while offering viable alternatives to sugarcane. Ensuring growers have the ability to transition to lasting, environmentally sensitive industries will be critical to securing the long-term sustainability of the catchment.

5.10. Future directions

To accelerate progress toward water quality targets and improve ecosystem outcomes, several strategic directions are recommended:

1. **Support targeted investment in highest-priority areas:** Focus on the areas that contribute disproportionately to pollutant loads and pesticide risk, for example those basins where an Intensive Management Response is recommended including the Tully and Herbert basins for nutrients, the Herbert Basin for fine sediment and the Murray Basin for pesticides. However, some level of active management is recommended across the Region in all Basins in accordance with the Management Response Framework.
2. **Resource and implement an integrated approach to management** by combining land management improvements with strategic remediation and system repair to achieve multiple benefits. This could include streambank and freshwater floodplain wetland remediation coupled with improved sugarcane management, and optimisation of fertiliser use alongside pesticide management in sugarcane.
3. Encourage a **diverse mix of validated management actions** that can be tailored to landholder and stakeholder needs, building on successful projects that have demonstrated water quality improvements alongside social and economic outcomes.
4. Recognise and facilitate **greater community stewardship** by broadening community engagement in NRM delivery, including meaningful involvement of landholders and Traditional Owners, to support collective action and enduring outcomes.
5. **Strengthen Traditional Owner leadership, engagement and capacity** in the Region by resourcing, supporting and strengthening Traditional Ecological Knowledge and aspirations of Traditional Owners, fostering meaningful engagement and partnerships, and expanding on-Country education and employment opportunities.
6. **Engage a combination of delivery mechanisms** such as regulation, incentives, market-based approaches, and extension to create a comprehensive approach to implementation that recognises the diversity of landholder motivations and circumstances.
7. **Build on successful engagement and extension models** to establish trust and provide tailored, consistent support to landholders. Design programs that acknowledge and address the barriers and enablers identified through locally relevant social research and evaluation.
8. **Support continued investment in science and innovation** including new technologies and methods, improved understanding of ecological and social drivers to identify effective management actions, and applied research at local scales to ensure solutions work under local conditions.
9. **Strengthen integrated monitoring and adaptive management** by collaborating with existing programs, formalising a regional coordination role to consolidate environmental, social and management data and information, and prioritising spatially relevant reporting that informs adaptive planning and guides investment in management practices and natural systems repair.
10. **Integrate climate change considerations into management planning**, recognising the increasing pressures from more variable and intense rainfall events, severe weather events, increased hot days, and wildfire risks.

By implementing these strategic directions through a collaborative approach that engages Traditional Owners, landholders, industry, government, and the broader community, the Wet Tropics Region can make significant progress toward improving water quality outcomes for the GBR while supporting sustainable and productive land uses.

6. References

Australian and Queensland governments (2024) Reef Water Quality Report Card 2021 and 2022. The State of Queensland. https://www.reefplan.qld.gov.au/tracking-progress/reef-report-card/2021-22

Australian and Queensland governments (2026) Reef 2050 Catchment Water Quality Strategy Healthy catchment for a healthy Reef and healthy people. State of Queensland, 2026. https://www.reefplan.qld.gov.au/__data/assets/pdf_file/0031/427837/reef-2050-catchment-water-quality-strategy.pdf

Australian Banana Growers' Council (2025). Self-reported banana production area including fallow collected by Australian Banana Growers' Council staff. Provided 21 April 2026.

Chariton A, Hejl N (2024) Question 6.1 What is the spatial and temporal distribution and risk of other pollutants in the Great Barrier Reef ecosystems, and what are the primary sources? In Waterhouse J, Pineda M-C, Sambrook K (Eds) 2022 Scientific Consensus Statement on land-based impacts on Great Barrier Reef water quality and ecosystem condition. Commonwealth of Australia (Department of Climate Change, Energy, the Environment and Water).

Coggan A, Thorburn P, Fielke S, Hay R, Smart JC (2021) Motivators and barriers to adoption of Improved Land Management Practices. A focus on practice change for water quality improvement in Great Barrier Reef catchments. Marine Pollution Bulletin, 170, 112628. https://www.sciencedirect.com/science/article/pii/S0025326X21006627

Connected Land & Sea (2025) Outcomes Report Terrain NRM Reef Trust Water Quality Project. Engagement with First Nations people of the Wet Tropics bioregion to inform Water Quality Strategy 2025. November 2024 - January 2025.

Cook FJ, Hicks W, Gardner EA, Carlin GD, Froggatt, DW (2000) Export of acidity in drainage water from acid sulphate soils. Marine Pollution Bulletin, 41(7–12), 319–326. https://doi.org/10.1016/S0025-326X(00)00138-7

Department of Environment and Science (2022) Queensland River Rehabilitation Management Guideline, Version 1.0, DES, Brisbane, Queensland.

Department of Environment, Science and Innovation (2022) Whole-of-System, Values-Based Framework, Wetland*Info* website, accessed 14 May 2025. Queensland Government, Brisbane, Queensland. Available at: https://wetlandinfo.des.qld.gov.au/wetlands/management/whole-system-values-framework/

Department of Environment, Science and Innovation (DESI) (2023a) Reef 2050 Wetlands Strategy, A strategy to manage wetlands in the Great Barrier Reef and its catchments. Brisbane: Queensland Wetlands Program, Queensland Government.

Department of Environment, Science and Innovation (2023b) Land use mapping. Queensland Government website, accessed 27 February 2025. Available at: https://www.qld.gov.au/environment/land/management/mapping/statewide-monitoring/qlump.

Department of Environment, Science and Innovation (2023c) Wetland data – version 6. Queensland Government website, accessed 27 February 2025. Available at: Wetland data - version 6 - Queensland series - Dataset - Open Data Portal | Queensland Government.

Department of the Environment, Tourism, Science and Innovation (DETSI) (2026) Modelled estimates of dissolved inorganic nitrogen, fine sediment and particulate nutrients delivered from the Great Barrier Reef catchments. Reef Report Card 2023/24 baseline loads. Version supplied March 2026.

Department of Primary Industries (DPI) (2025) Review of Land Management Targets Reef 2050 Water Quality Improvement Plan. Summary Report. Management Practice Adoption of Rural Economic Development—Central, the State of Queensland, June 2025.

Great Barrier Reef Marine Park Authority (2024) Great Barrier Reef Outlook Report 2024, Reef Authority, Townsville.

Great Barrier Reef Marine Park Authority (2025) GBRMPA Spatial Data Centre Coral Reef spatial data file (accessed 2025).

Kanakis K, Bickle M, Erbacher J (2024) Understanding the perceptions of producers: A tool for the extension toolbelt. Rural Extension & Innovation Systems Journal, 2024 20(1) – Field notes.
Michie S, van Stralen MM, and West R (2011) The behaviour change wheel: A new method for characterising and designing behaviour change interventions. Implementation Science*, 6*(42). https://doi.org/10.1186/1748-5908-6-42
McKenzie LJ, Collier CJ, Langlois LA, Yoshida RL (2024) Marine Monitoring Program: Annual Report for Inshore Seagrass Monitoring 2022–23. Great Barrier Reef Marine Park Authority.
McKenzie, LJ, Langlois LA, Roelfsema, CM (2022). Improving Approaches to Mapping Seagrass within the Great Barrier Reef: From Field to Spaceborne Earth Observation. Remote Sensing, 14, 2604. https://doi.org/10.3390/rs14112604
MCR (2023) Social Monitoring Benchmark Research Report. A report prepared for the Queensland Department of Environment and Science, 30 June 2023, Spring Hill.
MCR (2025) Social Monitoring – Wave 2 Research Report. A report prepared for the Queensland Department of Environment, Tourism, Science and Innovation, 30 May 2025, Spring Hill.
Murray-Prior R, Schultz T, Long P (2024) Question 7.2 What are the behavioural (attitudinal), economic, social and cultural factors that hinder or enable the uptake of management practices that aim to improve water quality outcomes for the Great Barrier Reef? In Waterhouse J, Pineda M-C, Sambrook K (Eds) 2022 Scientific Consensus Statement on land-based impacts on Great Barrier Reef water quality and ecosystem condition. Commonwealth of Australia (Department of Climate Change, Energy, the Environment and Water).
Puignou-Lopez O, Lewis SE, James CS, Davis AM, Mackay SJ (2025) Hydrology of the Great Barrier Reef catchment area along a latitudinal gradient: implications for estimating discharge. Journal of Hydrology: regional studies*,* 61, 102603.
Sambrook K, Waterhouse J, Smith R, Schultz T, Pineda MC & Molinari B (2026) Wet Tropics Regional Water Quality Strategy: Synthesis of supporting evidence. Version 2.0. C_2O Consulting and Terrain NRM, June 2026.
Star M, Gordon I, Bibost A (2024) Question 8.1 What are the co-benefits e.g., biodiversity, soil carbon, productivity, climate resilience, of land management to improve water quality outcomes for the Great Barrier Reef? In J. Waterhouse, M.-C. Pineda, & K. Sambrook (Eds.), 2022 Scientific Consensus Statement on land-based impacts on Great Barrier Reef water quality and ecosystem condition (p. 67). Commonwealth of Australia (Department of Climate Change, Energy, the Environment and Water).
State of Queensland (2023) Environmental Protection (Water and Wetland Biodiversity) Policy 2019. Queensland Government, October 2023. Available at: https://environment.qld.gov.au/management/water/policy/
State of Queensland (2020a) Environmental Protection (Water and Wetland Biodiversity) Policy 2019, Barron River Basin Environmental Values and Water Quality Objectives Basin 110 and adjacent coastal waters. Queensland Government, October 2020.
State of Queensland (2020b) Environmental Protection (Water and Wetland Biodiversity) Policy 2019, Daintree and Mossman River Basins Environmental Values and Water Quality Objectives Basin 108 and 109 and adjacent coastal waters. Queensland Government, October 2020.
State of Queensland (2020c) Environmental Protection (Water and Wetland Biodiversity) Policy 2019, Herbert River Basin Environmental Values and Water Quality Objectives Basin 116 and adjacent coastal waters. Queensland Government, October 2020.
State of Queensland (2020d) Environmental Protection (Water and Wetland Biodiversity) Policy 2019, Johnstone River Basin Environmental Values and Water Quality Objectives Basin 112 and adjacent coastal waters. Queensland Government, October 2020.
State of Queensland (2020e) Environmental Protection (Water and Wetland Biodiversity) Policy 2019, Mulgrave-Russell River Basin Environmental Values and Water Quality Objectives Basin 111 and adjacent coastal waters. Queensland Government, October 2020.
State of Queensland (2020f) Environmental Protection (Water and Wetland Biodiversity) Policy 2019, Tully River, Murray River and Hinchinbrook Island Basins Environmental Values and Water Quality

Objectives Basin 113, 114, 115 and adjacent coastal waters. Queensland Government, October 2020.
Terrain NRM (2024) Wet Tropics Plan for People and Country. https://www.wettropicsplan.org.au/
Thompson A, Davidson J, Logan M, Thompson C (2024) Marine Monitoring Program Annual Report for Inshore Coral Reef Monitoring: 2022–23. Report for the Great Barrier Reef Marine Park Authority, Great Barrier Reef Marine Park Authority, Townsville.149 pp.
Water Quality and Investigations (2024) Tahbil - Water Quality Data Portal. [website]. Queensland Government, Brisbane. https://apps.des.qld.gov.au/water-data-portal/
Waterhouse J, Pineda M-C, Sambrook K, Newlands M, McKenzie L, Davis A, Pearson R, Fabricius K, Lewis S, Uthicke S, Bainbridge Z, Collier C, Adame F, Prosser I, Wilkinson S, Bartley R, Brooks A, Robson B, DiazPulido G, Reyes C, Caballes C, Burford M, Thorburn P, Weber T, Waltham N, Star M, Negri A, Warne M St J, Templeman S, Silburn M, Chariton A, Coggan A, Murray-Prior R, Schultz T, Espinoza T, Burns C, Gordon I, Devlin M (2024) 2022 Scientific Consensus Statement: Conclusions. In Waterhouse J, Pineda M-C, Sambrook K (Eds) 2022 Scientific Consensus Statement on land-based impacts on Great Barrier Reef water quality and ecosystem condition. Commonwealth of Australia (Department of Climate Change, Energy, the Environment and Water).
Waterhouse J, Star M, Molinari B, Sambrook K, VanderGragt M, Leigh C, Sutcliffe T, Smith R, Choukroun S, Tracey D, Lewis S (2025) Decision framework for management options to maintain and improve water quality in the Great Barrier Reef catchment area. Analysis of key spatial factors impacting water quality and the condition of wetlands, corals and seagrass in the Great Barrier Reef. Commonwealth of Australia (Department of Climate Change, Energy, the Environment and Water).
Wet Tropics Waterways (2024) Wet Tropics Report Card 2024 (reporting on data 2022-23). Waterway Environments: Results. Wet Tropics Waterways and Terrain NRM, Innisfail.
Wilkinson S, Hairsine PB, Bartley R, Brooks A, Pietsch T, Hawdon A, Shepherd R (2022) Gully and Stream Bank Toolbox. A technical guide for gully and stream bank erosion control programs in Great Barrier Reef catchments. 3rd Edition. Commonwealth of Australia.

Appendix 1: Summary of stakeholder feedback

Basin Stakeholder Consultation, November/December 2024

The following tables summarise the feedback received from the stakeholder consultation workshops coordinated by Terrain NRM across the Region in November and December 2024. Detailed notes can be accessed through Terrain NRM.

Cross-regional messages

The following consistent messages arose in the basin-specific stakeholder consultation:

- Improve water quality and restore ecosystems.
- Strengthen industry capacity and grower support through long-term funding, extension services, education, and incentives.
- Invest in resilient infrastructure and local capacity to support sustainable outcomes across communities and landscapes.
- Advance integrated catchment planning that embeds sustainable land management, natural systems repair, facilitates co-benefits, cultural governance and climate resilience.
- Address biosecurity threats and industry challenges (e.g., TR4, weeds, pests) with coordinated monitoring and management.
- Promote diversification and innovation in agriculture, ecosystem services, and carbon opportunities to build resilience and economic sustainability.

Mossman-Daintree

Strategic Area	Stakeholder feedback
Sustainable land use & management	• Develop cost-effective pest and weed management strategies for long-term stewardship.
Natural Systems Repair	• Encourage rehabilitation and revegetation of waterways across the catchment. • Promote coastal revegetation and wetland reinstatement, including Blue Carbon opportunities. • Reinstate wetlands and waterways to support aquatic and terrestrial biodiversity. • Address feral pig issues impacting catchment health.
Delivery	• Investigate alternative cropping on ex-cane land and support farmers through transition. • Establish demonstration sites and field days to encourage uptake of new crops (e.g., kava, bana grass, sorghum). • Incentivise novel practices and support innovative growers during regional economic transition. • Promote income diversification and resilience through sustainable land use and alternative markets (e.g., Blue Carbon). • Involve growers in high-level transition planning, including responses to sugar mill closure. • Train and upskill agronomy service providers to meet demands of new crops. • Facilitate knowledge exchange between local growers and experienced farmers from other industries. • Organise workshops and educational resources on ecosystem services. • Explore green industry models (e.g., artificial oyster reefs) that benefit both livelihoods and the environment. • Undertake planning scheme reviews to rezone agricultural areas based on productivity.
Implementation	• Review sediment contributions to improve water quality outcomes.

Barron

Strategic Area	Stakeholder feedback
Lower Barron	
Sustainable land use & management	• Tackle water quality issues from residential land uses (fertilisers, pesticides). • Upgrade sewage pump stations to prevent overflow impacts and protect water quality.
Natural Systems Repair	• Address streambank erosion at known sites and sediment-related impacts on Traditional Owner's cultural values. • Control feral cattle and pigs to reduce erosion and pollution in sensitive areas like Copperlode Dam. • Implement green infrastructure solutions (e.g., sediment traps) to manage runoff. • Improve fish habitat quality and connectivity. • Protect mangroves to sustain ecosystem health and safeguard infrastructure.
Delivery	• Strengthen communication and coordination among agencies and working groups. • Improve enforcement to prevent illegal streambank destruction. • Collaborate on Indigenous-led catchment management initiatives.
Implementation	• Adopt integrated, landscape-scale planning that respects community values and protects greenfield areas. • Integrate climate adaptation strategies into catchment management. • Treat Trinity Catchment independently from Barron/Mulgrave for tailored management.
Upper Barron	
Sustainable land use & management	• Shift focus from water quality to soil health, regenerative farming, and local-scale indicators. • Promote Integrated Pest Management and research alternative pesticide methods, sharing outcomes through case studies. • Promote sustainable farming industries through altitude farming, agistment, and new marketing opportunities.
Natural Systems Repair	• Expand waterway restoration efforts, including riparian revegetation, erosion control, and weed management. • Improve enforcement of current regulations to protect catchment health.
Delivery	• Expand extension services for small crop growers or mixed cropping growers and graziers, ensuring unbiased advice beyond reef water quality. • Increase grazing extension services for both large and small producers to implement BMP. • Fund and support graziers to adopt Grazing Land Management (GLM) changes. • Improve access to soil conservation expertise in the region. • Build agronomic capacity through graduate programs and high school education to address skill shortages. • Provide certified courses and support organisations to strengthen local land restoration capacity. • Conduct hydrological mapping and account for development-driven changes in regional planning.
Implementation	• Reduce reliance on volunteers by expanding local employment and skills. • Enhance catchment coordination through improved communication and stakeholder collaboration. • Increase monitoring programs focused on soil health rather than just nutrients. • Develop a whole-of-catchment plan for the Barron with a clear implementation component. • Review the Tablelands Regional Council planning scheme with a catchment-scale lens. • Integrate carbon opportunities, including soil carbon, carbon markets, and natural capital, into planning and farming.

Mulgrave - Russell

Strategic Area	Stakeholder feedback
Mulgrave	
Sustainable land use & management	• Address sediment sources, erosion (including end-of-catchment and boat ramp areas), and impacts of sand extraction. • Promote property-specific farm management plans, cover cropping, and precision nutrient/herbicide use. • Improve adoption of soil health practices (lime, mill mud) by addressing barriers, costs, and logistics.
Natural Systems Repair	• Increase wetland remediation and restoration, replicating successful projects (e.g., Fig-tree Wetland). • Promote revegetation and rehabilitation of waterways and coastal areas to mitigate erosion and enhance biodiversity. • Understand and address changes in aquatic biota identified by Traditional Owners. • Increase efforts to control tilapia, cane grubs, Pond Apple, and Singapore daisy. • Implement coordinated feral pig management with shared responsibilities, training, and council collaboration. • Manage biosecurity risks from backyard escapees and address cattle impacts in tidal areas.
Delivery	• Support succession planning, small-scale farmers, and financial viability of the sugar industry. • Expand access to agronomic expertise, extension services, and precision equipment (e.g., bean planters, mud spreaders, laser levelling). • Support demonstration sites, field days, and knowledge exchange for crop diversification and transition. • Promote ecosystem service education and workshops. • Ensure water quality initiatives support cane industry viability while maintaining productivity for mill sustainability. • Establish a central database for catchment project tracking and promote collaboration across organisations.
Implementation	• Develop integrated, whole-of-catchment plans to balance water extraction, environmental needs, and cultural perspectives. • Map wetlands, riparian areas, and paleo-channels for targeted restoration and drainage management. • Establish normal flow standards, coordinate hydrology studies, and reinstate monitoring sites to track long-term changes. • Promote proactive, system-wide management rather than reactive responses. • Expand cultural mapping and integrate Traditional Owner knowledge into water quality management. • Conduct audits of Traditional Owner values and priorities, ensuring place-based engagement. • Support community-led initiatives for water flow and extraction management. • Strengthen regulations and enforcement to prevent sediment runoff, illegal clearing, and waste dumping. • Simplify and streamline red tape for riverine and in-stream works. • Explore green industry models (e.g., oyster reefs) and alternative markets (e.g., Blue Carbon). • Establish ongoing, well-funded programs to replace short-term cycles and ensure lasting impact. • Build disaster resilience in farms and catchments, with recovery support and long-term investment models.
Russell	
Sustainable land use & management	• Support farm-specific management plans addressing weeds, soil health, and cane yield.

Strategic Area	Stakeholder feedback
	• Ensure long-term maintenance of vegetated drains and improve on-farm drainage with laser levelling. • Improve soil health by addressing low pH and aluminium toxicity through liming. • Address sewage plant capacity issues to prevent pollution during high rainfall.
Natural Systems Repair	• Promote native vegetation (e.g., ribbon weed) for nutrient capture and sediment control. • Expand riparian revegetation and repair streambank erosion sites. • Explore bioreactors and sediment traps in targeted locations to reduce inflows. • Investigate declines in aquatic fauna and integrate Traditional Owner knowledge into planning. • Increase efforts to control invasive species, especially tilapia, and explore beneficial uses (e.g., fertiliser). • Secure funding for ongoing vegetated drain projects and long-term maintenance programs. • Implement integrated pig management with pilot studies, funding, and education to reduce impacts. • Address weed infestations (e.g., Deeral) and expand beef extension networks for BMP adoption. • Rehabilitate degraded paddocks for wetland reinstatement and vegetation restoration. • Manage sand buildup near the mouth of the Mulgrave and erosion in drainage networks.
Delivery	• Collaborate with growers and industry bodies to enhance yield and resilience. • Increase access to shared farming equipment and improve mill mud and lime application practices. • Improve drainage board management, expand sand trap capacity, and address sediment inflows.
Implementation	• Conduct whole-of-catchment hydrological studies to assess risks and guide management. • Explore alternative crops (e.g., sunhemp) with demonstrations and training.

Johnstone

Strategic Area	Stakeholder feedback
Lower Johnstone	
Sustainable land use & management	• Prevent spread of pests and diseases in banana and cane industries. • Encourage whole-of-farm planning approaches. • Implement pig control measures to reduce crop damage and erosion. • Prevent cattle-driven streambank degradation on grazing land.
Natural Systems Repair	• Provide recognition and incentives to farmers for wetland management (including vegetated drains). • Enhance farmer understanding of wetland values and management practices. • Promote wetland connectivity across the region. • Expand local-scale and groundwater monitoring to inform management. • Improve clarity and accessibility of water quality information for stakeholders.
Delivery	• Improve industry capacity (contractors, equipment) to implement improved practices. • Build local skilled extension services that can provide tailored ongoing guidance. • Develop tailored extension programs to adapt to changing demographic in the banana industry. • Increase regional capacity in soil conservation and farm design and improve access to soil conservation expertise in the region. • Establish knowledge-sharing platforms for stakeholders. • Support and integrate with local groups working on water quality initiatives (e.g., Mamu).
Implementation	• Strengthen enforcement of regulations (e.g., land boundaries). • Better integrate catchment planning to address patchiness of current initiatives. • Establish long-term funding mechanisms independent of political cycles. • Address limitations of current funding/reporting systems to incentivise valuable practices. • Improve coordination between government agencies for efficient decision-making and project delivery. • Streamline permit application and approval systems.
Upper Johnstone	
Sustainable land use & management	• Identify and plan for impacts of rapid development, urbanisation, and land subdivisions on hydrology and water quality. • Assess construction-related impacts and integrate findings into regional planning. • Address water quality issues from residential land uses (fertilisers, pesticides). • Understand impacts of agricultural changes (horticulture, small cattle properties) on water quality. • Improve weed management planning to account for water quality impacts.
Natural Systems Repair	• Identify and support biodiversity areas that deliver co-benefits for water quality and ecosystem health.
Delivery	• Promote farmer awareness of water quality issues and improved practices. • Expand extension services to support new and existing farmers in adopting sustainable practices.
Implementation	• Increase data collection to identify catchment issues and priorities. • Conduct assessments of existing information to refine water quality priorities. • Expand local-scale and groundwater monitoring to inform management practices.

Tully-Murray

Strategic Area	Stakeholder feedback
Sustainable land use & management	• Review and update BMP standards for banana and cane industries to reflect current needs.
Natural Systems Repair	• Take advantage of the ecological dynamics of the Wet Tropics to promote natural system repair rather than other practices that require more intensive management or construction work. Provide better extension/education/incentives on these natural dynamics and how to manage them.
Delivery	• Improve access to local extension services and strengthen retention of local expertise. • Understand and address land use changes driven by Panama disease (TR4) in bananas. • Increase engagement with growers stalled at minimum BMP requirements and address declining participation. • Enhance landholder education on ecosystem management to support landscape repair and BMP. • Find ways to incentivise valuable practices restricted by current BMP funding/reporting. • Provide targeted extension support for new banana growers lacking experience or local knowledge. • Address industry capacity gaps (contractors, machinery, mill). • Develop effective extension strategies and deliver workshops at the right time to boost adoption. • Improve grower recognition and reward good practice to encourage uptake.
Implementation	• Take an integrated catchment planning approach. Participants discussed a need to 'deliver programs to all people in the system' and better coordination of capacity for a better integrated management of the catchment. • Continue and expand local-scale water quality monitoring. • Improve presentation of water quality data to make it accessible and useful for growers.

Herbert

Strategic Area	Stakeholder feedback
Lower Herbert	
Sustainable land use & management	• Promote BMP initiatives that resolve cane yield constraints and support farm succession for long-term sustainability. • Assist landholders to plan and develop nutrient budgets. • Develop a whole-of-system approach to managing nutrients, sediment, and pesticides, integrating agronomic and natural systems management in the catchment.
Natural Systems Repair	• Improve fish habitat connectivity across the catchment including a study on the different types of wetlands and their functions. Recognise the need for improved connectivity and importance of fish habitat. • Increase wetland management research and implement riparian restoration strategies. • Promote grassed drains and streambank stabilisation to minimise erosion. • Increase remediation and resilience initiatives in the Lower Herbert Drainage Network. • Remove bunds at old rifle range at Halifax and Amos Road (Crystal Creek) to restore natural water flow. • Undertake streambank stabilisation projects at identified sites. For example, Herbert River Improvement Trust has list of waterway jobs that require 50-50 funding from landholders (prioritised by who will pay upfront).
Delivery	• Connect growers with science through peer-to-peer platforms and mentoring/ambassador programs. • Provide grants for to support increased adoption of efficient machinery. • Rebuild extension capacity with increased funded staff to deliver cost-effective nutrient management planning. • Build local skills and capacity in the environmental sector, including support for Traditional Owners. • Create work experience and cadetship opportunities for local youth with TropWATER. • Support farm succession to ensure the sustainability of industry while transitioning towards new best practices. • Establish a local water testing laboratory to strengthen monitoring capacity.
Implementation	• Review and synthesise current organisations working on water quality to improve program integration. • Establish projects to build improved infrastructure (e.g., roads) after natural disasters — “build back better.” • Undertake audits of circular economy initiatives in the Region (e.g., HSC, Canegrowers).
Upper Herbert	
Sustainable land use & management	• Implement whole-of-farm planning for horticultural properties, improving bank contouring to prevent erosion. • Implement improved practice road maintenance and whole-of-farm planning to reduce erosion and sediment run-off, including around wind farms. • Expand fertiliser reduction initiatives and promote regenerative grazing that balances productivity with cost-effectiveness. • Encourage whole-of-property grazing land management tailored to soil type or sub-catchment conditions. • Promote practices that manage timber thickening and promote integrated grazing land management to address weeds, woody thickening, and erosion.
Natural Systems Repair	• Increase wetland restoration initiatives and restore degraded sites, including old mine areas. • Strengthen support and coordination for weed management.

Strategic Area	Stakeholder feedback
Delivery	• Provide practical tools such as a one-stop guide for paddock restoration to support landholders.
Implementation	• Explore regenerative grazing practices that maintain productivity and cost-effectiveness.

Wet Tropics Regional perspectives: Delivery capacity

A workshop was held by Terrain NRM in Cairns on 24 June 2025 in conjunction with the feedback on the Reef 2050 Water Quality Improvement Plan Review to seek further feedback on the delivery and capacity aspects of the Wet Tropics Regional Water Quality Strategy. Attendees included representatives from industry groups, local delivery providers, local government and research organisations.

Regional capacity – strengths and gaps

	Strengths	**Gaps**
Capacity and skills	• Deep understanding of organisations with capacity and expertise for multi-part projects • Hidden expertise within growers • Tailored communication in some councils to suit audiences • Agricultural extension services supporting knowledge transfer • Mentoring and shadowing opportunities building skills • Peer-to-peer education leveraging landholder experience.	• Difficulty retaining extension staff; mentorship and knowledge transfer limited. • Lack of collaboration between agencies (e.g. QPWS and landholders).
Collaboration and partnership	• Strong engagement with landholders. • Active, vibrant Landcare groups. • Jointly owned catchment plans fostering shared responsibility. • NRMs knowledge platforms driving collaboration across groups.	• Need stronger support for true collaboration and resource sharing — current system wastes money rebuilding silos.
Infrastructure	• Infrastructure support like machinery operators, nurseries, and fencing contractors available.	• Extreme weather events exceed local capacity. • Limited support for professional development or controlling invasive species.
Funding and continuity	• Joint catchment plans and shared experience support delivery.	• Short-term project cycles, inconsistent funding, and lack of transparency make future planning difficult. • Innovation is stifled by restrictive funding models.

Regional water quality delivery approaches – strengths and gaps

Partnerships between Traditional Owners, industry, and community groups enable effective, skills-based project delivery, with peer-to-peer learning as a key strength.
However, barriers to using traditional knowledge, overreliance on volunteers, and a narrow framing of water quality targets, risk excluding broader cultural, community and catchment values.
Stronger support is needed for organisations that can effectively engage communities and coordinate regionally aligned delivery.

	Strengths	**Gaps**
Partnerships and local knowledge	• Strong partnerships between TOs, local government, industry, and landholders (e.g. Clean Creek project). • Peer-to-peer and local knowledge sharing is powerful.	• Need organisations that understand and respond to regional engagement needs more effectively. • Access to professional development/training opportunities • Traditional knowledge (First Nations or otherwise) not used because of legislative barriers to land management. • Restricting delivery to soil/nutrient targets ignores broader land and cultural values important to community and environment.
Traditional Owners and traditional knowledge	• Traditional Owner engagement and partnerships are recognised and valued.	• Legislative barriers prevent use of traditional knowledge in land management.
Volunteerism and community skills	• Small communities often work together across multiple projects; active Landcare and volunteer bases.	• Heavy reliance on volunteers to fill capacity gaps is unsustainable.

Co-benefits and strategic implementation – opportunities and community role

	Opportunities	**Community role**
Broader environmental benefits	• Greater inclusion of biodiversity and climate change outcomes in water quality projects.	• Volunteer efforts in landscape care, wildlife support, and fire management offer significant environmental value.
Place-based and local leadership	• Locally led, place-based, and TO-partnered projects seen as more relevant and sustainable.	•
Upskilling and capacity building	• Capacity-building for communities and organisations is essential to sustaining long-term water quality outcomes.	• Volunteers fill critical gaps, but their capacity is declining. • Chronic underfunding puts long-term project delivery at risk.

Appendix 2: Diagnostic tool for guiding program delivery

Guidance

This framework supports the design of targeted, evidence-based delivery strategies by identifying the barriers preventing adoption and the enablers that can be built upon. Rather than applying generic approaches, it uses the Behaviour Change Wheel (Michie et al., 2011) to match specific delivery strategies to diagnosed barriers within the target audience.

The COM-B model identifies three components that can enable or be a barrier to adoption:

- Capability – the physical and psychological ability to perform the behaviour, including having the necessary knowledge, skills, and confidence.
- Opportunity – the physical and social environment that enables the behaviour, including access to resources, infrastructure, time, and supportive social norms.
- Motivation – the reflective and automatic mechanisms that activate or inhibit behaviour, including beliefs about consequences, intentions, goals, habits, and emotional responses.

For a land manager to adopt a management response, all three components must be sufficiently present. Understanding which component(s) represent the primary barrier to adoption enables program designers to select the most appropriate delivery strategies.

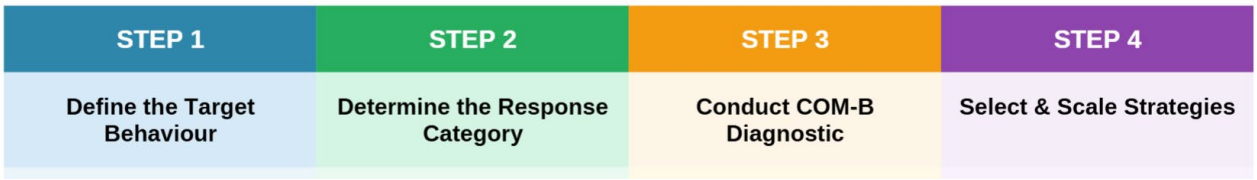
Note: This framework provides general guidance and should be used in conjunction with local knowledge and direct engagement with target land managers wherever possible. Where direct engagement is not feasible, program designers can draw on existing research and monitoring to inform their understanding of land manager capability, opportunity, and motivation. Key sources for the agricultural sector can be sourced from the Social Monitoring program (as part of the Paddock to Reef program and the Office of the Great Barrier Reef and World Heritage), for example:

The Perceptions of Practices survey (Paddock to Reef program) – measures capacity, opportunity, and motivations of landholders engaged in water quality programs to adopt targeted practices as described in the Water Quality Risk Frameworks.

Social Monitoring Benchmarking survey (Office of the Great Barrier Reef, DETSI) – a biennial survey that benchmarks the broader regional agricultural community, including both program participants and non-participants, using constructs aligned with the Perceptions of Practices survey.

For the urban sector, very little is known about the factors influencing adoption of improved practices (Murray-Prior et al., 2024). Direct engagement with urban land managers and stakeholders will be essential to inform program design in this context.

Diagnostic tool for guiding program delivery



Step 1: Define the Target Behaviour

Clearly define the specific behaviour or management response you want land managers to adopt:

- **WHO** needs to do the behaviour? (Target audience – agricultural landholders, urban land managers, councils, etc.)
- **WHAT** specifically do they need to do? (The specific management response from the Water Quality Risk Frameworks)
- **WHERE** will this occur? (Basin-specific context and priority areas)

Step 2: Determine the Management Response Category

Based on the pollutant exposure likelihood for the basin (as determined in the Regional Water Quality Targets), identify the appropriate Management Response Category. This determines the intensity and scale of your program:

Category	Exposure	Scale	Strategy Mix & Intensity
Foundational	Minimal	Region-wide, baseline/minimum standard	1–2 strategies, lower intensity
Proactive	Low	Local-scale, preventative actions	2–3 strategies, low-medium intensity
Accelerated	Moderate	Sub-catchment targeted to impact	3–5 integrated strategies, medium intensity
Intensive	High	Comprehensive, large scale, across multiple land uses	All strategies, maximum intensity

Step 3: Conduct COM-B Diagnostic

Use the following checklist to identify the primary barriers preventing adoption of the target behaviour. This diagnosis will guide your selection of delivery strategies in Step 4.

a) CAPABILITY Assessment

- ☐ Do they have the necessary knowledge about water quality and impacts?
- ☐ Do they have the skills to perform the management response?
- ☐ Do they have confidence in their ability?

b) OPPORTUNITY Assessment – Physical

- ☐ Is the necessary infrastructure available?
- ☐ Are resources (time, money) accessible?
- ☐ Is appropriate technology available?

c) OPPORTUNITY Assessment – Social

- ☐ Do they see others performing the behaviour?
- ☐ Is there community/peer support?
- ☐ Do they trust the science and delivery organisations?
- ☐ Are there positive social norms around the practice?
- ☐ Do local leaders model the behaviour?

d) MOTIVATION Assessment – Reflective

- ☐ Do they believe the action is important?
- ☐ Is it aligned with their identity/values?
- ☐ Do they see economic benefit?

e) MOTIVATION Assessment – Automatic

- ☐ Are existing management practices (i.e., habits) aligned or conflicting?
- ☐ Is there fear or anxiety about change?

Step 4: Delivery Strategy Matching Matrix

Based on your diagnostic assessment, match barriers to appropriate delivery strategies. The *number* of strategies and *intensity* of investment should be scaled according to the Management Response Category determined in Step 2.

COM-B Component	Primary Barriers	Recommended Strategies
CAPABILITY BARRIERS		
Lack of knowledge	Don't understand impacts Unaware of options	Knowledge & awareness Knowledge & awareness + Decision support
Lack of skills	Can't perform practice Can't use tools/technology	Capacity Technology & equipment + Capacity
PHYSICAL OPPORTUNITY BARRIERS		
Resource constraints	Can't afford change Lack time	Incentives & markets Technology + Decision support
No/expensive infrastructure	Missing equipment No market access	Technology & equipment Incentives & markets
SOCIAL OPPORTUNITY BARRIERS		
Negative norms	"No one else doing it"	Social norms & Trust
Lack of trust	Distrust science/orgs	Social norms + Knowledge & Awareness
REFLECTIVE MOTIVATION BARRIERS		
Low importance	"Not my problem"	Knowledge & Awareness + Social norms
Low confidence	"Too complex"	Capacity + Decision support
Economic concerns	"Not profitable"	Incentives & Markets + Decision support
AUTOMATIC MOTIVATION BARRIERS		
Established habits	Long-standing practices that don't align	Social norms + Technology
Risk aversion	Fear of change	Social norms + Incentives

Example 1: Grazing – Improving herd efficiency as part of an Intensive Response for sediment management

Target Management: Improving herd efficiency to enable land condition improvement.

COM-B Diagnosis:

- Capability: Varying levels of knowledge and skills
- Opportunity: Ecosystem markets
- Motivation: Small profit advantage; perception of small environmental advantage

Matched Strategy Package:

1. Knowledge & awareness: On farm trials, field days, demonstration sites, one-on-one engagement.
2. Capacity building: Computer literacy training, focused extension strategy to promote herd efficiency outcomes.
3. Decision support: Extension support for property level economic analysis
4. Incentives
5. Social norms: Champion farmer network; grower-to-grower learning networks

Example 2: Sugarcane – Switching to Lower Risk Products for Pesticides - as part of an Accelerated Response for pesticides

Target Management: Transition from higher-risk pesticides to lower-risk alternative products

COM-B Diagnosis:

- Capability: Limited knowledge of alternative products and their efficacy
- Opportunity: Some alternative products may be more expensive; need access to application guidance
- Motivation: Concerns about pest control effectiveness; uncertainty about impacts on yield

Matched Strategy Package:

1. Knowledge and awareness: Local trials and demonstrations to improve advisor and grower confidence in efficacy of alternative products.
2. Capacity building: Offer advisors training in the assessment of aquatic risk associated with different chemistry and the importance of timing.
3. Decision support: Product selection guidance; Pesticide Decision Support tool (Pesticide Projector)
4. Social norms: Grower networks sharing experiences with alternative products

Example 3: Stormwater Treatment Interventions in Urban Areas – as part of an Accelerated Response for DIN management

Target Management: Install and maintain stormwater treatment systems (e.g., biofilters, vegetated swales)

COM-B Diagnosis:

- Capability: Limited technical expertise in design, installation, and maintenance of treatment systems
- Opportunity: High capital costs; competing budget priorities; land availability constraints; unclear responsibilities between councils and developers
- Motivation: Uncertain about long-term effectiveness and maintenance burden; water quality may not be seen as core business

Matched Strategy Package:

1. Knowledge & awareness: Technical guidelines and case studies demonstrating water quality outcomes
2. Capacity building: Training for council staff, developers, and maintenance teams in design and upkeep
3. Decision support: Design tools, maintenance scheduling resources
4. Incentives: Co-funding for demonstration projects; developer incentives for incorporating treatment systems

Example 4: Streambank – Revegetation in the Riparian Zone as part of a Proactive Response for response for sediment

Target Management: Establish and maintain native vegetation in riparian zones to stabilise streambanks

COM-B Diagnosis:

- Capability: May lack knowledge of appropriate species selection and planting techniques
- Opportunity: Time and labour requirements; fencing costs to exclude stock
- Motivation: Concerns about loss of productive land; long timeframes before visible results

Matched Strategy Package:

1. Knowledge & awareness: Information on benefits of riparian vegetation for bank stability and water quality
2. Capacity building: Training on species selection, site preparation, and ongoing maintenance
3. Incentives: Access to small grants for fencing and planting materials

Get involved

To find out more about the Wet Tropics Regional Water Quality Strategy, or to connect with delivery programs in your area, contact Terrain NRM.

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