RURAL AND REGIONAL AFFAIRS AND TRANSPORT REFERENCES COMMITTEE

Identification of leading practices in ensuring evidence-based regulation of farm practices that impact water quality outcomes in the Great Barrier Reef

Public Hearing – Tuesday, 28 July 2020

Department of Environment and Science – Responses to Questions taken on Notice

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Questions tabled by Senator McDonald

1. **How many extension officers do DAF and DES have within the GBR catchment zone? Please list the positions, their locations, as well as serviceable area and what programmes do they support?**

- The Department of Environment and Science (DES) directly finances the employment of extension officers by partner agencies, industry organisations, private suppliers and Natural Resource Management (NRM) regional bodies to deliver specific agronomic and industry expertise.
- Seventy (70) positions (66.6 full time equivalents (FTE)) are funded this way through industry-based extension and practice projects across the Great Barrier Reef (Reef) catchments.
- There are 49.8 FTE regionally based agronomic extension officers supporting cane, grazing, bananas and horticulture industries across 19 projects.
- The remaining 16.8 FTE positions are employed under industry Best Management Practice (BMP) programs.

Table 1: Industry and NRM-based extension providers supporting Practice change projects contracted by DES (excluding DAF staff) – By Industry for 2020/21 financial year.

(As of 7 August 2020)

Industry	Regions serviced	FTEs	Base locations
Grazing Land Management, pasture and soil conservation, (excluding gully, riverine and wetland restoration projects)	Cape York	1.00	Atherton
	Burdekin Dry Tropics	9.40	Charters Towers, Bowen, Townsville, Lower Burdekin
	Fitzroy	4.1	Rockhampton, Emerald, Belyando
	Burnett Mary	2.90	Bundaberg
Sugarcane (nutrient management, soil management	Wet Tropics	11.71	Cairns, Gordonvale, Ingham, Innisfail, Tully, Herbert, Johnstone
	Burdekin Dry Tropics	5.00	Home hill, Lower Burdekin
	Mackay Whitsundays	10.50	Mackay, Proserpine
	Burnett Mary	2.20	Bundaberg, Childers, ISIS

Industry	Regions serviced	FTEs	Base locations
Bananas agronomists	Wet Tropics, Cape York	1.50	Innisfail
Horticulture	Wet Tropics	0.50	Johnstone
	Burnett Mary	1.00	Burnett, Mary and Burrum sub-catchments
Total FTE		49.8	

Table 2: Industry BMP facilitators employed under grants through DES - by Industry (August 2020)

Industry	Regions serviced	FTEs
Sugarcane BMP through Canegrowers Smartcane BMP	Wet Tropics, Burdekin, Mackay Whitsundays, Burnett Mary	10.8
Hort360 BMP – through Growcom	Wet Tropics	3.00
Bananas BMP through Australian Banana Growers Council (ABGC)	Wet Tropics, Cape York	3.00
Total FTE		16.8

- As at 30 June 2020, the Department of Agriculture and Fisheries (DAF) employed approximately 42 extension officers (FTE) working in Reef catchments, who provide economic, research and technical advice to producers on practices that can improve water quality. Details including positions, their location as well as the industry and region that is serviced are included in Table 3 below.
- The number of DAF extension officers servicing the Reef catchments fluctuates with external funding programs and the staggered commencement and completion dates of programs and projects.
- Senator McDonald sought advice about evidence provided at a previous inquiry by Mr Busby, former employee of the (then) Department of Primary Industries, that extension staff supporting the dairy industry had declined from 17 to two since deregulation of the dairy industry.
- It should be noted that dairy herd grazing is not subject to the Reef Regulations.
- DAF has dairy extension staff both in South-East Queensland and on the Atherton Tablelands, and facilitates additional delivery of research and development outcomes to industry via a collaborative approach with agribusiness. DAF advises that of the total 9.5 FTEs within its dairy group, four FTEs are allocated to extension work including discussion groups, field days, workshops and development trials, across all dairy production regions of Queensland.
- In 2000, an average of 91 farms were serviced per extension officer; today 75 farms are serviced per extension officer.

Table 3: DAF extension officers – Reef water quality (as at 30 June 2020)

Position Title	Location	FTEs	Industry	Regions serviced
Development Extension Officer	Biloela	2.00	Grains	Fitzroy
Development Extension Officer (Sustainable Grain Practices)	Biloela	1.00	Grains	Eastern Fitzroy (incl. Dawson and Callide)
Development Extension Officer (Sustainable Grain Practices)	Biloela	1.00	Grains	Northern Fitzroy (includes southern Burdekin and Isaac)

Position Title	Location	FTEs	Industry	Regions serviced
Development Extension Officer (Sustainable Grain Practices)	Biloela	1.00	Grains	Southern Fitzroy
Senior Development Extension Officer	Biloela	1.00	Grains	State wide
Senior Development Extension Officer (Sustainable Grain Practices)	Bundaberg	1.00	Grains	Upper Burnett, Boyne and Auburn catchments
Agricultural Economist	Charters Towers	1.00	Grazing	Burdekin
Extension Officer (Beef)	Charters Towers	1.00	Grazing	Burdekin
Principal Extension Officer - Beef	Charters Towers	0.40	Grazing	Burdekin
Principal Extension Officer (Beef)	Charters Towers	0.75	Grazing	Burdekin
Extension Officer (Beef)	Emerald	1.33	Grazing	Southern Burdekin
Extension Officer (Beef)	Mackay	2.00	Grazing	Mackay/Burdekin
Extension Officer (Beef)	Mareeba	0.36	Grazing	Wet Tropics
Senior Extension Officer (Beef)	Mareeba	1.00	Grazing	Wet Tropics
Agricultural Economist	Rockhampton	1.00	Grazing	Fitzroy /Burnett Mary
Beef Extension Officer	Rockhampton	1.00	Grazing	Fitzroy
Extension Officer (Beef)	Rockhampton	0.60	Grazing	Fitzroy
Extension Officer (Beef)	Rockhampton	0.75	Grazing	Fitzroy
Extension Officer (Beef)	Rockhampton	1.00	Grazing	Fitzroy
Principal Agricultural Economist	Rockhampton	1.00	Grazing	Fitzroy / State wide
Extension Officer (Beef)	Toowoomba	0.75	Grazing	Burnett Mary
Senior Extension Officer (Beef)	Toowoomba	0.90	Grazing	Burnett Mary
Extension Officer (Beef)	Townsville	0.50	Grazing	Burdekin
Extension Officer (Beef)	Charters Towers	1.00	Grazing	Burdekin
Beef Extension Officer	Mackay	1.00	Grazing	Mackay/Burdekin
Development Horticulturist	Bowen	1.00	Horticulture	Bowen
Development Horticulturist	South Johnstone	1.00	Horticulture	Wet Tropics
Senior Research Agronomist	Maroochy	1.00	Horticulture	State wide
Agricultural Economist	Townsville	1.00	Horticulture	Wet Tropics
Principal Project Officer	Mackay	1.00	Pesticides	State wide
Senior Project Officer	Mackay	1.00	Pesticides	Mackay Whitsundays
Senior Project Officer	Townsville	1.00	Pesticides	Lower Burdekin
Manager Agricultural Economics	Ingham	1.00	Sugarcane	Herbert / State wide
Development Officer (Farming Systems)	Cairns	1.00	Sugarcane	Mossman, Cairns, Babinda
Senior Development Extension Officer	South Johnstone	1.00	Sugarcane	Wet Tropics / State wide (training)
Senior Development Extension Officer	South Johnstone	1.00	Sugarcane	Johnstone/Tully
Agricultural Economist	Mackay	1.00	Sugarcane	Mackay/Whitsunday
Agronomist (Farming Systems)	Mackay	1.00	Sugarcane	Mackay/Whitsunday
Senior Agricultural Economist	Mackay	1.00	Sugarcane	Mackay/Whitsunday
Agricultural Economist	Townsville	1.00	Sugarcane	State wide (training)

Position Title	Location	FTEs	Industry	Regions serviced
Agricultural Economist	Townsville	0.50	Sugarcane	Burdekin
Extension Officer (Farming Systems)	Townsville	0.81	Sugarcane	Herbert
Senior Agricultural Economist	Townsville	1.00	Sugarcane	Burdekin/Wet Tropics
Project Leader (Education & Extension)	Townsville	0.50	Water Treatment Systems	State wide
Total		**42.15**		

2. What provision is there to increase frontline support (including extension) to primary producers given the impact of these regulations? I would like particular clarity with this considering the QLD Government has failed to release a budget for this year.

- The Queensland Government has allocated $13.8M in new funding to support the implementation of the Reef Regulations. This includes:
  - $10.1M for the 'Farming in Reef Catchments rebate scheme', delivered by the Queensland Rural Industry Development Authority, which provides rebates to producers to access agronomic services to support meeting regulatory requirements. The majority of this funding is still available for producers to access.
  - $3.7M has been allocated for compliance support.
- In addition, the Reef Regulations are being implemented alongside a suite of non-regulatory tools and initiatives to accelerate improved Reef water quality. These include:
  - enhanced extension and education
  - improved extension tools
  - trialling innovative approaches
  - improved monitoring and modelling of catchment pollutant loads
  - on-ground technical support for producers to implement property improvements and assist adoption of improved management practices.
- These strategies form part of the broader adaptive management framework of the joint Queensland and Australian Government Reef 2050 Water Quality Improvement Plan 2017-2022 (Reef 2050 WQIP).
- The Queensland Government has committed more than $261 Million to the Reef Water Quality Program over five years until 2022 to implement the Reef 2050 WQIP. A five-year investment plan (Part A Overview) (PDF, 665KB) outlines the key investment areas.
- In the 2020/21 financial year, there are over 20 projects that directly support on-ground extension, training and advice. This includes:
  - an additional allocation of just over $1.3 million dollars to extend practice change and restoration projects
  - approximately $2 million to support decision support tools and on farm trials, peer-to-peer training for producers in soil conservation, grazing land management, and nutrient budgeting as well as improved collaboration in regional extension delivery.

3. **In DAF's 2020 AgTrends update, the forecast for gross value of production for the cattle industry is down 5% from the 5-year average and for the sugar industry it is an even more shocking 16% below the 5-year average. Does this modelling, which is already providing concerning forecasts, account for the impact these regulations will have on gross value of production? If not, why not? And what impact will these regulations have (or have already had) on GVP?**

- All factors that impact the volume of production are considered in the Gross Value of Production (GVP) analysis, which includes,but is not limited to consideration of production practices, seasonal factors, and regulatory changes.
- The primary factors in determining the GVP of sugarcane in Queensland are: the mass (quantity) of sugarcane processed; the sugar content of the sugarcane; and the price that the raw sugar produced from that cane realises on the market.
- Similarly, the GVP of beef in Queensland is determined by assessing all the factors that will impact on the expected prices and quantities of beef produced in Queensland over the next financial year.
- In the case of 2019-20, the cane harvest was down on recent years due to drought in southern growing areas and wet, overcast conditions occurring in the north at inopportune times during the season. At this time, it is anticipated that the 2020-21 crop will be larger than that achieved in 2019-20.
- Moving forward it is expected that the main driver of GVP will be seasonal conditions and not the Reef Regulations. The Reef Regulations were developed in consultation with industry and technical experts, with the aim to incorporate management practices that are both sustainable and profitable. For example, the calculated nitrogen rate for sugarcane is based on the industry developed best management practice standard (Six Easy Steps method). It is therefore not expected that Reef Regulations will adversely impact on GVP forecasts.

4. **Given agriculture within the GBR catchment is already heavily regulated by the Water Act, Land Act, Vegetation Management Act and the Environmental Protection Act, what will these extra regulations actually achieve?**

- Managing farm practices to prevent nitrogen and sediment pollution off farm is not achieved by other Queensland legislation.
- The Reef Regulations will result in farmers in Reef catchments adopting farming practices that reduce the risk of nutrient and sediment pollution, while maintaining or improving their productivity and profitability.
- Widespread adoption of these lower risk practices is expected to go a significant way towards achieving the pollution load reduction targets for a healthy Reef, which is essential for ensuring thousands of Queensland jobs.

5. **How will these regulations benefit farmers (particularly financially)?**

- The Reef Regulations were developed in consultation with industry and technical experts, with the aim to incorporate management practices that are both sustainable and profitable.
- Prior research in grazing has shown that adopting these leading practices will reduce production and financial risk through matching stocking rates to carrying capacity.
- Past research in sugarcane has shown the financial benefits of adopting Six East Steps Nitrogen application rates (industry best practice nutrient management).

- The Reef Regulations relating to nutrient management do not require sugarcane farmers to go beyond the Six Easy Steps guidelines.
- The use of better record keeping of farm inputs will improve farmers capacity to make informed decisions relating to business performance and improve profitability.
- Contrary to recent claims by CANEGROWERS, the sugarcane minimum practice standards do not require nitrogen rates to be lowered to 15-30% below Six East Steps nutrient recommendations.
- In the Burdekin region, trials of practice change conducted over all major soil types showed that undertaking soil testing and applying fertiliser in accordance with the Six Easy Steps methodology was profitable 100% of the time when trialled for more than one year. These results have been demonstrated in other districts too, showing that more sustainable farming can also mean greater profitability in the sugarcane industry.
- A Sugar Research Australia commissioned project undertaken by DAF and Lifecycles, *Measuring the profitability and environmental implications when growers transition to Best Management Practices*, assessed the profitability of adopting best practice on six commercial sugarcane farms in the Wet Tropics. The project found that the economic benefit from adopting best practice across soil, fertiliser and pesticide management was between $25 and $220 per hectare per year. This included the adoption of nitrogen rates aligned with the Reef Regulations and Six Easy Steps.
- The *Reef Plan Action 4: Gap Analysis Report, Understanding the economics of improved management practices and systems on sugarcane farms*, completed by DAF in 2016, reviewed all published studies on sugarcane growing best practices for water quality outcomes that also included an economic analysis. The report found that the vast majority of trials showed that nitrogen rates aligned with Six Easy Steps, and the Reef Regulations, were the most profitable compared with higher nitrogen rates.
- CANEGROWERS recently applied for and received formal program recognition of the Smartcane BMP program under the Reef Regulations. Recognition requires the program owner to ensure that on-farm practices advocated and accredited by the program as industry best practice are at or above the regulated minimum practice standards. This will benefit accredited sugar cane farmers by acknowledging their efforts to implement best practices and by making them a low priority for compliance audits.
- The regulated grazing practice standards align with recommended grazing land management strategies for managing climatic variability including drought preparedness, management and recovery. The standards are outcome focused, allowing graziers to determine what strategies are best suited to their property for maintaining ground cover in at least fair condition.
- The Wambiana grazing trials, which have been running for over two decades, have shown that implementing grazing strategies that improve ground cover and land condition, such as variable stocking, spelling paddocks and matching the available pasture with cattle numbers, for most land types has resulted in higher average gross margins over the long term, as well as properties being more resilient to drought. This is due to the subsequent higher pasture production, higher market premiums for animals in better condition, and lower costs of production. Sediment run-off is also reduced under a lower stocking rate.

6. What social and economic impact will these regulations have on the small towns within the GBR catchment zone that rely on agriculture?

- The Queensland Government supports continued growth of the agricultural sector and the broader Queensland economy. The Reef Regulations allow for future development in regional Queensland that is compatible with the protection of the Great Barrier Reef. The Reef

Regulations reflect advice from industry and technical experts to ensure they are limited to requiring management practices that are both sustainable and profitable.

- The suggested average cost per grower of $38,000 over ten years with reference to the *Consultation Regulatory Impact Statement – Broadening and enhancing Reef protection regulations* (the Consultation RIS), is an over estimation. The Consultation RIS included the costs and benefits of regulatory proposals that were not adopted and will not be implemented. The *Decision RIS – Broadening and enhancing Reef protection regulations* (the Decision RIS) provided revised costs and benefits in light of these changes to the regulatory proposals. For example, the removal of the proposed offsets framework for agriculture resulted in significant cost reductions compared to the costs outlined in the Consultation RIS. Table 4 below outlines the difference in costs and benefits to agriculture included in the Consultation RIS published in September 2017, and the Decision RIS published in February 2019, as well as the net cost that could be derived from the figures.

Table 4: Costs and benefits to agriculture outlined in the Consultation RIS – Broadening and enhancing reef protection regulations compared to the Decision RIS

	Consultation RIS	Decision RIS
Costs to agriculture – Present value costs ($) over 10 years	783,251,024	536,609,628
Benefits to agriculture – Present value costs ($) over 10 years	355,427,514	285,188,661
Net costs to agriculture ($) over 10 years	427,823,510	251,420,967

- Costs were further reduced for the agricultural sector by the Queensland Government deciding not to commence regulated minimum practice standards in the Cape York region due to the water quality targets having been met for the region. This was not factored into the costs outlined in the Decision RIS as this decision was only made in response to the Reef Water Quality Report Card 2017 and 2018 results that were released in August 2019.
- The regulated minimum practice standards will also have no cost impact on growers already operating at best practice including the 570 growers accredited against Smartcane BMP.
- Agriculture is the dominant land use in the Great Barrier Reef catchment. According to the Australian Bureau of Statistics, this industry generated approximately $6.4 billion of gross value production in 2018-19 in the Great Barrier Reef catchment. The estimated gross value production for sugar was $1.1 billion and for beef, it was $2.8 billion in 2018-19 (ABS 7503.0, Value of Agricultural Commodities Produced, Australia, 2018-19 available at https://www.abs.gov.au/ausstats/abs@.nsf/mf/7503.0). It is unlikely that an industry of this size will face noticeable changes in the value of production or employment through meeting regulated minimum practice standards that mirror industry accepted practices.
- Many coastal regional centres rely on the significant contribution the Great Barrier Reef makes to the Queensland and Australian economies. In 2017, Deloitte Access Economics estimated the social, economic and iconic asset value of the Great Barrier Reef at $56 billion. This estimate was based on the value of Great Barrier Reef tourism, recreation and on the non-use values held by Australians for the Reef. This is seen as conservative as it does not include the value of the importance of the Reef to Traditional Owners, the rest of the world, and to Australia's 'brand'. Evidence suggests that all of these values are very high.
- Deloitte Access Economics estimated that the World Heritage site added $3.9 billion to the Queensland economy in 2015-16 and supported more than 33,000 full-time Queensland jobs.

The economic contribution mainly comes from tourism, commercial fishing and aquaculture production, recreation and scientific research and management. The Reef is critical to the cultural, economic and social wellbeing of the more than one million people who live in its catchment and to Australians generally.

7. What economic impact will these regulations have on local Councils, particularly regarding water treatment?

- Sewage treatment plant operators are already required to be licensed under the *Environmental Protection Act 1994* to release discharge.
- From 1 June 2021, a 'no residual impact' standard will apply for the release of nutrients and sediments in the Great Barrier Reef catchment to new operators, or those that intend to significantly expand (more than 10%) beyond their existing licence conditions. Where these activities cannot avoid or mitigate their water quality impacts through on-site treatment, they will be able to voluntarily meet this standard through an offset guided by the Point Source Water Quality Offsets Policy for activities under the *Environmental Protection Act 1994.*
- In direct response to the COVID-19 health and economic emergency, the Queensland Government delayed the commencement of this standard by six months.
- Offsets can provide a means for operators to address end-of-pipe water quality improvement at least cost compared to treatment plant upgrades. In 2015, the Queensland Urban Utilities' Beaudesert Nutrient Offsets Project spent $1 million to regenerate and rehabilitate an eroded riverbank to prevent five tonnes of nitrogen and 11,000 tonnes of soil from entering the Logan River. This action was undertaken as an alternative to an $8 million upgrade to the Beaudesert Sewage Treatment Plant that was considered necessary to meet regulated discharge standards.
- A departmental review has found that almost all local government owned sewage treatment plants in the Reef catchments are operating below capacity and are expected to be able to accommodate on average up to a 20% growth in waste loads before needing to expand or upgrade.
- It is expected that existing population growth in the Great Barrier Reef catchment over the next decade will be below levels that would result in this level of growth. However, if expansion was required, DES previously found the additional cost of the new standard to be $1.4 million per year collectively for all the 34 local governments in Reef catchments assuming a 1% annual population growth rate.
- Where existing operators change their operations to reduce discharge loads, or where new operations can demonstrate no residual impact to receiving waters from their activity, the no residual impact requirement would be met.
- The Queensland Government is working in partnership with local governments and NRM bodies to develop and trial water treatment techniques such as detention ponds, artificial wetlands and bioreactors to improve Reef water quality. Investment totalled $290,000 to the end of the 2019/20 financial year to support these local council wastewater projects with a further $41,000 committed this financial year.
- The Queensland Government provides a number of programs that support local council infrastructure upgrades.

8. **What will the process be for amending or completely changing the requirements of these regulations? How easily will the Department be able to make such changes and what recourse will farmers have if or when changes are made?**

- The regulatory requirements cannot be changed without the amending the Environmental Protection Regulation 2019 or the *Environmental Protection Act 1994* (EP Act). This includes changes to agricultural environmentally relevant activities (ERA) standards (i.e. minimum practice standards).
- Under the EP Act, standards have been prescribed for agricultural commodities such as sugarcane cultivation, banana cultivation and beef cattle grazing. To change these standards, the Chief Executive of DES must comply with the process for making a new standard under Chapter 5A, Part 1 of the EP Act.
- The process requires an assessment of the costs and benefits of the change in the standard as part of a RIS, a public consultation process, and the consideration of all public submissions received. The new standard must then be prescribed by regulation.
- Once made, the regulation prescribing the amended standard must be tabled in the Queensland Parliament. The Legislative Assembly may pass a resolution disallowing the regulation tabled if notice of the disallowance motion is given by any member within fourteen sitting days after the tabling. A regulation ceases to have effect if it is disallowed by the Legislative Assembly.
- The only time the chief executive can amend an agricultural ERA standard without first seeking public input is to make minor changes. A minor change is limited to changes that do not have an effect on the operation of the standard, such as correcting a spelling or grammatical error.
- To provide producers with certainty, the Queensland Minister for Environment and the Great Barrier Reef, Minister for Science, and Minister for the Arts stated that the agricultural ERA standards for sugarcane cultivation, banana cultivate, and beef cattle grazing would not be substantially changed for five years from the 1 December 2019. The statement was made during Queensland Parliamentary debate on the Environmental Protection (Great Barrier Reef Protection Measures) and Other Legislation Amendment Bill 2019.

9. **Is the Minister aware of the financial, economic and social impacts that these regulations will have on the QLD economy, the agriculture industry as a whole and individual farmers? What is the Minister doing to mitigate these impacts?**

- The Department of Environment and Science prepared and publicly released a *Consultation Regulatory Impact Statement - Broadening and enhancing Reef protection regulations* (the Consultation RIS) and a *Decision RIS – Broadening and enhancing Reef protection regulations* (the Decision RIS) prior to progressing the regulations. Both the Consultation RIS and Decision RIS used the best information available at the time to outline the estimated impacts and potential benefits of the regulatory proposals and the measures that would be implemented following consideration of the submissions received.
- Since 2009, the Queensland Government has invested about $120 million in industry-led best management practice programs, science and on-ground programs to help landholders improve their practices. This includes $10.1 million to provide a rebate of up to $1000 per producer to seek agronomic advice to meet the regulated standards.
- The Australian Government has also invested significantly in incentives and grants to improve water quality through initiatives such as Reef Rescue, the Reef Program, and now through the Reef Trust.

- The Queensland Government is continuing to invest in projects in Reef catchments to improve Reef water quality as per the joint Australian and Queensland government Reef 2050 Water Quality Improvement Plan (Reef 2050 WQIP). It has committed more than $261 Million to the Reef Water Quality Program over five years until 2022 to implement the Reef 2050 WQIP. A five-year investment plan (Part A Overview) (PDF, 665KB) outlines the key investment areas.

Questions tabled by Senator Rennick

1. Can the Department give in clear terms both the absolute and relative margin of error for the measurement instruments used by your Department with respect of water quality?

AND

2. Can the Department explain clearly the confidence intervals for your measuring instruments?

Response for Q1 & Q2:

- Through the Great Barrier Reef Catchment Loads Monitoring Program (GBR Loads Monitoring Program), the Department of Environment and Science (DES) collects discrete water quality samples throughout the year depending on the waterways flow, and these water samples are analysed for nutrients and sediments.
- The results of these analyses are used to calculate loads of nutrients and sediments and are reported annually on publicly available websites, for example, the *2017-2018 Great Barrier Reef Catchment Loads Monitoring Program Report* (interactive story map).
- DES uses its National Association of Testing Authorities (NATA) accredited laboratory, Chemistry Centre to undertake the analysis.
- The measurement error is based on measurement of uncertainty.
- The method used by the Chemistry Centre is based on NATA General Accreditation Guidance - Validation and verification of quantitative and qualitative test methods. https://www.nata.com.au/phocadownload/gen-accreditation-guidance/Validation-and-Verification-of-Quantitative-and-Qualitative-Test-Methods.pdf
- The Chemistry Centre measurements of uncertainty for the relevant parameters are:
  - Dissolved inorganic nitrogen:
    - Ammonium nitrogen as N (NH_4-N) uncertainty $\pm$ 8%
    - Oxidised nitrogen as N (NO_X-N) uncertainty $\pm$ 8%
  - Phosphate phosphorus as P (PO_4-P) uncertainty + 8%
  - Turbidity (NTU) uncertainty + 6%
  - Total suspended solids (TSS) uncertainty +12%

3. How many measurement instruments are used by the Department at each site to measure water quality?

- The GBR Catchment Loads Monitoring Program measures discrete water quality samples of nutrients and sediments at various sites (refer Appendix A).
- Multiple samples are taken throughout the year but increase substantially over the wet season to capture changes in the concentrations based on the storm rainfall and flow events.
- Sample collection is achieved by a combination of manual collection and the use of automated sampling equipment.
- The number of samples collected at each site over each year of the GBR Catchment Loads Monitoring Program are presented in Appendix A.

4. **Can you please list each of the nutrients or chemicals which the Department measures and the corresponding concentrations of each which give ratings of low, medium and high water quality?**

AND

5. **Can the Department explain clearly the target concentration measurements for each relevant nutrient or chemical?**

Response for Q4 & Q5:

- The list of all reported nutrient and sediment analytes measured through the GBR Catchment Loads Monitoring Program is provided in **Table 1** below.

Table 1. Summary information for each reported analyte in the catchment monitoring program.

Reported Pollutants	Abbreviation	Measured Analytes
Sediment (Total suspended solids)	TSS	Total suspended solids
Total nitrogen	TN	Total nitrogen as N
Particulate nitrogen	PN	Total nitrogen (suspended) as N
Dissolved organic nitrogen	DON	Organic nitrogen (dissolved) as N
Ammonium nitrogen as N	NH_4-N	Ammonium nitrogen as N
Oxidised nitrogen as N	NO_x-N	Oxidised nitrogen as N
Dissolved inorganic nitrogen	DIN	Ammonium nitrogen as N + Oxidised nitrogen as N
Total phosphorus	TP	Total phosphorus as P
Particulate phosphorus	PP	Total phosphorus (suspended) as P
Dissolved organic phosphorus	DOP	Organic phosphorus (dissolved) as P
Dissolved inorganic phosphorus	DIP	Phosphate phosphorus as P

- The joint Queensland-Australian Government *Reef 2050 Water Quality Improvement Plan* targets are load-based targets (e.g. tonnes of dissolved inorganic nitrogen) for nutrients rather than concentration-based targets (e.g. mg/L of dissolved inorganic nitrogen). The nutrient targets, based on an independent report by James Cook University, were developed to meet the 'chlorophyll a' guidelines set by the *Water Quality Guidelines for the Great Barrier Reef Marine Park* (Great Barrier Reef Marine Park Authority, 2010).
- **Water quality guideline values** are used as a general tool to help ensure that certain physical and chemical stressors in waterways do not exceed harmful levels. Water quality guidelines are technically-derived numerical measures (e.g. concentrations) or descriptive statements to protect aquatic ecosystems and human water uses and values (e.g. irrigation, stock watering, and recreation). Water quality guidelines are derived for a range of physico-chemical, biological and habitat indictors based on best-available science.
- The authoritative guidance and management framework for water quality in Australia is the **National Water Quality Guidelines**, *i.e. the Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. The National Water Quality Guidelines are a joint initiative of the Australian and New Zealand governments, in partnership with the Australian states and territories.

- The National Water Quality Guidelines provide guidance on setting water quality objectives designed to sustain current, or likely future, community values for natural and semi-natural water resources. The National Water Quality Guidelines underpin the Great Barrier Reef Marine Park and Queensland local and state water quality guidelines and objectives that are developed to be more specific to the local and regional conditions and values:
- The Great Barrier Reef Marine Park Authority has **Water Quality Guidelines for the Great Barrier Reef Marine Park (2010)** with set levels for specific pollutants that when exceeded prompt managers to take action. Regional catchment-level objectives are being implemented under Queensland's *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* for the Great Barrier Reef catchment, which includes state coastal waters.
- **The Queensland's *Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (EPP (Water and Wetland Biodiversity))*,** sets objectives to achieve the object of the *Environmental Protection Act 1994* (EP Act) to protect Queensland's waters while supporting ecologically sustainable development.
  - Water quality objectives for the physical, chemical and biological characteristics of the water (e.g. nitrogen content, dissolved oxygen, turbidity, toxicants, fish) are determined for the local conditions of Queensland waters.
  - The Reef water quality objectives (see link below) address requirements under chapter 4A of the EP Act to establish annual loads for sediments and dissolved inorganic nitrogen and are derived from the end-of-catchment anthropogenic water quality targets set out under the *Reef 2050 Water Quality Improvement Plan*.
- The Reef Water Quality report cards report the annual condition of inshore marine water quality using the Great Barrier Reef Report Card marine water quality metric. The Reef Report Card reports a grade in the condition of inshore water quality from very poor to very good. The grading of inshore marine water quality is based on the spatial extent of the inshore water body that did or did not exceed the relevant 'chlorophyll a' and water clarity indicator guidelines set in the W*ater Quality Guidelines for the Great Barrier Reef Marine Park* (2010).
- 'Chlorophyll a' and indicators of water clarity are a measure of the effects of excess nutrients and sediment on aquatic ecosystems and are recommended by the National water quality guidelines. The water quality metric was developed collaboratively between the Australian Institute of Marine Science, CSIRO, James Cook University, Great Barrier Reef Marine Park Authority, and the Great Barrier Reef Foundation, funded through the Australian Government's National Environmental Science Program (access the report from the link below).
- The following links provide more information on the documents and reports mentioned above:

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  - **Environmental Protection (Water and Wetland Biodiversity) Policy 2019 - Great Barrier Reef River Basins - End-of-Basin Load Water Quality Objectives** https://environment.des.qld.gov.au/__data/assets/pdf_file/0023/99320/gbr-river-basins-eob-load-wqos.pdf

- **Queensland water quality guidelines:** https://environment.des.qld.gov.au/management/water/quality-guidelines
- **Testing and implementation of an improved water quality index for the 2016 and 2017 Great Barrier Reef Report Cards – Summary report:** http://nesptropical.edu.au/wp-content/uploads/2018/08/NESP-TWQ-Project-3.2.5-Summary-Report.pdf

6. How does the Department measure or regulate the impact of scuba diving on the reef, if it does at all?

- The Great Barrier Reef Marine Park Authority is the responsible agency for regulating activities in the Marine Park.

7. How much land is under cultivation in the Great Barrier Reef Basin and can you express this as a percentage of the total size of the Basin?

- The Great Barrier Reef basin is largely rural and urban areas account for 0.7% of the area. Grazing is the dominant agricultural land use (73%). Sugarcane and horticulture crops are more prevalent on the coastal floodplains with high rainfall and irrigation. Grain crops and irrigated cotton are prevalent in the inland areas, particularly in the Fitzroy region. The total area occupied by cropping in the Great Barrier Reef basin is 3.5%.
- While cropping covers 3.5% of the area, it contributes 45% of the total Dissolved Inorganic Nitrogen (DIN) loads to the Great Barrier Reef lagoon, and 2.3% of the Total Suspended Sediment (TSS) load. The majority of sediment comes from grazing areas, which is additional to the cultivated cropping lands contributions below.
- A summary of the load contributions for DIN and TSS from cropping land uses is provided in Table 2 (below).

Table 2: Cropping Area, DIN and TSS total and percentage of total for each region

Region	Area (ha)	Area (%)	DIN (t/yr)	DIN (%)	TSS (kt/yr)	TSS (%)
Cape York	6,716	0.2	4.0	0.9	0.8	0.2
Wet Tropics	213,098	9.8	2,474.4	48.3	63.8	5.5
Burdekin	255,460	1.8	851.1	43.9	32.6	0.9
Mackay Whitsunday	154,590	17.1	858.5	69.9	29.0	5.6
Fitzroy	638,095	4.1	45.9	4.0	52.0	3.3
Burnett Mary	205,999	3.9	700.4	62.9	16.5	1.6
Total GBR	1,473,958	3.5	4,934.4	45.0	194.7	2.3

Crops include: Bananas, Dryland and Irrigated grain crops, Sugarcane and Horticulture
DIN - Dissolved Inorganic Nitrogen; TSS - total suspended sediment

Questions on Notice taken by Ms Nichols during hearing on 28 July 2020

1) **Senator Rennick: Do we have a basin management plan for the management of the disposal of renewables (specifically solar panels, which contain a lot of heavy metals), and the stopping of runoff, as they start to degrade over the next 10 years?**

- The Queensland Government is working on a number of initiatives in Queensland and in conjunction with the Australian Government and other states and territories to implement the National Waste Policy Action Plan.
- This Plan contains actions to develop product stewardship schemes for end-of-life products such as batteries and PV panels. These schemes will see the development of a comprehensive and coordinated management framework, including identification of collection and recycling options to improve the recovery of these products.
- On 1 July 2019, the Queensland Government released the Waste Management and Resource Recovery Strategy, which includes action plans to be developed in consultation with stakeholders to address waste streams such as PV panels.

2) **Senator Waters regarding the science consensus statement and the independent science panel: Did the panel review the regs?**

- Roger Shaw, the chair of the Reef 2050 Water Quality Improvement Plan Independent Science Panel (ISP), also chaired the Sugarcane Technical Working Group that was convened to assist in developing the cane minimum practice standards. Mr Shaw's involvement in this process resulted in changes to draft versions of the sugarcane standards. The ISP was not otherwise tasked with reviewing the Reef Regulations.
- Two members of the 2015-16 Great Barrier Reef Water Science Taskforce (Taskforce) reviewed the proposed strengthened Reef regulatory package prior to the legislation commencing on 1 December 2019. These members were: Diane Tarte, Director, Marine Ecosystems Policy Advisors, and Chair, Dry Tropics Partnership for Healthy Waters; and Allan Dale, Professor of Tropical Regional Development, the Cairns Institute, and James Cook University. The Taskforce members found that the key proposals within the package generally aligned with the intent and purpose of the related Taskforce recommendations.

3) **Senator Canavan: Do you have a figure for how much of that $130 million would potentially go to farmers.**

- In the current *Queensland Reef Water Quality Plan* (2017-22) there is just under $100 million allocated to working with farming communities. Of that, nearly $24 million is going directly to farmers through incentives to improve land management through a variety of projects.
- Over $50 million is provided for agronomy services and extension to provide support to farmers by creating tailored land and nutrient management plans and other extension support and nearly $11 million is being provided to the industry groups for best management practice programs, with both of those components supporting qualified staff in regional communities.
- Approximately $12 million is put towards decision support tools and on farm trials to improve the understanding of farm science and enable uptake of improved farming practices.

4) Senator Canavan re agricultural expansion in GBR catchment: Did you get any advice from the CSIRO on this issue?

- The latest data from the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) and the Australian Bureau of Statistics (ABS) was used to provide an estimated forecast of agricultural expansion in the Great Barrier Reef catchment for the *Consultation Regulatory Impact Statement on Broadening and enhancing reef protection regulations* (the Consultation RIS).
- The Consultation RIS states that, an "ABARES report forecasts a 1% expansion in the area each year under sugarcane cropping by 2021/22 (ABARES 2017). This 1% expansion was used in the impact assessment. However, it seems likely to be an overestimate as recent ABS environment accounts showed a large decrease in the area under sugarcane production of -4.1% between 2011 and 2016 (ABS 2017a).This is the only known official forecast of the sugar area. The ABS environmental accounts showed an increase in grazing area of 0.5% from 2011-2016 or 0.1% a year. Without an official forecast for changes in the area for grazing, this annual figure of 0.1% is used in the analysis. Similarly, horticulture including bananas showed an increase in area of 0.5% over five years, or 0.1%. This annual growth rate was used in the analysis."
- The references used can be found in the Consultation RIS available at https://www.qld.gov.au/__data/assets/pdf_file/0032/67883/enhancing-reef-protection-regulations-ris.pdf

5) Senator McDonald: Of the 42 positions that you identified that are new extension officers that will be funded-is that correct? Can I ask you to provide on notice a list of those positions and which departments they're held in?

- Response provided under tabled questions on notice above.

6) Can the Department explain clearly the target concentration measurements for each relevant nutrient or chemical?

AND

7) How many parts per million of nitrogen do you class as moderate versus poor?

- The joint Reef 2050 Water Quality Improvement Plan targets are load-based targets (e.g. tonnes of dissolved inorganic nitrogen) for nutrients rather than concentration-based targets (e.g. mg/L of dissolved inorganic nitrogen). The nutrient targets based on an independent report by James Cook University were developed to meet the 'chlorophyll a' guidelines set by the *Water Quality Guidelines for the Great Barrier Reef Marine Park* (Great Barrier Reef Marine Park Authority, 2010).
- Water quality guideline values are used as a general tool to help ensure that certain physical and chemical stressors in waterways do not exceed harmful levels. Water quality guidelines are technically derived numerical measures (e.g. concentrations) or descriptive statements to protect aquatic ecosystems and human water uses and values (e.g. irrigation, stock watering, and recreation). Water quality guidelines are derived for a range of physico-chemical, biological and habitat indictors based on best-available science.
- The authoritative guidance and management framework for water quality in Australia is the National Water Quality Guidelines, the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. The National Water Quality Guidelines are a joint initiative of the

Australian and New Zealand governments, in partnership with the Australian states and territories.

- The National Water Quality Guidelines provide guidance on setting water quality objectives designed to sustain current, or likely future, community values for natural and semi-natural water resources. The National Water Quality Guidelines underpin the Great Barrier Reef Marine Park and Queensland local and state water quality guidelines and objectives that are developed to be more specific to the local and regional conditions and values:
  - The Great Barrier Reef Marine Park Authority has **Water Quality Guidelines for the Great Barrier Reef Marine Park (2010)** with set levels for specific pollutants which when exceeded prompt managers to take action. Regional catchment-level objectives are being implemented under Queensland's *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* for the Reef catchment, which includes state coastal waters.
  - **The Queensland's *Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (EPP (Water and Wetland Biodiversity))*,** sets objectives to achieve the object of the *Environmental Protection Act 1994* (EP Act) to protect Queensland's waters while supporting ecologically sustainable development.
    - Water quality objectives for the physical, chemical and biological characteristics of the water (e.g. nitrogen content, dissolved oxygen, turbidity, toxicants, fish) are determined for the local conditions of Queensland waters.
    - The Reef water quality objectives (see link below) address requirements under Chapter 4A of the EP Act to establish annual loads for sediments and dissolved inorganic nitrogen and are derived from the end-of-catchment anthropogenic water quality targets set out under the *Reef 2050 Water Quality Improvement Plan*.
- The Reef Water Quality report cards report the annual condition of inshore marine water quality using the Great Barrier Reef Report Card marine water quality metric. The Reef Report Card reports a grade in the condition of inshore water quality from very poor to very good. The grading of inshore marine water quality is based on the spatial extent of the inshore water body that did or did not exceed the relevant 'chlorophyll a' and water clarity indicator guidelines set in the **Water Quality Guidelines for the Great Barrier Reef Marine Park (2010).**
- **'Chlorophyll a'** and **indicators of water clarity** are a measure of the effects of excess nutrients and sediment on aquatic ecosystems and are recommended by the National water quality guidelines. The water quality metric was developed collaboratively between the Australian Institute of Marine Science, CSIRO, James Cook University, Great Barrier Reef Marine Park Authority and the Great Barrier Reef Foundation, funded through the Australian Government's National Environmental Science Program (access the report from the link below).
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