Results for the Mackay-Whitsunday
2017 Report Card

Environmental Indicators

Technical Report

Mackay-Whitsunday Healthy Rivers to Reef Partnership
January 2019

HEALTHY RIVERS TO REEF PARTNERSHIP
MACKAY-WHITSUNDAY

Authorship statement

The Mackay-Whitsunday Healthy Rivers to Reef Healthy Partnership (Partnership) Results for the Mackay-Whitsunday 2017 Report Card technical report was compiled by the Partnership's Technical Officers, Emma Maxwell and Alysha Sozou.

Substantial input was received from the Regional Report Cards Technical Working Group (TWG) members. Some content was also drawn from technical reports from earlier Mackay-Whitsunday report cards.

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Contents

Terms and Acronyms

Basin	An area of land where surface water runs into smaller channels, creeks or rivers and discharges into a common point and may include many sub-basins or sub-catchments. Also known as river basin or catchment
Chl-*a*	Chlorophyll-*a*: A measure of overall phytoplankton biomass. It is widely considered a useful proxy to measure nutrient availability and the productivity of a system
Climate	Climate refers to both climate variability and climate change
DIN	Dissolved inorganic nitrogen
DO	Dissolved oxygen
Driver	An overarching cause of change in the environment
Ecosystem	A dynamic complex of plant, animal and microorganism communities and their non-living environment interacting as a functional unit
Fish (as an index)	Fish community health is assessed and included in the ecosystem health assessments (coasters). Inclusion in the report card will contribute to an assessment of the health of local fish communities
Fish Barriers (as an indicator)	Fish barriers relate to any barriers which prevent or delay connectivity between key habitats which has the potential to impact migratory fish populations, decrease the diversity of freshwater fish communities and reduce the condition of aquatic ecosystems (Moore, 2015a)
Flow (as an indicator)	Flow relates to the degree that the natural river flows have been modified in the Region's waterways. This is an important indicator due to its relevance to ecosystem and waterway health
FRP	Filterable reactive phosphorus
GBR	Great Barrier Reef
GBR report card	Great Barrier Reef Report Card developed under the Reef 2050 Water Quality Improvement Plan (2018)
GBRMPA	Great Barrier Reef Marine Park Authority
Impoundment (also impoundment length)	An indicator used in the 'in-stream habitat modification' indicator for freshwater basins in the Region. This index reports on the proportion (%) of the linear length of the main river channel inundated at the Full Supply Level of artificial in-stream structures such as dams and weirs
Index	Is generated by indicator categories (e.g. water quality made up of nutrients, water clarity, chlorophyll-*a* and pesticides)

Indicator	A measure of one component of an environmental dataset (e.g. particulate nitrogen)
Indicator category	Is generated by one or more indicators (e.g. nutrients made up of particulate nitrogen and particulate phosphorus)
Inshore (as a reporting zone)	Inshore is a reporting zone in the Mackay-Whitsunday report card that includes enclosed coastal, open coastal and mid-shelf waters.
In-stream Habitat Modification (as an indicator)	This basin indicator category is made up of two indicators; fish barriers and impoundment length
ISP	Independent Science Panel established under the Reef Plan, who have independently reviewed the methodologies involved in the report card assessments
LOR	Limit of reporting
Macroalgae (cover)	An indicator used in part to assess coral health. Macroalgae is a collective term used for seaweed and other benthic (attached to the bottom) marine algae that are generally visible to the naked eye. Increased macroalgae on a coral reef is often undesirable, indicating reef degradation (Diaz-Pulido and McCook, 2008)
MMP	Marine Monitoring Program: the Great Barrier Reef Marine Park Authority's Marine Monitoring Program, which provided water quality data for the Central and Whitsunday reporting zones in the report card
ms-PAF	multisubstance-Potentially Affected Fraction
NO_x	Oxidised nitrogen
NQBP	North Queensland Bulk Ports
Offshore (reporting zone)	Offshore is a reporting zone in the Mackay-Whitsunday report card that includes mid-shelf and offshore water bodies.
Overall Score	The overall scores for each reporting zone used in the report card are generated by an index or an aggregation of indices
Pesticides (as an indicator)	The PSII herbicides (Ametryn, Atrazine, Diuron, Hexazinone, Tebuthiuron, Bromacil, Fluometuron, Metribuzin, Prometryn, Propazine, Simazine, Terbuthylazine, Terbutryn) are included in pesticides reporting. Up to 28 pesticides with different modes of action will progressively be included in subsequent Mackay-Whitsunday report cards.
Phys-chem	The physical-chemical indicator category that includes two indicators: dissolved oxygen (DO) and turbidity

PN	Particulate nitrogen
PONSE	Proportion of Native (fish) Species Expected
Ports	NQBP port authority
PP	Particulate phosphorus
PSII herbicides	Photosystem II inhibiting herbicides (Ametryn, Atrazine, Diuron, Hexazinone, Tebuthiuron, Bromacil, Fluometuron, Metribuzin, Prometryn, Propazine, Simazine, Terbuthylazine, Terbutryn)
PSII-HEq	Photosystem II herbicide equivalent concentrations, derived using relative potency factors for each individual PSII herbicide with respect to a reference PSII herbicide, diuron.
QPSMP	Queensland Ports Seagrass Monitoring Program
RIMReP	Reef 2050 Integrated Monitoring and Reporting Program
Riparian Extent (as an indicator)	An indicator used in the assessments of both basin and estuarine zones in the pilot and 2015 report cards. This indicator uses mapping resources to determine the extent of the vegetated interface between land and waterways in the Region
Secchi	Secchi depth (m) – measure of water clarity
SF	Scaling factor
TSS	Total suspended solids

1. Introduction

1.1. Purpose of this Document

The purpose of this document is to provide detailed results to support the 2017 Mackay-Whitsunday report card on waterway health. The results provided in this document are for environmental reporting. This report card does not include stewardship reports or social and economic information, which will next be updated in the next report card (2018 report card).

This document presents indicator scores in their original scale along with standardised scores that (where relevant) were used for aggregation. Confidence in the results is also reported in this document.

The 2017 report card results in this document are compared to 2016, 2015 and 2014 report card results that have been calculated using the same methods, making results directly comparable. The data collection period is outlined with associated results.

This document describes:

- The 2017 condition assessments for environmental indicators;
- The confidence associated with 2017 results;
- Comparison of 2017 results to 2016, 2015 and 2014 results; and
- Additional information associated with 2017 environmental results contained in Appendices.

1.2. Background

The Mackay-Whitsunday Healthy Rivers to Reef Partnership (Partnership) was established in October 2014. The primary focus of the Partnership is to produce an annual report card on the ecological condition of the Region's waterways.

The report card includes assessments of five freshwater basins, eight estuaries, four inshore marine zones and one offshore marine zone (to the eastern boundary of the Great Barrier Reef Marine Park). Different indicators are assessed to provide the overall scores for these reporting areas throughout the Mackay-Whitsunday Region.

Since the release of the last report card (2016 report card), the Program Design[1] outlining the guiding framework for the development and scope of the 2017 – 2022 report cards was finalised. Some amendments to sites have occurred since the 2016 report card and are noted throughout this document (where relevant). Otherwise, methods for developing the scores for the 2017 report card are consistent with those used in the last report card.

[1] https://healthyriverstoreef.org.au/report-card/program-design/

For more detail on the methods used to produce the Mackay-Whitsunday report card and for more information on the Partnership, refer to the Methods for the Mackay-Whitsunday 2017 report card document[1] and the Mackay-Whitsunday Report Card Program Design 2017 to 2022 document[2].

1.3. Terminology

The report card assesses different indicators of ecosystem health to report on overall condition. Scores for indicators are aggregated together depending on the aspect of the environment they are assessing, such as water quality, coral or fish. The terminology used in this document for defining the level of aggregation of indicators is as follows:

- Overall score is generated by the aggregation of indices or by a single index score;
- Index/indices (e.g. water quality) are generated by the aggregation of indicator categories;
- Indicator categories (e.g. nutrients) are generated by one or more related indicators; and
- An indicator is a component of the environment that can be measured or calculated (e.g. particulate nitrogen).

In the report card, overall scores and scores for indices are represented in the format of a coaster (Figure 1). Presentation of the coasters can be with or without the outer ring (i.e. indicator categories).

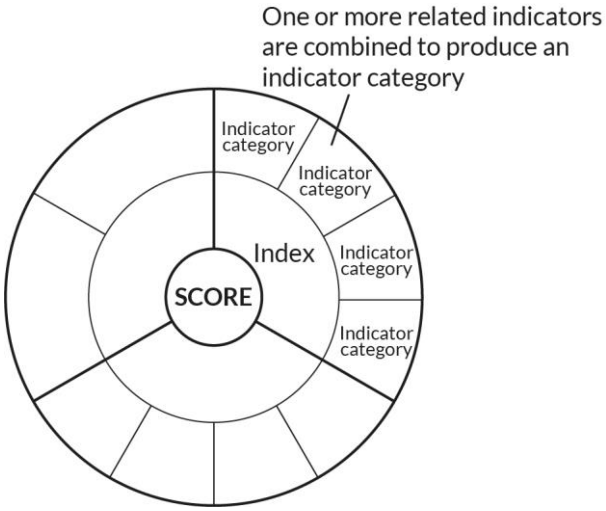

Figure 1. Terminology used for defining the level of aggregation of indicators and how they are displayed in the coasters in the report card.

1.4. General scoring of condition assessments

Ordinal categories are used to describe the scores for condition of indicators, indicator categories and the overall score. This follows a five-point scoring system:

Very Good (A), Good (B), Moderate (C), Poor (D), Very Poor (E).

[1] https://healthyriverstoreef.org.au/report-card/report-card-download/
[2] https://healthyriverstoreef.org.au/report-card/program-design/

All indicators have applicable scoring ranges and bandwidths which correspond to the five-point system. Individual scoring ranges are listed below the results tables presented throughout this document.

Results for indicators that had divergent scoring ranges and bandwidths were required to be translated into a common scoring range before aggregating (rolling up). The common scoring range used for reporting is based on that used by the Great Barrier Reef (GBR) report card (Table 1). Once standardised (where necessary), relevant scores were averaged to aggregate into the higher category.

Decision rules were developed for the minimum proportion of information required to generate the rolled up scores, as follows:

- ≥ 50% of measured indicators to generate the indicator category score (where relevant);
- ≥ 60% of indicator categories to generate an index score; and
- Overall scores for reporting zones are presented in the report card, even if not all indicator categories are available.

Table 1. Overall range of scores.

Scoring range	Condition grade and colour code
81 to 100	Very Good
61 to <81	Good
41 to <61	Moderate
21 to <41	Poor
0 to <21	Very Poor

1.5. Data used in the 2017 report card

Results for indicators that are reported annually in the 2017 report card are largely based on data collected between July 1st 2016 and June 30th 2017. This includes:

- Water quality indicators;
- Coral indicators; and
- Seagrass indicators.

This data collection period is not completely consistent for certain measures of water quality and coral in some of the marine zones. Where this occurs, it is identified within the document. Results for indicators that are reported less frequently are repeated from previous report cards and are based on data collected during:

- July 1st 2013 to June 30th 2014 for impoundment, riparian, wetland and mangrove/saltmarsh extent indicators (updated every four years and due for updating in the 2018 report card);
- July 1st 2014 to June 30th 2015 for fish barrier indicators (updated every four years, and due for updating in the 2019 report card); and
- July 1st 2015 to June 30th 2016 for freshwater fish indicators (updated every three years and due for updating in the 2018 report card).

1.6. Drivers of condition assessments in 2016-17

Population, the economy and climate are the key external forces that play a role on the condition of the Mackay-Whitsunday waterways, either directly or by driving activities that put pressure on the Region's waterways. In the reporting period from July 1st 2016 to June 30th 2017, the key drivers that are likely to directly affect scores of some of the environmental indicators relate to climatic variability, specifically rainfall and acute events such as cyclones.

1.6.1. Rainfall

The reporting period from July 1st 2016 to June 30th 2017 was wetter than the long-term average for the Mackay-Whitsunday Region. Rainfall in 2016-17 was the highest recorded rainfall compared to all previous reporting periods (Figure 2).

The wetter than average year, the timing of rainfall throughout the 2016-17 period and the late finish to the harvest of sugarcane meant that sugarcane growers in the Region had to adapt many aspects of soil, nutrient and pesticide management. This included delays in fertilising and spraying late harvested ratoons, which results in higher than normal inputs of fertiliser and pesticides just prior to or during the wet season (January to mid-March), when there is a higher risk of losses. The climatic conditions also meant that it was difficult to prepare the ground for cover crops, so many fallows were left weedy or bare. (P. Trendell 2018. pers. comm. 19/10/2018).

The biggest rainfall event for all five reporting basins (Don, Proserpine, O'Connell, Pioneer and Plane) was the period between March and April 2017, when Severe Tropical Cyclone Debbie (TC Debbie) crossed the coast into the region (Figure 3).

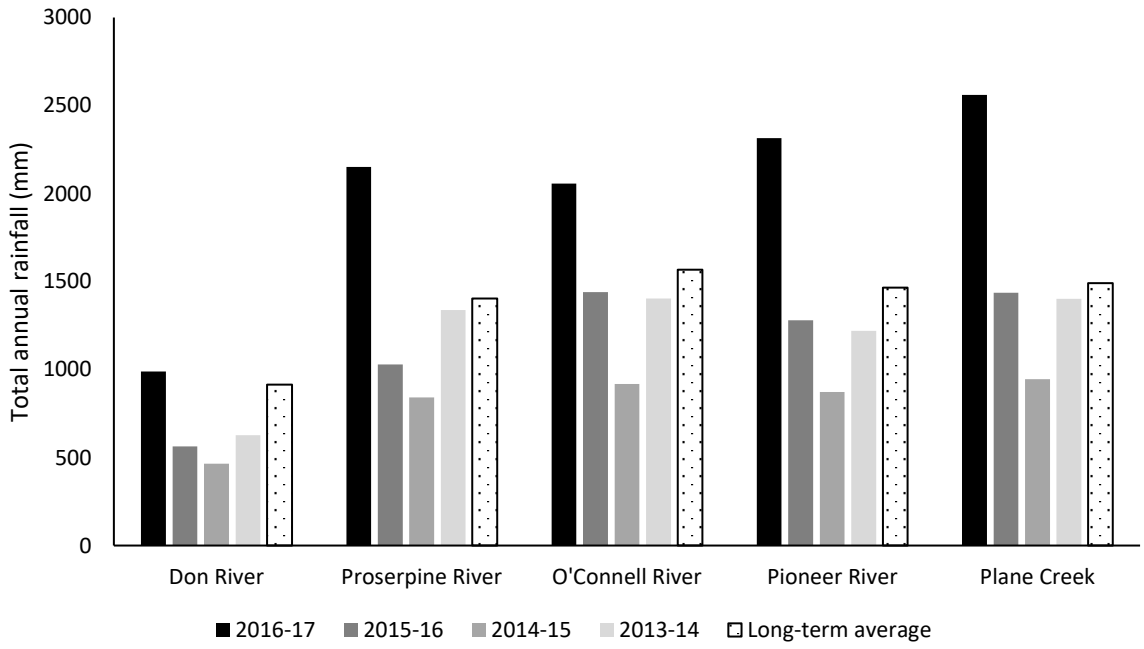

Figure 2. Total annual rainfall across the Mackay-Whitsunday Region for the 2016-17 reporting period compared to previous reporting periods and the long-term average (past 100 years). Data from the Australian Water Resources Assessment Modelling System, Bureau of Meteorology.

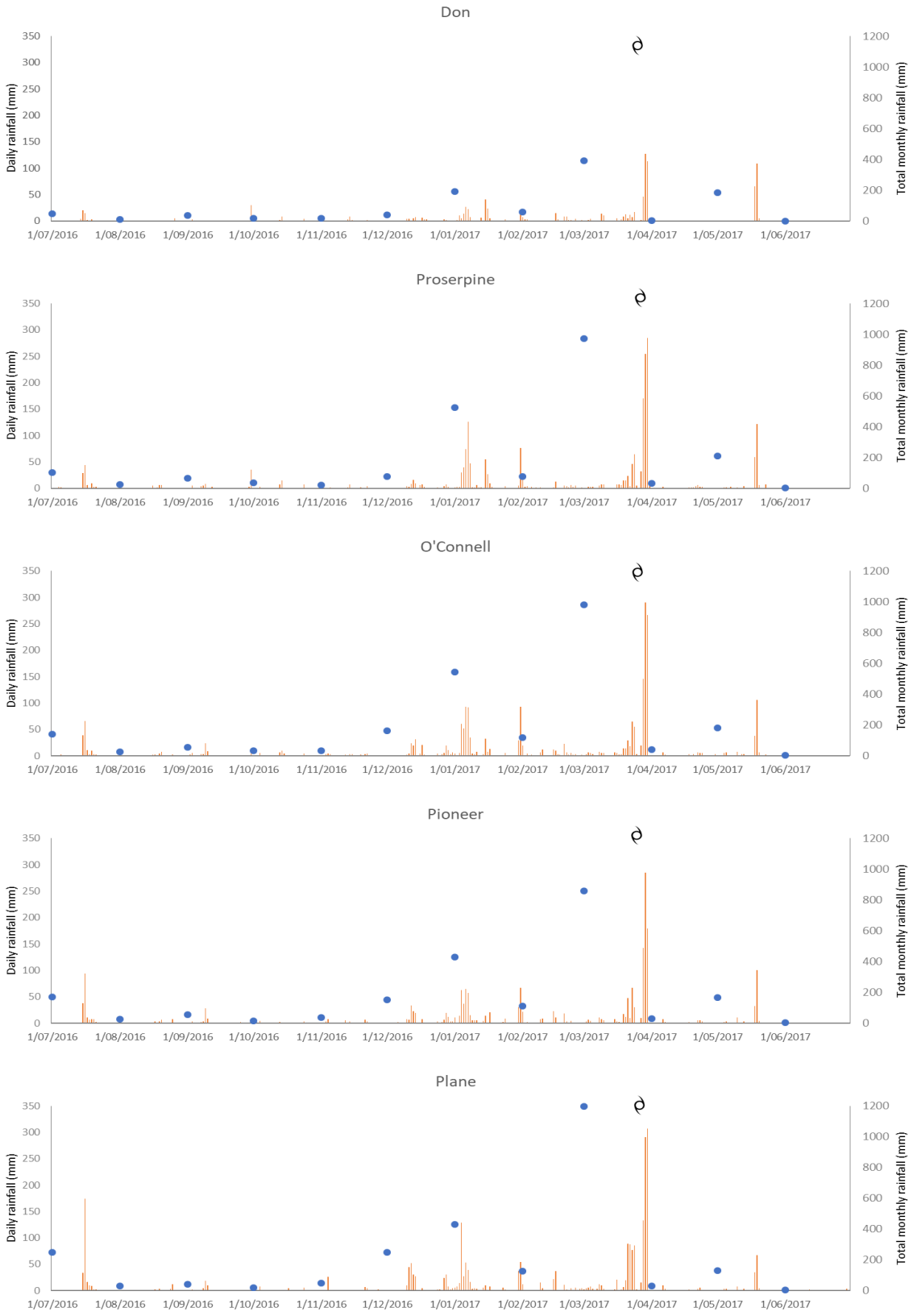

Figure 3. Total daily (orange bars) and monthly (blue dots) rainfall (mm) recorded from July 1st 2016 to June 30th 2017 in the five basins reported in the Mackay-Whitsunday report card. Data from the Australian Water Resources Assessment Modelling System, Bureau of Meteorology. TC Debbie is also depicted ☋.

1.6.2. Cyclones

TC Debbie made landfall near Airlie Beach on Queensland's Whitsunday coast on Tuesday, 28th March 2017, after crossing the Whitsunday Islands as a large and powerful category 4 storm system (Figure 4; Figure 5). Shortly after crossing the coast, TC Debbie slowed down moving inland at only 7km/h, and locations such as Airlie Beach and Proserpine were exposed to the very destructive winds near the cyclone's eye for many hours. TC Debbie weakened below TC strength around 3:00am AEST on Wednesday, 29th March. The remnant low then turned southeast and produced a broad swathe of damaging winds and torrential rainfall from central Queensland to the southeast. Clarke Range, west of Mackay, received 986mm in the 48 hours to 9am Wednesday 29th March, and Mt Jukes, northwest of Mackay, recorded 635mm in the 24 hours to 9am Thursday, 30th March.[1]

The 2017 report card reporting period is primarily from July 1 2016 to June 30 2017, which covers the period of Cyclone Debbie. However, dependent on the timing of monitoring, some indicators will not reflect potential impacts from the cyclone in this report. Details of monitoring periods are described for each indicator.

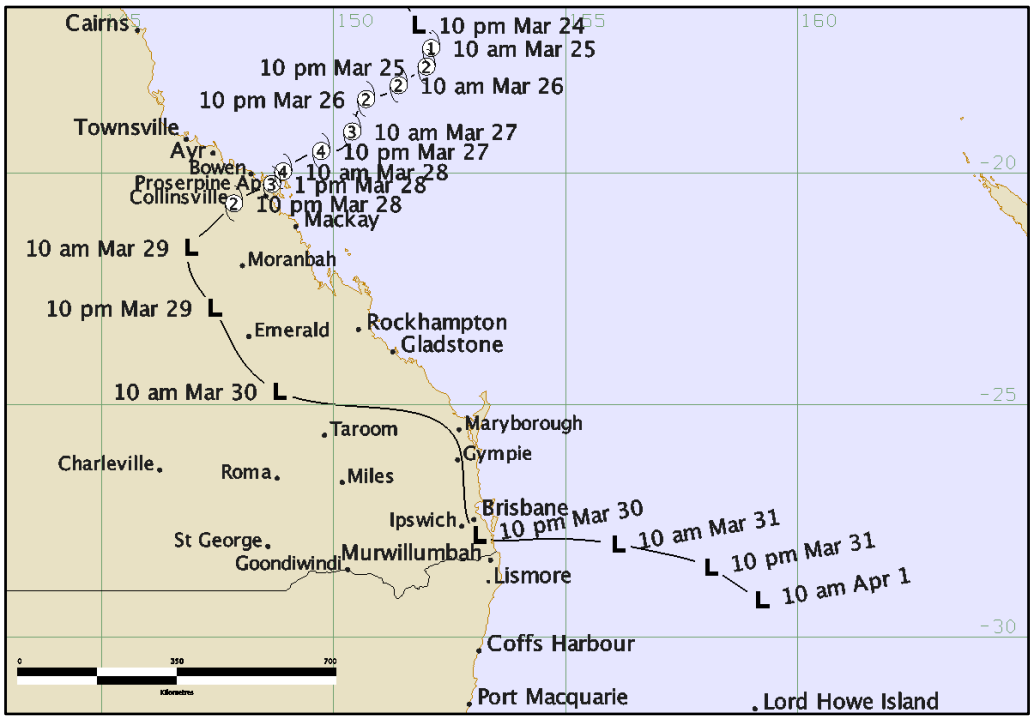

Figure 4. Tropical Cyclone Debbie track and intensity (all times in AEST). Source: Bureau of Meteorology.

[1] *Text source: Bureau of Meteorology* http://www.bom.gov.au/cyclone/history/database/Tropical-Cyclone-Debbie-Technical-Report-Final.pdf

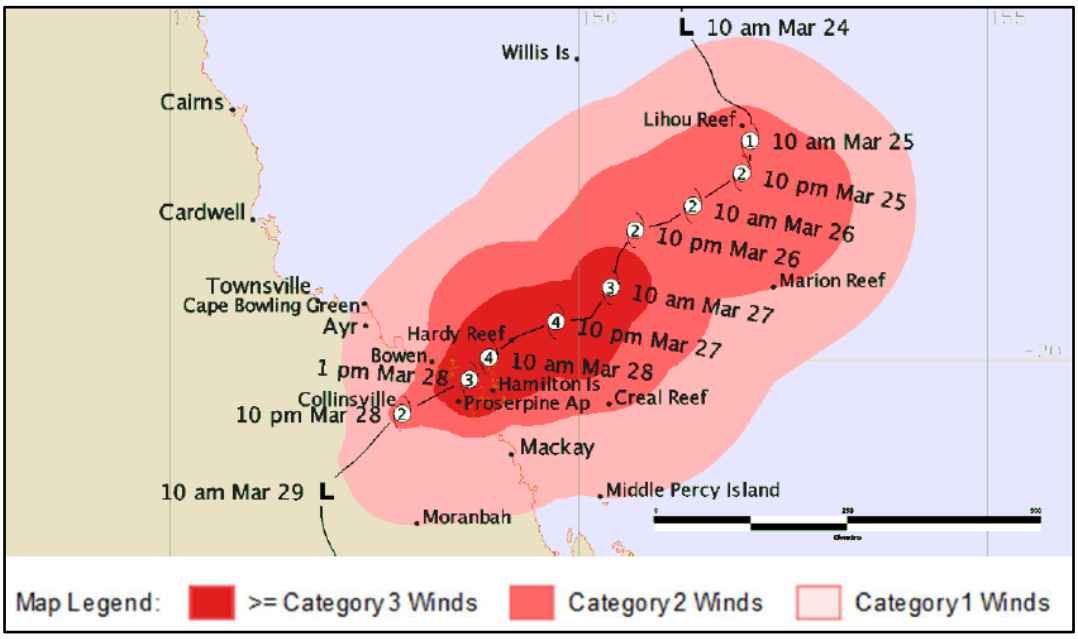

Figure 5. Tropical Cyclone Debbie track showing areas affected by very destructive (red), destructive (dark pink) and damaging (pink) winds produced by Tropical Cyclone Debbie (all times in AEST). Source: Bureau of Meteorology.

1.6.3. Climate change

Mass coral bleaching has been occurring on a global scale since 2014, triggered by record-breaking sea surface temperatures and amplified in 2016 by a strong El Nino (Great Barrier Reef Marine Park Authority 2017). During the summer of the reporting period from July 1st 2015 to June 30th 2016, consistently high sea surface temperatures across the GBR triggered one of the worst mass coral bleaching events recorded on the GBR (Great Barrier Reef Marine Park Authority 2017). Following the record-breaking temperatures of 2016, sea surface temperatures on the GBR again exceeded long-term averages from January to March 2017, causing an unprecedented second consecutive year of bleaching (Thompson et al. 2018). Patterns of bleaching intensity shifted from the northern reefs of the GBR in 2016 to the central reefs in 2017 (Figure 6). Whilst coral bleaching in 2017 was observed in the Wet Tropics, Burdekin, Mackay-Whitsunday and Fitzroy regions, the impacts varied. The most impacted reefs were located in the Wet Tropics and Burdekin regions (Thompson et al. 2018). The passage of TC Debbie damaged reefs in the Mackay Whitsunday Region, confounding the ability to assess coral bleaching impacts (Thompson et al. 2018).

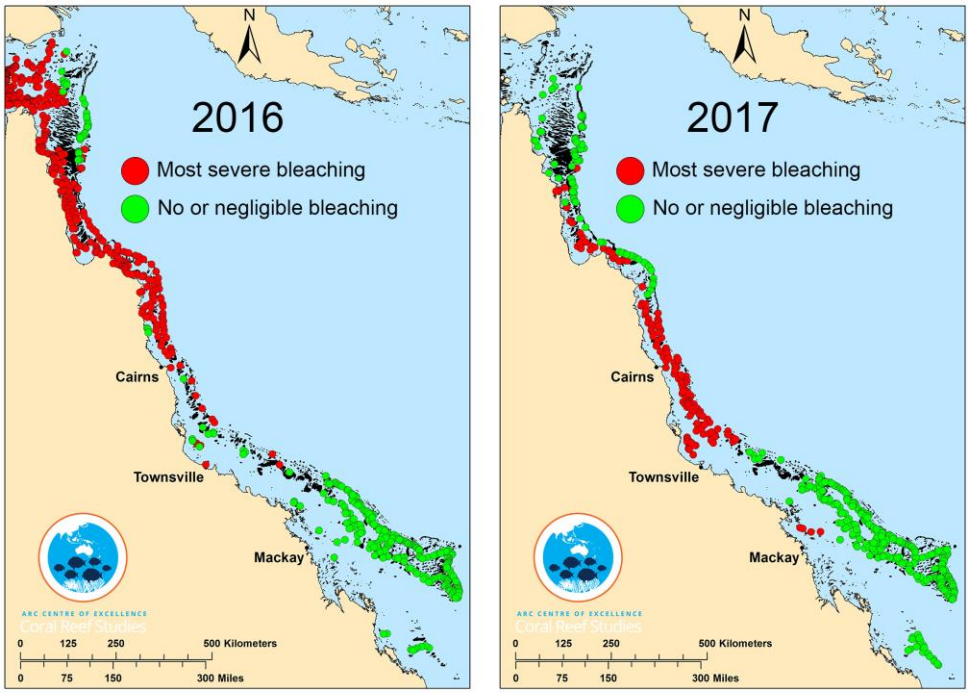

Figure 6. Composite map of surveyed corals across the 2016 and 2017 bleaching events. Only reefs at each end of the spectrum are shown: Red circles indicate reefs undergoing most severe bleaching (60% or more of corals visible to aerial surveys bleached). Green circles indicate reefs with no or minimal bleaching (10% or less of corals bleached). Source: Thompson et al. (2018)[1] courtesy of ARC Centre of Excellence Coral Reef Studies.

[1] Marine Monitoring Program: Annual report for inshore coral reef monitoring 2016-2017

2. Freshwater basin results

The indicators, relevant indicator categories and overall indices that are assessed for the basins are pictured in Figure 7.

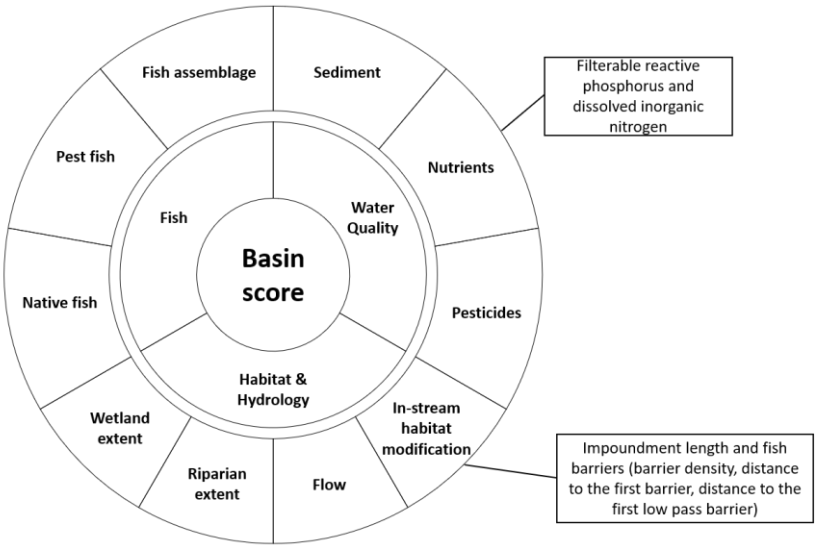

Figure 7. Indicator categories (outer ring) and indices (inner ring) that contribute to overall basin scores. Where multiple indicators are aggregated to determine the indicator category, these are listed in break-out boxes.

Four of the five freshwater basins assessed (Don, Proserpine, O'Connell and Plane) scored a 'C' grade for overall condition. This indicates that the overall condition of most of the freshwater basins has not changed much since the previous (2016) report card. An exception to this was the Pioneer basin, where the grade changed from a 'C' (moderate condition) in 2015 and 2016 to a 'D' (poor condition) in 2017. A poor grade for the Pioneer basin has not been recorded since 2014 (Table 2). It should be noted, however, that the change in grade for the Pioneer basin between 2016 and 2017 was because condition scores that determine these grades changed from 41 to 40, indicating that there has not been a substantial decline in condition during this period.

Scores for habitat and hydrology and fish are based on data repeated from the 2016 report card, due to the reporting frequency of these indicators being every three to four years, reflecting the gradual nature of change associated with indicators that inform these indices[1]. This means that any changes to overall basin scores in the 2017 report card are driven by water quality scores. It should also be noted that, while the overall grade for the Don basin has not changed during the 2014-2017 period (it remains a 'C'), this is the first year that there has been data to inform a water quality index score, and therefore the condition of water quality has contributed to the overall score for the Don basin for the first time.

[1] Indicators in the habitat and hydrology index (excluding fish barriers) and fish index are due for updating in the 2018 report card (released in 2019).

Table 2. Condition grades of freshwater basins for the 2017 report card in comparison to 2016, 2015 and 2014 report card scores.

Freshwater basin	2017 report card					2016	2015	2014
	Water quality	Habitat and hydrology	Fish	Basin score and grade		Basin score	Basin score	Basin score
Don	54	48		**51**	**C**	48	48	54
Proserpine		53		**53**	**C**	53	53	52
O'Connell	59	45	65	**56**	**C**	58	58	52
Pioneer	45	27	48	**40**	**D**	41	41	34
Plane	33	39	79	**50**	**C**	52	51	35

Scoring range: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap

2.1. Water quality in freshwater basins

Water quality condition scores were derived from end of catchment loads monitoring at one site in each of the Don, O'Connell, Pioneer and Plane basins. These sites were at the Don River in Bowen, the O'Connell River at the Caravan Park, the Pioneer River at Dumbleton Pump Station and Sandy Creek at Homebush, respectively.

The Don basin end of catchment monitoring site was established in November 2016, however due to the ephemeral nature of the Don River, water quality data was only collected in the months of January, March, April, May and June in 2017 (when there was surface flow in the Don River). This episodic flow regime of the Don River means that data will usually only be available during or shortly after rainfall. It is therefore anticipated that the scores for the Don River will be based on data from conditions that typically result in poorer water quality.

The addition of a water quality score in the Don basin for the first time in the 2017 report card is an important step towards improving the understanding of the water quality story of the Mackay-Whitsunday report card Region. It demonstrates the commitment to continuous improvement in the report card. Subsequent report cards will gradually provide a clearer picture of the condition of water quality in the Don basin. Water quality condition scores for the Don basin are based on comparison to draft guidelines for lowland freshwaters for the Don River outlined in the Draft environmental values and water quality guidelines: Don and Haughton River basins, Mackay-Whitsunday estuaries, and coastal/marine waters (Newham et al. 2017)[1].

While data was also collected from the Proserpine River end of catchment loads monitoring site at Glen Isla, this site is located in the estuary and therefore concentration of nutrients and sediments are influenced by seawater and tidal movements. While this data is suitable for determining pollutant loads leaving the Proserpine River (the purpose of the monitoring site), it is not suitable for reporting the ambient state (concentration) of nutrients and sediments in the freshwater ecosystem because their source (catchment or estuarine) cannot be determined with confidence. Nutrient and sediment indicator category results for the Proserpine basin are therefore not reported in the 2017 report card. However, pesticides are still reported for the Proserpine basin because: data from the Glen Isla site

[1] https://www.ehp.qld.gov.au/water/policy/pdf/don-haughton-mackay-whitsunday-main-report.pdf

still provides a good estimate of pesticide pressure from the freshwater catchment; the dilutive potential of the tidal inflow of seawater is not anticipated to dilute the magnitude of the ms-PAF score substantially (see methods[1] document for further detail) and a ms-PAF score calculated above the tidal zone would not necessarily provide a more accurate picture of the pesticide pressures in the catchment, as it would miss some of the inputs.

Some damage to monitoring equipment at the Proserpine, O'Connell, Pioneer and Plane basin sites was experienced during the TC Debbie event. This led to reduced sampling during periods of peak discharge, however supplementary manual sampling was undertaken at these sites following the decline of the floodwaters. The water quality index scores for the 2017 report card therefore are considered a good reflection of water quality in these basins during the 2016-17 period.

An additional end of catchment loads monitoring site was established on the O'Connell River at Stafford's Crossing in November 2016. While a score was calculated for water quality at this site, it was not incorporated in the water quality score for the O'Connell basin in the 2017 report card because a suitable method has not been developed to incorporate additional sites into freshwater basin scores (this is the first time the report card has had data for more than one site in a basin). Scores for this site compared to the site on the O'Connell River at the Caravan Park (used to produce the 2017 report card scores for the O'Connell basin) are very similar. These scores and the distribution of TSS, DIN and FRP indicator data for the two O'Connell River monitoring sites can be seen in Appendix A.

2.1.1. Sediments

Sediment indicator category scores were moderate across the O'Connell, Pioneer and Plane basin water quality sites for the 2016-17 reporting period, whilst those for the Don basin were poor (Table 3). This demonstrates that the annual medians for total suspended solids (TSS) at the sites monitored in these basins did not meet the guidelines. This is the third consecutive year that the O'Connell and Pioneer basin have remained in moderate condition for TSS. The Plane basin has been in a moderate condition for all report cards except for 2015, where the Sandy Creek site score for TSS was in good condition. 2017 is the first time that data has been available to score this indicator for the Don River.

Table 3. Results for the sediment indicator category (based on a measure of TSS) score for water quality in freshwater basins for the 2017 report card (2016-17 data) in comparison to 2016, 2015 and 2014 scores.

Freshwater Basin	2017 report card Sediment	2016 Sediment	2015 Sediment	2014 Sediment
Don (Don River)	29			
Proserpine				
O'Connell (O'Connell River)	57	55	58	55
Pioneer (Pioneer River)	60	59	59	53
Plane (Sandy Creek)	55	54	61	51

Sediment: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap

2.1.2. Nutrients

The results for indicators in the nutrient category for the 2017 report card are presented in Table 4. None of the annual medians for dissolved inorganic nitrogen (DIN) or filterable reactive phosphorus

[1] Insert link to methods document

(FRP) met relevant guidelines for the 2016-17 reporting period. Aggregated scores showed that nutrients remained in moderate condition for the second consecutive year in the O'Connell and Pioneer basins, whilst those for the Plane basin remained in poor condition, consistent with the previous reporting periods. The aggregated nutrient category score for the Don basin also showed poor condition during the 2016-17 reporting period.

Table 4. Results for DIN and FRP indicators and overall nutrients indicator category scores for water quality in freshwater basins for the 2017 report card (2016-17 data) in comparison to 2016, 2015 and 2014 report card scores.

Freshwater Basin	2017 report card			2016	2015	2014
	DIN	FRP	Nutrients	Nutrients	Nutrients	Nutrients
Don	42	24	**33**			
Proserpine						
O'Connell	60	60	**60**	60	90	55
Pioneer	35	55	**45**	52	53	46
Plane	30	17	**24**	39	27	16

DIN and FRP: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = assigned 90 | ■ No score/data gap

Nutrients: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap

2.1.3. Pesticides

The results for pesticides (based on the multi-substance-Potentially Affected Fraction, ms-PAF) in the 2017 report card were based on 13 herbicides, matching the 2016 report card. Subsequent report cards will move to include all pesticides reporting against Reef 2050 pesticide targets. The additive nature of the ms-PAF calculation means it is expected that scores for pesticides will get worse in subsequent years as more pesticides are included. For the first time, the equivalent aquatic species protected (%) by the mixture of pesticides is presented alongside the ms-PAF value.

The 2016-17 report card scores for the ms-PAF pesticide indicator show that: the Don basin was in very good condition; the O'Connell basin score dropped, but this did not result in a change of grade, so the indicator remained in a good condition in 2017 for the second year; and the Pioneer and Plane basins remained in a poor and very poor condition respectively, for the fourth year (Table 5).

The exceedance notices (Department Science, Information Technology and Innovation (DSITI) 2016-17a and DSITI 2016-17b) received for diuron in the Pioneer River and Sandy Creek in December 2016, and in the Proserpine River and Sandy Creek in January 2017, alongside the poor and very poor condition of the ms-PAF indicator in these basins highlight that pesticides are a key concern for the Region at these locations.

The climatic conditions (wetter than average year and timing of rainfall), which required sugarcane growers to adapt their management practices and undertake many activities later than usual, may have contributed to the changes in pesticide scores for the O'Connell Basin. In particular, the spray windows for products containing diuron[1] can mean that growers, in a season like this, focus on using the higher application rates of these pesticides across a larger proportion of their farm just before the

[1] No spray windows from November 1st to May 31st for Diuron/Hexazinone and December 1st to April 30th for Diuron only.

no spray window begins, leading to a higher risk of losses if there are run-off events in November, December or January (P. Trendell 2018. pers. comm. 19/10/2018).

Table 5. Results for the ms-PAF indicator (accounting for 13 or 5* pesticides), equivalent aquatic species protected (%) and overall standardised pesticides scores for freshwater basins for the 2017 report card (2016-17 data) in comparison to 2016, 2015 and 2014 report cards. *The 2014 report card score accounted for 5 pesticides only.

	2017 report card		Pesticides	Pesticides	Pesticides
Basin	**ms-PAF (%)**	**Pesticides**	**2016**	**2015**	**2014***
Don	0 (100% species protected)	**100**			
Proserpine	15 (85% species protected)	**30**			
O'Connell	5 (95% species protected)	**61**	74	40	66
Pioneer	15 (85% species protected)	**30**	35	31	19
Plane	22 (78% species protected)	**20**	19	16	16

ms-PAF scoring range: ■ Very Poor = >20% | ■ Poor = >10 to 20% | ■ Moderate = >5 to 10% | ■ Good = >1 to 5% | ■ Very Good = ≤1% | ■ No score/data gap

Pesticides: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap

2.1.4. Water quality index scores and confidence

The overall water quality index for the Don, O'Connell and Pioneer basins showed moderate condition, while the Plane basin showed poor condition (Table 6). Due to rules for the minimum proportion of information required to generate rolled up scores, a final water quality score could not be calculated for the Proserpine basin.

Despite a wetter than average year and occurrence of TC Debbie, ambient water quality did not change substantially from the 2016 report card (which was a drier than average year) in the Pioneer and Plane basins (Table 6). The change in water quality in the O'Connell basin was driven primarily by the lower pesticide indicator category score, which may have been reflective of the wetter than average year which required farmers to adjust herbicide management.

Whilst there were some changes in condition of some of the water quality indicators, interpreting cause and trend of results should be undertaken with caution; subsequent report cards may allow for interpretation of trends in results, which can improve our understanding in the direction of changes.

Table 6. Results for water quality indicator categories and final water quality index scores in freshwater basins for the 2017 report card (2016-17 data) in comparison to 2016, 2015 and 2014 report cards.

Water quality index	2017 report card				2016	2015	2014
Basin	**Sediment**	**Nutrients**	**Pesticides**	**Water quality**	**Water quality**	**Water quality**	**Water quality**
Don	29	33	100	**54**			
Proserpine			30				
O'Connell	57	60	61	**59**	63	63	59
Pioneer	60	45	30	**45**	48	48	40
Plane	55	24	20	**33**	37	35	28

Scoring range: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap

Confidence in water quality scores for the three basins is moderate (Table 7). This is primarily due to the low spatial representativeness of the monitoring program. Scores are calculated based on data from only one site per basin, and therefore can't confidently be inferred as representing the entire basin.

Table 7. Confidence associated with water quality index results in freshwater basins in the 2017 report card. Confidence criteria are scored 1-3 and then weighted by the value identified in parenthesis. Final scores (4.5 – 13.5) are additive across weighted confidence criteria. Final scores correspond to a rank from 1-5 (very low – very high), which indicates final confidence level. Unless specified, confidence in results is the same across basins.

Indicator category	Maturity of methodology (x0.36)	Validation (x0.71)	Representativeness (x2)	Directness (x0.71)	Measured error (x0.71)	Final	Rank
Sediment	3	3	1	3	2	8.8	3
Nutrients	3	3	1	3	2	8.8	3
Pesticides	1	2	1	2	2	6.6	2
					Water quality index	**8.8**	**3**

Rank based on final score: 1 (very low): 4.5 – 6.3; 2 (low): >6.3 – 8.1; 3 (moderate): >8.1 – 9.9; 4 (high): >9.9 – 11.7; 5 (very high): >11.7 – 13.5.

Improving spatial representativeness of water quality monitoring in basins is a high priority for the Partnership. A methodology is under development to allow condition scores from multiple sites to contribute to the overall water quality index in a basin. In the next (2018) report card, spatial representativeness will start to improve for the Plane and O'Connell basins, as data will be available from two additional GBRCLMP sites. Additional monitoring sites throughout the basins will be progressively rolled out in subsequent years.

2.2. Habitat and Hydrology in freshwater basins

Results for indicators and indicator categories that contribute to the habitat and hydrology index are presented below. The flow indicator will be incorporated as part of the 2018 report card.

2.2.1. In-stream habitat modification

Fish barrier indicator scores for the 2017 reporting period are shown in (Table 8). These scores are the same as the ones outlined in the previous two report cards, due to the reporting frequency of these indicators being every four years. This reporting frequency reflects the gradual nature of change associated with these indicators. Since this indicator was last assessed, the Mackay Regional Council have been progressively working to install fish ways or remove a number of high priority barriers. These changes will be captured when fish barrier indicators are updated in the 2019 report card (released in 2020).

Table 8. Results for fish barrier indicators in freshwater basins in the 2017 report card (2014-15 data). Indicators were assessed on Stream Orders (SO) ≥3 or ≥4 as indicated. *Insufficient data was available regarding barrier passability in the Don basin, so the score was based on expert opinion rather than measured.

	Barrier density		Stream to the 1st barrier		Stream to the 1st low passability barrier		Fish barriers	
Basin	km per barrier on SO ≥3	Score	% of stream before first barrier on SO ≥3	Score	% of stream before first low pass barrier on SO ≥4	Score	Total score	Fish barriers (standardised)
Don	10.5	4	23.7	2	*	4	10	**60**
Proserpine	2.7	2	38.5	3	91.4	4	9	**50**
O'Connell	5.3	3	33.4	3	85.3	4	10	**60**
Pioneer	5.6	3	0.1	1	0.5	1	5	**21**
Plane	2.4	2	27.9	2	70.5	3	7	**40**

Barrier density (km): ■ Very Poor/score of 1 = 0 to 2km | ■ Poor/score of 2 = >2 to 4km | ■ Moderate/score of 3 = >4 to 8km | ■ Good/score of 4 = >8 to 16km | ■ Very Good/score of 5 = >16km | ■ No score/data gap

Stream to 1st barrier (%): ■ Very Poor/score of 1 = 0 to <10% | ■ Poor/score of 2 = 10 to <30% | ■ Moderate/score of 3 = 30 to <50% | ■ Good/score of 4 = 50 to <100% | ■ Very Good/score of 5 = 100% | ■ No score/data gap

Stream to 1st low passability barrier (%): ■ Very Poor/score of 1= 0 to 50% | ■ Poor/score of 2 = >50 to 60% | ■ Moderate/score of 3 = >60 to 70% | ■ Good/score of 4 = >70 to 95% | ■ Very Good/score of 5= >95% | ■ No score/data gap

Total score: ■ Very Poor = 3 to 4 | ■ Poor = 5 to 7 | ■ Moderate = 8 to 10 | ■ Good = 11 to 13| ■ Very Good = 14 to 15 | ■ No score/data gap

Fish barriers (standardised): ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap

As with fish barrier indicators, scores for impoundment (Table 9) are repeated from the 2016, 2015 and 2014 report card, due to the reporting frequency of these indicators being every four years.

Table 9. Results for the impounded stream indicator in freshwater basins in the 2017 report card (2013-14 data).

Basin	Not impounded (km)	Impounded (km)	Total (km)	% total	Standardised impoundment
Don	954	0	954	0.0	**100**
Proserpine	528	37	565	6.6	**43**
O'Connell	598	16	614	2.6	**70**
Pioneer	498	54	552	9.8	**22**
Plane	671	28	698	4.0	**60**

Impoundment (% total): ■ Very Poor = ≥10% | ■ Poor = 7 to <10% | ■ Moderate = 4 to <7% | ■ Good = <4 to 1% | ■ Very Good <1% | ■ No score/data gap

Standardised impoundment: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap

With impoundment and fish barrier indicators aggregated up into the in-stream habitat modification indicator category, the Don and O'Connell basins are in good condition, the Proserpine and Plane basins are in moderate condition, and the Pioneer basin is in poor condition (Table 10). Despite the same impoundment data being used for the last four report cards, in-stream habitat modification indicator category scores are different to what was seen in the 2014 report card, because fish barrier indicators were not included during these reporting periods.

Table 10. Results for in-stream habitat modification indicator category in freshwater basins in the 2017 report card (data repeated from 2016 report card).

Basin	Impoundment	Fish barriers	In-stream habitat modification
Don	100	60	**80**
Proserpine	43	50	**47**
O'Connell	70	60	**65**
Pioneer	22	21	**21**
Plane	60	40	**50**

Scoring range: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap

2.2.2. Riparian and wetland extent

In the 2017 report card the same data has been used for percentage loss of riparian extent and wetland extent (palustrine wetlands only) as in the 2016, 2015 and 2014 report cards. All basins are in moderate condition for riparian extent (Table 11). Proserpine basin is the only basin in good condition in terms of wetland extent. The remaining basins are in poor to very poor condition relating to wetland extent (Table 11).

Table 11. Results for riparian and wetland (palustrine wetlands only) extent loss since pre-development (%) and standardised riparian and wetland extent in freshwater basins in the 2017 report card (2013-14).

Basin	Riparian extent (% loss since pre-development)	Wetland extent (% loss since pre-development)	Standardised riparian extent	Standardised wetland extent
Don	30	48	41	22
Proserpine	23	14	50	62
O'Connell	22	56	51	18
Pioneer	20	83	54	7
Plane	30	45	41	25

Riparian and wetland extent (% loss): ■ Very Poor = >50% | ■ Poor =>30 to 50% | ■ Moderate = >15 to 30% | ■ Good = >5 to 15% | ■ Very Good ≤5% | ■ No score/data gap

Standardised riparian and wetland extent: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap

2.2.3. Habitat and hydrology index scores and confidence

The overall habitat and hydrology index scores for the 2017 report card show that the Don, Proserpine and O'Connell basins were in moderate condition and the Pioneer and Plane basins were in poor condition, based on this index (Table 12). As data for habitat and hydrology is repeated data due to four-year data cycles, this data does not reflect potential impacts to these indicators from TC Debbie.

On-ground observations and aerial imagery of the Region have demonstrated changes to stream banks and in-stream morphology at certain locations because of TC Debbie. This includes the removal of some sand dams that may have been considered as barriers in the fish barrier indicator assessment.

Except for the fish barrier indicators, data for habitat and hydrology indicators are due to be updated in the 2018 report card (released in 2019).

Table 12. Results for habitat and hydrology indicator categories and the aggregated index in freshwater basins in the 2017 report card (using data repeated from 2016, 2015 and 2014 report cards).

Basin	In-stream habitat modification	Flow	Riparian extent	Wetland extent	Habitat and hydrology
Don	80		41	22	**48**
Proserpine	47		50	62	**53**
O'Connell	65		51	18	**45**
Pioneer	21		54	7	**27**
Plane	50		41	25	**39**

Scoring range: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap

There was high confidence in habitat and hydrology index scores for all but the Don basin (Table 13). Lower confidence in the Don basin habitat and hydrology scores were driven by the fact that fish barriers in the Don basin had not been ground-truthed, which had occurred in the other basins.

Table 13. Confidence associated with habitat and hydrology index results in freshwater basins for the 2017 report card. Confidence criteria are scored 1-3 and then weighted by the value identified in parenthesis. Final scores (4.5 – 13.5) are additive across weighted confidence criteria. Final scores correspond to a rank from 1-5 (very low – very high), which indicates final confidence level. Where confidence in results for the Don basin differ to the other basins, the relevant confidence score for the Don is presented in square parenthesis. Unless otherwise specified, confidence in results is the same across basins.

Indicator category	Maturity of methodology (x0.36)	Validation (x0.71)	Representativeness (x2)	Directness (x0.71)	Measured error (x0.71)	Final	Rank
In-stream habitat modification[1]						10.4 [7.7]	4 [2]
Riparian extent	9	3	2	2	2	9	3
Wetland extent	11.3	4	2	2	2	9	3
					Habitat and hydrology index	**10.4 [9]**	**4 [3]**

Impoundment	2	2	3	2	1	10.3	4
Fish barriers	1	2 [1]	3 [1]	2	2 [1]	10.6 [5.2]	4 [1]

[1]The in-stream habitat modification rank is based on the median final score of impoundment and fish barriers indicators.
Rank based on final score: 1 (very low): 4.5 – 6.3; 2 (low): >6.3 – 8.1; 3 (moderate): >8.1 – 9.9; 4 (high): >9.9 – 11.7; 5 (very high): >11.7 – 13.5.

2.3. Fish in freshwater basins

The data for the fish index presented in this report are the same as those presented in the 2016 report card, due to the reporting frequency of these indicators being every three years. It should be noted that sampling for this assessment was conducted by electrofishing, which identifies all species in a sample location, regardless of size. Results therefore do not necessarily reflect the expected catch of an angler fishing at the same location.

The proportion of observed native fish species compared to the modelled Proportion of Native Species Expected (PONSE) scores showed good condition for this indicator in the O'Connell and Plane basins

[1] In-stream habitat modification is the median of impoundment and fish barrier final scores.

and moderate in the Pioneer basin. Pest fish abundance scores showed very good in the Plane basin and good in the O'Connell and Pioneer basins (Table 14). The good condition achieved for the fish index in the Plane basin appears in conflict with the poor water quality index and poor fish barrier indicator scores for the same basin. This has been highlighted as an area of interest for further research.

The fish model and indicators used to produce these scores have been based on limited data and the assessment method is still being refined. Improving the models for these indicators will help give higher confidence in fish index scores in future report cards (Table 15). The development of a fish 'assemblage indicator' describing the taxonomic integrity of fish communities has also been identified as particularly important for improving our understanding of fish in freshwater throughout the Mackay-Whitsunday Region.

Table 14. Results for fish indicators in freshwater basins in the 2017 report card (2015-16 data).

Basin	Native fish richness (PONSE)	Pest fish (proportion of sample)	Fish (standardised)
Don			
Proserpine			
O'Connell	73	58	**65**
Pioneer	53	43	**48**
Plane	71	87	**79**

Scoring range: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap

Table 15. Confidence associated with fish index results in freshwater basins for the 2017 report card. Confidence criteria are scored 1-3 and then weighted by the value identified in parenthesis. Final scores (4.5 – 13.5) are additive across weighted confidence criteria. Final scores correspond to a rank from 1-5 (very low – very high), which indicates final confidence level. Unless otherwise specified, confidence in results is the same across basins.

Indicator category	Maturity of methodology (x0.36)	Validation (x0.71)	Representat-iveness (x2)	Directness (x0.71)	Measured error (x0.71)	Final	Rank
Native richness	2	2	2	2	2	9.0	3
Pest fish abundance	2	2	2	2	2	9.0	3
					Fish index	**9.0**	**3**

Rank based on final score: 1 (very low): 4.5 – 6.3; 2 (low): >6.3 – 8.1; 3 (moderate): >8.1 – 9.9; 4 (high): >9.9 – 11.7; 5 (very high): >11.7 – 13.5.

3. Estuary results

The indicators, relevant indicator categories and overall indices that are assessed for estuaries are pictured in Figure 8.

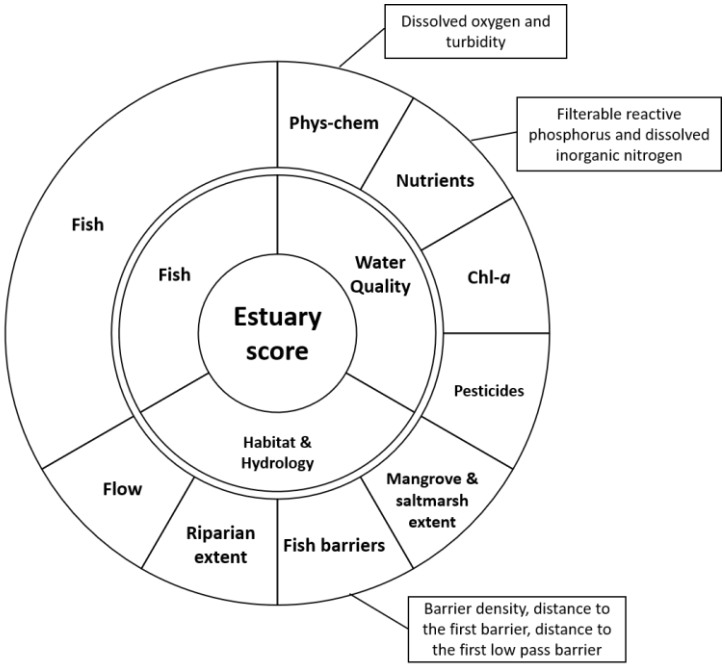

Figure 8. Indicator categories (outer ring) and indices (inner ring) that contribute to overall estuary scores. Where multiple indicators are aggregated to determine the indicator category, these are listed in break-out boxes.

All estuaries were in good condition in the 2017 report card and scored a 'B', with the exception of Sandy Creek estuary which was in moderate condition and scored a 'C' (Table 16). This represents an improvement in estuarine condition from moderate to good condition for the O'Connell River and Plane Creek estuaries since the 2016 reporting period. The condition of Sandy Creek estuary is consistent with that for the past two report cards.

Table 16. Condition grades of estuaries for the 2017 report card in comparison to 2016 and 2015* report card scores. *Data from 2015 report card is repeated from the 2014 report card.

	2017 report card					2016	2015
Estuary	Water quality	Habitat and hydrology	Fish	Estuary score and grade		Estuary score	Estuary score
Gregory	75	83		79	B	80	79
O'Connell	65	58		61	B	54	57
St Helens/Murray	62	61		61	B	61	63
Vines	61	68		64	B	72	73
Sandy	54	50		52	C	50	52
Plane	78	57		67	B	59	61
Rocky Dam	65	74		70	B	73	70
Carmila	37	96		66	B	73	79

Scoring range: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap

3.1. Water quality in estuaries

Water quality scores are derived from monthly grab sample data taken at one, two or three on-going monitoring sites, per estuary. Two additional monitoring sites at St Helens Creek and Murray Creek were incorporated into the combined St Helens/Murray Creek estuary water quality score for the 2016-17 reporting period that were not utilised in the 2015-16 reporting period. These additional sites are now included as part of the long-term monitoring of these estuaries for the Mackay-Whitsunday report card. A comparison of water quality scores for the combined St Helens Creek/Murray Creek estuary with and without these additional sites can be seen in Appendix B.

3.1.1. Nutrients

The scores for the indicators, DIN and FRP, and the nutrients indicator category in estuaries during the 2016-17 reporting period are presented in Table 17. The Gregory River and Plane Creek estuaries were the only estuaries to meet the guideline for DIN, however all estuaries met the guidelines for FRP. For the Gregory River, O'Connell River, Plane Creek, Rocky Dam Creek and Carmila Creek estuaries, 80% or more of the monthly medians met guidelines for FRP, which contributed to those estuaries achieving a score that shows very good condition for these indicators. Final nutrient indicator category scores were similar to the 2016 report card for nutrients; Vines Creek was the only estuary to change condition (from good to moderate) with low DIN indicator scores contributing to this result.

Table 17. Results for DIN and FRP indicators and nutrient indicator category in estuaries for the 2017 report card in comparison to 2016 and 2015* report card scores. *Data from 2015 report card is repeated from the 2014 report card.

	2017 report card			2016	2015
Estuary	**DIN**	**FRP**	**Nutrients**	**Nutrients**	**Nutrients**
Gregory	66	90	**78**	78	90
O'Connell^	59	90	**74**	75	78
St Helens/Murray	46	62	**54**	60	62
Vines	29	72	**50**	61	64
Sandy	33	65	**49**	46	41
Plane	61	90	**75**	74	74
Rocky Dam	43	90	**66**	66	66
Carmila	49	90	**69**	63	65

^ DIN and FRP from the O'Connell estuary are taken from the basin score.

DIN and FRP: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = assigned 90 | ■ No score/data gap

Nutrients: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap

3.1.2. Physio-chemical

The scores for the dissolved oxygen (DO) and turbidity indicators and the physio-chemical indicator category scores in estuaries for the 2016-17 reporting period are presented in Table 18. Scores for the physio-chemical indicator category varied across the Region for estuaries, with the Gregory River, Sandy Creek, Plane Creek and Rocky Dam Creek estuaries in very good, and Carmila Creek in very poor condition.

The very poor score for the physio-chemical indicator category in Carmila Creek estuary was due to super-saturated concentrations of dissolved oxygen. Super-saturation can occur through the rapid

growth of algae releasing oxygen through photosynthesis. This rapid growth of algae can also lead to high chlorophyll-*a* concentrations, which were also identified in this estuary (Table 20).

The physio-chemical indicator category score for the O'Connell River estuary increased from very poor in 2016 to good in 2017. This was due to improvement in scores for upper DO and turbidity indicators for this estuary.

Turbidity scores are based on comparison to draft guidelines for Mackay-Whitsunday estuaries (Newham et al. 2017)[1]. No turbidity scores were calculated for the four estuaries south of Mackay (Sandy Creek, Plane Creek, Rocky Dam Creek and Carmila Creek estuaries) as the draft guidelines for Mackay-Whitsunday estuaries listed turbidity in these estuaries as too variable to derive a guideline (Newham et al. 2017).

The distribution of nutrient and phys-chem indicator data can be seen in Appendix B.

Table 18. Results for DO and turbidity indicators and the phys-chem indicator category (this is calculated by averaging the poorer DO score with the turbidity score, or where there is no turbidity score the poorer DO score is used as the phys-chem score) for the 2017 report card in comparison to 2016 and 2015* report card scores. *Data from 2015 report card is repeated from the 2014 report card.

	2017 report card				2016	2015
Estuary	**Turbidity**	**lower DO**	**upper DO**	**Phys-Chem**	**Phys-Chem**	**Phys-Chem**
Gregory	90	79	90	**84**	84	85
O'Connell	72	90	53	**63**	18	53
St Helens/Murray	30	90	90	**60**	52	81
Vines	55	77	73	**64**	90	84
Sandy		90	90	**90**	77	90
Plane		90	90	**90**	68	67
Rocky Dam		90	90	**90**	90	90
Carmila		90	0	**0**	90	65

DO and turbidity: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = assigned 90 | ■ No score/data gap

Phys-chem: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap

3.1.3. Pesticides

Pesticide indicator category scores for in estuaries in the Region ranged from very good to poor during the 2016-17 reporting period (Table 19). The Carmila estuary was the only estuary to score very good for pesticides in this reporting period. As with the freshwater basin assessments, results for pesticides (ms-PAF) in estuaries were based on 13 herbicides. More pesticides will be progressively incorporated into scoring in subsequent report cards as information becomes available. For the first time, the equivalent aquatic species protected (%) by the mixture of pesticides is presented alongside the ms-PAF value.

[1] https://www.ehp.qld.gov.au/water/policy/pdf/don-haughton-mackay-whitsunday-main-report.pdf

Table 19. Results for the ms-PAF indicator (accounting for 13 pesticides), equivalent aquatic species protected (%) and overall standardised pesticides scores for water quality in estuaries for the 2017 report card (2016-17 data) in comparison to 2016 and 2015* report cards. *Data from 2015 report card is repeated from the 2014 report card.

	2017 report card		2016	2015
Estuary	**ms-PAF**	**Pesticides**	**Pesticides**	**Pesticides**
Gregory	8 (92% species protected)	**48**	54	36
O'Connell^	5 (95% species protected)	**61**	74	40
St Helens/Murray	2 (98% species protected)	**75**	77	59
Vines	2 (98% species protected)	**75**	78	79
Sandy	17 (83% species protected)	**26**	19	20
Plane	3 (97% species protected)	**70**	38	56
Rocky Dam	10 (90% species protected)	**41**	72	20
Carmila	1 (99% species protected)	**81**	50	61

^ Pesticides from the O'Connell estuary are taken from the basin score.

ms-PAF scoring range: ■ Very Poor = >20% | ■ Poor = >10 to 20% | ■ Moderate = >5 to 10% | ■ Good = >1 to 5% | ■ Very Good = ≤1% | ■ No score/data gap

Pesticides: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap

3.1.4. Water quality index scores and confidence

Water quality data for the estuaries capture the period when TC Debbie crossed the coast into the Region. Despite the magnitude of the impact of this event on the Region, aggregation of water quality indicator category scores shows that most estuaries, except the Sandy and Carmila Creek estuaries, were in good to very good condition (Table 20). The generally good scores in the estuary systems reflect the typical effect of large rainfall events flushing pollutants out of estuaries. The Region's estuaries are also short systems and experience large tidal ranges, which means that pollutants normally flush through them rapidly. It is likely that water quality in the estuary systems in the Region returned to pre—cyclone water quality conditions soon after the event. This is represented in the report card by the similar overall water quality index scores between the 2017 and 2016 report cards.

Carmila Creek estuary was the only estuary that scored a poor condition. Chlorophyll-*a* scored very poor for Carmila Creek estuary for the second consecutive year, and scores for physio-chemical indicator categories dropped from very good to very poor condition, due to super saturation of DO. It is currently unclear as to the drivers behind the consistently high concentrations of chlorophyll-*a* and the super saturation of DO for Carmila Creek estuary. As there are no apparent substantial anthropogenic pressures on this estuary and nutrient concentrations are in moderate to good condition, it is most likely that the atypical water quality is related to natural causes, although the nature of these is unknown. These results have highlighted Carmila Creek estuary as an area to undertake further investigation to help understand the high dissolved oxygen and chlorophyll-*a* concentrations occurring in this estuary.

Table 20. Results for water quality indicator categories and final water quality index scores in estuaries for the 2017 report card (2016-17 data) in comparison to 2016 and 2015* scores. *Data from 2015 report card is repeated from the 2014 report card.

Estuary	2017 report card					2016	2015
	Phys-chem	Nutrients	Pesticides	Chlorophyll-*a*	Water Quality	Water quality	Water quality
Gregory	84	78	49	90	**75**	76	75
O'Connell	63	74	61	63	**65**	50	57
St Helens/Murray	60	54	76	58	**62**	61	66
Vines	64	50	76	55	**61**	75	79
Sandy	90	49	27	51	**54**	51	53
Plane	90	75	71	75	**78**	62	66
Rocky Dam	90	66	41	65	**65**	71	66
Carmila	0	69	81	0	**37**	50	63

Scoring range: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap

Confidence in water quality index scores in estuaries is shown in Table 21. There is lower confidence in pesticide scores compared to the other indicators, because these scores are based on only three or four samples taken per estuary during the wet season. To improve confidence in estuary pesticide scores, three samples will be taken per month throughout the wet season, beginning in November 2018.

Lower confidence in the O'Connell, Vines and Carmila Creek estuary water quality scores is due to data collection occurring at only one sample site. In the other estuaries, there is higher confidence in water quality scores, because data is collected at either two, or three sites, making scores more spatially representative.

Table 21. Confidence associated with water quality index results in estuaries for the 2017 report card. Confidence criteria are scored 1-3 and then weighted by the value identified in parenthesis. Final scores (4.5 – 13.5) are additive across weighted confidence criteria. Final scores correspond to a rank from 1-5 (very low – very high), which indicates final confidence level. Where confidence in results for the O'Connell, Vines and Carmila Creek estuaries differ from the other estuaries, the relevant confidence scores for these estuaries are presented in square parenthesis. Unless otherwise specified, confidence in results is the same across estuaries.

Indicator category	Maturity of methodology (x0.36)	Validation (x0.71)	Representativeness (x2)	Directness (x0.71)	Measured error (x0.71)	Final	Rank
Phys-chem	3	3	2 [1]	3	1	10.1 [8.1]	4 [2]
Nutrients	3	3	2	3	1	10.1 [8.1]	4 [2]
Chl-a	3	3	2	3	1	10.1 [8.1]	4 [2]
Pesticides	3	3	1	3	2	8.8	3
					Water quality index	**10.1 [8.1]**	**4 [2]**

Rank based on final score: 1 (very low): 4.5 – 6.3; 2 (low): >6.3 – 8.1; 3 (moderate): >8.1 – 9.9; 4 (high): >9.9 – 11.7; 5 (very high): >11.7 – 13.5.

3.2. Habitat and hydrology in estuaries

Results for indicators and indicator categories that contribute to the habitat and hydrology index are presented below. The flow indicator will be incorporated as part of the 2018 report card.

3.2.1. Fish barriers

As with the freshwater basins, estuary fish barrier indicators are reported at four-year intervals. Thus, the data used in the 2017 report card for this indicator is the same as that used for calculating 2016 and 2015 report card scores (Table 22). This reporting frequency reflects the gradual nature of change associated with these indicators. Fish barrier indicators are due to be updated in the 2019 report card (released in 2020).

Table 22. Results for fish barrier indicators in estuaries in the 2017 report card (2014-15 data). Indicators assessed on Stream Order (SO) ≥3 or ≥4 as indicated. NB: no barriers, NLPB: no low passability barriers.

	Barrier density		Stream (%) to the first barrier		Stream (%) to 1st low passability barrier		Fish barriers	
Estuary	**km per barrier on SO ≥3**	**Score**	**% of stream before first barrier on SO ≥3**	**Score**	**% of stream before 1st low pass barrier on SO ≥4**	**Score**	**Total score**	**Fish barriers (standardised)**
Gregory	34.8	5	96.1	4	97.0	4	13	**80**
O'Connell	4.7	3	85.0	4	NLPB	5	12	**70**
St Helens/Murray	3.6	2	65.1	3	83.1	3	8	**41**
Vines	13.4	4	96.4	4	NLPB	5	13	**80**
Sandy	3.1	2	43.6	2	90.1	4	8	**41**
Plane	2.0	1	48.2	2	75.8	2	5	**21**
Rocky Dam	4.9	3	73.9	3	NLPB	5	11	**61**
Carmila	NB	5	NB	5	NLPB	5	15	**100**

Barrier density (km): ■ Very Poor/score of 1 = 0 to 2km | ■ Poor/score of 2 = >2 to 4km | Moderate/score of 3 = >4 to 8km | ■ Good/score of 4 = >8 to 16km | ■ Very Good/score of 5 = >16km | ■ No score/data gap

Stream to 1st barrier (%): ■ Very Poor/score of 1 = 0 to <40% | ■ Poor/score of 2 = 40 to <60% | Moderate/score of 3 = 60 to <80% | ■ Good/score of 4 = 80 to <100% | ■ Very Good/score of 5 = 100% | ■ No score/data gap

Stream to 1st low passability barrier (%): ■ Very Poor/score of 1 = 0 to 60% | ■ Poor/score of 2 = >60 to 80% | Moderate/score of 3 = >80 to 90% | ■ Good/score of 4 = >90 to <100% | ■ Very Good/score of 5 = 100% | ■ No score/data gap

Total score: ■ Very Poor = 3 to 4 | ■ Poor = 5 to 7 | ■ Moderate = 8 to 10 | ■ Good = 11 to 13| ■ Very Good = 14 to 15 | ■ No score/data gap

Fish barriers (standardised): ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap

3.2.2. Riparian and mangrove/saltmarsh extent

For the 2017 report card, the same data is used to calculate percentage loss of riparian extent and mangrove/saltmarsh extent as in the 2016, 2015 and 2014 report cards, due to the four yearly reporting frequency for these indicators. Mangrove/saltmarsh and riparian extent indicators are due for updating in the next (2018) report card (released in 2019). All estuaries were in good or very good condition with respect to mangrove/saltmarsh extent, while riparian extent varied from very poor in the O'Connell River estuary to very good in the Gregory River, Rocky Dam Creek and Carmila Creek estuaries (Table 23).

Table 23. Results for riparian and mangrove/saltmarsh extent loss since pre-development (%) and standardised riparian and mangrove & saltmarsh extent in estuaries in the 2017 report card (2013-14 data).

Estuary	2017 report card (repeated data)		2017 report card (repeated data)	
	Mangrove/saltmarsh extent (% loss since pre-development)	Riparian extent (% loss since pre-development)	Standardised mangrove/ saltmarsh extent	Standardised riparian extent
Gregory	3	4	88	81
O'Connell	3	62	87	16
St Helens/Murray	1	26	96	46
Vines	12	18	67	56
Sandy	6	39	79	31
Plane	2	17	91	58
Rocky Dam	5	4	81	82
Carmila	3	0	88	100

Riparian and mangrove/saltmarsh extent (% loss): ■ Very Poor = >50% | ■ Poor =>30 to 50% | ■ Moderate = >15 to 30% | ■ Good = >5 to 15% | ■ Very Good ≤5% | ■ No score/data gap

Standardised riparian and mangrove/saltmarsh extent: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap

3.2.3. Habitat and hydrology index scores and confidence

The overall habitat and hydrology index scores for estuaries for the 2017 report card ranged from moderate to very good across the Mackay-Whitsunday Region (Table 24). Due to the reporting frequency, these data do not reflect potential impacts to these indicators from TC Debbie. On-ground observations and aerial imagery of the Region have demonstrated changes to mangroves, stream banks and in-stream morphology at certain locations as a result of TC Debbie. This includes a loss of mangroves at the St Helens Creek and Murray Creek estuary which has resulted in St Helens Creek and Murray Creek estuaries joining further upstream than they did previously (P. Trendell 2018. pers. comm. 19/10/2018). Changes like this may be captured in mangrove/saltmarsh extent indicators, which are due for updating in the 2018 report card (released in 2019).

Table 24. Results for habitat and hydrology indicator categories and index in estuaries for 2017 report card (data repeated from 2016, 2015 and 2014 report cards).

Estuary	2017 report card (repeated data)				2017 report card (repeated data)
	Mangrove/ saltmarsh extent	Riparian extent	Flow	Fish barriers	Habitat and hydrology
Gregory	88	81		80	83
O'Connell	87	16		70	58
St Helens/Murray	96	46		41	61
Vines	67	56		80	68
Sandy	79	31		41	50
Plane	91	58		21	57
Rocky Dam	81	82		61	74
Carmila	88	100		100	96

Scoring range: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap

Confidence in habitat and hydrology scores for estuaries are shown in

Table 25.

Table 25. Confidence associated with habitat and hydrology index results in estuaries for the 2017 report card. Confidence criteria are scored 1-3 and then weighted by the value identified in parenthesis. Final scores (4.5 – 13.5) are additive across weighted confidence criteria. Final scores correspond to a rank from 1-5 (very low – very high), which indicates final confidence level. Unless otherwise specified, confidence in results is the same across estuaries.

Indicator category	Maturity of methodology (x0.36)	Validation (x0.71)	Representativeness (x2)	Directness (x0.71)	Measured error (x0.71)	Final	Rank
Fish barriers	1	2	3	2	1	9.9	4
Riparian extent	2	2	2	1	2	8.3	3
Mangrove & saltmarsh extent	2	2	2	1	2	8.3	3
					Habitat and hydrology index	**8.3**	**3**

Rank based on final score: 1 (very low): 4.5 – 6.3; 2 (low): >6.3 – 8.1; 3 (moderate): >8.1 – 9.9; 4 (high): >9.9 – 11.7; 5 (very high): >11.7 – 13.5.

3.3. Fish in estuaries

There is no score for condition of fish in estuaries. Identification of appropriate indicators and development of assessment methodology are required for progressing fish indicators in estuaries. Development of these indicators is planned to occur in collaboration with RIMReP and other regional report card Partnerships.

4. Inshore and offshore marine results

The indicators, relevant indicator categories and overall indices that are assessed for the inshore and offshore marine zones are pictured in Figure 9.

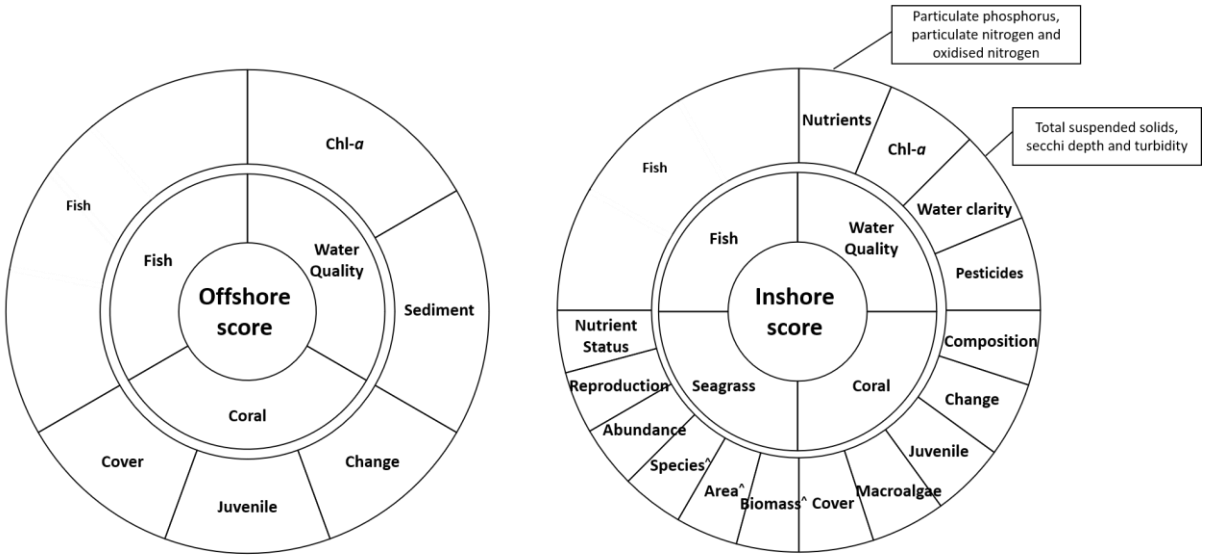

Figure 9. Indicator categories (outer ring) and indices (inner ring) that contribute to overall offshore and inshore marine scores for each zone. Where multiple indicators are aggregated to determine the indicator category, these are listed in break-out boxes.

The condition grades for inshore marine zones in the 2017 report card ranged from D (poor) to C (moderate), as shown in Table 26. In contrast, the offshore marine zone remained a B (good condition). Note that in the Northern zone, water quality does not contribute to the overall score for the 2016-17 reporting period, because there was insufficient data to derive nutrient and pesticide indicator category scores for this zone.

In the Whitsunday and Central zones, there was a drop in overall condition compared to 2016 (from moderate to poor condition). This change was driven primarily by a decline in water quality and coral scores, with some seagrass scores also decreasing since last year. Not all seagrass and coral scores captured the full impacts of TC Debbie, and some turbidity loggers were lost during the cyclone. The full picture of TC Debbie is therefore not captured in this report card.

The 2017 report card currently has no scores for any of the indicators for the Southern inshore zone. Through the report card development process, this knowledge gap was identified, and a monitoring program has now been funded and established for water quality, coral and seagrass in this zone. This demonstrates a commitment on improving the Region's report card through filling data gaps, and subsequently providing a better understanding of the ecological condition of the Region's local ecosystems. Results for some of the inshore marine indicators will be presented for the Southern inshore zone in the 2018 report card and it is envisaged that eventually, the full suite of indicators will be assessed for this zone in future report cards.

Table 26. Results for indices and overall marine scores for inshore and offshore zones reported in the 2017 report card (2016-17 data) in comparison to final scores in the 2016, 2015 and 2014 report cards. *Offshore coral scores have been amended since previous report cards which has impacted the overall scores for the offshore zone 2014-2016 (see Appendix C for score comparison).

Zone	2017 report card						2016	2015	2014
	Water quality	Coral index	Seagrass	Fish	Marine score and grade		Marine score	Marine score	Marine score
Northern		31	58		**44**	**C**	43	21	40
Whitsunday	7	52	29		**29**	**D**	47	39	28
Central	37	23	34		**31**	**D**	41	51	25
Southern									
Offshore	92	60			**76**	**B**	75*	75*	74*

Scoring range: Very Poor = 0 to <21 | Poor = 21 to <41 | Moderate = 41 to <61 | Good = 61 to <81 | Very Good = 81 to 100 | No score/data gap| Not applicable

4.1. Water quality in inshore and offshore marine ecosystems

Following the Marine Monitoring Program (MMP) approach for scoring and reporting *in-situ* water quality data (Thompson et al. 2014), the condition scores for nutrients, chlorophyll-*a* and water clarity were derived for the inshore zone. For the pesticide indicator category, only passive sampler data has been used to derive pesticide condition scores for the inshore zone. Where applicable, attempts have been made to use grab sample data to validate the passive sampler data results. The offshore marine zone uses only chlorophyll-*a* and TSS indicators to derive a water quality score. This is based off remote sensing data sourced from the Bureau of Meteorology for offshore waters.

Results for these indicators, indicator categories and the overall water quality index are presented in the sections below.

4.1.1. Nutrients, chlorophyll-*a* and water clarity

Indicators that contribute to the nutrient indicator category are oxidised nitrogen (NOx), particulate phosphorus (PP) and particulate nitrogen (PN), while Secchi depth, TSS and turbidity are the indicators that contribute to the water clarity indicator category. Condition scores are calculated by comparing annual means or medians to guideline values (with the appropriate statistic identified by the guideline values) for each indicator at each site within a zone. These scores are aggregated across sites and indicators to produce the nutrients, chlorophyll-*a* and water clarity indicator category scores.

Scheduled guideline values that are more localised to the marine waters in the Mackay-Whitsundays Region (DEHP, 2013) as per the Environmental Protection (Water) Policy 2009 (DEHP, 2009) have been used in the Whitsunday and Central inshore marine zones, however, these do not extend to the Northern inshore zone. Localised guidelines for the coastal waters of the Haughton, Burdekin and Don Basins region are in draft (Newham et al. 2017)[1]. To remain consistent with reporting in the 2016 report card, the current GBRMPA (2010) guidelines will be used for marine waters in the Northern inshore zone until localised guidelines have been scheduled. For details on the guidelines used for each site, refer to the Methods for the Mackay-Whitsunday 2017 report cards document[2].

[1] https://www.ehp.qld.gov.au/water/policy/pdf/don-haughton-mackay-whitsunday-main-report.pdf
[2] https://healthyriverstoreef.org.au/report-card/report-card-download/

Nutrient, chlorophyll-a and water clarity condition ranged from very good to very poor across the inshore marine waters in the Mackay-Whitsunday Region (Table 27). Appendix C presents site scores for individual indicators based on available data.

In the Northern zone, only chlorophyll-*a* and water clarity indicator scores are provided (Table 27) as minimum information rules for aggregating into indicator categories meant that a nutrients score could not be determined. Chlorophyll-*a* in the Northern zone was the only instance where any water quality indicator score showed condition was better than moderate in the inshore zone. The very good condition for chlorophyll-*a* in the Northern zone in the 2017 report card is the same for this indicator in the 2016 report card. Water clarity in the Northern zone was in moderate condition, however two out of five turbidity loggers did not capture the full TC Debbie period, as they were either damaged or lost due to the event, so there is potential that this score is underestimating turbidity (i.e. condition of turbidity may be worse).

Indicator category scores in the remaining zones demonstrated that guidelines were frequently not met (Table 27). The Whitsunday zone scored very poor for chlorophyll-a and nutrients indicator categories. The last time this occurred was during the 2013-14 reporting period. Scores in the Central inshore zone did not show a consistent decrease between the 2016 and 2017 report cards (Table 27). Importantly, it should be noted that, except for at two sites (Repulse Islands dive mooring and AMB12), NOx did not contribute to the final nutrients score and TSS did not contribute to the final water clarity score for the Central zone, meaning direct comparisons of condition between inshore marine zones cannot be made. Like the Northern zone, damaged and lost loggers due to TC Debbie meant that the full impact of the event on turbidity was not captured in either the Whitsunday or Central inshore marine zones, so there is potential that turbidity scores are underestimated (i.e. condition of turbidity may be worse). Despite this, condition associated with water clarity was poor in the Whitsunday and Central inshore marine zones.

Table 27. Results for inshore water quality indicator categories for the 2017 report card (2016-17 data) compared to 2016, 2015 and 2014 report cards. Scores in italics should be treated with caution due to lack of temporal representativeness (n = 2).

Inshore zone	2017			2016			2015			2014		
	Nutrients	Chl-a	Water clarity	Nutrients	Chl-a	Water clarity	Nutrients	Chl-a	Water clarity	Nutrients	Chl-a	Water clarity
Northern		89	50		89	40				2	3	54
Whitsunday	1	0	21	28	53	38	32	49	47	7	0	7
Central	55	29	25	36	38	52	64	52	32			
Southern												

Scoring range: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap

Apart from turbidity (which is recorded in 15-minute intervals with loggers), data from grab samples is used to derive scores for the other indicators. Only one grab sample was taken at each of the three sites in the Whitsunday zone after TC Debbie (at the end of May, Table 28), therefore scores for these

indicators are primarily representing conditions prior to the cyclone. In the Whitsunday zone, when these post-cyclone grab samples and turbidity data are excluded, water clarity scores improve to poor, but nutrients and chlorophyll-*a* grades do not improve and remain very poor (see Appendix C).

Table 28. Dates that grab samples were taken in the inshore marine zones, with those that occurred after TC Debbie (which occurred on the 28th of March) in italics.

Northern	Whitsunday	Central	Southern
Jul-2016	20-Sep-2016	25-Jul-2016	No data in 2016-17 financial year. Monitoring began in September 2017
Oct-2016	13-Jan-2017	9-Sep-2016	
Feb-2017	18-Feb-2017	28-Oct-2016	
Apr-2017	15-Mar-2017	7-Dec-2016	
	28-May-2017 (2 sites only)	20-Jan-2017	
		20-Feb-2017	
		3-May-2017	
		29-May-2017	

4.1.2. Pesticides

Pesticide data were collected by a combination of passive samplers and grab samples. Grab samples were taken during the wet and dry seasons as part of the ambient water quality monitoring programs for Abbot Point and, Mackay and Hay Point, both commissioned by North Queensland Bulk Ports (NQBP), in the Northern and Central Zones. Passive samplers were deployed as part of the MMP and were only installed in locations within the Central zone. For this report, only passive sampler data has been used to derive pesticide condition scores. Where applicable, grab sample data is presented alongside passive sampler results.

There was no score for pesticides in the Northern zone because the limit of reporting (LOR) for the pesticides based on grab sampling was too high (0.1 or 0.2 µg/L depending on pesticide) to allow reliable interpretation of PSII-HEq concentrations. However, these LORs did demonstrate that guideline values were met for most of the pesticides tested in these samples (atrazine, hexaxinone, simaxine, ametryn, diuron). The LOR did not confirm that guidelines were met for tebuthiuron.

There was no score for pesticides derived for the Whitsunday zone as part of the 2017 report card, following the decommissioning of the MMP site at Whitsunday Island in 2015. Prior to the decommission it was noted that the Whitsunday Island site typically had low pesticide concentrations and little seasonal variation (Kuhnert et al. 2015). There was also no score for pesticides in the Southern zone as part of the 2017 report card as pesticide sampling (and water quality sampling in general) did not occur in this zone during this reporting period.

The scores for pesticides are presented in Table 29. Based on passive sampler data, the overall condition for the pesticides indicator category in the Central zone for the 2016-17 reporting period is poor. This represents a decline in condition compared to all previous report cards, where condition was moderate and good with respect to this indicator category.

Poor condition for pesticides in the Central zone during the 2016-17 reporting period was due primarily to the high PSII-HEq scores at the Round/Flat Top Island site (Table 29), which was also the case during the 2016 report card reporting period. As passive samplers record a time-averaged concentration of pesticides, it is not known how long these high pesticide concentrations were

maintained during this period. The grab sample data collected by NQBP did not validate passive sampler results for pesticides in the Central inshore zone, however, the grab samples were not taken during the period of deployment of the passive sampler that detected the high pesticide concentrations at Round/Flat Top Island, nor were there recent rainfall events before the grab samples were taken. Therefore, this lack of validation is not particularly concerning.

Table 29. Pesticide scores for Mackay-Whitsunday inshore marine zones for the 2017 report card compared to 2016, 2015 and 2014 report cards. For Northern inshore zone the limit of reporting (LOR) was too high to allow reliable interpretation of PSII-HEq concentrations. *Repulse passive sampler score did not contribute to the PSII-HEq reported as it was outside of the risk period for pesticides. The PSII-HEq reported for each passive sampler site is the maximum recorded value out of n deployments per site.

Zone	Sample	Program	Site/s	Value obtained	PSII-Heq	PSII-Heq reported	Standardised score 2017	Standardised score 2016	Standardised score 2015	Standardised score 2014
Northern	Grab	Ports	Wet season 3 sites (1 sample in Feb 17)	<LOR						100
			Dry season 3 sites (1 sample in Jul 2016)	<LOR						
Whitsunday									93	91
Central	Passive	MMP	Repulse 25/11/16 - 17/12/16 | n = 1	max	4*	298	39	51	68	68
			Round Flat 3/08/16 - 2/02/17 | n = 4	max	670					
			Sarina 01/05/2016 - 8/04/17 | n = 8	max	77					
			Sandy Creek 19/05/16 - 7/03/17 | n = 4	max	148					
	Grab	Ports	Wet season 9 sites (1 sample 3/05/17)	max	1	Used for validation only		Used for validation only		
				median	0					
			Dry season 9 sites (1 sample 7/12/16)	max	2					
				median	0					
Southern										

PSII-HEq (ng/L) scoring range: ■ Very Poor >900 | ■ Poor 250 to 900 | ■ Moderate = 50 to 250 | ■ Good = 10 to 50 | ■ Very Good = <10 | ■ No score/data gap

Standardised scoring range: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap

4.1.3. Water quality index scores and confidence

Overall, the Whitsunday and Central inshore marine zones were in very poor and poor condition, respectively, based on water quality index scores derived during the 2016-17 reporting period (Table 30). This represents a decrease in water quality between the 2016 and 2017 report cards. Minimum information rules for aggregating data meant that a water quality index score was not calculated for the Northern zone (≥60% of indicator categories required to roll up into index score).

The offshore zone scored very good for the third year in a row for water quality (Table 30).

Table 30. Final 2017 report card score for water quality index scores for Mackay-Whitsunday marine zones and final scores compared to 2016, 2015 and 2014 report cards. Scores from 2015 and 2014 report cards have been back-calculated to exclude pesticide scores in the Whitsunday zone so that they are directly comparable to 2016 and 2017 scores.

Inshore zone	Nutrients	Chl-a	Water clarity	Pesticides	Water quality index 2017	Water quality index 2016	Water quality index 2015	Water quality index 2014
Northern		89	50					40
Whitsunday	1	0	21		7	40	42	4
Central	55	29	25	39	37	44	54	
Southern								
Offshore		94	89		92	93	94	95

Scoring range: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap | ■ Not applicable`

Confidence in water quality index scores generated for inshore and offshore marine zones is shown in Table 31. Three different laboratories are currently used due to data being drawn from three different programs, however this is not reflected in the confidence scores. This will change in 2018-19 when the same laboratory will be used to analyse samples collected from the Northern and Central inshore zone sites by NQBP.

The low confidence in the water quality index for the offshore zone (Table 31) was due to the use of remotely sensed data to inform indicator scores.

Table 31. Confidence associated with water quality index results in marine zones for the 2017 report card. Confidence criteria are scored 1-3 and then weighted by the value identified in parenthesis. Final scores (4.5 – 13.5) are additive across weighted confidence criteria. Final scores correspond to a rank from 1-5 (very low – very high), which indicates final confidence level.

Indicator category	Maturity of methodology (x0.36)	Validation (x0.71)	Representativeness (x2)	Directness (x0.71)	Measured error (x0.71)	Final	Rank
Nutrients	3	3	1	3	3	9.5	3
Chl-a	3	3	1	3	3	9.5	3
Water clarity	3	3	1	3	3	9.5	3
Pesticides	2	2	1	2	1	6.3	1
Inshore water quality index						**9.5**	**3**
Offshore chl-a	3	2	2	1	1	7.9	2
Offshore TSS	3	2	2	1	1	7.9	2
Offshore water quality index						**7.9**	**2**

Rank based on final score: 1 (very low): 4.5 – 6.3; 2 (low): >6.3 – 8.1; 3 (moderate): >8.1 – 9.9; 4 (high): >9.9 – 11.7; 5 (very high): >11.7 – 13.5.

4.2. Coral in inshore and offshore marine zones

The condition of coral indicators for the inshore and offshore zones for the 2017 report card are presented in Table 32. In this report card, the full impacts of TC Debbie are not captured in all coral scores, nor is bleaching related mortality from the 2016-17 period.

For offshore coral, sampling was undertaken just before TC Debbie occurred, so the 2017 results do not show any impacts of the cyclone. This survey also recorded minor bleaching, but it was too early to record any mortality as a result of bleaching. Offshore coral remained in a moderate condition. The

moderate score for offshore coral in the 2017 report card is therefore similar to previous report cards (Table 32). Importantly, scores for offshore coral from 2014 – 2016 report cards have been amended following the detection of an error in past scoring methodology for the coral change indicator. This has been rectified and the amended scores are shown in Table 32. Amended scores are reporting lower scores for coral change than what was presented in the 2016 report card and associated documents, and have resulted in reductions to overall coral index scores. Appendix C shows the comparison between amended scores and erroneous scores.

For coral in the inshore zones, some indicator scores are calculated from running means which can dampen big changes. Sampling was undertaken after TC Debbie at many sites, so its effects were captured at these sites. However, coral surveys in the Central zone could not be undertaken until August 2017 due to poor visibility. In order to allow some comparability of TC Debbie impacts on scores in the inshore zone, this data was included in the Central zone score despite being outside of the typical report card period.

TC Debbie caused a reduction in scores for most inshore coral indicators. Poor scores for the coral change indicator in the Whitsunday zone and poor juvenile scores in the Central zone in the 2016 report card questions the resilience of coral in these areas to recover after widespread disturbance (Thompson et al. 2016), like that caused by TC Debbie.

In the Northern and Whitsunday zones, the macroalgae indicator is in good or very good condition (Table 32). While this means there was low cover of macroalgae at most sites, this was likely due to the powerful water movement from TC Debbie which stripped the reefs of macroalgae, or as a result of high turbidity in the aftermath (Thompson et al. 2018). It is anticipated that macroalgae scores will be different in the next report card once macroalgae re-establishes. Therefore, the full impacts of TC Debbie on coral in the Mackay-Whitsunday Region are yet to be determined.

Confidence in scores for coral indicators is high and presented in Table 32.

Table 32. Results for inshore and offshore coral indicators for marine zones reported in the 2017 report card (2016-17 data) in the Mackay-Whitsundays compared to 2016, 2015 and 2014 report cards. *Offshore coral scores have been amended since previous report cards. ^2017 scores do not account for impacts of TC Debbie.

Zone	2017 report card						2016	2015	2014
	Cover	Macroalgae	Juvenile	Change	Composition	Coral index	Coral index	Coral index	Coral index
Northern	14	67	12			**31**	45		
Whitsunday	37	93	34	43	53	**52**	61	58	56
Central	35	1	18	40		**23**	31		
Southern									
Offshore	39^		95^	45^		**60^**	57*	57*	54*

Scoring range: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap | ■ Not applicable

Table 33. Confidence associated with coral index results in marine zones for the 2017 report card. Confidence criteria are scored 1-3 and then weighted by the value identified in parenthesis. Final scores (4.5 – 13.5) are additive across weighted confidence criteria. Final scores correspond to a rank from 1-5 (very low – very high), which indicates final confidence level. Unless otherwise specified, confidence in results is the same across marine zones where relevant.

Indicator category	Maturity of methodology (x0.36)	Validation (x0.71)	Representat-iveness (x2)	Directness (x0.71)	Measured error (x0.71)	Final	Rank
Cover	3	3	2	3	2	10.8	4
Change	3	3	2	3	2	10.8	4
Juvenile	3	3	2	3	2	10.8	4
Macroalgae	3	3	2	3	2	10.8	4
Composition	3	3	2	3	2	10.8	4
					Inshore coral index	**10.8**	**4**
Cover	3	3	1	3	1	8.1	2
Change	3	3	1	3	1	8.1	2
Juvenile	3	3	1	3	1	8.1	2
					Offshore coral index	**8.1**	**2**

Rank based on final score: 1 (very low): 4.5 – 6.3; 2 (low): >6.3 – 8.1; 3 (moderate): >8.1 – 9.9; 4 (high): >9.9 – 11.7; 5 (very high): >11.7 – 13.5.

4.3. Seagrass in inshore marine zones

Seagrass condition for the 2017 report card assessment was based on indicators measured as part of either the MMP and/or the Queensland Ports Seagrass Monitoring Program (QPSMP), depending on which zone is assessed. Different seagrass indicators are used for the two programs, with MMP-associated indicators being abundance, reproductive effort and nutrient status, while the QPSMP-associated indicators are area, biomass and species composition. For the QPSMP, seagrass surveys occurred prior to TC Debbie, so no impacts of this event are captured in the seagrass index scores in the Northern zone and part of the Central zone. The MMP captured impacts of TC Debbie in their late wet season surveys in 2017. Seagrass condition for the 2016-17 reporting period are shown in Table 34.

Seagrass condition in the Whitsundays zone are derived from data collected entirely from MMP sites, so include TC Debbie impacts. Seagrass abundance in the Whitsundays zone was affected by TC Debbie at sites near and south of Airlie Beach (McKenzie et al. 2018). The reef intertidal and estuarine habitats were the most severely affected. The most concerning losses were at Hamilton Island and Sarina Inlet, where seagrass cover was reduced to almost zero (McKenzie et al. 2018). Seagrass reproductive effort and nutrient status remained very poor. There was a reduction in the overall seagrass condition in the Whitsundays zone from moderate in the 2016 report card to poor in the 2017 report card (Table 34).

Seagrass condition ratings in the Central zone are derived from data collected from a combination of MMP and QPSMP sites. Seagrass condition in the Central zone declined from moderate to poor between the 2016 and 2017 report cards (Table 34). While seagrass abundance declined at half of the Central zone MMP sites after TC Debbie, there were exceptions. For example, shallow sites at Newry Bay near Cape Hillsborough appeared to escape the effects of the cyclone (McKenzie et al. 2018). In contrast, despite not capturing the impacts of TC Debbie, the QPSMP Hay Point seagrass meadow in the Central zone was in very poor condition. This was driven by low seagrass biomass in the meadow, most likely due to unfavourable environmental conditions, including above average rainfall in June, July and September 2016, and a large spike in river flow from the Pioneer River in July 2016. Light

loggers (deployed as part of the QPSMP program) demonstrated that benthic light fell below required levels for *Halophila* for periods in the four months leading up to the October 2016 survey. The reduction in light leading up to the spring growing season may have affected annual recruitment or resulted in the early loss of germinated shoots for this annual meadow (McKenna and Rasheed, 2017).

Seagrass condition ratings in the Northern zone are derived from data collected entirely from QSMP sites, so scores represent pre-cyclone conditions. Any impacts of TC Debbie in the Northern zone will be seen in the next report card. There was an increase in overall seagrass index score in the Northern zone between the 2016 report card and the 2017 report card. This did not result in a change in condition grade, which remained moderate (Table 34). The increase in the overall seagrass index score for this zone was driven primarily by increases in scores for seagrass composition in inshore meadows. In contrast, seagrass biomass in some deep-water meadows decreased due to a reduction in the morphologically larger *Halophila spinulosa* relative to the much smaller and less persistent species *Halophila ovalis* and *Halophila decipiens*. Benthic light levels were also recorded below required levels for *Halophila* growth at some deep-water sites, and this is may have contributed to seagrass condition declines at these sites (McKenna *et al*., 2017).

Overall seagrass index scores in the Northern and Whitsunday inshore zones presented in Table 34 could be perceived to be at odds with corresponding indicator scores. This is not an error in calculation, but a consequence of combining data from two different programs with different scoring approaches into the same reporting product. Importantly, to combine these programs the seagrass index score is derived from averaging site/meadow scores from within a zone, not averaging the indicator scores within a zone. A key difference between the two programs is that they derive site/meadow scores differently; the MMP takes the average of the indicator scores while the QPSMP takes a conservative approach and allocates the lowest of the indicator scores to the site/meadow. For the Northern zone where scores are calculated from QPSMP data, this has led to indicator scores that are good and very good, but a moderate final seagrass index. In comparison, in the Whitsundays, where the scores are calculated from MMP data, there was no data for reproductive effort and nutrient status indicators at a number of sites, meaning the final site/meadow scores (and hence the final seagrass index scores) are weighted towards the score of the remaining indicator, abundance.

Table 34. Results for inshore seagrass indicators for marine zones reported in the 2017 report card (2016-17 data) in the Mackay-Whitsundays compared to 2016, 2015 and 2014 report cards. Indicators are based on data collected from the Marine Monitoring Program (MMP) or the Queensland Ports Seagrass Monitoring Program (QPSMP).

2017 report card								2016	2015	2014*
Zone	**Abundance**	**Reproductive effort**	**Nutrient status**	**Biomass**	**Area**	**Species Composition**	**Seagrass Index**	**Seagrass Index**	**Seagrass index****	**Seagrass index****
Program	*MMP*			*QPSMP*						
Northern				62	94	83	**58^**	42	21	
Whitsunday	28	0	9				**29^**	42	16	24
Central	46	13	46	0		100	**34^**	50	49	26
Southern										

Scoring range: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap | ■ Not applicable

^To derive the seagrass index an average of *site/meadow* scores is calculated, not an average of indicator. To determine a site/meadow score the MMP takes the average of the indicator scores and QPSMP take the lowest of the indicator scores. This can sometimes lead to overall seagrass index scores and ratings appearing to contradict the indicator scores.

*Seagrass scores from 2014 are only from MMP.

**Seagrass scores in 2015 and 2014 do not account for subtidal sites in the MMP.

Confidence for seagrass condition indicators associated with the MMP and QPSMP and the overall seagrass condition index are shown in Table 35.

Table 35. Confidence associated with seagrass index results in marine zones for the 2017 report card. Confidence criteria are scored 1-3 and then weighted by the value identified in parenthesis. Final scores (4.5 – 13.5) are additive across weighted confidence criteria. Final scores correspond to a rank from 1-5 (very low – very high), which indicates final confidence level.

Indicator category	Maturity of methodology (x0.36)	Validation (x0.71)	Representativeness (x2)	Directness (x0.71)	Measured error (x0.71)	Final	Rank
Abundance	3	3	1	3	2	8.8	3
Reproductive effort	3	3	1	3	2	8.8	3
Nutrient status	3	3	1	3	2	8.8	3
Biomass	3	3	1	3	2	8.8	3
Area	3	3	1	3	2	8.8	3
Species composition	3	3	1	3	2	8.8	3
					Seagrass index	**8.8**	**3**

Rank based on final score: 1 (very low): 4.5 – 6.3; 2 (low): >6.3 – 8.1; 3 (moderate): >8.1 – 9.9; 4 (high): >9.9 – 11.7; 5 (very high): >11.7 – 13.5

4.1. Fish in inshore and offshore marine zones

There is no score for condition of fish in inshore and offshore marine zones. Identification of appropriate indicators and development of assessment methodology are required for progressing fish

indicators in inshore and offshore marine zones. Development of these indicators is planned to occur in collaboration with RIMReP and other regional report card Partnerships.

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Appendix A: Freshwater basins

Comparison of scores for O'Connell River sites and boxplots of monthly medians are presented for DIN, FRP and TSS indicators for freshwater basins. Locations of monitoring sites in freshwater basins are also presented.

Table AA 1. Comparison of results for dissolved inorganic nitrogen (DIN), filterable reactive phosphorus (FRP) and total suspended solids (TSS) indicators at two sites in the O'Connell River (2016-17 data).

O'Connell basin site	DIN	FRP	TSS
O'Connell River (Caravan Park)	60	60	57
O'Connell River (Stafford's Crossing)	55	57	55

Scoring range: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap

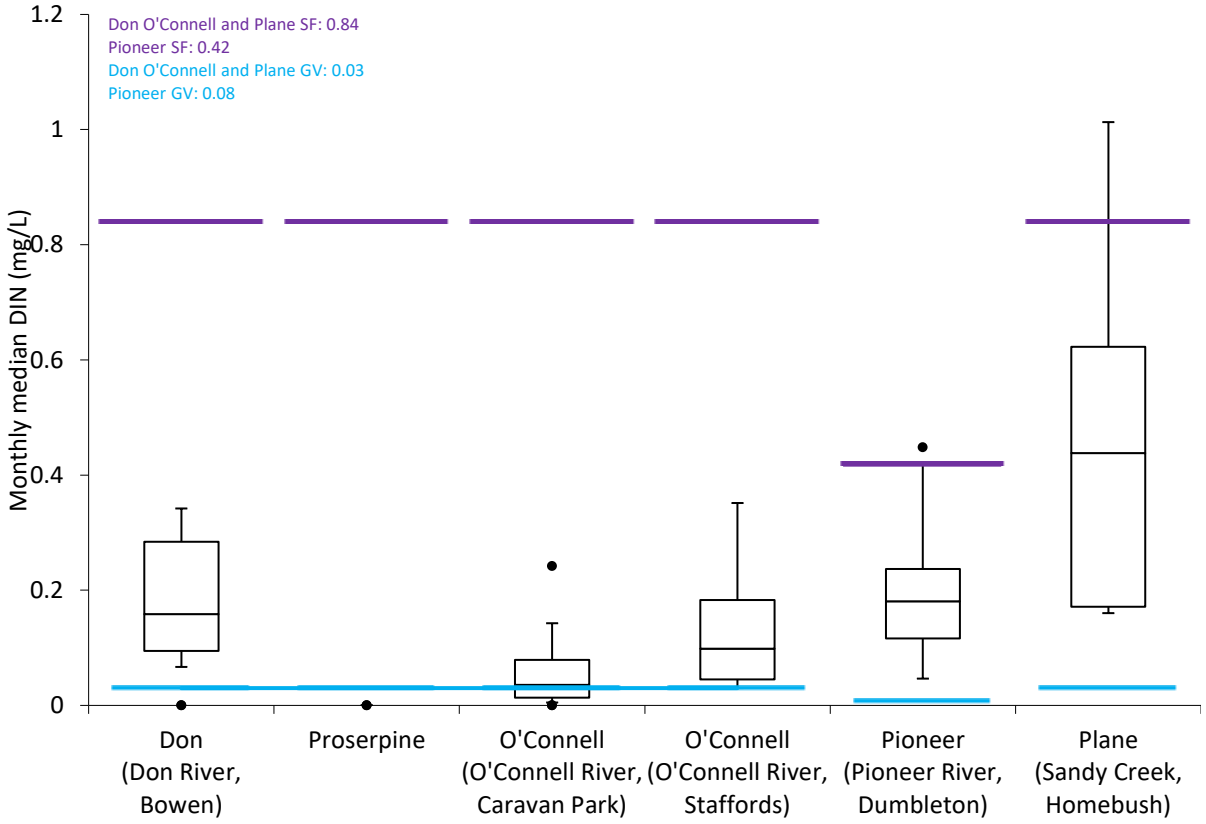

Figure AA 1. Box and whiskers plot (box 20th, 50th and 80th percentiles, whiskers 1.5x interquartile range [IQR]) of monthly median concentrations of dissolved inorganic nitrogen (DIN) in the Mackay-

Whitsunday freshwater basins for 2016-17, with scaling factors (SF) and guideline values (GV) for each basin. Outliers (>1.5x IQR) are also pictured.

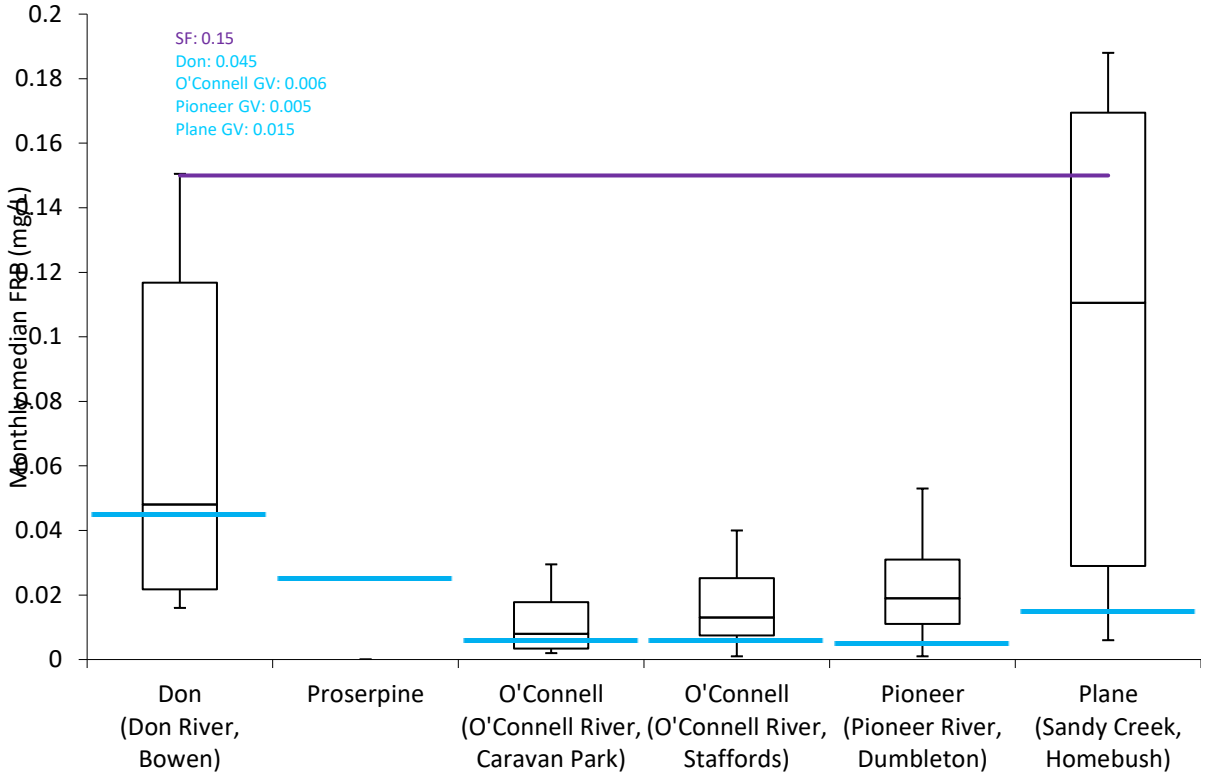

Figure AA 2. Box and whiskers plot (box 20th, 50th and 80th percentiles, whiskers 1.5x interquartile range [IQR]) of monthly median concentrations of filterable reactive phosphorus (FRP) in the Mackay-Whitsunday freshwater basins for 2016-17, with scaling factors (SF) and guideline values (GV) for each basin. Outliers (>1.5x IQR) are also pictured.

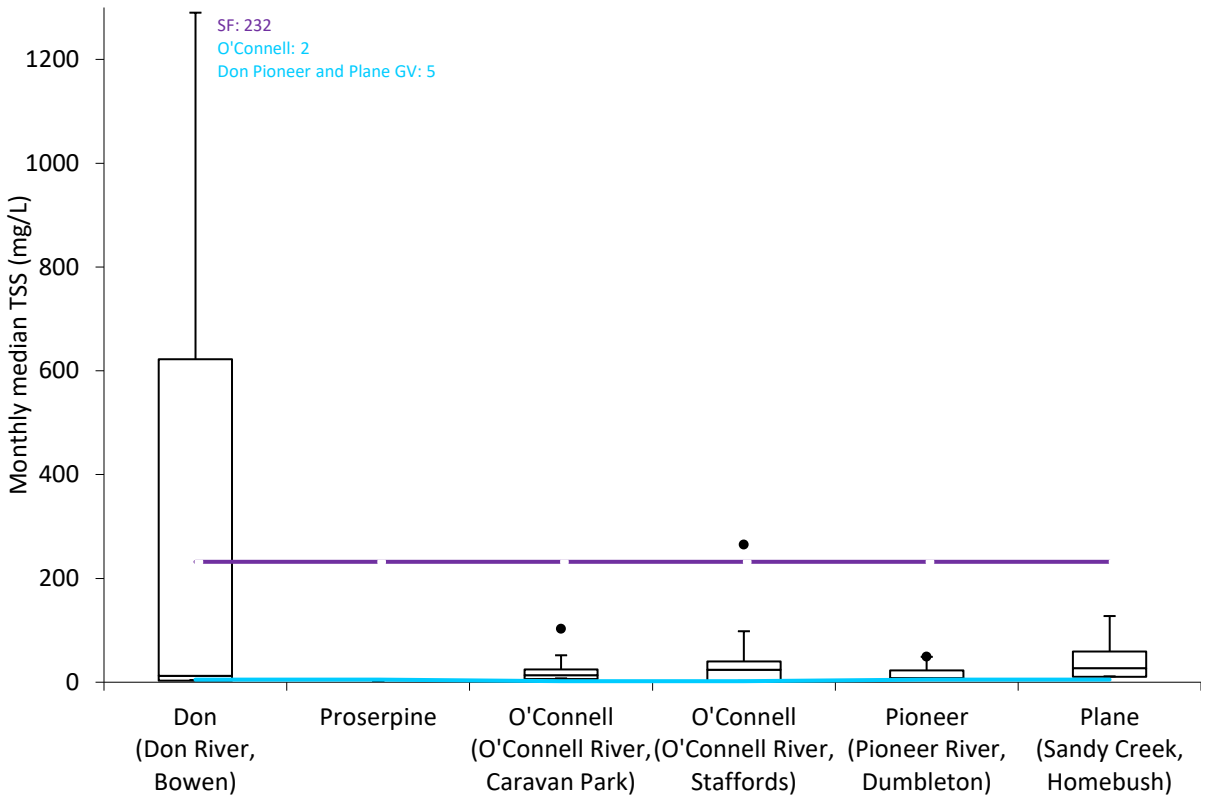

Figure AA 3. Box and whiskers plot (box 20th, 50th and 80th percentiles, whiskers 1.5x interquartile range [IQR]) of monthly median concentrations of total suspended solids (TSS) in the Mackay-Whitsunday freshwater basins for 2016-17, with scaling factors (SF) and guideline values (GV) for each basin. Outliers (>1.5x IQR) are also pictured.

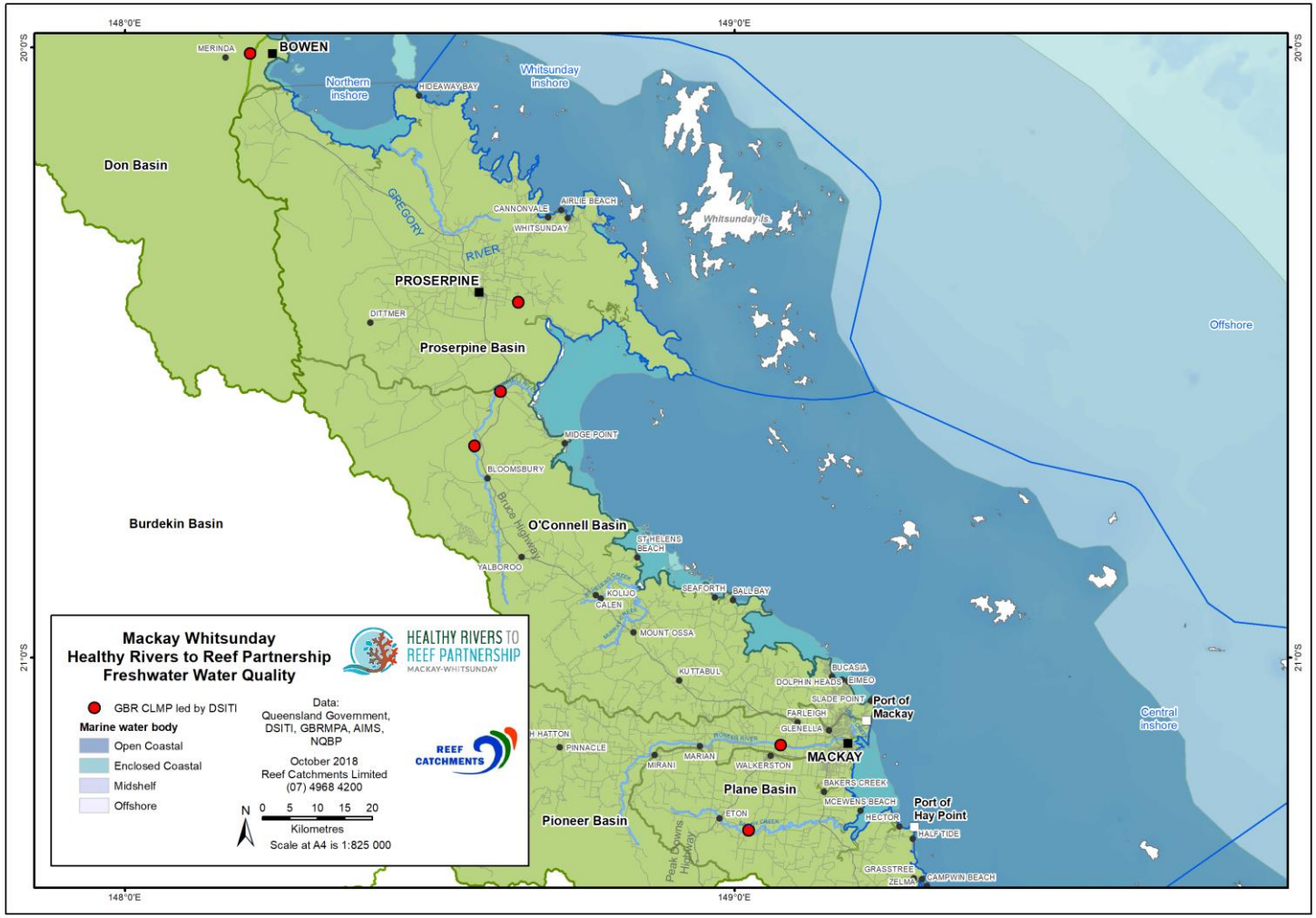

Figure AA 4. Basin water quality monitoring sites in the Mackay-Whitsunday Region for the 2017 report card.

Appendix B: Estuaries

Comparison of scores for St Helens/Murray estuary with and without new sites and boxplots of monthly medians are presented for chl-a, DIN, FRP, DO and turbidity indicators for estuaries. Locations of monitoring sites in each estuary are also presented.

Table AB 1. Impact of including additional sites from Murray/St Helens estuary on 2017 report card scores.

Indicator category/Index	Original sites	New sites
Nutrients	54	54
Phys-Chem	49	60
Chl-a	58	58
Water quality score	59	62
Final estuary score	60 (C)	61 (B)

Scoring range: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 to 100 | ■ No score/data gap

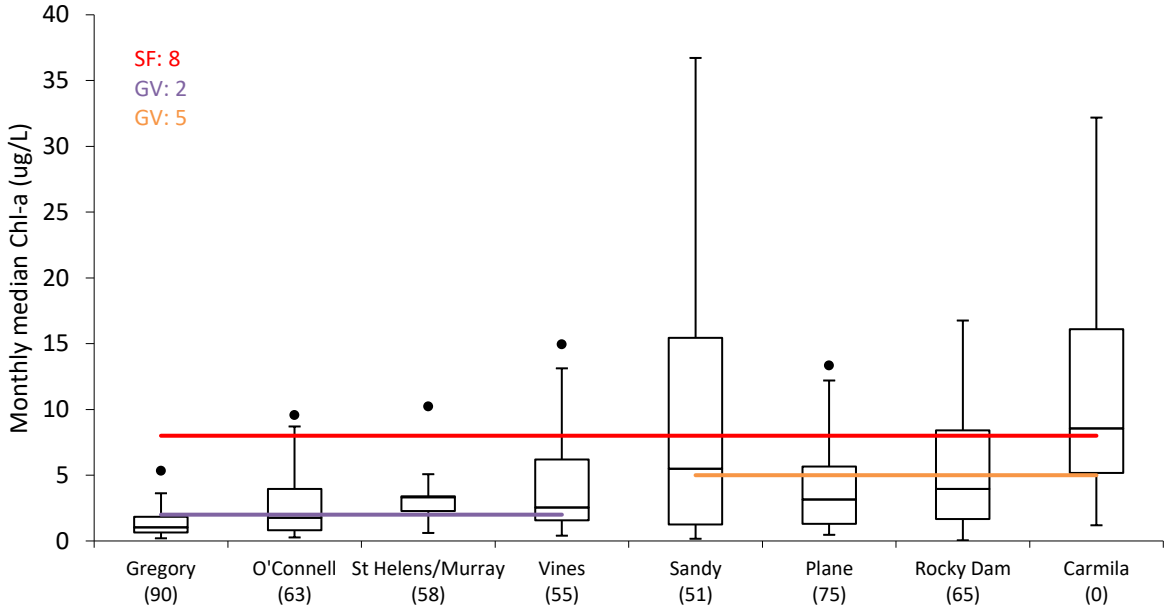

Figure AB 1. Box and whiskers plot (box showing 20th, 50th and 80th percentiles, whiskers 1.5x interquartile range [IQR]) of monthly concentrations of chlorophyll-*a* in the Mackay-Whitsunday estuaries for 2016-17, with scaling factors (SF) and guideline values (GV) for relevant estuaries. Outliers (>1.5x IQR) are also pictured (except for Sandy Creek estuary, which had an outlier of 70 µg/L). Following estuary names are the calculated indicator scores.

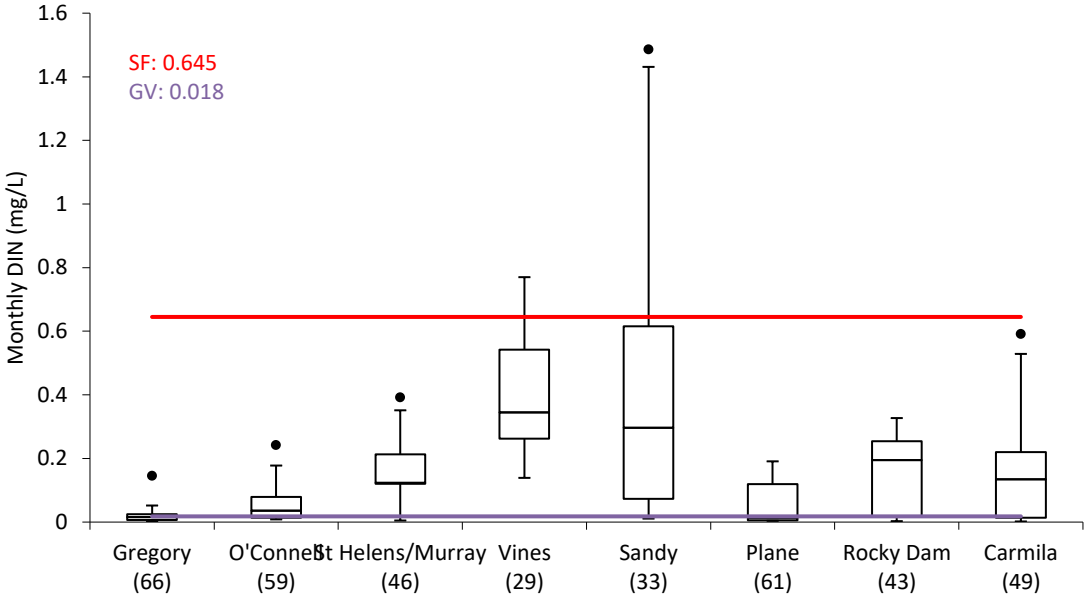

Figure AB 2. Box and whiskers plot (box showing 20th, 50th and 80th percentiles, whiskers 1.5x interquartile range [IQR]) of monthly concentrations of dissolved inorganic nitrogen (DIN) in the Mackay-Whitsunday estuaries for 2016-17, with scaling factors (SF) and guideline values (GV) for relevant estuaries. Outliers (>1.5x IQR) are also pictured. Following estuary names are the calculated indicator scores.

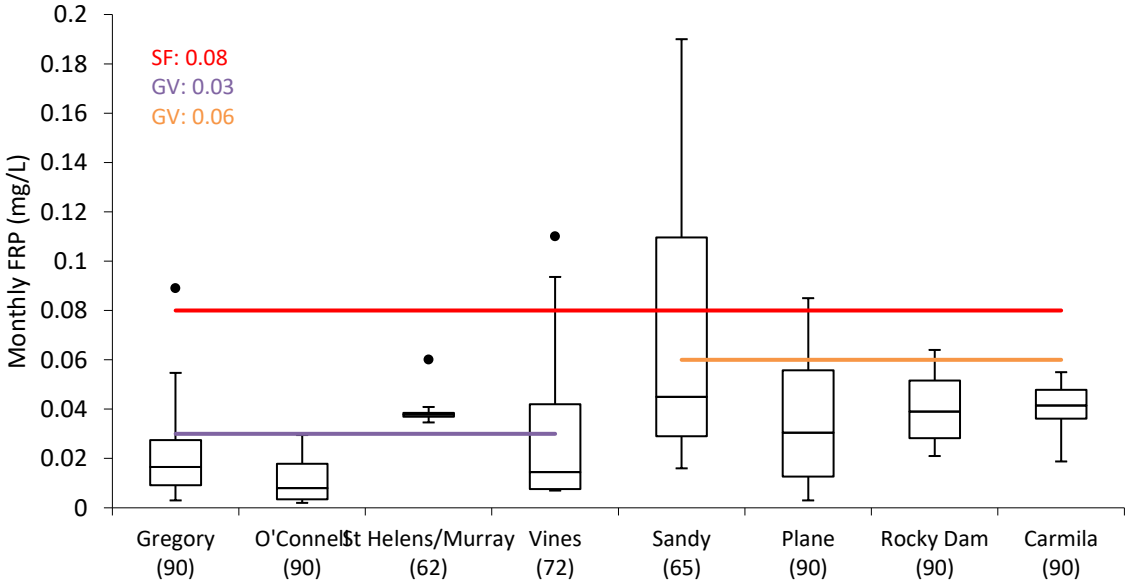

Figure AB 3. Box and whiskers plot (box showing 20th, 50th and 80th percentiles, whiskers 1.5x interquartile range [IQR]) of monthly concentrations of filterable reactive phosphorus (FRP) in the Mackay-Whitsunday estuaries for 2016-17, with scaling factors (SF) and guideline values (GV) for relevant estuaries. Outliers (>1.5x IQR) are also pictured. Following estuary names are the calculated indicator scores.

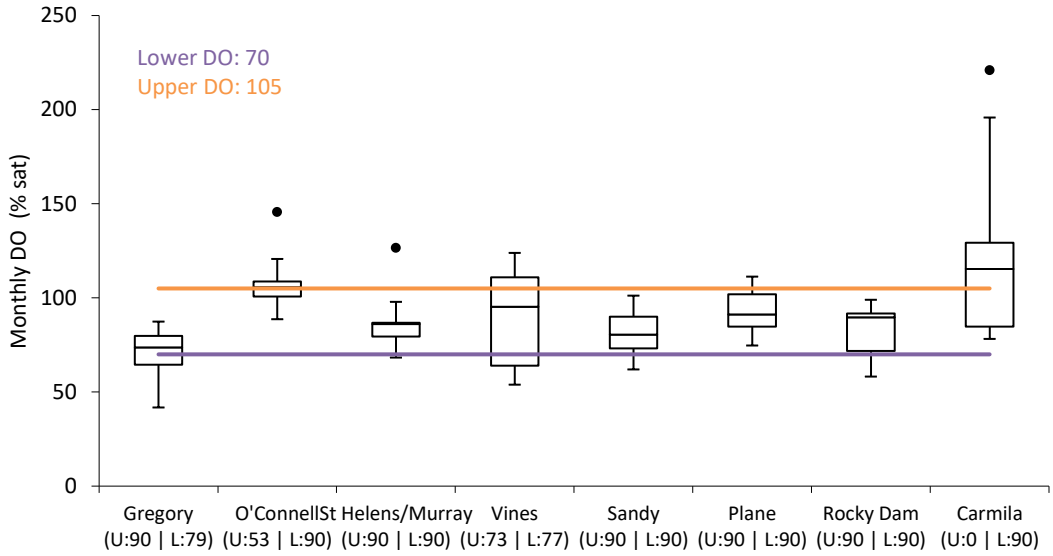

Figure AB 4. Box and whiskers plot (box showing 20th, 50th and 80th percentiles, whiskers 1.5x interquartile range [IQR]) of monthly concentrations of dissolved oxygen (DO) in the Mackay-Whitsunday estuaries for 2016-17, with upper and lower guideline values (GV) for relevant estuaries. Outliers (>1.5x IQR) are also pictured. Following estuary names are the calculated indicator scores calculated by comparing to the upper (U) and lower (L) guidelines for DO.

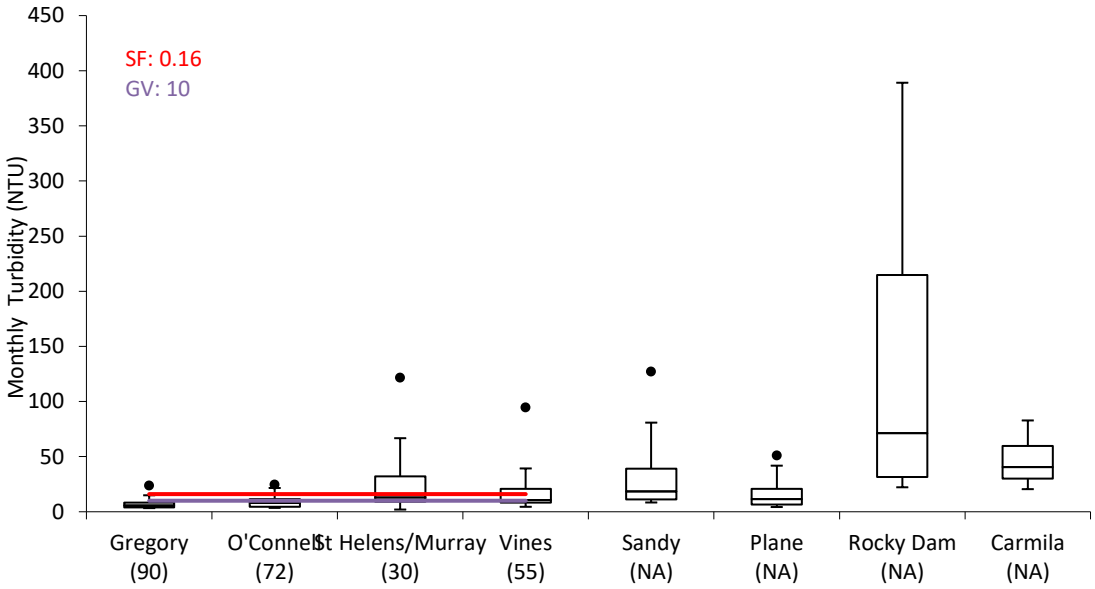

Figure AB 5. Box and whiskers plot (box showing 20th, 50th and 80th percentiles, whiskers 1.5x interquartile range [IQR]) of monthly concentrations of turbidity in the Mackay-Whitsunday estuaries for 2016-17, with scaling factors (SF) and guideline values (GV) for relevant estuaries (no guidelines for Sandy, Plane, Rocky Dam or Carmila Creek estuaries, so no score calculated). Outliers (>1.5x IQR) are also pictured. Following estuary names are the calculated indicator scores where relevant.

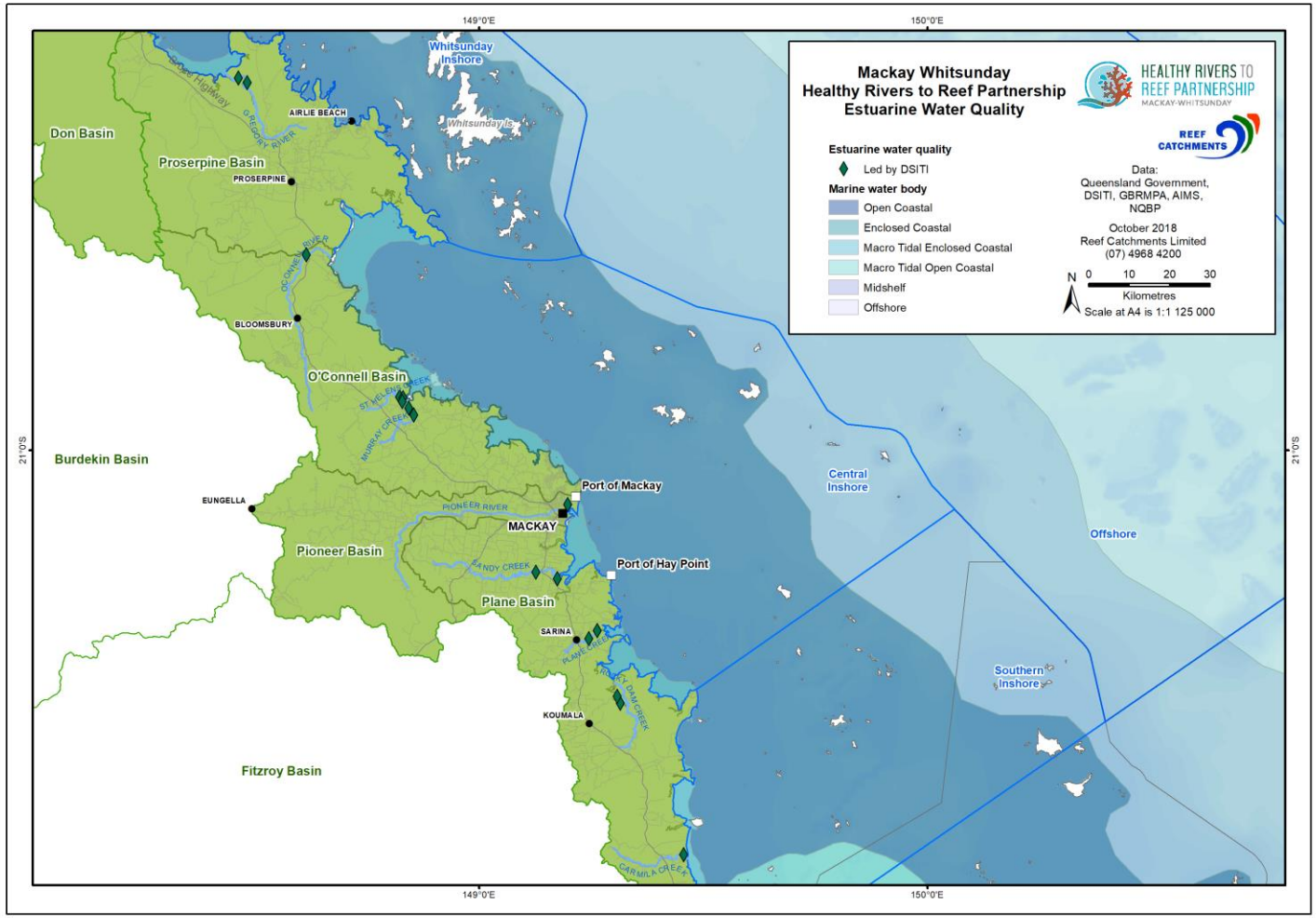

Figure AB 6. Estuary water quality monitoring sites in the Mackay-Whitsunday Region for the 2017 report card.

Appendix C: Marine environment

The scores presented below are inshore zone site scores for the Mackay-Whitsunday 2017 report card. Boxplots are presented for water quality indicators and summary statistics are tabulated for individual sites. Locations of monitoring sites for inshore marine zones are also presented.

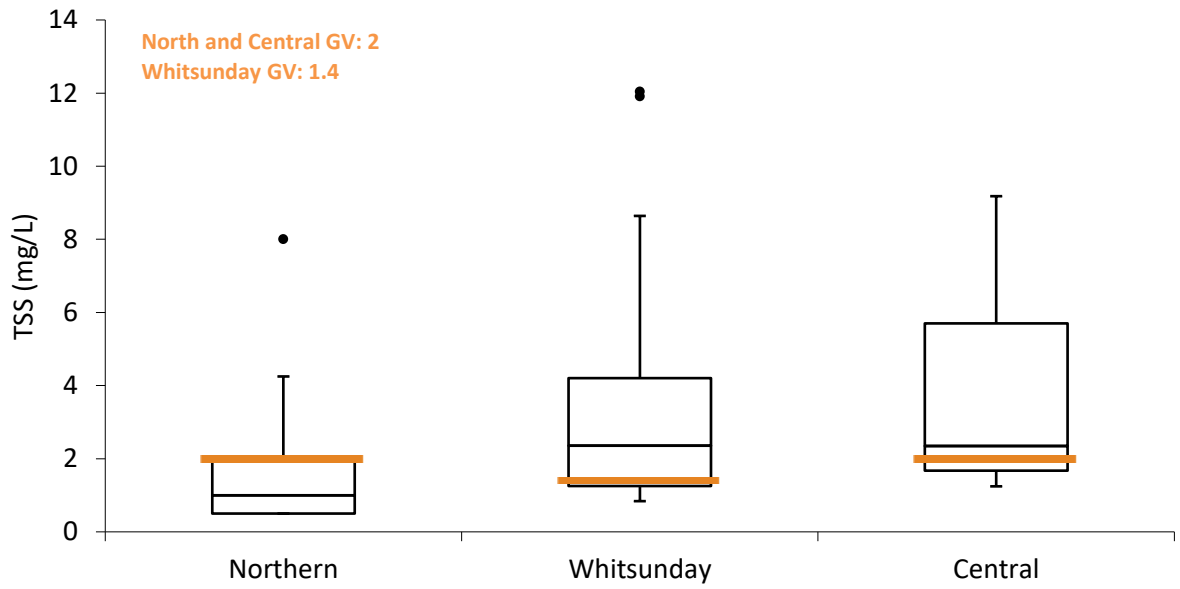

Figure AC 1. Box and whiskers plot (box 25th, 50th and 75th percentiles, whiskers 1.5x interquartile range [IQR]) for all total suspended solids (TSS) samples taken from relevant inshore zones in the Mackay-Whitsunday Region for 2016-17. Outliers (>1.5x IQR) are also pictured. Guideline values (GV) for each zone are pictured.

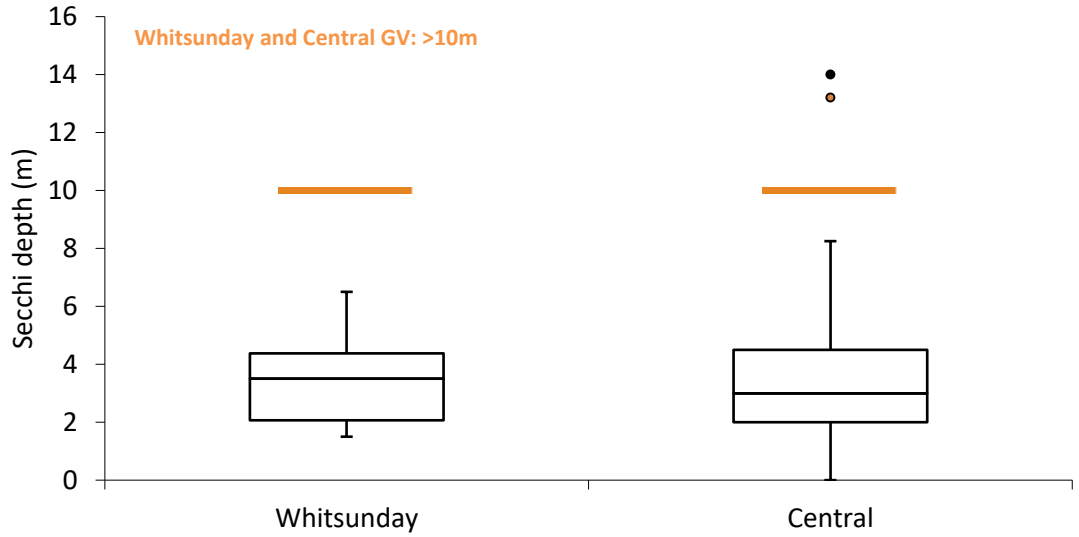

Figure AC 2. Box and whiskers plot (box 25th, 50th and 75th percentiles, whiskers 1.5x interquartile range [IQR]) for all secchi depth samples taken from relevant inshore zones in the Mackay-Whitsunday Region for 2016-17. Outliers (>1.5x IQR) are also pictured. Guideline values (GV) for each zone are pictured.

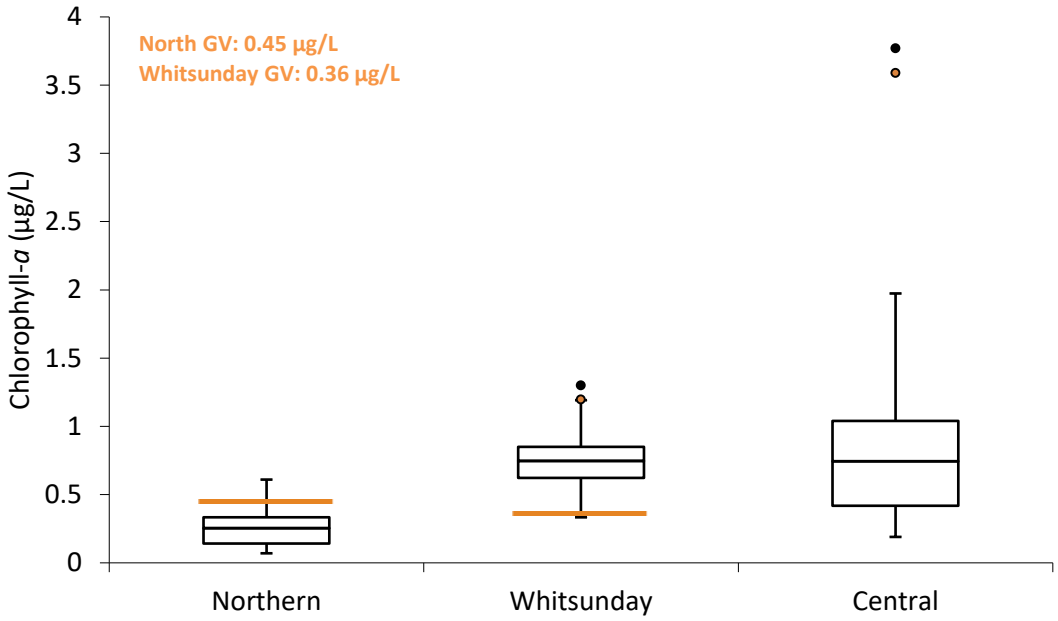

Figure AC 3. Box and whiskers plot (box 25th, 50th and 75th percentiles, whiskers 1.5x interquartile range [IQR]) for all chlorophyll-*a* samples taken from relevant inshore zones in the Mackay-Whitsunday Region for 2016-17. Outliers (>1.5x IQR) are also pictured. Guideline values (GV) for Northern and Whitsunday zones are pictured; Central GV not pictured as it varies from 0.36 - 2 µg/L depending on site location.

Figure AC 4. Box and whiskers plot (box 25th, 50th and 75th percentiles, whiskers 1.5x interquartile range [IQR]) for all particulate phosphorus samples taken from relevant inshore zones in the Mackay-Whitsunday Region for 2016-17. Where relevant outliers (>1.5x IQR) are also pictured (the Central inshore marine zone has one additional outlier that is not pictured: 116 µg/L). Guideline values (GV) for the Whitsunday zone are pictured; Central GV not pictured as it varies from 2.1 – 2.4 µg/L depending on site location.

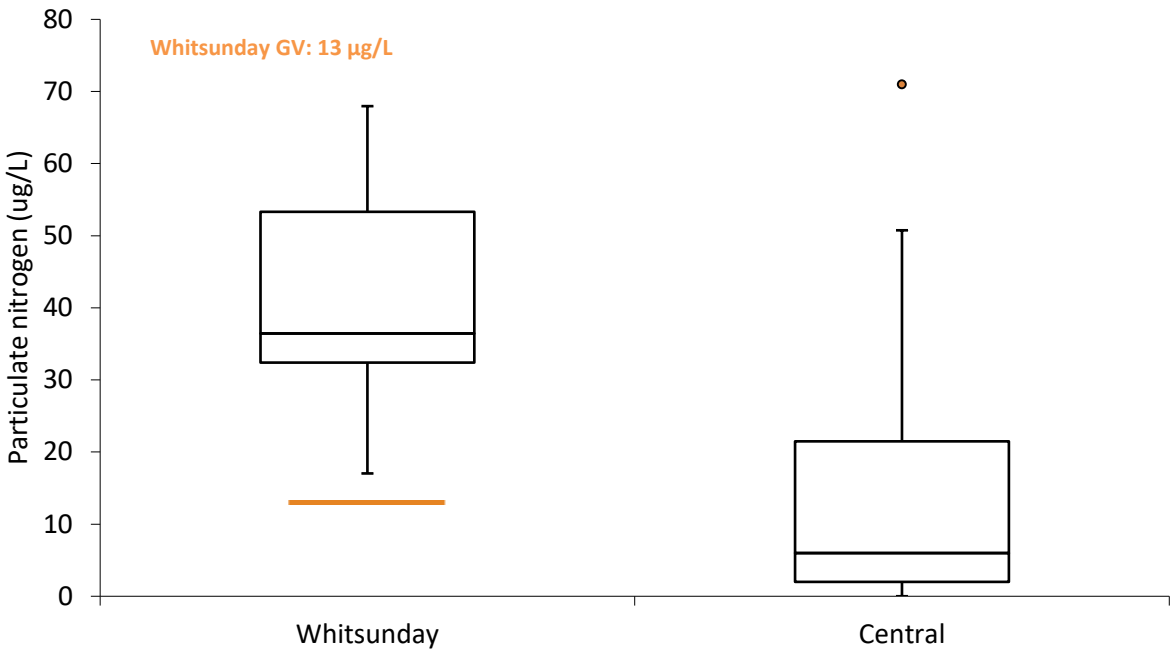

Figure AC 5. Box and whiskers plot (box 25th, 50th and 75th percentiles, whiskers 1.5x interquartile range [IQR]) for all particulate nitrogen samples taken from relevant inshore zones in the Mackay-Whitsunday Region for 2016-17. Where relevant outliers (>1.5x IQR) are also pictured (the Central inshore marine zone has two additional outliers that are not pictured: 132 µg/L and 352µg/L). Guideline values (GV) for the Whitsunday zone are pictured; Central GV not pictured as it varies from 13 – 20 µg/L depending on site location.

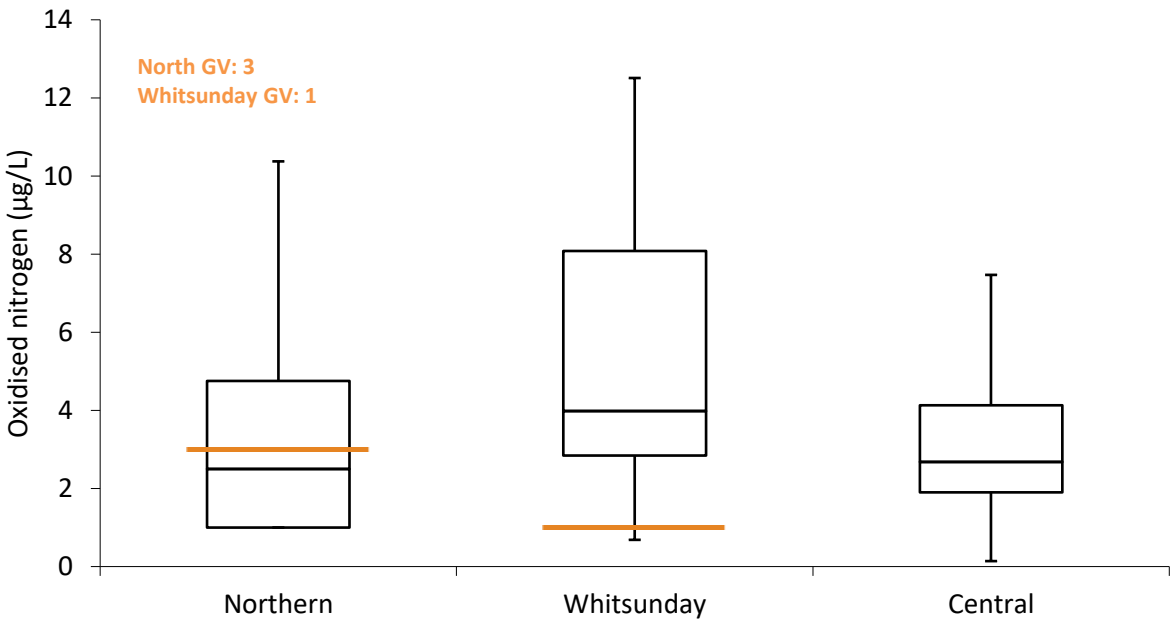

Figure AC 6. Box and whiskers plot (box 25th, 50th and 75th percentiles, whiskers 1.5x interquartile range [IQR]) for all oxidised nitrogen samples taken from relevant inshore zones in the Mackay-Whitsunday Region for 2016-17. Outliers (>1.5x IQR) are also pictured. Guideline values (GV) for the Northern and Whitsunday zone are pictured; Central GV not pictured as it varies from 0 – 4 µg/L depending on site location.

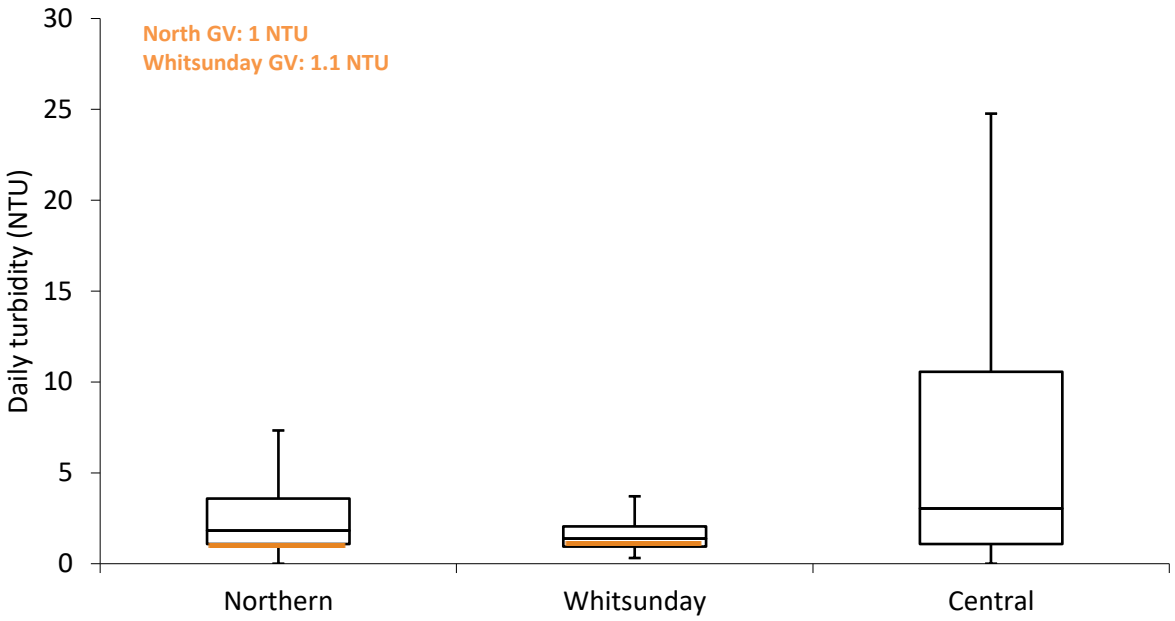

Figure AC 7. Box and whiskers plot (box 25th, 50th and 75th percentiles, whiskers 1.5x interquartile range) for daily turbidity taken from relevant inshore zones in the Mackay-Whitsunday Region for 2016-17. Guideline values (GV) for the Northern and Whitsunday zone are pictured; Central GV not pictured as it varies from 1 – 12 NTU depending on site location and season (wet vs dry). NB outliers (>1.5x IQR) are not pictured due to excessive quantity (n=130 for Northern, n = 70 for Whitsunday and n = 311 for Central), maximum turbidity values per site can be seen in tables below.

Table AC 1. 2016-17 indicator scores for Northern inshore marine sites (Abbot Point Program).

	Nutrients			Chl-a	Water clarity		
Site	**PN**	**PP**	**NOx***	**Chl-a***	**TSS***	**Turbidity**	**Secchi**
Amb1			0.78	0.82	0.13	-0.23	
Amb 2			-0.58	0.56	1.00	-1.00	
Amb 3			-0.87	0.65	-0.66	-0.45	
Amb 4a			0.58	0.58	-0.12	-0.42	
Amb 5			-1.00	1.00	1.00	-1.00	
Amb 6	Site discontinued in February 2017; no data used in 2017 report card from this site.						

Scoring range: ■ Very Poor = <-0.66 to -1 | ■ Poor = <-0.33 to -0.66 | ■ Moderate = <0 to -0.33 | ■ Good = 0 to 0.5 | ■ Very Good = >0.5 to 1 | ■ No score/data gap

Table AC 2. 2016-17 indicator category scores for Northern inshore marine sites (Abbot Point Program) compared to indicator category scores for the Northern inshore marine zone in 2016, 2015 and 2014 report cards.

Site	Nutrients*	Chl-a	Water clarity
Amb1		0.82	-0.05
Amb 2		0.56	0.00
Amb 3		0.65	-0.56
Amb 4a		0.58	-0.27
Amb 5		1.00	0.00
Amb 6	Site discontinued in February 2017; no data used in 2017 report card from this site.		
Northern 2017		0.72	-0.18
Northern 2016		0.74**	-0.35**
Northern 2015			
Northern 2014	-0.96^	-0.95	-0.11

*There must be data for ≥50% of indicators, according to the rules for minimum information for aggregating indicators into indicator categories. Thus, with no data for PN or PP a nutrients score cannot be calculated.

**Scores for chl-a and TSS are based on only one sample (taken in May 2016).

^For the 2014 pilot report card only, the indicator score for NOx was used on its own for the nutrients score.

Scoring range: ■ Very Poor = <-0.66 to -1 | ■ Poor = <-0.33 to -0.66 | ■ Moderate = <0 to -0.33 | ■ Good = 0 to 0.5 | ■ Very Good = >0.5 to 1 | ■ No score/data gap

Table AC 3. Summary statistics for water quality indicators in the Northern inshore marine sites from July 2016 to June 2017. Presented alongside statistics that were compared to guideline values. For all indicators except secchi, to meet the guideline the relevant statistic must be lower compared to the guideline (secchi must be higher than the guideline).

					Guidelines	
Site	**Indicator**	**n**	**Mean**	**Median**	**Comparison**	**Guideline value**
Amb1	NOx (µg/L)	4	1.75		mean	3
	PN (µg/L)	0			mean	20
	PP (µg/L)	0			mean	2.8
	Chl-*a* (µg/L)	4	0.26		mean	0.45
	TSS (mg/L)	3	1.83		mean	2
	Secchi (m)				mean	10
	Turb (NTU)	263*		1.18	median	1
Amb2	NOx (µg/L)	4	4.50		mean	3
	PN (µg/L)	0			mean	20
	PP (µg/L)	0			mean	2.8
	Chl-*a* (µg/L)	4	0.31		mean	0.45
	TSS (mg/L)	3	0.67		mean	2
	Secchi (m)				mean	10
	Turb (NTU)	318*		3.14	median	1
Amb3	NOx (µg/L)	4	5.50		mean	3
	PN (µg/L)	0			mean	20
	PP (µg/L)	0			mean	2.8
	Chl-*a* (µg/L)	4	0.29		mean	0.45
	TSS (mg/L)	3	3.17		mean	2
	Secchi (m)				mean	10
	Turb (NTU)	147*		1.37	median	1
Amb4	NOx (µg/L)	4	2.00		mean	3
	PN (µg/L)	0			mean	20
	PP (µg/L)	0			mean	2.8
	Chl-*a* (µg/L)	4	0.30		mean	0.45
	TSS (mg/L)	3	2.17		mean	2
	Secchi (m)				mean	10
	Turb (NTU)	296*		1.34	median	1
Amb5	NOx (µg/L)	4	8.75		mean	3
	PN (µg/L)	0			mean	20
	PP (µg/L)	0			mean	2.8
	Chl-*a* (µg/L)	4	0.15		mean	0.45
	TSS (mg/L)	3	1.00		mean	2
	Secchi (m)				mean	10
	Turb (NTU)	249*		2.49	median	1

*While turbidity loggers were deployed for the entire 2016/2017 reporting period (365 days), sample size is based on daily averages from *validated* data recovered from this period. Some data was lost during TC Debbie at AMB1 and AMB5. AMB3 was discontinued between February 2017 to November 2017.

Table AC 4. 2016-17 indicator scores for Whitsunday inshore marine sites (Marine Monitoring Program).

Site	Nutrients			Chl-a	Water clarity		
	NOx	PN	PP	Chl-a	TSS	Secchi	Turbidity
Double Cone Island	-1.00	-1.00	-1.00	-1.00	-0.25	-1.00	-0.03
Pine Island	-1.00	-1.00	-0.93	-0.97	-1.00	-1.00	-0.53
Seaforth Island	-1.00	-1.00	-1.00	-1.00	-0.75	-1.00	-0.41
Without post TC Debbie samples							
Double Cone Island	-1.00	-1.00	-0.65	-0.73	-0.10	-1.00	-0.02
Pine Island	-1.00	-1.00	-0.73	-0.85	-0.61	-1.00	-0.53
Seaforth Island	-1.00	-1.00	-0.65	-1.00	-0.44	-1.00	-0.10

Scoring range: ■ Very Poor = <-0.66 to -1 | ■ Poor = <-0.33 to -0.66 | ■ Moderate = <0 to -0.33 | ■ Good = 0 to 0.5 | ■ Very Good = >0.5 to 1 | ■ No score/data gap

Table AC 5. 2016-17 indicator category scores for Whitsunday inshore marine sites (Marine Monitoring Program) compared to indicator category scores for the Whitsunday inshore marine zone in 2016, 2015 and 2014 report cards.

Site	Nutrients	Chl-a	Water clarity
Double Cone Island	-1.00	-1.00	-0.43
Pine Island	-0.98	-0.97	-0.84
Seaforth Island	-1.00	-1.00	-0.72
Whitsunday 2017	-0.99	-0.99	-0.66
Without post TC Debbie samples			
Whitsunday 2017	-0.89	-1.00	-0.51
Whitsunday 2016	-0.54	-0.12	-0.38
Whitsunday 2015	-0.48	-0.20	-0.23
Whitsunday 2014	-0.88	-1.00	-0.88

Scoring range: ■ Very Poor = <-0.66 to -1 | ■ Poor = <-0.33 to -0.66 | ■ Moderate = <0 to -0.33 | ■ Good = 0 to 0.5 | ■ Very Good = >0.5 to 1 | ■ No score/data gap

Table AC 6. Final water quality scores for the Whitsunday zone for the 2017 report card with and without samples post TC Debbie.

Inshore zone	Nutrients	Chl-a	Water clarity	Pesticides	Water quality index 2017
Whitsunday	0	0	20		7
Without post TC Debbie samples					
Whitsunday	5	8	30		14

Table AC 7. Summary statistics for water quality indicators in the Whitsunday inshore marine sites from July 2016 to June 2017. Presented alongside statistics are guideline values, including the statistic that was compared to the guideline (where three values are listed, the median is compared to the middle of the listed values). For all indicators except secchi, to meet the guideline the relevant statistic must be lower compared to the guideline (secchi must be higher than the guideline).

									Guidelines	
Site	**Indicator**	**n**	**Mean**	**Minimum**	**25th %tile**	**Median**	**75th %tile**	**Maximum**	**Comparison**	**Guideline value**
Double Cone	NOx (µg/L)	5	2.67	0.68	1.32	3.37	3.57	4.40	median	0-1-2
	PN (µg/L)	5	46.91	29.40	35.92	50.46	50.79	67.97	median	12-13-15
	PP (µg/L)	5	4.46	2.43	2.62	4.89	5.26	7.08	median	1.8-2.4-2.8
	Chl-*a* (µg/L)	5	0.77	0.33	0.43	0.77	0.88	1.47	median	0.25-0.36-0.54
	TSS (mg/L)	5	2.64	0.93	1.34	1.66	3.88	5.39	median	0.9-1.4-2.3
	Secchi (m)	5	4.15	1.75	3.50	3.50	5.50	6.50	mean	10
	Turb (NTU)	277	2.02	0.48	0.88	1.13	1.60	83.74	median	0.7-1.1-2.1
Pine Island	NOx (µg/L)	5	8.45	3.41	4.78	9.68	11.86	12.51	median	0-1-2
	PN (µg/L)	5	35.42	17.03	30.46	34.55	36.02	59.06	median	12-13-15
	PP (µg/L)	5	5.88	2.59	3.37	4.57	8.49	10.37	median	1.8-2.4-2.8
	Chl-*a* (µg/L)	5	0.78	0.56	0.59	0.70	0.75	1.30	median	0.25-0.36-0.54
	TSS (mg/L)	5	5.81	0.84	1.22	3.05	11.91	12.04	median	0.9-1.4-2.3
	Secchi (m)	5	3.10	1.50	1.50	3.00	3.50	6.00	mean	10
	Turb (NTU)	216	1.88	0.48	1.10	1.59	2.34	6.71	median	0.7-1.1-2.1
Seaforth	NOx (µg/L)	4	5.20	2.66	2.66	4.86	7.40	8.42	median	0-1-2
	PN (µg/L)	4	46.11	31.67	35.56	45.52	56.06	61.71	median	12-13-15
	PP (µg/L)	4	4.87	3.23	4.04	4.91	5.74	6.42	median	1.8-2.4-2.8
	Chl-*a* (µg/L)	4	0.85	0.71	0.73	0.75	0.87	1.20	median	0.25-0.36-0.54
	TSS (mg/L)	4	2.52	1.05	1.49	2.36	3.39	4.32	median	0.9-1.4-2.3
	Secchi (m)	4	3.44	1.75	3.06	3.75	4.13	4.50	mean	10
	Turb (NTU)	344	2.53	0.31	0.97	1.46	2.32	69.11	median	0.7-1.1-2.1

*While turbidity loggers were deployed for the entire 2016/2017 reporting period (365 days), sample size is based on daily averages from validated data recovered from this period. Some data was lost during TC Debbie at Double Cone and Pine Island sites.

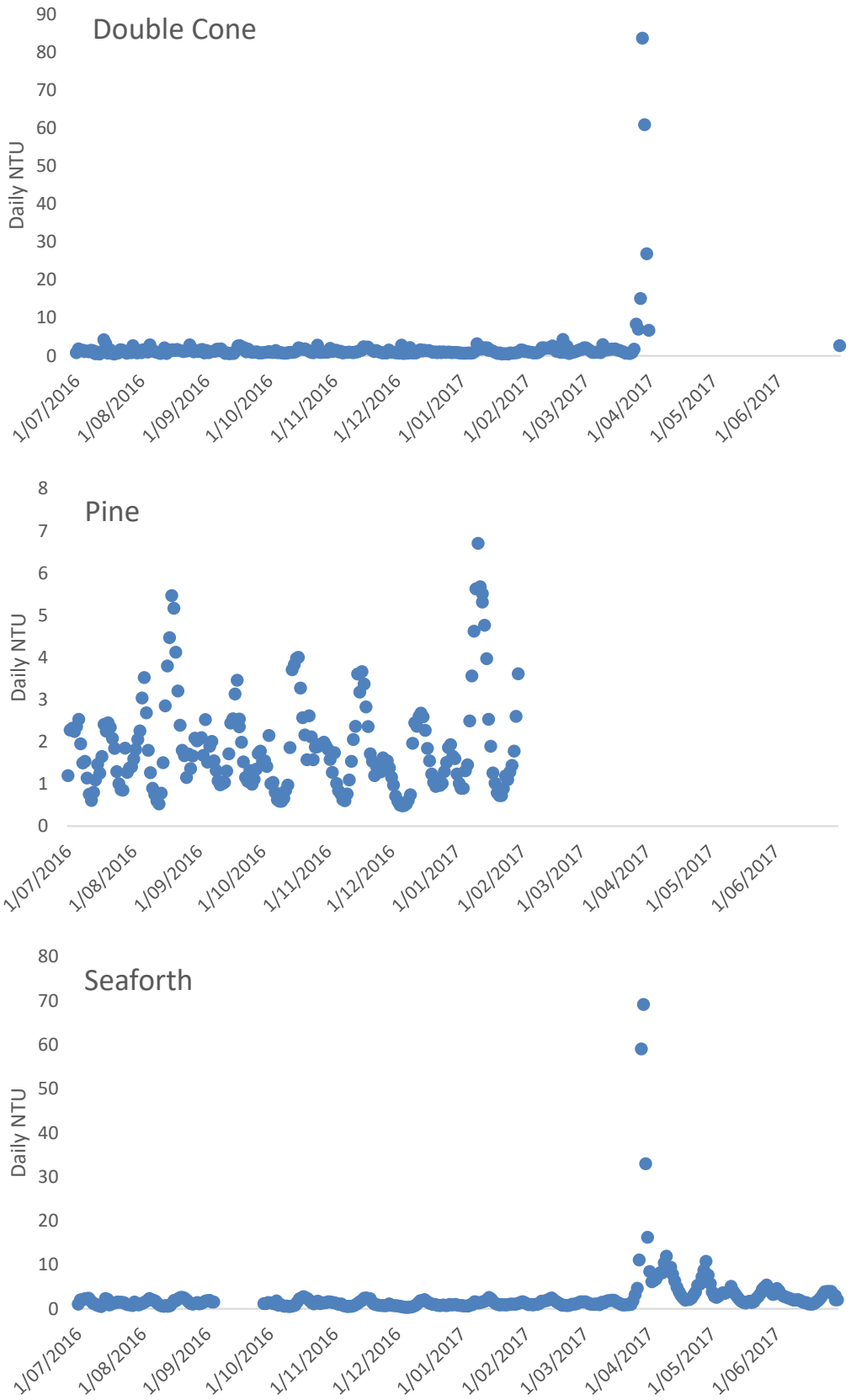

Figure AC 8. Daily NTU from all three Whitsunday inshore marine loggers 2016-17.

Table AC 8. 2016-17 indicator scores for Central inshore marine sites (Hay Point Ports Program and Marine Monitoring Program). For two sites guideline values for turbidity were scored for the wet (Nov-Apr) and dry (May-Oct) season; the average of these scores is used for the turbidity score in the water clarity index.

	Nutrients			Chl-a	Water clarity			Turbidity	
Site	Nox	PN	PP	Chl-a	TSS	Secchi	Turbidity	Dry	Wet
O'Connell River mouth	1.00			0.42					
Repulse Islands dive mooring	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00		
AMB 1		-1.00	-1.00	-0.55		-1.00	-1.00		
AMB 2		-0.63	-1.00	-1.00		-1.00	-0.16	-0.63	0.30
AMB 3B		1.00	0.40	-1.00		-1.00	0.86		
AMB 5		-0.04	-0.10	-0.95		-1.00	0.00	-1.00	1.00
AMB 6B		0.28	-0.64	-1.00		-1.00			
AMB 8		1.00	0.49	-0.84		-1.00	0.15	-0.71	1.00
AMB 10		0.58	0.16	-1.00		-1.00	-1.00		
AMB 11	1.00			1.00					
AMB 12	-1.00	1.00	1.00	0.12		-0.85	0.57		

Scoring range: ■ Very Poor = <-0.66 to -1 | ■ Poor = <-0.33 to -0.66 | ■ Moderate = <0 to -0.33 | ■ Good = 0 to 0.5 | ■ Very Good = >0.5 to 1 | ■ No score/data gap

Table AC 9. 2016-17 indicator category scores for Central inshore marine sites (Hay Point Ports Program and Marine Monitoring Program) compared to indicator category scores for the Central inshore marine zone in 2016, 2015 and 2014 report cards.

Site	Nutrients	Chl-a	Water clarity
O'Connell River mouth		0.42	
Repulse Islands dive mooring	-1.00	-1.00	-1.00
AMB 1	-1.00	-0.55	-1.00
AMB 2	-0.82	-1.00	-0.58
AMB 3B	0.70	-1.00	-0.07
AMB 5	-0.07	-0.95	-0.50
AMB 6B	-0.18	-1.00	
AMB 8	0.74	-0.84	-0.43
AMB 10	0.37	-1.00	-1.00
AMB 11		1.00	
AMB 12	0.33	0.12	-0.14
Central 2017	-0.10	-0.53	-0.59
Central 2016	-0.41	-0.38	-0.14
Central 2015	0.10	-0.15	-0.47
Central 2014			

Scoring range: ■ Very Poor = <-0.66 to -1 | ■ Poor = <-0.33 to -0.66 | ■ Moderate = <0 to -0.33 | ■ Good = 0 to 0.5 | ■ Very Good = >0.5 to 1 | ■ No score/data gap

Table AC 10. Summary statistics for water quality indicators in the Central inshore marine sites from July 2016 to June 2017. Presented alongside statistics are guideline values, including the statistic that was compared to the guideline (where three values are listed, the median is compared to the middle of the listed values). For all indicators except secchi, to meet the guideline the relevant statistic must be lower compared to the guideline (secchi must be higher than the guideline).

Site	Indicator	n	Mean	Minimum	25th %ile	Median	75th %ile	Maximum	Guidelines	
									Comparison	Guideline value
O'Connell River mouth	NOx (µg/L)	4	2.05	0.14		0.39		7.28	median	2-4-10
	PN (µg/L)	4								
	PP (µg/L)	4								
	Chl-*a* (µg/L)	4	1.63	0.70		0.97		3.88	median	0.8-1.3-2
	TSS (mg/L)	4								
	Secchi (m)	4								
	Turb (NTU)	NA								
Repulse Islands dive mooring	NOx (µg/L)	5	4.73	1.70	2.86	2.96	4.34	11.78	median	0-1-2
	PN (µg/L)	5	46.94	27.77	36.39	45.01	46.50	79.04	median	12-13-15
	PP (µg/L)	5	7.35	4.11	6.95	7.79	8.11	9.80	median	1.8-2.4-2.8
	Chl-*a* (µg/L)	5	0.88	0.58	0.75	0.84	0.85	1.39	median	0.25-0.36-0.54
	TSS (mg/L)	5	5.38	1.29	2.35	5.70	8.40	9.18	median	0.9-1.4-2.3
	Secchi (m)	5	2.35	1.50	1.50	1.75	2.50	4.50	mean	10
	Turb (NTU)	368	5.93	0.52	2.41	4.20	7.32	95.34	median	0.7-1.1-2.1
AMB 1	NOx (µg/L)									
	PN (µg/L)	8	60.25						mean	<20
	PP (µg/L)	8	17.13						mean	<2.8
	Chl-*a* (µg/L)	8	0.66						mean	<0.45
	TSS (mg/L)	0							mean	<2.0
	Secchi (m)	8	4.13						mean	>10
	Turb (NTU)	323				12.75			median	<1
AMB 2	NOx (µg/L)									
	PN (µg/L)	7	31.00						mean	<20
	PP (µg/L)	7	6.57						mean	<2.8
	Chl-*a* (µg/L)	7	1.47						mean	<0.45
	TSS (mg/L)	0							mean	<2.0
	Secchi (m)	7	4.36						mean	>10
	Turb (NTU)	231				5.91			median	D1-2-8 W5-12-33
AMB 3B	NOx (µg/L)									

Site	Indicator	n	Mean	Minimum	25th %ile	Median	75th %ile	Maximum	Guidelines	
									Comparison	Guideline value
	PN (µg/L)	8	4.13						mean	<20
	PP (µg/L)	8	2.13						mean	<2.8
	Chl-*a* (µg/L)	8	0.93						mean	<0.45
	TSS (mg/L)	0							mean	<2.0
	Secchi (m)	8	4.46						mean	>10
	Turb (NTU)	163							median	<1
AMB 5	NOx (µg/L)									
	PN (µg/L)	8	20.63						mean	<20
	PP (µg/L)	8	3.00						mean	<2.8
	Chl-*a* (µg/L)	8	0.87						mean	<0.45
	TSS (mg/L)	0							mean	<2.0
	Secchi (m)	8	2.95						mean	>10
	Turb (NTU)	244				4.30			median	D1-2-8 W5-12-33
AMB 6B	NOx (µg/L)									
	PN (µg/L)	8	16.50						mean	<20
	PP (µg/L)	8	4.38						mean	<2.8
	Chl-*a* (µg/L)	8	1.87						mean	<0.45
	TSS (mg/L)	0							mean	<2.0
	Secchi (m)	8	1.68						mean	>10
	Turb (NTU)	NA								
AMB 8	NOx (µg/L)									
	PN (µg/L)	8	6.63						mean	<20
	PP (µg/L)	8	2.00						mean	<2.8
	Chl-*a* (µg/L)	8	0.81						mean	<0.45
	TSS (mg/L)	0							mean	<2.0
	Secchi (m)	8	4.83						mean	>10
	Turb (NTU)	232				3.01			median	D1-2-8 W5-12-33
AMB 10	NOx (µg/L)									
	PN (µg/L)	8	13.38						mean	<20
	PP (µg/L)	8	2.50						mean	<2.8
	Chl-*a* (µg/L)	8	0.92						mean	<0.45
	TSS (mg/L)	0							mean	<2.0
	Secchi (m)	8	2.48						mean	>10
	Turb (NTU)	291				3.87			median	<1

Site	Indicator	n	Mean	Minimum	25th %ile	Median	75th %ile	Maximum	Guidelines	
									Comparison	Guideline value
AMB 11	NOx (µg/L)	1				2.50			median	<10
	PN (µg/L)	8								
	PP (µg/L)	8								
	Chl-*a* (µg/L)	8				0.87			median	<2.0
	TSS (mg/L)	0								
	Secchi (m)	8				2.15			median	>1
	Turb (NTU)	NA								
AMB 12	NOx (µg/L)	1				3.50			median	0-0-1
	PN (µg/L)	8				2.50			median	14-18-24
	PP (µg/L)	8				1.00			median	1.6-2.1-3
	Chl-*a* (µg/L)	8	0.41						mean	≤0.45
	TSS (mg/L)	0							median	1.1-1.6-2.4
	Secchi (m)	8	5.54						mean	10
	Turb (NTU)	302				0.67			median	<1

*While turbidity loggers were deployed for the entire 2016/2017 reporting period (365 days), sample size is based on daily averages from validated data recovered from this period. Some data was lost during TC Debbie at AMB8 (with a delay in redeployment due to pursuant weather constraints); AMB3B, Jan-March 2017 the instrument was retrieved but found to be flooded, with little data able to be recovered; AMB3B, April 2017 the instrument was lost and replaced; AMB2 Dec 16 – Feb 17 the instrument was retrieved but flooded, with little data recovered.

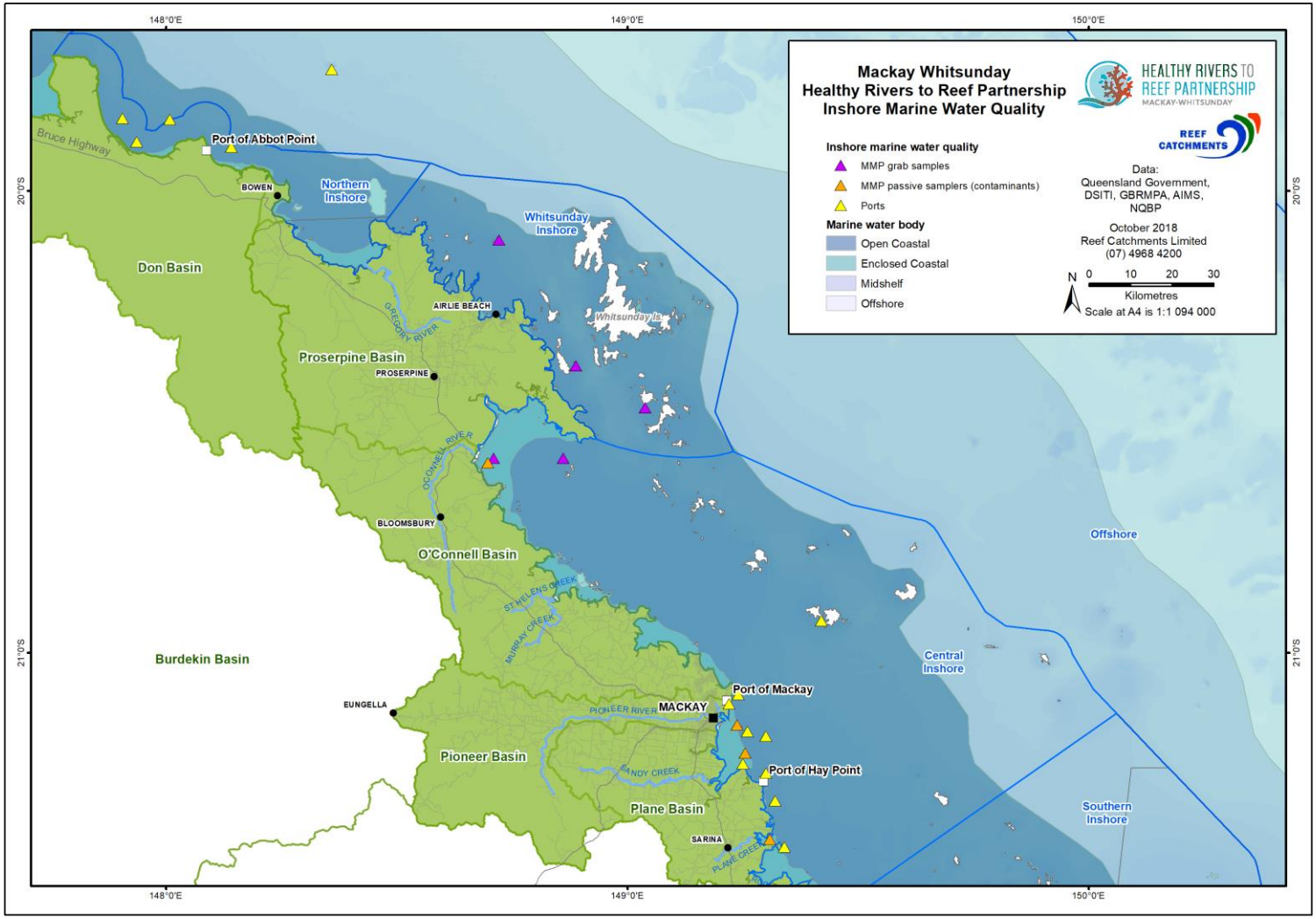

Figure AC 9. Inshore marine water quality monitoring sites in the Mackay-Whitsunday Region for the 2017 report card.

Table AC 11. Coral indicator scores for 2017 in the Northern inshore marine sites (Abbot Point coral monitoring program).

Zone	Reef ID	Depth	Cover	Macroalgae	Juvenile	Change	Composition	Coral index
Northern	N1	2	0.14	0.00	0.20			**0.11**
	N2	2	0.33	0.00	0.31			**0.21**
	N3	2	0.05	1.00	0.04			**0.36**
	N4	5	0.19	1.00	0.06			**0.42**
	N5	2	0.01	1.00	0.03			**0.35**
	N6	5	0.12	1.00	0.11			**0.41**
2017 Report card score: Moderate			0.14	0.67	0.12			0.31
2016 Report card score: Moderate			0.40	0.67	0.29			**0.45**
2015 Report card score: no data								
2014 Report card score: no data								

Scoring range: ■ Very Poor = 0 to <0.21 | ■ Poor = 0.21 to <0.41 | ■ Moderate = 0.41 to <0.61 | ■ Good = 0.61 to <0.81 | ■ Very Good = 0.81 – 1 | ■ No score/data gap

Table AC 12. Coral indicator scores for 2017 in the Whitsunday inshore marine sites (MMP coral monitoring program).

Zone	Reef ID	Reef	Depth	Cover	Macroalgae	Juvenile	Change	Composition	Coral index
Whitsunday	W1	Border	5	0.85	1.00	1.00	0.47	1.00	**0.86**
	W2		2	0.01	1.00	0.04	0.93	0.00	**0.40**
	W3	Daydream	5	0.06	1.00	0.11	0.69	0.00	**0.37**
	W4		2	0.47	1.00	0.10	0.65	0.00	**0.44**
	W5	Dent	5	0.48	1.00	0.14	1.00	0.50	**0.62**
	W6	Double	2	0.03	1.00	0.03	0.56	0.00	**0.32**
	W7	Cone	5	0.28	1.00	0.11	0.24	0.50	**0.43**
	W8	Hayman	5	0.69	1.00	1.00	0.16	0.50	**0.67**
	W9		2	0.61	1.00	0.51	0.33	0.50	**0.59**
	W10	Hook	5	0.64	1.00	0.30	0.15	0.50	**0.52**
	W11	Langford	5	0.60	1.00	0.78	0.00	0.50	**0.58**
	W12		2	0.19	1.00	0.16	0.33	1.00	**0.53**
	W13	Pine	5	0.27	1.00	0.20	0.22	0.50	**0.44**
	W14		2	0.24	0.00	0.39	0.41	0.50	**0.31**
	W15	Seaforth	5	0.20	0.82	0.42	0.00	1.00	**0.49**
	W16	Shute	2	0.50	1.00	0.17	0.69	1.00	**0.67**
	W17	Harbour	5	0.23	1.00	0.25	0.50	1.00	**0.60**
2017 Report card score: Moderate				0.37	0.93	0.34	0.43	0.53	**0.52**
2016 Report card score: Good				0.68	0.76	0.62	0.40	0.59	**0.61**
2015 Report card score: Moderate				0.64	0.74	0.60	0.40	0.53	**0.58**
2014 Report card score: Moderate				0.61	0.74	0.61	0.39	0.44	**0.56**

Scoring range: ■ Very Poor = 0 to <0.21 | ■ Poor = 0.21 to <0.41 | ■ Moderate = 0.41 to <0.61 | ■ Good = 0.61 to <0.81 | ■ Very Good = 0.81 – 1 | ■ No score/data gap

Table AC 13. Coral indicator scores for 2017 in the Central inshore marine sites (Hay Point coral monitoring program).

Zone	Reef ID	Cover	Macroalgae	Juvenile	Change	Composition	Coral index
Central	Keswick	0.52	0.00	0.04	0.53		**0.27**
	Round	0.34	0.00	0.27	0.39		**0.25**
	Slade	0.26	0.00	0.28	0.30		**0.21**
	Victor	0.26	0.05	0.12	0.37		**0.20**
2017 Report card score: Poor		0.35	0.01	0.18	0.40		**0.23**
2016 Report card score: Poor		0.44	0.00	0.15	0.64		**0.31**
2015 Report card score: no score		0.42		0.39			
2014 Report card score: no data							

Scoring range: ■ Very Poor = 0 to <0.21 | ■ Poor = 0.21 to <0.41 | ■ Moderate = 0.41 to <0.61 | ■ Good = 0.61 to <0.81 | ■ Very Good = 0.81 – 1 | ■ No score/data gap

Table AC 14. Coral indicator scores for 2017 in the offshore marine zone (Long-Term Monitoring Program) with amended scores (due to erroneous in coral change methodology) compared to indicator scores presented in the 2016, 2015 and 2014 report card. Also presented are original scores that were presented in the 2014-2016 report cards (and associated documents) that were calculated using erroneous methodology.

Year	Cover	Macroalgae	Juvenile	Change	Coral index
2017	39		95	45	60
2016	34		95	41	57
2015	38		99	33	57
2014	36		97	28	54
Original scores (using erroneous method relating to change indicator)					
2017*	**39**		**95**	**69**	**68**
2016	34		95	57	62
2015	38		99	43	60
2014	36		97	30	54

*The 2017 report card was launched online only in 2018. Original coral scores were released online in November 2018 and were amended in the online report card in January 2019. The 2017 technical report had not been released at time of coral score errors and subsequent amendments, however 2017 scores have been presented here for comparison.

Original scores reported in 2014-2016 report cards (using erroneous method)					
Year	**Cover**	**Macroalgae**	**Juvenile**	**Change**	**Coral index**
2016	32		95	42	**57**
2015	34		87	38	**53**
2014	32		68	33	**44**

Scoring range: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 – 100 | ■ No score/data gap | ■ Not applicable

Table AC 15. Final offshore scores and indices for 2017 compared to amended scores from 2016, 2015 and 2014 relating to erroneous methodology of coral change indicator. Also presented are original scores that were presented in the 2014 – 2016 report cards (and associated documents), that were calculated using erroneous offshore coral scoring methodology.

Year	Water quality	Coral index	Seagrass	Fish	Final
2017	92	60			76
2016	93	57			75
2015	94	57			75
2014	95	54			74
Original scores (using erroneous method relating to change indicator)					
2017*	92	68			79
2016	93	62			77
2015	94	60			77
2014	95	54			74

*The 2017 report card was launched online only in 2018. Original coral scores were released online in November 2018 and were amended in the online report card in January 2019. The 2017 technical report had not been released at time of coral errors and subsequent amendments, however 2017 scores have been presented here for comparison.

Original scores reported in 2014-2016 report cards (using erroneous method)					
2016	93	56			74
2015	94	53			73
2014	95	44			69

Scoring range: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 – 100 | ■ No score/data gap | ■ Not applicable

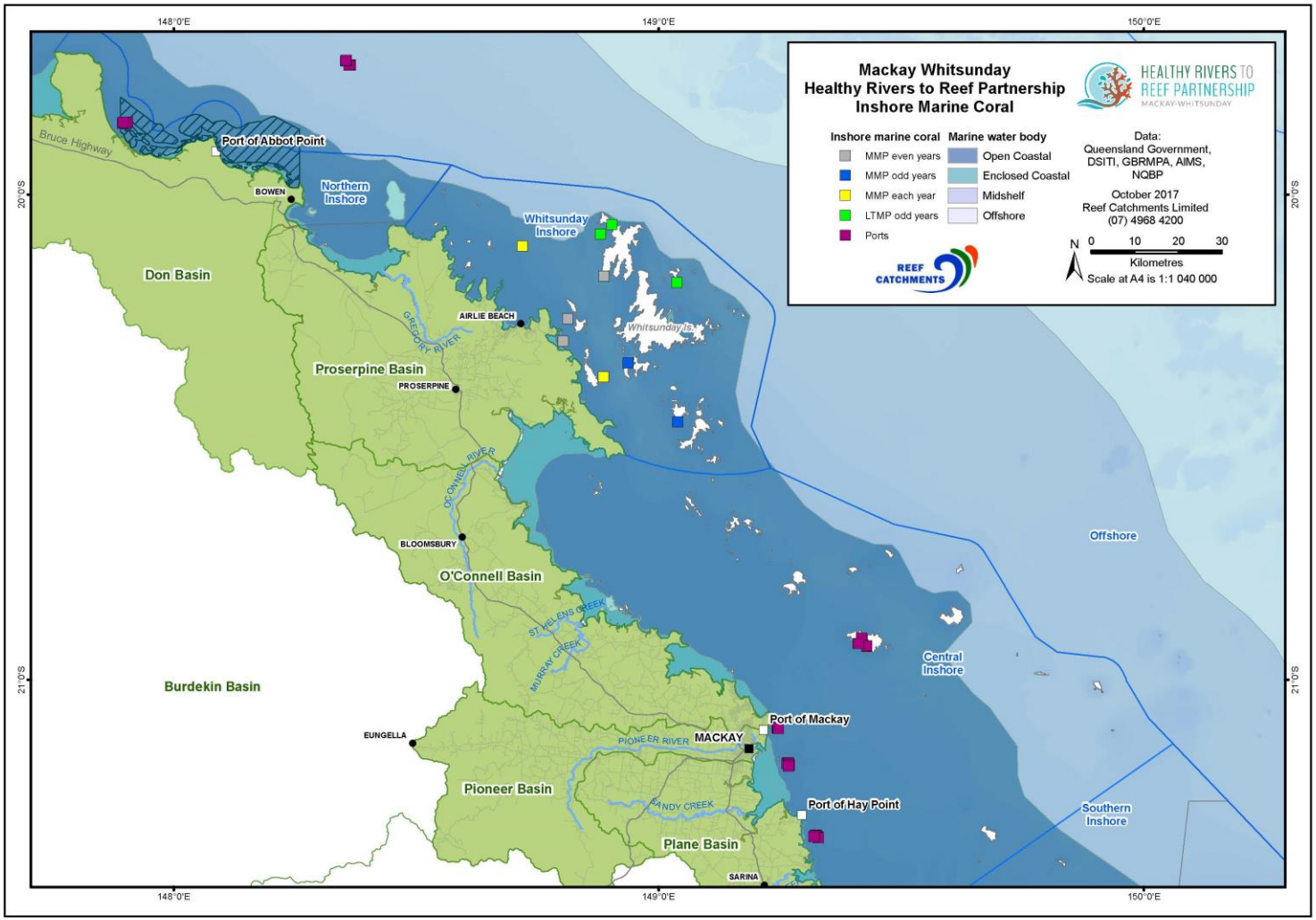

Figure AC 10. Inshore marine coral monitoring sites in the Mackay-Whitsunday Region for the 2017 report card.

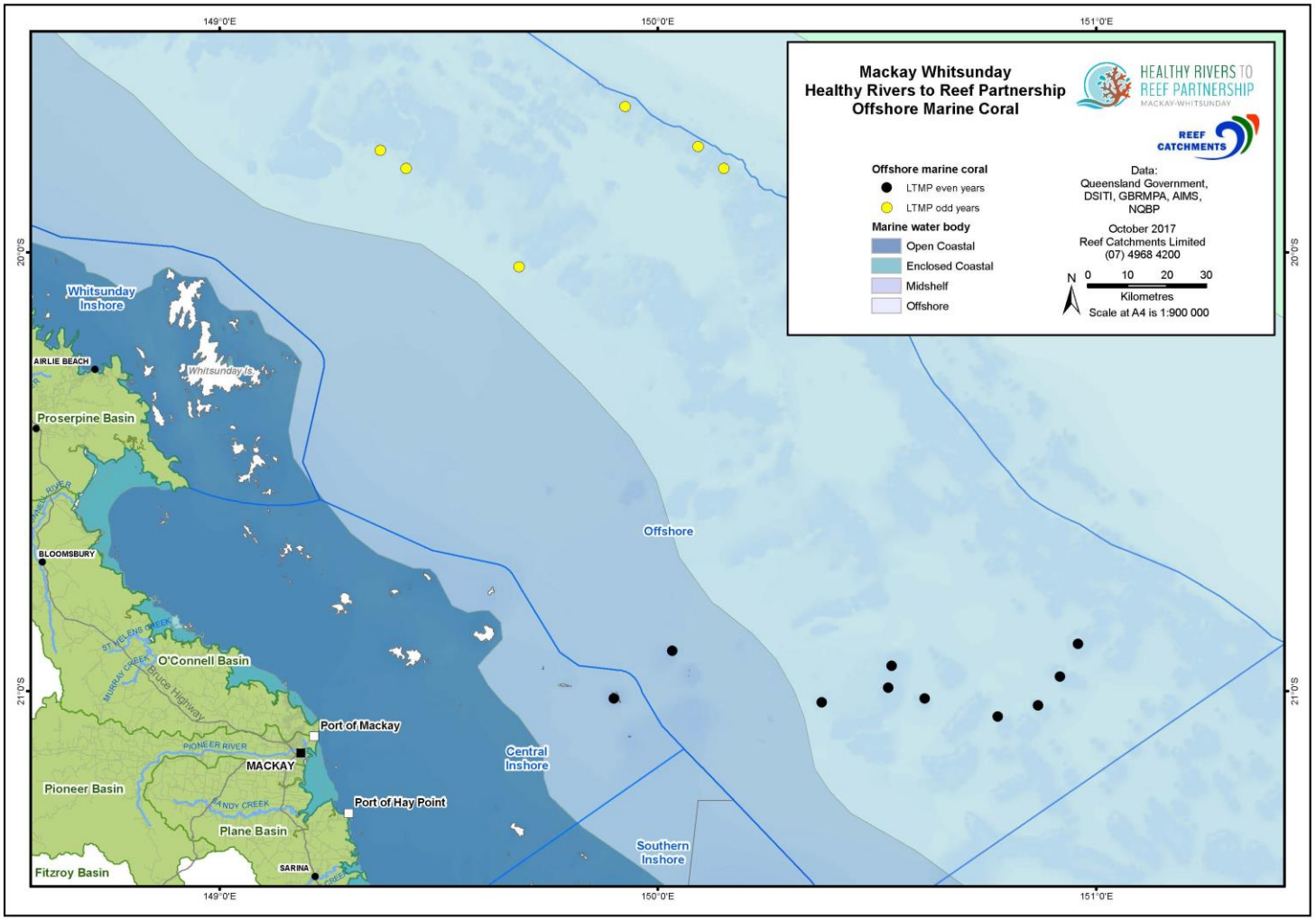

Figure AC 11. Offshore marine coral monitoring sites in the Mackay-Whitsunday Region for the 2017 report card.

Table AC 16. Results for seagrass indicators, based on 2016-17 data. Indicators are based on data collected from the Marine Monitoring Program (MMP) or the Queensland Ports Seagrass Monitoring Program (QPSMP) and black cells indicate an indicator does not contribute to a reporting zone. Seagrass Watch sites that contribute to the MMP are indicated (SW). NB site scores for QPSMP are determined from the lowest indicator score; for MMP site scores are an average of indicators.

Zone	Habitat	Depth	Location/Meadow	Meadow/ site	MMP			QPSMP				
					Abundance	Reproductive effort	Nutrient status	Biomass	Area	Sp. Composition	Overall site/meadow score	Overall zone score
Inshore Marine Northern	coastal	inshore	Abbot Pt.	API3				88	96	83	83	58
				API5				90	97	64	64	
				API7				74	93	90	74	
				API8				85	92	100	85	
				API9				96	91	100	91	
		deep		APD1				31		94	31	
				APD2				15		76	15	
				APD3				69		91	69	
				APD4				8		51	8	
Inshore Marine Whitsunday	reef	intertidal	Hydeaway Bay (**SW**)	HB1	50						50	29
				HB2	50						50	
			Hamilton Is.	HM1	0	0	0.2				0.1	
				HM2	0	0	18.5				6.2	
		subtidal	Tongue Bay	TO1	25						25	
				TO2	0						0	
	coastal	intertidal	Pioneer Bay (**SW**)	PI2	25						25	
				PI3	75						75	
Inshore Marine Central	coastal	intertidal	Midge Point	MP2	87.5	50	55.8				64.4	34
				MP3	62.5	0	53.3				38.6	
		subtidal	Newry Bay	NB1	100						100	
				NB2	0						0	
	estuarine	intertidal	Sarina Inlet	SI1	12.5	0	25.9				12.8	
				SI2	12.5	0	48.6				20.4	
	coastal	deep	Hay Point	HPD1				0.1		100	0.1	
Inshore Marine Southern												

Scoring range: ■ Very Poor = 0 to <21 | ■ Poor = 21 to <41 | ■ Moderate = 41 to <61 | ■ Good = 61 to <81 | ■ Very Good = 81 – 100 | ■ No score/data gap | ■ Not applicable

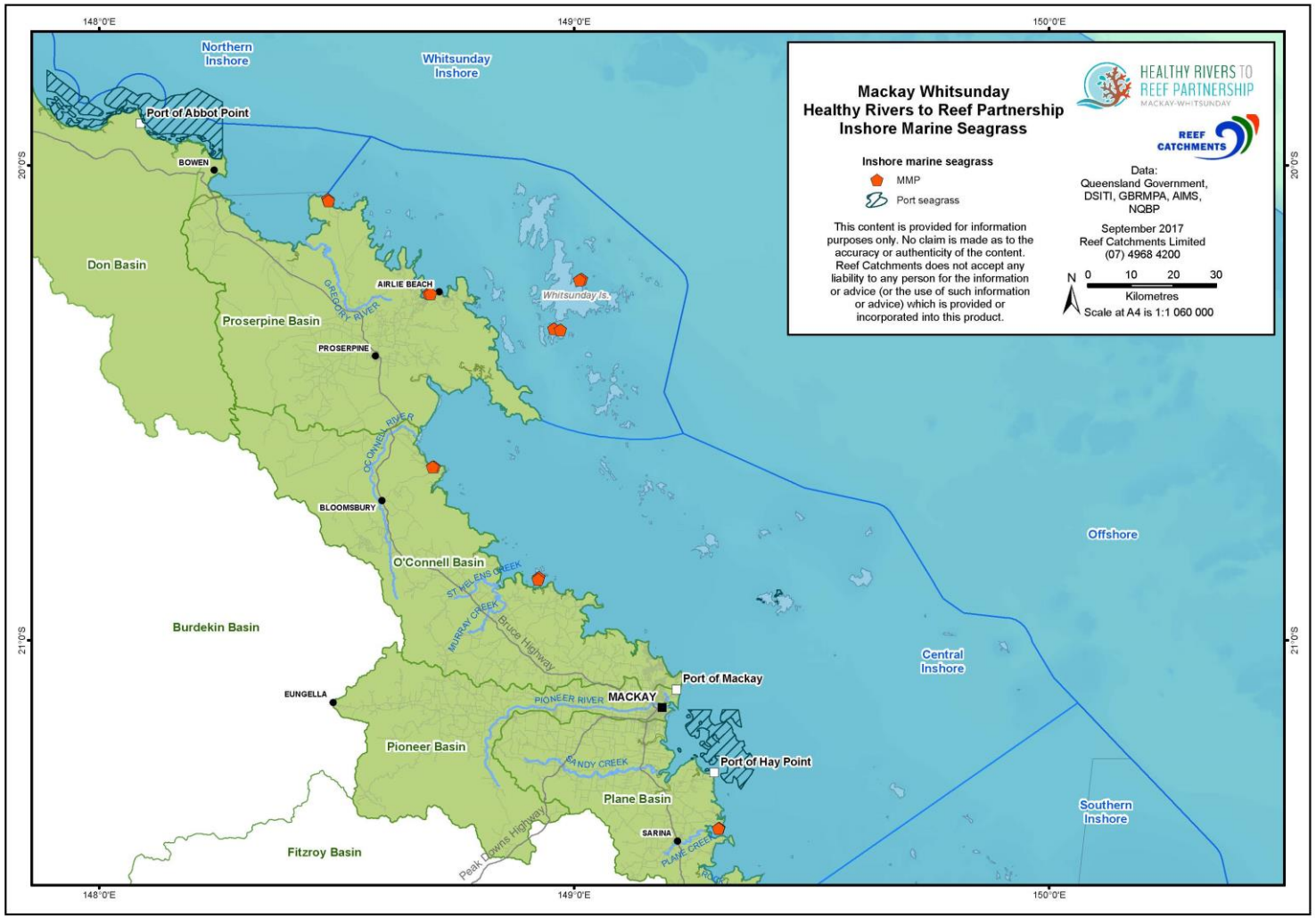

Figure AC 12. Inshore marine seagrass QPSMP and MMP monitoring sites in the Mackay-Whitsunday Region for the 2017 report card.