HEALTHY WATERS PARTNERSHIP
dry tropics

Townsville Dry Tropics
Waterways Report Card 2025

TECHNICAL REPORT

PART 5: Inshore Results

Reporting on data collected 2023 - 2024

JULY 2025 | Written by Adam Shand, Healthy Waters Partnership (HWP)

6 Inshore Marine Environment

Within the inshore environment, water quality and habitat are the two indices scored. Each of these indices are made up of indicator categories and indicators which are updated annually. All indicator categories use data provided by multiple partners of the Partnership team.

Index scores are calculated for the Cleveland Bay Inshore Marine Zone, and the Halifax Bay Inshore Marine Zone.

6.1 Water Quality

The water quality index for the Inshore Marine Environment of the Townsville Dry Tropics regions consists of three indicator categories: Nutrients, Physical-Chemical Properties, and Chlorophyll *a*. These are divided into eight indicators and for each indicator the parameters used to calculate scores are the:

- Water Quality Objectives (WQOs), and
- Annual means or medians (depending on the indicator), calculated from the monthly medians or means.

The Townsville Dry Tropics Methods Document (2025) provides definitions of the WQOs and guidelines for using mean or median values. Values can also be found in Appendix TT and Appendix VV.

The nutrients indicator category is comprised of four indicators, Nitrogen Oxides (NOx), Particulate Nitrogen (PN), Particulate Phosphorus (PP), and Total Phosphorus (TP). The scores for nutrients are averaged from the scores of the four indicators. The physical-chemical properties indicator category is comprised of three indicators, Turbidity, Total Suspended Solids (TSS), and Secchi Depth, and the score is calculated as the average from the scores of the three indicators. Finally, the Chlorophyll *a* indicator category is comprised of only one indicator, the Chlorophyll *a* indicator.

6.1.1 Monitoring Sites

In the 2023–2024 technical report, water quality data was collected from 20 sites (codes). Sites were grouped into eight geographic areas, six sub zones, and two zones as detailed in Table 59, with locations presented in Figure 17.

Table 1. Townsville Dry Tropics Inshore Marine water quality site summary.

Zone	Sub Zone	Geographic Area	Number of Sites
Cleveland Bay	Enclosed Coastal	Enclosed Coastal: Inside Port Zone	3
		Enclosed Coastal: Outside Port Zone	4
	Open Coastal	Open Coastal: Inside Port Zone	1
		Open Coastal: Outside Port Zone	3
	Magnetic Island	Magnetic Island	3
Halifax Bay	Enclosed Coastal	Enclosed Coastal	2
	Open Coastal	Open Coastal	2
	Midshelf	Midshelf	2

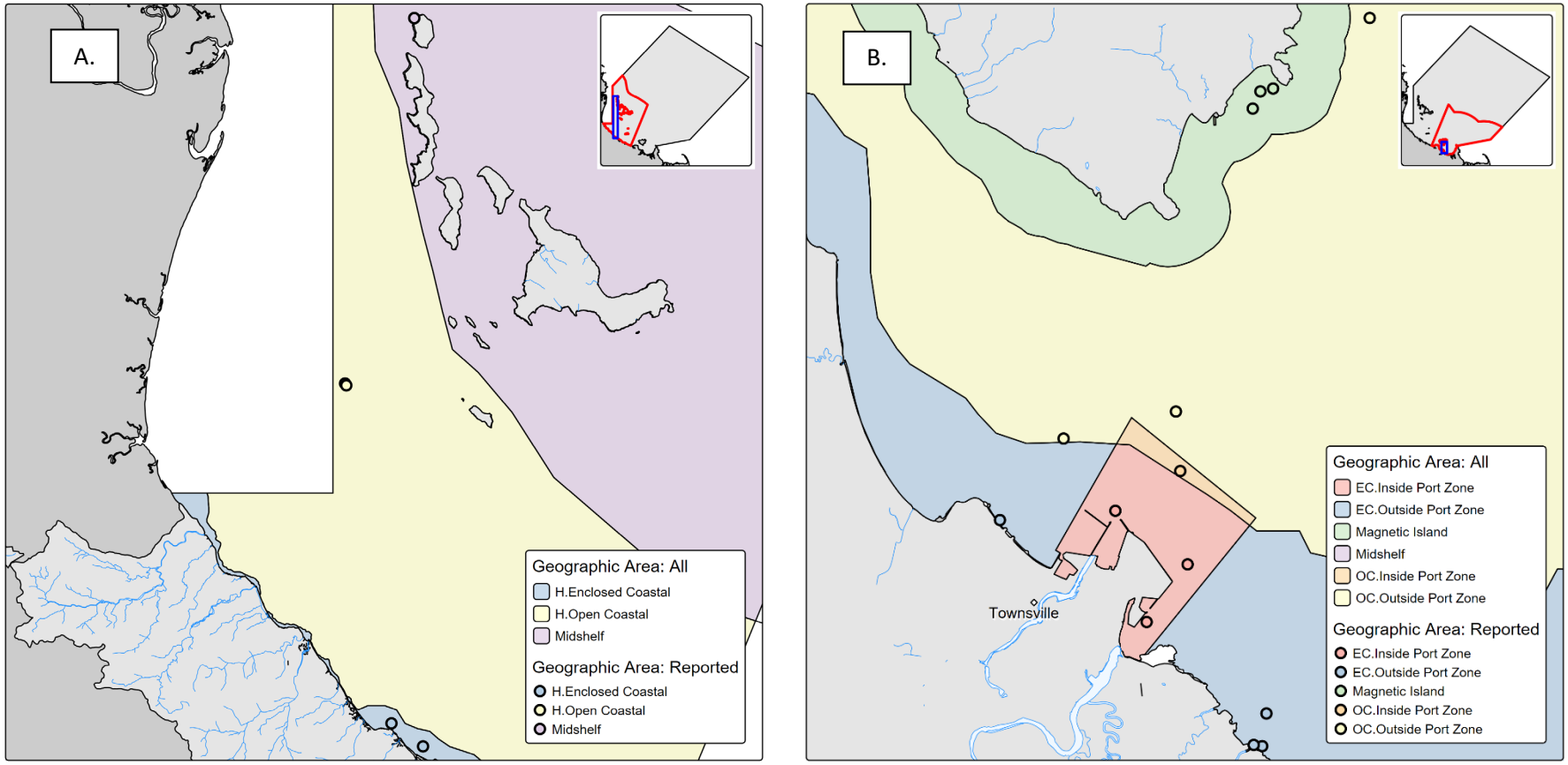

Figure 1. Inshore Marine Zones (A. = Halifax Bay, B. = Cleveland Bay), and Geographic Areas (see legend). In the inset map, the red boundary defines the extent of the inshore marine zone, the blue box defines the extent of the sampling sites.

6.1.2 Overall Summary: Inshore Water Quality

The water quality index was graded as “good” in both Cleveland Bay and in Halifax Bay. This marks an increase in score in Cleveland Bay (73 to 76) and a decrease in score in Halifax Bay (73 to 65) (Table 60, Table 61). In both Bays the Chlorophyll a indicator category declined an entire grade – the driving force for the overall decline in Halifax Bay. However, in Cleveland Bay this was offset by an increase in the Physical-Chemical Properties indicator category. Note; the inshore water quality index received a confidence grade of “low” (6.1.7 Confidence Scores).

Table 2. Current and previous water quality scores and grades for the Townsville Dry Tropics Inshore Marine Environment.

Zone	Nutrients	Phys-Chem Properties	Chlorophyll *a*	Water Quality					
				23-24	22-23	21–22	20–21	19–20	18–19
CB	87	69	72	76	73	78	73	79	36
HB	76	61	59	65	73	69	73	54	45

Standardised scoring range: ■ Very Poor (E) = 0 to <21 | ■ Poor (D) = 21 to <41 | ■ Moderate (C) = 41 to <61 | ■ Good (B) = 61 to <81 | ■ Very Good (A) = 81 – 100 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

Table 3. A comparison of nutrient and physical chemical properties indicator category scores, and the water quality index scores, for inshore sub zones between years.

Zone	Sub Zone	Nutrients					Phys-Chem					Chla					Water Quality				
		23-24	22-23	21-22	20-21	19-20	23-24	22-23	21-22	20-21	19-20	23-24	22-23	21-22	20-21	19-20	23-24	22-23	21-22	20-21	19-20
	CB.Enclosed Coastal	100	100	100	77	77	61	39	63	64	57	63	90	81	64	100	75	76	81	68	78
	CB.Open Coastal	100	100	100	100	100	72	36	72	74	82	ND	ND	ND	ND	ND	86	68	86	87	91
	Magnetic Island	38	22	20	26	16	79	91	79	80	85	80	84	83	83	80	66	66	61	63	60
Cleveland Bay		87	84	78	ND	ND	69	48	74	ND	ND	72	87	92	ND	ND	76	73	81	ND	ND
	HB.Enclosed Coastal	100	100	100	100	34	56	88	65	92	62	100	100	100	100	67	85	96	88	97	54
	HB.Open Coastal	61	65	64	49	28	49	60	49	55	67	40	61	75	69	69	50	62	62	58	54
	Midshelf	66	65	56	65	77	78	80	61	68	57	36	43	53	61	100	60	63	57	64	78
Halifax Bay		76	77	61	ND	ND	61	76	65	ND	ND	59	68	77	ND	ND	65	73	67	ND	ND

Standardised scoring range: Very Poor (E) = 0 to <21 | Poor (D) = 21 to <41 | Moderate (C) = 41 to <61 | Good (B) = 61 to <81 | Very Good (A) = 81 – 100 | ND = No Data | - = Not Applicable (data available but not usable) | X = Data was not updated this year.

6.1.2.1 *Key Messages*

- The Cleveland Bay inshore marine zone overall water quality grade remained “good” and the score increased from 73 to 76.
    - Grades for indicators with the nutrient indicator category continue to remain moderate to “very poor” within the Magnetic Island Sub Zone. These scores are the result of high concentrations of nutrients, stringent water quality objectives, and proximity to a range of anthropogenic activities.
    - Grades for Turbidity and TSS remained “very poor” in the Enclosed Coastal Outside Port Zone area. This location has had several years of low results and it is recommended that further investigation is conducted to determine the cause of the decline.
- The Halifax Bay inshore marine zone overall water quality grade remained “good” however declined from 73 to 65.
    - Most influential was the Chlorophyll a indicator in the Open Coastal and Midshelf Sub Zones.
    - Chlorophyll a decline from “good” (61) to “poor” (40) in the Open Coastal and Sub Zone and decline from “moderate” (43) to “poor” (36) in the Midshelf Sub Zone. Continued sampling is required to monitor for trends.

6.1.3 Nutrients

For the 2023–2024 technical report the nutrients indicator category is comprised of four indicators, Nitrogen Oxides (NOx), Particulate Nitrogen (PN), Particulate Phosphorus (PP), and Total Phosphorus (TP), however not all indicators are measured at each site (determined by data provider). The scores and grades for Cleveland and Halifax Bay, and their associated sub zones are presented in Table 62. Annual mean or median values (depending on the indicator), samples collected, months sampled, and WQOs are presented in Appendix TT. Historical scores are presented in Appendix UU.

6.1.3.1 *Results: Inshore Nutrients*

Cleveland Bay received a nutrient indicator category score of 87 (very good). Within the zone, the enclosed coastal and open coastal sub zones received nutrient indicator category grades of “very good” (100 each) while the Magnetic Island Sub Zone received a grade of “moderate” (38), with all three indicators in this sub zone (NOx, PN, and PP) graded as “moderate” or “very poor” (Table 62).

A lower nutrients indicator category score in the Magnetic Island Sub Zone relative to other sub zones could be attributed to a) environmental condition, and/or b) variations in sampling design.

Sampling design considerations include the use of more stringent water quality objectives (WQOs) due to its status as a green zone, the difference in sampling times and frequency of loggers compared to grab samples, or the minor variations in sampling programs and analysis methods conducted by the range of data providers (for example, LORs) (Appendix TT).

Equally, environmental condition considerations include nutrient sources such as septic systems, large infrastructure projects in close proximity, and a greater exposure to large southern influences such as the Burdekin River likely also contribute to a low grade and score.

A comparison of median values indicate that NOx concentrations were roughly equal to, or in some cases less than, the median values in other geographic areas (Appendix TT). Thus, it is possible to attribute differences in WQOs as the main driver of a low NOx score in the Magnetic Island Sub Zone

for the 2023-2024 report. However, it is important to note that over several reports, the Magnetic Island Sub Zone has consistently received low scores and grades, and not always due to more stringent WQOs. It is likely that the multitude of unique geographic and regulatory characteristics of the Magnetic Island Sub Zone, in combination, continue to result in a low NOx score.

Halifax Bay Inshore received a nutrient indicator category score of 65 (good). Within the zone, the open coastal and Midshelf sub zones received a nutrient indicator category grade of “good”, while the enclosed coastal sub zone received a grade of “very good” (Table 62).

Across all geographic areas the NOx indicator received a grade of “very good”, however no other indicator was measured at all geographic areas. Where measured, the PN indicator always received a grade of “poor”, while the PP indicator received a grade of “moderate” or “good”. The TP indicator was only measured at one geographic area (Enclosed Coastal), was graded as “very good”, and played a notable role in the final score for the Sub Zone.

Table 4. Standardised scores and grades for the nutrient indicator category and indicators comprising the nutrient indicator category in the Townsville Dry Tropics Inshore Marine Environment.

Zone	Sub Zone	Area	NOx	PN	PP	TP	Nutrients	Zone Nutrients
Cleveland Bay	Enclosed Coastal	Inside Port Zone	100	ND	ND	100	100	87
		Outside Port Zone	100	ND	ND	100	100	
			100	ND	ND	100	100	
	Open Coastal	Inside Port Zone	100	ND	ND	100	100	
		Outside Port Zone	100	ND	ND	100	100	
			100	ND	ND	100	100	
	Magnetic Island	Magnetic Island	57	15	41	ND	38	
			89	15	41	100	87	
Halifax Bay	Enclosed Coastal	Enclosed Coastal	100	ND	ND	100	100	76
	Open Coastal	Open Coastal	100	28	56	ND	61	
	Midshelf	Midshelf	85	35	79	ND	66	
			95	32	67	100	76	

Standardised scoring range: Very Poor (E) = 0 to <21 | Poor (D) = 21 to <41 | Moderate (C) = 41 to <61 | Good (B) = 61 to <81 | Very Good (A) = 81 – 100 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

6.1.4 Physical-Chemical Properties

For the 2023–2024 technical report the physical-chemical properties indicator category is comprised of three indicators, Turbidity (NTU), Total Suspended Solids (TSS), and (Secchi) Depth. The scores and grades for Cleveland and Halifax Bay, and their associated sub zones are presented in Table 63. Annual mean or median values (depending on the indicator and WQO), samples collected, months sampled, and WQOs are presented in Appendix VV. Historical scores are presented in Table 97.

6.1.4.1 *Results: Inshore Physical-Chemical Properties*

Cleveland Bay received a physical-chemical properties indicator category score of 69 (good). Within the zone, all three sub zones received a grade of "good" (Enclosed Coastal: 61, Open Coastal: 72, Magnetic Island: 79). Grades for indicators ranged from 0 to 84 for Turbidity, 3 to 100 for TSS, and 54 to 100 for Secchi, suggest a wide variability across the Bay (Table 63).

The wide variety in scores between, and within, three water-clarity related indicators of Turbidity, TSS and Secchi suggest a disconnected between the WQO's for these indicators and the ambient conditions at the sampling sites. (Appendix VV). Equally, spatial variations such as the proximity of sites relative to natural gradients related to distance from rivers, the coast and the port zone within each water body will contribute to variations in grades and scores measured against whole of water-body WQOs. For example, mean values for Secchi were similar in the Open Coastal Inside Port Zone and Open Coastal Outside Port Zone areas (1.2 and 1.1), with the Outside Port Zone having a greater Secchi value (more clarity) but differences in WQOs (i.e. the Inside Port Zone have objectives representative of a moderately disturbed environment) resulted in very different standardised scores (99 and 54) (Table 63, Appendix VV). Further, in the Enclosed Coastal Outside Port Sub Zone, the Secchi indicator did not record the same very low scores and grades as the Turbidity and TSS indicators for the same sub zone as there is only one location where Secchi depth is monitored (compared to the additional sites that measure Turbidity and TSS). The additional Turbidity and TSS sample sites are in close proximity to the mouth of Sandfly Creek where the bay is very shallow and muddy and can be subject to constant resuspension due to the tide and wind, particularly during and after events such as TC Kirrily, in addition to discharge from the Cleveland Bay Wastewater Treatment plant (Figure 17). Regardless of the influence, it should be noted that low scores for the Turbidity and TSS indicators in the Enclosed Coastal Outside Port Zone area have consistently occurred across multiple years of reporting.

Halifax Bay received a physical-chemical properties indicator category score of 61 (good). Within the zone, both the Enclosed Coastal and Open Coastal sub zone received a physical-chemical indicator category grade of "moderate", with the Midshelf sub zone receiving a grade of "good" (Table 63). For all indicators, scores showed a spatial correlation with improvements occurring in conjunction with distance offshore, with a comparison of concentrations at each site supporting this observation (Appendix VV).

Table 5. Standardised scores and grades for the physical-chemical properties indicator category and indicators comprising the physical-chemical properties indicator category in the Townsville Dry Tropics Inshore Marine Environment.

Zone	Sub Zone	Area	Turbidity	TSS	Secchi	Phys Chem	Zone Phys Chem
Cleveland Bay	Enclosed Coastal	Inside Port Zone	63	100	100	87	69
		Outside Port Zone	0	3	100	34	
			31	51	100	61	
	Open Coastal	Inside Port Zone	84	100	99	94	
		Outside Port Zone	0	95	54	50	
			42	97	77	72	
	Magnetic Island	Magnetic Island	67	98	73	79	
			43	79	85	69	
Halifax Bay	Enclosed Coastal	Enclosed Coastal	46	66	ND	56	61
	Open Coastal	Open Coastal	75	69	2	49	
	Midshelf	Midshelf	98	100	36	78	
			73	78	19	61	

Standardised scoring range: Very Poor (E) = 0 to <21 | Poor (D) = 21 to <41 | Moderate (C) = 41 to <61 | Good (B) = 61 to <81 | Very Good (A) = 81 – 100 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

6.1.5 Chlorophyll *a*

For the 2023–2024 technical report the scores and grades for the chlorophyll *a* indicator in Cleveland and Halifax Bays, and their associated sub zones are presented in Table 64. Annual mean values, samples collected, months sampled, and WQOs are presented in Appendix VV. Historical scores are presented in Table 97.

6.1.5.1 *Results: Inshore Chlorophyll a*

Cleveland Bay received a Chlorophyll *a* indicator category score of 72 (good), with both sub zones also receiving grades of "good" (Magnetic Island sub zone: 80, Enclosed Coastal Sub Zone: 63). The Open Coastal Sub Zone was not graded (Table 64). These grades declined from previous years' chlorophyll a grades of "very good" and potentially suggest the impact of a widespread environmental event such as TC Kirrily, however additional years of data would be required to confirm this assessment. Mean values were orders of magnitude greater in the Enclosed Coastal Sub Zone, however scores remained similar due water quality objectives (WQOs) which are designed to reflect the less stringent desired condition of the location (Appendix VV).

Halifax Bay received chlorophyll *a* score of 59 (moderate). The Enclosed Coastal Water Sub Zone receiving a score of 100 (very good), the Open Coastal Waters Sub Zone scored 40 (poor), and the Midshelf Sub Zone scored 36 (poor). Interestingly a spatial gradient is apparent in the annual mean concentration values of chlorophyll a, with concentration decreasing for the two sites further offshore (Open Coastal and Midshelf) (Appendix VV). However, similar to the Cleveland Bay WQOs which are designed to reflect the desired condition of the location indicate that chla concentration values should be even less in the Open Coastal Waters Sub Zone, which has more stringent requirements (Appendix VV, Table 97).

Table 6. Standardised scores and grades for the Chlorophyll a indicator in the Townsville Dry Tropics Inshore Marine Environment.

Zone	Sub Zone	Area	Chl *a*	Zone Chl *a*
Cleveland Bay	Enclosed Coastal	Inside Port Zone	ND	72
		Outside Port Zone	63	
			63	
	Open Coastal	Inside Port Zone	ND	
		Outside Port Zone	ND	
			ND	
	Magnetic Island	Magnetic Island	80	
			72	
Halifax Bay	Enclosed Coastal	Enclosed Coastal	100	59
	Open Coastal	Open Coastal	40	
	Midshelf	Midshelf	36	
			59	

Standardised scoring range: ■ Very Poor (E) = 0 to <21 | ■ Poor (D) = 21 to <41 | ■ Moderate (C) = 41 to <61 | ■ Good (B) = 61 to <81 | ■ Very Good (A) = 81 – 100 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

6.1.6 Overlap with the Wet Tropics Technical Report

The Townsville Dry Tropics reporting region shares four sites (BUR1, BUR2, Pandora, Pelorus) with the Wet Tropics reporting region (Appendix ZZ). Underlying data is identical, however differences in aggregation and reporting style may result in minor discrepancies in the presentation of results.

6.1.7 Confidence Scores

Overall, there was low confidence in the results due to limited spatial and temporal sampling for some indicators in both bays (Table 65). For example, within Cleveland Bay almost all sites are within an 11km section of water near the coastline, despite the Enclosed Coastal Waters stretching more than 58km. It is noted that there is less development in these other areas and thus current monitoring may capture most of the areas impacted by human activities. More sampling, both along the coast and further offshore, would enable a more accurate understanding of the water quality within the inshore area.

Further, variations in the sampling design and indicator selection between different data providers, as well as a range of limit of reporting values also reduce confidence in final scores.

Table 7. Confidence scores for the nutrients, physical-chemical properties, and Chlorophyll a indicator categories.

Indicator Category	Maturity (x0.36)	Validation (x0.71)	Representativeness (x2)	Directness (x0.71)	Measured error (x0.71)	Score (Rank)
Nutrients	2	3	1	3	1	7.6 (2)
Phys-Chem	2	3	1	3	1	7.6 (2)
Chlorophyll *a*	2	3	1	3	1	7.6 (2)

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

6.2 Habitat

The habitat index is comprised of two indicator categories: coral and seagrass, and both indicator categories source their results and discussion from reports published by partner organisations (Mckenna S., et al. 2025, Thompson, et al. 2025).

6.2.1 Overall Summary: Inshore Habitat

Overall habitat scores decreased in both bays (47 to 44 for Halifax, 53 to 37 for Cleveland), with the habitat grade decreasing from "moderate" to "poor" in Cleveland Bay. Both bays received their lowest scores since this technical report began, and these results highlight the ongoing and complex environmental and anthropogenic factors affecting coral and seagrass health including two acute disturbances over the 2023–24 summer. Most notably, marine heat wave conditions that caused coral bleaching and TC Kirrily that crossed the coast on 25th January 2024 causing minor storm damage (Table 66).

Table 8. Standardised score for the Inshore Marine Environment habitat index.

Zone	Coral	Seagrass	Habitat Index					
			23-24	22-23	21-22	20-21	19-20	18-19
Cleveland Bay	37	37	37	53	57	54	48	56
Halifax Bay	44	ND	44	47	45	49	52	52

Coral 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.

Seagrass Standardised scoring range: ■ = Very Poor: 0 to <25 | ■ = Poor: 25 to <50 | ■ = Moderate: 50 to <65 | ■ = Good: 65 to <85 | ■ = Very Good: 85 to 100 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

6.2.1.1 *Key Messages*

- The Cleveland Bay inshore marine zone grade declined from moderate to poor, and also showed a large score decrease (53 to 37).
    - The seagrass grade within Cleveland Bay declined from good to poor, while the score decreased from 68 to 37.
        - The biomass condition indicator was the primary driver of the decline scores. However, the area and composition condition indicators largely remain stable or increased for most meadows, indicating the potential for biomass recovery.
        - Biomass losses were driven primarily by system-wide induced pressures such as TC Kirrily, high winds, elevated wave heights and rainfall that resulted in extended periods of low light, potentially impacting seagrass. Realised impacts form environmental factors may take months to arrive and may linger for several months.
        - Concurrent and successive environmental conditions that are not favourable for seagrass growth and persistence, during and over multiple years are likely to have caused the seagrass condition loss recorded in the Townsville region.
    - The coral grade within Cleveland Bay remained "poor", however the score decreased slightly from 39 to 37. Scores and grades from coral in Cleveland Bay have fluctuated

within this range for the past four years due to exposure to several pressures including cyclones, and increased water temperatures leading to bleaching.
    - Low scores are primarily driven by the Juvenile and macroalgae indicators, suggesting limited coral recruitment and a high density of macroalgae competing for available space.
- The Halifax Bay inshore marine zone grade remained "moderate" although the score decreased slightly from 47 to 44.
    - The coral grade with Halifax Bay was 44 (moderate), the lowest score received in the past five years (by 1).
    - There remains a large amount of macroalgae recorded at three of six sites.

6.2.2 Coral

Coral data was primarily collected by the Great Barrier Reef Marine Monitoring Program (MMP)[1], and the Australian Institute of Marine Science's Long-term Monitoring Program (LTMP)[1]. Data was also collected by the citizen science group, Reef Check Australia (RCA)[1].

6.2.2.1 *Monitoring Sites*

Within Cleveland Bay six sites were sampled, with one site sampled twice by different monitoring programs (Geoffrey Bay). In Halifax Bay six sites were sampled, (Table 67). Reef locations are shown in Figure 19, noting that the Palms West Reef consists of two sites.

[1] MMP, LTMP, RCA

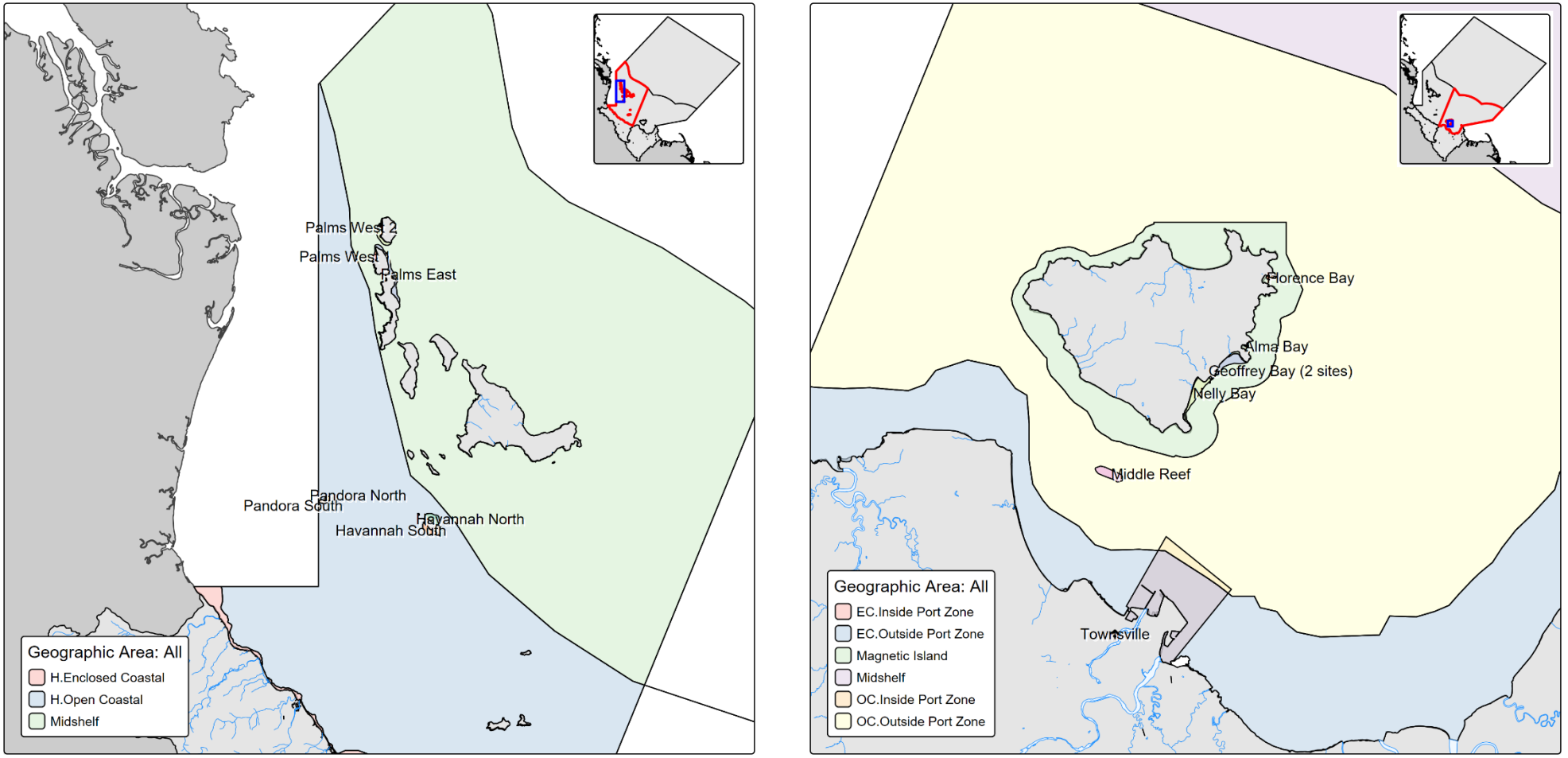

Figure 3. Coral reef sampling locations in the Halifax Bay and Cleveland Bay Inshore marine zones.

Table 9. Inshore Marine coral sampling locations and sampling programs.

Zone	Sampling Program	Sampling Site	ID
Cleveland Bay	MMP & RCA	Geoffrey Bay	1
	RCA	Alma Bay	2
		Florence Bay	3
		Middle Reef	4
		Nelly Bay	5
Halifax Bay	MMP	Palms East	6
		Palms West	7
		Pandora South	8
		Havannah South	9
	LTMP	Pandora North	10
		Havannah North	11

6.2.2.2 *Results: Inshore Coral*

In both bays scores decreased slightly however grades remained the same. In Cleveland Bay, the grade for the coral indicator category was “poor”, with a score of 37, while in Halifax Bay, the grade for the coral indicator category was “moderate” with a score of 44. Analysing these results across several years show a mixed trend of overall coral health decline and recovery as reefs have been exposed to pressures, such as increased water temperatures that contributed to coral bleaching in 2020. All indicators except Coral cover remain below the score for 2020 (Table 68).

Table 10. Inshore Marine Environment coral indicator category scores for current and previous technical reports.

Zone	Coral Standardised Score					
	23-24	22-23	21–22	20–21	19–20	18–19
Cleveland Bay	37	39	41	36	44	38
Halifax Bay	44	47	45	48	50	52

Standardised scoring range: ■ Very Poor (E) = 0 to <21 | ■ Poor (D) = 21 to <41 | ■ Moderate (C) = 41 to <61 | ■ Good (B) = 61 to <81 | ■ Very Good (A) = 81 – 100 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

Discussion has been paraphrased from the Marine Monitoring Program Annual Report for inshore coral reef monitoring 2023-24 report and applies to the Cleveland Bay and Halifax Bay sites collectively. Reference: (Thompson, et al. 2025).

Reefs in the Burdekin region were exposed to two acute disturbances over the 2023–24 summer:

- A marine heat wave caused coral bleaching adding to impacts of bleaching that occurred as a result of marine heat wave conditions in 2017, 2020 and to a lesser degree 2022 and,
- Cyclone Kirrily crossed the coast on 25th January 2024 causing minor storm damage.

The Coral cover indicator score remained categorised as “moderate” having declined slightly each year since 2024. Of the reefs monitored by the MMP in 2024, coral cover declined at Palms East, Lady Elliot and Magnetic.

The Cover change indicator score has been declining since 2019 but remains “moderate” in Halifax Bay, and “good” in Cleveland Bay. However, the rate of hard coral recovery was variable and scored “poor” at half of the reefs monitored.

The Juvenile coral indicator remained categorised as “poor”. Juvenile density increased at Havannah North while most other reefs remained close to densities observed in 2023.

The Macroalgae indicator was slightly improved from 2023 and remained categorised as “moderate” in Halifax Bay, and “very poor” in Cleveland Bay. The scores for this indicator varied drastically between reefs and depths ranging from “very poor” at Magnetic Island and 2m depths on reefs other than Palms East and Palms West where scores at both 2 m and 5 m depths were “very good”.

Table 11. Inshore Marine coral indicator and indicator category scores for all sites and zones.

Zone	ID	Hard Coral Composition	% Coral Cover	% Change Hard Coral	Juvenile Density	Macroalgae	Indicator Category
Cleveland Bay	1	50	43	65	25	0	36
	2	ND	54	ND	ND	ND	ND
	3	ND	62	ND	ND	ND	ND
	4	ND	49	ND	ND	ND	ND
	5	ND	40	ND	ND	ND	ND
Cleveland Bay		50	47	65	25	0	37
Halifax Bay	6	100	50	26	12	97	57
	7	0	47	54	35	100	47
	8	75	33	46	30	29	43
	9	100	56	33	29	1	44
	10	0	84	44	21	0	30
	11	50	32	50	78	0	42
Halifax Bay		54	50	42	34	38	44

Standardised scoring range: Very Poor (E) = 0 to <21 | Poor (D) = 21 to <41 | Moderate (C) = 41 to <61 | Good (B) = 61 to <81 | Very Good (A) = 81 – 100 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

6.2.3 Seagrass

Data for the seagrass indicator category was sourced from the Port of Townsville Long-Term Seagrass Monitoring Program (LTSMP), with monitoring conducted by James Cook University (JCU) (Mckenna S., et al. 2025). The 2023–2024 technical report uses data collected during September to October in 2023.

6.2.3.1 *Monitoring Sites*

Seagrass was only monitored in Cleveland Bay in 2023-2024. Across Cleveland Bay ten seagrass meadows are monitored in the LTSMP and divided into three spatially distinct groups: Magnetic Island, Cape Pallarenda/Strand, and Cleveland Bay (Table 70). Meadow locations are provided in Figure 20.

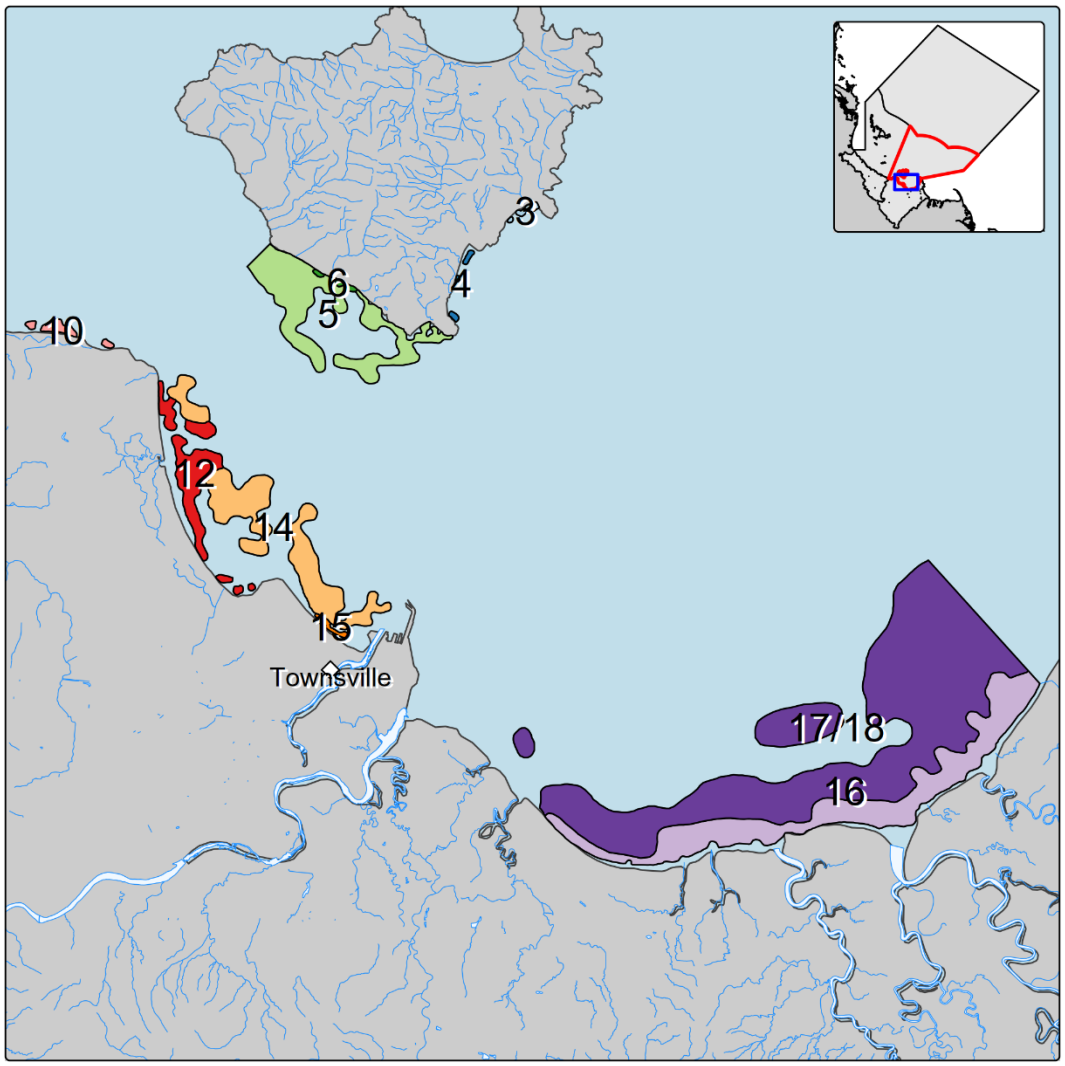

Figure 4. Seagrass meadow monitored for the LTSMP 2024 assessment.

Table 12. Overview of the Long-term Seagrass Monitoring Program (LTSMP) meadows. Adapted from (Mckenna S., et al. 2025).

Region	Meadow	ID	History
Magnetic Island	Geoffrey Bay	3	Detailed Annual >10 years
	Nelly Bay	4	Detailed Annual >10 years
	Cockle/Picnic Bay	5	Detailed Annual >10 years
	Cockle Bay	6	Detailed Annual >10 years
Cape Pallarenda – Strand	Shelly Beach	10	Detailed Annual >10 years
	Rowes Bay	12	Detailed Annual >10 years
	Pallarenda inc. Virago Shoal	14	Detailed Annual >10 years
	Strand	15	Detailed Annual >10 years
Cleveland Bay	Cleveland Bay	16	Detailed Annual >10 years
	Cleveland Bay	17/18	Detailed Annual >10 years

6.2.3.2 *Results: Inshore Seagrass*

In Cleveland Bay, the grade for seagrass monitoring meadows was poor with a score of 37. This is a large decrease in both score and grade from the previous reporting period (68, good) and all previous reporting periods (average grade of good). These results show a notable impact on overall seagrass health during the 2023-2024 reporting period (Table 71).

Table 13. Standardised score for the seagrass indicator category.

Zone	Seagrass Standardised Score					
	23-24	22-23	21-22	20-21	19-20	18-19
Cleveland Bay Inshore Marine Zone	37	68	73	71	52	74

Standardised scoring range: ■ = Very Poor: 0 to <25 | ■ = Poor: 25 to <50 | ■ = Moderate: 50 to <65 | ■ = Good: 65 to <85 | ■ = Very Good: 85 to 100| ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

Discussion has been paraphrased from the Port of Townsville Seagrass Monitoring Program 2024 report. Reference: (Mckenna S., et al. 2025).

"The seagrass condition category is comprised of three indicators: biomass, area, and species composition. Meadow scores are calculated as the lowest individual score of the three indicators, except when species composition is the lowest. When species composition is the lowest score the final meadow score is calculated as the average of the two lowest indicator scores" (Mckenna S., et al. 2025) (Carter, et al. 2025).

6.2.3.2.1 Magnetic Island Seagrass Meadows

Three of the four seagrass meadows measured in the Magnetic Island region received a grade of "very poor" in comparison to their long-term baseline due to the biomass condition indicator. Across the three seagrass condition indicators grades ranged from "very poor" to "very good" for Magnetic Island meadows. All meadows except one had a good-very good score for area and/or species composition.

Geoffrey Bay (meadow 3) seagrass biomass declined from "poor" to "very poor" and has become very sparse, with less than 5% cover. Nelly Bay (meadow 4) recorded its highest density in October 2023 however underwent a large decline by October 2024 to a "satisfactory" condition due to the loss of biomass 'hotspots'. Cockle Bay seagrass meadows (5 and 6) were both in "very poor" condition and declined in biomass. However, meadow 5 increased to the largest seagrass extent recorded in the Long-Term Seagrass Monitoring Program (LTSMP) for this meadow, with most gains occurring along the seaward edge. Much of this meadow expansion was by *Halophila ovalis* which has colonising traits (Kilminster, et al. 2015). A high number of dugong feeding trails were noted.

6.2.3.2.2 Cape Pallarenda – Strand Seagrass Meadows

The condition of meadows in Cape Pallarenda – Strand ranged from "very poor" to "very good". Meadow 10 has been on a downward trend for both the biomass and area condition indicators since 2017. A large amount of sediment scouring and sediment deposition has been noted by the LTSMP and MMP teams, and the seagrass that was present had rhizomes and roots exposed (scouring) or only had the rhizomes of the plant remaining. For meadows 12, 14, and 15, the condition of meadow 12 declined ("good" to "satisfactory"), meadow 14 remained the same (poor), and meadow 15 increased (from "good" to "very good").

6.2.3.2.3 Cleveland Bay Seagrass Meadows

The Cleveland Bay region of seagrass contains the largest continuous meadows across the entire Bay. The extent of the intertidal meadow 16 was in satisfactory condition while the subtidal meadow (17/18) was in good condition at the end of 2024. However, the density (biomass condition indicator) of meadow 16 is highly variable – fluctuating between peaks and troughs every three to four years. For example, meadow 16 has recently experienced a decline in meadow biomass at certain locations in the meadow, from 100 g DWm^2 in 2022, down to 9 g DWm^2 in 2024. The density of seagrass in meadow 17/18 remained satisfactory.

A timeseries map of meadow extent is available in (Appendix BBB).

Table 14. Seagrass indicator scores for all meadows in the Cleveland Bay Inshore Marine Environment.

Region	ID	Biomass	Area	Species Comp.	Meadow Score
Magnetic Island	3	5	85	77	5
	4	52	90	100	52
	5	24	100	95	24
	6	15	28	65	15
Cape Pallarenda – Strand	10	1	32	52	1
	12	60	95	78	60
	14	45	57	95	45
	15	85	99	99	85
Cleveland Bay	16	28	56	79	28
	17/18	50	73	96	50
Overall					37

Standardised scoring range: ■ = Very Poor Condition: 0 to <25 | ■ = Poor Condition: 25 to <50 | ■ = Satisfactory Condition: 50 to <65 | ■ = Good Condition: 65 to <85 | ■ = Very Good Condition: 85 to 100 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

6.2.4 Confidence Scores

There is very high confidence in the seagrass and coral indicator categories due to the efficacy and maturity of the habitat monitoring programs. Seagrass received a rank of 5 out of 5, and coral received a rank of 3, and 4 (Cleveland Bay was not as well represented as Halifax Bay) (Table 73).

Table 15. Confidence scores for the coral and seagrass indicator categories.

Indicator Category	Maturity (x0.36)	Validation (x0.71)	Representativeness (x2)	Directness (x0.71)	Measured error (x0.71)	Score (Rank)
Coral (CB)	3	3	1.5	3	2	9.8 (3)
Coral (HB)	3	3	2	3	2	10.8 (4)
Seagrass	3	3	3	3	3	13.5 (5)

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