dry tropics partnership for healthy waters

Dry Tropics Partnership for Healthy Waters
Waterways Report Card 2023

TECHNICAL REPORT

PART 1: Executive Summary

Reporting on data collected 2021 - 2022

1 General

1.1 Authorship Statement

This technical report presents the results of the Townsville Dry Tropics 2021–2022 Report Card (released in 2023) and was prepared by the Partnership's Senior Technical Officer (STO), Dinny Taylor, and the Partnership's Technical Officer (TO), Adam Shand. Significant support and review were received from the Regional Report Cards Technical Working Group (TWG) members, and the Wet Tropics and Mackay-Whitsunday-Isaac regional Report Cards. This report is endorsed by the Dry Tropics Partnership for Healthy Waters.

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1.2 Current Townsville Dry Tropics TWG Members and their Respective Organisations

Table 1. Current DTPHW TWG members and respective organizations.

Member	Organisation
Diane Tarte	TWG: Chair (Independent)
Dinny Taylor	DTPHW: STO
Adam Shand	DTPHW: TO
Richard Hunt	Wet Tropics Partnership
Brie Sherow	Mack-Whitsunday-Isaac Partnership
Lyndon Llewellyn	Australian Institute of Marine Science (AIMS)
Angus Thompson	AIMS
Glynis Orr	Department of Environment and Science (DES)
Carl Mitchell	DES
Jamie Corfield	DES
David Moffatt	DES
Andrew Moss	DES
Michael Newham	DES
Michael Rasheed	James Cook University (JCU)
Stephen Lewis	JCU
Paula Cartwright	JCU
Elaine Glen	Port of Townsville (POTL)
Adam King	Townsville City Council (TCC)

1.3 Acknowledgements

We thank partners who kindly contributed their data, members of the Townsville Dry Tropics Management Committee, and members of the Technical Working Group (TWG) who provided feedback on the document. Members include Townsville City Council (Townsville Water & Waste), Port of Townsville, Australian Institute of Marine Science, Department of Environment and Science, Queensland Herbarium (through the Department of Environment and Science), James Cook

University (TropWater), and Ornatas. Creative Commons (Receiving Environment Monitoring Program, Sewage Treatment Plant data) by Townsville City Council is licensed under CC BY 4.0/Adapted Material. Members of the Reef Independent Science Panel are also acknowledged for their advice and review of the document.

2 Executive Summary

This executive summary includes three summary sections covering:

- The Dry Tropics Partnership,
- Environmental Stressors in the Dry Tropics region during 2021–2022,
- The state and condition of the environment, including scores and grades for each index for each environment (Freshwater, Estuarine, Inshore Marine, and Offshore Marine), and site-specific scores and grades for litter.

2.1 The Dry Tropics Partnership

The Dry Tropics partnership for Healthy Waters (referred to as the Partnership) was formed in November 2018 and launched in January 2019. The current geographic scope of the Partnership covers the waterways and environment in the Dry Tropics region. On land, the Partnership region extends from the Crystal Creek catchment in the north, to the Ross River (upper) and Alligator Creek catchments in the south. In the water, the region extends from the coastline to the outer edge of the Great Barrier Reef (GBR) Marine Park. The reporting region for the partnership incorporates all islands within this area, including Magnetic Island and the Palm Island group.

The Dry Tropics reporting region is divided into seven unique zones based on the waterway type (freshwater, estuarine, inshore marine, and offshore marine), and riverine basin (Black and Ross) (Table 2, Figure 1). If required, zones are divided into sub-zones (or catchments) based on the prevailing sub-water type, and catchment. For further information on the methodology of constructing the Dry Tropics reporting region refer to “Methods for Townsville Dry Tropics 2021–2022 Report Card (released in 2023)”.

Table 2. The seven reporting zones in the Dry Tropics region.

Zone	Waterway
Ross Freshwater Basin	Freshwater
Black Freshwater Basin	Freshwater
Ross Estuarine Basin	Estuarine
Black Estuarine Basin	Estuarine
Cleveland Bay	Inshore Marine
Halifax Bay	Inshore Marine
Offshore Marine	Offshore Marine

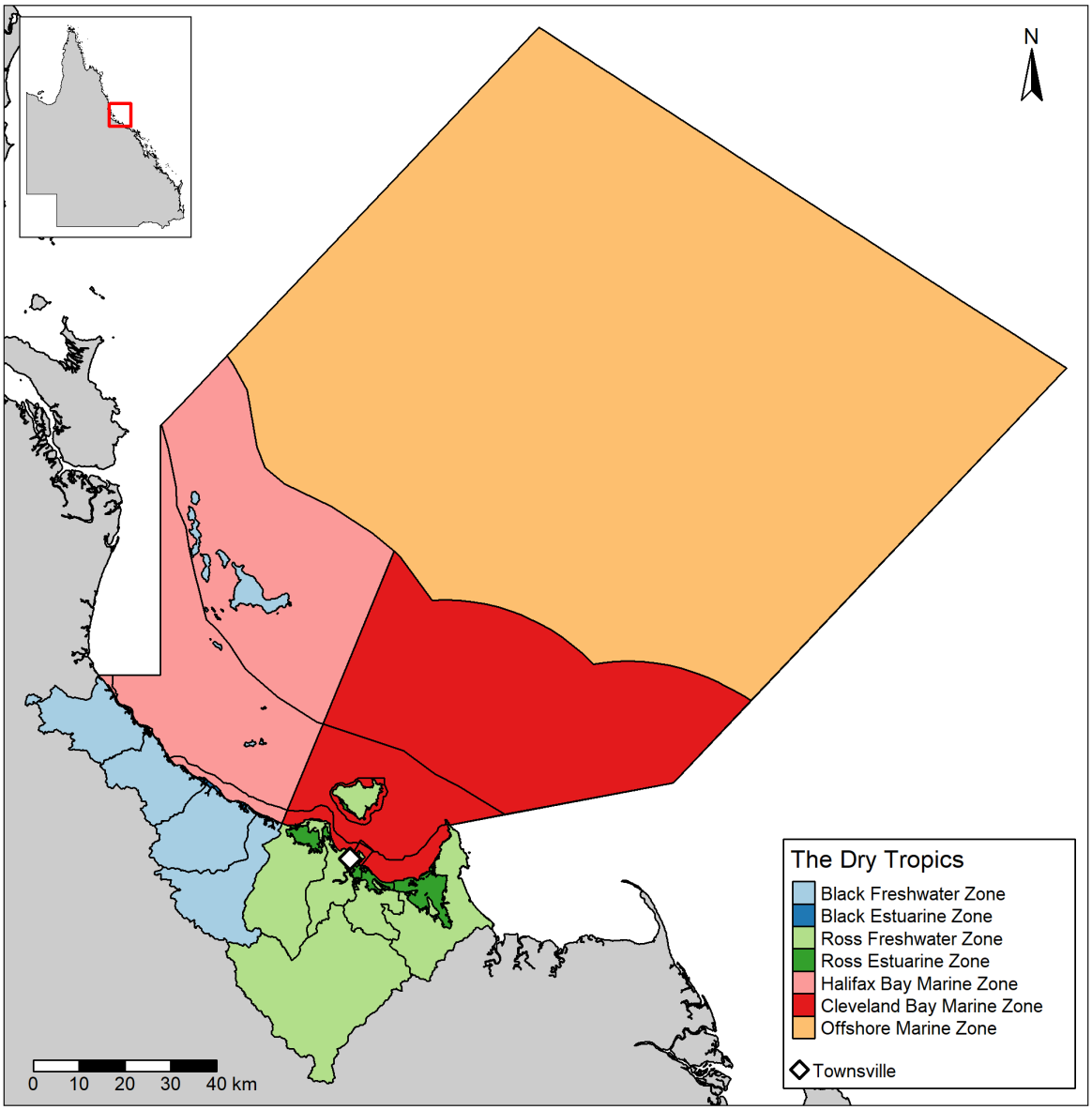

*Figure 1. Geographic boundary of the DTPHW reporting region, divided into seven zones (**Table 2**).*

In May 2019 the Partnership released its pilot annual Report Card, reporting and summarising data from the 2017–2018 financial year. In June 2020, the Partnership began releasing annual Report Cards for the proceeding financial year, and in June 2021, the Partnership also began releasing annual Management Response Reports, highlighting the management actions of partners (Table 3).

Table 3. Timeline of key DTPHW publications.

Released:	**2023**	**2022**	**2021**	**2020**	**2019**
Reporting period:	**2021–2022**	**2020–2021**	**2019–2020**	**2018–2019**	**2017–2018**
Report Card	✓ (current)	✓	✓	✓	✓ (pilot)
Stewardship Report	✓ (current)	✓	✓		

This document is a detailed technical report that provides context and insight into the annual Report Card. It is intended to be read in conjunction with the "Townsville Dry Tropics Program Design" and "Methods for Townsville Dry Tropics 2021–2022 Report Card (released in 2023)".

2.2 Climate and Land Use in the Dry Tropics Region

During 2021–2022, the Dry Tropics region recorded a wide range of weather events. There were no major flooding events, tropical cyclones, or changes to the prevailing La Niña conditions (Bureau of Meteorology 2022, Climate Council 2021). However, multiple heatwaves were experienced, both extremely high and low monthly rainfall figures were recorded, annual average seawater temperature was above average, and the risk of coral bleaching was above average (Bureau of Meterology 2023, NOAA 2023). Key influences are summarised below.

- Total rainfall was 1166mm in the Ross Basin, and 1383mm in the Black Basin. Annual rainfall in both basins was classified as "average", although slightly exceeding the long-term mean. Monthly rainfall ranged from "very much below average" to the "highest 1%" on record.
- Annual air temperature averaged 25.4°C in the Ross Basin, and 24.9°C in the Black Basin and exceeded the long-term annual mean in both basins. The monthly average air temperature across both basins was equal to or greater than average for every month of the year.
- The annual average sea surface temperature was 27.1°C and exceeded the long-term mean. Monthly average sea surface temperature was "very much above average" or the "highest 1%" on record for ten months of the year.
- The risk of coral bleaching ranged from "possible" to "highly likely".
- From 2016–2021 intensive land use increased by 6.19km^2, conservation and natural environment land use increased by 4.85km^2, and production from natural environments land use decreased by 22.6km^2.

2.3 State and Condition of the Environment

The results presented in this document describe the state and condition of the waterways and environment in the seven reporting zones of the Dry Tropics region (Figure 1, Table 2). Within each zone standardised scores and grades are produced for environmental indicators, indicator categories, and indices. Results from multiple indicators are aggregated into results for indicator categories, which are aggregated into results for indices (see Page 3). Indicators, and thus the indices reported for each zone vary (Table 4). Confidence levels based on how the data were collected and analysed are also reported.

Table 4. Indices measured in each zone of the Dry Tropics region.

Zone	Water Quality (WQ)	Latest update	Habitat and Hydrology (HH)	Latest update	Fish (F)	Latest update
Black Freshwater	✓	21–22	✓	19–20	✓	19–20
Black Estuarine	✓	21–22	✓ (Only Habitat)	21–22		
Halifax Bay	✓	21–22	✓ (Only Habitat)	21–22		
Ross Freshwater	✓	21–22	✓	19–20	✓	19–20
Ross Estuarine	✓	21–22	✓ (Only Habitat)	21–22		
Cleveland Bay	✓	21–22	✓ (Only Habitat)	21–22		
Offshore Marine	✓	19–20	✓ (Only Habitat)	21–22		

The index and standardised scores of each zone for the 2021–2022 reporting period are presented below for quick reference. Selected key messages for results of particular interest are provided and refer to indicators which are presented in detail within the results sections.

2.3.1 Freshwater Environment

Table 5. Comparison of 2021–2022 weighted scores for Water Quality (WQ), Habitat and Hydrology (HH), and Fish (F) indices in the Ross Freshwater Basin and the Black Freshwater Basin against previous years.

Zone	2021–2022			2020–2021			2019–2020			2018–2019		
	WQ	HH[1]	F[2]	WQ	HH	F	WQ	HH	F	WQ	HH	F
Ross	70 (B)	51 (C)	57 (C)	73 (B)	51 (C)	57 (C)	70 (B)	51 (C)	57 (C)	66 (B)	51 (C)	ND
Black	68 (B)	71 (B)	78 (B)	68 (B)	71 (B)	78 (B)	67 (B)	71 (B)	78 (B)	62 (B)	71 (B)	ND

■ 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 indicates no data available.

2.3.1.1 *Key Messages*

2.3.1.1.1 Water Quality

- The Ross Freshwater Basin saw a decrease in score from 73 to 70 within the same grade of 'good' with the decline associated with a decrease in the score for TP in Ross Lake and a decrease in the score for DIN in the Bohle River.
- The Black Freshwater Basin score and grade have remained stable across the reporting years.
- The Bohle River TP scores remain 'very poor' and the DIN scores have decreased with the grade decreased from 'moderate' to 'poor' compared with 2020–2021.
- There was an increase in the number of watercourses with 'very poor' or 'poor' scores associated with low dissolved oxygen % saturation in both the Ross and Black basins in the 2021–2022 year.

2.3.1.1.2 Habitat and Hydrology

- There have been no changes to the habitat and hydrology index scores for the 2021–2022 technical report.
    - The method of aggregation was updated for the 2021–2022 report. Historic scores have been back calculated (Appendix U).
    - The area assessed for the wetland extent indicator was updated for the 2021–2022 report. Historic scores have been back calculated (Appendix T).

2.3.1.1.3 Fish

- As no new data has been recorded there has been no change to the fish index scores for the 2021–2022 technical report.

[1] Habitat and Hydrology data is collected every four years. Latest update: 2022. Next update: 2026.

[2] Fish data is collected every three years. Latest update: 2020. Next update: 2023.

- Scores and grades are based on 2019–2020 data and may not be representative of 2021–2022 condition.

2.3.2 Estuarine Environment

Table 6. Comparison of 2021–2022 weighted scores for Water Quality and Habitat indices in the Ross Estuarine Basin and Black Estuarine Basin against previous years.

Basin	2021–2022		2020–2021		2019–2020		2018–2019	
	WQ	H[3]	WQ	H	WQ	H	WQ	H
Ross	83 (A)	73 (B)	88 (A)	73 (B)	88 (A)	73 (B)	39 (D)	73 (B)
Black	64 (B)	71 (B)	66 (B)	71 (B)	47 (C)	71 (B)	52 (C)	71 (B)

■ 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 indicates no data available.

2.3.2.1 *Key Messages*

2.3.2.1.1 Water Quality

- There was no change to the water quality index grade (although the Ross Estuarine Basin score decreased from 88 to 83 and Black Estuarine Basin score decreased from 66 to 64).
    - 9 of 13 watercourses received a grade of “good” or “very good” for both nutrients and physical-chemical properties indicator categories.
    - The Camp Oven Creek and Crystal Creek watercourses exhibited unusually low Turbidity scores and should be closely monitored moving forward.
    - Althaus Creek shows ongoing issues with turbidity, and further investigation is required to isolate specific drivers.
    - Louisa Creek shows ongoing issues with Low DO and TP and further investigation is required to isolate specific drivers.

2.3.2.1.2 Habitat

- The grade and score for the habitat index did not change in either the Ross Estuarine Basin or Black Estuarine Basin.
    - Across both habitat indicator categories vegetation loss was minimal, with a maximum loss of 0.09%. This amount of loss is within the margin of error of the method.

[3] Only Habitat data is collected. Data collected every four years. Latest update: 2022. Next update: 2026.

2.3.3 Inshore Marine Environment

Table 7. Comparison of 2021–2022 weighted scores for Water Quality and Habitat in Cleveland Bay and Halifax Bay against previous years.

Zone	2021–2022		2020–2021		2019–2020		2018–2019	
	WQ	H	WQ	H	WQ	H	WQ	H
Cleveland Bay	81 (A)	57 (C)	81 (A)	54 (C)	81 (A)	48 (C)	36 (D)	56 (C)
Halifax Bay	67 (B)	45 (C)	70 (B)	49 (C)	60 (C)	52 (C)	45 (C)	52 (C)

■ 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 indicates no data available.

2.3.3.1 *Key Messages*

2.3.3.1.1 Water Quality

- There has been no change in water quality grade since the previous report card (although the score for Halifax Bay decreased from 70 to 67).
    - All indicator categories have a grade of “good” or “very good”.
    - The inclusion of additional indicators (TP and FRP) would create a net gain in scores across both zones.
- Other than during the 2018–2019 reporting period that included a major flood event, the WQ scores for Cleveland Bay has consistently been 81 and Halifax Bay has improved to 67–70.

2.3.3.1.2 Habitat

- Habitat scores are improving from post flood (2019) conditions.
- Habitat in Cleveland Bay received its highest score in the past four years of 57 due to the recovery of seagrass.
- Habitat (coral) in Halifax Bay has received its lowest score in the past four years of 45.
    - Seagrass in Cleveland Bay has almost recovered to pre–2019 conditions.
    - Coral in Cleveland Bay has fluctuated between moderate and poor for the past four years.
    - There remains a significant amount of macroalgae recorded at four of six sites.

2.3.4 Offshore Marine Environment

Table 8. Comparison of 2021–2022 weighted scores for Habitat in the Offshore Marine Environment against previous years.

Zone	2021–2022		2020–2021		2019–2020		2018–2019	
	WQ	Habitat	WQ	Habitat	WQ	Habitat	WQ	Habitat
Offshore marine	NA	64 (B)	NA	62 (B)	100 (A)	56 (C)	97 (A)	59 (C)

■ 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. NA indicates no data available.

2.3.4.1 *Key Messages*

2.3.4.1.1 Water Quality

- No data was available for the 2021–2022 Dry Tropics Technical Report and water quality was not assessed.

2.3.4.1.2 Habitat

- The habitat index received its highest score in the past four years of 64.
    - Coral continues to recover from poor conditions in the previous reporting periods.
    - Juvenile density was graded as very good at 8 of 9 reefs surveyed.
    - All coral reefs had an overall grade of moderate or good.

2.3.5 Litter

Litter is a recently developed metric and was first included in the 2019–2020 report card. The methodology has been updated from the initial year of data collection, and data collected from new sites. Data from the previous years has been updated using the new method. Zone scores are not comparable as the Sites litter is collected from each year in each Zone varies, thus only site-specific scores and grades are presented (Table 9).

Table 9. Comparison of 2021–2022 standardised scores and grades for Litter in the Dry Tropics region against previous years.

Zone	Site	Scores and Grades		
		2019–2020	2020–2021	2021–2022
Halifax Bay	North West Beach, Pelorus Island	88 (VLP)	NA	NA
	West Beach, Pelorus Island	75 (LP)	NA	NA
	North Beach, Orpheus Island	5 (VHP)	NA	NA
	Big Rock Bay, Orpheus Island	24 (HP)	9 (VHP)	11 (VHP)
	Fig Tree Beach, Orpheus Island	NA	19 (VHP)	21 (HP)
	Picnic Bay, Orpheus Island	1 (VHP)	14 (VHP)	3 (VHP)
	Boulder Beach North, Orpheus Island	NA	NA	16 (VHP)
	Yanks Jetty, Orpheus Island	69 (LP)	80 (VLP)	NA
	Boulder Beach, Orpheus Island	NA	NA	2 (VHP)
	South Beach, Orpheus Island	42 (MP)	NA	11 (VHP)
	Fantome Island, Northern End	NA	14 (VHP)	36 (HP)
	Ollera Beach	40 (MP)	NA	NA
	Rollingstone Beach	50 (MP)	NA	NA
	Toomulla Beach	52 (MP)	NA	NA
	Toomulla main beach	NA	NA	78 (LP)
	Saunders Beach	66 (LP)	NA	NA
	Bushland Beach, Townsville	NA	65 (LP)	NA
Cleveland Bay	Myrmidon Reef	NA	95 (VLP)	NA
	Horseshoe Bay, Magnetic Island	NA	NA	34 (HP)
	Arthur Bay, Magnetic Island	NA	43 (MP)	NA
	Alma Bay, Magnetic Island	46 (MP)	61 (LP)	68 (LP)
	Alma Bay, Magnetic Island UW	93 (VLP)	96 (VLP)	NA
	Geoffrey Bay, Magnetic Island	NA	77 (LP)	NA
	Geoffrey Bay Reef, Magnetic Island UW	88 (VLP)	NA	NA
	Nelly Bay Beach, Magnetic Island	52 (MP)	73 (LP)	69 (LP)
	Nelly Bay, Magnetic Island UW	99 (VLP)	98 (VLP)	97 (VLP)
	Shelly Beach, Pallarenda	61 (LP)	31 (HP)	NA
	Shelly Cove, Cape Pallarenda Conservation Park	65 (LP)	68 (LP)	87 (VLP)
	Pallarenda Beach	NA	NA	69 (LP)
	Kissing Point, Townsville	NA	75 (LP)	NA
	Rowes Bay	71 (LP)	72 (LP)	83 (VLP)
	Strand Park, Townsville	60 (LP)	71 (LP)	NA
	Strand Waterpark Beach	NA	81 (VLP)	NA
Ross	Three Mile Creek, Pallarenda	NA	36 (HP)	NA
	Strand Rock Pool, Townsville	NA	46 (MP)	NA
	Queensland Country Bank Stadium	NA	25 (HP)	22 (HP)
	Ross Creek, Townsville	NA	NA	45 (MP)
	South Townsville Recreational Boat Park	NA	33 (HP)	NA
	Anderson Park, Townsville	NA	NA	87 (VLP)
	Sherriff Park Townsville	NA	NA	69 (LP)
	Aplins Weir Rotary Park	41 (MP)	35 (HP)	66 (LP)
	Apex Park, Condon	NA	NA	60 (LP)

■ Very High Pressure (VHP) = 0 to <20 | ■ High Pressure (HP) = 20 to <40 | ■ Moderate Pressure (MP) = 40 to <60 | ■ Low Pressure (LP) = 60 to <80 | ■ Slight Pressure (SP) = 80 to 100. ND indicates no data available.

2.3.5.1 *Key Messages*

- The east coast of Orpheus Island continues to have the highest litter pressure in the region.
- The northern beaches of Townsville have had low litter pressure on the occasion's collections have occurred there.
- Queensland Country Bank Stadium (high pressure) during events continues to have the highest litter pressure in the Ross litter zone, whilst Ross Creek has moderate pressure.
- Horseshoe Bay has the highest litter pressure on Magnetic Island.

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4 Glossary of Terms

Table 10. Glossary of terms used in the DTPHW Technical Report.

AIMS	Australian Institute of Marine Science.
Alien species	Species that are not native to any part of Australia.
Artificial barriers	Any barrier that prevents or delays connectivity between key habitats. Potentially impacting migratory fish populations, reducing diversity of aquatic species and the condition of aquatic ecosystems (Moore 2016).
Basin	Area of land where surface water runs to smaller creeks or rivers discharging into a common point, may include many sub-basins or sub-catchments.
BOM	Bureau of Meteorology.
Catchment area	Area of land from which rainfall flows into a river, lake or reservoir and discharges into a common point.
Chlorophyll-*a*	An indicator of phytoplankton biomass, widely considered a useful proxy of nutrient availability and system productivity.
Climate	Refers to both natural climate variability and climate change.
CVA	Conservation Volunteers Australia.
DES	Department of Environment and Science of the Queensland Government.
DHW	An accumulated measurement of sea surface temperature (SST) that assesses the instantaneous bleaching heat stress during the prior 12-week period. (Significant coral bleaching usually occurs when the DHW value reaches 4 °C-weeks. By the time the DHW value reaches 8 °C-weeks, severe, widespread bleaching and significant mortality are likely).
DIN	Dissolved Inorganic Nitrogen. Comprised of nitrate, nitrite, and ammonium.
DO	Dissolved Oxygen.
DTPHW	Dry Tropics Partnership for Healthy Waters.
Ecosystem	A dynamic complex of plant, animal and microorganism communities and their non-living environment interacting as a functional unit.
Ecosystem Health	An ecological system is healthy and free from 'distress syndrome' if it is stable and sustainable. That is, if it is active and maintains its organization and autonomy over time and is resilient to stress. Ecosystem health is thus closely linked to the idea of sustainability, which is seen to be a comprehensive, multiscale, dynamic measure of system resilience, organization, and vigour.

Enclosed Coastal (EC)	A partially smooth, semi protected water body including shallow, enclosed waters near an estuary mouth and generally considered the interface between coastal and inland waters. Its boundaries depend on the local or regional authorities.
Environmental values (EV)	Characteristics or qualities of a natural system that supports viable natural communities and human uses.
eReefs	Integrated modelling system to visualise, communicate and report reef information for the GBR.
Floor rounding	Rounding decimal places down to the nearest integer. (E.g., 60.9 = 60).
Flow (as an indicator)	The degree that the natural river currents or stream flows have been modified, influencing waterways and ecosystem health.
FRP	Filterable Reactive Phosphorus.
GBR	Great Barrier Reef.
GBR Report Card	GBR Report Card under the Reef Water Quality Protection Plan (2013).
GBRMPA	Great Barrier Reef Marine Park Authority.
GBRMP	Great Barrier Reef Marine Park.
High DO	High Dissolved Oxygen. Can be a sign of algae growth and poor water quality.
Impoundment length	An indicator used in the 'in-stream habitat modification' indicator for freshwater basins in the region. The proportion (%) of the linear length of the main river channel when at the full capacity of artificial in-stream structures, such as dams and weirs.
Index	The aggregation of indicator categories. E.g., the water quality index is an aggregation of nutrient, phys-chem, and chl a indicator categories.
Indicator	A measure of one component of an environment. E.g., the total amount of phosphorous (TP) present in the water.
Indicator category	The aggregation of indicators. E.g., the nutrient indicator category is an aggregation of TP and DIN indicators.
Inshore Marine environment	Includes Enclosed Coastal (EC), Open Coastal (OC) and Midshelf (MS) waters, extending east to the boundary with the offshore waters (Department of Environment and Science 2018, Great Barrier Reef Marine Park Authority 2009).
Inshore Marine Zone	Inshore Marine Zone is a reporting zone in the Townsville Dry Tropics Report Card that includes Inshore Marine environments.
ISP	Independent Science Panel.

Invasive species	Invasive species include both alien and translocated species.
JCU	James Cook University.
Low DO	Low Dissolved Oxygen. Can result in anoxic waterways (depletion of oxygen) and poor water quality.
LTMP	Long Term Monitoring Program of GBR Midshelf and offshore reef communities.
Macroalgae (cover)	Indicator used to assess coral health. Macroalgae includes seaweed and other visible benthic (attached to the bottom) marine algae.
MD	Moderate disturbed waters.
Midshelf Waters	Midshelf Waters are from 12 to 48 km offshore in the Burdekin region (waters south of approximately Pelorus Island) and 6 to 24 km offshore in the Wet Tropics region (waters north of Pelorus Island) (Great Barrier Reef Marine Park Authority 2009).
MMP	Marine Monitoring Program of the inshore reef communities along Wet Tropics, Burdekin, Mackay, Whitsunday, and Fitzroy regions of the GBR.
MSL	Mean Sea Level
Non-indigenous species	See Invasive species.
NOx	Generic term for nitrogen oxides such as mixtures of nitrites and nitrates.
NRM	Natural resource management.
NTU	Nephelometric Turbidity Unit. The units that turbidity is measured in.
OGBRWH	Office of the Great Barrier Reef and World Heritage, Queensland Government.
Offshore waters	Offshore waters extend 48 to 180 km in the Burdekin region (waters south of approximately Pelorus Island) and 24 to 170 km offshore in the Wet Tropics region (waters north of Pelorus Island) (Great Barrier Reef Marine Park Authority 2009).
Offshore Marine	Offshore is a reporting zone in the Townsville Dry Tropics Report Card that includes offshore waters.
Open Coastal (OC)	Open Coastal Waterbodies being at the seaward limit and extends 12 km offshore in the Burdekin region (waters south of approximately Pelorus Island) and 6 km offshore in the Wet Tropics region (waters north of Pelorus Island) (Great Barrier Reef Marine Park Authority 2009).

Palustrine wetlands	Vegetated, non-riverine or non-channel systems that include billabongs, swamps, bogs, springs, soaks etc and have more than 30% emergent vegetation.
Physical-chemical properties	(Phys-chem properties). Indicator category that includes dissolved oxygen and turbidity.
PN	Particulate Nitrogen.
POTL	Port of Townsville Limited.
PP	Particulate Phosphorus.
QA/QC	Quality Assurance / Quality Control.
QPSMP	Queensland Ports Seagrass Monitoring Program.
RE	Regional Ecosystem.
Reef 2050 Plan	The overarching framework of the Australian and Queensland governments for protecting and managing the reef until 2050.
REMP	Receiving Environment Monitoring Program. A REMP provides a basis for evaluating whether the discharge limits or other conditions imposed upon an activity have been successful in maintaining or protecting receiving environment values over time.
Resilience (seagrass)	A multivariate metric developed by the MMP to measure the capacity of seagrass to cope with disturbances (Collier et al., 2021). The resilience metric better accommodates differences in recovery strategies between species in comparison to previous indicators.
Riparian extent	Vegetation with a 50m buffer from a waterway.
RIMReP	Reef 2050 Integrated Monitoring and Reporting Program.
Secchi	Secchi depth. A measure used to gauge the transparency (clarity) of water.
TCC	Townsville City Council.
Translocated species	Species that are native to Australia but not native to the specific waterway.
TP	Total Phosphorus.
TSS	Total Suspended Solids.
Turbidity	A measure of how cloudy/opaque water is, recorded in NTU.
WQO	Water Quality Objectives. Defined for specific regions, these values act as a management target. They do not necessarily reflect 'natural' condition but

	rather a state that is considered acceptable considering environmental, social, and economic factors.
WQGV	Water Quality Guideline Values. Defined for broad scale regions, these values act as an 'earliest baseline' and ideally reflect the natural state of the environment pre-European/pre-developed settlement (or pre-land clearing). They allow managers to assess how water quality has changed from 'natural' condition.

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7 Introduction

7.1 Overview

The Dry Tropics Partnership for Healthy Waters (referred to as the Partnership) was launched in January 2019, with a focus on producing an annual Report Card. The pilot annual Report Card was released in May 2019 and reports on data mainly from the 2017–2018 year. Each year an annual report card is produced, with the current Report Card reporting on data mainly from the 2021–2022 year. Where a seasonal monitoring program extends outside of the year period, such as inshore coral, data from the whole monitoring period are included. For monitoring programs that collect data less frequently than annually (e.g., wetland and riparian extent) then the most recent data set is included.

The key deliverable for the Report Card is an assessment of the state of the environment. The Report Card focuses on three indices that are directly dependent on waterway health: Water Quality, Habitat and Hydrology, and Fish. Indices are scored and graded for the freshwater, estuarine, Inshore Marine, and offshore marine environments within the Townsville Dry Tropics region. However, not all indices are scored and graded for each environment (for example, fish is only scored within the freshwater environment).

To assess trends over time, summary results from previous reports are presented alongside this year's results. For some indicators, the methodology used has changed between years and therefore only data after the methodology change is compared to current results.

7.2 Report Card Zones

The results presented in the 2021–2022 Report Card cover all areas of the Townsville Dry Tropics reporting region. On land, the Partnership region extends from the Crystal Creek catchment in the north, to the Ross River (upper) and Alligator Creek catchments in the south. In the water the Partnership extends from the coastline to the outer edge of the Great Barrier Reef (GBR) Marine Park. The reporting region for the partnership incorporates all islands within this area, including Magnetic Island and the Palm Island group.

The Dry Tropics reporting region is divided into seven unique zones based on the waterway type (freshwater, estuarine, inshore marine, and offshore marine), and riverine basin (Black and Ross) (Table 11, Figure 2). If required, zones are divided into sub-zones (or catchments) based on the prevailing sub-water type, and catchment. For further information on the methodology of constructing the Dry Tropics reporting region refer to "Methods for Townsville Dry Tropics 2021–2022 Report Card (released in 2023)".

Table 11. The seven reporting zones in the Dry Tropics region.

Zone	Waterway
Ross Freshwater Basin	Freshwater
Black Freshwater Basin	Freshwater
Ross Estuarine Basin	Estuarine
Black Estuarine Basin	Estuarine
Cleveland Bay	Inshore Marine
Halifax Bay	Inshore Marine
Offshore Marine	Offshore Marine

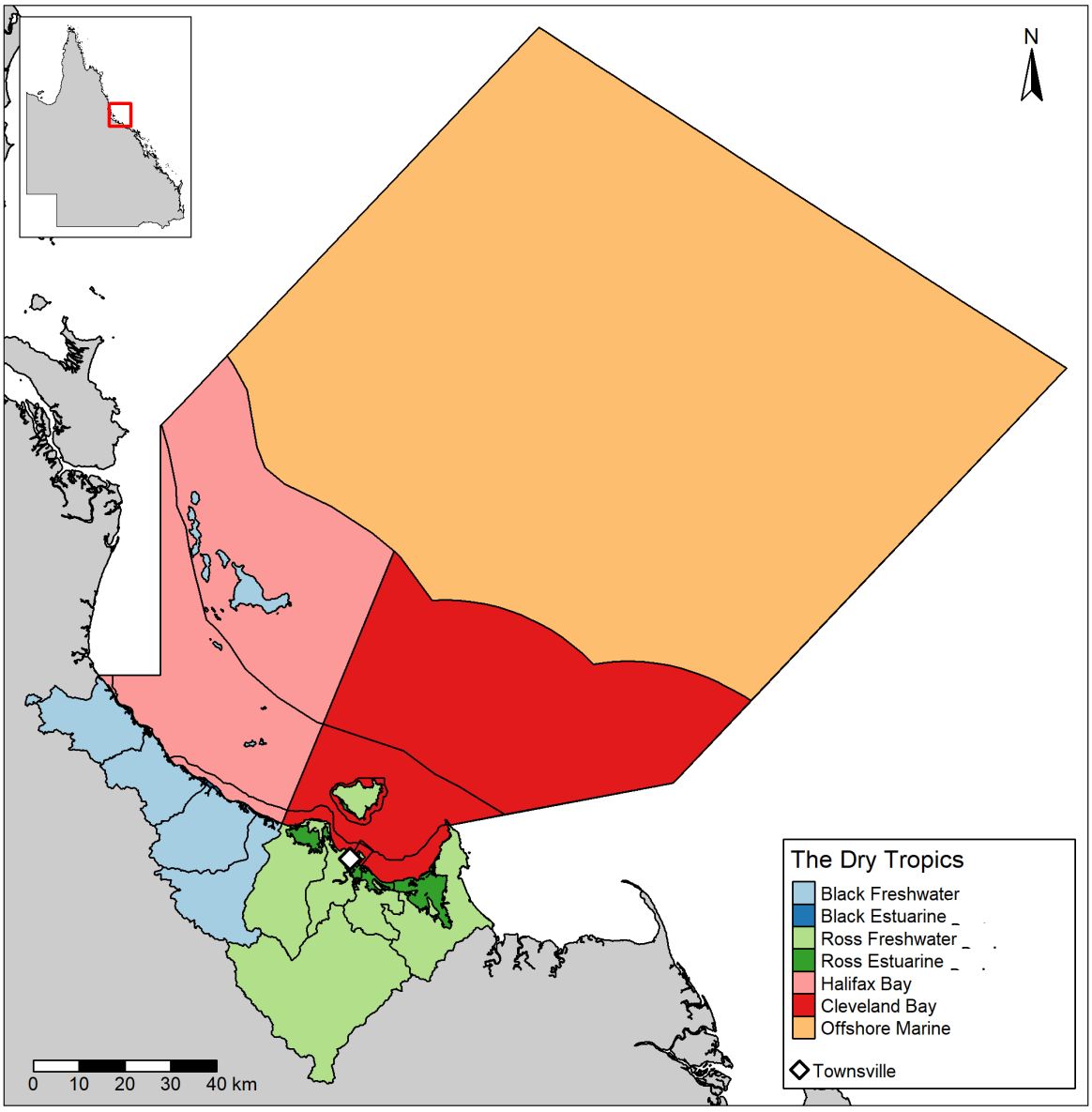

Figure 2. Geographic boundary of the DTPHW reporting region, divided into seven zones (Table 11).

8 Methods

Detailed methods can be found in "Methods for Townsville Dry Tropics 2021–2022 Report Card (released in 2023)". Key components required to understand the Technical Report are presented below.

8.1 Terminology and Data Aggregation

Data is reported and aggregated at multiple levels within this document. These levels are indicator, indicator category, and index. Results from multiple indicators are aggregated into results for indicator categories, which are aggregated into results for indices (Table 12).

Table 12. Levels of data aggregation used within the Technical Report and Report Card.

Indicator	Indicator Category	Index/Indices
Dissolved Inorganic Nitrogen	Nutrients	Water Quality
Total Phosphorus		
Turbidity	Physical-Chemical Properties	
Total Suspended Solids		

There are three indices in the report card: Water Quality, Habitat and Hydrology, and Fish. Some indices are only measured in certain zones, for example, the Habitat and Hydrology index is referred to as the Habitat index for the inshore and Offshore Marine Zones as hydrology indicators such as water flow are not included. A complete list of indicators can be found in Appendix A.

Scores for indicators and indicator categories can only be aggregated to the next level if they meet the "minimum information rules for aggregating data". These rules are:

1. ≥50% of indicators are required to aggregate to an indicator category,
2. ≥60% of indicator categories are required to aggregate to an index.

8.2 Scoring

All indicators and their aggregations are graded using five ordinal values commonly used in Report Cards: "Very Good" (A) to "Very Poor" (E). Each indicator is scored on a scale appropriate for the variable being measured and thus some indicators have different scoring ranges. To ensure results for all indicators are comparable, all scores are converted (if required) into a standardised score between 0 and 100 (Table 13).

Table 13. Standardised scoring range and corresponding grades used in the Technical Report.

Scoring Range	Grade and Colour Code
81 to 100	Very Good (A)
61 to <81	Good (B)
41 to <61	Moderate (C)
21 to <41	Poor (D)
0 to <21	Very Poor (E)

8.3 Presentation

The information in this technical report is summarised and presented in an annual Report Card. The Report Card uses a stylized coaster to present the final grades for each index with their associated colours (Figure 3. B). This coaster is a slimmed down version of the aggregation used within the technical report (Figure 3. A). A coaster is created for each of the seven zones in the Dry Tropics region (Figure 2).

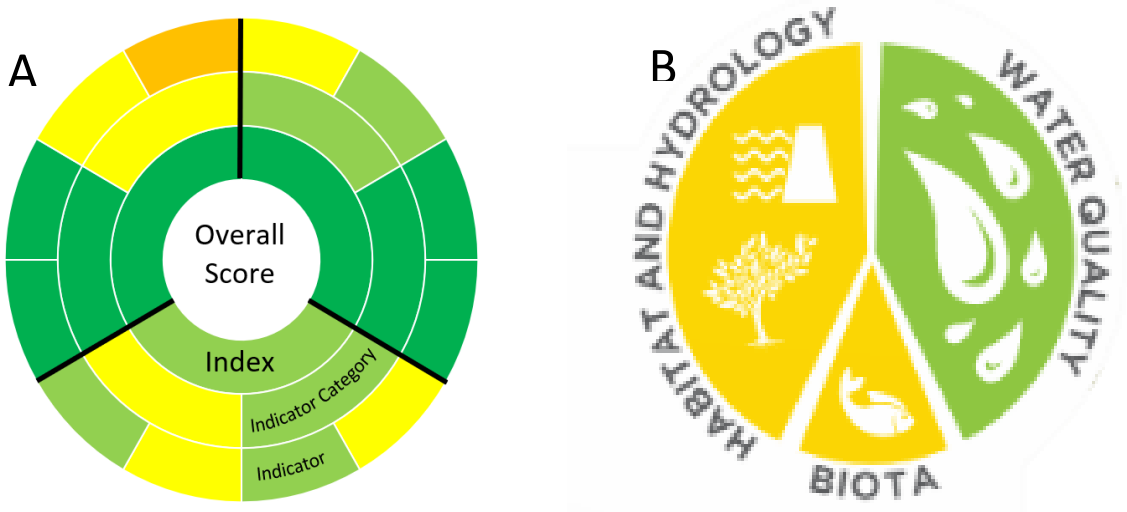

Figure 3. Coasters used within the Technical Report (A) and Report Card (B).

8.4 Confidence Measure

Results for each index are given a qualitative confidence score based on the accuracy and appropriateness of the data used in the analysis. Scores are calculated using five criteria which are weighted to reflect their importance (Table 14). Final confidence scores range from 4.5 (very low, with a rating of 1) to 13.5 (very high, with a rating of 5).

Table 14. The criteria, score and weighting used to generate indices confidence scores.

Criteria	Score	Weighting
Maturity of Methodology	New = 1; Developed = 2; Established = 3	0.36
Validation	Limited = 1; Not comprehensive = 2; Comprehensive = 3	0.71
Representativeness	Low = 1; Moderate = 2; High = 3	2
Directness	Conceptual = 1; Indirect = 2; Direct = 3	0.71
Measured error	>25% = 1; 10% – 25% = 2; <10% = 3	0.71

8.5 Objectives/Measures/Baselines For Scoring Data

Indicators are compared against either water quality objectives, ecosystem condition measures, or the earliest available data/baseline. Water quality objectives and ecosystem condition measures are used to assess whether actions positively or negatively influence the environment with respect to the objective or measure. The objective or measure may not reflect the 'natural' (pre-development) state of environment, but rather a state that is considered acceptable considering environmental, social, and economic factors. Earliest baselines ideally reflect the natural state of the environment pre-European/pre-developed settlement (or pre-land clearing). Comparing indicators against the

earliest baseline is important to show how the environment has changed from a 'natural' environment.

Although earliest baselines are ideal, for some indicator in this report card there is no known data available that accurately describes the state of the environment pre-development. The use of water quality objectives, ecosystem condition measures, or the earliest available data/baseline for each indicator are shown in Table 15. Note that all indicators within an indicator category use the same baseline, and indicator categories are presented instead.

Table 15. Summary of baselines used for each indicator category.

Index	Indicator Category	Objective/Measure/Baseline
Water Quality	Nutrients	Water Quality Objective
	Phys-Chem properties	
	Chlorophyll-a	
Habitat and Hydrology	Artificial Barriers	Earliest Baseline
	Coral condition (composition and cover change)	
	Seagrass Condition	
	Mangrove and Saltmarsh Extent	Ecosystem condition measure
	Riparian Extent	
	Wetland Extent	
	Coral Condition (Juvenile density and cover)	
	Coral Condition (macroalgae)	
Fish	Indigenous species expected within waterways	Earliest Baseline
	The proportion of Indigenous (native) fish	