HEALTHY WATERS PARTNERSHIP dry tropics

Townsville Dry Tropics
Waterways Report Card 2025

TECHNICAL REPORT

PART 7: Litter Results

Reporting on data collected 2023 - 2024

JULY 2025 | Written by Dinny Taylor, Healthy Waters Partnership (HWP)

8 Litter

The litter index is comprised of a single indicator to assess the “pressure” that the amount of litter and/or marine debris (from here referred to as litter) present in a location may be having on that environment. The litter pressure is the estimated mean amount of litter one person might collect from the site in one hour. The data used to derive the scores and grades for the litter index is from Tangaroa Blue Foundation's (TBF) Australian Marine Debris Initiative Database (AMDI). The data is collected by volunteers, and partners through the Reef Clean program which is funded through the Australian Government's Reef Trust.

The model was developed in 2023 for the combined regions of the Wet Tropics Waterways Partnership, Healthy Waters Partnership for the Dry Tropics, Healthy Rivers to Reef Partnership, and the Gladstone Healthy Harbours Partnership from ‘baseline’ data from the period ~2009 to June 2019 available from the AMDI following the method developed by Venables and Whitehead (2019). The litter collected at sites each year is compared with this baseline to determine their score and grade.

The model developed by Venables and Whitehead (2019) was based on a smaller dataset of 2016–2019 data that had been pre-cleaned by TBF. As more data became available in 2023, the model was re-fit using a negative binomial distribution (rather than Gaussian) to take the additional data into account. Further, as the model also included data for the Wet Tropics Waterways Partnership, the Healthy Rivers to Reef Partnership, and the Gladstone Healthy Harbours Partnership, the zones included in the model were redefined based on a combination of the location and the landuse category included within the AMDI data (refer Methods). During 2024, the score function used during the development for the previous year became unstable. A thorough investigation into a more stable score function was conducted (refer Methods 2024 Appendix I). All previous results for the model were recalculated during the 2022-2023 model year but have not been recalculated in the current year. These are provided in Section 8.2 below as a comparison with the current year data.

8.1 Monitoring Sites

There were 14 litter collection sites for the 2023–2024 period, and these are shown in Figure 23. There were eleven sites in Cleveland Bay, two sites in the Halifax Bay, and one site in the Ross Basin. There were no sites defined as the Black Basin. The litter collection sites include ReefClean monitoring and index sites by TBF (indicated in Table 78), TBF organised community collection events, and general community collections. Whilst the ReefClean sites are part of a monitoring program, TBF organised community collections are around this schedule, and general community collections are sporadic and dependent on the community providing the data to TBF.

Beach sites are defined by the AMDI landuse category where the volunteers collecting the litter have indicated whether the litter is largely sourced from direct deposit onto the land or washed up from the sea. It was considered that this was the best proxy available to define the boundary between a freshwater basin and the adjacent estuarine or inshore zone.

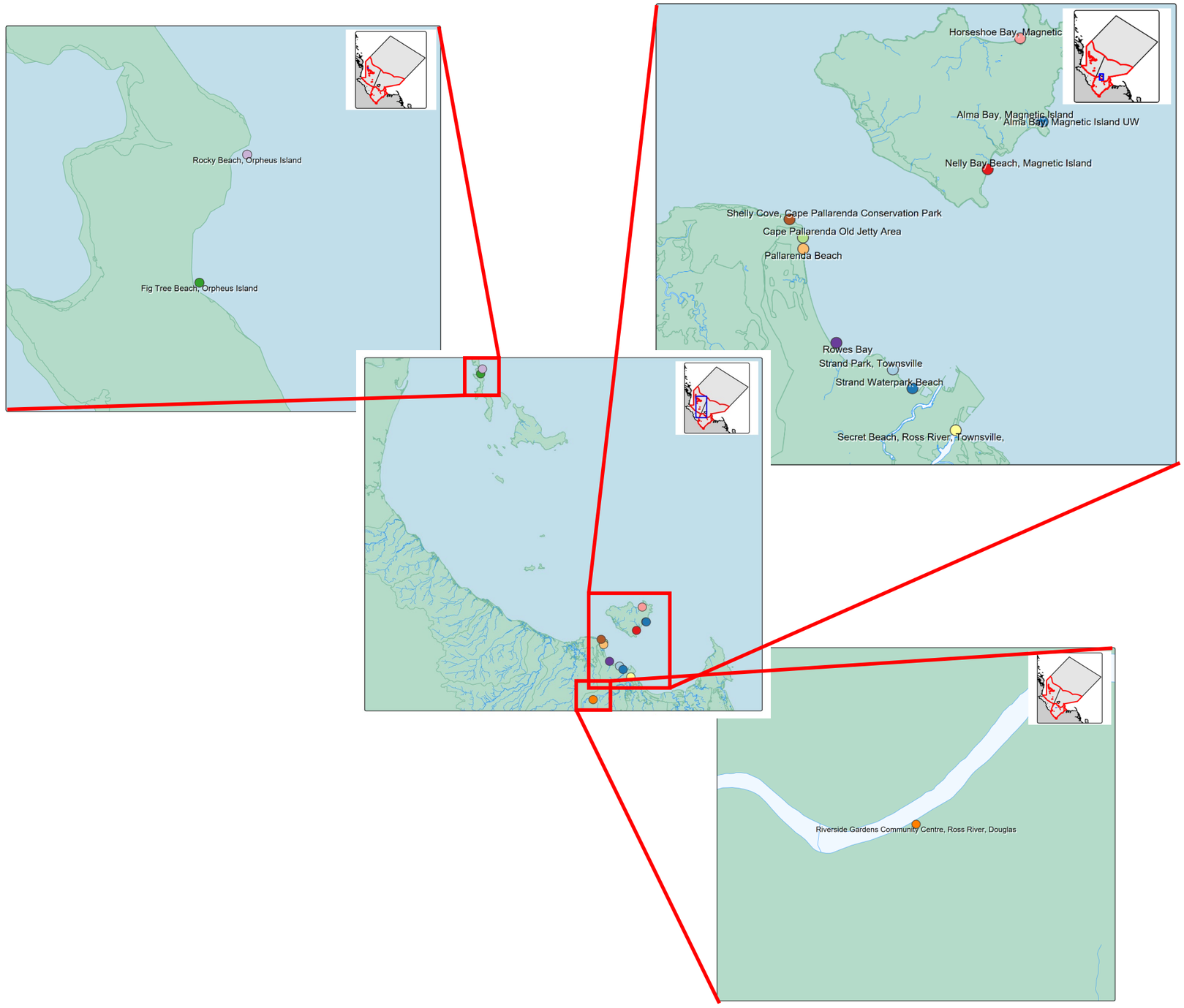

Figure 1: Litter collection sites in 2023-2024 in the Townsville Dry Tropics region

8.2 Comparison with previous years

Table 78 presents a comparison of the 2023–2024 year for the litter index with previous years.

Table 1: Comparison of Litter Index for 2023–2024 with previous Years

Zone	Site	Scores and Grades				
		2023-2024	2022-2023	2021-2022	2020-2021	2019-2020
Halifax Bay	North West Beach, Pelorus Island	ND	ND	ND	ND	95 (VLP)
	West Beach, Pelorus Island	ND	ND	ND	ND	80 (VLP)
	North Beach, Orpheus Island	ND	ND	ND	ND	4 (VHP)
	Little Pioneer Bay, Orpheus Island. underwater	ND	91 (VLP)	ND	ND	ND
	Rocky Beach, Orpheus Island	39 (HP)	ND	ND	ND	ND
	Fig Tree Bay, Orpheus Island	ND	28 (HP)	ND	ND	ND
	Big Rock Bay, Orpheus Island	ND	7 (VHP)	7 (VHP)	7 (VHP)	21 (HP)
	Fig Tree Beach, Orpheus Island	41 (MP)	ND	19 (VHP)	16 (VHP)	ND
	Pioneer Bay, Orpheus Island	ND	84 (VLP)	ND	ND	ND
	Picnic Bay, Orpheus Island	ND	5 (VHP)	2 (VHP)	11 (VHP)	0 (VHP)
	Boulder Beach North, Orpheus Island	ND	ND	14 (VHP)	ND	ND
	Yanks Jetty, Orpheus Island	ND	ND	ND	76 (LP)	74 (LP)
	Boulder Beach, Orpheus Island	ND	ND	1 (VHP)	ND	ND
	South Beach, Orpheus Island	ND	ND	10 (VHP)	ND	42 (MP)
	Fantome Island, Northern End	ND	57 (MP)	36 (HP)	12 (VHP)	ND
	North West Beach, Fantome Island	ND	61 (LP)	ND	ND	ND
	Ollera Beach	ND	ND	ND	ND	39 (HP)
	Rollingstone Beach	ND	ND	ND	ND	50 (MP)
	Toomulla Beach	ND	ND	ND	ND	53 (MP)
	Toomulla main beach	ND	ND	83 (VLP)	ND	ND
	Saunders Beach	ND	ND	ND	ND	71 (LP)
Cleveland Bay	Bushland Beach, Townsville	ND	55 (MP)	ND	62 (LP)	ND
	Myrmidon Reef underwater	ND	ND	ND	98 (VLP)	ND
	Radical Bay, Magnetic Island	ND	96 (VLP)	ND	ND	ND
	Horseshoe Bay, Magnetic Island#	91 (VLP)	83 (VLP)	34 (HP)	ND	ND
	Florence Bay, Magnetic Island	ND	51 (MP)	ND	ND	ND
	Arthur Bay, Magnetic Island	ND	ND	ND	43 (MP)	ND
	Alma Bay Beach, Magnetic Island#	33 (HP)	60 (LP)	71 (LP)	63 (LP)	45 (MP)
	Alma Bay, Magnetic Island underwater#	98 (VLP)	100 (VLP)	ND	98 (VLP)	97 (VLP)
	Geoffrey Bay, Magnetic Island	ND	ND	ND	80 (VLP)	ND
	Geoffrey Bay Reef, Magnetic Island underwater	ND	ND	ND	ND	93 (VLP)
	Nelly Bay Beach, Magnetic Island#	73 (LP)	77 (LP)	73 (LP)	77 (LP)	53 (MP)

Zone	Site	Scores and Grades				
		2023-2024	2022-2023	2021-2022	2020-2021	2019-2020
	Nelly Bay, Magnetic Island underwater	ND	99 (VLP)	99 (VLP)	99 (VLP)	100 (VLP)
	Shelly Beach, Pallarenda	ND	44 (MP)	ND	29 (HP)	63 (LP)
	Shelly Cove, Cape Pallarenda Conservation Park#	98 (VLP)	92 (VLP)	91 (VLP)	70 (LP)	67 (LP)
	Cape Pallarenda Old Jetty Area	56 (MP)				
	Pallarenda Beach#	85 (VLP)	84 (VLP)	72 (LP)	ND	ND
	Rowes Bay#	64 (LP)	89 (VLP)	87 (VLP)	75 (LP)	75 (LP)
	Kissing Point, Townsville	ND	ND	ND	79 (LP)	ND
	Strand Park, Townsville	80 (VLP)	ND	ND	74 (LP)	62 (LP)
	Strand Waterpark Beach	83 (VLP)	ND	ND	86 (VLP)	ND
	Secret Beach, Ross River, Townsville#	91 (VLP)	81 (VLP)	ND	ND	ND
Ross	Three Mile Creek, Pallarenda	ND	ND	ND	37 (HP)	ND
	Strand Rock Pool, Townsville	ND	74 (LP)	ND	47 (MP)	ND
	Jezzine Barracks Townsville Heritage Precinct	ND	63 (LP)	ND	ND	ND
	West End, Townsville	ND	66 (LP)	ND	ND	ND
	Ross Creek, Townsville	ND	59 (MP)	46 (MP)	ND	ND
	Queensland Country Bank Stadium	ND	ND	21 (HP)	23 (HP)	ND
	South Townsville Recreational Boat Park	ND	ND	ND	33 (HP)	ND
	Anderson Park, Townsville	ND	ND	91 (VLP)	ND	ND
	Sherriff Park Townsville	ND	ND	73 (LP)	ND	ND
	Aplins Weir Rotary Park#*	ND	74 (LP)	69 (LP)	35 (HP)	41 (MP)
	Lake Idalia Wetland Foreshore	ND	45 (MP)	ND	ND	ND
	Riverside Gardens Community Centre, Ross River, Douglas#	48 (MP)	ND	ND	ND	ND
	Apex Park, Condon	ND	ND	62 (LP)	ND	ND

Standardised scoring range: ■ 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 | ■ Very Low Pressure (VLP) = 80 to 100 | ND = No data available

Sites where litter has been collected underwater are indicated. Where there are two sites with the same location name, for example, Alma Bay, Magnetic Island is the beach area above the low tide mark and Alma Bay, Magnetic Island underwater is collected by diving out from the beach. If a site is not designated as underwater and is on the coast, it is above the low tide mark.

#ReefClean monitoring site or TBF Index Site cleaned with ReefClean partners.

*Aplin's Weir ceased as ReefClean monitoring site due to safety concerns.

As there are a small number of sites where litter collections occur each year, it is difficult to obtain a picture of whether improvement is occurring or not. There are a number of factors that are not included in the metric that could have a bearing on the amount of litter collected at sites, particularly land based sites, such as, the frequency of TCC emptying bins, the location of bins (ease of use to main trafficked areas), the number of people using the area on a daily, weekly, or monthly basis, proximity of the collection to a public holiday, or regional event. The variance associated with Zone, Site and Year accounted for a proportion of the total variance, however, the residual variance of the model indicates that there are potentially several variables that have not been identified.

8.3 Key Messages

- Alma Bay beach at Magnetic Island had the highest litter pressure in the region, and an increase in litter pressure from consistently low pressure in 2020-2023 to high pressure in 2023-2024.
- The litter pressure on the east coast of Orpheus Island appears to be decreasing which may be associated with regular collection as well as local factors.
- The most amount of litter pressure on the mainland was at Cape Pallarenda Old Jetty area with moderate litter pressure and Shelly Cove, Cape Pallarenda Conservation Park had the least with very low litter pressure on the mainland for Cleveland Bay. It is noted that Shelly Cove is a ReefClean monitoring site and has had consistently very low pressure since mid-2021 whereas Cape Pallarenda Old Jetty was a community member collection.
- The only site within the Ross Basin, the Riverside Gardens Community Centre had a moderate litter pressure.

8.4 Results

Litter pressure results are presented in Table 79. In the Ross Freshwater Basin, only one site was monitored and had moderate pressure.

For the Magnetic Island sites within Cleveland Bay, Horseshoe Bay, Alma Bay Beach, Alma Bay Underwater (diving), and Nelly Bay Beach are sites that are consistently cleaned and monitored under the ReefClean program. Alma Bay Beach has shown variable pressure across the monitoring years with moderate pressure in 2019-2020, which improved to low pressure for the period 2020-2023, and then decreased to high pressure in the most recent year. Alma Bay underwater site has consistently had very low pressure across the reporting years. The underwater sites are collected by diving and can be limited by the visibility on the day. The type of litter collected also tends to be heavier items that don't float and land on the beach sites. Nelly Bay Beach had moderate pressure in the first reporting year (2019-2020) but has had consistently low pressure since then.

The Townsville sites within Cleveland Bay are defined by the AMDI landuse category where the members collecting the data have indicated that the majority of the litter collected has been sea sourced. Sites that are regularly monitored under the ReefClean program include Shelly Cove, Pallarenda Beach, Rowes Bay Beach and Secret Beach. Shelly Cove has had consistently very low pressure for the last three years, which may be associated with the location access being more difficult for potential land deposited litter, particularly compared with Pallarenda Beach or Rowes Bay Beach, or the community collection from the Cape Pallarenda Old Jetty area which had moderate pressure. Pallarenda Beach has had consistently very low pressure for the last two years, however, at a lower score than achieved at Shelly Cove. Rowes Bay had low pressure in the current year, which is an increase in litter pressure from the previous two years where it had very low pressure. Secret Beach has only been monitored for the last two years as it is a new site to replace the previous Aplin's Weir site. Secret Beach has had consistently very low pressure for the two years of monitoring.

Only two sites were monitored within the Palm Island group of Halifax Bay with Fig Tree Beach having moderate pressure and Rocky Beach having high pressure. The litter pressure on the eastern side of Orpheus Island has decreased in the current year compared with the consistently very high pressure across most of these sites historically. The locations where the litter was collected in the most recent year were different from the previous years and this may have contributed to the reduction in the litter pressure. The Rocky Beach site, for example, is across some steep rocks where

it might be more difficult for litter to wash up, and the Fig Tree Beach site is easterly rather than south-easterly facing for some of the very high pressure sites historically. Discussion with K-M Coulter-Atkins (TBF, 2022) found that the litter on the eastern side of Orpheus Island is largely sourced from the sea and was found to be washing onto the beach whilst the litter collection was occurring. This suggests that the direction of onshore winds and currents may be a factor in the location of litter collected.

Table 2: Litter Index Results for 2023–2024

Zone	Site	Score (Grade)
Cleveland Bay	Alma Bay, Magnetic Island	33 (HP)
	Alma Bay, Magnetic Island Underwater	98 (VLP)
	Cape Pallarenda Old Jetty Area	56 (MP)
	Horseshoe Bay, Magnetic Island	91 (VLP)
	Nelly Bay Beach, Magnetic Island	73 (LP)
	Pallarenda Beach	85 (VLP)
	Rowes Bay	64 (LP)
	Secret Beach, Ross River, Townsville,	91 (VLP)
	Shelly Cove, Cape Pallarenda Conservation Park	98 (VLP)
	Strand Park, Townsville	80 (VLP)
	Strand Waterpark Beach	83 (VLP)
Halifax Bay	Fig Tree Beach, Orpheus Island	41 (MP)
	Rocky Beach, Orpheus Island	39 (HP)
Ross	Riverside Gardens Community Centre, Ross River, Douglas	48 (MP)

Standardised scoring range: ■ = Very High Pressure: 0 to <20 | ■ = High Pressure: 20 to <40 | ■ = Moderate Pressure: 40 to <60 | ■ = Low Pressure: 60 to <80 | ■ = Very Low Pressure: 80 to 100

8.5 Confidence Scores

The overall confidence score for the litter index was low with a score of 2 out of 5. The maturity is scored at 2, as a generalised linear negative binomial mixed model for data across a much larger region than solely the Townsville Dry Tropics has been developed. This has improved the robustness of the metric applying a distribution appropriate to the data and using a much larger dataset from which to derive the model. Validation is scored as 1 as modelling is used to derive an estimate of the amount of litter one might expect to collect in a one-hour period at each location at any time that location might be visited. This expected value considers the variability of the data available. Representativeness is scored at 1 as there is variation in the frequency of the data collection at each site, and variation in the way the data is reported. For example, some sites are cleaned up four times per year, whilst others may be cleaned once every few years. Whilst the model can consider the frequency of the collection by volunteers contributing to the AMDI in an individual year, it does not consider the last time litter was collected at each location (by anyone). It is not possible to do so as this information is not available. Some collectors may include the time they spend sorting the litter, whilst others may not. This brings variation into the data that is difficult to account for within the model. The measured error has been scored at 2 as the model provides estimates based on the variability of the data, however, there is also error associated with the transformation of the data to score and grade.

Table 3: Confidence scores for the Litter Index

Indicator Category	Maturity (x0.36)	Validation (x0.71)	Representativeness (x2)	Directness (x0.71)	Measured error (x0.71)	Score (Rank)
Litter	2	1	1	3	2	2 (low)

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.