

Gladstone Healthy Harbour Partnership 2020 Report Card Summary, ISP011: Seagrass

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Gladstone Harbour seagrass was in the best overall condition of the past decade, and one of the best conditions recorded in 18 years of monitoring. The majority of monitoring zones were in good or very good condition for seagrass biomass, area and species composition (Table 1). Nine meadows improved to pre-2010 conditions, signalling recovery from significant seagrass loss associated with tropical cyclones and flooding in the 2010-2011 period. Five monitoring meadows reached record biomass and/or area scores this reporting year. Rodds Bay monitoring meadows were in very good condition for the first time since 2009.

Improved seagrass meadow health was reflected across most Gladstone Harbour zones and Rodds Bay, and among different seagrass meadow types. Improvements were seen in The Narrows, Western Basin, Inner Harbour and Rodds Bay zones (Figures 1 and 2). Biomass, area and species composition in many of these meadows returned to levels not seen since major seagrass losses a decade ago. Several meadows across the Western Basin, South Trees and Rodds Bay had the highest biomass or area since monitoring began in 2002.

Table 1. Grades and scores for seagrass indicators (biomass, area and species composition), overall meadow, zone, and Gladstone Harbour scores for the GHHP 2020 reporting year. Scores are on 0 – 1 scale; cells are coloured according to grade, where dark green = very good, light green = good, yellow = satisfactory, orange = poor, red = very poor.

ZONE	MEADOW ID	BIOMASS	AREA	SPECIES COMPOSITION	OVERALL MEADOW SCORE	OVERALL ZONE SCORE
1. The Narrows	21	0.80	0.97	0.94	0.80	0.80
3. Western Basin	4	1.00	0.91	0.94	0.91	0.82
	5	0.89	0.92	0.88	0.88	
	6	0.90	0.90	0.78	0.84	
	7	0.76	0.73	1.00	0.76	
	8	0.90	0.82	0.59	0.71	
	52-57*	0.79	1.00	1.00	0.81	
5. Inner Harbour	58	0.70	0.97	0.76	0.70	0.70
8. Mid Harbour	43	0.33	0.95	0.59	0.33	0.44
	48	0.77	0.91	0.35	0.56	
9. South Trees Inlet	60	0.99	1.00	0.99	0.99	0.99
13. Rodds Bay	94	0.90	0.86	0.99	0.86	0.87
	96	0.89	1.00	0.94	0.89	
	104	0.85	0.85	0.91	0.85	
Gladstone Harbour						0.78

*Meadow 52-57 consists of a number of small meadows surrounding the Passage Islands in the Western Basin Zone (see Figure 1). These meadows are grouped for reporting purposes.

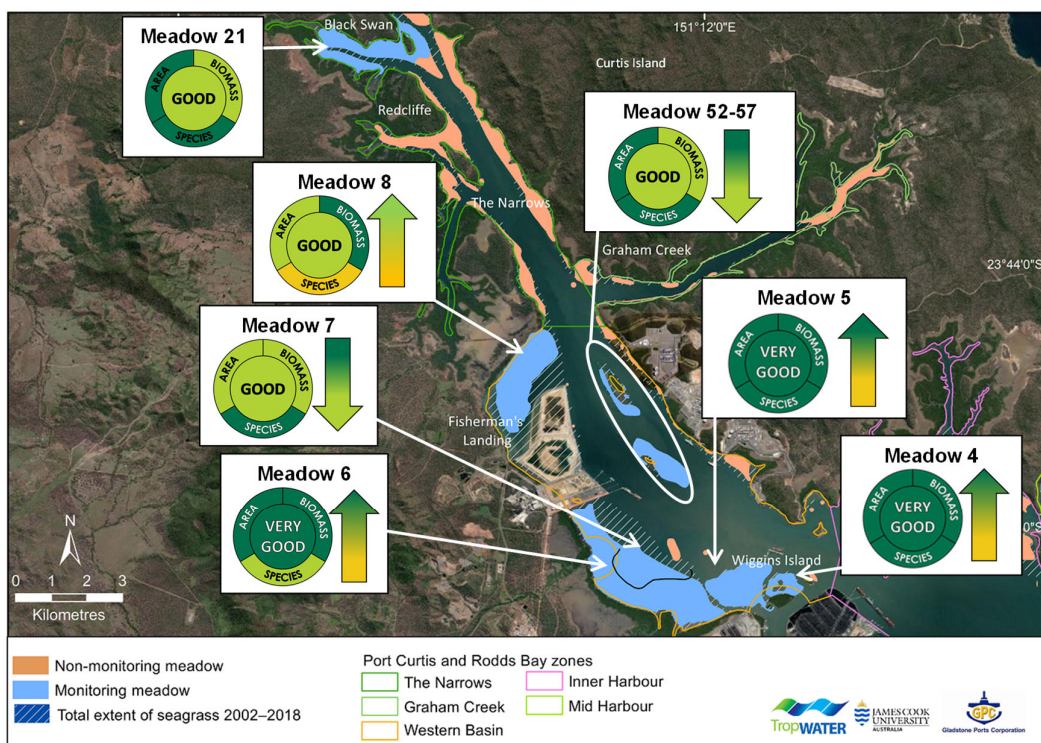


Figure 1. Seagrass distribution and meadow condition in The Narrows and Western Basin Zones (Port Curtis), November 2019 (2020 reporting year). Arrows indicate an overall grade change from the previous year.

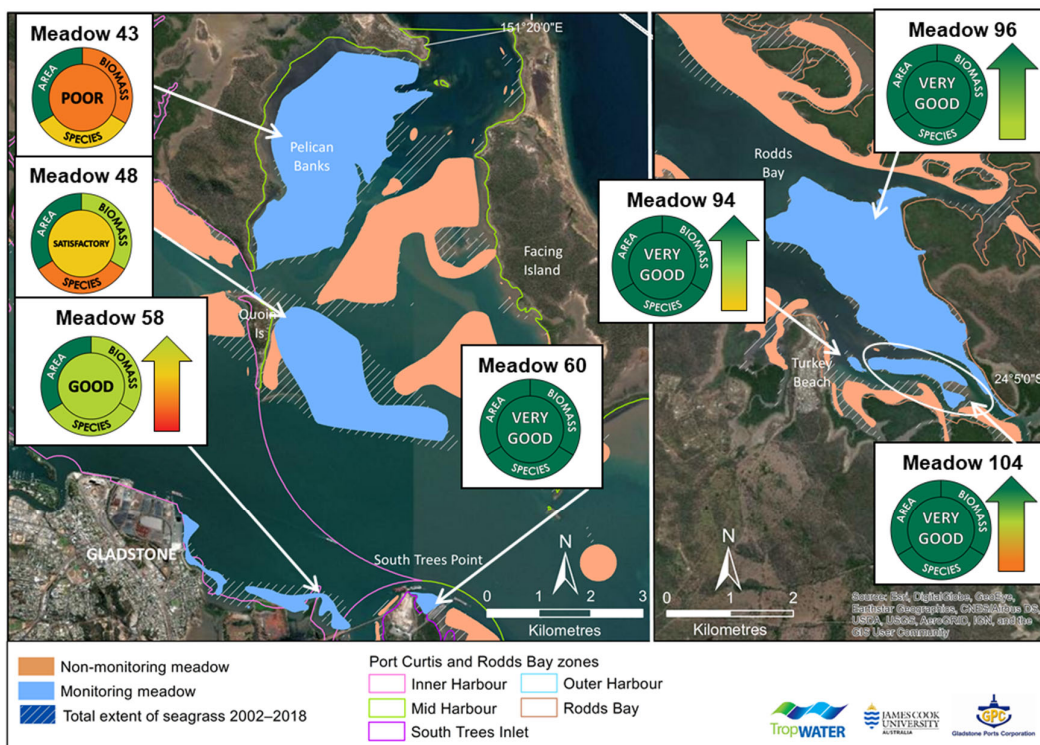


Figure 2. Seagrass distribution and meadow condition in the Inner Harbour, Mid Harbour, and South Trees Inlet Zones (Port Curtis), and Rodds Bay, November 2019 (2020 reporting year). Arrows indicate an overall grade change from the previous year.

Improvement in seagrass condition and meadow recovery over the past year was facilitated by environmental conditions that promote seagrass growth. Available light plays a major role in seagrass conditions and large-scale seagrass losses have been linked to flood plumes (Campbell and McKenzie 2004), including losses in Gladstone Harbour in 2010-2011 (McCormack et al. 2013). Analysis of the long-term patterns of seagrass condition from 18 years of annual monitoring reveal a strong relationship with rainfall and Calliope River flow (McCormack et al. 2013). Flow from the Calliope River in 2019 was the lowest since 2010; the second lowest flow was in 2018. Rainfall was below average in 2018 and 2019. Increased benthic light as a result of reduced rainfall and river flow over the last two years has created ideal conditions for seagrass growth. Favourable growth conditions have also seen a change in species composition in many meadows, with the most persistent species *Zostera muelleri* returning as the dominant species. Slightly below-average daytime tidal exposure this reporting year likely provided further protection from extreme desiccation and thermal stress for the region's intertidal seagrasses (Chartrand et al. 2019; Unsworth et al. 2012).

Seagrass meadows in the Mid Harbour zone were the exception to the overall good seagrass condition across Gladstone Harbour this reporting year. Seagrass in this zone remained in poor overall condition following significant biomass reductions in Meadow 43 at Pelican Banks, and the reduction in foundation species at both monitoring meadows, over the past five years. The Pelican Banks meadow typically experiences the best water quality conditions for seagrass growth in the area, based on historical monitoring of benthic light (Chartrand et al. 2016), and there are no obvious differences in environmental conditions or human activities in the area that would hinder recovery. The most parsimonious explanation is high levels of herbivory from dugong and green turtles. Herbivory from dugong is high in the Mid Harbour zone, with dugong feeding trails observed within meadows during every seagrass monitoring survey and during a detailed study of dugong feeding in recent years (Rasheed et al. 2017). Green turtles also regularly feed on the meadow (direct observations and Hamann et al. 2016; Limpus et al. 2017). Grazing pressure from megaherbivores has contributed to major seagrass meadow loss elsewhere in the world (Christianen et al. 2014) and, while it is unclear if there is an increase in grazing pressure at Pelican Banks, overgrazing may be a major inhibitor to this meadow's recovery.

Rodds Bay had large seagrass declines in 2009 and 2010 following large flooding events, culminating in the complete loss of all three monitoring meadows in 2011 (2012 reporting year). Subsequent recovery of seagrass at Rodds Bay has been relatively slow compared to other zones in Gladstone Harbour. Increases in area and biomass in the past two years have resulted in dramatic condition improvements and a return to pre-2010 condition. Meadows 94 and 96 recorded the highest biomass since 2008 and in all Rodds Bay meadows the dominant species has returned to the large, persistent *Z. muelleri*. Growth rates of *Z. muelleri* can exceed 7-8 mm per day (Kerr and Strother, 1989). The dominance of *Z. muelleri*, coupled with favourable growing conditions led to very large increases (130-560%) in biomass. After a complete loss of the standing crop occurs, such as in Rodds Bay in 2011, substantial delays in recovery are likely as initial recolonisation will be reliant on germination of seeds either from the seed bank or via dispersal from other meadows (Rasheed 1999; 2004). This initial re-establishment of seagrass meadows may take an extended period, 9 years in the case of Rodds Bay. However, once the meadow re-establishment begins and there are favourable growing conditions, meadow biomass and overall condition can improve quickly.

The robust condition of Gladstone Harbour and Rodds Bay seagrasses in the 2020 reporting year mean these meadows have a high level of resilience to pressures, including planned maintenance and capital dredging.

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