Australian Government

Government of South Australia
Department for Environment and Water

Ecological Monitoring of Lake Hawdon North and South Spring 2025

Ben Taylor, Ayesha Burdett, Tessa Roberts and Lauren Creasey

Nature Glenelg Trust

Report to the South Australian Government Department for Environment and Water

Citation

Taylor, B., Burdett, A., Roberts, T. and Creasey, L. (2026). *Ecological Monitoring of Lake Hawdon North and South, Spring 2025.* Report to the South Australian Government Department for Environment and Water. Nature Glenelg Trust, Mount Gambier, South Australia.

Correspondence in relation to this report contact

Mr Ben Taylor
Senior Wetland Ecologist
Nature Glenelg Trust
0434 620 646
ben.taylor@natureglenelg.org.au

OR

Mr Mark Bachmann
Managing Director
Nature Glenelg Trust
(08) 8797 8181
mark.bachmann@natureglenelg.org.au

Cover photo

Sharp-tailed sandpipers (*Calidris acuminata*) foraging in recently restored habitat at Lake Hawdon North, 17th November 2025 (photo Mark de Jong).

Disclaimer

Respect and Reconciliation

Aboriginal people are the First Peoples and Nations of South Australia. The Coorong, connected waters and surrounding lands have sustained unique First Nations cultures since time immemorial.

The *Healthy Coorong, Healthy Basin* program acknowledges the range of First Nations' rights, interests and obligations for the Coorong and connected waterways and the cultural connections that exist between Ngarrindjeri Nations and First Nations of the South East peoples across the region and seeks to support their equitable engagement.

Aboriginal peoples' spiritual, social, cultural and economic practices come from their lands and waters, and they continue to maintain their cultural heritage, economies, languages and laws which are of ongoing importance.

The Department for Environment and Water (DEW), Landscapes SA and Nature Glenelg Trust work across the State with Aboriginal South Australians to conserve and sustain Country. Through this work we seek to improve the relationship between Aboriginal and non-Aboriginal Australians and build respect based on mutual understanding and acceptance of each other.

Acknowledgements

Fieldwork for the waterbird census was conducted in collaboration with Friends of Shorebirds South East (FoSSE), the South Australian National Parks and Wildlife Service (NPWS) and the Limestone Coast Landscape Board (LCLB).

The project is part of the South Australian Government's *Healthy Coorong, Healthy Basin* Program, which is jointly funded by the Australian and South Australian governments.

Contents

Tables

Figures

Abbreviations

CSL	Coorong South Lagoon
DEM	Digital Elevation Model
DEW	South Australian Government Department for Environment and Water
FoSSE	Friends of Shorebirds South East
HCHB	*Healthy Coorong, Healthy Basin* program
LCLB	Limestone Coast Landscape Board
LHN	Lake Hawdon North
LHS	Lake Hawdon South
mAHD	metres Australian Height Datum (elevation relative to mean sea level)
NPWS	National Parks and Wildlife Service
OGW	On-Ground Works project (of the HCHB)
RBR	Regional Bird Refugia component (of the HCHB OGW)
WSEL	Water Surface Elevation (usually expressed in mAHD)

1. Introduction

1.1. Healthy Coorong, Healthy Basin

The Coorong, and Lakes Alexandrina and Albert Wetland is located at the terminus of the Murray-Darling Basin in South Australia. It is a system of shallow lakes, lagoons and wetlands covering over 140,000 hectares that is extremely diverse and an important refuge for migratory and non-migratory waterbirds in the Murray-Darling Basin. In 1985 the Coorong, and Lakes Alexandrina and Albert Wetland was declared a Ramsar Wetland of International Importance, largely due to its role in supporting a diverse and abundant waterbird community. The site is also subject to a number of international migratory bird agreements including the Japan Australia Migratory Bird Agreement, the China Australia Migratory Bird Agreement and the Republic of Korea Migratory Bird Agreement and is an Icon Site of the Murray-Darling Basin Living Murray Initiative.

It is well documented (e.g. Brookes et al. 2018) that the Coorong and Lower Lakes has undergone ecological decline, which has been exacerbated by unsustainable water extractions in the Murray-Darling Basin and the Millennium Drought. The *Healthy Coorong, Healthy Basin* (HCHB) program proposes to implement works to support the long-term health of the Coorong, with a focus on the Coorong South Lagoon (CSL). The program is being delivered by the South Australian Government Department for Environment and Water (DEW) and is jointly funded by the Australian and South Australian Governments.

The HCHB program will be achieved through six projects, including the On-Ground Works (OGW) project. The OGW project is proposing to implement short to medium term on-ground works to support the mitigation of threats to key Coorong biota while longer term options are being investigated. The OGW project includes the Regional Bird Refugia (RBR) component, which aims to improve the availability and quality of habitat for seven target migratory and non-migratory shorebirds at priority wetlands in the Lower Lakes and South East of South Australia to provide regional refugia while long-term solutions for the Coorong are developed and implemented. The seven target shorebird species are:

- sharp-tailed sandpiper;
- curlew sandpiper;
- red-necked stint;
- common greenshank;
- banded stilt;
- red-necked avocet, and
- red-capped plover.

A multi criteria decision analysis (MCDA) was undertaken to evaluate the potential of 23 wetlands in the South East region to provide habitat for key species of waterbirds disadvantaged by deteriorating conditions in the southern Coorong (Hunt et al. 2019). Lake Hawdon North (LHN) was one of two South East wetlands that received the highest MCDA score. Factors that contribute to the value of LHN as habitat for shorebirds include it's large size, close proximity to other habitat, seasonal water regime and the presence of large areas of open mudflat (Rogers et al. 2015). A feasibility assessment completed in July 2020 (Taylor 2020) indicated the availability of habitat for the target species could be greatly increased by restoring hydrology and removing shrubland vegetation that has invaded the lakebed in recent decades. This shrubland is unsuitable habitat for the target species and has established on former open mudflats (Taylor et al. 2014) that previously would have provided ideal shorebird habitat. Assuming habitat for the target species consists of open mudflats inundated from 0 (damp) to 10 cm depth, Taylor

(2020) found that restoration (shrubland removal combined with restored hydrology) could increase the carrying capacity of LHN for target species by 531%.

Following the 2020 feasibility assessment, further investigations were undertaken examining various aspects of the proposed restoration including:

- detailed design of infrastructure;
- the ideal method to remove shrubland vegetation from the lakebed;
- approvals;
- Traditional Owner perspectives;
- stakeholder and broader community engagement, and
- downstream environmental water requirements.

Construction of the Lake Hawdon North regulator commenced in October 2024 and was completed in May 2025. Habitat restoration works, involving the prescribed burning and mechanical clearance of shrubland vegetation from the lakebed, were approximately 60% complete at the end of 2025, with the remainder proposed for completion in autumn 2026.

The ecological objectives of the restoration of Lake Hawdon North have been defined as (Taylor et al. 2022b):

- specifically within LHN, to:

  Objective A. Improve the availability and quality of foraging habitat (open pan) for the seven HCHB target shorebird species, which are at risk from deteriorating conditions in the southern Coorong.

  Objective B. Increase the area of open pan/open water aquatic habitat, maintain a minimum area of *Machaerina arthrophylla* and *Gahnia filum* sedgelands and reduce the area of *Melaleuca halmaturorum* shrublands.

  Objective C. Do no harm, i.e. at the very least maintain identified existing ecological values, in particular the highly significant native fish community of the Lake Hawdon system, which includes diadromous species and covers both LHN and adjoining Lake Hawdon South Conservation Park.

- More broadly, to:
  - not adversely impact the health of the downstream Robe Lakes, and
  - provide additional complementary foraging habitat to act as a 'buffer' against worsening conditions in the CSL, particularly during drier periods when waterbirds rely heavily on coastal wetlands.

Nature Glenelg Trust, in collaboration with the Department for Environment and Water (DEW), has developed a baseline ecological monitoring program (Taylor et al. 2022b) to enable the ecological outcomes of restoration to be measured and assessed against those project objectives specific to LHN. The elements of the monitoring program and their relationship to the ecological objectives of the restoration project are as follows:

Objective A

- Shorebirds and other waterbirds: quantify the abundance of the seven HCHB target shorebird species and other waterbirds across LHN to establish a pre-restoration baseline and to guide future surveys. In 2024 this count was expanded to include the main (thrombolite) basin of Lake Hawdon South.

- Shorebird food resources: quantify the diversity and abundance of macroinvertebrate food resources for shorebirds in the sediments of both Lake Hawdon North and Lake Hawdon South to establish a pre-restoration baseline and a comparison between the two sites.

Objective B

- Vegetation transects: establish transects that describe the pre-restoration vegetation of LHN and enable future changes arising through restoration to be observed and monitored.
- *Melaleuca halmaturorum* recruitment: continue previously established monitoring of the abundance and size distribution of this invasive native species to provide an indication of the effectiveness of management, primarily grazing and hydrology, at preventing its proliferation within LHN.

Objective C

- Fish: undertake fish monitoring of existing and new monitoring locations throughout the Lake Hawdon system and compare results to previous data to provide a detailed understanding of the diversity, abundance and distribution of fish species and the demography of key threatened species.
- Bush birds: improve understanding of the diversity and abundance of bush birds in the areas of *Melaleuca halmaturorum* shrubland proposed for clearance to provide a basis for the restoration project to minimise impacts to fauna.

In 2021 comprehensive baseline ecological monitoring was undertaken (Taylor et al. 2022b) to document the status of Lake Hawdon North in its unrestored condition. This included a baseline waterbird census of the entire wetland in early November 2021. The baseline waterbird census was repeated in 2022, 2023 and 2024 (Taylor et al. 2022a, Taylor and Roberts 2025). In spring 2025, water levels in Lake Hawdon North were controlled by the newly completed regulator for the first time and habitat restoration works approximately 58% complete. The status of the lake in spring 2025 is referred to hereafter as "post-restoration", noting that habitat restoration works were not fully completed. This report documents the first monitoring of shorebirds and other waterbirds and vegetation transects post-restoration.

2. Shorebirds and Other Waterbirds

2.1. Methods

The first post-restoration waterbird census was conducted over three days on 10th and 11th November 2025 (LHN) and 12th November 2025 (LHS). The timing of the 2025 census was intended to coincide with the timing of previous censuses in 2021, 2022 and 2023 and therefore control for time of year as a factor potentially influencing shorebird and waterbird abundance. Additionally, the mid-November timing was anticipated to coincide with a water surface elevation (WSEL) of approximately 4.05 mAHD, as predicted by hydrological modelling (DEW 2021), at which shorebird habitat (open pan, 0 – 10 cm deep) is at the maximum extent in LHN.

LHN was counted by five teams and LHS by three teams. Teams consisted of two to four members, with at least one experienced shorebird and waterbird surveyor in each team. Teams included representatives from NGT, FoSSE, NPWS and LCLB. Team members are listed in Table 1.

Table 1. Baseline waterbird census team members in 2025.

2025 waterbird team members	
Annie Schofield	Janet Copping (FoSSE)

2025 waterbird team members	
Anthony Cresp (NPWS)	Jason Ashwell
Ben Taylor (NGT)	Jeff Campbell (FoSSE)
Birgita Hansen (FoSSE)	Josie Doyle (FoSSE)
Bryan Haywood (NGT)	Mark de Jong (LCLB)
Cath Bell (NPWS)	Sayaka Mori
Genevieve Kyi	Simon Brealey (FoSSE)
Greg Kerr (NGT)	Tim Collins (FoSSE)
Holly Prest (FoSSE)	Vicki Natt (FoSSE)

The survey area was assessed mostly on foot, with vehicle access around the margins of the wetland arranged prior with adjoining landholders. Two teams utilised all-terrain vehicles, provided and operated by NPWS, to traverse the lakebed of LHN. Teams were equipped with binoculars and spotting scopes. Call identification was also used to detect some species.

The survey area for LHN consisted of the mapped extents (DEW "LANDSCAPE_Wetlands" layer) of wetland polygons S0109028 and S0108576, as well as an adjacent wetland to the immediate north, wetland S0108587 (Figure 1). This adjacent wetland was included in the survey area because it is hydraulically connected to LHN when the WSEL exceeds approximately 4.15 mAHD, which is within the regulated WSEL range (3.60 – 4.30 mAHD) for LHN.

The survey area was superimposed with a grid of 220 square cells, each 400 × 400 m (16 ha) in size (Figure 1). Cells were aligned with Drain L to avoid the logistical difficulties of cells straddling both sides of the drain. Cell boundaries were identifiable to surveyors on the ground using the AvenzaMaps® application on mobile phones, enabling bird counts per cell to be made. Areas within cells but outside of the target wetland polygons (i.e. adjoining paddocks) were outside of the survey area and were not counted. Drain L itself was counted as part of cells in the row D-15 to P-15 immediately south of the drain.

Mudflat and open water habitats in each cell were assessed and all birds within these habitats counted. This included both inundated and damp mudflats. Parts of Lake Hawdon North that were assessed to be dry were not surveyed in 2025 as the 2021 census found waterbirds were absent from dry areas, except for very small numbers of red-capped plover. Other habitat types were not systematically counted, however birds observed within these habitats (shrublands, grasslands (mostly dominated by introduced pasture grasses), *Gahnia filum* sedgelands, *Machaerina arthrophylla* sedgelands) were opportunistically counted.

Birds in flight were counted but if they entered or exited the cell being counted the direction of movement was noted for later cross checking to avoid double-counting.

The depth of water in each cell was measured in an open location (where the DEM is more accurate compared to densely vegetated areas) and the location recorded. These data were used in combination with the DEM to map the overall extent of surface water within LHN at the time of the survey. Because the WSEL was not consistent across the survey area it was necessary to sub-divide the DEM within LHN and adjust the WSEL within sub-units, to align with field observations. Additionally, three telemetered water monitoring stations are now operating within LHN (DEW 2025b), providing real-time WSEL data for the lake.

Weather conditions in Robe (15 km to the west of LHN) over the three days of the survey were:

- 10th November at 3.00 pm: 100% cloud cover, 15.2°C, wind WNW 22 km/hr

- 11th November at 3.00 pm: 60% cloud cover, 14.5°C, wind W 13 km/hr
- 12th November at 3.00 pm: 100% cloud cover, 16.7°C, wind NW 11 km/hr

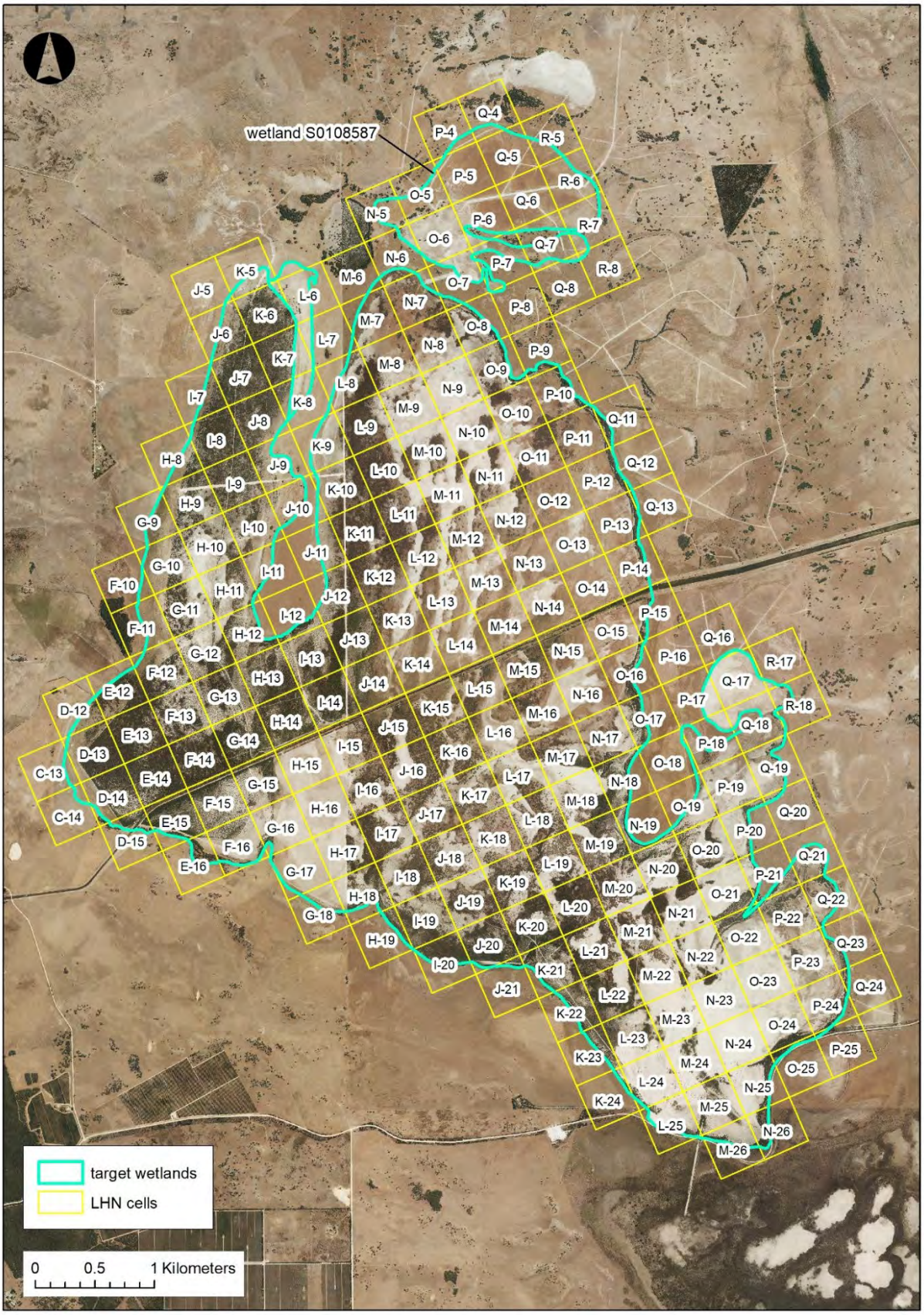


Figure 1. Lake Hawdon North survey area (target wetlands) and overlying grid of 220 cells.

The survey area for LHS covers 440 ha and is the area of open water/mudflat that initially receives inflows from the Bray Drain (Figure 2). The survey area was divided into three sub-areas, north, central and south, with teams counting different sub-areas. Sub-area boundaries were identifiable to surveyors on the ground using the AvenzaMaps® application on mobile phones. All other aspects of the methodology were as per Lake Hawdon North.

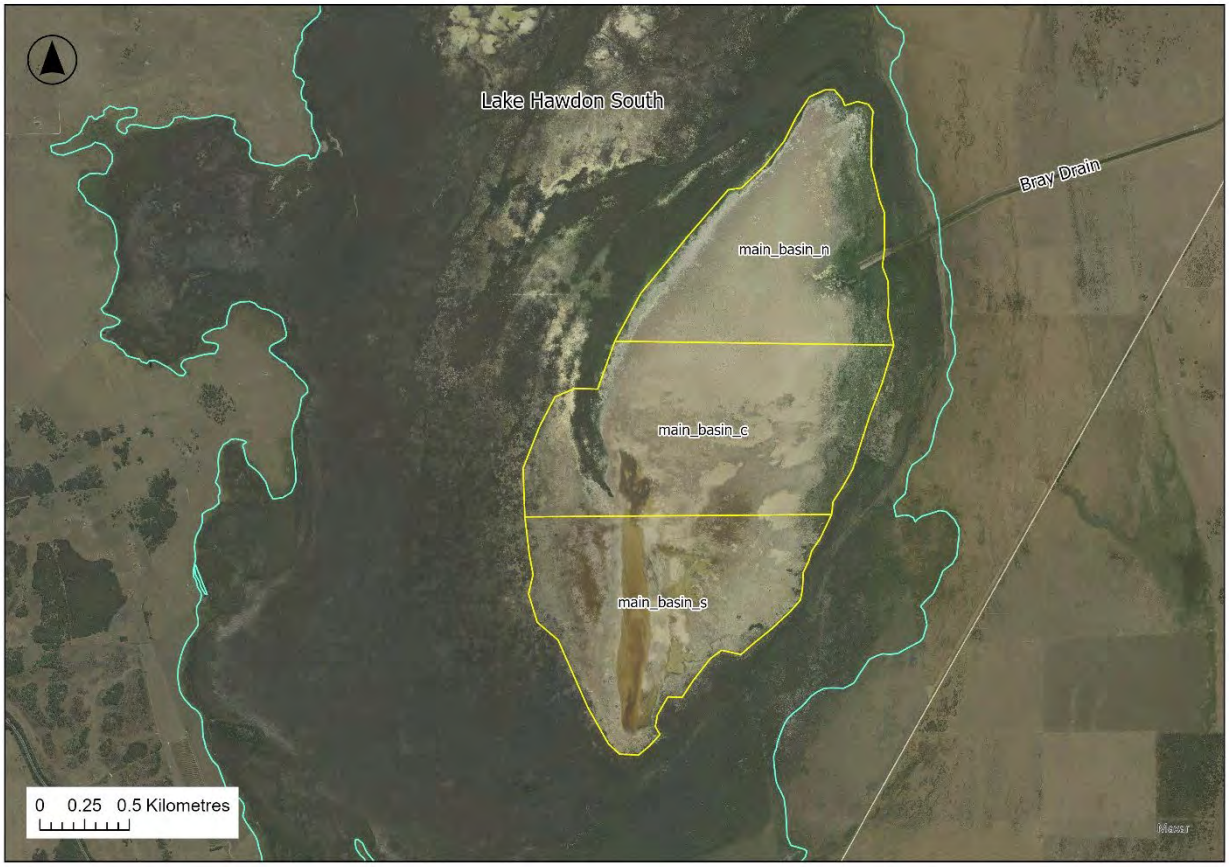


Figure 2. Lake Hawdon South survey area (yellow polygons).

2.2. Results

Water Levels

On 10-11 November 2025 the newly completed LHN regulator was closed with all flows passing through fishway exit LF3 (the most elevated fishway exit). The three telemetered water monitoring stations within the lake indicated a WSEL of 4.25 – 4.31 mAHD, i.e. the lake was close to its maximum regulated level (4.30 mAHD).

Table 2. WSEL within LHN at 6.00 am on 11th November 2025 (source: DEW 2025b).

Station	WSEL, 6.00 am, 11/11/25
A2391283 Lake Hawdon North Wetland, North of Drain L	4.31 mAHD
A2391185 Lake Hawdon North Wetland, South of Drain L	4.27 mAHD
A2391284 DRAIN L @ Lake Hawdon North Outlet	4.25 mAHD

Of the 220 waterbird monitoring cells within the survey area of LHN, 186 were partially or completely inundated at the time of the survey (Figure 3). This is almost double the value of the largest extent of inundation encountered during the four baseline surveys (November 2022, Table 3) and illustrates the effectiveness of the new regulator at retaining water in the lake.

Table 3. Number of grid cells partially or completely inundated at the time of survey (excluding Drain L) for each of the five survey events to date.

Survey Date	**Grid cells partially or completely inundated**
Baseline (pre-restoration) surveys	
November 2021	76
November 2022	97
November 2023	76
October 2024	6
Post-restoration surveys	
November 2025	186

On 12th November 2025 the entire survey area of LHS was inundated, with the water's edge aligning approximately with the edge of the survey area on the eastern side and extending well beyond the survey area on the western side. The majority of the survey area was 20 – 45 cm deep and all thrombolites were completely submerged. LHS was effectively full, with outflows trickling over the fishway at the Lake Hawdon Connector Drain and the weir at this location closed (stop logs in position). Assuming a flat water surface, this corresponds to a WSEL of 4.56 mAHD throughout LHS.

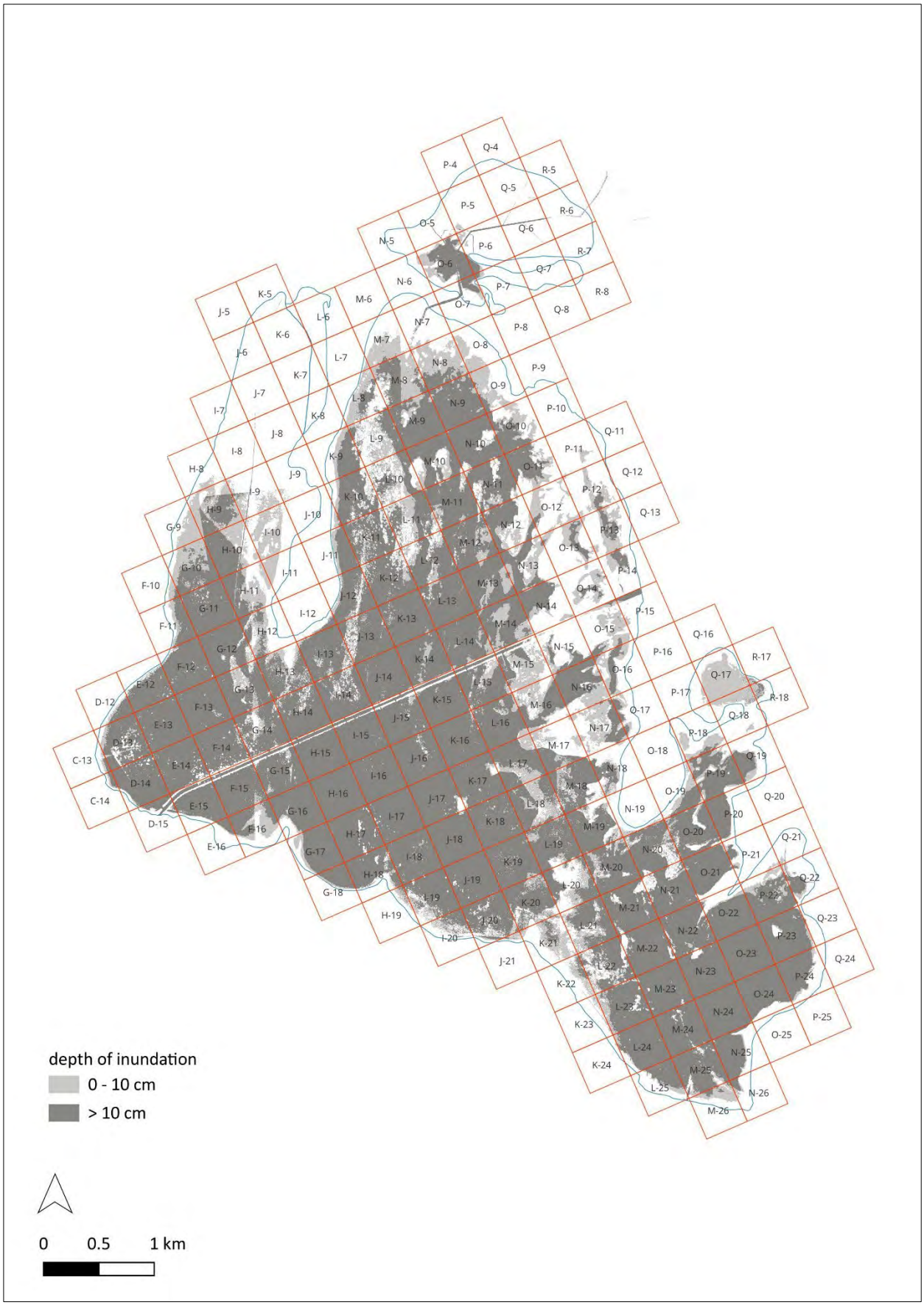


Figure 3. Estimated extent and depth of inundation of the survey area within LHN on 10-11th November 2025, based on the available 2m DEM.

Bird Abundance

As for the previous censuses of LHN, the 2025 baseline censuses recorded bird species in two categories:

- Species of open water and open pan habitat for which confident counts were obtained for the entire survey area. Total counts for these species are presented in Table 3 and counts for each cell are presented in Appendix A.
- Species recorded opportunistically. While these species were counted when observed, total numbers counted are not representative of the entire survey area because these species favour dense shrubland and/or *Gahnia filum* and/or *Machaerina arthrophylla* sedgeland vegetation that was not systematically surveyed for the census. For these species, counts for each cell are presented in Appendix B and total counts are presented in Appendix C.

In November 2025 a total of 30 species of open water and mudflat habitat were recorded, including 4 species not recorded in any of the previous baseline censuses; black-fronted dotterel, Eurasian coot, great crested grebe and ruddy turnstone. The total number of species of open water and mudflat habitat counted over the four years of the census is 52 following the 2025 count and includes six of the seven HCHB target species (Table 3).

In November 2025 the total abundance of waterbirds of open water and mudflat habitat was high (30,268) and similar to the previous high count in November 2023 (30,971). Both of these counts were considerably higher than counts in the other years (2021, 2022 and 2024). The 2025 count was also similar to the 2023 count in being dominated by waterfowl, particularly grey teal (21,485), black swan (973) and Australian shelduck (910). Other notable abundances were black-winged stilt (2156, 38 cells), whiskered tern (980, 55 cells), hoary-headed grebe (415) and glossy ibis (40). The abundance of HCHB target species was low (1,643) compared to the 2023 count (4,147) but included the highest count to date of red-necked stint (387) and a nationally important count of sharp-tailed sandpiper (1,204) (van Swinderen et al. 2025).

Table 4. Total counts for bird species of open water and mudflat habitat systematically counted for the Lake Hawdon North baseline census, 2021 – 2025. HCHB target species are indicated (bold).

Common Name	SA rating	EPBC rating	pre-restoration				post-
			Nov 2021	Nov 2022	Nov 2023	Oct 2024	Nov 2025
Australasian grebe			0	0	1	0	0
Australasian shoveler	R		22	0	1	0	18
Australian pelican			0	16	0	0	0
Australian shelduck			2786	1191	37	33	910
Australian white ibis			11	1	12	0	47
banded lapwing			5	0	2	6	0
black swan			159	54	121	13	973
black-fronted dotterel			0	0	0	0	18
black-winged stilt/pied stilt			1313	0	1697	0	2156
caspian tern			1	0	0	0	0
cattle egret			2	0	0	0	0
chestnut teal			116	4	39	139	217
common greenshank		**E**	**47**	**49**	**34**	**0**	**16**

Common Name	SA rating	EPBC rating	pre-restoration				post-
			Nov 2021	Nov 2022	Nov 2023	Oct 2024	Nov 2025
curlew sandpiper	**E**	**CR**	**0**	**0**	**5**	**0**	**2**
dusky moorhen			0	5	1	1	10
Eurasian coot			0	0	0	0	122
fairy tern	E	V	0	0	3	0	1
freckled duck	V		0	0	150	0	0
glossy ibis	R		0	0	3	0	40
great cormorant			2	0	4	0	0
great crested grebe			0	0	0	0	5
great egret			2	1	46	0	5
grey teal			1394	7	20608	851	21485
hardhead			6	0	62	1	0
hoary-headed grebe			11	0	148	13	415
intermediate egret	R		0	0	4	0	0
little black cormorant			0	0	2	4	0
little egret			27	7	7	0	3
little pied cormorant			0	0	9	0	0
marsh sandpiper			0	1	1	0	0
masked lapwing			153	200	126	51	101
musk duck	R		5	4	3	0	33
Pacific black duck			330	46	180	62	249
Pacific golden plover	R		0	0	3	0	0
pied cormorant			0	1	2	0	0
pink-eared duck			2	0	463	0	38
red-capped plover			**140**	**36**	**123**	**53**	**34**
red-kneed dotterel			0	0	181	15	29
red-necked avocet			**0**	**0**	**14**	**0**	**0**
red-necked stint			**331**	**16**	**286**	**65**	**387**
royal spoonbill			1	0	18	0	0
ruddy turnstone			0	0	0	0	2
sharp-tailed sandpiper		**V**	**674***	**21**	**3685****	**15**	**1204***
silver gull			702	155	168	10	608
straw-necked ibis			1	0	9	0	0
unidentified duck sp.			0	18	1400	19	0
unidentified egret sp.			0	2	2	0	0
unidentified wader sp.			0	31	134	0	0

Common Name	SA rating	EPBC rating	pre-restoration				post-
			Nov 2021	Nov 2022	Nov 2023	Oct 2024	Nov 2025
whiskered tern			1834	0	849	0	980
white-faced heron			123	50	329	7	160
white-necked heron			0	0	115	0	0
yellow-billed spoonbill			0	0	21	0	0
Total			**10200**	**1916**	**30971**	**1358**	**30268**

*nationally important, **internationally important (van Swinderen et al. 2025)

In November 2025 a total of 44 species were recorded opportunistically, including 5 not recorded in previous counts; brown quail, fairy martin, martin sp., New Holland honeyeater and red wattlebird. A notable record was 219 Latham's snipe recorded across 23 cells, making LHN nationally significant habitat for this species (van Swinderen et al. 2025). Note that to reduce the potential for double counting, the Latham's snipe total count is comprised only of observations made on 11th November, with observations made on 10th November excluded. Another notable record was a single female Australian painted snipe observed in cell E12. The total number of bird species recorded opportunistically for the census is 67 following the 2025 survey.

The total abundances of birds by species observed within the survey area in Lake Hawdon South in November 2025 are presented in Table 5. This count can be considered comprehensive for all species observed because the survey area is entirely open pan habitat and there is no basis to separate systematically and opportunistically counted species.

Table 5. Total counts for bird species within the survey area of Lake Hawdon South in October 2024 and November 2025. HCHB target species are indicated (bold).

Common Name	SA rating	EPBC rating	October 2024	November 2025
Australasian pipit			0	1
Australasian shoveler	R		88	105
Australian pelican			0	24
Australian raven			0	3
Australian shelduck			327	793
Australian white ibis			36	108
banded lapwing			2	0
black falcon			1	0
black swan			500	1205
black-shouldered kite			1	0
black-tailed native-hen			20	0
black-winged stilt/pied stilt			179	578
brown songlark			0	1
chestnut teal			8	16
common greenshank		**E**	**42**	**0**

Common Name	SA rating	EPBC rating	October 2024	November 2025
emu			0	5
Eurasian coot			0	11000
Eurasian skylark			1	5
galah			0	26
glossy ibis	R		0	23
great crested grebe			0	3
great egret			0	9
grey shrike-thrush			0	1
grey teal			11348	4520
hardhead			0	60
Latham's snipe	R	V	0	3
little grassbird			1	1
marsh sandpiper			1	0
masked lapwing			83	19
musk duck	R		0	1
Nankeen kestrel			1	1
Pacific black duck			0	345
pectoral sandpiper	R		1	0
pink-eared duck			58	0
purple swamphen			0	2
red-capped plover			**55**	**8**
red-necked stint			**1228**	**29**
royal spoonbill			8	41
sharp-tailed sandpiper		**V**	**4858**	**54**
silver gull			37	11
spiny-cheeked honeyeater			0	1
swamp harrier			6	8
wedge-tailed eagle			2	1
whiskered tern			1511	895
whistling kite			1	1
white-faced heron			17	17
white-fronted chat			21	4
yellow-billed spoonbill			0	4
		TOTAL	**20442**	**19932**

Target Species Distribution

Five of the seven HCHB target species were recorded in 2025, with red-necked avocet not recorded and banded stilt not yet recorded in any baseline census. The combined abundance and distribution of the HCHB target shorebird species recorded in the 2025 census is shown in Figure 4. Single species abundance and distribution maps for each of the six target species recorded are provided in Figure 5 to Figure 9.

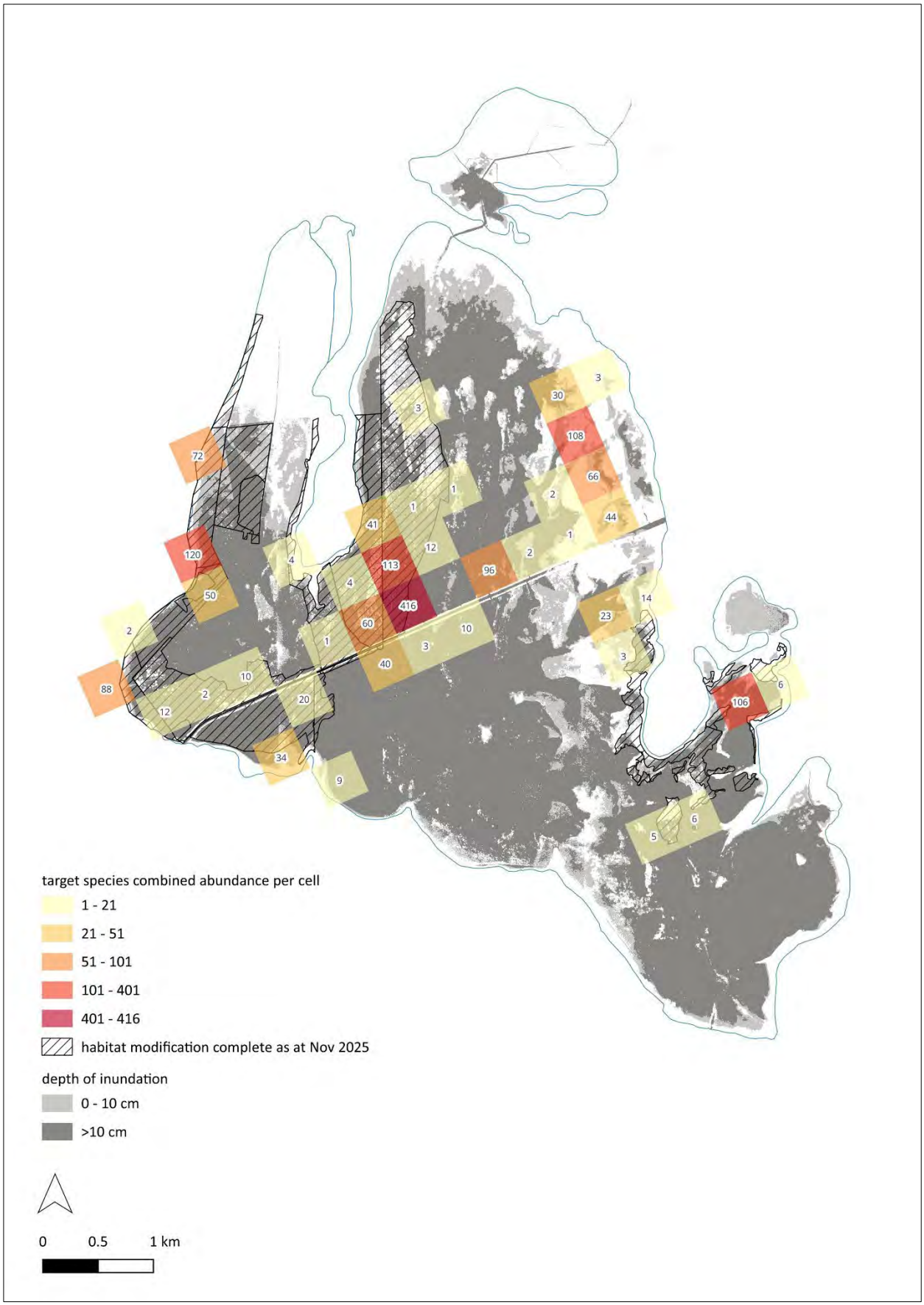


Figure 4. Distribution and abundance of HCHB RBR target shorebirds (combined) at LHN, 10 - 11 November 2025. Completed habitat modification and extent of inundation are also indicated.

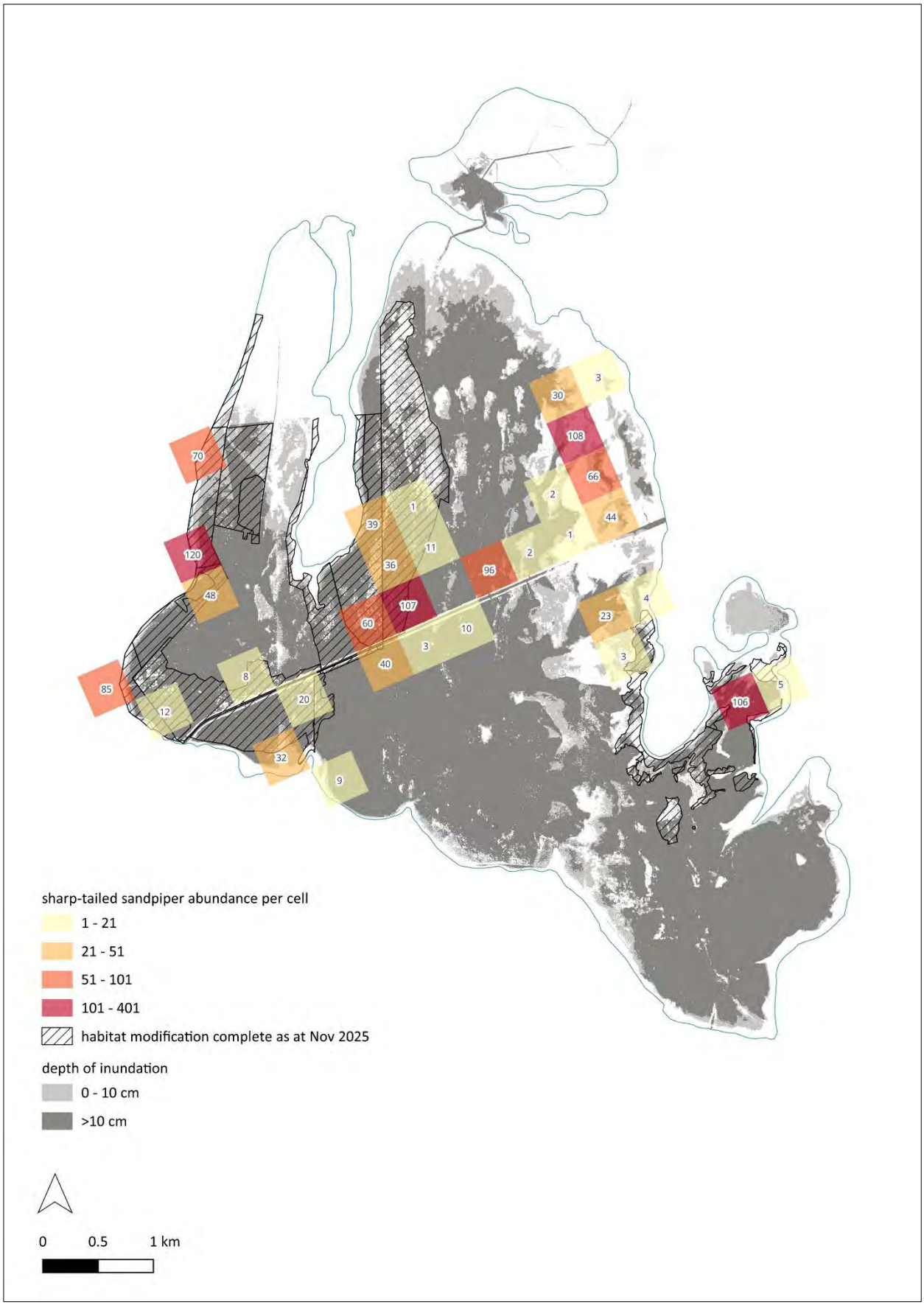


Figure 5. Distribution and abundance of sharp-tailed sandpiper at LHN, 10 - 11 November 2025. Completed habitat modification and extent of inundation are also indicated.

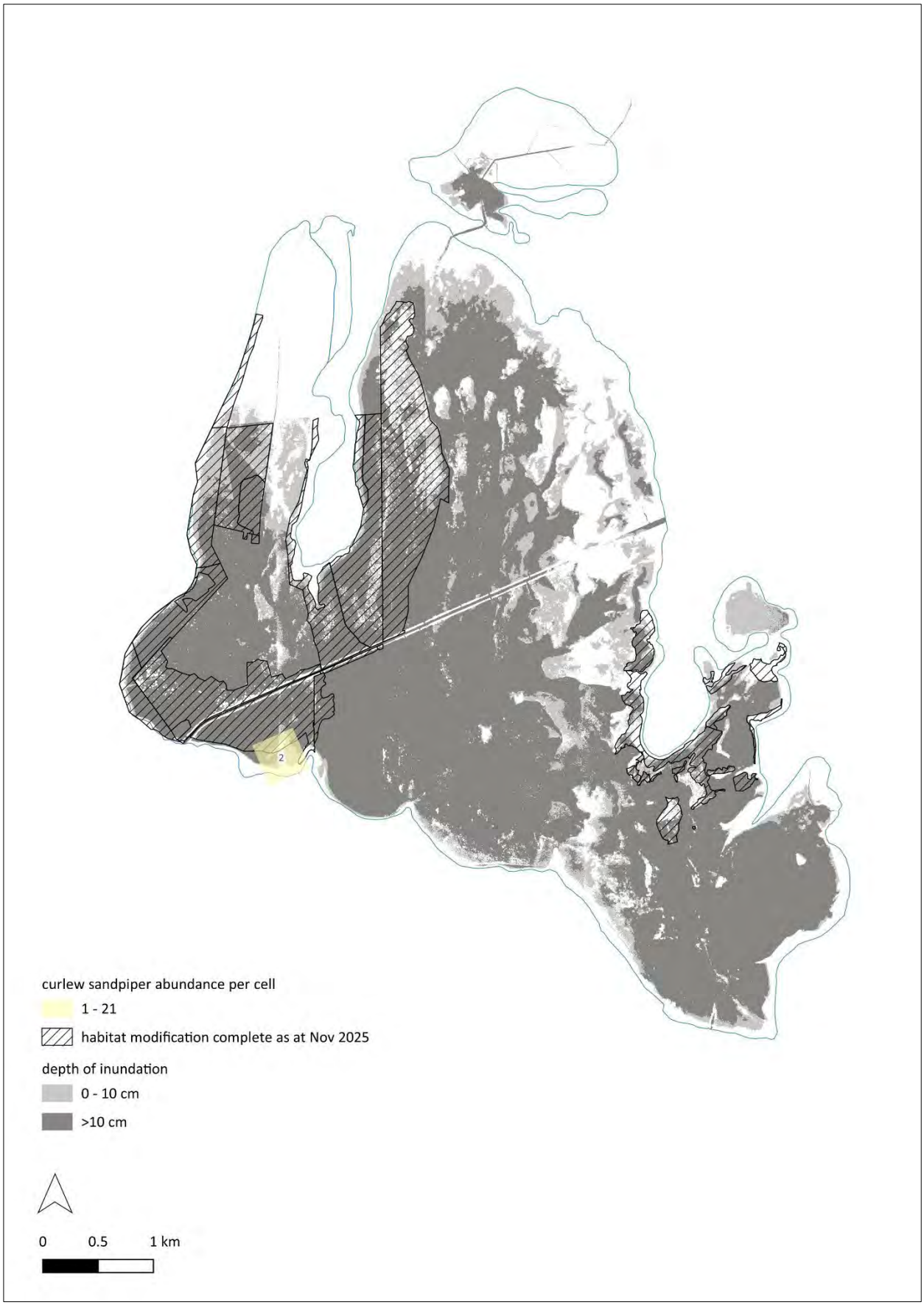


Figure 6. Distribution and abundance of curlew sandpiper at LHN, 10 - 11 November 2025. Completed habitat modification and extent of inundation are also indicated.

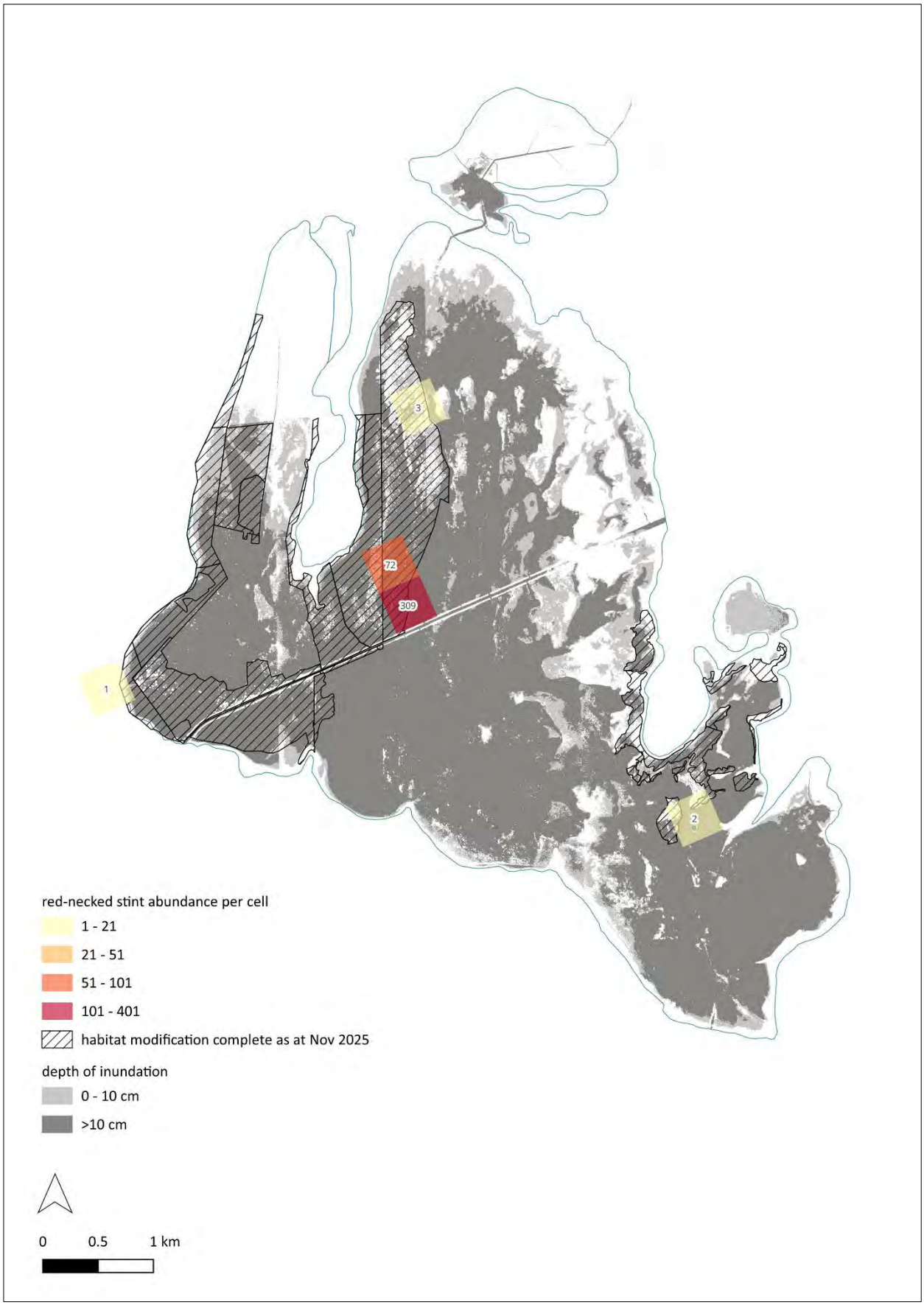


Figure 7. Distribution and abundance of red-necked stint at LHN, 10 - 11 November 2025. Completed habitat modification and extent of inundation are also indicated.

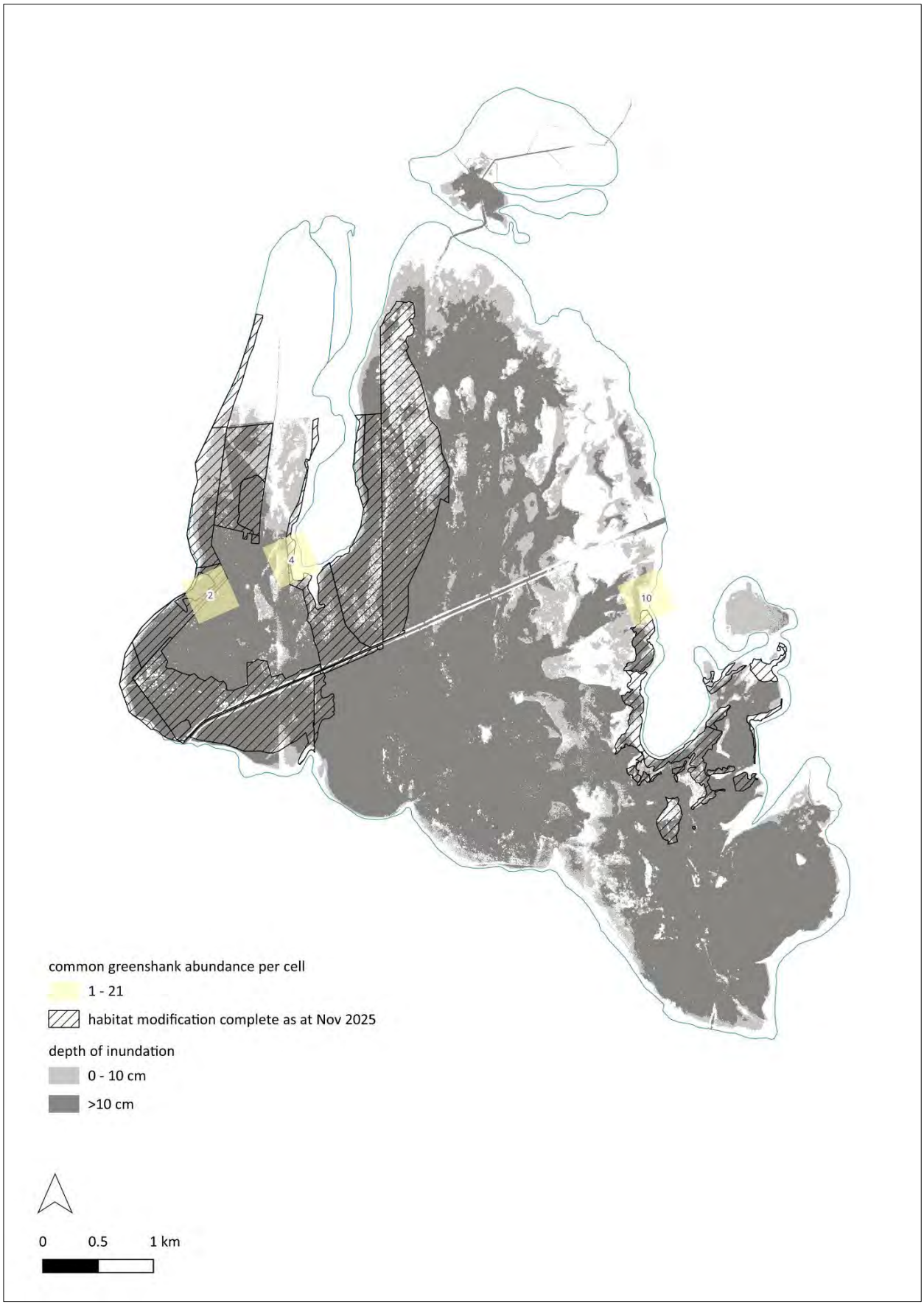


Figure 8. Distribution and abundance of common greenshank at LHN, 10 - 11 November 2025. Completed habitat modification and extent of inundation are also indicated.

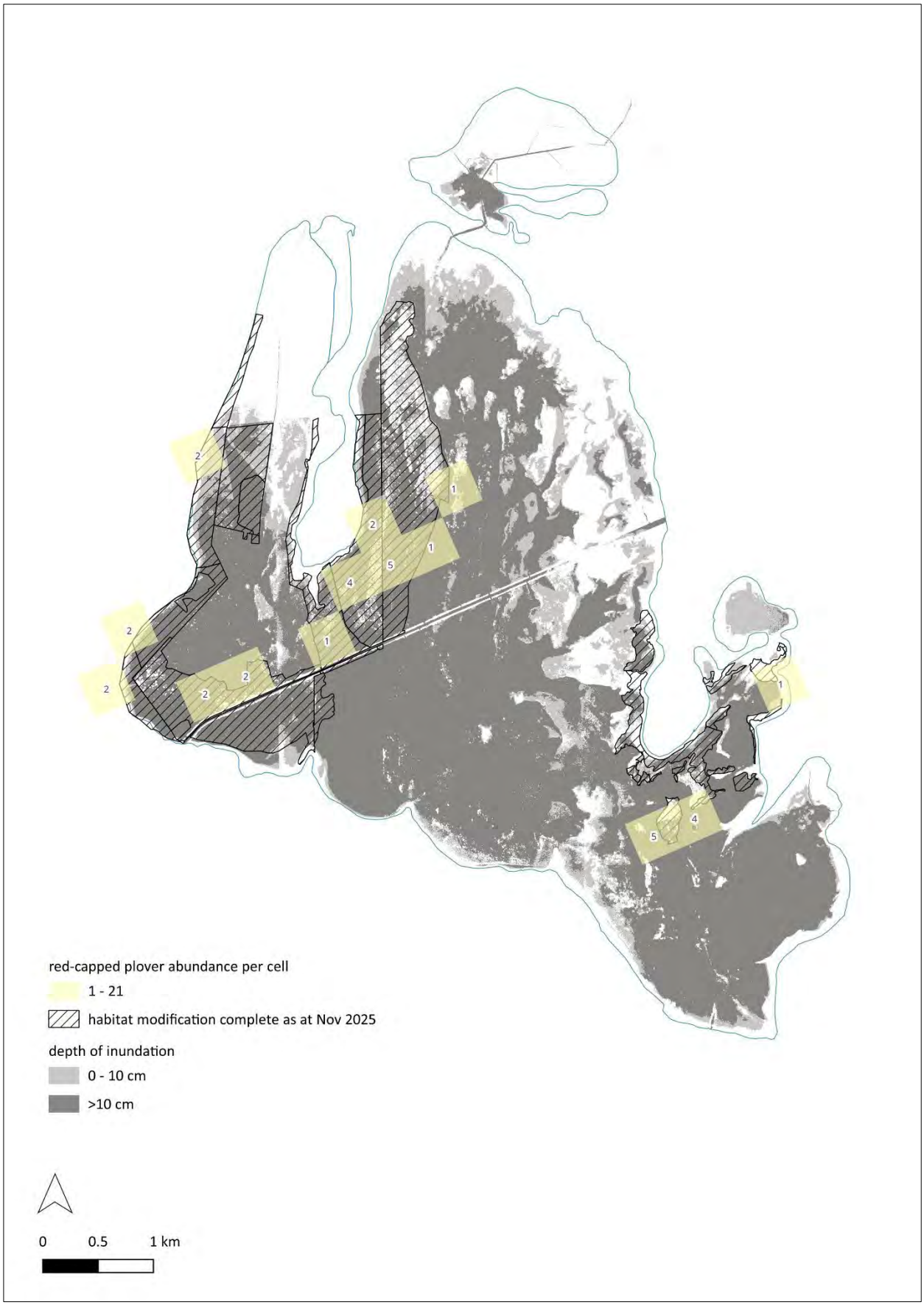


Figure 9. Distribution and abundance of red-capped plover at LHN, 10 - 11 November 2025. Completed habitat modification and extent of inundation are also indicated.

2.3. Discussion

Key Findings

The 2025 Lake Hawdon North waterbird census was the first post-restoration census undertaken. The count was dominated by waterfowl (particularly grey teal, black swan and Australian shelduck) with a lower abundance of HCHB target species, and waders generally, than the 2023 baseline (pre-restoration) census. However, the count of sharp-tailed sandpipers was nationally significant (van Swinderen et al. 2025) and the count of red-necked stint was the highest yet recorded. Encouragingly, a high proportion of the HCHB target species and other waders observed, including a nationally significant count of Latham's snipe (van Swinderen et al. 2025), were foraging in recently restored habitat that was formerly dense shrubland and typically dry by mid-November prior to regulator construction.

Breeding of red-capped plovers was observed in recently restored habitat in December 2025 (M. de Jong, pers. com., 17/12/2025). Acoustic monitoring in spring 2025 detected calling of Australasian bitterns suggestive of breeding within Lake Hawdon North (B. Clarke-Wood, pers. com., 8/12/2025).

The monitoring results were affected by two factors that likely contributed to lower abundances of HCHB target species than would be anticipated under optimal conditions. Firstly, habitat modification works in LHN (i.e. clearance of *Melaleuca halmaturorum* shrubland from the lakebed) were approximately 58% complete at the time of the census, with approximately 343 ha of approved mechanical clearance yet to be undertaken. Therefore, the extent of open pan, the target shorebird habitat within LHN, was considerably less at the time of the census than it will be when habitat modification works are completed. Secondly, water levels in LHN were considerably higher than anticipated. Modelling undertaken by DEW (2021) predicted a WSEL of around 4.0 mAHD in LHN by mid-November under average conditions post-restoration. During the census on 10-11 November 2025, LHN had a WSEL of 4.25 – 4.31 mAHD. Maximum foraging habitat availability for HCHB target species is understood to be provided at a WSEL of 4.03 mAHD (Figure 10). When the census was undertaken, foraging habitat availability for HCHB target species was approximately 50% of its maximum, with much of the lakebed too deeply inundated for shorebird foraging. These factors likely contributed to counts of HCHB target shorebirds, and wading species broadly, that were generally lower than baseline (pre-restoration) counts. However, the effectiveness of the regulator at retaining water in the lake provides a positive indication of what can be anticipated in LHN once habitat modification is complete, as discussed below.

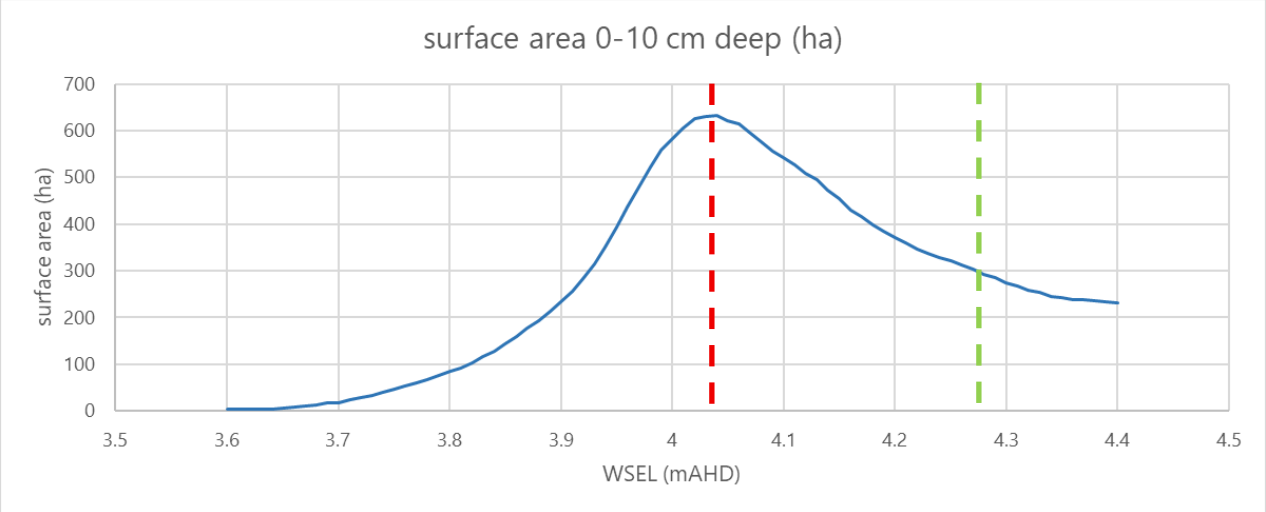


Figure 10. Relationship between WSEL and surface area 0-10 cm deep (foraging depth for HCHB target species) for Lake Hawdon North. The red dashed line indicates the WSEL (4.03 mAHD) at which the maximum area of foraging habitat for HCHB target species is provided. The green dashed line indicates the approximate WSEL on the date of the census.

Lake Hawdon South was also relatively deep when surveyed on 12 November 2025, mostly 20 – 45 cm within the survey area with very little shallow, open mudflat. This likely explains the low counts of HCHB target species and waders generally. The waterbird count of LHS was dominated by a single, large flock of 11,000 Eurasian coots, comprising 55% of total waterbird abundance. This species is not a wader; it typically feeds by up-ending or diving to graze on submerged plant material, illustrating the nature of the habitat available at the time of the count.

A large number (over 50) of southern bell frogs (*Ranoidea raniformis major*) were opportunistically detected, via call identification, across a widespread area of south-western Lake Hawdon South during the waterbird count on 12th November 2025 (B. Taylor, pers. obs.). This nationally vulnerable frog species was first detected in LHS in November 2021 (DEW 2025a) by FoSSE members Cath Bell and Maureen Christie during a waterbird count and now appears to be well established there.

Lake Hydrology

In 2025 the newly completed Lake Hawdon North regulator performed better than anticipated, with a WSEL in LHN in mid-November that was 25 – 30 cm higher than predicted by modelling (DEW 2021). This suggests that either the modelling was overly conservative, that conditions were wetter than average or a combination of both contributed to the outcome.

Rainfall in Robe is indicative of rainfall in the Lake Hawdon catchment. Total annual rainfall in Robe in 2025 was 618.7 mm, similar to the average of 631.6 mm (BOM 2026). This suggests 2025 was not a wetter than average year. However, the monthly distribution of rainfall shows above average rainfall in June, July, October and November and near average rainfall in August and September (Figure 11). Thus, the wetter than average second half of the year may have contributed to the retention of water in LHN.

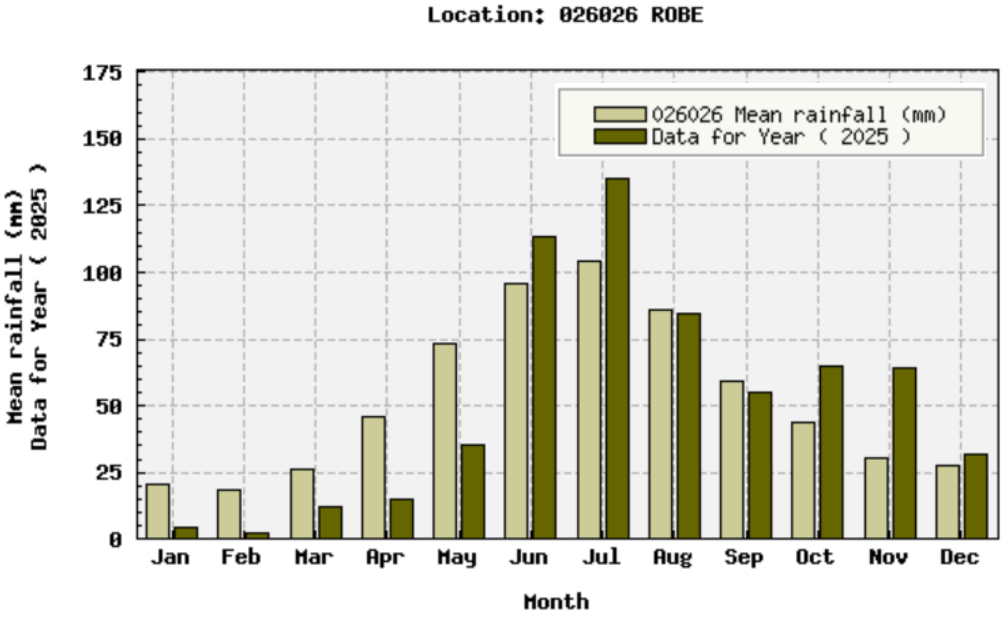


Figure 11. Comparison of monthly rainfall for Robe in 2025 with the long-term average (1861 – present).

However, the wetter second half of 2025 was preceded by an extended dry spell. Rainfall in January to May was well below average and followed the relatively dry year of 2024 (455.6 mm annual total in Robe) (BOM 2026). This contributed to very low Drain L flows through 2024 and in the first half of 2025, as recorded at Boomaroo Park 3.2 km downstream of the LHN regulator (Figure 12). Drain L flows were influenced by LHN regulator operations for the first time in 2025 and will be every year henceforth. Drain L was flowing unimpeded (albeit bypassed around regulator construction works) until 10 July. On that date

the regulator was completely closed to raise water levels in the lake and allow testing of the new infrastructure. This coincided with a drop in Drain L flows at Boomaroo Park (Figure 12) and a rapid rise in LHN WSEL (Figure 13). Thereafter the lake was maintained at approximately 4.10 mAHD (at the regulator) initially and then raised to approximately its maximum target level of 4.30 mAHD from late August. On 17th November the regulator was opened to drain and dry the lake to facilitate the completion of habitat modification works in late summer/autumn 2026. During the period that the lake held water, flows at Boomaroo Park varied considerably between 25 and 250 ML/day and were generally well below the median. Although evaporation and seepage losses within the lake have not been accounted for, these data suggest that 2025 was not an above average year based on Drain L flow rates at Boomaroo Park. On the contrary, the regulator was used to fill and retain water in the lake, rather than be left open until the lake, having filled passively, receded to the target regulated level of 4.30 mAHD, as was anticipated in an average to above average year.

In summary, the rainfall, flow rate and water level data do not indicate above average water availability in the Drain L catchment in 2025.Therefore, the better than anticipated water retention in LHN in spring 2025 is likely to be indicative of the restored hydrology henceforth.

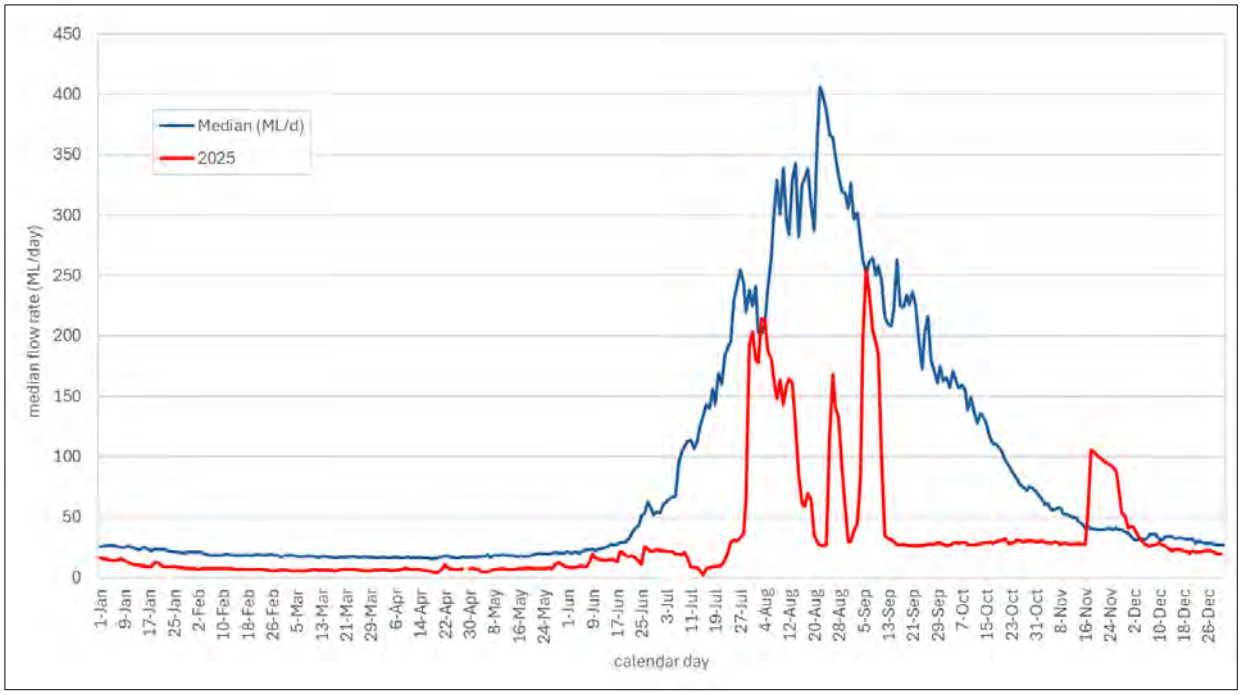


Figure 12. Comparison of median daily flow (ML/day) in Drain L at Boomaroo Park (blue line) with daily flow in 2025 (red line).

Figure 13. WSEL in LHN (mAHD) in 2025 at each of the three monitoring stations within the lake.

Recommendations

The 2025 census controlled for time of year as a factor potentially affecting waterbirds abundance in the Lake Hawdon system. The mid-November timing deliberately coincided with the timing of the baseline (pre-restoration) surveys (except the dry year of 2024). However, the water level in November 2025 was 20 – 25 cm above the optimal (a WSEL of 4.03 mAHD) at which the extent of foraging habitat for HCHB target species (open pan, inundated 0 -10 cm deep) is at its maximum in LHN. It is recommended that the timing of future censuses be triggered by water level, such that the census occurs when HCHB target species habitat availability is at its maximum, i.e. the WSEL in LHN is approximately 4.03 mAHD (noting the WSEL is rarely equal throughout the lake). The date at which this occurs is likely to vary between years but, as discussed above, is likely to be later in the season than the baseline surveys. As per the current monitoring protocols (Taylor et al. 2026), Lake Hawdon South should be surveyed at the same time as LHN. It can be reasonably assumed that, following the restoration of LHN, water depth throughout both LHN and LHS will be more closely aligned, thus optimal water levels in LHN are likely to coincide with near optimal water levels in LHS. To minimise the risk of double counting, ideally the entire Lake Hawdon system (North and South) should be counted over a single day. This may not be possible logistically, however conducting the census over as short a timeframe as possible is the objective. The use of all-terrain vehicles in LHN can greatly assist in reducing the time taken.

Conducting a second census later in the season, when available habitat is greatly reduced in area and HCHB target species are potentially highly concentrated, remains a recommendation (see Taylor et al. 2026) if resources are available.

The accurate measurement of the WSEL in LHN at the three telemetered monitoring stations within the lake allowed an assessment of the accuracy of the existing digital elevation model (DEM) covering the lake. Manual water depth measurements made in proximity to the monitoring stations during the waterbird census were compared to the DEM and revealed considerable inconsistencies. These measurements revealed that the elevation of the lakebed of LHN is up to 25 cm higher than that indicated by the DEM. The inconsistencies appear to be greater on the western side of the lake and less pronounced on the eastern side. The apparent inaccuracy of the existing DEM brings into question key knowledge that

informs management, such as the volume-depth relationship and the extent of HCHB target species habitat across the range of WSELs. It is recommended that a more accurate DEM be obtained for Lake Hawdon, covering both LHN and LHS (for which the existing DEM also has identified inaccuracies (Taylor et al. 2014)).

3. Vegetation Transects

Recommended monitoring of the vegetation of Lake Hawdon North includes (Taylor et al. 2026):

- Vegetation transect monitoring 1 year in 3;
- Vegetation mapping of the entire lake 1 year in 10.

There is also a *Melaleuca halmaturorum* recruitment monitoring program covering Lake Hawdon South and North that was last monitored in 2019 (Taylor and Brown 2019).

In October 2025 vegetation transect monitoring was repeated.

3.1. Methods

Seven vegetation transects, with a combined length of 2,105 m, were established and first monitored in Lake Hawdon North on 11th – 12th October 2021 at locations designed to:

- document the vegetation of the lowest elevations of Lake Hawdon North where, following hydrological restoration, the duration of inundation will be longest and therefore shorebirds are most likely to be concentrated post-restoration;
- document the vegetation in locations where changes to the vegetation are anticipated to be most pronounced post-restoration, e.g. due to mechanical clearance of shrubland and or highly altered hydrology; and
- align spatially with other parameters to enable deeper exploration of associations between these parameters and ecosystem response through future monitoring.

These seven transects were re-monitored on 22nd – 23rd October 2025, the second monitoring event and the first event post-restoration. The WSEL of LHN on the survey dates was 4.24 – 4.32 mAHD, most elevated on the eastern side and furthest from Drain L.

Transects are positioned to be indicative of vegetation zonation across the elevation gradient in the general area of the wetland in which they were located. Transect start locations are on elevated ground (typically within terrestrial (non-wetland) vegetation), and end locations at a low point on the wetland bed. The endpoint is located where a consistency of vegetation is apparent and elevation is consistent (i.e. the wetland bed is flat). The length of each transect is determined by these factors.

Both ends of each transect are permanently marked in the field using low survey pegs (not star droppers) to reduce the risk of vehicle collision (including vegetation clearance machinery during restoration), harm to animals and disturbance by livestock.

GPS coordinates (AMG, GDA 1994, Zone 54) are known for both ends of each transect and the compass bearing taken from the start point. A photograph was taken at each end, looking along the transect. A general site description was recorded noting forms of disturbance (e.g. stock impacts, native herbivores, fire, fences and tracks), along with measurements of weediness, vegetation health and evidence of change.

The vegetation composition and density was recorded along each transect. Where possible a tape measure was placed along the transect beginning at the terrestrial end. For transects longer than 200 m a handheld GPS was used to record the locations of changes to vegetation. For longer transects, particularly across structurally diverse vegetation, GPS approximation is considered to have a similar margin of error to tape measurement.

Figure 14. Vegetation transect locations (yellow lines) in Lake Hawdon North.

The three most dominant species were recorded for each of six defined strata in a six-metre envelope along each transect, made up of three metres each side of the line between the start and end posts. The defined strata were:

- 1st Tree: Trees
- 2nd Tree: Mallee or shrubs
- 1st Shrub: >2 metres
- 2nd Shrub: 1 – 2 metres
- 1st Ground: 0.3 – 1 metre, generally tall sedges and grasses or small shrubs
- 2nd Ground: <0.3 metre, generally forbs and small grasses or sedges

Previous surveyors using this methodology (e.g. Dickson et al. 2013) have found that where only the 2nd ground stratum is present over extended distances (several hundred metres), recording only three dominant species was insufficient to describe the vegetation. Therefore, in areas where only the 2nd ground stratum was present, a maximum of five co-dominant species was recorded. This included the open mudflat habitat that is the focus of restoration at Lake Hawdon North.

The projected cover of each of the species was recorded using the following categories:

- Dense (70 - 100%)
- Mid-dense (30 - 70%)
- Sparse (10 - 30%)
- Very Sparse (1 - <10%)
- Clumped (<1%), or
- Scattered (<1%)

At each location along the transect, where the projected cover of one or more dominant species changed in any strata, the location was recorded.

The management focus on *Melaleuca halmaturorum* required this species to be treated differently to other wetland plant species at Lake Hawdon North. The projected cover of this species was recorded wherever it was present, even if non-dominant, noting that this had the potential to make the number of species recorded in each strata greater than three. Additionally, *M. halmaturorum* was divided into size classes as follows:

- Seedling/sapling: <0.3 m height
- Juvenile: 0.3 – 1.0 m height
- Established: >1.0 m height

At the end (lowest elevation) of each transect, and within an area of consistent water depth and floristic composition, three permanent 2 x 2 m quadrats were re-monitored. The quadrats were located at positions 2, 6 and 10 m along the 10 m extension of the transect (Figure 15), on the left side when looking into the wetland. The quadrats had similar species composition and were located at the same depth (to within 2 cm).

The electrical conductivity, temperature, pH and dissolved oxygen concentration of surface water (where present) was recorded at the first quadrat and a depth measurement and photograph taken for all quadrats. Every plant species present within each quadrat was recorded and given a projected cover score using the Braun-Blanquet scale as follows:

- 5: 75 to 100%

- 4: 50 to 75%
- 3: 25-50%
- 2: 5 to 25%
- 1: numerous or scattered but less than 5% cover
- F: few, with small cover
- R: rare or solitary, with small cover.

Quadrats provide more detailed data on plant species present at the lowest lying elevation of the transect as all species are recorded, not only the dominant species.

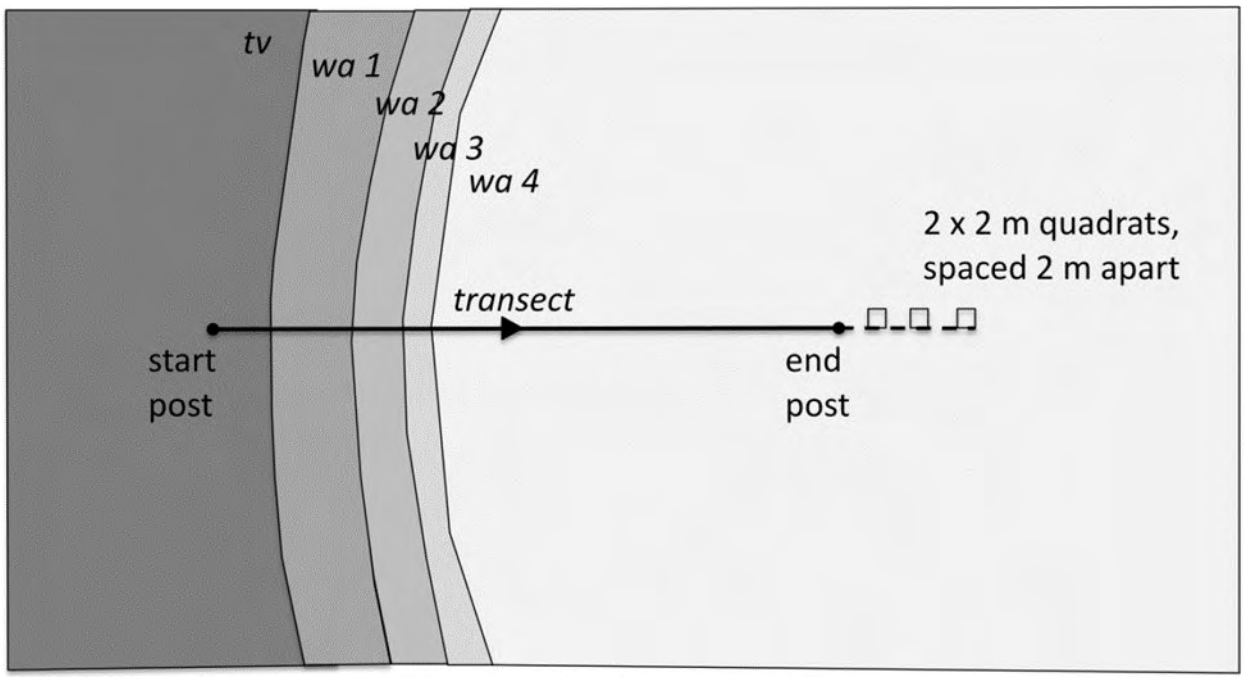


Figure 15 Arrangement of transects and quadrats.

3.2. Results

The following section provides specific details about transect location, length and initial start and end photopoint photos. Vegetation data for each transect is summarised using a kite chart, illustrating transect position and density of each of the dominant species recorded. Location details are also provided for each of the quadrats, along with species recorded and their cover core and a representative photo from one of the three quadrats.

Transect 1

Start Easting: 400495	End Easting: 400616
Start Northing: 5887535	End Northing: 5887693
Bearing (from start): 38°	
Length: 199 m	
Start photo	End photo
	
	

Figure 16. Aerial images of Transect 1 prior to restoration (above) and in mid-October 2025 after restoration works (below).

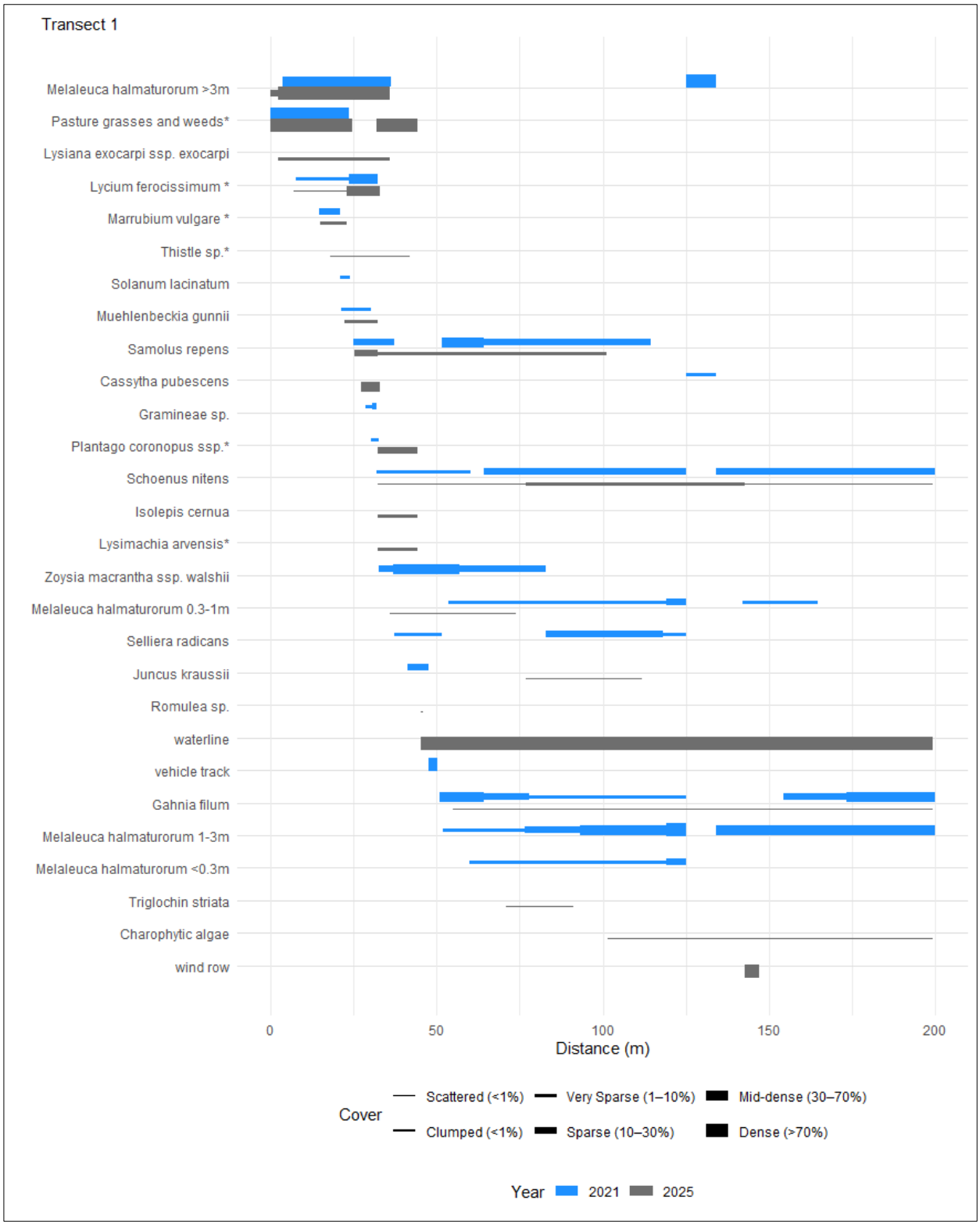


Figure 17. Kite chart for vegetation Transect 1.

Transect 1 Quadrats

Transect End Stake Easting	400616					
Transect End Stake Northing	5887693					
Survey date	11/10/2021			22/10/2025		
Quadrat number	1	2	3	1	2	3
Water quality and quantity						
EC (µS/cm)	No water			4808		
Temperature (°C)				15.23		
pH				8.35		
DO (mg/L)				0.55*		
depth (cm)	0	0	0	27	27	27
Species	Braun Blanquet Cover					
Gahnia filum	2	3	3	F	F	F
Schoenus nitens	1	1	1	F	F	F
Drosera pygmaea	R		R			
Gramineae sp.	R					
Melaleuca halmaturorum 0 - 0.3m	R					
Melaleuca halmaturorum 1 -2m	1	3	3			
Charophytic algae				F		F

*suspect inaccurate DO probe

Figure 18. Transect 1, Quadrat 1.

Transect 2

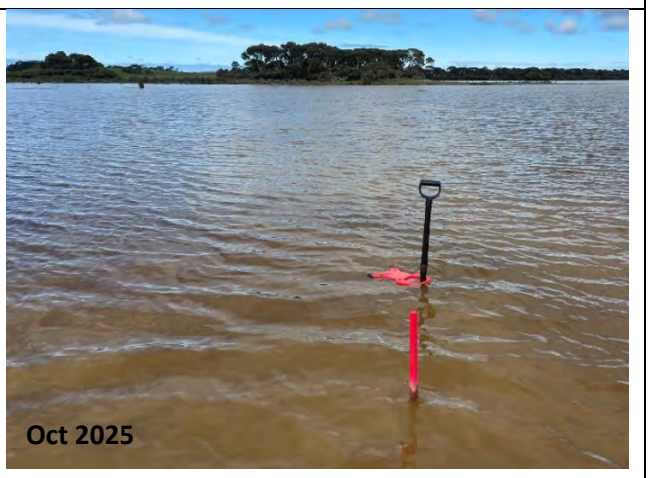
Start Easting: 401902	End Easting: 402033
Start Northing: 5887354	End Northing: 5887505
Bearing (from start): 25°	
Length: 199.9 m	
Start photo	End photo
 Oct 2021	 Oct 2021
 Oct 2025	 Oct 2025

Figure 19. Aerial images of Transect 2 prior to restoration (above) and in mid-October 2025 after restoration works (below).

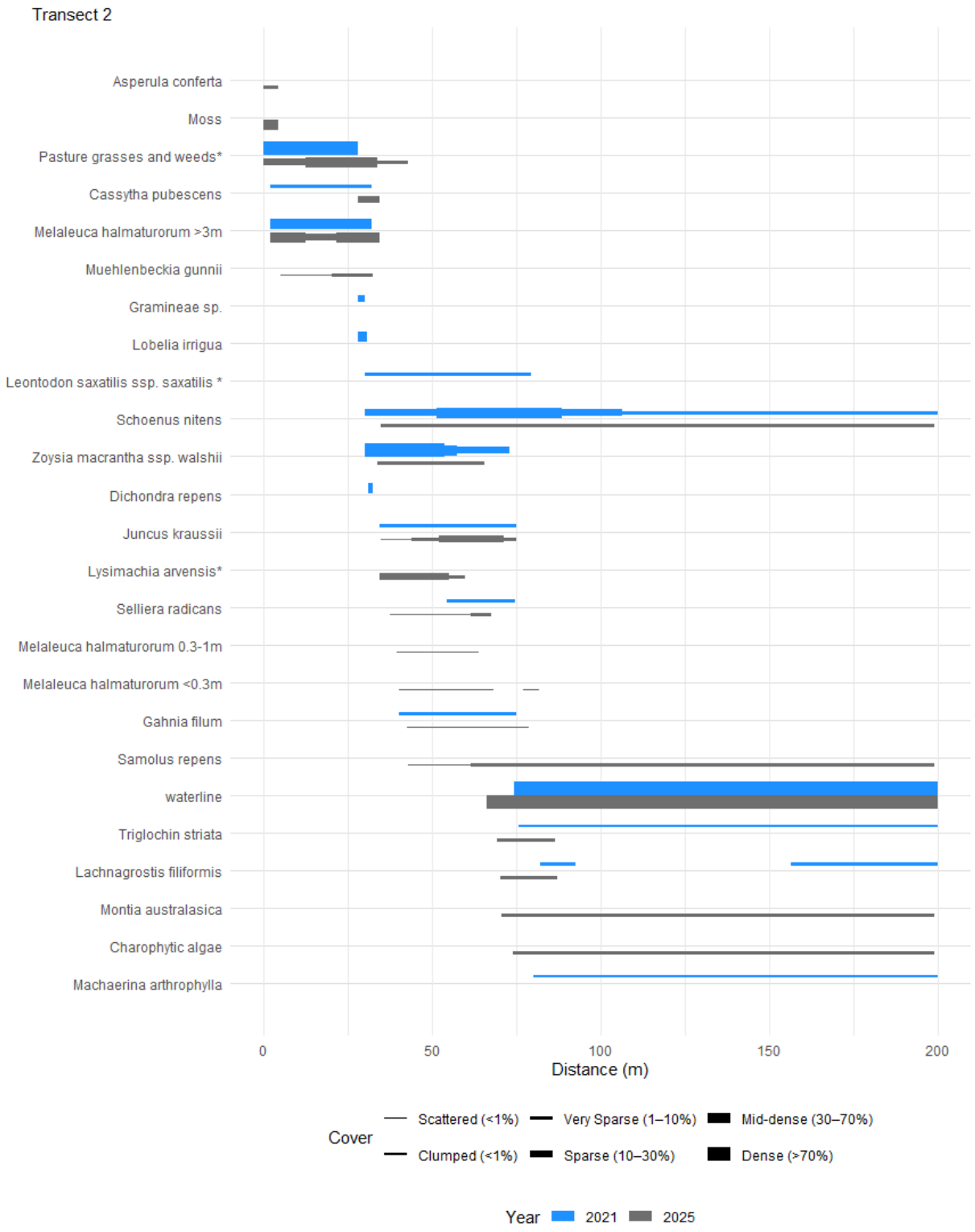


Figure 20. Kite chart for vegetation Transect 2.

Transect 2 Quadrats

Stake Easting	402033					
Stake Northing	5887506					
Survey date	11/10/2021			22/10/2025		
Quadrat number	1	2	3	1	2	3
Water quality and quantity						
EC (µS/cm)	4486			4725		
Temperature (°C)	15.5			16		
pH	8.85			8.43		
DO (mg/L)	17.97			0.62*		
depth (cm)	17.5	17	17.5	31	31	32
Species	Braun Blanquet Cover					
Schoenus nitens	1	1	1	1	1	2
Gramineae sp.					R	
Isolepis fluitans	F	F				
Charophytic algae				F	F	F
Triglochin striata		F	F	F		
Montia australasica				1	1	1
Samolus repens				F	F	F

*suspect inaccurate DO probe

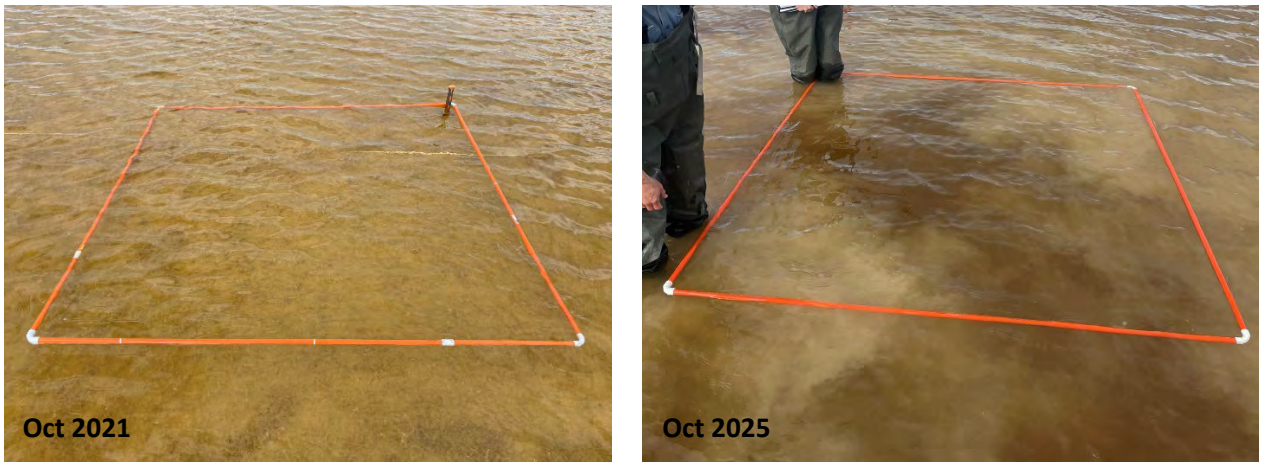


Figure 21. Transect 2, Quadrat 1.

Transect 3

Start Easting: 402807	End Easting: 403012
Start Northing: 5886822	End Northing: 5886970
Bearing (from start): 56°	
Length: 252.8 m	
Start photo	End photo
	
	

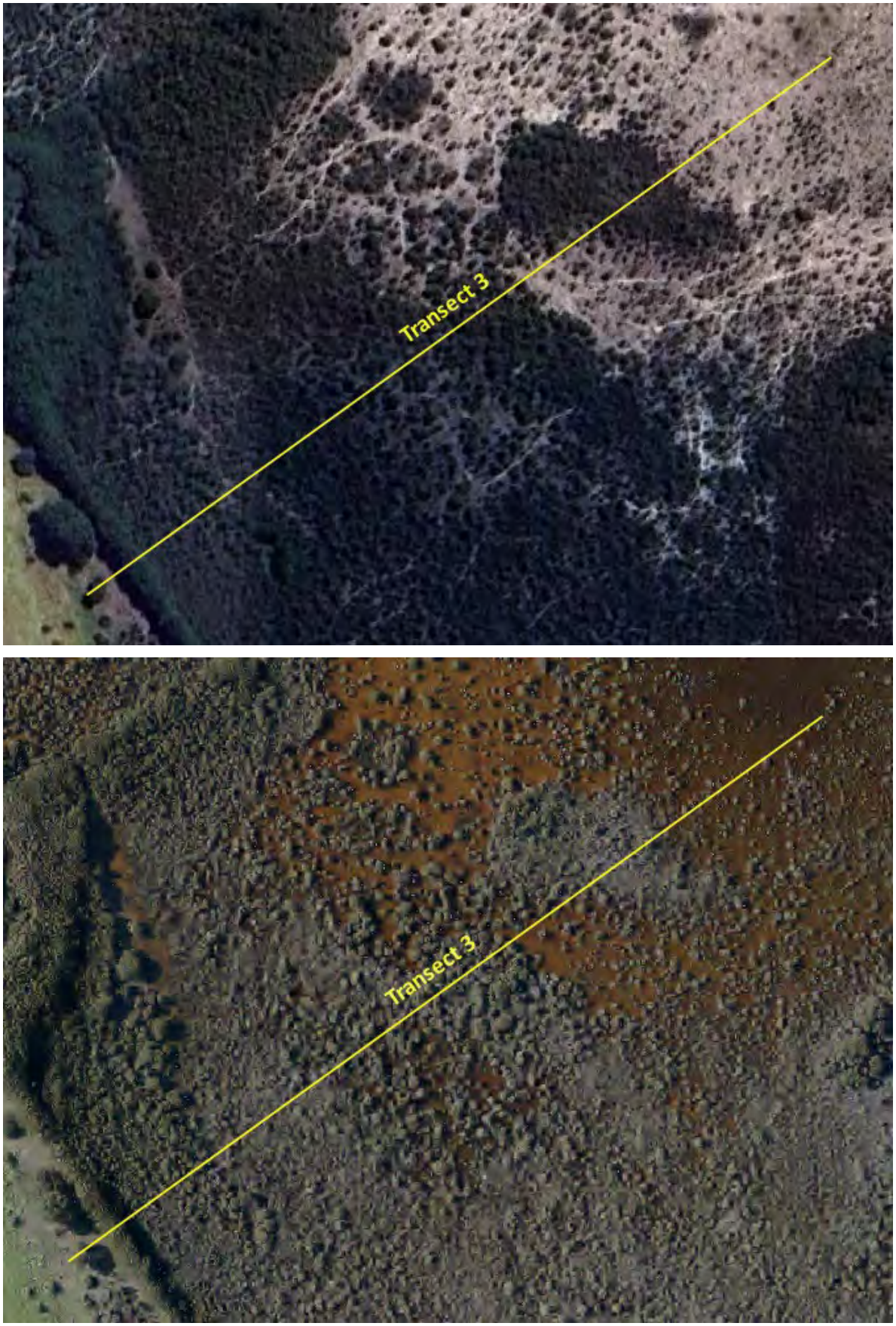


Figure 22. Aerial images of Transect 3 prior to restoration (above) and in mid-October 2025 (below). Habitat modification is proposed for autumn 2026 in this area of the lake.

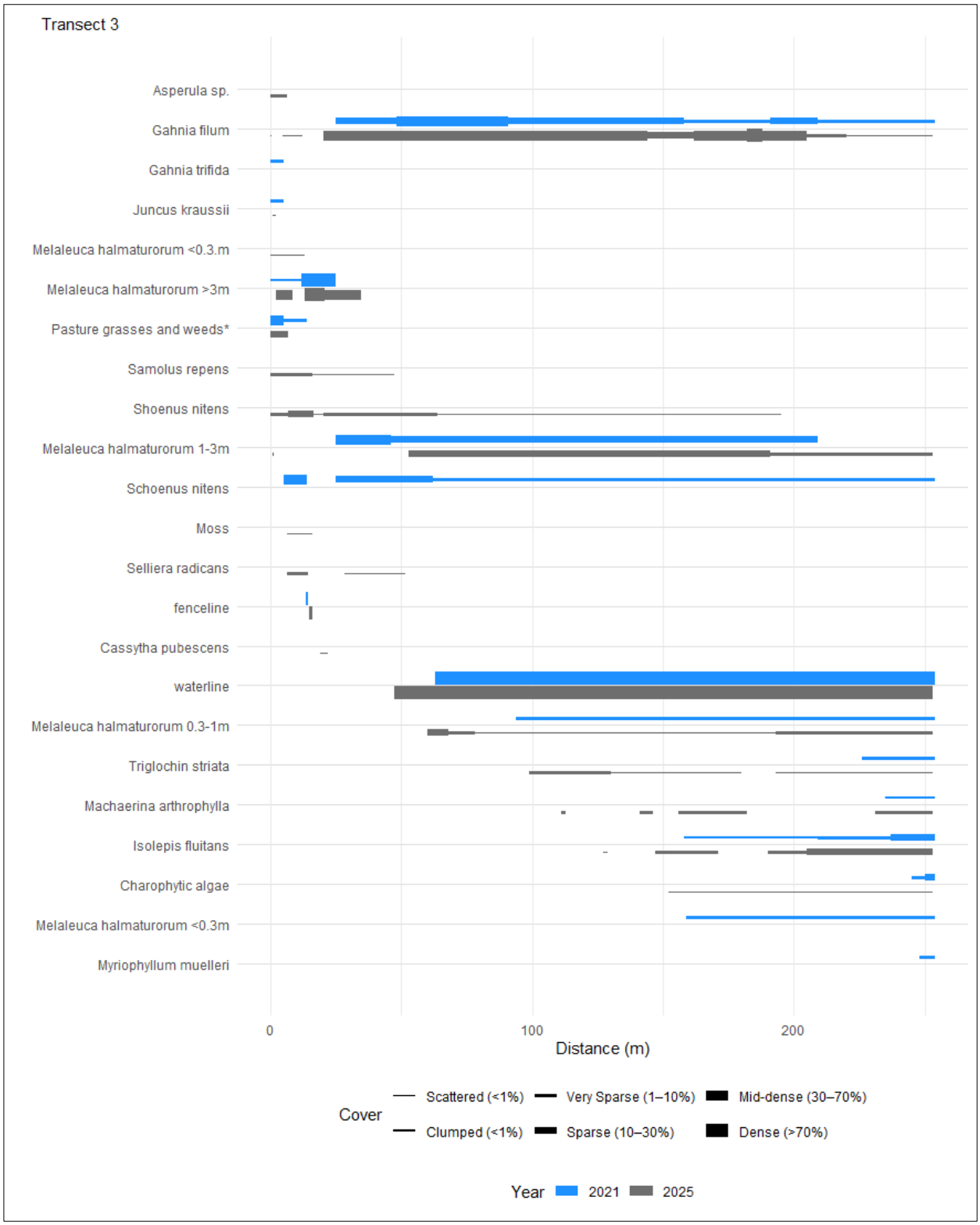


Figure 23. Kite chart for vegetation Transect 3.

Transect 3 Quadrats

Transect End Stake Easting	403012					
Transect End Stake Northing	5886971					
Survey Date	11/10/2021			23/10/2025		
Quadrat number	1	2	3	1	2	3
Water quality and quantity						
EC (µS/cm)	4022			4870		
Temperature (°C)	17.5			19.01		
pH	8.37			8.25		
DO (mg/L)	22.58			0.33*		
depth (cm)	16.5	16.5	18	24.5	24.5	24.5
Species	Braun Blanquet Cover					
Schoenus nitens	1	1	F			
Melaleuca halmaturorum 0 - 0.3m	1	1	1	F		F
Melaleuca halmaturorum 0.3 - 1m			2	R	R	
Lachnagrostis filiformis	2	2	3			
Isolepis fluitans	1	1	1	2	2	2
Charophytic algae	2	2	1	F	F	F
Myriophyllum muelleri	R	R	R		F	F
Triglochin striata	R			1	1	1
Samolus repens					F	
Selliera radicans	R	1	F			
Macherina arthrophylla						F

*suspect inaccurate DO probe

Figure 24. Transect 3, Quadrat 1.

Transect 4

Start Easting: 404147	End Easting: 403997
Start Northing: 5889111	End Northing: 5889335
Bearing (from start): 325°	
Length: 305.8 m	
Start photo	End photo
	
	

Figure 25. Aerial images of Transect 4 prior to restoration (above) and in mid-October 2025 (below). Habitat modification is not proposed in this area of the lake.

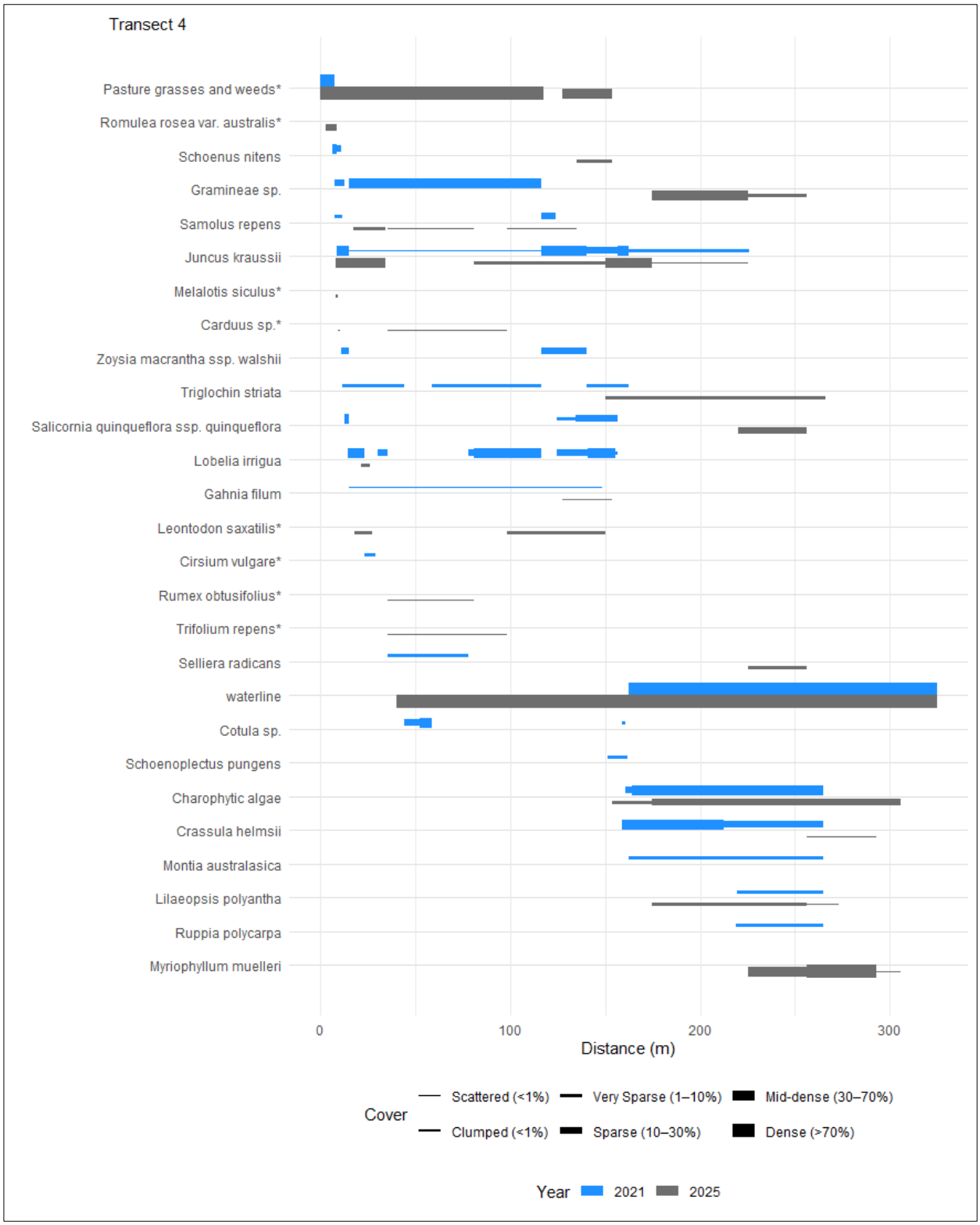


Figure 26. Kite chart for vegetation Transect 4.

Transect 4 Quadrats

Transect End Stake Easting	403997					
Transect End Stake Northing	5889335					
Survey date	12/10/2021			23/10/2025		
Quadrat number	1	2	3	1	2	3
Water quality and quantity						
EC (µS/cm)	5965			4875		
Temperature (°C)	17.05			19.44		
pH	9.06			8.78		
DO (mg/L)	18.9			0.37*		
depth (cm)	18	18	18	45	45	45
Species	Braun Blanquet Cover					
Charophytic algae				2	2	3
Myriophyllum muelleri	3	3	3	2	1	2
Lilaeopsis polyantha	2	2	2			
Montia australasica	1	1				
Crassula helmsii	1	1	1			

*suspect inaccurate DO probe

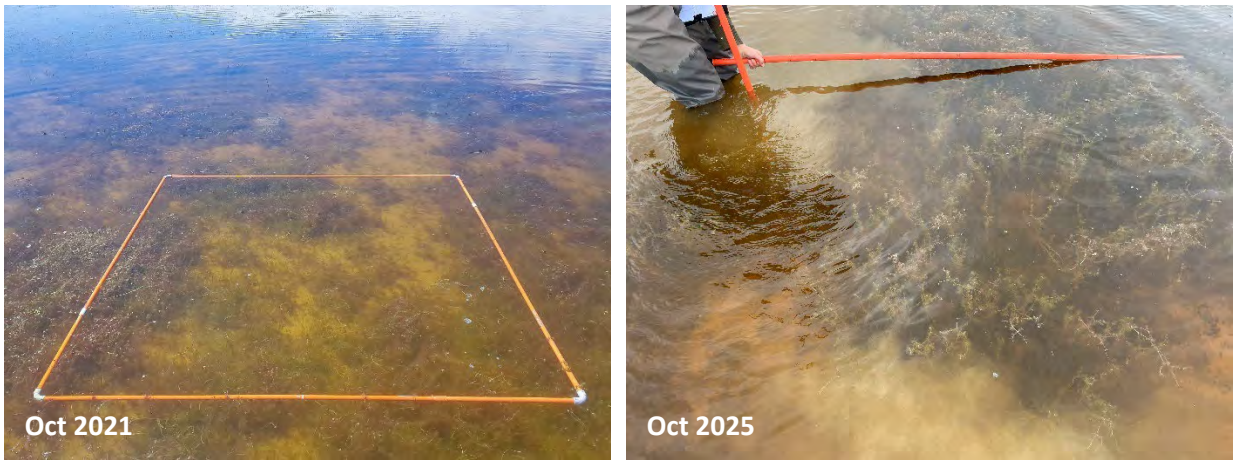


Figure 27. Transect 4, Quadrat 1 (2021, left) and Quadrat 3 (2025, right).

Transect 5

Start Easting: 404932	End Easting: 404570
Start Northing: 5887854	End Northing: 5887849
Bearing (from start): 270°	
Length: 362 m	
Start photo	End photo
	
	

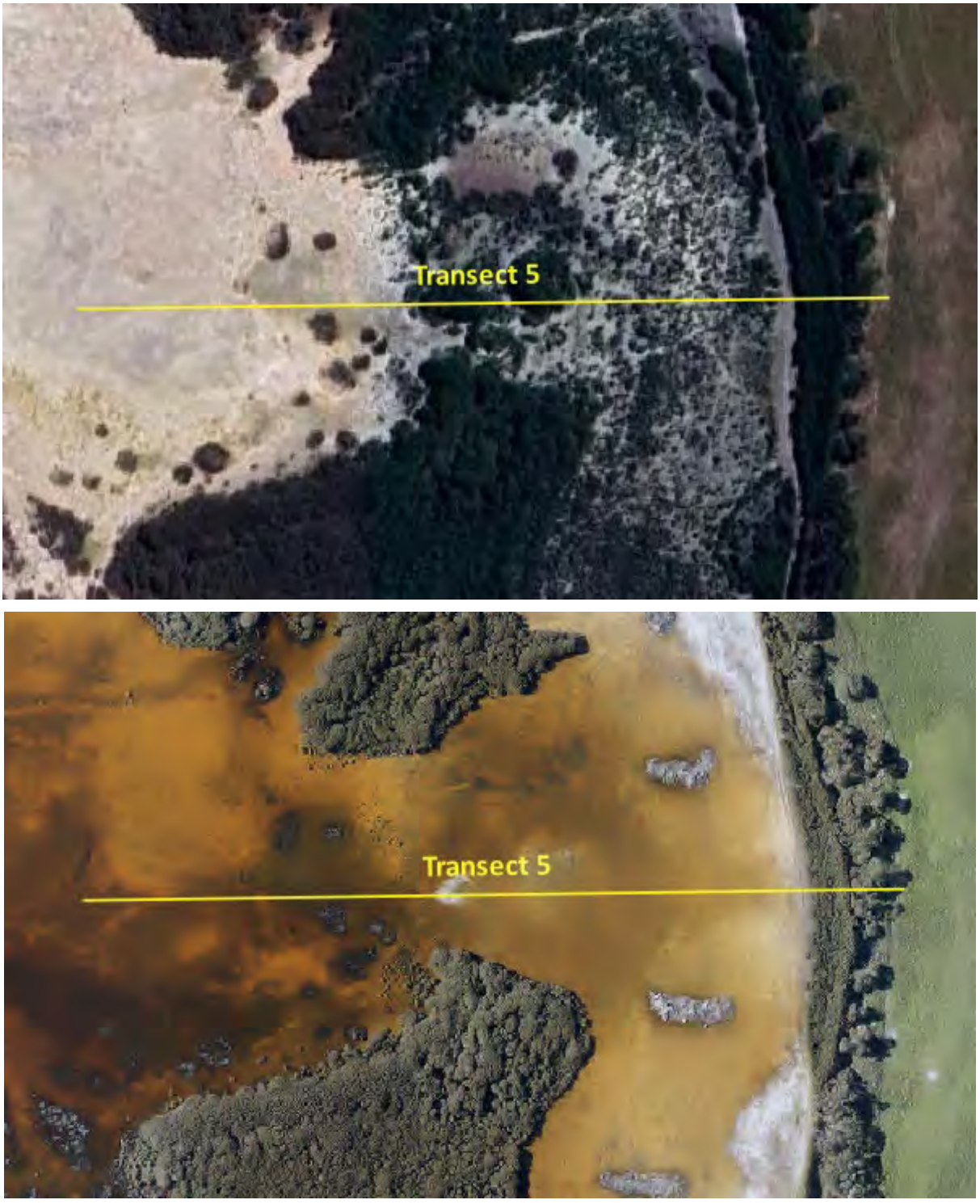


Figure 28. Aerial images of Transect 5 prior to restoration (above) and in mid-October 2025 after restoration works (below).

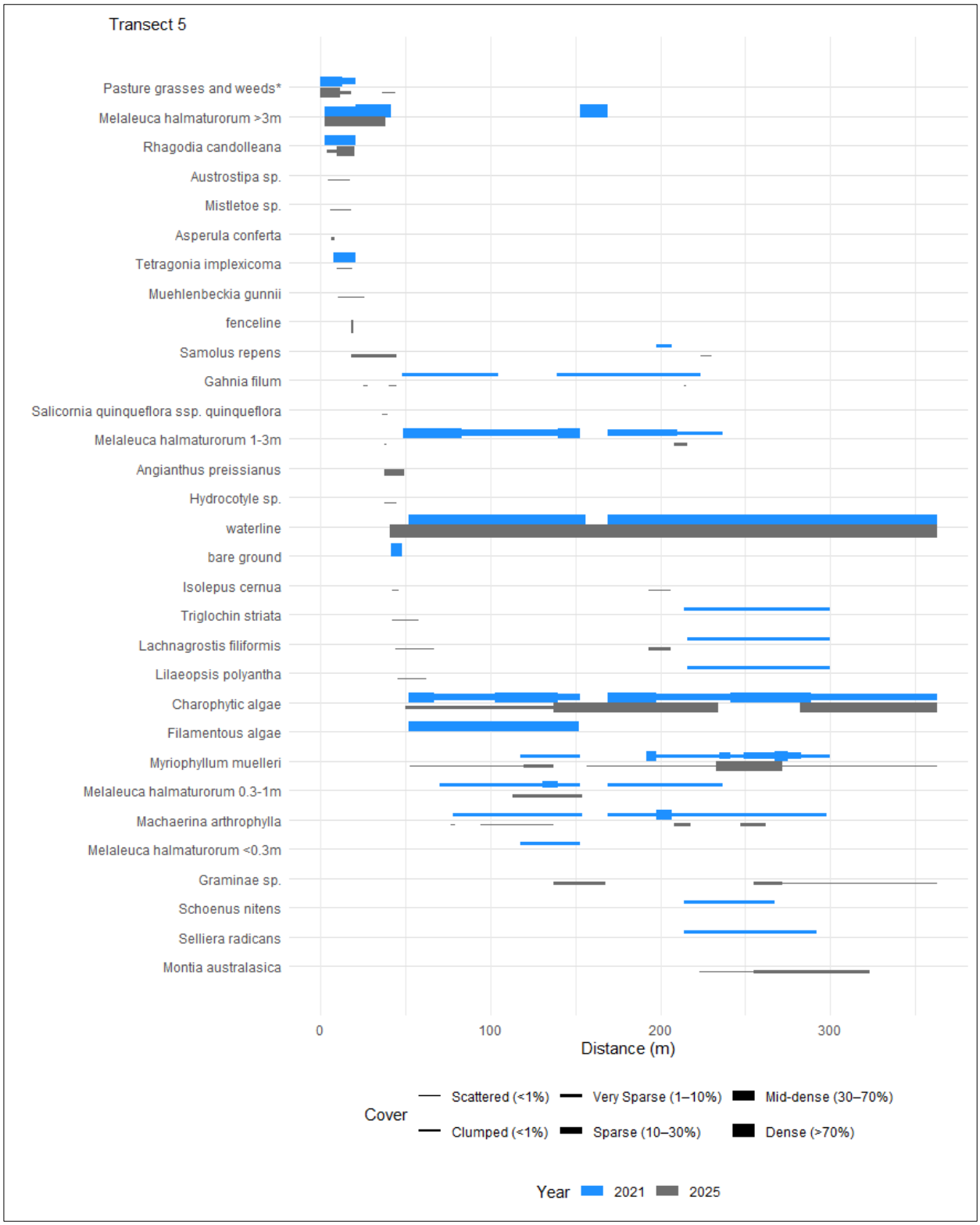


Figure 29. Kite chart for vegetation Transect 5.

Transect 5 Quadrats

Transect End Stake Easting	404569					
Transect End Stake Northing	5887848					
Survey date	12/10/2021			23/10/2025		
Quadrat number	1	2	3	1	2	3
Water quality and quantity						
EC (µS/cm)	5024			4294		
Temperature (°C)	15.3			19.8		
pH	8.44			8.71		
DO (mg/L)	17.21			0.34*		
depth (cm)	44	44	45	55	55	55
Species	Braun Blanquet Cover					
Charophytic algae	2	2	2	4	3	4
Myriophyllum muelleri		R			1	1
Montia australasica						1

*suspect inaccurate DO probe

Figure 30. Transect 5, indicative view of quadrat location (2021, left) and Quadrat 1 (2025, right).

Transect 6

Start Easting: 401185	End Easting: 401250
Start Northing: 5887412	End Northing: 5887690
Bearing (from start): 15°	
Length: 285.5 m	
Start photo	End photo
	
	

Figure 31. Aerial images of Transect 6 prior to restoration (above) and in mid-October 2025 after restoration works (below).

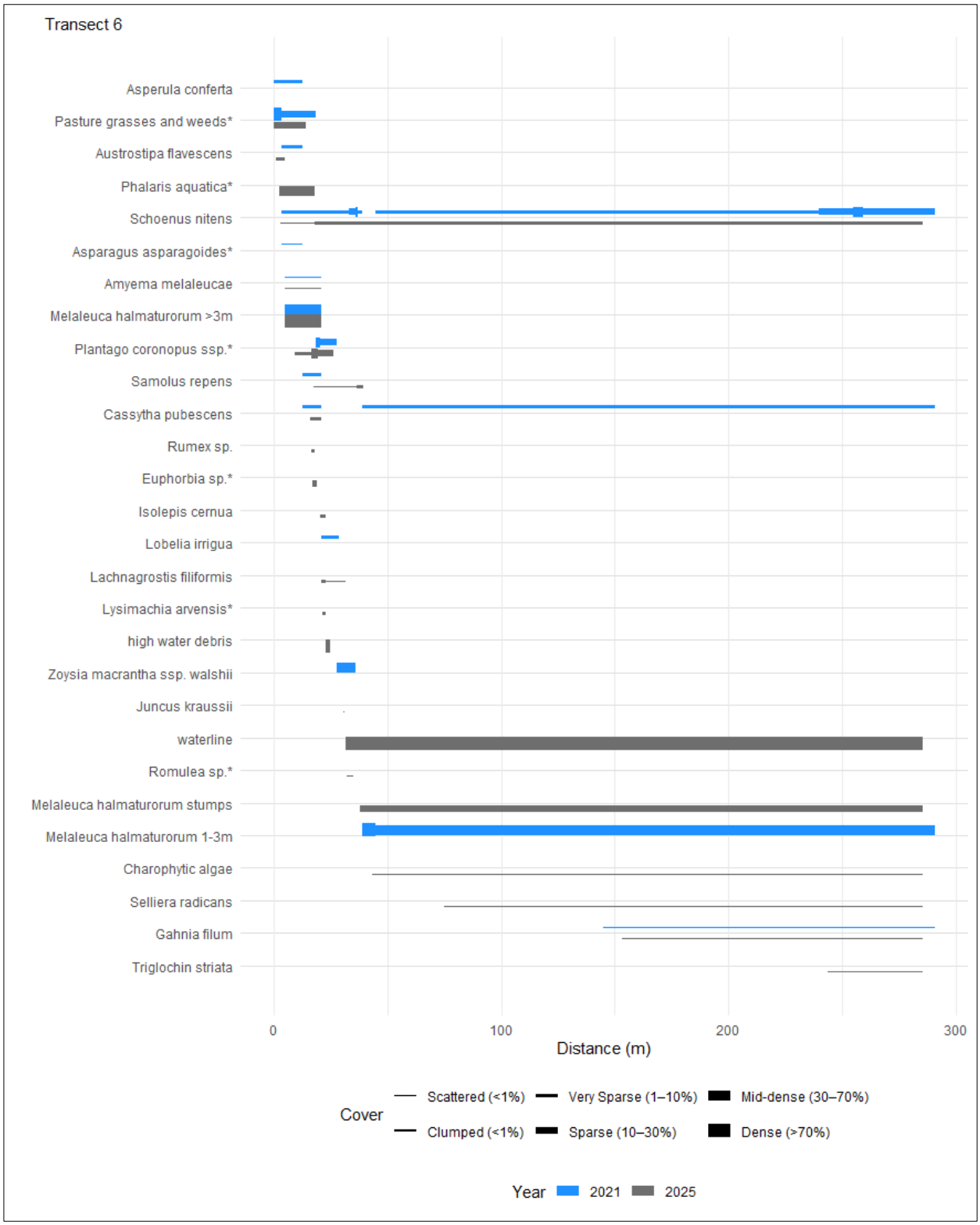


Figure 32. Kite chart for vegetation Transect 6.

Transect 6 Quadrats

Transect End Stake Easting	401250					
Transect End Stake Northing	5887690					
Survey date	12/10/2021			23/10/2025		
Quadrat number	1	2	3	1	2	3
Water quality and quantity						
EC (µS/cm)	No water			4825		
Temperature (°C)				16.3		
pH				8.32		
DO (mg/L)				2.25*		
depth (cm)	0	0	0	21	21	21
Species	Braun Blanquet Cover					
Gahnia filum	R					
Schoenus nitens	2	2	2	2	1	1
Drosera pygmaea	R	R	R			
Melaleuca halmaturorum 0.3 -1m		R				
Melaleuca halmaturorum 1 - 2m	2	2	3			
Charophytic algae				1	1	
Triglochin striata	F	R			R	
Samolus repens	F		R			
Selliera radicans	F	F	R			

*suspect inaccurate DO probe

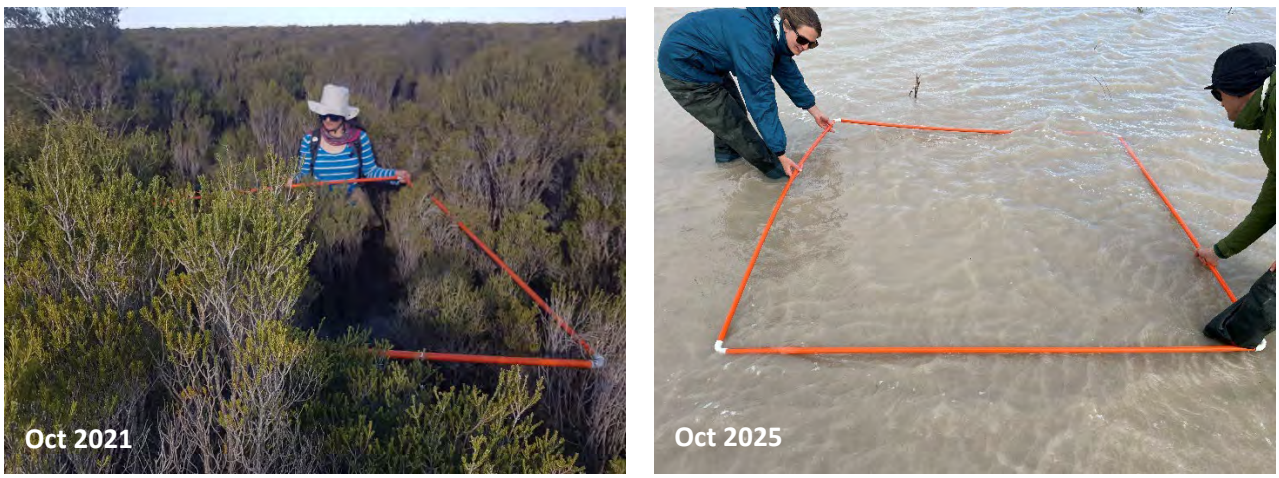


Figure 33. Transect 6, Quadrat 1.

Transect 7

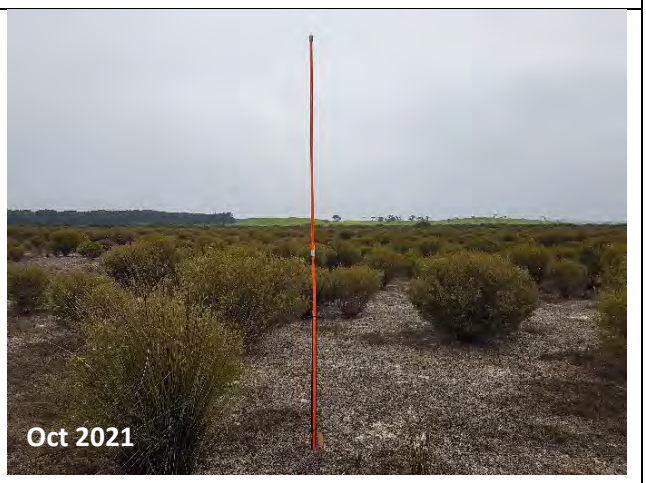
Start Easting: 400818	End Easting: 401316
Start Northing: 5889520	End Northing: 5889560
Bearing (from start): 85°	
Length: 500.2 m	
Start photo	End photo
	
	

Figure 34. Aerial images of Transect 7 prior to restoration (above) and in mid-October 2025 after restoration works (below).

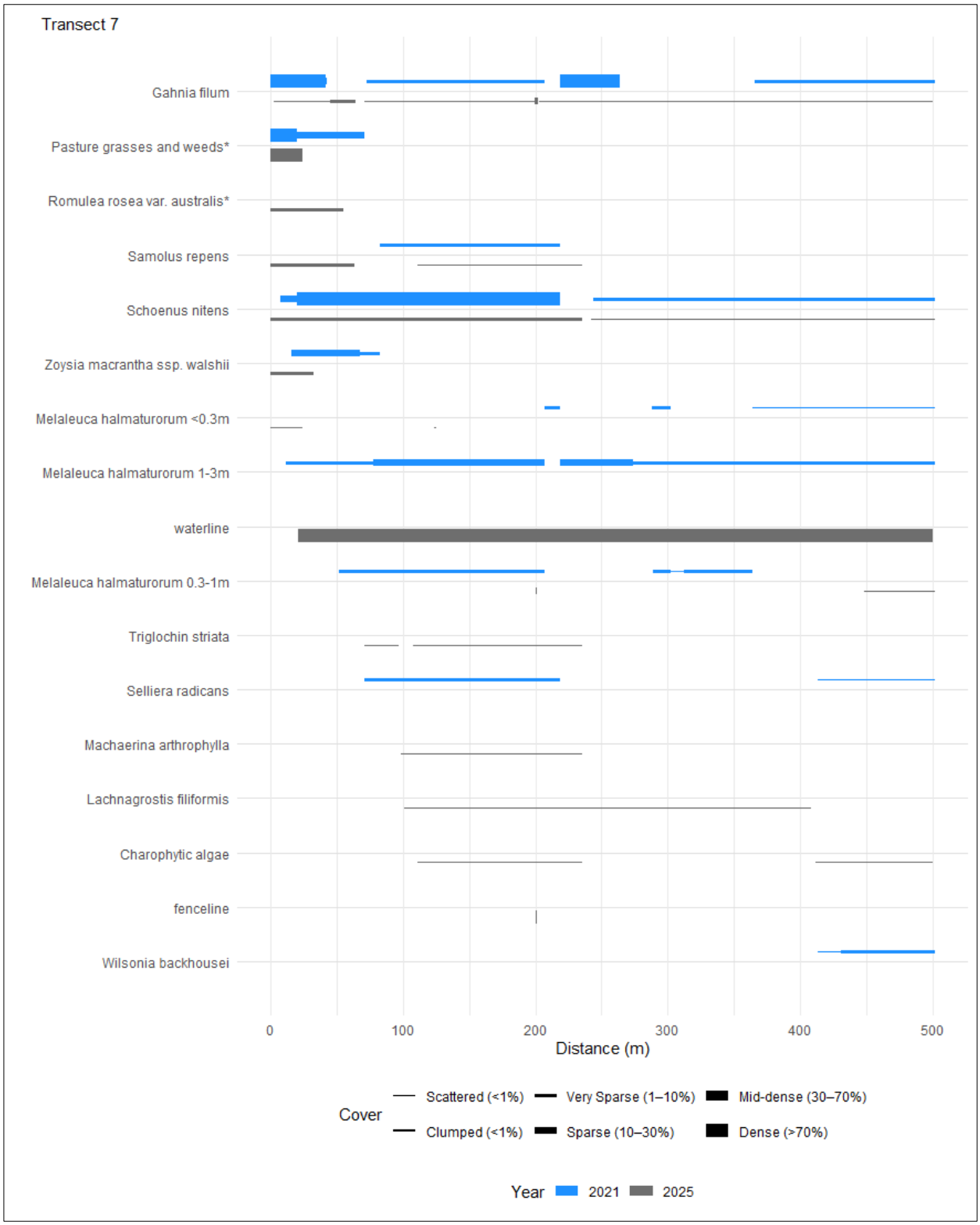


Figure 35. Kite chart for vegetation Transect 7.

Transect 7 Quadrats

Transect End Stake Easting	401316					
Transect End Stake Northing	5889560					
Survey date	13/10/2021			23/10/2025		
Quadrat number	1	2	3	1	2	3
Water quality and quantity						
EC (µS/cm)	No water			5140		
Temperature (°C)				17.38		
pH				8.56		
DO (mg/L)				0.36*		
depth (cm)	0	0	0	20	17	18
Species	Braun Blanquet Cover					
Gahnia filum	R	1	1	R		
Schoenus nitens	1	1	1	1	1	1
Melaleuca halmaturorum 0 - 0.3m			1			
Melaleuca halmaturorum 0.3 -1m		1	2			
Charophytic algae				2	2	2
Wilsonia backhousei	1	1	1			
Samolus repens	R		1			
Ruppia sp.				F		

*suspect inaccurate DO probe

Figure 36. Transect 7, Quadrat 1.

3.3. Discussion

Transects 1, 6 and 7 were dry in October 2021 but were inundated in October 2025 and at other transects the WSEL was 8 to 27 cm higher in 2025, illustrating the effectiveness of the newly completed Lake Hawdon North regulator at extending winter/spring inundation of the lake, particularly on the western side where the hydrological impact of Drain L was most pronounced prior to regulator construction.

As anticipated, a comparison of the vegetation transect monitoring data between October 2021 and October 2025 shows marked changes to shrubland extent and cover due to habitat modification at the transect locations where it was completed prior to monitoring (Transects 1, 2, 5, 6 and 7). *Melaleuca halmaturorum* was restricted to a narrow, riparian band of mature (>3 m) shrubland and mostly absent from the lower lakebed elevations where mechanical clearance had occurred in autumn 2025 (but note "Other Observations" below). Various mistletoe and some understorey species associated with the riparian band of *M. halmaturorum* showed similar extent and cover between years. Transect 3, where planned habitat modification works had not yet been undertaken, had *M. halmaturorum* present across its entire length in both 2021 and 2025, but showed a shift in height class, with shrubs in the <0.3 m category transitioning to the 0.3-1.0 m category between 2021 and 2025 across the lowermost 100 m of the transect.

Pasture grasses and weeds occurring as the understory of mature riparian shrubland showed evidence of downslope expansion at Transects 1, 2, 4 and 5, however a slight upslope retraction was evident at Transect 3. On balance, the change in distribution of riparian pasture grasses and weeds, which generally have a low tolerance of inundation, suggests a drying trend at Lake Hawdon North in the years between 2021 and 2025. The reversal of that drying trend by hydrological restoration may have occurred too recently to be reflected in the distribution of pasture grasses and weeds, but an upslope migration may occur in future years.

Changes to the distribution of perennial emergent sedge species such as *Gahnia filum*, *Machaerina arthrophylla* and *Juncus kraussii* were less pronounced, with a similar distribution of these species in 2021 and 2025 along most transects (Transects 1, 2, 4 and 7) but with reduced cover at those transects where habitat modification works has occurred. At Transect 5 both distribution and cover were greatly reduced in this way. Reduced extent and/or cover of emergent sedges in the most low-lying areas of the lakebed is an intended outcome of habitat modification, i.e. the restoration of open pan habitat, so the changes detected can be considered early evidence of successful restoration. However, the persistence of these changes over the longer term will be a more important measure of success.

Transect 4 provides an opportunity to examine the impact of hydrological restoration separately from habitat modification, which is not planned at that location. The dominant perennial emergent sedge at Transect 4, *Juncus kraussii*, showed a similar distribution between years, with no downslope extension recorded. This is an encouraging result that suggests the extent of open pan habitat at this location, and possibly more broadly on the eastern side of the lake, has been maintained between 2021 and 2025. However, within its distribution along the transect, there was an obvious downslope migration of areas of high cover of *J. kraussii*. As for the changes to riparian pasture grass distribution, this shift is likely to reflect a drying trend between the 2021 and 2025 monitoring events, a shift that hydrological restoration is yet to reverse but may do so in future years.

A suite of species recorded by the monitoring are submerged aquatic plants that are only detectable when the lake is inundated, or briefly thereafter. These include *Myriophyllum muelleri, Montia australasica, Isolepis fluitans* and Charophytic algae. For transects on the western side of the lake and where habitat modification had been undertaken (Transects 1, 2, 6 and 7), these species were mostly absent in 2021 but present across most of the inundated part of the transects in 2025.

This is an encouraging result that illustrates the persistence of the propagules of submerged aquatic species, despite drying and shrubland invasion over the last 60 years, which enabled a rapid floristic response to hydrological restoration in 2025.

Results for Transect 3, where the effect of hydrological restoration was less pronounced and habitat modification is yet to occur, were similarly favourable, with the distribution of Charophytic algae expanding and the cover of *Isolepis fluitans* increasing between 2021 and 2025.

The results at Transect 4 were more complex and difficult to interpret and may reflect the natural dynamics of submerged aquatic vegetation, with the water regime of the current and previous years leading to shifts in species dominance. However, Transect 4 demonstrated the persistence between 2021 and 2025 of the same overall extent of submerged aquatic bed / open pan habitat that is free of perennial emergent sedges and shrubs.

Other Observations

Although turbidity was not measured, we observed very high turbidity at transects located where extensive habitat modification works had occurred (Transects 1, 2, 6 and 7; see Figure 37) compared to the turbidity that is typical in Lake Hawdon North in spring (see 2021 quadrat photos). It is likely that disturbance of the lakebed by machinery in autumn 2025, combined with very high winds immediately prior to monitoring, caused elevated turbidity.

The duration of elevated turbidity in these areas in winter/spring 2025 is unclear. It is possible that elevated turbidity suppressed the growth of submerged aquatic plants in winter/spring 2025 in some areas of the lake, although the results showed submerged vegetation present despite the elevated turbidity.

Turbidity also presented a considerable challenge to estimating the cover of submerged aquatic species and may have affected the results. The effect was relatively localised, with turbidity not noticeably elevated at Transect 4, located approximately 1.2 km from the nearest habitat modification works.

Habitat modification works will continue in autumn 2026 and have the potential to cause elevated turbidity in spring 2026. However, the effect is anticipated to be temporary, with lakebed sediments likely to consolidate through time as the cover of submerged aquatic vegetation increases following restoration.

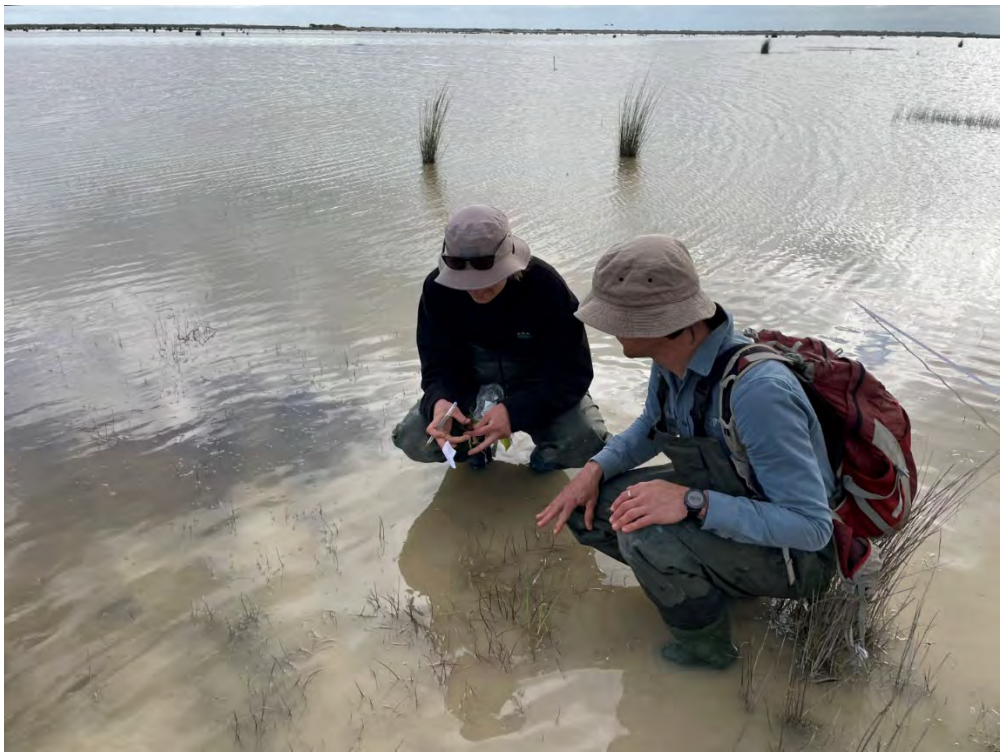


Figure 37. Highly turbid water, Transect 2, 22/10/2025.

To avoid damage to a fenceline bisecting Transect 7, a narrow strip of vegetation had not been mechanically cleared (Figure 38). The vegetation includes *M. halmaturorum* shrubs, currently lower than 1.5 m, that will provide an ongoing source of seed and likely contribute to the re-establishment of shrubland on the surrounding mudflats from which it was recently cleared. The removal of this linear strip of *M. halmaturorum*, e.g. via spraying, is recommended. There are other fencelines within the habitat restoration footprint that may require similar treatment.

Figure 38. Uncleared *Gahnia filum* and *Melaleuca halmaturorum* along a fenceline bisecting Transect 7.

Dense recruitment of *Gahnia filum* was evident in some areas within the more elevated zone (c.4.20 mAHD) of the mechanical (loader) clearance footprint, which were shallowly inundated (c.5 cm deep) on the date of survey (Figure 39). Given the elevation, hydrology alone is unlikely to maintain open pan habitat in such areas, and dense *G. filum* sedgeland will likely return without additional, ongoing management. Grazing may play a role, but regular burning will likely be required to maintain, or temporarily create, open pan in such areas over the longer term. Relatively high numbers of migratory shorebirds were observed in this habitat (e.g. cells G9, G10, F10, F11) during the waterbird census.

Figure 39. Dense recruitment of *G. filum* within mechanical clearance footprint the near the start of Transect 7.

Another observation throughout the mechanical (loader) clearance footprint (outside of the May 2025 prescribed burn footprint) was, in some locations, sparse, low (<0.5 m) *Melaleuca halmaturorum* shrubs that were alive and had not been removed by the loader (Figure 40). These shrubs were not completely submerged and therefore will likely survive inundation and continue to grow, providing an ongoing source of seed. Spot spraying (when dry) or hand-pulling (when inundated) is effective for individual plants, but the widespread yet sparse distribution of these shrubs presents a challenge for management.

Figure 40. Resprouting *Gahnia filum* and small *Melaleuca halmaturorum* not removed by mechanical clearance, Transect 7.

Figure 41 shows vegetation within the footprint of the May 2025 prescribed burn, proposed for mechanical (dozer) clearance in autumn 2026. The burn had effectively killed the *Melaleuca halmaturorum* shrubs but the *Gahnia filum* sedges had resprouted and extended new leaves above the water surface (c.35 cm deep), ensuring their survival of inundation.

Without further mechanical intervention, this area will revert to relatively dense *Gahnia filum* sedgeland, hence the need for mechanical (dozer) clearance that uproots and removes the *G. filum* tussocks, to restore open pan habitat. The underlying management assumption is that, following removal of mature *G. filum* tussocks, the restored hydrology, in combination with ongoing sheep grazing, will suppress the future recruitment of *G. filum* via seeds disbursed into these most low-lying areas of the lakebed.

Both forms of mechanical clearance employed at LHN in 2025, loader and dozer, created windrows of cleared vegetation and sediment that are elevated well above the maximum water level of the lake (Figure 42). In the approximately five months since their creation, plants had established on the windrows, including various pasture weeds and the resprouting bases of uprooted *Gahnia filum*. If the windrows remain in place they are likely to be colonised by *Melaleuca halmaturorum* that will provide an ongoing source of seed and compromise the ability to maintain open pan habitat on surrounding areas of the lakebed. Removal of windrows by further burning of dead vegetation (if possible) followed by spreading of sediment (if necessary) is recommended to ensure that linear islands of shrubland do not develop within the lake.

Figure 41. Within the footprint of the May 2025 prescribed burn, area yet to be mechanically cleared, showing resprouting *G. filum* and standing dead *M. halmaturorum* (10/11/2025).

Figure 42. Windrow created during mechanical (dozer) clearance within the footprint of the May 2025 prescribed burn, showing uprooted but resprouting *G. filum* and pasture weeds (9/11/2025).

REFERENCES

BOM (2026). *Climate statistics for Australian locations. Summary statistics ROBE*. Last updated 14/01/2026, Accessed 14/01/26. Australian Government Bureau of Meteorology, Canberra. http://www.bom.gov.au/climate/averages/tables/cw_026026.shtml

Brookes, J., Dalby, P., Dittmann, S., O'Conner, J., Paton, D., Quin, R., Rogers, D., Waycott, M. and Q., Y. (2018). *Recommended actions for restoring the ecological character of the South Lagoon of the Coorong*. Goyder Institute for Water Research Technical Report Series No. 18/04, Adelaide, South Australia.

DEW (2021). *Hydrological modelling of Lake Hawdon North flow regulation to inform the Regional Bird Refugia project*. DEW Technical report 2021/26, Government of South Australia, Department for Environment and Water, Adelaide.

DEW (2025a). *NatureMaps*. Last updated Accessed 16/12/2025. Department for Environment and Water, Adelaide, South Australia. http://spatialwebapps.environment.sa.gov.au/naturemaps/?locale=en-us&viewer=naturemaps

DEW (2025b). *Water Data SA. South East Drainage Network*. Last updated 22/12/25, Accessed 22/12/25. Department for Environment and Water, https://water.data.sa.gov.au/Data/Dashboard/53

Dickson, C., Whiterod, N., Bachmann, M., Haywood, B., Farrington, L. and Kivisalu, L. (2013). *Ecological Monitoring of Wetlands in the South East of South Australia 2012. Report to the Department of Environment, Water and Natural Resources, Government of South Australia*. Aquasave Consultants and NGT Consulting, Nature Glenelg Trust, Mount Gambier, South Australia.

Hunt, T. J., Paton, F. L. and Paton, D. C. (2019). *An initial assessment of the potential for wetlands in the South East and Lower Lakes regions of South Australia to support key species of Coorong waterbirds*. Goyder Institute for Water Research Technical Report Series No. 19/20, Adelaide, South Australia.

Rogers, D. I., Stamation, K., Loyn, R. H. and Menkhorst, P. (2015). *Literature review: management of non-tidal ponds for shorebirds*. Arthur Rylah Institute for Environmental Research Technical Report Series No. 264. Department of Environment, Land, Water and Planning, Heidelberg, Victoria.

Taylor, B. (2020). *Restoration Feasibility Assessment of Lake Hawdon North*. Report prepared for South Australian Government Department for Environment and Water. Nature Glenelg Trust, Mount Gambier.

Taylor, B. and Brown, L. (2019). *Lake Hawdon South Vegetation Monitoring 2008 - 2019*. Report to the South Australian Government Department for Environment and Water. NGT Consulting - Nature Glenelg Trust, Mount Gambier, South Australia.

Taylor, B., Gibbs, M., Hipsey, M., Lewis, M., Sharath, I., Brookes, J., Nicol, J., Clarke, K., Dalby, P., Clark, M. and Bice, C. (2014). *Investigations to inform diversion rules for the South East Flows Restoration Project in the Drain L Catchment*. Government of South Australia, through Department of Environment, Water and Natural Resources, Adelaide.

Taylor, B., Haywood, B. and Roberts, T. (2022a). *Baseline Waterbird Monitoring of Lake Hawdon North, 2022*. Report to the South Australian Government Department for Environment and Water. Nature Glenelg Trust, Mount Gambier, South Australia.

Taylor, B. and Roberts, T. (2025). *Baseline Waterbird Monitoring of Lake Hawdon North, Monitoring Results 2023 and 2024, Synthesis of Monitoring 2021 to 2024*. Report to the South Australian Government Department for Environment and Water. Nature Glenelg Trust, Mount Gambier, South Australia.

Taylor, B., Roberts, T., Farrington, L. and de Jong, M. (2026). *Lake Hawdon North Wetland Management Plan*. Prepared by Nature Glenelg Trust for the Department for Environment and Water, Adelaide, South Australia.

Taylor, B., Zukowski, S., Jackson, M., Whiterod, N., Haywood, B., Tuck, J., Farrington, L., McEvoy, P. and Prowse, T. (2022b). *Baseline Ecological Monitoring of Lake Hawdon North, 2021*. Report to the South Australian Government Department for Environment and Water. Nature Glenelg Trust, Mount Gambier, South Australia.

van Swinderen, L., Hansen, B. D., Fuller, R. A., Watkins, D., Rogers, D. I., Clemens, R. S., Newman, M., Woehler, E. J., Weller, D. R. and LeClair, S. (2025). *Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species*. Report for the Department of Climate Change, Energy, the Environment and Water. BirdLife Australia, Melbourne.

APPENDIX A – Bird Abundance Counts (Systematically Counted Species) for each survey cell, November 2025

			Counts per cell																																				
common name	Total	Cells pre	C-13	C-14	D-12	D-13	D-14	D-15	E-12	E-13	E-14	E-15	E-16	F-10	F-11	F-12	F-13	F-14	F-15	F-16	G-9	G-10	G-11	G-12	G-13	G-14	G-15	G-16	G-17	G-18	H-8	H-9	H-10	H-11	H-12	H-13	H-14	H-15
depth (cm)		0																																				
Species for which confident counts for entire survey area were obtained																																						
Australasian Grebe	0	0																																				
Australasian shoveler	18	5																		11																		
Australian pelican	0	0																																				
Australian shelduck	910	31																																				
Australian white ibis	47	15							9									1																			1	
banded lapwing	0	0																																				
black swan	973	31													2						1						2	65				7						
black-fronted dotterel	18	7				2			3			3			2												5		2								1	
black-winged stilt/pied stilt	2156	38	1			5	18	3	19			25	24		71	30					26	25					8	24	100	56							20	75
Caspian tern	0	0																																				
cattle egret	0	0																																				
chestnut teal	217	13				70	65				1				4	6						26										12						
common greenshank	16	3														2																			4			
curlew sandpiper	2	1																		2																		
dusky moorhen	10	5																																	1	3		
Eurasian coot	122	3																	41							6											75	
fairy tern	1	1																																				
freckled duck	0	0																																				
glossy ibis	40	5																										3										
great cormorant	0	0																																				
great crested grebe	5	4																																				1
great egret	5	2																	1																			
grey teal	21485	29			800	6400	1500		540		19				250	900		18	3000		2	1070				77						740					5	
hardhead	0	0																																				
hoary-headed grebe	415	11					7				82				8	50			150	13								44									3	15
intermediate egret	0	0																																				
little black cormorant	0	0																																				
little egret	3	3						1																														
little pied cormorant	0	0																																				
marsh sandpiper	0	0																																				
masked lapwing	101	37					1	1	2											5		20					2		1	2	2	2				1	2	
musk duck	33	4																	1																			
Pacific black duck	249	34				5	10									1		1		6							2		4									
Pacific golden plover	0	0																																				
pied cormorant	0	0																																				
pink-eared duck	38	2				24	14																															
red-capped plover	34	14	2		2						2							2			2																1	
red-kneed dotterel	29	7						7				2			10	2					6	1							1									
red-necked avocet	0	0																																				
red-necked stint	387	5	1																																			
royal spoonbill	0	0																																				
ruddy turnstone	2	1																																				
sharp-tailed sandpiper	1204	32	85				12								120	48		8		32	70						20		9									
silver gull	608	56	55				24		2							2		2		1		1						2	6					1	5			
straw-necked ibis	0	0																																				
unidentified duck sp.	0	0																																				
unidentified egret sp.	0	0																																				
unidentified wader sp.	0	0																																				
whiskered tern	980	55																																				
white-faced heron	160	27													1							1																
white-necked heron	0	0																																				
yellow-billed spoonbill	0	0																																				

			Counts per cell																																						
common name	Total	Cells pre	H-16	H-17	H-18	H-19	I-7	I-8	I-9	I-10	I-11	I-12	I-13	I-14	I-15	I-16	I-17	I-18	I-19	I-20	J-5	J-6	J-7	J-8	J-9	J-10	J-11	J-12	J-13	J-14	J-15	J-16	J-17	J-18	J-19	J-20	J-21	K-5	K-6	K-7
depth (cm)		0																																						
Species for which confident counts for entire survey area were obtained																																								
Australasian Grebe	0	0																																						
Australasian shoveler	18	5																													1									
Australian pelican	0	0																																						
Australian shelduck	910	31											1																											
Australian white ibis	47	15													2																5	1								
banded lapwing	0	0																																						
black swan	973	31												15			3															3								
black-fronted dotterel	18	7																																						
black-winged stilt/pied stilt	2156	38	20												8	16																								
Caspian tern	0	0																																						
cattle egret	0	0																																						
chestnut teal	217	13												2																										
common greenshank	16	3																																						
curlew sandpiper	2	1																																						
dusky moorhen	10	5																																						
Eurasian coot	122	3																																						
fairy tern	1	1																																						
freckled duck	0	0																																						
glossy ibis	40	5																																						
great cormorant	0	0																																						
great crested grebe	5	4													2																									
great egret	5	2																													4									
grey teal	21485	29											345	110																6	17								
hardhead	0	0																																						
hoary-headed grebe	415	11																																						
intermediate egret	0	0																																						
little black cormorant	0	0																																						
little egret	3	3																																						
little pied cormorant	0	0																																						
marsh sandpiper	0	0																																						
masked lapwing	101	37																												1										
musk duck	33	4																													1									
Pacific black duck	249	34											4	6	8																1									
Pacific golden plover	0	0																																						
pied cormorant	0	0																																						
pink-eared duck	38	2																																						
red-capped plover	34	14											4															2	5										
red-kneed dotterel	29	7																																						
red-necked avocet	0	0																																						
red-necked stint	387	5																											72	309										
royal spoonbill	0	0																																						
ruddy turnstone	2	1																												2										
sharp-tailed sandpiper	1204	32												60	40													39	36	107	3									
silver gull	608	56											1	108														18			1									
straw-necked ibis	0	0																																						
unidentified duck sp.	0	0																																						
unidentified egret sp.	0	0																																						
unidentified wader sp.	0	0																																						
whiskered tern	980	55	14	2	3									2	2	28	14	15	1												8	12	34	14		1				
white-faced heron	160	27																													4		8							
white-necked heron	0	0																																						
yellow-billed spoonbill	0	0																																						

			Counts per cell																																									
common name	Total	Cells pre	K-8	K-9	K-10	K-11	K-12	K-13	K-14	K-15	K-16	K-17	K-18	K-19	K-20	K-21	K-22	K-23	K-24	L-6	L-7	L-8	L-9	L-10	L-11	L-12	L-13	L-14	L-15	L-16	L-17	L-18	L-19	L-20	L-21	L-22	L-23	L-24	L-25	M-6
depth (cm)		0																																									
Species for which confident counts for entire survey area were obtained																																											
Australasian Grebe	0	0																																									
Australasian shoveler	18	5							4																				1													
Australian pelican	0	0																																									
Australian shelduck	910	31			3	118		250																	1			30													
Australian white ibis	47	15								8					2										4		1														
banded lapwing	0	0																																									
black swan	973	31				42				4																	33	46					10								
black-fronted dotterel	18	7																																								
black-winged stilt/pied stilt	2156	38																										81		10											
Caspian tern	0	0																																								
cattle egret	0	0																																								
chestnut teal	217	13				2																							8											
common greenshank	16	3																																								
curlew sandpiper	2	1																																								
dusky moorhen	10	5																											3											
Eurasian coot	122	3																																								
fairy tern	1	1						1																																		
freckled duck	0	0																																								
glossy ibis	40	5																																								
great cormorant	0	0																																								
great crested grebe	5	4								1																																
great egret	5	2																																								
grey teal	21485	29				11		55																						27											
hardhead	0	0																																								
hoary-headed grebe	415	11																																								
intermediate egret	0	0																																								
little black cormorant	0	0																																								
little egret	3	3																										1													
little pied cormorant	0	0																																								
marsh sandpiper	0	0																																								
masked lapwing	101	37			1		1	2	2															3		2															
musk duck	33	4																																								
Pacific black duck	249	34						31	14	12																		11	2												
Pacific golden plover	0	0																																								
pied cormorant	0	0																																								
pink-eared duck	38	2																																								
red-capped plover	34	14						1																		1															
red-kneed dotterel	29	7																																								
red-necked avocet	0	0																																								
red-necked stint	387	5																						3																	
royal spoonbill	0	0																																								
ruddy turnstone	2	1																																								
sharp-tailed sandpiper	1204	32					1	11		10																		96													
silver gull	608	56						10																		2		2	1	2											
straw-necked ibis	0	0																																								
unidentified duck sp.	0	0																																								
unidentified egret sp.	0	0																																								
unidentified wader sp.	0	0																																								
whiskered tern	980	55								100	50			10	14									2	4			18	20			16	14		8	2				
white-faced heron	160	27							3																																	
white-necked heron	0	0																																								
yellow-billed spoonbill	0	0																																								

			Counts per cell																																					
common name	Total	Cells pre	M-7	M-8	M-9	M-10	M-11	M-12	M-13	M-14	M-15	M-16	M-17	M-18	M-19	M-20	M-21	M-22	M-23	M-24	M-25	M-26	N-5	N-6	N-7	N-8	N-9	N-10	N-11	N-12	N-13	N-14	N-15	N-16	N-17	N-18	N-19	N-20	N-21	N-22
depth (cm)		0																																						
Species for which confident counts for entire survey area were obtained																																							
Australasian Grebe	0	0																																						
Australasian shoveler	18	5																																						
Australian pelican	0	0																																						
Australian shelduck	910	31					21				2			2			4		15												9			11				2	1	4
Australian white ibis	47	15								9	1																													
banded lapwing	0	0																																						
black swan	973	31												6	7		5		7							71	84			7	19							3		
black-fronted dotterel	18	7																																						
black-winged stilt/pied stilt	2156	38								8	55	6																		38	15		48	40					
Caspian tern	0	0																																						
cattle egret	0	0																																						
chestnut teal	217	13									2			2																										
common greenshank	16	3																																						
curlew sandpiper	2	1																																						
dusky moorhen	10	5									1																						2							
Eurasian coot	122	3																																						
fairy tern	1	1																																						
freckled duck	0	0																																						
glossy ibis	40	5																															4	14						
great cormorant	0	0																																						
great crested grebe	5	4																																						
great egret	5	2																																						
grey teal	21485	29																																						
hardhead	0	0																																						
hoary-headed grebe	415	11																																						
intermediate egret	0	0																																						
little black cormorant	0	0																																						
little egret	3	3																																						
little pied cormorant	0	0																																						
marsh sandpiper	0	0																																						
masked lapwing	101	37								2		5																								2				
musk duck	33	4																																						
Pacific black duck	249	34								24			2													2					2	2		2				2		
Pacific golden plover	0	0																																						
pied cormorant	0	0																																						
pink-eared duck	38	2																																						
red-capped plover	34	14															5																					4		
red-kneed dotterel	29	7																																						
red-necked avocet	0	0																																						
red-necked stint	387	5																																					2	
royal spoonbill	0	0																																						
ruddy turnstone	2	1																																						
sharp-tailed sandpiper	1204	32								2																				2	1		23	3					
silver gull	608	56							1		2				3							2				1	3			1				15	3		3	5		1
straw-necked ibis	0	0																																						
unidentified duck sp.	0	0																																						
unidentified egret sp.	0	0																																						
unidentified wader sp.	0	0																																						
whiskered tern	980	55				3	2		2	14	26	80		45	7	3		8	4								29	29		1	10		10	80	5			3	3	8
white-faced heron	160	27										2				1									4					1	7		1	1		1	1			
white-necked heron	0	0																																						
yellow-billed spoonbill	0	0																																						

			Counts per cell																																						
common name	Total	Cells pre	N-23	N-24	N-25	N-26	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20	O-21	O-22	O-23	O-24	O-25	P-4	P-5	P-6	P-7	P-8	P-9	P-10	P-11	P-12	P-13	P-14	P-15	P-16
depth (cm)		0																																						
Species for which confident counts for entire survey area were obtained																																								
Australasian Grebe	0	0																																						
Australasian shoveler	18	5																							1															
Australian pelican	0	0																																						
Australian shelduck	910	31	49	51																			12	1	200				7	1						4				
Australian white ibis	47	15												1				1																	1					
banded lapwing	0	0																																						
black swan	973	31	205	29									16	50									16	19	186															
black-fronted dotterel	18	7																																						
black-winged stilt/pied stilt	2156	38		29			10																			29			41	9										
Caspian tern	0	0																																						
cattle egret	0	0																																						
chestnut teal	217	13																																						
common greenshank	16	3																10																						
curlew sandpiper	2	1																																						
dusky moorhen	10	5																																						
Eurasian coot	122	3																																						
fairy tern	1	1																																						
freckled duck	0	0																																						
glossy ibis	40	5													15																					4				
great cormorant	0	0																																						
great crested grebe	5	4	1																																					
great egret	5	2																																						
grey teal	21485	29	3100	200												4		14						25	1500																
hardhead	0	0																																						
hoary-headed grebe	415	11	12	31																																				
intermediate egret	0	0																																						
little black cormorant	0	0																																						
little egret	3	3														1																								
little pied cormorant	0	0																																						
marsh sandpiper	0	0																																						
masked lapwing	101	37							2							2										2			2	2					3			2	2	
musk duck	33	4	17	14																																				
Pacific black duck	249	34											5					6						5												1		31		
Pacific golden plover	0	0																																						
pied cormorant	0	0																																						
pink-eared duck	38	2																																						
red-capped plover	34	14																																						
red-kneed dotterel	29	7																																						
red-necked avocet	0	0																																						
red-necked stint	387	5																																						
royal spoonbill	0	0																																						
ruddy turnstone	2	1																																						
sharp-tailed sandpiper	1204	32											30	108	66	44		4																	3					
silver gull	608	56	4	8					2						2		11	16	2			1	1		8					2						49	85	24	12	
straw-necked ibis	0	0																																						
unidentified duck sp.	0	0																																						
unidentified egret sp.	0	0																																						
unidentified wader sp.	0	0																																						
whiskered tern	980	55	12	2									90		4		40								11														40	
white-faced heron	160	27					3		1				52			12		9						7											18		10	3		
white-necked heron	0	0																																						
yellow-billed spoonbill	0	0																																						

			Counts per cell																																
common name	Total	Cells pre	P-17	P-18	P-19	P-20	P-21	P-22	P-23	P-24	P-25	Q-4	Q-5	Q-6	Q-7	Q-8	Q-11	Q-12	Q-13	Q-16	Q-17	Q-18	Q-19	Q-20	Q-21	Q-22	Q-23	Q-24	R-5	R-6	R-7	R-8	R-17	R-18
depth (cm)		0																																
Species for which confident counts for entire survey area were obtained																																		
Australasian Grebe	0	0																																
Australasian shoveler	18	5																																
Australian pelican	0	0																																
Australian shelduck	910	31		1		9				58											20	12	9										2	
Australian white ibis	47	15																																
banded lapwing	0	0																																
black swan	973	31				2				8																								
black-fronted dotterel	18	7																																
black-winged stilt/pied stilt	2156	38						524	330	267																42								
Caspian tern	0	0																																
cattle egret	0	0																																
chestnut teal	217	13								17																								
common greenshank	16	3																																
curlew sandpiper	2	1																																
dusky moorhen	10	5																																
Eurasian coot	122	3																																
fairy tern	1	1																																
freckled duck	0	0																																
glossy ibis	40	5																																
great cormorant	0	0																																
great crested grebe	5	4																																
great egret	5	2																																
grey teal	21485	29							250	500																								
hardhead	0	0																																
hoary-headed grebe	415	11																																
intermediate egret	0	0																																
little black cormorant	0	0																																
little egret	3	3																																
little pied cormorant	0	0																																
marsh sandpiper	0	0																																
masked lapwing	101	37		5	4			2													2	3	5			1								
musk duck	33	4																																
Pacific black duck	249	34		2																	26	4	7	7										1
Pacific golden plover	0	0																																
pied cormorant	0	0																																
pink-eared duck	38	2																																
red-capped plover	34	14																					1											
red-kneed dotterel	29	7																																
red-necked avocet	0	0																																
red-necked stint	387	5																																
royal spoonbill	0	0																																
ruddy turnstone	2	1																																
sharp-tailed sandpiper	1204	32			106																		5											
silver gull	608	56		3	3	3				12											57		1			4							5	7
straw-necked ibis	0	0																																
unidentified duck sp.	0	0																																
unidentified egret sp.	0	0																																
unidentified wader sp.	0	0																																
whiskered tern	980	55						1																										
white-faced heron	160	27																			1	2				1								5
white-necked heron	0	0																																
yellow-billed spoonbill	0	0																																

Note: species listed in red were recorded in the baseline census for the first time in November 2025.

APPENDIX B – Bird Abundance Counts (Opportunistically Counted Species) for each survey cell, November 2025

			Counts per cell																																										
common name	Total	Cells pre	C-13	C-14	D-12	D-13	D-14	D-15	E-12	E-13	E-14	E-15	E-16	F-10	F-11	F-12	F-13	F-14	F-15	F-16	G-9	G-10	G-11	G-12	G-13	G-14	G-15	G-16	G-17	G-18	H-8	H-9	H-10	H-11	H-12	H-13	H-14	H-15	H-16	H-17	H-18	H-19	I-7	I-8	I-9	I-10
depth (cm)		0																																												
Species counted opportunistically - counts not representative of entire survey area																																														
Australasian bittern	0	0																																												
Australian pipit	19	10	1																2								2											5								
Australian hobby	1	1																																												
Australian magpie	35	10																								1																				
Australian painted snipe	1	1							1																																					
Australian raven	0	0																																												
Australian reed warbler	9	6					1																			1											3									
Australian spotted crake	0	0																																												
Ballion's crake	1	1																																												
beautiful firetail	0	0																																												
black-tailed native-hen	290	18					21	12								1												9		1		12			41	8									16	2
blue-winged parrot	1	1																																												
brown falcon	0	0																																												
brown quail	1	1																																												
brown songlark	2	2																																												
brown thornbill	7	5																																	1											
collared sparrowhawk	1	1																																												
common blackbird	4	4																								1									1											
common bronzewing	0	0																																												
Eurasian skylark	29	12																																												
common starling	464	8						5																																						
crested pigeon	2	1																																												
eastern yellow robin	0	0																																												
emu	0	0																																												
European goldfinch	12	5						5																																						
fairy martin	3	1																																												
forest raven	0	0																																												
galah	70	7																																												
golden whistler	2	2																								1										1										
golden-headed cisticola	0	0																																												
grey butcherbird	0	0																																												
grey currawong	3	3																																1												
grey fantail	13	10						1																		1								1	1											
grey shrike-thrush	17	12					1	1								2										2									1											
Horsefield's bronze-cuckoo	0	0																																												
Latham's snipe	219	23							9						30	1					19											1		11	9		1				1					25
little grassbird	28	17																								3									3											
little raven	1	1						1																																						
magpie-lark	12	8						1																													1									
martin sp.	4	2																																												
Nankeen kestrel	0	0																																												
New Holland honeyeater	2	1														2																														
peregrine falcon	2	2																																												
purple swamphen	78	9																																												
raven sp.	37	9																																												
red wattlebird	2	2							1																																					
silvereye	13	4																																	1											
singing honeyeater	0	0																																												
southern emu-wren	1	1																																												
spiny-cheeked honeyeater	13	11						1								1																			2											
striated fieldwren	1	1																																												
stubble quail	0	0																																												
superb fairy-wren	15	6				2		5																																						
swamp harrier	17	16													1			1	1							1																				
tree martin	4	1																																												
unidentified bird of prey (family Accipitrida	0	0																																												
unidentified parrot sp. (genus Neophema)	0	0																																												
unidentified quail sp.	0	0																																												
unidentified rail sp.	0	0																																												
wedge-tailed eagle	4	3							1						1																															
welcome swallow	85	18				2	10	8			5					10		10								1																				
white-browed babbler	0	0																																												
white-browed scrubwren	7	7						1	1							1										1									1											
white-fronted chat	104	20												1	7			7			2											2					3	2								
willie wagtail	4	3													1																															
yellow-faced honeyeater	0	0																																												
yellow-rumped thornbill	0	0																																												

			Counts per cell																																											
common name	Total	Cells pre	I-11	I-12	I-13	I-14	I-15	I-16	I-17	I-18	I-19	I-20	J-5	J-6	J-7	J-8	J-9	J-10	J-11	J-12	J-13	J-14	J-15	J-16	J-17	J-18	J-19	J-20	J-21	K-5	K-6	K-7	K-8	K-9	K-10	K-11	K-12	K-13	K-14	K-15	K-16	K-17	K-18	K-19	K-20	K-21
depth (cm)		0																																												
Species counted opportunistically - counts not representative of entire survey area																																														
Australasian bittern	0	0																																												
Australian pipit	19	10					3																																							
Australian hobby	1	1																																												
Australian magpie	35	10																																												
Australian painted snipe	1	1																																												
Australian raven	0	0																																												
Australian reed warbler	9	6																																												
Australian spotted crake	0	0																																												
Ballion's crake	1	1																																												
beautiful firetail	0	0																																												
black-tailed native-hen	290	18	8																			12																									
blue-winged parrot	1	1																																												
brown falcon	0	0																																												
brown quail	1	1																																							1						
brown songlark	2	2																		1																										
brown thornbill	7	5																																											2	
collared sparrowhawk	1	1																																												
common blackbird	4	4																																												
common bronzewing	0	0																																												
Eurasian skylark	29	12																																								3					
common starling	464	8																																												
crested pigeon	2	1																																												
eastern yellow robin	0	0																																												
emu	0	0																																												
European goldfinch	12	5																																												
fairy martin	3	1																																												
forest raven	0	0																																												
galah	70	7																																											3	
golden whistler	2	2																																												
golden-headed cisticola	0	0																																											
grey butcherbird	0	0																																												
grey currawong	3	3										1																																		
grey fantail	13	10										1																																		3
grey shrike-thrush	17	12																																												1
Horsefield's bronze-cuckoo	0	0																																												
Latham's snipe	219	23	10															3			2	4																			54						
little grassbird	28	17	2				1															1	1																		1						
little raven	1	1																																												
magpie-lark	12	8																																												
martin sp.	4	2																																									2				
Nankeen kestrel	0	0																																													
New Holland honeyeater	2	1																																												
peregrine falcon	2	2			1																																								
purple swamphen	78	9				9	20															9																									
raven sp.	37	9																																												
red wattlebird	2	2																																												
silvereye	13	4																																												
singing honeyeater	0	0																																												
southern emu-wren	1	1																																											1	
spiny-cheeked honeyeater	13	11																											1																	2
striated fieldwren	1	1																																												
stubble quail	0	0																																												
superb fairy-wren	15	6										1																																		
swamp harrier	17	16			1		1																																						
tree martin	4	1																																												
unidentified bird of prey (family Accipitrida	0	0																																												
unidentified parrot sp. (genus Neophema)	0	0																																												
unidentified quail sp.	0	0																																												
unidentified rail sp.	0	0																																												
wedge-tailed eagle	4	3																																												
welcome swallow	85	18																																										5			
white-browed babbler	0	0																																												
white-browed scrubwren	7	7																											1																	
white-fronted chat	104	20				1	1													25																									
willie wagtail	4	3																																												
yellow-faced honeyeater	0	0																																												
yellow-rumped thornbill	0	0																																												

			Counts per cell																																										
common name	Total	Cells pr	K-22	K-23	K-24	L-6	L-7	L-8	L-9	L-10	L-11	L-12	L-13	L-14	L-15	L-16	L-17	L-18	L-19	L-20	L-21	L-22	L-23	L-24	L-25	M-6	M-7	M-8	M-9	M-10	M-11	M-12	M-13	M-14	M-15	M-16	M-17	M-18	M-19	M-20	M-21	M-22	M-23	M-24	M-25	M-26
depth (cm)		0																																												
Species counted opportunistically - counts not representative of entire survey area																																														
Australasian bittern	0	0																																												
Australian pipit	19	10																																												
Australian hobby	1	1																																												
Australian magpie	35	10													2																				1										
Australian painted snipe	1	1																																											
Australian raven	0	0																																											
Australian reed warbler	9	6																																	1										
Australian spotted crake	0	0																																											
Ballion's crake	1	1																																											
beautiful firetail	0	0																																											
black-tailed native-hen	290	18													4																									1					5	
blue-winged parrot	1	1																																												
brown falcon	0	0																																											
brown quail	1	1																																												
brown songlark	2	2											1																																
brown thornbill	7	5																																											
collared sparrowhawk	1	1																																											
common blackbird	4	4																																	1										
common bronzewing	0	0																																											
Eurasian skylark	29	12														1																												
common starling	464	8																																						1					
crested pigeon	2	1																																											
eastern yellow robin	0	0																																										
emu	0	0																																										
European goldfinch	12	5																																											
fairy martin	3	1																																		3									
forest raven	0	0																																											
galah	70	7																				2																						
golden whistler	2	2																																											
golden-headed cisticola	0	0																																											
grey butcherbird	0	0																																											
grey currawong	3	3																																											
grey fantail	13	10																																	1				2						
grey shrike-thrush	17	12																													1								2						
Horsefield's bronze-cuckoo	0	0																																											
Latham's snipe	219	23												4																							1								
little grassbird	28	17																													1				5	1						1			
little raven	1	1																																											
magpie-lark	12	8																																											
martin sp.	4	2																																											
Nankeen kestrel	0	0																																											
New Holland honeyeater	2	1																																											
peregrine falcon	2	2											1																																
purple swamphen	78	9													15																				10						1				
raven sp.	37	9													2																1				6					2					
red wattlebird	2	2																																											
silvereye	13	4																																		5									
singing honeyeater	0	0																																											
southern emu-wren	1	1																																											
spiny-cheeked honeyeater	13	11																																					1						
striated fieldwren	1	1																																											
stubble quail	0	0																																											
superb fairy-wren	15	6													3																														
swamp harrier	17	16												1								1									2				1										
tree martin	4	1																																											
unidentified bird of prey (family Accipitrid	0	0																																											
unidentified parrot sp. (genus Neophema)	0	0																																											
unidentified quail sp.	0	0																																											
unidentified rail sp.	0	0																																											
wedge-tailed eagle	4	3																																											
welcome swallow	85	18																																4		2	3							
white-browed babbler	0	0																																											
white-browed scrubwren	7	7																																											
white-fronted chat	104	20																																									8	1			
willie wagtail	4	3																																											
yellow-faced honeyeater	0	0																																											
yellow-rumped thornbill	0	0																																											

			Counts per cell																																											
common name	Total	Cells pre	N-5	N-6	N-7	N-8	N-9	N-10	N-11	N-12	N-13	N-14	N-15	N-16	N-17	N-18	N-19	N-20	N-21	N-22	N-23	N-24	N-25	N-26	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20	O-21	O-22	O-23	O-24	O-25	P-4
depth (cm)		0																																												
Species counted opportunistically - counts not representative of entire survey area																																														
Australasian bittern	0	0																																												
Australian pipit	19	10																																												
Australian hobby	1	1																																												
Australian magpie	35	10																																3												
Australian painted snipe	1	1																																												
Australian raven	0	0																																												
Australian reed warbler	9	6																																2												
Australian spotted crake	0	0																																												
Ballion's crake	1	1																																						1						
beautiful firetail	0	0																																												
black-tailed native-hen	290	18																												3												11		
blue-winged parrot	1	1																														1														
brown falcon	0	0																																												
brown quail	1	1																																												
brown songlark	2	2																																												
brown thornbill	7	5										2																							1											
collared sparrowhawk	1	1																1																												
common blackbird	4	4																																					1							
common bronzewing	0	0																																												
Eurasian skylark	29	12									5				1																	1	1	8												
common starling	464	8																																1												
crested pigeon	2	1																																												
eastern yellow robin	0	0																																												
emu	0	0																																												
European goldfinch	12	5											3					2																	1						1					
fairy martin	3	1																																												
forest raven	0	0																																												
galah	70	7											22																									10								
golden whistler	2	2																																												
golden-headed cisticola	0	0																																												
grey butcherbird	0	0																																												
grey currawong	3	3																																												
grey fantail	13	10																																		1										
grey shrike-thrush	17	12																																	1	2				2						
Horsefield's bronze-cuckoo	0	0																																												
Latham's snipe	219	23												1																				3						17						
little grassbird	28	17											2							1											1				1					1						
little raven	1	1																																												
magpie-lark	12	8																																	2	1										
martin sp.	4	2																																												
Nankeen kestrel	0	0																																												
New Holland honeyeater	2	1																																												
peregrine falcon	2	2																																												
purple swamphen	78	9											8																						2											
raven sp.	37	9											2					2																												
red wattlebird	2	2																																												
silvereye	13	4											2																									5								
singing honeyeater	0	0																																												
southern emu-wren	1	1																																												
spiny-cheeked honeyeater	13	11																1																	1											
striated fieldwren	1	1																																												
stubble quail	0	0																																												
superb fairy-wren	15	6											1																																	
swamp harrier	17	16																1		1	1												1							1						
tree martin	4	1																															4													
unidentified bird of prey (family Accipitrida	0	0																																												
unidentified parrot sp. (genus Neophema)	0	0																																												
unidentified quail sp.	0	0																																												
unidentified rail sp.	0	0																																												
wedge-tailed eagle	4	3								2																																				
welcome swallow	85	18											2																						2											
white-browed babbler	0	0																																												
white-browed scrubwren	7	7																1																												
white-fronted chat	104	20												1	1			15	15															3	2											
willie wagtail	4	3																																												
yellow-faced honeyeater	0	0																																												
yellow-rumped thornbill	0	0																																												

			Counts per cell																																							
common name	Total	Cells pr	P-5	P-6	P-7	P-8	P-9	P-10	P-11	P-12	P-13	P-14	P-15	P-16	P-17	P-18	P-19	P-20	P-21	P-22	P-23	P-24	P-25	Q-4	Q-5	Q-6	Q-7	Q-8	Q-11	Q-12	Q-13	Q-16	Q-17	Q-18	Q-19	Q-20	Q-21	Q-22	Q-23	Q-24	R-5	R-6	R-7	R-8	R-17	R-18
depth (cm)		0																																										
Species counted opportunistically - counts not representative of entire survey area																																												
Australasian bittern	0	0																																										
Australian pipit	19	10										1			2																		1	1	1									
Australian hobby	1	1																																										1
Australian magpie	35	10												8	4	7																			3								5	1
Australian painted snipe	1	1																																										
Australian raven	0	0																																										
Australian reed warbler	9	6											1																														
Australian spotted crake	0	0																																									
Ballion's crake	1	1																																									
beautiful firetail	0	0																																									
black-tailed native-hen	290	18															123																										
blue-winged parrot	1	1																																									
brown falcon	0	0																																									
brown quail	1	1																																									
brown songlark	2	2																																									
brown thornbill	7	5											1																														
collared sparrowhawk	1	1																																									
common blackbird	4	4																																									
common bronzewing	0	0																																									
Eurasian skylark	29	12								3	1	1			2	2																											
common starling	464	8														2																	32		20	400							3
crested pigeon	2	1																															2										
eastern yellow robin	0	0																																									
emu	0	0																																									
European goldfinch	12	5																																									
fairy martin	3	1																																									
forest raven	0	0																																									
galah	70	7										30		1																													2
golden whistler	2	2																																									
golden-headed cisticola	0	0																																									
grey butcherbird	0	0																																									
grey currawong	3	3											1																														
grey fantail	13	10																1																										
grey shrike-thrush	17	12																																			1						
Horsefield's bronze-cuckoo	0	0																																									
Latham's snipe	219	23														1																	10	2									
little grassbird	28	17											2																														
little raven	1	1																																									
magpie-lark	12	8														1																	2	2									2
martin sp.	4	2															2																											
Nankeen kestrel	0	0																																									
New Holland honeyeater	2	1																																									
peregrine falcon	2	2																																									
purple swamphen	78	9											4																														
raven sp.	37	9																															2									18	2
red wattlebird	2	2																																		1								
silvereye	13	4																																									
singing honeyeater	0	0																																									
southern emu-wren	1	1																																									
spiny-cheeked honeyeater	13	11																1	1															1										
striated fieldwren	1	1							1																																		
stubble quail	0	0																																									
superb fairy-wren	15	6										3																															
swamp harrier	17	16																	1																									
tree martin	4	1																																									
unidentified bird of prey (family Accipitrid	0	0																																									
unidentified parrot sp. (genus Neophema)	0	0																																									
unidentified quail sp.	0	0																																									
unidentified rail sp.	0	0																																									
wedge-tailed eagle	4	3																																									
welcome swallow	85	18										10	5				2																	2	2									
white-browed babbler	0	0																																									
white-browed scrubwren	7	7																																									
white-fronted chat	104	20																																2	5									
willie wagtail	4	3											2																															1
yellow-faced honeyeater	0	0																																									
yellow-rumped thornbill	0	0																																									

Note: species listed in red were recorded in the baseline census for the first time in November 2025.

APPENDIX C – Total Counts of Birds Counted Opportunistically

Counts are not representative of the entire survey area because these species favour dense shrubland and *Gahnia filum* and *Machaerina arthrophylla* sedgeland that was not systematically surveyed.

Common Name	SA rating	EPBC rating	Total opportunistic count				
			Nov 2021	Nov 2022	Nov 2023	Oct 2024	Nov 2025
Australasian bittern	E	E	0	0	1	0	0
Australasian pipit			16	15	2	0	19
Australian hobby			1	1	0	1	1
Australian magpie			25	50	7	3	35
Australian painted snipe	E	E	0	0	1	0	1
Australian raven			5	12	0	0	0
Australian reed warbler			0	6	0	12	9
Australian spotted crake			0	0	23	0	0
Ballion's crake			0	0	2	0	1
beautiful firetail	R		3	3	1	3	0
black-tailed native-hen			221	0	2514	25	290
blue-winged parrot	V	V	0	0	2	0	1
brown falcon			2	1	1	0	0
brown quail	V		0	0	0	0	1
brown songlark			6	13	0	2	2
brown thornbill			15	7	0	3	7
collared sparrowhawk			1	0	0	0	1
common blackbird			4	3	0	4	4
common bronzewing			2	0	0	0	0
common skylark			28	41	15	7	29
common starling			163	6	0	0	464
crested pigeon			3	0	4	0	2
eastern yellow robin			0	1	0	0	0
emu			4	3	1	0	0
European goldfinch			11	8	0	0	12
fairy martin			0	0	0	0	3
forest raven			0	4	0	0	0
galah			22	18	2	0	70
golden whistler			3	5	1	1	2
golden-headed cisticola			2	8	13	1	0
grey butcherbird			1	1	0	0	0
grey currawong			1	1	0	0	3
grey fantail			9	8	2	2	13
grey shrike-thrush			17	11	5	3	17
Horsefield's bronze-cuckoo			1	1	0	0	0
Latham's snipe	R	V	0	4	4	0	219
little grassbird			13	35	18	16	28
little raven			238	7	11	0	1
magpie-lark			25	16	5	0	12
martin sp.			0	0	0	0	4
Nankeen kestrel			2	0	1	0	0
New Holland honeyeater			0	0	0	0	2
peregrine falcon			0	0	1	1	2

Common Name	SA rating	EPBC rating	Total opportunistic count				
			Nov 2021	Nov 2022	Nov 2023	Oct 2024	Nov 2025
purple swamphen			0	1	0	5	78
raven sp.			22	46	55	0	37
red wattlebird			0	0	0	0	2
silvereye			92	5	1	0	13
singing honeyeater			2	1	0	0	0
southern emu-wren (south east SA)	R		0	2	2	0	1
spiny-cheeked honeyeater			9	19	2	0	13
striated fieldwren			8	8	2	0	1
stubble quail			0	3	0	1	0
superb fairy-wren			20	19	8	12	15
swamp harrier			8	9	7	1	17
tree martin			0	2	0	0	4
unidentified bird of prey (family Accipitridae)			0	0	1	0	0
unidentified parrot sp. (genus Neophema)			0	0	6	0	0
unidentified quail sp.			0	0	2	0	0
unidentified rail sp.			0	0	2	1	0
wedge-tailed eagle			3	2	1	0	4
welcome swallow			22	49	4	0	85
white-browed babbler			0	1	0	0	0
white-browed scrubwren			4	1	3	5	7
white-fronted chat			75	89	49	4	104
willie wagtail			2	0	0	0	4
yellow-faced honeyeater			0	1	0	0	0
yellow-rumped thornbill			0	1	3	0	0