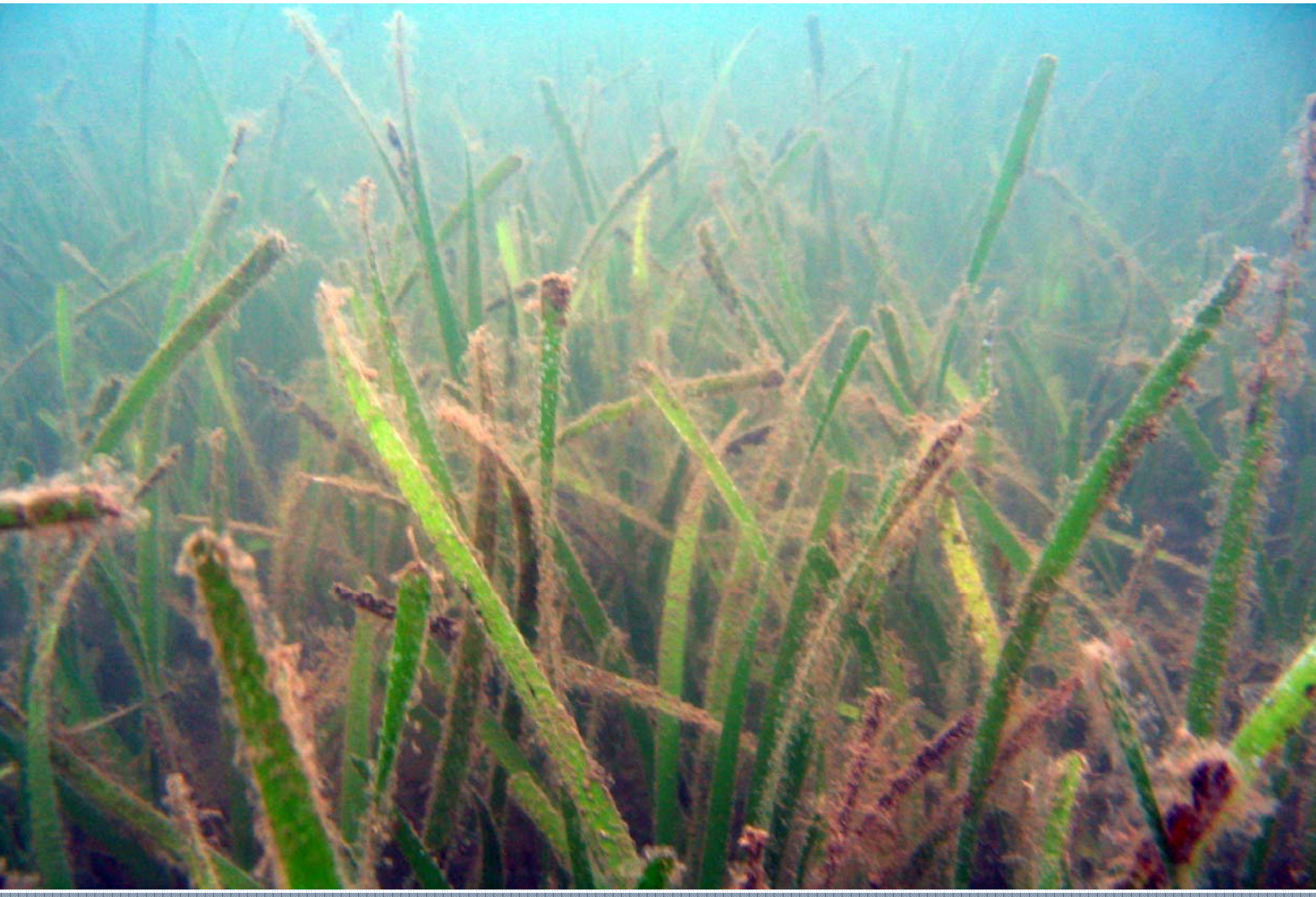
Cardno Ecology Lab

Shaping the Future

Marine and Freshwater Studies



Koolewong Marina Gosford

Seagrass Habitat Mapping

Job Number: EL1011005

Prepared for Gemsted Pty Ltd

2 August 2010

Cardno (NSW/ACT) Pty Ltd
Trading as Cardno Ecology Lab

ABN 95 001 145 035
4 Green Street
Brookvale
New South Wales 2100
Australia
Telephone: 02 9907 4440
Facsimile: 02 9907 4446
International: +61 2 9907 4440
ecologylab@cardno.com.au
www.cardno.com.au

Cover Image: *Posidonia australis* seagrass in the vicinity of Koolewong Marina. Photographer Dan Pygas, Cardno Ecology Lab

Document Control

Report Number	Date	Author		Reviewer	
EL1011005	2 August 2010	Daniel Pygas	DP	Dr Marcus Lincoln-Smith	MLS

Summary

Cardno Ecology Lab was commissioned by Gemsted Pty Ltd to provide a seagrass habitat survey in relation to the proposed extension of Koolewong Marina, Gosford. Gemsted Pty Ltd proposes to extend the current jetty by 125 m into Brisbane Water, incorporating 15 berthing arms. This survey will provide an accurate and up to date GIS based map that will help minimise and or mitigate any impacts on seagrass resulting from the proposal. It will also provide a preliminary assessment of the direct impacts on seagrass resulting from the placement of the proposed structures.

The aims of the survey were too:

- Map marine vegetation, including seagrasses, in the vicinity of the current and proposed marina structures;
- Produce a GIS-based map incorporating the current and proposed structures and any nearby marine vegetation;
- Provide a preliminary assessment of any direct impacts to seagrass arising from the proposal.

Marine vegetation was mapped on the 28 July 2010 using snorkel with the aid of handheld GPS. Data were used to produce a map of different marine vegetation types using MapInfo Professional GIS software. Three species of seagrass (*Posidonia australis*, *Zostera capricorni* and *Halophila* sp.) were observed, as well as mangroves and brown algae. The Class 1 noxious algae *Caulerpa taxifolia* was also found within the survey area.

Although large beds of seagrass were present, none were found in the footprint of the proposed marina structures, therefore no seagrass should be lost due to direct displacement by any proposed marina structure. It is also not expected that these structures would result in the shading of seagrass in its current distribution. The presence of *C. taxifolia*, both under the existing and proposed structures, requires that measures be implemented during the construction process to prevent its spread further into the survey area and also Brisbane Water. Such measures may include physical removal and / or treatment with salt to destroy the algae before works begin.

Table of Contents

Summary ..... **i**
1 Introduction **1**
1.1 Background and Aims 1
1.2 Previous Surveys 1
2 Study Methods **2**
2.1 Field Survey 2
2.2 Mapping 2
3 Results **3**
3.1 General Findings 3
3.2 Seagrass and other Marine Vegetation 3
4 Conclusions **4**
5 Acknowledgements **5**
6 References **6**
7 Figure **7**
8 Plates **9**

1 Introduction

1.1 Background and Aims

Cardno (NSW/ACT) Pty Ltd trading as Cardno Ecology Lab was commissioned by Gemsted Pty Ltd to map the seagrass habitat in the vicinity of Koolewong Marina, Brisbane Water Drive, Gosford. Gemsted Pty Ltd proposes to extend the current jetty (approximately 30 m long, including 16 wooden piers) 125 m into Brisbane Water. The proposed structure would include 15 berthing arms between 10 and 38.5 m long and between 0.9 and 2.5 m wide (ADW Johnson 2010). The Marina is situated along the western shore of Brisbane Water, a relatively shallow and tidal northern arm of Broken Bay, just south of Gosford, NSW. The M.V. Lady Kendall II, a 200 passenger, 34 m (106 ft) long timber cruiser that runs tours of Brisbane Water, regularly docks at the jetty.

Under the *Fisheries Management Act 1994* (*FM* Act) there are requirements for the protection of the marine environment, particularly for marine vegetation such as seagrasses and mangroves. Seagrasses differ from algae in that they are flowering plants adapted to life in the shallow marine environment. They fulfil a variety of ecological functions, including primary productivity, provision of fish nursery habitat and consolidation of sediments (Larkum *et al*. 1989). Under the *FM Act* it is an offence to remove or harm certain types of marine vegetation and a permit is required for this intent. The results of this survey will help to ensure that any potential impacts arising from the placement of the proposed marina structures on nearby seagrass beds and other aquatic vegetation are minimised or mitigated.

The specific aims of the survey were to:

- Determine the current distribution of seagrass beds and other marine vegetation within 50 m of the current and proposed new marina structures (the survey area);
- Prepare a GIS based map including the current and proposed structures and any marine vegetation within the survey area;
- Identify the presence of the noxious algae *Caulerpa taxifolia* and illustrate its distribution;
- Provide a preliminary assessment of any direct impacts on nearby seagrass arising from the placement of the proposed structures.

1.2 Previous Surveys

Industry and Investment NSW (I&I NSW) has recently mapped of aquatic vegetation in Brisbane Water (Creese *et al.* 2009). Vegetation was mapped at a scale of 1:1500 derived from aerial photographs with a positional accuracy of approximately 6 m. Vegetation boundaries were identified on orthorectified aerial photographs and boundary location and species identification were verified in the field. A diverse range of habitats was found throughout Brisbane Water, including seagrass, mangrove and saltmarsh communities. *Posidonia* and *Zostera* species of seagrass, along with mangroves, were mapped within, and adjacent to, the survey area. I&I NSW also undertook *C. taxifolia* surveys in Brisbane Water in 2006 (NSW DPI 2007). *C. taxifolia* was found just to the west of Rileys Island and also in Booker Bay, approximately 2.5 km and 5 km respectively southwest from the survey area. *C. taxifolia* is a Class 1 noxious species in all NSW waters under the *FM Act*. The invasive nature of *C. taxifolia* has raised concerns as it has the potential to grow rapidly, alter marine habitats and affect biodiversity (I&I NSW 2010). Fragments of *C. taxifolia* dislodged via disturbances to the seabed, either natural or anthropogenic, may remain viable for up to three days. It is also extremely difficult to eliminate once it has become established in the wild. It is therefore important to prevent this species from expanding its range.

2 Study Methods

2.1 Field Survey

Fieldwork was undertaken on 28 July 2010. The survey area included the marina structures and the intertidal and subtidal areas within 50 m of the current and proposed structures. At the time of the survey, conditions were cloudy with showers. The water was calm and water visibility was approximately 3-4 m. At the time of the survey the tide was rising to a high of 1.33 m at 11:51 before dropping to 0.52 m at 17:28 (NSW Department of Commerce 2010).

The marine vegetation in the survey area was observed using snorkel. Data on the composition, density and morphological characteristics of seagrasses and other marine vegetation were relayed to a second team member onboard a small punt. Measurements of the distance between the existing structure and seagrass beds were taken using a 30 m tape and positions were marked using handheld GPS (Garmin 24 channel, WGS 84 datum, Zone 56), with accuracy on the day of 5-6 m. Species of seagrass present and a qualitative estimate of density, patchiness and leaf length were also noted. In addition, notes were made describing the health of the seagrasses (i.e. epiphytic growth, physical damage from anchors or propellers etc.) within the study area.

Estimates of density were made by ranking each observation point using three categories as per King and Barclay (1986):

- 1 - low density (< 15% cover),
- 2 - medium density (15% - 50% cover), or
- 3 - high density (> 50% cover).

The level of patchiness was also estimated using three categories as per King and Barclay (1986):

- A – Individual strands or clumps,
- B – Patches up to 10 m diameter, or
- C – Beds of relatively even distribution.

Leaf length of seagrass was also categorised as follows:

- *Zostera* – S (short < 5 cm), M (medium 5 cm – 15 cm), L (long > 15 cm),
- *Posidonia* – S (short < 15 cm), M (medium 15 cm – 30 cm), L (long > 30 cm), or
- *Halophila* – S (short < 1 cm), M (medium 1 cm – 3 cm), L (long > 3 cm).

Photos were taken of the subtidal habitats and the depths at *P. australis* bed edges were recorded using a digital depth sounder. The depth of the seaward extent of *P. australis* was recorded at six locations for each of the two large beds either side of the existing jetty and the mean maximum depth for each bed calculated.

Notes were also made of the presence of the pest algae, *C. taxifolia* and other species of marine flora and fauna.

2.2 Mapping

GPS coordinates taken during the survey were plotted onto a georectified drawing of the existing and proposed marina structures (ADW Johnson 2010) using MapInfo Professional (version 10.0). The boundaries of seagrasses and marine vegetation containing similar species, densities, leaf lengths and patchiness were drawn according to the information gathered.

3 Results

3.1 General Findings

The intertidal zone within the study area consisted of an artificial sandstone rock wall fronted by a narrow sandy beach. Concrete piers (supporting the boathouse building which overhung the water) and wooden jetty piers provided additional intertidal and subtidal habitat. Sydney rock oysters (*Saccostrea glomerata*) and brown algae (*Sargassum* sp.) dominated the sandstone rock and piles (Plate 1a-b). Unvegetated sediment (Plate 1c) was present directly under, and in front, of the boathouse building and also under most of the jetty. Numerous holes, possibly from the activities of burrowing organisms, were observed on these unvegetated sections. Luderick (*Girella tripcuspidata*), glassfish (*Ambassis* sp.) and yellowfin bream (*Acanthopagrus australis*) were also seen swimming among the seagrass.

3.2 Seagrass and other Marine Vegetation

Three species of seagrass were observed: *Posidonia australis*, *Zostera capricorni* and *Halophila* sp. (Figure 1). The dominant species was *P. australis*, which was present in two separate beds, one either side of the jetty. Both these beds consisted of long leaved, dense and continuous seagrass (Pos3CL) (Plate 1d). The western bed was approximately 30 m wide and bordered *Z. Capricorni* (Plate 2a) approximately 8 m from the shore. The eastern bed was approximately 50 m wide and bordered *Z. Capricorni* approximately 40 m from the shore.

The mean maximum depth of the seaward extent of *P. australis* was as follows:

- Western bed: -1.4 m AHD (Standard Error = 0.04), with a maximum recorded depth of -1.5 m AHD;
- Eastern bed: -1.8 m AHD (Standard Error = 0.08), with a maximum recorded depth of -2.0 m AHD.

The western bed was nearer the jetty than the eastern (0.5 m compared to 3 m). Two isolated patches of Posidonia (< 1 m^2) were also present to the west of the southern bed (Pos3AL).

Z. capricorni occurred in two continuous beds situated between the *P. australis* and the shoreline (Plate 2b). These were separated directly in front of the boathouse building by an area of unvegetated sediment. The western bed was long-leaved and dense (Zos3CL), while the eastern bed was comprised of two distinct areas, the outer bed dense with long leaves (Zos3CL), the inner bed dense also but with much shorter leaves (Zos3CS) (Plate 2c). Both these beds extended under the boathouse building. A third bed of *Z. capricorni* was present between the existing jetty and the eastern *Posidonia* bed (Zos2BM) and a small patch of *Halophila* sp. was also observed to the east of the jetty adjacent to pile 7 (counting from the shore) (Hal1AS). A moderate degree of epiphytic growth was present on the leaves of each seagrass species. There was no obvious damage, such as propeller scars, to the seagrass due to boating activities.

A patch of *C. taxifolia* was found adjacent to eastern pile 6, extending under the jetty between piles 5 and 6. A few strands of very sparse *C. taxifolia* were also observed approximately 10 m seaward of the existing jetty, extending to approximately -3.4 AHD.

Several grey mangroves (*Avicennia marina*) were observed along the western and eastern shores either side of the boathouse. Along the eastern shore, *A. marina* pneumatophores (aerial roots) extended approximately 4-10 m seaward before merging with seagrass wrack (Plate 2d) and finally *Z. Capricorni*. Along the western shore much fewer mangroves were present and only a small number of pneumatophores were visible although there was a large amount of wrack just inshore of the *Z. capricorni.*

4 Conclusions

No seagrass was observed under the footprint of the proposed marina, therefore no seagrass would be lost via direct displacement under the proposed marina structures. The distance between the proposal and the nearest *P. australis* is approximately 7 m (from the southern corner of the proposal to the eastern *P. australis* bed). I&I NSW require a minimum distance of 2 m between *P. australis* and any new development. Due to the distance between the proposed marina structure and *P. australis*, it is not expected that this seagrass would be affected by any shading impacts from these structures. Although *Z. capricorni* and *Halophila* sp. were found to be nearer the proposed structure than *P. australis*, these species are still a sufficient distance away so that any shading impacts would be minimal, if at all present. In addition, *Z. capricorni* and *Halophila* sp. are already found to be growing in very close proximity to and probably in the shade of the existing jetty Each of the berthing arms is also located a sufficient distance from any seagrass so that any berthed vessels would not shade seagrass beds. Once the new marina is completed, vessels should also moor further from the seagrass beds than at present. Any potential impacts on seagrass due to mooring vessels, such as propeller scars or localised increases in turbidity, would therefore be reduced.

The presence of *C. taxifolia*, both under the existing jetty and under the proposed structure, requires that special consideration be given during the construction process to preventing its spread both within the survey area and also Brisbane Water. The algae could potentially be removed prior to works and deposited at landfill and / or the affected areas could be treated with salt to destroy the algae. Liaison with I&I NSW, both to inform them of the recent presence of this species in Brisbane Water and to receive guidance on appropriate control measures before, during and after construction, is recommended.

No additional information is currently available regarding the construction process, such as details of any potential dredging works or pile driving activities. Such processes have the potential to impact marine vegetation, including seagrasses, due to increased sedimentation and turbidity. As such, this report is not a complete assessment of impacts but rather a preliminary investigation of the potential direct impacts to seagrass resulting from the proposed structures. Once further information becomes available, it should be incorporated into a complete environmental impact assessment covering all aspects of the proposed development and potential impacts on aquatic ecology that may arise.

5 Acknowledgements

This report was written by Dan Pygas and reviewed by Dr Marcus Lincoln-Smith. Dan Pygas and Chris Roberts undertook the field survey.

6 References

ADW Johnson (2010). Project: 150134 – Boat House Marina. Proposed Marina Layout, 9 June 2010. 2 Bounty Close, Tuggerah, NSW, 2259.

Creese, R.G., Glasby, T.M., West, G. and Gallen, C. (2009). Mapping the habitats of NSW estuaries. Industry & Investment NSW, Port Stephens, NSW.

I&I NSW (2010). Fishing and Aquaculture. Pests and Diseases. Caulerpa taxifolia. (http://www.dpi.nsw.gov.au/fisheries/pests-diseases/marine-pests/species/caulerpa-taxifolia#-EM-Caulerpa-taxifolia--EM--in-Wallagoot-Lake---Case-Study---updated May-2010). Accessed 30 July 2010.

King, R.J. & Barclay, J.B. (1986). Aquatic angiosperms in coastal saline lagoons of New South Wales. III. Quantitative assessment of Zostera capricorni. Proceedings of the Linnean Society of NSW 109: 41-50.

Larkum, A. W. D., McComb, A. J. and Sheperd, S. A. (1989). Biology of Seagrasses - A Treatise on the Biology of Seagrasses with Special Reference to the Australian Region. Elsevier Science, Amsterdam, Netherlands, 841 pp.

NSW DPI (2007). Caulerpa Taxifolia Affected Areas. Brisbane Water. (http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/180642/Brisbane-Water.pdf). Accessed 30 July 2010.

NSW Department of Commerce (2010) New South Wales Tide Charts October 29, 2009 to January 5, 2011. The Great Outdoors Publications Pty Ltd, Hervey Bay, QLD.

7 Figure

Figure 1: Habitat map of species marine vegetation present in the vicinity of the current and proposed marina structures (ADW Johnson 2010), Koolewong Marina, Brisbane Water Drive, Gosford. 28 July 2010.

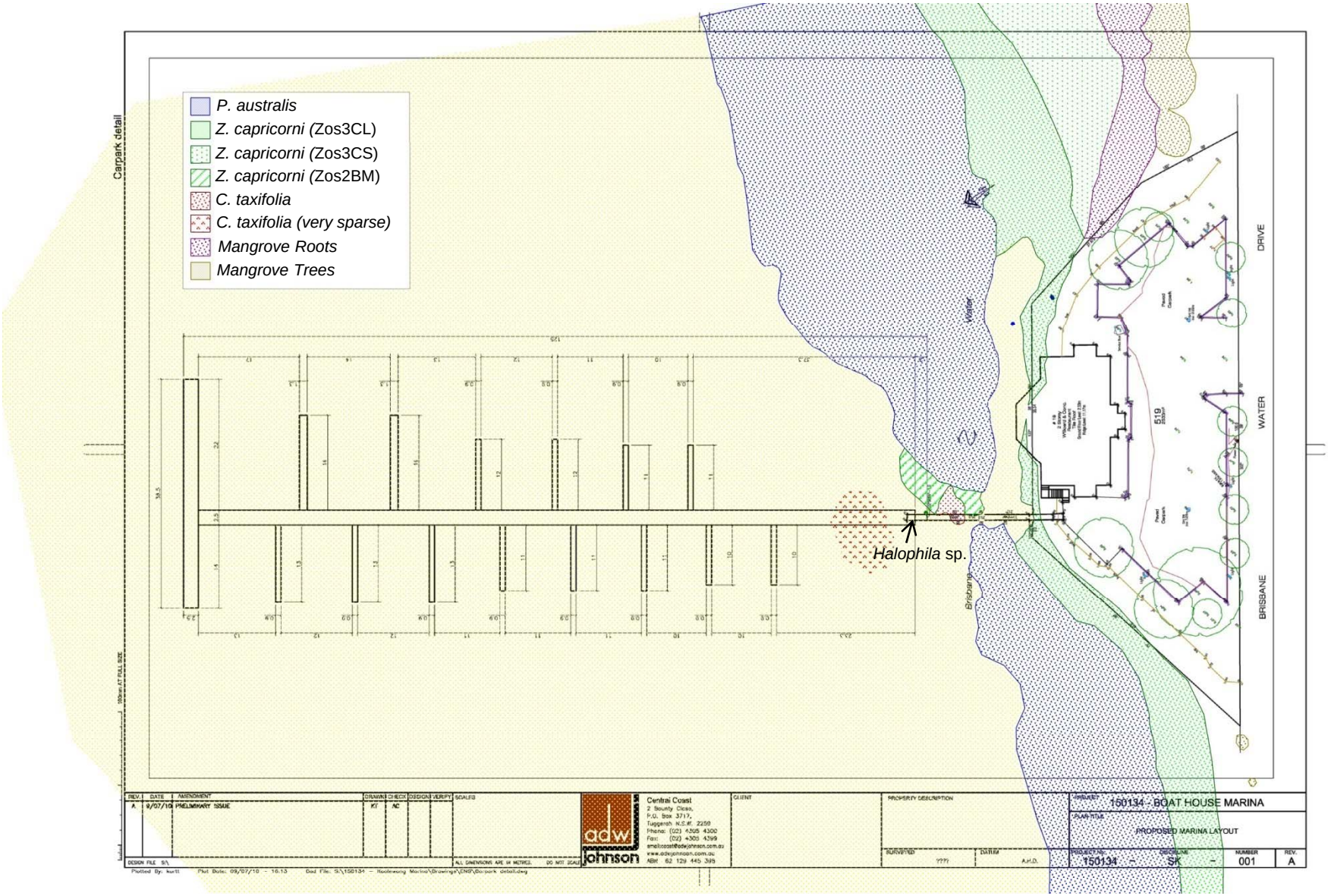


Figure 1: Habitat map of species of marine vegetation present in the vicinity of the current and proposed marina structures (ADW Johnson 2010), Koolewong Marina, Brisbane Water Drive, Gosford. 28 July 2010.

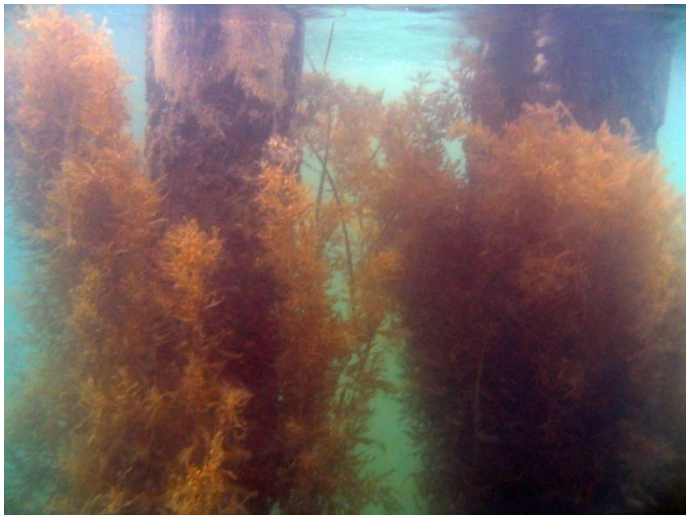
8 Plates

Plate 1: a) Sydney rock oysters (*Saccostrea glomerata*) on sandstone rocks at the bottom of the seawall. b) Brown algae (*Sargassum* sp.) present on rocks and wooden jetty piers. c) Unvegetated sediment under and below the boathouse and the jetty. d) Dense, long leaved and continuous *Posidonia australis* seagrass.

Plate 2: a) Adjacent *P. australis* and *Zostera. capricorni* seagrass beds. b) Dense, long leaved and continuous *Z. capricorni* seagrass. c) Short leaved *Z. capricorni*. d) Seagrass wrack adjacent to *Z. capricorni.*

a)

b)



c)

d)

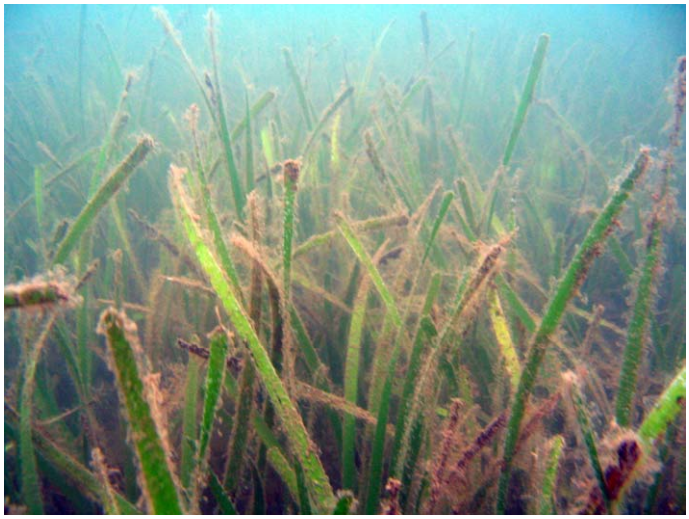
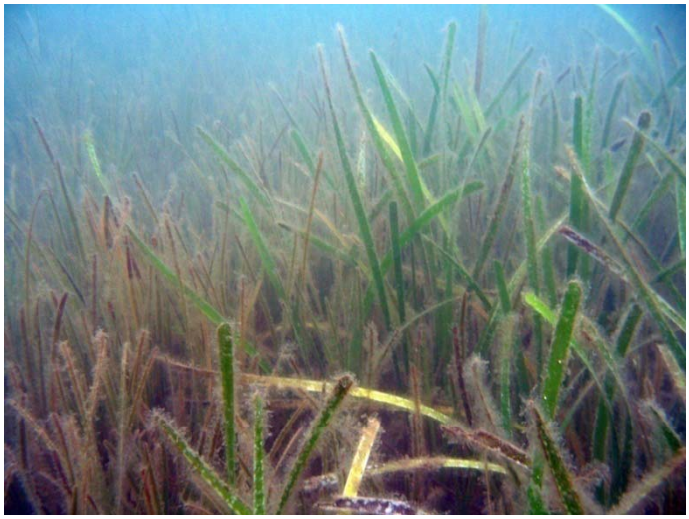
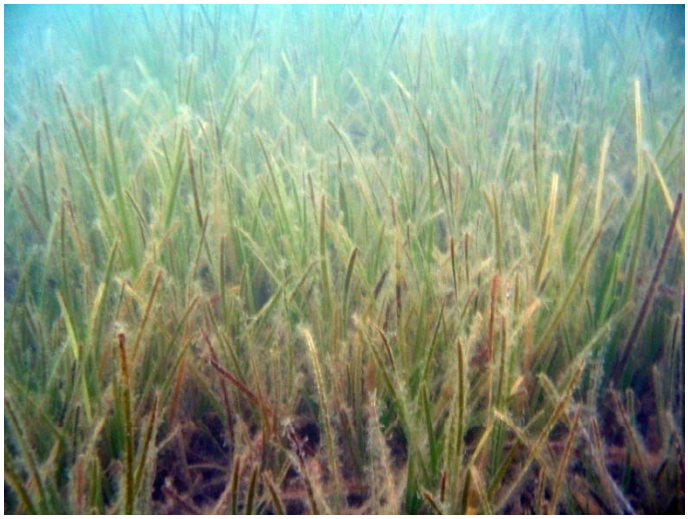


Plate 1: a) Sydney rock oysters (*Saccostrea glomerata*) on sandstone rocks at the bottom of the seawall. b) Brown algae (*Sargassum* sp.) present on rocks and wooden jetty piers. c) Unvegetated sediment under and below the boathouse and the jetty. d) Dense, long leaved and continuous *Posidonia australis* seagrass.

a)



b)



c)

d)

Plate 2: a) Adjacent *P. australis* and *Zostera capricorni* seagrass beds. b) Dense, long leaved and continuous *Z. capricorni* seagrass. c) Short leaved *Z. capricorni*. d) Seagrass wrack adjacent to *Z. capricorni*.