

MARINE HABITAT SURVEY
4 Cabarita Road, Avalon



September 2019



BIO-ANALYSIS Pty Ltd

Marine, Estuarine & Freshwater Ecology

2/1 Botham Close Charmhaven, NSW 2263

(Email) info@bioanalysis.com.au

(Mobile) 0414 477066

INTRODUCTION

Marine vegetation comprising saltmarsh, mangroves, seagrasses, and macroalgae are essential to coastal and estuarine systems. Marine vegetation provides food, habitat and nursery for many species including fish, crustaceans and birds, and also plays a role against erosion of the shoreline by stabilising bottom sediments (Butler and Jernakoff, 1999).

There have been large-scale declines of marine vegetation within NSW estuaries, especially concerning seagrass meadows (Smith and Pollard, 1998) and in some cases, these declines have been permanent (West *et al.*, 1990). Increased turbidity, siltation and the growth of epiphytic and benthic algae all have the potential to reduce the distribution and abundance of seagrass meadows.

Artificial structures such as wharves and jetties have the potential to adversely affect marine vegetation either directly through construction activities or indirectly by causing shading to the bottom.

The introduction of the exotic algae *Caulerpa taxifolia* in recent times has added new problems for managers of estuaries. The genus *Caulerpa* is highly invasive (Davis *et al.*, 1997) and direct disturbance associated with dredging and construction has the potential to exacerbate its spread. *Caulerpa taxifolia* can now be found in a number of NSW estuaries, and DPI (Fisheries) require that prior to any disturbance (e.g. construction of jetties) an assessment for the presence or absence of this noxious marine algae be done.

The study area is located at Avalon, on the tide-dominated Pittwater “estuary”, part of the Hawkesbury River, which is the largest estuarine system of NSW (Creese *et al.*, 2009). The Hawkesbury River system encompasses a large range of benthic habitats, such as mangroves, seagrass beds (*Zostera capricorni*, *Posidonia australis*, *Halophila*

sp.) and algae (Creese *et al.*, 2009), un-vegetated areas (beaches and mudflats) and also hard bottoms (natural and artificial). The invasive and noxious *Caulerpa taxifolia* has been recorded in Pittwater since 2001 (<http://www.dpi.nsw.gov.au/fisheries/pests-diseases/marine-pests/nsw/caulerpa-taxifolia>).

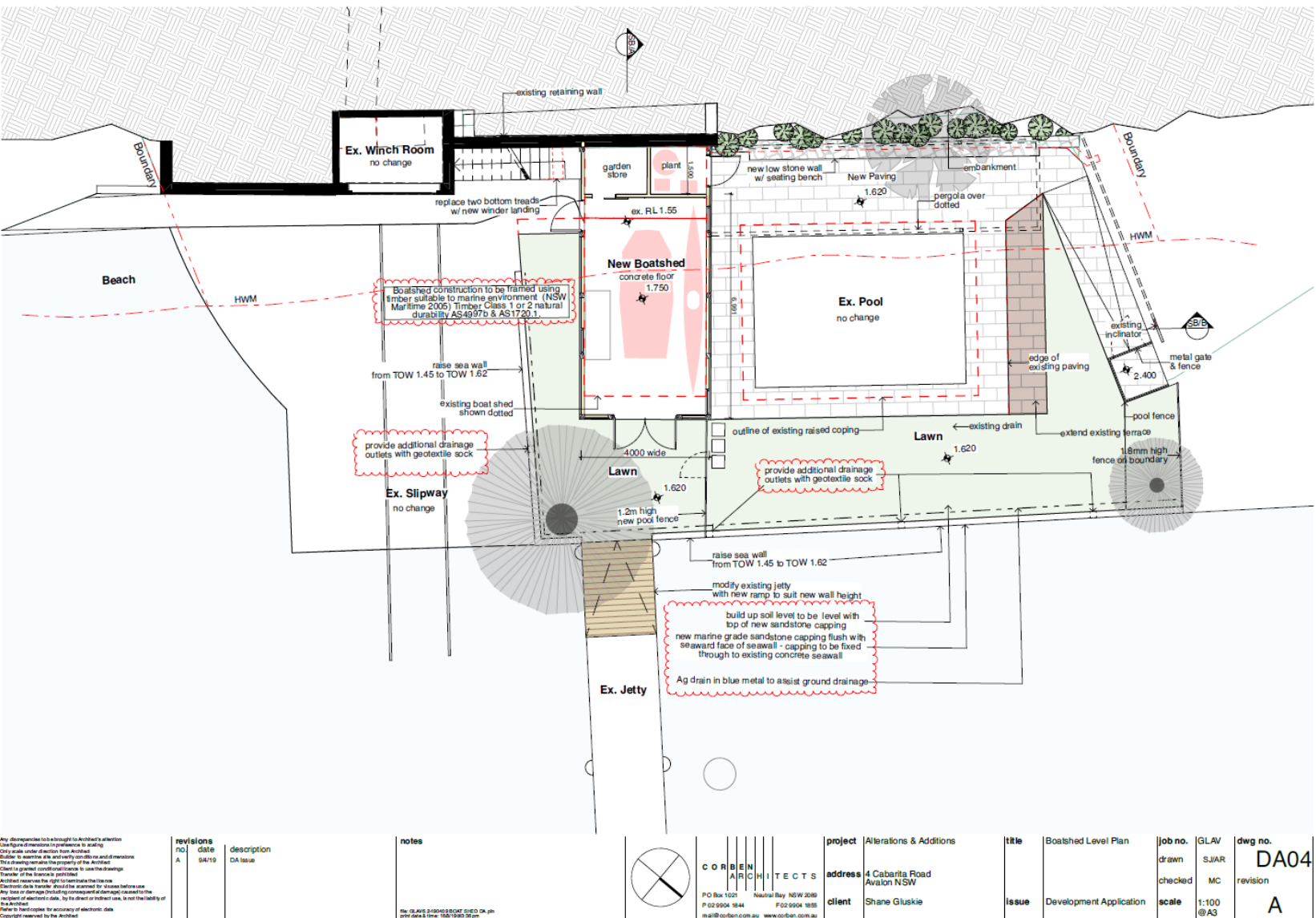
Pittwater is considered class 1 (major key fish habitat) following the NSW Policy and Guidelines for Fish Habitat Conservation and Management (2013 update).

SCOPE OF WORKS

The marine habitat survey was conducted with regards to upgrading the seawall at 4 Cabarita Road, Avalon. The alterations consist of raising the existing seawall, modifying the start of the existing jetty to match the raised seawall level and, landscaping works and rebuilding the existing boatshed above mean high water springs (MHWS) (Fig. 1).

As part of the works approval process, an assessment of the marine habitat at the site was required to fulfil NSW DPI requirements for reviewing foreshore developments (DPI Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management (2013 update) (Fairfull, 2013). The scope of work was therefore to identify the presence of wetland and marine vegetation and to estimate its relative abundance as well as ascertain whether or not the introduced algae *Caulerpa taxifolia* was present at the site. Furthermore, an assessment of the occurrence of threatened and protected species, as listed under the Fisheries Management Act 1994, NSW Biodiversity Conservation Act 2016 (BC Act) and the Environment Protection and Biodiversity Conservation (EPBC) Act 1999, was also to be made.

Figure 1. Plans of the proposed alterations designed by Corben Architects.



METHODOLOGY

Definitions

Proposal means the temporary works and the permanent structure below the MHWS (seawall and start of the jetty refurbished) proposed to be altered as described in “the scope of work” section of this report.

Subject site means the area directly affected by the proposal. In the case of this assessment the subject site corresponds to the existing seawall and a 5 m buffer.

Survey area corresponds to the study area plus an additional 10 m buffer to encompass important habitat features during the field surveys.

Study area means the subject site and any additional areas which are likely to be affected by the proposal, either directly or indirectly. The study area should extend as far as is necessary to take all potential impacts into account. In the case of this assessment the study corresponds to the survey area plus an additional buffer (up to 10 km) to take into accounts the potential presence of threatened species, populations and ecological communities based on database searches (Table 1).

Desktop Review

The desktop review consisted of searches of relevant databases and consultation of maps and other documentation in relation to the study area. Only estuarine and marine species and communities were considered in the assessment of habitat and likelihood of occurrence of threatened species, populations and ecological communities. The databases and resources consulted for the desktop review are listed in Table 1. The results of the database searches are summarised in the Appendix. An evaluation of presence of habitat and likelihood of occurrence of threatened species, populations and ecological communities as well as the potential for impacts are provided in the Appendix.

Table 1. Database and existing documentation consulted for the desktop review.

Source	Objective	Search area
BioNet Atlas – OEH website	Threatened and protected aquatic flora and fauna and populations	10 km radius of site
EPBC Act Protected Matters Search	Threatened aquatic flora and fauna, endangered populations and ecological communities and migratory species	1 km radius of site
NSW Department of Primary Industries (DPI) fisheries website	Listed aquatic threatened species, populations and ecological communities; protected species – Species FactSheets and PrimeFacts	5 km radius of site
NSW DPI Fisheries Spatial Data Portal	Critical habitats, estuarine habitats, key fish habitats	1 km radius
OEH website	Critical habitats OEH Threatened Species Profiles	1 km radius
NSW DPI website	Aquatic pests and diseases	1 km radius
SIX Maps, NSW Government – Spatial services	Aerial photographs	1 km radius
The Atlas of Living Australia	Threatened species occurrences	1 km radius

Field Survey

An inspection of the site was done on the 7/09/2019. The survey started at 13:30 pm on the incoming tide (high tide was at 2:53 pm with a height of 1.46 m at Pittwater Newport Wharf). Weather conditions were windy and overcast (strong NW and 0 to 50% cloud cover). The visibility of the water was good (~7 m). The area of the proposed works and an additional 10 m in all directions were assessed by the diver.

Limitations

This Marine Habitat Survey and report considered only the potential impacts to the aquatic environment, i.e. below the MHWS (Mean high water springs).

The species detected during the survey are only an indication of the species that potentially occur within the study area. Marine species can be highly mobile and the field surveys provide only a snapshot of the assemblages at a time of the year and under certain climatic conditions, therefore this list is not exhaustive.

Based on the desktop review and the field survey findings, the information gathered is considered sufficient to produce habitat maps and make an assessment of potential impacts of the proposal.

This present assessment focuses on the potential impacts of the proposed works on threatened species, populations and ecological communities found in estuarine and marine environments. This assessment does not include terrestrial or avian species (such as albatross and similar birds that would occur within the study area only rarely, if at all, and are not likely to be affected by the proposal).

RESULTS

Existing environment/available information on aquatic habitats

The seagrass (*Posidonia australis*) listed as endangered ecological communities under the EPBC “*Posidonia australis* seagrass meadows of the Manning-Hawkesbury ecoregion” (Department of the Environment (2018)) has been mapped in the vicinity of the survey area (Fisheries NSW Spatial Data Portal ; Creese *et al.*, 2009). The seagrass *Zostera capricorni* has been reported within the survey area (NSW DPI - Creese *et al.*, 2009) (Fig. 2).



Figure 2. Estuarine macrophytes mapped by NSW DPI. The red rectangle delimits the survey area. (Source: NSW DPI - Fisheries NSW Spatial Data Portal 06/09/2019).

The invasive and noxious algal species *Caulerpa taxifolia* is known to occur within Pittwater since 2001 (NSW DPI website: <https://www.dpi.nsw.gov.au/fishing/pests-diseases/marine-pests/found-in-nsw/caulerpa-taxifolia>), including within the survey area (Fig. 3).

'Caulerpa taxifolia affected areas' are areas where Caulerpa has been historically confirmed. Since the distribution of Caulerpa can change markedly over time, either expanding or contracting, Caulerpa will not necessarily be present in all these areas at any one time. In addition, the maps are based on surveys of areas where Caulerpa is known to occur or has been reported, not on comprehensive surveys of the entire waterway. Thus Caulerpa may occur in areas not shown on the maps. Report any sightings of Caulerpa outside the areas shown by calling our 24 hour hotline, 02 4916 3877.

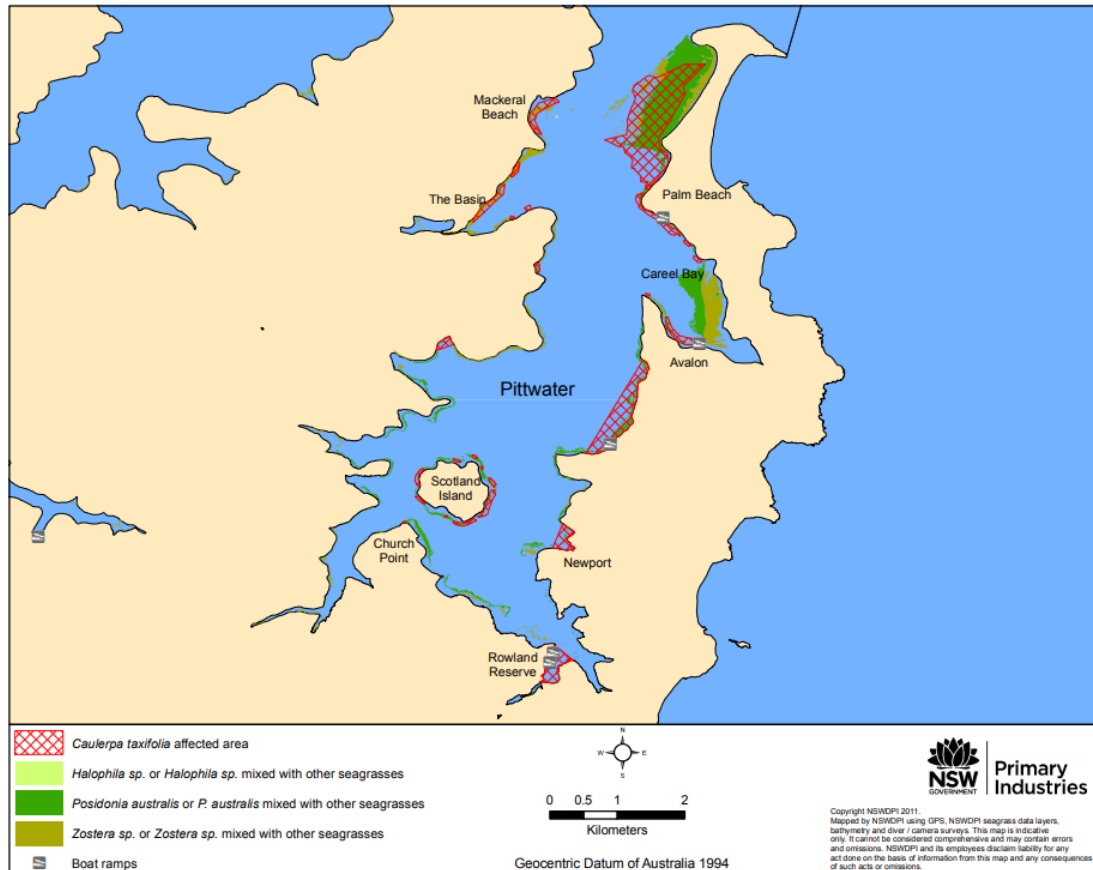


Figure 3. Distribution of *Caulerpa taxifolia* in Pittwater mapped by NSW DPI in 2001 (Source: NSW DPI, accessed 06/09/2019).

Field survey results

Intertidal area

The intertidal area consisted of an artificial concrete seawall, existing jetty piles and artificial slipway and rails (Fig. 4 - 5). The hard substratum was colonised by Sydney rock oysters (*Saccostrea glomerata*), macroalgae (mainly *Hormosira banksii*) and various gastropods (Figs. 4 - 5) and ascidians on the piles.

Subtidal area

The subtidal habitat extended seaward from the seawall to the lower sections of the piles supporting the jetty. From the base of the seawall and up to 10 to 13 m seaward (1.3 m depth), pebbles, small boulders and sand were present overlying rocky sandstone reef (Figs. 6 - 7).

From 10 to 13 m distance from the seawall, the seabed consisted of soft sediment, fine sand and silt, with the proportion of the latter increasing with depth. Scattered small boulders were found on the soft sediment (Figs. 6 - 7).

Large boulders were present under the existing jetty and up to 10 m seaward of the seawall (Figs. 8 - 9). The boulders under the jetty and the piles supporting the jetty were colonised by sessile fauna including sponges, ascidians and bryozoans (Figs. 8 - 9).

The subtidal hard substratum and soft sediment were colonised by marine vegetation (see “marine vegetation section”).

Marine Vegetation

Macroalgae were found on the hard substratum (base of the seawall, boulders, flat sandstone rocky substratum and piles). The main species were *Hormosira banksia*, *Gracilaria* sp. in the shallows (Fig. 6), *Sargassum* sp., *Ecklonia radiata* (Fig. 9) and in deeper water the calcareous algae *Halimeda* sp. (up to 40% cover) (Figs. 10 and 113).

Three species of seagrasses were present within the extended survey area. *Zostera capricorni* was present from 2 - 4 m from the seawall in small patches, sparse (< 10% cover) with very short leaves (3 - 4 cm) (Fig. 13). In deeper water, 5m seaward of the seawall, *Zostera capricorni* increased in leaf length and percentage cover with the depth up to 30 % cover (Figs. 13 and 16). *Posidonia australis* was found approximately 14 - 16 m from the seawall at a depth of 1.4 m in isolated clumps (~5% cover). This *Posidonia* extended out to around 35 - 40 m at a depth of 4.0 m. At this depth a dense *Posidonia* bed with 60 - 80% cover was found, approximately 40m from the seawall (Figs. 10, 11 and 16). The seagrass *Halophila* sp. was also found within the survey area but was very sparse (Fig. 14).

The invasive algae *Caulerpa taxifolia* was present from 8 to 10 m (1.0 – 1.2 m depth) seaward from the seawall with a percentage cover of up to 30% (Figs. 10, 14 and 16). *Caulerpa taxifolia* was also found colonising the piles and boulders under the jetty (Fig. 15).

No mangroves, wetlands or saltmarshes were identified in direct or close proximity to the survey area.

Ichthyofauna

Adult yellowfin bream (*Acanthopagrus australis*) and luderick (*Girella tricuspidata*) were observed during the survey. These species are of commercial and recreational importance. No pipefish or seahorses (Syngnathids) were recorded during the survey, however they are known to be in Pittwater and the Hawkesbury River and its tributaries. The NSW Government has listed all seahorses, pipefish, pipehorses and seadragons as protected under the NSW Fisheries Management Act 1994. The proposed works are unlikely to have an impact on Syngnathids and ichthyofauna in general as the subject site offers limited suitable habitats for Syngnathids and limited key fish habitats (sparse *Zostera capricorni* and macroalgae within the first 5 meters inshore).

Threatened species of fish that are unlikely to be present within the subject site and/or be affected by the proposal include: the Macquarie Perch (*Macquaria australasica*) is a freshwater species and is very unlikely to occur within the subject site; the survey area present suitable habitats for the Black Rockcod (*Epinephelus daemeli*), such as little caves and crevices in the boulder area under the jetty, potentially for juveniles or small individuals. These habitats are situated outside the subject site.

Threatened sharks and rays might opportunistically venture into this part of the estuary (e.g. occasional visit and foraging); however, the study area offers poor habitats for these species.

Other fauna

Threatened marine mammals (seals, whales, dolphins) are known to occur in the Hawkesbury River, Pittwater and nearby coastal areas. Dolphins may occasionally occur in the area of the subject site. Seals and whales are unlikely to pass through and visit the study area. The Hawkesbury River and tributaries including Pittwater do not offer suitable habitats for dugongs.

Threatened marine turtles are present in Hawkesbury River system and nearby waters and may occasionally venture into the study area or explore the greater area, but the proposed works site offers very little suitable habitats to support marine turtles.

Key threatening processes

No Key threatening processes listed under the Fisheries Management Act 1994 or BC Act 2016 were identified associated with the proposal and related activities.



Figure 4. Foreshore: artificial concrete seawall and a drainage outlet (to be upgraded). Structures were colonised by oysters, various gastropods and turfing algae.



Figure 5. Artificial concrete seawall and small intertidal boulders at the base. Structures were colonised by oysters, various gastropods and turfing algae.

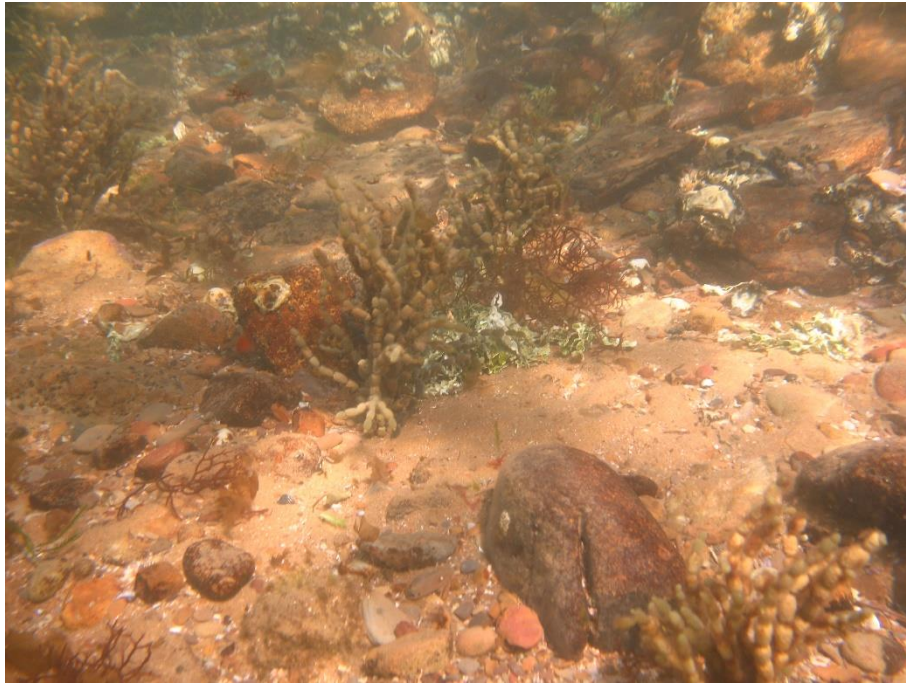


Figure 6. Base of the artificial sandstone seawall and subtidal sand, pebbles and small boulders colonised by macroalgae (*Hormosira banksia* and *Gracilaria* sp.)



Figure 7. Subtidal sand, pebbles, small boulders. The hard substratum was colonised by macroalgae and turfing algae.



Figure 8. Subtidal boulders under the jetty colonised by sessile fauna and marine vegetation.



Figure 9. Subtidal boulders under the jetty colonised by sessile fauna and marine vegetation.



Figure 10. Soft sediments with sparse boulders colonised by macroalgae (*Sargassum* sp., the calcareous *Halimeda* sp. and the noxious *Caulerpa taxifolia*) and seagrasses (*Posidonia australis* and *Zostera capricorni*).



Figure 11. Fine sand and silt found in deeper water colonised by *Posidonia australis*, *Zostera australis* and sparse macroalgae.



Figure 12. *Zostera capricorni* found in the shallow areas (short leaves).



Figure 13. *Zostera capricorni* found in deeper water on soft sediments in association with the calcareous algae *Halimeda* sp.



Figure 14. The invasive and noxious algae *Caulerpa taxifolia* and sparse seagrass *Halophila* sp. (bottom right corner).



Figure 15. The invasive and noxious algae *Caulerpa taxifolia* and turfing algae colonising a pile supporting the jetty.



Figure 16. Distribution of the seagrasses and macroalgae present in the survey area.

Assessment of impact

In terms of addressing the matters to be taken into consideration in relation to biodiversity, ecology and environment protection and to assess the potential impacts of the proposal, the following can be stated:

There will be a limited and localised impact on the quality of water entering the waterways as a result of the works (upgrade of the seawall). An increase in turbidity is expected locally during the alteration of the seawall and the foreshore works (landscaping and upgrade of the boatshed). The deployment of booms and silt curtains during the construction works would minimise the effects of turbidity and run-off on the seabed and limit the impact on the marine vegetation included seagrasses located in the vicinity of the proposed development, outside the footprint of the proposed works. It is expected that the siltation will resettle mostly in the area and that the tidal movements will quickly disperse the finer sediment plumes.

Seagrasses (*Posidonia australis*, up to 60% cover and *Zostera capricorni* up to 30% cover) present in the study area and immediate vicinity, outside the footprint of the proposed works. During the construction work phase, potential direct and indirect impacts on seagrasses and on marine vegetation such as anchoring, heavy equipment laid/dragged and the deposition of material on the seafloor should be avoided in vegetated areas.

No additional shading impact on the marine vegetation is expected. No reclamation or dredging is planned.

The noxious algae *Caulerpa taxifolia* was found within the survey area. Great attention should be brought to minimise further dispersion of this invasive species during the works. Anchorage, post driving and dragging equipment on the bottom should be avoided in the areas where *Caulerpa taxifolia* is present. It will be important to inspect anchors, chains and other equipment that could have been in contact with *Caulerpa taxifolia* and, if found, to remove and dispose of any fragments

of this algae using adequate methods approved by NSW DPI to avoid contamination of other areas.

As a note, the rails of the existing slipway should remain in place as proposed. Removing them and especially the supporting piles would have a significant and direct impact on the seagrasses (*Zostera capricorni* and *Posidonia australis*) and a high risk of spreading fragments of *Caulerpa taxifolia*.

No wetlands, mangroves, or saltmarsh were found at the site or in adjacent areas.

The seabed in the proposed development area consists mainly of hard substratum (seawall and boulders) inshore and soft substratum seaward (fine sand and silts) with sparse scattered boulders.

It is expected that the proposed development will not alter flow, currents and wave action as the existing seawall will be refurbished/replaced without any additions or changes below the MHWS. The change to water quality during the construction phase would be minor and temporary and it is expected that the siltation will resettle mostly in the area with the use of booms and silt curtains and that the tidal movements will quickly disperse the finer sediment plumes.

PERMIT REQUIREMENTS

Based on the background information and the site survey the proposal may require a NSW DPI fisheries permit due to the proximity of seagrasses beds.

CONCLUSIONS

- Seagrasses (*Posidonia australis*, up to 60% cover and *Zostera capricorni* up to 30% cover and very sparse *Halophila* sp. were present in the study area and immediate vicinity, outside of the footprint of the proposed works.
- Macroalgae (*Hormosira banksii*, *Ecklonia radiata*, *Sargassum* sp., *Halimeda* sp. and turfing algae) with low to medium percentage cover were found within and in the vicinity of the subject site. The impact on these macroalgae should be limited to the structures to be replaced (seawall);
- The noxious algae *Caulerpa taxifolia* was largely present in the survey area with percentage covers up to 30%;
- There were no, mangroves, saltmarsh or protected wetlands found at the site or in adjacent areas;
- No threatened fauna were found during the survey and the proposal is unlikely to have an impact on threatened fauna that may venture within the subject site;
- No significant impacts are likely on matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), Fisheries Management Act 1994 (FM Act) and NSW Biodiversity Conservation Act 2016 (BC Act) as a result of the proposal;
- The proposed development will have a very limited temporary impact on the aquatic environment if caution is taken to avoid degradation of the seagrasses within close proximity to the proposal and to avoid further dispersion of the noxious algae *Caulerpa taxifolia*.

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APPENDIX

Summary of threatened/protected/migratory aquatic fauna species with the potential to occur within the study area (primarily terrestrial or primarily avian species not included).

Species	FM/BC Act Status	EPBC Status	Presence of Habitat	Likelihood of Occurrence	Likelihood of Impact
Fish (Teleosts)					
<i>Epinephelus daemeli</i> Black Rockcod	V	V	Suitable habitat for juveniles and small individuals in the study site	Very low	Low
<i>Macquaria australasica</i> Macquarie Perch	E1	E	None, mostly occurs in freshwater. Juveniles may occur in estuaries.	Unlikely	Unlikely
<i>Prototroctes maraena</i> Australian Grayling	E	V	None, mostly occurs in freshwater. Juveniles may occur in estuaries.	Recorded in the Hawkesbury-Nepean catchment but unlikely within this section of the estuary	Unlikely
Syngnathiforms (seahorses, sea dragons, pipefish)	Collection and possession prohibited	Listed as marine species	Present, seagrasses, macroalgae and piles present at site	Likely, especially within seagrasses	Low
Fish (rays)					
<i>Manta alfredi</i> Reef Manta Ray		M	Poor foraging habitat	Vagrant, unlikely within this section of the estuary	Low
<i>Manta birostris</i> Giant Manta Ray		M	Poor foraging habitat	Vagrant, unlikely within this section of the estuary	Low
Fish (sharks)					
<i>Carcharias taurus</i> (east coast population) Grey Nurse Shark (east coast population)	E4A	CE	Absent, occurs in gutters or in rocky caves around inshore rocky reefs and islands.	Vagrant, no known critical habitat or aggregation site within 10 km radius	Low

Species	FM/BC Act Status	EPBC Status	Presence of Habitat	Likelihood of Occurrence	Likelihood of Impact
<i>Carcharodon carcharias</i> Great White Shark	V	V, M	Very poor potential foraging habitat	Vagrant, unlikely within this section of the estuary	Low
<i>Lamna nasus</i> Porbeagle, Mackerel Shark		M	Poor potential foraging habitat	Vagrant, unlikely within this section of the estuary	Low
<i>Rhincodon typus</i> Whale Shark		V, M	No suitable foraging habitat	Vagrant, unlikely within this section of the estuary	Low
Mammals (seal)					
<i>Arctocephalus forsteri</i> New Zealand fur-seal	V		Absent, prefers rocky parts of islands with jumbled terrain and boulders.	Vagrant.	Low
<i>Arctocephalus pusillus doriferus</i> Australian Fur-seal	V		Absent, prefers rocky parts of islands with jumbled terrain and boulders.	Vagrant	Low
Mammals (whales, dolphins, dugong)					
<i>Balaenoptera bonaerensis</i> Antarctic Minke Whale		M	Very poor potential foraging habitat	Vagrant	Low
<i>Balaenoptera edeni</i> Bryde's Whale		M	Very poor potential foraging habitat	Vagrant	Low
<i>Balaenoptera musculus</i> Blue Whale	E1	E	Very poor potential foraging habitat	Vagrant	Low
<i>Caperea marginata</i> Pygmy Right Whale		M	Very poor potential foraging habitat	Vagrant	Low
<i>Dugong dugon</i> Dugong	E1	M	Very poor potential foraging habitat	Vagrant	Low

Species	FM/BC Act Status	EPBC Status	Presence of Habitat	Likelihood of Occurrence	Likelihood of Impact
<i>Eubalaena australis</i> Southern Right Whale	E1	E	Very poor potential foraging habitat	Vagrant	Low
<i>Lagenorhynchus obscurus</i> Dusky Dolphin		M	Very poor potential foraging habitat	Vagrant	Low
<i>Megaptera novaeangliae</i> Humpback Whale	V	V, M	Very poor potential foraging habitat	Vagrant	Low
<i>Sousa chinensis</i> Indo-Pacific Humpback Dolphin		M	Poor potential foraging habitat	Vagrant	Low
Reptiles					
<i>Caretta caretta</i> Loggerhead Turtle	E1	E, M	May be present	Vagrant	Low
<i>Chelonia mydas</i> Green turtle	V	V, M	May be present,	Vagrant	Low
<i>Dermochelys coriacea</i> Leathery Turtle, Leatherback Turtle, Luth		E, M	May be present	Vagrant	Low
<i>Eretmochelys imbricata</i> Hawksbill Turtle		V, M	May be present	Vagrant	Low
<i>Natator depressus</i> Flatback Turtle		V, M	May be present	Vagrant	Low
Birds (restricted list)					
<i>Eudyptula minor</i> Little Penguin	E2		No breeding habitat present. Potential foraging habitat.	Vagrant (foraging)	Low
Vegetation					
<i>Posidonia australis</i> seagrass meadows of the Manning-Hawkesbury ecoregion (populations)	E2	E	No presence known in the survey area	Unlikely, no Posidonia found in the survey area	Unlikely

Species	FM/BC Act Status	EPBC Status	Presence of Habitat	Likelihood of Occurrence	Likelihood of Impact
Saltmarsh	E1		No presence known in the survey area	Unlikely, no saltmarsh found in the survey area	Unlikely

BC Act (carried over from TSC Act): E1 = Endangered, E2 = Endangered Population, E4 = Extinct, E4A = Critically Endangered, V = Vulnerable

FM Act: E1 = Endangered, E2 = Endangered Population, E4 = Extinct, E4A = Critically Endangered, V = Vulnerable

EPBC Act: M = Listed migratory species under Bonn Convention, CD = Conservation Dependent, CE = Critically Endangered, E = Endangered, V = Vulnerable, X = Extinct