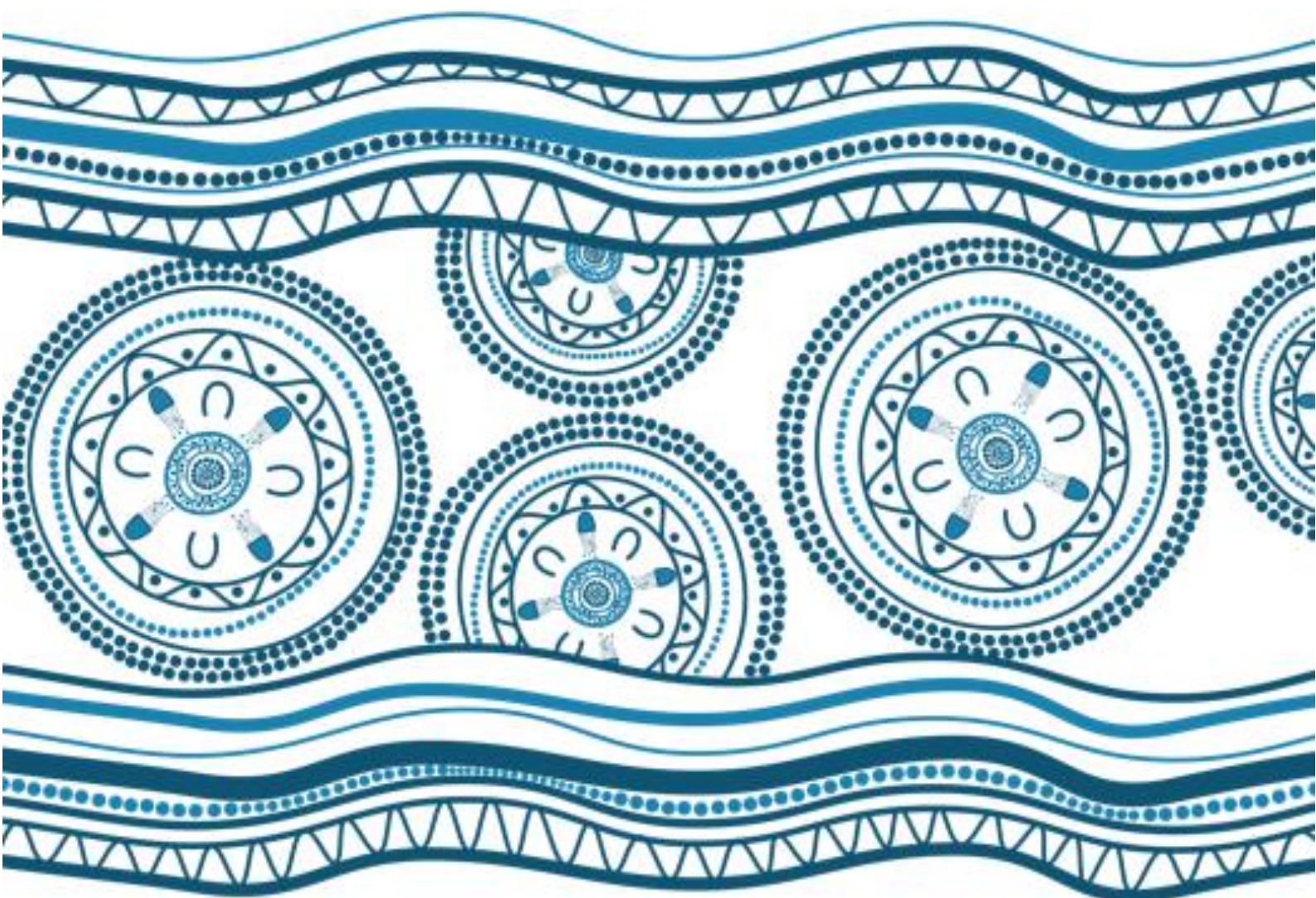


Chapter 10

Marine biodiversity



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10 Marine biodiversity

This chapter presents an assessment of the impacts of the project on marine biodiversity and identifies mitigation and management measures to minimise and reduce these impacts.

The assessment presented in this chapter draws on information from Appendix H (Marine Biodiversity Assessment Report).

10.1 Assessment methodology

The project was referred to the Australian Government Minister for the Environment on 22 October 2020 under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (reference: 2020/8825). On 12 January 2021 the project was declared a 'Controlled Action'. This was due, in part, to the project's potential impacts on four listed species and ecological communities. The assessment of the project's impacts on these threatened species and ecological communities is to be carried out in accordance with the assessment bilateral agreement between the NSW and Commonwealth Governments. Therefore, this chapter addresses both State and Commonwealth assessment requirements.

The method for assessing impacts on marine biodiversity included:

- Searching State and Commonwealth databases to identify potential species and communities likely to occur within three kilometres of the project area (the study area)
- Carrying out habitat assessments and targeted surveys for seagrass, rock rubble reef, White's Seahorse and Black Rockcod to confirm the distribution, extent, condition and health of these species (for details of surveys carried out refer to section 3 of Appendix H (Marine Biodiversity Assessment Report))
- Assessing the impacts to determine how construction and operation of the project would potentially impact the habitat and marine fauna in Botany Bay
- Recommending mitigation measures to avoid, mitigate and offset these impacts.

The desktop study area (three kilometre buffer) and the marine study area (where surveys were carried out) is shown in Figure 10-1. The proposed swept ferry path was excluded from the study area because marine biodiversity within this area would not be impacted by the project due to the water depth and lack of associated activity and development in this area. However, the potential impact from vessel and ferry movements was considered.

10.1.1 Policy framework

A full list of policy documents considered for the biodiversity assessment is provided in section 2 of Appendix H (Marine Biodiversity Assessment Report). The key policies and guidance documents include:

- Australian Government *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- *Fisheries Management Act 1994* (FM Act) (NSW)
- *Biodiversity Conservation Act 2016* (BC Act) (NSW)
- *Coastal Management Act 2016* (NSW)
- State Environmental Planning Policy (Coastal Management) 2018 (Coastal SEPP) (NSW Government, 2018a)
- Biodiversity Assessment, Environmental Impact Assessment Practice Note EIA-N06 (NSW Roads and Maritime Services, 2015a)
- Policy and Guidelines for Fish Habitat Conservation and Management – Update 2013 (NSW Department of Primary Industries (DPI), 2013)
- Significant Impact Guidelines 1.1 - Matters of National Environmental Significance (Australian Government, Department of the Environment, 2013)
- Biodiversity Assessment Method (NSW Office of Environment and Heritage, 2017)

- Aquatic Ecology in Environmental Impact Assessment – Environmental Impact Assessment Guideline (Smith, M. 2003)
- Threatened Species Assessment Guidelines (NSW DPI, 2008)
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft) (NSW Department of Environment and Conservation, 2004)
- Underwater Piling Noise Guidelines (Government of South Australia, Department of Planning, Transport and Infrastructure, 2012)
- Great Barrier Reef Underwater Noise Guidelines (McPherson et al., 2017)
- Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (Australian Government Department of Agriculture, Water and the Environment, 2017)
- Marine Estate Management Strategy (NSW Marine Estate Management Authority, 2018).



Figure 10-1: Marine study area

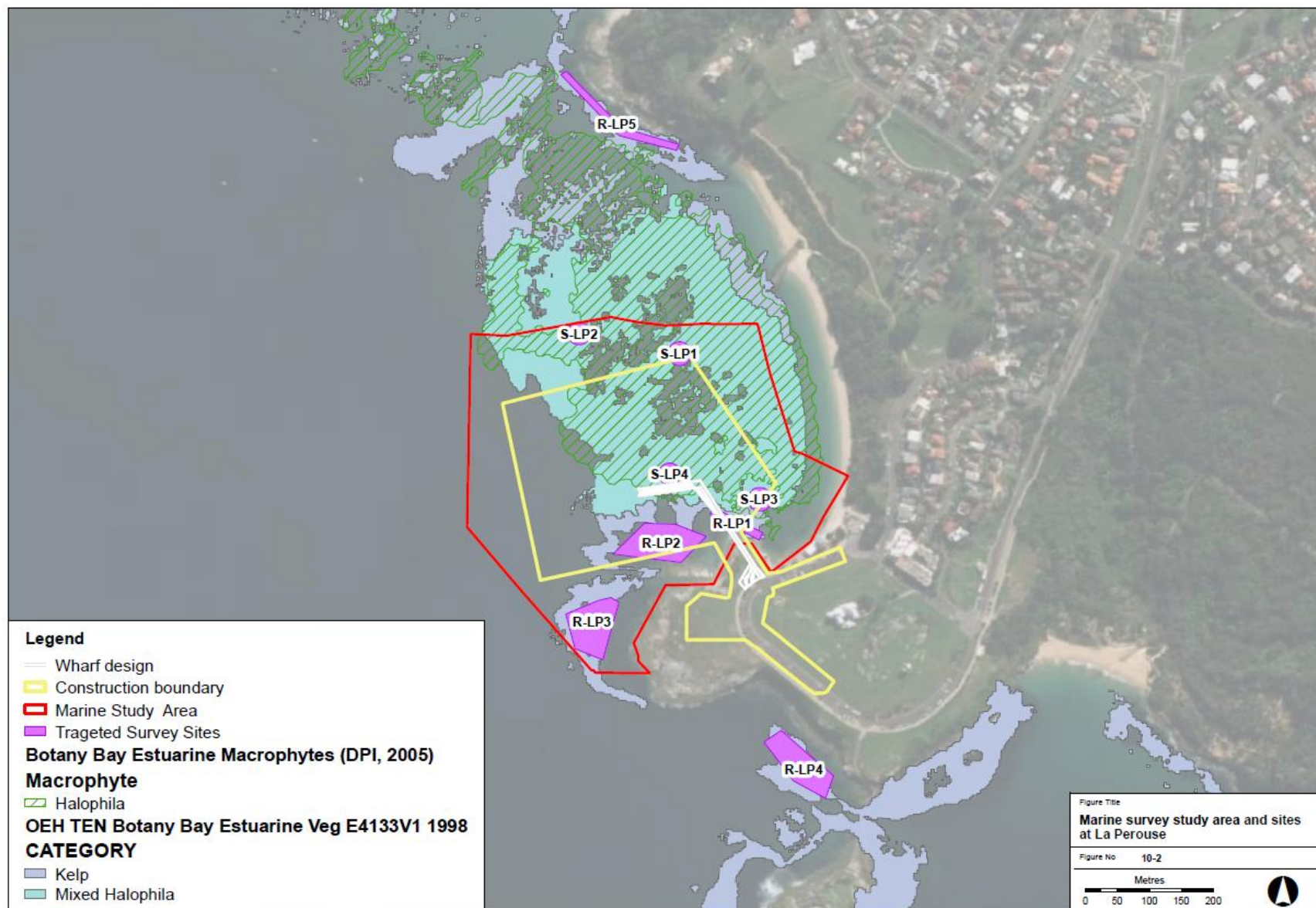


Figure 10-2: Marine survey study area and sites at La Perouse

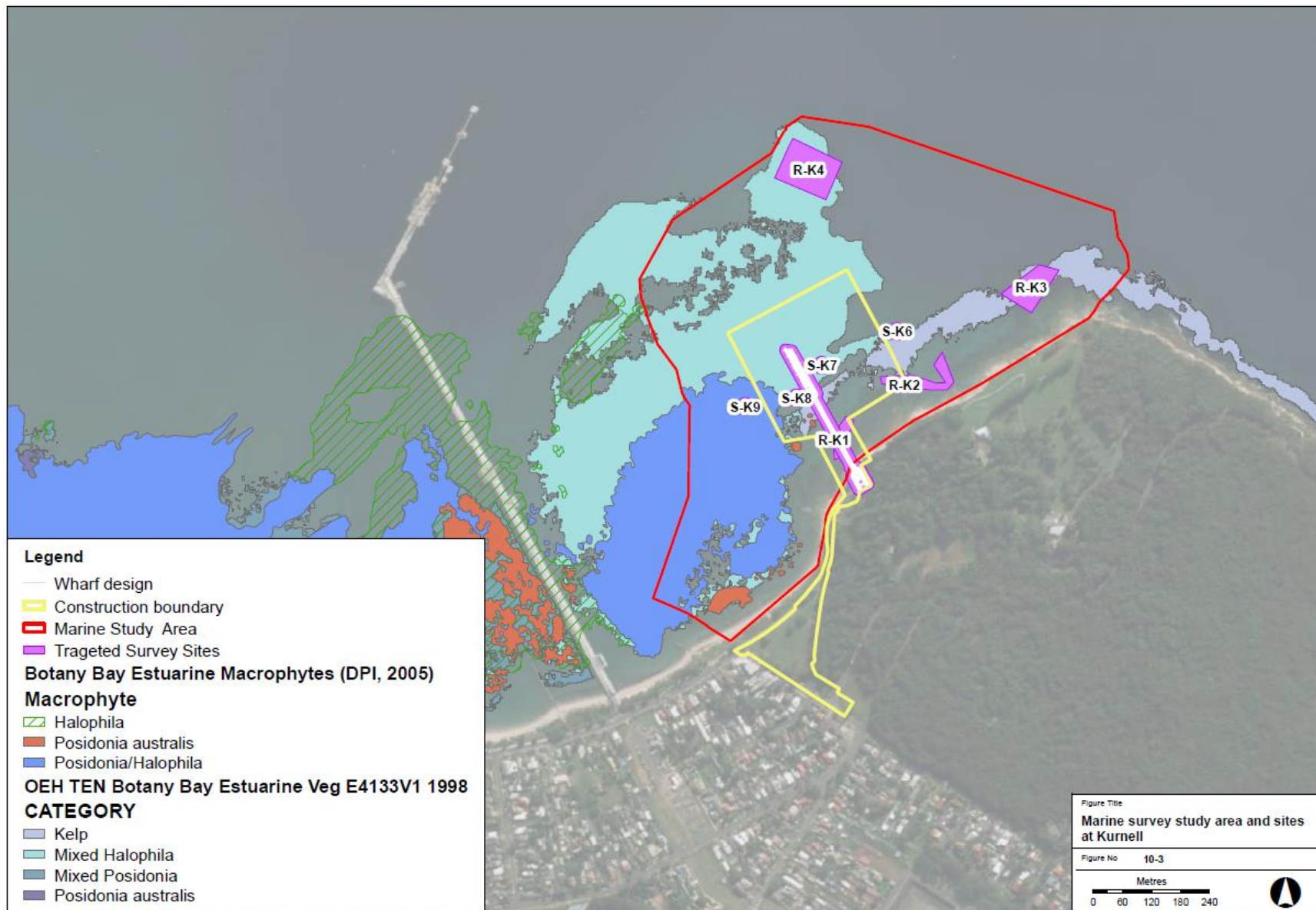


Figure 10-3: Marine survey study area and sites at Kurnell

10.2 Existing environment

This section describes the habitat types and marine fauna in the desktop and marine study areas.

10.2.1 Habitat types

Figure 10-4 and Figure 10-5 show the habitat extent in the study area.

Intertidal and subtidal

The intertidal area at La Perouse consists of a rocky shoreline on the western side of the headland that is between 10 to 40 metres wide. It becomes steeper with more crevices, cracks and ledges towards the south-west. This leads into a sandy beach along the shore of Frenchmans Bay.

In the subtidal zone, a rocky reef occurs around the foreshore of the La Perouse headland extending around 50 metres seaward where it gives way to soft sandy sediments with many steep drop offs. Most of the rocky reef occurs around Frenchmans Bay and towards Bare Island with minimal rocky substrate near the proposed wharf.

The intertidal area at Kurnell consists of a rocky shoreline from Silver Beach (a sandy beach) to Inscription Point to the east.

Subtidal rocky reefs are located along the inner shoreline and offshore (known as Watt's reef) located about 500 metres to the north of the proposed wharf at Kurnell. Macroalgae (such as kelp) covers the majority of these rocky reefs.

The intertidal areas include various common species such as periwinkle, barnacle, sea snails, whelk and algae. The subtidal areas comprise a mix of kelp and algae.

Seagrass communities

Table 10-1 below summarises the seagrass community in the study area.

La Perouse

Seagrass distribution within the La Perouse marine study area is patchy. *Halophila spp* is the main species. It is found throughout most of the soft sediment, particularly in the deeper areas. *Zostera capricorni* is mainly confined to the southern corner along Frenchmans Bay and it is growing with *Halophila spp*. Some small isolated patches of *Posidonia australis* are growing amongst other seagrasses in the shallower areas closer to the shore.

The August and September 2020 field investigations noted that the density of *Halophila spp* within Frenchmans Bay has increased since previous seagrass mapping surveys in May 2020, most likely due to seasonal fluctuation.

Kurnell

Seagrass distribution at Kurnell is widespread throughout the Kurnell marine study area. It typically extends from one to five metres water depth. The main species in the area are *Posidonia australis*, *Zostera capricorni* and *Halophila spp*. *Zostera capricorni* and *Halophila spp* were found in the deeper areas towards the east. *Zostera capricorni* was also abundant in shallower waters close to the shoreline.

Posidonia australis was typically confined to a large dense bed on the western side of the proposed wharf in shallow water (1-3.5 metres). There are also smaller isolated patches amongst other seagrasses in the shallow waters close to the shoreline to the east.

The August and September 2020 field investigations noted that the density of *Halophila spp* at Kurnell has decreased since previous seagrass mapping surveys in May 2020. This is likely due to storm damage in June and July 2020. A review of aerial imagery from various dates over recent

years indicates that the seagrass condition, distribution and extent near Kurnell regularly changes due to storm events, as well as seasonal fluctuations.

Table 10-1: Seagrass communities in the marine study area

Seagrass	Extent within marine study area (ha)
La Perouse	
<i>Halophila</i>	5.31
<i>Zostera/Halophila</i>	0.39
<i>Posidonia/Halophila</i>	0.03
<i>Posidonia/Zostera</i>	0.02
<i>Posidonia</i>	-
Open water (unmapped area within marine study area)	~7.20
Kurnell	
<i>Halophila</i>	0.14
<i>Zostera/Halophila</i>	6.45
<i>Posidonia/Halophila</i>	0.10
<i>Posidonia/Zostera</i>	0.09
<i>Posidonia</i>	7.00
Open water (unmapped area within marine study area)	~39.20

Benthic infauna

Benthic infauna are animals living within marine sediments. Samples from the marine study area suggests there is good foraging habitat for a range of species. There is a higher abundance and diversity of benthic infauna at Kurnell than La Perouse, most likely due to coastal processes at Kurnell allowing for higher flow rates and more opportunity for habitat availability. The infauna is dominated by polychaete (worms) and crustaceans (invertebrates with hard skeletons) and molluscs.

Key fish habitat

Table 10-2 summarises the key fish habitat within the marine study area. The sensitivity of these habitats is listed based on the sensitivity classification scheme under the Policy and Guidelines for Fish Habitat Conservation and Management (NSW DPI, 2013).

Table 10-2: Key fish habitat within the marine study area

Marine habitat	Within study area	
	La Pouse	Kurnell
Rocky reef		
Broken reef and rock amongst sandy sediments	-	Type 2 – moderate sensitivity
Fringing subtidal reef along the shoreline	Type 2 – moderate sensitivity	
Offshore rocky reef rises	Type 2- moderate sensitivity with sections of Type 1 – high sensitivity	
Seagrass		
Halophila	Type 1 – high sensitivity	
Zostera	Type 1 – high sensitivity	
Posidonia/Halophila	Type 1 – high sensitivity	
Posidonia/Zostera	Type 1 – high sensitivity	
Posidonia	-	Type 1 – high sensitivity
Open water (unmapped area)	Type 3 – minimal sensitivity	

Threatened ecological communities

Posidonia australis is a protected endangered population under the FM Act and a protected threatened ecological community under the Commonwealth EPBC Act. The previous section describes its location in the study area. It is also found extensively along the Kurnell shoreline west of the proposed wharf towards Towra Point Nature Reserve. *Posidonia australis* has seen a continued decline in distribution in the wider Sydney region over the last decade due to historical and current urbanisation and associated disturbance. It is particularly susceptible to damage, as it is one of the slower growing species, which can affect its ability to recover.

Critical habitat

Critical habitat is listed under the FM Act and the EPBC Act. There is no critical habitat listed to occur within the marine study area.



Figure 10-4: Mapped marine habitats at La Perouse showing seasonal variation

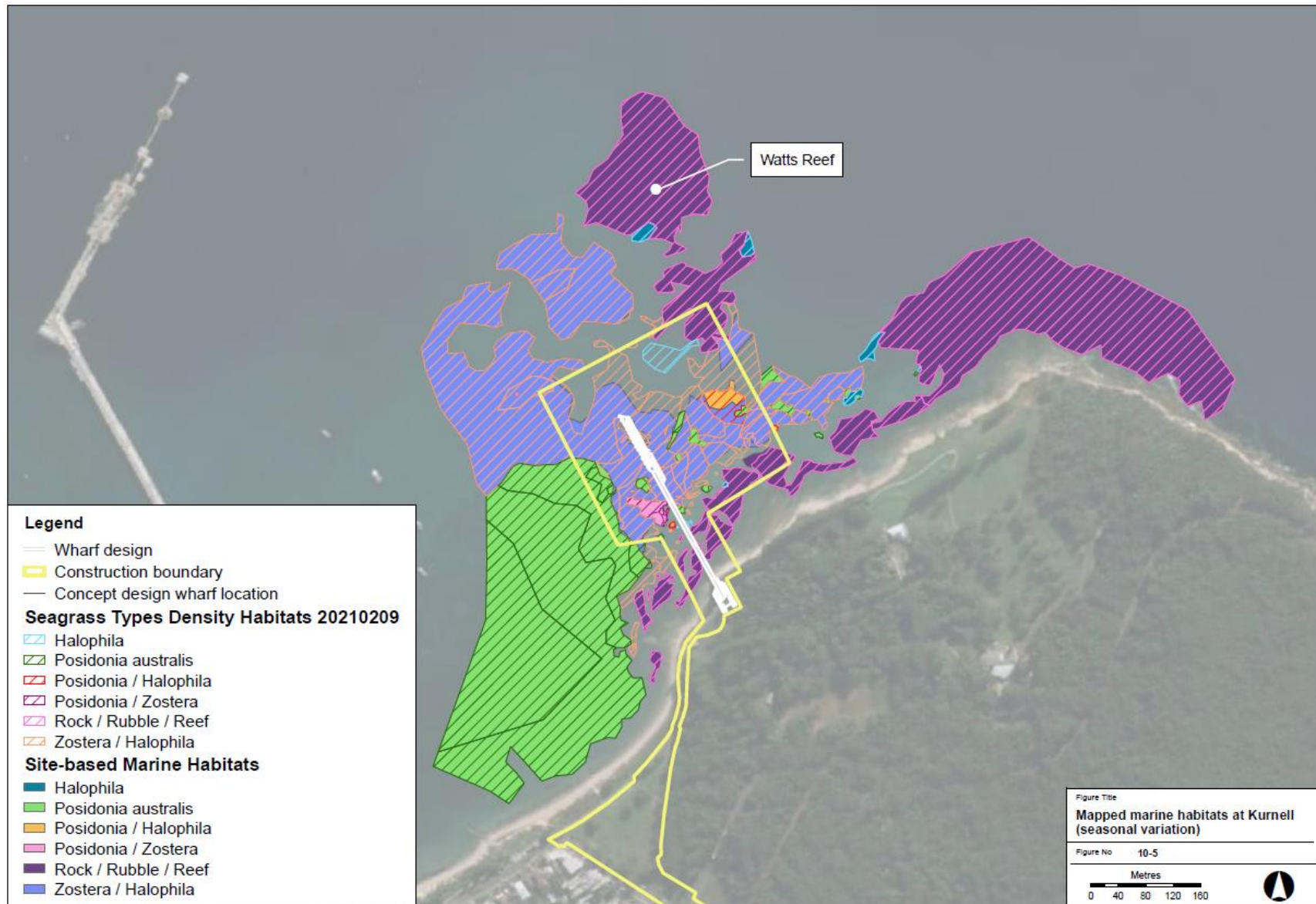


Figure 10-5: Mapped marine habitats at Kurnell showing seasonal variation

10.2.2 Marine fauna

Potential species

There are 47 Commonwealth listed species and 28 State listed species that potentially occur within the desktop study area that are listed and protected under Commonwealth and State legislation (some of which occur under both). Of note:

- Southern Right Whale and Humpback Whale migrate along the coastline between May and November each year and have been spotted in Botany Bay. The Grey Nurse Shark also enters Botany Bay to breed but they typically prefer deeper waters
- The seagrass provides suitable foraging habitat for marine turtles, seahorses and other protected species
- The rocky reefs support Black Rockcod and other species
- Various marine birds forage over the area.

A likelihood assessment was completed to determine if listed threatened species are likely to occur in the desktop study area. Table 10-3 lists the threatened marine fauna species that are likely or possible to occur in the desktop study area, which includes:

- 11 marine mammals
- Two turtles
- One shark species
- Fish, seahorse, pipefish and seadragon
- 31 marine birds.

Table 10-3: Marine fauna species possible or likely to occur within the desktop study area

Name	Commonwealth listing classification	State listing classification	Likelihood of occurrence
Marine mammals			
Australian Fur-Seal	Marine	Vulnerable, protected	Likely (transient)
Australian Sealion	-	Protected	Likely (transient)
Blue Whale	Endangered, migratory	-	Possible (transient offshore)
Bottlenose Dolphin	-	Protected	Likely
Common Dolphin	-	Protected	Likely
Dugong	Vulnerable, migratory	-	Possible (transient)
Dusky Dolphin	Migratory		Possible (transient)
False Killer Whale	-	Protected	Possible (transient)
Humpback Whale	Vulnerable, migratory	Vulnerable, protected	Likely (transient)
New Zealand Fur-Seal	Marine	Vulnerable, protected	Likely
Southern Right Whale	Endangered, migratory	-	Possible (transient)
Marine reptiles			
Loggerhead Turtle	Endangered, migratory	Endangered	Possible (transient)
Green Turtle	Vulnerable, migratory	Vulnerable	Possible (recorded)
Sharks			
Grey Nurse Shark	Critically endangered	Critically endangered	Possible
Fish			
Black Rockcod	Vulnerable	Vulnerable	Likely
White's Seahorse	Endangered	Endangered	Likely
Seahorses, pipefish and seadragons	-	Protected	Likely
Marine birds			
Antipodean Albatross	Vulnerable, migratory	Vulnerable	Possible (transient)
Australian Pelican	-	Protected	Likely

Name	Commonwealth listing classification	State listing classification	Likelihood of occurrence
Brown Booby	Protected under international agreement	Protected	Possible
Cape Petrel	-	Protected	Possible (transient offshore)
Caspian Tern	Protected under international agreement	Protected	Possible (transient)
Chatham Albatross	Endangered, migratory	-	Possible (transient)
Common Diving-petrel	-	Protected	Likely
Common Tern	Protected under international agreement	Protected	Possible (transient)
Fairy Prion	-	Protected	Likely (transient)
Fairy Tern	-	Protected	Possible (transient)
Fluttering Shearwater	-	Protected	Possible (transient)
Gibson's Albatross	Vulnerable	Vulnerable	Possible (transient) vagrant
Gould's Petrel	Endangered	Vulnerable	Possible (transient) vagrant
Great Cormorant	-	Protected	Likely
Gull-billed Tern	Protected under international agreement	Protected	Possible (transient)
Hutton's Shearwater	-	Protected	Possible (transient)
Kelp Gull	-	Protected	Likely
Little Penguin	-	Protected	Likely
Little Tern	Protected under international agreement	Endangered, protected	Possible (transient)
Northern Royal Albatross	Endangered, migratory, marine	-	Possible (transient)
Pacific Gull	-	Protected	Likely
Pied Oystercatcher	-	Endangered, protected	Likely
Salvin's Albatross	Vulnerable, migratory	-	Possible (transient)

10.2.3 Matters of National Environmental Significance

The project has the potential to significantly impact four nationally listed threatened species and ecological communities:

- *Posidonia australis* seagrass
- Black Rockcod
- Cauliflower Soft Coral
- White's Seahorse.

The project was declared a Controlled Action under the EPBC Act in January 2021.

Targeted surveys were carried out to confirm the presence of these species within the marine study area. The presence of *Posidonia australis* is outlined in section 10.2.1 above. The targeted surveys did not identify White's Seahorse or the Black Rockcod in the study area. The species are known in the region and there is habitat outside of the construction boundary but within the study area, which is in good condition that could support these species. It is therefore assumed that these species could be present within the study area. The surveys did not identify the presence of Cauliflower Soft Coral in the study area. Further, the rocky reef and seagrass habitats in the study area do not support Cauliflower Soft Coral. There is more suitable habitat in the high current and exposed locations further around to Bare Island at La Perouse and further north east towards Inscription and Sutherland points at Kurnell. Both of these regions are outside of the construction boundary.



Figure 10-6: Black Rockcod and White's Seahorse habitat at La Perouse



Figure 10-7: Black Rockcod and White's Seahorse habitat at Kurnell

10.2.4 Wetlands and conservation areas

There are no wetlands or conservation areas within the construction boundary. The nearest include:

- Towra Point Nature Reserve, an area protected by the *National Parks and Wildlife Act 1974* (NSW), which is an internationally important wetland located about two kilometres to the west of the proposed wharf at Kurnell
- Towra Point Aquatic Reserve, an area protected by the *Marine Estate Management Act 2014* (NSW), is located about two kilometres to the west of the proposed wharf at Kurnell
- A protected coastal wetland (listed under the Coastal SEPP) is located about 650 metres south west of the proposed wharf at Kurnell
- Cape Banks Aquatic Reserve, an area protected by the *Marine Estate Management Act 2014*, is located about two kilometres east of the proposed wharf at Kurnell, on the northern headland of Botany Bay.

Figure 10-8 shows the wetlands and conservation areas near the project.

There are no areas of outstanding biodiversity value listed under the BC Act that occur within the study area.

There are no biodiversity stewardship sites, private conservation lands and other lands identified as offsets within the study area.

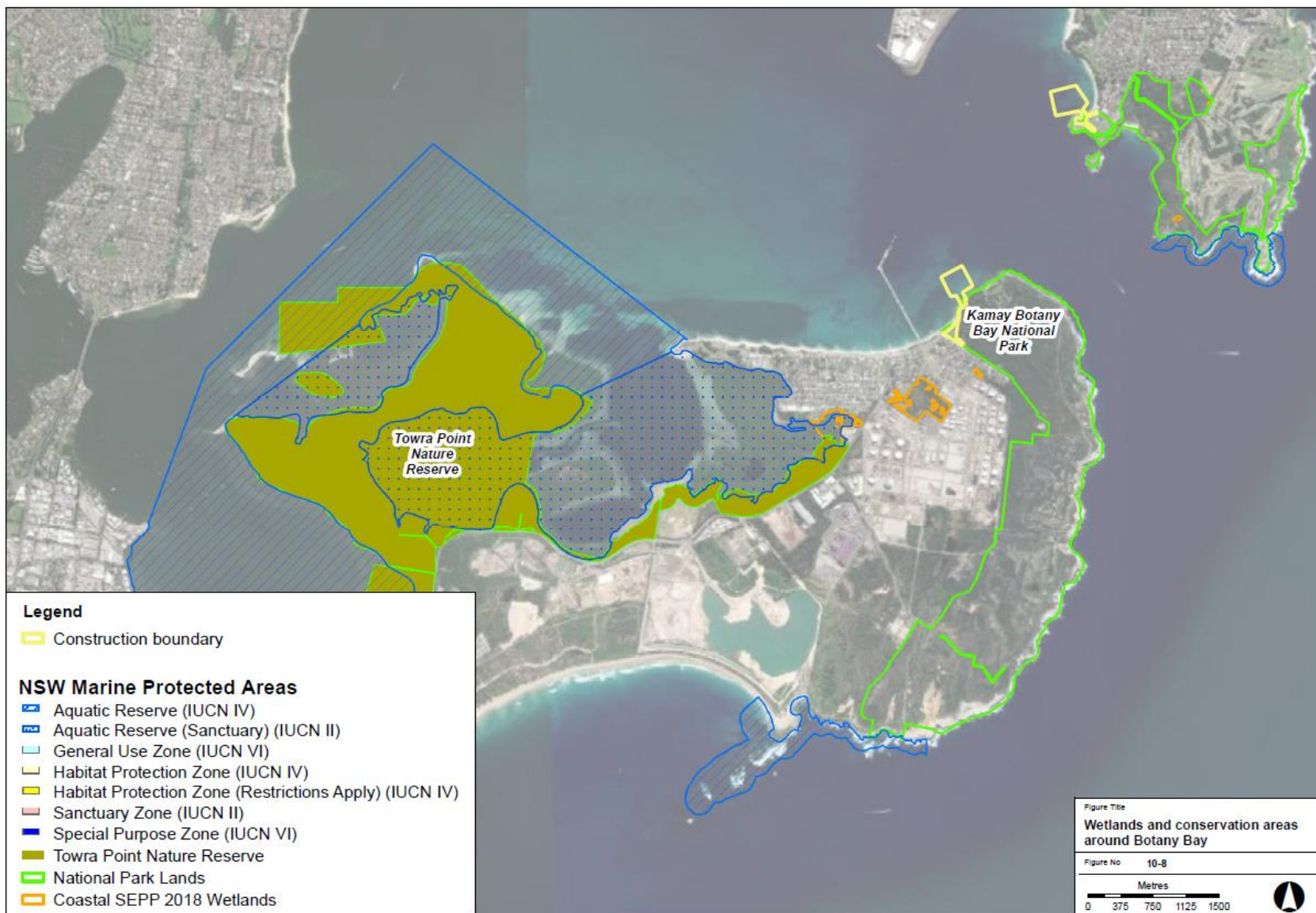


Figure 10-8: Wetlands and conservation areas around Botany Bay

10.2.5 Marine pests and diseases

Marine pests are common within Botany Bay. They are likely transferred in ballast water and on ship hulls. They present a risk as they compete with native and local species for habitat.

Two non-native marine seaweed pests have recently been found in NSW which compete with native seaweeds within the low intertidal and shallow subtidal zones.

Diseases such as Pacific Oyster Mortality Syndrome (POMS) and QX (a parasite that effects Sydney rock oysters) are known to affect natural stocks within Botany Bay. *Caulerpa taxifolia* (a fast growing marine algae) is known to have colonised various NSW waterways in the wider region. These diseases can have a major impact on regional populations but can also have significant impacts on aquaculture stocks and production.

10.2.6 Existing commercial, recreational and cultural uses

Other than abalone gathering and rock lobster trapping, commercial fishing does not take place in Botany Bay. Recreational fishing is permitted and popular in Botany Bay. Methods include line fishing, spear fishing, recreational netting and hand collection.

There are several shellfish harvesting and aquaculture lease areas around Towra Point. They include Quibray Bay and near the mouth of the Georges River. The aquaculture production is focused on Sydney Rock Oysters.

Botany Bay is an important place for cultural fishing practices for Aboriginal people. In particular, the harvesting of Mullet around March to June is associated with a time of celebration and harvest at Frenchmans Bay and Yarra Bay, La Perouse. During consultation for the project, the following species were identified as valuable for culture and general sustenance:

- Fish: Mullet, Flathead, Yellow Fin Bream, Tarwhine, Kingfish, Whiting, Black fish
- Octopus
- Crustaceans: Blue Swimmer Crabs, Rock Lobster
- Cockles
- Abalone.

10.3 Assessment of potential impacts

This section discusses the potential direct and indirect impacts on marine biodiversity values. It also describes the significance of impacts on species protected under State and Commonwealth legislation.

10.3.1 Assessment of construction impacts

Piling, vessel traffic movements, mooring and anchoring, and the construction and removal of the temporary causeway (Kurnell) and platform (La Perouse) (refer to Chapter 5 (Project description)) may directly and indirectly impact marine species during construction. There is the potential for direct habitat loss, injury and death from construction plant and equipment, vessel strikes, propeller wash, entrapment and entrainment. There is also the potential for indirect impacts from underwater noise, light spill, turbidity, sediment disturbance, spills and other incidents.

Habitat and community loss

Benthic habitat where the wharves are constructed would be directly impacted and lost from piling. This habitat includes seagrass communities, with subtidal reefs located on the edges of the construction boundaries. The habitat supports other species as described in section 10.2.2.

Benthic habitat would be indirectly and temporarily impacted due to vessel activity, mooring (shading) and anchoring. These impacts could extend across the construction boundary where vessels move but would be most concentrated around the wharves.

While the construction activities would also disturb and mobilise the sediments (refer to Chapter 18 (Coastal processes)) the resulting turbidity and sediment deposition would be localised and well below the natural levels that occur in Botany Bay during a heavy storm. Any disturbed coarse sediment would quickly fall out of suspension close to the area of activity. While finer sediment would remain in suspension and disperse over a wider area, it would almost immediately mix with the mobile sediment movement that occurs across Botany Bay. Given the low level of sediment disturbance, it would not add to the overall sediment transport and movement patterns that naturally occur in Botany Bay.

As such, the project is unlikely to generate turbid waters that would reduce light levels or cause any perceptible depositional settlement over the benthic habitat. Therefore, there is expected to be no indirect benthic habitat impact beyond the immediate area where construction is taking place. While a small piling spoil mound would be created around each location, they would be within the area and footprint disturbed by the piling equipment.

Table 10-4 predicts the potential direct habitat loss during construction from all of the activities listed above. The number of anchor points and movement of vessels is unknown and these impacts cannot be predicted. As such, a 15 metre buffer surrounding the wharf structures has been used to estimate the impact around each wharf to provide a conservative assumption for construction vessels that will moor and shade. This area contains the impact area which would be directly impacted by piling activities. It is conservatively estimated that the total area within this buffer zone would result in a total loss of habitat.

There would be other areas within the construction boundary which would be impacted from the movement of construction vessels and anchor points. Pre-construction and post-construction monitoring surveys would accurately reflect the actual impacts to habitat within the construction boundary.

Table 10-4 presents key fish habitat type and impacts within the 15 metre buffer area for each of the three seagrass surveys carried out, as well as an average.

Table 10-4: Predicted direct habitat loss from construction impacts

Location and habitat type	Area of impact (m ²)			
	June survey	October survey	December survey	Average
La Perouse				
Seagrass impact (Type 1 Key Fish Habitat) Consisting of <i>Halophila sp.</i>	5,026	5,004	4,378	4,803
Subtidal impact (Type 2 Key Fish Habitat) Macroalgae	1,421	1,421	1,297	1,380
Kurnell				
Seagrass impact (Type 1 Key Fish Habitat) Comprised of:	7,195	6,596	6,857	6,906
<i>Halophila sp.</i>	-	44	96	70
<i>Posidonia australis</i>	168	256	223	216
<i>Posidonia sp.</i> / <i>Halophila sp.</i>	31	55	72	53
<i>Posidonia sp.</i> / <i>Zostera sp.</i>	311	338	291	313
<i>Zostera sp.</i> / <i>Halophila sp.</i>	6686	5902	6176	6,255
Subtidal impact (Type 2 Key Fish Habitat) (Macroalgae)	1,579	1,439	1,424	1,481

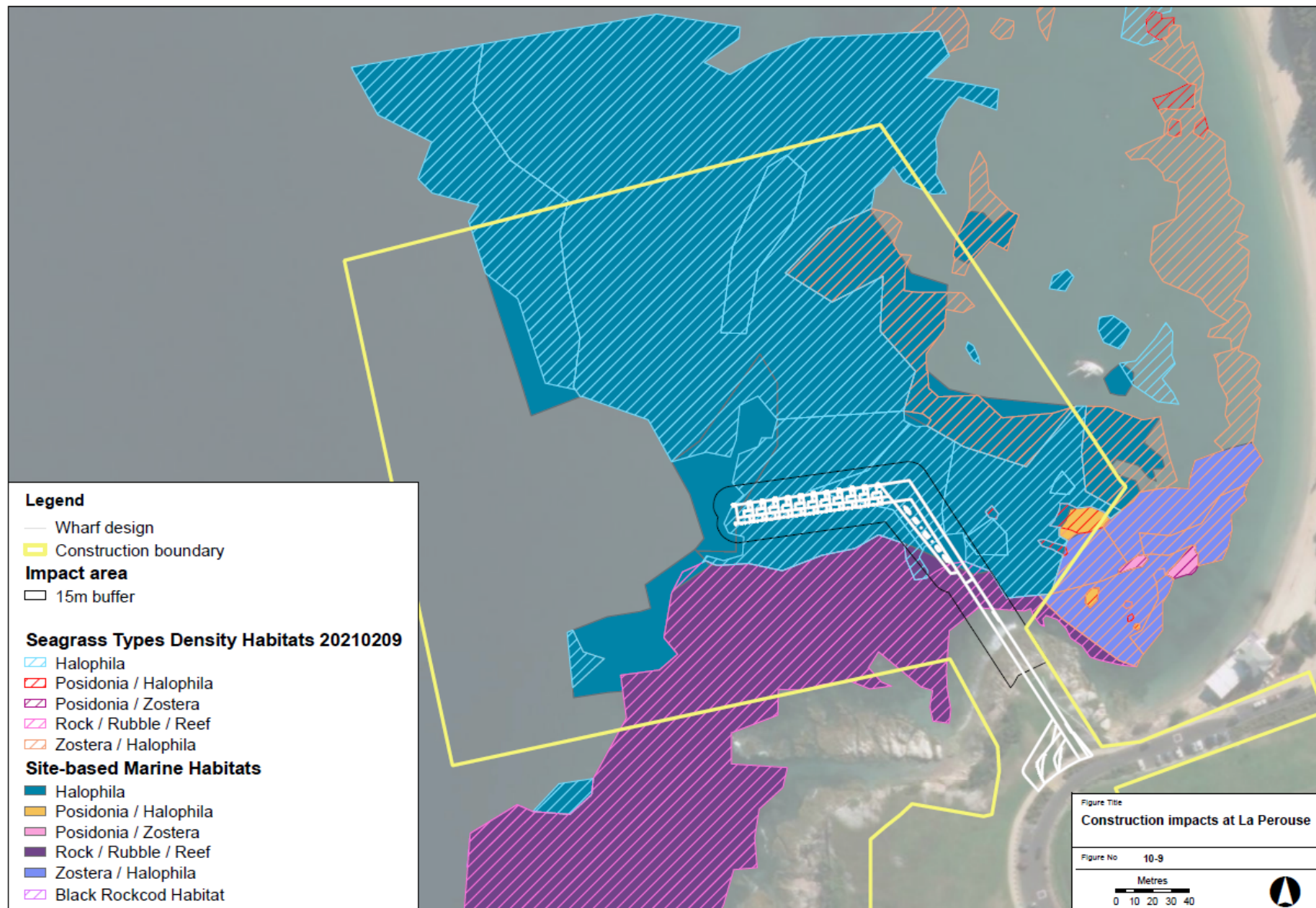


Figure 10-9: Construction impacts at La Perouse

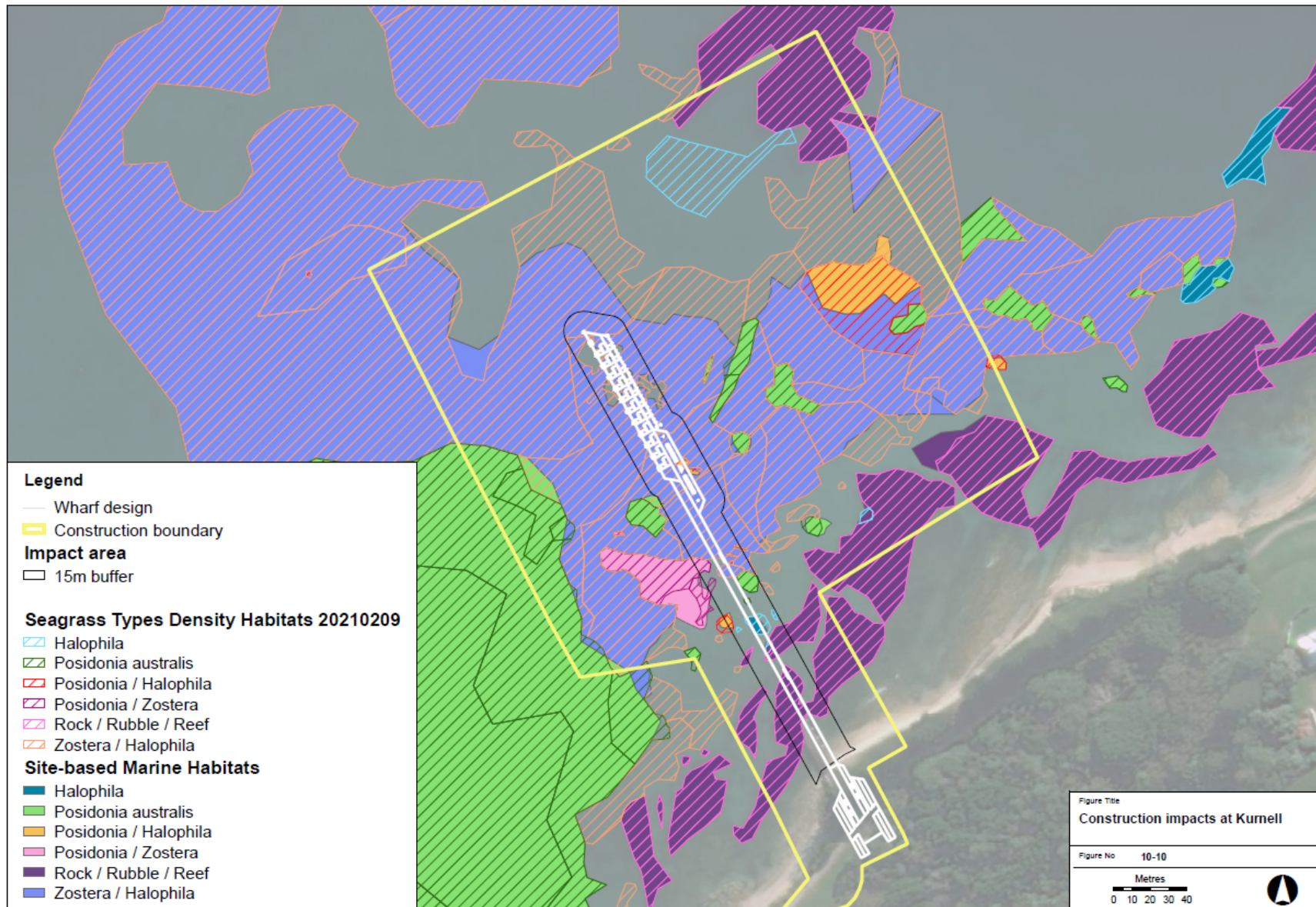


Figure 10-10: Construction impacts at Kurnell

Marine fauna

Piling and vessel movements have the potential to cause direct and indirect impacts. Injury or death may occur from vessel strikes. Behavioural changes may occur due to underwater noise, which is assessed in Chapter 16 (Underwater noise and vibration). Sessile (immobile) species and those benthic species living in the sediments (infauna) would be affected more notably than the mobile species that can leave the area during construction.

Threatened fauna habitat loss

The habitat loss above may result in a loss of available foraging habitat. It may also result in species becoming more exposed and vulnerable as there are fewer hiding places available. Dive surveys indicated that there is no habitat for Black Rockcod within the construction boundary that would be directly impacted. Habitat for White's Seahorse is associated with *Posidonia australis*, therefore, the direct loss of seagrass would result in reduced habitat for White's Seahorse. The marine biodiversity offset strategy would consider measures (such as artificial structures) to compensate for the loss of seahorse habitat and avoid the permanent displacement of these species.

Fauna strikes

Construction would require a variety of vessels, including large barges which would move infrequently and smaller vessels to transport staff every day. An average of eight vessel movements are expected per day, around and between the project areas. These vessels would be travelling at low speeds to comply with maritime safety restrictions in Botany Bay. Generally, the slow speed and vessel noise would deter larger mammals (whales, seals and dolphins), reducing the vessel strike risk. Fauna in Botany Bay are already used to high numbers of boats and ships, with limited reports of any vessel strike impacts.

Entrapment and entrainment

There are no construction activities which are likely to cause entrapment or entrainment for marine fauna.

Bioaccumulation

Construction of the project is unlikely to increase the impact from bioaccumulation on marine fauna. Marine sediment testing (refer to Chapter 17 (Soil, water and contamination)) showed low levels of pollutant concentrations in sediments near the proposed wharves. Sediment disturbance would be very limited and localised, likely below natural disturbance in Botany Bay. Whilst there are pollutants in the sediments, they would be already mobilised by natural sediment disturbance processes. The risk of pollution due to spills is assessed in Chapter 24 (Hazard and risk). With the spill mitigation proposed, the risk of pollution bioaccumulation in the marine environment would be avoided.

Turbidity and sedimentation

While the construction works would generate turbid waters the extent and scale of the disturbance would be limited and below the natural sediment movement and transport processes that takes place in this part of the Bay (refer to Chapter 18 (Coastal processes)). The construction activities would not cause additional turbidity or sediment dispersion or depositional impacts that would affect the fauna in Botany Bay. Further, the fauna in the Bay is already used to, and can tolerate, the degree of light loss and sediment deposition that occurs naturally due to storm events and other activities.

Marine pests and diseases

While there is the potential for pest species and diseases to be brought into Botany Bay on the hulls of vessels or in ballast water, standard management measures that are commonly adopted across the industry to manage this risk would be used to limit the potential for any associated impacts.

Artificial light

Artificial light can affect nesting, breeding, foraging and the migration of marine fauna. The construction areas would be lit for safety and security reasons. This may attract fish to the area as they feed on other species attracted to the light. This attraction may increase their risk of predation but also increase foraging success. Turtles and fish may be disorientated if they follow natural moon phases and visibility cues in their environment. Marine birds can also be disorientated by artificial light.

The level and extent of light introduced to support the project would be minor compared to ambient artificial light levels in the area. As such, the security and safety lighting are not expected to have a significant impact on marine fauna.

Spills, accidents and waste

While marine fauna and habitats are notably impacted by chemical spills and accidents, the project would be managed in accordance with the maritime safety protocol (refer to Chapter 24 (Hazard and risk)). The adoption of a Spill Management Plan would ensure standard measures that are proven and effective in minimising and managing spill risks would be implemented. Construction waste and debris would be managed by a waste management plan and in accordance with the Threat Abatement Plan for impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (Australian Government, Department of Environment and Energy, 2018b).

10.3.2 Assessment of operational impacts

Vessel traffic movements may continue to directly and indirectly impact marine species once the project is operational. Also, the wharves would shade habitat for periods of the day, while the wharves may affect sediment movement along both shorelines. Propeller wash from the operational ferries and other vessels using the wharves may also create a scour channel which would harm, destroy or expose nearby habitat, affecting its condition and health.

Habitat and community loss

The wharves would shade the seabed and restrict light to seagrass which it needs to survive. The extent of shading would be greatest under the wharves, while the shadow cast across the day and over the year could affect adjacent areas. It is predicted that the wharves would shade an area of habitat that would have already been impacted during construction (a distance of about nine metres from the wharf structures).

The impact of shading means that the seagrass under and near the wharves would not be able to recover and would result in fragmentation of habitat connectivity. This can compromise the function and success of habitats.

Other habitat shaded by the wharves, such as the rocky reef habitat, are not as sensitive to shading impacts as seagrass.

Scour, erosion and sediment transport changes

The constructed wharves would form open structures. While small-scale erosion and accretion (build-up) of sediment may occur around each pile it would be within the shading footprint; the impacts of which are described above.

The sediment transport impact along the coastline of installing the wharves is described in Chapter 18 (Coastal processes). The open structures of the wharves are designed to avoid impacts on sediment transport, and therefore no impacts on habitat characteristics or patterns are expected.

Propeller wash

Localised scour from the operational ferries and other vessels using the wharves would continue to disturb the area within the swept path (refer to Chapter 18 (Coastal processes)). This would prevent habitat from growing in these areas. Areas of habitat within the areas impacted by the predicted scour are shown in Table 10-5.

Table 10-5: Areas of habitat impacted by propeller wash

Location and habitat type	Area of impact (m2)			
	June survey	October survey	December survey	Average
La Pouse				
Seagrass impact (Type 1 Key Fish Habitat) Consisting of <i>Halophila sp.</i>	7,022	7,039	6,088	6,716
Subtidal impact (Type 2 Key Fish Habitat) Macroalgae	818	818	835	823
Kurnell				
Seagrass impact (Type 1 Key Fish Habitat) See species below:	2,822	2,811	2,894	2,846
<i>Posidonia australis</i>	37	45	45	43
<i>Posidonia sp.</i> / <i>Zostera sp.</i>	45	65	65	58
<i>Zostera sp.</i> / <i>Halophila sp.</i>	2,740	2,712	2,784	2,745

Marine fauna

Marine fauna may be affected by the above habitat shading. Injury or death may occur from vessel strikes, while behavioural changes may occur due to underwater noise (refer to Chapter 16 (Underwater noise and vibration)).

Threatened fauna habitat loss

The seagrass affected by the shading of the wharves would impact habitat for seahorses. Species would have less habitat to forage and may be more exposed to predators from the fragmentation between seagrass patches.

Fauna strikes

The ferries and other commercial and recreational vessels using the wharves would be subject to the same navigational controls and restrictions described above in relation to construction vessel movements. This would limit the potential for marine mammal fauna strikes, injury or death.

Entrapment and entrainment

As open structures, there would be no elements of the wharves which could cause entrapment or entrainment impacts.

Turbidity and sedimentation

The ferries would operate on a swept path into and out of the wharf areas. This would create localised scour (refer to Chapter 18 (Coastal processes)). The mobilised sediment quantities would be small-scale and localised. The scale of any turbidity and sediment dispersion would be below the natural sediment movement and transport processes that take place in this part of Botany Bay. This means the operational ferries and other vessels using the wharves would not cause any additional turbidity or sediment dispersion or depositional impacts that would affect the marine fauna in Botany Bay.

Artificial light

The wharves, ferries and other vessels would be lit for security and safety reasons. As described above, despite the introduction of light into the marine environment, the existing high levels of ambient light in the area are unlikely to affect the marine ecology as they have habituated (become used) to the conditions.

Spills, accidents and waste

Consistent with the potential for spills and accidents during construction the ferries and other vessels would operate in accordance with standard maritime practices to avoid accidents and to manage spills (refer to Chapter 24 (Hazard and risk)). Wharf maintenance activities would also take place in accordance with standard operating procedures to manage spills and accidents.

Waste from the ferry operation would be managed by the operator in accordance with the Threat Abatement Plan for impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (Australian Government, Department of Environment and Energy, 2018b). There will be general waste bins and recycling bins at each wharf to avoid waste and rubbish, including recreational fishing debris, from entering the marine environment and harming marine ecology.

10.3.3 Key threatening processes

Key Threatening Processes (KTP) are listed under State and Commonwealth legislation as processes which adversely affect threatened species, populations or ecological communities, or could cause species, populations or ecological communities that are not threatened to become threatened. Table 10-6 list the three potential KTPs created by this project.

Table 10-6: Key threatening processes relevant to the project

Key threatening process	Listing	Assessment
Introduction of non-indigenous fish and marine vegetation to the coastal waters of New South Wales	State (FM Act)	As outlined above, there is potential for vessels to introduce and carry non-indigenous pests and diseases which may compete for habitat with native species. Standard management measures that are commonly adopted across the industry to manage this risk would be used to limit the potential for any associated impacts.
Novel biota and their impact on biodiversity	Commonwealth (EPBC Act)	As above.
Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris.	Commonwealth (EPBC Act)	The project will provide public access and promote increased fishing and recreational activities surrounding the wharves. This may increase the risk of small debris entering the marine environment which could be harmful to the marine fauna. There would be waste facilities, signage and maintenance of the wharves to avoid these impacts.

10.3.4 Significant impacts

This section considers the significance of the project's marine biodiversity impacts in terms of State and Commonwealth listed and protected threatened species, populations, ecological communities and their habitats.

State listed and protected threatened biota and habitat

The following species and habitat are State listed and protected under the respective Acts:
Under the FM Act:

- *Posidonia australis*
- White's Seahorse
- Black Rockcod
- Grey Nurse Sharks.

Under the BC Act:

- Australian Fur Seals
- Humpback Whale
- New Zealand Fur-Seal
- Green Turtle
- Loggerhead Turtle
- Antipodean Albatross
- Pied Oystercatcher.

The project is likely to have impacts to *Posidonia australis* and White's Seahorse, with indirect and possible impacts to Black Rockcod. These species are also listed under the EPBC Act and are discussed below.

For all the other species listed under the FM act and the BC act it is anticipated there will be temporary disturbances to these species if present through construction of the wharves. The impacts are not expected to have any significant and/or adverse effects on the likelihood of extinction.

Commonwealth listed and protected threatened biota and habitat

The Commonwealth determined the project to be a Controlled Action owing to its potential to have a significant impact on the following threatened species and ecological communities:

- Threatened Ecological Community *Posidonia australis* Seagrass Meadows of the Manning-Hawkesbury Ecoregion – endangered
- White's Seahorse – endangered.
- Black Rockcod – vulnerable
- Cauliflower Soft Coral – endangered

There would be a direct loss of *Posidonia australis* from construction, shading and ferry scour. It is anticipated that 682 square metres of *Posidonia australis* Seagrass Meadows of the Manning-Hawkesbury Ecoregion will be impacted by the project.

With the loss of the *Posidonia australis* there would be an impact to White's Seahorse, but it is not expected to be considered significant due to adjacent areas of habitat availability. In addition, the areas to be impacted consist of mixed habitat and experience high exposure to coastal processes. There may be temporary disturbance from construction noise on the distribution of White's Seahorse in the wider area, however the noise would be temporary.

Black Rockcod habitat has not been identified within the project footprint. However, it is likely that Black Rockcod would be disturbed by construction noise. The potential impacts would be temporary and are highly dependent on the location of an individual fish at the time of the noise occurring.

This project is unlikely to impact Cauliflower Soft Coral as there were no sightings of the species during any of the surveys completed.

A significance assessment was carried out for values associated with the *Posidonia australis* Seagrass Meadows of the Manning-Hawkesbury Ecoregion and White's Seahorse in accordance with the Significant Impact Criteria outlined in the Significant Impact Guidelines 1.1 Matters of National Environmental Significance (Australia Government, Department of Environment, 2013) as required under the EPBC Act. The outcome of these assessments was that significant impacts would occur as defined under the EPBC Act. While these have been minimised, they cannot be fully avoided if the project were to be built. Therefore, a mix of management measures and biodiversity offset measures would be needed as described below in section 10.4. Further detail of these assessments against the significance criteria is provided in Table 26 of Appendix H (Marine Biodiversity Assessment Report).

As Black Rockcod and Cauliflower Soft Coral are unlikely to be significantly impacted, an assessment against the EPBC Act significance criteria was not required.

10.4 Environmental management measures

10.4.1 Biodiversity offset

Following the application of environmental management measures to avoid and minimise impacts to biodiversity, the project would be required to provide biodiversity offsets for the residual impacts. A draft Marine Biodiversity Offsets Strategy (MBOS) is being prepared to identify the mechanism for delivery of offsets in accordance with the *NSW Biodiversity Offsets Policy for Major Projects, Fact Sheet: Aquatic Biodiversity* and EPBC Environmental Offsets Policy. The MBOS establishes the process for identifying and securing offsets prior to commencement of the action to mitigate the residual impacts of the project. The potential offsets could involve:

- Rehabilitation of seagrass habitat – by transplanting
- Rehabilitation of other aquatic habitats
- Seagrass habitat improvements – addressing catchment water quality and pollution
- Creation of arterial habitats (under the proposed wharves for White's Seahorse)
- Support for further research into transplanting seagrass (through grants and collaboration).

Further details on offsets requirements under State and Commonwealth are provided in Appendix H (Marine Biodiversity Assessment Report).

10.4.2 Management measures

Measures to be implemented during detailed design and construction to manage and mitigate the project impacts to marine biodiversity are outlined in Table 10-7. To develop appropriate mitigation measures for this marine biodiversity assessment, the interactions between mitigation measures for this assessment and the other relevant technical chapters, as described in section 10.3, have also been considered.

Table 10-7: Environmental management measures for marine biodiversity

Impact	ID	Environmental management measure	Responsibility	Timing
Lighting impacts to marine habitat and fauna	MB1	Design and lighting opportunities will be considered during the detailed design, including: a) Use of light permeable materials for the wharves to minimise shading impacts to marine habitats b) Measures in the National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds, and Migratory Shorebirds (Australian Government Department of Environment and Energy, 2020).	Transport for NSW	Detailed design
Marine biodiversity impacts	MB2	A Construction Biodiversity Management Plan (BMP) will be prepared in accordance with the Biodiversity Assessment Method (NSW DPIE, 2020h). It will be implemented under the Construction Environmental Management Plan (CEMP). The BMP will detail the measures and procedures to minimise and manage construction impacts on marine biodiversity. The BMP will include: a) Sensitive area maps that identify sensitive habitats, protection areas, no anchoring zones, and exclusion zones to protect seagrass and threatened species b) Define procedures addressing relevant matters specified in the NSW DPI Fisheries Policy and guidelines for fish habitat conservation and management (NSW Department of Primary Industries, 2013). c) Include measures to prevent and monitor: <ul style="list-style-type: none"> • Water pollution • Sediment disturbance during construction 	Contractor	Pre-construction and construction

Impact	ID	Environmental management measure	Responsibility	Timing
		<ul style="list-style-type: none"> Construction vessel/barge movements, anchoring, and shading Impact on known Black Rockcod habitat where possible Biosecurity risks Vessel strike by maintaining safe distances and approaches as identified in section 2.3 and 2.5 of the Biodiversity Conservation Regulation 2017 and limiting speeds. <p>d) Define and implement marine ecology induction to all workers during site inductions</p> <p>e) Consultation with DPI Fisheries, NSW Environment, Energy and Science Group, Randwick City Council, Sutherland Shire Council, National Parks and Wildlife Service for the preparation of the BMP.</p>		
Habitat degradation on sensitive environments related to vessel anchoring and mooring: construction	MB3	Establish no anchoring zones to minimise impacts from anchor points within seagrass meadows of <i>Posidonia Australis</i> at Kurnell and La Pouse.	Contractor	Pre-construction and construction
	MB4	Avoid fixed location of barges at locations of <i>Posidonia australis</i> outside of the marine habitat impact area within the construction boundary to minimise shading impacts.	Contractor	Pre-construction and construction
Marine pests	MB5	Implement biosecurity management measures applicable and relevant to the project in accordance with relevant NSW DPI Fisheries policies and procedures and National biofouling management guidelines for marinas, slipways, boat maintenance and recreational boating facilities (DAWE, 2021).	Contractor (Construction) Transport for NSW (Operations)	Pre-construction, construction and operation
Habitat degradation and turbidity on sensitive environments related to vessel wash and disturbance: operations	MB6	<p>Establish suitable navigation channels to avoid areas of listed species habitat, including:</p> <p>Kurnell</p> <p>a) Watts reef (likely Black Rockcod habitat)</p> <p>b) Large TEC seagrass meadow of <i>Posidonia Australis</i></p> <p>La Pouse</p> <p>c) Avoid accessing near reef habitat</p> <p>d) No access over patch of <i>Posidonia Australis</i> to the east of the wharf</p>	Contractor (Construction) Transport for NSW (Operations)	Pre-construction, construction and operation
Boat strike and vessel impacts on marine fauna	MB7	Vessels are to maintain safe distances and approaches as identified in section 2.3 and 2.5 of the Biodiversity Conservation Regulation 2017.	Transport for NSW	Operation
	MB8	Where possible, areas of known Black Rockcod habitat will be identified in detailed design and avoided during construction and within the ferry swept path during operation.	Transport for NSW	Detailed design, construction and operation

Impact	ID	Environmental management measure	Responsibility	Timing
Habitat degradation and turbidity on sensitive environments related to vessel wash and disturbance	MB9	<p>Establish areas of no wash zones in consultation with Port Authority NSW, NSW DPI Fisheries and Transport for NSW at:</p> <ul style="list-style-type: none"> a. La Perouse to minimise wash effects on the coastal subtidal and intertidal reef areas b. Watts Reef near Kurnell to minimise wash effects on the subtidal habitat on the reef c. Near both wharves to minimise excess wash from the ferry and recreational vessel access. 	Transport for NSW	Construction and operation
Seagrass habitat loss	MB10	<p>A Marine Biodiversity Offset Strategy (MBOS) will be prepared in consultation with NSW DPI Fisheries. As a minimum the MBOS will include:</p> <ul style="list-style-type: none"> a. Pre and post construction seagrass monitoring program to validate construction impacts b. A seagrass translocation and rehabilitation plan c. Investigation of other offset opportunities which may include artificial marine fauna habitat such as seahorse habitat structures, environmentally friendly moorings or research trials on environmentally friendly moorings. 	Transport for NSW	Pre-construction, construction and operation