Appendix G
Marine ecology

Australian Industrial Energy

Port Kembla Gas Terminal

Marine Ecology Impact Assessment

November 2018

Executive Summary

Overview

Australian Industrial Energy (AIE) proposes to develop the Port Kembla Gas Terminal (the project) in Port Kembla, New South Wales (NSW). The project involves the development of a liquified natural gas (LNG) import terminal including a Floating Storage and Regasification Unit (FSRU) moored at Berth 101 in the Inner Harbour, visiting LNG carriers, wharf offloading facilities and the installation of new pipeline to connect to the existing gas transmission network.

This Marine Ecology Impact Assessment has been prepared to support the Environmental Impact Statement for the project. Assessment of the existing marine ecology and potential impacts from the construction and operation of the project has been completed using a combination of methods, including:

- Review of relevant environmental legislation
- Desktop assessment to describe the existing environment within Port Kembla and to determine the likelihood of any threatened biota and their habitats occurring in the project area. This assessment included database searches, review of existing studies and review of other EIS assessments
- Field validation exercise to confirm that marine ecology within the Inner Harbour (inclusive of the berth) and Outer Harbour is consistent with observations historically made within these areas. Use of both field and historical data to describe the extant conditions.
- Understanding of potential construction and operational impacts on the marine ecology (directly and indirectly) from the proposed project activities and assessment of these impacts.
- Determining a number of management and mitigation measures to avoid and minimise impacts to the marine ecology values.

Existing environment

Marine Habitat

Marine habitat within the port is restricted to the hard substrate habitat and the soft sediments. Hard substrate habitat consists of infrastructure such as piles, quay walls and breakwater around the perimeter of the port. Such hard substrate presents ideal habitat for biofouling communities within the sheltered environment. Assemblages around the Inner Harbour have been described as sparse with community structures reflective of the highly disturbed environment; species noted within these communities are polychaete worms, bryozoans, barnacles and ascidians (Worley Parsons, 2012). Comparatively, a higher diversity and abundance of sessile invertebrates has previously been reported in the Outer Harbour (Worley Parsons, 2012). Surveys undertaken for the EIS found communities generally consistent with those previously described, with the addition of the macroalgae *Dictyota dichotoma* on the shallow subtidal zone of the surveyed piles.

The seabed within the Inner Harbour has previously been described as consisting of fine, unconsolidated silt expanses with large decapod burrows (Worley Parsons, 2012). Historically the seagrass species *Halophila ovalis* has been recorded within the Inner Harbour benthos (Pollard and Pethebridge, 2002; EcoLogical Australia, 2003), however seagrasses have not been detected on more recent surveys (2012, 2018). There are no known mapped seagrass communities adjacent to the project.

Macroalgae has been known to occur in sparse distributions across soft sediments habitats within the port. More recent investigations (2018) did not identify any macroalgae within the proposed dredge footprint, other than those observed along the berth piles.

The different habitats within the Inner and Outer Harbour have been found to support varying diversities in fish assemblages and compositions. The higher diversity within the Outer Harbour may have reflected the use of area, including macroalgal habitat and breakwater, as nursery for juvenile species (AWT, 1999; AECOM, 2010). The eastern breakwater environments in the Outer Harbour also provided niche habitat for species including mado, yellowtail and moon-wrasse, with the red morwong as the only species observed in deeper soft sediment habitat (AECOM, 2010). In contrast the highly utilised and developed Inner Harbour is not known to support as many species. Those that occur are typical of inshore habitats being glass perchlet and Japanese striped goby (AWT, 1999; Pollard & Pethebridge, 2002; UNSW, 2009). Fish assemblages identified as part of these studies are common across the region and did not include any threatened species. The area also does not support any key fish habitat.

Marine Fauna

Schedule 4, 4A and 5 of the FM Act provides lists of critically endangered, endangered and vulnerable species, populations and ecological communities occurring in NSW. The following were identified as potentially occurring in the Port Kembla area and were thus assessed under the FM Act assessment criteria:

- The grey nurse shark (*Carcharias taurus*) listed as **critically endangered**. The species may transit the region during local migrations between aggregation sites however, the port environment is not considered to be key habitat for this species.
- The Australian grayling (*Prototrocetes marena*) listed as **endangered.** The closest known record of the species is in the estuary at Minnamurra, approximately 50 km south of Port Kembla (NSW DPI, 2016b). Due to the distance from this record, lack of suitable habitat and absence of records from previous port surveys, it is unlikely that the species will be present in the Port Kembla area.
- The black rockcod (*Epinephelus daemelii*) listed as **vulnerable.** Juveniles of the black rockcod are commonly found in inshore areas and estuaries where there is suitable sheltered habitat such as rock crevices, caves and gutters (NSW DPI, 2015). It is possible that the species could use the rock breakwalls, piles and quay walls within the port, however previous investigations within Port Kembla have not identified the black rockcod as present within the port (AECOM, 2010; Worley Parsons, 2012). The black rockcod is therefore identified as having a ‘may occur’ likelihood of occurrence
- The great white shark (*Carcharodon carcharias*) listed as **vulnerable**. This species is known to be present near seal colonies and thus may visit the wider region as a transient visitor due to the nearby seal haul out site at the Five Islands Nature Reserve (DSEWPC, 2013). However, it is considered unlikely that the species will venture into the shallow waters of Port Kembla where there is frequent movement of vessels causing disturbance and a lack of food sources.

The NSW government introduced the BC Act in 2016 and repealed the former *Threatened Species Conservation Act 1994*. Schedule 1 of the BC Act provides lists of critically endangered, endangered, vulnerable species and populations occurring in NSW. The following were identified as potentially occurring in the Port Kembla area and were thus assessed under the BC Act criteria:

- The southern right whale (*Eubalaena australis*) listed as **endangered.** This species is likely to occur within the Outer Harbour having been previously recorded within the port (Worley Parsons, 2012).
- The blue whale (*Balaenoptera musculus*) listed as **endangered.** This species is unlikely to occur within Port Kembla due to lack of suitable habitat.
- Marine turtles – leatherback (**endangered**), loggerhead (**endangered**) and green (**vulnerable**) turtles could potentially visit the port as transient visitors however, it is unlikely that they use the port for nesting or foraging purposes and as such, these species are considered unlikely to occur within the Port Kembla area.
- The long-nosed fur seal (*Arctocephalus forsteri*) and the Australian fur seal (*Arctocephalus pusillus*) listed as **vulnerable.** These species are likely to occur, having been previously recorded within the Outer Harbour.

The EPBC Act Protected Matters Search Tool was used to identify MNES and other matters protected under the EPBC Act that are predicted to occur in, or relate to the project area. This search identified the following MNES of relevance to the project:

- No Wetlands of International Significance
- No Commonwealth Marine Areas
- 69 Listed Threatened Species (marine species excluding marine birds)
- 56 Listed Migratory Species (marine species excluding marine birds)
- 83 Listed Marine Species
- 12 Whales and other Cetaceans
- 42 threatened and migratory bird species

Of these, the following species/groups were identified as likely to occur in the port; these have been assessed in accordance with the related Significant Impact Guidelines 1.1 (Commonwealth of Australia, 2013):

- Southern right whale (*Eubalaena australis*)
- Humpback whale (*Megaptera novaeangliae*)
- Long-nosed fur seal (*Arctocephalus forsteri*)
- Australian fur seal (*Arctocephalus pusillus*)
- Indian ocean bottlenose dolphin (*Tursiops aduncus*)
- Bottlenose dolphin (*Tursiops truncates s. str.*)
- Syngnathids

Introduced marine species

A number of introduced marine species surveys have identified an extensive list of species present in the port. Introduced marine species accounted for 50 % of the coverage of the hard substrate assemblages within Port Kembla with more pest species and higher abundances of pest species present in the Outer Harbour compared to the Inner Harbour (Johnston, 2006).

Of the species recorded within Port Kembla, *Alexandrium* spp. dinoflagellates are listed as High National Priority Pests while the ascidians *Ciona intestinalis* and *Styela clava* and bryozoan *Schizoporella errata* are classified as Medium National Priority Pests (Hayes *et al.*, 2005).

Whilst the toxic dinoflagellate species *Alexandrium catenella* were recorded during surveys conducted in 2002 and 2009 within the port (Pollard & Pethebridge, 2002; AECOM, 2010), none were found during the later 2011 survey (Worley Parsons, 2012). In addition, no toxic dinoflagellate blooms have been recorded within Port Kembla. However the risk of blooms remain given the historical records of toxic dinoflagellate species at the port.

Physical environment

Port Kembla's Inner Harbour is considered a relatively low energy environment with low discharges from creeks and drains and little wave energy propagation into the Inner Harbour. The Outer Harbour, on the other hand, is known to be impacted by long wave events, which are typically multi-directional, with long waves from multiple directions occurring at the same time. The predominant directions are from the east, the north, and also from the west, which is likely to be due to waves reflecting off of the beach.

Land use in the immediate vicinity of Port Kembla contributes to the ambient marine water quality within the port. In addition, the ambient marine water quality within Port Kembla is also subject to tidal influences from the Port Kembla entrance.

Historically water quality within the Inner and Outer Harbours has been impacted by urban and industrial discharges as well as port activities. Water quality monitoring within the port has indicated concentrations of metals (aluminium, cadmium, copper, lead, zinc, tin and arsenic) exceeded the ANZECC (2000) 95% trigger values for protection of marine waters. These exceedances were generally highest in the vicinity of Allan's Creek, Gurungaty waterway and Darcy Road drain. Average total suspended solids were found to be higher within the Inner Harbour than the Outer Harbour. pH levels were generally lower in the Inner Harbour than the Outer Harbour, indicating freshwater discharge influences from the existing waterways within the Inner Harbour.

Water temperatures within the port are generally higher than those measured offshore due to slower tidal flushing patterns and existing industrial thermal discharges (hot water discharge within Allan's Creek) to the Inner Harbour. As a result, water temperatures within the Inner Harbour are generally one to two degrees warmer than temperatures beyond the entrance to the port. The Outer Harbour benefits from greater tidal flushing and is generally less than 0.25 degrees warmer than water temperatures beyond the entrance to the port (AECOM, 2010).

Marine sediments within the port are generally characterised as soft silty clays dominating the surface sediments with an underlying layer of stiff clay. Metals (arsenic, cadmium, chromium, copper, manganese, mercury, lead, vanadium and zinc), Polycyclic Aromatic hydrocarbons (PAH), dioxins and Tributyltin (TBT) have been recorded within these sediments across the Inner Harbour exceeding the screening levels for ocean and land disposal (National Assessment Guideline for Disposal – NAGD, and National Environment Protection Measures – NEPM) (WorleyParsons, 2012; Geochemical Assessments, 2013). Further, bioavailability investigations also found concentrations of cadmium, copper, lead and zinc exceeded NAGD screening level in many samples (Geochemical Assessments, 2013).

Recent investigations undertaken as part of the EIS have indicated the presence of contaminated sediments within the proposed dredging and disposal areas; these results were generally consistent with previous investigations. Concentrations of contaminants of concern were largely consistent across the dredging and disposal areas, with the primary contaminants of concern including heavy metals, PAH, dioxins and TBT at concentrations above the nominated screening levels.

Impact assessment

The redevelopment of the berth has an estimated duration of 10 -12 months and will include the removal of the existing structure by dredging and excavation of 600,000 m^3 of material from the quay wall, installation of mooring infrastructure and topside port infrastructure. Redevelopment of the berth will temporarily and/or permanently alter the existing biofouling, benthic and fish communities within the port. This is discussed below.

Disturbance of the biofouling communities encrusting on the piles and the benthic ecology on the seabed

Removal of the existing infrastructure, including the extraction of the piles, will lead to the removal of the biofouling communities associated with the berth infrastructure leading to a temporary loss of biodiversity from the project footprint, and the likely avoidance of/displacement from the area by associated mobile fauna. Slow moving or semi-sedentary mobile fauna may suffer mortality if located on the piles at the time of removal. This may include small, slow moving fishes such as Syngnathids. Recolonisation of the new piles is expected to commence following installation, after which, the biofouling community will undergo a long-term natural recruitment succession process reaching mature level community within a few years.

Dredging activities have the potential to impact directly on biofouling and benthic communities through direct removal of the substrate from the environment, and indirectly through generation of turbid plumes that will lead to suspension of sediment, affecting filter feeding organisms (UNEP, 2013). The dredged areas within the berth will eventually be covered with fine layers of silt from the vessel propeller wash, and will be colonised with similar benthic communities from the surrounding areas within the Inner Harbour.

Development of the perimeter bund and disposal of the dredged sediment will directly impact on existing benthic communities within the Outer Harbour disposal area through smothering and burial of epibenthic fauna. These Outer Harbour benthic communities have been previously subject to six dredged material disposal campaigns. The construction of the perimeter bund and subsequent dredged sediment disposal is expected to permanently remove a maximum 16.5 ha of benthic habitat and associated benthic communities from the Outer Harbour area. This will be offset by the creation of the reclamation area infrastructure providing new surface for colonisation by biofouling communities.

Deterioration of water quality (increased turbidity, mobilisation of contaminants, thermal and residual chlorine release)

The removal and placement of the sediment from the berth area was identified as the activity with the greatest potential to impact water quality (Cardno, 2018). Modelling of total suspended solids predicts that the extent of the dredge plume will be confined to Port Kembla with significant TSS concentrations (95^{th} percentile) confined to the vicinity of the dredging and disposal areas. Turbidity has the potential to impact on fish feeding ability (de Robertis *et al.* 2003), fish gills causing damage (Au *et al*. 2004; Wong *et al*. 2013), feeding and respiratory organs of filter-feeding organisms (Airoldi 2003; Maldonado *et al.* 2008). However, it is likely that as such organisms are already established within a marine environment historically exposed to numerous dredging and disposal campaigns within Port Kembla, these species will be resilient to any short-term increases in suspended solids resulting from dredging and disposal activities.

Handling of the berth sediment through dredging and disposal may have the potential to mobilise contaminants known to occur within the sediment (metals, PAH and TBT). Elutriate testing completed through previous sediment investigations (Worley Parsons, 2012) indicated that whilst concentrations of heavy metals were reported above the screening levels in sediments, concentrations of dissolved metals in elutriate waters were below the ANZECC

trigger levels for 95% protection of species. Bioavailability testing, on the other hand, indicated that some heavy metals (cadmium, chromium copper, lead and zinc) have the potential to be bioavailable to marine organisms (Worley Parsons, 2012). Considerable increases in heavy metal concentrations of copper, tin and zinc in the tissue of Sydney rock oysters, *Saccostrea glomerata*, have been directly linked to the 2009 dredging and disposal campaign within Port Kembla (Hedge & Knott, 2009). Whilst not directly related to dredging, elevated metals and PCB concentrations have also been recorded in tissues of fish from Port Kembla between 1975 and 1995 (He & Morrison, 2001). The potential release of contaminants is likely to be localised within the Port Kembla environment and medium-term in nature. Suspended sediment will be confined within silt curtains at the berth while dredge material will be confined within the perimeter bund at the Outer Harbour to minimise the migration of sediment and contaminants during disposal. Contaminated sediment will be capped with uncontaminated material at the disposal area. The duration of exposure to toxicants are considered to be short in duration while long-term toxic effects are considered unlikely.

Handling of sediment may trigger blooms of the toxic dinoflagellate *Alexandrium catenella* when conditions are favourable. Such blooms may deplete dissolved oxygen and produce toxins, causing environmental damage including fish kills. The risk of blooms is considered to remain given the historical records of toxic dinoflagellate species at Port Kembla; however, the likelihood of a bloom occurring is low because cysts had not been detected during previous investigations.

Release of cool water from the FSRU will have minor impacts on seawater temperatures confined within the port limits. At the point of exit from the FSRU the discharged water will be up to 7 degrees cooler than ambient sea temperatures. Discharged water will be denser than ambient water, which means that it will immediately sink to the bottom of the water column. Thermal modelling predicts that initial near field mixing will reduce the 5th percentile temperature differential to one degree at each end of the proposed berth. On average, temperatures within the port are generally expected to decrease by 0.1 to 0.2 degrees.

Release of cool water from the FSRU will also involve release of residual chlorine. The FSRU will operate an on-board marine growth prevention system which will use sodium hypochlorite as a natural biocide. Some excess sodium hypochlorite is expected to be discharged within the Inner Harbour. The IFC World Bank Group Environmental, Health, and Safety (EHS) Guidelines for LNG Facilities consider total residual oxidants concentrations, as chlorine is very reactive in seawater. These guidelines stipulate that the concentration of total residual oxidants in cooling/cold water discharges in marine water at the point of discharge should be maintained below 0.2 parts per million (ppm) (IFC, 2017). Consideration has been given to the dilution of the discharge stream within the mixing zone of the Inner Harbour. The discharge plume is predicted to have been diluted by a factor of four by the time the plume reaches the floor of the Inner Harbour and a dilution factor of 30 at a distance of 400 m from the discharge point. Residual chlorine is expected to be restricted to the Inner Harbour environment. It is expected that the marine communities in close proximity to the discharge point will be adversely effected by the decrease in temperature/presence of residual chlorine. This is likely to include the biofouling communities at adjacent pylons, the benthic community under and adjacent to the FSRU and benthic/pelagic fish passing through the plume area. Potential impacts to these communities will vary depending on species, life history and stage, and season. Decreases in temperature and the presence of residual chlorine may lead to the avoidance of the area by mobile species, and the inhibition of growth, spawning or larval settlement of sessile organisms.

Noise pollution from pile driving and rock placement activities

Artificial noise emissions may occur during the following planned activities: pile removal and pile driving, tubular steel wall installation, dredging activities, vessel and plant movements and

placement of rock armouring for protection of the perimeter bund. Disturbance to marine fauna from underwater noise may occur in response to noise generated by these activities which will be restricted to the Inner and Outer Harbour regions.

Piling and dredging activities are the key activities associated with the berth redevelopment which may generate underwater noise. Piling and dredging construction activities have potential to generate noise that could displace fauna from the area realising a temporary reduction in diversity. They also have potential to cause a temporary or permanent threshold shift (TTS or PTS) in the hearing ability of sensitive fauna that use acoustic means of navigation or communication. Underwater noise impacts from dredging are not anticipated to cause permanent auditory damage to marine fauna in the area. Once construction is completed, underwater noise will be restricted to standard shipping noise associated with vessel movements between port environments.

Based on the likelihood of occurrence of marine fauna within the port, it is expected that the southern right whale, humpback whale, long nosed seal and Australian fur seal and resident fish are amongst the fauna that may be most impacted by noise generated during construction. Whales and seals are not expected to suffer from TTS or PTS in their hearing ability as they are most likely going to be within the Outer Harbour, away from the source of noise. Fish on the other hand may be susceptible to intense acoustic vibrations, as many hearing specialist species possess an air-filled swim bladder (Gordon *et al.,* 2003). Syngnathids have are also known to exhibit physiological stress response under noisy conditions (Anderson, 2009). Impacts on fish from noise sources generated during planned construction activities are expected to be restricted to a short-term period and may result in behavioural responses such as avoidance of the area. Such actions would be temporary in nature and localised. It is therefore considered that the species are unlikely to be impacted by noise and frequencies generated during the project works.

Artificial light emissions

Artificial light emissions may occur through the use of vessel and site construction safety lighting during the construction phase of the project, and once constructed, from lights installed as part of the new berth infrastructure and FSRU. Artificial lighting may affect fauna by altering use of visual cues for orientation, navigation or other purposes, resulting in behavioural responses, which can alter foraging and breeding activity in marine turtles, cephalopods, birds, fish, dolphins, and other pelagic species.

Construction is planned for 24 hours per day, seven days per week across 10-12 months. Therefore, night time lighting will be required to enable a safe working environment. The existing berth is currently lit at night, it is therefore assumed that marine fauna species currently using the project area will be habituated to extant light conditions. Similar lighting will be installed on the redeveloped berth and on the FSRU and LNG Carriers when in berth. This lighting is expected to be minimal in comparison to cumulative light emissions of other illuminated infrastructure within Port Kembla. The proposed works are likely to contribute to but not elevate or increase the existing landscape lighting profile. As such, construction based lighting is not predicted to result in any change in migratory behaviours of birds that use the area and are already habituated to current light conditions.

Pest introduction and proliferation

Proposed activities may support spread, dispersal or expansion of existing marine pest populations within the project area. Vessels carrying invasive marine pests (IMP) may unintentionally but successfully introduce new species to the region where the activity is occurring or carry pests from the region to other areas. IMPs may be carried within the external biological fouling on the vessel hull, within seawater pipes (e.g. cooling water) and associated

infrastructure or on submersible marine instruments and equipment. Ballast water exchange may also allow for the transportation and proliferation of IMPs within the area of activity.

Dredge barges and construction vessels are known to have a high risk for translocation of invasive marine species (Pollard & Pethebridge, 2002; Wells *et al., 2009*). These vessels often have long residency times in ports, have numerous surfaces where marine species can attach, and may not have well-maintained anti-fouling. As such, this increases the likelihood of these vessels becoming infected by a potentially invasive marine species, and infecting a port with said species. The risk is further increased where vessels are between ports with similar environmental characteristics.

Due to the pervasiveness of introduced species in Port Kembla, including targeted high priority pests, there is also risk of translocation of invasive species from the port on departing project vessels. The consequences of this may be higher than an introduction into Port Kembla, depending on the value of the destination port environment.

Marine fauna collisions/interactions

Interaction with marine fauna may potentially occur during the dredging and disposal activities. There is potential for interactions with marine fauna during construction of the perimeter bund. There is also potential for collision to occur between marine fauna and larger vessels associated with the operation of the project. The consequences of such collisions between marine fauna and vessels/construction materials for the marine organisms range from changes to fauna behavioural patterns to injury or death of the organism due to a direct collision.

Due to the slow speed of vessels associated with dredging and disposal activities, likelihood of marine fauna collisions is expected to be minimal. Deep to shallow water transition zones, and deep-water channels, are where high shipping traffic coincides with natural cetacean habitats. At these locations, collisions between vessels and cetaceans are considered more likely (WDCS, 2006).

The risk of potential vessel strike during construction is considered low for all marine species likely to occur in the project area, including cetaceans, sharks and fish. This risk accounts for works being concentrated within a small area of the Inner and Outer Harbour limited by the port boundaries, and being undertaken at relatively low vessel speeds. This will limit the potential for encounters to a small spatial footprint. Similarly, the risk of potential vessel strike during operation of the project is considered low for all marine species. This risk also accounts for the avoidance behaviour marine fauna species adopt to evade vessels until the vessel disruption has elapsed. The risk of interaction between marine fauna and construction materials during rock armouring of the bund wall is low, as fauna would need to be directly in the path of the rock placement activities.

Accidental release of solid waste

A variety of hazardous and non-hazardous solid waste may be released unintentionally into the environment from overfull and / or uncovered bins or if blown off the deck of a vessel. Accidental spillage during transfers of waste from vessel to shore, and incorrectly disposed items may also cause the unintentional release of solid waste into the surrounding environment. Non-hazardous solid waste includes plastics, packaging and paper materials and products while examples of hazardous solid wastes include oily and contaminated wastes, aerosol products, fluorescent tubes, batteries and medical waste.

There is capacity for non-hazardous solid waste such as plastic bags to affect the environment and cause entanglement or ingestion by fauna. The ingestion of solid wastes like plastic bags can consequently result in internal tissue damage, prevention of normal feeding behaviours and potentially death of the affected fauna. The pollution of the immediate environment with the

release of hazardous solid waste has the likely consequence of negatively affecting the health of marine ecology within the area. Particularly fish and cetaceans are susceptible to chemical impacts, including disease or physical injury after ingesting or absorbing the waste.

Accidental release of hydrocarbon, chemicals and other liquid waste

There are no planned releases of liquids, chemicals and hydrocarbon compounds during the construction of the project. Rather, all liquid waste will be stored for discharge to an appropriate onshore facility. There is, however, potential that a leak or spill of hydrocarbons or other liquids (including environmentally hazardous wastes and non-hazardous substances) may occur at the site. Such an occurrence would result in the localised reductions in water quality and contamination of nearby marine receiving environment.

Damaged fuel tank associated with vessel collision

Oil spills from damaged tanks may impact on marine fauna through ingestion and accumulation, skin contact, interference with feeding and vapour inhalation. Some marine mammals have the capacity to identify and avoid oil slicks (Geraci, 2012), while others have been observed surfacing and feeding in oil affected areas (Matkin *et al.*, 2008). Whales are more susceptible to impacts from surface oil than other species due to their skimming of food from surface waters. Oil can potentially disrupt the efficiency of the feeding mechanism for days by blocking the whales plates (Geraci, 1985). Other impacts include congested lungs, damaged airways or emphysema as consequences of vapour inhalation of surface oil.

Surface oil impacts on the transient fur seal visitors at the port may lead to the long-term coating of individuals with oil, inhibiting their swimming ability as well as their ability to thermoregulate (Engdelhardt, 1983). Fur seals may also absorb oil through the skin, via inhalation of atomised particles in the air, and through ingestion via the gastrointestinal tract (Engelhardt, 1983). Further impacts on seals includes eye irritation, congestion of lungs and airways from inhalation, gastrointestinal ulcerations and damage to the kidney, liver and brain (IPIECA, 2015).

Open sea fish are typically known to have the ability to identify and avoid surface slicks (Kennish, 1997; Hayes *et al.,* 1992). Compared to other marine organisms, fish are unlikely to experience as much exposure to surface oil since diesel would remain on the sea surface. However, since eggs, larvae and fish in their early juvenile stages are likely to inhabit the planktonic sea surface waters, recruitment success could be affected. The surface oil would predominantly have lethal or near-lethal impacts on the future growth and development of exposed larvae/eggs/juvenile fish (Kennish, 1997).

Preening and feeding / diving actions on the surface of affected waters may lead to the ingestion of surface oils by seabirds which may lead to intestinal irritation (Hayes *et al*., 1992). Seabirds may also experience fouling during feeding and diving for prey, wading or during roosting on the surface of waters affected by surface oils. Fouling can consequently cause the loss of buoyancy, inability to fly and loss of waterproofing properties of plumage resulting in hyperthermia in affected seabirds.

Krill and baitfish, known as prey species, occupying the surface water environments may also be impacted by surface oils. These disruptions to the food chain through the reduced availability of suitable prey may be detrimental to the behaviour and survival of certain bird species, which feed on surface water biota. The quantity of marine wildlife affected and the extent of surface oil's impact is reliant on a variety of factors including the weather, season and biological productivity of the afflicted region (Clark *et al*., 1989).

An oil spill within the port due to vessel / plant collision and rupturing of a fuel tank may result in confined impacts upon a wide variety of organisms inhabiting the port environment within the biofouling and benthic communities. However if an oil spill occurred outside the port, impacts

could extend to sensitive receptors such as rocky habitat (Red Point headland, Tom Thumb Islands and Five Islands Nature Reserve) and sandy beaches (Wollongong City Beach, Fisherman's Beach or North Beach) around Port Kembla.

Management and mitigation measures

To reduce or eliminate the impacts from identified hazards, a number of management controls are suggested for implementation. The environmental risks associated with these hazards will be limited within the port environment and are expected to be short term in nature, with low risk on existing species with the implementation of the nominated management controls. As such, risks associated with planned and unplanned project activities are generally considered acceptable and as low as reasonably practical.

Biofouling and benthic community disturbance

- Works to remove the current quay wall and piles will commence after a visual inspection for protected mobile fauna (e.g. Syngnathids). If present, these will be relocated to adjacent habitats, outside the zone of influence by the proposed works, where feasible.
- Dredging will be carried out using mechanical backhoe dredge, split barges and supporting tug vessels, as opposed to suction-style dredging, to minimise the potential mobilisation of sediments within the Inner Harbour.
- Disposal of the dredged material will be limited to the Outer Harbour disposal area within the perimeter bund.

Water quality

- Physical controls such as installation of silt curtains prior to commencement of construction works will be adequate in minimising the spread of any sediments within the water column at the dredging and disposal locations.
- Dredging techniques that minimise sediment resuspension during excavation and disposal (such as using mechanical methods over hydraulic methods) will be implemented throughout the project. Barge loads will also be controlled such that overflow of barge loads is prevented.
- Screening technologies will be implemented to ensure that any contaminated sediments are disposed of responsibly. Contaminated dredge material will be placed such that it may be capped by uncontaminated material in accordance with a dredge management plan.
- Daily visual observations will be undertaken for any potential toxic dinoflagellate blooms within the Inner Harbour.
- Water quality monitoring program will be implemented to ensure construction works do not cause exceed the project's agreed marine water quality criteria.
- Water temperature and residual chlorine monitoring program will be implemented during operation of the project to document natural variations in water temperature and the extent of temperature differences, residual chlorine concentrations, and dispersion pathways of the cold water discharge plume.

Artificial noise emissions

- During underwater piling activities the standard operational procedures will be implemented (DPTI, 2012).

- Works to remove the piles will commence after a visual inspection for protected mobile fauna (e.g. syngnathids). If present these will be relocated to adjacent habitats, outside the zone of influence by the proposed works, where feasible, to mitigate risk of acoustic impacts.
- Vessel and heavy machinery will be maintained in accordance with the manufacturer specifications to reduce noise emissions.
- The interaction of all vessels with cetaceans and pinnipeds will be compliant with Part 8 of the EPBC Regulations (2000). The Australian Guidelines for Whale and Dolphin Watching (DoEE, 2017) for sea-faring activities will be implemented across the entire project.

Artificial light emissions

- Light spill from the nearshore vessel operations will be minimised where possible using directional lighting. Light shields could be considered to avoid spill if sensitive receptors are determined during activities to be negatively affected.
- Lighting on vessel decks or the berth construction area will be managed to reduce direct light spill onto marine waters or surrounding landscape, unless such actions do not comply with site safety or navigation and vessel safety standards (AMSA Marine Orders Part 30: Prevention of Collisions; AMSA Marine Orders Part 21: Safety of Navigation and Emergency Procedures).

Pest introduction and proliferation

- Vessels will be sourced locally (within NSW waters) to complete the construction works, where possible.
- International vessels will empty ballast water in accordance with the latest version of the Australian Ballast Water Management Requirements (DAWR, 2017).
- If an IMP is identified or suspected, then the contractor is obliged to immediately (within 24 hours) notify the NSW Department of Primary Industries Aquatic Biosecurity Unit hotline on (02) 4916 3877.
- New biosecurity requirements may come into force during the life of the project. If this occurs, these management controls will be reviewed to confirm adequacy.
- Project activities to adhere to the National System for the Prevention and Management of Marine Pest Incursions (National System) and NSW requirements for IMP identification and management.

Marine fauna collision/interaction

- Operations of vessels will be commensurate with Part 8 of the EPBC Regulations (Interacting with Cetaceans and Whale Watching).
- The Australian Guidelines for Whale and Dolphin Watching (DoEE, 2017) for sea-faring activities will be implemented across the entire project.

Accidental release of solid waste

- Appropriate waste containment facilities will be included on site and managed to avoid overflow or accidental release to the environment.
- No waste materials will be disposed of overboard of vessels, all non-biodegradable and hazardous wastes will be collected, stored, processed and disposed of in accordance

with the vessel's Garbage Management Plan as required under Regulation 9 of MARPOL Annex V.

- Hazardous wastes will be separated, labelled and retained in storage onboard within secondary containment (e.g. bin located in a bund).
- All recyclable and general wastes will be collected in labelled, covered bins (and compacted where possible) for appropriate disposal at a regulated waste facility.
- Solid non-biodegradable and hazardous wastes will be collected and disposed of onshore at a suitable waste facility.

Accidental release of hydrocarbons, chemicals and other liquid waste

- All liquid waste will be stored for discharge to an appropriate onshore facility.
- Chemicals and hydrocarbons will be packaged, marked, labelled and stowed in accordance with MARPOL Annex I, II and III regulations.
- A Materials Safety Data Sheet (MSDS) will be available for chemicals and hydrocarbons in locations nearby to where the chemicals / wastes are stored.
- Vessel operators will have an up to date Shipboard Oil Pollution Emergency Plan (SOPEP) and Shipboard Marine Pollution Emergency Plan (SMPEP). All shipboard chemical and hydrocarbon spills will be managed in accordance with these plans by trains and competent crew.
- Any contaminated material collected will be contained for appropriate onshore disposal.
- Any equipment or machinery with the potential to leak oil will be enclosed in continuous bunding or will have drip trays in place where appropriate.
- Following rainfall events, bunded areas on open decks of the vessels or within any construction laydown areas will be cleared of rainwater.
- All hoses for pumping and transfers will be maintained and checked as per the Planned Maintenance System.

Damaged fuel tank associated with vessel or plant collision

- Visual observations will be maintained by watch keepers on all vessels and plant/moving machinery.
- Regular notification will be made to the Australian Hydrographic Office and AMSA before and during operations.
- Vessels will operate in compliance with all marine navigation and vessel safety requirements in the International Convention of the SOLAS 1974 and the Navigation Act 2012. This includes the requirement for all equipment and procedures to comply with the AMSA Marine Orders parts 3, 6, 21 and 30.
- Marine diesel oil compliant with MARPOL Annex VI Regulation 14.2 (i.e. sulphur content of less than 3.50% m/m) will be the only diesel engine fuel to be used by the vessels.
- Oil spill responses will be executed in accordance with the vessel's SOPEP, as required under MARPOL.
- Emergency spill response procedures will be developed and implemented when required.

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Appendix C – Assessment under the Environment Protection and Biodiversity Conservation Act 1999

1. Introduction

1.1 Background

Australian Industrial Energy (AIE) proposes to develop the Port Kembla Gas Terminal (the project) in Port Kembla, New South Wales (NSW). The project involves the development of a liquefied natural gas (LNG) import terminal including a Floating Storage and Regasification Unit (FSRU) moored at Berth 101 in the Inner Harbour, visiting LNG carriers, wharf offloading facilities and the installation of new pipeline to connect to the existing gas transmission network.

NSW currently imports more than 95% of the natural gas it uses, with the majority of supplies coming as interstate supplies from Victoria and NSW currently imports more than 95% of its natural gas requirements from Victoria, South Australia and Queensland. An import terminal would enable NSW to control and secure its own direct supplies. The project has the capacity to deliver in excess of 100 petajoules of natural gas per annum to NSW. LNG will be sourced from worldwide suppliers and transported by LNG carriers to the gas terminal at Port Kembla. The LNG will then be re-gasified for input into the NSW gas transmission network.

The project has been declared critical state significant infrastructure in accordance with section 5.13 of the Environmental Planning and Assessment Act, 1979 (EP&A Act) and Schedule 5 of the State Environmental Planning Policy (SEPP) State and Regional Development. An Environmental Impact Statement (EIS) is required to support the application for approval for determination by the NSW Minister for Planning.

1.2 Project overview

The project comprises the development of a LNG import terminal and incorporates four key components located within industrial land at Port Kembla. The components include:

- LNG carrier vessels — there are hundreds of these in operation worldwide transporting LNG from production facilities all around the world to demand centres
- Floating Storage and Regasification Unit (FSRU) — a cape-class ocean-going vessel which would be moored at Berth 101 (the berth) in Port Kembla. There are around 30 such vessels currently in operation around the world
- Berth and wharf facilities — including landside offloading facilities to transfer natural gas from the FSRU into a natural gas pipeline located on shore
- Gas pipeline — a Class 900 carbon steel high-pressure pipeline connection from the berth to the existing gas transmission network at Cringila.

At present it is envisaged that an LNG shipment will be required every 2 – 3 weeks to provide for an annual supply of up to 100PJ of gas. Supply could be increased further to around 140 – 150 PJ per annum through a slight increase in LNG delivery schedules and pipeline upgrades. It will take 10 – 12 months to complete construction and other works in order to start operations for the project and subject to approval processes, it is possible to have first gas by early 2020. Construction of the project will involve

- Excavation and dredging of about 600,000 m^3 of material at the berth and to the south east of the existing berth pocket. Allowing for typical bulking factors, this volume would equate to about 720,000 cubic metres
- Transport and placement of dredge material to be used for the reclamation in the Outer Harbour at Port Kembla.
- Construction of a new berth pocket south east of the existing berth.

- Installation of topside port infrastructure including a high pressure gas loading arms and high a pressure gas flowline.

Excavation and dredging would be carried out by long reach excavator and backhoe dredger. The long reach excavator would be situated on land and would primarily be used to excavate the existing berth and revetment. Material excavated by the long reach excavator would be put in haul trucks and transported a short distance to a stockpile at the berth to allow road transport to the Outer Harbour for disposal.

The backhoe dredger would be situated in the Inner Harbour adjacent to the berth and would primarily be used to excavate the deeper sediments at the berth. Material dredged by the backhoe dredger would be place in two split hopper barges for transport to the Outer Harbour for disposal.

The volume of material to be excavated by long reach excavator and transported by haul truck versus the volume of material to be dredged by backhoe dredger and transported by barge may vary depending on the preference and capacity of the construction contractor.

A perimeter bund will be constructed at the reclamation area to ensure the stability of the site. Construction of the bund will require removal of an existing layer of soft sediments that have been previously placed within the reclamation footprint; this activity will be undertaken using a backhoe dredger and hopper barge. The maximum footprint identified for the reclamation area consists of approximately 16.5ha. The hopper barges will carry the sediment from the berth for dumping within the reclamation footprint area.

Historically, Port Kembla has been subject to a number of dredging and disposal campaigns where material from the Inner Harbour was dredged and disposed of within the Outer Harbour area. These campaigns were undertaken in 1994, 1999, 2004, 2006, 2008 and 2015 being the most recent campaign.

Refer to Figure 1-1 for layout of the dredge (berth) and disposal area.

Paper Size ISO A4

0 50 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Australian Industrial Energy
Port Kembla Gas Terminal

Project No. **21-27477**
Revision No. **A**
Date **24 Oct 2018**

Project layout

Figure 1-1

G:\21\27477\GIS\Maps\Deliverables\EIS\21_27477_EIS_Z001_Project_Layout_V2.mxd

Data source: Aerial imagery - nearmap 2018 (image date 16/04/2018, date extracted 01/08/2018); General topo - NSW LPI DTDB 2017, 2015 & 2015; Berth footprint - Australian Industrial Energy. Created by: afoddy

1.3 Environmental assessment requirements

The EIS has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) which were provided on 10 August 2018 by the Department of Planning and Environment. Table 1-1 sets out the assessment requirements of the SEARs of relevance to marine ecology.

Table 1-1 Secretary's environmental assessment requirements relevant to marine ecology

Category	Secretary's Requirements	Cross reference to section in EIS
Biodiversity	• the biodiversity values and the likely biodiversity impacts of the project • the impacts of the project on aquatic ecology, including impacts on key fish habitat and threatened species of fish	Section 3 (Existing environment) Section 4 (Impact assessment)
Water and soils	• an assessment of the likely impacts of the project on the marine environment, watercourses, riparian land, water related infrastructure and other water users, and soil resources - including sediment/ turbidity plumes from dredging and reclamation activities, the release of cold water from LNG regasification (including thermal pollution discharge modelling), and the use and discharge of water during construction, commissioning and maintenance of the pipeline infrastructure • identify and estimate the quality and quantity of all pollutants, including dioxins and biocides (particularly tributyltin) from antifouling paints and chemicals used over the life of the project, that may be mobilised by project activities, and describe the nature and degree of impacts that mobilisation may have on the receiving environment and human health • identify sensitive receiving environments and include a strategy to avoid or minimise impacts on these environments	Section 3 (Existing environment) Section 4 (Impact assessment) Section 5 (Management and mitigation measures)

1.4 Purpose of this document

This Marine Ecology Impact Assessment (MEIA) has been prepared to support the EIS for the project. The MEIA report provides a description of the existing environment against which to assess the potential impacts on the marine ecology during the construction and operational phases of the project.

1.5 Scope

The scope of this MEIA includes:

- Description of existing marine environment within the project study area
- Assessment of potential construction and operational impacts on marine ecology
- Provision of mitigation and management measures, where relevant.

This report has been prepared with consideration of the following:

- Secretary's environmental assessment requirements relevant to marine ecology
- Recent investigations undertaken as part of this EIS (contamination assessment, noise assessment, thermal and turbidity plume modelling and other relevant assessments)
- Historical investigations undertaken for Port Kembla of relevance to marine ecology.

1.6 Glossary

Table 1-2 Glossary of terms and acronyms

Term	Definition
AIE	Australian Industrial Energy
AQIS	Australian Quarantine and Inspection Service
AMSA	Australian Maritime Safety Authority
AIS	Automatic identification system
ANZECC/ARMCANZ	Australian and New Zealand Environment and Conservation Council/Agriculture and Resource Management Council of Australia and New Zealand
ARPA	Automatic radar plotting aid
BC Act	Biodiversity Conservation Act 2016
berth	Refers to Berth 101
Biosecurity Act	Biosecurity Act 2015
Disposal area	Refers to designated area within the reclamation area for placement of dredged material
DoEE	Department of the Environment and Energy
DPI	Department of Primary Industries
DPTI	South Australia Department of Planning, Transport and Infrastructure
EIS	Environmental Impact Statement
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999.
EP&A Act	Environmental Planning and Assessment Act 1979
EP&A Regulation	Environmental Planning and Assessment Regulation 2000
EPL	Environmental protection licence
FM Act	Fisheries Management Act 1994
FSRU	Floating Storage Regasification Unit
IMP	Introduced Marine Pest
LNG	Liquid Natural Gas

Term	Definition
MARPOL	International Convention for the Prevention of Pollution from Ships
MNES	Matters of National Environmental Significance
MEIA	Marine Ecology Impact Assessment
MGPS	Marine growth prevention system MGPS
MNES	Matters of National Environmental Significance
MSDS	Materials Safety Data Sheet
NAGD	National Ocean Disposal Guidelines for Dredged Material
NEPM	National Environment Protection Measures
NSW EPA	NSW Environmental Protection Authority
Locality	The area within a 5 km radius of the project area.
Migratory Species	Species listed under listed under international agreements (I.e. Ramsar, JAMBA and CAMBA conventions) to which Australia is a party.
OEH	Office of Environment and Heritage.
PAH	Polycyclic aromatic hydrocarbons
PMS	Planned Maintenance System
PMST	Protected Matters Search Tool
POEO Act	Protection of the Environment Operations Act 1997
Port Kembla	Refers to both Inner and Outer Harbours
PTS	Permanent threshold shift
Reclamation area	Area proposed within Port Kembla for future expansion of the Outer Harbour
SEARs	Secretary's environmental assessment requirements
SEPP	State Environment Planning Policy
SMPEP	Shipboard Marine Pollution Emergency Plan
SOLAS	International Convention of the Safety of Life at Sea 1974
SOPEP	Shipboard Oil Pollution Emergency Plan
SSI	State Significant Infrastructure
Study area	The area that would be directly impacted by construction and operation of the project.
TBT	Tributyltin
Threatened biota	Threatened species, populations or ecological communities listed under the BC Act and/or the EPBC Act.
TTS	Temporary threshold shift

2. Methodology

2.1 Approach

Assessment of the existing marine ecology and potential impacts from the construction and operation of the project has been completed using a combination of methods.

The main components of the methodology for the assessment included:

- Review of relevant environmental legislation
- Desktop assessment to describe the existing environment within Port Kembla and to determine the likelihood of any threatened biota and their habitats occurring in the project area. This assessment included database searches, review of existing studies and review of other EIS assessments
- Field validation exercise to confirm that marine ecology within the Inner Harbour (inclusive of the Berth) and Outer Harbour is consistent with observations historically made within these areas. Use of both field and historical data to describe the extant conditions.
- Understanding of potential construction and operational impacts on the marine ecology (directly and indirectly) from the proposed project activities and assessment of these impacts.
- Determining a number of management and mitigation measures to avoid and minimise impacts to the marine ecology values.

2.2 Desktop assessment

2.2.1 Review of relevant legislation

State and Commonwealth environmental legislation of relevance to the project was identified and reviewed. This included the following:

- *Fisheries Management Act 1994* (FM Act)
- *Biosecurity Act 2015*
- *Biodiversity Conservation Act 2016* (BC Act)
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

2.2.2 Review of databases and searches

A database review was undertaken to identify threatened marine ecology (flora and fauna) species, populations and ecological communities (biota) listed under the FM Act, BC Act and EPBC Act, that could be expected to occur in the locality, based on previous records, known distribution ranges, and habitats present. Resources pertaining to the project area and locality (i.e. within a 10 km radius of the site) that were reviewed included:

- Department of the Environment and Energy (DoEE) Protected Matters Search Tool (PMST), for Matters of National Environmental Significance (MNES) known or predicted to occur in the locality.
- DoEE online species profiles and threats database
- Office of Environment and Heritage (OEH) BioNet Atlas (licensed) for records of threatened species, populations and endangered ecological communities listed under the BC Act that have been recorded within the project area (OEH, 2018a).

- OEH threatened biota profiles for descriptions of the distribution and habitat requirements of threatened biota (OEH, 2018b).
- Department of Primary Industries (DPI) mapping the estuarine habitats of NSW.

Results from the EPBC Act PMST are presented in Appendix A. Following the collation of database records and threatened species and community profiles, a 'likelihood of occurrence' assessment was prepared for these threatened and migratory species and is presented in Appendix B and Appendix C.

2.2.3 Review of existing information

A number of studies have been undertaken within the Inner Harbour and Outer Harbour since the 1970s with the most recent undertaken in 2013). These have been reviewed and, where relevant, information used to provide description of marine ecology within Port Kembla. The review included the following studies:

- 2013: Pilot sediment investigation for potential maintenance dredge areas, Geochemical Assessments 2013
- 2012: Berth 101 Upgrade Project Marine Assessment: Marine Ecological Assessment. 301015-02809-00-CS-REP-0001, Worley Parsons 2012
- 2010: Environmental Assessment of Port Kembla Outer Harbour Development, AECOM 2010
- 2010: Environmental Assessment of Port Kembla Outer Harbour Development, AECOM 2010 (Fish Census)
- 2010: Environmental Assessment of Port Kembla Outer Harbour Development, AECOM 2010 (Macroalgal Study)
- 2009: Survey of marine faunal communities in the area of the proposed Port Kembla Outer Harbour Development. Daffron, K., E. Johnston, G., Clark 2009
- 2006: Harbour Health Monitoring Program – Port Kembla Harbour, New South Global Consulting, 2006 (Settlement Plate Studies)
- 2005: Port Kembla Outer Harbour Reclamation Area Sediment Sampling and Testing, Patterson Britton & Partners 2005
- 2004: Tweed, S.J. (2004) Assemblages and Habitat Provision Along Breakwaters: a Comparison with Natural Shores from South Eastern Australia
- 2003: Examination of Port Kembla Harbour Video for Presence of Seagrass, EcoLogical Australia, May 2003
- 2002: Pollard, D.A. & Pethebridge, R.L. (2002) Report on Port Kembla Introduced Marine Pest Species Survey
- 2001: He, Z. & Morrison, R.J. (2001). Changes in the marine environment of Port Kembla Harbour, NSW, Australia, 1975-1995: A Review. Marine Pollution Bulletin 42(3): 193-201
- 1994: Technical Report: Contaminants in Fish from Port Kembla Harbour, EPA NSW, June 1994
- 1992: Port Kembla Dredge Spoil Report: The environmental Impacts of spoil disposal off Port Kembla following construction of the grain terminal, EPA 1992
- 1984: Moran, P.J. (1984). Water quality control and its effect on the concentration of heavy metals in Port Kembla Harbour, N.S.W. Marine Pollution Bulletin 15(8): 294-297.
- Aerial photographs and satellite imagery of the study area

2.2.4 Review of EIS documentation

A number of separate assessments have been undertaken as part of the project EIS to understand existing conditions, inclusive of contamination in sediment and water, noise pollution etc. Findings from these have been reviewed and, where relevant, information used to assess potential impacts from the project on the marine ecology. The review included the following studies:

- Water quality, hydrodynamics and hydrogeology, EIS Volume 1 Chapter 12
- Contamination – dredging and disposal areas report EIS Volume 2 Appendix E3
- Hydrodynamic modelling report, EIS Volume 2 Appendix F
- Noise and vibration assessment report, EIS Volume 2 Appendix L.

Terrestrial biodiversity has been separately assessed within Chapter 14 of the EIS and within EIS Volume 2 Appendix H.

2.3 Site investigation

Following review of legislation, databases, existing studies and EIS assessments, a field validation exercise was undertaken on 5 October 2018 to confirm marine communities at the berth and within the proposed dredge footprint are consistent with previous studies.

Underwater video footage was captured by a diver at three berth piles across the berth. Video was captured from the surface of the water down to the seabed and then 20 m out along the seabed perpendicular to the berth. The video feed was qualitatively interpreted by a marine ecologist.

A review of sediment cores collected from the site as part of the geochemical assessment informed the type of benthic communities that may occur within the Outer Harbour.

2.4 Impact assessment

The impact assessment was undertaken for environmental values and protected matters identified from the desktop assessment (Section 2.2) and site investigation (Section 2.3). To complete this risk assessment the following process was adopted:

- Describe which project activities have potential to harm which environmental features and why (hazard identification)
- Describe the consequences of the potential impact being realised
- Identify relevant management controls to reduce or eliminate the potential environmental risk
- Discuss overall environmental outcomes.

Impact analysis for each identified hazard was conducted in a systematic manner following the general process of:

- Identifying the key concerns
- Consideration of sensitive environmental features potentially affected either directly or indirectly by the activities
- Where practicable, quantification of the magnitude of the stressor, the concentration of contaminant and/or level of disturbance
- Consideration of timing, duration and other factors affecting the impact and risk (water depth temperature, tides etc.).

3. Existing environment

3.1 Environmental legislation

3.1.1 State legislation

Environmental Planning and Assessment Act 1979

The key legislation in NSW for regulation of the use of land is the Environmental Planning and Assessment Act 1979 (EP&A Act) and the Environmental Planning and Assessment Regulation 2000 (EP&A Regulation). The EP&A Act institutes a system for environmental planning and assessment, including approvals and environmental impact assessment requirements for proposed developments. The project has been declared critical State Significant Infrastructure (SSI) in accordance with Section 5.13 of the EP&A Act. The Minister for Planning is the consent authority and the project is to be assessed in accordance with the provisions of Division 5.2 of the EP&A Act.

This EIS has been prepared to address the SEARs issued under section 5.16 and the environmental assessment and consultation requirements under section 5.17 of the EP&A Act.

Fisheries Management Act 1994

The objectives of the *Fisheries Management Act 1994* (FM Act) are to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations. Part 7 of the FM Act requires a permit for a number of activities, including those involving dredging and reclamation work and those involving harm to marine vegetation. The project will involve dredging of around 600,000 m^3 with material anticipated to be primarily disposed of within the Outer Harbour disposal area. In accordance with Section 5.23 of the EP&A Act, a permit under section 201, 205 or 219 of the FM Act is not required for approved SSI, although full assessments of potential impacts must be submitted to the consent authority for consideration.

Schedule 4, 4A and 5 of the FM Act (1994) provides lists of critically endangered, endangered and vulnerable species, populations and ecological communities occurring in NSW. Those of relevance to the project have been identified and assessed under the FM Act assessment criteria for likelihood of occurrence within project area (refer to Section 3.3.1).

Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) aims to conserve biodiversity at a bioregional and state scale and lists a number of threatened species, populations and ecological communities to be considered in deciding whether there is likely to be a significant impact on threatened biota, or their habitats.

Schedule 1 of the BC Act (2016) provides lists of critically endangered, endangered, vulnerable species and populations occurring in NSW. Those of relevance to the project have been identified and assessed under the BC Act assessment criteria for likelihood of occurrence within the project area (refer to Section 3.3.2).

Biosecurity Act 2015

The *Biosecurity Act 2015* (Biosecurity Act) specifies the duties of public and private landholders as to the control of priority pests. The Biosecurity Act defines priority pests by local government area and assigns duties for their control. Part 3 of the Biosecurity Act provides that any person who deals with biosecurity matter and who knows, or ought reasonably to know, the biosecurity risk posed or likely to be posed by the biosecurity matter has a duty to ensure that, so far as is

reasonably practicable, the biosecurity risk is prevented, eliminated or minimised. As such, if present, priority pests located on the project site should be assessed and controlled.

Prohibited matter of relevance to the project include those listed marine species in Part 1 and Part 2 of Schedule 2. These include marine pest finfish, invertebrates and plants.

Protection of the Environment Operations Act 1997

The objectives of the *Protection of the Environment Operations Act 1997* (POEO Act) are to protect, restore and enhance the quality of the environment, in recognition of the need to maintain ecologically sustainable development. The POEO Act provides for an integrated system of licensing and contains a core list of activities requiring an environment protection licence (EPL) from the NSW Environmental Protection Authority (NSW EPA). These activities are called 'scheduled activities' and are listed in Schedule 1 of the POEO Act.

Clause 19 of Schedule 1 defines extractive industries that are considered scheduled activities and includes water based extraction activities that involve the extraction, processing or storage of more than 30,000 tonnes per year of extractive materials. The project will involve excavation and dredging of around 600,000 cubic metres of extractive materials and will therefore constitute a scheduled activity requiring an EPL for construction of the terminal.

Clause 9 of Schedule 1 applies to chemical storage facilities and includes developments with capacity to store more than 200 tonnes of liquefied gases. The FSRU will be permanently moored at the berth and will therefore likely constitute a scheduled activity requiring an EPL.

Section 45 of the Act provides a list of matters to be taken into consideration by the appropriate regulatory authority in licensing functions. Matters of relevance to the project include any relevant pollution likely to be caused by the activity and its likely impact on the environment including the measures to be taken for prevention, control and mitigation of the pollution. Matters of relevance to the project also include any relevant environmental impact statement, or other statement of environmental effects, prepared or obtained under the EP&A Act, any relevant species impact statement prepared or obtained under the *Threatened Species Conservation Act 1995* or Part 7A of the FM Act.

3.1.2 Commonwealth legislation

Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's central piece of environmental legislation that provides a legal framework to protect and manage environmental values considered to be of national environmental significance.

The EPBC Act requires approval from the Commonwealth Minister for the Environment and Resources for actions that are likely to have a significant impact on listed matters of national environmental significance (MNES). It is the responsibility of the applicant proposing to undertake an action to initially consider whether the proposal is likely to have a significant impact on any MNES. If the applicant considers there is potential for significant impacts upon any matters protected under the EPBC Act, then a referral is required to be submitted to the Minister for the Environment and Energy. Developments considered likely to result in significant impacts are defined as "controlled actions" and require assessment and approval.

Consideration of potential impacts upon listed threatened species and communities and any other MNES potentially impacted by the project has been undertaken as part of the EIS (refer to Section 3.3.3). The project is not considered likely to have a significant impact on MNES, therefore the project has not been referred to the Minister under the EPBC Act.

3.2 Marine habitat

3.2.1 Biofouling community

Hard substrate habitat within Port Kembla consists of infrastructure such as breakwalls, piles and quay walls around the perimeter of the port. Such hard substrate presents ideal habitat for biofouling communities within the sheltered environment. Assemblages around the Inner Harbour have been described by previous studies as sparse with community structures reflective of the highly disturbed environment; species noted within these communities are polychaete worms, bryozoans, barnacles and ascidians (Worley Parsons, 2012). Comparatively, a higher diversity and abundance of sessile invertebrates has previously been reported in the Outer Harbour (Worley Parsons, 2012).

Surveys of the berth piles undertaken in 2012 identified the Sydney rock oyster (*Saccostrea glomerata*) dominating the intertidal zone while oyster limpets (*Patelloida mimula*) were common and sea squirts (*Cunjevoi pyura*) were occasionally present (Worley Parsons, 2012). The subtidal zone (down to 2 m depth) consisted of a mixture of encrusting bryozoan (*Watersipora subtorquata*), polychaete tubeworms (predominantly *Hydroides elegans*), compound ascidians (*Botrylloides leachii*), solitary ascidians (*Styela plicata*) and blue mussels (*Mytilus galloprovincialis*) (Worley Parsons, 2012). Large hydroids, arborescent bryozoans (*Bugula flabellata* and *Bugula stolonifera*), small sponges and barnacles were also common in this zone. Beyond 2 m depth, encrusting communities were smothered by silt inhibiting identification of taxa (Worley Parsons, 2012). Introduced species accounted for 50 % of the coverage of the hard substrate assemblages within Port Kembla (Johnston, 2006).

Biofouling communities identified during the 2018 field investigation were generally consistent with those recorded during the 2012 survey, refer to Plate 3-1. Oysters and gastropods dominated the intertidal zone with compound ascidians, tubeworms and bryozoans present in the subtidal zone. A differentiator with the previous survey was the presence of the brown algae *Dictyota dichotoma* at the shallow sub-tidal zone. This difference is potentially a result of seasonal variation.

Plate 3-1 Biofouling communities on the berth piles

3.2.2 Benthic communities

The seabed within the Inner Harbour has previously been described as consisting of fine, unconsolidated silt expanses with large decapod burrows (Worley Parsons, 2012). This was also confirmed during the 2018 field investigation via the underwater video footage, refer to Plate 3-2.

Historically the seagrass species *Halophila ovalis* has been recorded within the Inner Harbour benthos (Pollard and Pethebridge, 2002; EcoLogical Australia, 2003). More recently this species has not been detected. Surveys in 2012 and 2018 confirm the persistent absence of any seagrasses from the Inner Harbour dredge footprint (Worley Parsons, 2012; current survey results). Furthermore, no seagrass was recorded in the Outer Harbour reclamation area during the conduct of the geochemical assessment in 2018. There are no known mapped seagrass communities adjacent to the project.

Macroalgae has been known to occur in sparse distributions across soft sediments habitats within both the Inner Harbour and Outer Harbour. The diversity and abundance has been considered to be higher in the Outer Harbour compared to the Inner Harbour, with 26 and 15 species recorded, respectively (Pollard and Pethebridge, 2002). The dominant forms of macroalgae were encrusting and turfing algae present in across areas surveyed in the Outer Harbour at depths greater than 10 m (AECOM, 2010). Although macroalgae have been previously observed in the Inner Harbour, 2018 investigations identified none are present within the proposed dredge footprint, other than those described along the berth piles (refer to Section 3.2.1).

Plate 3-2 Benthic communities within proposed dredging footprint

3.2.3 Fish communities

The different habitats within the Inner and Outer Harbour have been found to support varying diversities in fish assemblages and compositions. The higher diversity within the Outer Harbour as observed during the 1999, 2002 and 2009 surveys may have reflected the use of area, including macroalgal habitat and breakwater, as nursery for juvenile species (AWT, 1999; AECOM, 2010). The eastern breakwater environments also provided niche habitat for species including mado (*Atypichthys strigatus*), yellowtail (*Trachurus novaezelandiae*) and moon-wrasse (*Thalassoma lunare*) (AECOM, 2010). Whereas other species such as the red morwong (*Cheilodactylus fuscus*) was the only species observed in deeper soft sediment habitat (AECOM, 2010). In contrast the highly utilised and developed Inner Harbour is not known to support as many species. Those that occur are typical of inshore habitats being glass perchlet (*Ambassis jacksoniensis*) and Japanese striped goby (*Tridentiger trigonocephalus*) AWT, 1999; Pollard & Pethebridge, 2002; UNSW, 2009). Fish assemblages identified as part of these studies are common across the region and did not include any threatened species.

3.3 Marine fauna

A likelihood of occurrence assessment was conducted on marine fauna identified by the PMST and BioNet Atlas searches to determine the likelihood of these species, or species' habitat, occurring within the Port Kembla area.

A likelihood of occurrence ranking was attributed to each species based on the following framework:

- **Unlikely to occur**: species has not been recorded in the region AND/OR current known distribution does not encompass the Port Kembla region AND/OR suitable habitat is generally lacking from the Inner and Outer Harbours.
- **May occur**: mapped species' distribution incorporates the Port Kembla region AND/OR potentially suitable habitat occurs within the Inner and Outer Harbours.
- **Likely to occur**: species has been recorded in the region and potentially suitable habitat is present within the Inner and Outer Harbours.

The following sections detail the likelihood of occurrence assessments and rankings for each species identified in the Protected Matters search against the relevant legislation, including life history and habitat information, which was used to inform the assessments.

3.3.1 Fisheries Management Act 1994

Schedule 4, 4A and 5 of the FM Act provides lists of critically endangered, endangered and vulnerable species, populations and ecological communities occurring in NSW. These are summarised in Table 3-1 and discussed in more detail below.

The grey nurse shark (*Carcharias taurus*) was identified as the only **critically endangered** species listed under Schedule 4 of the FM Act to potentially occur in the Port Kembla area and was assessed under the FM Act assessment criteria (Table 3-1). The species is known to aggregate and migrate between key locations along the NSW coastline and a critical habitat site for the species, located at Bass Point 10 km south of Port Kembla (NSW DPI, 2016a). The species may transit the region during local migrations between aggregation sites however, the port environment is not considered to be key habitat for this species.

The Australian grayling (*Prototrocetes marena*) was identified as the only **endangered** species under Schedule 4A of the FM Act 1994 with potential to occur in the Port Kembla area and was assessed under the FM Act assessment criteria (Table 3-1). Australian grayling undergo a marine phase as juvenile fish to grow into adults before migrating back into freshwater environment. The closest known record of the species is in the estuary at Minnamurra, approximately 50 km south of Port Kembla (NSW DPI, 2016b). Due to the distance from this record, lack of suitable habitat and absence of records from previous port surveys, it is unlikely that the species will be present in the Port Kembla area.

The black rockcod (*Epinephelus daemelii*) and great white shark (*Carcharodon carcharias*) were identified as the only **vulnerable** species under Schedule 5 of the FM Act to potentially occur in the Port Kembla area and were assessed under the FM Act assessment criteria (Table 3-1). Juveniles of the black rockcod are commonly found in inshore areas and estuaries where there is suitable sheltered habitat such as rock crevices, caves and gutters (NSW DPI, 2015). It is possible that the species could use the rock breakwalls, piles and quay walls within the port, however previous investigations within Port Kembla have not identified the black rockcod as present within the port (AECOM, 2010; Worley Parsons, 2012). The black rockcod is therefore identified as having a 'may occur' likelihood of occurrence.

The great white shark is known to be present near seal colonies and thus may visit the wider region as a transient visitor due to the nearby seal haul out site at the Five Islands Nature

Reserve (DSEWPC, 2013). However, it is considered unlikely that the species will venture into the shallow waters of Port Kembla where there is frequent movement of vessels causing disturbance and a lack of food sources.

Table 3-1 Potential for species listed under the FM Act 1994 to occur at the project site

Species	Status (FM Act)	Distribution and habitat	Likelihood of occurrence
Grey nurse shark (*Carcharias taurus*)	CE	Found primarily in warm temperate inshore waters around rocky reefs and islands, in or near deep sandy-bottomed gutters or caves. In southern NSW, the species can be found at reefs around Sydney, Bateman's Bay and Narooma (DoEE, 2018).	**May occur** Species may transit the area during migrations.
Australian grayling (*Prototrocetes marena*)	En	Spawning occurs between late summer and winter in lower freshwater reaches of rivers. Larvae drift out to sea before migrating back into freshwaters in spring where individuals remain for the remainder of their lives (DoEE, 2018).	**Unlikely to occur** Habitat within Port not suitable for species.
Black rockcod (*Epinephelus daemelii*)	V	Usually found in caves, gutters and beneath bommies on rocky reefs, from near shore to depths of at least 50 m (NSW DPI, 2015).	**May occur** Species may use habitat within Port as shelter.
White shark (*Carcharodon carcharias*)	V	Typically found from inshore waters to the outer continental shelf and more frequently found in waters with high prey density, such as around fur seal colonies (DoEE, 2018).	**Unlikely to occur** Habitat within Port not suitable for species.

3.3.2 Biodiversity Conservation Act 2016

The NSW government introduced the BC Act in 2016 and repealed the former *Threatened Species Conservation Act 1994*. Schedule 1 of the BC Act provides lists of critically endangered, endangered, vulnerable species and populations occurring in NSW. These are summarised in Table 3-2 and discussed in more detail below. Critically endangered marine species listed under Schedule 1 of the BC Act are unlikely to occur within the Port Kembla area.

The southern right whale (*Eubalaena australis*) is listed as **endangered** under Schedule 1 of the BC Act and is likely to occur within the Outer Harbour having been previously recorded within the port (Worley Parsons, 2012). This species was assessed under the BC Act assessment criteria (Table 3-2; Appendix B).

The blue whale (*Balaenoptera musculus*) is listed as **endangered** under Schedule 1 of the BC Act 2016. The species is unlikely to occur within Port Kembla due to lack of suitable habitat.

Both leatherback and loggerhead turtles are listed as **endangered** under Schedule 1 of the BC Act 2016, whereas the green turtle is listed as **vulnerable**. These species were assessed under the BC Act assessment criteria (Table 3-2; Appendix B). These turtles could potentially visit the port as transient visitors however, it is unlikely that they use the port for nesting or foraging purposes and as such, these species are considered unlikely to occur within the Port Kembla area.

The long-nosed fur seal (*Arctocephalus forsteri*) and the Australian fur seal (*Arctocephalus pusillus*) are listed as **vulnerable** under Schedule 1 of the BC Act 2016 and are both likely to occur, having been previously recorded within the Outer Harbour. The species were assessed under the BC Act assessment criteria (Table 3-2; Appendix B). There is a known haul out site for the Australian fur seal, approximately 3.5 km from the port entrance, at the Five Islands Nature Reserve (Department of Environment and Conservation NSW, 2005).

Review of each species habitats and distributions identified the southern right whale and two fur seals as having a 'possible' likelihood of occurrence within the project area and were therefore further assessed under the BC Act (refer to Appendix B).

Table 3-2 Potential for species listed under the BC Act 2016 to occur at the project site

Species	Status (BC Act)	Distribution and habitat	Likelihood of occurrence
Southern right whale (*Eubalaena australis*)	En	Oceanic waters between 20° S and 55° S however, moves close inshore (5-10 m depth) during winter for calving and mating (NSW OEH, 2018b).	**Likely to occur** Records of sightings for the Outer Harbour.
Blue whale (*Balaenoptera musculus*)	En	Species habitat is variable between the two sub-species found in Australian waters. The Antarctic blue whale tends to remain at high latitudes, migrating to lower latitudes for feeding, breeding and calving during the Australian summer (DoEE 2018). The pygmy blue whale expands throughout the Indian Ocean, with individuals moving between Australia and Indonesia (DoEE 2018).	**Unlikely to occur** Habitat unsuitable for species.
Leatherback turtle, Leathery turtle (*Dermochelys coriacea*)	En	Occurs in inshore and offshore marine waters. Pelagic however, ventures close to shore during the nesting season. Forages throughout Australian coastal shelf waters (DoEE, 2018)	**Unlikely to occur** Foraging habitat not found within the Port.
Loggerhead turtle (*Caretta caretta*)	En	Pelagic species that forage in deeper waters. Have been recorded as far south as Jervis Bay. Females come ashore to lay eggs on tropical beaches during warmer months (NSW OEH, 2018b).	**Unlikely to occur** Nesting and foraging habitat not found within the Port.
Green turtle (*Chelonia mydas*)	V	Widely distributed in tropical and sub-tropical seas but can occur in coastal waters of NSW. Ocean-dwelling and spends most of its lifecycle at sea however they settle in shallow benthic foraging habitats such as tropical tidal and sub-tidal coral and rocky reef habitat and	**Unlikely to occur** Nesting and foraging habitat not found within the Port.

Species	Status (BC Act)	Distribution and habitat	Likelihood of occurrence
		inshore seagrass beds (DoEE, 2018). Females also lay eggs on beaches throughout their range (NSW OEH, 2018b).	
Long-nosed fur seal, New Zealand fur seal (*Arctocephalus forsteri*)	V	Occurs in Australian coastal waters and offshore islands of South and Western Australia as well as southern Tasmania (IUCN, 2018). Small populations also present along the southern NSW coast, particularly on Montague Island but also other isolated areas to north of Sydney (NSW OEH, 2018b).	**Likely to occur** Known haul-out site near Port Kembla.
Australian fur seal, Australo-african fur-seal (*Arctocephalus pusillus*)	V	Preference for rocky parts of islands and foraging occurs in oceanic waters of the continental shelf. There are 10 established breeding colonies, all restricted to the Bass Strait with six occurring in Victoria and four in Tasmania. In NSW the species can be found at Montague Island (DoEE, 2018).	**Likely to occur** Known haul-out site near Port Kembla.

3.3.3 Environmental Protection and Biodiversity Conservation Act 1999

The following provides an assessment of MNES relevant to the project area. The EPBC Act PMST (Appendix A) was used to identify MNES and other matters protected under the EPBC Act that are predicted to occur in, or relate to the project area. A PMST search, using a point taken between the Inner and Outer Harbour, including a 5 km buffer area, identified the following relevant matters:

- No Wetlands of International Significance
- No Commonwealth Marine Areas
- 69 Listed Threatened Species (marine species excluding marine birds)
- 56 Listed Migratory Species (marine species excluding marine birds)
- 83 Listed Marine Species
- 12 Whales and other Cetaceans

Review of the habitat requirements and distributions for the species identified in the Protected Matters search identified a number of species as likely present within Port Kembla (Table 3-3).

Forty two threatened and/or migratory marine bird species were identified in the PMST as being potentially relevant to the project area or surrounding area. Marine birds may occasionally overfly the region, however the project area does not support important habitat for marine birds such as mudflats, sandflats and wetlands. Likelihood of occurrence for the threatened and/or migratory birds is provided in Table 3-4 and Table 3-5.

The following species were therefore assessed under the EPBC Act 1999 'in accordance with the Significant Impact Guidelines 1.1' (Commonwealth of Australia, 2013) in Appendix C:

- Southern right whale (*Eubalaena australis*)
- Humpback whale (*Megaptera novaeangliae*)
- Long-nosed fur seal (*Arctocephalus forsteri*)
- Australian fur seal (*Arctocephalus pusillus*)
- Indian ocean bottlenose dolphin (*Tursiops aduncus*)
- Bottlenose dolphin (*Tursiops truncates s. str.*)

Table 3-3 Potential for species listed under the EPBC Act 1999 to occur at the project site

Species	Status (EPBC Act)	Distribution and habitat	Likelihood of occurrence
Listed threatened species			
Black rockcod, Black cod, Saddled rockcod (*Epinephelus daemelii*)	V	Usually found in caves, gutters and beneath bommies on rocky reefs, from near shore to depths of at least 50 m (NSW DPI, 2015)	**May occur** Species likely to use habitat within Port as shelter.
Australian Grayling (*Prototroctes maraena*)	V	Spawning occurs between late summer and winter in lower freshwater reaches of rivers. Larvae drift out to sea before migrating back into freshwaters in Spring where individuals remain for the remainder of their lives (DoEE, 2018).	**Unlikely to occur** Habitat within Port Kembla not suitable for species.
Blue whale (*Balaenoptera musculus*)	En, Mig Listed marine species Whales and Cetaceans	Species habitat is variable between the two sub-species found in Australian waters. The Antarctic blue whale tends to remain at high latitudes, migrating to lower latitudes for feeding, breeding and calving during the Australian summer (DoEE 2018). The pygmy blue whale expands throughout the Indian Ocean, with individuals moving between Australia and Indonesia (DoEE 2018).	**Unlikely to occur** Habitat unsuitable for species.
Southern right whale (*Eubalaena australis*)	En, Mig Listed marine species Whales and Cetaceans	Oceanic waters between 20° S and 55° S however, moves close inshore (5-10 m depth) during winter for calving and mating (NSW OEH, 2018b).	**Likely to occur** Records of sightings within Outer Harbour.
Humpback whale (*Megaptera novaeangliae*)	V, Mig Listed marine species	Oceanic waters. Regularly observed in NSW waters in June and July during northward migration, and October and November during Sothern	**Likely to occur** Records of sightings within Outer Harbour.

Species	Status (EPBC Act)	Distribution and habitat	Likelihood of occurrence
	Whales and Cetaceans	migration (NSW OEH, 2018b). Humpback whale sighted in the Inner Harbour in August 2006 and September 2012.	
Loggerhead turtle (*Caretta caretta*)	En, Mig Listed marine species	Pelagic species that forage in deeper waters. Have been recorded as far south as Jervis Bay. Females come ashore to lay eggs on tropical beaches during warmer months (NSW OEH, 2018b).	**Unlikely to occur** Nesting and foraging habitat not present within Port.
Green turtle (*Chelonia mydas*)	V, Mig Listed marine species	Widely distributed in tropical and sub-tropical seas but can occur in coastal waters of NSW. Ocean-dwelling and spends most of its lifecycle at sea however they settle in shallow benthic foraging habitats such as tropical tidal and sub-tidal coral and rocky reef habitat and inshore seagrass beds (DoEE, 2018). Females also lay eggs on beaches throughout their range (NSW OEH, 2018b).	**Unlikely to occur** Nesting and foraging habitat not present within Port.
Leatherback turtle, Leathery turtle (*Dermochelys coriacea*)	En, Mig Listed marine species	Occurs in inshore and offshore marine waters. Highly pelagic however, ventures close to shore during the nesting season. Forages throughout Australian coastal shelf waters (DoEE, 2018)	**Unlikely to occur** Nesting and foraging habitat not present within Port.
Hawksbill turtle (*Eretmochelys imbricata*)	V, Mig Mig Listed marine species	Pelagic during first 5-10 years then settling in tropical tidal and sub-tidal coral and rocky reef habitat. Have been recorded in temperate regions as far south as Northern NSW (DoEE, 2018).	**Unlikely to occur** Nesting and foraging habitat not present within Port.
Flatback turtle (*Natator depressus*)	V, Mig Listed marine species	Found only in the tropical waters of northern Australia, Papua New Guinea and Irian Jaya, inhabiting soft bottom sediments over the continental shelf (DoEE, 2018).	**Unlikely to occur** Nesting and foraging habitat not present within Port.
Grey nurse shark (east coast population) (*Charcharias taurus*)	CE	Found primarily in warm temperate inshore waters around rocky reefs and islands, in or near deep sandy-bottomed gutters or caves. In southern NSW, the species can be found at reefs around Sydney, Bateman's Bay and Narooma (DoEE, 2018). A critical habitat site for the species is located at Bass Point, 10 km	**May occur** Individuals may transit the area during migrations between aggregation areas.

Species	Status (EPBC Act)	Distribution and habitat	Likelihood of occurrence
		south of Port Kembla (NSW DPI, 2016a).	
White shark, Great white shark (*Carcharodon carcharias*)	V, Mig	Typically found from inshore waters to the outer continental shelf and more frequently found in waters with high prey density, such as around fur seal colonies (DoEE, 2018). Known aggregations occur in nearshore waters of NSW, the most well-known of these occurs at Stockton Beach, Newcastle (DoEE, 2018).	**Unlikely to occur** Habitat unsuitable for species.
Whale shark (*Rhincodon typus*)	V, Mig	Oceanic and coastal, often seen far offshore but also comes close inshore and sometimes enters lagoons or coral atolls. Most commonly seen in waters off northern WA, NT and Queensland (DoEE, 2018)	**Unlikely to occur** Habitat unsuitable for species.
Listed migratory species (not listed above as a Listed Threatened Species)			
Bryde's whale (*Balaenoptera edeni*)	Mig Listed marine species Whales and Cetaceans	Occurs in temperate to tropical waters, both oceanic and inshore, and has been recorded in all Australian States except NT (DoEE, 2018).	**Unlikely to occur** Habitat unsuitable for species.
Pygmy right whale (*Caperea marginata*)	Mig Listed marine species Whales and Cetaceans	Records of the species in Australian waters are distributed between 32° S and 47° S however few or no records are available for NSW, eastern Victoria and the northern part of the Great Australian Bight (DoEE, 2018).	**Unlikely to occur** Habitat unsuitable for species.
Dusky dolphin (*Lagenorhynchus obscurus*)	Mig Listed marine species Whales and Cetaceans	Occurs in temperate and sub-Antarctic waters throughout the southern hemisphere and across southern Australian waters from WA to Tasmania however is considered uncommon in Australian waters (DoEE, 2018).	**Unlikely to occur** Port Kembla is outside the range of this species.
Porbeagle, Mackerel shark *(Lamna nasus*)	Mig	Primarily inhabits oceanic waters around the edge of the continental shelf, occasionally moving into coastal waters. In Australia, the species occurs in waters from Southern Queensland to south-west Australia (Francis *et al*., 2002).	**Unlikely to occur** Port Kembla is outside the range of this species.
Giant manta ray, chevron manta ray, Pacific manta ray,	Mig	Occurs in offshore waters, often around oceanic islands, sometimes coastal, and most common in tropical waters.	**Unlikely to occur**

Species	Status (EPBC Act)	Distribution and habitat	Likelihood of occurrence
Pelagic manta ray, Oceanic manta ray (*Manta birostris*)		Uncommon in Australian waters although does aggregate around Ningaloo Reef (Fishes of Australia, 2018).	Habitat unsuitable for species.
Killer whale, Orca (*Orcinus orca*)	Mig Listed marine species Whales and Cetaceans	Occurs in all Australian waters and frequently in South Australia, Victoria and Tasmania on the continental shelf and near seal colonies. Preferred habitat includes oceanic, pelagic and neritic regions, in both warm and cold waters (DoEE, 2018).	**Unlikely to occur** Habitat unsuitable for species.
Listed marine species (not previously listed)			
Long-nosed fur seal, New Zealand fur seal (*Arctocephalus forsteri*)	Listed marine species	Occurs in Australian coastal waters and offshore islands of South and Western Australia as well as southern Tasmania (IUCN, 2018). Small populations also present along the southern NSW coast, particularly on Montague Island but also other isolated areas to north of Sydney (NSW OEH, 2018b).	**Likely to occur** Potential haul-out site at Five Islands.
Australian fur seal, Australo-african fur-seal (*Arctocephalus pusillus*)	Listed marine species	Preference for rocky parts of islands and foraging occurs in oceanic waters of the continental shelf. There are 10 established breeding colonies, all restricted to the Bass Strait with six occurring in Victoria and four in Tasmania. In NSW the species can be found at Montague Island (DoEE, 2018). Seals are semi regular (every 1-2 years) visitors to the Outer Harbour.	**Likely to occur** Known haul-out site at Five Islands.
Minke whale (*Balaeanoptera acutorostrata*)	Listed marine species Whales and Cetaceans	Occurs widely in tropical, temperate and polar waters of both hemispheres. In the southern hemisphere, most commonly found in waters south of 60° S. Occurs both offshore and inshore and can enter coastal rivers and lagoons. Recorded in all Australian States except the NT (Smith, 2001).	**Unlikely to occur** Habitat unsuitable for species.
Common dolphin, Short-beaked common dolphin (*Delphinus delphis*)	Listed marine species Whales and Cetaceans	Found in offshore waters, they have been recorded off all Australian States and territories and appear to occur in two main clusters; southern-southeastern	**Unlikely to occur** Habitat unsuitable for species.

Species	Status (EPBC Act)	Distribution and habitat	Likelihood of occurrence
		Indian Ocean and the Tasman Sea (DoEE, 2018).	
Risso's dolphin, Grampus (*Grampus griseus*)	Listed marine species Whales and Cetaceans	Inhabits subtropical, temperate and subantarctic waters, both inshore and offshore although is generally considered pelagic and oceanic. Occurs mainly in upper continental slope usually in waters deeper than 1000 m. In Australia, the species has been recorded in all states except Tasmania and NT (DoEE, 2018).	**Unlikely to occur** Habitat unsuitable for species.
Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin (*Tursiops aduncus*)	Listed marine species Whales and Cetaceans	Occurs continuously around Australian mainland in estuarine and coastal waters (DoEE, 2018).	**Likely to occur** Species known throughout NSW and habitat occurs in Port area.
Bottlenose dolphin (*Tursiops truncates s. str.*)	Listed marine species Whales and Cetaceans	Occurs throughout Australian waters, usually found offshore in waters deeper than 30 m but may be found in coastal waters (DoEE, 2018).	**Likely to occur** Species known throughout NSW and habitat occurs in Port area.
Syngnathids 21 species (i.e. seahorses, seadragons, pipefish and pipehorses)	Listed marine species	In NSW, found in a variety of habitats ranging from deep reefs to coastal algae, weed or seagrass habitats, or around man-made structures such as jetties or mesh nets (NSW DPI, 2018).	**May occur** Habitat may be suitable for species.

Note: CE: Critically Endangered; En: Endangered; V: Vulnerable; Mig: Migratory

Table 3-4 Potential for bird species listed under the EPBC Act 1999 to occur at the project site

Species	Status (EPBC Act)	Distribution and habitat	Likelihood of occurrence
Antipodean albatross (*Diomedea antipodensis*)	V, Mig	A pelagic marine bird that forages in the southwest Pacific Ocean, Southern Ocean and Tasman Sea (Walker and Elliot, 2006). The species is also known to forage off the coast of NSW (DoEE, 2018). Antipodes Island (southwest of New Zealand) is the major breeding area, although a small colony also nests on Campbell Island (south of New Zealand) (Walker and Elliot, 2006).	**Unlikely to occur** Core habitat for this species is not found within the project area. This species is unlikely to occur in the area.
Australasian bittern (*Botaurus poiciloptilus*)	En	The Australasian bittern occurs from south-east QLD to south-east SA, Tasmania (TAS) and in the south-west of WA. The Australasian Bittern's preferred habitat is comprised of wetlands with tall dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water. It favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and reeds growing over a muddy or peaty substrate (TSSC, 2011).	**Unlikely to occur** Core habitat for this species is not found within the project area. This species is unlikely to occur in the area.
Australian fairy tern (*Sternula nereis nereis*)	V	The Australian fairy tern is known from the coastline around Australia (excluding NT), with sightings concentrated in VIC, SA, WA and TAS. The Australian fairy tern was known to occur in NSW, however they are now considered to be absent within the state (DoEE, 2018)	**Unlikely to occur** This species is unlikely to occur in the area.
Australian painted snipe (*Rostratula australis*)	En	The Australian painted snipe has been most commonly recorded in eastern Australia, and at wetlands across all states. This species generally inhabits freshwater wetlands and water logged grassland or saltmarsh (Marchant and Higgins, 1993). In NSW, the painted snipe was recorded from the Murray-Darling Basin (NSW Scientific Committee, 2014).	**Unlikely to occur** Core habitat for this species is not found within the project area.
Bar-tailed godwit (bauera), western Alaskan bar-tailed godwit (*Limosa lapponica baueri*)	V	The bar-tailed godwit is widespread along the east and south east coast of QLD, NSW and VIC. The species occurs in coastal habitats and brackish wetlands, foraging in sheltered intertidal areas, and roosting on sandy beaches, sandbars and spits (Marchant and Higgins, 1993). Breeding areas are in northeast Siberia and west Alaska	**May occur** The project area is highly modified and is not considered to support foraging and roosting for this species. This species may fly over the region

Species	Status (EPBC Act)	Distribution and habitat	Likelihood of occurrence
		(Higgins and Davies, 1996). Undertakes migrations south from breeding grounds in the Northern Hemisphere. Departs for Australia in July, and arrives in August in northwest Australia at which point small numbers disperse throughout Australia. Commences the return journey in February (Marchant and Higgins, 1993).	during annual migrations.
Black-browed albatross (*Thalassarche melanophris*)	V, Mig	The black-browed albatross is a pelagic species that occurs throughout Antarctic, sub-Antarctic and temperate waters. Breeding occurs on sub-Antarctic and Antarctic islands (Marchant and Higgins, 1990). Towards the end of breeding season, the species migrates northwards to the continental shelves of South America, South Africa and southern Australia (VIC, TAS and NSW) (DoEE, 2018).	**Unlikely to occur** Core habitat for this species is not found within the project area. This species is unlikely to occur in the area.
Buller's albatross, pacific albatross (*Thalassarche bulleri*)	V, Mig	The Buller's albatross inhabits the sub-tropical and sub-Antarctic waters of the southern Pacific Ocean (Marchant and Higgins, 1990). This species breeds in the Chatham, Snares and Solander Islands in New Zealand, but its distribution extends into Australian waters, including off the coast of Sydney (DoEE, 2018). Migration and dispersal patterns are poorly understood, although there is some evidence that juvenile birds migrate to the Humboldt Current between eastern Australia and western South America (Marchant and Higgins, 1990).	**Unlikely to occur** Core habitat for this species is not found within the project area. This species is unlikely to fly over the area.
Campbell albatross, campbell black-browed albatross (*Thalassarche impavida*)	V, Mig	The Campbell albatross is known to forage over the continental shelf off NSW, VIC and TAS. The only known breeding area for this species is Campbell Island off the southern coast of New Zealand (DoEE, 2018; Marchant and Higgins, 1990).	**Unlikely to occur** Core habitat for this species is not found within the project area. This species is unlikely to occur in the area.
Chatham albatross (*Thalassarche eremita*)	En, Mig	The Chatham albatross has only one known breeding area– The Pyramid, off the east coast of New Zealand (DoEE, 2018). The species forages in the coastal waters of Tasmania and southern and eastern New Zealand, and there is some evidence to suggest that the species undertakes migrations to the coast of South America. This species is considered a rare visitor to southeast Australian waters (Marchant and Higgins, 1990).	**Unlikely to occur** Core habitat for this species is not found within the project area. This species is unlikely to fly over the area.

Species	Status (EPBC Act)	Distribution and habitat	Likelihood of occurrence
Curlew sandpiper (*Calidris ferruginea*)	CE, Mig	The curlew sandpiper occurs along the coastlines and inland waters of Australia. Commonly found foraging on sheltered intertidal mudflats and roosting on dry beaches, spits and islets. Breeding occurs during June and July in Siberia. Species depart breeding grounds in early August, and arrive in Australia in late August and early September. Flocks stopover in northern Australia and arrive in south-eastern Australia in September (DoEE, 2018). This bird is known to forage on shorelines only and is not a marine bird.	**May occur** The project area is highly modified and is not considered to support foraging and roosting for this species. This species may overfly the region during annual migrations.
Eastern curlew, far eastern curlew (*Numenius madagascariensis*)	CE, Mig	The eastern curlew is a migratory shorebird, frequently found in the north, east and south-east regions in Australia. The species forages in open, sheltered intertidal mudflats and sandflats, and roosts on sandy spits and islets (Marchant and Higgins, 1993). Breeds in northern hemisphere, migrating into Australia in boreal winter. Arrives in eastern Australia, NSW, from August to December (DoEE, 2018; Marchant and Higgins, 1993). This bird is known to feed on shorelines only and is not a marine bird.	**May occur** The project area is highly modified and is not considered to support foraging and roosting for this species. This species may overfly the region during annual migrations.
Fairy prion (southern) (*Pachyptila turtur subantarctica*)	V	The fairy prion forages over continental shelves and the continental slope, and occasionally feeds in deep coastal waters. Breeding occurs on Macquarie Island and has been previously recorded on New Zealand offshore islands (DoEE, 2018). Little information is available on migration pathways.	**Unlikely to occur** Core habitat for this species is not found within the project area. This species is unlikely to fly over the area.
Gibson's albatross (*Diomedea antipodensis gibsoni*)	V	The Gibson's albatross has been known to forage between Coffs Harbour, NSW and Wilson's Promontory, VIC. Other feeding areas include the Tasman Sea and lower latitudes towards the mid-Pacific Ocean. Nesting occurs on Adam's Island and Auckland Island off the coast of New Zealand. Only one bird of this species has been recorded Australia. It was recaptured off Wollongong, NSW in September 1997 (DoEE, 2018).	**Unlikely to occur** Core habitat for this species is not found within the project area. This species is unlikely to occur in the area
Gould's petrel, Australian Gould's petrel (*Pterodroma leucoptera leucoptera*)	En	This subspecies of Gould's petrel is endemic to Australian waters (DoEE, 2018; O'Dwyer *et al.*, 2007). Little is known of the movement, migration and dispersal patterns of this species; however, it is thought that during the non-breeding season, birds move to	**May occur** No critical habitat for this species known to occur within the project area.

Species	Status (EPBC Act)	Distribution and habitat	Likelihood of occurrence
		the north Tasman Sea or east Pacific Ocean. Breeding occurs in only two areas – Cabbage Tree Island and the Boondelbah Islands, off the Newcastle coast (DoEE, 2018; Marchant and Higgins, 1990; Roberson and Bailey, 1991).	This species may fly over or forage in the surrounding area.
Kermadec petrel (western) (*Pterodroma neglecta neglecta*)	V	The Kermadec petrel is a pelagic petrel of the Pacific Ocean (Marchant and Higgins, 1990). This species breeds on islands, islets and atolls in the southern Pacific Ocean. Within Australia, the species nests at Ball's Pyramid (off the coast of Port Macquarie) and Phillip Island. This species occasionally reaches the eastern coast of the Australian mainland (DoEE, 2018).	**Unlikely to occur** Core habitat for this species is not found within the project area. This species is unlikely to occur in the area.
Northern buller's albatross, pacific albatross (*Thalassarche bulleri platei*)	V	The northern buller's albatross inhabits the sub-tropical and sub-Antarctic waters of the southern Pacific Ocean (Marchant and Higgins, 1990). This species only breeds on Chatham and Three Kings Island in New Zealand. In Australian water, this species is a non-breeding visitor and is known to forage near the east coast (DoEE, 2018).	**Unlikely to occur** Core habitat for this species is not found within the project area. This species is unlikely to occur in the area.
Northern giant-petrel (*Macronectes halli*)	V, Mig	The northern giant petrel breeds on sub-Antarctic islands (Marchant and Higgins, 1990). Adult species generally remain close to breeding areas year-round; however, juveniles undertake long dispersal events, although these movements are not well-understood (Marchant and Higgins, 1990). This species is commonly seen in the winter months in the inshore and offshore waters of Sydney (Pizzey and Knight, 1999).	**May occur** The project area is highly modified and is not considered to support foraging and roosting for this species. This species may overfly the region during annual migrations.
Northern royal albatross (*Diomedea sanfordi*)	En, Mig	The pelagic northern royal albatross occurs in the Australian coastal and marine aerial habitats in the southern Indian Ocean, and from south eastern Australia through to Antarctica. The species is known to frequently forage in Tasmanian and South Australian waters, but less frequently in NSW waters (DoEE, 2018). Breeding grounds occur on Chatham Island and Taiaroa Head on the South Island of New Zealand (DoEE, 2018).	**Unlikely to occur** Core habitat for this species is not found within the project area. This species is unlikely to occur in the area.
Northern Siberian bar-tailed godwit, bar-tailed godwit (menzbieri)	CE	The bar-tailed godwit, slightly larger and stockier than the L. limosa, breeds in northern Siberia and spends most of its non-breeding period in north of Western Australia (Higgins and Davies, 1996). The species has been recorded regularly	**Unlikely to occur** Core habitat for this species is not found within the project area. This species

Species	Status (EPBC Act)	Distribution and habitat	Likelihood of occurrence
(*Limosa lapponica menzbieri*)		along the east and south east coasts of QLD, NSW and VIC. This species migrates to Norfolk Island, Lord Howe Island and sub-Antarctic islands (DoEE, 2018)	is unlikely to occur in the area.
Orange-bellied parrot (*Neophema chrysogaster*)	CE	The orange-bellied parrot breeds during the summer in a coastal strip of south-western Tasmania and migrates northwards to feed in coastal marshes and dunes. Historical reports of this species were recorded in the Sydney region, however more recent records are quite rare (DoEE, 2018).	**May occur** This species may overfly the region during annual migrations.
Red knot, knot (*Calidris canutus*)	En, Mig	The red knot is a coastal bird occurring in most suitable habitats in Australia. They inhabit sheltered intertidal flats and sand beaches. This species is typically scarce in NSW, this is due to the lack of suitable habitat (Higgins and Davies, 1996). The red knot migrates from breeding grounds in north east Siberia to Australia, arriving in August (DoEE, 2018). This bird is known to feed on shorelines only and is not a marine bird.	**May occur** The project area is highly modified and is not considered to support foraging and roosting for this species. This species may overfly the region during annual migrations.
Salvin's albatross (*Thalassarche salvini*)	V, Mig	The Salvin's albatross breeds off the south coast of New Zealand, and Crozet Island in the Indian Ocean (Gales, 1998). The foraging area for this species covers much of the southern Pacific Ocean, and it is particularly associated with the Humboldt Current. Salvin's albatross are less oceanic than most albatross species, and are described as occurring more frequently inshore than offshore (Marchant and Higgins, 1990).	**Unlikely to occur** Core habitat for this species is not found within the project area. This species is unlikely to occur in the area.
Shy albatross, Tasmanian shy albatross (*Thalassarche cauta cauta*)	V, Mig	The shy albatross occurs in Australian waters below 25°S, but is most frequently observed off southeast Australia and Tasmania *(Brothers et al*., 1997; Hedd *et al*., 2001). It appears to be less pelagic than most albatross species, and occurs more frequently inshore than offshore. Breeding areas occur in the Bass Strait and off southern Tasmania. Although endemic to Australia, this species does undertake migrations throughout the southern oceans, from Africa through to South America (Marchant and Higgins, 1990).	**Unlikely to occur** Core habitat for this species is not found within the project area. This species is unlikely to occur in the area.
Sooty albatross (*Phoebetria fusca*)	V, Mig	The sooty albatross is a pelagic species that forages between southern NSW and Argentina, and breeds on islands in the southern Indian and Atlantic Oceans (Marchant	**Unlikely to occur** Core habitat for this species is not found within the project

Species	Status (EPBC Act)	Distribution and habitat	Likelihood of occurrence
		and Higgins, 1990).The species is a regular migrant to Australia's southern waters. They are typically found foraging in inshore waters within the autumn and winter months (Pizzey and Knight, 1999).	area. This species is unlikely to occur in the area.
Southern giant-petrel (*Macronectes giganteus*)	En, Mig	The southern giant petrel is widespread but generally found in low densities across landmasses in Antarctic waters in summer, and is thought to move to areas north of 50 °S in winter. Breeding occurs on six islands in the Southern Ocean and Australian Antarctic Territory (DoEE, 2018).	**May occur** The project area is highly modified and is not considered to support foraging and roosting for this species. This species may overfly the region during annual migrations.
Southern royal albatross (*Diomedea epomophora*)	V, Mig	The southern royal albatross is a pelagic species with a wide distribution that includes south east NSW. Breeding takes place in the Auckland Islands, off the south coast of New Zealand. Feeding areas are mostly between Western Australia and South America in the Southern Ocean. They are moderately common in offshore waters of southern Australia (Pizzey and Knight, 1999).	**Unlikely to occur** Core habitat for this species is not found within the project area. This species is unlikely to occur in the area.
Swift parrot (*Lathamus discolor*)	CE	Endemic to south-eastern Australia, the swift parrot breeds only in Tasmania and migrates to the Australian mainland in autumn (Higgins, 1999). In NSW, the species is known to winter mostly on the western slopes of the Great Dividing Range and some areas along the northern and southern coasts including Sydney region (Swift Parrot Recovery Team, 2001).	**May occur** This species may fly over the area during migration.
Wandering albatross (*Diomedea exulans*)	V, Mig	The wandering albatross undertakes extensive circum-polar migrations. Breeding areas are confined to Antarctic and sub-Antarctic islands in the Atlantic Ocean, Indian Ocean and waters off the southern coast of New Zealand. There are a number of species that migrate during the non-breeding season to the coastal waters off Wollongong, south of Sydney (Nicholls and Robertson, 2007). Juveniles migrate from their natal grounds to the subtropical Indian Ocean and Tasman Sea (Weimerskirch *et al.*, 2006).	**May occur** This species may fly over the area during migration.
White-bellied storm-petrel	V	The white-bellied storm petrel occurs in the tropical and subtropical waters of the Pacific, Indian and Atlantic Oceans, and is known to occur off the	**Unlikely to occur** Core habitat for this species is not found within the project

Species	Status (EPBC Act)	Distribution and habitat	Likelihood of occurrence
(*Fregetta grallaria grallaria*)		coast of NSW (Marchant and Higgins, 1990). It breeds in colonies on small islets and rocks in the Lord Howe Island (northeast of Sydney) and Kermadec Island complexes (northeast of New Zealand) (Hutton, 1991; Marchant and Higgins, 1990; McAllan *et al*., 2004; DoEE, 2018).	area. This species is unlikely to occur in the area.
White-capped albatross (*Thalassarche cauta steadi*)	V, Mig	The white-capped albatross is common off the coast of south east Australia (DoEE, 2018). Breeding takes place off the south coast of New Zealand (Marchant and Higgins, 1990). Little is known of the breeding biology or migration patterns of this species (DoEE, 2018).	**Unlikely to occur** Core habitat for this species is not found within the project area. This species is unlikely to occur in the area.

Note: CE: Critically Endangered; En: Endangered; V: Vulnerable; Mig: Migratory

Table 3-5 Potential for migratory bird species listed under the EPBC Act 1999 to occur at the project site

Name	Description	Migratory patterns	Likelihood of occurrence
Bar-tailed godwit (*Limosa lapponica*)	A wading bird that occurs in coastal habitats and brackish wetlands. Forages in sheltered intertidal areas, including beaches. Roosts on sandy beaches, sandbars and spits (Marchant and Higgins, 1990).	Undertakes migrations south from breeding grounds in the Northern Hemisphere. Departs for Australia in July, and arrives in August in northwest Australia at which point small numbers disperse to east and south Australia. Commences the return journey in February (Marchant and Higgins, 1993).	**May occur** Core habitat for this species not known within the project area. This species may overfly the region during annual migrations.
Common noddy (*Anous stolidus*)	Mainly occurs across much of Queensland's coast, and Australian islands including, Norfolk and Lord Howe Island (DoEE, 2018).	Migratory patterns are poorly known. Outside of breeding season, islands including Norfolk and Lord Howe are completely deserted. Species are known to forage far from shore, and kilometres from breeding grounds (DoEE, 2018).	**Unlikely to occur** Core habitat for this species is not found within the project area. This species is unlikely to occur in the area.
Fleshy-footed shearwater (*Ardenna carneipes*)	A large broad-winged, blackish-brown shearwater. It typically forages and moves over continental shelves and slopes and occasionally inshore waters (BirdLife International, 2017a). Mainly occurs (and breeds) off southern Australia; however the waters off NSW to QLD is listed as a	The shearwater migrates between breeding colonies in the southern Indian and south-western Pacific Oceans west to South Africa, north to the Arabian Sea, Maldives and Sri Lanka, and north-west to the Pacific Ocean. The birds depart Lord Howe Island at the completion of the breeding season (late August to mid May) (DoEE, 2018).	**Unlikely to occur** Core habitat for this species is not found within the project area. This species is unlikely to occur in the area.

Name	Description	Migratory patterns	Likelihood of occurrence
	BIA for foraging for this species.		
Fork-tailed swift (*Apus pacificus*)	Non-breeding visitor to all states and territories of Australia (Higgins, 1999) and is almost exclusively aerial and mainly occur over foothills an in coastal areas in Australia. Widespread across most areas of Australia, they have been recorded in NSW (DoEE, 2018).	The fork-tailed swift usually arrives in Australia around October; some arrive early in September, however, this is rare. Some birds have been sighted in NSW arriving between October–March (DoEE, 2018).	**May occur** Core habitat for this species not known within the project area. This species may overfly the region during annual migrations.
Lesser frigatebird, least frigatebird (*Fregata ariel*)	Smallest aerial species in the Fregatidae family. Distributed throughout tropical waters across the Indian and Pacific Oceans. Species have been recorded along the east coast near Byron Bay. Breeding sites are located on northern oceanic islands, including Christmas, Manowar and Cocos-Keeling Islands (Marchant and Higgins, 1993).	Species are aerial feeders, and can forage up to 500 km from breeding sites. Little is known on migratory patterns (Marchant and Higgins, 1993).	**Unlikely to occur** Core habitat for this species is not found within the project area. This species is unlikely to occur in the area as a transient visitor.
Little tern (*Sternula albifrons*)	A small, slight tern with gregarious behaviour. Australian population consists of several sub-populations, with the eastern population's distribution covering the east coast of Australia. This species generally occurs along sandy coastlines and mangrove mudflats (DoEE, 2018).	Can be sedentary, or wholly or partly migratory. The eastern population is migratory and vacates the east coast in late summer-autumn. The migratory pathway of this population is poorly understood (DoEE, 2018).	**May occur** Core habitat for this species not known within the project area. This species may overfly the region during annual migrations.
Pectoral sandpiper (*Calidris melanotos*)	The species prefers coastal and near coastal wetland habitats that have open fringing mudflats and low, emergent or fringing vegetation (Higgins and Davies, 1996).	Breeding occurs in northern Russia and North America, and the species is transient through Central America and the Caribbean while on corridor to non-breeding areas in South America. There are also scattered records from Hawaii,	**Unlikely to occur** Core habitat for this species is not found within the project area. This species is unlikely to occur

Name	Description	Migratory patterns	Likelihood of occurrence
	Species is widespread, but scattered throughout NSW (DoEE, 2018).	Polynesia and Australasia (DoEE, 2018).	in the area as a transient visitor.
Short-tailed shearwater (*Ardenna tenuirostris*)	A marine, pelagic shearwater. Distributed throughout the Pacific Ocean, with breeding areas on islands off the NSW coast (Marchant and Higgins, 1993).	Undertakes summer migration southwards from Northern Pacific to breeding grounds along the south and south east islands of Australia (Marchant and Higgins, 1993).	**Unlikely to occur** Core habitat for this species is not found within the project area. This species is unlikely to occur in the area as a transient visitor.
Streaked shearwater (*Calonectris leucomelas*)	A marine, pelagic shearwater. Distributed throughout the northwest Pacific Ocean, with breeding areas along the coast and/or islands of China, Japan, North Korea, South Korea and Russia. Recorded in NSW (DoEE, 2018; Marchant and Higgins, 1990).	Undertakes migrations to warmer waters during winter, typically to Vietnam, the Philippines, New Guinea and Australia (Marchant and Higgins, 1990; Yamamoto et al., 2010).	**Unlikely to occur** Core habitat for this species is not found within the project area. This species is unlikely to occur in the area as a transient visitor.
Wedge-tailed Shearwater (*Ardenna pacifica*)	A marine, pelagic shearwater. This species breeds on the east and west coasts of Australia and on off-shore islands. The species is common in the Indian Ocean, the Coral Sea and the Tasman Sea (Lindsey 1986). In tropical zones the species may feed over cool nutrient-rich waters. The species has been recorded in offshore waters of eastern Victoria and southern NSW, mostly over continental slope.	Movement patterns are poorly known but some populations are known to be migratory, departing nests in early April to early May and spending the non-breeding season in the tropics, often north of the equator. Tropical breeding populations may spend the non-breeding season near breeding islands (Marchant & Higgins 1990).	**May occur** Core habitat for this species not known within the project area. This species may overfly the region during annual migrations.

Note: CE: Critically Endangered; En: Endangered; V: Vulnerable; Mig: Migratory.

3.4 Introduced marine species

A comprehensive survey of pest species in Port Kembla conducted in May 2000 identified 35 introduced species and 14 cryptogenic species (Pollard & Pethebridge, 2002). The species identified in the survey were:

- Two dinoflagellates (*Alexandrium* sp. (catenella type) and *Alexandrium ostenfeldii* / *peruvianum)*
- One hydrozoan (*Halecium delicatulum*)
- Four species of polychaetes (*Boccardia chilensis, Boccardia proboscidea, Hydroides dirampha, and Hydroidesezoensis*)
- Eight species of crustaceans (*Megabalanus rosa, Cirolana harfordi, Paracerceis sculpta, Sphaeroma walkeri, Corophium acutum, Paradexamine pacifica, Liljeborgia c.f. dellavallei* and *Elasmopus rapax*)
- 15 species of broyzoa (A*mathia* sp.*, Bowerbankia* sp.*, Bugula dentata, Bugula flabellata, Bugula neritina, Bugula stolonifera, Cryptosula pallasiana, Schizoporella errata, Schizoporella* sp*. A, Schizoporella* sp*. B, Schizoporella* sp*. C, Schizoporella unicornis, Tricellaria occidentalis, Watersipora arcuata* and *Watersipora subtorquata*)
- Three species of ascidian (*Botryllus schlosseri, Ciona intestinalis* and *Styela plicata).*

A number of smaller surveys conducted in 1991, 2000 and 2006 also identified additional introduced species (Pollard & Pethebridge, 2002; Johnston, 2006) including:

- Two fish species (*Acanthogobius flavimanus* and *Tridentiger trigonocephalus)*
- Three invertebrate species (the bivalve *Theora lubrica*, and the colonial ascidians *Botrylloides leachii* and *Perophora japonica)*
- Seven additional unidentified cryptogenic species

As evidenced by the extensive list of species recorded during previous surveys, introduced marine species accounted for 50 % of the coverage of the hard substrate assemblages within Port Kembla with more pest species and higher abundances of pest species present in the Outer Harbour compared to the Inner Harbour (Johnston, 2006).

Of the species recorded within Port Kembla, *Alexandrium* spp. dinoflagellates are listed as High National Priority Pests while the ascidians *Ciona intestinalis* and *Styela clava* and bryozoan *Schizoporella errata* are classified as Medium National Priority Pests (Hayes *et al.*, 2005).

Some toxic dinoflagellate species such as *Alexandrium* spp. can form dormant sedentary cysts that accumulate in bottom sediments. Under favourable conditions, these cysts can germinate, triggering blooms which deplete dissolved oxygen and produce toxins, causing environmental damage including fish kills. The toxins produced by *Alexandrium catenella* are known to bioaccumulate in fish, molluscs, crustaceans, polychaetes and some echinoderms with consumers of contaminated organisms suffering from paralytic shellfish poisoning; there is also evidence of direct toxicity to fish (NIMPIS, 2018).

Whilst the toxic dinoflagellate species *Alexandrium catenella* were recorded during surveys conducted in 2002 and 2009 within the port (Pollard & Pethebridge, 2002; AECOM, 2010), none were found during the later 2011 survey (Worley Parsons, 2012). In addition, no toxic dinoflagellate blooms have been recorded within Port Kembla. However the risk of blooms remain given the historical records of toxic dinoflagellate species at the port.

3.5 Hydrodynamic conditions

Port Kembla's Inner Harbour is considered a relatively low energy environment with low discharges from creeks and drains and little wave energy propagation into the Inner Harbour.

The Outer Harbour, on the other hand, is known to be impacted by long wave events, which are typically multi-directional, with long waves from multiple directions occurring at the same time. The predominant directions are from the east, the north, and also from the west, which is likely to be due to waves reflecting off of the beach.

Additional information is provided in the EIS Volume 1: Chapter 12 Water Quality, Hydrodynamics and Hydrology.

3.6 Water Quality

Land use in the immediate vicinity of Port Kembla contributes to the ambient marine water quality within the port. The creeks and waterways that drain industrial, coal and iron ore stockpile areas (Figure 3-1) include:

- Allan's Creek, Gurungaty Waterway and No. 1 Products Berth within the Inner Harbour
- The Cut passage which connects the Inner and Outer Harbours
- Darcy Road Drain within the Outer Harbour

In addition, the ambient marine water quality within Port Kembla is also subject to tidal influences from the Port Kembla entrance (Figure 3-1).

Paper Size ISO A4

0 250 500 750 1,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Australian Industrial Energy
Port Kembla Gas Terminal

Project No. **21-27477**
Revision No. **-**
Date **24/10/2018**

Existing environment

FIGURE 3-1

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Print date: 24 Oct 2018 - 16:03

Data source: . Created by: afoddy

Historically water quality within the Inner and Outer Harbours has been impacted by urban and industrial discharges as well as port activities. Water quality monitoring within Port Kembla has indicated concentrations of metals (aluminium, cadmium, copper, lead, zinc, tin and arsenic) exceeded the ANZECC (2000) 95% trigger values for protection of marine waters. These exceedances were generally highest in the vicinity of the creeks and waterways identified above. Average total suspended solids were found to be higher within the Inner Harbour (5.9 mg/L) than the Outer Harbour (3.2 mg/L). pH levels were generally lower in the Inner Harbour than the Outer Harbour, indicating freshwater discharge influences from the existing waterways within the Inner Harbour.

Water temperatures within Port Kembla are generally higher than those measured offshore due to slower tidal flushing patterns and existing industrial thermal discharges (hot water discharge within Allan's Creek) to the Inner Harbour. As a result, water temperatures within the Inner Harbour are generally one to two degrees warmer than temperatures beyond the entrance to the port. The Outer Harbour benefits from greater tidal flushing and is generally less than 0.25 degrees warmer than water temperatures beyond the entrance to the port (AECOM, 2010).

Additional information is provided in the EIS Volume 1: Water Quality, Hydrodynamics and Hydrology.

3.7 Sediment quality

Marine sediments within Port Kembla are generally characterised as soft silty clays dominating the surface sediments with an underlying layer of stiff clay. Metals (arsenic, cadmium, chromium, copper, manganese, mercury, lead, vanadium and zinc), Polycyclic Aromatic hydrocarbons (PAH), dioxins and Tributyltin (TBT) have been recorded within these sediments across the Inner Harbour exceeding the screening levels for ocean and land disposal (National Assessment Guideline for Disposal – NAGD, and National Environment Protection Measures – NEPM) (WorleyParsons, 2012; Geochemical Assessments, 2013). Further, bioavailability investigations also found concentrations of cadmium, copper, lead and zinc exceeded NAGD screening level in many samples (Geochemical Assessments, 2013).

Recent investigations undertaken as part of the EIS have indicated the presence of contaminated sediments within the proposed dredging and disposal areas; these results were generally consistent with previous investigations. Concentrations of contaminants of concern were largely consistent across the dredging and disposal areas, with the primary contaminants of concern including heavy metals, PAH, dioxins and TBT at concentrations above the nominated screening levels.

A dredging management plan should be prepared prior to the dredging of Berth 101, outlining the contamination management and mitigation measures, including surface water monitoring, which will be implemented during the course of the works to minimise potential impacts to the receiving waters.

Given the presence of acid sulfate soils in all measured samples an acid sulfate soil management plan should be devised if there is a likelihood that dredged material could become oxidised during the removal and disposal process.

Additional information is provided in the EIS Volume 2 Appendix E3 Contamination – dredging and disposal areas.

4. Impact assessment

The redevelopment of the berth has an estimated duration of 10 -12 months and will include the removal of the existing structure by dredging and excavation of 600,000 m^3 of material from the quay wall, installation of mooring infrastructure and topside port infrastructure.

Redevelopment of the berth will temporarily and/or permanently alter the existing biofouling, benthic and fish communities within Port Kembla. The methods used during construction that have the potential to harm the environment include:

- Disturbance of the biofouling communities encrusting on the piles and the benthic ecology on the seabed
- Deterioration of water quality (increased turbidity, mobilisation of contaminants and thermal release)
- Noise pollution from pile driving and rock placement activities
- Artificial light emissions

Other impacts from unplanned events may also arise from the project activities. The risks to the environment from these activities are:

- Pest introduction and proliferation
- Marine fauna collisions/interactions
- Accidental release of solid waste
- Accidental release of hydrocarbon, chemicals and other liquid waste
- Damaged fuel tank associated with vessel collision

The following section addresses potential impacts from planned activities. Following that, potential impacts from unplanned activities are considered.

4.1 Biofouling and benthic community disturbance

Environmental hazard description

Disturbance to the biofouling and benthic habitats may occur during the following planned activities:

- Removal of the existing berth infrastructure (including removal of the piles and quay wall)
- Pile driving
- Dredging of the seabed
- Development of the perimeter bund
- Placement of the dredged material within the disposal area
- Placement / anchoring of construction vessels

Impact analysis

Removal of the existing infrastructure, including the extraction of the piles, will lead to the removal of the biofouling communities associated with the berth infrastructure. This will also lead to temporary loss of biodiversity from the project footprint, and the likely avoidance of/displacement from the area by associated mobile fauna. Slow moving or semi-sedentary mobile fauna may suffer mortality if located on the piles at the time of removal. This may include small, slow moving fishes such as Syngnathids.

Removal of the biofouling communities will not permanently effect the biodiversity of the project footprint. Recolonisation of the new piles is expected to commence following installation, after which, the biofouling community will undergo a long-term natural recruitment succession process (Hamer and Mills, 2015). It is expected that a mature level community, comparable to that currently present will be achieved within a few years and is dependent on other factors such as the discharge of cold water and residual chlorine from the FSRUs. The assemblages that occur on that infrastructure supports species which are more likely to be non-native and represented on other subtidal hard substrates within the Inner and Outer Harbour areas.

Piling activities, both pile extraction and installation, have potential to generate turbid plumes, however these effects are expected to be localised to the immediate project area and wider impacts are unlikely to extend beyond the Outer Harbour. The area of disturbance due to pile driving activity is expected to be small and any sediment generated during works is predicted to have little impact.

Dredging activities have the potential to impact directly on biofouling and benthic communities through direct removal of the substrate from the environment, and indirectly through generation of turbid plumes that will lead to suspension of sediment, affecting filter feeding organisms (UNEP, 2013). The dredged areas within the berth will eventually be covered with fine layers of silt from the vessel propeller wash, and will be colonised with similar benthic communities from the surrounding areas within the Inner Harbour.

Development of the perimeter bund and disposal of the dredged sediment will directly impact on existing benthic communities within the Outer Harbour disposal area through smothering and burial of epibenthic fauna. These Outer Harbour benthic communities have been previously subject to six dredged material disposal campaigns. The construction of the perimeter bund and subsequent dredged sediment disposal is expected to permanently remove a maximum 16.5 ha of benthic habitat and associated benthic communities from the Outer Harbour area. This however will be offset by the creation of the reclamation area infrastructure providing new surface for colonisation by biofouling communities.

The impacts to benthic infauna associated with the Inner Harbour are not expected to be permanent. Migration and recolonisation into the disturbed footprint from adjacent soft sediment environments will begin immediately following construction and occur over subsequent weeks and months.

Management and mitigation measures relevant to this environmental hazard are described in Section 5.1.

4.2 Water quality

Environmental hazard description

Potential construction phase impacts are primarily associated with water quality impacts generated during the removal, handling and placement of dredged sediments. In particular, dredging and disposal activities may generate turbid plumes, increase rates of sedimentation, mobilise contaminants and disturb dinoflagellate cysts within the Inner Harbour. Other potential construction impacts within the Inner Harbour include generation of turbid plumes from pile removal, pile driving and tubular steel hammering.

Key potential impacts on water quality within the Outer Harbour include generation of turbid plume from rock dumping for creation of perimeter bund.

Operational phase impacts are primarily associated with release of cold thermal water from project potentially impacting on marine communities within the vicinity of the discharge point. The discharged seawater will contain residual chlorine from the on-board marine growth

prevention system (MGPS) which will also have the potential to impact on marine communities in the vicinity of the discharge point.

Impact analysis

Turbidity

Numerical modelling has been undertaken for this EIS report to define the potential impacts associated with sediment plume dispersion (Cardno, 2018). The removal and placement of the sediment from the berth area was identified as the activity with the greatest potential to impact water quality. Model scenarios were developed in order to assess impacts to TSS and sediment deposition associated with the dredging and disposal of sediments within the Inner and Outer Harbours, respectively. Consideration was also given to associated activities such as piling operations and the removal of sediments with poor engineering properties from beneath the proposed Outer Harbour perimeter bund however it was concluded that the turbid plumes associated with these activities would be less significant than those considered in the modelled scenarios.

Figure 4-1 presents the modelled scenarios for 95th percentile TSS concentrations for the surface, mid-depth and bottom layers of the model. Modelling predicts that the extent of the dredge plume will be confined to Port Kembla with significant TSS concentrations confined to the vicinity of the dredging and disposal areas.

Turbidity has the potential to impact fish feeding ability, with piscivorous fish being affected to a greater extent than planktivorous fish due to the requirement of visually identifying prey over greater distances (de Robertis *et al.* 2003). In extreme cases, high levels of suspended sediments can also cause gill damage in fish (Au *et al*. 2004; Wong *et al*. 2013).

The increase in turbidity and total suspended solids may also effect the feeding and respiratory organs of filter-feeding organisms (Airoldi 2003; Maldonado *et al.* 2008). However, it is likely that as such organisms are already established within a marine environment prone to large spikes in turbidity following rainfall events and historically exposed to numerous dredging and disposal campaigns within Port Kembla, these species will be resilient to any short-term increases in suspended solids resulting from dredging and disposal activities.

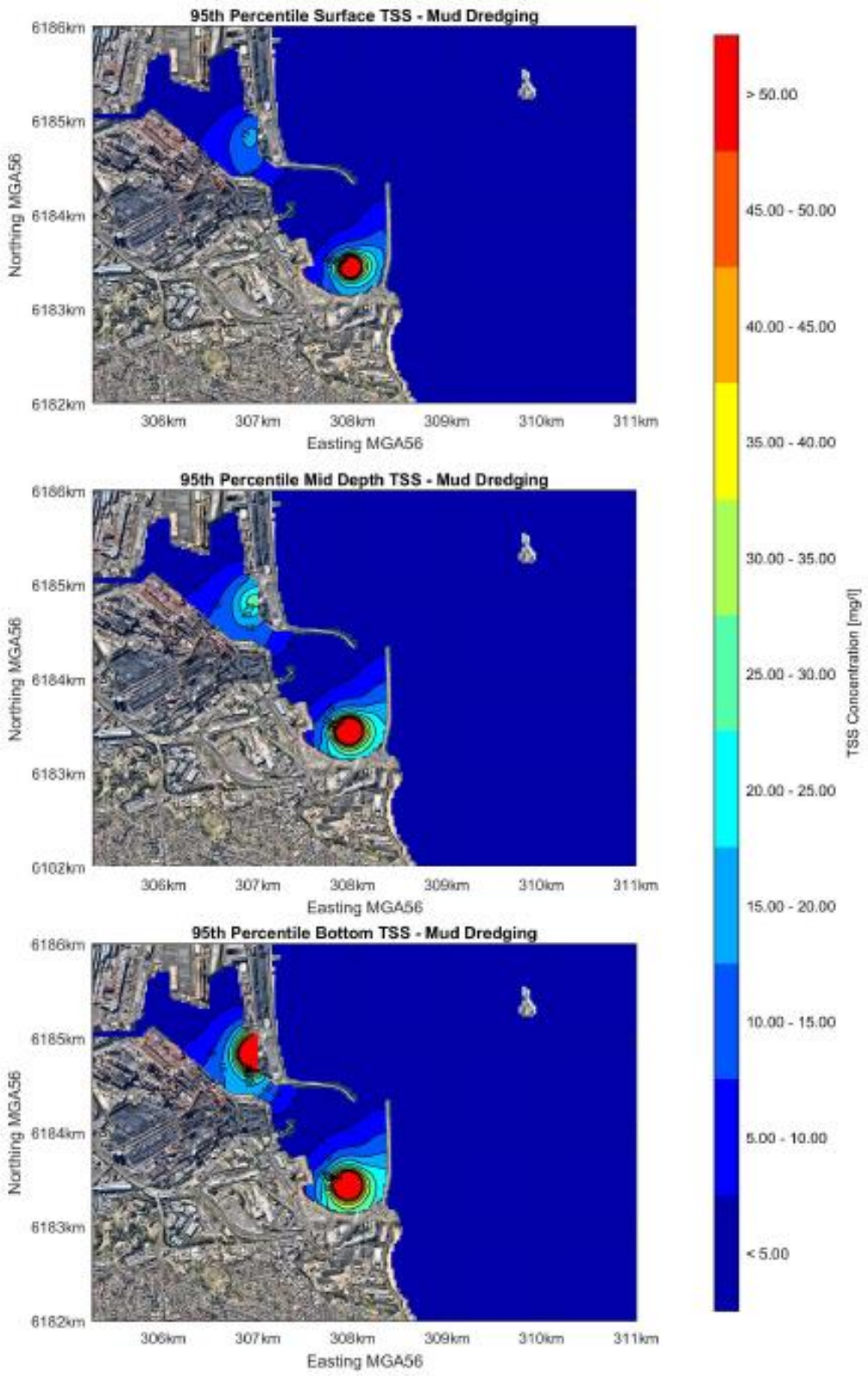

Figure 4-1 Predicted sedimentation of fines post dredging and disposal (Cardno, 2018)

Mobilisation of contaminants

Sediment sampling and analysis conducted for the EIS has confirmed the presence of contaminated sediments within the proposed dredging and disposal areas. Handling of the berth sediment through dredging and disposal could therefore have the potential to cause mobilisation of these contaminants into the water column. However, elutriate testing completed through previous sediment investigations (Worley Parsons, 2012) indicated that whilst concentrations of heavy metals were reported above the screening levels in sediments, concentrations of dissolved metals in elutriate waters were below the ANZECC trigger levels for 95% protection of species. Bioavailability testing, on the other hand, indicated that some heavy metals (cadmium, chromium copper, lead and zinc) have the potential to be bioavailable to marine organisms within the sediments (Worley Parsons, 2012).

Release of pollutants such as heavy metals, metalloids, TBT and PAHs into the water column can result in toxic effects on sessile invertebrates (Nayer *et al.* 2004). Considerable increases in heavy metal concentrations of copper, tin and zinc in the tissue of Sydney rock oysters, *Saccostrea glomerata*, have been directly linked to the 2009 dredging and disposal campaign within Port Kembla (Hedge & Knott, 2009). Resuspension of contaminated sediment has also been identified as a driver for the establishment of tolerant invasive species (see Section 4.5) as well as in reducing recruitment of dominant species such as barnacles and polychaetes (Piola & Johnston 2007; Knott *et al.* 2009). Whilst not directly related to dredging, elevated metals and PCB concentrations has also been recorded in tissues of fish from Port Kembla between 1975 and 1995 (He & Morrison, 2001). High-level contaminant exposure has been linked to various toxic effects including immune system depression, disease breakouts, reproductive effects and endocrine disruption in marine mammals (Vos *et al.* 2003).

There is generally no recreational / commercial fishing or aquaculture within Port Kembla, some recreational fishing occurs within the Outer Harbour (Worley Parsons, 2012). Hedge & Knott (2009) found that metal concentrations were lower in the oyster tissues located in the Outer Harbour; however the risk to human health from contaminant exposure through ingesting fish from the Other Harbour still remains as fish move freely between the Inner and Outer Harbours.

The potential release of contaminants is likely to be localised within the Port Kembla environment and medium-term in nature. Suspended sediment will be confined within silt curtains at the berth while dredge material will be confined within the perimeter bund at the Outer Harbour to minimise the migration of sediment and contaminants during disposal. The duration of exposure to toxicants are considered to be short in duration while long-term toxic effects are considered unlikely.

Dinoflagellate cysts

The toxic dinoflagellate species *Alexandrium catenella* has been previously recorded in 2002 and 2009, however no toxic dinoflagellate blooms have been historically observed within Port Kembla and none have occurred during any of the historical dredging campaigns. Dredging of sediments with potential dinoflagellate cyst may cause the cysts to germinate triggering blooms when conditions are favourable. Blooms of the toxic dinoflagellate may deplete dissolved oxygen and produce toxins, causing environmental damage including fish kills.

The risk of blooms is considered to remain given the historical records of toxic dinoflagellate species at Port Kembla, however the likelihood of a bloom occurring is considered to be low. Monitoring and management measures may assist in reducing the extent of the bloom, if it occurs.

Thermal water

Numerical modelling has been undertaken for this EIS to assess the behaviour and extent of the thermal discharge plume in light of the existing intakes and outlets operated by BlueScope Steel, who currently discharge warm water into the Inner Harbour. The modelling indicates that the release of cool water from the FSRU will only have minor impacts on seawater temperatures. These impacts are expected to be confined to within the port limits.

At the point of exit from the FSRU the discharged water will be up to 7 degrees cooler than ambient sea temperatures. Discharged water will be denser than ambient water, which means that it will immediately sink to the bottom of the water column. From examination of the 50th percentile summer seawater temperature plot shown in Figure 4-2, it is apparent that existing warm water discharges have a significant influence on water temperatures within the Inner Harbour during summer months. The model results indicate that the extent of the existing warm water plumes will be reduced by the proposed release of cool water within the Inner Harbour.

Predicted 5th percentile (low temperatures) summer and winter plots are shown in Figure 4-3 and differential plots of predicted seawater temperatures presented in Figure 4-4. The model results show that predicted reductions in temperature are greatest during winter when BlueScope warm water discharges are reduced. The model predicts that initial near field mixing will reduce the 5th percentile temperature differential to one degree at each end of the proposed berth. On average, temperatures within the port are generally expected to decrease by 0.1 to 0.2 degrees.

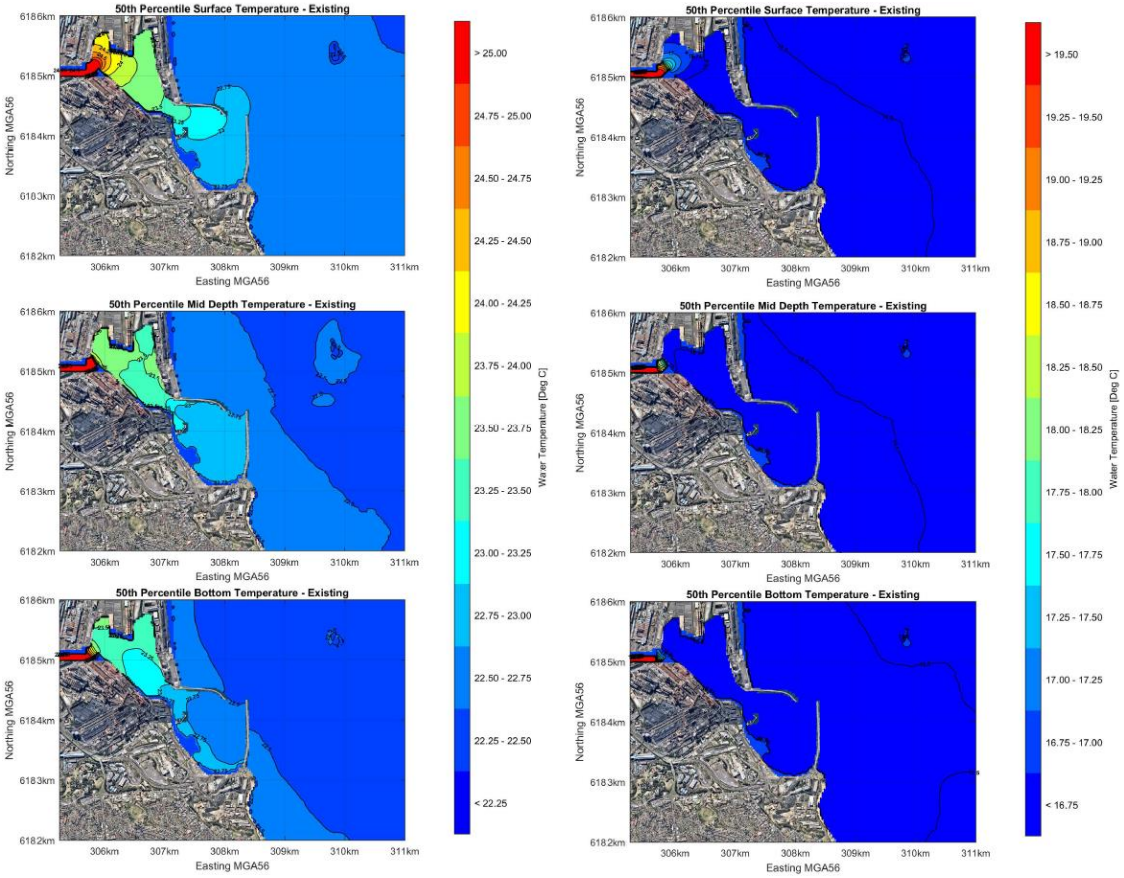

Figure 4-2 Existing 50th percentile summer and winter seawater temperatures (Cardno, 2018)

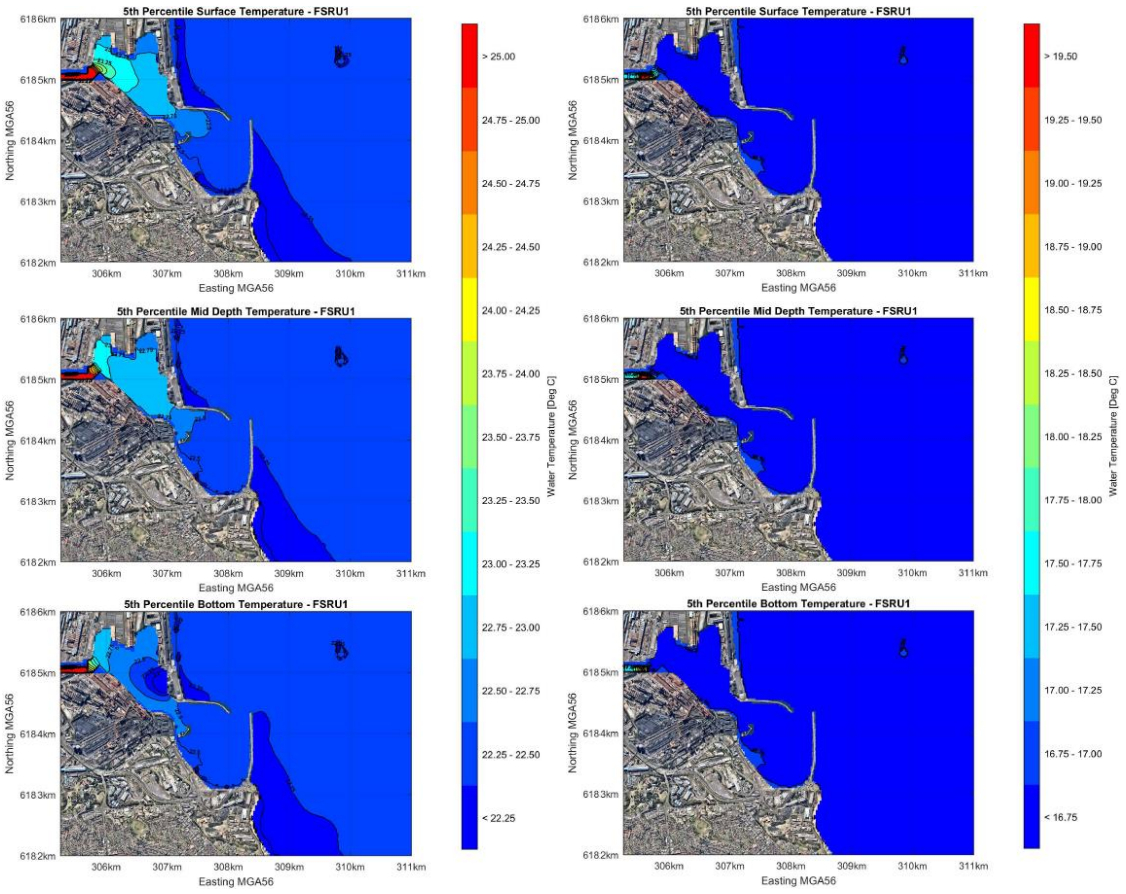

Figure 4-3 Predicted 5th percentile summer and winter seawater temperatures (Cardno, 2018)

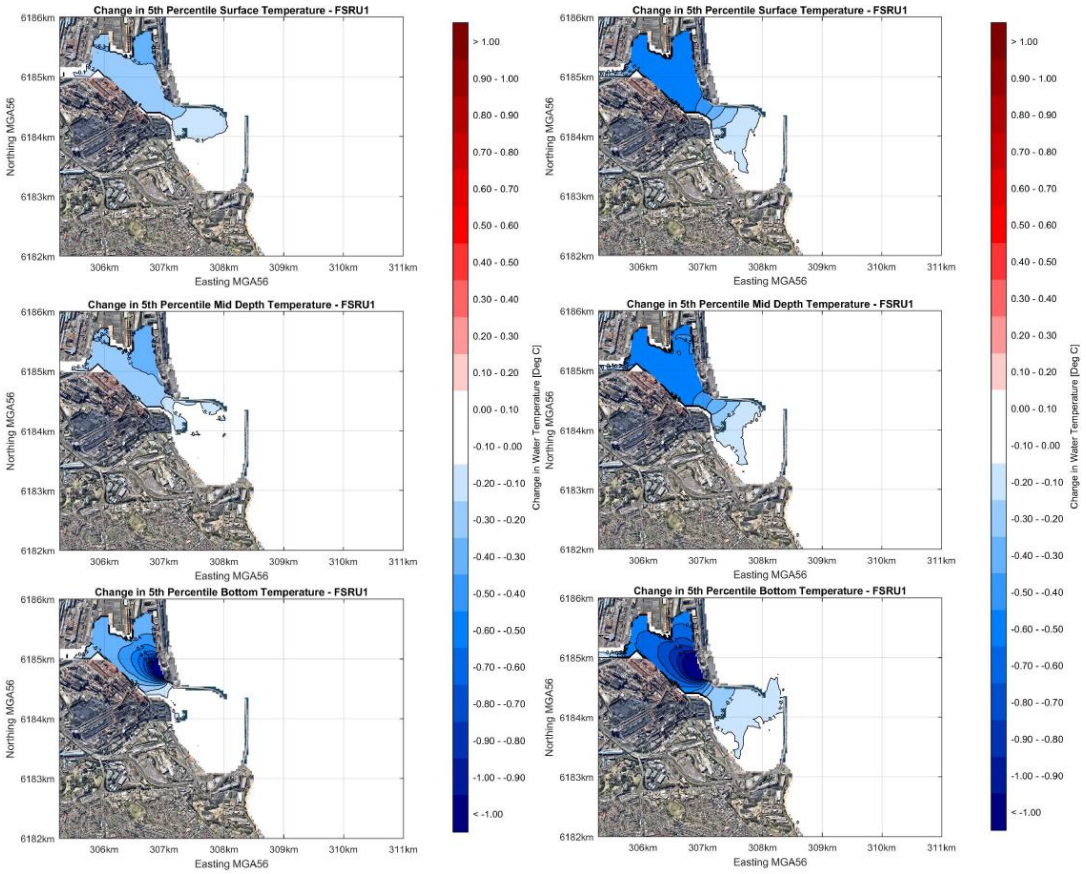

Figure 4-4 Predicted 5th percentile summer and winter seawater temperature differential plots (Cardno, 2018)

Residual levels of sodium hypochlorite within the FSRU discharge

The FSRU will operate an on-board MGPS. The MGPS takes seawater from the surrounding area, uses its natural salts to produce a solution of sodium hypochlorite, which acts as a natural biocide, is then used on-board to ensure all the systems remain free of marine growths. Sodium hypochlorite degrades naturally and so most of the created solution will be used within the vessel well before the water is ready for re-release. However, some excess sodium hypochlorite is expected to remain prior to discharge and dilution within the Inner Harbour.

The ANZECC guidelines provide a 95% species protection default guideline value (previously known as trigger value) for total residual chlorine within freshwater aquatic environments of 3 µg Cl/L. No equivalent values are provided for the marine environment however the guidelines note that the freshwater value "was adopted as a marine low reliability trigger value, to be used only as an indicative interim working level" (ANZECC/ARMCANZ, 2000).

Consideration should be given to concentration values of total residual oxidants measured as µg Cl per L or ppm, as chlorine is very reactive in seawater, reacting with bromine to form chloride ions and HOBr. Such values are provided in the IFC World Bank Group Environmental, Health, and Safety (EHS) Guidelines for LNG Facilities, which include specific information relating to discharges associated with FSRUs. These guidelines stipulate the following in relation to residual sodium hypochlorite in seawater *"Free chlorine (total residual oxidant in estuarine/marine water) concentration in cooling/cold water discharges (to be sampled at point of discharge) should be maintained below 0.2 parts per million (ppm)." (IFC, 2017).*

Prior to re-releasing the seawater back into the surrounding area, the operators of the vessel will aim to match the profile of the discharged water, as close as possible, to the pre-discharge profile and will ensure that free chlorine (total residual oxidant in estuarine/marine water) concentrations remain below 0.2 ppm. Changing the profile of the discharge water can be done by modifying the frequency of production and the concentration of sodium hypochlorite produced on-board from the intake of seawater.

Consideration has also been given to the dilution of the discharge stream within the mixing zone of the Inner Harbour based on the results of the near field mixing models. The discharge plume is predicted to have been diluted by a factor of four by the time the plume reaches the floor of the Inner Harbour and a dilution factor of 30 at a distance of 400m from the discharge point. Residual chlorine is expected to be restricted to the Inner Harbour environment.

It is expected that the marine communities in close proximity to the discharge point will be adversely affected by the decrease in temperature/presence of residual chlorine. This is likely to include the biofouling communities at adjacent pylons, the benthic community under and adjacent to the FSRU and benthic/pelagic fish passing through the plume area. Potential impacts to these communities will vary depending on species, life history and stage, and season. Decreases in temperature and the presence of residual chlorine could lead to the avoidance of the area by mobile species, and the inhibition of growth, spawning or larval settlement of sessile organisms.

Management and mitigation measures relevant to all water quality environmental hazards are described in Section 5.2.

4.3 Artificial noise emissions

Environmental hazard description

Artificial noise emissions may occur during the following planned activities:

- Pile removal and pile driving
- Tubular steel wall installation
- Dredging activities
- Vessel and plant movements
- Placement of rock armouring for protection of the perimeter bund

Disturbance to marine fauna from underwater noise may occur in response to noise generated by these activities which will be restricted to the Inner and Outer Harbour regions.

Impact analysis

Piling and dredging activities are the key activities associated with the berth redevelopment which will generate underwater noise. Once construction is completed, underwater noise will be restricted to standard shipping noise associated with vessel movements between port environments. It should be noted, that piling is currently planned to occur prior to the commencement of dredging, thus piling activities would be terrestrial and underwater noise generated would be much reduced compared to underwater piling. However, as the construction schedule has not been finalised, there is potential for underwater piling to occur. Potential for impact associated with underwater piling has therefore been considered following.

Piling and dredging construction activities have potential to generate noise that could displace fauna from the area realising a temporary reduction in diversity. They also have potential to cause a temporary or permanent threshold shift (TTS or PTS) in the hearing ability of sensitive fauna that use acoustic means of navigation or communication. This is discussed in more detail in the following sections.

Currently, there are no quantitative national guidelines on acceptable exposure levels for megafauna to underwater noise generated by construction works, specifically for pile driving. However, the South Australian Department of Planning, Transport and Infrastructure (DPTI) has developed *Underwater Piling Noise Guidelines* (2012) which provide relevant behavioural and physiological noise criteria for some species of megafauna. These are reproduced in Table 4-1 for impact piling.

Table 4-1 Behavioural and physiological noise criteria for some megafauna

Species	Impact	Noise exposure criteria for impact piling
Cetaceans and pinnipeds	Behavioural	SPL 160 dB re: 1µPa
Low frequency cetaceans (All baleen whales, including southern right whale and humpback whale)	Physiological (TTS)	Peak 224 dB re: 1µPa SEL 183 dB (M_{lf}) re: 1µPa^2-s
	Physiological (PTS)	Peak 230 dB re: 1µPa SEL 198 dB (M_{mf}) re: 1µPa^2-s
	Physiological (TTS)	Peak 224 dB re: 1µPa SEL 183 dB (M_{mf}) re: 1µPa^2-s

Species	Impact	Noise exposure criteria for impact piling
Mid frequency cetaceans (Majority of toothed whales including dolphins and killer whale)	Physiological (PTS)	Peak 230 dB re: 1µPa SEL 198 dB (M_{mf}) re: 1µPa^2-s
High frequency cetaceans (Other toothed whales)	Physiological (TTS)	Peak 224 dB re: 1µPa SEL 183 dB (M_{hf}) re: 1µPa^2-s
	Physiological (PTS)	Peak 230 dB re: 1µPa SEL 198 dB (M_{hf}) re: 1µPa^2-s
Pinnipeds (seals and sea lions including Australian fur seal)	Physiological (TTS)	Peak 212 dB re: 1µPa SEL 171 dB (M_{pw}) re: 1µPa^2-s
	Physiological (PTS)	Peak 218 dB re: 1µPa SEL 186 dB (M_{pw}) re: 1µPa^2-s

Underwater noise associated with dredging activities will depend on the dredge type (e.g. hydraulic pipeline cutterhead dredges, bucket dredges or hopper dredges) utilised for construction. A review of source sound power levels associated with these dredges (U.S. Army Corps of Engineers, 2015) indicates conservative source levels of 186-188 dB re: 1µPa (rms). Based on this, the authors concluded that *"it is unlikely that underwater sound from conventional dredging operations can cause physical injury to fish species"* and *"the area of influence was limited to less than 100 m from the source"* (U.S. Army Corps of Engineers, 2015). However, based on the noise exposure criteria presented above, dredging operations are likely to cause a temporary behavioral shift as marine fauna avoid the area immediately in the vicinity of dredging. Dredging activities also have the potential to result in temporary threshold shifts (TTS) for cetaceans (e.g. Southern right whale) and pinnipeds (e.g. Australian fur seal and Long-nosed fur seal) if these mammals are present during dredging activities (Table 4-1).

Underwater noise impacts from dredging are not anticipated to cause permanent auditory damage to marine fauna in the area. This is discussed further following.

Cetaceans

Four species of cetaceans are considered likely to occur in the project area. Dolphin species can be classified as 'mid frequency' cetaceans. This is due to the species producing and using sounds ranging from tens of kHz to 100 kHz for echolocation, communication and navigation. In contrast, baleen whales such as the southern right and humpback whales can be classified as a 'low frequency' cetacean due to the species producing and using sounds ranging from 12 kHz to below 1 kHz (McCauley, 1994). This makes the species particularly sensitive to artificially generated low frequency noise.

Observed responses from cetaceans to artificially generated sound include changes in swimming direction, increases in swimming speed and marked 'shocked' reactions. Other noted reactions in response to anthropogenic sound include changes to the diving, surfacing and breathing behaviours and avoidance of the sound source and the immediate area, among other behavioural changes (NRC, 2003). However, the extent and intensity of these reactions are not consistent and fluctuate widely depending on a variety of factors in relation to the individual animal and scenario (NRC, 2003).

Animals are expected to avoid areas where noise is being generated. This has been observed in other coastal locations where construction work has been undertaken (e.g. Darwin, Townsville). Following cessation of construction works animals are known to return to the area,

as such any displacement is expected to be temporary and will support mitigation of risk of impact upon the animals.

Subsurface noise generated by construction activities also has the potential to disrupt the ability of marine fauna to perceive natural sounds, in a phenomenon called 'auditory masking'. It is possible for auditory masking to interfere with communication and the social functions of marine animals, the identification of predators and prey, and the navigation and coordination capabilities of these animals.

Richardson *et al.* (1995) suggests that insufficient evidence has been obtained with regards to call masking among whales though there are indications that observed lengthening of calls by humpback whales and orcas to low-frequency noise may be in response to auditory masking (Fristrup *et al.*, 2003; Foote *et al.*, 2004). As such, it is possible that auditory masking could affect whales such as the humpback whale or the Southern right whale however, it is considered that the species will avoid the area during the construction phase and is therefore unlikely to be impacted by frequencies generated by the proposed activities.

While animals are expected to move out of the zone of impact/influence of any noise generated during construction, pile driving works and rock placement are expected to generate noise thresholds that give potential to cause a temporary or permanent hearing shift in animals.

As identified in Table 4-1, the DPTI Noise Piling Guidelines (DPTI, 2012) indicate temporary and permanent threshold shifts in cetaceans to occur at 183 dB (re 1 $\mu Pa^2.s$) and 198 dB (re 1 $\mu Pa^2.s$), respectively. Planned piling and rock placement activities are expected to generate noise that would surpass these guideline values and, therefore, has potential to cause direct physical damage to cetacean physiology, which will require risk management.

Other marine mammals

Other marine mammals such as the Australian fur seal and long-nosed fur seal may be present within the project area. Pinniped response to noise is poorly documented, but has been known to cause short-term disturbance, with increased activity following loud noises and displacement from haul-outs, but within minutes, activity levels are likely to drop and displaced pinnipeds return (Demarchi *et al.*, 1998). The impact assessment completed by Kongsberg Maritime Ltd (2015) considered potential acoustic impacts to pinnipeds from a range of construction activities. Impact thresholds were reported to range from 171-218 dB (re 1 µPa rms at 1 m) across both permanent and temporary threshold shifts. They noted a non-injury threshold was set at 180 dB by the US government. DPTI guidelines (DPTI, 2012) indicate temporary and permanent threshold shifts in pinnipeds to occur at 171 dB (re 1 $\mu Pa^2.s$) and 186 dB (re 1 $\mu Pa^2.s$), respectively. Similar to findings for cetaceans, proposed pile driving and rock placement activities have the potential to impact pinnipeds if they are present in close proximity to the activity.

Marine turtles

There is a lack of research investigating the impacts of noise on turtles. Bartol and Musick (2003) found that turtles have high hearing sensitivity to low frequency sound, detecting sounds frequencies in the range of 100 to 700 Hz. Turtles have also been reported to develop erratic swimming behaviour and increase swimming activity in response to increased levels of artificial sound (McCauley *et al.*, 2002).

Several species of marine turtle were identified by the PMST as potentially occurring within the project area. However upon review of each species distribution and habitat (Table 3-3), none were considered likely to occur in the project area due to a lack of suitable foraging and nesting habitat. Therefore marine turtles are considered unlikely to be impacted by noise and frequencies generated during the project works.

Sharks and fish

Elasmobranchs (rays, skates and sharks) utilise low frequency sound to detect prey (Myrberg *et al.*, 1978). Due to their lack of swim bladders, they are not classified as hearing specialists (Nelson, 1967). Sharks have demonstrated highest hearing sensitivity to low frequency noise ranging from 40 Hz to 800 Hz (Myrberg, 2001). These low frequency sounds generally mimic noise from prey, are irregularly pulsed, broadband, and transmitted with no sudden increase in intensity (Myrberg *et al.,* 1978). Beyond those frequencies, sharks may exhibit avoidance of the source of acoustic disturbance. Review of the habitat and distribution of the grey nurse shark and white shark identified that the species are unlikely to occur in the project area, although may transit the wider region during movements between aggregation sites. It is therefore considered that the species are unlikely to be impacted by noise and frequencies generated during the project works.

The ability of fish to withstand underwater noise and their sensitivity to it varies widely across species. According to Amoser and Ladich (2005), most fish are classified as hearing generalists, with relatively poor hearing, reduced sensitivity to noise and vibrations in comparison with hearing specialists, which have developed hearing specialisations. Gordon *et al.* (2003) suggest that hearing specialists are especially susceptible to intense acoustic vibrations, as many hearing specialist species possess an air-filled swim bladder. A number of species of fish are considered to have no known noise sensitivities to underwater noise impacts. These include the goatfish, sweetlip, red emperor, triggerfish, snapper, rock cod, tuna and mackerel (Willis *et al.,* 2010, Nedwell *et al.,* 2016, Yelverton *et al.,* 1975). Others such as syngnathids have no known audiograms of noise sensitivities (McCauley and Salgado-Kent, 2008), however they have been known to exhibit physiological stress response under noisy conditions (Anderson, 2009). The hearing capability, habits, distance to the noise source and timing of noise occurrence in the fish lifecycle are also factors that contribute to fish sensitivity and resilience to underwater noise (McCauley and Salgado-Kent, 2008).

Impacts on fish from noise sources generated during planned construction activities are expected to be restricted to a short-term period and may result in behavioural responses such as avoidance of the area. Such actions would be temporary in nature and localised. At a population level, the behavioural responses are not expected to be significant. It is therefore considered that the species are unlikely to be impacted by noise and frequencies generated during the project works.

Birds

A variety of migratory and local shorebirds may occur in the region, with bird numbers and species being highly dependent upon the time of year.

Pile driving and other construction activities have the potential to disturb birds in residence via the generation of artificial noise, which may cause a local reduction in shorebird use of the project area during construction.

Management and mitigation measures for the project relevant to artificial noise emissions are detailed in Section 5.3.

4.4 Artificial light emissions

Environmental hazard description

Artificial light emissions may occur through the use of vessel and site construction safety lighting during the construction phase of the project, and once constructed, from lights installed as part of the new berth infrastructure and FSRU.

Impact analysis

Artificial lighting has the potential to affect fauna by altering use of visual cues for orientation, navigation or other purposes, resulting in behavioural responses, which can alter foraging and breeding activity in marine turtles, cephalopods, birds, fish, dolphins, and other pelagic species. Continuous lighting in the same location for an extended period may result in disturbance to marine fauna including:

- Fish and other pelagic species (e.g. zooplankton, squid, and larval fish) may be attracted to lights either directly or indirectly. This can in turn, alter predatory fish behaviour.
- Turtles can be attracted to lights (note turtles are unlikely to be present within the project area due to a lack of foraging and nesting habitat).

Construction is planned for 24 hours per day, seven days per week across 10-12 months. Therefore, night time lighting will be required to enable a safe working environment. The existing berth is currently lit at night, it is therefore assumed that marine fauna species currently using the project area will be habituated to extant light conditions. Similar lighting will be installed on the redeveloped berth and on the FSRU and LNG Carriers when in berth. This lighting is expected to be minimal in comparison to cumulative light emissions of other illuminated infrastructure within Port Kembla. The proposed works are likely to contribute to but not elevate or increase the existing landscape lighting profile. As such, construction based lighting is not predicted to result in any change in migratory behaviours of birds that use the area and are already habituated to current light conditions.

Management and mitigation measures for the project relevant to artificial light emissions are detailed in Section 5.4.

4.5 Pest introduction and proliferation

Environmental hazard description

Proposed activities may support spread, dispersal or expansion of existing marine pest populations within the project area. Vessels carrying invasive marine pests (IMP) may unintentionally but successfully introduce new species to the region where the activity is occurring or carry pests from the region to other areas.

IMPs may be carried within the external biological fouling on the vessel hull, within seawater pipes (e.g. cooling water) and associated infrastructure or on submersible marine instruments and equipment. Ballast water exchange may also allow for the transportation and proliferation of IMPs within the area of activity.

Before vessels can proceed to the project area, state, national and international quarantine obligations will have to be fulfilled by all vessels. For vessels sourced from high risk or international destinations, ballast water exchange record requirements will need to be complied with, including possession of relevant state and national documentation such as the Australian Quarantine and Inspection Service (AQIS) clearance documentation in order to verify compliance with ballast water and biofouling management measures.

Impact analysis

According to DAWR (2015), introduced marine species are species that are found in Australia due to human activity, whether by accidental or intentional release, escape, dissemination or placement. Marine pests are exotic marine species that are subject to national marine pest biosecurity and cause, or are likely to cause, unacceptable impacts to the environment, economy, human health or social values.

Ecosystem health, biodiversity, fisheries, aquaculture, human health and waterway industries including tourism are at potential risk from the impacts of marine pests (Wells *et al*., 2009). The extent of the detrimental effects of introduced marine pests may include depletion of viable fishing areas and aquaculture stock, out-competing native flora and fauna, over-predation of native flora and fauna, reduction of coastal aesthetics and increased maintenance costs, human illness through released toxins, reduction in vessel performance, damage to vessel engines and propellers and damage to industrial infrastructure.

The introduction of new species is not a rare occurrence. However, the physical, chemical and biological circumstances of the environment into which the species has been introduced are important determining factors as to whether the species will successful establish and become an invasive pest.

Flora and fauna species atypical to the region can be attracted to newly created hard substrate habitats; such as those that would be provided by the presence the newly installed piles and quay wall.

Dredge barges and construction vessels associated with the proposed works have a high risk for translocation of invasive marine species (Pollard & Pethebridge, 2002; Wells *et al., 2009*). These vessels often have long residency times in ports, have numerous surfaces where marine species can attach, and may not have well-maintained anti-fouling. As such, this increases the likelihood of these vessels becoming infected by a potentially invasive marine species, and infecting a port with said species. The risk is further increased where vessels are between ports with similar environmental characteristics.

Previous surveys of Port Kembla identified introduced species with two species listed as a High National Priority Pest and three species listed as Medium National Priority Pests (Pollard & Pethebridge, 2002; Johnston, 2006; Hayes *et al., 2005*). Introduced species in Port Kembla were also higher than in other NSW ports, contributing 50 % of the coverage of hard substrate assemblages in Port Kembla (Pollard & Pethebridge, 2002; Johnston, 2006). Due to the pervasiveness of introduced species in Port Kembla, including targeted high priority pests, there is also risk of translocation of invasive species from the port on departing project vessels. The consequences of this may be higher than an introduction into Port Kembla, depending on the value of the destination port environment.

Management and mitigation measures for the project relevant to pest introduction and proliferation are detailed in Section 5.5.

4.6 Marine fauna collision/interaction

Environmental hazard description

Interaction with marine fauna can potentially occur during the dredging and disposal activities. There is potential for interactions with marine fauna during rock armour placement on the perimeter bund. There is also potential for collision to occur between marine fauna and larger vessels associated with the operation of the project. The consequences of such collisions between marine fauna and vessels/construction materials for the marine organisms range from changes to fauna behavioural patterns to injury or death of the organism due to a direct collision.

Impact analysis

Due to the slow speed of vessels associated with dredging and disposal activities, likelihood of marine fauna collisions is expected to be minimal. Deep to shallow water transition zones, and deep-water channels, are where high shipping traffic coincides with natural cetacean habitats. At these locations, collisions between vessels and cetaceans are considered more likely (WDCS, 2006). A number of instances of vessel collisions resulting in the death of cetaceans have occurred in Australian waters though data suggests that these instances are commonly associated with fast ferries and container ships (WDCS, 2006). Some cetaceans are known to be capable of detecting and manoeuvring to avoid collision with vessels (WDCS, 2006). There is a variety of whale responses to the advance of vessels, with some whale species known to be inquisitive and approach vessels that are slow moving or stationary, while other whale species dive or stay motionless in the presence of vessels. However, whales typically do not approach vessels and are more likely to adapt evasive behaviours to avoid nearby ships, including the employment of longer dives.

The risk of potential vessel strike during construction is considered low for all marine species likely to occur in the project area, including cetaceans, sharks and fish. This risk accounts for works being concentrated within a small area of the Inner and Outer Harbour limited by the port boundaries, and being undertaken at relatively low vessel speeds. This will limit the potential for encounters to a small spatial footprint.

Similarly, the risk of potential vessel strike during operation of the project is considered low for all marine species. This risk also accounts for the avoidance behaviour marine fauna species adopt to evade vessels until the vessel disruption has elapsed.

The risk of interaction between marine fauna and construction materials during rock armouring of the bund wall is low, as fauna would need to be directly in the path of the rock placement activities.

Management and mitigation measures for the project relevant to marine fauna collisions/interactions are detailed in Section 5.6.

4.7 Accidental release of solid wastes

Environmental hazard description

A variety of hazardous and non-hazardous solid waste may be released unintentionally into the environment from overfull and / or uncovered bins or if blown off the deck of a vessel. Accidental spillage during transfers of waste from vessel to shore, and incorrectly disposed items may also cause the unintentional release of solid waste into the surrounding environment.

Non-hazardous solid waste includes plastics, packaging and paper materials and products while examples of hazardous solid wastes include oily and contaminated wastes, aerosol products,

fluorescent tubes, batteries and medical waste. Additional information is provided in the EIS Volume 1: Chapter 21 Waste Management.

Impact analysis

There is capacity for non-hazardous solid waste such as plastic bags to affect the environment and cause entanglement or ingestion by fauna. The ingestion of solid wastes like plastic bags can consequently result in internal tissue damage, prevention of normal feeding behaviours and potentially death of the affected fauna.

The pollution of the immediate environment with the release of hazardous solid waste has the likely consequence of negatively affecting the health of marine ecology within the area. Particularly fish and cetaceans are susceptible to chemical impacts, including disease or physical injury after ingesting or absorbing the waste.

Management and mitigation measures for the project relevant to accidental release of solid wastes are detailed in Section 5.7.

4.8 Accidental release of hydrocarbons, chemicals and other liquid waste

Environmental hazard description

Vessels require a wide variety of liquids, chemicals and hydrocarbon compounds to operate and to be maintained. Vessel engines and equipment such as cranes, pile drivers and heavy machinery operate on diesel fuel while hydraulic and lubricating oils are required for the operation and continual maintenance of mechanical components. Fuel drums may also be retained in dedicated storage areas while some vessel engines adopt independent storage tanks. Examples of hazardous liquids include corrosion inhibitors, biocide and miscellaneous chemicals like cleaning agents and lubricating oils. Release of chlorine from the FSRU discharge water is discussed in Section 4.2.

In addition, other liquid wastes such as sewage and food waste will be generated during construction. There are various scenarios that may result in accidental release of liquid waste, including tank failure, pipework failure or inadequate bunding.

If refuelling is required during the proposed activity, then refuelling events have the potential to cause environmental impacts through reduction in water quality and / or contamination of marine ecology. Spills during refuelling can occur through several pathways, including fuel hose breaks, coupling failure or tank overfilling.

Impact analysis

There are no releases planned during the construction of the project. Rather, all liquid waste will be stored for discharge to an appropriate onshore facility. There is potential that a leak or spill of hydrocarbons or other liquids (including environmentally hazardous wastes and non-hazardous substances) may occur at the site. Such an occurrence would result in the localised reductions in water quality and contamination of nearby marine receiving environment.

Management and mitigation measures for the project relevant to accidental release of hydrocarbons, chemicals and other liquid wastes are detailed in Section 5.8.

4.9 Damaged fuel tank associated with vessel or plant collision

Environmental hazard description

During the activities, there is a possibility that vessels or plant could collide. The rupture of a vessel's fuel tank is the predominant risk resulting from a potential vessel or plant collision. The significance of the risk is attributed to the release of diesel into the environment from the damaged fuel tank. In the event of a tank rupture from vessel collision, a standard tank is expected to empty into the environment within hours.

Impact analysis

Marine mammals

Geraci (2012) cited studies that suggested that marine mammals have the capacity to identify and avoid oil slicks. In contrast, other sources indicate that this is not evident (Etkin, 1997) with examples of marine mammals observed surfacing and feeding in oil affected areas (Matkin *et al.*, 2008).

Understanding of the effects of surface oil on marine mammals has not been fully developed. The impact of oil on marine wildlife is influenced by the characteristics of the oil and the extent to which it has been weathered. Through direct contact and ingestion, organisms oiled in the early stages of a spill experience higher levels of toxicity than those exposed to weathered oil. No known key breeding, feeding or rest areas are located in the project area, where any potential surface spill may occur. Therefore, it is unlikely that numerous species would be exposed in the event of a spill.

Marine mammals may be affected by oil slicks via a number of pathway mechanisms, as outlined by Geraci (2012): ingestion and accumulation, skin contact, interference with feeding and vapour inhalation. These are discussed following.

Ingestion and accumulation: Feeding behaviours that rely on surface skimming are especially susceptible to the ingestion of surface oil condensate. The following effects may occur as a consequence of oil condensate ingestion:

- Acute effects include neurological damage and liver disorders (Geraci, 2012), gastrointestinal ulceration, haemorrhaging and secondary organ dysfunction due to ingestion of oil (Etkin, 1997).
- Chronic poisoning via ingestion of components that have entered the food web (Neff *et al.*, 1976).

The material characteristics of hydrocarbons mean they readily adhere to rough surfaces on fauna, e.g. fur, calluses and hair. Due to their hairless and smooth-skinned features, hydrocarbons typically do not stick to whales and dolphins, with testing conducted by Geraci *et al.* (1985) confirming that cetacean skin is a suitable barrier to oil. However, Etkin (1997) reported the development of eye and skin lesions on cetaceans due to prolonged exposure to oil.

The loss of food species and loss of access to feeding areas due to the surface condensate coupled with the species selective diet can result in interference with feeding through substantial decrease in body mass in marine mammals exposed to oil spills. The stress associated with oil spill exposure also has an effect on the body mass of marine mammals (UNEP, 2013). Baleen feeders rely on a sieve-like mechanism called a baleen to filter nutrient-rich water for food such as plankton and small fish. The whale's tongue then shifts the food to the oesophagus. This feeding mechanism is vulnerable to a heavy oil spill inclusive of exposure to weathered oil, as indicated by the combined evidence of studies conducted by Geraci *et al.* (1985). Oil can

potentially disrupt the efficiency of the feeding mechanism for days by blocking the baleen plates. As such, whales, which skim food inclusive of from surface waters, are therefore more susceptible to impacts from surface oil than other species.

Congested lungs, damaged airways or emphysema are possible consequences of vapour inhalation of surface oil, depending on the inhalation concentration. The inhalation of oil vapours is also known to cause irritation and harm to soft tissue e.g. the mucous eye membranes. The damage to an individual is greatest when it is trapped, panicked and exposed continuously or for prolonged periods to the oil (Geraci, 2012).

Pinnipeds

Surface diesel impacts on the transient fur seal visitors at Port Kembla may lead to the long-term coating of individuals with oil, inhibiting their swimming ability as well as their ability to thermoregulate (Engdelhardt, 1983). Fur seals may also absorb oil through the skin, via inhalation of atomised particles in the air, and through ingestion via the gastrointestinal tract (Engelhardt, 1983). Further impacts on seals includes eye irritation, congestion of lungs and airways from inhalation, gastrointestinal ulcerations and damage to the kidney, liver and brain (IPIECA, 2015).

Fish

Open sea fish are typically known to have the ability to identify and avoid surface slicks (Kennish, 1997; Hayes *et al.,* 1992). Compared to other marine organisms, fish are unlikely to experience as much exposure to surface oil since diesel would remain on the sea surface. However, since eggs, larvae and fish in their early juvenile stages are likely to inhabit the planktonic sea surface waters, recruitment success could be affected. The surface oil would predominantly have lethal or near-lethal impacts on the future growth and development of exposed larvae/eggs/juvenile fish (Kennish, 1997).

Birds

The feeding and resting behaviours of birds on surface waters and within intertidal areas renders them exposed to surface oil condensate. The predominant feeding behaviours of seabird species are either by skimming surface water or by dive bombing. The primary impact mechanisms faced by seabirds include ingestion of oil, impact on feeding areas and fouling of plumage.

Seabird fouling can occur when contact is made between the seabirds and floating hydrocarbons. According to Hayes *et al.* (1992), seabirds may experience fouling during feeding and diving for prey, wading in shallower waters / intertidal areas or during roosting on the surface of waters affected by surface condensate. The structural integrity, performance and function of a seabird's plumage are affected by oil fouling. Fouling can consequently cause the loss of buoyancy, inability to fly and loss of waterproofing properties of plumage resulting in hyperthermia in affected seabirds.

Preening and feeding / diving actions on the surface of affected waters can lead to the ingestion of surface oils by seabirds. Changes in blood characteristics and intestinal irritation are some of the consequences of oil ingestion by bird species (Hayes *et al*., 1992). The quantity of hydrocarbons required to instigate effects in seabirds is not known. However, the extent of impacts on seabirds is dependent on the type of hydrocarbon they are exposed to, duration of exposure and the type of seabird affected.

As noted above, hydrocarbon condensate on the water surface can affect a wide number of prey species occupying the surface water environments, e.g. krill and baitfish. These disruptions to the food chain through the reduced availability of suitable prey caused by surface condensate

may be detrimental to the behaviour and survival of certain bird species, which feed on surface water biota. The quantity of marine wildlife affected and the extent of surface oil's impact is reliant on a variety of factors including the weather, season and biological productivity of the afflicted region (Clark *et al*., 1989).

Marine reptiles

Marine turtles are not likely to occur in the project area and are therefore not considered to be at risk from interaction with surface diesel.

Habitat receptors

An oil spill within Port Kembla due to vessel / plant collision and rupturing of a fuel tank may result in confined impacts upon a wide variety of organisms inhabiting the port environment within the saltmarsh and mangrove system, marine ecology encrusting on port infrastructure and benthic communities. However if an oil spill occurred outside Port Kembla, impacts could extend to sensitive receptors such as rocky habitat (Red Point headland, Tom Thumb Islands and Five Islands Nature Reserve) and sandy beaches (Wollongong City Beach, Fisherman's Beach or North Beach) around Port Kembla, refer to Figure 3-1.

Management and mitigation measures for the project relevant to damaged fuel tanks associated with vessel or plant collision are detailed in Section 5.9.

5. Management and mitigation measures

5.1 Biofouling and benthic community disturbance

Management controls

To reduce or eliminate the impact of disturbance on biofouling and benthic communities, a number of management controls can be implemented:

- Works to remove the current quay wall and piles will commence after a visual inspection for protected mobile fauna (e.g. Syngnathids). If present, these will be relocated to adjacent habitats, outside the zone of influence by the proposed works, where feasible.
- Dredging will be carried out using mechanical backhoe dredge, split barges and supporting tug vessels, as opposed to suction-style dredging, to minimise the potential mobilisation of sediments within the Inner Harbour.
- Disposal of the dredged material will be limited to the Outer Harbour disposal area within the perimeter bund.

Environmental outcome

The berth redevelopment activities will occur in / over benthic habitats that are widely represented at the local scale within Port Kembla. Once the berth has been constructed, further disturbance or damage to soft sediment habitats and benthic communities is not anticipated. The newly constructed berth will likely be recolonised with comparable biofouling communities. Changes to local hydrodynamics resulting from the berth redevelopment are likely to be insignificant.

Disposal of the dredge material will be undertaken within the Outer Harbour disposal area which has been extensively disturbed over the years and subject to the Outer Harbour Development approval.

The environmental risks associated with planned seabed disturbance will be limited to the immediate surrounds of the berth, and are expected to be short term in nature, with low risk on existing species with the implementation of the nominated management controls. As such, risks associated with planned seabed disturbance are considered acceptable and as low as reasonably practical.

5.2 Water quality

Management controls

To reduce or eliminate the potential impacts of resuspension of sediments and its associated impacts on water quality and existing marine ecology, the following controls should be implemented prior to dredge activities:

- Physical controls such as installation of silt curtains prior to commencement of construction works will be adequate in minimising the spread of any sediments within the water column at the dredging and disposal locations.
- Dredging techniques that minimise sediment resuspension during excavation and disposal (such as using mechanical methods over hydraulic methods) will be implemented throughout the project. Barge loads will also be controlled such that overflow of barge loads is prevented.
- Screening technologies will be implemented to ensure that any contaminated sediments are disposed of responsibly. Contaminated dredge material will be placed such that it

may be capped by uncontaminated material in accordance with a dredge management plan.

- Daily visual observations will be undertaken to detect any potential toxic dinoflagellate blooms within the Inner Harbour.
- A water quality monitoring program will be implemented to ensure construction works do not cause exceed the project's agreed marine water quality criteria.
- A water temperature and residual chlorine monitoring program will be implemented during operation of the project to document natural variations in water temperature and the extent of temperature differences, residual chlorine concentrations, and dispersion pathways of the cold water discharge plume.

Environmental outcome

Sediment plumes will inevitably be generated during the proposed dredging and disposal activities, however, modelling indicates that adopting the proposed approach of mechanical dredging and barge hopper disposal within a perimeter bund will cause the least impacts of dredging operations on the marine environment.

The management controls are considered effective in reducing the potential environmental impacts to a marine environment which has been historically subject to numerous dredging campaigns. As such, the risk associated with unplanned releases of contaminants and effects on water quality is considered as low as reasonably practicable.

5.3 Artificial noise emissions

Management controls

The following controls can be implemented for the purposes of managing or mitigating the impact of noise generation on marine fauna:

- During underwater piling activities the following standard operational procedures will be implemented (DPTI, 2012):
  - *Pre-start procedure* – The presence of marine mammals should be visually monitored by a suitably trained crew member for at least 30 minutes before the commencement of the soft start procedure. Particular focus should be put on the shut-down zone but the observation zone should be inspected as well, for the full extent where visibility allows. Observations should be made from the piling rig or a better vantage point if possible.
  - *Soft start procedure* – If marine mammals have not been sighted within or are likely to enter the shut down zone during the pre-start procedure, the soft start procedure may commence in which the piling impact energy is gradually increased over a 10-minute period. The soft start procedure should also be used after long breaks of more than 30 minutes in piling activity. Visual observations of marine mammals within the safety zones should be maintained by trained crew throughout soft starts. The soft start procedure may alert marine mammals to the presence of the piling rig and enable animals to move away to distances where injury is unlikely.
  - *Normal operation procedure* – If marine mammals have not been sighted within or are not likely to enter the shut down or observation zone during the soft start procedure, piling may start at full impact energy. Trained crew should continuously undertake visual observations during piling activities and shut-down periods. After long breaks in piling activity or when visual observations ceased or were hampered by poor visibility, the pre-start procedure should be used. Night-time or low visibility operations may

proceed provided that no more than three shut-downs occurred during the preceding 24 hour period.

  - *Stand-by operations procedure* – If a marine mammal is sighted within the observation zone during the soft start or normal operation procedures, the operator of the piling rig should be placed on stand-by to shut-down the piling rig. An additional trained crew member should continuously monitor the marine mammal in sight.
  - *Shut-down procedure* – If a marine mammal is sighted within or about to enter the shutdown zone, the piling activity should be stopped immediately. If a shut-down procedure occurred and marine mammals have been observed to move outside the shut-down zone, or 30 minutes have lapsed since the last marine mammal sighting, then piling activities should recommence using the soft start procedure. If marine mammals are detected the shut-down zone during poor visibility, operations should stop until visibility improves.

- Works to remove the piles will commence after a visual inspection for protected mobile fauna (e.g. syngnathids). If present these will be relocated to adjacent habitats, outside the zone of influence by the proposed works, where feasible, to mitigate risk of acoustic impacts.
- Vessel and heavy machinery will be maintained in accordance with the manufacturer specifications to reduce noise emissions.
- The interaction of all vessels with cetaceans and pinnipeds will be compliant with Part 8 of the Environment Protection and Biodiversity Conservation (EPBC) Regulations (2000). The Australian Guidelines for Whale and Dolphin Watching (DoEE, 2017) for sea-faring activities will be implemented across the entire project. This includes the implementation of the following guidelines:
  - Caution zone (300 m either side of whales and 150 m either side of dolphins) –vessels must operate at no wake speed in this zone.
  - Caution zone must not be entered when calf (whale or dolphin) is present
  - No approach zone (100 m either side of whales and 50 m either side of dolphins) – vessels should not enter this zone and should not wait in front of the direction of travel or an animal or pod, or follow directly behind
  - If there is a need to stop, reduce speed gradually
  - Do not encourage bow riding
  - If animals are bow riding, do not change course or speed suddenly.

Environmental outcome

Underwater noise generated by pile driving and dredging activities within the project area may result in localised influences on marine fauna. These activities are a key component in the berth redevelopment and thus elimination of these components is not considered practicable.

Due to the mobile nature of the local marine fauna (fish and syngnathids) and transitory nature of marine fauna found in the wider area (cetaceans and pinnipeds), marine fauna will not remain in the region during construction. With the implementation of identified management controls, behavioural impacts (e.g. avoidance patterns and swimming movements away from the area) are the most probable form of impact to marine fauna due to anthropogenic noise generated by this activity, particularly for sensitive species such as cetaceans. Generated noise is anticipated to mainly induce temporary and localised behavioural impact, with afflicted marine species expected to adopt normal behavioural patterns within a short time frame in the open waters surrounding the project area.

5.4 Artificial light emissions

Management controls

To reduce or eliminate the impact of artificial lighting, the following management controls will be implemented during construction:

- Light spill from the nearshore vessel operations will be minimised where possible using directional lighting. Light shields could be considered to avoid spill if sensitive receptors are determined during activities to be negatively affected.
- Lighting on vessel decks or the berth construction area will be managed to reduce direct light spill onto marine waters or surrounding landscape, unless such actions do not comply with site safety or navigation and vessel safety standards (AMSA Marine Orders Part 30: Prevention of Collisions; AMSA Marine Orders Part 21: Safety of Navigation and Emergency Procedures).

Environmental outcome

Minimum lighting is required for safety purposes across the construction site, on board the vessels, and for navigational purposes. Vessel presence is required to undertake the activities and therefore environmental consequences due to lighting spill into the marine environment are possible. It is necessary for all vessels in Australian waters to comply with the navigation safety requirements prescribed within the Navigation Act 2012 and the subordinate Marine Orders concerning workplace safety equipment (e.g. lighting) and navigation. While light spill will be reduced wherever possible, the elimination of deck lighting on vessels or the elimination of lighting in the project area during construction would result in:

- Increased probability for collisions and accidents
- Presenting new safety risks to crew members
- Non-compliance with safety and maritime codes and regulations.

The use of directional lighting to reduce the risk and impact of artificial lighting to faunal species has been identified. This would need to also adhere to any required site safety codes. Even with this control in place, negligible spill of artificial lighting is unavoidable.

Given the coastal nature of the development, and the 24/7 operations at Port Kembla, potential influences on marine fauna from construction based lighting associated with the proposed works is expected to be minimal.

5.5 Pest introduction and proliferation

Management controls

The following controls and processes should be employed when possible in order to mitigate or eliminate the risk of introducing pests:

- Vessels will be locally sourced (within NSW waters) to complete the construction works, where possible.
- International vessels will empty ballast water in accordance with the latest version of the Australian Ballast Water Management Requirements (DAWR, 2017).
- If an IMP is identified or suspected, then the contractor will notify the NSW Department of Primary Industries Aquatic Biosecurity Unit immediately (within 24 hours) hotline on (02) 4916 3877.

- Changes to Australia's biosecurity system came into effect on 16 June 2016 with commencement of the *Biosecurity Act 2015*. New biosecurity requirements may come into force during the life of the project. If this occurs, these management controls will be reviewed to confirm adequacy
- Project activities will adhere to the National System for the Prevention and Management of Marine Pest Incursions (National System) and NSW requirements for IMP identification and management.

Environmental outcome

Organisms from the natural environment naturally collect on vessels and submersible equipment as biofouling. Vessels also require ballast water for safe operational purposes. Introduced marine pests are known to occur within Port Kembla. As such, the risk of spread are difficult to eliminate.

To mitigate the possibility of introducing IMPs, the planned activities will be conducted with equipment and vessels, which would ideally have been operational and active within NSW waters that have the same pest profile risk since their last dry-dock inspection or cleaning session.

Because of these factors, the risk of the successful introduction of an IMP is considered as low as reasonably practicable.

5.6 Marine fauna collision/interaction

Management controls

The following controls may be adopted and should be executed when possible to mitigate or eliminate the risk of collision between vessels and marine fauna:

- Operations of vessels will be commensurate with Part 8 of the EPBC Regulations (Interacting with Cetaceans and Whale Watching).
- The Australian Guidelines for Whale and Dolphin Watching (DoEE, 2017) for sea-faring activities will be implemented across the entire project. This includes the implementation of the following guidelines:
  - Caution zone (300 m either side of whales and 150 m either side of dolphins) – vessels must operate at no wake speed in this zone.
  - Caution zone must not be entered when calf (whale or dolphin) is present
  - No approach zone (100 m either side of whales and 50 m either side of dolphins) – vessels should not enter this zone and should not wait in front of the direction of travel or an animal or pod, or follow directly behind
  - If there is a need to stop, reduce speed gradually.
  - Do not encourage bow riding.
  - If animals are bow riding, do not change course or speed suddenly.

Environmental outcome

As these activities require the presence of vessels, there is no potential for the elimination of vessels from the locality. All construction vessels will be restricted to a 4-knot speed limit. In order to reduce the chance of vessel interaction with marine fauna (cetaceans and pinnipeds), the management and legislative control measures would be implemented. Vessels will be operating within a small spatial footprint, and collision risk will therefore be limited. On this basis,

the potential risks associated with collision and interference with marine animals from vessel activities are considered as low are reasonably practical.

5.7 Accidental release of solid waste

Management controls

The following management controls have been considered and may be implemented if feasible in order to mitigate or remove the risk of accidental solid waste release:

- Appropriate waste containment facilities will be included on site and managed to avoid overflow or accidental release to the environment.
- No waste materials will be disposed of overboard of vessels, all non-biodegradable and hazardous wastes will be collected, stored, processed and disposed of in accordance with the vessel's Garbage Management Plan as required under Regulation 9 of MARPOL Annex V.
- Hazardous wastes will be separated, labelled and retained in storage onboard within secondary containment (e.g. bin located in a bund).
- All recyclable and general wastes will be collected in labelled, covered bins (and compacted where possible) for appropriate disposal at a regulated waste facility.
- Solid non-biodegradable and hazardous wastes will be collected and disposed of onshore at a suitable waste facility.

Environmental outcome

Small amounts of solid non-biodegradable and hazardous wastes will be generated during the proposed activities. Storage of these wastes across the construction footprint and plant / vessels in fully enclosed containers is considered good (and common) practice within the construction industry. Stored wastes will be regularly removed to an appropriate onshore facility.

During the activities, given the adoption of the industry standard management controls listed above, it is considered that all practicable measures have been implemented and the likelihood of solid wastes being discharged to the environment has been reduced to as low as reasonably practicable.

The unplanned release of non-hazardous and hazardous solid wastes through inadequate containment and practices is unlikely to have any significant environmental effects, as impacts would be temporary and localised. The management controls are considered effective in reducing the potential environmental impact to the marine environment. As such, the risk associated with unplanned releases of non-hazardous and hazardous solid wastes is considered as low as reasonably practicable.

5.8 Accidental release of hydrocarbons, chemicals and other liquid waste

Management controls

The following controls will be adopted when feasible in order to mitigate or eliminate the potential for the spillage of hydrocarbons, environmentally hazardous chemicals and liquid-waste to the marine environment:

- All liquid waste will be stored for discharge to an appropriate onshore facility.
- Chemicals and hydrocarbons will be packaged, marked, labelled and stowed in accordance with MARPOL Annex I, II and III regulations. These include provisions for all

chemicals (environmentally hazardous) and hydrocarbons to be stored in closed, secure and appropriately bunded areas.

- A Materials Safety Data Sheet (MSDS) will be available for chemicals and hydrocarbons in locations nearby to where the chemicals / wastes are stored.
- Vessel operators will have an up to date Shipboard Oil Pollution Emergency Plan (SOPEP) and Shipboard Marine Pollution Emergency Plan (SMPEP). All shipboard chemical and hydrocarbon spills will be managed in accordance with these plans by trains and competent crew.
- Any contaminated material collected will be contained for appropriate onshore disposal.
- Any equipment or machinery with the potential to leak oil will be enclosed in continuous bunding or will have drip trays in place where appropriate.
- Following rainfall events, bunded areas on open decks of the vessels or within any construction laydown areas will be cleared of rainwater.
- All hoses for pumping and transfers will be maintained and checked as per the Planned Maintenance System (PMS).

Environmental outcome

The use of chemicals or hydrocarbons on-board vessels and heavy machinery is essential for the proposed construction activities. Similarly, since open deck drainage is an essential safety feature of any marine vessel, the risk of discharge from deck drainage cannot be eliminated. However, it is anticipated that any impacts to water quality resulting from a hydrocarbon or chemical spillage would be temporary and constrained to the immediate vicinity, if such an incident did occur. In such cases, spillage of hydrocarbons or environmentally hazardous chemicals may be attributed to machinery, engines and tanks leaking these liquids into the marine environment. Due to these limited impacts and the management controls implemented to reduce the risk of contaminants reaching the surrounding environment to levels as low as reasonably possible, the risks of a small hydrocarbon spill are considered to be environmentally acceptable.

Vessels will also adopt safety measures consistent with the requirements of the Protection of the Sea (Prevention of Pollution from Ships) Act 1983 and MARPOL Annex I, II and III. These safety precautions and safeguards may entail, among other measures, the assignment of correct stowage and designation of appropriate storage and handling areas. The risks of discharge to the environment are mitigated by the adoption of these safety control measures, resulting in the reduction of these risks to levels as low as reasonably possible. A variety of measures have been implemented to prepare for spill response should any incident occur.

The risks and measures adopted to address any potential spill resulting from hydrocarbon refuelling are similar to those outlined for spills due to discharge. Refuelling of vessels or plant may only be carried out in controlled environment, which would reduce the effects of an accidental spill. Keeping equipment well serviced and maintaining spill clean-up and containment equipment are some of the safeguards that can be adopted.

As such, the risk associated with unplanned releases of hydrocarbons, chemicals and other liquid wastes is considered as low as reasonably practicable.

5.9 Damaged fuel tank associated with vessel or plant collision

Management controls

The following management controls may be adopted and executed for the purposes of mitigating or eliminating the risk of hydrocarbon spillage due to vessel collision:

- Visual observations will be maintained by watch keepers on all vessels and plant/moving machinery.
- Regular notification will be made to the following Australian Government agencies before and during operations:
  - The Australian Hydrographic Office of proposed activity, location and commencement date to enable a 'Notice to Mariners' to be issued
  - In the event of a spill resulting in notification to AMSA, other sea users (e.g. fishing industry) will be informed of the incident via Marine Notices to prevent vessels entering an area where hydrocarbons have been released
- Vessels will operate in compliance with all marine navigation and vessel safety requirements in the International Convention of the SOLAS 1974 and the Navigation Act 2012. This includes the requirement for all equipment and procedures to comply with the following AMSA Marine Orders:
  - Marine Orders - Part 30: Prevention of Collisions
  - Marine Orders - Part 21: Safety of Navigation and Emergency Procedures
  - Marine Orders - Part 27: Radio Equipment: sets out ship requirements regarding radio installations, equipment, watch keeping arrangements, sources of energy, performance standards, maintenance requirements, personnel and recordkeeping
  - Marine Orders Parts 3 and 6 – Seagoing Qualifications and Marine Radio Qualifications: ensures seafarer competency standards meet the needs of the Australian Shipping Industry
  - Vessels will be equipped with appropriate navigational systems which may include an automatic identification system (AIS) and an automatic radar plotting aid (ARPA) system capable of identifying, tracking and projecting the closest approach for any vessel (time and location) within the operational area and radar range (up to approximately 70 km)
- Marine diesel oil compliant with MARPOL Annex VI Regulation 14.2 (i.e. sulphur content of less than 3.50% m/m) will be the only diesel engine fuel to be used by the vessels.
- Oil spill responses will be executed in accordance with the vessel's SOPEP, as required under MARPOL.
- Emergency spill response procedures will be developed and implemented when required.

Environmental outcome

In order to undertake the activities, vessel and other mobile plant presence is required and no alternative is available. Navigation and safety instruments and equipment can be found on vessels and within mobile plant, as prescribed by the International Convention of the SOLAS 1974 and actioned through the *Navigation Act 2012*. These are necessary for the safe navigation of the vessel and plant to avoid potential collisions.

In order to combat the possible eventuality of a spill from collision risk, measures must be implemented to respond to spills and minimise their effects. Marine user notifications and stakeholder consultation for affected parties within the activity zone are some of the other

industry standard and activity-specific controls in place to reduce the risk of vessel collision, which could result in ruptured fuel tanks and oil slicks.

These standards and controls are considered to reduce the likelihood of a vessel/plant collision. With all controls in place risk of vessel/plant collision is considered managed to as low as reasonably possible.

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Appendices

Appendix A – Protected Matters Search Report

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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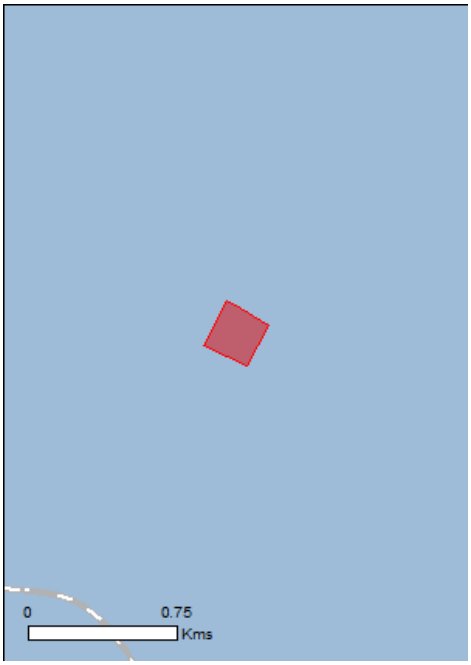

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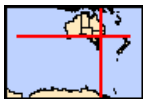

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	70
Listed Migratory Species:	56

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	10
Commonwealth Heritage Places:	None
Listed Marine Species:	82
Whales and Other Cetaceans:	12
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	1
Regional Forest Agreements:	None
Invasive Species:	49
Nationally Important Wetlands:	3
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community likely to occur within area
Illawarra and south coast lowland forest and woodland ecological community	Critically Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or

Name	Status	Type of Presence
		related behaviour likely to occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area
Pterodroma neglecta neglecta Kermadec Petrel (western) [64450]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Status	Type of Presence
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Fish		
Epinephelus daemelii Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Prototroctes maraena Australian Grayling [26179]	Vulnerable	Species or species habitat likely to occur within area
Frogs		
Heleioporus australiacus Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat may occur within area
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat known to occur within area
Litoria littlejohni Littlejohn's Tree Frog, Heath Frog [64733]	Vulnerable	Species or species habitat may occur within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat likely to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Isoodon obesulus obesulus Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern) [68050]	Endangered	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Plants		
Acacia bynoeana Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat may occur within area
Caladenia tessellata Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat likely to occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat likely to occur within area
Cynanchum elegans White-flowered Wax Plant [12533]	Endangered	Species or species habitat known to occur within area
Genoplesium baueri Yellow Gnat-orchid [7528]	Endangered	Species or species habitat likely to occur within area
Haloragis exalata subsp. exalata Wingless Raspwort, Square Raspwort [24636]	Vulnerable	Species or species habitat known to occur within area
Melaleuca biconvexa Biconvex Paperbark [5583]	Vulnerable	Species or species habitat may occur within area
Persoonia hirsuta Hairy Geebung, Hairy Persoonia [19006]	Endangered	Species or species habitat may occur within area
Pimelea spicata Spiked Rice-flower [20834]	Endangered	Species or species habitat likely to occur within area
Pterostylis gibbosa Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat likely to occur within area
Pultenaea aristata [18062]	Vulnerable	Species or species habitat may occur within area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat known to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur

Name	Status	Type of Presence
		within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Hoplocephalus bungaroides Broad-headed Snake [1182]	Vulnerable	Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sharks		
Carcharias taurus (east coast population) Grey Nurse Shark (east coast population) [68751]	Critically Endangered	Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna pacifica Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Ardenna tenuirostris Short-tailed Shearwater [82652]		Breeding known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur

Name	Threatened	Type of Presence within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Sternula albifrons Little Tern [82849]		Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat known to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Name	Threatened	Type of Presence
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat likely to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur

Name	Threatened	Type of Presence within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Thalasseus bergii Crested Tern [83000]		Breeding known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land - Australian Postal Commission
Commonwealth Land - Australian Postal Corporation
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Commonwealth Trading Bank of Australia
Defence - AIRTC WOLLONGONG
Defence - Graovac House
Defence - HYDROGRAPHIC OFFICE
Defence - LAKE ILLAWARRA CADET FACILITY
Defence - THROSBY TRG DEPOT-PORT KEMBLA
Defence - TS ALBATROSS-WOLLONGONG

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eudyptula minor Little Penguin [1085]		Breeding known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species

Name	Threatened	Type of Presence
		habitat likely to occur within area
Larus dominicanus Kelp Gull [809]		Breeding known to occur within area
Larus novaehollandiae Silver Gull [810]		Breeding known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Pelagodroma marina White-faced Storm-Petrel [1016]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus pacificus Wedge-tailed Shearwater [1027]		Breeding known to occur

Name	Threatened	Type of Presence
		within area
Puffinus tenuirostris Short-tailed Shearwater [1029]		Breeding known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Species or species habitat may occur within area
Sterna bergii Crested Tern [816]		Breeding known to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov. Pacific Albatross [66511]	Vulnerable*	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Fish		
Acentronura tentaculata Shortpouch Pygmy Pipehorse [66187]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Hippocampus whitei White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240]		Species or species habitat likely to occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Solenostomus paradoxus Ornate Ghostpipefish, Harlequin Ghost Pipefish, Ornate Ghost Pipefish [66184]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Five Islands	NSW

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat may occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Coomaditchy Lagoon	NSW
Five Islands Nature Reserve	NSW
Lake Illawarra	NSW

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-34.462094 150.898775,-34.4622 150.89899,-34.463049 150.900664,-34.464535 150.899634,-34.463757 150.897659,-34.462094 150.898775

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix B – Assessment under the Biodiversity Conservation Act 2016

Southern right whale	Assessment under the BCA 2016
The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:	
a. in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	Feeding grounds of the southern right whale are in deep sub-Antarctic waters. Migratory behaviour generally may occur between 60ºS and 32ºS. Breeding occurs at specific sites along the southern Australian coast. Due to the distance between species breeding and feeding grounds, it is unlikely that the project will affect the species lifecycle. Individuals may travel through the area during migrations however the species will be able to avoid project activities and will not be affected by the project construction and operation works. Identified management measures will be implemented, such as adherence to EPBC Policy Statement 2.1 (Interaction between Offshore Seismic Exploration and Whales) Part A (DEWHA, 2008). Therefore, activities associated with the project will not disrupt the lifecycle of these species.
b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: – *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction* – *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*	No endangered ecological community or critically endangered ecological community is located within the project area.
c. in relation to the habitat of a threatened species or ecological community: – *the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity*	Habitat for the southern right whale generally consists of feeding grounds in the sub-Antarctic waters and breeding grounds along the South Australian coast. The closest known breeding ground for this species is located 250 km away in Eden, NSW.

Southern right whale	Assessment under the BCA 2016
	Habitat for this species will not be impacted by the project activities.
– *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity*	Habitat for this species will not be fragmented or isolated as a result of the project activities.
– *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality*	Habitat for this species will not be removed, modified, fragmented or isolated as a result of the project activities. As such the long term survival of this species will not be impacted by the project.
d. *whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)*	No declared areas of outstanding biodiversity value are present within or around the project area.
e. *whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process*	Key threatening processes are listed under Schedule 4 of the BC Act 2016. The relevant threatening process to this species involves the entanglement in or ingestion of anthropogenic debris in marine and estuarine environments. The proposed berth demolition works may generate anthropogenic debris during the redevelopment of the berth. There is potential for the southern right whale to ingest or become entangled in the debris. During dredging works, there is also potential for mobilisation of contaminants contained in sediments and subsequent ingestion by the whale. Identified management measures will be implemented to minimise the risk of entanglement and ingestions through appropriate debris management and removal from site and installation of silt curtains restrict sediment plume migration. In the event that a southern right whale individual becomes entangled during the works, the NSW ORRCA Whale and Dolphin Rescue should be notified.

Long-nosed fur seal	Assessment under the BCA 2016
The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:	
a. in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The long-nosed fur seal occurs in Australian coastal waters and offshore islands of South and Western Australia as well as southern Tasmania (IUCN, 2018). Small populations also are present along the southern NSW coast, particularly on Montague Island but also other isolated areas north of Sydney (NSW OEH, 2018b). There are no known breeding sites within or around Port Kembla. Therefore, activities associated with the project will not disrupt the lifecycle of these species.
b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: – *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction* – *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*	No endangered ecological community or critically endangered ecological community is located within the project area.
c. in relation to the habitat of a threatened species or ecological community: – *the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity*	Long-nosed fur seals may visit the Outer Harbour utilising the breakwater on occasion. The project will create a permanent bund for the disposal area potentially creating additional habitat of interest to seals.
– *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity*	Habitat for this species will not be fragmented or isolated as a result of the project activities.
– *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality*	Habitat for this species will not be removed, modified, fragmented or isolated as a result of the project activities. As such the long term survival of this species will not be impacted by the project.

Long-nosed fur seal	Assessment under the BCA 2016
d. *whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)*	No declared areas of outstanding biodiversity value are present within or around the project area.
e. *whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process*	Key threatening processes are listed under Schedule 4 of the BC Act 2016. The relevant threatening process to this species involves the entanglement in or ingestion of anthropogenic debris in marine and estuarine environments. The proposed berth demolition works may generate anthropogenic debris during the redevelopment of the berth. There is potential for the long-nosed fur seal to ingest or become entangled in the debris. During dredging works, there is also potential for mobilisation of contaminants contained in sediments and subsequent ingestion by the seal. Identified management measures will be implemented to minimise the risk of entanglement and ingestions through appropriate debris management and removal from site and installation of silt curtains restrict sediment plume migration.

Australian fur seal	Assessment under the *BCA 2016*
The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:	
a. *in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction*	The Australian fur seal's preferred habitat is rocky parts of islands. Foraging generally occurs in oceanic waters off the continental shelf. There are ten established breeding colonies, all restricted to the Bass Strait with six occurring in Victoria and four in Tasmania. In NSW the species can be found at Montague Island (DoEE, 2018). Seals are semi regular visitors to the Outer Harbour. There are no known breeding sites within or around Port Kembla. Therefore, activities associated with the project will not disrupt the lifecycle of these species.

Australian fur seal	Assessment under the *BCA 2016*
b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: – *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction* – *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*	No endangered ecological community or critically endangered ecological community is located within the project area.
c. in relation to the habitat of a threatened species or ecological community: – *the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity*	The Australian fur seals may visit the Outer Harbour utilising the breakwater on occasion. The project will create a permanent bund for the disposal area potentially creating additional habitat of interest to seals.
– *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity*	Habitat for this species will not be fragmented or isolated as a result of the project activities.
– *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality*	Habitat for this species will not be removed, modified, fragmented or isolated as a result of the project activities. As such the long term survival of this species will not be impacted by the project.
– *whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)*	No declared areas of outstanding biodiversity value are present within or around the project area.
d. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process	Key threatening processes are listed under Schedule 4 of the BC Act 2016. The relevant threatening process to this species involves the entanglement in or ingestion of anthropogenic debris in marine and estuarine environments. The proposed berth demolition works may generate anthropogenic debris during the redevelopment of the berth. There is potential for the Australian fur seal to ingest or become entangled in the debris. During dredging works, there is also potential for mobilisation

Australian fur seal	Assessment under the *BCA 2016*
	of contaminants contained in sediments and subsequent ingestion by the seal. Identified management measures will be implemented to minimise the risk of entanglement and ingestions through appropriate debris management and removal from site and installation of silt curtains restrict sediment plume migration.

Appendix C – Assessment under the Environment Protection and Biodiversity Conservation Act 1999

Southern right whale	Assessment under the *EPBC Act 1999*
An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	
– *lead to a long-term decrease in the size of a population*	Feeding grounds of the southern right whale are in deep sub-Antarctic waters. Migratory behaviour generally may occur between 60ºS and 32ºS. Breeding occurs at specific sites along the southern Australian coast. Due to the distance between species breeding and feeding grounds, it is unlikely that the project will lead to a decrease in the size of the whale population. Individuals may travel through the area during migrations however the species will be able to avoid project activities and will not be affected by the project construction and operation works. Identified management measures will be implemented, such as adherence to EPBC Policy Statement 2.1 (Interaction between Offshore Seismic Exploration and Whales) Part A (DEWHA, 2008).
– *reduce the area of occupancy of the species*	The project will not reduce the area of occupancy of the southern right whale as the species is unlikely to occupy the area of the project. The southern right whale has rarely been observed within Port Kembla.
– *fragment an existing population into two or more populations*	The project will not fragment an existing population into two or more populations.
– *adversely affect habitat critical to the survival of a species*	Due to the distance between species breeding and feeding grounds, it is unlikely that the project will impact on habitat critical to the survival of the species.
– *disrupt the breeding cycle of a population*	The project will not disrupt the breeding cycle of the species population.
– *modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*	The availability or quality of habitat for this species will not be modified, destroyed, removed, isolated or decreased as a result of the project activities. Breeding and feeding grounds for the southern right whale are not known to occur within or around the project area.

Southern right whale	Assessment under the *EPBC Act 1999*
– *result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*	Half of the existing communities within Port Kembla consist of introduced species. The project will not result in invasive species that are harmful to the species becoming established in the species habitat.
– *introduce disease that may cause the species to decline*	The project will not result in the introduction of disease that may cause the species to decline.
– *interfere with the recovery of the species.*	The project will not interfere with the recovery of the species.
An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:	
– *substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species*	The project will not substantially modify, destroy or isolate an area of important habitat for the migratory species. Breeding and foraging grounds for the southern right whale are not known to occur within the project area.
– *result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species*	The project will not result in an invasive species that is harmful to the species becoming established in the species habitat.
– *seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species*	The project will not disrupt the lifecycle of an ecologically significant proportion of the population of the migratory species.

Long-nosed fur seal (*Arctocephalus forsteri*) and Australian fur seal (*Arctocephalus pusillus*)

These species were identified in the Protected Matters search as 'Listed Marine Species'. There are no assessment guidelines under the EPBC Act 1999 for species under this category therefore no assessment was made under the Act however, these species were assessed under the BC Act 2016.

Indian Ocean bottlenose dolphin (*Tursiops aduncus*) and Bottlenose dolphin (*Tursiops truncates s. str.*)

These species were identified in the Protected Matters search as 'Listed Marine Species'. There are no assessment guidelines under the EPBC Act 1999 for species under this category; therefore, no assessment was made under the Act however, these species were assessed under the BC Act 2016.

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