



Shoreline EPBC Referral

Marine Component

Prepared for:

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frc reference: 160304

Document Control Summary

Project No.: 160304
Status: Final Report
Project Director: Carol Conacher
Project Manager: Liz West
Title: Shoreline EPBC Referral: Marine Component
Project Team: Liz West, James Bone, Cameron Forward and Carol Conacher
Client: Biodiversity Assessment and Management Pty Ltd
Client Contact: Jo Chambers
Date: 6 May 2016
Edition: 160304i
Checked by: Carol Conacher _____
Issued by: Liz West _____

Distribution Record

BAAM Ecology: as pdf

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Summary

The proposed Shoreline project is on a 310 ha site to the south of Redland Bay, along the foreshore of Moreton Bay, Queensland (subject site). The proposed project seeks to introduce a traditional urban development pattern, structured around a series of well designed neighbourhoods serviced by a local village centre.

frc environmental was commissioned to assess issues relating to aquatic ecology and wetlands to inform a referral under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999*.

Scale of Potential Impacts

There will be no direct impacts of the proposed Shoreline project to Moreton Bay or to marine plants on the site. Indirect impacts to the marine ecosystems may include:

- increases in turbidity, suspended solids and sedimentation during construction
- spills of hydrocarbons and other contaminants during construction
- nutrient enrichment or contamination of downstream waters due to the disturbance of nutrient rich or contaminated sediment during construction
- acid sulfate runoff from disturbance of acid sulfate soils during construction
- increased stormwater runoff (with greater non-permeable surfaces on the site) and associated contaminants and foreshore erosion
- increased waterway usage for recreation
- spread of weeds and pests, and
- increased litter.

Mitigation measures include:

- retention of natural vegetation along the foreshore and surrounding waterways
- water sensitive urban design
- implementation of sediment and erosion control plans
- adherence to applicable Australian Standards and codes for the storage of fuels and fishing
- implementation of a weed management strategy

- implementation of an erosion and stormwater management plan
- implementation of an acid sulphate soil management plan, if applicable, and
- implementation of litter reduction strategies.

Overall, while the timing of some potential impacts may be long-term (e.g. construction impacts may occur over the 8 to 15 year build out time and other impacts are ongoing), potential impacts are likely to be localised (within 100's of metres) and of low intensity where appropriate mitigation measures are developed and implemented.

Existing Environment

The subject site is on the foreshore of Moreton Bay, a wave dominated estuary that supports a wide variety of aquatic flora (including seagrass, mangroves and saltmarsh communities) and fauna (including commercially important and threatened species).

There is a continuous band of mangroves (approximately 20 to 130 m wide) along the foreshore of the subject site. A number of small creeks and a tidally inundated artificial pond on the subject site are also lined with mangroves. There are some seagrass communities located approximately 200 to 400 m from the subject site.

Matters of National Environmental Significance

The marine matters of national environmental significance relevant to the subject site are the Moreton Bay Ramsar wetland, three species of threatened and migratory marine turtles (green turtle, loggerhead turtle and hawksbill turtle) and the migratory dugong and Indo-Pacific humpback dolphin.

Risk to Matters of National Environmental Significance

The assessment of the proposed Shoreline project has not identified any significant impacts on the values of any of the subject matters of national environmental significance. Where minor impacts have been identified, mitigation measures and management plans will minimise impacts of the proposed Shoreline project to adjacent and downstream waterways, including Moreton Bay.

1 Background

The proposed Shoreline project is on a 310 ha site to the south of Redland Bay, straddling Serpentine Creek Road and includes areas along the foreshore of Moreton Bay, from Lot 2 RP 149309 in the north, to Lot 2 RP 140163 in the south (subject site; Figure 1.1 and Map 1). The proposed project seeks to introduce a traditional development pattern, structured around a series of well designed neighbourhoods serviced by a local village centre.

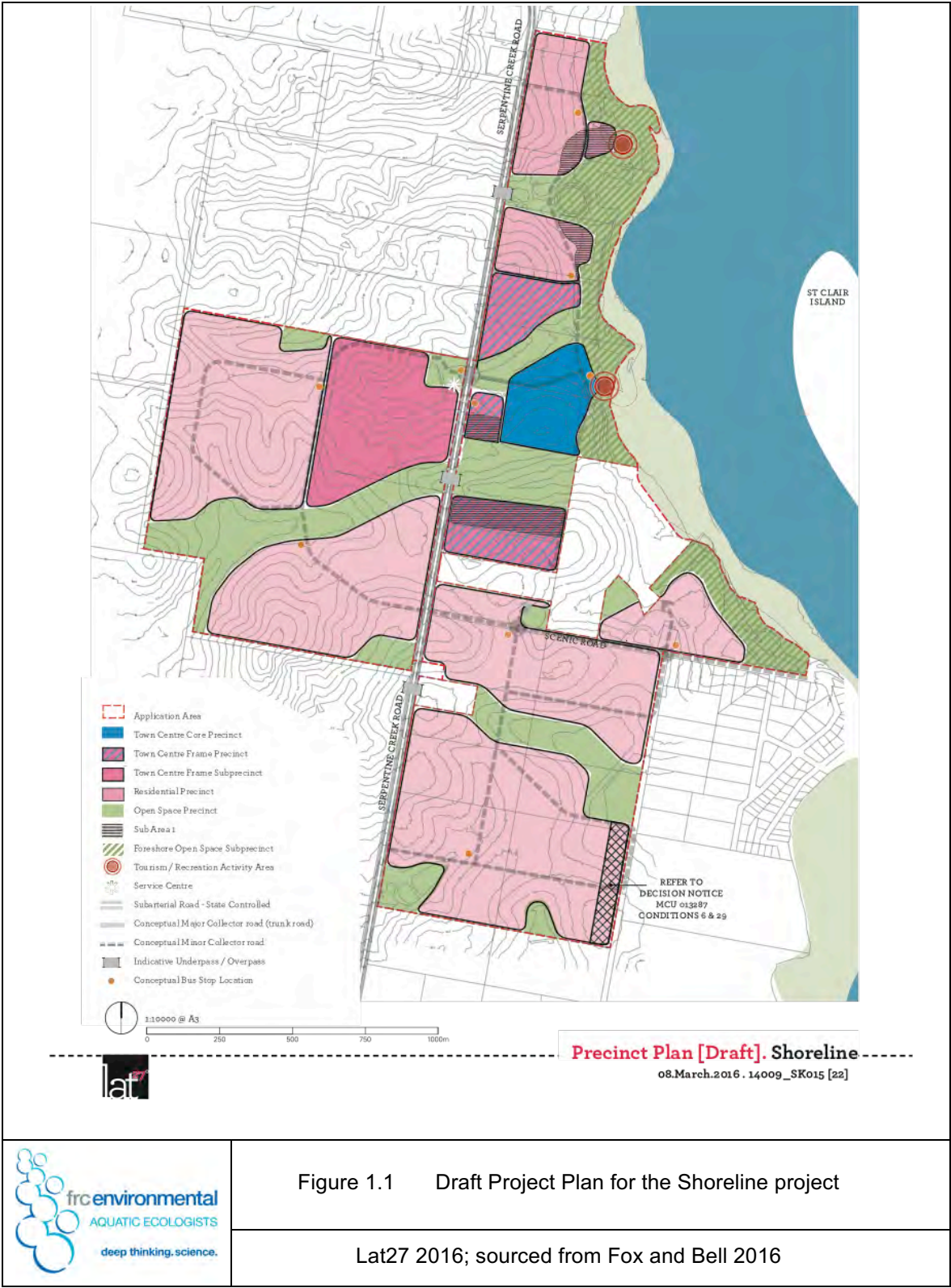
The subject site has been extensively cleared and is currently predominantly used for market gardening, horticulture and grazing.

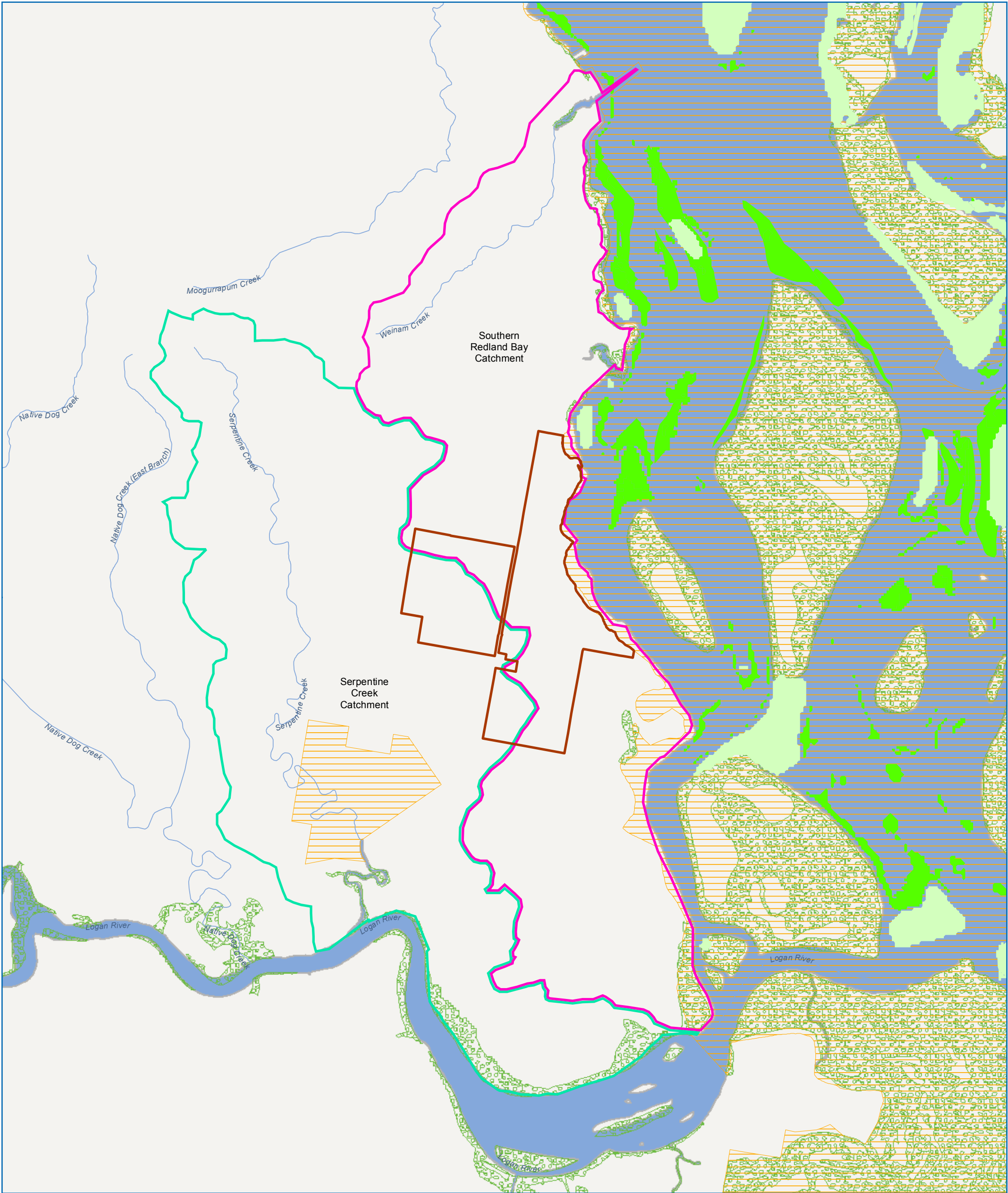
1.1 Scope of Work

frc environmental was commissioned to undertake environmental assessment services to inform a referral under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) with respect to marine¹ ecology. Specifically, frc environmental was requested to:

- briefly describe the existing marine ecosystems that may be impacted by the proposed project, based on our brief field surveys (done in November 2013), and on a review of the literature
- describe the marine Matters of National Environmental Significance (MNES) that may be impacted by the proposed project
- assess the likely occurrence of listed marine MNES in the area that may be impacted by the proposed Shoreline project
- assess likely impacts to these MNES, with reference to criteria in *The Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DoTE 2013a)
- assess the likely risk to each aquatic MNES, and
- summarise potential impacts and risk to marine MNES as a result of the construction and operation of the Project.

¹ With the definition of 'marine' ecology including estuarine ecology.





Shoreline EPBC Referral
Aquatic Component

Map 1:
Location of proposed Shoreline development
in relation to RAMSAR wetlands, seagrass
and mangrove communities

LEGEND

- Shoreline Development Boundary
- RCC Catchments
 - Serpentine Creek Catchment
 - Southern Redland Bay Catchment
- Mangroves
- Ramsar Wetland
- Watercourse

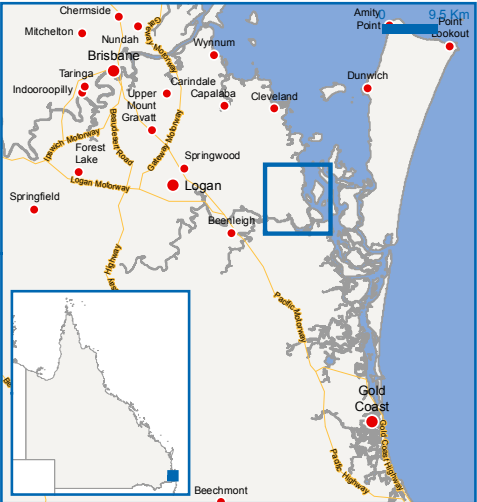
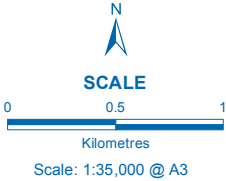
Seagrass Moreton Bay 2011 Survey Roelfsema

- 1-25%
- 25-50%
- 50-75%
- 75-100%

SOURCES

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© State of Queensland (Department of Science, Information Technology and Innovation) 2016
© Commonwealth of Australia (Department of Environment) 2010
Seagrass: Roelfsema, 2011

DATE	DRAWN BY	VERSION	PROJECTION
2016-04-28	JWB	01	Coordinate System: GDA 1994 MGA Zone 56 Projection: Transverse Mercator Datum: GDA 1994



2 The Proposed Project and Potential Area of Impact

2.1 Project Description

The proposed Shoreline project comprises an urban village containing 4,100 lots to cater for approximately 10,000 people. Large areas of the proposed project will provide extensive open space and environmental areas.

Key features of the proposed project include:

- a new village with readily identifiable boundaries accommodating up to 10,000 people clustered about a small local commercial centre, which contains convenience retailing, cafes / restaurants and commercial facilities
- a range of residential types and densities developed at an average of 15 dwellings / tenements per hectare
- a 29 ha foreshore park fronting Moreton Bay, with conservation and recreation areas
- a build out time of 8 to 15 years
- the creation of two major wildlife corridors connecting the coastal areas with habitat to the west of the site
- best practice storm water treatment, including the integration of recreation areas and open space with stormwater conveyance and treatment, and
- vertical realignment of Serpentine Creek Road to accommodate the proposed intersections, a fauna overpass and two fauna underpasses (Giles Consulting International 2014) (Figure 1.1).

The proposed Shoreline project incorporates a 25 to 100 m setback between the highest astronomical tide (HAT) and the edge of the development (Design Flow 2014). The area between HAT and the development is zoned 'Foreshore Open Space'. In addition, there are 'Open Spaces' approximately 50 to 100 m wide along each of the creeks leading to the bay. There is no proposed development or direct disturbance to areas below HAT. Further, no marine plants (as defined under the Queensland *Fisheries Act 1994*) are proposed to be disturbed by the proposed Shoreline project.

2.2 Potential Impacts and Mitigation

There will be no direct impacts of the proposed Shoreline project to Moreton Bay or to marine plants. Indirect impacts to the marine ecosystem may include:

- increases in turbidity, suspended solids and sedimentation during construction
- spills of hydrocarbons and other contaminants during construction
- nutrient enrichment or contamination of downstream waters due to the disturbance of nutrient rich or contaminated sediment during construction
- acid sulfate runoff from disturbance of acid sulfate soils (ASS) during construction
- increased stormwater runoff (with greater non-permeable surfaces on the subject site) and associated contaminants and foreshore erosion
- increased waterway usage for recreation, including fishing
- spread of weeds and pests, and
- increased litter.

Increased Turbidity, Sediment Suspension and Smothering

Excavation activities during construction of the proposed project have the potential to contribute sediment to the downstream waterways. This risk is highest during the wet season or following heavy rain. Any increase in the sediment load entering the system would be expected to directly increase turbidity and suspended sediments in the water column, and may lead to enhanced sediment deposition and the smothering of benthic communities.

The potential impacts of increased turbidity, sediment suspension and smothering on marine communities include:

- reduced respiration and feeding of benthic invertebrate communities leading to a reduction in abundance and biodiversity
- traumatisation of fish gill tissues affecting growth and survival
- reduced growth of marine plants by limiting light for photosynthesis
- burying of aquatic plants (including roots and mangrove pneumatophores) and invertebrate communities (burrowing polychaetes and crustaceans), and
- reduced seagrass diversity and reductions in epifaunal densities.

The effects of increased suspended solids and sedimentation resulting from excavation and construction are highly variable and will depend on the techniques used, the season and the characteristics of the sediment. Coarse sediments settle from the water column quickly and are less likely to move away from the excavation site. Fine sediments remain suspended longer and may be carried further before settling, and consequently are more likely to smother marine organisms.

Where an Erosion and Sediment Control Management Plan is developed and implemented, potential impacts of increases in turbidity, suspended solids and smothering during construction will largely be mitigated. Retention of natural vegetation in surrounding waterways and Water Sensitive Urban Design (WSUD) will also mitigate potential impacts.

Spills of Hydrocarbons and other Contaminants

A moderate spill of hydrocarbons or other contaminants from a construction vehicle or other equipment, may impact the local marine ecosystem. Hydrocarbons, heavy metals and other contaminants can have major impacts on aquatic communities, and can impact growth, morphology, reproduction and development of aquatic flora and fauna. The biological effects of toxicant discharge are usually greatest in low energy environments (such as within estuaries or lakes), where accumulation and retention in fine sediments can occur (Gundlach & Hayes 1978; Jackson et al. 1989). The hydrocarbon type and concentration, together with environmental factors (e.g. wave and wind action) and previous exposure influence the severity of impact.

Where fuel storage and handling activities during construction are undertaken in accordance with AS1940 (*Storage and Handling of Flammable and Combustible Liquids* – encompassing spill containment and response protocols), the risk of moderate and acute spills during construction is considered to be minor.

Nutrient Enrichment and Disturbance of Contaminated Sediments

Excavation and construction activities may result in an increase in the concentration of nutrients or contaminants in waterways downstream of construction sites due to runoff from disturbed areas. Increased concentrations of nutrients and contaminants in coastal waters can impact the health, composition and resilience of local floral and faunal communities. Where the runoff is a one-off occurrence, communities may be adversely impacted, but would be expected to recover over time.

Where an Erosion and Sediment Control Management Plan is developed and implemented, potential impacts associated with an increase in the concentration of nutrients or contaminants during construction will largely be mitigated.

Acid Sulfate Soils

Acid sulfate soils occur naturally over low-lying coastal areas, mainly below 5 m Australian height datum (AHD). When exposed to air (e.g. due to excavation), potential ASS can cause harm to the marine ecosystem. There will be no development below 5 m AHD for the proposed Shoreline project (Fox and Bell, pers. comm. April 2016). If required, an Acid Sulfate Soil Management Plan (ASSMP) will be developed to ensure that ASS encountered are appropriately identified and treated. If applicable, the impacts of disturbing ASS on aquatic ecology can be substantially managed and minimised through the ASSMP.

Spread of Weeds and Pests

Construction works in and around wetlands and waterways have the potential to spread aquatic weeds if vehicles and other plant and equipment are not appropriately washed down. If aquatic weeds become established, they can obstruct smaller waterways, displacing native flora species and reducing the quality of habitat for native aquatic fauna.

Increased urban density near the wetland areas may lead to an increase in weed cover in mangrove and saltmarshes. This may be a result of dumping of garden refuse in the wetland areas, by seeds and propagules being inadvertently spread along access tracks and paths by vehicles or on foot, and by the air and water borne spread of seeds and propagules from gardens and landscaped areas.

A weed management strategy, and a strategy for the maintenance of wetland and native plant areas on the subject site would reduce the risk of the spread or introduction of weeds and pests.

Increased Litter

An increase in human activity associated with the proposed Shoreline project may eventuate in an increase in the amount of litter entering the downstream waterways and pose a threat to marine fauna. For example, entanglement in debris can lead to death

from asphyxiation, abrasion, infection or reduced ability to feed or avoid predators (Laist 1997). Debris such as plastic bags are commonly mistaken for prey items and ingested, or can be accidentally ingested (e.g. fishing line). Ingestion of litter and debris can cause fatal blockages in the digestive system for a range of fauna, including marine turtles and mammals (Laist 1997).

Risks associated with increased litter can be minimised by:

- the development and implementation of the Erosion and Stormwater Management Plan, and measures including gross pollutant traps
- educational signage, explicitly stating the risk to wildlife of disposing rubbish in the water
- the provision of public use rubbish bins, and
- support of local and state action plans (DEHP 2013b).

Increased Stormwater Runoff

The proposed Shoreline project will result in a greater area of non-permeable surfaces, and therefore a greater volume of stormwater runoff. Stormwater runoff may increase the risk of erosion, decrease salinity levels and carry a range of pollutants (sediments and nutrients) into adjacent waterways, particularly during high flow following heavy rainfall.

An increase in non-permeable surfaces on the subject site may result in a greater volume of stormwater (freshwater) runoff to downstream waterways. However, the size of the catchments potentially impacted are relatively small, and this is unlikely to result in a measurable change to current fluctuations in salinity levels in downstream waterways.

Waterways on the subject site will be revegetated, and integrated with stormwater treatment systems to improve water quality. In addition, most of the existing dams will be decommissioned and the waterway re-established. Constructed wetlands to treat stormwater; bioretention basins to accept and treat piped stormwater; and sediment basins to capture coarse sediment will be established in the 'Foreshore Open Space' and 'Open Space' areas. These features can be designed to improve the value of the existing waterways to aquatic ecology.

The WSUD objectives for the proposed Shoreline project are:

- 80% reduction in total suspended solids
- 6% reduction in total phosphorous

- 45% reduction in total nitrogen, and
- 90% reduction in gross pollutants (Design Flow 2014).

More detailed design and modelling will be required to ensure these objectives can be attained. However, given the current and proposed land uses, these objectives appear to be attainable, particularly given the large areas of 'Foreshore Open Space', and 'Open Space' in the proposed design, and the proposed stormwater treatment plan. Where these objectives are attained, there would be an improvement to water quality entering downstream waterways.

Erosion and Stormwater Management Plans will be developed for the proposed Shoreline project. Where erosion and sediment control devices on the subject site have been designed in accordance with best practices, including the *Soil Erosion and Sediment Control Engineering Guidelines for Queensland Construction Sites 1996*, impacts will be minor.

Increased Waterway Use

Increased waterway use for recreational activities is likely to occur as a result of the high number of people predicted to use the area. Recreational activities in Moreton Bay are likely to be limited to swimming and fishing, as there are no boardwalks, jetties or boat / kayak launching areas proposed below HAT. Swimming and fishing can directly damage marine communities (e.g. trampling on seagrass beds); alter the behaviour of marine life (either attract or deter fauna); increase the risk of invasive species and litter; and / or deplete stocks.

Recreational fishing in Moreton Bay is regulated by the *Moreton Bay Marine Park Zoning Plan 2008* (NPSR 2015) and fishing rules and regulations for Queensland administered by the Department of Agriculture and Fisheries (DAF 2016). Therefore, there is likely to be a low risk of impacts from increases in swimming and fishing activities in waters adjacent to the proposed project.

2.3 Scale of Potential Impacts

While the timing of some potential impacts may be long-term (e.g. construction impacts may occur over the 8 to 15 year build out time and other impacts may be ongoing), overall potential impacts are likely to be localised and of low intensity where appropriate mitigation measures and management plans are developed and implemented. There is

no proposed development or direct disturbance to areas below HAT or to marine plants. The spatial area of any potential indirect impacts from the proposed Shoreline project is likely to be within 100's of metres of the subject site where appropriate mitigation measures and management plans are developed and implemented.

3 Existing Environment

3.1 Moreton Bay

Moreton Bay is a wave-dominated estuary (150,000 ha in area) located on the southeast coast of Queensland, approximately 15 km east of Brisbane. The bay is separated from the ocean by a series of offshore barrier islands, which restrict large-scale flow of oceanic water. The western shore of Moreton Bay is dominated by mangrove forests, supported by soft sediments derived from flood plumes, while the eastern side of the bay is dominated by mangroves in sandy sediments (Lovelock et al. 2011). Saltmarsh habitats occur alongside mangrove systems and exhibit differences between the western and eastern banks. Extensive hypersaline saltmarsh areas occur on the western side, whereas narrow saltmarsh areas occur on the eastern side due to freshwater processes on the barrier islands (Lovelock et al. 2011).

Water quality generally improves across the bay with strong tidal processes evident (Dennison & Abal 1999). Low outflow and tidal processes generally create low turbidity conditions for extensive seagrass beds to grow in the eastern bay region. In contrast, in some western regions of the bay, strong outflow from the drainage basins create turbid conditions, inhibiting seagrass growth (DNPSR 2015). Seagrass beds in Moreton Bay support a wide range of species, including commercially important, nationally threatened and migratory fauna (DNPSR 2015).

The Moreton Bay catchment covers approximately 227,000 ha and consists of 14 major river catchments from six drainage basins, namely; South Coast, Logan-Albert, Brisbane, Pine, Maroochy and Noosa Rivers (DoTE 2016q). The Brisbane and the Logan-Albert drainage basins predominantly feed southern Moreton Bay. The proposed Shoreline project is approximately 4 km north of the Logan-Albert outflow into Moreton Bay and has a frontage of 2.4 km of foreshore on Moreton Bay.

3.2 Catchments

The proposed Shoreline project is located in the Redlands catchment, and is predominantly in the southern Redland Bay subcatchment, with a small section also in the Serpentine Creek subcatchment (Map 1). The subject site rises steeply from the coast to an elevation of approximately 35 m AHD, with a predominant north-south ridge contributing to minor catchments flowing east and west. The waterways on the subject site are ephemeral, with small pools persisting after significant rainfall. There are also a number of man-made dams on the subject site.

Southern Redland Bay subcatchment is a narrow strip of coastal land with several short waterways. Weinam and Torquay Creeks drain the northern end of the catchment, with several small unnamed creeks flowing from west to east and discharging into Moreton Bay. The dominant land use is rural non-urban, with some with recent urban residential development in the lower Weinam and Torquay Creek areas. Serpentine Creek catchment rises in the Days Road Conservation Area and flows south into the lower reach of Logan River.

3.3 Key Habitats in the Vicinity of the Subject Site

Mapping by the Queensland Government indicates there are small patches of seagrass approximately 200 to 300 m east of the proposed Shoreline project and larger patches to the north of St Claire Island, approximately 400 m from the proposed project (DAFF 2008; Roelfsema et al. in review) (Map 1). No seagrass was observed on the intertidal flats in a brief field survey at low tide in November 2013.

Extensive areas of mangrove and saltmarsh / claypan and unvegetated sediment characterise the intertidal flats adjoining the subject site (Map 1). To the east of the subject site there are two mangrove dominated islands: St Clair and the larger Pannikin Island.

A brief field survey in November 2013 identified a continuous band of mangroves that varied in width from approximately 20 to 130 m along the foreshore of the subject site (Figure 3.1; Map 1). A number of small creeks and a tidally inundated artificial pond (that used to be an aquaculture facility) were also lined with mangroves. In a number of areas, mangrove seedlings appeared to be colonising to landward of the existing mature mangroves (Figure 3.2). To the east, broad intertidal mud flats extended out in front of the mangroves (Figure 3.3 and Figure 3.4). The shallow intertidal flats near the foreshore were covered in mangrove pneumatophores and had abundant macroinvertebrates on them.

The mangroves were dominated by *Avicennia marina* (grey mangrove). On the seaward side the mangroves formed an open to closed forest, up to 8 m high, while on the landward side they were often smaller, sometimes forming closed shrublands. Other mangrove species found in the area include:

- *Aegiceras corniculatum* (river mangrove)
- *Ceriops australis* (yellow mangrove)
- *Excoecaria agallocha* (blind your eye mangrove), and

- *Rhizophora stylosa* (red or stilt mangrove).

Figure 3.1

Mangrove forest dominated by *Avicennia marina*.



Figure 3.2

Mangroves seedlings colonising to landward.



Figure 3.3

Mangroves dominated by *Avicennia marina* along the northern foreshore. Broad intertidal flats extend out from the foreshore.



Figure 3.4

Broad intertidal flats extend out from the foreshore.



To landward of the mangroves there were areas of saltmarsh dominated by species such as *Sporobolus virginicus* (salt couch), *Suaeda arbusculoides* (jelly bean plant), *Suaeda australis* (seablite) and *Phragmites australis* (common reed). To landward again, there were stands of *Casuarina glauca* (she oak; Figure 3.5). Nearer the shore there was *Sporobolus virginicus* underneath the *Casuarina*, indicating this area was inundated by extreme high tides.

There were abundant macroinvertebrates (crabs and molluscs) in the mangroves and in the intertidal area to landward.

Figure 3.5

Casuarina forest behind the mangroves.



4 Matters of National Environmental Significance

The EPBC Act is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places — defined in the EPBC Act as MNES (DoTE 2014a).

The nine MNES to which the EPBC Act applies are:

- world heritage properties
- national heritage places
- wetlands of international importance (Ramsar wetlands)
- nationally threatened species and ecological communities
- migratory species
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions, and
- a water resource in relation to coal seam gas development and large coal mining development.

In addition, the EPBC Act confers jurisdiction over actions that have a significant impact on the environment where the actions affect, or are taken on, Commonwealth land, or are carried out by a Commonwealth agency (even if that significant impact is not on one of the nine MNES).

When an activity is referred to the federal environment department, it is assessed to determine whether or not it will have a significant impact on nationally protected matters. The minister or departmental delegate determines whether the activity will need to be further assessed – this is the 'referral decision'. A referral decision will deem the action is either:

- **a controlled action:** a significant impact on an MNES is likely, and further assessment is required
- **not a controlled action, particular manner:** no further assessment is required but the action must be carried out in the manner described in the decision

- **not a controlled action:** unlikely to have significant impact on MNES, no further assessment required, or the
- **action clearly unacceptable:** the activity cannot proceed as it will have an unacceptable impact on MNES.

This report has been prepared to assist in this referral decision with respect to marine MNES.

4.1 Protected Matters Search

The Protected Matters Search Tool was used to assist in determining whether marine MNES were likely to occur in or near the area potentially impacted by the proposed Shoreline development. The search area included the subject site and a 5 km buffer zone. This search area was considered to include all marine areas that are within the likely extent of impact, in order to adequately identify all marine MNES that could potentially be impacted by the proposed project.

The following MNES relevant to marine ecology were listed in this search:

- World Heritage Properties – none
- National Heritage Places – none
- Wetlands of International Importance – 1
- Great Barrier Reef Marine Park – none
- Commonwealth Marine Areas – none
- Listed Threatened Ecological Communities – 1
- Listed Threatened Species – 14
- Listed Migratory Species – 22

Other matters listed in the search results included 109 listed marine species and 14 whales and other cetaceans.

There are no World Heritage Properties, National Heritage Places, Commonwealth Lands, Commonwealth Heritage Places, Commonwealth reserves or critical habitats in the vicinity of the Project Area. Likewise, the Great Barrier Reef Marine Park is approximately 350 km north of the proposed project and will not be affected. The Temperate East Marine Bioregional Plan (Commonwealth of Australia 2012) has been prepared under

section 176 of the EPBC Act for Commonwealth Marine Area (which extend from 3 to 200 nautical miles from the coastline). The Commonwealth Marine Area is approximately 25 km east of the proposed project will not be affected by the proposed project.

Listed 'marine species' and 'whales and other cetaceans' are protected in Commonwealth Marine Areas under the EPBC Act. The closest Commonwealth Marine Area is three nautical miles offshore. The Project will not have a significant impact on Commonwealth Marine Areas and thus listed 'marine species' and species listed only as 'marine species' or 'whales and other cetaceans' are not considered further in this report. However, species that are also listed as 'migratory' or 'threatened' are also protected in state waters (i.e. coastal waters to three nautical miles and other waters under Queensland jurisdiction) under the EPBC Act.

Under section 34 of the EPBC Act, threatened ecological communities listed as vulnerable are not protected under Part 3 'Requirements for Environmental Approvals' of the Act. The listed threatened ecological community in the vicinity of the proposed project is listed as 'vulnerable', and is consequently not considered further in this report.

'Wetlands of international importance', 'threatened species' and 'migratory species' are discussed in the following sections.

Results of the EPBC Act Protected Matters Search for within 5 km of the subject site are provided in Appendix A. These results are indicative only. Further assessment is required (DoTE 2014b), and is provided in the remainder of this Chapter.

4.2 Wetlands of International Importance (Ramsar Wetlands)

The proposed project is adjacent to the Moreton Bay Ramsar wetland. This wetland is approximately 113,314 ha in its entirety, and comprises:

- Moreton Island
- parts of North Stradbroke Island
- parts of South Stradbroke Island
- parts of Bribie Island
- some of the Southern Bay Islands
- waters and tributaries of Pumicestone Passage
- some intertidal and subtidal areas of the western bay, southern bay and sandy channels of the Broadwater region

- marine areas and sand banks within the central and northern bay, and
- some beach habitats (DoTE 2014c).

Aquatic habitats within the Moreton Bay Ramsar wetland include seagrass and shoals, tidal flats, mangroves, saltmarshes, coral communities, freshwater wetlands, peatland habitats, ocean beach and foredunes.

Moreton Bay Ramsar wetland was declared as it:

- is one of the largest estuarine bays in Australia which is enclosed by a barrier island of vegetated sand dunes
- plays a substantial role in the natural functioning of a major coastal system through its protection from oceanic swells providing habitat for wetland development, receiving and channeling the flow of all rivers and creeks east of the Great Dividing Range from the McPherson Range in the south to the north of the D'Aguilar Range
- supports over 355 species of marine invertebrates, at least 43 species of shorebirds, 55 species of algae associated with mangroves, seven species of mangrove and seven species of seagrass
- is a significant feeding ground for green turtles and is a feeding and breeding ground for dugong. Moreton Bay also has the most significant concentration of young and mature loggerhead turtles in Australia, and is ranked among the top ten dugong habitats in Queensland
- supports more than 50,000 wintering and staging shorebirds during the non-breeding season. At least 43 species of shorebirds use intertidal habitats in the Bay, including 30 migratory species listed by JAMBA and CAMBA, and
- is particularly significant for the population of wintering Eastern curlews (3,000 to 5,000) and the Grey-tailed tattler (more than 10,000).

4.3 Listed Threatened Marine Species

Fourteen threatened (endangered or vulnerable) marine species were listed as potentially occurring within 5 km of the proposed project using the protected matters search tool. The likelihood that these species are present in the area potentially impacted by the proposed Shoreline project, was assessed using the criteria in Table 4.1.

One freshwater threatened species was also recorded in this search: the Mary River cod (*Maccullochella mariensis*). This species is restricted to the Mary River catchment, and

consequently there is a very low likelihood it would occur within the freshwater habitats adjacent to the subject site.

Table 4.1 Criteria used to assess the likelihood of occurrence of species.

Likelihood of Occurrence	Definition
low	The species is considered to have a low likelihood of occurring in the area potentially impacted by the Project, or occurrence is infrequent and transient. Existing database records are considered historic, invalid or based on predictive habitat modelling. The habitat does not exist for the species, or the species is considered locally extinct. Despite a low likelihood based on the above criteria, the species cannot be totally ruled out of occurring in the potentially impacted area.
moderate	There is habitat for the species; however, it is either marginal or not particularly abundant. The species is known from the wider region.
high	The species is known to occur in the potentially impacted area, and there is core habitat in this area.

Ecological information used in the assessment of the likelihood of occurrence of each threatened marine species included:

- the results of literature search
- the results of field surveys, and
- professional experience.

The likelihood of occurrence of each species was supported by evidence of their habitat preferences, and the availability and distribution of critical habitats close to the proposed project and of the wider region. Habitats of particular importance to Commonwealth listed marine and estuarine species (i.e. critical habitats) include their preferred / key:

- nesting / breeding areas
- feeding habitats, and
- migration corridors (Reeves 2008; Stern 2009).

It also includes areas where the species may not presently occur, which are critical if the species is to recover from its currently threatened state (Gibson & Wellbelove 2010). The presence and condition of these key areas / habitats, and other habitats that are vital for the day-to-day survival of listed species, can assist in determining whether a species is

likely to occur within a particular area. The likelihood of occurrence of a species within an area will in turn influence the extent of likely impacts on the population from any proposed project.

Where appropriate management plans are implemented, there are unlikely to be significant impacts to the aquatic environment (refer to Section 2). Never-the-less the 'potential area of impact' for the purposes of this assessment comprised shallow inshore waters of Moreton Bay adjacent to the proposed development, and the creeks that run through the subject site. The likelihood of occurrence of each listed aquatic threatened species within this area is shown in Table 4.2

4.4 Listed Migratory Marine Species

Twenty-one migratory marine species were listed as potentially occurring within 5 km of the proposed project using the protected matters search tool. Of these listed migratory species, 12 species are also listed as threatened species.

Where appropriate management plans are implemented, there are unlikely to be significant impacts to the marine environment (refer to Section 2). Never-the-less the 'potential area of impact' for the purposes of this assessment comprised shallow inshore waters of Moreton Bay adjacent to the proposed development, and the creeks that run through the subject site. The likelihood of occurrence of each listed marine migratory species within this area is shown in Table 4.3.

Table 4.2 Threatened marine species listed as potentially occurring within 5 km of subject site on the online Protected Matters search tool, and their likelihood of occurrence in the area potentially impacted by the Shoreline project.

Species	Common Name	EPBC Act Threatened Status	Ecological Information	Likelihood of Occurrence in Area of Potential Impact
Mammals				
<i>Balaenoptera musculus</i>	blue whale	E	<p>While the blue whale may occur in coastal and continental shelf waters off eastern Australia, they are typically found around the southern coastline off Western Australia and South Australia, where there are a number of known coastal aggregation sites associated with migratory routes (DSEWPAC 2012b). Blue whales are considered to be occasional visitors to the Moreton Bay region, with 1 stranding recorded from Moreton Island, 1 sighting reported from North Stradbroke Island and 1 animal whaled at the Tangalooma whaling station when in operation (Chilvers et al. 2005).</p> <p><i>Feeding Areas</i></p> <p>Blue whales feed at the ocean surface and at depth (Gill & Morrice 2003; McCauley et al. 2004). Within Australian waters, there are two known major feeding areas; off the South Australian; and, Western Australian coastlines. The blue whale feeds primarily on krill, but will also consume fish and squid (Kawamura 1980). The distribution of the primary krill prey extends into Eastern Australian waters (M. 1980), however feeding areas within this region are unknown.</p> <p><i>Breeding Areas</i></p> <p>Blue whales calve in deep waters off tropical island shelves outside of Australian waters (DoTE 2016b).</p> <p><i>Migration Routes</i></p> <p>The blue whale migrates from Antarctic and sub-Antarctic waters in the summer into Western Australian waters en route to Indonesian Archipelago waters for breeding (Double et al. 2012; Double et al. 2014). In Australia, they primarily use western and southern coastal waters during migration (DEWHA 2008).</p> <p><i>Key Threats</i></p> <p>Key threats include whaling, climate change, noise interference and vessel disturbance (DoTE 2016b).</p> <p>Summary</p> <p>Moreton Bay is not considered to be core habitat for this species, and the area is unlikely to support important populations or offer habitat critical to the survival of this species. There is a low likelihood that blue whales will occur within marine habitats adjacent to the Shoreline project, particularly given the relatively shallow water in the area.</p>	low
<i>Eubalaena australis</i>	southern right whale	E	<p>Southern right whale sightings in Australian waters are seasonal, typically occurring between May and November (DoTE 2016j). They are primarily found around the southern coastline off southern Western Australia and far west as South Australia, where there are a number of known coastal aggregation sites (DoTE 2016j). Sightings in Queensland waters are rare, but this species has been observed off Moreton Island, North Stradbroke Island and in Moreton Bay (Chilvers 2000) (Noad 2000).</p> <p><i>Feeding Areas</i></p> <p>Southern right whales are thought to feed in deep, offshore waters. Australian populations of southern right whales are likely to forage between 40°S and 65°S, generally south of Australia. The species typically consumes copepods in the northern part of these waters, while at higher latitudes (south of 50°S), krill is the main prey item (DoTE 2016j).</p> <p><i>Breeding Areas</i></p> <p>Southern right whales calve very close to the coast in Australia, usually in waters <10 m deep, primarily in Western Australia and South Australia (DSEWPAC 2012b). Nursery grounds are occupied from May to October (DoTE 2016j).</p> <p><i>Migration Routes</i></p> <p>The migratory paths between calving and feeding areas are not well understood. However, there is substantial movement along the coast, indicating that connectivity of coastal habitats is important (DoTE 2016j).</p>	low

Species	Common Name	EPBC Act Threatened Status	Ecological Information	Likelihood of Occurrence in Area of Potential Impact
<i>Key Threats</i> Key threats include whaling, climate change, vessel disturbance, competition with fisheries for prey, noise interference and habitat degradation (DoTE 2016j). <i>Summary</i> While they may migrate along the coast, inshore coastal waters have no particular significance to southern right whales. Moreton Bay is not considered to be core habitat, unlikely to support important populations, or offer habitat critical to the survival of this species. There is a low likelihood that southern right whales will occur within marine habitats adjacent to the Shoreline project, particularly given the relatively shallow water in the area.				
<i>Megaptera novaeangliae</i>	humpback whale	V	<p>Humpback whales occur in two separate populations within Australian waters, the west coast and the east coast populations. Sightings along the coastlines are highly seasonal and linked to the northerly and southerly migration routes to breeding areas in tropical waters (DoTE 2016p). The migratory pathway of humpback whales is on the eastern side of the large sand islands that separate Moreton Bay and the Pacific Ocean. Moreton Bay is an important resting area for humpback whales during migration, particularly during the southward migration in September and October (Chilvers et al. 2005).</p> <p><i>Feeding Areas</i></p> <p>Eastern Australian humpback whales are likely to forage at higher latitudes, south of 55°S, and will only feed opportunistically upon arrival into coastal Australian waters (DoTE 2016p).</p> <p><i>Breeding Areas</i></p> <p>Calving takes place during winter in tropical waters at low latitudes (15°S to 20°S) (Chittleborough 1965; W.H. 1966). The breeding area for the eastern population of the humpback whale is presumed to be off the coast between central and northern Queensland (Smith et al. 2012).</p> <p><i>Migration Routes</i></p> <p>During summer, humpback whales feed in high latitudes and during winter move north to tropical waters for calving, using close, coastal waters (DoTE 2016p). During migration, resting is undertaken around the Hervey Bay region (Chaloupka et al. 1999; Paterson et al. 2001; Double et al. 2010) and around Moreton Bay (DEH 2005).</p> <p><i>Key Threats</i></p> <p>Key threats include whaling, climate change, competition with fisheries for prey, noise interference and habitat degradation (DoTE 2016p).</p> <p><i>Summary</i></p> <p>While some areas in the north of Moreton Bay are important resting areas for humpback whales, the area potentially impacted by the proposed Shoreline project is not considered to be core habitat and is unlikely to support important populations or offer habitat critical to the survival of this species. There is a low likelihood that humpback whales will occur within marine habitats adjacent to the Shoreline project, particularly given the relatively shallow water in the area.</p>	low
Reptiles				
<i>Caretta caretta</i>	Loggerhead Turtle	E	<p>Loggerhead turtles are primarily found around coral and rocky reefs, seagrass beds and muddy bays throughout eastern, northern and western Australia (Limpus et al. 1992; Prince 1994; Limpus 1995a). Moreton Bay is an important foraging ground for the loggerhead turtle (DoTE 2013b).</p> <p><i>Feeding Areas</i></p> <p>The loggerhead turtle forages in a wide range of intertidal and subtidal habitats, including coral and rocky reefs, seagrass meadows, and non-vegetated sand or mud areas (Limpus 2008b). They tend to maintain small home ranges within their foraging grounds (within approximately 10 to 15 km of coastline). Moreton Bay is an important foraging ground for the loggerhead turtle (DoTE 2013b).</p>	moderate

Species	Common Name	EPBC Act Threatened Status	Ecological Information	Likelihood of Occurrence in Area of Potential Impact
Chelonia mydas	green turtle	V	<p><i>Breeding Areas</i></p> <p>Loggerhead turtles nest on open, sandy beaches (Spotila 2004). The three major nesting areas for loggerhead turtles in Queensland are in the Great Barrier Reef, and include:</p> <ul style="list-style-type: none">· the Capricorn Bunker Island Groups, especially Wreck, Tryon and Erskine islands· Mon Repos and adjacent beaches of the Woongarra Coast and Wreck Rock Beach, together with· the islands of the Swain Reefs, especially Pryce Island and Frigate, Bylund, Thomas and Bacchi cays. <p>A small number of loggerhead turtles nest on the local sand islands of Bribie, Moreton, and North and South Stradbroke (DNPRSR 2007).</p> <p><i>Migration Routes</i></p> <p>Loggerhead turtles show fidelity to both their feeding and breeding areas, and can make reproductive migrations between foraging and nesting areas of over 2,600 km (Limpus et al. 1992).</p> <p><i>Key Threats</i></p> <p>Key threats include commercial and recreational fishing, coastal infrastructure and development (including industrial, residential and tourism development), Indigenous harvest, feral animal predation, and climate change (DoTE 2016e).</p> <p>Summary</p> <p>Moreton Bay supports a significant loggerhead turtle feeding population. Loggerhead turtles are moderately likely to occur within marine habitats adjacent to the Shoreline project, particularly in the adjacent seagrass beds.</p>	
			<p>The green turtle is globally distributed in tropical and sub-tropical waters, and is usually associated with shallow marine habitats that support seagrass and algal communities (DoTE 2013c). Green turtles are known to feed on the seagrass in Moreton Bay (DNPRSR 2007).</p> <p><i>Feeding Areas</i></p> <p>Immature green turtles are carnivorous (Brand-Gardner et al. 1999), while adults are generally herbivorous, feeding mostly on algae and seagrass. Adults will occasionally eat other items such as mangrove fruit, sponges and jellyfish (Forbes 1994; Pendoley & Fitzpatrick 1999). Adult green turtles typically forage in shallow benthic habitats such as tidal and subtidal coral and rocky reefs and inshore seagrass beds and algae mats (Poiner & Harris 1996; Musick & Limpus 1997; Robins et al. 2002). Green turtles are known to feed on the seagrass in Moreton Bay (DNPRSR 2007).</p> <p><i>Breeding Areas</i></p> <p>Green turtles nest on sandy beaches. In Queensland, southern green turtle populations typically nest around the Capricorn-Bunker Groups and adjacent islands in the southern Great Barrier Reef (Limpus et al. 2003), but also nest on islands of the outer edge of the reef (DoTE 2013c). There are no key nesting areas in Moreton Bay, however, some turtles nest on the sandy beaches of the outer islands.</p> <p><i>Migration Routes</i></p> <p>Green turtles can migrate more than 2,600 km between their feeding and nesting grounds.</p> <p><i>Key Threats</i></p> <p>Key threats include commercial and recreational fishing, coastal infrastructure and development (including industrial, residential and tourism development), Indigenous harvest, feral animal predation, and climate change (DoTE 2016f).</p> <p>Summary</p> <p>Moreton Bay supports feeding populations of green turtles. Green turtles may occur in the seagrass beds adjacent to the proposed project, however, this seagrass habitat is likely to be patchy and sparse compared to other areas in Moreton Bay. Green turtles are moderately likely to</p>	moderate

Species	Common Name	EPBC Act Threatened Status	Ecological Information	Likelihood of Occurrence in Area of Potential Impact
occur within marine habitats adjacent to the Shoreline project, particularly in the adjacent seagrass beds.				
<i>Dermochelys coriacea</i>	leatherback turtle	E	<p>The leatherback turtle is a pelagic species in tropical, subtropical and temperate waters. On the Australian east coast, leatherback turtles typically occur from south-east Queensland to central New South Wales. As the most pelagic of all marine turtles, the leatherback turtle spends much of its time in the open ocean and venturing close to shore, mainly during the nesting season (Lutz & Musick 1996; Benson et al. 2007; GBRMPA 2011). There is no known resident population of leatherback turtles in Moreton Bay (DNPRSR 2007).</p> <p><i>Feeding Areas</i></p> <p>The leatherback turtle is a pelagic feeder, primarily consuming gelatinous organisms such as jellyfish and salps (Kaplan 1995; Bjorndal 1997). Their distribution reflects the distribution of their food, and can be explained by 'hot spots' of jellyfish abundance (Leary 1957; Lazell 1980). Foraging leatherbacks have been recorded as far south as Bass Strait and through the Gulf of Carpentaria (GBRMPA 2011).</p> <p><i>Breeding Areas</i></p> <p>Leatherback turtles require sandy beaches to nest. There are no large leatherback turtle rookeries in Australia; however, leatherback turtles occasionally nest within the Great Barrier Reef, with nesting recorded at Wreck Rock and adjacent beaches near Bundaberg (one to three nests per annum) (GBRMPA 2011). Sporadic nesting has been recorded at other widely scattered sites in Queensland; however, there is a strong likelihood that leatherback turtles have not nested in Queensland since 1996 (Hamman et al. 2006; GBRMPA 2011).</p> <p><i>Migration Routes</i></p> <p>The leatherback turtle spends much of its time in the open ocean and may traverse thousands of kilometres over its lifetime from feeding areas to nesting beaches (Lutz & Musick 1996; Benson et al. 2007). Leatherback turtles are known to migrate from Australia to rookeries in Indonesia, Papua New Guinea and Solomon Islands (Limpus 1995b; Hamman et al. 2006).</p> <p><i>Key Threats</i></p> <p>Key threats include commercial and recreational fishing, coastal infrastructure and development (including industrial, residential and tourism development), Indigenous harvest, feral animal predation, and climate change (DoTE 2016g).</p> <p>Summary</p> <p>Given that there is no known population in Moreton Bay, there are no key nesting habitats and it's largely pelagic existence, there is a low likelihood that leatherback turtles occur within marine habitats adjacent to the Shoreline project.</p>	low
<i>Eretmochelys imbricata</i>	hawksbill turtle	V	<p>The hawksbill turtle is globally distributed in tropical, sub-tropical and temperate waters (GBRMPA 2013c). There is a small resident population of hawksbill turtles in Moreton Bay.</p> <p><i>Feeding Areas</i></p> <p>Hawksbill turtles are heavily reliant on coral reef and rocky habitats, where they forage mainly on sponges but also seagrass, algae, squid, gastropods, sea cucumbers, soft corals and jellyfish (GBRMPA 2013c). As juveniles, they eat plankton (Meylan 1984). Feeding areas occur throughout eastern Queensland, from Torres Strait to Julian Rocks in northern New South Wales.</p> <p><i>Breeding Areas</i></p> <p>Hawksbill turtles nest on sandy beaches in the northern Great Barrier Reef and the Torres Strait. In Australia, the key nesting and inter-nesting areas include:</p> <ul style="list-style-type: none"> · Milman Island and the inner Great Barrier Reef Cays north from Cape Grenville Central · Torres Strait islands · Crab Island · Murray Islands 	moderate

Species	Common Name	EPBC Act Threatened Status	Ecological Information	Likelihood of Occurrence in Area of Potential Impact
			<ul style="list-style-type: none">· Darnley Island· Woody Island· Red Wallis and Woody Wallis Islands· Bramble Cay and Johnson Islet (Torres Strait), and· Western Cape York Peninsula (DEHP 2005). <p><i>Migration Routes</i></p> <p>Hawksbill turtles that nest or forage on the east coast of Australia migrate to Indonesia, Papua New Guinea, the Solomon Islands, and Vanuatu (GBRMPA 2013c).</p> <p><i>Key Threats</i></p> <p>Key threats include commercial and recreational fishing, coastal infrastructure and development (including industrial, residential and tourism development), Indigenous harvest, feral animal predation, and climate change (DoTE 2016i).</p> <p>Summary</p> <p>Despite not providing critical habitat, there is a small resident population of hawksbill turtles in Moreton Bay, and they may feed in, or traverse, the area adjacent to the proposed project. There is a moderate likelihood that hawksbill turtles occur within marine habitats adjacent to the Shoreline project.</p>	
<i>Lepidochelys olivacea</i>	olive turtle	ridley E	<p>Olive ridley turtles occur in tropical and sub-tropical regions of the Pacific and Indian oceans. In Australia, they are found in soft-bottomed, shallow, protected waters from the Joseph Bonaparte Gulf in Western Australia to southern Queensland (GBRMPA 2013d). They are typically not associated with coral reef habitat or shallow inshore seagrass flats (Limpus 2008a). Very few individuals have been recorded in Moreton Bay (e.g. only 3 reported captures by fishers in trawl nets; Robins & Mayer 1998).</p> <p><i>Feeding Areas</i></p> <p>Olive Ridley turtles feed in continental shelf waters on crabs, echinoderms, shellfish and gastropods (GBRMPA 2013d). A substantial part of the immature and adult population forage over shallow benthic habitats (Harris 1994 cited in Limpus 2008a); however, large juvenile and adult olive ridley turtles have been recorded in both benthic and pelagic foraging habitats (Musick & Limpus 1997). Foraging habitat can range from depths of several metres (Conway 1994) to over 100 m (Whiting et al. 2005).</p> <p><i>Breeding Areas</i></p> <p>There are two main breeding areas for olive ridley turtles in Australia, one in the Northern Territory with about 1,000 nesting females per year, and the other in the Gulf of Carpentaria with less than 100 nesting females per year (GBRMPA 2013d). There are no records of nesting from the east coast of Australia.</p> <p><i>Migration Routes</i></p> <p>Studies in the eastern Pacific and Atlantic Ocean show long distance reproductive migratory behaviour for olive ridley turtles, which is similar to other sea turtle species (Meylan 1982).</p> <p><i>Key Threats</i></p> <p>Key threats include commercial and recreational fishing, coastal infrastructure and development (including industrial, residential and tourism development), Indigenous harvest, feral animal predation, and climate change (DoTE 2016m).</p> <p>Summary</p> <p>Moreton Bay does not provide critical habitat and is unlikely to support important populations or offer habitat critical to the survival of this species. Further, very few individuals have been recorded in Moreton Bay. There is a low likelihood that olive ridley turtles occur within marine</p>	low

Species	Common Name	EPBC Act Threatened Status	Ecological Information	Likelihood of Occurrence in Area of Potential Impact
habitats adjacent to the Shoreline project.				
<i>Natator depressus</i>	flatback turtle	V	<p>Unlike other marine turtles, the flatback turtle lacks an oceanic phase and remain in the surface waters of the continental shelf throughout its life. Little is known about their foraging habits and habitat, although juvenile and adult turtles seem to occupy similar habitats and both forage on soft-bodied (mostly benthic) organisms (Limpus et al. 1994) (e.g. 4 reported captures in trawl nets in Robins & Mayer 1998).</p> <p><i>Feeding Areas</i></p> <p>The flatback turtle tends to forage in shallow continental shelf waters with soft substrates, feeding on a variety of soft-bodied animals, including soft corals, sea pens, sea cucumbers and jellyfish (Limpus 2007). Catch records from trawlers (as bycatch) indicate that the flatback turtle also feeds in turbid, shallow (depth of 10 m to 40 m) inshore waters. The foraging distribution for the eastern Australian stock encompasses from Hervey Bay to Torres Strait and possibly into the Gulf of Papua (Limpus 2007).</p> <p><i>Breeding Areas</i></p> <p>Flatback turtle nesting habitat includes sandy beaches in the tropics and subtropics, with all recorded nesting beaches in Australia (Limpus et al. 1989). In eastern Queensland, flatback turtles nest between Bundaberg in the south to the Torres Strait in the north. The main nesting sites in the southern Great Barrier Reef are:</p> <ul style="list-style-type: none">· Curtis Island· Peak Island· Facing Island· Hummock Hill Island, and· Wild Duck islands (Limpus 1971; Limpus et al. 1983). <p>Scattered aperiodic nesting occurs along the mainland and on inshore islands between Townsville and the Torres Strait (Limpus et al. 1994). Nesting activity is greatest between late November and early December ceasing sometime in late January.</p> <p><i>Migration Routes</i></p> <p>Flatback Turtles make long reproductive migrations similar to other species of sea turtles, although most of these movements are restricted to the continental shelf (DoTE 2013d). Migrations have been recorded between Australia and Indonesia, Papua New Guinea, Solomon Islands and Vanuatu (GBRMPA 2013a).</p> <p><i>Key Threats</i></p> <p>Key threats include commercial and recreational fishing, coastal infrastructure and development (including industrial, residential and tourism development), Indigenous harvest, feral animal predation, and climate change (DoTE 2016r).</p> <p>Summary</p> <p>Moreton Bay is not considered to be core habitat and is unlikely to support important populations or offer habitat critical to the survival of this species. Further, very few individuals have been recorded in Moreton Bay. There is a low likelihood that flatback turtles occur marine habitats adjacent to the Shoreline project.</p>	low
Fish and Sharks				
<i>Epinephelus daemeli</i>	black rockcod	V	<p>The black rockcod occurs in warm temperate and subtropical waters of the south-western Pacific, including south-eastern Australia and parts of New Zealand (DSEWPaC 2012a). Black rockcod generally inhabit near-shore rocky and offshore coral reefs at depths down to 50 m, but are occasionally recorded from deeper waters. In coastal waters adult black rockcod are found in rock caves, rock gutters and on rock reefs. Recently settled juveniles are often found in coastal rock pools, while older juveniles can be found in estuaries (DSEWPaC 2012a).</p> <p><i>Feeding Areas</i></p>	low

Species	Common Name		EPBC Act Threatened Status	Ecological Information	Likelihood of Occurrence in Area of Potential Impact
				<p>Black rockcod are a large, opportunistic carnivore that preys on smaller fishes and crustaceans (McCulloch 1922; Pogonoski et al. 2002a). It is likely that they feed in and around rocky or coral reef habitats.</p> <p><i>Breeding Areas</i></p> <p>Little is known about their reproductive behaviour, but they are known to aggregate during spawning (Malcolm & Harasti 2010).</p> <p><i>Key Threats</i></p> <p>Current threats to black rockcod are incidental by-catch by commercial and recreational fishers, and illegal fishing activities (DSEWPaC 2012a). Modification of estuarine habitat is considered a potential threat to juvenile black cod (DSEWPaC 2012a).</p> <p>Summary</p> <p>Given the banks are predominantly lined by mangroves with sandy or muddy substrates, there is a low likelihood that black rockcod occur within marine habitats adjacent to the Shoreline project.</p>	
<i>Carcharias taurus</i>	grey nurse shark		CE	<p>The grey nurse shark occurs in two distinct populations on the east and west coast of Australia. The eastern coastal species is distributed from southern Queensland to southern New South Wales, with sharks primarily aggregating within inshore rocky reefs and islands (DoTE 2016c). Critical habitat for the shark includes those sites used for aggregation and several of these are noted within the Moreton Bay Marine Park (Environment Australia 2014).</p> <p><i>Feeding Areas</i></p> <p>Grey nurse sharks may work cooperatively to feed (Compagno 1984; Ireland 1984) and feed on a variety of smaller vertebrate, squids and crustaceans (Compagno1984). It is likely that feeding takes place around aggregate areas.</p> <p><i>Breeding Areas</i></p> <p>Little data is present on the breeding areas of the grey nurse shark, however the females may give birth at select pupping grounds (DoTE 2016c). Within pregnant grey nurse sharks of eastern Australia, a southerly migration is noted to pupping grounds from northerly mating and gestation aggregation sites (Bansemer & Bennett 2008).</p> <p><i>Migration Routes</i></p> <p>North to south migration between key critical habitats in grey nurse sharks occurs between aggregation sites for both male and female sharks (Bansemer and Bennett 2008).</p> <p><i>Key Threats</i></p> <p>Key threats include commercial fisheries bycatch and tourism (DoTE 2016c).</p> <p>Summary</p> <p>As the area adjacent to the subject site does not meet key habitat requirements for this species, there is a low likelihood that this species would occur within marine habitats adjacent to the Shoreline project.</p>	low
<i>Carcharodon carcharias</i>	great white shark		V	<p>Great white sharks are found in most coastal waters of Australia, with the exception of the Northern Territory. The shark generally inhabits both inshore coastal and continental habitats (Pogonoski et al. 2002 in DEWHA 2009), however within Australian waters, the great white shark primarily inhabits those areas from the coast to 100 metres (DoTE 2016d). There are few records of great white sharks in Moreton Bay (Karczmarski et al. 1997).</p> <p><i>Feeding Areas</i></p> <p>Juvenile individuals selectively hunt smaller prey classes (e.g. fish and other sharks), while larger individuals appear to selectively hunt marine mammals (Malcolm et al. 2001; Estrada et al. 2006). Seasonal site fidelity appears to occur (CMAR 2007).</p> <p><i>Migration Routes</i></p>	low

Species	Common Name	EPBC Act Threatened Status	Ecological Information	Likelihood of Occurrence in Area of Potential Impact
			<p>Seasonal migration is apparent in both juvenile and adult great white sharks and display highly directional, coastal migration up the eastern coast with through interconnected habitat areas during autumn to winter (Bruce et al. 2006).</p> <p><i>Breeding Areas</i></p> <p>Limited data is available for particular breeding areas, however it is expected to occur from spring through to summer in temperate areas (Francis 1996; Uchida et al. 1996).</p> <p><i>Key Threats</i></p> <p>Key threats include commercial fisheries bycatch and human protective measures (DoTE 2016d).</p> <p>Summary</p> <p>There is a low likelihood that great white sharks occur within marine habitats adjacent to the Shoreline project, particularly given the relatively shallow water in the area.</p>	
<i>Pristis zijsron</i>	green sawfish	V	<p>In Australian waters, green sawfish have historically been recorded in the coastal waters off Broome, Western Australia, around northern Australia and down the east coast as far as Jervis Bay in New South Wales (Stevens et al. 2005). However, there have been no records of this species south of Cairns since the 1960s (Stevens et al. 2005). The green sawfish inhabits inshore marine waters, estuaries and river mouths with both sandy and muddy bottom habitats (Allen 1997; Peverell et al. 2004; Stevens et al. 2005). It has been recorded in very shallow water (<1 m) to offshore trawl grounds in over 70 m of water (Stevens et al. 2005)</p> <p><i>Feeding Areas</i></p> <p>Sawfish feed on fishes and benthic invertebrates. They are relatively active on the mud and sand flats on a moving tide, presumably feeding (GBRMPA 2012).</p> <p><i>Breeding Areas</i></p> <p>Estuarine habitats are used as nurseries with juveniles migrating into marine waters (Thorburn et al. 2007).</p> <p><i>Key Threats</i></p> <p>Key threats include fisheries pressure and habitat degradation (DoTE 2016u).</p> <p>Summary</p> <p>The green sawfish has not been recorded south of Cairns since the 1960s. There is an extremely low likelihood for the species to be within marine or freshwater habitats adjacent to the Shoreline project.</p>	low
<i>Rhincodon typus</i>	whale shark	V	<p>The whale shark is found in all oceanic and coastal waters around Australia, however is more common in those of northern Western Australia, the Northern Territory and Queensland (Compagno 1984; Last & Stevens 1994). Whale sharks prefer warmer surface waters with cold-water upwellings (Pogonoski et al. 2002b). It is noted as a pelagic shark, but will also come into coastal waters (DoTE 2016v).</p> <p><i>Feeding Areas</i></p> <p>Whale sharks primarily feed on planktonic and nektonic prey using a suction filter feeding technique (Compagno 1984). The shark appears to aggregate seasonally in response to a pulse surge in prey in the areas around:</p> <ul style="list-style-type: none">· Ningaloo Reef (DoTE 2016v)· Christmas Island (DEH 2005)· Coral Sea (DEH 2005) <p>Overall feeding appears typically to occur near or at the water surface (Compagno 1984).</p>	low

Species	Common Name	EPBC Act Threatened Status	Ecological Information	Likelihood of Occurrence in Area of Potential Impact
			<p><i>Breeding Areas</i></p> <p>Data on sexual activity of the whale shark is limited, and no evidence of pupping has yet been recorded (Rowat & Brooks 2012). As no observations have occurred off the highly populated coastline of Eastern Australia, it would presume to only occur, in remote areas offshore.</p> <p><i>Key Threats</i></p> <p>Key threats include predation, habitat degradation, competition with fisheries and tourism (DoTE 2016v).</p> <p>Summary</p> <p>As the adjacent area does not meet habitat requirements of this species, there is an extremely low likelihood for whale sharks to occur within marine habitats adjacent to the Shoreline project.</p>	

Source: (DoTE 2014b)

CE Critically Endangered

E endangered

V vulnerable

Table 4.3 Migratory marine species listed as potentially occurring within 5 km of the subject site, on the online Protected Matters search tool, and their likelihood of occurrence in the area potentially impacted by the Shoreline project..

Species	Common Name	EPBC Act Threatened Status	Ecological Information	Likelihood of Occurrence in Area of Potential Impact
Mammals				
<i>Balaenoptera edeni</i>	Bryde's whale	-	<p>Bryde's whales occur within all Australian waters except Northern Territory, and, are found in both inshore and offshore waters (Bannister et al. 1996). There are a limited number of sightings in Australia. Bryde's whale is an occasional visitor to the Moreton Bay region, with two sightings recorded from Moreton and North Stradbroke islands (Chilvers et al. 2005).</p> <p><i>Feeding Areas</i></p> <p>Bryde's whales feed on a variety of prey items (Martin 1990; Kato 2002) and are broken into two key 'forms' (Best 1977). The coastal whale will consume schooling fishes while the offshore whale ingest crustaceans and cephalopods (Best 1960; 1977; Nemoto & Kawamura 1977; Ohsumi 1977; Kawamura 1980). No specific feeding areas are known for Bryde's whale, however it appears that the whale may follow local movements of prey (DoTE 2016a). Limited dive times have led to the whale being considered as pelagic (DoTE 2016a).</p> <p><i>Breeding Areas</i></p> <p>There are no known breeding areas for Bryde's whale, however the offshore form does travel northerly to tropical waters during winter and may be for breeding and calving (Kato 2002).</p> <p><i>Migration Routes</i></p> <p>Limited migration occurs for Bryde's whale. The inshore form appears to display limited movement while the offshore form migrates from subtropical to tropical waters, presumably for reproductive purposes.</p> <p><i>Key Threats</i></p> <p>Key threats include competition with fisheries and oceanic pollution (DoTE 2016a).</p> <p>Summary</p> <p>Moreton Bay is not considered to be core habitat for this species, and the area is unlikely to support important populations or offer habitat critical to the survival of this species. There is a low likelihood that Bryde's whales occur within marine habitats adjacent to the Shoreline project, particularly given the relatively shallow water in the area.</p>	low
<i>Balaenoptera musculus</i>	blue whale	E	See Table 4.2.	low
<i>Eubalaena australis</i>	southern right whale	E	See Table 4.2.	low
<i>Megaptera novaeangliae</i>	humpback whale	V	See Table 4.2.	low
<i>Orcaella heinsohni</i> (previously known as <i>Orcaella brevirostris</i>)	Australian snubfin dolphin	–	<p>This species is listed as <i>Orcaella brevirostris</i> (Irrawaddy dolphin) in the EPBC search results. However, in 2005, genetic analysis showed the dolphin described as the Irrawaddy dolphin in Australia was actually a different species, now described as the Australian snubfin dolphin, <i>Orcaella heinsohni</i> (Beasley et al. 2005). While Irrawaddy dolphins occur across southern Asia and the Gulf of Papua New Guinea, in both coastal and freshwater systems (Culik 2010), the Australian snubfin dolphin occur only in waters off the northern half of Australia and is Australia's only endemic dolphin species. The Australian snubfin dolphin occurs from approximately Broome on the west coast to the Brisbane River on the east coast, of which the latter was considered outside the normal range (Parra et al. 2002). There appears to be 'hotspots' of higher densities along the Queensland coast (Parra et al. 2002) and preliminary data suggest that they occur in small, localised populations (Stacey & Arnold 1999).</p> <p>They appear to inhabit shallow waters <15 m deep within 10 km of the coast and up to 20 km of a river mouth, often in proximity to seagrass meadows (GBRMPA 2013b). It is doubtful that they venture very far upstream in river systems, although occasional vagrants may venture upstream</p>	low

Species	Common Name	EPBC Act Threatened Status	Ecological Information	Likelihood of Occurrence in Area of Potential Impact
			<p>(Parra et al. 2002).</p> <p><i>Feeding Areas</i></p> <p>Like the Irrawaddy dolphin the Australian snubfin dolphin is assumed to be an opportunistic-generalist feeder, taking food from the bottom and water column. Diet consists primarily of fish, but includes cephalopods (squid and octopus) and crustaceans (prawns and crabs). Feeding may occur in a variety of habitats, from mangroves to sandy bottom estuaries and embayments, to rock and / or coral reefs. Feeding primarily occurs in shallow waters (less than 20 m) close to river mouths and creeks (DoTE 2016s).</p> <p><i>Breeding Areas</i></p> <p>There is limited information on the breeding and calving areas of the Australian snubfin dolphin, however mating is likely to occur year round (DoTE 2016s).</p> <p><i>Migration Routes</i></p> <p>Limited information exists on their migration routes; however, home ranges and territories for appear to be large (DoTE 2016s).</p> <p><i>Key Threats</i></p> <p>Key threats include competition with fisheries, incidental capture in nets, habitat destruction and degradation, pollution and interaction with vessels (DoTE 2016s).</p> <p>Summary</p> <p>The Brisbane River is considered the southern-most extent of the Australia snubfin dolphin range, and even so tenuously. Therefore, there is a low likelihood that Irrawaddy dolphin or Australian snubfin dolphins occur within marine habitats adjacent to the Shoreline project.</p>	
<i>Sousa chinensis</i>	Indo-Pacific humpback dolphin	–	<p>The distribution of Indo-Pacific humpback dolphins appears to be continuous along the east coast of Queensland (Corkeron et al. 1997). The Indo-Pacific humpback dolphin usually inhabits shallow coastal waters in association with rivers or creeks, estuaries, enclosed bays and coastal lagoons (Hale et al. 1998; Parra 2006). Recent surveys conducted in the far northern section of the Great Barrier Reef Marine Park showed that most sightings of Indo-Pacific humpback dolphins occurred in waters less than 5 km from land, 20 km from the nearest river mouth, and in waters less than 15 m deep (Parra et al. 2006b). Moreton Bay is one of the southernmost bay systems with a resident Indo-Pacific humpback dolphin population and is estimated to have approximately 100 and 163 individuals, predominantly in the western side of the bay (Chilvers et al. 2005; Parra et al. 2006a).</p> <p><i>Feeding Areas</i></p> <p>Indo-Pacific humpback dolphins have only been recorded feeding in shallow waters. They feed in a variety of habitats, from mangroves to sandy bottom estuaries and embankments to rock and / or coral reefs (DEHP 2013a; DSEWPC 2013). They are opportunist-generalist feeders, consuming a wide variety of coastal and estuarine fishes, but also reef, littoral and demersal fishes, and some cephalopods and crustaceans (Parra 2005).</p> <p><i>Breeding Areas</i></p> <p>No key calving areas are known in Australian waters (Bannister et al. 1996).</p> <p><i>Migration Routes</i></p> <p>Indo-Pacific humpback dolphins are considered to be migratory, with evidence of migration across international boundaries (Culik 2003). In Queensland, there is evidence to indicate possible seasonality between different habitats (DEHP 2013a). Home ranges appear to be large.</p> <p><i>Key Threats</i></p> <p>Key threats include habitat destruction and degradation, bycatch in gillnets and shark nets, illegal sport killing, overfishing of prey species, pollution and human interaction threats arising from tourism and transport (DoTE 2016w).</p>	moderate

Species	Common Name	EPBC Act Threatened Status	Ecological Information	Likelihood of Occurrence in Area of Potential Impact
<i>Dugong dugon</i>	dugong	-	<p>Summary</p> <p>Given their known population in Moreton Bay and preference for shallow coastal and estuarine areas, the Indo-Pacific humpback dolphin is moderately likely to feed in or traverse within marine habitats adjacent to the Shoreline project.</p> <p>Dugong occur in all northern coastal waters from Broome in Western Australia to Moreton Bay in Queensland (Marsh et al. 2002; Marsh et al. 2011). The population of dugongs in Moreton Bay has been estimated to range between approximately 503 to 1019 individuals. The eastern banks of Moreton Bay supported 80–98% of the dugong population at any one time. In this area, there are several dugong 'hot spots' generally associated with seagrass communities (Lanyon 2003; Chilvers et al. 2005).</p> <p><i>Feeding Areas</i></p> <p>Dugongs feed almost exclusively on seagrass, particularly <i>H. uninervis</i>, <i>H. ovalis</i> and <i>H. spinulosa</i>, and principally inhabit seagrass meadows of shallow, protected bays and mangrove channels (Preen 1992; Preen et al. 1995; Lanyon & Morris 1997; Marsh et al. 2011). Their dependence on seagrass for food generally limits them to waters within 20 km of the coast, although individuals have been sighted further from the coast during aerial surveys (e.g. Marsh & Lawler 2002) and they have been observed feeding in deep-water (water depth of more than 20 m) seagrass (Lee Long et al. 1997).</p> <p><i>Breeding Areas</i></p> <p>Limited data suggests that dugong utilise tidal sandbanks and estuaries for calving (Marsh et al. 1984; Marsh et al. 2011). Mating herds have been observed in Moreton Bay (Marsh et al. 2011).</p> <p><i>Migration Routes</i></p> <p>Dugongs prefer shallow and protected areas with seagrass meadows, however they can be highly migratory due to their search for suitable seagrass or warmer waters (Marsh et al. 2002) and are known to travel several hundred kilometres. Dugongs have evolved to cope with the inherently unpredictable and patchy nature of seagrass meadows by moving to alternative areas known to support seagrass in the past.</p> <p><i>Key Threats</i></p> <p>Key threats include habitat degradation, pollution, anthropogenic noise and interaction with fisheries (DoTE 2016h).</p>	moderate
			<p>Summary</p> <p>Moreton Bay supports feeding and breeding populations of dugong. Dugong are moderately likely to occur within the marine habitats adjacent to the Shoreline project, particularly in the adjacent seagrass beds.</p> <p>Dusky dolphins mostly occur in temperate and sub-Antartic, inshore waters (Ross 2006; DoTE 2016k). There are only thirteen records of the dusky dolphin in Australian waters (Bannister et al. 1996; Gill et al. 2000; Ross 2006).</p> <p><i>Feeding Areas</i></p> <p>Dusky dolphins are considered to be surface feeders (DoTE 2016k). Limited evidence suggests they feeds offshore during the night and rests inshore during the day (Sekiguchi et al. 1992; Bannister et al. 1996; Würsig et al. 1997). No Australia-specific feeding information is available, however it would be expected that Australian populations of the dusky dolphin exhibit similar behaviour.</p> <p><i>Breeding Areas</i></p> <p>No breeding or calving areas are identified in Australian waters (DoTE 2016k).</p> <p><i>Migration Routes</i></p> <p>Limited information is available for seasonal movement patterns in Australia, but movement patterns may be linked to the position of the Subtropical Convergence and / or ENSO events (DoTE 2016k).</p>	
<i>Lagenorhynchus obscurus</i>	dusky dolphin	-		low

Species	Common Name	EPBC Act Threatened Status	Ecological Information	Likelihood of Occurrence in Area of Potential Impact			
Orcinus orca	killer whale	-	Key Threats				
			Key threats include pollution and interaction with fisheries.				
			Summary				
			Moreton Bay is not considered to be core habitat for this species, and the area is unlikely to support important populations or offer habitat critical to the survival of this species. There is a low likelihood that dusky dolphins will occur within marine habitats adjacent to the Shoreline project, particularly given the relatively shallow water in the area.				
			Killer whales are found throughout Australian state, continental and oceanic waters. Within these waters, killer whales are predominantly found in southern state waters (Ling 1991; Chatto & Warneke 2000).	low			
			Feeding Areas				
			Killer whales feed on an abundance of prey types, including fish, invertebrates, birds and marine mammals (Bannister et al. 1996; Saulitis et al. 2000). In Australia, foraged generally occurs in coastal or oceanic waters (DoTE 2016t). Therefore, foraging by killer whales within Moreton Bay would be highly unlikely.				
			Breeding Areas				
			No calving areas are known in Australian waters (DoTE 2016t).				
			Migration Routes				
Killer whales are noted to probably follow migratory routes (DoTE 2016t), however, these migratory routes would generally occur along typical habitats; oceanic or continental shelf waters.							
			Key Threats				
			Key threats include pollution, targeted hunting and illegal killing, and interactions with fisheries, including the potential for incidental capture (DoTE 2016t).				
			Summary				
			Moreton Bay is not considered to be core habitat for this species, and the area is unlikely to support important populations or offer habitat critical to the survival of this species. There is a low likelihood that killer whales will occur within marine habitats adjacent to the Shoreline project.				
			Reptiles				
			Caretta caretta	loggerhead turtle	E	See Table 4.2.	moderate
			Chelonia mydas	green turtle	V	See Table 4.2.	moderate
			Dermochelys coriacea	leatherback turtle	E	See Table 4.2.	low
			Eretmochelys imbricata	hawksbill turtle	V	See Table 4.2.	moderate
			Lepidochelys olivacea	olive ridley turtle	E	See Table 4.2.	low
Natator depressus	flatback turtle	V	See Table 4.2.	low			

Species	Common Name	EPBC Act Threatened Status	Ecological Information	Likelihood of Occurrence in Area of Potential Impact
Fish and Sharks				
<i>Pristis zijsron</i>	green sawfish	V	See Table 4.2.	low
<i>Rhincodon typus</i>	whale shark	V	See Table 4.2.	low
<i>Carcharodon carcharias</i>	great white shark	V	See Table 4.2.	low
<i>Lamna nasus</i>	mackerel shark	–	<p>The mackerel shark is a wide ranging coastal and oceanic species found in temperate and cold-temperate waters worldwide, preferring water temperatures below 18°C (Stevens et al. 2006). In Australia, this species occurs from southern Queensland to south-west Australia (Last & Stevens 2009). They typically occur in oceanic waters off the continental shelf, although they occasionally enter coastal waters (Francis et al. 2002).</p> <p><i>Feeding Areas</i></p> <p>Mackerel sharks are thought to be reasonably flexible in the types of habitat used for foraging (Pade et al. 2009). The mackerel shark feeds on pelagic fish and cephalopods, with elasmobranchs forming a small part of their diet (Joyce et al. 2002).</p> <p><i>Breeding Areas</i></p> <p>Mackerel sharks in the southern hemisphere are thought to give birth off New Zealand and Australia in winter (Francis & Stevens 2000); however, little is known of their key pupping areas.</p> <p><i>Migration Routes</i></p> <p>The mackerel shark is known to undertake seasonal migrations, although the timing and details of these migratory movements are not well-understood (Saunders et al. 2011).</p> <p><i>Key Threats</i></p> <p>The key threat to this species is overfishing (DoTE 2016I).</p> <p>Summary</p> <p>Mackerel shark typically occurs in waters off the continental shelf. While they may venture into the coastal area of Moreton Bay, there is a low likelihood they will occur within marine habitats adjacent to the Shoreline project.</p>	low
Rays				
<i>Manta birostris</i>	giant manta ray	–	<p>The taxonomy of mantra rays has recently been revised and the genus <i>Manta</i> now includes two distinct species:</p> <ul style="list-style-type: none"> · <i>Manta birostris</i> a more oceanic species that migrates large distances in cooler waters, and · <i>Manta alfredi</i> more common on the continental shelf, around tropical and subtropical coral and rocky reefs, islands and along coastlines (Marshall 2008; Marshall et al. 2009; Couturier et al. 2011; see below). <p><i>Feeding Areas</i></p> <p>The manta rays feeds on plankton, and can be encountered in large numbers along productive coastlines with regular upwelling, oceanic island groups and particularly offshore pinnacles and seamounts (Marshall et al. 2011). They can also be encountered on shallow reefs while being cleaned or feeding at the surface inshore and offshore. In inshore areas, they can occasionally be observed in sandy bottom areas and seagrass beds (Marshall et al. 2011).</p>	low

Species	Common Name	EPBC Act Threatened Status	Ecological Information	Likelihood of Occurrence in Area of Potential Impact
<i>Manta alfredi</i>	Reef Manta Ray,		<p><i>Breeding Areas</i></p> <p>There is little information on the reproductive biology of the giant manta ray (Marshall et al. 2011).</p> <p><i>Migration Routes</i></p> <p>While the manta rays is widely distributed and appears to be a migratory species, regional populations appear to be small considering the scale of their habitat (Marshall et al. 2011).</p> <p><i>Key Threats</i></p> <p>No threat data is available (DoTE 2016o).</p> <p>Summary</p> <p>The area adjacent to the Shoreline Project does not provide critical habitat for <i>M. birostris</i>, and as such, there is a low likelihood that they will occur within marine habitats adjacent to the Shoreline project.</p>	low
			<p>As above, the taxonomy of mantra rays has recently been revised and the genus <i>Manta</i> now includes two distinct species:</p> <ul style="list-style-type: none">· <i>Manta birostris</i> a more oceanic species that migrates large distances in cooler waters (see above), and· <i>Manta alfredi</i> more common on the continental shelf, around tropical and subtropical coral and rocky reefs, islands and along coastlines (Marshall 2008; Marshall et al. 2009; Couturier et al. 2011). <p>Of the two giant manta ray species, the most likely species to occur near the coastline is <i>M. alfredi</i>. This species shows high site affinity that is likely to be related to feeding areas, cleaning stations, reproductive sites and migratory landmarks (Couturier et al. 2011).</p> <p><i>Feeding Areas</i></p> <p>The manta rays feeds on plankton, and can be encountered in large numbers along productive coastlines with regular upwelling, oceanic island groups and particularly offshore pinnacles and seamounts (Marshall et al. 2011). They can also be encountered on shallow reefs while being cleaned or feeding at the surface inshore and offshore. In inshore areas, they can occasionally be observed in sandy bottom areas and seagrass beds (Marshall et al. 2011).</p> <p><i>Breeding Areas</i></p> <p>There is little information on the reproductive biology of the manta rays (Marshall et al. 2011).</p> <p><i>Migration Routes</i></p> <p>While the manta rays is widely distributed and appears to be a migratory species, regional populations appear to be small considering the scale of their habitat (Marshall et al. 2011).</p> <p><i>Key Threats</i></p> <p>No threat data is available (DoTE 2016n).</p> <p>Summary</p> <p>While the area adjacent to the Shoreline Project may provide some habitat requirements for vagrant <i>M. alfredi</i>, there is an extremely low likelihood that they will occur within marine habitats adjacent to the Shoreline project.</p>	

Source: (DoTE 2014b)
E endangered
V vulnerable

5 Potential Impacts to Marine MNES

5.1 Significant Impacts

In order to decide whether an action is likely to have a significant impact (refer to Appendix B for definitions of impacts), it is necessary to take into account the nature and magnitude of potential impacts. In determining the nature and magnitude of an action's impacts, it is important to consider matters such as:

- the sensitivity of the environment that will be impacted
- the timing, duration and frequency of the action and its impacts
- all on-site and off-site, and direct and indirect impacts
- the total impact that can be attributed to the action over the entire geographic area affected, and over time
- existing levels of impact from other sources, and
- the degree of confidence with which the impacts of the action are known and understood, and
- avoidance and mitigation measures.

The Sensitivity of the Environment that will be Impacted

Important habitats, including seagrass and mangrove communities, adjacent to the proposed Shoreline project, are considered relatively sensitive. Further, Moreton Bay Ramsar wetland supports a wide range of flora and fauna sensitive to change.

While communities adjacent to the proposed project may be sensitive to changes in water quality (turbidity, suspended sediments, nutrients and contaminants), sedimentation, invasive species and litter, potential impacts from the proposed Shoreline project are localised and of low intensity. There are unlikely to be any significant impacts to Moreton Bay (including seagrass, mangroves and wetland communities) from the proposed Shoreline project.

The local marine ecosystem is considered not sensitive to the low intensity potential impacts from the proposed Shoreline project where appropriate mitigation measures are implemented.

The Timing, Duration and Frequency of the Action and its Impacts

The timing of some potential impacts may be long-term, with construction impacts occurring over the 8 to 15 year build out time and other impacts likely to be ongoing. However, potential impacts are predicted to be localised and of low intensity where appropriate management plans are developed and implemented.

On-site and Off-site, and Direct and Indirect Impacts

There will be no direct impacts from the proposed Shoreline project on the marine ecosystem or marine plants on-site or off-site.

Indirect impacts both on-site and off-site are considered to be minor, and include possible changes to water quality (turbidity, suspended sediments, nutrients and contaminants), sedimentation, introduction of invasive species and increased litter. However, the mitigated risk of indirect on-site and off-site impacts is low.

The Total Impact that can be Attributed to the Action Over the Entire Geographic Area Affected, and Over Time

There is no proposed development or direct disturbance to areas below HAT or to marine plants. The spatial area of any potential indirect impacts from the proposed Shoreline project is likely to be within 100's of metres of the subject site where appropriate mitigation measures are implemented. Therefore, the magnitude and geographical extent of the likely impacts of the proposed Shoreline project are low.

Existing Levels of Impact from Other Sources

Potential impacts from the proposed Shoreline project are considered to be low compared to existing impacts. Major pressures include sediment (and nutrients), population growth, climate variability and litter (Healthy Waterways 2016). The region supports significant economic value and is home to over 3 million people and a significant number of interstate and international visitors (ABS 2012). The WSUD objectives of the Shoreline project will result in water quality improvement over existing conditions.

The Degree of Confidence with which the Impacts of the Action are Known and Understood.

It is considered that potential impacts of the proposed Shoreline project on-site and off-site have been assessed with a 'high' degree of confidence, where appropriate best practice environmental monitoring and mitigation plans are adopted. Urban development on the Moreton Bay foreshore and in southeast Queensland is very common, and impacts from previous projects are well understood and will be used to inform appropriate mitigation and management.

Mitigation Measures

Mitigation measures include:

- retention of natural vegetation along the foreshore and surrounding waterways
- WSUD
- implementation of sediment and erosion control plans
- adherence to applicable Australian Standards and codes for the storage of fuels and fishing
- implementation of a weed management strategy
- implementation of an erosion and stormwater management plan, and
- implementation acid sulphate soil management plan, if applicable.

5.2 Wetlands of International Importance

The Significant Impact Criteria

The *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DoTE 2013a) indicate that an action will require approval if the action is occurring within or outside a declared Ramsar wetland if the action has, will have or is likely to have a significant impact on the ecological character of the Ramsar wetland. The ecological character is the combination of the ecosystem components, processes and benefits / services that characterise the wetland at a given point in time.

An action is likely to have a significant impact on the ecological character of a declared Ramsar wetland if there is a real chance or possibility that it will result in:

- areas of the wetland being destroyed or substantially modified
- a substantial and measurable change in the hydrological regime of the wetland, for example, a substantial change to volume, timing, duration and frequency of ground and surface water flows to and within the wetland
- the habitat or lifecycle of native species, including invertebrate fauna and fish species, dependant upon the wetland being seriously affected
- a substantial and measurable change in the water quality of the wetland – for example, a substantial change in the level of salinity, pollutants, or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human health, or
- an invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland.

The Appendix of the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DoTE 2013a) states that establishing a new subdivision in an existing suburb, with established infrastructure designed to manage environmental impacts, upstream of a large Ramsar wetland (such as the Moreton Bay Ramsar wetland) would not be expected to have a significant impact on the wetland.

The significant impact assessment for the proposed Shoreline project on Moreton Bay Ramsar wetland is shown in Table 5.1.

Table 5.1 Significant impact assessment for wetlands of international importance.

Significance Criterion	Moreton Bay Ramsar Wetland
Areas of the wetland being destroyed or substantially modified.	The proposed Shoreline project will have no direct impact on the Ramsar wetland. Indirect impacts will be of low magnitude following mitigation, with no areas of the Ramsar wetland destroyed or substantially modified.
A substantial and measurable change in the hydrological regime of the wetland, for example, a substantial change to volume, timing, duration and frequency of ground and surface water flows to and within the wetland.	<p>The proposed Shoreline project will have no direct impact on the Ramsar wetland or marine plants.</p> <p>There will be an increase in non-permeable surfaces on the subject site and therefore a greater volume of stormwater runoff to the wetland. However, the size of the proposed development is relative small (< 310 ha) compared to the subcatchments (approximately 1,340 ha for Southern Redland Bay and 1,660 ha for Serpentine Creek catchments); catchment (28,100 ha for the Redlands catchment); and, Ramsar wetland (approximately 113,314 ha). Therefore, any increased volume of runoff is likely to be minimal and not result in a substantial or measurable change to the hydrological regime (volume, timing, duration and frequency) of the Moreton Bay Ramsar wetland.</p>
The habitat or lifecycle of native species, including invertebrate fauna and fish species, dependent upon the wetland being seriously affected.	Where appropriate mitigation measures are developed and employed, there are unlikely to be significant impacts to aquatic flora and fauna in the Ramsar wetland.
A substantial and measurable change in the water quality of the wetland – for example, a substantial change in the level of salinity, pollutants, or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human health.	Provided suitable mitigation measures are undertaken, any changes to the water quality of the wetland (including changes to salinity, pollutants and nutrients) will be minor and temporary. Spills of contaminants, and the introduction of pollutants, are considered unlikely where appropriate management strategies are in place.
An invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland.	No marine invasive species are predicted to colonise the area as a result of the proposed Shoreline project. Increased urban density near the wetland areas may lead to an increase in weed cover in mangrove and saltmarshes. This may be a result of dumping of garden refuse in the wetland areas, by seeds and propagules being inadvertently spread along access tracks and paths by vehicles or on foot, and by the air and water borne spread of seeds and propagules from gardens and landscaped areas. However, a weed management strategy, and a strategy for the maintenance of wetland and native plant areas on the subject site would reduce this risk of invasive species. Therefore, invasive species that are harmful to the ecological character of the wetland are unlikely to be established (or spread) in the wetland due to the development of the Shoreline project.

5.3 Listed Threatened Species

Three species of marine turtle listed as threatened under the EPBC Act were considered moderately likely to occur in this area. All other threatened aquatic species listed as possibly occurring in the area, were considered to have a low likelihood of occurrence in the area that may be impacted by the proposed development.

The Significant Impact Criteria

Critically Endangered and Endangered Species

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
- reduce the area of occupancy of the species
- fragment an existing population into two or more populations
- adversely affect habitat critical to the survival of a species
- disrupt the breeding cycle of a population
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat
- introduce disease that may cause the species to decline, or
- interfere with the recovery of the species.

The significant impact assessment of the proposed Shoreline project for loggerhead turtles is shown in Table 5.2. Loggerhead turtle is the only critically endangered species that are moderately likely to use the shallow, inshore areas adjacent to the proposed development (see Table 4.2)

Table 5.2 Significant impact assessment for endangered marine species moderately likely to occur within the area potentially impact by the proposed Shoreline project.

Significance Criterion	Loggerhead turtle
Lead to a long-term decrease in the size of a population ¹	Loggerhead turtle may occur in the shallow waters offshore of the proposed project. Following appropriate mitigation measure, there no significant impacts to loggerhead turtle or seagrass communities are likely. Therefore, there will be no long-term decrease in the size of the population from the proposed Shoreline project.
Reduce the area of occupancy of the species	The proposed Shoreline project will have no direct impact on marine ecosystems or marine plants. With appropriate mitigation, indirect impacts are likely to be minimal with no significant impact to the area of occupancy for loggerhead turtles.
Fragment an existing population into two or more populations	The proposed Shoreline project will not fragment populations of loggerhead turtles into two or more populations.
Adversely affect habitat critical to the survival of a species	There is no habitat critical to the survival of loggerhead turtles in the area potentially impacted by the proposed Shoreline project.
Disrupt the breeding cycle of a population ¹	The area potentially impacted by the proposed Shoreline project is not a known loggerhead turtle breeding ground and is unlikely to impact the breeding cycle of this species.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The area potentially impacted by the proposed Shoreline project does not contain habitat that is essential to the survival or reproduction of loggerhead turtles and thus no long-term impacts to the species are predicted to occur.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	There are no marine invasive species predicted to be introduced from the proposed Shoreline project.
Introduce disease that may cause the species to decline	There are no potential impacts associated with the introduction or spread of diseases predicted
Interfere with the recovery of the species	The premise of the marine turtle recovery plan is to reduce the likelihood that current threats will cause mortalities, or to modify activities to reduce the potential for future mortalities at all stages of a marine turtle's life, and to ensure that traditional harvest of marine turtles by indigenous Australians and Torres Strait Islanders is ecologically sustainable (Environment Australia 2003). The proposed Shoreline project is unlikely to interfere with the recovery of marine turtles outlined in the marine turtle recovery plan.

¹ A 'population of a species' is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to a:

- geographically distinct regional population, or collection of local populations, or
- population, or collection of local populations, that occurs within a particular bioregion.

Vulnerable Species

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of an important population of a species
- reduce the area of occupancy of an important population
- fragment an existing important population into two or more populations
- adversely affect habitat critical to the survival of a species
- disrupt the breeding cycle of an important population
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat
- introduce disease that may cause the species to decline, or
- interfere substantially with the recovery of the species.

The significant impact assessment of the proposed Shoreline project for green and hawksbill turtles is shown in Table 5.3. Green and hawksbill turtles are the only vulnerable species that are moderately likely to use the shallow, inshore areas adjacent to the proposed development (see Table 4.2)

Table 5.3 Significant impact assessment for vulnerable marine species moderately likely to occur within the area potentially impact by the proposed Shoreline project.

Significance Criterion	Green turtle	Hawksbill turtle
Lead to a long-term decrease in the size of an important population ¹ of a species	Green turtles may occur in downstream areas of the proposed Shoreline project, particularly in seagrass beds located approximately 200 to 400 m from the subject site. Following appropriate mitigation measure, there are no significant impacts to green turtles or seagrass predicted. Therefore, there will be no long-term decrease in the size of an important population from the proposed Shoreline project.	Although rarer than green and loggerhead turtles, hawksbill turtles may occur in downstream areas of the proposed Shoreline project. Following appropriate mitigation measure, there are no significant impacts to hawksbill turtles predicted. Therefore, there will be no long-term decrease in the size of an important population from the proposed Shoreline project.
Reduce the area of occupancy of an important population	The proposed Shoreline project will have no direct impact on marine ecosystems or marine plants. With appropriate mitigation, indirect impacts are likely to be minimal with no significant impact to the area of occupancy for green turtles.	The proposed Shoreline project will have no direct impact on marine ecosystems or marine plants. With appropriate mitigation, indirect impacts are likely to be minimal with no significant impact to the area of occupancy for hawksbill turtles.
Fragment an existing important population into two or more populations	The proposed Shoreline project will not fragment populations of green turtles into two or more population.	The proposed Shoreline project will not fragment populations of hawksbill turtles into two or more population.
Adversely affect habitat critical to the survival of a species	There is no habitat critical to the survival of green turtles in the area potentially impacted by the proposed Shoreline project	There is no habitat critical to the survival of green turtles in the area potentially impacted by the proposed Shoreline project
Disrupt the breeding cycle of an important population	The area potentially impacted by the proposed Shoreline project is not a known green turtle breeding ground and is unlikely to impact on the breeding cycle of the population.	The area potentially impacted by the proposed Shoreline project is not a known hawksbill turtle breeding ground and is unlikely to impact on the breeding cycle of the population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The area potentially impacted by the proposed Shoreline project does not contain habitat is not essential to the survival or reproduction of green turtles and thus no long-term impacts to the species are predicted to occur.	The area potentially impacted by the proposed Shoreline project does not contain habitat is not essential to the survival or reproduction of hawksbill turtles and thus no long-term impacts to the species are predicted to occur.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	There are no marine invasive species predicted to be introduced from the proposed Shoreline project.	There are no marine invasive species predicted to be introduced from the proposed Shoreline project.
Introduce disease that may cause the species to decline	There are no potential impacts associated with the introduction or spread of diseases predicted	There are no potential impacts associated with the introduction or spread of diseases predicted
Interfere with the recovery of the species	The premise of the marine turtle recovery plan is to reduce the likelihood that current threats will cause mortalities, or to modify activities to reduce the potential for future mortalities at all stages of a marine turtle's life, and to ensure that traditional harvest of marine turtles by indigenous Australians and Torres Strait Islanders is ecologically sustainable (Environment Australia 2003). The proposed Shoreline project is unlikely to interfere with the recovery of marine turtles outlined in the marine turtle recovery plan.	The premise of the marine turtle recovery plan is to reduce the likelihood that current threats will cause mortalities, or to modify activities to reduce the potential for future mortalities at all stages of a marine turtle's life, and to ensure that traditional harvest of marine turtles by indigenous Australians and Torres Strait Islanders is ecologically sustainable (Environment Australia 2003). The proposed Shoreline project is unlikely to interfere with the recovery of marine turtles outlined in the marine turtle recovery plan.

¹ An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity, and / or
- populations that are near the limit of the species range.

5.4 Migratory Species

No marine species listed as migratory under the EPBC Act were considered highly likely to occur within the area that may be potentially impacted by the proposed Shoreline project. However, three species of marine turtle, dugong and the Indo-Pacific humpback dolphin were considered moderately likely to occur in this area.

The three species of marine turtle were listed as migratory species and threatened species. The likelihood of significant impacts to these species are summarised in Table 5.2 and Table 5.3.

The criteria below are relevant to migratory species that are not threatened:

- 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
- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

The significant impact assessment of the proposed Shoreline project for dugong and Indo-Pacific humpback dolphin is shown in Table 5.4

Table 5.4 Significant impact assessment for migratory species moderately likely to occur within the area potentially impact by the proposed Shoreline project.

Significance Criterion	Dugong	Indo-Pacific humpback dolphin
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	Following appropriate mitigation measure, significant impacts to dugong and their habitat, including seagrass communities, are unlikely. Therefore, the proposed Shoreline project is unlikely to substantially modify, destroy or isolate an area of important habitat.	Following appropriate mitigation measure, significant impacts to Indo-Pacific humpback dolphins and their habitat are unlikely. Therefore, the proposed Shoreline project is unlikely to substantially modify, destroy or isolate an area of important habitat.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	There are no marine invasive species are predicted to introduced from the proposed Shoreline project.	There are no marine invasive species are predicted to introduced from the proposed Shoreline project.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	Following appropriate mitigation measure, significant impacts to dugong and their habitat, including seagrass communities, are unlikely. Therefore, the proposed Shoreline project is unlikely to seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of dugong.	Following appropriate mitigation measure, significant impacts to Indo-Pacific humpback dolphins and their habitat are unlikely. Therefore, the proposed Shoreline project is unlikely to seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of Indo-Pacific humpback dolphins.

6 Risk Assessment

The potential impacts of the proposed Shoreline project on MNES were assessed using a risk-based approach, with the level of *risk* being an outcome of both the *consequence* and *likelihood* of the potential impact (Table 6.1). Risk was assessed on the unmitigated and mitigated impacts (Table 6.2).

Table 6.1 Risk assessment matrix.

Likelihood	Consequence				
	Catastrophic	Major	Moderate	Minor	Insignificant
	Irreversible Permanent	Long Term	Medium Term	Short Term Manageable	Manageable
	(5)	(4)	(3)	(2)	(1)
Almost Certain (5)	(25) Extreme	(20) Extreme	(15) High	(10) Medium	(5) Medium
Likely (4)	(20) Extreme	(16) High	(10) Medium	(8) Medium	(4) Low
Possible (3)	(15) High	(12) High	(9) Medium	(6) Medium	(3) Low
Unlikely (2)	(10) Medium	(8) Medium	(6) Medium	(4) Low	(2) Low
Rare (1)	(5) Medium	(4) Low	(3) Low	(2) Low	(1) Low

Table 6.2 Summary of the risk of potential impacts to aquatic Matters of National Environmental Significance as a result proposed Shoreline development.

Potential Impact	Potential Impact to Marine Ecosystems	Mitigation Measures	Significance of Impact (Unmitigated Impact)	Significance of Impact (Mitigated Impact)
Increased turbidity, sediment suspension and smothering of aquatic habitats	<ul style="list-style-type: none"> reduced respiration and feeding of benthic invertebrate communities leading to a reduction in abundance and biodiversity traumatization of fish gill tissues affecting growth and survival reduced growth of marine plants by limiting light for photosynthesis burying of aquatic plants (including roots and mangrove pneumatophores) and invertebrate communities (burrowing polychaetes and crustaceans), and reduced seagrass diversity and reductions in epifaunal densities. 	<ul style="list-style-type: none"> develop and implement an erosion and sediment control management plan natural vegetation and buffers are retained areas that are temporarily disturbed during construction are rehabilitated with vegetation, or so that native vegetation can recolonise. disturbance to sediment in the waterways is minimised movement of any disturbed sediment is minimised if substantial areas of sediment need to be disturbed during construction, it is tested and appropriate management measures are implemented according to the results 	<p>Moreton Bay Ramsar Wetland – Low (4)</p> <p>Marine turtles – Low (1)</p> <p>Indo-Pacific humpback dolphin – Low (1)</p> <p>Dugong – Low (1)</p>	<p>Moreton Bay Ramsar Wetland – Low (2)</p> <p>Marine turtles – Low (1)</p> <p>Indo-Pacific humpback dolphin – Low (1)</p> <p>Dugong – Low (1)</p>
Spills of hydrocarbons and other contaminants	<ul style="list-style-type: none"> impacts on growth, morphology, reproduction and survival of freshwater, marine and estuarine biota 	<ul style="list-style-type: none"> vehicle maintenance areas, portable refuelling stations and storage of fuels, oils and batteries undertaken within bunded areas that are designed and constructed in accordance AS1940 (2004) – <i>The storage and handling of flammable and combustible liquids</i> appropriate spill containment kits are available, and used for the clean up of spills 	<p>Moreton Bay Ramsar Wetland – Low (4)</p> <p>Marine turtles – Low (1)</p> <p>Indo-Pacific humpback dolphin – Low (1)</p> <p>Dugong – Low (1)</p>	<p>Moreton Bay Ramsar Wetland – Low (2)</p> <p>Marine turtles – Low (1)</p> <p>Indo-Pacific humpback dolphin – Low (1)</p> <p>Dugong – Low (1)</p>
Nutrient enrichment and disturbance of contaminated sediments ¹	<ul style="list-style-type: none"> excessive nutrients leading to eutrophication, algal growth, and low dissolved oxygen levels low dissolved oxygen can kill aquatic biota and encourage anaerobic micro-organism growth changes to aquatic plant community composition and distribution trophic shifts and reduction in species richness of benthic invertebrate communities reduced habitat availability due to deterioration of mangrove, saltmarsh and macrophyte communities reduction in available prey (e.g. molluscs, fish) for vertebrate species such as dolphins 	<ul style="list-style-type: none"> an erosion and sediment control management plan is developed and implemented earthworks and clearing are done in the dry season / periods of high rainfall are avoided, where practical disturbance to sediment in the waterways is minimised movement of any disturbed sediment is minimised if substantial areas of sediment need to be disturbed during construction, it is tested and appropriate management measures are implemented according to the results 	<p>Moreton Bay Ramsar Wetland – Low (4)</p> <p>Marine turtles – Low (1)</p> <p>Indo-Pacific humpback dolphin – Low (1)</p> <p>Dugong – Low (1)</p>	<p>Moreton Bay Ramsar Wetland – Low (2)</p> <p>Marine turtles – Low (1)</p> <p>Indo-Pacific humpback dolphin – Low (1)</p> <p>Dugong – Low (1)</p>

Potential Impact	Potential Impact to Marine Ecosystems	Mitigation Measures	Significance of Impact (Unmitigated Impact)	Significance of Impact (Mitigated Impact)
Disturbance of acid sulfate soils	<ul style="list-style-type: none"> lowering of pH, release of soluble aluminium and iron, which are toxic to gilled animals and aquatic plants oxidation of ferrous iron causing large decreases in dissolved oxygen alteration of natural food chain and nutrient cycles fish kills and disease mass mortality of invertebrates chronic effects to biota include reduced hatching and declined growth rates 	<ul style="list-style-type: none"> develop and implement an acid sulfate soil management plan, if acid sulphate soils are detected 	<p>Moreton Bay Ramsar Wetland – Low (4)</p> <p>Marine turtles – Low (1)</p> <p>Indo-Pacific humpback dolphin – Low (1)</p> <p>Dugong – Low (1)</p>	<p>Moreton Bay Ramsar Wetland – Low (2)</p> <p>Marine turtles – Low (1)</p> <p>Indo-Pacific humpback dolphin – Low (1)</p> <p>Dugong – Low (1)</p>
Spread of weeds and pests	<ul style="list-style-type: none"> reduction in availability and quality of habitats for biota 	<ul style="list-style-type: none"> disturbance of vegetation is minimised temporarily disturbed areas are rehabilitated so native vegetation can grow appropriate wash-down procedures for vehicles, plant and equipment are adopted a weed management plan developed and implemented 	<p>Moreton Bay Ramsar Wetland – Low (4)</p> <p>Marine turtles – Low (1)</p> <p>Indo-Pacific humpback dolphin – Low (1)</p> <p>Dugong – Low (1)</p>	<p>Moreton Bay Ramsar Wetland – Low (2)</p> <p>Marine turtles – Low (1)</p> <p>Indo-Pacific humpback dolphin – Low (1)</p> <p>Dugong – Low (1)</p>
Increased litter	<ul style="list-style-type: none"> threaten marine life through entanglement or ingestion 	<ul style="list-style-type: none"> Stormwater Management Plan, including measures such as gross pollutant traps educational signage, explicitly stating the risk to wildlife of disposing rubbish in the water, and the provision of public use rubbish bins. 	<p>Moreton Bay Ramsar Wetland – Low (4)</p> <p>Marine turtles – Low (1)</p> <p>Indo-Pacific humpback dolphin – Low (1)</p> <p>Dugong – Low (1)</p>	<p>Moreton Bay Ramsar Wetland – Low (2)</p> <p>Marine turtles – Low (1)</p> <p>Indo-Pacific humpback dolphin – Low (1)</p> <p>Dugong – Low (1)</p>
Increased stormwater runoff (with greater non-permeable surfaces on the subject site) and foreshore erosion	<ul style="list-style-type: none"> changes to community composition and distribution of aquatic communities mangroves – reduced growth rates and seedling survivorship 	<ul style="list-style-type: none"> revegetation of waterways Erosion and Stormwater Management Plan, including stormwater treatment plans to improve water quality <p>Water Sensitive Urban Design Objective</p>	<p>Moreton Bay Ramsar Wetland – Low (4)</p> <p>Marine turtles – Low (1)</p> <p>Indo-Pacific humpback dolphin – Low (1)</p> <p>Dugong – Low (1)</p>	<p>Moreton Bay Ramsar Wetland – Low (2)</p> <p>Marine turtles – Low (1)</p> <p>Indo-Pacific humpback dolphin – Low (1)</p> <p>Dugong – Low (1)</p>
Increased waterway usage for recreation, including fishing	<ul style="list-style-type: none"> avoidance of the area of potential impacts by large marine vertebrates decrease in populations through overfishing and bycatch 	<ul style="list-style-type: none"> Moreton Bay Marine Park zoning plan and the recreational fishing rules for Queensland 	<p>Moreton Bay Ramsar Wetland – Low (4)</p> <p>Marine turtles – Low (1)</p> <p>Indo-Pacific humpback dolphin – Low (1)</p> <p>Dugong – Low (1)</p>	<p>Moreton Bay Ramsar Wetland – Low (2)</p> <p>Marine turtles – Low (1)</p> <p>Indo-Pacific humpback dolphin – Low (1)</p> <p>Dugong – Low (1)</p>

7 Conclusion

The marine MNES relevant to the proposed Shoreline project are the Moreton Bay Ramsar wetland, three species of threatened and migratory marine turtles (green turtle, loggerhead turtle and hawksbill turtle) and the migratory dugong and Indo-Pacific humpback dolphin. The assessment of the proposed Shoreline project has not identified any effects that would significantly impact on the values of any marine MNES. Where minor impacts have been identified, mitigation measures and management plans will minimise impacts of the proposed Shoreline project to adjacent and downstream waterways. Following appropriate mitigation, the proposed Shoreline project is unlikely to result in a significant impact on the Moreton Bay Ramsar wetland or listed threatened or migratory marine species.

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Appendix A EPBC Protected Matters Search



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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[Summary](#)

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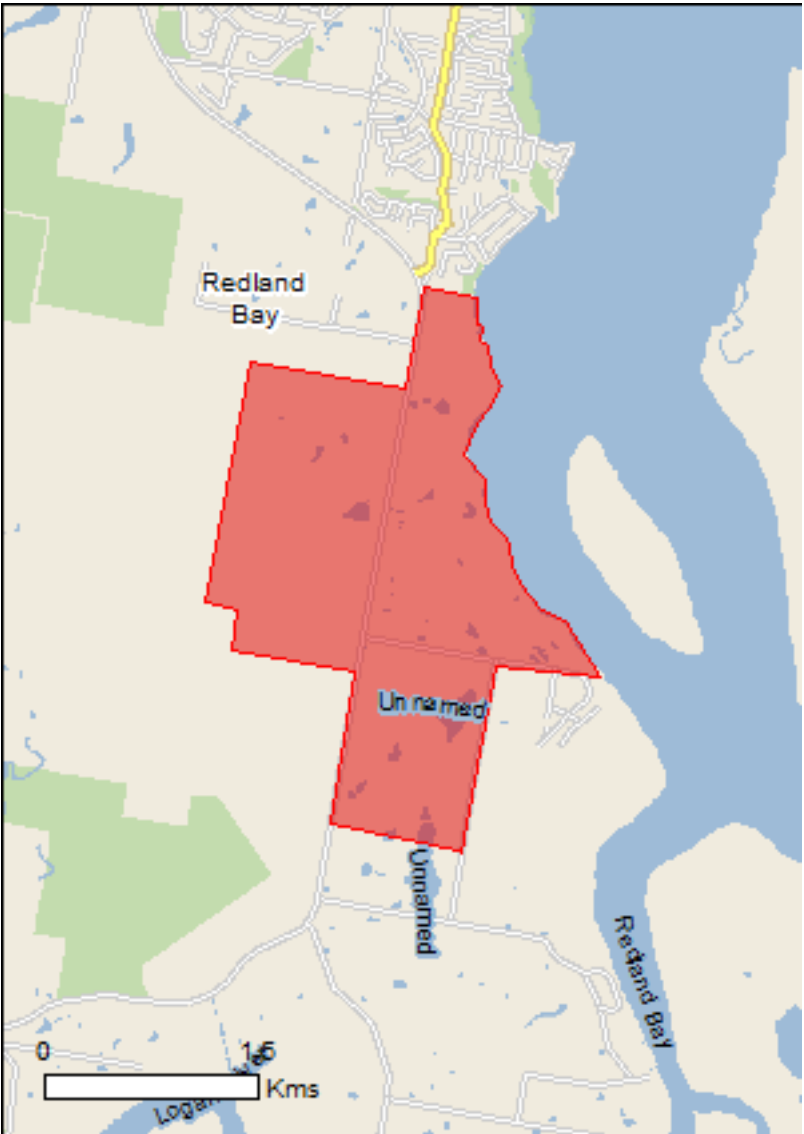
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[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

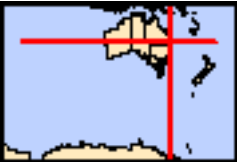
[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

Buffer: 5.0Km



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:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	58
Listed Migratory Species:	79

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:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	109
Whales and Other Cetaceans:	14
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	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:	3
Regional Forest Agreements:	None
Invasive Species:	38
Nationally Important Wetlands:	2
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)		[Resource Information]
Name		Proximity
Moreton bay		Within Ramsar site

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
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community may 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 ferruginea Curlew Sandpiper [856]	Critically Endangered	Roosting known to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat likely to occur within area
Diomedea exulans antipodensis Antipodean Albatross [82269]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans exulans Tristan Albatross [82337]	Endangered	Species or species habitat may occur within area
Diomedea exulans gibsoni Gibson's Albatross [82271]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Species or species habitat may occur within area
Erythroriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat 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

Name	Status	Type of Presence
		within area
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat may occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat may occur within area
Macronectes giganteus 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
Numenius madagascariensis Eastern Curlew [847]	Critically Endangered	Roosting known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Poephila cincta cincta Black-throated Finch (southern) [64447]	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 [77037]	Endangered	Species or species habitat likely to occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta salvini Salvin's Albatross [82343]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris impavida Campbell Albatross [82449]	Vulnerable	Species or species habitat may occur within area
Turnix melanogaster Black-breasted Button-quail [923]	Vulnerable	Species or species habitat likely to occur within area
Fish		
Epinephelus daemeli Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat may occur within area
Maccullochella mariensis Mary River Cod [83806]	Endangered	Translocated population known to occur within area

Name	Status	Type of Presence
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 may 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 may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known 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 habitat may 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
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Arthraxon hispidus Hairy-joint Grass [9338]	Vulnerable	Species or species habitat may occur within area
Baloghia marmorata Marbled Baloghia, Jointed Baloghia [8463]	Vulnerable	Species or species habitat may occur within area
Corchorus cunninghamii Native Jute [14659]	Endangered	Species or species habitat likely to occur within area
Cryptocarya foetida Stinking Cryptocarya, Stinking Laurel [11976]	Vulnerable	Species or species habitat may occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area
Macadamia integrifolia Macadamia Nut, Queensland Nut, Smooth-shelled Macadamia, Bush Nut, Nut Oak [7326]	Vulnerable	Species or species habitat likely to occur within area
Phaius australis Lesser Swamp-orchid [5872]	Endangered	Species or species habitat likely to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Coeranoscincus reticulatus Three-toed Snake-tooth Skink [59628]	Vulnerable	Species or species habitat may occur within area
Delma torquata Collared Delma [1656]	Vulnerable	Species or species habitat may 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	Species or species habitat known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	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
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 Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding may 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		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable*	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered*	Species or species habitat may occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Species or species habitat may occur within

Name	Threatened	Type of Presence area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Species or species habitat may occur within area
Macronectes giganteus 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
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Sterna albifrons Little Tern [813]		Species or species habitat may occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may 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*	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
Migratory Marine Species		
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
Carcharodon carcharias Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known 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
Dugong dugon Dugong [28]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely 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 may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat known to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may 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	Congregation or aggregation known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to 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

Name	Threatened	Type of Presence
Myiagra cyanoleuca Satin Flycatcher [612]		habitat known 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]	Critically Endangered	Roosting known to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]		Roosting known to occur within area
Calidris ferruginea Curlew Sandpiper [856]		Roosting known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Roosting known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]		Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]		Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]		Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Roosting known to occur within area	
Gallinago megala Swinhoe's Snipe [864]	Roosting likely to occur within area	
Gallinago stenura Pin-tailed Snipe [841]	Roosting likely to occur within area	
Heteroscelus brevipes Grey-tailed Tattler [59311]	Roosting known to occur within area	
Heteroscelus incanus Wandering Tattler [59547]	Roosting known to occur within area	

Name	Threatened	Type of Presence
Limicola falcinellus Broad-billed Sandpiper [842]	Critically Endangered	Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew [847]		Roosting known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[<u>Resource Information</u>]
* 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]		Roosting known to occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur

Name	Threatened	Type of Presence
Ardea ibis Cattle Egret [59542]	Critically Endangered	within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]		Roosting known to occur within area
Calidris ferruginea Curlew Sandpiper [856]		Roosting known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Roosting known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]		Roosting known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat may occur within area
Charadrius bicinctus Double-banded Plover [895]	Vulnerable*	Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]		Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]		Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Cuculus saturatus Oriental Cuckoo, Himalayan Cuckoo [710]	Endangered*	Species or species habitat known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]		Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]		Species or species habitat may occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]		Species or species habitat may occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Roosting known to occur within area

Name	Threatened	Type of Presence
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Heteroscelus incanus Wandering Tattler [59547]		Roosting known to occur within area
Himantopus himantopus Black-winged Stilt [870]		Roosting known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]		Endangered Species or species habitat may occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Macronectes giganteus 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 known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew [847]		Critically Endangered Roosting known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area

Name	Threatened	Type of Presence
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting 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
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may 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*	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 glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Fish		

Name	Threatened	Type of Presence
Acentronura tentaculata Shortpouch Pygmy Pipehorse [66187]		Species or species habitat may occur within area
Campichthys tryoni Tryon's Pipefish [66193]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys ocellatus Orange-spotted Pipefish, Ocellated Pipefish [66203]		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
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
Hippichthys heptagonus Madura Pipefish, Reticulated Freshwater Pipefish [66229]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus kelloggi Kellogg's Seahorse, Great Seahorse [66723]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Hippocampus whitei White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240]		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
Micrognathus andersonii Anderson's Pipefish, Shortnose Pipefish [66253]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Micrognathus brevirostris thorntail Pipefish, Thorn-tailed Pipefish [66254]		Species or species habitat may occur within area
Microphis manadensis Manado Pipefish, Manado River Pipefish [66258]		Species or species habitat may occur within area
Solegnathus dunckeri Duncker's Pipehorse [66271]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		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 paegnius Rough-snout Ghost Pipefish [68425]		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 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		
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Reptiles		
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known 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	Species or species habitat known to occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Laticauda laticaudata a sea krait [1093]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	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
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may 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
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely 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	Congregation or aggregation known to occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area

Name	Status	Type of Presence
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
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
Bayview	QLD
Carbrook Wetlands 1	QLD
Carbrook Wetlands 2	QLD

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
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
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		
Frogs		
Rhinella marina		
Cane Toad [83218]		Species or species habitat likely to 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
Felis catus		
Cat, House Cat, Domestic Cat [19]		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
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
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. rotundata		
Bitou Bush [16332]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Cryptostegia grandiflora Rubber Vine, Rubbervine, India Rubber Vine, India Rubbervine, Palay Rubbervine, Purple Allamanda [18913] Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Hymenachne amplexicaulis Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass [31754]		Species or species habitat likely to 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] Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Parthenium hysterophorus Parthenium Weed, Bitter Weed, Carrot Grass, False Ragweed [19566]		Species or species habitat likely to occur within area
Protasparagus densiflorus Asparagus Fern, Plume Asparagus [5015]		Species or species habitat likely to occur within area
Protasparagus plumosus Climbing Asparagus-fern, Ferny Asparagus [11747]		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
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

Reptiles
Hemidactylus frenatus Asian House Gecko [1708]
Species or species habitat likely to occur within area

Nationally Important Wetlands	[Resource Information]
Name	State
Carbrook Wetlands Aggregation	QLD
Moreton Bay	QLD

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.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

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

-27.678699 153.307818,-27.678622 153.307646,-27.677102 153.299578,-27.668665 153.301123,-27.667373 153.293312,-27.665168 153.293656,-27.664788 153.291768,-27.651332 153.294514,-27.652928 153.304299,-27.647226 153.3055,-27.647759 153.308762,-27.649355 153.308762,-27.649431 153.309105,-27.650191 153.30902,-27.650496 153.309449,-27.651484 153.309706,-27.652776 153.310393,-27.653613 153.309878,-27.655133 153.30859,-27.656502 153.30799,-27.657946 153.309277,-27.659163 153.309277,-27.660227 153.30962,-27.661063 153.310564,-27.661443 153.310908,-27.662659 153.311079,-27.663724 153.311509,-27.665244 153.312882,-27.665776 153.314341,-27.668893 153.316487,-27.668285 153.310049,-27.678699 153.307818,-27.678699 153.307818

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](#)
- [-Parks and Wildlife Commission NT, Northern Territory Government](#)
- [-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, Atherton and Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- 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.

Appendix B Significant Impact Definitions

What is a Significant Impact?

A 'significant impact' is an impact that is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment that is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts.

When is a Significant Impact Likely?

To be 'likely', it is not necessary for a significant impact to have a greater than 50 per cent chance of happening; it is sufficient if a significant impact is a real or not a remote chance or possibility.

Considerations for Assessing Significant Impacts

In order to decide whether an action is likely to have a significant impact, it is necessary to take into account the nature and magnitude of potential impacts. In determining the nature and magnitude of an action's impacts, it is important to consider matters such as:

- the sensitivity of the environment that will be impacted
- the timing, duration and frequency of the action and its impacts
- all on-site and off-site, and direct and indirect impacts
- the total impact that can be attributed to the action over the entire geographic area affected, and over time
- existing levels of impact from other sources, and
- the degree of confidence with which the impacts of the action are known and understood, and
- avoidance and mitigation measures.

When deciding whether or not a proposed action is likely to have a significant impact on a MNES, the precautionary principal is relevant, that is a lack of information about potential

impacts will not justify a decision that the action is not likely to have a significant impact. Further, only adverse impacts can be considered when deciding whether a proposed action is likely to have a significant impact on a MNES.

What is a population of an endangered and critically endangered species?

A 'population of a species' is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:

- a geographically distinct regional population, or collection of local populations, or
- a population, or collection of local populations, that occurs within a particular bioregion.

What is an important population of a vulnerable species?

An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity, and / or
- populations that are near the limit of the species range.

What is the population of a migratory species?

'Population', in relation to migratory species, means the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries including Australia.

What is an invasive species?

An 'invasive species' is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources or which is a

predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.

What is habitat critical to the survival of a species or ecological community?

‘Habitat critical to the survival of a species or ecological community’ refers to areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the minister under the EPBC Act.

What is important habitat for a migratory species?

An area of ‘important habitat’ for a migratory species is:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or
- habitat that is of critical importance to the species at particular life-cycle stages, and/or
- habitat utilised by a migratory species which is at the limit of the species range, and/or
- habitat within an area where the species is declining.

What is an ecologically significant proportion for migratory species?

Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, what is an 'ecologically significant proportion' of the population varies with the species (each circumstance will need to be evaluated). Some factors that should be considered include the species' population status, genetic distinctiveness and species-specific behavioural patterns (for example, site fidelity and dispersal rates).