walker

TOONDAH HARBOUR

CHAPTER 24
THREATENED SPECIES SIGNIFICANT IMPACT ASSESSMENT

saunders havill group

24. Threatened Species Significant Impact Assessment

24.1. Introduction

A range of threatened species has the potential to utilise habitats within and adjacent to the Project footprint including species listed as vulnerable, endangered and critically endangered. Significant impact criteria differ depending on the status of the 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.

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.

Assessment for all threatened listed species with the potential to be impacted by the Project is provided in the sections below.

24.2. Threatened Terrestrial Species

Four terrestrial species listed as threatened under the EPBC Act were identified as having some potential to be found on or adjacent to the Project footprint (refer to Chapter 15). These are:

- Koala – Vulnerable;
- Grey-headed flying-fox – Vulnerable;
- Water mouse – Vulnerable; and
- White-throated needletail – Vulnerable.

24.2.1 Koala Threatened Species Significant Impact Assessment

The status of the koala (*Phascolarctos cinereus*) was changed from vulnerable to endangered on 12 February 2022. The EPBC Act requires proponents to address the significant impact criteria relevant at the time the decision was made on the approval process, i.e., at the time of the referral decision (s158A of the EPBC Act). The Toondah Harbour Project was made a controlled action on 23 July 2018.

This section should be read in conjunction with Chapter 15, which provides detailed information on existing koala populations in and around the PDA, potential impacts resulting from the Project and proposed management measures.

24.2.1.1 *Relevant Conservation Advice and Recovery Plans*

The National Recovery Plan for the Koala has been developed with relevant state and territory governments to provide an overarching national conservation framework for the listed koala that aligns with local, state and territory government plans, programs and strategies including the EPBC Act Conservation Advice for *Phascolarctos cinereus* (Koala) combined populations of Queensland, New South Wales and the Australian Capital Territory. It does not replace these pre-existing plans, programs and strategies but aims to complement them.

The goal of the National Recovery Plan for the Koala is to stop the trend of decline in population size of the listed koala, by having resilient, connected, and genetically healthy metapopulations across its range, and to increase the extent, quality and connectivity of habitat occupied.

The National Recovery Plan for the Koala lists land use threats from urbanisation, agricultural expansion, mining and energy extraction and its associated transport infrastructure, the modification of natural processes of fire, hydrology and soil erosion as impacting the koala. It also identified climate change-induced droughts, heatwaves, changes to fire regimes and disease as exacerbating the land use impacts. Impact pathways are described as:

- Increased and sustained patch isolation may lead to inbreeding, reducing genetic health of isolated populations, ultimately reducing fecundity;
- Reduced habitat quality (e.g., loss of food and shelter trees, changes in hydrology, loss of suitable microhabitats, exposure to dogs and vehicles), can place increased physiological stress on individuals increasing cortisol and other adverse inflammatory pathways in individuals which, in turn, increase susceptibility to disease and reduce fecundity;
- Habitat loss directly reduces carrying capacity of a given landscape, making populations more susceptible to extinction;
- Loss of connectivity reduces natural movement such as the ability of individuals to disperse safely, therefore reducing gene flow and health levels of genetic exchange among adjacent populations; and
- Fragmentation can increase mortality during movements made through the intervening matrix, for example, by dog attack and car strikes.

In addition, the landscape effects are described as disrupting natural processes which sustain koala habitat, impacting the mortality, recruitment, nutrition and climate adaption of their food and shelter trees.

Koalas present within the current urban environment of the PDA are separated from continuous habitat by extensive urban development and utilise food and shelter trees within parks, gardens and street plantings in the landscape within and surrounding the PDA. There are poorly connected, narrow corridors of suitable vegetation along waterways and lineal parklands that may allow koalas to access bushland habitats to the west and south of the PDA, although the threat posed by vehicles in the suburb has historically resulted in significant koala mortality, with 251 koala casualties reported from vehicle strike between 1994 and 2008 in the suburb of Cleveland (BAAM, 2009) and 52 between 2009 and 2021. Disease is also prevalent, likely exacerbated by the threats and stressors associated with the urban habitat.

The Project responds to the strategies and actions of the Koala Recovery Plan and conservation and recovery actions from the Conservation Advice (DAWE 2022b) through the Proponent proposing the implementation of:

- Building knowledge of the koalas utilising the PDA and surrounds through sponsoring koala research within and surrounding the location through the Koala Safe Neighbourhood program and information sharing with RCC throughout the up to 20-year construction phase;
- Initiating and maintaining community engagement and education with existing residents, new residents and visitors to raise awareness of the koala in the local area;
- Forming partnerships with local community groups to increase community involvement in the management of habitats within the PDA; and
- Undertaking strategic habitat restoration through increasing available food and shelter resources within the PDA, and by working with RCC to target programs outside of the Project footprint that will increase habitat connectivity and improve safe koala movement opportunities.

24.2.1.2 *Assessment Against the EPBC Act Significant Impact Assessment Criteria*

Potential impacts to koala from Project activities are addressed in Section 15.4.2 with adaptive management and monitoring measures outlined in Section 15.5. Assessment against the EPBC Act significant impact criteria for threatened species is provided in Table 24-1.

The Project will not impact critical koala habitats or cause decline in the Cleveland urban koala population. With implementation of the stated measures for safe Koala movement through the PDA, Koala tree planting within the PDA and the Proponent's contribution to measures to increase Koala habitat and improve safe movement for Koalas outside of the PDA through the KSN program, the Project is unlikely to have a significant long-term impact on the local urban Koala population.

The Project will not have a significant impact on the koala.

Table 24-1: Assessment of Koala Against the Vulnerable Threatened Species Significant Impact Criteria.

Significant Impact Criteria for Vulnerable Species	Assessment Summary
Lead to a long-term decrease in the size of an important population	The PDA supports a portion of the eastern Redlands urban koala population – part of the broader Koala Coast population. The mitigation measures proposed for the Project will double available food resources for the local koala population and provide safe habitat and movement opportunities for koalas within and through the PDA through the raising of Middle Street on a viaduct structure to allow free koala passage beneath the road, and by imposing a 40 km/hr speed limit and installation of electronic signage and traffic calming on Shore Street East. Impacts to koalas that may lead to a long-term decrease in the size of this urban population as a result of increased traffic outside of the Project footprint is a broader issue – a threat that is increasing independent of the Project due to growing infill, medium and higher density residential development in the suburb of Cleveland and elsewhere on the east coast of the Redlands. To counter this threat, the Proponent is proposing to undertake or contribute to actions both within and external to the PDA including: ▪ Undertake supplemental koala tree planting in parkland south of the PDA to connect directly to habitats of Nandeebie Park and in other locations identified by RCC, to improve urban habitat quality and connectivity. ▪ Include the PDA and surrounds in the RCC KSN Program, funding local koala research and monitoring, and initiating and sponsoring community actions to improve Koala safety. ▪ Provide funding and assistance to RCC through the KSN program to provide smart signage on streets external to the PDA. The combination of these actions within and outside of the PDA will reduce the impacts of urbanisation, both Project-related and independent of the Project, on the local urban koala population. As a result, it is not expected that the Project will lead to a long-term decrease in the number of koalas present within the PDA, or in the surrounding urban environment.
Reduce the area of occupancy of an important population the species	Of the 132 koala food trees present in the Project footprint, one primary and 18 secondary food trees would need to be removed (15 of which are in car park plantings). Non-food trees that koalas may roost in would also be cleared from the existing car parks and ferry terminal. These trees are predominantly isolated and within a high-traffic environment and there are no koala records from these locations. Through supplemental planting in key locations within GJ Walter Park, the trade college grounds and vacant land to the south of the grounds, resources for the koalas present within the PDA will be increased by 100% over a 1 ha area. There will be no reduction in the area of occupancy of koalas as a result of the Project.
Fragment an existing important population into two or more populations	The proposed underpass for Koalas beneath the Middle Street corridor will ensure increased traffic volumes resulting from the Project do not present a barrier to Koala movement within the PDA. Outside of the PDA, the proponent will work with RCC to slow of traffic at key locations in Middle Street and Shore Street West to improve the likelihood of Koalas moving safely through the suburb. To counter the potential for increased traffic outside of the PDA proponent will work with RCC through the KSN program to implement tested methods of informing and changing driver behaviour.

Significant Impact Criteria for Vulnerable Species	Assessment Summary
	Existing Koala habitat connections will remain intact, and the population will not be fragmented.
Adversely affect habitat critical to the survival of the species	Assessment of the site has determined that GJ Walter Park and the trade college grounds support critical habitat for koala. Of the 132 koala food trees present in the PDA, one primary and 18 secondary food trees (15 of which are in car park plantings) would need to be removed from within the Project footprint. Through supplemental planting in key locations within GJ Walter Park, trade college grounds and vacant land to the south of the grounds, resources for the koalas present within the PDA will be increased by 100% over a 1 ha area. Complementary actions proposed inside and outside of the PDA in alignment with RCC's Koala Conservation Strategy will further increase the area of occupancy for koalas in the surrounding urban environment. Development of the Project will not adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	Construction activities will create noise and other disturbance that may impact individual koalas, with potential implications for the health of breeding females. Increased artificial light and increased human presence for the operational phase of the Project may also disturb and cause stress to breeding koalas. Measures to minimise and monitor these impacts are proposed, including employing all possible noise reduction strategies for construction activities, the implementation of a lighting strategy designed for ecologically sensitive locations, shielding noise generating activities and light sources where monitoring indicates koalas are affected, and provision of educational information for visitors to the harbour and parklands. It is not expected that the Project will disrupt the breeding cycle of the koalas present, which comprise a proportion of the Cleveland urban koala population – a component of the broader Koala Coast population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Habitat area and resources for the koalas present within the PDA will be doubled as a result of the impact mitigation measures proposed for the development. Existing critical habitat will not be modified, destroyed, removed or isolated, or decreased in availability or quality.
Result in invasive species that are harmful to the species becoming established in the species' habitat	The PDA is urban in nature with the koala habitat present occurring within landscaped gardens and parkland that are regularly maintained. Therefore, there will be no opportunity for invasive species to establish in these environments.
Introduce disease that may cause the species to decline	The action will not introduce disease, although stress is considered to lead to disease in koalas. The proposed koala monitoring program for the Project will document health and breeding activity during certain construction activities. The proponent will contribute to the development and implementation of the KSN program which will include ongoing monitoring of the Koala population in Cleveland. Any intervention for sick Koalas would be coordinated with State government experts. The Project would not cause the introduction of new Koala diseases.
Will the action interfere substantially with the recovery of the species	The Redland City LGA incorporates both bushland and urban koala populations, and while bushland habitat has specific protections under the State's Koala Conservation Strategy, urban habitat for koalas is not as well-protected. The long-term presence of a healthy urban koala population in Cleveland is likely to depend on the implementation of treatments to allow safe koala passage across dangerous roads, bolstering suitable urban habitat, and community participation in koala conservation. While the

Significant Impact Criteria for Vulnerable Species	Assessment Summary
	development can play a part in advancement of these strategies, the issues are significantly broader than can be addressed by the Project alone. By becoming a partner in the delivery of the Redlands Coast Action Plan through providing funding to the Safe Koala Neighbourhoods program the proponent will contribute to koala recovery.

24.2.2 Grey-Headed Flying-fox Threatened Species Significant Impact Assessment

Grey-headed flying-fox (*Pteropus poliocephalus*) is listed as vulnerable under the EPBC Act therefore is required to be assessed against significant impact criteria for vulnerable species.

This section should be read in conjunction with Chapter 15, which provides detailed information on existing grey-headed flying-fox populations at the PDA, potential impacts resulting from the Project and proposed management measures.

24.2.2.1 *Relevant Conservation Advice and Recovery Plans*

The Threatened Species Scientific Committee reported in September 2001 that estimates of the abundance of the species declined in the order of 30% between 1989 and 1998-2001, with a recommendation to include the species in the vulnerable category and to encourage research into accurate estimates of abundance and mortality associated with human activities. The National Flying-fox Monitoring Program commenced in 2012 and is ongoing. In an assessment of the data, advice from Westcott *et al*. (2015) was that it is too early to use the monitoring data to estimate population trends; however, long-term threats to the species are exacerbated by the impacts of climate change and the species should continue to be considered vulnerable.

The National Recovery Plan for Grey-headed Flying-fox (DAWE, 2021a) cites the following threats to grey-headed flying-fox:

- Habitat loss (both roosting and foraging habitat);
- Clearing of winter forage in coastal lowlands of northern NSW and southern Qld;
- Camp disturbance due to conflict with people (particularly in coastal areas);
- Death from heat stress (known to occur when temperatures exceed 40 deg C);
- Entanglement in netting and barbed wire fencing;
- Climate change impacts on temperature, fire and drought, including flow-on effects of changing flowering and fruiting times of forage species;
- Electrocution on power lines; and
- Public misunderstanding of disease risk leading to harassment.

Vulnerability of the species to threats are listed as rapidly expanding human populations, increasing numbers of black flying-foxes reducing available habitat, and a limited ability to recover from threatening process such as culling at orchards and die-offs during extreme weather events.

The Project responds to the strategies and actions of the Grey-headed Flying-fox Recovery Plan and conservation and recovery actions from the Threatened Species Scientific Committee through proposing the implementation of:

- A proposal to plant approximately 1,000 koala food trees of predominantly *Eucalypts tereticornis* within the PDA will ensure the continued value of the location for grey-headed flying-fox, particularly as this eucalypt flowers from winter-spring and will provide foraging resources during months when flowering and fruiting trees are

most scarce. This proposal aligns with Priority Action 1.4 of the National Recovery Plan – to increase the extent and viability of foraging habitat for the grey-headed flying fox that is productive during winter and spring; and

- The National Recovery Plan includes barbed wire fencing and overhead powerlines as threats to the species. During construction and in the completed development there will be no use of barbed wire fencing, as flying-foxes may become entangled. The development will not include overhead powerlines so that the potential for flying-fox electrocution is eliminated.

24.2.2.2 *Assessment Against the EPBC Act Significant Impact Assessment Criteria*

Potential impacts to grey-headed flying-fox from Project activities are addressed in Section 15.4.3 with adaptive management and monitoring measures outlined in Section 15.5. Assessment against the EPBC Act significant impact criteria for threatened species is provided in Table 24-2.

There are no flying-fox camps present within the PDA, and the Project footprint is not within 20 km of a nationally significant flying-fox camp. The 132 *Eucalyptus tereticornis* present are considered to represent a critical resource for the species, and one of these would need to be removed from the Project footprint. A further four trees of high forage value for the species would be removed and 32 trees of lower forage value. The proposed planting of an additional 1 ha (1,000) trees within the PDA (predominantly winter-spring flowering *Eucalyptus tereticornis*) will provide additional and valuable foraging resources for grey-headed flying-fox. The species is well-adapted to urban environments, visiting parks and suburban gardens to feed at night.

The Project will not result in a Significant Impact on the grey-headed flying-fox.

Table 24-2: Assessment of Grey-headed Flying-fox Against the Vulnerable Threatened Species Significant Impact Criteria.

Significant Impact Criteria for a Vulnerable Species	Assessment Summary
Lead to a long-term decrease in the size of an important population of a 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. There are currently no criteria available to define an 'important population' of grey-headed flying fox. It is likely that 'nationally important Flying-fox camps' support important populations of the species and foraging resources within 20 km of nationally important grey-headed flying-fox camps are considered to represent critical resources for the species. There are no flying-fox camps present within the PDA, and the PDA is not within 20 km of a nationally important camp or at the limit of the species range. The action will not lead to a decrease in the size of an important population of grey-headed flying-fox.
Reduce the area of occupancy of an important population?	Thirty-seven trees that provide grey-headed flying-fox foraging resources occur within the Project footprint. Planting approximately 1,000 koala food trees, predominantly *Eucalyptus tereticornis,* within the PDA will ensure the continued value of the location for grey-headed flying-fox, particularly as this eucalypt flowers winter-spring and will provide foraging resources during months when flowering and fruiting trees are most scarce. No long-term decrease in the number of grey-headed flying-fox that may use the PDA is expected because of the Project.
Fragment an existing important population into two or more populations	No habitat fragmentation will result from the Project.

Significant Impact Criteria for a Vulnerable Species	Assessment Summary
Adversely affect habitat critical to the survival of a species?	The National Recovery Plan (DAWE, 2021a) describes habitat supporting winter and spring flowering vegetation communities as habitat critical to the survival of the species. While not supporting bushland habitat, five trees that provide critical grey-headed flying-fox feeding resources occur within the Project footprint and would need to be removed for the development. Planting approximately 1,000 koala food trees of predominantly *Eucalyptus tereticornis* within the PDA will ensure the continued value of the location for grey-headed flying-fox. Additionally, the Recovery Plan includes habitat containing native species used for foraging within 20 km of a nationally important camp as critical habitat. The nearest 'Nationally Important Flying-fox Camp' as identified in the National Flying-fox Monitoring Viewer is at Westlake Drive, Mount Ommaney, approximately 36 km west of the PDA. The action will not adversely affect habitat critical to the survival of grey-headed flying-fox.
Disrupt the breeding cycle of an important population?	The Recovery Plan states that few diet plants flower in winter, and those that flower reliably in winter occur on coastal lowlands in northern NSW and southern Queensland (Eby *et al*. 1999, Eby and Lunney 2002), and there is also evidence that spring forage is currently inadequate to provide reliable resources during critical periods in the reproductive cycle of grey-headed flying-foxes (Eby and Law 2008). While not supporting bushland habitat, five trees that provide critical grey-headed flying-fox feeding resources occur within the Project footprint and would need to be removed for the development. Planting approximately 1,000 Eucalyptus tereticornis within the PDA will ensure the continued value of the location for grey-headed flying-fox. The time lag between loss of five important forage trees and the establishment of new plantings is not significant in the local, urban context and the location of the site, which is distant from nationally important flying-fox camps. The action will not disrupt the breeding cycle of an important grey-headed flying-fox population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The Project is located within an urban environment. Reproductive cycle of Grey-headed Flying-foxes (Eby and Law 2008). While not supporting bushland habitat, five trees that provide critical grey-headed flying-fox feeding resources occur within the footprint of the Project and would need to be removed for the development. Planting approximately 1,000 *Eucalyptus tereticornis* within the PDA will ensure the continued value of the location for grey-headed flying-fox. The action will not modify, destroy, remove or isolate or decrease the habitat to the extent that the species is likely to decline.
Will the action result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The Project is located within an urban environment with grey-headed flying-fox habitat occurring only within parkland and gardens that will be regularly maintained. There is no risk of the introduction of invasive species that are harmful to grey-headed flying-fox to the location.
Introduce disease that may cause the species to decline?	Disease is not listed as a threat to grey-headed flying-fox. There is no known grey-headed flying-fox disease which could be introduced to the PDA as a result of the development.
Interfere substantially with the recovery of the species?	There are many threatening processes throughout the range of the species, and these are primarily associated with habitat removal, climate change and human/grey-headed flying-fox

Significant Impact Criteria for a Vulnerable Species	Assessment Summary
	conflicts that are not a component of the habitats present within the PDA. There are no flying-fox camps present, and residents of the location are familiar with flying-foxes feeding in their gardens and parklands by night. As the Project would not interfere with habitat critical to the survival of the species or affect important populations of the species, the action will not interfere substantially with the recovery of the species.

24.2.3 Water Mouse Threatened Species Significant Impact Assessment

Water mouse (*Xeromys myoides*) is listed as vulnerable under the EPBC Act therefore is required to be assessed against significant impact criteria for vulnerable species.

This section should be read in conjunction with Chapter 15, which provides detailed information on existing water mouse populations at the Project footprint, potential impacts resulting from the Project and proposed management measures.

24.2.3.1 *Relevant Conservation Advice and Recovery Plans*

The National Recovery Plan for the Water Mouse (DERM, 2010) describes the habitat and distribution of the species as coastal saltmarsh, mangrove and adjacent freshwater wetland habitats in the Northern Territory, Queensland and New Guinea, within Queensland being known from the Proserpine area south to near the Queensland/NSW border. A study of water mouse habitat attributes in SEQ by Russell and Hale (2009) further refined habitat preferences of the species in this region as those coastal systems with a wide mangrove zone of short mangroves and a high percentage of relatively tall vegetation cover in the sedge/saltmarsh zone. In their assessment, the authors stated that the removal of vegetation at the forest–sedge/saltmarsh boundary is likely to destroy habitat required for nesting.

There are 57 Atlas of Living Australia records for water mouse from the region between 1966 and 2014. The locations of these records are discussed in Section 15.3.5, showing there are no previous records for water mouse on the mainland shores of Moreton Bay between Pumicestone Passage 54 km to the north of the PDA and Behms Creek 22 km to the south. Despite being within the species range and including habitat characteristics important for the species, the habitat within and surrounding the Project footprint is not mapped as essential habitat for water mouse by the Queensland Government.

A number of threats to the species are identified in Conservation Advice (DAWE 2021b), specifically these are:

- Habitat loss, fragmentation and degradation through urban development and resource extraction, recreational activity, pesticide application and grazing;
- Climate change, through saltwater intrusion, and increased extreme weather events (i.e., cyclonic events, storm surges and/or spring tides); and
- Invasive species, through predation and/or nest destruction by foxes, pigs or cats, and weed invasion.

Potential habitat for the species in the vicinity of the PDA is currently subject to habitat fragmentation and degradation from urban development, and also likely from predation by foxes and cats.

The overall objective of the National Recovery Plan for the species is to improve the conservation status of the water mouse and its habitat through habitat protection, reducing threats to species' survival, research and increasing public participation in recovery activities.

The National Recovery Plan sites key actions required for the recovery of the water mouse as:

- Confirming and documenting the current distribution of the species;
- Mapping known populations and their habitat;
- Assessing the impact of known threatening processes;
- Developing and implementing a threat management plan to rehabilitate habitat at priority sites;
- Engaging the community in efforts to protect existing populations by establishing voluntary agreements with relevant landowners and managers; and
- Coordinating the recovery process.

Suggested locations for rehabilitation were:

- Lower Noosa and Maroochy Rivers;
- The western shore of Pumicestone Passage;
- The Behms Creek to Pimpama River corridor; and
- Coomera River area of southern Moreton Bay.

Environs of the PDA that may have once been suitable for water mouse are not included in any priority rehabilitation area. The historical and existing threats to water mouse at this location will remain with or without the presence of the Project, and while marine and foreshore habitats outside of the Project footprint are proposed to be protected from Project impacts, there are no specific measures proposed to enhance water mouse habitat, as the species is not present and any suitable habitats are significantly isolated from those locations where water mouse is known to occur.

24.2.3.2 *Assessment Against the EPBC Act Significant Impact Assessment Criteria*

Potential impacts to water mouse from Project activities are addressed in Section 15.4.4 with adaptive management and monitoring measures outlined in Section 15.5. Assessment against the EPBC Act significant impact criteria for threatened species is provided in Table 24-3.

EPBC Act-listed vulnerable water mouse is not present within or adjacent to the PDA and there are no previous records of the species on the mainland shores of Moreton Bay between Pumicestone Passage and Behms Creek and no evidence of their presence was recorded during field surveys. They are largely thought to be extinct on this stretch of coastline.

The Project will not result in a significant impact on the water mouse.

Table 24-3: Assessment of Water Mouse Against the Vulnerable Threatened Species Significant Impact Criteria.

Significant Impact Criteria for a Vulnerable Species	Assessment Summary
Lead to a long-term decrease in the size of an important population of a species	The species is not present within or adjacent to the PDA. The action will not lead to a long-term decrease in the size of an important population of the species.
Reduce the area of occupancy of an important population?	The species is largely thought to be extinct on the western shores of Moreton Bay between Pumicestone Passage 54 km to the north of the PDA and Behms Creek 22 km to the south. The action will not reduce the area of occupancy of an important population.
Fragment an existing important population into two or more populations	The species is largely thought to be extinct on the western shores of Moreton Bay between Pumicestone Passage and Behms Creek. The action will not fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species?	The species is largely thought to be extinct on the western shores of Moreton Bay between Pumicestone Passage and Behms Creek. The action will not adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population?	The species is largely thought to be extinct on the western shores of Moreton Bay between Pumicestone Passage and Behms Creek. The action will not disrupt the breeding cycle of an important population of the species.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The shores of the PDA are not suitable for the species due to historical infilling and clearing of coastal habitats. There are several ongoing threatening processes, specifically human disturbance, freshwater runoff and the presence of feral and domestic predators, which will continue to impact on the suitability of habitat for the species, with or without the Project. As a result, there are no records of the species from the location or surrounds. The action will not modify, destroy, remove, isolate or decrease the 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	The species is largely thought to be extinct on the western shores of Moreton Bay between Pumicestone Passage and Behms Creek. The action will not result in invasive species introduction to water mouse habitat.
Introduce disease that may cause the species to decline?	The species is largely thought to be extinct on the western shores of Moreton Bay between Pumicestone Passage and Behms Creek. The action will not result in the introduction of disease that may cause water mouse to decline.
Interfere substantially with the recovery of the species?	The shores of the PDA are not suitable for the species due to historical infilling and clearing of coastal habitats. There are several ongoing threatening processes, specifically human disturbance, freshwater runoff and the presence of feral and domestic predators, which will continue to impact on the suitability of habitat for the species, with or without the Project. As a result of historical and current land uses and threatening processes, there are no records of the species from the location or surrounds. It is unlikely this portion of coastline will ever be suitable for reintroduction of the species due to landform changes and ongoing threatening processes associated with its proximity to human settlement, therefore the PDA and surrounds are unlikely to be important for recovery of the species.

24.2.4 White-throated Needletail Threatened Species Significant Impact Assessment

White-throated needletail (*Phascolarctos cinereus*) is listed as vulnerable therefore is required to be assessed against significant impact criteria for vulnerable species.

This section should be read in conjunction with Chapter 15, which provides detailed information on existing white-throated needletail populations at the Project footprint, potential impacts resulting from the Project and proposed management measures.

24.2.4.1 *Relevant Conservation Advice and Recovery Plans*

There is no national recovery plan for the species.

Conservation objectives for white-throated needletail set out in the draft referral guideline are to retain habitats and resources necessary for the species to successfully migrate and, where appropriate, breed throughout its natural range in Australia.

24.2.4.2 *Assessment Against the EPBC Act Significant Impact Assessment Criteria*

Potential impacts to white-throated needletail from Project activities are addressed in Section 15.4.5 with adaptive management and monitoring measures outlined in Section 15.5. Assessment against the EPBC Act significant impact criteria for threatened species is provided in Table 24-4.

White-throated needletail has not been recorded from previous surveys of the PDA and there are three Wildlife Online records of the species within 3 km of the PDA. It has been assessed as likely to occur as a regular visitor feeding on insects in the air.

The Draft referral guideline for 14 birds listed migratory under the EPBC Act (DOE, 2015) have been used to inform the significant impact assessment (Table 24-4). There is no national recovery plan for the species.

The urban nature of the PDA is such that it does not form critical habitat, and significant impacts to the species are not predicted.

The Project will not result in a significant impact on the white-throated needletail.

Table 24-4: Assessment of White-throated Needletail Against the Vulnerable Threatened Species Significant Impact Criteria.

Significant Impact Criteria for a Vulnerable Species	Assessment Summary
Lead to a long-term decrease in the size of an important population of a species	An internationally important population of the species is 100 birds, while a nationally important population is 10 birds (DOE, 2015). As the species has not been recorded from the site and there are only three records from within 3 km of the PDA, the PDA is not considered to support an important population.
Reduce the area of occupancy of an important population?	The PDA is not considered to support an important population.
Fragment an existing important population into two or more populations	The PDA is not considered to support an important population.
Adversely affect habitat critical to the survival of a species?	A key habitat for the species may be large tracts of native vegetation, particularly forest. It is found to roost in tree hollows in tall trees on ridgetops, on bark or rock faces, and appears to have

Significant Impact Criteria for a Vulnerable Species	Assessment Summary
	traditional roost sites (DOE, 2015). None of these habitat features are present in the PDA, the species has not been recorded roosting in the PDA and it is not considered to represent habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population?	The species does not breed in Australia.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	Habitat within the PDA is not important to the species.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	There is no risk of the Project introducing invasive species to the location that are harmful to white-throated needletail.
Introduce disease that may cause the species to decline?	Disease is not listed as a threat to white-throated needletail and as a mostly aerial species, there is no risk of disease introduction because of the Project.
Interfere substantially with the recovery of the species?	The PDA does not support critical habitat or an important population of the species. The Project will not interfere with the recovery of the species.

24.3. Threatened Shorebird Species

Seven threatened shorebird species were identified as having some potential to be found on or adjacent the PDA (refer to Chapter 17). These are:

- Eastern curlew – Critically Endangered;
- Great knot – Critically Endangered;
- Curlew sandpiper – Critically Endangered;
- Red knot – Endangered;
- Lesser sand plover – Endangered;
- Bar-tailed godwit (Western Alaskan) – Vulnerable; and
- Greater sand plover – Vulnerable

Of the seven species, three are listed as critically endangered, two as endangered, and two as vulnerable under the EPBC Act. The shorebird species outlined above have been assessed against the relevant listed threatened species and ecological communities significant impact criteria in the sections below.

24.3.1 Eastern Curlew Threatened Species Significant Impact Assessment

The eastern curlew (*Numenius madagascariensis*) is listed as critically endangered under the EPBC Act, therefore is required to be assessed against significant impact criteria for critically endangered species.

This section should be read in conjunction with Chapter 17 of the Draft EIS, which provides detailed information on existing eastern curlew populations at the Project footprint, potential impacts resulting from the Project and proposed management measures.

24.3.1.1 *Relevant Conservation Advice and Recovery Plans*

EPBC Act conservation advice for eastern curlew, listed as critically endangered under the EPBC Act, lists the primary conservation objectives, conservation and management actions and monitoring and research priorities for the species. These are:

Australian conservation objectives:

- Achieve a stable or increasing population;
- Maintain and enhance important habitat;
- Reduce disturbance at key roosting and feeding sites; and
- Raise awareness of eastern curlew within the local community.

Conservation and management actions:

- Work with governments along the EAAF to prevent destruction of key migratory staging sites;
- Develop and implement an International Single Species Action Plan for eastern curlew with all range states;
- Support initiatives to improve habitat management at key sites;
- Maintain and improve protection of roosting and feeding sites in Australia;
- Incorporate requirements for eastern curlew into coastal planning and management; and
- Manage important sites to identify, control and reduce the spread of invasive species.
- Manage disturbance at important sites when eastern curlews are present – e.g., discourage or prohibit vehicle access, horse riding and dogs on beaches, and implement temporary site closures; and
- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.

Monitoring priorities:

- Enhance existing migratory shorebird population monitoring programmes, particularly to improve coverage across northern Australia.

Research priorities:

- More precisely assess eastern curlew life history, population size, distribution and ecological requirements particularly across northern Australia;
- Improve knowledge about dependence of eastern curlew on key migratory staging sites, and wintering sites to the north of Australia; and
- Improve knowledge about threatening processes including the impacts of disturbance and hunting.

The Project is not in conflict with the objectives, actions or priorities outlined in the conservation advice for eastern curlew. Conservation and management actions listed in the conservation advice for eastern curlew are more relevant to Commonwealth and State Government planning, however a number of these actions could be delivered through the Project's offsets strategy. The proposed long-term monitoring of shorebird use of Toondah Harbour and the surrounding area during construction and operation of the Project will add to population monitoring programs being carried out in Moreton Bay.

24.3.1.2 *Assessment Against the EPBC Act Significant Impact Assessment Criteria*

Potential impacts to eastern curlew from Project activities are addressed in Section 17.4.3 with adaptive management and monitoring measures outlined in Section 17.5. Assessment against the EPBC Act significant impact criteria for threatened species is provided in Table 24-5.

Habitats used by eastern curlew within or adjacent to the Project footprint include tidal flat feeding habitat and two roost sites: Nandeebie Claypan located 100 m south-west of the Project footprint (the most recent survey data show that this

roost site has now been abandoned) and Oyster Point located 400 m south-west of the Project footprint. Eastern curlews also roost on a sandbank 2 km east of the Project footprint. Eastern curlews do not roost at Cassim Island. Tidal flat habitat within or adjoining the Project footprint was used by an average of 3.5 (maximum of five) eastern curlew at any point in time for feeding during the summer months within the past five years. Over the past five years, eastern curlew was recorded roosting at Oyster Point on 21% of summer high tide surveys, with an average of 13 and a maximum of 45 birds when present.

Assessments of the likelihood of significant residual impacts of the Project on eastern curlew in accordance with significant impact criteria for a critically endangered species are summarised in Table 24-5. The loss of 28.9 ha of feeding habitat corresponds to 0.29 % of the approximately 10,000 ha of important tidal flat habitat within Moreton Bay (Fuller *et al*. 2021).

The Project is likely to have a significant residual impact on eastern curlew by adversely affecting feeding habitat and reducing the area of occupancy of the species in feeding habitat by 0.29% within Moreton Bay.

Table 24-5: Assessment of Eastern Curlew Against the Critically Endangered Threatened Species Significant Impact Criteria.

Significant Impact Criteria for a Critically Endangered Species	Assessment Summary
Lead to a long-term decrease in the size of a population	**Significant residual impact unlikely.** Dredging and reclamation will remove 28.9 ha of tidal flat feeding habitat that is used by an average of 3 (maximum of 5) eastern curlew at any point in time over the past 5 years, which corresponds to 0.01% of the flyway population. Due to the substantial decline in the eastern curlew population migrating to Australia (81% decline over 30 years), including in Moreton Bay, which is regulated by loss of critical staging habitat in south-east Asia (i.e., outside of Australia), the current eastern curlew population in Moreton Bay is expected to be substantially below the carrying capacity for the species. Consequently, the loss of 0.29% of tidal flat feeding habitat in Moreton Bay is unlikely to lead to a long-term decrease in the size of the eastern curlew population (see Section 17.4.3.4 for more detail). The potential for short-term impacts from noise during Phase 1 activities on birds foraging on adjacent tidal flats and the Nandeebie Claypan roost site will be minimised by scheduling activities generating noise levels exceeding 60 dB(A) in the receiving environment to the winter months when fewer migratory shorebirds are present. Noise impacts after the completion of Phase 1 activities are not likely due to the reduced noise levels that are predicted. Longer-term impacts during operation are not likely if the recommended mitigation measures are successfully implemented to minimise the risk of increased disturbance to the Nandeebie Claypan and Oyster Point roost sites by increased public use of adjacent public spaces. Notwithstanding, Nandeebie Claypan appears to have now been abandoned as a roost site. Several alternative and preferred roost sites are also present in the local area, including the sandbank 2 km east of the Project footprint, Thornlands and Geoff Skinner Reserve at Wellington Point.
Reduce the area of occupancy of the species	**Significant residual impact likely.** Dredging and reclamation will reduce the area of occupancy of the species in tidal flat feeding habitat by 0.29% within Moreton Bay.
Fragment an existing population into two or more populations	**Significant residual impact unlikely.** The Project is unlikely to fragment the population of eastern curlew, a highly mobile species.
Adversely affect habitat critical to the survival of the species	**Significant residual impact likely.** Dredging and reclamation within the Project footprint will adversely affect 28.9 ha of feeding habitat used by an average of 3 (maximum of 5) eastern curlew. Coastal processes modelling (BMT 2022) predicts a small area of scouring due to increased currents over tidal flats adjacent to the Project footprint. However, there is unlikely to be a significant increase in turbidity or sedimentation and therefore no significant impact on benthic invertebrate communities in tidal flats adjacent to the Project footprint is predicted. The external revetments around the perimeter of the Project footprint have been designed to be a

Significant Impact Criteria for a Critically Endangered Species	Assessment Summary
	rock armour pitched wall with no public access, and the only constructed access to the tidal flats is the boat ramp for non-motorised vessels. Consequently, the Project does not promote public access to the adjacent tidal flats at low tide and is therefore unlikely to increase disturbance to eastern curlew using feeding habitat adjacent to the Project footprint. The Project will not adversely affect roosting habitat used by eastern curlew.
Disrupt the breeding cycle of a population	**Significant residual impact unlikely**. No pathways have been identified for Project activities to disrupt the breeding cycle of a population of eastern curlew, which breeds in the northern hemisphere.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Significant residual impact unlikely.** As outlined above, although the Project will remove 28.9 ha of tidal flat feeding habitat, this is unlikely to cause eastern curlew to decline since the carrying capacity for the species within Moreton Bay is likely to be substantially greater than the current population size. The Project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of roosting habitat used by the species.
Result in invasive species that are harmful to the species becoming established in its habitat	**Significant residual impact unlikely.** No pathways have been identified for an invasive species that is harmful to eastern curlew becoming established.
Introduce disease that may cause the species to decline	**Significant residual impact unlikely.** No pathways have been identified for the introduction of disease that may cause eastern curlew to decline.
Interfere with the recovery of the species	**Significant residual impact unlikely.** Recovery of eastern curlew depends critically on reversal of the current trajectory of habitat loss and degradation of critical staging habitat in south-east Asia. Substantial recovery of the 65% of habitat lost to land reclamation and other development in the Yellow Sea alone (corresponding to a loss of 731,000 ha of tidal flats) is unlikely to occur to the extent that the loss of 28.9 ha of tidal flat feeding habitat in Moreton Bay is likely to interfere with the recovery of eastern curlew.

24.3.2 Great Knot Threatened Species Significant Impact Assessment

Great knot (*Calidris tenuirostris*) is listed as critically endangered under the EPBC Act, therefore is required to be assessed against significant impact criteria for critically endangered species.

This section should be read in conjunction with Chapter 17 of the Draft EIS, which provides detailed information on existing great knot populations at the Project footprint, potential impacts resulting from the Project and proposed management measures.

24.3.2.1 *Relevant Conservation Advice and Recovery Plans*

EPBC Act conservation advice for great knot, listed as critically endangered under the EPBC Act, lists the primary conservation and management actions and monitoring and research priorities for the species. These are:

Conservation and Management Actions:

- Work with governments along the EAAF to prevent destruction of key breeding and migratory staging sites;
- Protect important habitat in Australia;
- Support initiatives to improve habitat management at key sites;
- Maintain and improve protection of roosting and feeding sites in Australia;

- Advocate for the creation and restoration of foraging and roosting sites;
- Incorporate requirements for great knot into coastal planning and management;
- Manage important sites to identify, control and reduce the spread of invasive species; and
- Manage disturbance at important sites which are subject to anthropogenic disturbance when great knots are present – e.g., discourage or prohibit vehicle access, horse riding and dogs on beaches, implement temporary site closures.

Survey and monitoring priorities:

- Enhance existing migratory shorebird population monitoring programmes, particularly to improve coverage across northern Australia; and
- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.

Information and research priorities:

- Undertake work to more precisely assess great knot life history, population size, distribution and ecological requirements particularly across northern Australia;
- Improve knowledge about dependence of great knot on key migratory staging sites, and non-breeding sites to the in south-east Asia; and
- Improve knowledge about threatening processes including the impacts of disturbance and hunting.

The Project is not in conflict with the objectives, actions or priorities outlined in the conservation advice for great knot. Conservation and management actions listed in the conservation advice for great knot are more relevant to Commonwealth and State Government planning, however a number of these actions could be delivered through the Project's offsets strategy. The proposed long-term monitoring of shorebird use of Toondah Harbour and the surrounding area during construction and operation of the Project will add to population monitoring programs being carried out in Moreton Bay.

24.3.2.2 *Assessment Against the EPBC Act Significant Impact Assessment Criteria*

Potential impacts to great knot from Project activities are addressed in Section 17.4 with adaptive management and monitoring measures outlined in Section 17.5. Assessment against the EPBC Act significant impact criteria for threatened species is provided in Table 24-6.

Habitats used by great knot include tidal flat feeding habitat in the Project footprint and two adjacent roost sites: Nandeebie Claypan located 100 m south-west of the Project footprint (recent surveys have shown this roosting site has been abandoned) and Oyster Point located 400 m south-west of the Project footprint. Tidal flat habitat within or closely adjoining the Project footprint was used by only a single great knot detected on one of the 49 summer month surveys, in December 2014. No great knot has been observed using the tidal flat feeding habitat in the Project footprint within the past five years. Over the past five years, great knot was recorded roosting at Oyster Point on 12% of summer high tide surveys, with an average of two and a maximum of six birds when present. A single great knot has been recorded roosting on the sandbank 2 km east of the Project footprint on a single survey. Great knot has not been recorded roosting at Cassim Island.

Assessments of the likelihood of significant residual impacts of the Project on great knot in accordance with significant impact criteria for a critically endangered species are summarised in Table 24-6. The loss of 28.9 ha of feeding habitat, which corresponds to 0.29 % of the approximately 10,000 ha of important tidal flat habitat within Moreton Bay (Fuller *et al*. 2021).

The Project is likely to have a significant residual impact on great knot by adversely affecting feeding habitat critical to the survival of the species and destroying feeding habitat that is characterised as important habitat for great knot because it is located within the MBRS and is used by great knot, albeit rarely.

Table 24-6: Assessment of Great Knot Against the Critically Endangered Threatened Species Significant Impact Criteria.

Significant Impact Criteria for a Critically Endangered Species	Assessment Summary
Lead to a long-term decrease in the size of a population	**Significant residual impact unlikely.** Dredging and reclamation will remove 28.9 ha of feeding habitat that is used rarely by up to one great knot at any point in time, which corresponds to less than 0.001% of the flyway population. Due to the substantial decline in the great knot population migrating to Australia (83% decline over 25 years), including in Moreton Bay (from estimates of up to 2,750 birds in the 1990s to estimates of around 1,250 in the mid- to late-2000s), regulated by loss of critical staging habitat in south-east Asia (i.e. outside of Australia), the current great knot population in Moreton Bay is expected to be substantially below the carrying capacity for the species. Consequently, the loss of 0.29% of tidal flat feeding habitat in Moreton Bay is unlikely to lead to a long-term decrease in the size of the great knot population (see Section 17.4.3.4 for more detail). The potential for short-term impacts from noise during stage 1 activities on birds foraging on adjacent tidal flats and the Nandeebie Claypan roost site will be minimised by scheduling activities generating noise levels exceeding 60 dB(A) in the receiving environment to the winter months when fewer migratory shorebirds are present. Noise impacts after the completion of stage 1 activities are not likely due to the reduced noise levels that are predicted. Longer-term impacts during operation are not likely if the recommended mitigation measures are successfully implemented to minimise the risk of increased disturbance to the Nandeebie Claypan and Oyster Point roost sites resulting from increased public use of adjacent public spaces. Several alternative and preferred roost sites are also present in the local area, and the Nandeebie Claypan appears to have now been abandoned as a roost site.
Reduce the area of occupancy of the species	**Significant residual impact unlikely.** Dredging and reclamation is unlikely to reduce the area of occupancy of the species in feeding habitat within Moreton Bay since the habitat in the Project footprint is so rarely used by great knot.
Fragment an existing population into two or more populations	**Significant residual impact unlikely.** The Project is unlikely to fragment the population of great knot, a highly mobile species.
Adversely affect habitat critical to the survival of the species	**Significant residual impact likely**. Dredging and reclamation within the Project footprint will adversely affect 28.9 ha of feeding habitat used rarely by up to one great knot. The modelling reported in BMT (2022) predicts a small area of scouring due to increased currents over tidal flats adjacent to the Project footprint. However, there is unlikely to be a significant increase in turbidity or sedimentation and therefore no significant impact on benthic invertebrate communities in tidal flats adjacent to the Project footprint is predicted. The external revetments around the perimeter of the Project footprint have been designed to be a rock armour pitched wall with no public access, and the only constructed access to the tidal flats is the boat ramp for non-motorised vessels. Consequently, the Project does not promote public access to the adjacent tidal flats at low tide and is therefore unlikely to increase disturbance to the very few great knots that may use feeding habitat adjacent to the Project footprint. The Project will have no direct impacts on roosting habitat used by great knot.
Disrupt the breeding cycle of a population	**Significant residual impact unlikely.** No pathways have been identified for Project activities to disrupt the breeding cycle of a population of great knot, which breeds in the northern hemisphere.
Modify, destroy, remove, isolate or decrease the	**Significant residual impact unlikely.** As outlined above, although the Project will remove 28.9 ha of tidal flat feeding habitat, this is unlikely to cause great knot to decline since great knot rarely uses

Significant Impact Criteria for a Critically Endangered Species	Assessment Summary
availability or quality of habitat to the extent that the species is likely to decline	this habitat and the carrying capacity for the species within Moreton Bay is likely to be substantially greater than the current population size. The Project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of roosting habitat used by the species.
Result in invasive species that are harmful to the species becoming established in its habitat	**Significant residual impact unlikely.** No pathways have been identified for an invasive species that is harmful to great knot becoming established.
Introduce disease that may cause the species to decline	**Significant residual impact unlikely.** No pathways have been identified for the introduction of disease that may cause great knot to decline.
Interfere with the recovery of the species	**Significant residual impact unlikely.** Recovery of great knot depends critically on reversal of the current trajectory of habitat loss and degradation of critical staging habitat in south-east Asia. Substantial recovery of the 65% of habitat lost to land reclamation and other development in the Yellow Sea over the past 50 years alone (corresponding to a loss of 731,000 ha of tidal flats) is unlikely to occur to the extent that the loss of 28.9 ha of tidal flat feeding habitat in Moreton Bay is likely to interfere with the recovery of great knot.

24.3.3 Curlew Sandpiper Threatened Species Significant Impact Assessment

Curlew sandpiper (*Calidris ferruginea*) is listed as critically endangered under the EPBC Act, therefore is required to be assessed against significant impact criteria for critically endangered species.

This section should be read in conjunction with Chapter 17, which provides detailed information on existing curlew sandpiper populations at the Project footprint, potential impacts resulting from the Project and proposed management measures.

24.3.3.1 *Relevant Conservation Advice and Recovery Plans*

EPBC Act conservation advice for curlew sandpiper, listed as critically endangered under the EPBC Act, lists the primary conservation objectives, conservation and management actions and monitoring and research priorities for the species. These are:

Australian conservation objectives:

- Achieve a stable or increasing population;
- Maintain and enhance important habitat.;
- Reduce disturbance at key roosting and feeding sites; and
- Raise awareness of curlew sandpiper within the local community.

Conservation and management actions:

- Work with governments along the EAAF to prevent destruction of key migratory staging sites;
- Support initiatives to protect and manage key staging sites of curlew sandpiper;
- Maintain and improve protection of roosting and feeding sites in Australia;
- Incorporate requirements for curlew sandpiper into coastal planning and management;
- Manage important sites to identify, control and reduce the spread of invasive species;
- Manage disturbance at important sites when curlew sandpiper are present – e.g., discourage or prohibit vehicle access, horse riding and dogs on beaches, and implement temporary site closures; and

- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.

Monitoring priorities:

- Enhance existing migratory shorebird population monitoring programmes, particularly to improve coverage across northern Australia.

Research priorities:

- More precisely assess curlew sandpiper population size, distribution and ecological requirements particularly across northern Australia;
- Improve knowledge about dependence of curlew sandpiper on key migratory staging sites, and wintering sites to the north of Australia; and
- Improve knowledge about threatening processes including the impacts of disturbance and hunting.

The Project is not in conflict with the objectives, actions or priorities outlined in the conservation advice for curlew sandpiper. Conservation and management actions listed in the conservation advice for curlew sandpiper are more relevant to Commonwealth and State Government planning, however a number of these actions could be delivered through the Project's offsets strategy. The proposed long-term monitoring of shorebird use of Toondah Harbour and the surrounding area during construction and operation of the Project will add to population monitoring programs being carried out in Moreton Bay.

24.3.3.2 *Assessment Against the EPBC Act Significant Impact Assessment Criteria*

Potential impacts to curlew sandpiper from Project activities are addressed in Section 17.4 with adaptive management and monitoring measures outlined in Section 17.5. Assessment against the EPBC Act significant impact criteria for threatened species is provided in Table 24-7.

The curlew sandpiper has not been recorded foraging within or adjacent to the Project footprint and has not been recorded roosting at the Nandeebie Claypan or Oyster Point roost sites within the past 10 years. There are also no records of the species using either Cassim Island or the sandbank 2 km east of the Project footprint for roosting.

An assessment of the likelihood of significant residual impacts of the Project on curlew sandpiper in accordance with significant impact criteria for a critically endangered species is summarised in Table 24-7.

The Project will not result in a significant impact on curlew sandpiper.

Table 24-7: Assessment of Curlew Sandpiper Against the Critically Endangered Threatened Species Significant Impact Criteria.

Significant Impact Criteria for a Critically Endangered Species	Assessment Summary
Lead to a long-term decrease in the size of a population	**Significant residual impact unlikely.** Curlew sandpiper does not use tidal flat feeding habitat within the Project footprint. Consequently, the loss of 28.9 ha of tidal flat from dredging and reclamation is unlikely to lead to a long-term decrease in the size of the curlew sandpiper population. Curlew sandpiper has not used roost sites adjacent to the Project footprint within the past 10 years, so any potential impacts to roost sites are unlikely to lead to a long-term decrease in the size of the population.
Reduce the area of occupancy of the species	**Significant residual impact unlikely.** Dredging and reclamation is unlikely to reduce the area of occupancy of the species in feeding habitat within Moreton Bay since the habitat in the Project footprint is not used by curlew sandpiper.

Significant Impact Criteria for a Critically Endangered Species	Assessment Summary
Fragment an existing population into two or more populations	**Significant residual impact unlikely.** The Project is unlikely to fragment the population of curlew sandpiper, a highly mobile species.
Adversely affect habitat critical to the survival of the species	**Significant residual impact unlikely.** Curlew sandpiper does not use tidal flat feeding habitat within the Project footprint. Furthermore, there is no evidence that curlew sandpiper uses adjacent habitats. The Project will have no direct impacts on roosting habitat last used by curlew sandpiper more than 10 years ago.
Disrupt the breeding cycle of a population	**Significant residual impact unlikely.** No pathways have been identified for Project activities to disrupt the breeding cycle of a population of curlew sandpiper, which breeds in the northern hemisphere.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Significant residual impact unlikely.** Curlew sandpiper does not use tidal flat feeding habitat within the Project footprint or adjacent areas. Dredging and reclamation within the Project footprint will not cause curlew sandpiper to decline since the species does not use this habitat. The carrying capacity for the species within Moreton Bay is likely to be substantially greater than the current population size. The Project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of roosting habitat last used by curlew sandpiper more than 10 years ago.
Result in invasive species that are harmful to the species becoming established in its habitat	**Significant residual impact unlikely.** No pathways have been identified for an invasive species that is harmful to curlew sandpiper becoming established.
Introduce disease that may cause the species to decline	**Significant residual impact unlikely.** No pathways have been identified for the introduction of disease that may cause curlew sandpiper to decline.
Interfere with the recovery of the species	**Significant residual impact unlikely.** Recovery of curlew sandpiper depends critically on reversal of the current trajectory of habitat loss and degradation of critical staging habitat in south-east Asia. Substantial recovery of the 65% of habitat lost to land reclamation and other development in the Yellow Sea over the past 50 years alone (corresponding to a loss of 731,000 ha of tidal flats) is unlikely to occur to the extent that the loss of 28.9 ha of tidal flat potential feeding habitat in Moreton Bay is likely to interfere with the recovery of curlew sandpiper.

24.3.4 Red Knot Threatened Species Significant Impact Assessment

Red knot (*Calidris canutus*) is listed as endangered under the EPBC Act therefore is required to be assessed against significant impact criteria for endangered species.

This section should be read in conjunction with Chapter 17, which provides detailed information on existing red knot populations at the Project footprint, potential impacts resulting from the Project and proposed management measures.

24.3.4.1 *Relevant Conservation Advice and Recovery Plans*

EPBC Act conservation advice for red knot, listed as endangered under the EPBC Act, lists the primary conservation and management actions and monitoring and research priorities for the species. These are:

Conservation and management actions:

- Work with governments along the EAAF to prevent destruction of key breeding and migratory staging sites;
- Protect important habitat in Australia;
- Support initiatives to improve habitat management at key sites;
- Maintain and improve protection of roosting and feeding sites in Australia;

- Advocate for the creation and restoration of foraging and roosting sites;
- Incorporate requirements for red knot into coastal planning and management;
- Manage important sites to identify, control and reduce the spread of invasive species; and
- Manage disturbance at important sites which are subject to anthropogenic disturbance when red knots are present – e.g., discourage or prohibit vehicle access, horse riding and dogs on beaches, implement temporary site closures.

Survey and monitoring priorities:

- Enhance existing migratory shorebird population monitoring programmes, particularly to improve coverage across northern Australia; and
- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.

Information and research priorities:

- Undertake work to more precisely assess red knot life history, population size, distribution and ecological requirements particularly across northern Australia;
- Improve knowledge about dependence of red knot on key migratory staging sites, and non-breeding sites to the in south-east Asia; and
- Improve knowledge about threatening processes including the impacts of disturbance and hunting.

The Project is not in conflict with the objectives, actions or priorities outlined in the conservation advice for red knot. Conservation and management actions listed in the conservation advice for red knot are more relevant to Commonwealth and State Government planning, however a number of these actions could be delivered through the Project's offsets strategy. The proposed long-term monitoring of shorebird use of Toondah Harbour and the surrounding area during construction and operation of the Project will add to population monitoring programs being carried out in Moreton Bay.

24.3.4.2 *Assessment Against the EPBC Act Significant Impact Assessment Criteria*

Potential impacts to red knot from Project activities are addressed in Section 17.4 with adaptive management and monitoring measures outlined in Section 17.5. Assessment against the EPBC Act significant impact criteria for threatened species is provided in Table 24-8.

Red knot has not been recorded foraging within or adjacent to the Project footprint and has not been recorded roosting at the Nandeebie Claypan or Oyster Point roost sites within the past 10 years, besides a single record of a single bird at Oyster Point in 2021. Similarly, red knot has been recorded only once roosting on the offshore sandbank, when two birds were recorded. Red knot does not roost at Cassim Island.

An assessment of the likelihood of significant residual impacts of the Project on red knot in accordance with significant impact criteria for an endangered species is summarised Table 24-8.

The Project will not result in a significant impact on red knot.

Table 24-8: Assessment of Red Knot Against the Endangered Threatened Species Significant Impact Criteria.

Significant Impact Criteria for an Endangered Species	Assessment Summary
Lead to a long-term decrease in the size of a population	**Significant residual impact unlikely.** Red knot does not use tidal flat feeding habitat in the Project footprint. Consequently, the removal of 28.9 ha of tidal flat feeding habitat for migratory shorebirds due to dredging and reclamation is unlikely to lead to a long-term decrease in the size of the red knot population. Red knot has very rarely used roost sites adjacent to the Project in very small numbers within the past 10 years (a single record of one bird at Oyster Point in the last 10 years), so any potential impacts to roost sites are unlikely to lead to a long-term decrease in the size of the population.
Reduce the area of occupancy of the species	**Significant residual impact unlikely.** Dredging and reclamation is unlikely to reduce the area of occupancy of the species in feeding habitat within the MBRS since the habitat in the Project footprint is not used by red knot.
Fragment an existing population into two or more populations	**Significant residual impact unlikely.** The Project is unlikely to fragment the population of red knot, a highly mobile species.
Adversely affect habitat critical to the survival of the species	**Significant residual impact unlikely.** Tidal flat feeding habitat within the Project footprint is not used by red knot. Furthermore, there is no evidence that red knot uses adjacent habitats. The Project will have no direct impacts on roosting habitat used very rarely by very small numbers of red knot.
Disrupt the breeding cycle of a population	**Significant residual impact unlikely.** No pathways have been identified for Project activities to disrupt the breeding cycle of a population of red knot, which breeds in the northern hemisphere.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Significant residual impact unlikely.** The removal of 28.9 ha of tidal flat feeding habitat within the Project footprint is unlikely to cause red knot to decline since the species does not use this habitat and the carrying capacity for the species within Moreton Bay is likely to be substantially greater than the current population size. The Project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of roosting habitat used very rarely by very small numbers of red knot.
Result in invasive species that are harmful to the species becoming established in its habitat	**Significant residual impact unlikely.** No pathways have been identified for an invasive species that is harmful to red knot becoming established.
Introduce disease that may cause the species to decline	**Significant residual impact unlikely.** No pathways have been identified for the introduction of disease that may cause red knot to decline.
Interfere with the recovery of the species	**Significant residual impact unlikely.** Recovery of red knot depends critically on reversal of the current trajectory of habitat loss and degradation of critical staging habitat in south-east Asia. Substantial recovery of the 65% of habitat lost to land reclamation and other development in the Yellow Sea over the past 50 years alone (corresponding to a loss of 731,000 ha of tidal flats) is unlikely to occur to the extent that the loss of 28.9 ha of tidal flat feeding habitat in Moreton Bay that is not used by red knot is likely to interfere with the recovery of the species.

24.3.5 Lesser Sand Plover Threatened Species Significant Impact Assessment

Lesser sand plover (*Charadrius mongolus*) is listed as endangered under the EPBC Act, therefore is required to be assessed against significant impact criteria for endangered species.

This section should be read in conjunction with Chapter 17 of the Draft EIS, which provides detailed information on existing lesser sand plover populations at the Project footprint, potential impacts resulting from the Project and proposed management measures.

24.3.5.1 *Relevant Conservation Advice and Recovery Plans*

EPBC Act conservation advice for lesser sand plover, listed as endangered under the EPBC Act, lists the primary conservation and management actions and monitoring and research priorities for the species. These are:

Conservation and management actions:

- Work with governments along the EAAF to prevent destruction of key breeding and migratory staging sites;
- Protect important habitat in Australia;
- Support initiatives to improve habitat management at key sites;
- Maintain and improve protection of roosting and feeding sites in Australia;
- Advocate for the creation and restoration of foraging and roosting sites;
- Incorporate requirements for lesser sand plover into coastal planning and management;
- Manage important sites to identify, control and reduce the spread of invasive species; and
- Manage disturbance at important sites which are subject to anthropogenic disturbance when lesser sand plovers are present – e.g., discourage or prohibit vehicle access, horse riding and dogs on beaches, implement temporary site closures.

Survey and monitoring priorities:

- Enhance existing migratory shorebird population monitoring programmes, particularly to improve coverage across northern Australia; and
- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.

Information and research priorities:

- Undertake work to more precisely assess lesser sand plover life history, population size, distribution and ecological requirements particularly across northern Australia;
- Improve knowledge about dependence of lesser sand plover on key migratory staging sites, and non-breeding sites to the in south-east Asia; and
- Improve knowledge about threatening processes including the impacts of disturbance and hunting.

The Project is not in conflict with the objectives, actions or priorities outlined in the conservation advice for lesser sand plover. Conservation and management actions listed in the conservation advice for lesser sand plover are more relevant to Commonwealth and State Government planning, however a number of these actions could be delivered through the Project's offsets strategy. The proposed long-term monitoring of shorebird use of Toondah Harbour and the surrounding area during construction and operation of the Project will add to population monitoring programs being carried out in Moreton Bay.

24.3.5.2 *Assessment Against the EPBC Act Significant Impact Assessment Criteria*

Potential impacts to lesser sand plover from Project activities are addressed in Section 17.4 with adaptive management and monitoring measures outlined in Section 17.5. Assessment against the EPBC Act significant impact criteria for threatened species is provided in Table 24-9.

Habitat used by lesser sand plover comprises tidal flat feeding habitat within or adjacent to the Project footprint. Tidal flat habitat within the Project footprint was used by two lesser sand plovers on only one of 49 surveys during the summer months in the past five years.

While the Nandeebie Claypan and Oyster Point roost sites are potentially suitable for the species, it has not been recorded roosting at these sites over the past 25 years. There are no records of the species roosting at Cassim Island or the sandbank 2 km east of the Project footprint.

An assessment of the likelihood of significant residual impacts of the Project on lesser sand plover in accordance with significant impact criteria for an endangered species is summarised in Table 24-9. The loss of 28.9 ha of feeding habitat, which corresponds to 0.29 % of the approximately 10,000 ha of important tidal flat habitat within Moreton Bay (Fuller *et al*. 2021). The loss of 28.9 ha of feeding habitat, which corresponds to 0.29 % of the approximately 10,000 ha of important tidal flat habitat within Moreton Bay (Fuller *et al*. 2021).

The Project is likely to have a significant residual impact on lesser sand plover by adversely affecting feeding habitat critical to the survival of the species and destroying feeding habitat that is characterised as important habitat for lesser sand plover because it is located within the MBRS and is used by lesser sand plover, albeit rarely.

Table 24-9: Assessment of Lesser Sand Plover Against the Endangered Threatened Species Significant Impact Criteria.

Significant Impact Criteria for an Endangered Species	Assessment Summary
Lead to a long-term decrease in the size of a population	**Significant residual impact unlikely.** Dredging and reclamation will remove 28.9 ha of feeding habitat that is used rarely by up to two lesser sand plovers at any point in time, which corresponds to up to 0.001% of the flyway population. Due to the substantial decline in the lesser sand plover population migrating to Australia (75% decline over 24 years), including in Moreton Bay, which is regulated by loss of critical staging habitat in south-east Asia (i.e., outside of Australia), the current lesser sand plover population in Moreton Bay is expected to be substantially below the carrying capacity for the species. Consequently, the loss of 0.29% of tidal flat feeding habitat in Moreton Bay that is used rarely by lesser sand plover is unlikely to lead to a long-term decrease in the size of the lesser sand plover population (see Section 17.4.3.4 for more detail). The potential for short-term impacts from noise during stage 1 activities on birds foraging on adjacent tidal flats and roosting at Nandeebie Claypan will be minimised by scheduling activities that generate noise levels exceeding 60 dB(A) in the receiving environment in the winter months when fewer migratory shorebirds are present. Noise impacts after the completion of stage 1 activities are not likely due to the reduced noise levels that are predicted for remaining works. Longer-term operational impacts are not likely if the recommended mitigation measures are successfully implemented to minimise the risk of increased disturbance to roosting birds by increased public use of public spaces adjacent to the Nandeebie Claypan and Oyster Point roost sites, which are potentially suitable for the species.
Reduce the area of occupancy of the species	**Significant residual impact unlikely.** Dredging and reclamation is unlikely to reduce the area of occupancy of the species in feeding habitat within Moreton Bay since the habitat in the Project footprint is so rarely used by lesser sand plover.

Significant Impact Criteria for an Endangered Species	Assessment Summary
Fragment an existing population into two or more populations	**Significant residual impact unlikely.** The Project is unlikely to fragment the population of lesser sand plover, a highly mobile species.
Adversely affect habitat critical to the survival of the species	**Significant residual impact likely.** Dredging and reclamation within the Project footprint will adversely affect 28.9 ha of feeding habitat used rarely by up to two lesser sand plovers. The modelling reported in BMT (2022) predicts a small area of scouring due to increased currents over tidal flats adjacent to the Project footprint but there is unlikely to be a significant increase in turbidity or sedimentation and therefore no significant impact on benthic invertebrate communities in tidal flats adjacent to the Project footprint is predicted. The external revetments around the perimeter of the Project footprint have been designed to be a rock armour pitched wall, with no public access, and the only constructed access to the tidal flats is the boat ramp for non-motorised vessels. Consequently, the Project does not promote public access to the adjacent tidal flats at low tide and is therefore unlikely to increase disturbance to the very few lesser sand plovers that may use feeding habitat adjacent to the Project footprint. The Project will have no direct or indirect impacts on roosting habitat for lesser sand plover as adjacent roost sites have not been used by the species over the past 25 years.
Disrupt the breeding cycle of a population	**Significant residual impact unlikely.** No pathways have been identified for Project activities to disrupt the breeding cycle of a population of lesser sand plover, which breeds in the northern hemisphere.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Significant residual impact unlikely.** As outlined above, although the Project will remove 28.9 ha of tidal flat feeding habitat, this is unlikely to cause lesser sand plover to decline since lesser sand plover rarely uses this habitat and the carrying capacity for the species within Moreton Bay is likely to be substantially greater than the current population size. The project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of roosting habitat that has not been used by lesser sand plover over the past 25 years.
Result in invasive species that are harmful to the species becoming established in its habitat	**Significant residual impact unlikely.** No pathways have been identified for an invasive species that is harmful to lesser sand plover becoming established.
Introduce disease that may cause the species to decline	**Significant residual impact unlikely**. No pathways have been identified for the introduction of disease that may cause lesser sand plover to decline.
Interfere with the recovery of the species	**Significant residual impact unlikely.** Recovery of lesser sand plover depends critically on reversal of the current trajectory of habitat loss and degradation of critical staging habitat in south-east Asia. Substantial recovery of the 65% of habitat lost to land reclamation and other development in the Yellow Sea over the past 50 years alone (corresponding to a loss of 731,000 ha of tidal flats) is unlikely to occur to the extent that the loss of 28.9 ha of tidal flat feeding habitat in Moreton Bay, used rarely by lesser sand plover, is likely to interfere with the recovery of the species.

24.3.6 Bar-tailed Godwit Threatened Species Significant Impact Assessment

Bar-tailed godwit (*Limosa lapponica baueri*) is listed as vulnerable under the EPBC Act therefore is required to be assessed against significant impact criteria for vulnerable species.

This section should be read in conjunction with Chapter 17, which provides detailed information on existing bar-tailed godwit populations at the Project footprint, potential impacts resulting from the Project and proposed management measures.

24.3.6.1 *Relevant Conservation Advice and Recovery Plans*

EPBC Act conservation advice for bar-tailed godwit, listed as vulnerable under the EPBC Act, lists the primary conservation and management actions and monitoring and research priorities for the species. These are:

Conservation and management actions:

- Work with governments along the EAAF to prevent destruction of key breeding and migratory staging sites;
- Protect important habitat in Australia;
- Support initiatives to improve habitat management at key sites;
- Maintain and improve protection of roosting and feeding sites in Australia;
- Advocate for the creation and restoration of foraging and roosting sites;
- Incorporate requirements for bar-tailed godwit into coastal planning and management;
- Manage important sites to identify, control and reduce the spread of invasive species;
- Manage disturbance at important sites which are subject to anthropogenic disturbance when bar-tailed godwits are present – e.g., discourage or prohibit vehicle access, horse riding and dogs on beaches, implement temporary site closures.

Survey and monitoring priorities:

- Enhance existing migratory shorebird population monitoring programmes, particularly to improve coverage across northern Australia; and
- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.

Information and research priorities:

- Undertake work to more precisely assess bar-tailed godwit life history, population size, distribution and ecological requirements particularly across northern Australia;
- Improve knowledge about dependence of bar-tailed godwit on key migratory staging sites, and non-breeding sites to the in south-east Asia; and
- Improve knowledge about threatening processes including the impacts of disturbance and hunting.

The Project is not in conflict with the objectives, actions or priorities outlined in the conservation advice for bar-tailed godwit. Conservation and management actions listed in the conservation advice for bar-tailed godwit are more relevant to Commonwealth and State Government planning, however a number of these actions could be delivered through the Project's offsets strategy. The proposed long-term monitoring of shorebird use of Toondah Harbour and the surrounding area during construction and operation of the Project will add to population monitoring programs being carried out in Moreton Bay.

24.3.6.2 *Assessment Against the EPBC Act Significant Impact Assessment Criteria*

Potential impacts to bar-tailed godwit from Project activities are addressed in Section 17.4 with adaptive management and monitoring measures outlined in Section 17.5. Assessment against the EPBC Act significant impact criteria for threatened species is provided in Table 24-10.

The population of bar-tailed godwit in the MBRS is characterised as an important population under the EPBC Act. Important habitats used by bar-tailed godwit within or adjacent to the Project footprint include tidal flat feeding habitat and two roost sites: Nandeebie Claypan located 100 m south-west of the Project footprint (Nandeebie Claypan has since been abandoned as a roost site) and Oyster Point located 400 m south-west of the Project footprint. Tidal flat habitat within or closely adjoining the Project footprint was used by an average of 13 (maximum of 24) bar-tailed godwit at any point in time for feeding during the summer months within the past five years. Mangrove trees in the interior of the Cassim Island roost site were used occasionally by up to two bar-tailed godwits. This is an unusual roost site for this species, but a sandbar in the interior of the roost site was used as a mid-tide roost and by up to 25 bar-tailed godwits as a high tide roost on the occasional lowest neap high tides. Over the past five years, bar-tailed godwit was recorded roosting at Oyster Point on 30% of summer high tide surveys, with an average of 405 and a maximum of 825 birds when present.

An assessment of the likelihood of significant residual impacts of the Project on bar-tailed godwit in accordance with significant impact criteria for a vulnerable species is summarised in Table 24-10.

The loss of 28.9 ha of feeding habitat, which corresponds to 0.29 % of the approximately 10,000 ha of important tidal flat habitat within Moreton Bay reported by Fuller *et al*. (2021) is likely to have a significant residual impact on bar-tailed godwit by adversely affecting feeding habitat and reducing the area of occupancy of the species in feeding habitat by 0.29% within Moreton Bay.

Table 24-10: Assessment of Bar-tailed Godwit Against the Vulnerable Threatened Species Significant Impact Criteria.

Significant Impact Criteria for a Vulnerable Species	Assessment Summary
Lead to a long-term decrease in the size of an important population	**Significant residual impact unlikely**. Dredging and reclamation will remove 28.9 ha of tidal flat feeding habitat that is used by an average of 13 (maximum of 24) bar-tailed godwit at any point in time over the past five years, which corresponds to 0.001% or 0.01% of the flyway population respectively. Due to the substantial decline in the bar-tailed godwit population migrating to Australia (32% decline over 29 years), including in Moreton Bay, which is regulated by loss of critical staging habitat in south-east Asia (i.e., outside of Australia), the current bar-tailed godwit population in Moreton Bay is expected to be substantially below the carrying capacity for the species. Consequently, the loss of 0.29% of tidal flat feeding habitat in Moreton Bay is unlikely to lead to a long-term decrease in the size of the bar-tailed godwit population (see Section 17.4.3.4 for more detail). The Project will have no direct impact on roost sites used by bar-tailed godwit. The potential for short-term impacts from noise during stage 1 construction activities on birds foraging on adjacent tidal flats and occasional roosting at the Cassim Island and Nandeebie Claypan roost sites will be minimised by scheduling activities that generate noise levels exceeding 60 dB(A) in the receiving environment to the winter months when fewer migratory shorebirds are present. Noise impacts after the completion of these activities are not likely due to the reduced noise levels predicted for future works. Longer-term operational impacts are not likely if the recommended mitigation measures are successfully implemented to minimise the risk of increased disturbance to roosting birds due to increased public use of public spaces adjacent to Oyster Point roost sites and the risk of

Significant Impact Criteria for a Vulnerable Species	Assessment Summary
	increased disturbance to the Cassim Island roost site associated with non-motorised watercraft. Several alternative and preferred roost sites are present in the local area.
Reduce the area of occupancy of an important population of the species	**Significant residual impact likely.** Dredging and reclamation will reduce the area of occupancy of the species in tidal flat feeding habitat by 0.29% within Moreton Bay.
Fragment an existing important population into two or more populations	**Significant residual impact unlikely.** The Project is unlikely to fragment the population of bar-tailed godwit, a highly mobile species.
Adversely affect habitat critical to the survival of the species	**Significant residual impact likely.** Dredging and reclamation within the Project footprint will adversely affect 28.9 ha of feeding habitat used by an average of 13 (maximum of 24) bar-tailed godwit over the past five years. The modelling reported by BMT (2022) predicts a small area of scouring due to increased currents over tidal flats adjacent to the Project footprint. However, there is unlikely to be a significant increase in turbidity or sedimentation and therefore no significant impact on benthic invertebrate communities in tidal flats adjacent to the Project footprint is predicted. The external revetments around the perimeter of the Project footprint have been designed to be a rock armour pitched wall, with no public access, and the only constructed access to the tidal flats is the boat ramp for non-motorised vessels. Consequently, the Project does not promote public access to the adjacent tidal flats at low tide and is therefore unlikely to increase disturbance to bar-tailed godwit using feeding habitat adjacent to the Project footprint. The Project will have no direct impacts on roosting habitat used by Bar-tailed.
Disrupt the breeding cycle of an important population	**Significant residual impact unlikely.** No pathways have been identified for Project activities to disrupt the breeding cycle of a population of bar-tailed godwit, which breeds in the northern hemisphere.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Significant residual impact unlikely.** As outlined above, although the Project will remove 28.9 ha of tidal flat feeding habitat, this is unlikely to cause bar-tailed godwit to decline since the carrying capacity for the species within Moreton Bay is likely to be substantially greater than the current population size. The project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of roosting habitat used by the species.
Result in invasive species that are harmful to the species becoming established in its habitat	**Significant residual impact unlikely.** No pathways have been identified for an invasive species that is harmful to bar-tailed godwit becoming established.
Introduce disease that may cause the species to decline	**Significant residual impact unlikely.** No pathways have been identified for the introduction of disease that may cause bar-tailed godwit to decline.
Interfere substantially with the recovery of the species	**Significant residual impact unlikely.** Recovery of bar-tailed godwit depends critically on reversal of the current trajectory of habitat loss and degradation of critical staging habitat in south-east Asia. Substantial recovery of the 65% of habitat lost to land reclamation and other development in the Yellow Sea alone (corresponding to a loss of 731,000 ha of tidal flats) is unlikely to occur to the extent that the loss of 28.9 ha of tidal flat feeding habitat in Moreton Bay is likely to interfere substantially with the recovery of bar-tailed godwit.

24.3.7 Greater Sand Plover Threatened Species Significant Impact Assessment

Greater sand plover (*Charadrius leschenaultii*) is listed as vulnerable under the EPBC Act therefore is required to be assessed against significant impact criteria for vulnerable species.

This section should be read in conjunction with Chapter 17, which provides detailed information on existing greater sand plover populations at the Project footprint, potential impacts resulting from the Project and proposed management measures.

24.3.7.1 *Relevant Conservation Advice and Recovery Plans*

EPBC Act conservation advice for greater sand plover, listed as vulnerable under the EPBC Act, lists the primary conservation and management actions and monitoring and research priorities for the species. These are:

Conservation and management actions:

- Work with governments along the EAAF to prevent destruction of key breeding and migratory staging sites;
- Protect important habitat in Australia;
- Support initiatives to improve habitat management at key sites;
- Maintain and improve protection of roosting and feeding sites in Australia;
- Advocate for the creation and restoration of foraging and roosting sites;
- Incorporate requirements for greater sand plover into coastal planning and management;
- Manage important sites to identify, control and reduce the spread of invasive species; and
- Manage disturbance at important sites which are subject to anthropogenic disturbance when greater sand plovers are present – e.g., discourage or prohibit vehicle access, horse riding and dogs on beaches, implement temporary site closures.

Survey and monitoring priorities:

- Enhance existing migratory shorebird population monitoring programmes, particularly to improve coverage across northern Australia; and
- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.

Information and research priorities:

- Undertake work to more precisely assess greater sand plover life history, population size, distribution and ecological requirements particularly across northern Australia;
- Improve knowledge about dependence of greater sand plover on key migratory staging sites, and non-breeding sites to the in south-east Asia; and
- Improve knowledge about threatening processes including the impacts of disturbance and hunting.

The Project is not in conflict with the objectives, actions or priorities outlined in the conservation advice for greater sand plover. Conservation and management actions listed in the conservation advice for greater sand plover are more relevant to Commonwealth and State Government planning, however a number of these actions could be delivered through the Project's offsets strategy. The proposed long-term monitoring of shorebird use of Toondah Harbour and the surrounding area during construction and operation of the Project will add to population monitoring programs being carried out in Moreton Bay.

24.3.7.2 *Assessment Against the EPBC Act Significant Impact Assessment Criteria*

Potential impacts to greater sand plover from Project activities are addressed in Section 17.4 with adaptive management and monitoring measures outlined in Section 17.5. Assessment against the EPBC Act significant impact criteria for threatened species is provided in Table 24-11.

The greater sand plover has not been recorded foraging within the Project footprint, has been recorded rarely foraging adjacent to the Project footprint in small numbers and has not been recorded roosting at the Nandeebie Claypan or Oyster Point roost sites within the past 25 years.

An assessment of the likelihood of significant residual impacts of the Project on greater sand plover in accordance with significant impact criteria for a vulnerable species is summarised in Table 24-11.

The Project will not result in a significant impact on greater sand plover.

Table 24-11: Assessment of Greater Sand Plover Against the Vulnerable Threatened Species Significant Impact Criteria.

Significant Impact Criteria for a Vulnerable Species	Assessment Summary
Lead to a long-term decrease in the size of an important population	**Significant residual impact unlikely.** Greater sand plover does not use tidal flat feeding habitat within or adjacent to the Project footprint. Consequently, the removal of 28.9 ha of tidal flat feeding habitat through dredging and reclamation is unlikely to lead to a long-term decrease in the size of the greater sand plover population. Greater sand plover has not used roost sites adjacent to the Project footprint within the past 25 years so the Project will have no impacts on roosting sites used by greater sand plover.
Reduce the area of occupancy of an important population of the species	**Significant residual impact unlikely.** Dredging and reclamation is unlikely to reduce the area of occupancy of the species in feeding habitat within Moreton Bay since the habitat in the Project footprint is not used by greater sand plover.
Fragment an existing important population into two or more populations	**Significant residual impact unlikely.** The Project is unlikely to fragment the population of greater sand plover, a highly mobile species.
Adversely affect habitat critical to the survival of the species	**Significant residual impact unlikely.** Dredging and reclamation within the Project footprint will adversely affect 28.9 ha of potential feeding habitat that is not used by greater sand plover. Furthermore, the species rarely uses adjacent habitats in very small numbers. The Project will have no direct impacts on roosting habitat last used by greater sand plover more than 25 years ago.
Disrupt the breeding cycle of an important population	**Significant residual impact unlikely.** No pathways have been identified for Project activities to disrupt the breeding cycle of a population of greater sand plover, which breeds in the northern hemisphere.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Significant residual impact unlikely.** As outlined above, although the Project will remove 28.9 ha of tidal flat feeding habitat for migratory shorebirds, this is unlikely to cause greater sand plover to decline since the species does not use this habitat and the carrying capacity for the species within Moreton Bay is likely to be substantially greater than the current population size. The Project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of roosting habitat, which was last used by greater sand plover more than 25 years ago.
Result in invasive species that are harmful to the species becoming established in its habitat	**Significant residual impact unlikely.** No pathways have been identified for an invasive species that is harmful to greater sand plover becoming established.

Significant Impact Criteria for a Vulnerable Species	Assessment Summary
Introduce disease that may cause the species to decline	**Significant residual impact unlikely.** No pathways have been identified for the introduction of disease that may cause greater sand plover to decline.
Interfere substantially with the recovery of the species	**Significant residual impact unlikely.** Recovery of greater sand plover depends critically on reversal of the current trajectory of habitat loss and degradation of critical staging habitat in south-east Asia. Substantial recovery of the 65% of habitat lost to land reclamation and other development in the Yellow Sea over the past 50 years alone (corresponding to a loss of 731,000 ha of tidal flats) is unlikely to occur to the extent that the loss of 28.9 ha of tidal flat feeding habitat in Moreton Bay is likely to interfere substantially with the recovery of greater sand plover.

24.4. Threatened Marine Species

Five threatened marine species were identified as having some potential to be found on or adjacent the Project footprint (refer to Chapter 16). These are:

- Southern right whale – Endangered;
- Loggerhead turtle – Endangered;
- White's seahorse – Endangered;
- Green turtle – Vulnerable; and
- Hawksbill turtle – Vulnerable.

Three of the species are listed as endangered, and two as vulnerable under the EPBC Act. The five marine species outlined above have been assessed against the relevant listed threatened species and ecological communities significant impact criteria in the sections below.

24.4.1 Southern Right Whale Threatened Species Significant Impact Assessment

The southern right whale (*Eubalaena australis*) is listed as endangered under the EPBC Act, therefore is required to be assessed against significant impact criteria for endangered species.

This section should be read in conjunction with Chapter 16, which provides detailed information on existing southern right whale populations at the Project footprint, potential impacts resulting from the Project and proposed management measures.

24.4.1.1 *Relevant Conservation Advice and Recovery Plans*

There is no approved conservation advice for this species (DAWE 2022). The Conservation Management Plan for the Southern Right Whale (DSEWPC 2012) lists interim recovery objectives (2011-2021) and key threats for this species.

The interim recovery objectives are:

- Demonstrate that the number of southern right whales occurring off south-west Australia (nominally south-west Australian population) is increasing at or near the maximum biological rate;
- Demonstrate that the number of southern right whales occurring off south-east Australia (nominally south-east Australian population) is showing signs of increase;
- The nature and degree of difference between the south-eastern and south-western Australian populations of southern right whales is clearly understood;
- Current levels of legal and management protection for southern right whales are maintained or improved and an appropriate adaptive management regime is in place; and

- Anthropogenic threats are demonstrably minimised.

Key threats are entanglement, vessel disturbance, whaling, climate variability and change, noise interference, habitat modification and overharvesting of prey, with seismic surveys and climate change the highest risks to the south-east population (DSEWPC 2012).

The Project will not increase the risk to this species through entanglement, whaling, climate change, over harvesting of prey, or habitat modification.

24.4.1.2 *Assessment Against the EPBC Act Significant Impact Assessment Criteria*

Potential impacts to southern right whale from Project activities are addressed in Section 16.5 with adaptive management and monitoring measures outlined in Section 16.6. Assessment against the EPBC Act significant impact criteria for threatened species is provided in Table 24-12.

The southern right whale migrates between the Southern Ocean and Australian waters, with most of the population using southern Australian waters to breed, calve and rest in the winter months. This species only occasionally uses Moreton Bay. It usually only migrates as far north as Sydney, in NSW, although it occasionally migrates as far north as Hervey Bay. It generally occurs within 2 km offshore of the coast (DSEWPC 2012). Moreton Bay is not considered to be core habitat for the southern right whale, however, individuals have been sighted in Moreton Bay on rare occasions.

The likelihood of vessel collisions on the south east population of this species is considered possible, the consequence minor, and the overall risk high (DSEWPC 2012). However, it is considered that this risk will increase as shipping traffic grows. Further, the impact on an individual, especially in south-east Australia, may have a significant, potentially population-scale effect, if further evidence confirms this as a small demographically discrete population (DSEWPC 2012). The new marina berths and facilities will address existing community demand for boating infrastructure and will not increase boat usage on its own. However, the Project will facilitate a small increase in ferry trips and allow larger vessels to use the channel (refer to Draft EIS Section 3.1). The risk to this species from increased vessel disturbance is low during construction (Section 16.5.1) and operation (Section 16.5.3) and will be further reduced by the mitigation outlined in Section 16.6.

The likelihood of an impact of risk from shipping noise on the south east population of this species is considered to be almost certain, the consequence minor, and the overall risk moderate (DSEWPC 2012). The risk from noise from the proposed development is considered to be low (Section 16.5) and will be further reduced by the mitigation outlined in Section 16.6.

Assessments of the likelihood of significant residual impacts of the Project on southern right whale in accordance with significant impact criteria for an endangered species are summarised in Table 24-12.

The Project will not result in a significant impact on the southern right whale.

Table 24-12: Assessment of Southern Right Whale Against the Endangered Threatened Species Significant Impact Criteria.

Significant Impact Criteria for an Endangered Species	Assessment Summary
Lead to a long-term decrease in the size of a population	The potential impacts of the Project are unlikely to lead to long-term decrease in the size of the south eastern population. While the Project is within the range of this species, it only occasionally occurs in the area. While the loss of one individual through vessel strike may potentially impact the south east population, the proposed development alone will not increase recreational boat traffic. While there may be an increase in ferry traffic, the proposed mitigation measures will reduce this threat. Other potential impacts from the Project are minor and will not lead to the long-term decrease of this population.
Reduce the area of occupancy of the species	The Project will not reduce the area of occupancy of this species, as the area is not frequently used by this species, the area is a minor fraction of the area used by this species, and does not provide significant habitat for this species.
Fragment an existing population into two or more populations	The Project will not fragment the existing south eastern population of this species, as it will be able to continue to migrate along the east coast of Australia, and as this area is not frequently used by this species.
Adversely affect habitat critical to the survival of the species	The Project is not in habitat that is critical to the survival of this species, and consequently will not adversely impact habitat critical to survival.
Disrupt the breeding cycle of a population	The breeding area for the south eastern population of this species is off Victoria and southern NSW, with Warrnambool in Victoria the only consistently used calving area in eastern Australia. The Project footprint is not used for breeding or mating, or for transitioning through for these activities. The Project will consequently not disrupt 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 proposed loss of habitat occurs in an area not used by this species (as it is too shallow). The loss of this habitat will not cause the species to decline.
Result in invasive species that are harmful to the species becoming established in its habitat	The Project will not result in the introduction of invasive species that are harmful to southern right whales.
Introduce disease that may cause the species to decline	The Project will not introduce disease that may cause this species to decline.
Interfere with the recovery of the species	The potential impacts of the Project to this species are low, and will not interfere with, or inhibit the recovery of this species.

24.4.2 Loggerhead Turtle Threatened Species Significant Impact Assessment

The loggerhead turtle (*Caretta caretta*) is listed as endangered under the EPBC Act, therefore is required to be assessed against significant impact criteria for endangered species.

This section should be read in conjunction with Chapter 16, which provides detailed information on existing loggerhead turtle populations at the Project footprint, potential impacts resulting from the Project and proposed management measures.

24.4.2.1 *Relevant Conservation Advice and Recovery Plans*

There is no approved conservation advice for this species (DAWE 2022). The Recovery plan for Marine Turtles in Australia (DEE 2017) lists interim recovery objectives (20117-2027) and key threats for marine turtles, including this species.

Interim recovery objectives comprise:

- Current levels of legal and management protection for marine turtle species are maintained or improved, both domestically and throughout the migratory range of Australia's marine turtles;
- The management of marine turtles is supported;
- Anthropogenic threats are demonstrably minimised;
- Trends in nesting numbers at index beaches and population demographics at important foraging grounds are described.

Key threats comprise climate change and variability, marine debris, habitat modification, Indigenous take, vessel disturbance, noise interference, recreation and offroad vehicles, diseases and pathogens. The most significant threats for the south west Pacific stock of this species, which include turtles using SEQ waters, are fisheries bycatch, marine debris, light pollution and climate change (DEE 2017).

The Project will not increase the risk from these most significant threats, nor from Indigenous take, recreation and offroad vehicles. Risks from habitat modification, vessel disturbance, marine debris, light noise are unlikely, and summarised in Section 16.5. Risk from diseases and pathogens are addressed in Table 24-13.

24.4.2.2 *Assessment Against the EPBC Act Significant Impact Assessment Criteria*

Potential impacts to loggerhead turtle from Project activities are addressed in Section 16.5 with adaptive management and monitoring measures outlined in Section 16.6. Assessment against the EPBC Act significant impact criteria for threatened species is provided in Table 24-13.

While Moreton Bay is listed on the National Conservation Values Atlas (NCVA) as a biologically important area (BIA) for loggerhead turtle nesting and inter nesting, this is limited to low density and infrequent nesting on the sand islands of Moreton, North and Bribie on the eastern side of Moreton Bay. These islands and Caloundra Beaches on the Sunshine coast have been identified as peripheral sites of interest with changing climate (DAWE 2022). There are no records of marine turtles nesting within the Marine Investigation Area (MIA) for the Project. Loggerhead turtles nest on open sandy beaches, which do not occur in the MIA, and consequently there is no suitable nesting habitat in the MIA. Moreton Bay is an important foraging habitat for loggerhead turtles, with the main foraging habitat on the Eastern Banks. No "Critical Habitat" as defined under Section 207A of the EPBC Act (Register of Critical Habitat) has been identified and listed for marine turtles, including this species (DEE 2017).

Assessments of the likelihood of significant residual impacts of the Project on loggerhead turtle in accordance with significant impact criteria for an endangered species are summarised in Table 24-13.

The Project will not result in a significant impact on the loggerhead turtle.

Table 24-13: Assessment of Loggerhead Turtle Against the Endangered Threatened Species Significant Impact Criteria.

Significant Impact Criteria for an Endangered Species	Assessment Summary
Lead to a long-term decrease in the size of a population	The Project will result in the direct loss of foraging habitat for loggerhead turtles, comprised of 37 ha of seagrass, 25 ha of unvegetated soft sediment and 1 ha of rubble habitat. Part of this area is

Significant Impact Criteria for an Endangered Species	Assessment Summary
	in the current navigation channel and is already highly disturbed by boat traffic. While Moreton Bay is an important feeding ground for loggerhead turtles, the main foraging habitat is on the Eastern Banks of Moreton Bay, with 40% of the estimated marine turtle population observed there in recent surveys. Consequently, there is a low risk that habitat loss due to the Project will lead to a long-term decrease in the size of the loggerhead population. While Moreton Bay is listed in the ANCA as a BIA for nesting for this species, no loggerhead turtles nest in the MIA.
Reduce the area of occupancy of the species	There will be a slight decrease in the area available for this species, however this will have a negligible impact as the density of turtles here is low compared to the Eastern Banks of Moreton Bay.
Fragment an existing population into two or more populations	The Project will not fragment the existing population of loggerhead turtles, as they will be able to swim around the proposed works, and as the density of this species in the MIA is low.
Adversely affect habitat critical to the survival of the species	No habitat critical to the survival of this species will be impacted.
Disrupt the breeding cycle of a population	The Project will not disrupt the breeding cycle of loggerhead turtle populations as it is not an important nesting area, nor a critical route to important nesting areas.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	While some habitat will be lost, it is not considered to be significant habitat for this species, and the loss is unlikely to cause the species to decline.
Result in invasive species that are harmful to the species becoming established in its habitat	The Project will not result in the introduction of invasive species that are harmful to loggerhead turtles.
Introduce disease that may cause the species to decline	The Project will not introduce a disease that may cause this endangered species to decline. While a number of diseases and infections are caused or exacerbated by poor water quality, to date, there are no recorded occurrences of diseases and pathogens affecting the viability of a marine turtle stock in Australia (DEE 2017). Further the Project will not negatively impact water quality, other than for relatively brief increase in turbidity during dredging.
Interfere with the recovery of the species	Potential impacts of the Project to this species are minor. Therefore, there is a low risk that the Project will interfere with the recovery of the loggerhead turtle population.

24.4.3 White's Seahorse Threatened Species Significant Impact Assessment

The White's seahorse (*Hippocampus whitei*) is listed as endangered under the EPBC Act, therefore is required to be assessed against significant impact criteria for endangered species.

This section should be read in conjunction with Chapter 16, which provides detailed information on existing White's seahorse populations at the Project footprint, potential impacts resulting from the Project and proposed management measures.

24.4.3.1 *Relevant Conservation Advice and Recovery Plans*

There is no approved Conservation Advice or Recovery plan for this species. However, management and research actions that will benefit the conservation of the species are listed in the Conservation Advice for this species and comprise:

- Collate and synthesise data collected to quantify the significance of high and moderate risk threat interactions with *H. whitei* (Medium priority);
- Reduce the impact of public and private boat moorings that impact on *H. whitei* habitats (High priority). Council to maintain best practice management of protective swimming nets by using the suggested NSW DPI seahorse friendly cleaning methods (High Priority);
- Consider information on *H. whitei* distribution, abundance and habitat preferences during development and review of Marine Park Zoning Plans (Medium priority);
- Negotiate with relevant authorities to encourage the identification, assessment and modification of natural resource management plans and policies to minimise impacts on *H. whitei* habitats (Medium priority);
- Continue to monitor the distribution and abundance of *H. whitei* at important sites (Port Stephens and Sydney Harbour) to inform population status and to assist in determining the effectiveness of recovery actions (High priority);
- Develop and trial artificial habitats to promote recovery of *H. whitei* populations (High priority);
- Implement research using eDNA to investigate the occurrence of *H. whitei* in estuaries and embayments across its range (High priority);
- Implement genetics research to investigate population structure of *H. whitei* across its entire range (NSW and QLD) (Medium priority); and
- Encourage the reporting of sightings of seahorses along the east coast of Australia to iSeahorse and iNaturalist (Medium priority).

It is considered the most important populations are in Port Stephens and Sydney Harbour, and research and management are focussed in these areas. However, research on their distribution outside these areas, management of their preferred habitats, and the development of artificial habitats are also recommended (FSC 2019).

24.4.3.2 *Assessment Against the EPBC Act Significant Impact Assessment Criteria*

Potential impacts to White's seahorse from Project activities are addressed in Section 16.5 with adaptive management and monitoring measures outlined in Section 16.6. Assessment against the EPBC Act significant impact criteria for threatened species is provided in Table 24-14.

White's seahorse has been recorded in estuaries between St Georges Basin, NSW to Hervey Bay, Queensland, with most individuals recorded in Sydney Harbour and Port Stephens in NSW. Only small populations (<10 individuals) have been recorded in Moreton Bay (FSC 2019). White's seahorse prefers complex habitats including soft corals, sponges and seagrass beds, and in Sydney Harbour have also been recorded in high densities on nets surrounding swimming areas, and on other artificial habitats such as jetties. The seagrass beds and other habitats within the MIA may provide habitat for this species, as it has been recorded in seagrass beds at Wynnum near a jetty, and at Victoria Point (D. Burfeind pers comm. 2022). However, the species is considered to be rare in Queensland waters (despite extensive surveys), and there is no evidence to suggest there are large populations outside Sydney Harbour and Port Stephens (FSC 2019).

The primary cause for the decline in abundance of White's seahorse is the loss of natural habitats across their range in eastern Australia, including anchor damage, sand inundation and damage from moorings, and cleaning of swimming nets. Artificial habitats ('seahorse hotels') are being trialled in Port Stephens and Sydney Harbour, with preliminary results indicating this is successful (FSC 2019).

While the MIA may provide habitat for this species, there is unlikely to be a large population in the MIA. Assessments of the likelihood of significant residual impacts of the Project on White's seahorse in accordance with significant impact criteria for an endangered species are summarised in Table 24-14.

The Project will not result in a significant impact on the White's seahorse.

Table 24-14: Assessment of White's Seahorse Against the Endangered Threatened Species Significant Impact Criteria.

Significant Impact Criteria for an Endangered Species	Assessment Summary
Lead to a long-term decrease in the size of a population	There is no evidence there are large numbers of this species in Moreton Bay or in the MIA (FSC 2019). While the Project will result in the loss of a small area of potential habitat for this species, there are large areas of this habitat in Moreton Bay. Further, the proposed artificial structures in the Project footprint could provide habitat for this species. That is, it is unlikely that the Project will lead to a long-term decline in the population of White's seahorse.
Reduce the area of occupancy of the species	There will be a slight decrease in the area available for this species, however given the area of habitat available in Moreton Bay, and throughout its distribution, this will not significantly decrease its distribution.
Fragment an existing population into two or more populations	The Project will not fragment an existing population of White's seahorse.
Adversely affect habitat critical to the survival of the species	While some potential habitat will be lost, there is no evidence there are large numbers of this species in Moreton Bay or in the MIA, with populations highest in Sydney Harbour and Port Stephens (FSC 2019). Consequently, the loss of this potential habitat is unlikely to significantly impact this species.
Disrupt the breeding cycle of a population	While some potential habitat will be lost, there is no evidence there are large numbers of this species in Moreton Bay or in the MIA, with populations highest in Sydney Harbour and Port Stephens (FSC 2019). Consequently, the loss of potential habitat is unlikely to disrupt the breeding cycle.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	While some potential habitat will be lost, there is no evidence there are large numbers of this species in Moreton Bay or in the MIA, with populations highest in Sydney Harbour and Port Stephens (FSC 2019). Consequently, the loss of potential is unlikely to cause this species to decline.
Result in invasive species that are harmful to the species becoming established in its habitat	The Project will not result in the introduction of invasive species that are harmful to White's seahorse.
Introduce disease that may cause the species to decline	The Project will not introduce disease that may cause this species to decline.
Interfere with the recovery of the species	As there are not likely to be many White's seahorse in the MIA, any impacts associated with the Project are unlikely to interfere with the recovery of this species. Mitigation of any potential impacts could include establishment of 'seahorse hotels' in areas where they are known to occur, e.g., Victoria Point and Wynnum.

24.4.4 Green Turtle Threatened Species Significant Impact Assessment

The green turtle (*Chelonia mydas*) is listed as vulnerable under the EPBC Act, therefore is required to be assessed against significant impact criteria for vulnerable species.

This section should be read in conjunction with Chapter 16, which provides detailed information on existing green turtle populations at the Project footprint, potential impacts resulting from the Project and proposed management measures.

24.4.4.1 *Relevant Conservation Advice and Recovery Plans*

There is no approved conservation advice for this species (DAWE 2022). The Recovery plan for Marine Turtles in Australia (DEE 2017) lists interim recovery objectives (20117-2027) and key threats for marine turtles, including this species.

Interim recovery objectives comprise:

- Current levels of legal and management protection for marine turtle species are maintained or improved, both domestically and throughout the migratory range of Australia's marine turtles;
- The management of marine turtles is supported;
- Anthropogenic threats are demonstrably minimised; and
- Trends in nesting numbers at index beaches and population demographics at important foraging grounds are described.

Key threats comprise climate change and variability, marine debris, habitat modification, Indigenous take, vessel disturbance, noise interference, recreation and offroad vehicles, diseases and pathogens. The most significant threats for the southern Great Barrier Reef stock of this species, including green turtles in Moreton Bay (DES 2018), are chemical discharge, ingestion of marine debris and climate change (DEE 2017).

With respect to these most significant threats, the Project will not result in an increase in chemical discharge (Draft EIS Chapter 9), an increase in debris (Sections 16.5 and 16.6) or increase the risk from climate change. Further, the Project will not increase risks from Indigenous take. Risks from habitat modification, vessel disturbance, marine debris, light noise are unlikely, and summarised in Section 16.5. Risk from diseases and pathogens are addressed in Table 24-15.

24.4.4.2 *Assessment Against the EPBC Act Significant Impact Assessment Criteria*

Potential impacts to green turtle from Project activities are addressed in Section 16.5 with adaptive management and monitoring measures outlined in Section 16.6. Assessment against the EPBC Act significant impact criteria for threatened species is provided in Table 24-15.

Moreton Bay is identified as a BIA for the green turtle. No "Critical Habitat" as defined under Section 207A of the EPBC Act (Register of Critical Habitat) has been identified and listed for marine turtles, including this species (DEE 2017). Green turtles in the MIA are a small subset of the population in Moreton Bay. The population of green turtles in Moreton Bay has not been identified as an important population in a recovery plan and is not a key source population for breeding or dispersal. While the Project will result in the direct loss of foraging habitat for these turtles, including 37 ha of seagrass, this is a small proportion of the total area of seagrass in Moreton Bay

Assessments of the likelihood of significant residual impacts of the Project on green turtle in accordance with significant impact criteria for a vulnerable species are summarised in Table 24-15.

The Project will not result in a significant impact on the green turtle.

Table 24-15: Assessment of Green Turtle Against the Vulnerable Threatened Species Significant Impact Criteria.

Significant Impact Criteria for a Vulnerable Species	Assessment Summary
Lead to a long-term decrease in the size of an important population	An 'important population' is defined in the Guidelines as 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. Green turtles in the MIA are a small subset of the population in Moreton Bay. The population of green turtles in Moreton Bay has not been identified as an important population in a recovery plan and is not a key source population for breeding or dispersal. Green turtles in Moreton Bay are predominantly part of the south east Great Barrier Reef stock. The distribution of animals in this stock extends from Darwin to Southern NSW, and out to New Caledonia and Fiji. That is, the green turtles in Moreton Bay are not at a geographic limit of the species range, and are unlikely to be necessary for maintaining genetic diversity, given their broad distributional range, and as there are nine distinct stocks in Australian waters. While the Project will result in the direct loss of foraging habitat for these turtles, including 37 ha of seagrass, this is a small proportion of the total area of seagrass in Moreton Bay (17,900 ha). Further, the main foraging habitat is on the Eastern Banks of Moreton Bay, with 40% of the estimated marine turtle population observed there in recent surveys. As the green turtles in the MIA are not an important population and as the potential impact to them is relatively low, the Project will not lead to a long-term decrease in the size of an important green turtle population.
Reduce the area of occupancy of an important population of the species	As above, the green turtles in the MIA are not considered an important population according to the Guidelines. Further, while here will be a slight decrease in the area available for these species, this is unlikely to significantly impact them as the density of turtles here is low compared to the Eastern Banks of Moreton Bay.
Fragment an existing important population into two or more populations	The Project will not fragment the existing populations of green turtles.
Adversely affect habitat critical to the survival of the species	The Project will not affect habitat critical to the survival of green turtles as there is no nesting sites or important foraging grounds in the Project footprint or MIA.
Disrupt the breeding cycle of an important population	The Project will not disrupt the breeding cycle of an important green turtle population as: ▪ green turtles in the MIA are not considered an important population; and ▪ there are no important nesting areas, nor critical routes to important nesting areas in the MIA.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The Project will result in the loss of a relatively small area if habitat used by this species, however not to the extent that the species is likely to decline.
Result in invasive species that are harmful to the species becoming established in its habitat	The Project will not result in the introduction of invasive species that are harmful to green turtle populations.

Significant Impact Criteria for a Vulnerable Species	Assessment Summary
Introduce disease that may cause the species to decline	The Project will not introduce disease that may cause this species to decline. While some turtle diseases and infections are caused or exacerbated by poor water quality, to date, there are no recorded occurrences of diseases and pathogens affecting the viability of a marine turtle stock in Australia (DEE 2017). Further the Project will not negatively impact water quality, other than for relatively brief increase in turbidity during dredging.
Interfere substantially with the recovery of the species	The Project will not significantly interfere with the recovery of this species as while a small area of habitat will be lost, this is a small part of this habitat in Moreton Bay, and a small part of the foraging habitat used by this stock. Further, other potential impacts (e.g., noise, water quality, vessel strike) will not significantly disturb this species.

24.4.5 Hawksbill Turtle Threatened Species Significant Impact Assessment

The hawksbill turtle (*Eretmochelys imbricata*) is listed as vulnerable under the EPBC Act, therefore is required to be assessed against significant impact criteria for vulnerable species.

This section should be read in conjunction with Chapter 16, which provides detailed information on existing hawksbill turtle populations at the Project footprint, potential impacts resulting from the Project and proposed management measures.

24.4.5.1 *Relevant Conservation Advice and Recovery Plans*

There is no approved conservation advice for this species (DAWE 2022). The Recovery plan for Marine Turtles in Australia (DEE 2017) lists interim recovery objectives (20117-2027) and key threats for marine turtles.

Interim recovery objectives comprise:

- Current levels of legal and management protection for marine turtle species are maintained or improved, both domestically and throughout the migratory range of Australia's marine turtles.
- The management of marine turtles is supported.
- Anthropogenic threats are demonstrably minimised.
- Trends in nesting numbers at index beaches and population demographics at important foraging grounds are described.

Key threats comprise climate change and variability, marine debris, habitat modification, indigenous take, vessel disturbance, noise interference, recreation and offroad vehicles, diseases and pathogens. The main current threats to Hawksbill Turtles are disturbance and habitat damage due to coastal development; by-catch from fisheries and shark control; predation on nests; boat strikes; entanglement and ingestion of marine debris; and unsustainable levels of indigenous harvest in some areas. Potential threats include climate change, chance disasters (e.g., oil spills) and feral predator invasions (DEH 2005).

With respect to these most significant threats, the Project will not result in an increase in chemical discharge (Draft EIS Chapter 9), an increase in debris (Sections 16.5 and 16.6) or increase the risk from climate change. Further, the Project will not increase risks from indigenous take. Risks from habitat modification, vessel disturbance, marine debris, light noise are unlikely, and summarised in Section 16.5. Risk from diseases and pathogens are addressed in Table 24-16.

24.4.5.2 *Assessment Against the EPBC Act Significant Impact Assessment Criteria*

Potential impacts to hawksbill turtle from Project activities are addressed in Section 16.5 with adaptive management and monitoring measures outlined in Section 16.6. Assessment against the EPBC Act significant impact criteria for threatened species is provided in Table 24-16.

Hawksbill turtles have a global distribution, with a small resident population in Moreton Bay (McPhee 2017). Hawksbill turtles in Moreton Bay primarily feed on sponges, seagrass and algae. No "Critical Habitat" as defined under Section 207A of the EPBC Act (Register of Critical Habitat) has been identified and listed for marine turtles, including this species (DEE 2017). Hawksbill turtles in the MIA are a small subset of the population in Moreton Bay. The population of this species in Moreton Bay has not been identified as an important population in a recovery plan and is not a key source population for breeding or dispersal. While the Project will result in the direct loss of foraging habitat for these turtles, it is a small proportion of the area available to them. Further, the main foraging habitats in Moreton Bay are the reefs surrounding Jercuruba (Peel Island), Minjerribah (North Stradbroke Island) and Flinders Reef, which will not be significantly impacted by the project.

The Project will not result in a significant impact on the hawksbill turtle.

Table 24-16: Assessment of Hawksbill Turtle Against the Vulnerable Threatened Species Significant Impact Criteria.

Significant Impact Criteria for a Vulnerable Species	**Assessment Summary**
Lead to a long-term decrease in the size of an important population	An 'important population' is defined in the Guidelines as 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. Hawksbill turtles in the MIA are a small subset of the population in Moreton Bay. The population of this species in Moreton Bay has not been identified as an important population in a recovery plan and is not a key source population for breeding or dispersal. Loggerhead turtles in Moreton Bay are part of the south west Pacific stock. The distribution of animals in this stock extends from the Gulf of Carpentaria to southern NSW, and to the east beyond Fiji. That is, the loggerhead turtles in Moreton Bay are not at a geographic limit of the species range and are unlikely to be necessary for maintaining genetic diversity, given their broad distributional range. While the Project will result in the direct loss of foraging habitat for these turtles, it is a small proportion of the area available to them. Further, the main foraging habitats in Moreton Bay are the reefs surrounding Jercuruba (Peel Island), Minjerribah (North Stradbroke Island) and Flinders Reef, which will not be significantly impacted by the Project. As the hawksbill turtles in the MIA are not an important population, and as the potential impact to them is relatively low, the Project will not lead to a long-term decrease in the size of an important hawksbill turtle population.
Reduce the area of occupancy of an important population of the species	The area of occupancy of this species will not be significantly reduced, as the MIA does not provide a large area, or high value habitat for this species. The main foraging habitat are the reefs surrounding Jercuruba (Peel Island), Minjerribah (North Stradbroke Island) and Flinders Reef, which will not be significantly impacted by the Project.

Significant Impact Criteria for a Vulnerable Species	Assessment Summary
Fragment an existing important population into two or more populations	The Project will not fragment the existing populations of this species.
Adversely affect habitat critical to the survival of the species	The Project will not affect habitat critical to the survival of hawksbill turtles as there are no nesting sites or important foraging grounds in the MIA.
Disrupt the breeding cycle of an important population	The Project will not disrupt the breeding cycle of hawksbill turtle populations as it is not an important nesting area, nor a critical route to important nesting areas.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	While some habitat will be lost, it is not considered to be significant habitat for these species, and the loss is unlikely to cause them to decline. While there may be minor impacts to water quality it is unlikely that the Project will modify, destroy, remove, isolate, or decrease the availability or quality of habitat for the hawksbill turtle to the extent that this species is likely to decline.
Result in invasive species that are harmful to the species becoming established in its habitat	The Project will not result in the introduction of invasive species that are harmful to hawksbill turtle populations.
Introduce disease that may cause the species to decline	The Project will not introduce disease that may cause these marine turtle species to decline. While some turtle diseases and infections are caused or exacerbated by poor water quality, to date, there are no recorded occurrences of diseases and pathogens affecting the viability of a marine turtle stock in Australia (DEE 2017). Further the Project will not negatively impact water quality, other than for relatively brief increase in turbidity during dredging.
Interfere substantially with the recovery of the species	The Project will not interfere with the recovery of this species.

24.5. Summary of Significant Residual Impacts to Threatened Species

Assessment against the relevant criteria for the threatened species MNES found the following species are likely to be significantly impacted by the Project:

- Eastern curlew – Critically endangered;
- Great knot – Critically endangered;
- Lesser sand plover – Endangered; and
- Bar-tailed godwit – Vulnerable.

All four threatened species likely to be impacted are migratory shorebird species that use the mudflats where reclamation and dredging will occur as foraging habitat. It is of note that two of the species, great knot and lesser sand plover, have very rarely been observed using the mudflats. A single great knot was observed during one survey of the 49 carried out at the mudflats. That was in 2014 and the species has not been observed on the mudflats since that time. Two lesser sand plovers were observed during a single survey of the 49 carried out, which was in 2019. Eastern curlew is observed regularly at the site but in low numbers (average of 3.5 when present). They do not utilise the adjacent Cassim Island roost site and, while they were observed regularly at Nandeebie Claypan, this roost site is considered abandoned as no migratory shorebirds have been observed since 2019. The bar-tailed godwit is observed regularly in small numbers (average of 13 when present) as well as Cassim Island which they occasionally use as a mid-tide roost site (i.e., they must find another site for roosting during high tides).

Importantly, significant impacts are considered likely for all four species due to a loss of critical habitat or 'area of occupancy' for that species. Tidal flats in Toondah Harbour are only considered critical habitat for these species as they are located within the Moreton Bay Ramsar Site (MBRS) and therefore automatically considered important habitat. If the site was not in the MBRS it would not meet any other criteria to be considered critical habitat for these species.

Dredging and reclamation will reduce the area of occupancy of the species in tidal flat feeding habitat by 0.29% within Moreton Bay. As addressed in section 17.4.3.4, Moreton Bay likely retains significant carrying capacity in available foraging habitat for these species therefore it can be reasonably expected that these migratory bird species will utilise other foraging habitat nearby. Consequently, the loss of a relatively small area of feeding habitat as a result of the Project is unlikely to result in a proportionate reduction in the population sizes of these species.