



Narrabeen Lagoon Entrance Clearance Works 2023

Review of Environmental Factors



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Document Control

| Ver | Effective Date | Description of Revision | Prepared by: | Reviewed by: |
|-----|-------------------|---------------------------|--------------|----------------|
| 00 | 16 June 2023 | Draft for Council review. | TJM, DC & AS | Louise Collier |
| 01 | 23 June 2023 | Final draft. | TJM | LCC |
| 02 | 20 July 2023 | Final REF | TJM | LCC |
| 03 | 21 September 2023 | Revised final REF | TJM | LCC |

Prepared For: Northern Beaches Council
Project Name: Narrabeen Lagoon Entrance Clearance Works 2023 REF
Rhelm Reference: J1834
Document Location: C:\Rhelm Dropbox\J1800-J1899\J1834 - Narrabeen Lagoon Entrance Clearance Works 2023\4. Reports\REF\RR-1834-01-03 Narrabeen ECW REF.docx
Client Reference: N/A

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Executive Summary

The proposal

Northern Beaches Council proposes to undertake clearance of the sand that has accumulated in the entrance channel of Narrabeen Lagoon for flood mitigation purposes, with the excavated material to be placed on Collaroy-Narrabeen Beach.

The entrance clearance works would take place in and around the entrance channel of Narrabeen Lagoon, either side of the Ocean Street bridge. East of Ocean Street and on the southern shore of the entrance channel is Birdwood Park and the Narrabeen Surf Life Saving Club (SLSC). On the northern shore is the Lake Park car park. West of the Ocean Street bridge, the southern shore of the lagoon is residential land and the northern shore is public open space and the NRMA Sydney Lakeside Holiday Park.

The proposed sand replenishment area on Collaroy-Narrabeen Beach is located between Goodwin and Stuart Street, which would be accessed from Mactier Street. An alternative access at Wetherill Street may also be used.

Need for the proposal

Narrabeen Lagoon is an Intermittently Open and Closed Lake or Lagoon (ICOLL). Wave activity and ocean tides cause sand to infill the narrow channel entrance at North Narrabeen, which leads to periodic closing of the lagoon to the ocean (RHDHV, 2022). When the entrance of the lagoon is closed for longer periods of time there is a risk of socio-economic and environmental impacts to the community and the lagoon ecosystem, including:

- Increased flood levels throughout the lagoon (Cardno, 2019; RHDHV, 2022);
- Reductions in water quality for estuary ecosystem and human health and recreational amenity due to lack of tidal flushing;
- Reduced biodiversity due to lack of recruitment through the entrance.

The *Narrabeen Lagoon Floodplain Risk Management Study and Plan* (Cardno, 2019) recommended the entrance clearance works be undertaken as the highest priority flood risk mitigation option under the Plan.

Proposal objectives

The objectives of the proposal are:

- To mitigate flood risk to low-lying properties surrounding Narrabeen Lagoon; and
- To maintain or enhance beach amenity.

Options considered

The *Narrabeen Lagoon Entrance Management Strategy* (RHDHV, 2022) was prepared to review current entrance management practices and make recommendations for ongoing management. The review of medium-term entrance management options identified two preferred options:

- Option 1 – current entrance clearance practice;
- Option 2 – As above, but with increased frequency and lesser clearance volume.

Option 2 was selected as the preferred option as it provided an opportunity to trial a new approach that may potentially keep the entrance open longer.

Another alternative considered in this REF is Option 6 – Do nothing. However, Option 6 is not considered feasible due to the flood risk to the community.

Environmental impacts

The key potential environmental impacts of the proposal include:

- Short-term impacts to water quality during the works;
- Traffic impacts and temporary loss of parking due to the haulage of material from the Lagoon to the beach;
- Temporary loss of public access through the works area, and resultant short-term loss of public open space for recreational usage;
- Noise impacts associated primarily with the movements of trucks transporting the sand, and also associated with the clearance works in the Lagoon;
- Short-term impacts to biodiversity, in particular shorebirds and waders, due to noise and localised loss of habitat and water quality impacts; and
- Short-term impacts to visual amenity during the works.

It is considered that these impacts can be appropriately managed through implementation of the safeguards and mitigation measures in this REF.

The key benefits relate to the reduction in flood risk to the community and the associated reduction in socio-economic impacts of flooding.

Justification and conclusion

The need for the proposal was justified on the basis of the socio-economic benefits of reduced flood risk to the community. The assessment of environmental and social impacts has determined the proposal is not likely to have a significant impact and therefore assessment under Division 5.2 of the EP&A Act is not required.

Abbreviations

| Term / Acronym | Abbreviation |
|------------------------------------|---|
| AHD | Australian Height Datum |
| AHIMS | Aboriginal Heritage Information Management System |
| AHIP | Aboriginal Heritage Impact Permit (under the NP&W Act). |
| ASS | Acid Sulfate Soils |
| BC Act | <i>Biodiversity Conservation Act 2016 (NSW)</i> |
| BDAR | Biodiversity Development Assessment Report |
| BoM | Bureau of Meteorology |
| CEMP | Construction environmental management plan |
| CMP | Coastal Management Program |
| DCCEEW | Australian Government Department of Climate Change, Energy, the Environment and Water |
| DPE | NSW Department of Planning and Environment |
| EIA | Environmental impact assessment |
| EPA | Environment Protection Authority |
| EP&A Act | <i>Environmental Planning and Assessment Act 1979 (NSW)</i> |
| EPBC Act | <i>Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)</i> |
| ESCP | Erosion and Sediment Control Plan |
| ESD | Ecologically sustainable development. |
| FM Act | <i>Fisheries Management Act 1994 (NSW)</i> |
| KFH | Key Fish Habitat |
| KTP | Key Threatening Process |
| ICOLL | Intermittently Open and Closed Lake or Lagoon |
| LALC | Local Aboriginal Land Council |
| LEP | Local Environmental Plan. |
| LGA | Local Government Area |
| LG Act | <i>Local Government Act 1993 (NSW)</i> |
| MHL | Manly Hydraulics Lab |
| MNES | Matters of national environmental significance under the EPBC Act. |
| NML | Noise Management Level |
| NP&W Act | <i>National Parks and Wildlife Act 1974 (NSW)</i> |
| NSW DPI | NSW Department of Primary Industries |
| PoEO Act | <i>Protection of the Environment Operations Act 1997 (NSW)</i> |
| REF | Review of environmental factors |
| SEPP | State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act. |
| SEPP (Biodiversity & Conservation) | State Environmental Planning Policy (Biodiversity and Conservation) 2021 |

| Term / Acronym | Abbreviation |
|-----------------------------------|---|
| SEPP (Resilience & Hazards) | State Environmental Planning Policy (Resilience and Hazards) 2021 |
| SEPP (Transport & Infrastructure) | State Environmental Planning Policy (Transport and Infrastructure) 2021 |
| SIS | Species Impact Statement |
| SLSC | Surf Life Saving Club |
| SOI | Southern Oscillation Index |
| SPL | Sound Power Level |
| TEC | Threatened Ecological Community |
| TfNSW | Transport for NSW |
| TMP | Traffic Management Plan |

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1 Introduction

1.1 Proposed Activity

Northern Beaches Council proposes to undertake clearance of the sand that has accumulated in the entrance channel of Narrabeen Lagoon for flood mitigation purposes, with the excavated material to be placed on Collaroy-Narrabeen Beach.

The location of the proposal is shown in **Figure 1-1** and **Section 3** describes the proposal in more detail.

1.2 Proposal Location

Narrabeen Lagoon and Collaroy-Narrabeen Beach are located in the Northern Beaches local government area (LGA) in the suburbs of Narrabeen and Collaroy.

The works would be carried out on or over the land falling within the project footprint mapped in **Figure 1-1** and summarised in **Table 1-1**.

The entrance clearance works would take place in and around the entrance channel of Narrabeen Lagoon, either side of the Ocean Street bridge. East of Ocean Street and on the southern shore of the entrance channel is Birdwood Park and the Narrabeen Surf Life Saving Club (SLSC). On the northern shore is the Lake Park car park. West of the Ocean Street bridge, the southern shore of the lagoon is residential land and the northern shore is public open space and the NRMA Sydney Lakeside Holiday Park.

The proposed sand replenishment area on Collaroy-Narrabeen Beach is located between Goodwin and Stuart Street, which would be accessed from Mactier Street. An alternative access at Wetherill Street may also be used.

Table 1-1: Schedule of land parcels within project area

| Lot and DP | Land Tenure | Description |
|----------------------|---|---|
| 7069 DP 1058602 | Crown land with Council as Crown land manager | Lake Park Reserve, including part of entrance channel |
| 7301 DP 1140671 | Crown land with Council as Crown land manager | Bed of the lagoon and beach down to Tourmaline St |
| 7106 DP1058609 | Crown land, Lake Park Reserve Management Trust (R49115) with Council as the Trust manager | Sydney Lakeside Holiday Park |
| Lot 9 Sec 63 DP 5768 | Council land | Birdwood Park, Birdwood Dune |
| 7351 DP 1166942 | Crown land with Council as Crown land manager | Collaroy-Narrabeen Beach |



Figure 1-1: Proposal location

1.3 Purpose of the Report

This Review of Environmental Factors (REF) has been prepared by Rhelm Pty Ltd (Rhelm) on behalf of Northern Beaches Council (hereafter, 'Council'). For the purposes of these works, Council is both the proponent and determining authority under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The purpose of this report, the REF, is to describe the proposal and consider the likely impacts of the proposal on the environment and the community, and to identify the environmental safeguards and mitigation measures that will be implemented during the works.

The description of the proposal and environmental impact assessment has been prepared in accordance with the requirements of section 171 of the *Environmental Planning and Assessment Regulation 2021*, the *Guidelines for Division 5.1 assessments* (DPE, 2022a), the *Fisheries Management Act 1994* (FM Act), *Biodiversity Conservation Act 2016* (BC Act) and *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In doing so, the REF fulfils the requirements of Section 5.5 of the EP&A Act with respect to Council's obligation to examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

The findings of the REF would be considered when evaluating:

- Whether the proposal is likely to have a significant impact on the environment and therefore whether an environmental impact statement is required and approval should be sought from the Minister for Planning under Division 5.2 of the EP&A Act;
- The significance of any impact on threatened species or endangered populations or communities listed under the BC Act and/or the FM Act, in Section 1.7 of the EP&A Act and therefore the requirement for a Species Impact Statement (SIS) or Biodiversity Development Assessment Report (BDAR);
- The significance of any impact on Matters of National Environmental Significance (MNES) listed under the EPBC Act and the need to make a referral to the Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW) for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act.

2 Project Need and Options Considered

2.1 Need for the Proposal

Narrabeen Lagoon is an Intermittently Open and Closed Lake or Lagoon (ICOLL). Wave activity and ocean tides cause sand to infill the narrow channel entrance at North Narrabeen, which leads to periodic closing of the lagoon to the ocean (RHDHV, 2022). When the entrance of the lagoon is closed for longer periods of time there is a risk of socio-economic and environmental impacts to the community and the lagoon ecosystem, including:

- Increased flood levels throughout the lagoon (Cardno, 2019; RHDHV, 2022);
- Reductions in water quality for estuary ecosystem and human health and recreational amenity due to lack of tidal flushing;
- Reduced biodiversity due to lack of recruitment through the entrance.

The *Narrabeen Lagoon Floodplain Risk Management Study and Plan* (Cardno, 2019), which evaluated flood behaviour and options to mitigate flood risk to the community, recommended the entrance clearance works be undertaken as the highest priority flood risk mitigation option under the Plan. The entrance clearance works enable effective and efficient mechanical opening of the lagoon entrance by Council during a flood event. Modelling undertaken for the Floodplain Risk Management Study demonstrated that the entrance clearance works were effective in reducing flood levels when compared to a fully shoaled entrance (Cardno, 2019; refer also to **Section 2.1**). Hence the proposal seeks to manage flood risk and the associated socio-economic impacts of flooding to the community.

Depending on prevailing conditions, the entrance of the lagoon tends to remain open for a months to years following an entrance clearance operation, during which time sand gradually infills the entrance channel until the entrance closes again (RHDHV, 2022).

Typical water quality in the lagoon entrance has been described as generally 'good', with the exception of periodic declines when periods of rain coincide with a closed entrance. While the entrance is open there is tidal exchange with the ocean, which flushes the lower estuary and improves water quality (RHDHV, 2022). The open entrance also permits biological exchange with the ocean, such as recruitment of fish, crustaceans and other species to the lagoon.

The improved tidal flushing would also result in a short-term improvement in water quality for aquatic recreation in the lower estuary, a popular swimming location, and the recruitment of recreationally important species would support fishing in the lagoon.

Although Narrabeen Lagoon is an ICOLL, the proposal would result in the entrance being more open than would likely be the case under natural conditions.

Collaroy-Narrabeen Beach, the location of the proposed placement of the cleared sand from the lagoon entrance, is an open coast beach subject to a high wave energy environment. Beach volumes fluctuates due to erosion events and beach rotation associated with cycles of El Niño-La Niña, in addition to which there is long term recessionary trend of 0.05 m/yr (NBC, 2016). When the beach is in an eroded state, public access to or along the beach is difficult and can present a public safety risk (NBC, 2016). The placement of the sand material cleared from the lagoon entrance on Collaroy-Narrabeen Beach is, where feasible, targeted at sections of the beach that are more eroded. Hence, the sand placement seeks to improve the visual and recreational amenity of the beach for beach users.

The entrance clearance works are historically undertaken every three to five years, most recently in 2021. A summary of past entrance clearance operations is provided in the *Entrance Management Strategy* (RHDHV, 2022). The amount of material cleared has varied, typically ranging from 30,000 to 70,000 m³.

2.2 Proposal Objectives

While the primary objective of the proposed works is for flood mitigation, additional benefits include improved beach amenity at the proposed sand placement site and improved water quality while the lagoon entrance is open.

The objectives of the proposal are:

- To mitigate flood risk to low-lying properties surrounding Narrabeen Lagoon; and
- To maintain or enhance beach amenity.

The proposal is consistent with the objectives of the *Lagoon Entrance Management Operational Management Standard* (EM-OMS 455). A recent review of the management of Narrabeen Lagoon entrance conducted by Royal Haskoning-DHV (RHDHV, 2022) also recommended continuation of the periodic entrance clearance operations.

In addition, the Narrabeen Lagoon entrance clearance works are identified as Action O7 in the *Collaroy-Narrabeen Beach and Fishermans Beach Coastal Zone Management Plan* (NBC, 2016).

2.3 Alternatives Considered

The *Narrabeen Lagoon Entrance Management Strategy* (RHDHV, 2022) was prepared to review current entrance management practices and make recommendations for ongoing management. The review of medium-term entrance management options included consideration of the following options:

- Option 1 – current entrance clearance practice;
- Option 2 – As above, but with increased frequency and lesser clearance volume;
- Option 3 – Mobile sand pumping, large volume;
- Option 4 – Mobile sand pumping, more regularly with a smaller volume; and
- Option 5 – Installation of low flow pipes.

Another alternative considered in this REF is Option 6 – Do nothing. However, Option 6 is not considered feasible due to the flood risk to the community.

The evaluation of Options 1 to 5 presented in RHDHV (2022) considered:

- Capital and operating costs;
- Reduction of flood risk to property;
- Social impacts; and
- Environmental impacts.

Option 1, the proposal, was recommended as an ongoing medium term management strategy, provided factors such as beach rotation are taken into account.

Under certain circumstances, when the entrance channel is well established and the beach has rotated in an anti-clockwise direction to minimise beach width at the entrance, Option 2 may be feasible and was recommended for a trial.

Options 3 and 4 are not recommended based on current capital and operational costs (RHDHV, 2022). Option 5 is not recommended as it may not be feasible due to the presence of a rock shelf under the entrance (RHDHV, 2022).

The options evaluation also considered potential placement areas on Collaroy-Narrabeen Beach. The key constraint to beach placement is access for trucks delivering the sand from the entrance. Those considered include:

- Option A – Mactier Street. This is the only access that has a signalised intersection with Pittwater Road that enables safe right-hand turns out of Mactier Street and back to the lagoon entrance. Hence it was the preferred access point; and
- Option B – Wetherill Street. The intersection of Wetherill Street is not controlled by traffic signals, and therefore the only safe truck movements would be left-in, left-out movements. This would necessitate trucks turning left out of Wetherill Street onto Pittwater Road and returning to the lagoon entrance by completing a loop via Anzac Avenue, Seaview Parade, Ocean Grove and Pittwater Road. While it provides for safe truck movements, it would likely have some traffic and noise impacts on residents businesses located on roads comprising the loop.

Option A was identified as the preferred option, noting Option B is also feasible. Hence, the proposal considers Mactier Street as the main access point for the beach placement works and Wetherill Street as a secondary alternative.

2.4 Preferred Option

Considering both Options 1 and 2, Council determined to proceed with a trial of Option 2 as the preferred option for the entrance clearance operation with Option A – Mactier Street preferred as the main beach access. Option B – Wetherill Street is included as an alternative access.

3 Description of the Proposal

3.1 The Proposal

The design of the proposed entrance clearance and beach nourishment works prepared by Baird Associates is provided in **Appendix A**.

The rationale for the design was to remove as much of the clean marine sand that had accumulated in the flood tide shoals since the previous entrance clearance works in 2021 and to trial Option 2 from the Entrance Management Strategy (RHDHV, 2022), with the excavation focussing on the western shoal and adopting a channel configuration through the eastern shoal. The intent of this approach is to seek to prolong the period of entrance open conditions following the works.

The design adopted the following design requirements:

- Appropriate batter slopes (of 6H:1V);
- Provide a smooth bed profile that minimises holes that may lead to water quality issues;
- To adopt a 10 m buffer from the rock revetment along the northern shoreline east of the Ocean Street bridge; and
- To adopt a 10 m buffer from seagrass located in the entrance channel (**Section 6.6.3**).

The clearance works propose the removal of 9,700 m³ and 12,800 m³ east and west of the Ocean Street bridge (respectively), summing to a total of 22,500 m³ of marine sand to be removed from the entrance channel (**Figure 3-1**). In the event the construction program and budget permits, up to 17,500 m³ additional marine sand would be excavated from the two areas east and west of the Ocean Street bridge, with a potential maximum excavation for the proposal of 40,000 m³.

The material extracted from the lagoon entrance would be transported via truck to Collaroy-Narrabeen Beach. The beach would be accessed via one of two designated access points (Mactier and Wetherill Streets) and the sand placed in accordance with the design profiles (refer **Appendix A**) between Goodwin and Stuart Streets (**Figure 1-1**). However, the main access to which the majority of the sand would be directed would be Mactier Street and Wetherill Street would only be used during low traffic periods.

Council is currently considering the possibility of using some of the material excavated from Narrabeen Lagoon to replenish the beach further to the south at Fisherman's Beach, which would be accessed via Anzac Parade. Fishermans Beach is in the same coastal sediment compartment. In the event that proposal proceeds, it would be subject to a separate REF.



Figure 3-1: Entrance clearance works footprint

3.2 Works Methodology

With respect to the construction methodology, an indicative works methodology is described below and would be finalised upon selection of a preferred Contractor. The description below provides for flexibility in the method of conducting the entrance clearance works by excavator or by cutter pump dredging.

The works would be staged as described in the sub-sections below.

Stage 1 – Site Establishment

Stage 1 would involve the following activities:

- Obtain necessary approvals, permits and licences;
- Establish main site compound / staging area in Birdwood Park car park;
- Delivery of plant and equipment to the site compound;
- Implement environmental safeguards, including traffic controls;
- Establish stockpile / de-watering area(s); and
- Artificially close the lagoon entrance (if required).

Once engaged, the Contractor would prepare a Construction Environmental Plan (CEMP) prior to commencement. Once the CEMP has been approved by Council, the Contractor would establish the main works compound in the Birdwood Park car park, to include a site office, parking area, plant and equipment compound and a bunded stockpile / de-watering area for excavated material.

Depending on the final works method developed by the Contractor, another site compound may be established on the northern shoreline of the lagoon on the small beach immediately west of the Ocean Street bridge to enable mobilisation of equipment (e.g. excavator and/or dredger) and/or stockpiling and de-watering of material (**Figure 3-1**). This compound may not be established until during Stage 2.

The works area would be fenced and the required environmental safeguards and traffic controls would be established at this time.

If not already closed, the lagoon entrance would be artificially closed with a sand berm prior to the commencement of Stage 2. The purpose of closing the entrance would be to stabilise lagoon water levels (at around 0.6 mAHD) to facilitate the works while ensuring seagrasses remain submerged, and to prevent the transport of any suspended material out of the lagoon during the works.

Stage 2 – Construction Phase

Stage 2 would involve the following activities:

- Undertake entrance clearance works east and west of the Ocean Street bridge via either traditional excavation with an excavator or cutter pump dredge. The former would require establishment of a working area formed of sand in the entrance channel for the excavator to work from and excavated material would be loaded onto a truck and transported to the stockpile area. Where a cutter pump dredge is used the material would be pumped through a pipe network to a dewatering basin;
- Stockpiling of excavated material for de-watering. The stockpiling area / dewatering basin would be located at the base of the Birdwood Park dune;

- Sieving of any excavated material that may exceed the specifications for placement on the beach and either offsite disposal or beneficial re-use of the excess material (as appropriate);
- An excavator would load trucks with de-watered sediment and transport to Mactier Street (or Wetherill Street) at Collaroy-Narrabeen Beach; and
- Transfer of sand from the Mactier Street (or Wetherill Street) access point via tracked bulldozer (or similar) to the designated placement areas.

The entrance clearance works would commence in the western shoal and then progress to the eastern shoal.

Where excavators are used, a working area comprised of sand may need to be established in the entrance channel to enable the excavator to travel out further from the natural shoreline (e.g. see **Figure 3-2**). With this approach, excavation would likely proceed from east to west up to the Ocean Street Bridge. A similar approach would then be adopted for the western shoal.



Figure 3-2: Entrance clearance works – traditional excavation methodology (source: RHDHV, 2022)

Where a cutter pump dredge is used, the dredge would likely be mobilised from the boat ramp next to Lakeside Park. The dredge is to start in the western shoal and progress to the eastern shoal. Due to the fact that the cutter pump dredge sucks up a slurry of sand and water, the material is likely to be wetter and require more de-watering compared to the mobile excavation methodology. **Figure 3-3** shows the cutter suction dredge (left) being used in the 2021 clearance works. The image to the right shows the excavator loading a truck from the dewatering basin and site compound in the right background.



Figure 3-3: 2021 entrance clearance works – cutter pump dredging methodology (source: SCS, 2022)

Following de-watering (and sieving if required), the material would be loaded by excavator from the stockpile / de-watering area on to trucks for transport south along Ocean Street and Pittwater Road to Mactier Street. The truck would reverse to the end of Mactier Street (or Wetherill Street) and dump the sand onto the beach. From this point a bulldozer would transfer the sand to the desired placement area in accordance with the design (refer **Figure 3-4**). The beach replenishment would likely start in the southern-most extent of the placement area and work back towards Goodwin Street.



Figure 3-4: 2021 entrance clearance works – dumping sand on Collaroy-Narrabeen Beach (source: SCS, 2022)

Stage 3 – Post-Construction Phase:

- Site demobilisation;
- Restoration of the works area as required; and
- Mechanical opening of the lagoon entrance.

Silt curtains will be removed once any suspended sediments have settled following the completion of works.

In this phase the works compounds would be dis-established and plant and machinery demobilised from the lagoon and beach placement worksites. The worksites would be restored to their pre-works condition, rectifying any damage as required.

3.3 Works Compound and Ancillary Areas

The main site compound / staging area in the Birdwood Park car park (refer **Figure 3-1**) will comprise:

- A site office;
- Stockpiling / dewatering area; and
- Materials storage.

The site will be fenced to prevent public access and would be used for overnight storage of plant and machinery.

A second staging area for mobilisation of machinery and/or stockpiling / dewatering material may be required on the northern shoreline of the lagoon immediately to the west of the Ocean Street bridge.

3.4 Construction Hours and Duration

The works would be restricted to standard construction hours as follows:

- Monday to Friday 7am to 6pm;
- Saturdays from 8am to 1pm.

The works would largely be undertaken Monday to Friday, although some Saturday works may be necessary to keep to the proposed program. No work would be undertaken on Sundays or public holidays.

It is anticipated that the works would take around 12 to 16 weeks. The works would be undertaken outside the peak holiday period (i.e. Summer school holidays).

3.5 Plant and Equipment

The plant and equipment to be used would depend on the chosen works methodology, but may include any or all of the following:

- Cutter pump dredge with generator (assume mounted on barge);
- 23T or larger excavators (one to three, depending on the chosen methodology);
- Dump trucks;
- D65 bulldozer;
- Front end loader;
- Bogie tippers; and
- Light construction vehicles travelling to the site, or between work areas, each day.

3.6 Traffic Management and Access

Works traffic would be managed in accordance with the Traffic Management Plan (TTPP, 2023; **Appendix C**). Further information on the expected truck movements, haulage routes and potential impacts on local traffic and access is provided in **Section 6.4.2**.

4 Statutory and Planning Framework

This section provides a review of the statutory and planning framework for the proposal and considers the provisions of relevant environmental planning policies and other legislation.

4.1 NSW Environmental Planning and Assessment Act 1979

4.1.1 State Environmental Planning Policies

State Environmental Planning Policy (Transport and Infrastructure) 2021

Chapter 2 of the Transport and Infrastructure SEPP aims to enable the effective delivery of infrastructure across the State.

Section 2.56 of the SEPP permits development on any land for the purpose of flood mitigation works to be carried out by or on behalf of a public authority without consent. Section 2.65 permits development on any land for purposes of waterway or foreshore management activities (which includes beach nourishment) to be carried out by or on behalf of a public authority without consent.

As the proposed entrance clearance works are a flood mitigation activity undertaken under the *Narrabeen Lagoon Floodplain Risk Management Study and Plan* (Cardno, 2019), and the beach replenishment is a foreshore management activity, and the works are to be carried out by Council, the proposal can be assessed under Division 5.1 of the EP&A Act. Development consent is not required.

Sections 2.10 to 2.15 of the Transport and Infrastructure SEPP contains provision for public authorities to consult with local Councils and other public authorities prior to the commencement of certain types of development. Consultation as required under the SEPP is discussed in **Section 5**.

State Environmental Planning Policy (Resilience and Hazards) 2021

The proposal would be undertaken on land falling within the Coastal Environment and Coastal Use Areas coastal management areas mapped under SEPP (Resilience and Hazards). The provisions of Divisions 3 and 4 of the Resilience and Hazards SEPP are not relevant to the proposed activity as it does not require consent. Nonetheless, the related provisions have effectively been addressed in this REF.

There is no coastal vulnerability area mapping for the locality; however, the proposal footprint would be within land vulnerable to coastal hazards. The impact of the proposal on coastal hazards is discussed in **Section 6.1**.

Division 5 of the Resilience and Hazards SEPP contains general provisions relating to development in the coastal zone. Section 2.12 provides that development consent must not be granted on land within the coastal zone unless the consent authority is satisfied that the proposed development is not likely to increase the risk of coastal hazards on that land or other land. The proposed works are not anticipated to increase the risk of coastal hazards. The placement of sand on Collaroy-Narrabeen Beach would increase the beach volume, thereby providing an improved erosion buffer for adjacent development (albeit a minor improvement).

Section 2.13 requires that the consent authority take into consideration the relevant provision of any certified CMP that applies to the land. The Narrabeen Lagoon entrance clearance works are identified as Action O7 in the *Collaroy-Narrabeen Beach and Fishermans Beach Coastal Zone Management Plan* (NBC, 2016) and are therefore wholly consistent with the certified Plan for Collaroy-Narrabeen Beach.

Under Section 2.6(2) of the SEPP, beach nourishment may be carried out by or on behalf of a public authority without consent.

4.1.2 Local Environmental Plans

While the proposal is located in the Northern Beaches LGA, both the Warringah and Pittwater Local Environmental Plans (LEPs) apply to the proposed activity.

Under the Warringah LEP 2011, the bed of the lagoon is zoned W1 – Natural Waterways and Collaroy-Narrabeen Beach is zoned RE1 – Public Recreation. The construction compound and ancillary work areas are also located on land zoned RE1.

Under the Pittwater LEP 2014, a portion of the bed of the lagoon located east of the Ocean Street bridge is zoned W1 – Natural Waterways and a small corner of the lagoon entrance where the temporary berm would be constructed is located on land zoned RE1.

The compatibility of the proposal with the objectives of these zones is discussed in **Table 4-1**. The proposal is consistent with the land use zonings.

Table 4-1: Land use zonings

| Zoning | Objectives |
|---------------------------|--|
| Warringah LEP 2011 | |
| W1 – Natural Waterways | <p>The objectives of this zone are:</p> <ul style="list-style-type: none"> To protect the ecological and scenic values of natural waterways. To present development that would have an adverse effect on the natural values of waterways in this zone. To provide sustainable fishing industries and recreational fishing. <p>As detailed in Section 2, by opening the lagoon entrance, the proposal would improve tidal flushing and enable recruitment of recreationally fished species. The adverse impacts of the proposal would be short-term and it is considered they could be appropriately managed provided the safeguards and mitigation measures identified in this REF are implemented.</p> |
| RE1 – Public Recreation | <p>The objectives of this zone are:</p> <ul style="list-style-type: none"> To enable land to be used for public open space or recreational purposes. To provide a range of recreational settings and activities and compatible land uses. To protect and enhance the natural environment for recreational purposes. To protect, management and restore public land that is of ecological, scientific, cultural or aesthetic value. To present development that could destroy, damage or otherwise have an adverse effect on those values. <p>As detailed in Section 2, the proposal provides for improved recreational amenity through improved water quality while the lagoon entrance remains open and via increased beach volume on Collaroy-Narrabeen Beach.</p> |
| Pittwater LEP 2014 | |
| W1 – Natural Waterways | <p>The objectives of this zone are:</p> <ul style="list-style-type: none"> To protect the ecological and scenic values of natural waterways. To present development that would have an adverse effect on the natural values of waterways in this zone. To provide sustainable fishing industries and recreational fishing. To ensure development does not adversely impact on the natural environment or obstruct navigation of the waterway. |

| Zoning | Objectives |
|-------------------------|---|
| | <ul style="list-style-type: none"> To provide opportunities for private access to the waterway where these do not cause unnecessary impact to public access to the foreshore. <p>As detailed in Section 2, by opening the lagoon entrance, the proposal would improve tidal flushing and enable recruitment of recreationally fished species. The adverse impacts of the proposal would be short-term and it is considered they could be appropriately managed provided the safeguards and mitigation measures identified in this REF are implemented. Impacts on navigation would be short-term.</p> |
| RE1 – Public Recreation | <p>The objectives of this zone are:</p> <ul style="list-style-type: none"> To enable land to be used for public open space or recreational purposes. To provide a range of recreational settings and activities and compatible land uses. To protect and enhance the natural environment for recreational purposes. To allow development that does not substantially diminish public use of, or access to, public open space resources. To provide passive and active public open spaces resources, and ancillary development, to meet the needs of the community. <p>As detailed in Section 2, the proposal provides for improved recreational amenity through improved water quality while the lagoon entrance remains open and via increased beach volume on Collaroy-Narrabeen Beach. Adverse impacts on the use of, or access to, public open space would be short-term.</p> |

As the proposal is permitted without consent under the SEPP (Transport and Infrastructure), the consent provisions of the LEPs do not apply to the project.

4.2 Other Relevant NSW Legislation

Table 4-2 lists the NSW legislation relevant to the proposal or the land on which the proposed works would be undertaken.

Table 4-2: Other relevant NSW legislation

| Legislation and Application | Relevance to the Proposal |
|--|---|
| <p>Crown Land Management Act 2016: to provide for the ownership, use and management of the Crown land of New South Wales, to provide clarity concerning the law applicable to Crown land, to require environmental, social, cultural heritage and economic considerations to be taken into account in decision-making about Crown land, to provide for the consistent, efficient, fair and transparent management of Crown land for the benefit of the people of NSW, and to provide for the management of Crown land having regard to the principles of Crown land management.</p> | <p>The tenure of the land within the proposal footprint is discussed in Table 1-1. The subject land is Crown land under the care and control of Council. Under section 3.21 of the Act, Councils manage Crown land as if it were public land under the <i>Local Government Act 1993</i> (LG Act). Council has ongoing permission to manage Crown land and no landowners’ consent is required.</p> <p>Notwithstanding, Council maintains a Crown Lands Licence (no. 565952) for lagoon entrance clearance works (including the beach replenishment works), for which it pays an annual fee.</p> |
| <p>Roads Act 1993: provides for the construction and maintenance of public roads. Requires consent to dig up, erect a structure or carry out work in, on or over a road.</p> | <p>Pittwater Road is State Road under the care and control of TfNSW, and all other roads to be used by construction vehicles are local roads managed by Council. A Road Occupancy Licence may be required for the use of the roads to transport material to Collaroy-Narrabeen Beach.</p> <p>An approval under Section 138 of the Roads Act would not be required for the works.</p> |

| Legislation and Application | Relevance to the Proposal |
|---|--|
| <p>Fisheries Management Act 1994 (FM Act): provides for the protection of fishery resources and values for current and future generations. Makes it an offence to harm fisheries and resources without an appropriate assessment, inclusion of safeguards and/or the appropriate permissions to carry out certain work.</p> | <p>Under Part 7 of the FM Act, section 200(1) requires that a local government authority obtain a permit prior to carrying out dredging or reclamation work. The entrance clearance and beach replenishment works would meet the definition of dredging and reclamation under the Act.</p> <p>A section 205 permit is required if the proposed works involve harm to marine vegetation including mangroves, seagrasses, macroalgae or any other marine vegetation declared by the regulations to be marine vegetation. The design of the proposal has avoided direct impacts to (live) seagrass. Indirect impacts to seagrass would be managed in accordance with the mitigation measures in this REF.</p> <p>There are no Endangered species or populations listed under the FM Act or the related Cth EPBC Act that are likely to occur in the proposal footprint.</p> |
| <p>Biodiversity Conservation Act 2016 (BC Act): provides for a strategic approach to conservation in NSW. It includes provisions for risk-based assessment of native plant and animal impacts, including a Biodiversity Assessment Method (BAM) to assess the impact of actions on threatened species, threatened ecological communities and their habitats.</p> | <p>Under the BC Act, an assessment of significance must be completed to determine the significance of impacts to threatened species, populations and/or communities or their habitat. As discussed in Section 6.6, there are 8 species of marine birds and shorebirds listed under the BC Act were considered to have a moderate to high likelihood of occurrence in the study area. However, Assessments of Significance (refer Appendix G) concluded the proposal is unlikely to significantly impact Threatened species and a BDAR or SIS is not required.</p> |
| <p>Biosecurity Act 2015: The object of this Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers.</p> | <p>Reporting and managing biosecurity risks in the marine environment is considered a general biosecurity duty under the Act. The marine pest species, <i>C. taxifolia</i>, is not present within the proposal area. Safeguards are recommended to minimise the spread/import of <i>C. taxifolia</i> as a result of the proposal (refer Section 6.6).</p> |
| <p>Protection of the Environment Operations Act 1997 (PoEO Act): focuses on environmental protection and provisions for the reduction of water, noise and air pollutions and the storage, treatment and disposal of waste. Introduces licencing provisions for scheduled activities that are of a nature and scale that have potential to cause environmental pollution. Also includes measures to limit pollution and manage waste.</p> | <p>The proposal would not involve the undertaking or carrying out of a scheduled activity.</p> <p>If the safeguards and mitigation measures in this REF are implemented and monitored, there is unlikely to be any material harm, water, noise or air pollution impact (refer to Section 6). This would include controls to manage the risk of sediment resuspension, accidental spills or releases of fuel, hydraulic fluids or other contaminants to the environment.</p> |
| <p>Marine Pollution Act 2012: sets out provisions to prevent pollution in the marine environment.</p> | <p>The proposal is unlikely to result in any oil, noxious liquids, pollutant, sewage or garbage discharge as controlled under this Act, providing relevant safeguards and mitigation measures in this REF are implemented (refer to Section 6).</p> |
| <p>Contaminated Land Management Act 1997: Must report to EPA if contaminated land is encountered during the works that meets the duty to report</p> | <p>As discussed in Section 6.2, there is a low likelihood of encountering contaminated material during the entrance clearance works because the material to be excavated</p> |

| Legislation and Application | Relevance to the Proposal |
|--|---|
| <p>contamination requirements under section 60 of this Act.</p> <p>Aims to establish a process for investigating and (where appropriate) remediating land that the EPA considers to be contaminated significantly enough to require regulation under Division 2 of Part 3.</p> <p>The Act aims to set out accountabilities for managing contamination if the EPA considers the contamination is significant enough to require regulation under Division 2 of Part 3.</p> | <p>from the lagoon entrance is expected to comprise clean marine sand.</p> <p>Safeguards have been included in the event suspected contaminated material is encountered during the works.</p> |
| <p>Heritage Act 1977: provides for the protection of conservation of buildings, works, maritime heritage (wrecks), archaeological relics and places of heritage value through their listing on various State and local registers. Makes it an offence to harm any non-Aboriginal heritage values without permission.</p> | <p>The proposal is unlikely to impact any State heritage listed sites (refer Section 6.7).</p> |
| <p>National Parks and Wildlife Act 1974 (NP&W Act): provides for the protection of Aboriginal heritage values, national parks and ecological values. Makes it an offence to harm Aboriginal objects, places or sites without permission.</p> | <p>A search of the Aboriginal Heritage Information Management System (AHIMS) indicates two sites near the project footprint, neither of which are likely to be adversely impacted by the proposal (refer Section 6.7). An Aboriginal Heritage Impact Permit (AHIP) is not required for the proposal.</p> |

As noted in **Section 4.1.1**, the proposal is located within the Coastal Use Area and Coastal Environment Area under the Resilience and Hazards SEPP. The SEPP gives effect to the objectives of the *Coastal Management Act 2016*.

Table 4-3: Objectives under Sections 8 and 9 of the *Coastal Management Act 2016*

| Objectives | Relevance to the Proposal |
|---|--|
| <p>8(2)(a) to protect and enhance the coastal environmental values and natural processes of coastal waters, estuaries, coastal lakes and coastal lagoons, and enhance natural character, scenic value, biological diversity and ecosystem integrity</p> | <p>The proposal would not significantly impact coastal environmental values and the natural processes of coastal waters. The entrance to the lagoon would likely remain open for a period of time before slowly closing. As an ICOLL, periodic opening of the entrance occurs naturally, albeit likely less regularly than occurs due to the entrance clearance works. Biological diversity and ecosystem integrity are unlikely to be impacted.</p> |
| <p>8(2)(b) to reduce threats to and improve the resilience of coastal waters, estuaries, coastal lakes and coastal lagoons, including in response to climate change</p> | <p>The proposal would generally have a net neutral impact to coastal waters and estuaries. There would be a short-term improvement in lagoon water quality due to tidal flushing when the entrance is open.</p> |
| <p>8(2)(c) to maintain and improve water quality and estuary health</p> | <p>The proposal would result in short to medium-term water quality improvements in the lower estuary and would assist in maintaining the estuarine ecology. Provided the safeguards and mitigation measures in Section 6 are implemented, negligible adverse impacts are anticipated.</p> |

| Objectives | Relevance to the Proposal |
|--|--|
| 8(2)(d) to support the social and cultural values of coastal waters, estuaries, coastal lakes and coastal lagoons | The proposal would support social values of the estuary through improved water quality for aquatic recreation. It would also enhance amenity of Collaroy-Narrabeen Beach through improved beach volume. No impacts to cultural values are anticipated. |
| 8(2)(e) to maintain the presence of beaches, dunes and the natural features of foreshores, taking into account the beach system operating at the relevant place | The proposal would result in short to medium-term modifications to the natural features of the entrance channel of Narrabeen Lagoon and to the Collaroy-Narrabeen Beach sand replenishment area, however these would be short to medium-term and within the range of natural fluctuation within these systems. |
| 8(2)(f) to maintain and, where practicable, improve public access, amenity and use of beaches, foreshores, headlands and rock platforms | The proposal would provide improved public access over the tidal range along Collaroy-Narrabeen Beach in the sand replenishment zone. |
| 9(2)(a) to accommodate both urbanised and natural stretches of coastline. (i) the type, bulk, scale and size of development is appropriate for the location and natural scenic quality of the coast, and | The proposal does not involve building works. |
| (ii) adverse impacts of development on cultural and built environment heritage are avoided or mitigated, and | There would be no impact on cultural and built environmental heritage. |
| (iii) urban design, including water sensitive urban design, is supported and incorporated into development activities, and | Urban design is not relevant to the works proposed. |
| (iv) adequate public open space is provided, including for recreational activities and associated infrastructure, and | During the works there would be impact on public open space used for recreational purposes. |
| (v) the use of the surf zone is considered | The proposal would have negligible, short-term impacts on the immediate surf zone near the lagoon entrance. No impacts on the Surfing Reserve are anticipated. |
| 9 (2)(b) to accommodate both urbanised and natural stretches of coastline. | N/A |

4.3 Commonwealth Legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

Under the EPBC Act a referral to the Australian Government is required for proposed 'actions that have the potential to significantly impact on matters of national environmental significance (MNES) or the environment of Commonwealth land'. These are considered in **Section 6.6** and **Appendix D** of the REF.

The assessment of the proposal's impact on MNES and the environment of Commonwealth land found that there is unlikely to be a significant impact on relevant matters of national environmental significance or on Commonwealth land. Accordingly, the proposal has not been referred to the Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW) under the EPBC Act.

4.3.2 Native Title Act 1993

The *Native Title Act 1993* recognises and protects native title. There are no active native claims for the Northern Beaches LGA.

4.4 Confirmation of Statutory Position

The proposal is categorised as development for the purpose of for the purpose of flood mitigation works and is being carried out by or on behalf of a public authority. Under section 2.56 of the Resilience and Hazards SEPP, the proposal is permissible without consent. The proposal is not State significant infrastructure and is subject to environmental impact assessment under Division 5.1 of the EP&A Act.

Accordingly, Northern Beaches Council is the determining authority for the proposal, with this REF fulfilling the obligation under section 5.5 of the EP&A Act 'to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity'.

5 Consultation

5.1 Transport and Infrastructure SEPP Consultation

Division 2.10 of the Transport and Infrastructure SEPP details the consultation requirements relating to activities falling under the SEPP. The proposal triggers the notification requirements under Sections 2.10 and 2.12 in relation to:

- Development with impacts on council-related infrastructure or services; and
- Development with impacts on flood liable land.

However, Section 2.17(b) states that Sections 2.10-2.15 do not apply with respect to development that would require notice of the intention to carry out development to a council or public authority that is carrying out the development.

Under Section 2.13, a public authority must not carry out development on flood liable land that may be carried out without development unless the authority has given written notice of the intention to carry out the development to the State Emergency Service (SES). The SES was contacted via email on 12 May 2023 and response was received on 6 June 2023. A copy of the response from the SES is provided in **Appendix C**. The key points raised by the SES are summarised in **Table 5-1**.

Table 5-1: Consultation summary

| Matter raised by the SES | Response |
|---|---|
| <i>Consider the impact of flooding on the site up to and including the PMF.</i> | Flooding in Narrabeen Lagoon is discussed in Section 6.1 . Measures to manage the risk of flooding during the works are identified in Section 6.1.3 . It is noted that the primary purpose of the project is for flood mitigation. |
| <i>Pursue, if relevant, site design and stormwater management that minimises any risk to the community.</i> | Not applicable. The proposal does not involve construction of a structure or building. |
| <i>Ensure workers and people using the area during and after the entrance clearance works are aware of the flood risk, for example by using signage.</i> | Measures to manage flood risk during construction will be included in the CEMP. All construction personnel will be inducted in the CEMP. The flood risk at the site has been communicated to the community via the <i>Narrabeen Lagoon Floodplain Risk Management Study and Plan</i> (Cardno, 2019), which involved an extensive community engagement program (including public exhibition) and is available on Council's webpage. |
| <i>In addition, if the construction phase of the upgrades causes disruption to the operation of local roads, this may impact the ability for emergency vehicles to use these routes. The NSW SES requests that notification be provided where there are likely to be significant delays in the operation of the roads affected by the upgrades.</i> | The TMP prepared by TTPP (2023; refer Appendix B) considers that it is unlikely the construction phase would result in any impact on roads or adjacent private properties such that there would be impact to the ability of emergency services to respond to an incident. |

6 Environmental Impact Assessment

This section of the REF provides a detailed description of the potential environmental impacts associated with the construction and operation of the proposal. All aspects of the environment potentially impacted upon by the proposal are considered. This includes consideration of:

- Potential impacts on matters of national environmental significance under the EPBC Act
- The factors specified in the guidelines *Is an EIS required?* (DUAP, 1996) and as required under section 171(1) of the *Environmental Planning and Assessment Regulation 2021*. The factors specified in section 171(2) of the *Environmental Planning and Assessment Regulation 2021* are also considered in **Appendix D**.

A series of safeguards and mitigation measures are provided to address the potential impacts of the proposal.

6.1 Hydrology, Hydraulics and Geomorphology

6.1.1 Existing Environment

Narrabeen Lagoon

Narrabeen Lagoon is an ICOLL with a catchment of around 55 km². The entrance channel naturally closes due to the gradual movement of sand into the entrance channel as a result of wave activity and longshore currents, as well as tidal flows. The volume of sand moved into the entrance channel is larger than the volume transported out of the entrance on the ongoing tide, resulting in the formation of a large flood tide shoal that closes the lagoon off from the ocean (RHDHV, 2022).

The conceptual model presented in **Figure 6-1** illustrates the coastal processes resulting in formation of the flood tide delta.

When the entrance is closed the lagoon water levels are a function of the entrance berm level, catchment inflows, direct rainfall and losses via evaporation and/or via seepage through the berm. Catchment inflows can cause the lagoon water levels to rise sufficient to overtop the berm, which then initiates a process of scouring out of the berm to form a channel connecting the lagoon water body and the ocean (Cardno, 2019). The depth of scour is limited by a rock shelf under the entrance that is around 0 mAHD, with a gutter at around -1 mAHD.

When the entrance is open, lagoon water levels are influenced by ocean tides. As the entrance gradually shoals with sand, the tidal signal decreases. When the lagoon is open, water levels in the tidal portions of the estuary are maintained at 0.2-0.4 mAHD (RHDHV, 2022). However, water levels would also be subject to other processes such as wave activity, and elevated ocean water levels and storm surge during a coastal storm.

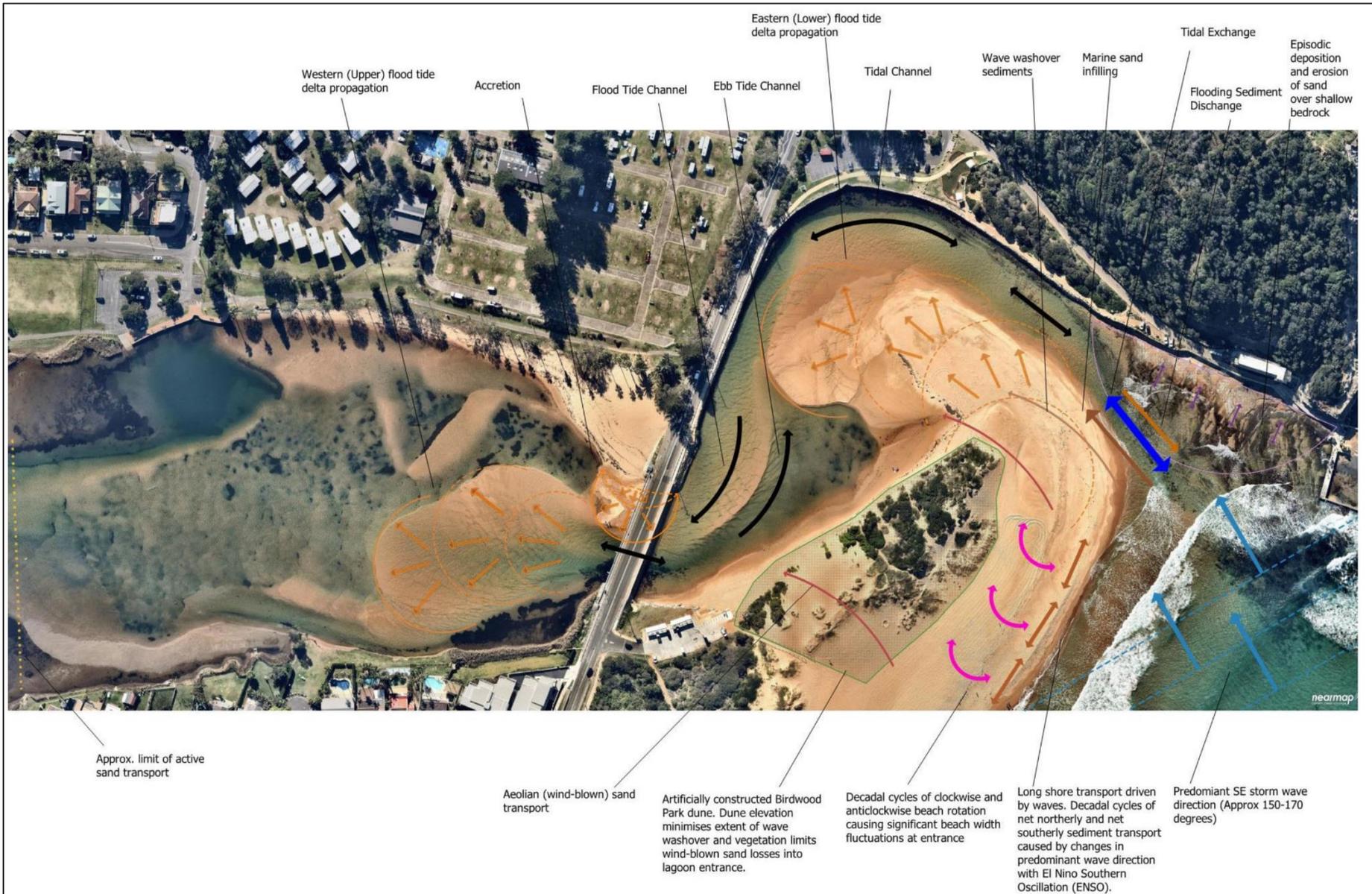


Figure 6-1: Conceptual model of coastal processes at the entrance of Narrabeen Lagoon (source: RHDHV, 2022)

Cardno (2019) report that flooding of low-lying land around Narrabeen Lagoon occurs after heavy rain in the catchment and/or elevated ocean water levels (whether due to storm surge or king tides). When the entrance of the lagoon is closed for longer periods of time there is a significant risk of socio-economic and environmental impacts to the community due to increased flood levels throughout the lagoon (Cardno, 2019; RHDHV, 2022).

Historically the entrance was predominantly closed (RHDHV, 2022); however, since 1975 Northern Beaches Council has managed the entrance of the lagoon to mitigate flood risk to the community through mechanical opening of the entrance if it is closed at the time a flood occurs. The other key activity undertaken is the periodic entrance clearance works, which serve to increase the frequency and duration of entrance opening for flood mitigation purposes (RHDHV, 2022). The entrance is now predominantly open.

The *Narrabeen Lagoon Floodplain Risk Management Study and Plan* (Cardno, 2019), which evaluated flood behaviour and options to mitigate flood risk to the community, recommended entrance clearance works be undertaken as the highest priority flood risk mitigation option under the Plan.

Collaroy-Narrabeen Beach

Collaroy-Narrabeen Beach is an open coast beach subject to a high wave energy environment. Beach volumes fluctuates due to erosion events and beach rotation associated with cycles of El Niño-La Niña, in addition to which there is long term recessionary trend of 0.05 m/yr (NBC, 2016).

The Coastal Zone Management Plan (NBC, 2016) describes the coastal processes and hazards affecting Collaroy-Narrabeen Beach. The coastal hazards include:

- Beach erosion - Storm bite for the design storm is estimated at 250 m³/m north of Frazer Street, reducing to 200 m³/m at Collaroy Services Beach Club, and reducing to 150 m³/m south of Collaroy SLSC;
- Beach rotation – The beach responds to changes in the Southern Oscillation Index (SOI), accreting at the northern end during El Niño (negative SOI) with erosion in the south. This process reverses under La Niña conditions (positive SOI) with erosion occurring more in the north and accretion at the southern end;
- Shoreline recession – Rates of shoreline recession have been estimated at a long-term recession of 0.05 m/year, with an additional 0.04 m/year estimated for sea level rise;
- Coastal inundation – Wave runup levels of 6-8 mAHD can occur and overtop the dune crest levels at locations, including south of Devitt Street, and in particular south of Stuart Street near Collaroy SLSC and Collaroy Services Beach Club.

There is therefore considerable risk to built and natural assets from coastal hazards. There have historically been a range of coastal protection works along the beach, including a structure between Stuart Street and Devitt Street (NBC, 2016). In recent years vertical seawalls have been constructed in front of private properties between Clarke and Stuart Streets, replacing the existing structure that was in this location.

The Birdwood Dune is an important morphological feature, stabilising the position of the entrance channel, limiting wind-blown sand transport into the lagoon, and protecting the lagoon from wave washover, thereby protecting the Ocean Street bridge and adjacent foreshore (RHDHV, 2022).

6.1.2 Potential Impacts

Narrabeen Lagoon

During the works, the lagoon water levels would be stabilised to around 0.4-0.6 mAHD by the construction of an artificial berm at the entrance. The berm would be removed following the completion of the works and the entrance opened. As discussed above, the entrance of the lagoon tends to remain open for a couple of years following an entrance clearance operation, during which time sand gradually infills the entrance channel until the entrance closes again (RHDHV, 2022). During this time there is tidal exchange with the ocean, with the tidal range decreasing gradually as the entrance is filled with sand.

There is a risk of a coastal storm or flood event during construction. Should a flood event occur, it may be necessary to remove the berm and mechanically open the entrance for flood mitigation purposes in accordance with EM-OMS 455, or in a larger flood event the entrance may open naturally. If a coastal storm were to occur, there would be a risk of wave overtopping of the artificial berm and propagation of storm surge into the lagoon. In a large event the artificial berm could be breached. Both of these circumstances would present a risk to safety for construction personnel and there is a risk of mobilisation of plant and machinery. However, given the relatively short duration of the works, this risk is considered low.

No damage to the rock shelf under the entrance is anticipated. Similarly, the works have been offset 10 m from the revetment on the northern shoreline of the entrance channel to avoid the risk of undermining of this structure.

The use of the foreshores for movement of vehicles and machinery during the works has potential to cause erosion and sedimentation into the waterway.

The entrance clearance works would involve the removal of sand from the entrance channel with the intent of improving the hydraulic efficiency of the entrance with respect to conveyance of flood flows. Modelling undertaken for the Floodplain Risk Management Study demonstrated that the entrance clearance works were effective in reducing flood levels when compared to a fully shoaled entrance (Cardno, 2019). Even after the completion of the works when the entrance closes again, the mechanical opening of the entrance by Council during a flood are more successful as a result of the clearance works (RHDHV, 2022). Hence the proposal reduces flood risk and the associated socio-economic impacts of flooding to the community.

While the entrance remains open there would be an increased risk of storm surge propagating up the lagoon during a large coastal storm, although this risk would decrease over time as the entrance gradually closes.

Changes to the lagoon hydrodynamics arising from the altered bathymetry also have potential to occur, with potential to impact bed and/or bank stability. This risk has been mitigated to a degree through the design of the works, with the configuration of the works taking into account the main flow paths, providing a consistent bed profile with no deep holes, and by adopting batter slopes of 1H:6V (i.e. the natural angle of repose of sand).

Collaroy-Narrabeen Beach

Similarly, there is a risk of a coastal storm occurring during the works, with resultant wave attack and beach erosion presenting a risk to construction personnel, plant and machinery. In addition, any sand that had been placed on the beach at the time the storm occurs could be transported offshore.

Depending on the size of the storm event, it would be gradually transported back onshore once the storm has passed.

There is also potential for the movement of trucks and machinery along the beach to cause localised erosion and sedimentation, as well as compaction of the beach sands.

Based on the proposed clearance volumes, an average of 40.9 m³/m (and up to 72.7 m³/m) would be placed on the beach between Goodwin and Stuart Street. This additional sand would have the effect of increasing the volume of sand in this section of the beach, thereby increasing the buffer width to accommodate sand transport offshore during a smaller coastal erosion event. However, it is anticipated that the sand would be mobilised due to cross-shore and longshore sediment transport processes, resulting in re-distribution following initial placement. The rate of transport would depend upon the conditions after completion of the works.

6.1.3 Mitigation Measures

The following measures and safeguards will be adopted to minimise the potential impacts of the proposal to hydrology and geomorphology:

- The Contractor's Construction Environmental Management Plan (CEMP) will detail when and how the entrance should be opened and closed.
- A temporary berm would be established across the lagoon entrance, with a crest height of 2 mAHD, to maintain the lagoon water level of not less than 0.4 mAHD for the duration of the works and prevent waves and tidal currents impacting the works.
- Local weather and marine forecasts provided by the Bureau of Meteorology (BoM) would be monitored daily for the duration of the works, as would lagoon water levels as measured at the Ocean Street bridge gauge (station ID 213408D) maintained by MHL.
- An Incident Response Plan shall be prepared as part of the CEMP, to include consideration of catchment floods and coastal storms. All construction personnel will be inducted in the Plan.
- In the event of a forecast high rainfall/flood event or big ocean swells, plant and equipment is to be relocated to higher ground.
- In the event of a catchment flood during the works:
 - Works are to cease immediately and all plant and equipment secured or moved to higher ground,
 - A mechanical breakout is to be implemented under the direction of Council in accordance with EM-OMS 455, and
 - A temporary berm is to be re-established at the lagoon entrance as soon as possible following the breakout event to facilitate the completion of the works.

6.2 Soils and Sediments

6.2.1 Existing Environment

A search of the EPA's contaminated land record conducted on 2 June 2023 did not identify any contaminated sites within the project footprint.

A review of the Acid Sulfate Soils (ASS) mapping prepared under the Warringah LEP 2000 (WLEP2000; refer **Figure 6-2**) shows that the proposed works intersect areas of the lagoon entrance mapped as ASS Class 1, Class 4 and Class 5. The proposed beach replenishment area intersects areas mapped ASS Class 4 and Class 5. However, the works are not expected to encounter ASS. As is evident based on the coastal

processes (refer **Section 6.1**) and taking into account the methodology adopted for the design (which targets as a priority previously dredged areas, refer **Section 3.1**), the material within the dredge footprint is expected to be clean marine sand. Field testing of sediment samples undertaken prior to the 2006 entrance clearance works concluded there was no risk of Actual or Potential ASS in the top 500-700 mm of sand in the entrance channel (SESL, 2006; cited Cardno, 2021). In the previous entrance clearance works in 2021, this was generally found to be the case, although there was some small amounts of fluvial material encountered during the 2023 entrance clearance works. Hence, it has been assumed for the purposes of this assessment that the material to be excavated is comprised of marine sands, with a low likelihood of encountering small amounts of fluvial material.

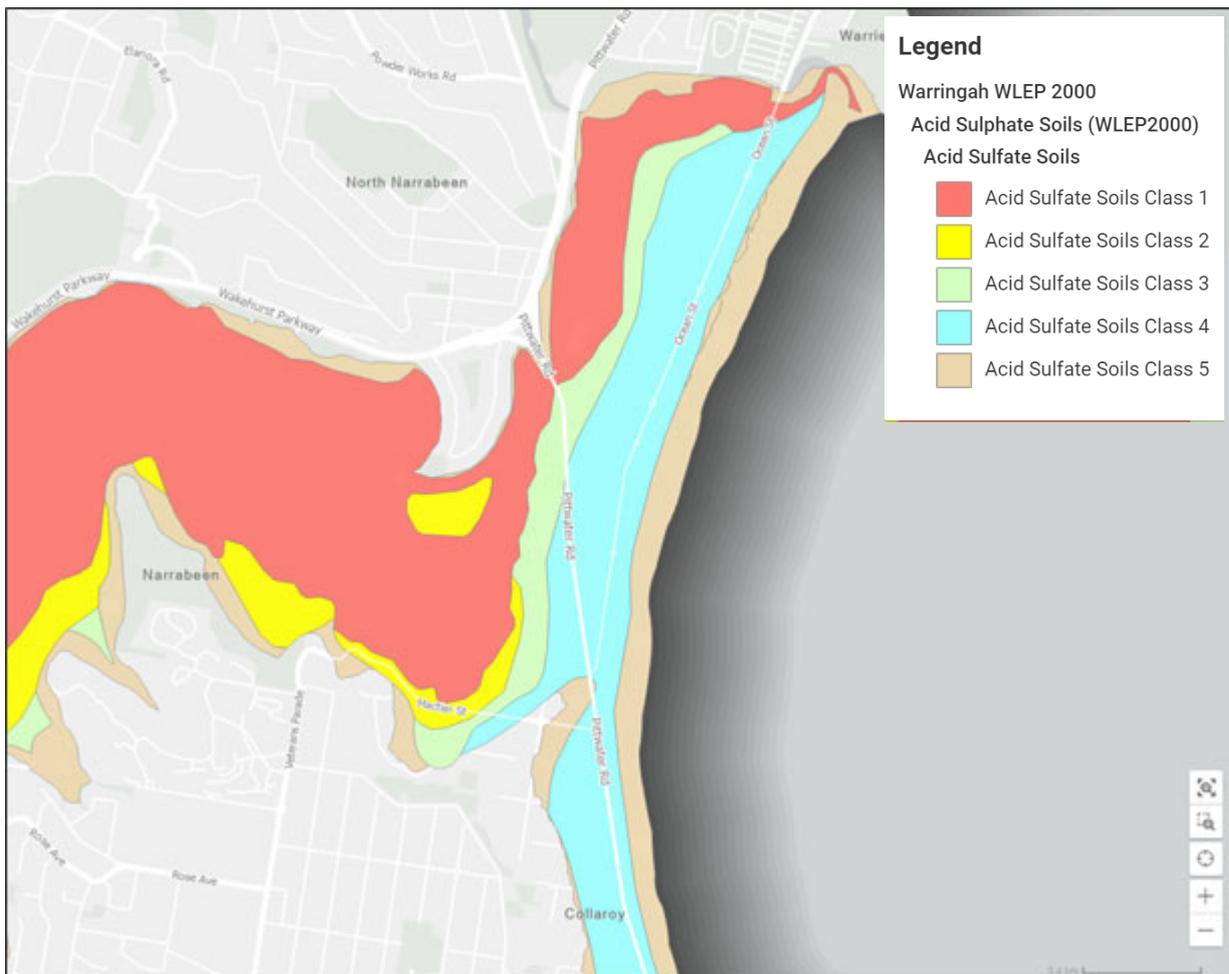


Figure 6-2: Acid Sulfate Soils (source: WLEP2000)

6.2.2 Potential Impacts

The proposed clearance works are not expected to encounter any contaminated material or ASS.

There is a low risk of encountering some fluvial material. In the event a small amount of fluvial material is excavated from the entrance channel, it is anticipated that it would be generally well mixed with the clean marine sand, although it is likely to have a darker colour. Upon placement of the excavated material on the beach, it is anticipated that any finer fluvial material would be washed out of the coarser sand relatively quickly.

However, if the works are not properly managed, there is a risk of erosion from the stockpile area and sedimentation of the waterway, or aeolian transport of excavated material.

No operational phase impacts on soils or benthic sediments are anticipated.

6.2.3 Mitigation Measures

The following measures and safeguards will be adopted to minimise the potential impacts of the proposal to soils and sediments:

- The depth of excavation shall be progressively monitored during the works to ensure it conforms to the design. This should be undertaken by the Contractor, but also independently verified by Council.
- The CEMP shall identify the steps to be taken in the event of over-excavation.
- In the event material other than clean marine sands are encountered during the clearance works, a field pH test should be undertaken to test for ASS. If the field testing confirms the presence of Actual or Potential ASS, the material will be managed in accordance with the Acid Sulfate Soil Manual (ASSMAC, 1998).
- In the event suspected contaminated material is encountered during the works, works shall cease immediately, the material contained and Council's Project Manager contacted to determine a suitable course of action, to include as a minimum, laboratory testing of the material.
- An Erosion and Sediment Control Plan (ESCP) is to be prepared and implemented in accordance with Landcom (2004) *Managing Urban Stormwater – Soils and Construction – Volume 1* (the 'Blue Book').
- Movement of excavated material is not to be undertaken during periods of high rainfall or high wind.
- Erosion and sediment controls will be checked and maintained on a regular basis and records of such inspections kept and provided upon request.
- Visual monitoring of local water quality (e.g. turbidity, hydrocarbon spills/slicks) is to be undertaken on a regular basis to identify any potential spills or deficient silt curtains or erosion and sediment controls.
- Stockpiles for de-watering of excavated material would be suitably bunded and water discharged back into the lagoon monitored visually for high suspended sediments loads.

6.3 Surface Water Quality

6.3.1 Existing Environment

Three sites in Narrabeen Lagoon are monitored by Council with support from the Department of Planning and Environment (DPE). The water quality and ecosystem health monitoring program has been ongoing since 2010, tracking two key indicators: algae (chlorophyll-a concentrations) and water clarity (or turbidity). The historical water quality grades for Narrabeen Lagoon are presented in **Figure 6-3**, where the grades are as follows:

- A - excellent;
- B – good;
- C – fair;
- D – poor; and
- E – very poor.

Historically the water quality of the larger Narrabeen Lagoon has been rated fair to good.

Typical water quality in the lagoon entrance has been described as generally ‘good’, with the exception of periodic declines when periods of rain coincide with a closed entrance. While the entrance is open there is tidal exchange with the ocean, which flushes the lower estuary and improves water quality (RHDHV, 2022).

| Year | Algae | Water clarity | Overall grade |
|---------|-------|---------------|---------------|
| 2010–11 | B | C | B |
| 2013–14 | B | B | B |
| 2014–15 | D | C | C |
| 2015–16 | B | B | B |
| 2016–17 | B | E | C |
| 2017–18 | C | C | C |
| 2018–19 | B | C | B |
| 2019–20 | C | B | B |
| 2020–21 | A | B | B |

Figure 6-3: Historical water quality grades for Narrabeen Lagoon (source: DPE, 2023b)

There are also DPE Beachwatch monitoring locations at Birdwood Park, North Narrabeen Beach and Collaroy Beach. The Beachwatch program evaluates water quality for recreational users by analysing bacteriological data as an indicator of faecal contamination. The *State of the Beaches Report 2021-2022* (DPE, 2022c) gave a Beach Suitability Grade of Poor, indicating that the site is susceptible to faecal contamination, particularly after rain and occasionally during dry conditions. The North Narrabeen Beach and Collaroy Beach both had a Beach Suitability Grade of Good and was considered suitable for swimming most of the time.

6.3.2 Potential Impacts

There is potential for water quality impacts to arise during the entrance clearance works in relation to:

- Suspension of bed sediments during the excavation/dredging works, leading to localised increases in turbidity;
- Increased turbidity in the entrance channel associated with discharges from the dewatering area;
- Increased turbidity due to erosion from stockpiles;
- Accidental spills or leaks of oil, fuels and/or hydraulic fluids from excavators (or dredge), trucks and other plant and machinery used for the clearance works or for the sand placement on the beach.

In the operational phase it is expected that water quality in the entrance channel would be improved due to the re-introduction of tidal flows following the completion of the works.

6.3.3 Mitigation Measures

In addition to those mitigation measures relating to erosion and sediment control listed in **Section 6.2.3**, the following measures and safeguards will be adopted to minimise the potential impacts of the proposal on water quality:

- Silt curtains are to be installed around any sensitive marine habitats (i.e. seagrasses) prior to the commencement of work. The silt curtains will be monitored and maintained for the duration of the works as required to contain any suspended sediments.
- Re-fuelling of plant and equipment, or any other activity with potential to result in an accidental spill, is to be undertaken in an impervious bunded area away from drainage lines.
- Any re-fuelling of plant or machinery or storage of hazardous materials on barges (or vessels) is to occur in a double-bunded area.
- An emergency spill kit is to be kept on site at all times and maintained throughout the works. The spill kit must be of an appropriate type for the volume and type of substances to be used during the works. Spill kits for barges (if required) must be specific for working in the marine environment.
- In the event of an accidental spill, Council's Project Manager is to be notified as soon as practicable.
- Emergency contacts will be recorded in the CEMP and kept in readily accessible places in vehicles, vessels and at the site office. All workers will be advised of these contact details and procedures.
- All works personnel will be trained in the use of the spill kits kept on site.
- Vehicles, vessels and plant will be properly maintained and regularly checked for leaks of fuel or other fluids.
- No vehicle or vessel wash down will occur on the site.

6.4 Traffic, Navigation and Access

This section has been informed by the TMP prepared by TTPP (2023; refer **Appendix B**).

6.4.1 Existing Environment

The road network surrounding the proposed works footprint is summarised below:

- Pittwater Road is a two-way divided State Road with three lanes in each direction and a posted speed limit of 60-70 km/h. It has several signalised intersections and a 40km/h school zone between Mactier and Robertson Streets. A bus lane is provided southbound in the AM from 6am to 10am and northbound in PM between 3pm and 7pm. Parking is generally permitted outside these hours.
- Ocean Street is a two-way local road with on lane in each direction, on-street parking on both sides of the road and a posted speed limit of 50 km/h. There is a 40 km/h school zone between Wellington and Waterloo Streets.
- Walsh Street is a two-way local road with provision for on-street parking on both sides of the road. The posted speed limit is 50 km/h and it is a shared on-road cycle route. Walsh Street is a left turn entry only from Pittwater Road and left turn exit only into Pittwater Road. There is a three tonne load limit on Walsh Street between Collins Street and Narrabeen Park Parade.
- Mactier Street is a two-way no-through local access road east of Pittwater Road with a posted speed limit of 50 km/h. This intersection with Pittwater Road is signalised. There is unrestricted on-street parking for around 10 cars.
- Wetherill Street is a two-way no-through local access road east of Pittwater Road with a posted speed limit of 50 km/h. This intersection with Pittwater Road is not signalised. There is unrestricted on-street parking for around eight cars.
- Ocean Grove is a two-way local access road east of Pittwater Road with a posted speed limit of 50 km/h. This intersection with Pittwater Road is signalised. There is kerb-side parking on both sides of the road.

- Seaview Parade is a two-way road connecting Ocean Grove and Anzac Parade with a posted speed limit of 50 km/h and kerb-side parking on both sides of the road.
- Anzac Avenue is a two-way no-through road east of Pittwater Road with a posted speed limit of 50 km/h. This intersection with Pittwater Road is signalised. There is kerb-side parking on both sides of the road.

The nearest Transport for NSW (TfNSW) Traffic Volume Counter is located on Pittwater Road about 20 m north of Jenkins Street. At this location, Average Annual Daily Traffic (AADT) volumes for 2023 are:

- 14,660 vehicles northbound on a weekday and 9,753 on a weekend; and
- 16,739 vehicles southbound on a weekday and 9,433 on a weekend.

Of the total traffic movements on weekdays, 8.11% are heavy vehicles, dropping to 5.67% on weekends.

There are several bus services that run through the project locality, as listed in **Table 6-1**. **Figure 6-4** maps the bus routes.

Bus stops servicing bus route 155 are located every 200-300 m along Ocean Street at Albemarle Street, Octavia Street, Emerald Street and Malcolm Street.

Table 6-1: Existing bus services (source: Transport for NSW)

| Bus route | Route description | Frequency of services |
|-----------|--|--|
| 155 | Bayview Garden Village to Narrabeen and Frenchs Forest | 25-35 minutes during AM/PM peak periods. Hourly during off-peak. |
| 181X | Narrabeen to City Wynyard (Express) | 10 min during AM/PM peak periods. Does not run off-peak. |
| 182 | Mona Vale to Narrabeen | 10 minutes during AM/PM peak periods. Hourly during off-peak. |
| 185 | Mona Vale to Narrabeen via Warriewood Valley | 30 minutes |
| 190X | Avalon Beach to City Wynyard (Express) | 10 min during AM/PM peak periods. Does not run off-peak. |
| 199 | Palm Beach to Manly via Mona Vale & Dee Why | 10-15 minutes |



Figure 6-4: Bus routes servicing the project locality (source: Transport for NSW, 2023)

There is provision for pedestrians with footpaths located on both sides of Ocean Street near Narrabeen Lagoon. Pedestrian access is also achievable along the lagoon foreshores either side of the Ocean Street bridge, with connectivity from Birdwood Park to Collaroy-Narrabeen Beach.

There are beach accessways for pedestrians at the end of Goodwin Street, Mactier Street, Clarke Street, Wetherill Street and Stuart Street, and some properties located between Goodwin and Stuart Street also have direct beach access. Pedestrian access is also available along the beach, provided there is sufficient volume of sand and the erosion scarp (if present) is not too high. After coastal erosion events access can be difficult and unsafe due to presence of steep and high erosion scarps along the beach and some beach accessways may not be usable under these conditions (NBC, 2016).

Pittwater Road and Ocean Street are part of a regional cycle network. There is an off-road shared user path on the western side of Pittwater Road. There is an on-road cycling lane on both sides of Ocean Street from Pittwater Road to Malcolm Street.

There is a boat ramp located on the northern shoreline of the lagoon west of the Community Environment Centre. Navigation in the entrance channel of Narrabeen Lagoon is limited by the water depths and clearance under the Ocean Street bridge. Boating is generally limited to parts of the lagoon west of the Ocean Street bridge, except for small craft (e.g. kayaks, paddleboards and dinghies).

6.4.2 Potential Impacts

It is anticipated that the workforce would be relatively small at around five to ten workers on site at any given time. The Birdwood Park construction compound would be used for parking of light vehicles related to construction and staff would be encouraged to carpool. The amount of light vehicle traffic associated with construction is expected to be negligible.

The proposed haulage routes for loaded trucks travelling to the beach access points and unloaded trucks returning to Birdwood Park is shown in **Figure 6-5**. Loaded trucks would travel via Narrabeen Park Parade, Walsh Street and Pittwater Road to Mactier Street (or Wetherill Street). For trucks that unload material via Mactier Street, the trucks would return to the lagoon, making a right hand turn out of Mactier Street at the signalised intersection and onto Pittwater Road and travelling via Ocean Street. For trucks taking material to Wetherill Street access point, returning trucks would make a left hand turn onto Pittwater Road, then travel via Ocean Grove, Seaview Parade and Anzac Avenue, before turning right back on to Pittwater Road and then travelling via Ocean Street to the lagoon.

It is only possible to unload one truck at a time at the beach access points. As such, there is a need for a layover area for trucks while waiting for access to Mactier Street (or Wetherill Street). This layover area would be located on the southern side of Walsh Street between Narrabeen Park Parade and Collins Street (refer **Figure 6-5**). At this location the carriageway is 11 m wide and has plenty of on-street parking to enable truck layover. There are no residences which would be impacted by the truck movements.

No trucks would be permitted to wait on Pittwater Road.

Based on the proposed clearance volume and progress of the 2021 entrance clearance works and adopting the proposed excavation volumes detailed in **Section 3.1**, it is estimated that 12 tonne bogie tipper trucks would undertake a total of 3,654 truck movements to transport 22,500 m³ of sand, with a further 2,842 truck movements required if the additional 17,500 m³ of material is excavated (TPPP, 2023).

For the minimum excavation volume of 22,500 m³ this translates to around 48 laden truck movements per work day (or an average of five laden truck movements per hour during the week days and on Saturday) over a period of around 14 weeks (77 full working days). If the additional excavation of 17,500 m³ of material is undertaken, it would generate around 37 additional truck movements per day or four truck movements per hour if the scheduled duration of construction remains at 14 weeks. This is considered a maximum potential number of truck movements for purposes of this impact assessment.



Figure 6-5: Haulage routes (source: TTPP, 2023)

Based on a review of the existing traffic volumes on the road network, the impact assessment in the TMP (TTPP, 2023) concluded that there was sufficient volume in the road network to accommodate the construction vehicle movements.

There would be a temporary loss of parking on Mactier Street (and Wetherill Street) as a result of the works. The Birdwood Park carpark would also be unavailable for public parking during the works.

The construction compound and works site would be fenced to prevent public access and alternative pedestrian access provided as required. No impacts on public transport are anticipated as a result of the construction traffic movements. Pedestrian access along Collaroy-Narrabeen Beach would also be disrupted due to fencing of the works area. However, there are other alternative accessways that pedestrians could use to divert around the beach placement area.

Swimmers, vessels and small water craft would not be permitted to transit the works area during the construction phase, with access prohibited from the upstream extent of the works area to the lagoon entrance. This would be a short term impact on waterway users for the duration of the works only.

There would be no adverse impacts on traffic, navigation or access in the operational phase. The entrance clearance works would have a short to medium-term benefit for vessels and small watercraft navigating the entrance channel through improved under-keel clearance. There would also be improved beach volume at the sand placement area on Collaroy-Narrabeen Beach, providing a medium term improvement in access along the beach and from the beach accessways to the water for beach users.

6.4.3 Mitigation Measures

The following measures and safeguards will be adopted to minimise the potential impacts of the proposal on traffic, navigation and access:

- The TMP and accompanying Traffic Guidance Schemes (TTPP, 2023) would be implemented as part of the CEMP.
- Council will seek a relaxation of the three tonne load limit on Walsh Street from the Traffic Management Committee to enable trucks to use this route during construction.
- The community engagement plan would be prepared and implemented as specified in **Section 6.8.3**.
- In the event the additional clearance area is to be excavated and the volume of truck movements and/or duration of construction is increased, prior notification would also be provided to the community.
- Truck movements are to managed effectively to avoid queuing of traffic when loading and unloading excavated material.
- The transfer of sand onto roads will be minimised by adoption of measures to remove sand from truck wheels prior to accessing the road network. Any sand tracked onto the road shall be removed as soon as is practicable.
- Signage will be erected notifying the public of parking changes in the affected locations.
- Trucks are not permitted to park in side streets where they will block access for local residents.
- The works areas will be fenced to prohibit public access during construction.
- Where access for pedestrians or cyclists is impacted, suitable alternative, safe access will be provided.
- Where possible, public access to the waterway and for navigation is to be maintained during the works.

- Appropriate signage will be provided to notify waterway users of the exclusion area during construction.

6.5 Noise and Vibration

6.5.1 Existing Environment

The proposed works are located in a residential area, with some small businesses, a SLSC and the NRMA Sydney Lakeside Holiday Park also located nearby. The nearest receivers to the Narrabeen Lagoon entrance channel works area include:

- Residences on the southern shoreline of the lagoon, west of the bridge, which are around 40 to 45 m from the clearance works. The nearest residence is located about 55 m from the Birdwood Park works compound; and
- Camp/caravan sites in southern part of Sydney Lakeside Holiday Park that are located adjacent to the lagoon about 30 to 40 m distant from the shoreline.

Sensitive receivers near the works area in Narrabeen Lagoon include:

- North Narrabeen SLSC is located about 55 m from the Birdwood Park works compound;
- Lake Park sports fields, about 140 m west of the works footprint;
- The lagoon foreshores and waterways and adjacent beach, which are passive recreation areas; and
- The Coastal Environment Centre, which is about 75 m from the works area.

The proposed placement area on Collaroy-Narrabeen Beach is located between the ocean and residential development. No works would be undertaken on private land and the distance of the residences from the placement area varies depending on the location of the dwelling in relation to the property boundary; however, the minimum distance between a residential façade and the works area is around 10 m. Sensitive receivers nearby include:

- Narrabeen Lakes Primary School, which is located on the opposite side of Pittwater Road north of Goodwin Street, about 147 m distant from the placement area;
- St Faith’s Anglican Church on Clarke Street, about 165 m from the placement area; and

The beach and ocean also comprises both passive and active recreation areas.

It is anticipated that the local noise environment would generally be representative of a coastal residential environment and anthropogenic noise would be dominated by traffic on Ocean Street and Pittwater Road.

6.5.2 Criteria

The EPA’s *Draft Construction Noise Guideline (2020)* provides noise management levels (NMLs) for residences as summarised in **Table 6-2**.

Table 6-2: Noise management levels for residential receivers (source: EPA, 2020)

| Time of day | Noise management level ($L_{Aeq, 15 \text{ min}}$) |
|--|--|
| Recommended standard hours: | Noise affected |
| <ul style="list-style-type: none"> • Monday to Friday 7am to 6pm • Saturday 8am to 1pm • No work Sundays or public holidays | RBL + 10dB |
| | Highly noise affected |
| | 75 dB(A) |

| Time of day | Noise management level ($L_{Aeq, 15 \text{ min}}$) |
|---------------------------------------|--|
| Outside of recommended standard hours | Noise affected |
| | RBL + 5dB |
| | Highly noise affected 65 dB(A) |

For purposes of this assessment, the local noise environments at each of the two works locations has been characterised using the TfNSW Noise Calculator as R2, for which the representative noise environment has background noise levels of:

- 45 dB(A) during the day (7am to 6pm);
- 40 dB(A) in the evening (6pm to 10pm); and
- 35 dB(A) during the night (10pm to 7am).

These values are used as the Rating Background Levels (RBLs) for residential receivers in the study area.

The noise criteria for the relevant types of sensitive receivers are provided in **Table 6-3**. It is noted that the NMLs for residential receivers are applied at the façade of the residence, whereas the noise criteria for sensitive receivers may be applied at either externally or internally, depending on the receiver type. Insertion losses, which are the reduction in noise levels as measured external to a building versus internally, are generally around 10 dB(A).

Table 6-3: Noise criteria sensitive receivers (source: EPA, 2020)

| Receiver type | Noise management level ($L_{Aeq, 15 \text{ min}}$) |
|--|--|
| Classrooms at schools and other educational institutions | Internal noise level 45 dB(A) |
| Places of worship | Internal noise level 45 dB(A) |
| Active recreation areas | External noise level 65 dB(A) |
| Passive recreation areas | External noise level 60 dB(A) |
| Community centres | Depends on the intended use of the centre |

6.5.3 Potential Impacts

During construction there would be noise associated with the operation of trucks, plant and machinery. The sound power levels (SPLs) associated with the expected plant and machinery are provided in **Table 6-4**.

Table 6-4: Plant and associated sound power levels

| Plant | SWL ($L_{Aeq, dB(A)}$) |
|---|-----------------------------|
| Barge / workboat | 108 |
| 23T excavators or Excavator (tracked) 35T | 110 |
| Road truck / delivery truck | 108 |
| Tipper truck / bogie tippers | 110 |
| Tipper truck / bogie tipper pass-by | 106 |

| Plant | SWL (L_{Aeq} , dB(A)) |
|-----------------------------|-----------------------------|
| D65 bulldozer | 116 |
| Front-end loader | 91 |
| Light construction vehicles | 88 |

A distance-based assessment was undertaken for the noisiest plant (i.e. the D65 bulldozer) using the TfNSW noise calculator assuming a direct line of sight to the receiver and adopting standard construction hours for the works. During the day time the works would be audible for a distance of around 240 m from the source and exceed the NML of 65 dB(A) and be considered ‘moderately intrusive’ during the day for residences within 105 m of the works. The works would be ‘highly intrusive’ (i.e. be ≥ 75 dB(A)) for residences located within 35 m of the works. Based on this assessment, and noting the bulldozer would likely only be used in the beach placement area, the key affected residences would be those located near the beach placement site.

For the sensitive receivers near the beach placement site, the works would not have a direct line of sight. Updating the distance-based assessment for the noisiest plant (i.e. the D65 bulldozer), the works would not be expected to be audible at Narrabeen Lakes Primary School or St Faith’s Anglican Church. The works at the beach placement site would however be audible to recreational users of the beach and adjacent ocean.

To evaluate noise emissions from the clearance works area in the lagoon entrance channel, a distance-based assessment was undertaken for the noisiest plant expected to be used at this location (i.e. the D65 bulldozer) using the TfNSW noise calculator assuming a direct line of sight to the receiver and adopting standard construction hours for the works. The works would be audible during the daytime for a distance of 145 m of the source, and would exceed the NML of 65 dB(A) and be considered ‘moderately intrusive’ for a distance of 55 m. No residences are expected to experience ‘highly intrusive’ levels of noise.

For sensitive receivers near the clearance works site, the works would be exceed the NML for passive recreation and be ‘moderately intrusive’ for a radius of 50 m, and ‘highly intrusive’ for both active and passive recreational users for a distance of about 25 m from the source.

An assessment of potential noise impacts associated with the estimated daily bogie truck movements reported in **Section 6.4.2** were entered into the TfNSW Road Traffic Noise calculator adopting the AADT volumes from the nearest TfNSW Traffic Volume Counter. The increase in traffic noise arising from the additional heavy vehicle movements along Pittwater Road are expected to change by 0.1 dB(A), which is not expected to impact adjacent receivers. Even with the additional 37 truck movements per day associated with the additional clearance area (i.e. the ‘worst case scenario’), the increase in traffic noise remains around 0.1 dB(A).

It is understood that no noise complaints were received during the 2021 entrance clearance works.

With respect to vibration, none of the plant proposed to be used during the works is particularly vibratory. However, some vibration may be perceived by nearby receivers from truck pass-bys.

6.5.4 Mitigation Measures

The following measures and safeguards will be adopted to minimise the potential impacts of the proposal on noise and vibration:

- Works are to be carried out during standard construction hours, as per **Section 3.4**.
- Noise impacts are to be minimised in accordance with the *Draft Construction Noise Guideline* (EPA, 2020). The CEMP shall include reasonable and feasible measures to reduce noise impacts to receivers, including:
 - Where practicable, adopting quieter work methods and using quieter plant and equipment;
 - Operating plant and equipment in a quiet and efficient manner (e.g. minimising reversing alarms, turning equipment off when not in use);
 - Regularly inspecting and maintaining equipment to ensure it is in good working order;
 - Limiting the idling of trucks as much as possible;
 - Considering proximity to residences and sensitive receivers when selecting overnight parking locations for trucks and other vehicles used in the works;
 - Taking care when unloading trucks at the beach access points to minimise noise.
- Local residents would be notified of the commencement of works via direct mail-out, on Council's webpage and via the local media. A contact should be provided to impacted residents to enable them to make further enquiries or complaints.
- Signage will be erected at the works sites with the relevant contact details of the person(s) to whom community members can make complaints or enquiries.
- A complaints register will be established for the duration of the works to record any noise or other complaints related to the works. Any complaints received shall be responded to promptly and appropriately.
- Should any noise or vibration complaints be received, the need for additional mitigation measures would be investigated and implemented where reasonable and feasible.

6.6 Biodiversity

This chapter provides the biodiversity impact assessment undertaken by H2O Consulting on behalf of Rhelm.

6.6.1 Methodology

The methodology adopted by H2O Consulting is summarised below.

Threatened Species Searches

Relevant statutory databases were searched during March 2023, applying a 10 km radius around the project footprint to identify threatened biodiversity, migratory species and MNES that may potentially occur in the Narrabeen locality. The following databases and information sources were searched:

- Bionet - Atlas of NSW Wildlife (records from the last 20 years);
- NSW DPI Fisheries Threatened Species Lists; and
- EPBC Act Protected Matters Search Tool.

Ecological Mapping

Available mapping of existing ecological features important to this assessment was sourced from the DPI-Fisheries NSW Spatial Data Portal, including mapping of Estuarine Macrophytes, Aquaculture Areas, Marine Protected Areas and Key Fish Habitat.

A review of the potential environmental constraints identified via these maps was then undertaken.

Site Investigations

Site investigations of the benthic, aquatic and terrestrial habitats within the project footprint and adjacent areas were completed on 22 March 2023. The site investigations undertaken to inform this assessment involved:

- Inspection and description of general habitat within and adjacent to the project footprint;
- Description of intertidal flora and fauna present;
- Description of subtidal flora and fauna present in shallow areas; and
- Verification and mapping of macrophytes (e.g. seagrasses).

At the time of the field survey the lagoon entrance was closed and the lagoon water level was high. Weather conditions were overcast with light, variable winds. The field survey was undertaken upstream of the entrance berm, taking into account the waterway and adjacent foreshores up to approximately Malcolm Street. Aquatic habitat and features of interest were photographed using an underwater digital camera. Aquatic habitat was described based on dominant flora and fauna observed.

Habitat Mapping

Estuarine habitat mapping from the 2021 entrance clearance works was analysed based on recent high resolution aerial imagery (Nearmap) and verified in situ, being updated in the field by taking measurements from known fixed points using a differential GPS receiver with 30-70 cm accuracy. Measurements were then used to update polygons using GIS-based mapping software, creating the following shapefiles:

- In situ estuarine mapping data
- Aerial imagery

For seagrass habitat, density (abundance) and patchiness (sociability) was estimated using categories for each seagrass species present as per King and Barclay (1986; refer **Table 6-5**).

Data obtained during the field survey along with aerial imagery was used to develop habitat maps for the project area.

Table 6-5: Density and patchiness categories for seagrass (after: King and Barclay, 1986)

| Attribute | Description |
|-------------------|--|
| Density | |
| Low | Sparse growth, up to 15% cover |
| Medium | Moderate growth, 15 – 50% cover |
| High | Abundant growth, greater than 50% cover |
| Patchiness | |
| Clumps | Individual strands or clumps (less than 1 m ²) |

| Attribute | Description |
|-----------|---|
| Patches | Patches of between 1 and 5 m ² |
| Beds | An area of relatively continuous seagrass greater than 5 m ² |

Threatened Species Assessment

The threatened species assessment was undertaken by desktop review of ‘sightings’, assessment of the habitat in the Study Area, and determining the likelihood of occurrence of each species using the criteria outlined in **Table 6-6**. Species considered further were those in the ‘Known’, ‘High’ and ‘Moderate’ categories and where impacts on the species from the proposed works are considered to possibly or likely occur.

Table 6-6: Likelihood of occurrence criteria

| Likelihood of occurrence | Criteria |
|--------------------------|--|
| Known | <ul style="list-style-type: none"> The species was observed within the study area. The species is known to inhabit the study area. |
| High | <ul style="list-style-type: none"> It is likely that the species utilises habitat or resources that are abundant or in good condition within the study area. The species is known or likely to visit the study area during regular seasonal movements or migrations. |
| Moderate | <ul style="list-style-type: none"> The species has infrequently been recorded previously in the Study Area or similar habitats in the locality. The study area contains potential marginal and/or modified habitat and resources for the species, which it may occasionally utilise. The species is unlikely to maintain sedentary populations but may seasonally use resources within the study area opportunistically or during migrations. |
| Low | <ul style="list-style-type: none"> The species has not been recorded previously in the study area or similar habitats in the locality. The study area is beyond the current distribution range of the species. If present in the study area the species would likely be a transient visitor. The study area contains only very marginal habitat for the species, which would not be relied upon for its on-going local existence. |
| Unlikely | <ul style="list-style-type: none"> The species is highly restricted to certain geographical areas not including the study area. The habitat within the study area is unsuitable for the species. |

Limitations

The site investigation included an assessment of habitat values present within the study area and was limited to opportunistic observations of species present at the time of survey. Habitat assessments are conservative, defaulting to assume presence where there is insufficient knowledge to determine otherwise.

Numerous threatened fauna species are seasonal in geographical distribution and/or may be transient in nature. For instance, some migratory bird species may be seen only at certain times of the year as

they migrate to more significant nearby sites, while other fauna are only present during certain seasons (e.g. migration patterns or seasons).

The density and coverage of seagrass will change seasonally and/or in response to weather events. Weather events that result in high levels of bed erosion and/or sedimentation may smother and cover shorter seagrasses such as *Zostera* beds. Seagrass may increase in coverage during summer months and retract in coverage and density during winter months.

This impact assessment is limited to aquatic flora and fauna (including marine birds and shorebirds). Additional habitat descriptions of terrestrial/shoreline vegetation communities have been provided and general recommendations provided. However, this assessment does not include for detailed impact assessment of terrestrial biodiversity values.

6.6.2 Existing Environment

Threatened Biodiversity and MNES

Searches of the Bionet database identified records for 94 species listed under the BC Act within a 10 km radius of the project footprint. These included:

- 40 threatened marine birds and/or shorebirds;
- 3 threatened marine mammals; and
- 4 threatened marine reptiles.

The Bionet species records are mapped in **Figure 6-6**. The red line indicates the search area, namely a five kilometre buffer on the study area, and the numbers in brackets after the common name indicates the number of records from the last 20 years.

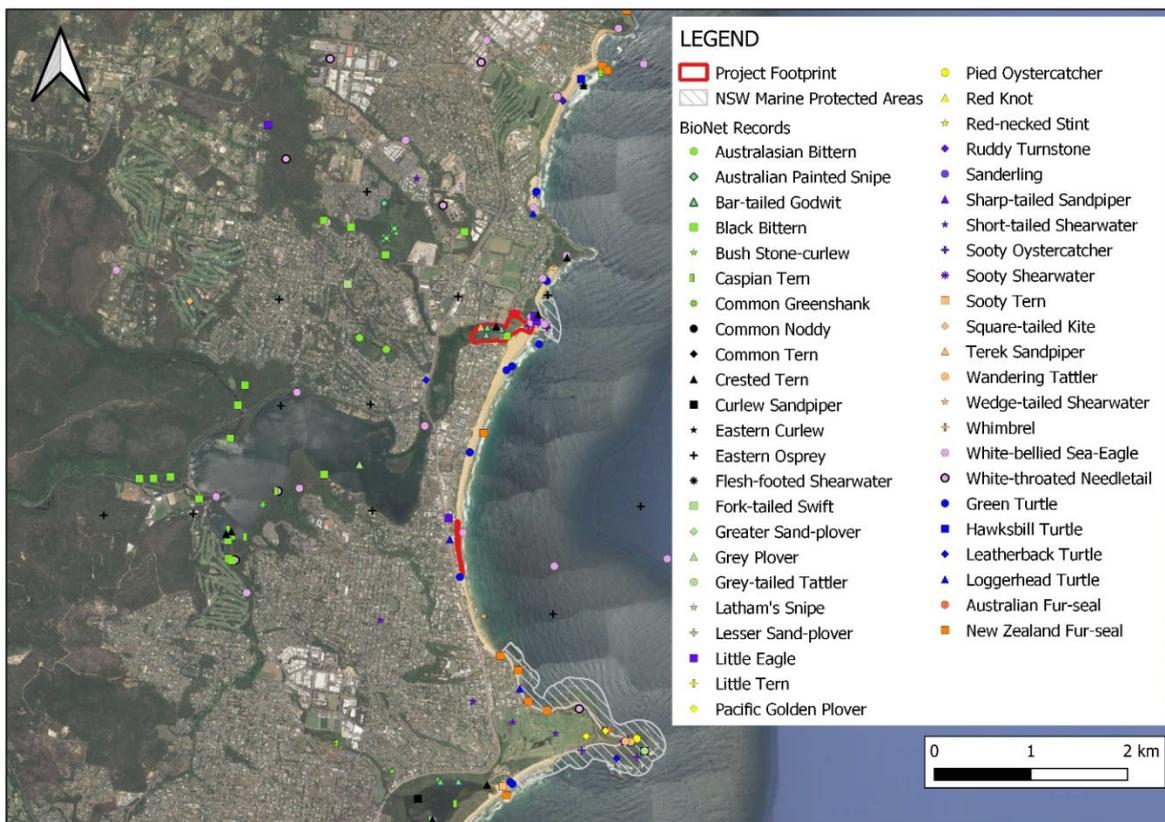


Figure 6-6: Bionet species records for locality (after: H2O Consulting)

Review of Threatened Species Listings under the FM Act for species that may occur in the project area or wider locality (catchment or adjacent waters) identified the following listings relevant to this study:

- 3 threatened sharks and rays; and
- 3 threatened fish.

The EPBC Act Protected Matters Search Tool identified the following threatened species with distributions within a 10 km radius of the project footprint (**Appendix E**):

- 108 threatened species;
- 63 migratory species; and
- 9 Threatened Ecological Communities (TEC).

In addition to the above, the Protected Matters Search Tool identified 81 protected marine species that include certain species of fish, along with some marine birds, reptiles and mammals. A total of four marine mammals were identified as listed cetaceans (**Appendix E**).

Of the EPBC Act listed threatened and/or migratory species and communities, the following estuarine or coastal species were identified as being relevant for this assessment:

- 34 marine birds and shorebirds;
- 5 marine mammals;
- 5 marine turtles;
- 5 sharks and rays;
- 6 fish;
- 1 invertebrate, and
- 2 TECs.

Based on the combined search results of the Bionet database and Protected Matters Search Tool, A range of threatened and/or migratory species were identified as being a total of 65 marine birds and shorebirds (including waders), seven marine mammals, five marine reptiles, five sharks and rays and six fish species which are considered threatened and/or migratory species were identified to require further consideration. A summary of the threatened and migratory species considered as part of this assessment, along with consideration of their likelihood of occurrence, is provided in **Appendix F**. Those species that have a moderate or higher likelihood of occurrence in the locality and potential to be impacted by the proposal are listed in **Table 6-7**.

Table 6-7: Threatened species that may potentially be impacted by the proposal (source: H2O Consulting)

| Species name | Statutory listing* | | No. records | Likelihood of occurrence |
|---|--------------------|-----------------|-------------|--------------------------|
| | BC Act | EPBC Act | | |
| <i>Ardenna pacifica</i> (Wedge-tailed Shearwater) | P | MA, J | 4 | Moderate |
| <i>Ardenna tenuirostris</i> (Short-tailed Shearwater) | P | MA, C, J, K | 18 | High |
| <i>Calidris acuminata</i> (Sharp-tailed Sandpiper) | P | MA, C, J, K | 6 | Moderate |
| <i>Calidris ferruginea</i> (Curlew Sandpiper) | E, P | CE, MA, C, J, K | 3 | Moderate |
| <i>Haematopus longirostris</i> (Pied Oystercatcher) | E, P | - | 2 | Known |

| Species name | Statutory listing* | | No. records | Likelihood of occurrence |
|---|--------------------|-------------|-------------|--------------------------|
| | BC Act | EPBC Act | | |
| <i>Limosa lapponica</i> (Bar-tailed Godwit) | P | MA, C, J, K | 10 | High |
| <i>Pandion cristatus</i> (Eastern Osprey) | V,P | - | 29 | Known |
| <i>Xenus cinereus</i> (Terek Sandpiper) | V, P | MA, C, J, K | 2 | Moderate |

*Key: P = Protected, V = Vulnerable, E = Endangered, CE = Critically Endangered, MA = Marine, C = CAMBA, J = JAMBA, K = ROKAMBA

Existing Ecological Mapping and Aerial Imagery

Existing mapping of estuarine macrophytes by NSW DPI shows *Zostera capricorni* seagrass beds present within and adjacent to the clearance works footprint in the lagoon entrance channel. Mapping shows a moderate bed on the south bank of Narrabeen Lagoon, adjacent to the west side of Ocean Street Bridge, and an extensive bed that starts to the west of the project footprint and extends south into the upper reaches of the lagoon. A thin, continuous bed also runs along the north shore of the lagoon on the west side of the project footprint. The Endangered *Posidonia australis* seagrass population does not occur in Narrabeen Lagoon. Existing mapping also identified isolated saltmarsh and mangrove populations to occur in the vicinity to the west of the project footprint, but not within the project footprint or immediate vicinity.

The nearest Marine Protected Area is the Narrabeen Head Aquatic Reserve, located off Narrabeen Headland, extending from North Narrabeen Rockpool to south Turrimetta Beach, approximately 200 m from the project footprint (**Figure 6-6**). Long Reef Aquatic Reserve is located to the south of the project area around Long Reef Headland. It is about 850 m south of the southern extent of the proposed sand nourishment area on Collaroy-Narrabeen Beach.

A review of the Fisheries Spatial Data Portal indicates there are no aquaculture leases or commercial fisheries exist inside Narrabeen Lagoon or in the nearby vicinity.

The entirety of tidal areas within the project footprint are identified as Key Fish Habitat (KFH). Narrabeen Lagoon is considered to be Type 2 – Moderately Sensitive KFH, based on it being a lagoon that is subject to artificial opening. However, areas of Type 1 – Highly sensitive KFH may also occur inside the lagoon (i.e. seagrass beds >5 m²) (Fairfull, 2013). Collaroy-Narrabeen Beach would be classified as Type 3 KFH due to the dynamic nature of the beach.

Description of Habitat and Biota

Lagoon Intertidal Habitats

Intertidal habitat in the investigation area was comprised of natural sandy banks and banks vegetated with reeds and other macrophytes, rock revetment, and the shallow sand flat in the middle of Narrabeen Lagoon. Within the proposed dredging zones to the west of Ocean Street bridge, the unvegetated shallow sand flat provides intertidal habitat, used as foraging habitat by shorebirds and marine birds.

On the eastern side of the Ocean Street bridge, intertidal habitat is provided by the rock revetment on the northern shoreline. The rocks in the lower sections of the revetment provide hard substrata for common invertebrate species dominated by dense assemblages of Sydney Rock Oysters (*Saccostrea glomerata*), with other common species including Striped-Mouth Conniwinks (*Bembicium nanum*) and Smooth Shore Crabs (*Cyclograpsus audouinii*) (**Figure 6-7d**).



Figure 6-7: Typical habitat in the project area (source: H2O Consulting)

On the western side the bridge, intertidal habitat consists of soft sandy banks, vegetated banks and a short stone seawall. The northern shoreline consists of a large sandy bank that extended 250 m to the west, before a short (60 m) stone seawall and a grassy bank with a small boat ramp. Intertidal vegetation occurs in shallow areas adjacent to the shoreline, dominated by Common Reeds (*Phragmites australis*). On the southern shoreline, the intertidal area is comprised of soft sediment and vegetated banks, with occasional isolated seawalls associated with individual properties. Upper intertidal areas were dominated by the reeds *P. australis*, with sporadic populations of Salt Marsh Rush (*Juncus kraussii*) and four young Grey Mangroves (*Avicennia marina*) were also observed (Figure 6-7a). Invertebrate species in this area were sparse, limited to Sydney Mud Whelks (*Pyrazus ebeninus*) and the upper reaches of patchy oyster reefs that extended into subtidal areas. These small patchy occurrences of oyster reef were limited to the southern shoreline, just under the Ocean Street bridge, with high loads of mixed shell debris observed in the surrounding areas (Figure 6-7b).

The intertidal area and various habitat types, including the sand flat within the proposed clearance footprint, provide foraging and resting habitat for common marine birds and shorebirds. Species that were observed during the survey included Silver Gull (*Chroicocephalus novaehollandiae*), Australian Pelican (*Pelecanus conspicillatus*), Great Egret (*Ardea alba*), Australian Pied Oystercatcher (*Haematopus longirostris*), Plover (*Vanellus miles*) and the common Pacific Black Duck (*Anas superciliosa*).

Lagoon Subtidal Habitats

The subtidal habitat in the project area consisted of a moderately sloping seabed, with some deeper channels. The seabed in the general project area comprised of a mixture of soft sediment, clean marine sands, silt, gravel, shell rubble and large rocks. Benthic habitat within the proposed project footprint was a combination of soft sandy sediment and accumulations of seagrass wrack, with some silty sediment observed closer to Ocean Street bridge in the northeast corner. Some accumulations of wrack in shallow areas were observed to have a layer of cyanobacterial growth, however no live (attached) seagrasses were present.

Benthic habitat to the east of the Ocean Street bridge consisted of soft sandy sediment, bioturbated in parts, with large rocks in deeper areas on the northern side of the Lagoon entrance channel associated with the rock revetment. Rocks provided habitat for dense assemblages of Sydney Rock Oysters (*S. glomerata*) and the common macroalgae Gulfweed (*Sargassum sp.*). Barnacle exoskeletons were also observed on these rocks but did not appear alive (**Figure 6-7d**). To the south near the bridge, a large deposit of seagrass wrack and debris was observed; however, no living seagrasses were observed east of the Ocean Street bridge during this survey.

To the west of the Ocean Street bridge, benthic habitat was predominantly clean marine sands, with some accumulations of gravel, shell rubble supporting oyster reefs and *Z. capricorni* seagrass beds. On the northern shore, subtidal habitat consisted of unvegetated clean marine sands and patchy accumulations of wrack for the entirety of the eastern section of the project footprint and adjacent seabed. Some small high-density patches of the seagrass *Z. capricorni* were mapped adjacent to the seawall, ~60 m to the north of the proposed clearance footprint (**Figure 3-1**). An extensive section of mixed medium- and high-density beds were mapped ~25 m from the western clearance footprint, extending ~60 m back to shore and continuing west past the boat ramp at the western boundary of the project area (**Figure 3-1**). Shallow areas also supported small (<5 m²), scattered *S. glomerata* oyster reefs.

On the southern shore inside of the bridge, subtidal habitat was observed to support an extensive bed of high-density *Z. capricorni*, with its outer fringes ~10 m from the southern boundary of the project footprint (**Figure 3-1**). This bed extended to shore and ~80 m west along the southern shore before a 100 m stretch of unvegetated clean marine sand and shell rubble. Some isolated, small (<5 m²) *S. glomerata* oyster reefs were also observed in this area. A long, thin (<20 m) stretch of mixed density *Z. capricorni* patches and small beds were mapped along the southern shore, ranging from 15-40 m proximity to the southwest of the project footprint (**Figure 3-1**). An additional short, thin stretch of mixed density patches were mapped with a 10 m proximity across 80 m of the southwest project footprint. Seagrass transitioned to extensive, high-density beds past the proposed dredging zone and extended to the west beyond the project area (**Figure 3-1**).

The seagrass beds >5 m² occurring in the project area comprise Type 1 – Highly sensitive KFH. These are located outside of the project footprint.

The seagrass beds and rocks formed protective habitats supporting a diversity of less cryptic fish that were observed to include Yellowfin Bream (*Acanthopagrus australis*), Dusky Flathead (*Platycephalus fuscus*), Common Toadfish (*Tetractenos hamiltoni*), Sand Whiting (*Sillago ciliata*) and small schooling fish.

Lagoon Supratidal Areas

The stockpiling and dewatering site at the base of the Birdwood Park sand dune, at the entrance of Narrabeen Lagoon, is a moderately-sized vegetated sand dune. The sand dune was vegetated by common coastal dune vegetation occurred on some foredunes including Hairy Spinifex (*Spinifex hirsutus*), Pennywort (*Hydrocotyle bonariensis*) and Guinea Flower (*Hibbertia scandens*), with some larger shrubs on the inner side of the dune, such as Coastal Wattle (*Acacia sophorae*). The sand flat stretched from the northern end of the dune around to the beach front, providing some soft sediment intertidal habitat on the shore of the lagoon.

Collaroy-Narrabeen Beach Placement Area

The sand placement site on Collaroy-Narrabeen Beach is an open coastal beach with an easterly aspect and comprised of a clean marine sands. Common coastal dune vegetation occurred on some foredunes including Hairy Spinifex (*S. hirsutus*), Pennywort (*H. bonariensis*) and Guinea Flower (*H. scandens*).

6.6.3 Potential Impacts

The *Guidelines for Aquatic Ecology in Environmental Impact Assessment* (Lincoln Smith, 2003) categorises aquatic ecological impacts in terms of potential physical, chemical and biological effects, which allows for the nature of impacts and their likely magnitude to be assessed. More recently, research on impacts to marine fauna has had increased focus on behavioural impacts as a result of additional sources of disturbance such as underwater noise (Erbe, 2012) and light (Tidau, 2021). A summary of the potential impacts on aquatic biota is provided in **Table 6-8**.

Further discussion on potential impacts to sensitive habitats and species is provided below. The proposal is not expected to trigger any habitat offset requirements for marine species under the BC Act.

Table 6-8: Potential aquatic ecological impacts associated with the proposal (source: H2O Consulting)

| Impact | Likelihood | Description |
|---|------------|--|
| Physical impacts | | |
| Removal or modification of KFH | Known | Unvegetated sand shoals in the lagoon entrance channel will be removed. These areas comprise Type 2 – Moderately Sensitive KFH. |
| Removal or loss of marine vegetation | Unlikely | The works would not remove any marine vegetation. |
| Disturbance to a TEC or Endangered Population | Unlikely | There are no TECs or Endangered Populations in the works footprint. |
| Disturbance to a threatened or migratory species or their habitat | Possible | The removal of shallow intertidal sand shoals in the lagoon entrance channel has potential to impact on the availability of foraging habitat for some threatened marine or migratory bird species. There is similar habitat elsewhere in Narrabeen Lagoon and in Dee Why Lagoon to the south that could be utilised by these species until such time as the lagoon entrance shoals re-form. |
| Physical disturbance to marine fauna and flora | Likely | The clearance works would disturb any epibenthic organisms (sessile invertebrates) and benthic infauna associated with the sediments that are to be removed. There is unlikely to be physical disturbance of marine vegetation or mobile fauna species, which are anticipated to move away from the works area. There is potential for physical disturbance of any benthic infauna associated with sand placement area as well. |

| Impact | Likelihood | Description |
|--|------------|--|
| Barriers to fish passage | None | The works are not expected to result in any permanent barriers to fish passage. The placement of silt curtains to mitigate potential sedimentation in seagrass beds is not expected to act as a real barrier to fish passage. |
| Injury caused by ingestion of, or entanglement in, harmful marine debris | Possible | The proposed works are not expected to generate any marine debris, provided the mitigation measures in this REF are implemented. |
| Potential for increased risk of vessel strike for marine fauna | Unlikely | There would be no vessel movements in the ocean. There may be vessel movements in the entrance channel if a dredge is used to undertake the works. However, the closure of the entrance during the works is likely to preclude the presence of marine megafauna that could be at risk of vessel strike. |
| Generation of noise resulting in injury | Unlikely | The level of underwater noise expected to be generated by the works is expected to be well below levels potentially harmful to marine fauna. |
| Chemical | | |
| Changes in water quality | Likely | <p>The entrance clearance works, including excavations (or dredging) and de-watering, are expected to result in elevated turbidity levels at the time the works are happening. The risk of resultant impacts to marine biota, in particular seagrasses, would be mitigated through the deployment of silt curtains.</p> <p>There is potential for some mobilisation of sand into the immediate nearshore surf zone during the sand placement. However, this would be minor in the context of the natural mobilisation of sand due to wave activity.</p> <p>The risk of other water quality impacts (e.g. spills) would be mitigated through the safeguards identified in this REF.</p> |
| Mobilisation of contaminants | Unlikely | As discussed in Section 6.2 , the material excavated from the lagoon entrance is expected to be clean marine sand. |
| Nutrication | Unlikely | The works are not expected to result in any nutrient inputs as the sediments to be dredged are expected to be clean marine sands that has accumulated since the previous clearance works in 2021. |
| Biological | | |
| Invasion or spread of non-native or invasive species | Possible | There is potential for the introduction of the aquatic weed <i>Caulerpa taxifolia</i> (or other aquatic pests or weeds) via construction machinery brought to the site for the works. |
| Introduction of disease or pathogens | Unlikely | No diseases or pathogens have been identified in the study area that pose a risk to marine flora and fauna. |
| Behavioural | | |
| Generation of underwater noise | Unlikely | The level of underwater noise associated with the entrance clearance works may result in some behavioural changes for fish and crustaceans who may move away from works area but are not expected to have any material behavioural impacts (e.g. on migratory marine species). |

Seagrasses

Given the design of the clearance works adopts a 10 m buffer from seagrasses, and that some patches/beds are located further away than this, direct impacts to seagrasses are not anticipated. There is however potential for indirect impacts through increased turbidity and mobilisation of sediments, resulting in sedimentation of, and reduced light penetration to, seagrasses where they are growing close to the works. Seagrasses, particularly *Z. capricorni*, are susceptible to changes in light availability and sedimentation (Kirkman and Kuo 2012) that may arise from water quality disturbances during sand clearance. This could result in decline in seagrass health or smothering. In addition, there is potential for seagrass damage by vessels, barge anchors and/or silt curtains. However, *Z. capricorni* is known to have a high capacity to re-establish from the natural seed bank (Waycott *et al.*, 2014) and any such impacts are expected to be short-term, provided the mitigation measures in this REF are implemented.

Given direct impacts to seagrasses and estuarine macrophytes have been avoided, the proposal is not expected to trigger any offsetting requirements under the FM Act.

Marine birds, shorebirds and waders

Impacts to these types of birds that may arise due to the entrance clearance works may include short-term disturbance to habitat quality relating to reduced water quality, lower prey abundances, construction noise, and loss or modification of some of the existing foraging habitat. Such foraging habitat for these species is well represented further upstream in Narrabeen Lagoon or the intertidal and wash zones of Collaroy-Narrabeen Beach; however, it is likely that these species may continue to use habitat in the study area during works. The assessments of significance in **Appendix G** has considered potential foraging and roosting impacts on Threatened Wading Shorebirds and Marine birds in more detail. No significant impacts are anticipated.

A wide diversity of marine birds that forage along the NSW coastline are likely to also forage in habitat in and around the study area at times. The Australian Pelican (*Pelecanus conspicillatus*) and Great Egret (*Ardea alba*) were observed near the lagoon entrance during the site survey, while species such as the Eastern Osprey (*Pandion cristatus*) and White-bellied Sea Eagle (*Haliaeetus leucogaster*) have also been known to frequent the area (Cardno, 2021). These shorebirds and raptors typically forage over the water and detect prey aerially from above (Billerman *et al.*, 2020; DAW, 2020). There is potential that reduced prey detection success from waters with elevated levels of turbidity may impact on some species that forage as waders or aerially (Lunt and Smee, 2015), or due to a decrease in available prey as a result of disturbance from dredging works. The potential for detrimental impacts to the water quality from the proposed dredging operations is considered generally limited in spatial extent considering the vast areas of coastal waters these species utilise for foraging, thus, it is highly unlikely that any disturbance to aerial foraging for these species would be of ecological significance. The assessments of significance for Threatened marine birds and shorebirds concluded significant impacts to these species was unlikely and that further assessment is not required (refer **Appendix G**).

Marine mammals

It is unlikely that marine mammals such as dolphins and fur-seals would enter the shallow entrance channel of the lagoon. It is also unusual for these species to occur in shallow water amongst the surf zone of Collaroy-Narrabeen Beach, with any such occurrences likely transient or an opportunistic pursuit of prey. Given these species forage over very large areas of the coastline and the limited habitat the

works area provides, the potential for significant impacts on these species as a result of the proposed clearance works is considered low.

Marine reptiles

Marine turtles are known to travel along the adjacent. However, the periodic entrance closure and shallow tidal channel when open would likely preclude access by turtles. It is anticipated that any passing turtles would avoid the works area on Collaroy-Narrabeen Beach. Hence, the works are considered unlikely to impact on any threatened marine turtles that may be transiting the area.

Fish, sharks and rays

Large sharks and rays including the Threatened Great White Shark (*Carcharodon carcharias*) and Grey Nurse Shark (*Carcharias taurus*) are known to travel along the adjacent coastline but are highly unlikely to occur close to shore or in the lagoon, thus further assessment for these species is not required.

Given the relatively slow forward progress of the dredge or machinery during the clearance works, any fish, sharks and rays would have sufficient time and mobility to move away from the works to suitable alternative areas nearby. Direct impacts on these species are considered unlikely. It is possible, however, that the disturbed seabed and uncovering of benthic infaunal prey species in the works area may attract species such as Yellowfin Bream (*Acanthopagrus australis*) and Dusky Flathead (*Platycephalus fuscus*).

Cryptic species such as protected Syngnathid fishes are likely restricted to habitat associated with the seagrasses, which are not expected to be directly impacted. The Endangered White's Seahorse (*Hippocampus whitei*) is not known to occur in the lagoon, which lacks its preferred habitat among *P. australis*.

It is extremely unlikely that benthic habitat within and in Lagoon entrance channel would provide suitable habitat for the Vulnerable Black Rockcod (*Epinephelus daemeli*), particularly given its episodic connectivity with coastal waters. Further, the small amounts of rocky subtidal habitat located in the project area would provide only marginal potential habitat for juvenile Black Rockcod (NSW DPI, 2015). Hence, it is considered unlikely the works would impact Black Rockcod.

Marine invertebrates

The clearance works would likely result in the loss of some invertebrate and infauna community assemblages, which would likely to consist of various polychaetes, gastropods and bivalves. However, re-colonisation of the benthic sediments in the works footprint would likely begin soon after the works and rapidly recover to pre-works diversity and abundance (Dernie *et al.*, 2003). The same impact is expected with respect to any benthic infauna at the beach replenishment site.

Key Threatening Processes

The following Key Threatening Processes (KTPs) are potentially relevant to the proposal:

- *Entanglement in, or ingestion of, anthropogenic debris in marine and estuarine environments* (KTP under the FM Act and EPBC Act) – The generation of marine debris would be avoided by implementation of the safeguards and mitigation measures in this REF, in particular those relating to waste management and accidental spills (refer **Sections 6.9 and 6.3**); and
- *Introduction of non-indigenous fish and marine vegetation* (KTP under the FM Act) – The risk of importation of pests, weeds or diseases to Narrabeen Lagoon and Collaroy-Narrabeen Beach is

considered manageable provided the hygiene procedures identified in this REF are implemented (refer **Section 6.6.4**).

6.6.4 Mitigation Measures

The following measures and safeguards will be adopted to minimise the potential impacts of the proposal on biodiversity:

- The location of sensitive seagrass habitat will be marked on the design drawings. Direct disturbance of seagrasses will be avoided, including by operation of vessels or machinery, dredge pipes or silt curtains, and dewatering discharge.
- The position of the dredge pipe/excavator bucket shall be inspected regularly to ensure no impacts to seagrasses.
- Stockpiling and dewatering areas should not be placed on vegetated land or habitat for roosting or nesting habitat for shorebirds.
- Silt curtains shall be placed around seagrass beds to prevent sedimentation from clearance works, including dewatering activities. The silt curtains should be placed so as to avoid direct contact with the seagrass beds and inspected weekly to ensure their ongoing effectiveness.
- The measures identified in **Sections 6.2.3 and 6.3.3** will be implemented to minimise the impact of erosion and sedimentation, and water quality impacts, on biodiversity.
- All equipment and machinery will be clean and free of *C. taxifolia* and other pests and weeds prior to being mobilised to the site.
- Sand placement areas on Collaroy-Narrabeen Beach are to inspected for fauna prior to the commencement of works, and after storm events or high seas, to avoid trampling of birds (such as Shearwaters) that may have washed ashore.
- The works on Collaroy-Narrabeen Beach shall avoid vegetated land.

6.7 Heritage

6.7.1 Existing Environment

Listed Aboriginal and non-Aboriginal cultural heritage sites and places were identified via a search of the relevant State and federal statutory and non-statutory registers, including:

- World Heritage List;
- Commonwealth Heritage List;
- National Heritage List;
- State Heritage Register;
- Warringah and Pittwater LEPs;
- Transport for NSW and Sydney Water Section 170 Heritage and Conservation Registers;
- Register of the National Estate;
- Aboriginal Heritage Information Management System (AHIMS).

The items of local significance located near the study area are listed in **Table 6-9**. Those items that are closest to the proposal footprint are mapped in **Figure 6-8**.

Table 6-9: Listed heritage items in the study area

| Item | Location | Listing | Proximity to study area |
|--|---|--|--|
| Ocean rock pool – Narrabeen Beach | Narrabeen Headland | Pittwater LEP Item 2270137 | 73 m to east of project footprint |
| Group of Washington Palms (<i>Washingtonia robusta</i>) | Southern foreshore west of the Ocean Street bridge | Warringah LEP Item I91 | Adjacent to project footprint / 23 m from clearance area |
| Stone Wall | Located along Ocean Street between the bridge and Malcolm Street | Warringah LEP Item I93 | Adjacent to Birdwood Park construction access, along haulage route |
| Narrabeen Lake Bridge (RTA Bridge No. 56) | Pittwater Road bridge over Narrabeen Lagoon | Warringah LEP Item 35771 | Along haulage route |
| House | 1184-1186 Pittwater Road (corner of Clarke Street and Pittwater Road) | Warringah LEP Item I25 | Abuts beach replenishment area |
| Narrabeen Fire Station | 9 Ocean Street, Narrabeen | Register of the National Estate (non-statutory archive), Warringah LEP 2011 Item I94 | Along haulage route |
| Vegetation group | 58–62 Ocean Street (corner of King Street), Narrabeen | Warringah LEP 2011 Item I95 | Within 500 m of replenishment area |
| House known as ‘Lemville’ | 14 Goodwin Street, Narrabeen | Warringah LEP 2011 Item I90 | Within 500 m of replenishment area |
| House known as ‘Chez Nous’ | 19 Frazer Street, Collaroy | Warringah LEP 2011 Item I135 | Within 500 m of replenishment area |
| Narrabeen Primary School: | | | |
| <ul style="list-style-type: none"> • Memorial known as “SS Collaroy Memorial” • Sandstone memorial • School administration building • Main school building | 1299 Pittwater Road, Narrabeen | Warringah LEP 2011 Items I98, I99, I100, I101 | Within 500 m of replenishment area |
| Narrabeen Lagoon Catchment | Wakehurst Parkway, Narrabeen | Register of the National Estate (non-statutory archive) | Encompasses clearance area |



Figure 6-8: Locally listed heritage items (source: SEED Portal, accessed 13/06/2023)

There were no items listed on the World Heritage, Commonwealth Heritage, National Heritage, State Heritage or Section 170 Registers.

There are two AHIMS sites in proximity to the works:

- Site 45-6-0738 – Narrabeen Head, which is an archaeological site with a midden and an open camp site; and
- Site 45-6-2747 – Octavia Street Burial, which is a burial site located on Ocean Street.

Neither of these sites are located within the proposed project footprint.

6.7.2 Potential Impacts

No direct impacts to heritage listed sites, including AHIMS sites, are anticipated as a result of the proposal. There is potential for indirect impacts to built heritage items located along the haulage route or in proximity to the works due to the vibration associated with truck movements, which can indirectly impact structures. However, no such issues have arisen during past entrance clearance works and no impacts are anticipated.

The proposed clearance areas are located within the curtilage of the ‘Narrabeen Lagoon Catchment’ site. The Statement of Significance for this item identifies the importance of the recreational and ecological values of the lagoon. As discussed, in **Sections 6.8 and 6.6** (respectively), impacts to these values are expected to be short-term and limited to the works phase. Provided the mitigation measures and safeguards in this REF are implemented, no significant impacts are anticipated.

There remains potential to encounter unexpected finds during the works. The risk is generally considered low given the clearance area in the lagoon entrance channel is expected to comprise clean marine sand (refer **Sections 6.1 and 6.2**). No excavation is proposed in the replenishment area, although the placement of the sand on the beach has potential to result in some disturbance of surficial sediments. However, similar to the lagoon entrance, this area is a highly dynamic environment and is subject to regular cycles of erosion and accretion (refer **Section 6.1**). Hence, it is considered there is a low likelihood of unexpected finds.

No operational phase impacts to items of Aboriginal or non-Aboriginal cultural heritage significance are anticipated during the operational phase.

6.7.3 Mitigation Measures

The following measures and safeguards will be adopted to minimise the potential impacts of the proposal on heritage:

- No works shall be undertaken outside the project footprint (refer **Figure 1-1**) or on private land.
- The CEMP will include a procedure for managing unexpected finds during construction. The procedure will be implemented if unanticipated heritage items, relics or archaeological material are located during the works.
- All works personnel will be inducted on their responsibilities in relation to heritage items and sites, informing them of the location and significance of known heritage items in proximity to the works and the unexpected finds procedure in the CEMP.
- If unexpected ‘relics’ are encountered during excavation, a Section 146 relics notification will be forwarded to Heritage NSW. ‘Relics’ cannot be impacted without appropriate approvals under the *Heritage Act 1977*.

6.8 Socio-economic

6.8.1 Existing Environment

The Australian Bureau of Statistics 2021 Census Community Profile for the Northern Beaches LGA (ABS, 2023) records a population of 263,554 people, of which 0.6% identify as Aboriginal and/or Torres Strait Islanders. Portuguese, Italian and Spanish are the three languages other than English most commonly spoken in the home.

The main land use types adjacent to the works areas include residential and public open space / recreational land. There are also some community facilities (e.g. the Coastal Environment Centre and SLSC) and tourist accommodation (Sydney Lakeside Holiday Park) near the clearance works area.

The public open space areas are comprised of the Lagoon waterway and adjacent shorelines, Birdwood Park and Dune, and Collaroy-Narrabeen Beach. Narrabeen Lagoon, and in particular the entrance channel either side of the Ocean Street bridge, is a popular recreational area for both land-based and aquatic recreational activities such as swimming and paddling, snorkelling, boating, use of personal watercraft, fishing, walking, picnics and BBQs, cycling, and general enjoyment of the natural environment (RHDHV, 2022). Fluctuations in lagoon water levels and periodic water quality issues (refer **Sections 6.1.1 and 6.3.1**, respectively) may on occasion affect aquatic recreational activities, although the opening of the lagoon affords benefits to aquatic recreation due to improved water quality associated with tidal flushing of the entrance channel.

The section of Collaroy-Narrabeen Beach in the replenishment area footprint is also popular for walking, sunbathing and swimming. As discussed in **Section 6.1.1**, beach amenity and access can be negatively impacted at times when there is less sand on the beach.

The North Narrabeen SLSC was founded in 1912-1913 and is located near Birdwood Park. It is an important community hub, hosts events and provides volunteer surf life-saving patrols and training. Nippers training is typically on a Sunday from October to March. The SLSC also hosts competitions over Summer. The North Narrabeen Boardriders club also has a dedicated space located in the SLSC.

The North Narrabeen National Surfing Reserve, which is located adjacent to the Lagoon entrance, was dedicated in October 2009 in recognition of its important role in the history of surfing culture in Australia and the number of surfing champions associated with the local area (RHDHV, 2022). North Narrabeen Beach is a world-famous surf break, known to have one of the most consistent, quality surf breaks on the east coast of Australia. The presence of sand bars, rips, rocky reefs, tidal conditions and swell characteristics of the site all contribute to the creation of a quality surf break. The quality of one of the key breaks in the Surfing Reserve, the Alley left break, is on any given day generally a result of recent large swells as well as the decadal rotation of the whole of Collaroy-Narrabeen Beach (resulting in more or less sand at North Narrabeen depending on the rotation state).

North Narrabeen Beach hosts local, state, national and international surfing competitions, including the World Surf League Championship tour event (the Narrabeen Classic) and Sydney Surf Pro Challenger Series, which is held annually at North Narrabeen Beach (RHDHV, 2022). The Surfing Reserve and various surfing competitions held on Narrabeen Beach attract large number of visitors and contribute to the regional economy.

The impact of flooding on low-lying land around Narrabeen Lagoon is discussed in **Section 6.1**. Catchment flood events can have a range of socio-economic impacts, including damage due to flooding of public and private land, disruption to daily activities such as travelling around the local area and general stress, as well as displacement of residents when evacuations are required. The *Narrabeen Lagoon Floodplain Risk Management Study* (Cardno, 2019) calculated (pre-mitigation or existing) average annual damage costs of flooding at \$11.54 million.

6.8.2 Potential Impacts

During the works there would be short-term, minor impacts on the recreational use of the Lagoon entrance channel and foreshores, and of the replenishment area. Fencing would prohibit public access to the works area. The potential impacts on traffic, transport and public access are discussed in **Section 6.4.2**. There may also be some disruption to the community associated with noise during the works, as detailed in **Section 6.5.3**. Visual impacts are discussed in **Section 6.11.2**. Impacts to local businesses are not anticipated as a result of the works.

In the operational phase, the key benefit of the proposal is related to flood mitigation. As well as alleviating the social impacts of flooding, the entrance clearance works were shown to reduce the average annual damages associated with flooding by \$2.4 million (Cardno, 2019). In addition, the entrance clearance works, also make the mechanical entrance opening more efficient. Other benefits associated with the proposal include:

- Improved water quality for recreational users of the lower reaches of Narrabeen Lagoon associated with reinstatement of tidal flushing;
- Recreational fishing opportunities associated with recruitment of fish and prawns during entrance open conditions (where coincident with a recruitment event); and
- Improved public access and beach amenity due to increased beach volume associated with the replenishment works on Collaroy-Narrabeen Beach.

These benefits are associated with the entrance opening and would be of a medium-term duration.

The potential impacts of the proposal on North Narrabeen surf break is not known, although many local experts agree that the quality of the surf break is more directly associated with other conditions and does not appear to be influenced by the Lagoon entrance condition (RHDHV, 2022).

6.8.3 Mitigation Measures

The following measures and safeguards will be adopted to minimise the adverse socio-economic impacts of the proposal:

- The CEMP would include the mitigation measures in **Sections 6.1.3, 6.3.3, 6.4.3 and 6.5.4**.
- Northern Beaches Council will prepare a community engagement plan prior to the commencement of works, to be implemented during construction to provide timely and up to date information to the community during construction. It would include, as a minimum:
 - Mechanisms to provide details and timing of proposed activities to affected residents and local businesses, including changes to traffic and access; and
 - A contact name and telephone number for complaints. Contact details will be clearly displayed at the entrance to the entrance clearance works sites and all affected beach accessways at the replenishment area.
- A webpage and telephone number will be established for enquiries regarding the proposal and will remain active for the duration of the works.
- All enquiries and complaints will be tracked through a tracking system and be acknowledged within 24 hours of being received.

6.9 Air Quality and Climate

6.9.1 Existing Environment

The existing air quality near the location of the proposal is primarily influenced by emissions from motor vehicles and residential activities. Air quality is also influenced by the prevailing weather and climatic conditions, bushfires and other natural factors such as pollen. The *NSW Annual Air Quality Statement 2022* (DPE, 2023d) reports that pollutant levels were within National Environmental Protection Measures 100% of the time for the East Sydney Region, which encompasses the Northern Beaches LGA.

The nearest BoM automatic weather stations is at Terrey Hills (066059), about 4 km away from the project location. Mean monthly rainfall over Spring (when the works would be undertaken) ranges from 55.2 mm to 96.3 mm, with an average number of days with at least 10 mm of rainfall ranging from 1.8 to 3.4 days (BoM, 2023).

6.9.2 Potential Impacts

Rainfall events have the potential to create runoff from stockpiles of excavated material, increasing turbidity in the Lagoon or nearshore zone along Collaroy-Narrabeen Beach. However, provided the mitigation measures in **Section 6.3.3** are implemented, this risk is considered low.

The potential impacts of the proposal on air quality are related to exhaust emissions from works vehicles, plant and machinery, and aeolian transport of excavated material. Emissions from vehicles, plant and machinery would be short-term and temporary, and would be unlikely to noticeably change the air quality of the locality.

The risk of aeolian transport of excavated material is considered low given it will be wet when excavated, although there is a chance of mobilisation of material under windy conditions or during transport. This risk would be managed through implementation of the mitigation measures in **Section 6.2.3**.

There would be no operational phase impacts on air quality or climate.

6.9.3 Mitigation Measures

The following measures and safeguards will be adopted to minimise the impacts of the proposal on air quality:

- The CEMP would include the mitigation measures in **Sections 6.2.3 and 6.3.3**.
- All plant, equipment and vehicles will be maintained to ensure good operating conditions and exhaust emissions in compliance with the relevant legislation, including the PoEO Act.
- Machinery and vehicles will be turned off rather than left to idle when not in use.

6.10 Waste Management

6.10.1 Existing Environment

There are no waste generating activities associated with the entrance clearance area or sand placement area. Rubbish bins are provided for visitors to Birdwood Park.

6.10.2 Requirements

Section 143 of the PoEO Act requires waste to be transported to a place that can lawfully accept it and that the owner of the waste and the transporter are responsible for ensuring that waste is transported to a suitable waste facility. Principles of waste management and the Resource Management Hierarchy (e.g. avoid, reduce, reuse, dispose) are also embodied in the *Waste Avoidance and Resource Recovery Act 2001*.

6.10.3 Potential Impacts

Based on historic entrance clearance works and noting the proposed works methodology, it is expected that the amount of waste material or materials of a hazardous nature generated as result of the works would be negligible. General waste from construction personnel and maintenance activities would be generated during the works at the Bird Park construction compound. There is potential for accidental spills of hydrocarbons, hydraulic fluids and other chemicals, although this risk is considered manageable provided the mitigation measures detailed in **Section 6.3.3** are implemented during the works.

The design of the sand replenishment works on Collaroy-Narrabeen Beach assumes all material excavated from the Lagoon would be placed on the beach, although there is a low potential for excavation of a small amount of material unsuitable for this purpose which would require an alternative disposal method.

Waste generation is not expected during the operational phase.

6.10.4 Mitigation Measures

The following measures and safeguards will be adopted to minimise the impacts of the proposal on air quality:

- The CEMP would include the mitigation measures in **Section 6.3.3**.
- The CEMP would identify potential waste streams associated with the works. The CEMP would include measures to minimise waste, outline methods of disposal, re-use and recycling and monitoring, as appropriate.
- Any excavated material that requires off-site disposal will be classified in accordance with the *Waste Classification Guidelines* (EPA, 2014) and disposed of at a suitably licenced waste management facility where an appropriate beneficial re-use cannot be identified.

6.11 Visual Amenity and Landscape Character

6.11.1 Existing Environment

The landscape character of project locality is characterised by the residential land use, recreational open space and natural environments associated with Narrabeen Lagoon, Birdwood Dune, Narrabeen Head and Collaroy-Narrabeen Beach.

The proposed placement area on Collaroy-Narrabeen Beach is characterised by residential development with landscaped gardens and the beach, with dune vegetation located between these two land uses in places.

The project locality is generally a coastal suburban environment, with views to and along the coast and across Narrabeen Lagoon. The headlands, remnant bushland, coastal views and seascape are key components of the high visual amenity of the locality.

6.11.2 Potential Impacts

The proposal would result in short-term, temporary visual impacts to the locality during the works phase due to the presence of stockpiles, machinery and vehicles and the use of fencing to preclude access to the site compound(s) and works areas.

Following the completion of the works, there would be minor, short to medium-term visual impacts associated with the removal of the sand shoals in the Lagoon entrance and increase in beach volume

arising from the placement of sand in the placement area. However, these changes would be within the range of natural variation due to coastal and catchment flood processes.

6.11.3 Mitigation Measures

The following measures and safeguards will be adopted to minimise the impacts of the proposal on the visual amenity of the locality:

- The site compound would be fenced and screened where possible.
- Works would be undertaken during standard construction hours. Outside these times, all plant, machinery and equipment would be kept in the construction compound.
- The works site will be kept clean and tidy for the duration of the works.
- No vegetation removal is permitted.
- All works compounds / staging areas are to be reinstated to their original, pre-works condition following the completion of the works.

6.12 Utilities and Services

6.12.1 Existing Environment

A Dial Before you Dig search was undertaken on 22 March 2023 to identify utilities and services in the proposal footprint:

- Council stormwater assets located at the end of Mactier Street and running from Ocean Street across Birdwood Park and discharging to the Lagoon; and
- A 750 mm Sydney Water potable water main located on the western side of the Ocean Street bridge.

No sub-surface utility investigations were undertaken to confirm the location of utilities and services.

There is potential for unknown services to exist with the proposal footprint.

6.12.2 Potential Impacts

There is potential for the works to impact utilities and services located in the proposal footprint, including previously unknown services. It is considered that impacts to the utilities identified in **Section 6.12.1** could be reasonably avoided during the works and the risk to these utilities is considered low.

No operational phase impacts are anticipated.

6.12.3 Mitigation Measures

The following measures and safeguards will be adopted to minimise the impacts of the proposal on utilities and services:

- The location of utilities and services within the proposal footprint, or with potential to be impacted by the works, will be confirmed by the Contractor prior to the commencement of works to enable further assessment and mitigation of any potential impacts to utilities.

6.13 Cumulative Impacts

6.13.1 Existing Environment

It is possible that there would also be other projects in the construction phase at the same time as the entrance clearance works.

A review of Council's Development Applications (DA) register identified the following DA that may potentially result in concurrent construction with the proposed entrance clearance works:

- DA2021/1612 – Construction of coastal protection works at 1 Clarke Street and 1192, 1194, 1196 and 1204 Pittwater Road. A review of the latest NearMap imagery (1/05/2023) indicates these works have not yet commenced, and there is no record of a Construction Certificate having been issued by Council.

All other DAs for Collaroy, Narrabeen and North Narrabeen for properties located in the vicinity of the proposal footprint are for minor developments such as alterations and additions to a residential development.

A search of the NSW Planning Portal undertaken on 13 June 2023 did not identify any other DAs or State Significant Applications for the general locality.

6.13.2 Potential Impacts

There is potential for the construction of the coastal protection works and the entrance clearance works to be undertaken concurrently. Should this occur, cumulative impacts may include:

- Short-term, temporary impacts to traffic, on-street parking and access on the affected roads and footpaths accessways associated with respective projects;
- Temporary loss of pedestrian access to the beach via beach accessways from both projects;
- Cumulative noise and vibration impacts to local residents, businesses and users of recreational areas associated with the respective projects; and
- Increased visual impacts to the locality.

6.13.3 Mitigation Measures

The following measures and safeguards will be adopted to minimise the cumulative impacts of the proposal on the locality:

- Where possible, scheduling of the works will avoid the respective projects being in construction at the same time.
- Prior to the commencement of works, Council will coordinate with any other local developments (including the coastal protection works under DA2021/1612) in an effort to minimise cumulative impacts to the community associated with traffic, noise, etc.

7 Environmental Management

7.1 Environmental Management Plans

A number of safeguards and mitigation measures have been identified in this REF in order to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the proposal. Should the proposal proceed, these safeguards and mitigation measures would be incorporated applied during the works and during operation of the proposal.

A Construction Environmental Management Plan (CEMP) will be prepared to describe the safeguards and mitigation measures identified. The CEMP would provide a framework for establishing how these measures would be implemented and who would be responsible for their implementation.

The CEMP will be prepared prior to the commencement of works and must be reviewed and approved by Northern Beaches Council prior to the commencement of any on-site work. The CEMP will be a working document, subject to ongoing change and updated as necessary to respond to specific requirements.

7.2 Summary of Safeguards and Mitigation Measures

The safeguards and mitigation measures detailed in this REF are summarised in **Table 7-1**.

Table 7-1: Summary of safeguards and mitigation measures

| No. | Environmental safeguards | Responsibility | Timing |
|------|---|----------------|---------------------------------|
| GEN1 | <p>A CEMP will be prepared prior to the commencement of works and must be reviewed and approved by Council prior to the commencement of works. As a minimum, the CEMP will address the following:</p> <ul style="list-style-type: none"> Any requirements associated with statutory approvals. Details of how the project will implement the identified safeguards outlined in the REF. Issue-specific environmental management plans (if required). Roles and responsibilities. Communication requirements. Induction and training requirements. Procedures for monitoring and evaluating environmental performance, and for corrective action. Reporting requirements and record-keeping. Procedures for emergency and incident management. Procedures for audit and review. <p>The approved CEMP will be implemented during the undertaking of the activity.</p> | Contractor | Pre-construction |
| GEN2 | All personnel working on site will receive training to ensure awareness of environment protection requirements to be implemented during the project. This will include up-front site induction and regular 'toolbox' style briefings. | Contractor | Pre-construction / Construction |
| HHG1 | The Contractor's CEMP will detail when and how the entrance should be opened and closed. | Contractor | Pre-construction |
| HHG2 | A temporary berm would be established across the lagoon entrance, with a crest height of 2 mAHD, to maintain the lagoon water level of not less than 0.4 mAHD for the duration of the works and prevent waves and tidal currents impacting the works. | Contractor | Pre-construction |

| No. | Environmental safeguards | Responsibility | Timing |
|------|---|----------------|------------------|
| HHG3 | Local weather and marine forecasts provided by the BoM would be monitored daily for the duration of the works, as would lagoon water levels as measured at the Ocean Street bridge gauge (station ID 213408D) maintained by MHL. | Contractor | Construction |
| HHG4 | An Incident Response Plan shall be prepared as part of the CEMP, to include consideration of catchment floods and coastal storms. All construction personnel will be inducted in the Plan. | Contractor | Pre-construction |
| HHG5 | In the event of a forecast high rainfall/flood event or big ocean swells, plant and equipment is to be relocated to higher ground. | Contractor | Construction |
| HHG6 | In the event of a catchment flood during construction: <ul style="list-style-type: none"> • Works are to cease immediately and all plant and equipment secured or moved to higher ground, • A mechanical breakout is to be implemented under the direction of Council in accordance with EM-OMS 455, and • A temporary berm is to be re-established at the lagoon entrance as soon as possible following the breakout event to facilitate the completion of the works. | Contractor | Construction |
| SS1 | The depth of excavation shall be progressively monitored during the works to ensure it conforms to the design. This should be undertaken by the Contractor, but also independently verified by Council. | Contractor | Construction |
| SS2 | The CEMP shall identify the steps to be taken in the event of over-excavation. | Contractor | Pre-construction |
| SS3 | In the event material other than clean marine sands are encountered during the clearance works, a field pH test should be undertaken to test for ASS. If the field testing confirms the presence of Actual or Potential ASS, the material will be managed in accordance with the <i>Acid Sulfate Soil Manual</i> (ASSMAC, 1998). | Contractor | Construction |
| SS4 | In the event suspected contaminated material is encountered during the works, works shall cease immediately, the material contained and Council's Project Manager contacted to determine a suitable course of action, to include as a minimum, laboratory testing of the material. | Contractor | Construction |
| SS5 | An Erosion and Sediment Control Plan (ESCP) is to be prepared and implemented in accordance with Landcom (2004) <i>Managing Urban Stormwater – Soils and Construction – Volume 1</i> (the 'Blue Book'). | Contractor | Pre-construction |
| SS6 | Movement of excavated material is not to be undertaken during periods of high rainfall or high wind. | Contractor | Construction |
| SS7 | Erosion and sediment controls will be checked and maintained on a regular basis and records of such inspections kept and provided upon request. | Contractor | Construction |
| SS8 | Visual monitoring of local water quality (e.g. turbidity, hydrocarbon spills/slicks) is to be undertaken on a regular basis to identify any potential spills or deficient silt curtains or erosion and sediment controls. | Contractor | Construction |
| SS9 | Stockpiles for de-watering of excavated material would be suitably bunded and water discharged back into the lagoon monitored visually for high suspended sediments loads. | Contractor | Construction |
| WQ1 | Silt curtains are to be installed around any sensitive marine habitats (i.e. seagrasses) prior to the commencement of work. The silt curtains will be | Contractor | Construction |

| No. | Environmental safeguards | Responsibility | Timing |
|-------------|--|----------------|------------------|
| | monitored and maintained for the duration of the works as required to contain any suspended sediments. | | |
| WQ2 | Re-fuelling of plant and equipment, or any other activity with potential to result in an accidental spill, is to be undertaken in an impervious bunded area away from drainage lines. | Contractor | Construction |
| WQ3 | Any re-fuelling of plant or machinery or storage of hazardous materials on barges (or vessels) is to occur in a double-bunded area. | Contractor | Construction |
| WQ4 | An emergency spill kit is to be kept on site at all times and maintained throughout the works. The spill kit must be of an appropriate type for the volume and type of substances to be used during the works. Spill kits for barges must be specific for working in the marine environment. | Contractor | Construction |
| WQ5 | In the event of an accidental spill, Council's Project Manager is to be notified as soon as practicable. | Contractor | Construction |
| WQ6 | Emergency contacts will be recorded in the CEMP and kept in readily accessible places in vehicles, vessels and at the site office. All workers will be advised of these contact details and procedures. | Contractor | Construction |
| WQ7 | All construction personnel will be trained in the use of the spill kits kept on site. | Contractor | Construction |
| WQ8 | Vehicles, vessels and plant will be properly maintained and regularly checked for leaks of fuel or other fluids. | Contractor | Construction |
| WQ9 | No vehicle or vessel wash down will occur on the site. | Contractor | Construction |
| TT1 | The TMP and accompanying Traffic Guidance Schemes (TTPP, 2023) would be implemented as part of the CEMP. | Contractor | Construction |
| TT2 | Council will seek a relaxation of the three tonne load limit on Walsh Street from the Traffic Management Committee to enable trucks to use this route during construction. | Council | Pre-construction |
| TT3 | In the event the additional clearance area is to be excavated and the volume of truck movements and/or duration of construction is increased, prior notification would also be provided to the community. | Council | Construction |
| TT4 | Truck movements are to managed effectively to avoid queuing of traffic when loading and unloading excavated material. | Contractor | Construction |
| TT5 | The transfer of sand onto roads will be minimised by adoption of measures to remove sand from truck wheels prior to accessing the road network. Any sand tracked onto the road shall be removed as soon as is practicable. | Contractor | Construction |
| TT6 | Signage will be erected notifying the public of parking changes in the affected locations. | Contractor | Pre-construction |
| TT7 | Trucks are not permitted to park in side streets where they will block access for local residents. | Contractor | Construction |
| TT8 | The works areas will be fenced to prohibit public access during construction. | Contractor | Construction |
| TT9 | Where access for pedestrians or cyclists is impacted, suitable alternative, safe access will be provided. | Contractor | Construction |
| TT10 | Where possible, public access to the waterway and for navigation is to be maintained during the works. | Contractor | Construction |

| No. | Environmental safeguards | Responsibility | Timing |
|------|---|----------------------|-----------------------|
| TT11 | Appropriate signage will be provided to notify waterway users of the exclusion area during construction. | Contractor | Construction |
| NV1 | Works are to be carried out during standard construction hours. | Contractor | Construction |
| NV2 | <p>Noise impacts are to be minimised in accordance with the Draft Construction Noise Guideline (EPA, 2020). The CEMP shall include reasonable and feasible measures to reduce noise impacts to receivers, including:</p> <ul style="list-style-type: none"> • Where practicable, adopting quieter work methods and using quieter plant and equipment; • Operating plant and equipment in a quiet and efficient manner (e.g. minimising reversing alarms, turning equipment off when not in use); • Regularly inspecting and maintaining equipment to ensure it is in good working order; • Limiting the idling of trucks as much as possible; • Considering proximity to residences and sensitive receivers when selecting overnight parking locations for trucks and other vehicles used in the works; • Taking care when unloading trucks at the beach access points to minimise noise. | Contractor | Construction |
| NV3 | Local residents would be notified of the commencement of works via direct mail-out, on Council's webpage and via the local media. A contact should be provided to impacted residents to enable them to make further enquiries or complaints. | Council | Pre-construction |
| NV4 | Signage will be erected at the works sites with the relevant contact details of the person(s) to whom community members can make complaints or enquiries. | Contractor | Construction |
| NV5 | A complaints register will be established for the duration of the works to record any noise or other complaints related to the works. Any complaints received shall be responded to promptly and appropriately. | Contractor | Construction |
| NV6 | Should any noise or vibration complaints be received, the need for additional mitigation measures would be investigated and implemented where reasonable and feasible. | Contractor | Construction |
| BD1 | The location of sensitive seagrass habitat will be marked on the design drawings. Direct disturbance of seagrasses will be avoided, including by operation of vessels or machinery, dredge pipes or silt curtains, and dewatering discharge. | Council / Contractor | Design / Construction |
| BD2 | The position of the dredge pipe shall be inspected regularly to ensure no impacts to seagrasses. | Contractor | Construction |
| BD3 | Stockpiling and dewatering areas should not be placed on vegetated land or habitat for roosting or nesting habitat for shorebirds. | Contractor | Construction |
| BD4 | Silt curtains shall be placed around seagrass beds to prevent sedimentation from clearance works, including dewatering activities. The silt curtains should be placed so as to avoid direct contact with the seagrass beds and inspected weekly to ensure their ongoing effectiveness. | Contractor | Pre-construction |
| BD5 | The measures identified in Sections 6.2.3 and 6.3.3 will be implemented to minimise the impact of erosion and sedimentation, and water quality impacts, on biodiversity. | Contractor | Construction |

| No. | Environmental safeguards | Responsibility | Timing |
|-----|---|----------------|------------------|
| BD6 | All equipment and machinery will be clean and free of <i>C. taxifolia</i> and other pests and weeds prior to being mobilised to the site. | Contractor | Construction |
| BD7 | Sand placement areas on Collaroy-Narrabeen Beach are to inspected for fauna prior to the commencement of works, and after storm events or high seas, to avoid trampling of birds (such as Shearwaters) that may have washed ashore. | Contractor | Construction |
| BD8 | The works on Collaroy-Narrabeen Beach shall avoid vegetated land. | Contractor | Construction |
| HE1 | No works shall be undertaken outside the project footprint or on private land. | Contractor | Construction |
| HE2 | The CEMP will include a procedure for managing unexpected finds during construction. The procedure will be implemented if unanticipated heritage items, relics or archaeological material are located during construction. | Contractor | Pre-construction |
| HE3 | All construction personnel will be inducted on their responsibilities in relation to heritage items and sites, informing them of the location and significance of known heritage items in proximity to the works and the unexpected finds procedure in the CEMP. | Contractor | Construction |
| HE4 | If unexpected 'relics' are encountered during excavation, a Section 146 relics notification will be forwarded to Heritage NSW. 'Relics' cannot be impacted without appropriate approvals under the <i>Heritage Act 1977</i> . | Contractor | Construction |
| SE1 | Northern Beaches Council will prepare a community engagement plan prior to the commencement of works, to be implemented during construction to provide timely and up to date information to the community during construction. It would include, as a minimum: <ul style="list-style-type: none"> • Mechanisms to provide details and timing of proposed activities to affected residents and local businesses, including changes to traffic and access; and • A contact name and telephone number for complaints. Contact details will be clearly displayed at the entrance to the entrance clearance works sites and all affected beach accessways at the replenishment area. | Council | Pre-construction |
| SE2 | A webpage and telephone number will be established for enquiries regarding the proposal and will remain active for the duration of the works. | Council | Pre-construction |
| SE3 | All enquiries and complaints will be tracked through a tracking system and be acknowledged within 24 hours of being received. | Contractor | Construction |
| AQ1 | All plant, equipment and vehicles will be maintained to ensure good operating conditions and exhaust emissions in compliance with the relevant legislation, including the PoEO Act. | Contractor | Construction |
| AQ2 | Machinery and vehicles will be turned off rather than left to idle when not in use. | Contractor | Construction |
| WM1 | The CEMP would identify potential waste streams associated with the works. The CEMP would include measures to minimise waste, outline methods of disposal, re-use and recycling and monitoring, as appropriate. | Contractor | Construction |
| WM2 | Any excavated material that requires off-site disposal will be classified in accordance with the I (EPA, 2014) and disposed of at a suitably licenced waste management facility where an appropriate beneficial re-use cannot be identified. | Contractor | Pre-construction |

| No. | Environmental safeguards | Responsibility | Timing |
|-----|--|----------------|---------------------------------|
| VA1 | The construction compound would be fenced and screened where possible. | Contractor | Construction |
| VA2 | Construction activities would be undertaken during standard construction hours. Outside these times, all plant, machinery and equipment would be kept in the construction compound. | Contractor | Construction |
| VA3 | The works site will be kept clean and tidy for the duration of the works. | Contractor | Construction |
| VA4 | No vegetation removal is permitted. | Contractor | Construction |
| VA5 | All construction compounds / staging areas are to be reinstated to their original, pre-works condition following the completion of the works. | Contractor | Construction |
| UT1 | The location of utilities and services within the proposal footprint, or with potential to be impacted by the works, will be confirmed by the Contractor prior to the commencement of works to enable further assessment and mitigation of any potential impacts to utilities. | Contractor | Pre-construction |
| CU1 | Where possible, construction scheduling will avoid the respective projects being in construction at the same time. | Council | Construction |
| CU2 | Prior to the commencement of construction, Council will coordinate with any other local developments (including the coastal protection works under DA2021/1612) in an effort to minimise cumulative impacts to the community associated with traffic, noise, etc. | Council | Pre-construction / Construction |

7.3 Licencing and Approvals

A summary of licences and approvals required for the proposal is provided below:

- A permit under Section 200 of the FM Act; and
- A Road Occupancy Licence from TfNSW.

8 Justification and Conclusion

8.1 Justification

Narrabeen Lagoon is an ICOLL. When the entrance of the lagoon is closed for longer periods of time there is a significant risk of socio-economic and environmental impacts to the community and the lagoon ecosystem, including:

- Increased flood levels throughout the lagoon (Cardno, 2019; RHDHV, 2022);
- Reductions in water quality for estuary ecosystem and human health and recreational amenity due to lack of tidal flushing;
- Reduced biodiversity due to lack of recruitment through the entrance.

The *Narrabeen Lagoon Floodplain Risk Management Study and Plan* (Cardno, 2019) recommended the entrance clearance works be undertaken as the highest priority flood risk mitigation option under the Plan. The proposal reduces flood risk and the associated socio-economic impacts of flooding to the community.

While the primary objective of the proposed works is for flood mitigation, additional benefits include improved beach amenity at the proposed sand placement site and improved water quality while the lagoon entrance is open.

The objectives of the proposal are:

- To mitigate flood risk to low-lying properties surrounding Narrabeen Lagoon; and
- To maintain or enhance beach amenity.

8.2 Objects of the EP&A Act

The objects of the EP&A Act are considered in **Table 8-1**.

Table 8-1: Objects of the EP&A Act

| Object | Comment |
|---|---|
| 1.3(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State’s natural and other resources. | The proposal facilitates improved social and economic welfare for the community, primarily through the mitigation of flood risks, as detailed in Section 6.8.2 . The proposal would not result in significant impact on any natural or other resources. |
| 1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment. | The design of the entrance clearance works has considered potential impacts to biodiversity (in particular seagrasses) and built infrastructure (the rock revetment). Similarly the beach replenishment design considers the desired beach amenity outcomes. The proposal itself has been justified from an economic and social perspective in the Floodplain Risk Management Study and Plan (Cardno, 2019). |
| 1.3(c) To promote the orderly and economic use and development of land. | The proposal facilitates the development of the land by mitigating flood risk to low-lying land around Narrabeen Lagoon. |
| 1.3(d) To promote the delivery and maintenance of affordable housing. | Not relevant to the proposal. |

| Object | Comment |
|--|---|
| 1.3(e) To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats. | The design of the entrance clearance works has adopted a 10 m buffer from seagrass beds. An ecological impact assessment was undertaken for the proposal by H2O Consulting and is summarised in Section 6.6 . The assessment concluded that no significant impact to biodiversity would result from the proposal. |
| 1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage). | The proposal is not expected to adversely impact any Aboriginal or non-Aboriginal heritage sites or items. The mitigation measures in Section 6.7.3 would manage the risk of impact to previously unidentified heritage. |
| 1.3(g) To promote good design and amenity of the built environment. | Not relevant to the proposal. |
| 1.3(h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants. | Not relevant to the proposal. |
| 1.3(i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State. | Not relevant to the proposal. |
| 1.3(j) To provide increased opportunity for community participation in environmental planning and assessment. | Community engagement with the community and key stakeholders would continue through the works phase. |

8.3 Conclusion

The proposed Narrabeen Lagoon entrance clearance works are subject to assessment under Division 5.1 of the EP&A Act. This REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

This has included consideration (as relevant) of impacts on threatened species and ecological communities and their habitats and other protected fauna and native plants. It has also considered potential impacts to MNES listed under the Commonwealth EPBC Act.

A number of potential environmental impacts from the proposal have been avoided or reduced during the design development, including excavating areas subject to clearance works in 2021 that would comprise clean marine sand, avoidance of sensitive seagrass habitat and adoption of an appropriate set back from the existing rock revetment on the northern shoreline of the entrance channel. In addition, the selection of beach access points for the sand replenishment works has carefully considered the potential traffic and road safety impacts. The proposal as described in the REF best meets the project objectives but would still result in some impacts on water quality, biodiversity, traffic and transport, public access, noise and vibration visual amenity, and socio-economic values. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would mitigate the impacts of flooding of low-lying land around Narrabeen Lagoon, thereby reducing the socio-economic impacts of flooding on the community. At the same time, the

proposal would provide improved amenity and access to (and along) Collaroy-Narrabeen Beach. On balance the proposal is considered justified.

Significance of Impact under the NSW Legislation

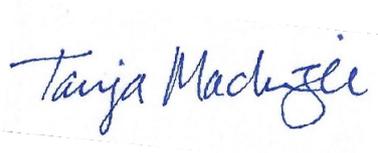
The proposal would be unlikely to cause a significant impact on the environment. Therefore, it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning and Public Spaces under Division 5.2 of the EP&A Act. A Biodiversity Development Assessment Report or Species Impact Statement is not required. The proposal is subject to assessment under Division 5.1 of the EP&A Act. Consent from Northern Beaches Council is not required.

Significance of Impact under the Commonwealth Legislation

The proposal is not likely to have a significant impact on MNES or the environment of Commonwealth land within the meaning of the EPBC Act. A referral to the Australian Department of Climate Change, Energy, the Environment and Water (DCCEEW) is not required.

9 Certification

This REF provides a true and fair review of the proposal in relation to its potential effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposal.



Tanja Mackenzie

Principal Environmental Scientist (CEnvP 0447)

Rhelm Pty Ltd

21 September 2023

I have examined this REF and accept it on behalf of Northern Beaches Council.



Chris McLean

Senior Floodplain Management Officer

Northern Beaches Council

Date: 21/09/2023

10 References

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R h e l m

Appendix A

Design Drawings

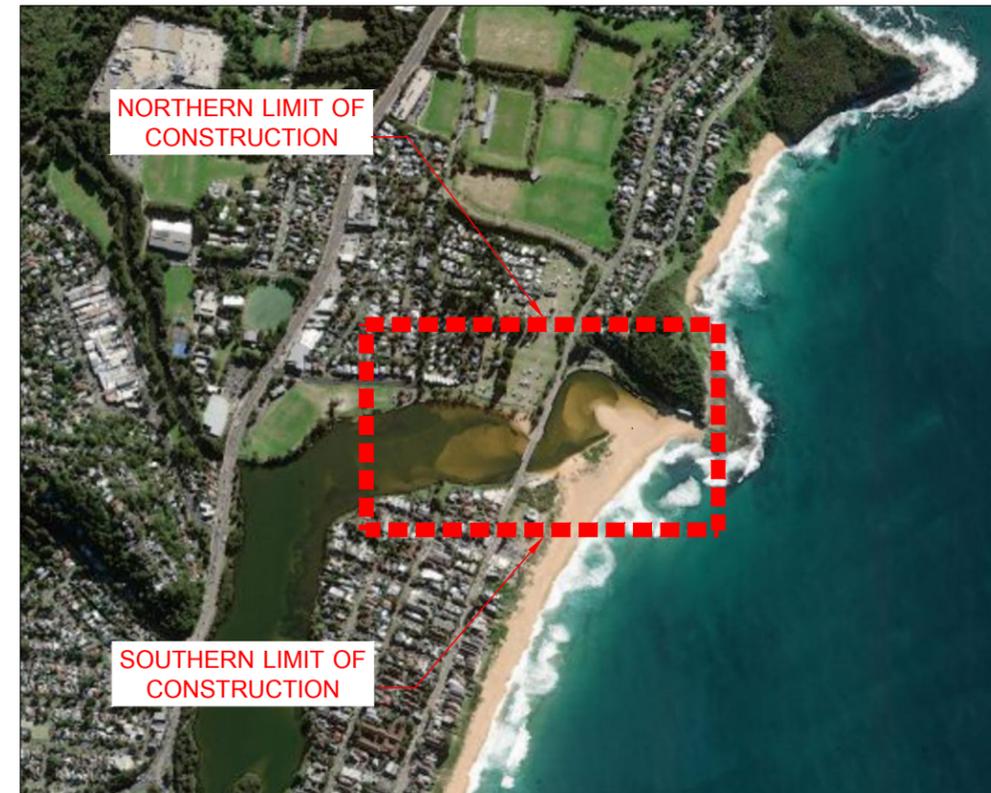
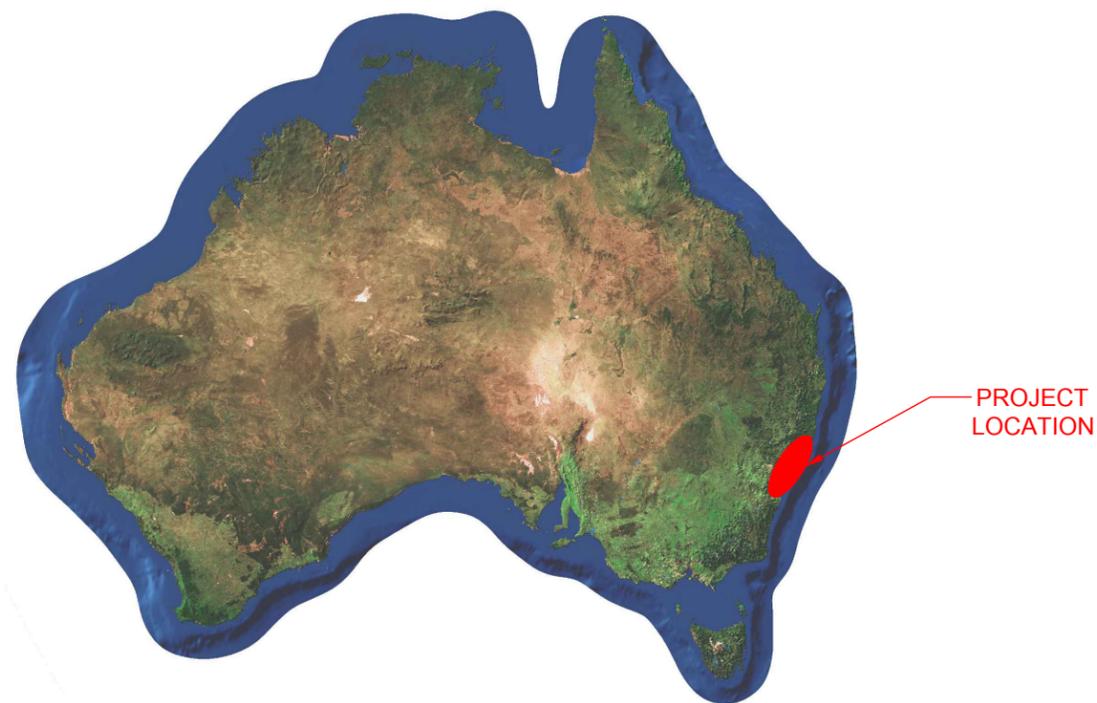
Narrabeen Lagoon Entrance Clearance Work

ISSUED FOR REVIEW

OVERALL PROJECT LOCATION PLAN

PROJECT LOCATION:

DATE: 2023/06/22



PREPARED FOR:

Northern Beaches Council



NOT FOR CONSTRUCTION

PREPARED BY:

Baird.

Baird Australia

Suite 8, Level 22
227 Elizabeth Street
Sydney, NSW 2000
+61-2-8278-7266

| DRAWING NUMBER | DRAWING TITLE | REVISION |
|----------------|-------------------------------|----------|
| 13142-504-000 | TITLE PAGE AND DRAWING INDEX | REV. A |
| 13142-504-010 | EXISTING CONDITIONS | REV. A |
| 13142-504-020 | STAGING PLAN AND NOTES | REV. A |
| 13142-504-030 | BEACH REPLENISHMENT LOCATIONS | REV. A |
| 13142-504-040 | SECTIONS 1-4 | REV. A |
| 13142-504-050 | SECTIONS 5-8 | REV. A |
| 13142-504-060 | SECTIONS 9-12 | REV. A |
| 13142-504-070 | SECTIONS 13-16 | REV. A |
| 13142-504-080 | SECTIONS 17-20 | REV. A |
| 13142-504-090 | SECTIONS 21-22 | REV. A |
| 13142-504-100 | SECTIONS 23-24 | REV. A |
| 13142-504-110 | SECTIONS 25-26 | REV. A |
| 13142-504-120 | SECTIONS 27-28 | REV. A |
| 13142-504-130 | SECTIONS 29-30 | REV. A |

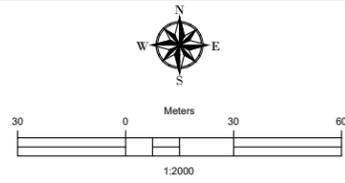


LEGEND

- HIGH DENSITY ZOSTERA
- MEDIUM DENSITY ZOSTERA
- LOW DENSITY ZOSTERA
- MANGROVE
- OYSTER REEF
- ROCK AND RUBBLE

NOTES:

- VERTICAL DATUM AUSTRALIAN HEIGHT DATUM (m AHD).
- HORIZONTAL DATUM: MGA GDA2020.
- EXISTING LEVELS: SURVEY DATE 23/01/2023, C.M.C SURVEYORS.
- B.M ADOPTED PM7786, R.L. 2.290 (CLASS LB)
- DESIGN BATTER SLOPES AT 1V:6H
- MINIMUM 10m DREDGE AREA DISTANCE FROM SEAGRASS AREAS AND ROCKWALL.



| PH | REV | DESCRIPTION | DRN | DSN | APR | QCM | YYYY-MM-DD |
|------------------|------------------------|----------------------------|----------------------------------|-----|-----|-----|------------|
| B | A | ISSUED FOR REVIEW | MDST | JC | JC | JC | 2023-06-22 |
| REVISIONS | | | | | | | |
| (PH) | (A) | (C) | (E) | | | | |
| PHASE OF ISSUE | PRELIMINARY (B) DESIGN | PERMIT (D) TENDER DOCUMENT | CONSTRUCTION DOCUMENT (F) RECORD | | | | |

PREPARED FOR:

PREPARED BY:

Baird.

Baird Australia

NARRABEEN LAGOON CLEARANCE WORK

EXISTING CONDITIONS

DRAWING NUMBER: 13142-504-010 REV. A DATE: 2023-06-22

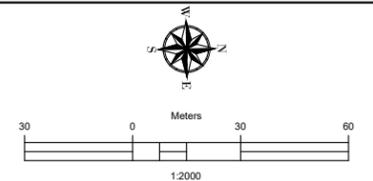


NOTES:

1. WORKS ARE TO BE UNDERTAKEN IN ACCORDANCE WITH THE NARRABEEN LAGOON ENTRANCE CLEARANCE WORKS REVIEW OF ENVIRONMENTAL FACTORS (RHELM, 2023).
2. WORKS SHOULD BE FENCED OFF TO PREVENT PUBLIC ACCESS.
3. NO SAND TO BE PLACED ON PRIVATE PROPERTY OR DIRECTLY IN FRONT OF A STORMWATER DRAIN.
4. SAND IS TO BE PLACED AND SHOULD BE GRADED AT A SLOPE OF 1:5 AND EXTEND TO THE MAIN WATER LINE (0m AHD). THE NORTHERN-MOST AND SOUTHERN-MOST EXTENTS OF THE PLACEMENT SITE SHOULD BE GRADED TO FORM A SMOOTH TRANSITION BETWEEN AREAS OR THE NATURAL BEACH PROFILE.
5. PRE-WORKS SURVEY TO BE COLLECTED BY COUNCIL TO INFORM PLACEMENT ON SITE (DESIGN PROFILE FOR BEACH SECTIONS). AT THE NORTHERN AND SOUTHERN EXTENTS OF THE PLACEMENT AREA, GRADING IS REQUIRED TO ENSURE SMOOTH TRANSITION TO THE NATURAL BEACH PROFILE.

NOTES:

- VERTICAL DATUM AUSTRALIAN HEIGHT DATUM (m AHD).
- HORIZONTAL DATUM: MGA GDA2020.
- EXISTING LEVELS: SURVEY DATE 23/01/2023, C.M.C SURVEYORS.
- B.M ADOPTED PM7786, R.L. 2.290 (CLASS LB)
- DESIGN BATTER SLOPES AT 1V:6H
- MINIMUM 10m DREDGE AREA DISTANCE FROM SEAGRASS AREAS AND ROCKWALL.



| PH | REV | DESCRIPTION | DRN | DSN | APR | QCM | YYYY-MM-DD |
|------------------|------------------------|----------------------------|----------------------------------|-----|-----|-----|------------|
| B | A | ISSUED FOR REVIEW | MDST | JC | JC | JC | 2023-06-22 |
| REVISIONS | | | | | | | |
| (PH) | (A) | (C) | (E) | | | | |
| PHASE OF ISSUE | PRELIMINARY (B) DESIGN | PERMIT (D) TENDER DOCUMENT | CONSTRUCTION DOCUMENT (F) RECORD | | | | |

PREPARED FOR:

northern beaches council

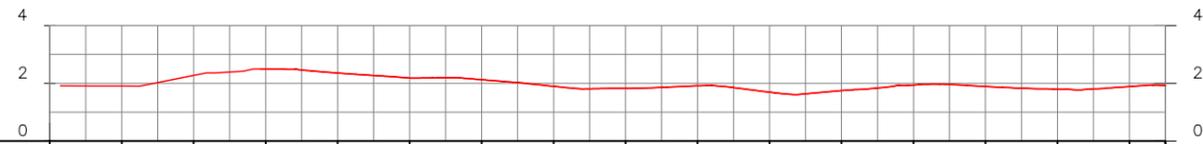
PREPARED BY:

Baird.
Baird Australia

NARRABEEN LAGOON CLEARANCE WORK
BEACH REPLENISHMENT LOCATIONS

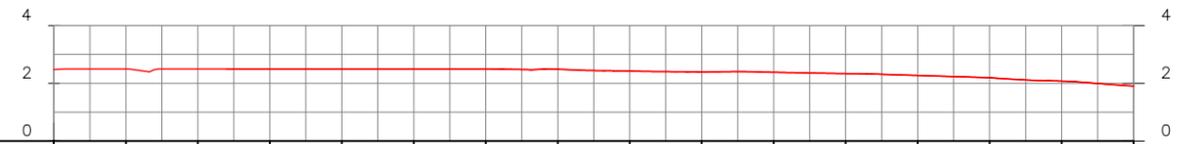
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SECTION 01



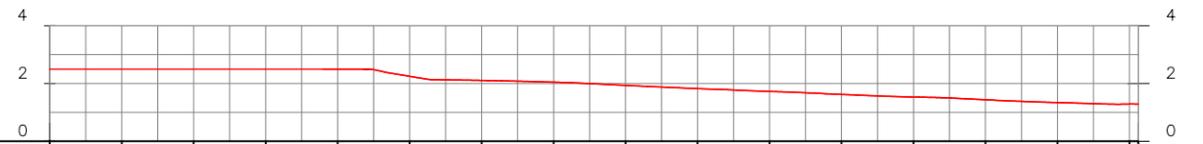
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|-----------------|---|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Existing Ground | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 | 155 |
| | | 1.91 | 2.28 | 2.50 | 2.36 | 2.18 | 2.13 | 1.90 | 1.83 | 1.92 | 1.69 | 1.75 | 1.94 | 1.89 | 1.79 | 1.89 | 1.92 |
| Dredge Design | | | | 2.50 | 2.36 | 2.18 | 2.13 | 1.90 | 1.83 | 1.92 | 1.69 | 1.75 | 1.94 | 1.89 | 1.79 | 1.89 | 1.92 |
| Cut & Fill | | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Station | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 | 155 |

SECTION 02



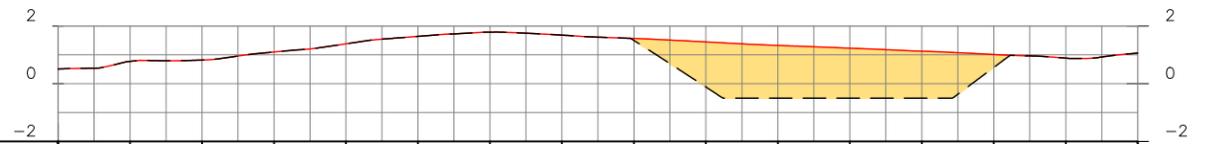
| | | | | | | | | | | | | | | | | |
|-----------------|---|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Existing Ground | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 |
| | | 2.48 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.49 | 2.42 | 2.39 | 2.38 | 2.34 | 2.27 | 2.19 | 2.08 | 1.91 |
| Dredge Design | | | | 2.50 | 2.50 | 2.50 | 2.50 | 2.49 | 2.42 | 2.39 | 2.38 | 2.34 | 2.27 | 2.19 | 2.08 | 1.91 |
| Cut & Fill | | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Station | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 |

SECTION 03



| | | | | | | | | | | | | | | | | |
|-----------------|---|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Existing Ground | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 |
| | | 2.50 | 2.50 | 2.50 | 2.50 | 2.25 | 2.11 | 2.05 | 1.94 | 1.82 | 1.73 | 1.62 | 1.53 | 1.44 | 1.34 | 1.29 |
| Dredge Design | | | | | 2.50 | 2.25 | 2.11 | 2.05 | 1.94 | 1.82 | 1.73 | 1.62 | 1.53 | 1.44 | 1.34 | 1.29 |
| Cut & Fill | | | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Station | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 |

SECTION 04

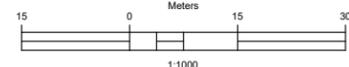


| | | | | | | | | | | | | | | | | |
|-----------------|---|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|------|
| Existing Ground | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 |
| | | 0.51 | 0.77 | 0.82 | 1.10 | 1.38 | 1.64 | 1.79 | 1.68 | 1.57 | 1.45 | 1.33 | 1.23 | 1.13 | 1.01 | 0.89 |
| Dredge Design | | 0.51 | 0.77 | 0.82 | 1.10 | 1.38 | 1.64 | 1.79 | 1.68 | 1.50 | -0.11 | -0.50 | -0.50 | -0.50 | 0.57 | 0.89 |
| Cut & Fill | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.07 | -1.56 | -1.83 | -1.73 | -1.63 | -0.45 | 0.00 |
| Station | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 |

LEGEND

- EXISTING BED
- DESIGN PROFILE
- DREDGING AREA

- NOTES:
- VERTICAL DATUM AUSTRALIAN HEIGHT DATUM (m AHD).
 - HORIZONTAL DATUM: MGA GDA2020.
 - EXISTING LEVELS: SURVEY DATE 23/01/2023, C.M.C SURVEYORS.
 - B.M ADOPTED PM7786, R.L. 2.290 (CLASS LB)
 - DESIGN BATTER SLOPES AT 1V:6H
 - MINIMUM 10m DREDGE AREA DISTANCE FROM SEAGRASS AREAS AND ROCKWALL.



| | | | | | | | | | | |
|----------------|-------------|---------------------|-----------------------|-------------------|-----|------|-----|------------|----|------------|
| B | | A | | ISSUED FOR REVIEW | | MDST | JC | JC | JC | 2023-06-22 |
| PH | REV | DESCRIPTION | | DRN | DSN | APR | QCM | YYYY-MM-DD | | |
| REVISIONS | | | | | | | | | | |
| (PH) | (A) | (C) | (E) | | | | | | | |
| PHASE OF ISSUE | PRELIMINARY | PERMIT | CONSTRUCTION DOCUMENT | | | | | | | |
| | (B) DESIGN | (D) TENDER DOCUMENT | (F) RECORD | | | | | | | |

PREPARED FOR:



PREPARED BY:

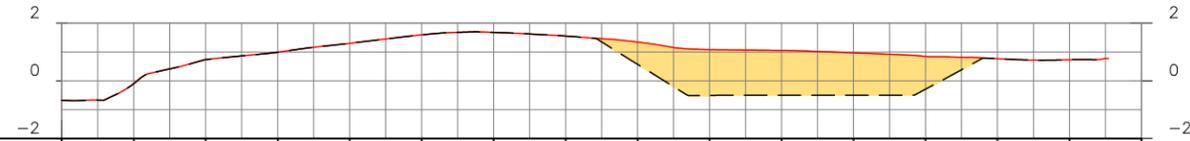


NARRABEEN LAGOON CLEARANCE WORK

SECTIONS 1-4

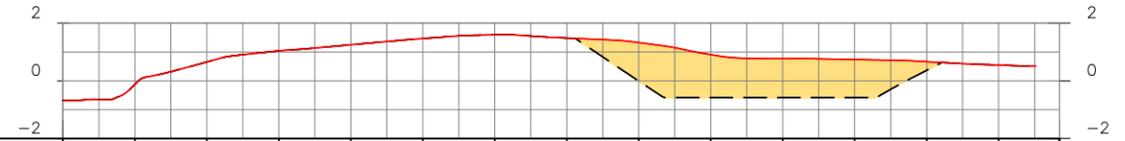
DRAWING NUMBER: 13142-504-040 REV. A DATE: 2023-06-22

SECTION 05



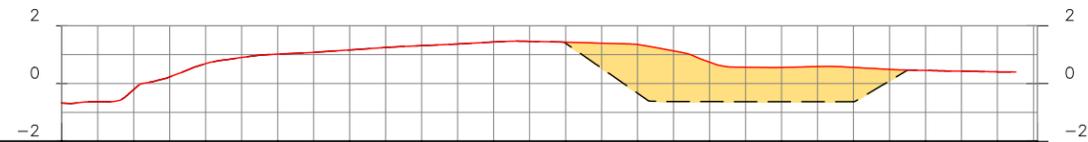
| | | | | | | | | | | | | | | | | |
|-----------------|-------|-------|------|------|------|------|------|------|-------|-------|-------|-------|-------|------|------|-----|
| Existing Ground | -0.67 | -0.10 | 0.73 | 0.99 | 1.30 | 1.59 | 1.68 | 1.55 | 1.34 | 1.08 | 1.05 | 0.97 | 0.84 | 0.77 | 0.73 | |
| Dredge Design | -0.67 | -0.10 | 0.73 | 0.99 | 1.30 | 1.59 | 1.68 | 1.55 | 0.57 | -0.51 | -0.50 | -0.50 | -0.29 | 0.77 | 0.73 | |
| Cut & Fill | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.77 | -1.59 | -1.55 | -1.47 | -1.14 | 0.00 | 0.00 | |
| Station | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 |

SECTION 06



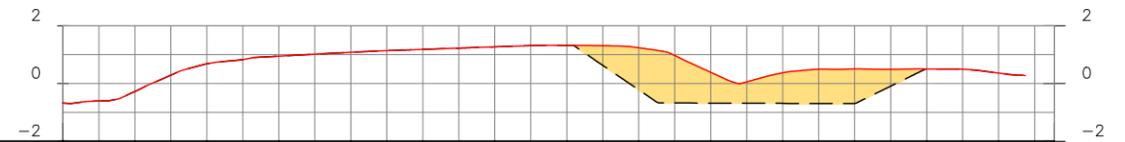
| | | | | | | | | | | | | | | | |
|-----------------|-------|-------|------|------|------|------|------|------|-------|-------|-------|-------|-------|------|-----|
| Existing Ground | -0.67 | -0.12 | 0.65 | 1.04 | 1.25 | 1.47 | 1.59 | 1.48 | 1.33 | 0.91 | 0.77 | 0.74 | 0.66 | 0.54 | |
| Dredge Design | -0.67 | -0.12 | 0.65 | 1.04 | 1.25 | 1.47 | 1.59 | 1.48 | -0.01 | -0.58 | -0.58 | -0.58 | 0.36 | 0.54 | |
| Cut & Fill | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -1.34 | -1.49 | -1.35 | -1.32 | -0.30 | 0.00 | |
| Station | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 138 |

SECTION 07



| | | | | | | | | | | | | | | | |
|-----------------|-------|-------|------|------|------|------|------|-------|-------|-------|-------|-------|------|------|--|
| Existing Ground | -0.67 | -0.21 | 0.69 | 1.02 | 1.16 | 1.31 | 1.44 | 1.43 | 1.35 | 0.74 | 0.56 | 0.56 | 0.45 | 0.41 | |
| Dredge Design | -0.67 | -0.21 | 0.69 | 1.02 | 1.16 | 1.31 | 1.44 | 1.40 | -0.34 | -0.62 | -0.63 | -0.63 | 0.45 | 0.41 | |
| Cut & Fill | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.04 | -1.69 | -1.36 | -1.19 | -1.19 | 0.00 | 0.00 | |
| Station | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | |

SECTION 08



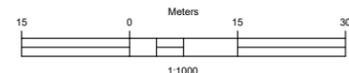
| | | | | | | | | | | | | | | | |
|-----------------|-------|-------|------|------|------|------|------|------|-------|-------|-------|-------|------|------|--|
| Existing Ground | -0.67 | -0.28 | 0.68 | 0.95 | 1.08 | 1.18 | 1.27 | 1.33 | 1.24 | 0.39 | 0.37 | 0.51 | 0.51 | 0.36 | |
| Dredge Design | -0.67 | -0.28 | 0.68 | 0.95 | 1.08 | 1.18 | 1.27 | 1.33 | -0.22 | -0.68 | -0.68 | -0.69 | 0.50 | 0.36 | |
| Cut & Fill | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -1.46 | -1.07 | -1.06 | -1.20 | 0.00 | 0.00 | |
| Station | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | |

LEGEND

- EXISTING BED
- DESIGN PROFILE
- DREDGING AREA

NOTES:

- VERTICAL DATUM AUSTRALIAN HEIGHT DATUM (m AHD).
- HORIZONTAL DATUM: MGA GDA2020.
- EXISTING LEVELS: SURVEY DATE 23/01/2023, C.M.C SURVEYORS.
- B.M ADOPTED PM7786, R.L. 2.290 (CLASS LB)
- DESIGN BATTER SLOPES AT 1V:6H
- MINIMUM 10m DREDGE AREA DISTANCE FROM SEAGRASS AREAS AND ROCKWALL.



| PH | REV | DESCRIPTION | MDST | JC | JC | JC | 2023-06-22 |
|-----------|-------------|---------------------|-----------------------|----|----|----|------------|
| | | | | | | | |
| | | | | | | | |
| REVISIONS | | | | | | | |
| (PH) | (A) | (C) | (E) | | | | |
| PHASE OF | PRELIMINARY | PERMIT | CONSTRUCTION DOCUMENT | | | | |
| ISSUE | (B) DESIGN | (D) TENDER DOCUMENT | (F) RECORD | | | | |

PREPARED FOR:



PREPARED BY:



NARRABEEN LAGOON CLEARANCE WORK

SECTIONS 5-8

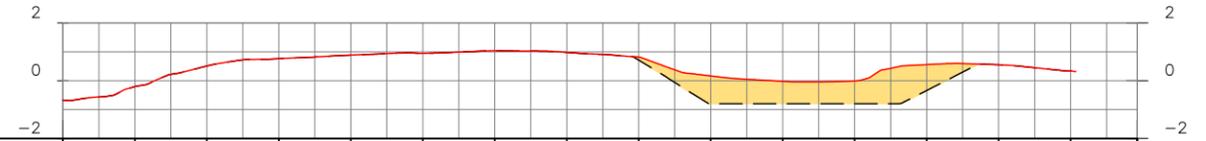
DRAWING NUMBER: 13142-504-050 REV. A DATE: 2023-06-22

SECTION 09



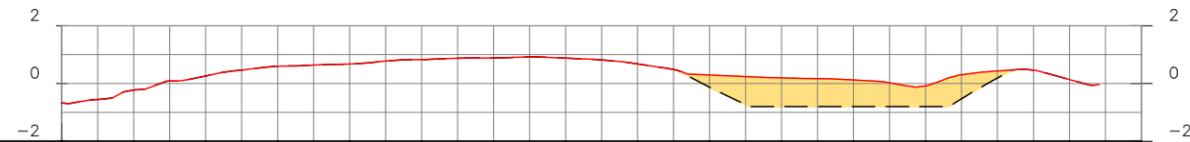
| | | | | | | | | | | | | | | | |
|-----------------|-------|-------|------|------|------|------|------|------|-------|-------|-------|-------|-------|------|-----|
| Existing Ground | -0.67 | -0.22 | 0.64 | 0.86 | 0.98 | 1.08 | 1.15 | 1.14 | 1.01 | 0.14 | -0.12 | 0.49 | 0.55 | 0.56 | |
| Dredge Design | -0.67 | -0.22 | 0.64 | 0.86 | 0.98 | 1.08 | 1.15 | 1.14 | 0.18 | -0.77 | -0.78 | -0.79 | 0.23 | 0.56 | |
| Cut & Fill | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.84 | -0.91 | -0.66 | -1.28 | -0.32 | 0.00 | |
| Station | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 |

SECTION 10



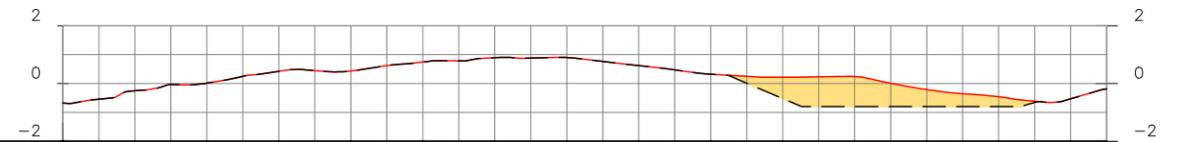
| | | | | | | | | | | | | | | | |
|-----------------|-------|-------|------|------|------|------|------|------|-------|-------|-------|-------|-------|------|------|
| Existing Ground | -0.67 | -0.21 | 0.51 | 0.76 | 0.89 | 0.95 | 1.04 | 0.98 | 0.82 | 0.16 | -0.02 | -0.01 | 0.56 | 0.55 | 0.33 |
| Dredge Design | -0.67 | -0.21 | 0.51 | 0.76 | 0.89 | 0.95 | 1.04 | 0.98 | 0.71 | -0.80 | -0.80 | -0.80 | -0.34 | 0.55 | 0.33 |
| Cut & Fill | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.11 | -0.96 | -0.78 | -0.79 | -0.90 | 0.00 | 0.00 |
| Station | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 |

SECTION 11



| | | | | | | | | | | | | | | | | |
|-----------------|-------|-------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|------|-----|
| Existing Ground | -0.67 | -0.22 | 0.26 | 0.60 | 0.68 | 0.83 | 0.89 | 0.88 | 0.68 | 0.30 | 0.20 | 0.12 | -0.08 | 0.43 | 0.14 | |
| Dredge Design | -0.67 | -0.22 | 0.26 | 0.60 | 0.68 | 0.83 | 0.89 | 0.88 | 0.68 | -0.13 | -0.80 | -0.80 | -0.80 | 0.19 | 0.14 | |
| Cut & Fill | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.42 | -1.00 | -0.92 | -0.72 | -0.24 | 0.00 | |
| Station | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 |

SECTION 12



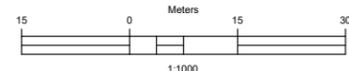
| | | | | | | | | | | | | | | | | |
|-----------------|-------|-------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|
| Existing Ground | -0.67 | -0.25 | 0.01 | 0.42 | 0.44 | 0.75 | 0.90 | 0.90 | 0.62 | 0.32 | 0.22 | 0.24 | -0.21 | -0.46 | -0.53 | -0.19 |
| Dredge Design | -0.67 | -0.25 | 0.01 | 0.42 | 0.44 | 0.75 | 0.90 | 0.90 | 0.62 | 0.32 | -0.52 | -0.80 | -0.80 | -0.80 | -0.53 | -0.19 |
| Cut & Fill | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.74 | -1.04 | -0.59 | -0.34 | 0.00 | 0.00 |
| Station | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 145 |

LEGEND

- EXISTING BED
- DESIGN PROFILE
- DREDGING AREA

NOTES:

- VERTICAL DATUM AUSTRALIAN HEIGHT DATUM (m AHD).
- HORIZONTAL DATUM: MGA GDA2020.
- EXISTING LEVELS: SURVEY DATE 23/01/2023, C.M.C SURVEYORS.
- B.M ADOPTED PM7786, R.L. 2.290 (CLASS LB)
- DESIGN BATTER SLOPES AT 1V:6H
- MINIMUM 10m DREDGE AREA DISTANCE FROM SEAGRASS AREAS AND ROCKWALL.



| PH | REV | DESCRIPTION | MDST | JC | JC | JC | DATE |
|-----------|-------------|---------------------|-----------------------|----|----|----|------------|
| B | A | ISSUED FOR REVIEW | | | | | 2023-06-22 |
| REVISIONS | | | | | | | |
| (PH) | (A) | (C) | (E) | | | | |
| PHASE OF | PRELIMINARY | PERMIT | CONSTRUCTION DOCUMENT | | | | |
| ISSUE | (B) DESIGN | (D) TENDER DOCUMENT | (F) RECORD | | | | |

PREPARED FOR:



PREPARED BY:

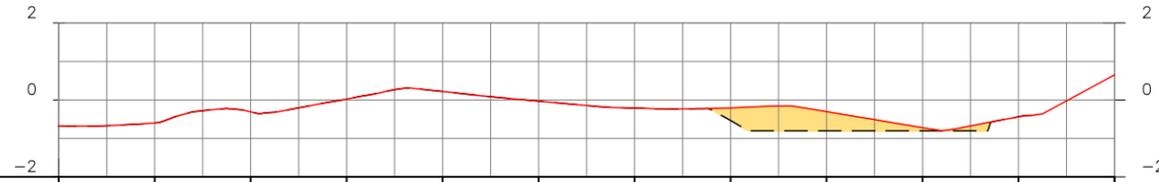


NARRABEEN LAGOON CLEARANCE WORK

SECTIONS 9-12

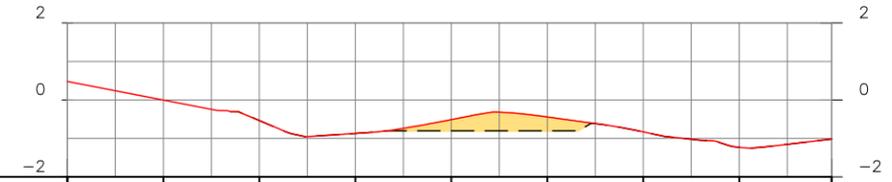
DRAWING NUMBER: 13142-504-060 REV. A DATE: 2023-06-22

SECTION 17



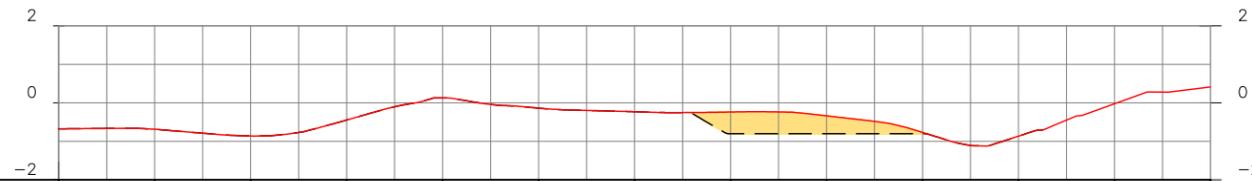
| | | | | | | | | | | | | |
|-----------------|-------|-------|-------|------|------|-------|-------|-------|-------|-------|-------|------|
| Existing Ground | -0.67 | -0.60 | -0.31 | 0.02 | 0.22 | -0.03 | -0.21 | -0.21 | -0.30 | -0.72 | -0.44 | 0.65 |
| Dredge Design | -0.67 | -0.60 | -0.31 | 0.02 | 0.22 | -0.03 | -0.21 | -0.53 | -0.80 | -0.80 | -0.44 | |
| Cut & Fill | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.33 | -0.50 | -0.08 | 0.00 | |
| Station | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 |

SECTION 19



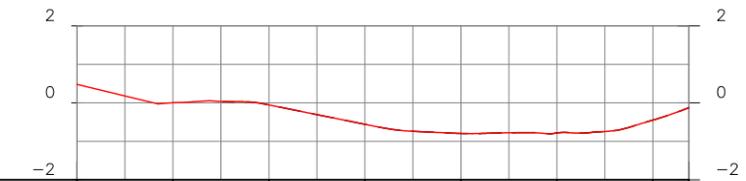
| | | | | | | | | | |
|-----------------|------|------|-------|-------|-------|-------|-------|-------|-------|
| Existing Ground | 0.48 | 0.00 | -0.54 | -0.87 | -0.51 | -0.44 | -0.83 | -1.23 | -1.02 |
| Dredge Design | | | -0.54 | -0.87 | -0.80 | -0.80 | -0.83 | -1.23 | -1.02 |
| Cut & Fill | | | 0.00 | 0.00 | -0.29 | -0.36 | 0.00 | 0.00 | 0.00 |
| Station | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 |

SECTION 18



| | | | | | | | | | | | | | |
|-----------------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|------|
| Existing Ground | -0.67 | -0.69 | -0.86 | -0.45 | 0.13 | -0.14 | -0.23 | -0.24 | -0.34 | -0.77 | -0.87 | -0.02 | 0.41 |
| Dredge Design | -0.67 | -0.69 | -0.86 | -0.45 | 0.13 | -0.14 | -0.23 | -0.80 | -0.80 | -0.80 | -0.87 | | |
| Cut & Fill | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.56 | -0.46 | -0.03 | 0.00 | | |
| Station | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |

SECTION 20



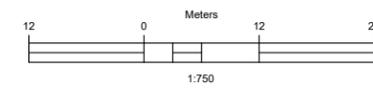
| | | | | | | | | |
|-----------------|------|------|-------|-------|-------|-------|-------|-------|
| Existing Ground | 0.48 | 0.00 | -0.05 | -0.56 | -0.80 | -0.78 | -0.45 | -0.12 |
| Dredge Design | | | -0.05 | -0.56 | -0.80 | -0.78 | -0.45 | -0.13 |
| Cut & Fill | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Station | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 64 |

LEGEND

- EXISTING BED
- - - DESIGN PROFILE
- DREDGING AREA

NOTES:

- VERTICAL DATUM AUSTRALIAN HEIGHT DATUM (m AHD).
- HORIZONTAL DATUM: MGA GDA2020.
- EXISTING LEVELS: SURVEY DATE 23/01/2023, C.M.C SURVEYORS.
- B.M ADOPTED PM7786, R.L. 2.290 (CLASS LB)
- DESIGN BATTER SLOPES AT 1V:6H
- MINIMUM 10m DREDGE AREA DISTANCE FROM SEAGRASS AREAS AND ROCKWALL.



| PH | REV | DESCRIPTION | MDST | JC | JC | JC | 2023-06-22 |
|------------------|-------------|---------------------|-----------------------|----|----|----|------------|
| B | A | ISSUED FOR REVIEW | | | | | |
| REVISIONS | | | | | | | |
| (PH) | (A) | (C) | (E) | | | | |
| PHASE OF ISSUE | PRELIMINARY | PERMIT | CONSTRUCTION DOCUMENT | | | | |
| | (B) DESIGN | (D) TENDER DOCUMENT | (F) RECORD | | | | |

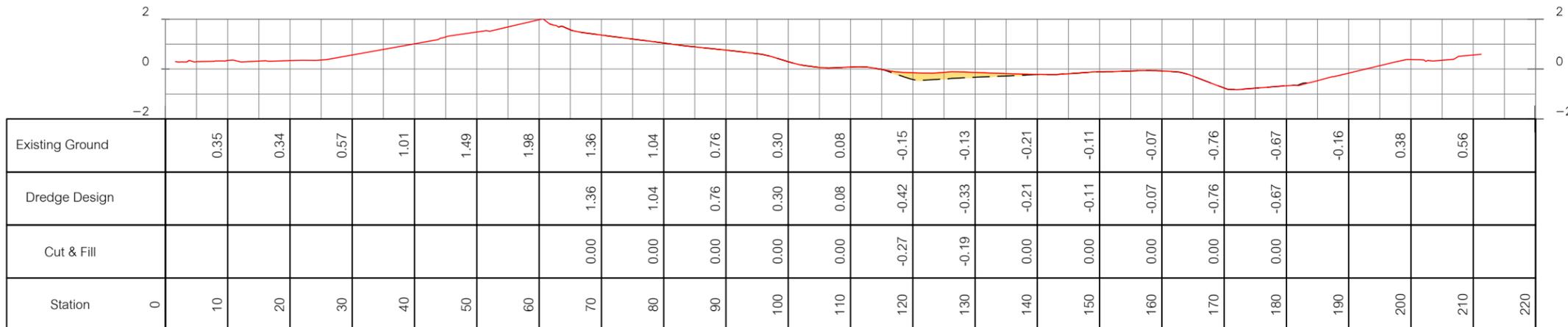
PREPARED FOR:

PREPARED BY:

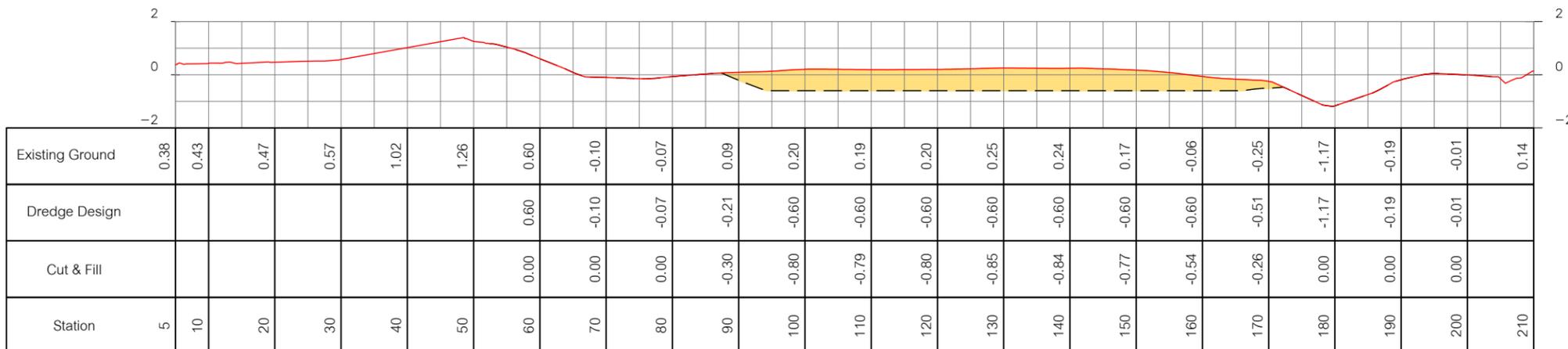
NARRABEEN LAGOON CLEARANCE WORK
 SECTIONS 17-20

DRAWING NUMBER: 13142-504-080 REV. A DATE: 2023-06-22

SECTION 21



SECTION 22

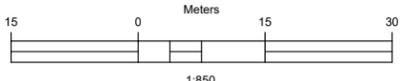


LEGEND

- EXISTING BED
- DESIGN PROFILE
- DREDGING AREA

NOTES:

- VERTICAL DATUM AUSTRALIAN HEIGHT DATUM (m AHD).
- HORIZONTAL DATUM: MGA GDA2020.
- EXISTING LEVELS: SURVEY DATE 23/01/2023, C.M.C SURVEYORS.
- B.M ADOPTED PM7786, R.L. 2.290 (CLASS LB)
- DESIGN BATTER SLOPES AT 1V:6H
- MINIMUM 10m DREDGE AREA DISTANCE FROM SEAGRASS AREAS AND ROCKWALL.



| PH | REV | DESCRIPTION | DRN | DSN | APR | QCM | YYYY-MM-DD |
|----|-----|-------------------|------|-----|-----|-----|------------|
| B | A | ISSUED FOR REVIEW | MDST | JC | JC | JC | 2023-06-22 |

REVISIONS

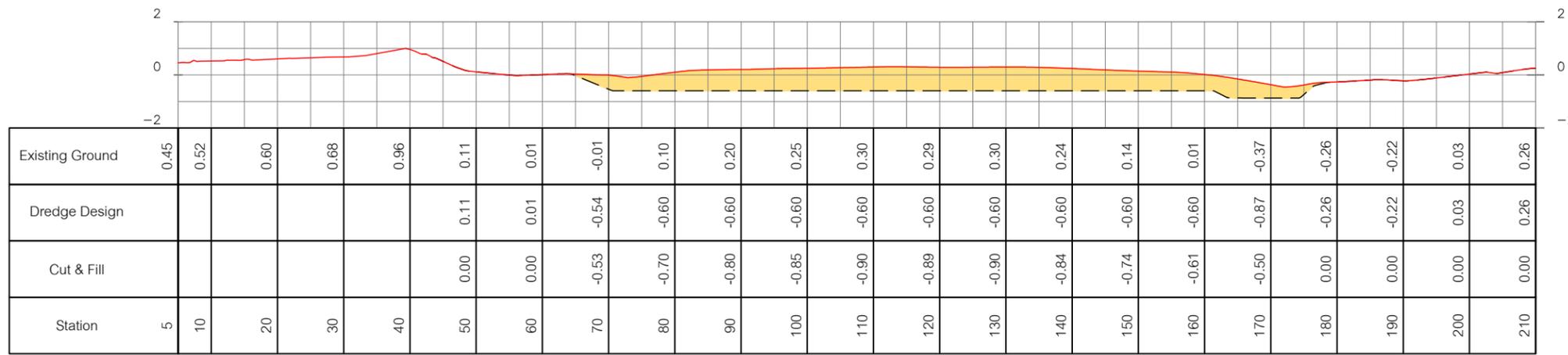
| | | | |
|---------------------|----------------------------|--------------------------------|--------------------------------------|
| (PH) PHASE OF ISSUE | (A) PRELIMINARY (B) DESIGN | (C) PERMIT (D) TENDER DOCUMENT | (E) CONSTRUCTION DOCUMENT (F) RECORD |
|---------------------|----------------------------|--------------------------------|--------------------------------------|



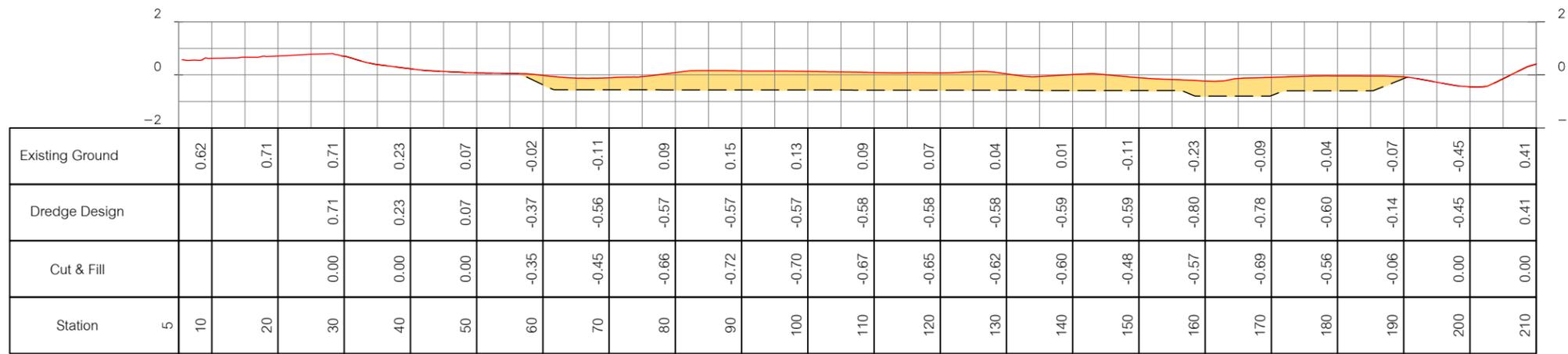
NARRABEEN LAGOON CLEARANCE WORK
SECTIONS 21-22

DRAWING NUMBER: 13142-504-090 REV. A DATE: 2023-06-22

SECTION 23



SECTION 24

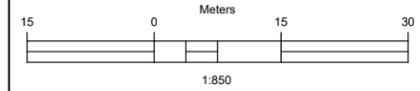


LEGEND

- EXISTING BED
- DESIGN PROFILE
- DREDGING AREA

NOTES:

- VERTICAL DATUM AUSTRALIAN HEIGHT DATUM (m AHD).
- HORIZONTAL DATUM: MGA GDA2020.
- EXISTING LEVELS: SURVEY DATE 23/01/2023, C.M.C SURVEYORS.
- B.M ADOPTED PM7786, R.L. 2.290 (CLASS LB)
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| | | | | | | | | | | | | |
|---------------------|----------------------------|--------------------------------|---------------------------|-------------------|--|-----|-----|------|-----|------------|----|------------|
| B | | A | | ISSUED FOR REVIEW | | | | MDST | JC | JC | JC | 2023-06-22 |
| PH | REV | DESCRIPTION | | | | DRN | DSN | APR | QCM | YYYY-MM-DD | | |
| REVISIONS | | | | | | | | | | | | |
| (PH) PHASE OF ISSUE | (A) PRELIMINARY (B) DESIGN | (C) PERMIT (D) TENDER DOCUMENT | (E) CONSTRUCTION DOCUMENT | (F) RECORD | | | | | | | | |

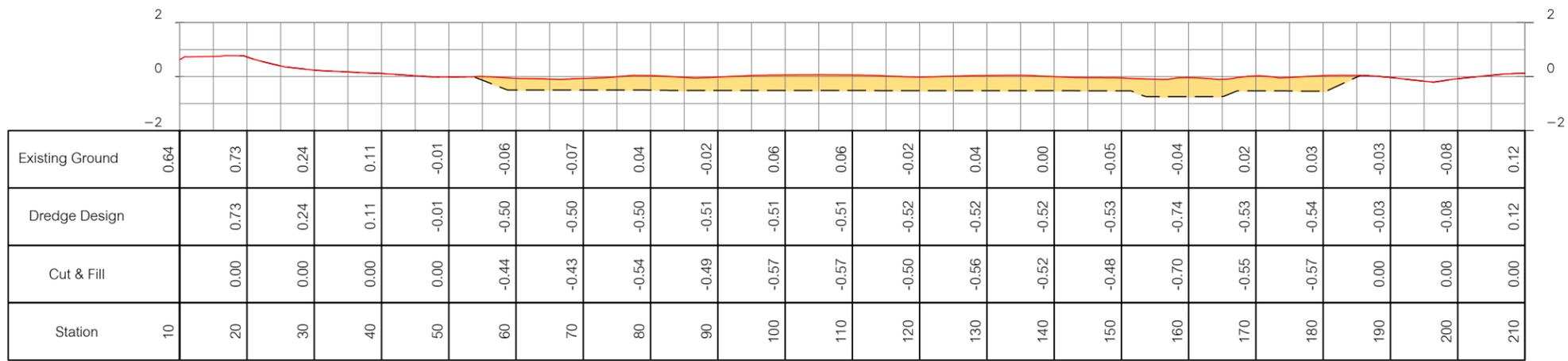
PREPARED FOR:

PREPARED BY:

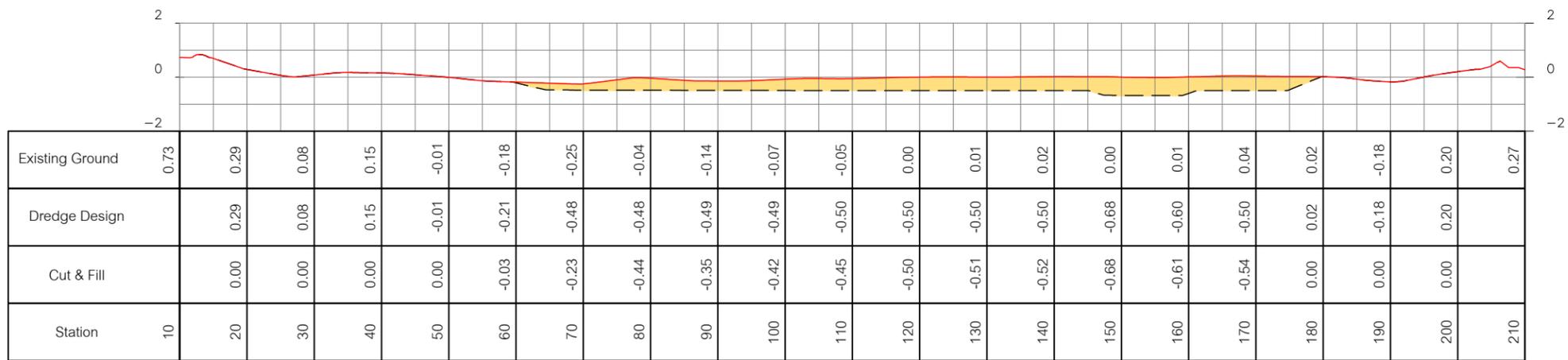
NARRABEEN LAGOON CLEARANCE WORK
SECTIONS 23-24

DRAWING NUMBER: 13142-504-100 REV. A DATE: 2023/06/22

SECTION 25



SECTION 26

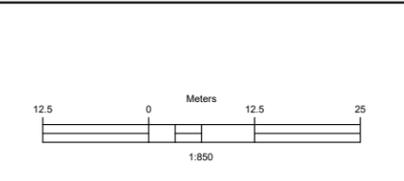


LEGEND

- EXISTING BED
- DESIGN PROFILE
- DREDGING AREA

NOTES:

- VERTICAL DATUM AUSTRALIAN HEIGHT DATUM (m AHD).
- HORIZONTAL DATUM: MGA GDA2020.
- EXISTING LEVELS: SURVEY DATE 23/01/2023, C.M.C SURVEYORS.
- B.M ADOPTED PM7786, R.L. 2.290 (CLASS LB)
- DESIGN BATTER SLOPES AT 1V:6H
- MINIMUM 10m DREDGE AREA DISTANCE FROM SEAGRASS AREAS AND ROCKWALL.



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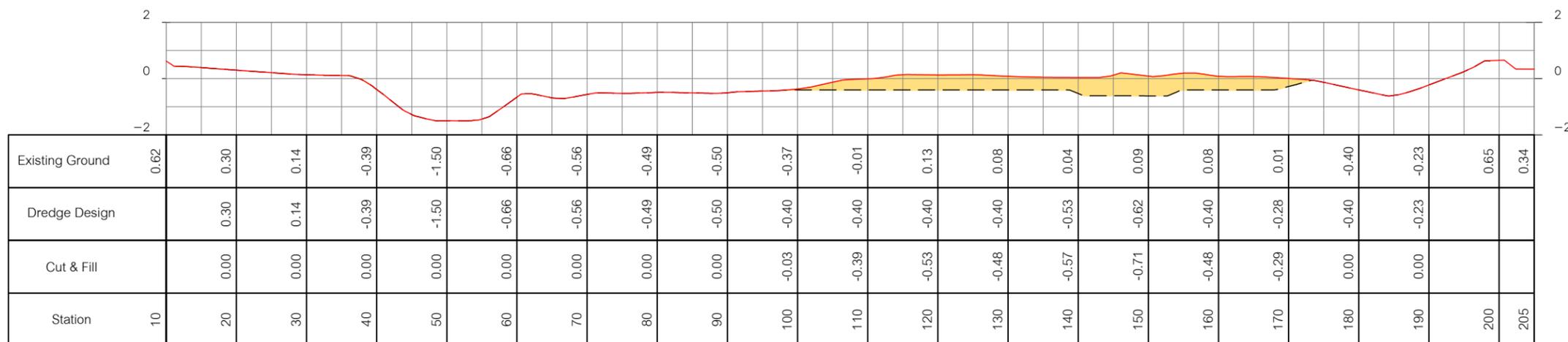
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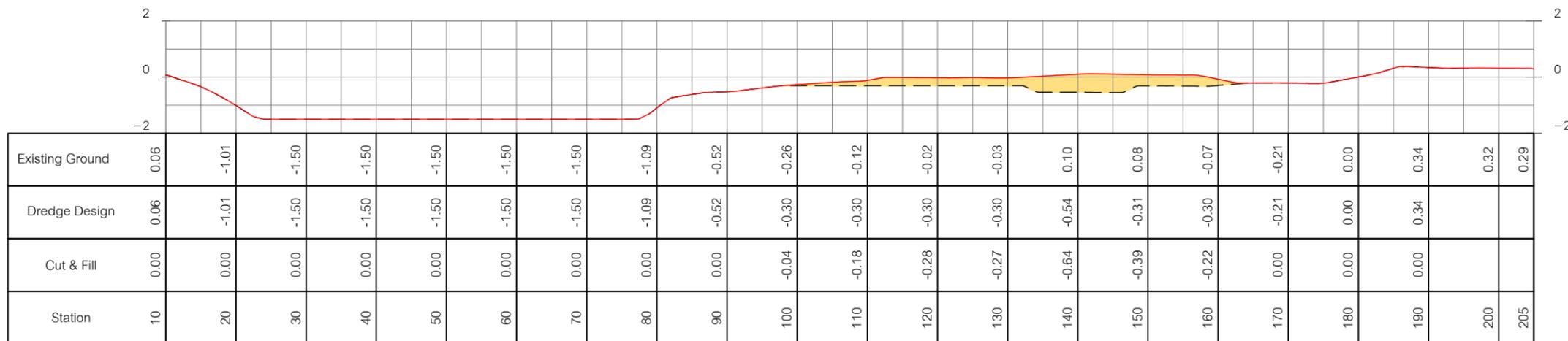
NARRABEEN LAGOON CLEARANCE WORK
 SECTIONS 25-26

DRAWING NUMBER: 13142-504-110 REV. A DATE: 2023-06-22

SECTION 27



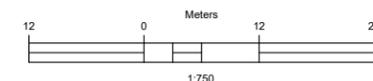
SECTION 28



LEGEND

- EXISTING BED
- DESIGN PROFILE
- DREDGING AREA

- NOTES:**
- VERTICAL DATUM AUSTRALIAN HEIGHT DATUM (m AHD).
 - HORIZONTAL DATUM: MGA GDA2020.
 - EXISTING LEVELS: SURVEY DATE 23/01/2023, C.M.C SURVEYORS.
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PREPARED FOR:

PREPARED BY:

NARRABEEN LAGOON CLEARANCE WORK
SECTIONS 27-28

DRAWING NUMBER: 13142-504-120 REV. A DATE: 2023-06-22



Appendix B

Traffic Management Plan



Traffic Management Plan Narrabeen Lagoon Entrance Clearance

Prepared for:

Rhelm

30 June 2023

The Transport Planning Partnership

Traffic Management Plan

Narrabeen Lagoon Entrance Clearance

Client: Rhelm

Version: V03

Date: 30 June 2023

TTPP Reference: 23066

Quality Record

| Version | Date | Prepared by | Reviewed by | Approved by | Signature |
|---------|------------|--------------------------|--------------|---------------|---|
| V01 | 24/05/2023 | Paul Cai, Clinton Cheung | Stephen Read | Wayne Johnson | Draft |
| V02 | 28/06/2023 | Paul Cai, Clinton Cheung | Stephen Read | Wayne Johnson |  |
| V03 | 30/06/2023 | Paul Cai, Clinton Cheung | Stephen Read | Wayne Johnson |  |

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APPENDICES

- A. TRAFFIC GUIDANCE SCHEME
- B. SWEEP PATH ANALYSIS

1 Introduction

1.1 Overview

The Transport Planning Partnership (TPPP) has been commissioned by Rhelm to prepare a Traffic Management Plan (TMP) for the Narrabeen Lagoon Entrance Clearance Works REF.

Narrabeen Lagoon Entrance is located on Sydney's northern beaches. Northern Beaches Council proposes to undertake clearance of the sand that has been accumulated in the entrance channel of Narrabeen Lagoon for flood mitigation purposes, with the excavated material to be placed on Collaroy-Narrabeen Beach. Public parking in the Birdwood Park car park would be temporarily unavailable due to the use of these car parks as construction compounds.

The proposed sand replenishment area on Collaroy-Narrabeen Beach is located between Goodwin and Stuart Street. The primary access for unloading of sand is from Mactier Street, with an alternative access at Wetherill Street when required.

The Narrabeen Lagoon Clearance works have been conducted multiple times over the past by Northern Beaches Council (formerly Warringah Council and Pittwater Council), most recently in 2021.

In preparation of this report, reference has been made to the following documents:

- Cardno 2021, Traffic Management Plan – Narrabeen Lagoon Entrance Clearance Works and Ocean Street Bridge Abutments.
- Transport for NSW 2022, Traffic Control at Work Sites Technical Manual, Issue No. 6.1.

This report has been prepared and checked by engineers who hold the TfNSW Prepare Work Zone Traffic Management Plans (PWZTMP) certification.

1.2 Objective of Works

The objectives of the Narrabeen Lagoon Entrance Clearance Works are:

- To mitigate flood risk to the low-lying residential properties surrounding Narrabeen Lagoon;
- To improve the water quality of Narrabeen Lagoon;
- To conserve or enhance the biological diversity of the Lagoon system; and
- To maintain or enhance beach amenity of Collaroy-Narrabeen beach.

1.3 Purpose of this Plan

The overall principles of this traffic management plan during the construction works include:

- manage access to/from adjacent properties
- manage and control construction vehicle activity in the vicinity of the site
- provide an appropriate and convenient environment for pedestrians and cyclists
- minimise impact on pedestrian movements
- provide alternative detour routes
- carry out construction activity in accordance with the approved work hours
- maintain appropriate public transport access; and
- estimate indicative traffic generation associated with the construction works.

1.4 Report Structure

This TMP is structured as follow:

- Section 2 describes the existing conditions
- Section 3 describes the proposed construction methodology
- Section 4 assesses the construction impacts of the proposed works
- Section 5 details the construction traffic management measures
- Section 6 provides a summary of the key findings and draws conclusions.

2 Existing Conditions

2.1 Site Description

Narrabeen Lagoon is located within Northern Beaches Local Government Area (LGA). Ocean Street Bridge passes over the entrance channel of the lagoon between Narrabeen Headland and Birdwood Park. The entrance channel is approximately 2km long and 150m wide and links the main body of the lagoon to the ocean.

Figure 2.1: Site Location



2.2 Surrounding Road Network

The site is surrounded by a network of state road and local roads. A description of the key roads that would be utilised during construction activities is detailed below. The road network surrounding the site is shown in Figure 2.2.

2.2.1 Pittwater Road

Pittwater Road is a two-way divided State Road (MR164) with three traffic lanes in each direction. Pittwater Road is a dual carriageway, with the width of each carriageway measuring approximately 10m. A bus lane is provided in the southbound direction in the AM between 6am – 10am, and in the northbound direction in the PM between 3pm – 7pm. Parking is generally permitted outside of these hours. The posted speed limit is 60 – 70km/h. It has several signalised intersections and a 40km/h school zone between Mactier Street and Robertson Street.

2.2.2 Ocean Street

Ocean Street is a two-way local collector road with one traffic lane in each direction and on-street parking on both sides of the road. The width of the carriageway is approximately 12.6m, providing enough space for on-street parking and cycle lanes on both sides of the road. It has a posted speed limit of 50km/h. St Joseph's Catholic Primary School is also located on this street with a school zone 40km/h limit between Wellington Street and Waterloo Street.

2.2.3 Walsh Street

Walsh Street is a two-way local road with one traffic lane in each direction. Walsh Street is a residential area between Collins Street and Pittwater Road. The width of the carriageway is approximately 10.9m, providing enough space for on-street parking on both sides of the road. It has a posted speed limit of 50km/h and is a shared on-road cycle route. Walsh Street is left turn entry only from Pittwater Road and left turn exit only into Pittwater Road. The street is signposted with "No Truck 3t and Over" signage between Collins Street and Narrabeen Park Parade in the eastbound direction only.

2.2.4 Mactier Street

Mactier Street is a two-way no-through local access street to the east of Pittwater Road. Traffic signals are provided at this intersection of Mactier Street / Pittwater Road, which will assist the turning movements at the intersection. It has a posted speed limit of 50km/h. The width of the carriageway is approximately 12.8m. The road provides unrestricted on-street parking spaces for approximately 10 cars.

2.2.5 Wetherill Street

Wetherill Street is a two-way no through local access street to the east of Pittwater Road. The intersection of Wetherill Street / Pittwater Road is a priority-controlled intersection, with Pittwater Road being the major road and Wetherill Street being the minor road. The

carriageway width is approximately 11.5m. The road provides unrestricted on-street parking spaces for approximately 8 cars.

2.2.6 Ocean Grove

Ocean Grove is a two-way road with a carriageway width of approximately 11m between Pittwater Road and Seaview Parade. Kerb-side parking is permitted on both sides of Ocean Grove. Traffic signals are provided at the intersection of Ocean Grove / Pittwater Road, which will assist the turning movements at this intersection. The speed limit on Ocean Grove is 50km/h.

2.2.7 Seaview Parade

Seaview Parade is a two-way road connecting Ocean Grove with Anzac Avenue. It has a carriageway width of approximately 12m with kerb-side parking on both sides of the road. The intersection of Seaview Parade / Anzac Avenue is a priority-controlled intersection with Anzac Avenue being the major road.

2.2.8 Anzac Avenue

Anzac Avenue is a two-way no through road to the east of Pittwater Road. Traffic signals are provided at the intersection of Anzac Avenue / Pittwater Road, which will assist the turning movements at the intersection. The width of the carriageway is about 12m with kerb-side parking on both sides of the road. It has a posted speed limit of 50km/h.

Figure 2.2: Road Network



2.3 Public Transport Facilities

Bus route 155 between Frenchs Forest and Bayview is the only bus service which operates along Ocean Street and Narrabeen Park Parade, Narrabeen. Bus stops are located every 200-300m along Ocean Street at Albemarle Street, Octavia Street, Emerald Street and Malcolm Street. The frequency of Route 155 on weekdays is once every 25-35 minutes during morning and evening peak hours, and once every hour outside of the peak. The service runs once every hour on weekends and public holidays.

Several bus routes also run north-south on Pittwater Road, including Bus Routes 182, 185, 181X, 190X and 199, as well as B-Line Bus Routes B1 and BN1. Route 181X also travels partly along the southern end of Ocean Street between Waterloo Street and Pittwater Road.

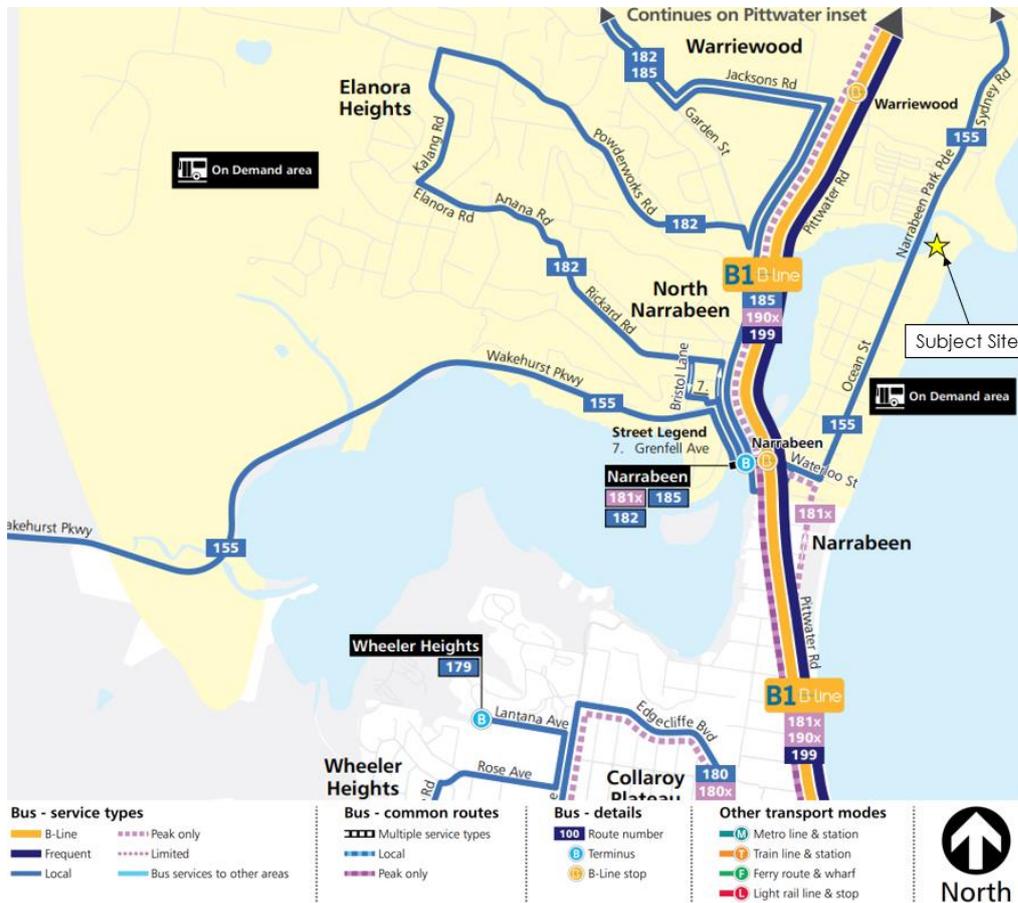
Summary of existing bus services are summarised in Table 2.1.

Table 2.1: Existing Bus Services

| Bus Route | Route Description | Frequency |
|-----------|--|--|
| 155 | Bayview Garden Village to Narrabeen and Frenchs Forest | 25-35 minutes during morning/evening peaks period Hourly during off-peaks |
| 181X | Narrabeen to City Wynyard (Express) | 10 min during morning/evening peaks period Does not run off-peak |
| 182 | Mona Vale to Narrabeen | 10 minutes during morning/evening peaks period Hourly during off-peaks |
| 185 | Mona Vale to Narrabeen via Warriewood Valley | 30 minutes |
| 190X | Avalon Beach to City Wynyard (Express) | 10 min during morning/evening peaks period Does not run off-peak |
| 199 | Palm Beach to Manly via Mona Vale & Dee Why | 10-15 min |

Information Source: Transport for NSW

Figure 2.3: Site Nearby Bus Stops



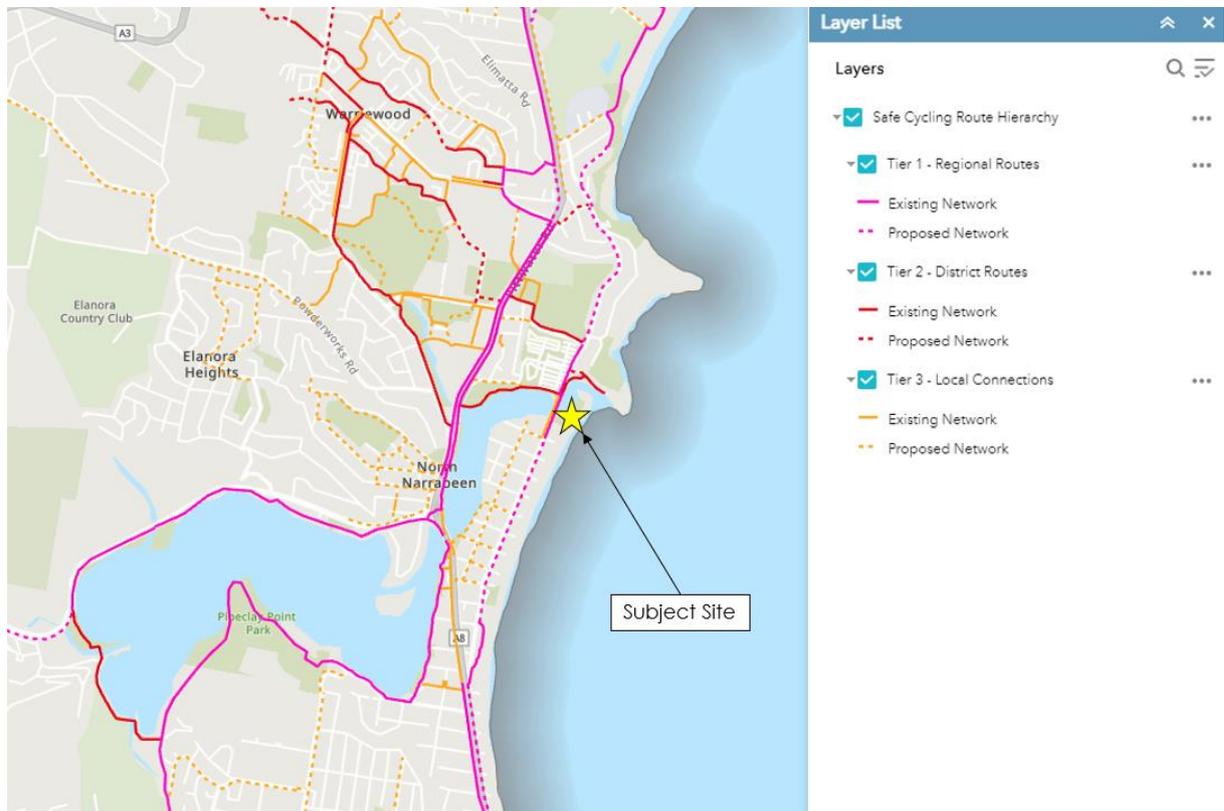
Source: TfNSW Northern Beaches and Lower North Shore Public Transport Network Map

2.4 Pedestrian and Cyclist Infrastructure

Well-established pedestrian infrastructure is provided surrounding the site. The area surrounding Narrabeen Lagoon Entrance is a popular destination for pedestrians. The pedestrian infrastructure provides good connectivity to the surrounds.

A number of off-road cycle paths and dedicated on-road cycle lanes are provided within the vicinity. The existing and proposed cycleway network is shown in Figure 2.4.

Figure 2.4: Cycleway Network



Source: Northern Beaches Council Bike Plan 2020 Safe Cycling Network

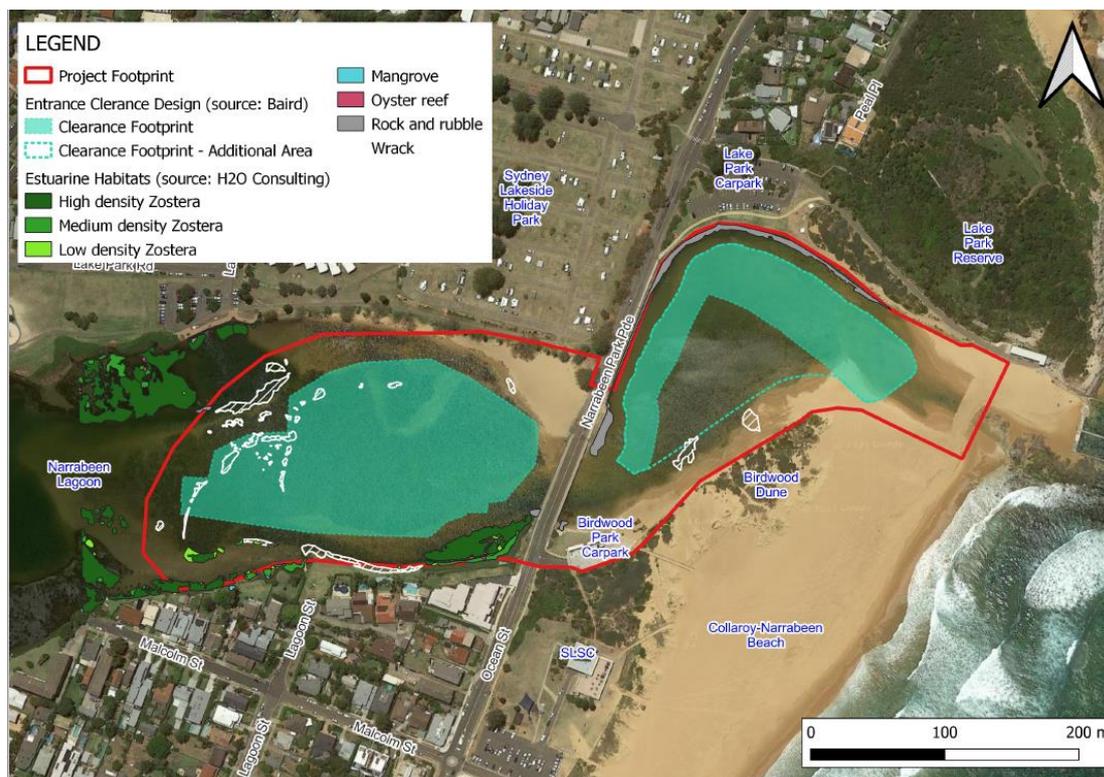
3 Proposed Construction Methodology

3.1 Description of Works

For the Narrabeen Lagoon Entrance Clearance Works sand is transported from Narrabeen Lagoon Entrance to Collaroy-Narrabeen Beach. Sand will be loaded into rigid 12-tonne bogie tipper trucks (~8m long) from Birdwood Park Carpark or from a stockpile area on the north-western side of Ocean Street bridge and driven to Mactier Street (primary access) or Wetherill Street (alternative access) via the nominated haulage routes as shown in Figure 3.2 and Figure 3.3.

It is proposed that the 2023 works will involve the excavation of approximately 9,700 m³ of sand east and 12,800 m³ of sand west of Ocean Street Bridge, summing to a total of 22,500 m³ of marine sand from the lagoon entrance as shown in the green area in Figure 3.1. An optional extra dredging of 17,500 m³ to the east of Ocean Street Bridge is also being proposed if budget and time permit, as shown in the red area in Figure 3.1. As per previous operations, a sand stockpile area will be located east of the Birdwood Park carpark and also on the north-western side of Ocean Street bridge. The sand will then be transported from the Birdwood Park Carpark to Mactier Street or Wetherill Street, and unloaded onto the beach. Sand will be placed between Goodwin and Stuart Street. The nominated truck routes are provided in Section 3.6 of this report.

Figure 3.1: Narrabeen Lagoon Entrance Clearance Zones



3.2 Work Hours and Duration

The works would be restricted to standard construction hours as follows:

- 7:00am-6:00pm Monday to Friday
- 8:00am-1:00pm on Saturday

The works would largely be undertaken Monday to Friday, although some Saturday works may be necessary to keep to the proposed program. No work would be undertaken on Sundays or public holidays.

It is anticipated that the works would be completed in around 12 to 16 weeks. The works would be undertaken outside of the peak holiday periods (i.e. the peak winter east coast low season and December/January summer school holidays).

3.3 Construction Workforce

The number of employees on any given day is expected to be between 5-10 for the Clearance works as per previous operations. It assumed that the majority will arrive at the work site before 7.00 am and leave the work site after 6.00 pm. This will generate a minimal increase in trips, consisting of inbound light vehicle traffic between 6.30 am – 7.00 am and outbound light vehicle traffic between 6.00 pm – 6.30 pm. Therefore, the peak vehicle movements generated by construction workforce will be earlier than the typical network morning peak hour (8 am to 9 am) and later than the network afternoon peak hour (5 pm to 6 pm) on a weekday.

3.4 Construction Worker Parking

Construction staff will utilise the Birdwood Park carpark as the primary site compound. The maximum expected staff numbers would be able to be accommodated within the existing car park. However, construction staff would be encouraged to carpool to reduce traffic turning movements generated by the construction staff.

3.5 Construction Vehicle Type and Volumes

As per the 2018 and 2021 works, it is anticipated that the plant and equipment to be used may include any or all of the following:

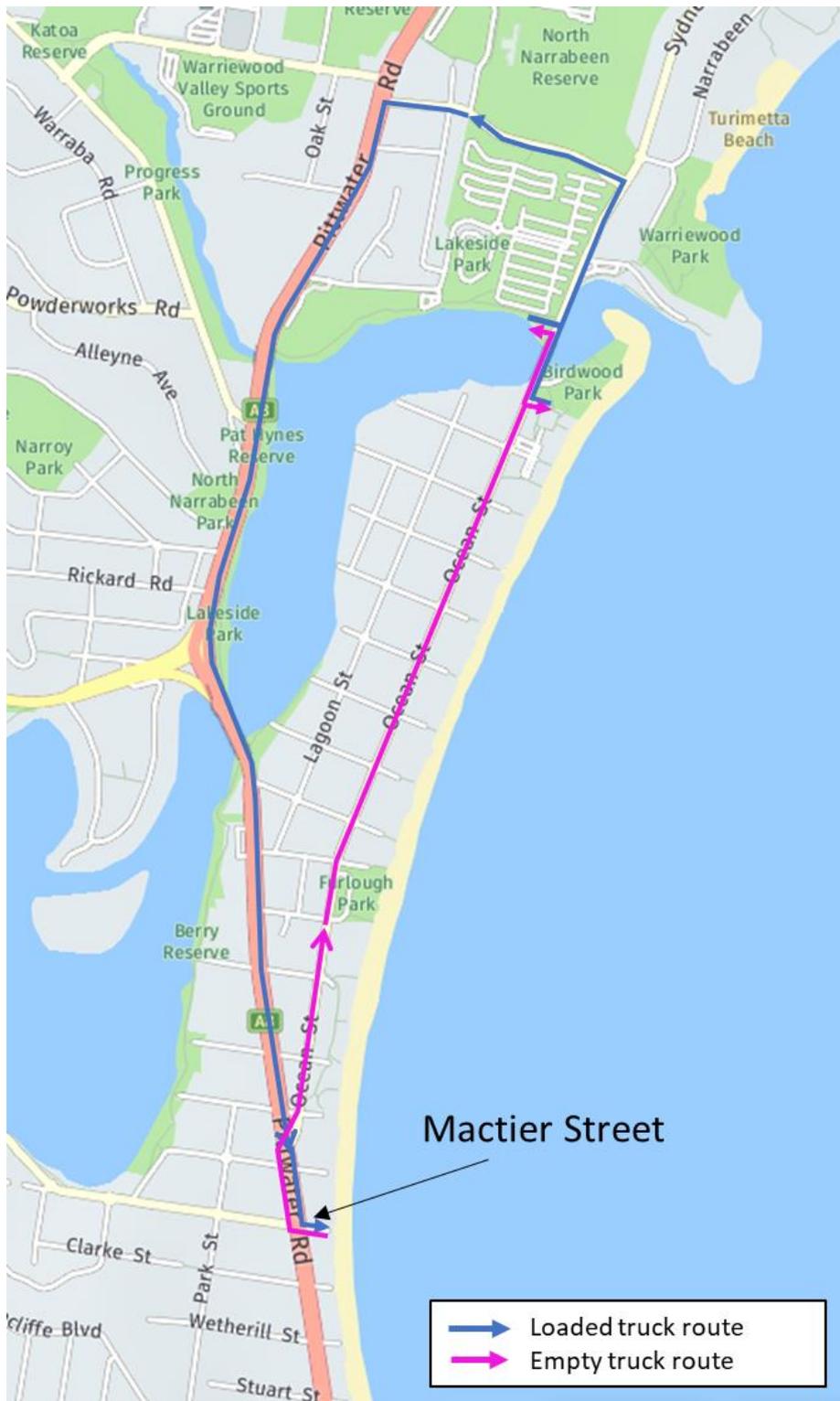
- Cutter pump dredge with generator
- 23t excavators
- 40t articulated dump truck
- Bulldozer

- Front end loader
- 12t Bogie tipper trucks
- Light construction vehicles travelling to the site, or between work areas

3.6 Construction Vehicle Movement Routes

Construction vehicles would be loaded with sand at the site compound at Birdwood Park carpark or the stockpile area on the north-western side of Ocean Street bridge. The primary route for transport of excavated sand from the lagoon to the beach would be via Ocean Street, Walsh Street, Pittwater Road and Mactier Street. The proposed primary truck routes are shown in Figure 3.2.

Figure 3.2: Primary Construction Vehicle Routes (Mactier Street Access)

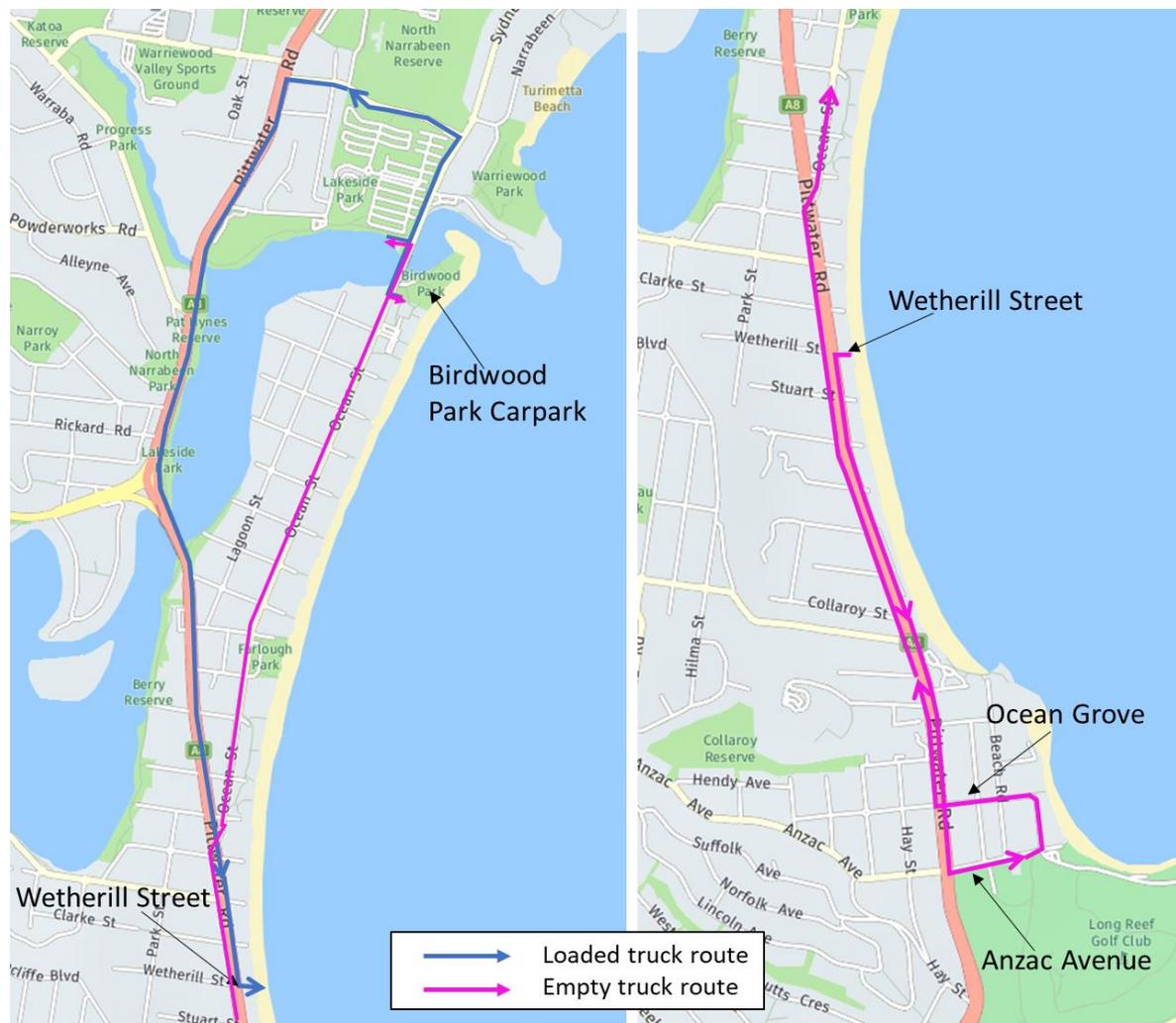


An alternative access at Wetherill Street may also be used. This alternative unloading area would assist in transporting excavated material further south of Collaroy-Narrabeen Beach when required. Since the intersection of Wetherill Street and Pittwater Road is unsignalised

and Pittwater Road has three lanes in each direction, truck movements are required to be left-in and left-out only. It is proposed that empty trucks exiting from Wetherill Street onto Pittwater Road southbound would perform a loop movement via Anzac Avenue, Seaview Parade, Ocean Grove and Pittwater Road to travel north back to the Birdwood Park Carpark or the stockpile area on the north-western side of Ocean Street bridge. The alternative construction vehicle route is shown in Figure 3.3.

Swept path analysis has been conducted demonstrating a rigid tipper truck (8m long) looping around via Anzac Avenue, Seaview Parade, Ocean Grove and Pittwater Road, as shown in Appendix B.

Figure 3.3: Alternative Construction Vehicle Routes (Wetherill Street Access)



3.7 Truck Layover Area

Based on previous Clearance Work experience, it was found that a truck layover area was required due to the ability to only unload one truck at a time. Therefore, trucks are to use a truck layover area while waiting to access the beach front at Mactier Street (or Wetherill Street).

An appropriate truck layover area has been identified on the southern side of Walsh Street between Narrabeen Park Parade and Collins Street as shown in Figure 3.2. At this location, Walsh Street is approximately 11m wide with plenty of on-street parking available and no adjacent residential houses. It is recommended that additional signage be provided to inform truck and other road users to use caution in this area. If a temporary truck zone is required on Walsh Street, an application for the truck zone will be submitted to Council for approval. This will be a separate application to this Traffic Management Plan.

No trucks are permitted to wait on Pittwater Road in the bus lane just prior to Mactier Street, as Pittwater Road is a state road with high traffic volumes and regular bus services.

4 Construction Impacts Assessment

4.1 Traffic Generation

It is anticipated that approximately 22,500 m³ of sand would be excavated and transported from Narrabeen Lagoon to Collaroy-Narrabeen Beach, and an extra excavation of 17,500 m³ of sand pending budget and time. A similar sized transportation truck (12 tonne bogie tipper truck) would again be used during the 2023 clearance works. The anticipated truck movements are shown in Table 4.1.

It is estimated that a total of 3,645 laden truck movements would be required to transport 22,500 m³ of sand during the 2023 clearance works. Assuming the scheduled duration of 14 weeks (77 full working days), this equates to approximately 48 laden truck movements per weekday or an average of 5 laden truck movements per hour during the weekday and Saturday.

However, it is noted that efficiency and productivity can be improved through additional truck movements per day and thus enabling completion of works within a shorter timeframe.

If the additional excavation of 17,500 m³ of sand is undertaken, it will generate approximately 37 additional truck movements per day or 4 additional truck movements per hour if the scheduled duration remains as 14 weeks. Therefore, this will result in an average of 9 truck movements per hour if a total of 40,000 m³ of sand is to be excavated within 14 weeks.

As a comparison, the number of truck movements per hour for the 2021 clearance works was about 8-9 truck movements per hour. Therefore, the forecasted traffic generation of the 2023 clearance works will be similar to the traffic generation of the 2021 operation, including the extra excavation of 17,500 m³ of sand. Therefore, the forecasted traffic generation would be accommodated by the existing road network.

Table 4.1: Traffic Generation

| Traffic Generation Estimate | |
|---|--|
| Volume of Sand to be Transported | 22,500 m ³ |
| Approximate Capacity of Truck | 6.174 m ³ / truck (based on 2018 operation) |
| Total Number of Estimated Truck Movements | 3,645 laden truck movements |
| Scheduled Duration for Sand Transportation | 14 weeks x 5.5 days / week = 77 days |
| Number of Truck Movements per Day | 48 laden truck movements / weekday |
| Average Number of Truck Movements per Hour | 5 laden truck movements / hour |
| Additional Volume of Sand to be Transport if Approved | 17,500 m ³ |
| Additional Number of Truck Movements per Day | 37 laden truck movements / day |
| Additional Number of Truck Movements per Hour | 4 laden truck movement / hour |

4.2 Pedestrian Management and Cycle Access

Temporary fencing would be used around the site perimeter providing separation between the construction site and the footpath.

Pedestrian movements on the footpath along the site frontages would be maintained at all stages. Site personnel would assist construction vehicles as they arrive or depart the site to manage safe vehicle interactions with pedestrians. Pedestrians would have right of way at all times. Access to the site would require authorisation from the construction site manager and be prohibited for the general public.

Nearby cycling activity would not be impacted by the proposed construction works.

As per previous post-completion reports and audits, the following pedestrian management measures are recommended:

- Installation of barricades on both footpaths (opposite sides of the road) at the intersection of Mactier Street (or Wetherill Street) / beach front;
- The area of the beach where sand replenishment works is being carried out be cordoned off from pedestrian movements by installing Para webbing around the perimeter of the works area on the beach;
- Maintain access to beach access ways without being blocked with stockpiles, where feasible. Where it may not be feasible, appropriate signage would be provided to direct pedestrians to use another footpath; and

- Maintain safe access and provide level areas in front of surf clubs for the launching of rescue boats and undertaking surf club activities.

4.3 Public Transport Impacts

Construction traffic generation is expected to be low, and unlikely to result in any impacts to public transport routes on the broader road and transport network.

4.4 Emergency Services

Access to the subject site and neighbouring sites by emergency vehicles would not be affected by the works as the roads and footpath would be unaffected. Emergency protocols on the site would include a requirement for site personnel to assist with emergency access from the street.

Liaison would be maintained with police and emergency services agencies throughout the construction period and a 24-hour contact would be made available for 'out-of-hours' emergencies and access.

There would be no impact on access for emergency vehicles to neighbouring properties as a result of the proposed construction activities.

5 Construction Traffic Management Measures

5.1 Traffic Guidance Scheme

Traffic Guidance Schemes (TGSs) have been prepared and designed in accordance with TfNSW Traffic Control at Works Sites manual. The TGSs are provided in Appendix A.

Advisory road signages would be installed along surrounding streets to warn drivers approaching the site of construction vehicles entering and exiting the site and works zone and the presence of portable boom barriers. Traffic controllers would wait for a suitable gap in traffic to allow them to assist trucks to exit the site.

All advisory signs would be installed in accordance with AS 1742.3 *Manual of Uniform Traffic Control Devices - Traffic Control Devices for Works on Roads* and the TfNSW *Traffic Control at Worksites Manual*. Signs would be installed and maintained throughout the construction period where it applies.

5.2 Inspection of Traffic Control Measures

It is the project managers responsibility to implement the traffic control measures as identified in the TMP and monitor the effectiveness of the traffic control measures.

Temporary traffic controls will be regularly inspected by the Construction Contractor to identify potential safety hazards to enable implementation of corrective solutions. Daily inspections and maintenance of controls will be undertaken by the contractor, and any maintenance/amendments will be recorded. The site supervisor will check all relevant traffic control management measures on-site prior to commencement of works each day.

5.3 Monitoring

Monitoring under this TMP will be undertaken by the contractor during weekly inspections of construction vehicle activities to monitor conformance with the requirements of the Council and this plan. Weekly inspections will focus on the following key issues:

- Safe movement of traffic and pedestrians
- Signage and barriers are clearly visible
- Construction roads support safe working and driving
- Safety of persons and property in and around the work site

Traffic will be monitored on the road network including construction vehicle movements entering and departing the work site.

5.4 Worker Induction and Parking

All workers and subcontractors on-site would be required to undergo a site induction. The induction will include the routes to/ from the site, on-site parking, environmental, OH&S, driver protocols and emergency procedure. This would be the responsibility of the Construction Contractor.

Sufficient off-street parking will be provided for construction staff. Nevertheless, it is encouraged to promote the use of public transport and/or carpooling.

5.5 Vehicle Access and Transport Routes

All construction vehicles will enter and exit the site in a forward direction, and all loading/unloading shall be undertaken on-site during the approved work hours.

Construction vehicles shall radio/call the site office on approach to the site to ensure that space is available within the site loading area. The queuing or marshalling of construction vehicles shall not be permitted on public roads other than at the approved layover area.

Other protocols would be in place to ensure:

- site inductions are implemented for construction workers.
- heavy vehicle drivers shall adhere to the nominated transport routes.
- heavy vehicle drivers and construction workers are aware of pedestrians and cyclists in the vicinity of the site.
- drivers shall be aware of the existing sign posted speed limits.

6 Conclusion

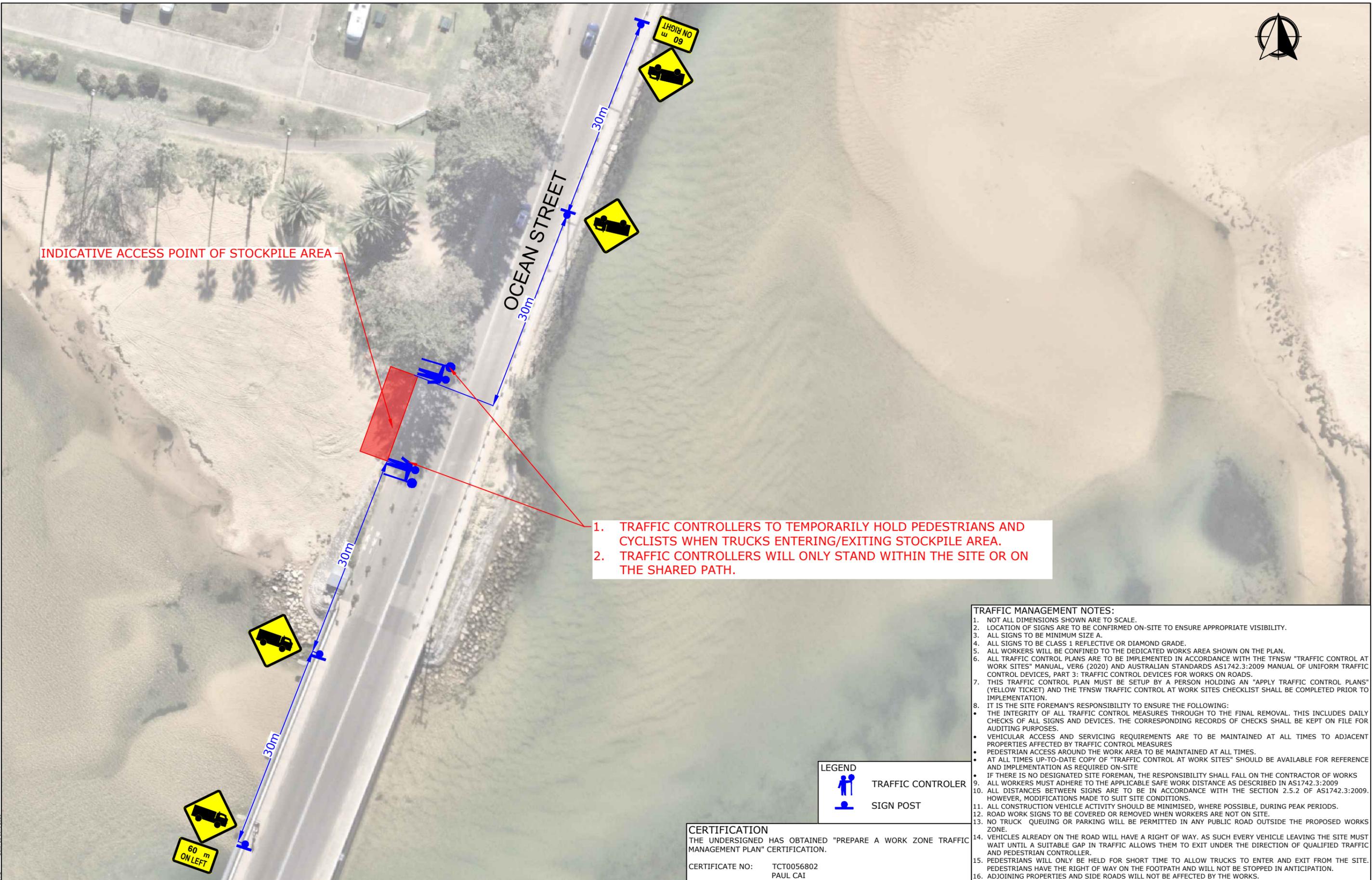
The proposed 2023 Narrabeen Lagoon Entrance Clearance Works Project has been assessed with regard to the traffic, parking and active transport impacts. The main findings from this Traffic Management Plan were:

- The 2023 Narrabeen Lagoon Entrance Clearance Works will follow a similar procedure to previous clearance works, most recently in 2021. Learnings from past operations have been taken into consideration to optimise the construction methodology and to minimise impacts to the community and road network.
- The 2023 Clearance Works is proposed to excavate about 22,500 m³ of sand, an additional excavation of 17,500 m³ of sand is optional if budget and time permit. Sand will be loaded into trucks from Birdwood Park Carpark or from a secondary stockpile area on the north-western side of Ocean Street bridge.
- Based on similar truck capacity used in the 2021 Traffic Management Plan, there will be up to 48 truck movements per day (or 5 truck movements per hour) to transport a total of 22,500 m³ of sand over a timeframe of 14 weeks (77 days). If additional 17,500 m³ of sand is to be excavated, this will increase the truck movement to be 9 trucks per hour. This forecasted traffic generation of the 2023 operation will be similar to the traffic generation of previous operations.
- The primary sand transportation route will be the same as previous Clearance Works, with trucks travelling in an anti-clockwise direction along Narrabeen Park Parade, Walsh Street, Pittwater Road, Mactier Street and Ocean Street. The truck layover area will be on the southern side of Walsh Street between Narrabeen Park Parade and Collins Street.
- An alternative unloading area at Wetherill Street is being proposed for the 2023 clearance works. Loaded trucks will travel along Narrabeen Park Parade, Walsh Street, Pittwater Road and Wetherill Street to unload the sand. Empty trucks exiting from Wetherill Street will travel on Pittwater Road southbound, perform a loop movement via Anzac Avenue, Seaview Parade and Ocean Grove onto Pittwater Road northbound to travel back to Birdwood Park Carpark.
- Mitigation measures for pedestrians, cyclists and beach users have been addressed to ensure their safety and that impacts during construction are minimised.
- The community should be notified about the project through different mediums such as online, on-site and through newspapers so they are aware about the project and know how they will be temporarily impacted.

The overall traffic, transport and parking impacts during construction work are supported.

Appendix A

Traffic Guidance Scheme



INDICATIVE ACCESS POINT OF STOCKPILE AREA

1. TRAFFIC CONTROLLERS TO TEMPORARILY HOLD PEDESTRIANS AND CYCLISTS WHEN TRUCKS ENTERING/EXITING STOCKPILE AREA.
2. TRAFFIC CONTROLLERS WILL ONLY STAND WITHIN THE SITE OR ON THE SHARED PATH.

- TRAFFIC MANAGEMENT NOTES:**
1. NOT ALL DIMENSIONS SHOWN ARE TO SCALE.
 2. LOCATION OF SIGNS ARE TO BE CONFIRMED ON-SITE TO ENSURE APPROPRIATE VISIBILITY.
 3. ALL SIGNS TO BE MINIMUM SIZE A.
 4. ALL SIGNS TO BE CLASS 1 REFLECTIVE OR DIAMOND GRADE.
 5. ALL WORKERS WILL BE CONFINED TO THE DEDICATED WORKS AREA SHOWN ON THE PLAN.
 6. ALL TRAFFIC CONTROL PLANS ARE TO BE IMPLEMENTED IN ACCORDANCE WITH THE TfNSW "TRAFFIC CONTROL AT WORK SITES" MANUAL, VER6 (2020) AND AUSTRALIAN STANDARDS AS1742.3:2009 MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES, PART 3: TRAFFIC CONTROL DEVICES FOR WORKS ON ROADS.
 7. THIS TRAFFIC CONTROL PLAN MUST BE SETUP BY A PERSON HOLDING AN "APPLY TRAFFIC CONTROL PLANS" (YELLOW TICKET) AND THE TfNSW TRAFFIC CONTROL AT WORK SITES CHECKLIST SHALL BE COMPLETED PRIOR TO IMPLEMENTATION.
 8. IT IS THE SITE FOREMAN'S RESPONSIBILITY TO ENSURE THE FOLLOWING:
 - THE INTEGRITY OF ALL TRAFFIC CONTROL MEASURES THROUGH TO THE FINAL REMOVAL. THIS INCLUDES DAILY CHECKS OF ALL SIGNS AND DEVICES. THE CORRESPONDING RECORDS OF CHECKS SHALL BE KEPT ON FILE FOR AUDITING PURPOSES.
 - VEHICULAR ACCESS AND SERVICING REQUIREMENTS ARE TO BE MAINTAINED AT ALL TIMES TO ADJACENT PROPERTIES AFFECTED BY TRAFFIC CONTROL MEASURES
 - PEDESTRIAN ACCESS AROUND THE WORK AREA TO BE MAINTAINED AT ALL TIMES.
 - AT ALL TIMES UP-TO-DATE COPY OF "TRAFFIC CONTROL AT WORK SITES" SHOULD BE AVAILABLE FOR REFERENCE AND IMPLEMENTATION AS REQUIRED ON-SITE
 - IF THERE IS NO DESIGNATED SITE FOREMAN, THE RESPONSIBILITY SHALL FALL ON THE CONTRACTOR OF WORKS
 9. ALL WORKERS MUST ADHERE TO THE APPLICABLE SAFE WORK DISTANCE AS DESCRIBED IN AS1742.3:2009.
 10. ALL DISTANCES BETWEEN SIGNS ARE TO BE IN ACCORDANCE WITH THE SECTION 2.5.2 OF AS1742.3:2009. HOWEVER, MODIFICATIONS MADE TO SUIT SITE CONDITIONS.
 11. ALL CONSTRUCTION VEHICLE ACTIVITY SHOULD BE MINIMISED, WHERE POSSIBLE, DURING PEAK PERIODS.
 12. ROAD WORK SIGNS TO BE COVERED OR REMOVED WHEN WORKERS ARE NOT ON SITE.
 13. NO TRUCK QUEUING OR PARKING WILL BE PERMITTED IN ANY PUBLIC ROAD OUTSIDE THE PROPOSED WORKS ZONE.
 14. VEHICLES ALREADY ON THE ROAD WILL HAVE A RIGHT OF WAY. AS SUCH EVERY VEHICLE LEAVING THE SITE MUST WAIT UNTIL A SUITABLE GAP IN TRAFFIC ALLOWS THEM TO EXIT UNDER THE DIRECTION OF QUALIFIED TRAFFIC AND PEDESTRIAN CONTROLLER.
 15. PEDESTRIANS WILL ONLY BE HELD FOR SHORT TIME TO ALLOW TRUCKS TO ENTER AND EXIT FROM THE SITE. PEDESTRIANS HAVE THE RIGHT OF WAY ON THE FOOTPATH AND WILL NOT BE STOPPED IN ANTICIPATION.
 16. ADJOINING PROPERTIES AND SIDE ROADS WILL NOT BE AFFECTED BY THE WORKS.

LEGEND

TRAFFIC CONTROLLER

SIGN POST

CERTIFICATION
 THE UNDERSIGNED HAS OBTAINED "PREPARE A WORK ZONE TRAFFIC MANAGEMENT PLAN" CERTIFICATION.
 CERTIFICATE NO: TCT0056802
 PAUL CAI

| REV. | DESCRIPTION | DRAWN | CHECK | APP'D | DATE |
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| A | ISSUE FOR DISCUSSION | HT | PC | SR | 28/06/23 |
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PROJECT: NARRABEEN LAGOON ENTRANCE CLEARANCE

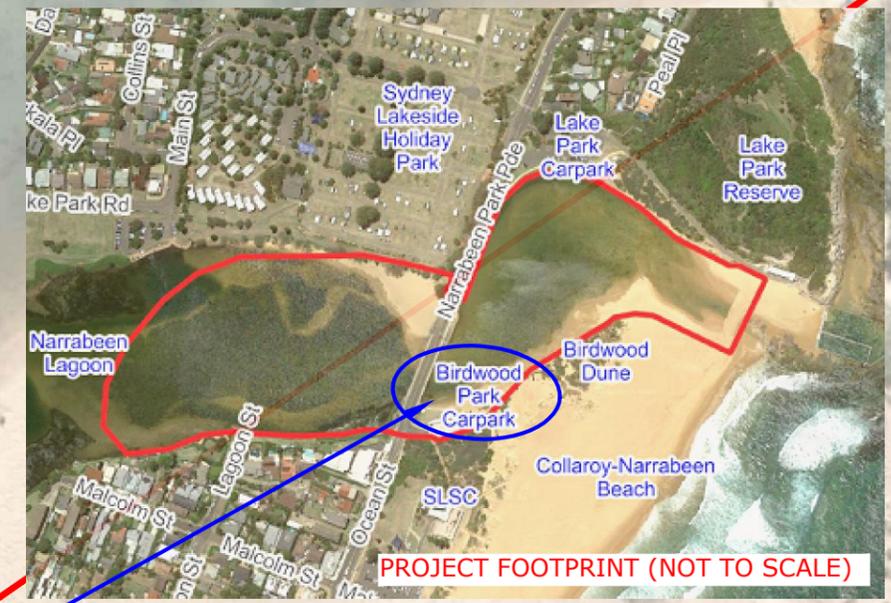
TITLE: TRAFFIC GUIDANCE SCHEME
 STOCKPILE AREA NORTHWEST OF OCEAN STREET BRIDGE

| | | | |
|-------------|--------------|------|--|
| DWG No. | 23066CAD005 | | |
| | FIGURE 1 | | |
| DATE STAMP | 28 JUNE 2023 | | |
| PROJECT No. | SCALE | REV. | |
| 23066 | 1:500 @A3 | A | |

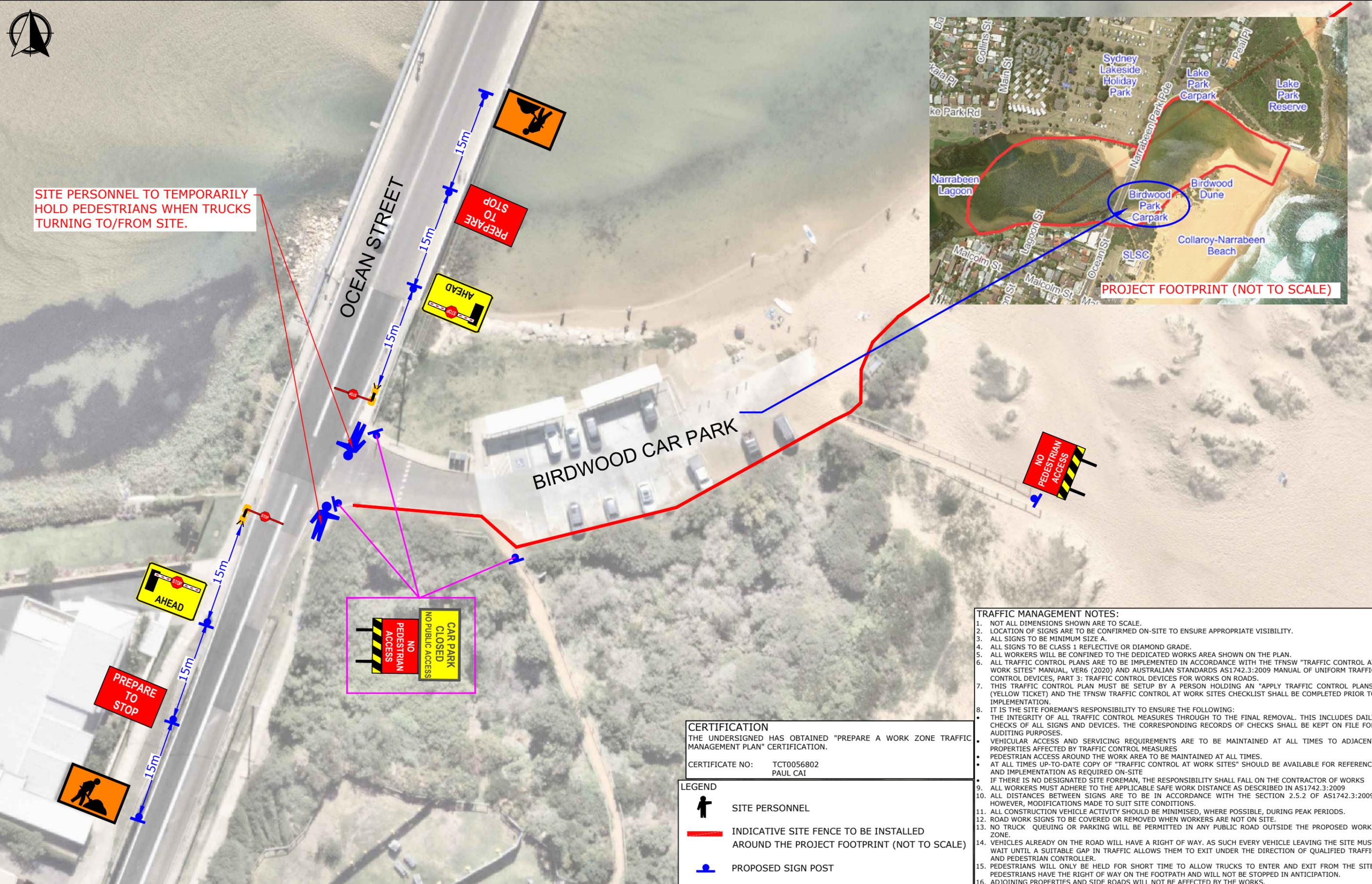
Filename: 23066CAD005-230623-TPP.dwg Date: 28 June 2023



SITE PERSONNEL TO TEMPORARILY HOLD PEDESTRIANS WHEN TRUCKS TURNING TO/FROM SITE.



PROJECT FOOTPRINT (NOT TO SCALE)



NO PEDESTRIAN ACCESS
NO PUBLIC ACCESS
CAR PARK CLOSED

CERTIFICATION
 THE UNDERSIGNED HAS OBTAINED "PREPARE A WORK ZONE TRAFFIC MANAGEMENT PLAN" CERTIFICATION.
 CERTIFICATE NO: TCT0056802
 PAUL CAI

- LEGEND**
- SITE PERSONNEL
 - INDICATIVE SITE FENCE TO BE INSTALLED AROUND THE PROJECT FOOTPRINT (NOT TO SCALE)
 - PROPOSED SIGN POST

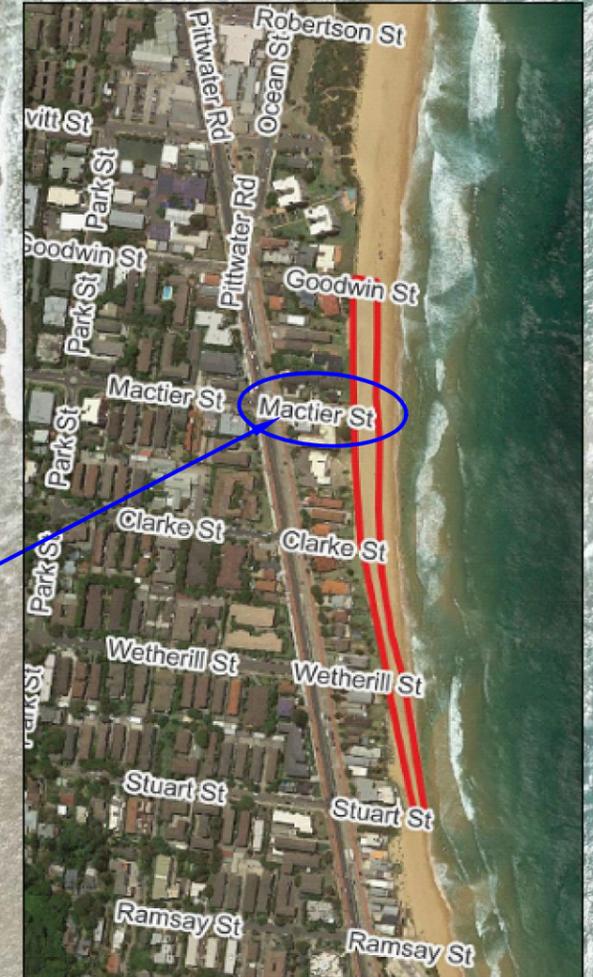
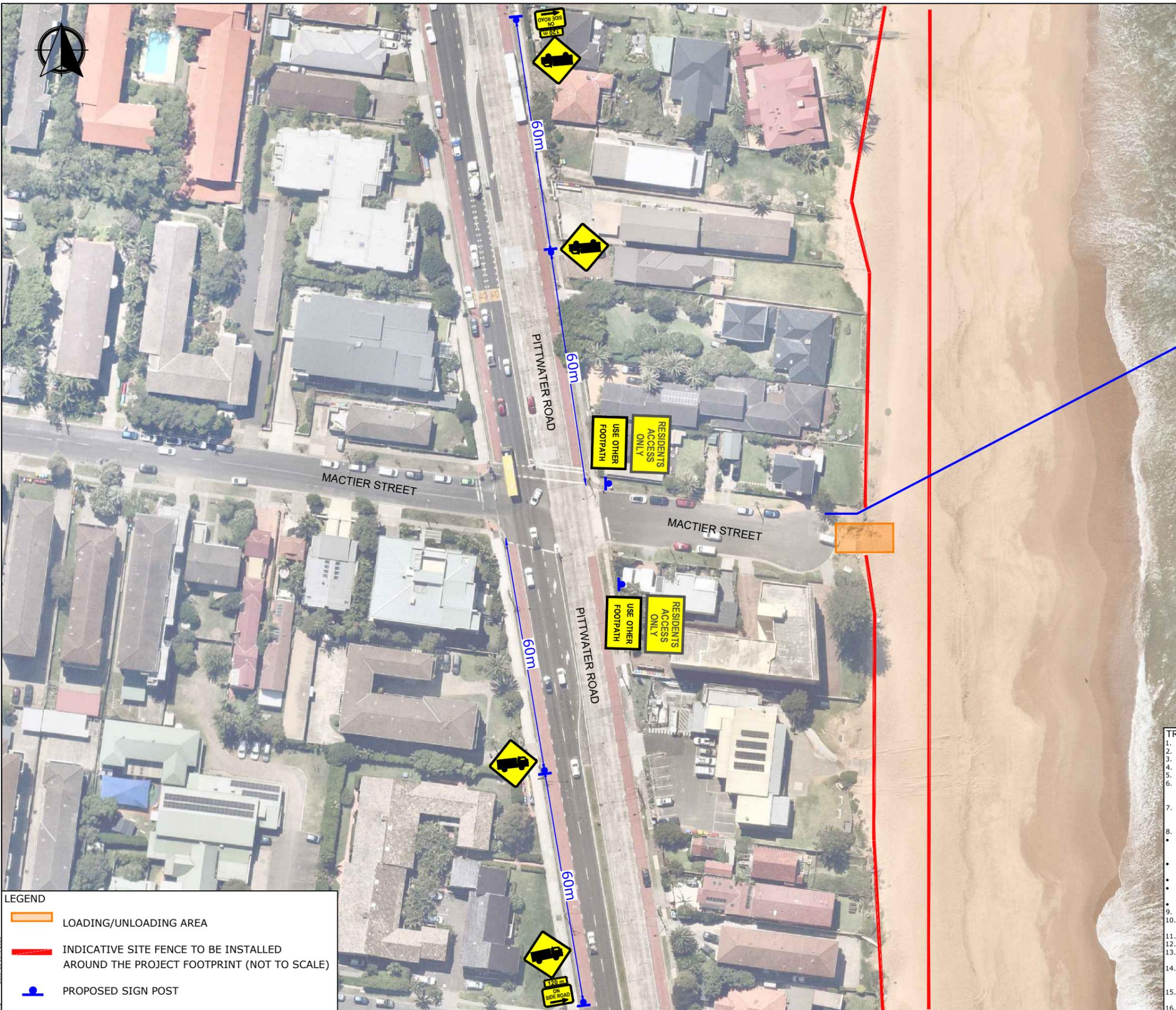
- TRAFFIC MANAGEMENT NOTES:**
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| REV. | DESCRIPTION | DRAWN | CHECK | APP'D | DATE |
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| A | ISSUE FOR DISCUSSION | HT | PC | SR | 28/06/23 |
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PROJECT: NARRABEEN LAGOON ENTRANCE CLEARANCE
 TITLE: TRAFFIC GUIDANCE SCHEME OCEAN STREET & BIRDWOOD CAR PARK

| | | | |
|-------------|--------------|------|--|
| DWG No. | 23066CAD005 | | |
| | FIGURE 2 | | |
| DATE STAMP | 28 JUNE 2023 | | |
| PROJECT No. | SCALE | REV. | |
| 23066 | 1:500 @A3 | A | |



PROJECT FOOTPRINT (NOT TO SCALE)

CERTIFICATION
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 PAUL CAI

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LEGEND

- LOADING/UNLOADING AREA
- INDICATIVE SITE FENCE TO BE INSTALLED AROUND THE PROJECT FOOTPRINT (NOT TO SCALE)
- PROPOSED SIGN POST

| REV. | DESCRIPTION | DRAWN | CHECK | APP'D | DATE |
|------|----------------------|-------|-------|-------|----------|
| A | ISSUE FOR DISCUSSION | HT | PC | SR | 28/06/23 |
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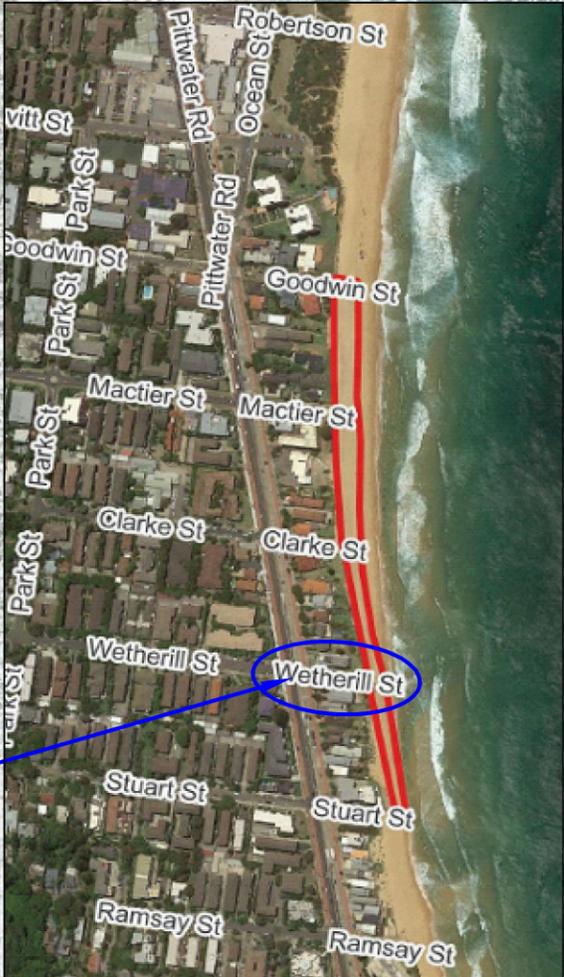
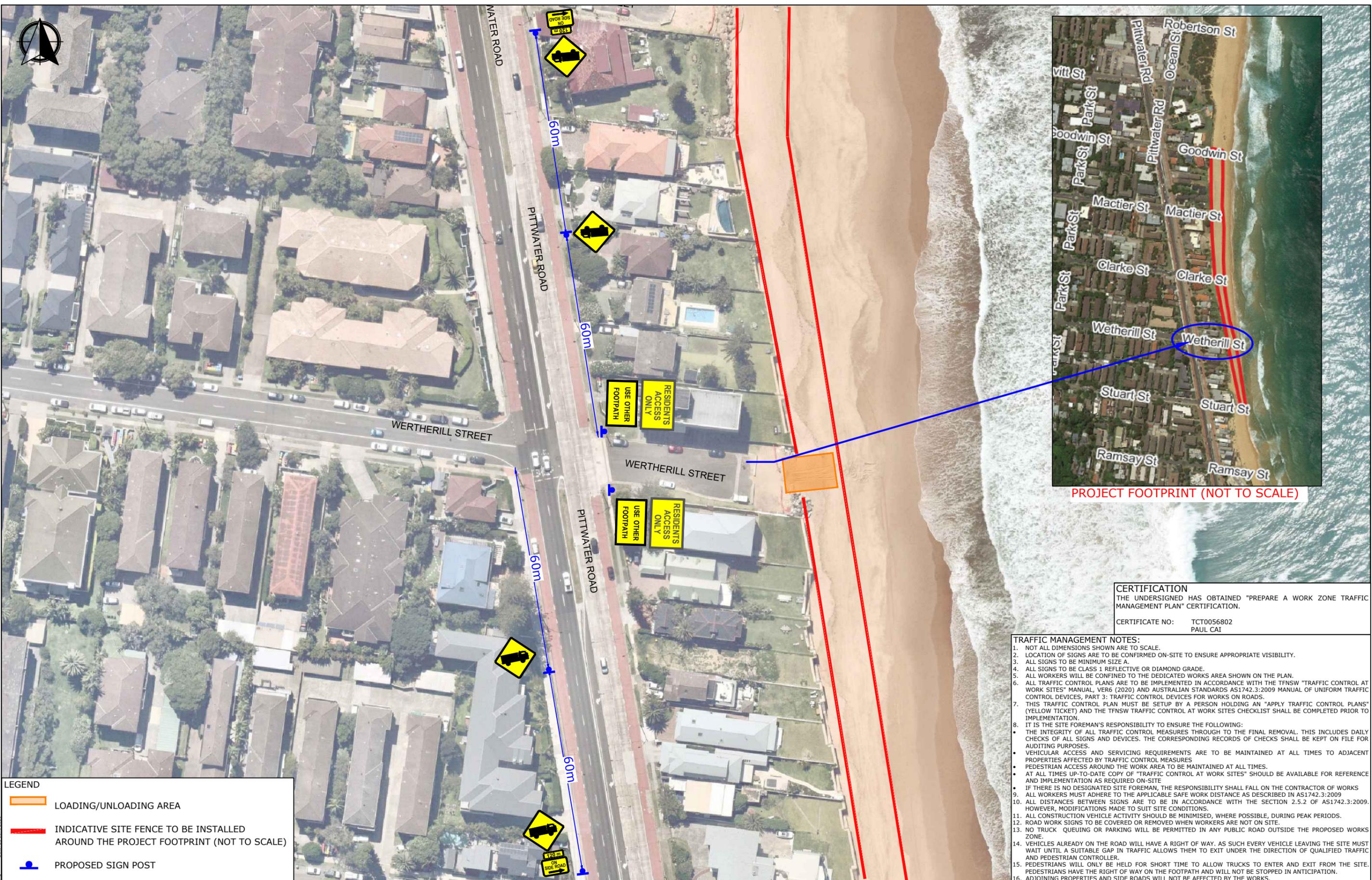


PROJECT: NARRABEEN LAGOON ENTRANCE CLEARANCE

TITLE: TRAFFIC GUIDANCE SCHEME
PITTWATER ROAD & MACTIER STREET

| | | | |
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| DWG No. | 23066CAD005 | | |
| | FIGURE 3 | | |
| DATE STAMP | 28 JUNE 2023 | | |
| PROJECT No. | SCALE | REV. | |
| 23066 | 1:1000 @A3 | A | |

Filename: 23066CAD005-230623-TPP.dwg Date: 28 June 2023



PROJECT FOOTPRINT (NOT TO SCALE)

CERTIFICATION
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 PAUL CAI

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LEGEND

- LOADING/UNLOADING AREA
- INDICATIVE SITE FENCE TO BE INSTALLED AROUND THE PROJECT FOOTPRINT (NOT TO SCALE)
- PROPOSED SIGN POST

| REV. | DESCRIPTION | DRAWN | CHECK | APP'D | DATE |
|------|----------------------|-------|-------|-------|----------|
| A | ISSUE FOR DISCUSSION | HT | PC | SR | 28/06/23 |
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PROJECT: NARRABEEN LAGOON ENTRANCE CLEARANCE

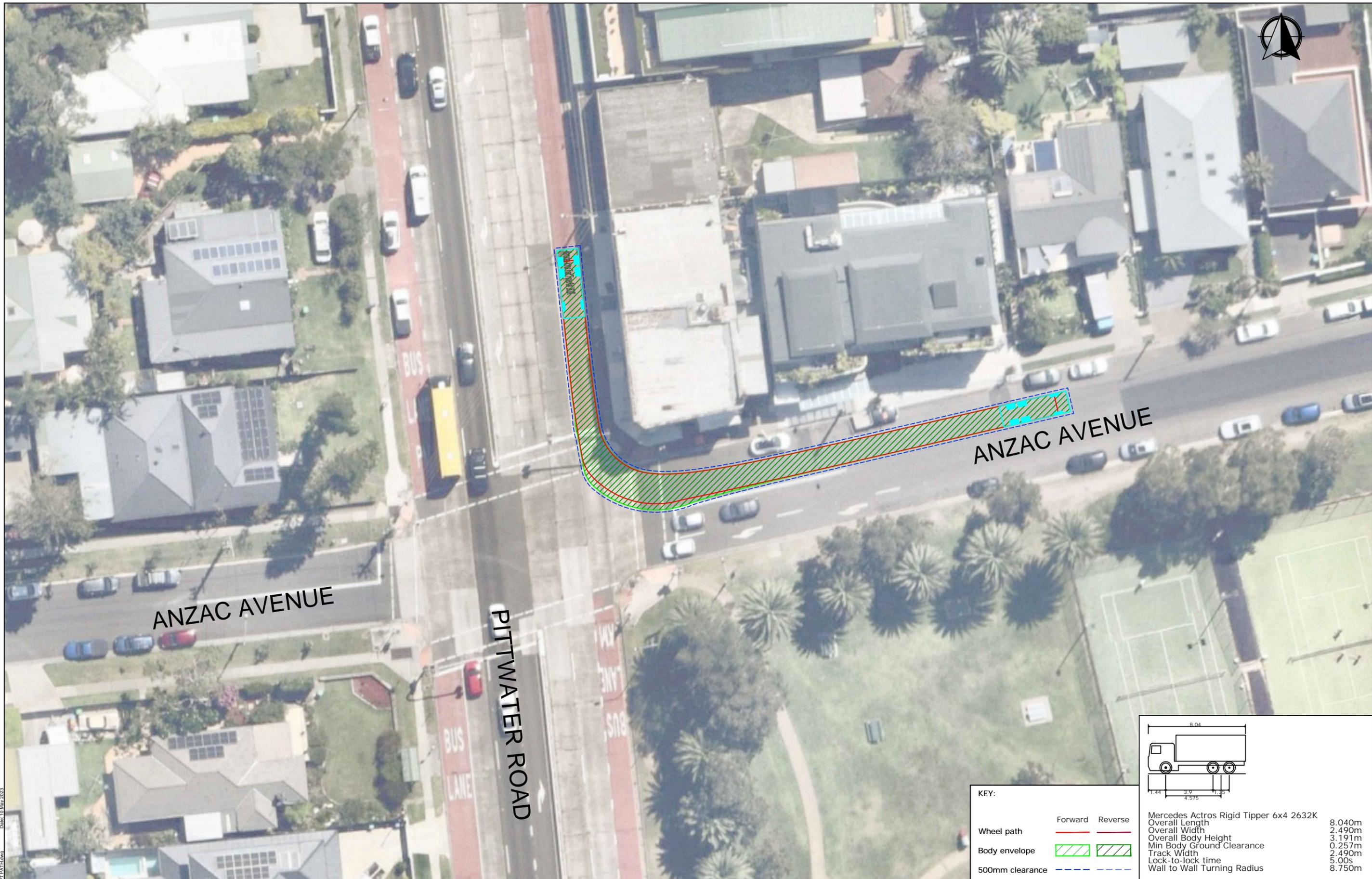
TITLE: TRAFFIC GUIDANCE SCHEME
PITTWATER ROAD & WETHERILL STREET

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| DWG No. | 23066CAD005 | | |
| | FIGURE 4 | | |
| DATE STAMP | 28 JUNE 2023 | | |
| PROJECT No. | SCALE | REV. | |
| 23066 | 1:1000 @A3 | A | |

File Name: 23066CAD005-230623-TPP.dwg Date: 28 June 2023

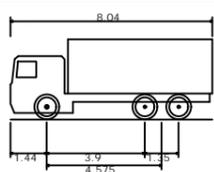
Appendix B

Swept Path Analysis



KEY:

| | | |
|-----------------|---------|---------|
| Wheel path | Forward | Reverse |
| Body envelope | | |
| 500mm clearance | | |



| | |
|--|--------|
| Mercedes Actros Rigid Tipper 6x4 2632K | |
| Overall Length | 8.040m |
| Overall Width | 2.490m |
| Overall Body Height | 3.191m |
| Min Body Ground Clearance | 0.257m |
| Track Width | 2.490m |
| Lock-to-lock time | 5.00s |
| Wall to Wall Turning Radius | 8.750m |

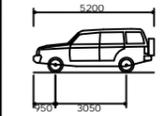
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| A | ISSUE FOR DISCUSSION | HT | PC | SR | 09/05/23 |
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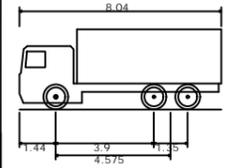
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| PROJECT | NARRABEEN LAKE PROJECT | | |
| TITLE | SWEPT PATH ANALYSIS 8m TIPPER TRUCK | | |

| | | |
|-------------|-------------|------|
| DWG No. | 23066CAD003 | |
| | FIGURE 1 | |
| DATE STAMP | 09 MAY 2023 | |
| PROJECT No. | SCALE | REV. |
| 23066 | 1:400 @A3 | A |

File name: 23066CAD003-230509-SWEPT PATH.dwg Date: 10 May 2023



| | |
|---|--------|
| B99 Vehicle (Realistic min radius) (2004) | |
| Overall Length | 5200mm |
| Overall Width | 1940mm |
| Overall Body Height | 1878mm |
| Min Body Ground Clearance | 272mm |
| Track Width | 1840mm |
| Lock-to-lock time | 4.00s |
| Curb to Curb Turning Radius | 6250mm |



| | |
|--|--------|
| Mercedes Actros Rigid Tipper 6x4 2632K | |
| Overall Length | 8.040m |
| Overall Width | 2.490m |
| Overall Body Height | 3.191m |
| Min Body Ground Clearance | 0.257m |
| Track Width | 2.490m |
| Lock-to-lock time | 5.00s |
| Wall to Wall Turning Radius | 8.750m |

KEY:

| | | |
|-----------------|---------|---------|
| Wheel path | Forward | Reverse |
| Body envelope | | |
| 500mm clearance | | |

| REV. | DESCRIPTION | DRAWN | CHECK | APP'D | DATE |
|------|----------------------|-------|-------|-------|----------|
| A | ISSUE FOR DISCUSSION | HT | PC | SR | 09/05/23 |
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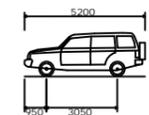


PROJECT: NARRABEEN LAKE PROJECT

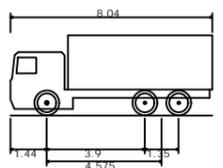
TITLE: SWEPT PATH ANALYSIS
8m TIPPER TRUCK & 5.2m B99 VEHICLE

| | |
|------------------------|-----------------|
| DWG No. 23066CAD003 | |
| FIGURE 2 | |
| DATE STAMP 09 MAY 2023 | |
| PROJECT No. 23066 | SCALE 1:400 @A3 |
| REV. A | |

File name: 23066CAD003-230509-SWEPT PATH.dwg Date: 10 May 2023



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 Overall Length 5200mm
 Overall Width 1940mm
 Overall Body Height 1878mm
 Min Body Ground Clearance 272mm
 Track Width 1840mm
 Lock-to-lock time 4.00s
 Curb to Curb Turning Radius 6250mm



Mercedes Actros Rigid Tipper 6x4 2632K
 Overall Length 8.040m
 Overall Width 2.490m
 Overall Body Height 3.191m
 Min Body Ground Clearance 0.257m
 Track Width 2.490m
 Lock-to-lock time 5.00s
 Wall to Wall Turning Radius 8.750m

KEY:

| | | |
|-----------------|---------|---------|
| Wheel path | Forward | Reverse |
| Body envelope | | |
| 500mm clearance | | |

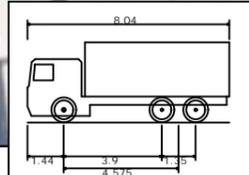
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| A | ISSUE FOR DISCUSSION | HT | PC | SR | 09/05/23 |
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| | | | | | |
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PROJECT: NARRABEEN LAKE PROJECT
 TITLE: SWEPT PATH ANALYSIS
 8m TIPPER TRUCK & 5.2m B99 VEHICLE

| | | | |
|-------------|-------------|------|--|
| DWG No. | 23066CAD003 | | |
| | FIGURE 3 | | |
| DATE STAMP | 09 MAY 2023 | | |
| PROJECT No. | SCALE | REV. | |
| 23066 | 1:400 @A3 | A | |

File name: 23066CAD003-230509-SWEPT PATH.dwg Date: 10 May 2023



KEY:

| | | |
|-----------------|---------|---------|
| Wheel path | Forward | Reverse |
| Body envelope | | |
| 500mm clearance | | |

| | |
|--|--------|
| Mercedes Actros Rigid Tipper 6x4 2632K | |
| Overall Length | 8.040m |
| Overall Width | 2.490m |
| Overall Body Height | 3.191m |
| Min Body Ground Clearance | 0.257m |
| Track Width | 2.490m |
| Lock-to-lock time | 5.00s |
| Wall to Wall Turning Radius | 8.750m |

File name: 23066CAD003-230509-SWEPT PATH.dwg Date: 10 May 2023

| REV. | DESCRIPTION | DRAWN | CHECK | APP'D | DATE |
|------|----------------------|-------|-------|-------|----------|
| A | ISSUE FOR DISCUSSION | HT | PC | SR | 09/05/23 |
| | | | | | |
| | | | | | |
| | | | | | |



PROJECT: NARRABEEN LAKE PROJECT

TITLE: SWEPT PATH ANALYSIS
8m TIPPER TRUCK

| | | | |
|-------------|-------------|------|--|
| DWG No. | 23066CAD003 | | |
| | FIGURE 4 | | |
| DATE STAMP | 09 MAY 2023 | | |
| PROJECT No. | SCALE | REV. | |
| 23066 | 1:400 @A3 | A | |

The Transport Planning Partnership
Suite 402 Level 4, 22 Atchison Street
St Leonards NSW 2065

P.O. Box 237
St Leonards NSW 1590

02 8437 7800

info@tpp.net.au

www.tpp.net.au



Appendix C

Stakeholder Response

Our Ref: ID 1964

06 June 2023

Tanja Mackenzie
Rhelm
50 Yeo Street
Neutral Bay NSW 2089

email: tanja.mackenzie@rhelm.com.au
cc: shelly.stingmore@one.ses.nsw.gov.au

Dear Tanja,

Notification under section 2.13 of the State Environmental Planning Policy (Transport and Infrastructure) 2021 in relation to the proposed entrance clearance works for Narrabeen Lagoon

Thank you for the notification under section 2.13 of the State Environmental Planning Policy (Transport and Infrastructure) 2021 in relation to the proposed entrance clearance works for Narrabeen Lagoon, Narrabeen. It is understood that the proposed works include:

- the excavation of between 32,500 and 40,000 m³ of material from the entrance channel immediately west and east of the Ocean Street bridge
- the excavated sand being placed on Collaroy-Narrabeen Beach

The NSW State Emergency Service (NSW SES) is the agency responsible for dealing with floods, storms and tsunamis in NSW. This role includes, planning for, responding to and coordinating the initial recovery from floods. As such, the NSW SES has an interest in the public safety aspects of the development of flood prone land, particularly the potential for changes to land use to either exacerbate existing flood risk or create new flood risk for communities in NSW.

The NSW SES has reviewed the proposed upgrade and the flood risk information (e.g. Narrabeen Lagoon Flood Study 2013 and Narrabeen Lagoon Floodplain Risk Management Study and Plan 2019 etc.) available to the NSW SES. It is identified that the site is at risk of flooding within a 20% Annual Exceedance Probability (AEP) Flood. We note that the Narrabeen Lagoon Floodplain Risk Management Study has identified that the most effective structural option for the Narrabeen Lagoon floodplain is the continuation of the sand clearance from above and below Ocean Street Bridge as a flood mitigation measure. Based on this review, the NSW SES provides the following advice:

- consider the impact of flooding on the site up to and including the PMF.
- pursue, if relevant, site design and stormwater management that minimises any risk to the community.
- ensure workers and people using the area during and after the entrance clearance works are aware of the flood risk, for example by using signage.

In addition, if the construction phase of the upgrades causes disruption to the operation of local roads, this may impact the ability for emergency vehicles to use these routes. The NSW SES requests that notification be provided where there are likely to be significant delays in the operation of the roads affected by the upgrades.

Please feel free to contact Sharon Ladeira via email at rra@ses.nsw.gov.au should you wish to discuss any of the matters raised in this correspondence. The NSW SES would also be interested in receiving future correspondence regarding the outcome of this referral via this email address.

Yours sincerely

A handwritten signature in black ink that reads 'Claire Flashman'.

Claire Flashman
Acting Planning Coordinator, Emergency Risk Management
NSW State Emergency Service



Appendix D

Consideration of Clause 171(2)
factors and MNES and
Commonwealth Land

Clause 171(2) Checklist

In addition to the requirements of the *Is an EIS required? guideline* (DUAP 1996) as detailed in the REF, the following factors, listed in clause 171(2) of the *Environmental Planning and Assessment Regulation 2021*, have also been considered to assess the likely impacts of the proposal on the natural and built environment.

| Environmental factor | Impact |
|---|---|
| <p>(a) The environmental impact on the community,</p> <p>During the works there would be works-related noise and visual impacts to surrounding receivers and impacts to traffic, navigation and access associated with the fencing of the works areas. Impacts would be minimised through implementation of the mitigation measures in Section 7 of this REF.</p> <p>In the operational phase there would be a benefit to the community through a reduction in the socio-economic impact of flooding over the medium-term.</p> | <p>Moderate, short-term negative</p> <p>Medium-term positive</p> |
| <p>(b) The transformation of the locality,</p> <p>The impact of the proposal on visual amenity and landscape character is considered minor and would be associated with the presence of the works sites and associated fencing, which would disrupt views across the lagoon and to/along the beach.</p> <p>In the operational phase, the impacts are considered negligible, being within the range of natural fluctuation for the locality.</p> | <p>Minor, short-term negative</p> <p>Negligible medium-term</p> |
| <p>(c) The environmental impact on the ecosystems of the locality,</p> <p>As discussed in the assessment of the potential impacts to biodiversity, the design has avoided direct impacts to seagrasses. However, the works would result in the loss over the medium-term of intertidal sand flats that are roosting and foraging habitat for shorebirds and waders, including migratory species. Nonetheless, it is considered that these impacts are minor in the context of the available habitat in the locality.</p> <p>Impacts to biodiversity would be minimised through implementation of the mitigation measures in Section 7 of this REF.</p> | <p>Minor, medium-term negative</p> <p>Negligible long-term</p> |
| <p>(d) Reduction of the aesthetic, recreational, scientific or other environmental quality or value of the locality,</p> <p>There would be temporary aesthetic impacts during the works, including elevated noise levels and restricted recreational access.</p> <p>Landscape character and visual impacts have been assessed as negligible to minor.</p> <p>No long-term impacts to environmental quality and value are anticipated.</p> | <p>Moderate, short-term negative</p> <p>Negligible to minor, short-term</p> <p>Negligible long-term</p> |
| <p>(e) The effects on any locality, place or building that has –</p> <p>(i) Aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance, or</p> <p>(ii) Other special value for present or future generations,</p> <p>Impacts to listed heritage sites and items as a result of the works are not anticipated.</p> | <p>Negligible short to long term</p> |
| <p>(f) The impact on the habitat of protected animals, within the meaning of the <i>Biodiversity Conservation Act 2016</i>,</p> <p>The assessment of impacts to biodiversity concluded that there would be a minor impact to biodiversity during the works due to the loss over the medium-term of intertidal sand flats that are roosting and foraging habitat for shorebirds and waders,</p> | <p>Minor, short-term negative</p> |

| Environmental factor | Impact |
|--|-----------------------------------|
| <p>including migratory species. Nonetheless, it is considered that these impacts are minor in the context of the available habitat in the locality.</p> <p>No significant impacts to threatened species are anticipated.</p> <p>Impacts to biodiversity would be minimised through implementation of the mitigation measures in Section 7 of this REF.</p> | <p>Negligible, long-term</p> |
| <p>(g) The endangering of a species of animal, plant or other form of life, whether living on land, in water or in the air,</p> <p>The proposal is unlikely to endanger any species of animal, plant or other form of life, whether living on land, in water or in the air provided safeguards and management measures identified in Section 7 of the REF are implemented.</p> | <p>No impact</p> |
| <p>(h) Long-term effects on the environment,</p> <p>No long-term impacts to the environment are anticipated. The proposal would result in medium-term impacts through the excavation of material from the lagoon entrance and placement of sand on the beach. These changes in geomorphology are within the range of natural variation within the system and would be less apparent in the short to medium-term due to the re-distribution of sand due to coastal processes.</p> | <p>Minor, medium-term</p> |
| <p>(i) Degradation of the quality of the environment,</p> <p>The proposal would result in localised sediment disturbance during the works, which would result in temporary impacts to water quality. There is also potential for accidental spills/leaks of fuel, oil or other chemicals to impact water quality during construction.</p> <p>Impacts would be minor with implementation of the safeguards and mitigation measures identified in Section 7 of the REF.</p> | <p>Minor, short-term negative</p> |
| <p>(j) Risk to the safety of the environment,</p> <p>Construction related activities pose potential risks to the safety of the environment through spills/leaks of fuel, oil or other chemicals.</p> <p>The risk is considered low provided the safeguards and management measures identified in Section 7 of the REF are implemented.</p> | <p>No impact</p> |
| <p>(k) Reduction in the range of beneficial uses of the environment,</p> <p>Following the proposal, there would be no reduction in the range of beneficial uses of the environment.</p> | <p>No impact</p> |
| <p>(l) Pollution of the environment,</p> <p>Construction related activities may result in pollution of the environment through spills/leaks of fuel, oil or other chemicals, air and noise emissions, and temporary increase in suspended sediments. Impacts would be minor with implementation of the safeguards and management measures identified in Section 7 of the REF.</p> | <p>Minor, short-term negative</p> |
| <p>(m) Environmental problems associated with the disposal of waste,</p> <p>All wastes generated by the proposal would (if required) be disposed of at an off-site facility which is licenced to receive such waste.</p> <p>There would be no significant environmental problems associated with waste disposal.</p> | <p>Negligible, short-term</p> |
| <p>(n) Increased demand on natural or other resources that are, or are likely to become, in short supply,</p> | <p>No impact</p> |

| Environmental factor | Impact |
|---|---|
| <p>The proposal involves the transport of sand excavated from the lagoon entrance onto Collaroy-Narrabeen Beach. This is within the same sediment compartment and in keeping with the general northerly littoral drift of sand along the beach.</p> <p>All resources required by the proposal are readily available and are not likely to become in short supply.</p> | |
| <p>(o) The cumulative environmental effect with other existing or likely future activities,</p> <p>Assessment of cumulative impacts for the proposal is provided in Section 6.13. Other projects with the same timing of this proposal include coastal protection works proposed for Collaroy-Narrabeen Beach to the north of the beach placement area.</p> | |
| <p>(p) The impact on coastal processes and coastal hazards, including those under projected climate change conditions,</p> <p>Consideration of coastal processes and coastal hazards is detailed in Sections 6.1 and 6.2.</p> <p>No significant impacts to coastal processes are anticipated for the proposal, which effectively adopts a ‘working with nature’ approach that uses the natural coastal processes.</p> | <p>No impact</p> |
| <p>(q) Applicable local strategic planning statements, regional plans or district strategic plans made under the Act, Division 3.1,</p> <p>Towards 2040, the Northern Beaches Local Strategic Planning Statement, has as Priority 8 that the LGA will be ‘Adapted to the impacts of natural and urban hazards and climate change’. The proposed entrance clearance works are identified as an existing project to build coastal resilience.</p> <p>Similarly, the North District Plan prepared by the Greater Sydney Commission has as Planning Priority N22 ‘Adapting to the impacts of natural and urban hazards and climate change’. Under this umbrella, Objective 37 is ‘Exposure to natural and urban hazards is reduced’. The proposal directly supports this objective by reducing risk to the community from flooding.</p> <p>The other plans and strategies of relevance to the proposal are discussed in Section 2.</p> | <p>The proposal aligns with applicable strategies and plans</p> |
| <p>(r) Other relevant environmental factors.</p> | <p>In considering the potential impacts of this proposal all relevant environmental factors have been considered, refer to Section 6 of this assessment.</p> |

Matters of National Environmental Significance and Commonwealth land

Under the environmental assessment provisions of the EPBC Act, the following MNES and impacts on Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Australian Government DCCEEW.

A referral is not required for proposed actions that may affect nationally listed threatened species, endangered ecological communities and migratory species. Impacts on these matters are still assessed as part of the REF in accordance with Australian Government significant impact criteria and taking into account relevant guidelines and policies.

| Environmental factor | Impact |
|---|-------------------|
| (a) Any impact on a World Heritage property? | No impact |
| (b) Any impact on a National Heritage place? | No impact |
| (c) Any impact on a wetland of international importance? | No impact |
| <p>(d) Any impact on a listed threatened species or community?</p> <p>No threatened species were observed during the field survey. One critically endangered species, the Curlew Sandpiper, is considered to have a moderate likelihood of occurrence in the study area. This is due to the presence of potential habitat for this species in the project area in the form of supratidal and intertidal sand flats. These habitats are used for resting and foraging. There would be short to medium-term impacts to these sand flats due to the excavations, however, they would recover over time as the entrance channel gradually infills. In addition, it is considered that there is suitable alternative habitat in the locality that could be used in the interim.</p> <p>An Assessment of Significance for this species concluded that the proposal is unlikely to significantly impact on any threatened species or communities.</p> <p>There were no TECs present in the project area at the time of the assessment.</p> | Minor, short-term |
| <p>(e) Any impacts on listed migratory species?</p> <p>Six migratory birds were considered to have a moderate to high likelihood of occurrence in the proposal area due to the presence of potential habitat in the form of supratidal and intertidal sand flats. These habitats are used for resting and foraging. There would be short to medium-term impacts to these sand flats due to the excavations, however, they would recover over time as the entrance channel gradually infills. In addition, it is considered that there is suitable alternative habitat in the locality that could be used in the interim.</p> <p>An Assessment of Significance for these species of migratory birds concluded that the proposal is unlikely to significantly impact on any threatened species or communities.</p> | Minor, short-term |
| (f) Any impact on a Commonwealth marine area? | No impact |
| (g) Does the proposal involve a nuclear action (including uranium mining)? | No |
| (h) Additionally, any impact (direct or indirect) on the environment of Commonwealth land? | No impact |



Appendix E

Protected Matters Search Tool
Results



Australian Government

Department of Climate Change, Energy,
the Environment and Water

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 21-Mar-2023

[Summary](#)

[Details](#)

[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)

Summary

Matters of National Environment Significance

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

| | |
|---|------|
| World Heritage Properties: | None |
| National Heritage Places: | None |
| Wetlands of International Importance (Ramsar) | None |
| Great Barrier Reef Marine Park: | None |
| Commonwealth Marine Area: | None |
| Listed Threatened Ecological Communities: | 5 |
| Listed Threatened Species: | 90 |
| Listed Migratory Species: | 61 |

Other Matters Protected by the EPBC Act

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

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

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

| | |
|---|------|
| Commonwealth Lands: | 4 |
| Commonwealth Heritage Places: | None |
| Listed Marine Species: | 81 |
| Whales and Other Cetaceans: | 13 |
| Critical Habitats: | None |
| Commonwealth Reserves Terrestrial: | None |
| Australian Marine Parks: | None |
| Habitat Critical to the Survival of Marine Turtles: | None |

Extra Information

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

| | |
|---|------|
| State and Territory Reserves: | 1 |
| Regional Forest Agreements: | None |
| Nationally Important Wetlands: | None |
| EPBC Act Referrals: | 9 |
| Key Ecological Features (Marine): | None |
| Biologically Important Areas: | 3 |
| Bioregional Assessments: | 1 |
| Geological and Bioregional Assessments: | None |

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities

[\[Resource Information \]](#)

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

Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

| Community Name | Threatened Category | Presence Text |
|--|-----------------------|---------------------------------------|
| Coastal Swamp Oak (<i>Casuarina glauca</i>) Forest of New South Wales and South East Queensland ecological community | Endangered | Community likely to occur within area |
| Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland | Endangered | Community may occur within area |
| Coastal Upland Swamps in the Sydney Basin Bioregion | Endangered | Community may occur within area |
| Eastern Suburbs Banksia Scrub of the Sydney Region | Critically Endangered | Community may occur within area |
| River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria | Critically Endangered | Community likely to occur within area |

Listed Threatened Species

[\[Resource Information \]](#)

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.

Number is the current name ID.

| Scientific Name | Threatened Category | Presence Text |
|---|-----------------------|---|
| BIRD | | |
| Anthochaera phrygia Regent Honeyeater [82338] | Critically Endangered | Species or species habitat known to occur within area |
| Botaurus poiciloptilus Australasian Bittern [1001] | Endangered | Species or species habitat known to occur within area |
| Calidris canutus Red Knot, Knot [855] | Endangered | Species or species habitat known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|--|-----------------------|--|
| Calidris ferruginea Curlew Sandpiper [856] | Critically Endangered | Species or species habitat likely to occur within area |
| Callocephalon fimbriatum Gang-gang Cockatoo [768] | Endangered | Species or species habitat known to occur within area |
| Calyptorhynchus lathami lathami South-eastern Glossy Black-Cockatoo [67036] | Vulnerable | Species or species habitat known to occur within area |
| Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877] | Vulnerable | Species or species habitat likely to occur within area |
| Dasyornis brachypterus Eastern Bristlebird [533] | Endangered | Species or species habitat may occur within area |
| Diomedea antipodensis Antipodean Albatross [64458] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Diomedea antipodensis gibsoni Gibson's Albatross [82270] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Diomedea epomophora Southern Royal Albatross [89221] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Diomedea exulans Wandering Albatross [89223] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Diomedea sanfordi Northern Royal Albatross [64456] | Endangered | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
|--|-----------------------|--|
| Erythrotriorchis radiatus Red Goshawk [942] | Vulnerable | Species or species habitat may occur within area |
| Falco hypoleucos Grey Falcon [929] | Vulnerable | Species or species habitat may occur within area |
| Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438] | Vulnerable | Species or species habitat likely to occur within area |
| Grantiella picta Painted Honeyeater [470] | Vulnerable | Species or species habitat likely to occur within area |
| Hirundapus caudacutus White-throated Needletail [682] | Vulnerable | Species or species habitat known to occur within area |
| Lathamus discolor Swift Parrot [744] | Critically Endangered | Species or species habitat known to occur within area |
| Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380] | Vulnerable | Species or species habitat known to occur within area |
| Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060] | Endangered | Species or species habitat may occur within area |
| Macronectes halli Northern Giant Petrel [1061] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat likely to occur within area |
| Pachyptila turtur subantarctica Fairy Prion (southern) [64445] | Vulnerable | Species or species habitat known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---------------------|--|
| Phoebetria fusca Sooty Albatross [1075] | Vulnerable | Species or species habitat may occur within area |
| Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033] | Endangered | Species or species habitat may occur within area |
| Pterodroma neglecta neglecta Kermadec Petrel (western) [64450] | Vulnerable | Foraging, feeding or related behaviour may occur within area |
| Pycnoptilus floccosus Pilotbird [525] | Vulnerable | Species or species habitat may occur within area |
| Rostratula australis Australian Painted Snipe [77037] | Endangered | Species or species habitat known to occur within area |
| Sternula nereis nereis Australian Fairy Tern [82950] | Vulnerable | Breeding likely to occur within area |
| Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460] | Vulnerable | Species or species habitat may occur within area |
| Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273] | Vulnerable | Species or species habitat may occur within area |
| Thalassarche carteri Indian Yellow-nosed Albatross [64464] | Vulnerable | Species or species habitat likely to occur within area |
| Thalassarche cauta Shy Albatross [89224] | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche eremita Chatham Albatross [64457] | Endangered | Foraging, feeding or related behaviour may occur within area |

| Scientific Name | Threatened Category | Presence Text |
|--|------------------------|--|
| Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459] | Vulnerable | Species or species habitat may occur within area |
| Thalassarche melanophris Black-browed Albatross [66472] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche salvini Salvin's Albatross [64463] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche steadi White-capped Albatross [64462] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| FISH | | |
| Epinephelus daemeli Black Rockcod, Black Cod, Saddled Rockcod [68449] | Vulnerable | Species or species habitat likely to occur within area |
| Hippocampus whitei White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240] | Endangered | Species or species habitat likely to occur within area |
| Macquaria australasica Macquarie Perch [66632] | Endangered | Species or species habitat may occur within area |
| Prototroctes maraena Australian Grayling [26179] | Vulnerable | Species or species habitat likely to occur within area |
| Seriolella brama Blue Warehou [69374] | Conservation Dependent | Species or species habitat known to occur within area |
| Thunnus maccoyii Southern Bluefin Tuna [69402] | Conservation Dependent | Species or species habitat likely to occur within area |

FROG

| Scientific Name | Threatened Category | Presence Text |
|--|---------------------|--|
| Heleioporus australiacus Giant Burrowing Frog [1973] | Vulnerable | Species or species habitat known to occur within area |
| Litoria aurea Green and Golden Bell Frog [1870] | Vulnerable | Species or species habitat likely to occur within area |
| Mixophyes balbus Stuttering Frog, Southern Barred Frog (in Victoria) [1942] | Vulnerable | Species or species habitat may occur within area |
| MAMMAL | | |
| Balaenoptera musculus Blue Whale [36] | Endangered | Species or species habitat may occur within area |
| Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183] | Vulnerable | Species or species habitat known to occur within area |
| Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184] | Endangered | Species or species habitat known to occur within area |
| Eubalaena australis Southern Right Whale [40] | Endangered | Species or species habitat likely to occur within area |
| Isoodon obesulus obesulus Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern) [68050] | Endangered | Species or species habitat known to occur within area |
| Notamacropus parma Parma Wallaby [89289] | Vulnerable | Species or species habitat may occur within area |
| Petauroides volans Greater Glider (southern and central) [254] | Endangered | Species or species habitat likely to occur within area |
| Petaurus australis australis Yellow-bellied Glider (south-eastern) [87600] | Vulnerable | Species or species habitat likely to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|--|---------------------|--|
| <u>Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)</u> | | |
| Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104] | Endangered | Species or species habitat known to occur within area |
| <u>Pseudomys novaehollandiae</u> | | |
| New Holland Mouse, Pookila [96] | Vulnerable | Species or species habitat likely to occur within area |
| <u>Pteropus poliocephalus</u> | | |
| Grey-headed Flying-fox [186] | Vulnerable | Roosting known to occur within area |
| PLANT | | |
| <u>Acacia bynoeana</u> | | |
| Bynoe's Wattle, Tiny Wattle [8575] | Vulnerable | Species or species habitat may occur within area |
| <u>Acacia terminalis subsp. terminalis MS</u> | | |
| Sunshine Wattle (Sydney region) [8882] | Endangered | Species or species habitat likely to occur within area |
| <u>Asterolasia elegans</u> | | |
| [56780] | Endangered | Species or species habitat may occur within area |
| <u>Caladenia tessellata</u> | | |
| Thick-lipped Spider-orchid, Daddy Long-legs [2119] | Vulnerable | Species or species habitat likely to occur within area |
| <u>Cryptostylis hunteriana</u> | | |
| Leafless Tongue-orchid [19533] | Vulnerable | Species or species habitat likely to occur within area |
| <u>Eucalyptus camfieldii</u> | | |
| Camfield's Stringybark [15460] | Vulnerable | Species or species habitat likely to occur within area |
| <u>Genoplesium baueri</u> | | |
| Yellow Gnat-orchid, Bauer's Midge Orchid, Brittle Midge Orchid [7528] | Endangered | Species or species habitat likely to occur within area |
| <u>Lasiopetalum joyceae</u> | | |
| [20311] | Vulnerable | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
|--|-----------------------|--|
| Melaleuca biconvexa Biconvex Paperbark [5583] | Vulnerable | Species or species habitat may occur within area |
| Melaleuca deanei Deane's Melaleuca [5818] | Vulnerable | Species or species habitat may occur within area |
| Persicaria elatior Knotweed, Tall Knotweed [5831] | Vulnerable | Species or species habitat may occur within area |
| Persoonia hirsuta Hairy Geebung, Hairy Persoonia [19006] | Endangered | Species or species habitat may occur within area |
| Pimelea curviflora var. curviflora [4182] | Vulnerable | Species or species habitat may occur within area |
| Prostanthera densa Villous Mintbush [12233] | Vulnerable | Species or species habitat known to occur within area |
| Rhizanthella slateri Eastern Underground Orchid [11768] | Endangered | Species or species habitat may occur within area |
| Rhodamnia rubescens Scrub Turpentine, Brown Malletwood [15763] | Critically Endangered | Species or species habitat likely to occur within area |
| Rhodomyrtus psidioides Native Guava [19162] | Critically Endangered | Species or species habitat may occur within area |
| Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307] | Vulnerable | Species or species habitat likely to occur within area |
| Thesium australe Austral Toadflax, Toadflax [15202] | Vulnerable | Species or species habitat may occur within area |

REPTILE

| Scientific Name | Threatened Category | Presence Text |
|--|------------------------|---|
| Caretta caretta Loggerhead Turtle [1763] | Endangered | Species or species habitat known to occur within area |
| Chelonia mydas Green Turtle [1765] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768] | Endangered | Foraging, feeding or related behaviour known to occur within area |
| Eretmochelys imbricata Hawksbill Turtle [1766] | Vulnerable | Species or species habitat known to occur within area |
| Hoplocephalus bungaroides Broad-headed Snake [1182] | Vulnerable | Species or species habitat may occur within area |
| Natator depressus Flatback Turtle [59257] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| SHARK | | |
| Carcharias taurus (east coast population) Grey Nurse Shark (east coast population) [68751] | Critically Endangered | Species or species habitat known to occur within area |
| Carcharodon carcharias White Shark, Great White Shark [64470] | Vulnerable | Species or species habitat known to occur within area |
| Galeorhinus galeus School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark [68453] | Conservation Dependent | Species or species habitat may occur within area |
| Rhincodon typus Whale Shark [66680] | Vulnerable | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
|-----------------|---------------------|---------------|
|-----------------|---------------------|---------------|

[Sphyrna lewini](#)

Scalloped Hammerhead [85267]

Conservation
Dependent

Species or species
habitat likely to occur
within area

| SNAIL |
|-------|
|-------|

[Meridolum maryae](#)

Maroubra Woodland Snail, Maroubra
Land Snail [89884]

Endangered

Species or species
habitat likely to occur
within area

| Listed Migratory Species | [Resource Information] |
|--------------------------|--------------------------|
|--------------------------|--------------------------|

| Scientific Name | Threatened Category | Presence Text |
|-----------------|---------------------|---------------|
|-----------------|---------------------|---------------|

| Migratory Marine Birds |
|------------------------|
|------------------------|

[Anous stolidus](#)

Common Noddy [825]

Species or species
habitat likely to occur
within area

[Apus pacificus](#)

Fork-tailed Swift [678]

Species or species
habitat likely to occur
within area

[Ardenna carneipes](#)

Flesh-footed Shearwater, Fleshy-footed
Shearwater [82404]

Foraging, feeding or
related behaviour
likely to occur within
area

[Ardenna grisea](#)

Sooty Shearwater [82651]

Species or species
habitat likely to occur
within area

[Calonectris leucomelas](#)

Streaked Shearwater [1077]

Species or species
habitat known to
occur within area

[Diomedea antipodensis](#)

Antipodean Albatross [64458]

Vulnerable

Foraging, feeding or
related behaviour
likely to occur within
area

[Diomedea epomophora](#)

Southern Royal Albatross [89221]

Vulnerable

Foraging, feeding or
related behaviour
likely to occur within
area

| Scientific Name | Threatened Category | Presence Text |
|--|---------------------|--|
| Diomedea exulans Wandering Albatross [89223] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Diomedea sanfordi Northern Royal Albatross [64456] | Endangered | Species or species habitat may occur within area |
| Fregata ariel Lesser Frigatebird, Least Frigatebird [1012] | | Species or species habitat likely to occur within area |
| Fregata minor Great Frigatebird, Greater Frigatebird [1013] | | Species or species habitat may occur within area |
| Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060] | Endangered | Species or species habitat may occur within area |
| Macronectes halli Northern Giant Petrel [1061] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Phaethon lepturus White-tailed Tropicbird [1014] | | Species or species habitat may occur within area |
| Phoebastria fusca Sooty Albatross [1075] | Vulnerable | Species or species habitat may occur within area |
| Sternula albifrons Little Tern [82849] | | Species or species habitat may occur within area |
| Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460] | Vulnerable | Species or species habitat may occur within area |
| Thalassarche carteri Indian Yellow-nosed Albatross [64464] | Vulnerable | Species or species habitat likely to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|--|---------------------|--|
| Thalassarche cauta Shy Albatross [89224] | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche eremita Chatham Albatross [64457] | Endangered | Foraging, feeding or related behaviour may occur within area |
| Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459] | Vulnerable | Species or species habitat may occur within area |
| Thalassarche melanophris Black-browed Albatross [66472] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche salvini Salvin's Albatross [64463] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche steadi White-capped Albatross [64462] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Migratory Marine Species | | |
| Balaenoptera edeni Bryde's Whale [35] | | Species or species habitat may occur within area |
| Balaenoptera musculus Blue Whale [36] | Endangered | Species or species habitat may occur within area |
| Caperea marginata Pygmy Right Whale [39] | | Foraging, feeding or related behaviour may occur within area |
| Carcharhinus longimanus Oceanic Whitetip Shark [84108] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---------------------|---|
| Carcharodon carcharias White Shark, Great White Shark [64470] | Vulnerable | Species or species habitat known to occur within area |
| Caretta caretta Loggerhead Turtle [1763] | Endangered | Species or species habitat known to occur within area |
| Chelonia mydas Green Turtle [1765] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768] | Endangered | Foraging, feeding or related behaviour known to occur within area |
| Dugong dugon Dugong [28] | | Species or species habitat may occur within area |
| Eretmochelys imbricata Hawksbill Turtle [1766] | Vulnerable | Species or species habitat known to occur within area |
| Eubalaena australis as Balaena glacialis australis Southern Right Whale [40] | Endangered | Species or species habitat likely to occur within area |
| Lagenorhynchus obscurus Dusky Dolphin [43] | | Species or species habitat may occur within area |
| Lamna nasus Porbeagle, Mackerel Shark [83288] | | Species or species habitat likely to occur within area |
| Megaptera novaeangliae Humpback Whale [38] | | Species or species habitat known to occur within area |
| Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---------------------|---|
| Mobula birostris as Manta birostris Giant Manta Ray [90034] | | Species or species habitat may occur within area |
| Natator depressus Flatback Turtle [59257] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Orcinus orca Killer Whale, Orca [46] | | Species or species habitat may occur within area |
| Rhincodon typus Whale Shark [66680] | Vulnerable | Species or species habitat may occur within area |
| Migratory Terrestrial Species | | |
| Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651] | | Species or species habitat may occur within area |
| Hirundapus caudacutus White-throated Needletail [682] | Vulnerable | Species or species habitat known to occur within area |
| Monarcha melanopsis Black-faced Monarch [609] | | Species or species habitat known to occur within area |
| Motacilla flava Yellow Wagtail [644] | | Species or species habitat likely to occur within area |
| Myiagra cyanoleuca Satin Flycatcher [612] | | Species or species habitat known to occur within area |
| Rhipidura rufifrons Rufous Fantail [592] | | Species or species habitat known to occur within area |
| Symposiachrus trivirgatus as Monarcha trivirgatus Spectacled Monarch [83946] | | Species or species habitat may occur within area |

Migratory Wetlands Species

| Scientific Name | Threatened Category | Presence Text |
|--|-----------------------|--|
| Actitis hypoleucos Common Sandpiper [59309] | | Species or species habitat likely to occur within area |
| Calidris acuminata Sharp-tailed Sandpiper [874] | | Species or species habitat known to occur within area |
| Calidris canutus Red Knot, Knot [855] | Endangered | Species or species habitat known to occur within area |
| Calidris ferruginea Curlew Sandpiper [856] | Critically Endangered | Species or species habitat likely to occur within area |
| Calidris melanotos Pectoral Sandpiper [858] | | Species or species habitat may occur within area |
| Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877] | Vulnerable | Species or species habitat likely to occur within area |
| Gallinago hardwickii Latham's Snipe, Japanese Snipe [863] | | Species or species habitat known to occur within area |
| Limosa lapponica Bar-tailed Godwit [844] | | Species or species habitat known to occur within area |
| Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat likely to occur within area |
| Pandion haliaetus Osprey [952] | | Species or species habitat known to occur within area |
| Tringa nebularia Common Greenshank, Greenshank [832] | | Species or species habitat likely to occur within area |

Other Matters Protected by the EPBC Act

Commonwealth Lands

[\[Resource Information \]](#)

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

Commonwealth Land Name

State

Communications, Information Technology and the Arts - Australian Postal Corporation

Commonwealth Land - Australian Postal Commission [13228]

NSW

Communications, Information Technology and the Arts - Telstra Corporation Limited

Commonwealth Land - Australian Telecommunications Commission [13225]NSW

Commonwealth Land - Australian Telecommunications Commission [13226]NSW

Unknown

Commonwealth Land - [13227]

NSW

Listed Marine Species

[\[Resource Information \]](#)

Scientific Name

Threatened Category

Presence Text

Bird

[Actitis hypoleucos](#)

Common Sandpiper [59309]

Species or species habitat likely to occur within area

[Anous stolidus](#)

Common Noddy [825]

Species or species habitat likely to occur within area

[Apus pacificus](#)

Fork-tailed Swift [678]

Species or species habitat likely to occur within area overfly marine area

[Ardenna carneipes as Puffinus carneipes](#)

Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]

Foraging, feeding or related behaviour likely to occur within area

[Ardenna grisea as Puffinus griseus](#)

Sooty Shearwater [82651]

Species or species habitat likely to occur within area

| Scientific Name | Threatened Category | Presence Text |
|---|-----------------------|--|
| Bubulcus ibis as Ardea ibis Cattle Egret [66521] | | Species or species habitat may occur within area overfly marine area |
| Calidris acuminata Sharp-tailed Sandpiper [874] | | Species or species habitat known to occur within area |
| Calidris canutus Red Knot, Knot [855] | Endangered | Species or species habitat known to occur within area overfly marine area |
| Calidris ferruginea Curlew Sandpiper [856] | Critically Endangered | Species or species habitat likely to occur within area overfly marine area |
| Calidris melanotos Pectoral Sandpiper [858] | | Species or species habitat may occur within area overfly marine area |
| Calonectris leucomelas Streaked Shearwater [1077] | | Species or species habitat known to occur within area |
| Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877] | Vulnerable | Species or species habitat likely to occur within area |
| Diomedea antipodensis Antipodean Albatross [64458] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Diomedea antipodensis gibsoni as Diomedea gibsoni Gibson's Albatross [82270] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Diomedea epomophora Southern Royal Albatross [89221] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|--|-----------------------|---|
| Diomedea exulans Wandering Albatross [89223] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Diomedea sanfordi Northern Royal Albatross [64456] | Endangered | Species or species habitat may occur within area |
| Fregata ariel Lesser Frigatebird, Least Frigatebird [1012] | | Species or species habitat likely to occur within area |
| Fregata minor Great Frigatebird, Greater Frigatebird [1013] | | Species or species habitat may occur within area |
| Gallinago hardwickii Latham's Snipe, Japanese Snipe [863] | | Species or species habitat known to occur within area overfly marine area |
| Haliaeetus leucogaster White-bellied Sea-Eagle [943] | | Species or species habitat known to occur within area |
| Hirundapus caudacutus White-throated Needletail [682] | Vulnerable | Species or species habitat known to occur within area overfly marine area |
| Lathamus discolor Swift Parrot [744] | Critically Endangered | Species or species habitat known to occur within area overfly marine area |
| Limosa lapponica Bar-tailed Godwit [844] | | Species or species habitat known to occur within area |
| Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060] | Endangered | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|-----------------------|--|
| Macronectes halli Northern Giant Petrel [1061] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Merops ornatus Rainbow Bee-eater [670] | | Species or species habitat may occur within area overfly marine area |
| Monarcha melanopsis Black-faced Monarch [609] | | Species or species habitat known to occur within area overfly marine area |
| Motacilla flava Yellow Wagtail [644] | | Species or species habitat likely to occur within area overfly marine area |
| Myiagra cyanoleuca Satin Flycatcher [612] | | Species or species habitat known to occur within area overfly marine area |
| Neophema chrysostoma Blue-winged Parrot [726] | | Species or species habitat may occur within area overfly marine area |
| Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat likely to occur within area |
| Pachyptila turtur Fairy Prion [1066] | | Species or species habitat known to occur within area |
| Pandion haliaetus Osprey [952] | | Species or species habitat known to occur within area |
| Phaethon lepturus White-tailed Tropicbird [1014] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
|--|---------------------|---|
| Phoebetria fusca Sooty Albatross [1075] | Vulnerable | Species or species habitat may occur within area |
| Rhipidura rufifrons Rufous Fantail [592] | | Species or species habitat known to occur within area overfly marine area |
| Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037] | Endangered | Species or species habitat known to occur within area overfly marine area |
| Stercorarius skua as Catharacta skua Great Skua [823] | | Species or species habitat may occur within area |
| Sternula albifrons as Sterna albifrons Little Tern [82849] | | Species or species habitat may occur within area |
| Symposiachrus trivirgatus as Monarcha trivirgatus Spectacled Monarch [83946] | | Species or species habitat may occur within area overfly marine area |
| Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460] | Vulnerable | Species or species habitat may occur within area |
| Thalassarche bulleri platei as Thalassarche sp. nov. Northern Buller's Albatross, Pacific Albatross [82273] | Vulnerable | Species or species habitat may occur within area |
| Thalassarche carteri Indian Yellow-nosed Albatross [64464] | Vulnerable | Species or species habitat likely to occur within area |
| Thalassarche cauta Shy Albatross [89224] | Endangered | Foraging, feeding or related behaviour likely to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---------------------|--|
| Thalassarche eremita Chatham Albatross [64457] | Endangered | Foraging, feeding or related behaviour may occur within area |
| Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459] | Vulnerable | Species or species habitat may occur within area |
| Thalassarche melanophris Black-browed Albatross [66472] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche salvini Salvin's Albatross [64463] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche steadi White-capped Albatross [64462] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Tringa nebularia Common Greenshank, Greenshank [832] | | Species or species habitat likely to occur within area overfly marine area |
| Fish | | |
| Acentronura tentaculata Shortpouch Pygmy Pipehorse [66187] | | Species or species habitat may occur within area |
| Festucalex cinctus Girdled Pipefish [66214] | | Species or species habitat may occur within area |
| Filicampus tigris Tiger Pipefish [66217] | | Species or species habitat may occur within area |
| Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---------------------|--|
| Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231] | | Species or species habitat may occur within area |
| Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233] | | Species or species habitat may occur within area |
| Hippocampus whitei White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240] | Endangered | Species or species habitat likely to occur within area |
| Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242] | | Species or species habitat may occur within area |
| Lissocampus runa Javelin Pipefish [66251] | | Species or species habitat may occur within area |
| Maroubra perserrata Sawtooth Pipefish [66252] | | Species or species habitat may occur within area |
| Notiocampus ruber Red Pipefish [66265] | | Species or species habitat may occur within area |
| Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268] | | Species or species habitat may occur within area |
| Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275] | | Species or species habitat may occur within area |
| Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183] | | Species or species habitat may occur within area |
| Solenostomus paradoxus Ornate Ghostpipefish, Harlequin Ghost Pipefish, Ornate Ghost Pipefish [66184] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---------------------|---|
| Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276] | | Species or species habitat may occur within area |
| Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277] | | Species or species habitat may occur within area |
| Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279] | | Species or species habitat may occur within area |
| Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280] | | Species or species habitat may occur within area |
| Urocampus carinirostris Hairy Pipefish [66282] | | Species or species habitat may occur within area |
| Vanacampus margaritifer Mother-of-pearl Pipefish [66283] | | Species or species habitat may occur within area |
| Mammal | | |
| Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20] | | Species or species habitat may occur within area |
| Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21] | | Species or species habitat may occur within area |
| Dugong dugon Dugong [28] | | Species or species habitat may occur within area |
| Reptile | | |
| Caretta caretta Loggerhead Turtle [1763] | Endangered | Species or species habitat known to occur within area |
| Chelonia mydas Green Turtle [1765] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|--|---------------------|---|
| Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768] | Endangered | Foraging, feeding or related behaviour known to occur within area |
| Eretmochelys imbricata Hawksbill Turtle [1766] | Vulnerable | Species or species habitat known to occur within area |
| Natator depressus Flatback Turtle [59257] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Pelamis platurus Yellow-bellied Seasnake [1091] | | Species or species habitat may occur within area |

Whales and Other Cetaceans [[Resource Information](#)]

| Current Scientific Name | Status | Type of Presence |
|---|------------|--|
| Mammal | | |
| Balaenoptera acutorostrata Minke Whale [33] | | Species or species habitat may occur within area |
| Balaenoptera edeni Bryde's Whale [35] | | Species or species habitat may occur within area |
| Balaenoptera musculus Blue Whale [36] | Endangered | Species or species habitat may occur within area |
| Caperea marginata Pygmy Right Whale [39] | | Foraging, feeding or related behaviour may occur within area |
| Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60] | | Species or species habitat may occur within area |
| Eubalaena australis Southern Right Whale [40] | Endangered | Species or species habitat likely to occur within area |

| Current Scientific Name | Status | Type of Presence |
|---|--------|--|
| Grampus griseus Risso's Dolphin, Grampus [64] | | Species or species habitat may occur within area |
| Lagenorhynchus obscurus Dusky Dolphin [43] | | Species or species habitat may occur within area |
| Megaptera novaeangliae Humpback Whale [38] | | Species or species habitat known to occur within area |
| Orcinus orca Killer Whale, Orca [46] | | Species or species habitat may occur within area |
| Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51] | | Species or species habitat may occur within area |
| Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418] | | Species or species habitat likely to occur within area |
| Tursiops truncatus s. str. Bottlenose Dolphin [68417] | | Species or species habitat may occur within area |

Extra Information

State and Territory Reserves [\[Resource Information \]](#)

| Protected Area Name | Reserve Type | State |
|---------------------|-----------------|-------|
| Narrabeen | Aquatic Reserve | NSW |

EPBC Act Referrals [\[Resource Information \]](#)

| Title of referral | Reference | Referral Outcome | Assessment Status |
|--|-----------|-----------------------|-------------------|
| Not controlled action | | | |
| Construction of a high-capacity fibre optic submarine cable | 2006/2914 | Not Controlled Action | Completed |
| Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia | 2015/7522 | Not Controlled Action | Completed |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|-----------|---|-------------------|
| Not controlled action | | | |
| Installation of Sydney-Guam Submarine Cable | 2007/3848 | Not Controlled Action | Completed |
| Japan-Guam-Australia Sunshine Coast Branch Marine Cable Route Survey (JGA) QLD | 2018/8373 | Not Controlled Action | Completed |
| sewage treatment plant process and reliability renewals project | 2005/2186 | Not Controlled Action | Completed |
| Not controlled action (particular manner) | | | |
| Construction and operation of a subsea telecommunications cable, between Sydney and New Zealand | 2015/7480 | Not Controlled Action (Particular Manner) | Post-Approval |
| Japan-Guam-Australia (JGA) Fibre Optic Cable project | 2016/7795 | Not Controlled Action (Particular Manner) | Post-Approval |
| Tasman Global Access submarine cable marine route survey, Narrabeen, NSW | 2015/7442 | Not Controlled Action (Particular Manner) | Post-Approval |

| Referral decision | | | |
|--|-----------|-------------------|-----------|
| Breeding program for Grey Nurse Sharks | 2007/3245 | Referral Decision | Completed |

Biologically Important Areas

| Scientific Name | Behaviour | Presence |
|-----------------|-----------|----------|
|-----------------|-----------|----------|

Dolphins

| | | |
|---|----------|-----------------|
| Tursiops aduncus | | |
| Indo-Pacific/Spotted Bottlenose Dolphin [68418] | Breeding | Likely to occur |

Sharks

| | | |
|-----------------------------------|----------|----------------|
| Carcharias taurus | | |
| Grey Nurse Shark [64469] | Foraging | Known to occur |

Whales

| | | |
|--|----------|----------------|
| Megaptera novaeangliae | | |
| Humpback Whale [38] | Foraging | Known to occur |

Bioregional Assessments

| SubRegion | BioRegion | Website |
|-----------|--------------|----------------------------|
| Sydney | Sydney Basin | BA website |

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

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

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

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



Appendix F

Likelihood of Occurrence Tables
(source: H2O Consulting)

| Scientific and Common Names | Statutory Listings | | No. BioNet Records | Likelihood of Occurrence | Possibility of Impact |
|---|--------------------|-------------------|--------------------|--------------------------|-----------------------|
| | BC/F M Acts | EPBC Act | | | |
| Threatened Ecological Community | | | | | |
| <i>Posidonia australis</i> seagrass meadows of the Manning-Hawkesbury ecoregion | E | E | N/A | None | None |
| Marine Birds and Shorebirds | | | | | |
| <i>Anous stolidus</i> Common Noddy | P | MA, MI | 1 | Low | Unlikely |
| <i>Apus pacificus</i> Fork-tailed Swift | P | MA, MI | 2 | Low | Unlikely |
| <i>Ardenna carneipes</i> Flesh-footed Shearwater | V, P | MA, MI | 1 | Low | Unlikely |
| <i>Ardenna grisea</i> Sooty Shearwater | P | MA, MI | 3 | Low | Unlikely |
| <i>Ardenna pacifica</i> Wedge-tailed Shearwater | P | MA, MI | 4 | Moderate | Possible |
| <i>Ardenna tenuirostris</i> Short-tailed Shearwater | P | MA, MI | 18 | High | Possible |
| <i>Arenaria interpres</i> Ruddy Turnstone | P | MA, MI | 6 | Low | Unlikely |
| <i>Botaurus poiciloptilus</i> Australasian Bittern | E, P | E | 2 | Low | Unlikely |
| <i>Burhinus grallarius</i> Bush Stone-curlew | E, P | | 13 | Low | Unlikely |
| <i>Calidris acuminata</i> Sharp-tailed Sandpiper | P | MA, MI | 6 | Moderate | Possible |
| <i>Calidris alba</i> Sanderling | V, P | MA, MI | 2 | Low | Unlikely |
| <i>Calidris canutus</i> Red Knot | P | E, MA, MI | 2 | Low | Unlikely |
| <i>Calidris ferruginea</i> Curlew Sandpiper | E, P | CE, MA, MI | 3 | Moderate | Possible |
| <i>Calidris ruficollis</i> Red-necked Stint | P | MA, MI | 9 | Low | Unlikely |
| <i>Charadrius leschenaultia</i> Greater Sand-plover | V, P | V, MA, MI | 2 | Low | Unlikely |
| <i>Charadrius mongolus</i> Lesser Sand-plover | V, P | E, MA, MI | 1 | Low | Unlikely |
| <i>Cuculus optatus</i> Oriental Cuckoo | P | MI | 1 | Low | Unlikely |
| <i>Diomedea antipodensis</i> Antipodean Albatross | V, P | V, MA, MI | N/A | Low | Unlikely |

| Scientific and Common Names | Statutory Listings | | No. BioNet Records | Likelihood of Occurrence | Possibility of Impact |
|--|--------------------|---------------|--------------------|--------------------------|-----------------------|
| | BC/F M Acts | EPBC Act | | | |
| <i>Diomedea antipodensis gibsoni</i> Gibson's Albatross | P | N/A | | Low | Unlikely |
| <i>Diomedea epomophora</i> Southern Royal Albatross | P | V, MA, MI | N/A | Low | Unlikely |
| <i>Diomedea exulans</i> Wandering Albatross | E, P | V, MA, MI | N/A | Low | Unlikely |
| <i>Diomedea sanfordi</i> Northern Royal Albatross | P | E, MA, MI | N/A | Low | Unlikely |
| <i>Fregetta grallaria grallaria</i> White-bellied Storm-petrel (Australasian) | N/A | V | N/A | Low | Unlikely |
| <i>Gallinago hardwickii</i> Latham's Snipe | P | MA, MI | 2 | Low | Unlikely |
| <i>Haematopus fuliginosus</i> Sooty Oystercatcher | V, P | N/A | 12 | High | Unlikely |
| <i>Haematopus longirostris</i> Pied Oystercatcher | E, P | N/A | 2 | Known | Possible |
| <i>Haliaeetus leucogaster</i> White-bellied Sea-eagle | V, P | N/A | 40 | High | Unlikely |
| <i>Hieraaetus morphnoides</i> Little Eagle | V, P | N/A | 5 | High | Unlikely |
| <i>Hirundapus caudacutus</i> White-throated Needletail | P | V, MA, MI | 8 | Low | Unlikely |
| <i>Hydroprogne caspia</i> Caspian Tern | P | MI | 9 | Moderate | Unlikely |
| <i>Ixobrychus flavicollis</i> Black Bittern | V, P | N/A | 20 | High | Low |
| <i>Limosa lapponica</i> Bar-tailed Godwit | P | MA, MI | 10 | High | Possible |
| <i>Limosa lapponica baueri</i> Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit | P | V | N/A | Low | Unlikely |
| <i>Lophoictinia isura</i> Square-tailed Kite | V, P | N/A | 4 | Low | Unlikely |
| <i>Macronectes giganteus</i> Southern Giant Petrel | E, P | E, MA, MI | N/A | Low | Unlikely |
| <i>Macronectes halli</i> Northern Giant Petrel | V, P | V, MA, MI | N/A | Low | Unlikely |
| <i>Numenius madagascariensis</i> Eastern Curlew | P | CE, MA, MI | 1 | Known | Unlikely |

| Scientific and Common Names | Statutory Listings | | No. BioNet Records | Likelihood of Occurrence | Possibility of Impact |
|--|--------------------|-----------|--------------------|--------------------------|-----------------------|
| | BC/F M Acts | EPBC Act | | | |
| <i>Numenius phaeopus</i> Whimbrel | P | MA, MI | 1 | Low | Unlikely |
| <i>Onychoprion fuscata</i> Sooty Tern | V, P | N/A | 1 | Low | Unlikely |
| <i>Pachyptila turtur subantarctica</i> Fairy Prion (southern) | P | V | N/A | Low | Unlikely |
| <i>Pandion cristatus</i> Eastern Osprey | V, P | N/A | 29 | High | Unlikely |
| <i>Phoebastria fusca</i> Sooty Albatross | N/A | V | N/A | Low | Unlikely |
| <i>Pluvialis fulva</i> Pacific Golden Plover | P | MA, MI | 6 | Low | Unlikely |
| <i>Pluvialis squatarola</i> Grey Plover | P | MA, MI | 2 | Low | Unlikely |
| <i>Prototroctes maraena</i> Australian Grayling | N/A | V | N/A | Low | Unlikely |
| <i>Pterodroma leucoptera leucoptera</i> Gould's Petrel, Australian Gould's Petrel | V, P | E | N/A | Low | Unlikely |
| <i>Pterodroma neglecta neglecta</i> Kermadec Petrel (Western) | V, P | V | N/A | Low | Unlikely |
| <i>Pycnoptilus floccosus</i> Pilotbird | N/A | V | N/A | Low | Unlikely |
| <i>Sterna hirundo</i> Common Tern | P | MA, MI | 3 | High | Low |
| <i>Sternula albifrons</i> Little Tern | E, P | MA, MI | 1 | Low | Unlikely |
| <i>Sternula nereis nereis</i> Australian Fairy Tern | P | V | N/A | Low | Unlikely |
| <i>Thalassarche bulleri</i> Buller's Albatross, Pacific Albatross | P | V, MA | N/A | Low | Unlikely |
| <i>Thalassarche bulleri platei</i> Northern Buller's Albatross, Pacific Albatross | P | V, MA | N/A | Low | Unlikely |
| <i>Thalassarche carteri</i> Indian Yellow-nosed Albatross | N/A | V, MA, MI | N/A | Low | Unlikely |
| <i>Thalassarche cauta</i> Shy Albatross | V, P | E, MA, MI | N/A | Low | Unlikely |
| <i>Thalassarche eremita</i> Chatham Albatross | P | E, MA, MI | N/A | Low | Unlikely |

| Scientific and Common Names | Statutory Listings | | No. BioNet Records | Likelihood of Occurrence | Possibility of Impact |
|---|--------------------|---------------|--------------------|--------------------------|-----------------------|
| | BC/F M Acts | EPBC Act | | | |
| <i>Thalassarche impavida</i> Campbell Albatross, Campbell Black-browed Albatross | P | V, MA, MI | N/A | Low | Unlikely |
| <i>Thalassarche melanophris</i> Black-browed Albatross | N/A | V MA, MI | N/A | Low | Unlikely |
| <i>Thalassarche salvini</i> Salvin's Albatross | V, P | V, MA, MI | N/A | Low | Unlikely |
| <i>Thalassarche steadi</i> White-capped Albatross | P | V, MA, MI | N/A | Low | Unlikely |
| <i>Thalasseus bergii</i> Crested Tern | P | MA, MI | 13 | High | Unlikely |
| <i>Tringa brevipes</i> Grey-tailed Tattler | P | MA, MI | 4 | Low | Unlikely |
| <i>Tringa incana</i> Wandering Tattler | P | MA, MI | 2 | Low | Unlikely |
| <i>Tringa nebularia</i> Common Greenshank | P | MA, MI | 1 | Low | Unlikely |
| <i>Xenus cinereus</i> Terek Sandpiper | V, P | MA, MI | 2 | Moderate | Possible |
| Marine Mammals | | | | | |
| <i>Arctocephalus forsteri</i> New Zealand Fur-seal | V, P | MA | 10 | Low | Unlikely |
| <i>Arctocephalus pusillus doriferus</i> Australian Fur-seal | V, P | MA | 1 | Low | Unlikely |
| <i>Balaenoptera borealis</i> Sei Whale | P | V, C, MI | N/A | Low | Unlikely |
| <i>Balaenoptera musculus</i> Blue Whale | P | E, C, MI | N/A | Low | Unlikely |
| <i>Balaenoptera physalus</i> Fin Whale | P | V, C, MI | N/A | Low | Unlikely |
| <i>Eubalaena australis</i> Southern Right Whale | E, P | E, C, MI | N/A | Low | Unlikely |
| <i>Physeter macrocephalus</i> Sperm Whale | V, P | C, MI | 3 | Low | Unlikely |
| Marine Reptiles | | | | | |
| <i>Caretta caretta</i> Loggerhead Turtle | E, P | E, MA, MI | 6 | Low | Unlikely |
| <i>Chelonia mydas</i> Green Turtle | V, P | V, MA, MI | 13 | Low | Unlikely |
| <i>Dermochelys coriacea</i> | E, P | E, MA, MI | 5 | Low | Unlikely |

| Scientific and Common Names | Statutory Listings | | No. BioNet Records | Likelihood of Occurrence | Possibility of Impact |
|---|--------------------|-----------|--------------------|--------------------------|-----------------------|
| | BC/F M Acts | EPBC Act | | | |
| Leatherback Turtle | | | | | |
| <i>Eretmochelys imbricata</i> Hawksbill Turtle | P | V, MA, MI | 1 | Low | Unlikely |
| Flatback Turtle | | | | | |
| <i>Natator depressus</i> Flatback Turtle | P | V, MA, MI | N/A | Low | Unlikely |
| Sharks and Rays | | | | | |
| Grey Nurse Shark (east coast population) | | | | | |
| <i>Carcharias taurus</i> (east coast population) Grey Nurse Shark (east coast population) | CE, P | CE | N/A | Low | Unlikely |
| White Shark, Great White Shark | | | | | |
| <i>Carcharodon carcharias</i> White Shark, Great White Shark | V, P | V, MI | N/A | Low | Unlikely |
| School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark | | | | | |
| <i>Galeorhinus galeus</i> School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark | P | CD | N/A | Low | Unlikely |
| Whale Shark | | | | | |
| <i>Rhincodon typus</i> Whale Shark | P | V, MI | N/A | Low | Unlikely |
| Scalloped Hammerhead | | | | | |
| <i>Sphyrna lewini</i> Scalloped Hammerhead | E | CD | N/A | Low | Unlikely |
| Fish | | | | | |
| Eastern gemfish | | | | | |
| <i>Rexea solandri</i> (eastern Australian population) Eastern gemfish | N/A | CD | N/A | Low | Unlikely |
| Black Rockcod, Black Cod, Saddled Rockcod | | | | | |
| <i>Epinephelus daemeli</i> Black Rockcod, Black Cod, Saddled Rockcod | V, P | V | N/A | Low | Unlikely |
| White's Seahorse, Crowned Seahorse, Sydney Seahorse | | | | | |
| <i>Hippocampus whitei</i> White's Seahorse, Crowned Seahorse, Sydney Seahorse | E | E, MA | N/A | Low | Unlikely |
| Macquarie Perch | | | | | |
| <i>Macquaria australasica</i> Macquarie Perch | N/A | E | N/A | None | Unlikely |
| Blue Warehou | | | | | |
| <i>Seriolella brama</i> Blue Warehou | N/A | CD | N/A | Low | Unlikely |
| Southern Bluefin Tuna | | | | | |
| <i>Thunnus maccoyii</i> Southern Bluefin Tuna | N/A | CD | N/A | Low | Unlikely |
| Other | | | | | |
| Cauliflower Soft Coral | | | | | |
| <i>Dendronephthya australis</i> Cauliflower Soft Coral | E, P | E | N/A | Low | Unlikely |

CD = Conservation Dependent, P = Protected, V = Vulnerable, E = Endangered, CE = Critically Endangered, MA = Marine Species, MI = Migratory, C = Cetacean.



Appendix G

Assessments of Significance
(source: H2O Consulting)

Threatened Shorebirds

Review of Species

| Species | Distribution | Habitat and Prey | Breeding |
|--|--|---|--|
| Pied Oystercatcher (<i>Haematopus longirostris</i>) Endangered (BC Act) | Distributed around the entire Australian coastline, although it is most common in coastal Tasmania and parts of Victoria. In NSW the species is thinly scattered along the entire coast. | Favours intertidal flats of inlets and bays, open beaches and sandbanks. Forages on exposed sand, mud and rock at low tide for molluscs, worms, crabs and small fish. | Nests between August and January, mostly on coastal or estuarine beaches, although occasionally they use saltmarsh or grassy areas. |
| Sharp-tailed Sandpiper (<i>Calidris acuminata</i>) Protected (BC Act), Marine/Migratory Species (EPBC Act) | Migrates from breeding grounds in the northern hemisphere to the southern hemisphere to winter. | Common in the southeast of Australia in coastal and inland freshwater locations. Feeds on seeds, crustaceans, molluscs and insects on wet sand at the edge of the water or in shallow waters. | Non-breeding migratory species that breeds in the northern hemisphere, particularly northern Siberia. |
| Curlew Sandpiper (<i>Calidris ferruginea</i>) Endangered (BC Act), Critically Endangered Marine/Migratory Species (EPBC Act) | Migrates from breeding grounds in the northern hemisphere to the southern hemisphere to winter. | The species is found across a majority of Australian coastline. Birds will inhabit coastal littoral and estuarine environmental such as mudflats, sandflats and lagoons. Foraging occurs at the water's edge and around exposed macroalgae and seagrass for crustaceans, molluscs, worms and seeds. | Non-breeding migrant to Australia. It breeds in the northern hemisphere in Siberia, traveling to Africa, Asia and Australia in the non-breeding period, generally from September to April. |
| Bar-tailed Godwit (<i>Limosa lapponica</i>) Protected (BC Act), Marine/Migratory Species (EPBC Act) | Migrates from breeding grounds in the northern hemisphere to the southern hemisphere to winter. | The species occurs across coastal Australia and is often observed at major coastal river estuaries in NSW. Feeds on crustaceans, molluscs, worms and some plants at the water's edge and in shallow water. | Non-breeding migratory species that travels from their Arctic breeding grounds on a non-stop flight to Australia. The birds generally arrive around September and return in March. |
| Terek Sandpiper (<i>Xenus cinereus</i>) Vulnerable (BC Act), Marine/Migratory Species (EPBC Act) | Widespread across the North Atlantic and Indian Ocean, spending non-breeding season in Africa, Indonesia, New Zealand and Australia. | Common in coastal areas, predominantly in northern and eastern Australia. Forages on open mudflats and sheltered estuaries and occasionally on sandy beaches. Feeds on crustaceans, molluscs, insects, seeds and arachnids. | Non-breeding migratory species that travels from northern Russia and Europe to Australia, arriving. |

Sources: DE (2023), NSW DPE (2021a; 2021b; 2021c; 2020)

Five Part Test for Threatened Shorebirds – BC Act

Pied Oystercatcher (*Haematopus longirostris*) – Endangered

Curlew Sandpiper (*Calidris ferruginea*) - Endangered

Terek Sandpiper (*Xenus cinereus*) - Vulnerable

(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Pied Oystercatchers typically use sandy habitats, which may include those areas associated with the sand banks of Narrabeen Lagoon and to a lesser extent the open sandy habitat of Narrabeen Beach. The species is known to forage on exposed sand and mud, and occasionally rocks at low tide. The clearance works will likely result in disturbance to a small amount of habitat this species uses in the locality. These disturbances will likely include removal of habitat via excavation and modification of habitat via sand placement and the presence of machinery and equipment which may reduce available habitat. Increased noise during works may also the quality and availability of foraging habitat at low tide. These disturbances are unlikely to have any adverse effects on the

lifecycle of any individuals that may use this location at times, given the habitat to be removed is not considered nesting habitat, while there is availability of similar foraging habitat in the vicinity of the Project Area. It is likely that individuals will continue to forage at low tide when works are not being undertaken and use similar habitat in nearby areas when works are being conducted.

The Curlew Sandpiper may utilise the sandy, sheltered habitat within the Project Area around the banks of Narrabeen Lagoon and to a lesser extent the foreshore of Narrabeen Beach. The species is known to forage at the edge or in shallow water in vicinity to seagrass beds and seagrass wrack and roost on sandy beaches. The clearance works will likely result in disturbance to a small amount of habitat that this species may use in the locality. These disturbances will likely include reduction of foraging habitat as a result of excavation, while the presence of machinery and sand stockpiling may temporarily reduce a small amount of potential roosting habitat. These disturbances are unlikely to have any adverse effects on the lifecycle of individuals that may use this location at times, given the extensive availability of similar habitat in proximity to the Project Area.

The Terek Sandpiper is a rare migrant to southeast Australian coasts, with any presence likely to be transient. The species typically prefers sandbanks in proximity to mangroves for foraging and roosting habitat and would likely utilise mangrove habitat further into Narrabeen Lagoon, outside of the locality. Preferential habitat around mangroves is very minimal in the Project Area and is not expected to be directly impacted by the proposal.

Given the above, it is unlikely that the proposed activity has potential to adversely affect the life cycle of shorebird species such that a viable local population is placed at risk of extinction.

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable

c) in relation to the habitat of a threatened species or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

The sandy habitat that will be removed is limited to clean and mobile marine sand shoals that have accumulated in the lower lagoon, the dewatering site to the east of Ocean Street bridge and any areas on the shoreline near the construction compound and where machinery may be stored. This habitat will gradually return over the medium-term and as sediments accumulate in the lagoon entrance channel again. Any modifications to areas on Narrabeen Beach where sand is deposited will be very short-term as coastal processes return the sand to the natural system. These modifications are not expected to result in any net habitat loss over ecological significant time scales.

No habitat is expected to become fragmented or isolated as a result of the proposal.

The habitat to be removed and modified provides sheltered habitat for wading birds to forage in shallow areas of Narrabeen Lagoon. These shallow sand flats are comprised of clean, yet unstable marine sands that have undergone regular removal for decades as part of entrance clearance works. Given the species that use this habitat are nomadic and migratory species that have large foraging territories, the habitat to be removed and modified is not considered to be of ecological significance to the long-term survival of the species in the locality. While other habitats nearby that include the upper sections of Narrabeen Lagoon and Dee Why Lagoon provide similar habitat for shorebirds to utilise if disturbed during the proposed works.

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

No

(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process

NSW KTPs with potential to be exacerbated by the proposal do not have potential to impact on the Pied Oystercatcher, Curlew Sandpiper or Terek Sandpiper.

Conclusion

Shorebirds that utilise habitat in the vicinity of the Project Area are unlikely to be significantly affected by the proposed activity. The proposal will result in some disturbances to available foraging habitat during the clearance works and some disturbances along a small stretch of Narrabeen Beach. These modifications are not expected to be long-term or result in ecologically significant disturbances to these species.

Significant Impact Criteria – Threatened and Migratory Shorebirds – EPBC Act

| Sharp-tailed Sandpiper (<i>Calidris acuminata</i>) - Migratory Curlew Sandpiper (<i>Calidris ferruginea</i>) - Critically Endangered and Migratory Bar-tailed Godwit (<i>Limosa lapponica</i>) – Migratory Terek Sandpiper (<i>Xenus cinereus</i>) – Vulnerable and Migratory | Likelihood of Impact |
|--|----------------------|
| An action is likely to have a significant impact on a threatened or migratory species if there is a real chance or possibility that it will: | |
| Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species | |
| The entrance clearance works will temporarily modify habitat that migratory species may periodically use for foraging and on occasions roosting. Physical disturbance from the works include increased noise and a reduction in water quality, which may temporarily modify a small amount of foraging habitat, however, this modification will be short-term and limited to a confined area of the lagoon with similar foraging habitat available in adjacent areas. | Unlikely |
| Result in an invasive species that is harmful to the migratory species becoming established in area of important habitat for the migratory species | |
| The proposal is not likely to result in an invasive species harmful to the Sharp-tailed Sandpiper, Curlew Sandpiper, Bar-tailed Godwit or Terek Sandpiper becoming established in the area. | Unlikely |
| Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species | |
| The proposed dredging is not likely to seriously disrupt the lifecycle of an ecologically significant proportion of the population of the Sharp-tailed Sandpiper, Curlew Sandpiper, Bar-tailed Godwit or Terek Sandpiper. These species are migratory species that breed in the northern hemisphere; thus, no breeding or nesting sites will be impacted by the proposed works. Their occurrence in NSW is sporadic and distributed across large stretches of the coastline around Australia. While the Project Area is not considered an ecologically significant site at a population level for these species. | Unlikely |
| Lead to a long-term decrease in the size of a population | |
| The proposal is not likely to lead to a long-term decrease in the size of these migratory shorebird populations, which breed in the northern hemisphere. No breeding or nesting sites will be impacted by the proposed works. These species travel extensive distances and frequent coastlines around Australia, with an abundance of alternative habitat to utilise for foraging and roosting if individuals are disturbed by the works. | Unlikely |
| Reduce the area of occupancy of the species | |
| The proposal will be limited to some short-term disturbance that may reduce habitat quality in the Project Area and potentially some adjacent areas at times, due to physical presence, noise and a reduction in water quality. Disturbance with potential to impact occupancy are likely to be temporary and only last for the duration of works and are not expected to impact the area of occupancy of these shorebirds at any ecologically significant scales. | Unlikely |
| Fragment an existing population into two or more populations | |
| The proposal is not expected to result in any habitat that these shorebirds may use to become fragmented or isolated from other areas of habitat. It is expected that opportunistic habitat use across the locality will continue by these species, while the proposed action does not have potential to fragment movement between habitats within the locality for these species. | Unlikely |
| Adversely affect habitat critical to the survival of a species | |
| The habitat is not considered to be critical to the survival of the listed migratory shorebirds. Areas of similar habitat are also available in areas adjacent to the Project Area. | Unlikely |
| Disrupt the breeding cycle of a population | |
| The habitat is not considered to be critical to the life cycles (including breeding and nesting) of the listed migratory shorebirds, as all species are non-breeding migrants that nest in the northern hemisphere. | Unlikely |
| Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline | |
| The proposal will result in some temporary reduction in habitat availability and quality for foraging and roosting; however, this is likely to be short term and the removed sands are likely to accumulate again following completion of the works. Given the small scale of the works and that the habitat is not considered critical to these species it is very unlikely the proposed action has potential to result in any decline in these species. | Unlikely |
| Result in invasive species that are harmful to a critically endangered, endangered or vulnerable species becoming established in the endangered, critically endangered or vulnerable species' habitat | |
| No known invasive species harmful to the endangered, vulnerable and/or migratory shorebirds are likely to be released or have their populations enhanced as a result of this proposal. | Unlikely |
| Introduce disease that may cause the species to decline | |
| The proposal is not expected to introduce diseases that may cause migratory shorebird species to decline. | Unlikely |

| | |
|--|----------|
| Interfere with the recovery of the species | |
| The proposal is not expected to interfere with the recovery of migratory shorebird species. | Unlikely |
| Conclusion | |
| The proposal is unlikely to result in a significant impact on threatened migratory shorebirds. Impacts will be confined to short-term disturbances that may reduce habitat quality and availability. These impacts are likely to be limited to temporary habitat modifications such as a reduction in available foraging habitat due to the works and some construction noise and disturbances. The habitat at Narrabeen Lagoon represents a small area that may be used by these migratory shorebirds for foraging and roosting in the wider locality and is not considered critical to their lifecycle. Thus, the proposed action does not constitute a significant impact on these species. | |

Marine Birds

Review of Species

| Species | Distribution | Habitat and Prey | Breeding |
|---|---|--|--|
| Wedge-tailed Shearwater (<i>Ardenna pacifica</i>) Protected (BC Act), Marine/Migratory Species (EPBC Act) | Widespread across the Indian and Pacific Ocean, spending non-breeding season in the tropics. | Found in association with tropical and subtropical waters, and offshore waters over the continental slope of eastern Victoria and southern NSW, mostly associated with sea surface temperatures of 13.9-24.4 °C. | Breeds and nests on east and west coasts of Australia and offshore islands. |
| Short-tailed Shearwater (<i>Ardenna tenuirostris</i>) Protected (BC Act), Marine/Migratory Species (EPBC Act) | Migrates from wintering grounds in the northern hemisphere to the southern hemisphere to breed during summer. | Very common in NSW coastal waters during migration periods. Feeds on krill, small fish and other small marine creatures. Food is caught mostly at the surface of the water but sometimes birds are seen diving for food. | Breeds and nests in coastal areas and offshore islands in south and southeast Australia, typically from November to March. |

Sources: BirdLife (2023), DPE (2018)

Significant Impact Criteria – Threatened and Migratory Marine Birds – EPBC Act

| Wedge-tailed Shearwater (<i>Ardenna pacifica</i>) - Migratory Short-tailed Shearwater (<i>Ardenna tenuirostris</i>) – Migratory | Likelihood of Impact |
|---|----------------------|
| An action is likely to have a significant impact on a threatened or migratory species if there is a real chance or possibility that it will: | |
| Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species | |
| The entrance clearance works will temporarily modify habitat that migratory marine birds may periodically use to forage and roost. Increased noise and a reduction in water quality may temporarily modify foraging habitat Shearwaters are typically pelagic species and will generally hunt and forage over the ocean, while foraging in a lagoon would likely only occur very occasionally and so is not considered an important foraging habitat for these species. Potential roosting and resting habitat that Shearwaters may use occasionally along Narrabeen Beach may be disturbed during nourishment with sand, however these changes are not expected to result in any modification or loss of habitat | Unlikely |
| Result in an invasive species that is harmful to the migratory species becoming established in area of important habitat for the migratory species | |
| The proposal is not likely to result in an invasive species harmful to the Wedge-tailed or Short-tailed Shearwater becoming established in the area. | Unlikely |
| Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species | |
| Shearwaters, including the Wedge-tailed and Short-tailed Shearwater are known to forage over large areas of coastal and offshore and may transiently utilise waters within or near the Study Area. Breeding habitat does not occur within the Project Area and is predominately restricted to offshore islands off the east, south and west coasts of Australia for Wedge-tailed | Unlikely |

and Short-tailed Shearwaters. Shearwaters are also typically pelagic feeders and would likely only use lagoon habitat for foraging very occasionally.

During migrations, these species are known to become injured or die in large numbers due to fatigue from extensive migration distance, starvation and weather events such as high wind, storms and large waves. Shearwaters have previously been observed to wash up on beaches along the NSW coastline. The presence of machinery and trucks on the foreshore of Narrabeen Beach involved in sand placement and sand distribution may pose a threat to injured birds that have been washed ashore. The birds' injuries and fatigue may reduce their capacity to move away from machinery and trucks, which have potential to trample or crush birds resulting in fatalities. However, given the rarity that washing ashore events will coincide with the works and considering events that would naturally follow fatigued birds washing ashore such as predation or drowning, it is not likely that the proposal will have an adverse effect on the life cycle of the species such that local populations are likely to be placed at risk of extinction. It is still recommended that fauna checks be undertaken following weather events to reduce the possibility of harm.

With consideration that breeding and foraging habitat does not typically include habitat within the Project Area, it is very unlikely that an ecologically significant proportion of a population would be seriously disturbed by the proposed works.

Conclusion

The proposal is unlikely to result in a significant impact on these migratory marine birds. Impacts will be confined to short-term disturbance that may reduce the quality and availability of a small area of non-core and very marginal habitat. While these impacts are likely to be limited to temporary habitat disturbance. The habitat within Narrabeen Lagoon and along the adjacent beach also only represents a very small area used by these species and is not considered critical to their lifecycle. Thus, the proposed action does not constitute a significant impact on these species.



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