ENVIRONMENT PROTECTION AUTHORITY

THIS IS THE APPROVED Dredge Management Plan - as reviewed by Jackie Agnew, Sam Gaylard and Jonathon Song

REFERRED TO IN CONDITION S-288

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MARITIME CONSTRUCTIONS

Adelaide Beach Management Review Implementation Project

Dredge Trial

Dredge Management Plan

Department for Environment and Water

Document Control

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Contractor	MC Dredging and Port Development Pty Ltd (Maritime Constructions)
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Prepared By	Simon Spencer	Environmental Manager & Project Manager, MCDP
Review By	Sikko Krol	Business Unit Manager, MCDP
IMS Check By	Tony Bornholm	IMS Manager, MCDP
Approved By	Shane Fiedler	CEO MCDP

Change Log

Revision	Section	Change
A1	All	Initial Document; Issued for Internal Review
B1	All	Issued for Client Review
B2	All	MC responses and edits to Client Review
B3	All	Issued for Client Review
B4	All	DEW revision and comments
B5	All	MC responses and edits to Client Review
C1	All	Issued for Client Review
C2	All	Final Revision for EPA Review
C3	All	Final

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1 ABBREVIATIONS & DEFINITIONS

Table 1-1; Abbreviations

Abbreviation	Written in Full
ABMR	Adelaide Beach Management Review
ADS	Adelaide Dolphin Sanctuary
AHD	Australian Height Datum
CD	Chart Datum
CSD	Cutter Suction Dredger
DMP	Dredge Management Plan
DEW	Department for Environment and Water
EPA	Environment Protection Authority (SA)
IMS	Integrated Management System
LAT	Lowest Astronomical Tide
MCDP	MC Dredging and Port Development Pty Ltd
RA	Rehandling Area
SBA	Sand Borrow Area
SHB	Split Hopper Barge
SPA	Sand Placement Area

Table 1-2; Definitions

Term	Definition
Client	Department for Environment and Water
Contract	Dredging services contract
Contractor	MC Dredging and Port Development Pty Ltd
Project	Adelaide Beach Management Review Implementation - Dredge Trial
Works	All dredging, tug and barge activities
Nearshore	Shallow draft waters and/or intertidal waters
Onshore	Intertidal and above high water

2 INTRODUCTION

2.1 Background

Sand naturally moves north along the Adelaide metropolitan coast, with erosion an ongoing issue at the southern end of the system and downdrift of structures, and accretion of sand at the northern end of the system, as well as on the southern side of structures.

An independent review into Adelaide Beach Management recommended the South Australian Government investigate the feasibility of dredging to manage sand in the 'Northern Management Area' between West Beach and North Haven.

2.2 Purpose

The aim of the Dredge Trial is to "*assess the effectiveness of dredging methodologies for sand management and coast protection purposes*".

The feasibility of dredging as a means of managing sand on Adelaide managed beaches will be independently evaluated. Preliminary criteria include: -

Effectiveness

- Placement of sand via dredging methods (nearshore or onshore) increases beach width (sand above the mean high-water mark) for protection from storm events.

Environmental feasibility

- Activities avoid harm to the environment and risk of impacts are mitigated as far as practicable to protect marine water quality and ecology.

Operational feasibility

- Availability and capability of plant and equipment to perform dredging and placement activities in the locations required.

Social feasibility

- Acceptable levels of disruption to the community from noise, odour, access, visual amenity, and other socio-cultural values identified by stakeholders.

Sustainable

- An adequate volume of sand able to be sourced and moved from one or more location/s to maintain sandy beaches within the Northern Management Area over the long-term (e.g. 20 years).

2.3 Dredge Trial Design

As part of the implementation of the recommendations from the Adelaide Beach Management Review, the Department for Environment and Water (DEW) has undertaken a series of further investigations to inform the technical and operational feasibility of dredging for the purpose of sand management on Adelaide's metropolitan beaches.

The identification of suitable sand borrow areas (SBAs) required physical investigations to obtain data on sediment characteristics and contamination, benthic habitat, bathymetry and sand volumes.

The SBAs and placement methodology outlined in this Dredge Management Plan provide an opportunity to test the feasibility of dredging and the effectiveness of nearshore and onshore placement methods as an approach to sand management.

The methods will test various scenarios to provide information on the technical, environmental, operational and social feasibility of dredging for sand management on Adelaide's metropolitan beaches.

Further investigations are ongoing to identify sustainable sand borrow areas for long-term recycling of sand within the Northern Management Area as well as offshore sand sources to restore West Beach, should the effectiveness of placement methodologies be demonstrated in this trial.

2.5 Dredge Management Plan

DEW procured the services of MC Dredging and Port Development Pty Ltd (MCDP) to develop this Dredge Management Plan (DMP) for a Dredge Trial to test the feasibility of dredging for sand management in the Northern Management Area of the Adelaide metropolitan coastline.

The purpose of this document is to detail the management actions to be taken during the dredging and placement phases of the Dredge Trial to ensure they are carried out in a controlled and auditable manner in line with MCDP's Environmental Protection Authority (EPA) dredging licence 42842.

The DMP covers the following:

1. Scope of Work, including intended work methodologies, sand borrow and placement sites, and equipment to be used
2. Environmental conditions
3. Environmental requirements
4. Environmental risk assessment
5. Reporting

As required under EPA licence 42842, the DMP also includes environmental management plans which aim to identify, as far as reasonably practicable, environmental risks associated with the dredging and placement processes and outline procedures to prevent, minimise and manage such risks:

- Water Quality Monitoring Plan (Appendix 1)
- Seagrass Monitoring Plan (Appendix 2)
- Noise Monitoring Plan (Appendix 3a) and Underwater Noise Monitoring Plan (Appendix 3b).

The DMP and environmental management plans seek to:

- identify potential environmental risks associated with the Dredge Trial;
- minimise environmental impacts that may be caused by dredging and placement activities; and
- ensure potential impacts on the community and the marine environment near the borrow and placement areas are local and temporary.

2.4 Project Timeframe

March 2024 – Commencement of investigations into the technical and operational feasibility of dredging.

May 2024 – Commencement of consultation with key regulators (EPA, Planning and Land Use Services, Coast Protection Board).

July 2024 – Commencement of baseline monitoring; engagement with key community stakeholder groups.

September 2024 – Mobilisation of dredge plant and equipment; commencement of dredging and placement.

November 2024 – Conclusion of dredging and placement; demobilisation and site clean-up; reporting.

Physical and environmental monitoring will continue for 12 months post-dredging and placement operations (i.e. to November 2025), to inform assessment of technical and environmental feasibility including monitoring for any longer-term impacts to seagrass.

3 ROLES AND RESPONSIBILITIES

3.1 Client

DEW

- Regular review of the Contractor's performance in accordance with this DMP
- Community engagement

3.2 Dredging Contractor

MC Dredging and Port Development Pty Ltd (Maritime Constructions / MCDP)

As the EPA licence holder:

- Ensuring compliance with the conditions of the EPA Licence and EPA-approved DMP.
- Complying with all applicable legislation, permits, codes of practice and standards.
- Training of staff and sub-contractors in their environmental responsibilities and obligations under the *Environmental Protection Act 1993* (EP Act).
- Communication of the requirements of this document with all staff and sub-contractors.
- Implementation of the measures outlined in this document.
- Reporting all incidences as per legislative requirements and development of corrective actions to prevent recurrence.
- Responding to any complaints received.
- Undertaking regular monitoring of environmental performance and implementing corrective action as required should performance criteria not be met.

Water Quality Compliance:

- Dredging operations will be adaptively managed (modified) if Level 2 alarm trigger exceeded (refer to Figure 2, p. 8 of WQMP - Appendix 1).
- Dredging operations will cease as soon as practicable (but no longer than 3 hrs) if a Level 3 hold trigger is exceeded. An assessment will be undertaken by the EPA to determine whether background turbidity is a significant influence and if so, then dredging can recommence.
- Operations to actively monitor and track plume formations and introduce mitigation actions.
- Operations to monitor sediment type during dredging and ensure suitability.
- The following adaptive management measures will be considered:
  - Reduce overflow times (partial loading).
  - Dredging on certain tides.
  - Reduce dredging hours.

3.3 Water Quality and Seagrass Monitoring

EPIC Environmental and Hydrobiology

- Carry out Water Quality Monitoring Plan (Appendix 1) and Seagrass Monitoring Plan (Appendix 2).
- Report compliance and non-compliance to dredging contractor and client representative via web-based notification system within the timeframe specified in this DMP.

3.4 Noise Monitoring

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- Develop and implement Noise Monitoring Plan (Appendix 3a) and Underwater Noise Monitoring Plan (Appendix 3b).

3.5 Hydrographic survey

MC Dredging and Port Development Pty Ltd (Maritime Constructions / MCDP)

- Carry out pre-dredge, progress and post-dredge hydrographic/terrestrial surveys and volumetric analysis; Vessel positioning.

3.6 Contact Details

In an Emergency, contact the Project Supervisor.

Project Manager	Simon Spencer	0499 777 291
Project Supervisor	Brad Watts	0428 862 502
Project Engineer	Avi Patel	0452 429 290

4 SCOPE OF WORK

4.1 Project Overview

The Dredge Trial involves the Contractor (MCDP):

1. Dredging sand from Sand Borrow Areas (SBAs):
    a. North Haven Marina sand trap (SBA1).
    b. West Beach sand bar (SBA2).
    c. West Beach Harbour Sand Trap (SBA3).
    d. Rehandling area (RA).

2. Depositing sand within Sand Placement Areas (SPAs):
    a. Nearshore at West Beach (SPA1).
    b. Onshore at West Beach (SPA2).
    c. Rehandling area (RA).

Sand sourced from SBAs may be deposited in the Rehandling Area (RA) before being placed at West Beach in the nearshore (SPA1) or onshore (SPA2).

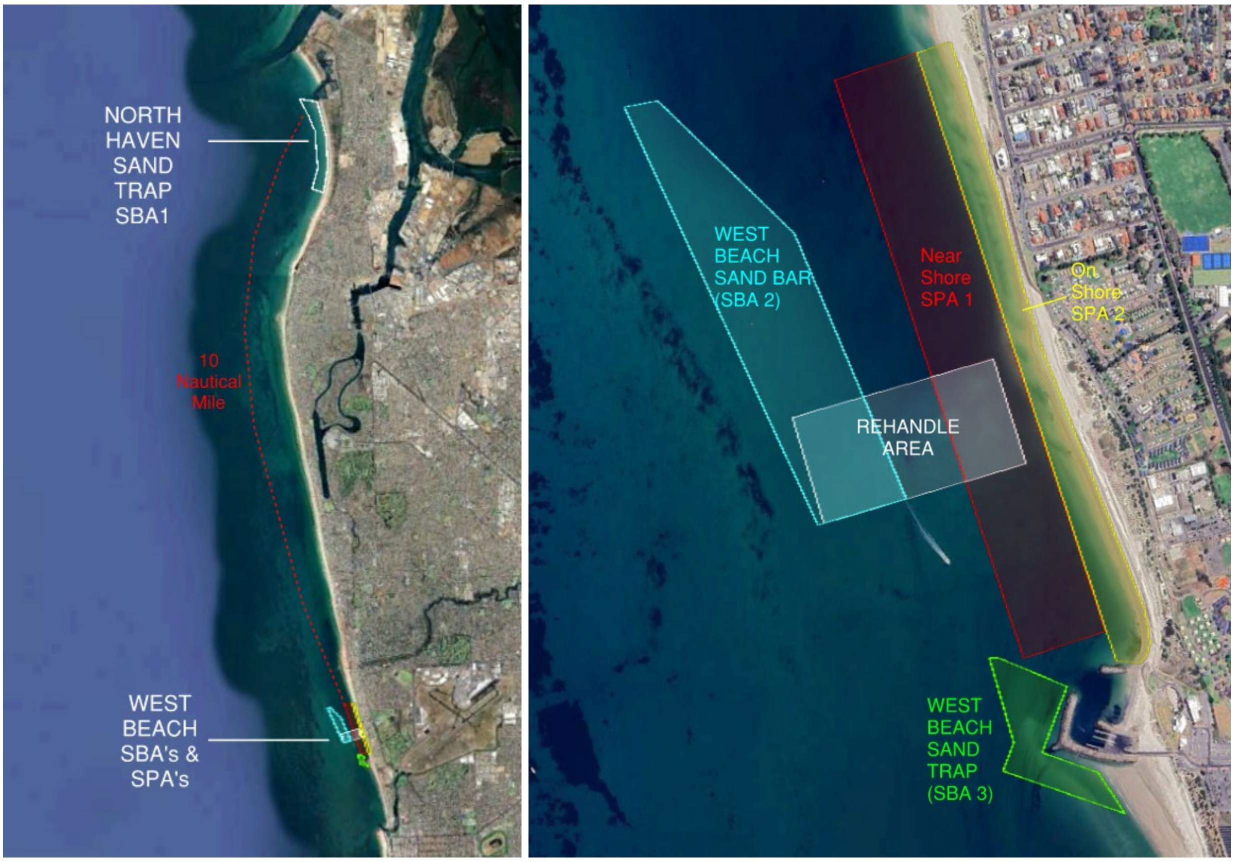

Figure 4-1; Sand Borrow Areas (SBAs) and Sand Placement Areas (SPAs)

Table 4-1; Summary of locations and activities

Area	Location	Dredging Activity	Placement Activity
SBA1	North Haven Marina Sand Trap	Cutter Suction Dredge (CSD) pumping into Split Hopper Barge (SHB)	n/a
SBA2	West Beach Sand Bar	CSD pumping direct to SPA or RA	n/a
SBA3	West Beach Harbour Sand Trap	CSD pumping direct to SPA or RA	n/a
RA	Rehandling Area West Beach Harbour dredge discharge area (also referred to as Restricted Zone)	CSD pumping direct to SPA	SHB Receipt point CSD pumping direct to RA
SPA1	Nearshore at West Beach - waters accessible by SHB	n/a	SHB Receipt point CSD pumping direct to SPA
SPA2	Onshore at West Beach - targeting high water mark using a swale to place sand directly on beach	n/a	CSD pumping direct to SPA

4.2 Dredging Activity Timeline

Proposed dates for dredging operations are:

- Mobilisation of plant and equipment from 27 September 2024.
- Commencement of dredging operations from 30 September 2024.
- Completion of dredging operations by late November (including demobilisation and site clean-up).

Table 4-2 Proposed Target per fortnight interval at each sand borrow area*

Dredge location	Late Sept	Early Oct	Late Oct	Early Nov	Late Nov
SBA1	Target	Target	Possible	Possible	
SBA2	Possible	Possible	Target	Target	Possible
SBA3	Possible	Possible	Target	Target	Possible
RA		Target	Target	Target	Possible

**Subject to change depending on outcomes and likely weather opportunities.*

If the volume of sand dredged and placed is insufficient to enable meaningful evaluation of dredging and placement methodologies, an extension to the above timeframes may be requested.

4.3 Sand Borrow Areas (SBAs)

The following sand borrow areas (SBAs) have been identified as suitable for the purpose of trialling dredging and placement at West Beach:

- **SBA1** – North Haven Marina Sand Trap
- **SBA2** – West Beach Sand Bar
- **SBA3** – West Beach Harbour Sand Trap

4.3.1 Sand Borrow Area 1: North Haven Marina Sand Trap

The North Haven Marina Sand Trap (See Figure 4.2) is an accreting body of sand located to the south of the North Haven Marina breakwater. Sand naturally drifts north and accretes at this location, eventually drifting into the marina channel and protected waters which requires annual maintenance dredging to maintain navigability.

Dredging sand from SBA1 to create a sand trap will provide an opportunity to buffer sand ingress into the marina channel to provide maintenance benefits, as well as test the feasibility of dredging sand from this location, transport to West Beach via Split Hopper Barge (SHB) and monitor the effectiveness of nearshore bottom placement by SHB at West Beach (SPA1).

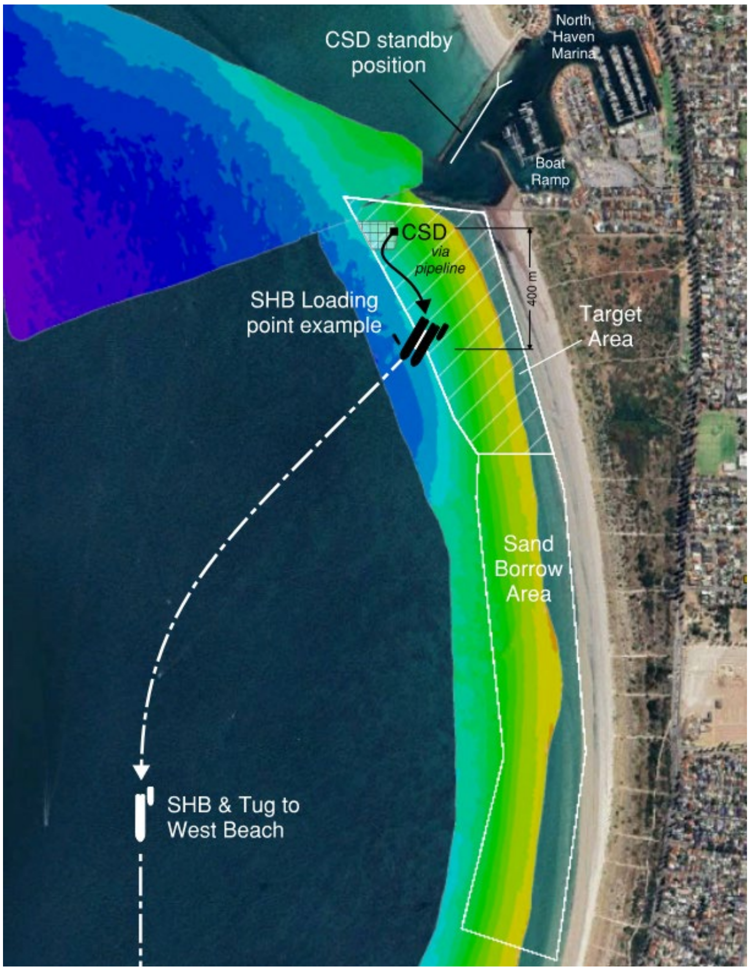

Figure 4-2*; SBA1 - North Haven Marina Sand Trap*

4.3.2 Sand Borrow Area 2: West Beach Sand Bar

The West Beach Sand Bar is an accreting body of sand located approximately 450-500m offshore of West Beach (refer Figure 4-1, 4-3 and 4-6).

Dredging sand from SBA2 provides an opportunity to improve understanding of coastal processes at West Beach and to test placement nearshore and onshore placement methodologies and effectiveness.

SBA2 is a source of sand for nourishment within the SPAs via CSD and direct pipeline either to the nearshore (SPA1) or onshore (SPA2) placement areas.

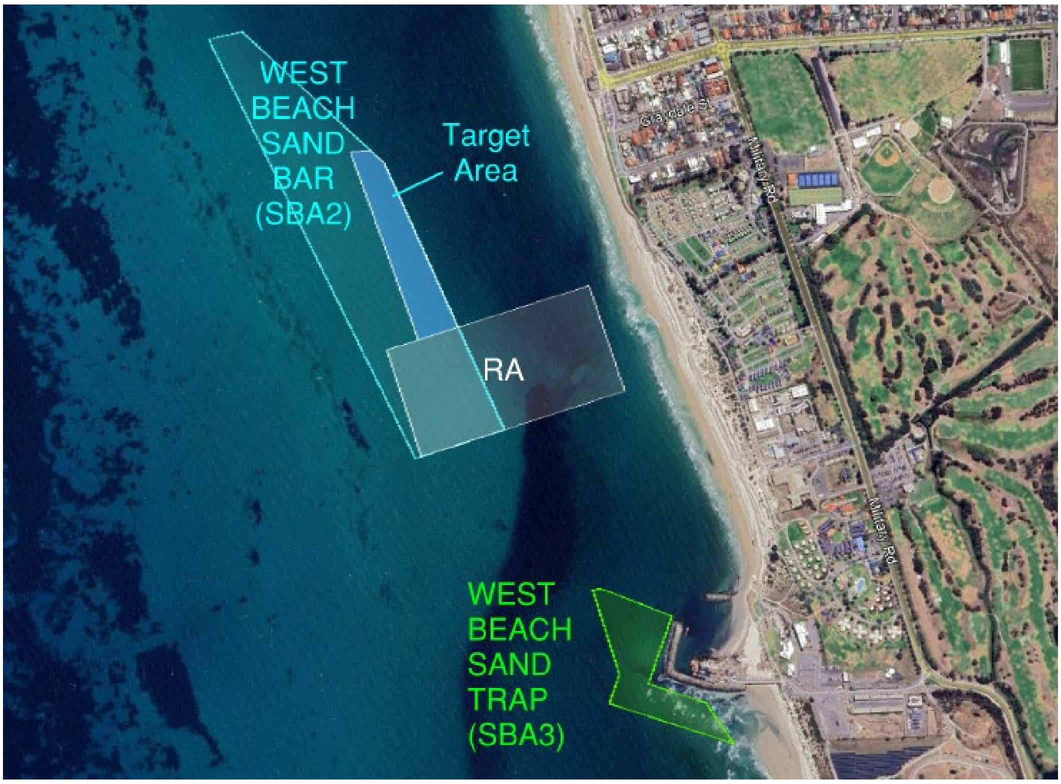

Figure 4-3; West Beach SBAs and RA

4.3.3 Sand Borrow Area 3: West Beach Harbour Sand Trap

The West Beach Harbour Sand Trap (See Figure 4-3 and 4-4) is an accreting body of sand located to the west and south of the West Beach Harbour breakwater. SBA3 is a source of sand for nourishment within the SPAs via CSD and direct pipeline either to the nearshore (SPA1) or onshore (SPA2) placement areas.

Dredging within West Beach Harbour and channel occurs on an as-needed basis when wrack and sediment threaten to impede navigation. No dredging of channel materials is proposed for nourishment of West Beach.

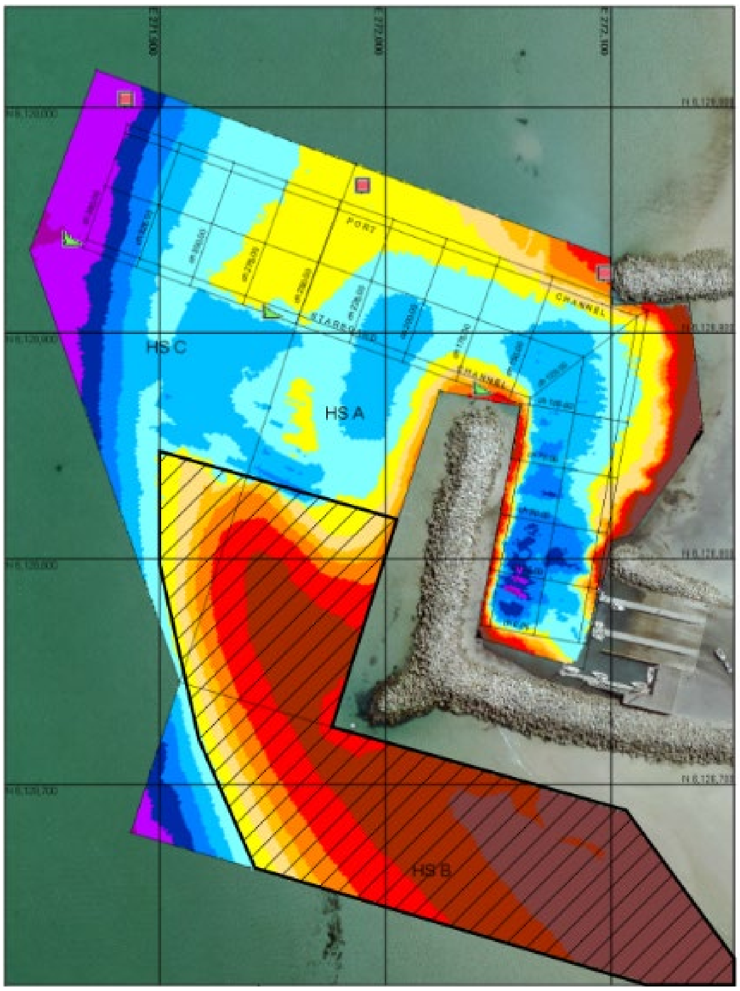

Figure 4-4; West Beach Harbour Sand Trap – SBA3 (HSA, HSB, HSC)

4.4 Sand Placement Areas (SPAs)

The Dredge Trial aims to assess the most effective means of sand placement for sand retention. Two broad sand placement areas (SPAs) at West Beach – nearshore and onshore extending from just north of the West Beach Harbour to 1500m north – have been identified for trialling placement of dredged material (Figure 4-6).

4.4.1 Sand Placement Area 1 – West Beach nearshore

Nearshore at West Beach has suitable water depths for access with the SHB for bottom placement. High tide will enable access to shallower sections (eastern side) of SPA1 when there is greater than 3m of water. SPA1 is an in-water placement location and hence use of floating Diffuser Barge may also be applicable here but with greater tide accessibility (needing 1m of water depth). In basic terms, this is an 'in-water' placement area.

4.4.2 Sand Placement Area 2 – West Beach onshore

Onshore at West Beach is typically for placement above sea level, operating in the narrow strip between high tide and the toe of the dunes. This narrow strip may change depending on tide and wave height. Placement within this SPA will be pumped via dredge pipeline directly onto the beach into a swale and managed by civil plant. In basic terms, this is an 'on-land' placement area.

4.4.3 RA – Rehandling Area

Offshore of West Beach for intermediary placement of dredged materials; coincides with the existing West Beach Harbour dredge discharge 'Restriction Zone' and will be referred to in this DMP as the 'Rehandling Area' (RA).

The location of the RA is in proximity of the nearshore placement area and within the approved dredge material placement area under DEW's West Beach Harbour dredge maintenance contract (see Figure 4-5 – area marked by six St. Andrews Crosses).

Due to shallow water depths, the SHB-placed sand in the RA is for further handling via CSD at a later date. Coinciding SHB operations and CSD operations at West Beach is not advisable for vessel safety reasons and hence it will be ideal to have all SHB movements completed before rehandling via CSD or in opposing sequence.

Figure 4-5; Restriction Zone (Rehandling Area)

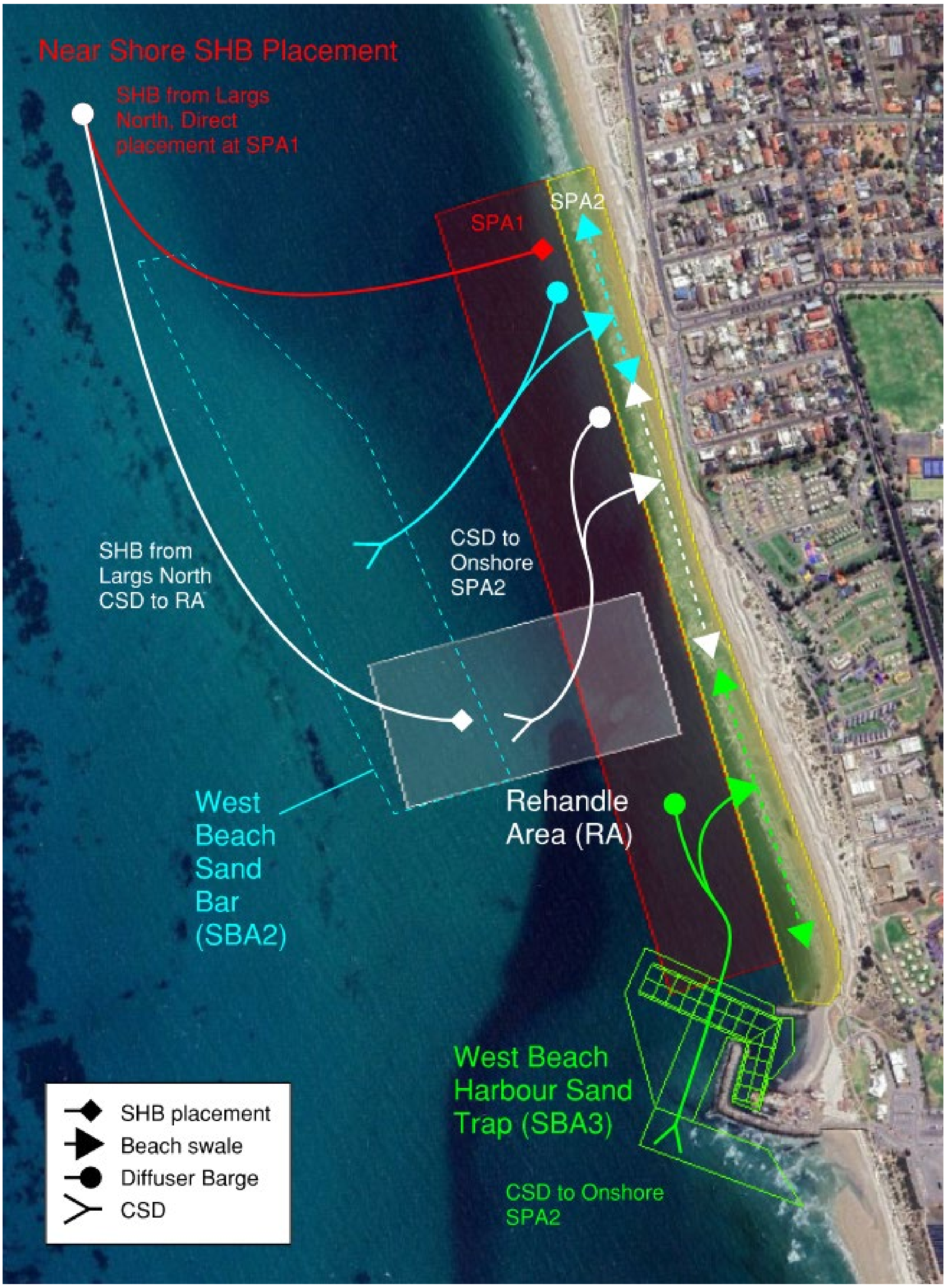

Figure 4-6; West Beach Sand Borrow Areas, Sand Placement Areas, and Methods

4.5 Dredging and Placement Scenario Summary

A combination of the following scenarios will be trialled:

Scenario 1: SBA1 – SPA1 via SHBs

- Dredging by CSD in SBA1 and discharge of dredged materials in a nearby anchored stationary SHB.
- Transport of SHB and placement of dredged materials via bottom placement within nearshore SPA1.

Scenario 2: SBA1 – RA via SHBs – SPA1 via pipeline

- Dredging by CSD in SBA1 and discharge of dredged materials in a nearby anchored stationary SHB.
- Transport of SHB and placement of dredged materials via bottom placement within Rehandling Area (RA).
- Dredging of material from RA by CSD and discharge via pipeline and Diffuser Barge to SPA1.

Scenario 3: SBA1 – RA via SHBs – SPA2 via pipeline

- Dredging by CSD in SBA1 and discharge of dredged materials in a nearby anchored stationary SHB.
- Transport of SHB and placement of dredged materials via bottom placement within Rehandling Area (RA).
- Dredging of material from RA by CSD and discharge via pipeline onshore to SPA2, using civil plant to build beach.

Scenario 4: SBA2 – SPA1 via pipeline

- Dredging by CSD in SBA2 and discharge via pipeline and Diffuser Barge to SPA1.

Scenario 5: SBA2 – SPA2 via pipeline

- Dredging by CSD in SBA2 and discharge via pipeline onshore to SPA2, using civil plant to build beach.

Scenario 6: SBA3 – SPA1 via pipeline

- Dredging by CSD in SBA2 and discharge via pipeline and Diffuser Barge to SPA1.

Scenario 7: SBA3 – SPA2 via pipeline

- Dredging by CSD in SBA3 and discharge via pipeline onshore to SPA2, using civil plant to build beach.

Table 4-3; Summary of Dredging and Placement Options

*	Dredging and Disposal					Rehandling and Placement			
	Dredge Site	**Dredge Method**	**Transport Means**	**Placement Area**	**Placement Method**	**Dredge Method**	**Transport Means**	**Placement Area**	**Placement Method**
1	SBA1	CSD-1	SHB	SPA1	Pattern Placement	N/A	N/A	N/A	N/A
2				Rehandling Area	Direct Placement	CSD-2	Pipeline	SPA1	Diffuser Barge
3								SPA2	Civils Onshore
4	SBA2	CSD-2	Pipeline	SPA1	Diffuser Barge	N/A	N/A	N/A	N/A
5				SPA2	Civils Onshore				
6	SBA3	CSD-2	Pipeline	SPA1	Diffuser Barge	N/A	N/A	N/A	N/A
7				SPA2	Civils Onshore				

4.6 Dredge Volumes

The total Target Volume for the trial is 90,000m^3, with a minimum volume of 75,000m^3 and a maximum volume of 150,000m^3. Maximum volumes from each individual site are:

- SBA1 up to 20,000 m^3
- SBA2 up to 100,000 m^3
- SBA3 up to 30,000 m^3

4.6.1 Hydrographic survey

Dredging activities will be guided by pre-dredge, progress, and post-dredge hydrographic survey results.

Dredge volumes and placement volumes will be calculated and reported.

Survey within the nearshore placement area will be critical for tug operations to navigate the seabed depth changing conditions.

Survey frequency will be high with weekly and in some cases daily progress captures, depend on rate of progress.

4.6.2 Geospatial analysis and data capture

The CSD will utilise Trimble Marine Construction (TMC) software to position and control dredging at any given location including GPOS positioning, and dredge adapted software controlling dredge depth and swing.

Tug SEA PELICAN will be tracked using standard AIS as well as superficially tailored TMC position enabling the skipper to accurately position the SHB over a nominated location. Placement locations will be recorded and compared with subsequent hydrographic surveys. Vessel tracking data will assist in cycle time management and real time forward planning.

The SHBs are to be fitted with AIS and trackable.

Beach survey data will be tied with hydrographic data to report on depth changes and overall volume changes.

4.7 Operating Hours

Dredging works involving CSD and SHB will be 24/7 during suitable weather periods for up to 8 weeks within September and November 2024.

Civil works including dozer and excavator on the beach is expected to be for a shorter period (e.g. <6 weeks) and will primarily be during daylight hours. Efficient production and maximum recovery of sand on the beach may require night-time civil activities to maintain good operations and take advantage of weather windows.

Any night-time works will be cognisant of acceptable noise levels and undertaken in accordance with the Noise Monitoring Plan (Appendix 3a).

4.8 Placement Methods

The proposed equipment for use in this Dredge Trial includes a cutter suction dredge (CSD) and a split hopper barge (SHB) for the placement of dredged sand in SPAs at West Beach, along with civil plant for on-beach placement activities using a Dozer and Excavator.

A number of placement methodologies are intended to be trialled:

1) SHB bottom placement in the nearshore SPA1,
2) Pumping dredged sand from SBA2 or SBA3 via pipeline to the nearshore SPA1 using a Diffuser Barge.
3) Pumping dredged sand from SBA2 or SBA3 via pipeline to the onshore SPA2 using Dozer and Excavator (civil plant).

4.8.1 Cutter Suction Dredge

4.8.1.1 SBA1

The primary CSD will work inwards towards the beach, cutting a path into the shallower waters (targeting contour -3mAHD or approximately -1.5mCD).

Actual operating areas in terms of water depths will be within the range of 0 to -4mCD within the SBA. Sand materials dredged will be targeted initially at the -2.5mCD contour and dredging landwards at -2.5mCD and potentially deeper.

Dredge operator can lower cutterhead depth if there is good available sand below -2.5mCD. Hard materials could be expected at ~1.5m below seabed (e.g. at -4mCD) and will be clearly identified by the dredge operator, presenting as increases and changes to cutterhead pressure. Primarily it is critical that clay is not disturbed and/or mobilised.

Hindmarsh clays are expected to exist at depth and will be avoided but could be encountered at any depth so caution is critical.

From the dredge, the sand and water mixture is pumped via a pipeline of approximately 400m in length towards the SHB. The pipeline will be submerged during dredging operations and periodically floated and moved, along with pipe anchor adjustment as required.

4.8.1.2 SBA2

Dredging within SBA2 will target areas to minimise potential impacts on the coastal processes. Dredging depths could be in the order of –4.5 to –5.5 mCD in SBA2.

4.8.1.3 SBA3

Dredging within SBA3 will target areas of sand accretion to a dredge depth of –2.4 mCD.

4.8.1.4 RA

When all the materials from the Rehandling Area have been relocated, the second CSD, will work within the designated West Beach Rehandling Area targeting the major deposits of sand as directed by DEW within the existing dredge footprint assigned. Specific approach will be defined according to hydrographic survey evidence of target sands.

From the dredge, the dredged materials are pumped via a pipeline of approximately 800-1000m in length towards a shore connection for placement of materials onshore or nearshore. The pipeline will be submerged during dredging operations and periodically floated and moved, along with pipe anchor adjustment as required.

Discharge will either be via pipe diffuser nearshore (SPA1) or piped to land and placed with civil equipment (SPA2).

4.8.1.5 Pipeline route and management

CSD Pipeline will be submersed resting on the seabed during dredging operations and floated when moving or inspecting pipeline via use of introducing air into the dredge pipeline. Pipeline will run directly from dredge area to shoreline and turn along the beach for onshore placement or be managed in slack pipe scenario where a diffuser barge can be moved around easily.

Pipe anchors will be used to position the pipeline in a stationary alignment and each pennant will be affix with a strobe for night navigation and safety purposes.

4.8.2 Split Hopper Barge

SHB will be moored on a dual anchor along the western boundary of the dredge footprint, targeting deep water and avoiding seagrass meadow, typically meaning at the -5mCD contour line.

Specific mooring details are subject to vessel master preference and experience. Vessel masters are to be afforded flexibility on anchor, ground tackle and mooring line selection depending on findings during SHB and tug activities. SHB single mooring may require additional anchoring to a 2nd point in moderate wind conditions (strong and extreme conditions will most likely result in weather standby) and may be also affected by the dredge discharge line position in relation to the barge. All considerations will be considered and changes will be made as necessary for the safety of crew and equipment.

Hi-resolution seagrass footprint detail will be available to vessel masters and project supervisors for the purposes of avoiding anchor damage to existing established seagrass meadows.

4.8.2.1 Filling SHB

Discharge pipe from the dredge will pump slurry into the SHB at an estimated rate of 100-200m^3 per hour. At this rate to completely fill the 760m^3 SHB with sand it will take 4-8 hours overall, dependent on weather, production from the dredge and connection/disconnection activities. Slurry discharged into the hopper will comprise mostly water with sand content ranging from 10-40%. Once the SHB is initially filled with water/sand, excess water will overflow off the deck of the SHB with sand accumulating within. After multiple hours of pumping the SHB will be less buoyant and the overall mass of sand within the SHB can be determined by checking the vessels overall displacement (Plimsol line) and using the displacement calculations to ascertain current fill amount. Filling may cease prior to complete fill if suspended sands are overflowing too easily with no meaningful retention of sand.

Pipe will be connected via a floating pontoon connected to the discharge line. Flexible pipe will be lowered from the SHB deck, pipe retrieved by crew at water level using anchor barge and manually connected on deck of pontoon. Floating pontoon enables safe connection in varied conditions and is primarily reliant on a straight alignment created by a fixed pipe over a long pontoon. Communications between crew and dredge operator will confirm the dredge pump instructions.

The relatively short pipeline of 400m is selected here to allow for high slurry concentrations (>20%) which will ensure quick filling and a comparatively lower volume of water reducing the total volume lost in overflow.

To ensure an even fill, the slurry will be diffused evenly across the barge using discharge pipeline along the deck.

Partial filling may be required depending on the resulting draft of the SHB and available water depth at the placement location. This will be affected by tide and weather and is at the discretion of vessel masters and supervisors. Individual load volumes will be recorded and reported but may vary significantly depending on operational decision processes and available times between standby events or other defining operational matters.

4.8.2.2 SHB Tow by Tug

Once a SHB has been filled or partially filled, it will be transported with a tugboat to West Beach. Tug will tie up in a ‘composite tow’ position and ‘push’ the barge hipped up to the SHB.

Total time required to voyage route will vary depending on weather and total SHB volume filled, however it is expected to take 4-8hrs and will be the limiting factor in logistics between barge swaps. Meaning that the CSD is likely to fill one SHB before the second arrives empty for filling.

4.8.2.3 SHB Placement at West Beach

SHB and Tug composite unit will approach the nearshore placement area and accurately position within a designated placement cell within SPA1 or, if weather is poor, within designated deeper water within the Rehandling Area when tides are low or swell is high.

Navigation of the SHB will be of critical focus due to the changing water depths at the placement location and the changing draft of the vessel when loaded or lightship. The SHB will be able to approach when fully loaded approximately in 3m water depth and if grounded at the Bow may be pulled off by the Tug astern. Alternatively splitting the barge and unloading will increase buoyancy resulting of a draft ~1m enabling the barge to float off. Regular hydrographic surveys (up to daily) of placement activities will aid the placement pattern of sand, avoid shallow areas and identify how placement effects overall water depth and variation in placement behaviour, volume differencing etc.

The SHB will be opened, and its load will be placed directly underneath its hull. Upon emptying of the SHB, the SHB will be returned by tugboat to the designated anchor area.

SHB placement locations (DGPS) will be recorded and incorporated into sand nourishment analysis. Tug operator will maintain a written record of daily activities including specific logs on placement location, timing and estimated volume.

Designated placement cells are 100 x 40m each, divided into 2 columns A and B, running a total of 35 rows. Primarily Rows 1-15 will be target for near shore placement and the western half of RA (Figure 4-7).

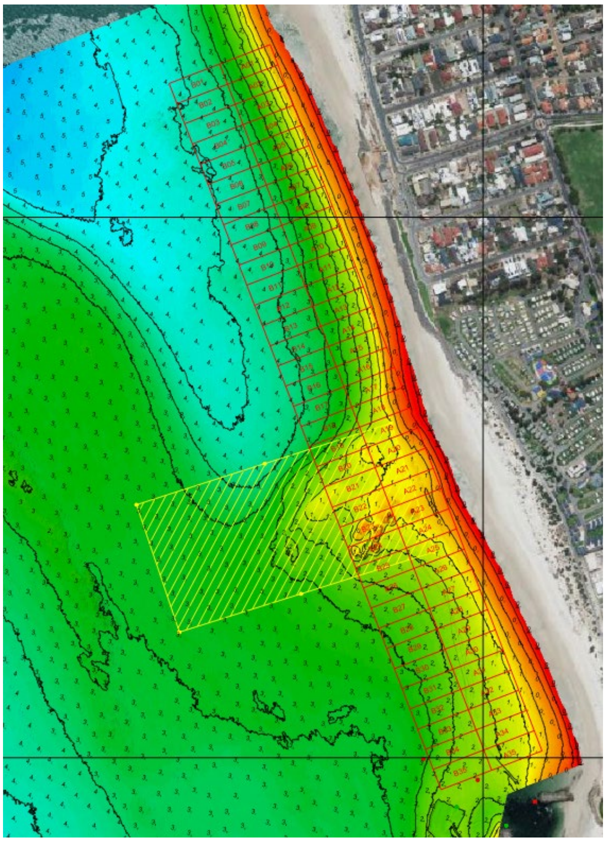

Figure 4-7 SPA1 and RA placement areas over recent hydrographic survey

4.8.3 Diffuser Placement

Diffuser placement can occur in shallow waters not accessible by the SHB. The diffuser must be accessible to the anchor barge during low tide and will dictate the water depth that it always operates in.

Diffuser is a small floating pontoon with a pipe elbow pointing downwards, dredge pipe is connected to this and diffuser is anchored into position and moved multiple times daily to reduce mounding (Figure 4-8). The risks that relate to this method are primarily pipe related. All pipes and connections must be inspected daily for leaks and damage. Weather may make access to the diffuser difficult and may move or flip the diffuser. All aspects mentioned here are relevant to the currently active diffusers at North Haven and West Beach.

Inspections of diffuser to identify any failures or potential failures in system is a regular requirement and typically completed every 2-3 hours during operation. If sand and water mixture escape the enclosed system due to an event such as a broken pipe flange, dredging will immediately cease. This is normally identified by monitoring the line pressure gauge.

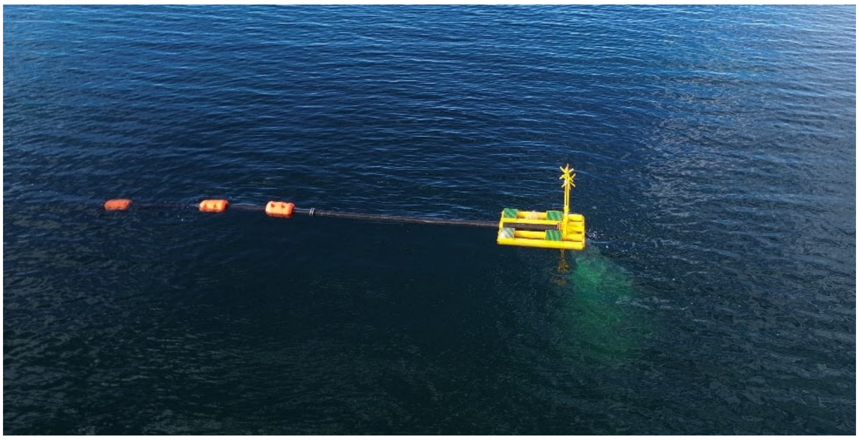

Figure 4-8 Pipeline connected to floating Diffuser Barge discharging sand downwards

4.8.4 Beach discharge onshore

Nourishment will be attended with a dozer and/or excavator every day to control and adjust the discharge area and pipe to prevent any scouring or free drainage directly into the tidal area.

Machine works can be restricted to day shift only however maximum recovery of sands would justify 24/7 civil operations, so a reduction of noise overnight will directly translate to reduction in sand recovery overall.

Machinery is common on this beach with dump trucks running seasonally.

Noise generated by these activities will be recorded irrespective.

Placement of dredge materials is to be focussed above the highwater mark, however sand placement within the intertidal area is inevitable on an eroding beach. Mass accumulation of sand will enable a higher elevation as the beach is constructed and progressed along the beach.

Beach nourishment is completed by use of a pipe from the CSD discharging onshore and civil machinery on the beach within a swale to redistribute the material within the nourishment area. The distribution of the dredge materials shall be done in a manner to make sure that particles velocities are reduced, promoting settlement within a swale reducing the risk of turbidity to the nearshore environment.

Nourishment area will be attended with a dozer and/or excavator every day to control and adjust the discharge area and pipe to prevent any scouring or free drainage directly into the tidal area.

Civil plant will need to continually remove heavy particulates out of the discharge point to prevent inundation of sand. Not doing so will result in excess build up and creation of alternative water flow routes which will eventually result in swale wall failure or excessive scouring.

Pipe will be continuously added at the discharge as the swale builds in volume and works can advance along the beach.

Daily inspections of discharge pipeline would be undertaken to identify any failures or potential failures in system. If dredge slurry escapes the enclosed system due to an event such as a broken flange, dredging will immediately cease. Clean-up will take place and repairs to system completed prior to the recommencement of onshore discharge.

The discharge and associated earthworks must occur with no disturbance to the dune vegetation and other ecological values and maintain safe access to the beach as much as is reasonably practicable while ensuring public safety.

4.8.4.1 Imported Quarry Sand

Onshore placement may need to be coordinated with existing quarry sand placement activities and overlap with dredge discharge onshore. Aspects related to environmental monitoring and regulation remain relevant however quarry sand incorporated into beach nourishment activities is unlikely to contribute to any additional impacts other than public interactions and traffic management. It is likely that this material will form a useful basis for swale wall construction. Alternatively, dredge discharge may be isolated and zoned away from the quarry sand placement areas.

4.9 Site compound and crew transfer

For dredging works at SBA1, crew will operate out of North Haven Marina facilitating crew transfer, parts and equipment, office. Tug crew will operate via crew transfer vessel at North Haven (Figure 4-9).

For dredging works at SBA2 and SBA3, crew will operate out of Glenelg North site office, occupied by separate dredging contract with DEW for Glenelg and West beach. Crew will transfer at the West Beach Harbour.

4.10 Weather standby scenarios

In the event that weather prevents works from continuing, marine plant may be brought into calm waters for safe mooring. Most notable the SHB weather standby locations are nominated as Outer Harbour 1, Outer Harbour 8 and Osborne Berth 4. Location will be determined by shipping activity however the preference is to moor at OH1 for time saving reasons.

Appropriate arrangements have been made with Flinders Ports authorities about deed of use.

Figure 4-9; North Haven facilities layout

4.11 Stop works scenarios

Dredge works may be required to stop for environmental reasons, most notably Water Quality stop works triggers as defined in the WQMP. Dredge Operator must be instructed by the Dredge Supervisor to stop dredging within 3 hours of stop works being triggered on Eagle.io dashboard. WQMP clearly states the trigger levels and the live web-based platform available for regularly monitoring. Notifications will be sent to relevant project personnel of ALARM and STOP works triggers.

Other STOP work triggers may result from instruction from Project Manager in the event that there is a significant community, regulator or client concern raised (e.g. distressed dolphin).

Dredge operations may stop work at any point for environmental, mechanical or safety reasons and is at the discretion of all MC personnel on site at the time.

5 DREDGING AND PLACEMENT EQUIPMENT AND METHODS

This section provides an overview of the main dredging plant and equipment and their general working principles.

Plant summary:

- Dredging Spread:
  - CSD KINGSTON (Damen CSD350)
  - Crew in roster 2:1 (2 x dayshift, 2 x nightshift, 2 x RnR)
  - Anchor Barge KENNY
  - Tender Vessel LLOYD
  - 1000m dredge delivery pipeline
- Placement Spread:
  - Tugboat SEA PELICAN (15T bollard pull):
    - 9 crew in roster 2:1 (3 x dayshift, 3 x nightshift, 3 x RnR)
  - Tugboat assist CHAPMAN (3T bollard pull)
  - 2 x Split Hopper Barges (760m^3 hopper capacity; leased from Heron Construction)

Table 5-1; Vessel Summary

Vessel Name	Vessel Type	Dimensions	Weight (t)
KINGSTON	CSD	Length – 16.5m Beam – 6.0m	55
KENNY	Anchor Barge	Length – 9m Beam – 3.8m	12
LLOYD	Workboat	Length – 7.61m Beam – 2.3m	2
SEA PELICAN	Primary TUG	Length O.A – 23.5m Beam – 7.5m	180
CHAPMAN	Assistance TUG	Length – 13.72 Beam – 4.31m	60
WH761	SHB	Length – 59.4m Beam – 11.04m	630
WH762	SHB	Length – 59.4m Beam 11.04m	630

5.1 Cutter Suction Dredgers

CSD are used for deepening and widening channels, maintaining navigation channels, beach nourishment, and creating new ports or berths. They can operate in a variety of water depths and sediment types.

For the Dredge Trial, MCDP will allocate two types of CSD's, the difference being in its anchoring and manoeuvring. One CSD will be working with a spud carriage and the other CSD working on three wires. Note that the one working on spuds can be converted to working with three wires, but the one designed to work with three wires cannot be converted to working with spuds.

5.1.1 CSD Details; with Spuds

In general, a CSD is a stationary dredge and consists of a U-shaped pontoon, which is held in position by a fixed spud (the "Working Spud") and two side anchors (Figure 5-1).

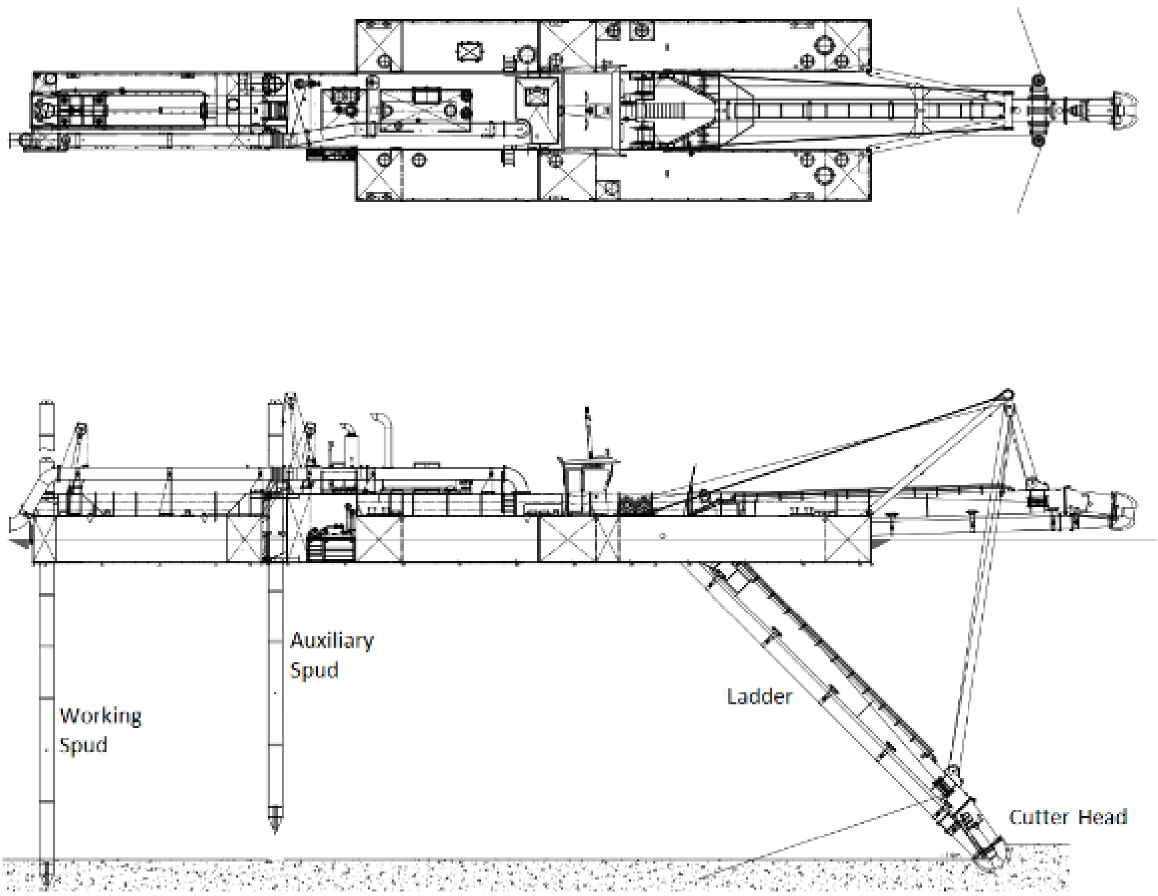

Figure 5-1; General layout of CSD KINGSTON

The sand is loosened by rotating a cutter head (the "cutter"). The cutter head, which is hydraulically driven, encloses the suction intake of a centrifugal (dredge) pump. The cutter head is mounted at the extremity of a fabricated steel structure (the 'ladder'), which is attached to the main hull by heavy hinges, enabling rotation in the vertical plane. The ladder assembly is lowered and raised by means of the ladder winch controlled from the operator's cabin.

During the dredging activities, the CSD swings around the main spud with the help of its side winches and anchors. The operation of the cutter section consists of cutting the seabed with the cutter head and pumping the mixture of water and sand by means of the centrifugal pump into the suction mouth.

The anchors to achieve this movement will be placed such as to minimise intermediate relocation. The total area which a dredge can cover without re-locating its anchors is called the "cut". Depending on the width and length of the dredge area, several "cuts" might be needed. Each "cut" will then have an overlap with another cut to cover the entire dredge area (Figure 5-2).

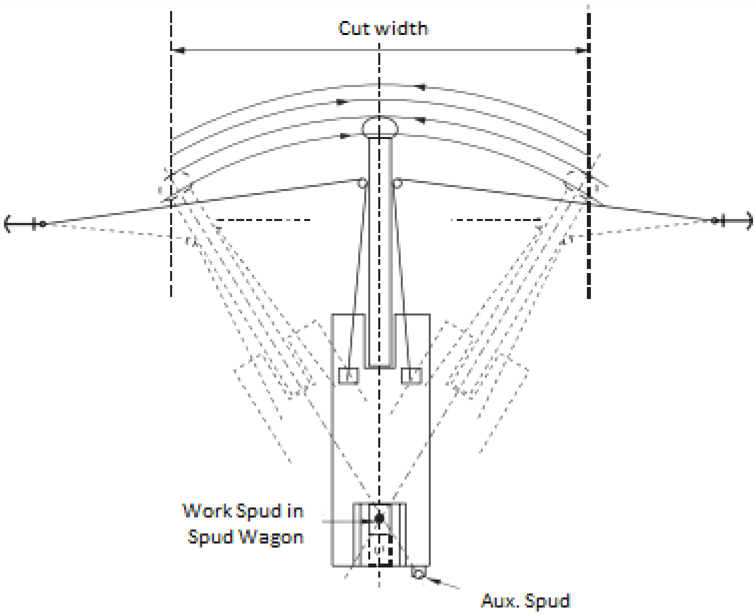

Figure 5-2; Graphical presentation of the working method of a spudded CSD

After loosening and suction, the sand and water mixture is pumped through a floating and/or submersed pipeline, which is connected to the rear end of the CSD, to the allocated discharge location.

5.1.2 CSD Details; with Three Wires

The CSD built and used by MCDP are a stationary type of dredgers consisting of a U-shaped **mono-hull** pontoon which is held in position by means of three anchors. The mono-hull design of the pontoon (Figure 5-3 below) is to provide a greater rigidity against the environmental elements when working in nearshore environments.

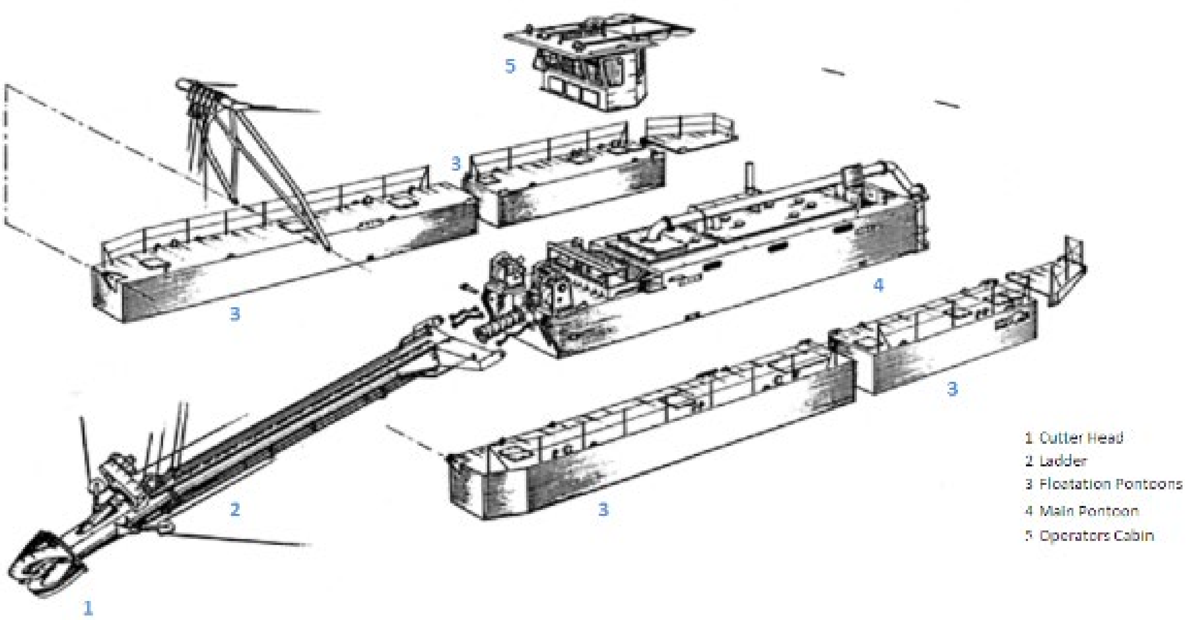

Figure 5-3; Diagram of a demountable Cutter Suction Dredger

By means of winches, the cutter (and therefore the whole pontoon), is pulled in turns to the port and starboard side-anchor. In this way (part of) a circular movement in the horizontal plane is made of which the rear anchor serves as centre point of the circle. Forward movement of the dredger is controlled by releasing length of wire on the rear anchor, while simultaneously heaving wire in on the two forward anchors (Figure 5-4).

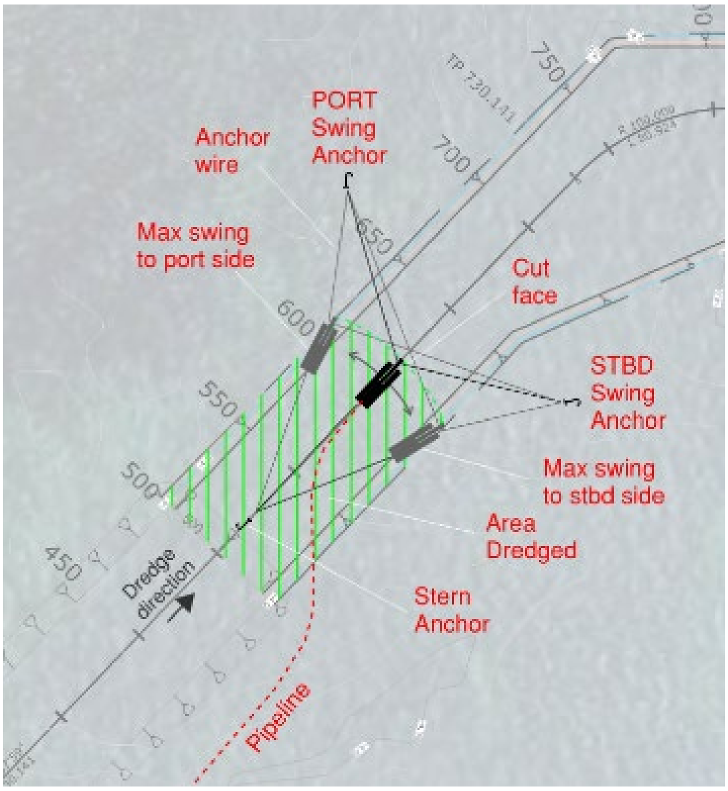

Figure 5-4; Example of anchor spread pattern when working with a 3-wire CSD

The anchors to achieve this movement will be placed in such a manner as to minimise intermediate relocation. The total area which a dredge can cover without re-locating its anchors is called the "cut". Depending on the width and length of the dredge area, several "cuts" might be needed. Each "cut" will then have an overlap with another cut in order to cover the entire dredge area.

5.1.3 CSD Dredging Methodology

The cut face of a CSD is the area where the dredger's cutter head comes into contact with the seafloor and loosens the sand. Maintaining a stable and uniform cut face is important for efficient pump operations and to minimize damage to the seafloor. The sand is loosened by rotating a cutting head (the "cutter"). The cutter head, which is hydraulically driven, encloses the suction intake of a centrifugal dredge pump (Figure 5-5).

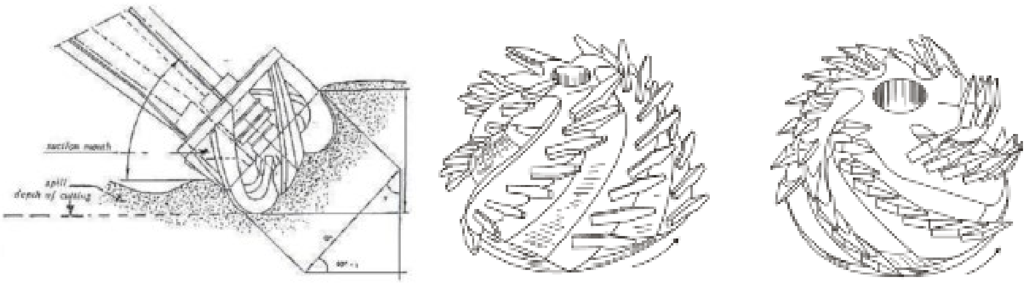

Figure 5-5; Diagram of a Rosebud Cutter Head

As the dredger moves forward, the tensioned wires help to maintain the dredger's position and orientation relative to the cut face. By adjusting the tension on the wires, the dredger can control its lateral and longitudinal movements, ensuring that the cut face is uniform and stable.

The tensioned wire system also helps to prevent the dredger from drifting or veering off course. Overall, the use of tensioned wires is an important component of cutter suction dredging operations and helps to ensure safe and efficient dredging practices and appropriate cutting forces at the cut face.

5.2 Split Hopper Barges

A SHB has two sides of the hull that are pivotally connected to each other on the deck. When the hopper is open (Figure 5-6) the barge splits in two and sand is released via the bottom of the hull.

The SHB will be loaded at Largs Bay via a dredge pipeline directly discharging into the SHB's hopper. The sand and water mixture will fill the hopper with heavy particles (sand) accumulating within the hopper and once total volume capacity is reached, water will 'overflow' back to the adjacent environment. Fines occurring within the dredge sediment will be 'flushed' from the hopper back into the surrounding waters.

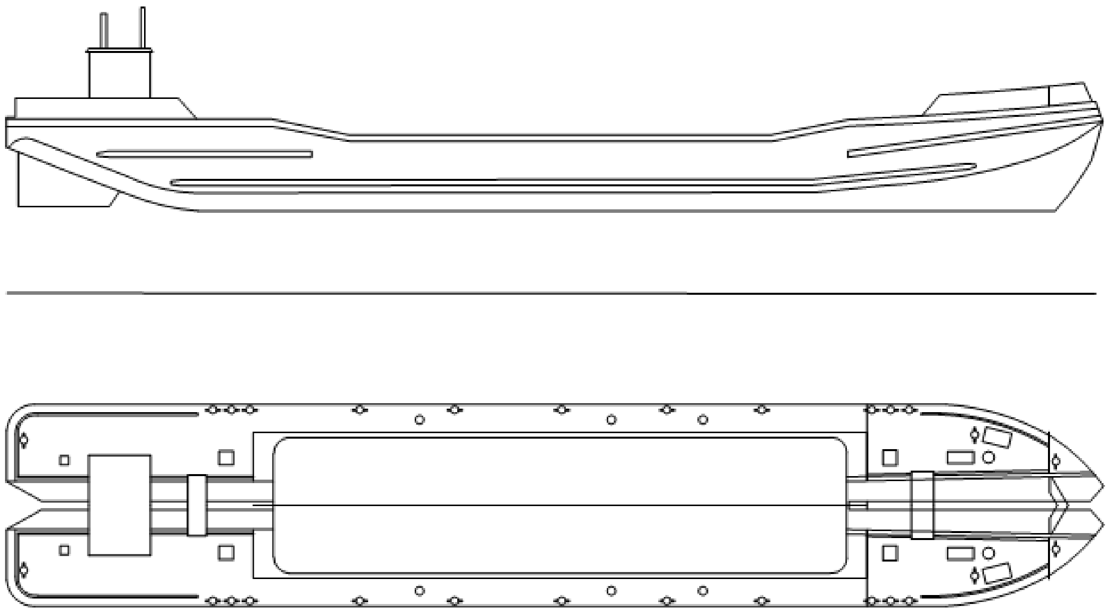

Figure 5-6; Diagram of Split Hopper Barge (SHB)

Once the SHB has reached capacity, it will be transported with the aid of a tugboat to its placement location. Upon reaching the placement location, the SHB will be opened and its load will be discharged directly underneath the hull of the vessel.

Figure 5-7; Working of a SHB

Figure 5-8; Proposed SHB W.H 761 and W.H 762

6 ENVIRONMENTAL REQUIREMENTS

This chapter presents an overview of the relevant Commonwealth, State legislation and dredge licence requirements for this Dredge Trial.

6.1 Legislative Framework

6.2 Commonwealth Government

6.2.1 National Assessment Guidelines for Dredging 2009

Guideline for assessing contamination in marine sediments intended to be placed at sea.

6.2.2 Environment Protection and Biodiversity Conservation Act 1999

Requires developments to be referred where there is the potential for a 'significant impact' on a matter of national environmental significance (MNES).

6.2.3 Environment Protection (Sea Dumping) Act 1981

Provides the framework for assessing activities that involve placement of material at sea within Commonwealth water. Although this Act is not applicable to the Gulf St Vincent, its guideline is used for assessing contamination in marine sediments intended to be placed at sea (the *National Assessment Guidelines for Dredging 2009*).

6.2.4 Maritime Safety and Pollution Legislation

The Commonwealth Government has put in place several instruments in relation to maritime safety and pollution, including *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*, the *Protection of the Sea (Prevention of Pollution from Ships) (Orders) Regulations* and various Marine Orders made under the Act and Regulation (e.g. Marine Orders 91, 93, 94, 95, 96, 97). This legislation is reflected in State level instruments (e.g. *Pollution of Marine Waters (Prevention of Pollution from Ships) Act 1987*).

6.2.5 Historic Shipwrecks Act 1976

Requires a permit for any activities that have the potential to damage or interfere with a historic shipwreck.

6.2.6 Biosecurity Act 2015

The Department of Agriculture, Fisheries and Forestry (DAFF) key biosecurity responsibility is to prevent and manage invasive species that pose a threat to agricultural, fishery and forestry resources. Its key legislation is the Biosecurity Act 2015 ('the Biosecurity Act'). The risks of marine pest incursions from international shipping are managed by DAFF.

To support DAFF's intention regarding biofouling management, vessel class specific requirements and a range of national best practice biofouling management guidelines have been developed to assist vessels to reduce the likelihood of accumulating and translocating marine pests. Guidelines applicable to the Contractor's vessels are:

- National Biofouling Management Guidance for Non-Trading Vessels
- National Biofouling Management Guidance for Commercial Vessels
- Australian ballast water management requirements

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6.3 South Australian Government

6.3.1 Environment Protection Act 1993

Provides the regulatory framework to protect South Australia's environment including land, air and water. The Act outlines the obligations of businesses and individuals to protect the environment, as well as enforcement processes and penalties for non-compliance.

6.3.1.1 EPA SA Dredge Guideline

Assists dredging proponents and licensees meet their general environmental duty under Section 25 of the *Environment Protection Act 1993.*

6.3.1.2 EPA Code of Practice for Vessel and Facility Management (Marine and Inland Waters)

This code of practice of the SA EPA is established for the prevention of pollution from the construction, use, and maintenance of vessels and related facilities. It provides guidance for all types of vessels and vessel owners.

6.3.2 Coast Protection Act 1972

Provides for the protection of the coast of South Australia and establishes the Coast Protection Board.

6.3.3 Native Vegetation Management Act 1991

Clearance of native vegetation requires approval unless there is an exemption under this Act. A 'Significant Environmental Benefit' (SEB) offset would be required if native vegetation were to be cleared. As there is no terrestrial component to the Project, the Act therefore would only apply to marine species, specifically seagrass. Seagrass will be monitored (see Appendix 2).

6.3.4 Fisheries Management Act 2007

In South Australia, primary responsibility for the control of noxious and pest marine species is vested in Primary Industries and Regions South Australia (PIRSA). In this regard, PIRSA's authority is vested in the South Australia *Fisheries Management Act 2007.* PIRSA has developed a range of controls and guidance measures intended to limit the risk of the introduction, or translocation, of marine pest species in SA waters.

6.3.5 Historic Shipwrecks Act 1981

Legislation complementary to the Commonwealth *Historic Shipwrecks Act 1976*, for South Australian Waters.

6.3.6 Protected Areas

Marine parks are declared under the *Marine Parks Act 2007* and aquatic reserves are declared under the *Fisheries Management Act 2007*. The Project Area does not intersect with any protected areas.

Adelaide Dolphin Sanctuary is a marine protected area in proximity to the Project Area. Located on the east coast of Gulf St Vincent covering the estuary of the Port River, Port Adelaide and northwards past St Kilda.

7 EXISTING ENVIRONMENT

7.1 Jurisdiction

The Project Area extends from North Haven to West Beach and is located within the Green Adelaide Landscape Region and traverses the Local Government Areas of the City of Charles Sturt, City of West Torrens and City of Port Adelaide Enfield.

7.2 Conservation / Sanctuary Areas / Marine Parks

The Project Area is not located within a Marine Park or conservation area. Works are unlikely to have a significant impact on any critical habitat or any species listed under the *Environmental Protection and Biodiversity Conservation (EPBC) Act 1999* (see EPBC self-assessment - Appendix 5).

7.3 Coastal Processes

7.3.1 Wind and swell

The predominant winds along the Adelaide coastline are southerly, although there are occasional strong north-westerly winds. The direction of wind-driven waves and coastal processes vary from year to year, but the dominant southerly winds lead to a net drift of sand in a northerly direction along the metropolitan coast. The waves generated by these winds are low to medium energy waves. These waves strike the metropolitan coast at an oblique angle and induce a coastal process known as littoral transport.

Both North Haven and West Beach are exposed to the South and West, likely to experience unsuitable swell and winds conditions during works over spring with regular coastal breezes likely to occur later.

7.3.2 Currents

The Adelaide metropolitan coastline experiences mild tidal flow moving in a north and south direction as the tide floods and ebbs into St Vincent Gulf. Outer Harbour entrance and Port River will maintain moderate currents during tidal changes.

7.3.3 Tides

Tides within Gulf St Vincent are semi-diurnal; i.e. with two high and two low tides a day, but not always at equal levels (BOM 2024). A few times per year the water level is almost constant for several days, known as a ‘dodge’ tide.

Tidal ranges go from 0 to 3m depending on diurnal pattern and regional conditions.

Australian Height Datum (AHD) will be converted to Chart Datum (CD) through reference to ‘South Australian standard and secondary ports’ within Department of Planning Transport and Infrastructure (DPTI) 2020 Tide Tables book (pg.133), with ‘OUTER HARBOR’ being the closest port for these works. Figure 7-1 lists 0mAHD as -1.45mCD. Using this conversion, -3mAHD can be translated to - 1.55mCD.

	Heights above Chart Datum			Chart Datum		High Water Full & Change
	LAT	ISLW	Predict. Datum	Local Datum	AHD	
Ports	m	m	m	m	m	H : m
OUTER HARBOR	0.08	-0.05	0.0	30.995	-1.45	04 : 48

Figure 7-1: South Australian standard and secondary ports (DPTI 2020 Tide Tables, pg.133)

7.4 Water Quality

Existing water quality conditions are currently being monitored through a water quality monitoring program (for details see below – section 9) to assist with appropriate monitoring and regulation of the trial.

Monitoring equipment was deployed on the 25 July 2024 at six locations and data continuously gathered since that date. A live feed of the data can be accessed through the Water Quality Monitoring Dashboard.

Refer to the Water Quality Monitoring Plan (Appendix 1) for more detail.

7.5 Sediment Characteristics

Sediment sampling and analysis of potential sand borrow areas was undertaken between March and August 2024 (Figure 7-2 to 7-4). These areas included:

- SBA1 – North Haven Marina Sand Trap
- SBA2 – West Beach Sand Bar
- SBA3 – West Beach Harbour Sand Trap
- RA – Rehandling Area (West Beach)

The objectives of the sediment characterisation works were as follows:

- To assess the contamination status and provide classification of sand/sediment materials within the targeted sand borrow areas to assess whether this material is suitable for beach nourishment purposes.

The sediment characterisation sampling program was undertaken in accordance with, and with reference to, the guidance and procedures presented in the following:

- National Assessment Guidelines for Dredging, Commonwealth of Australia, 2009 (NAGD).
- Dredge Guideline, South Australian Environment Protection Authority (SA EPA) 2020.
- Standard for the Production and Use of Waste Derived Fill, SA EPA, 2013 (the WDF Standard).
- National Environment Protection (Assessment of Site Contamination) Measure 1999 (the ASC NEPM, as amended 2013).
- Site Contamination – Acid Sulfate Soil Materials, SA EPA, 2007.

Sediment cores were recovered from each sampling location to a maximum depth of 1.5 m (or prior refusal) using a sediment coring tube manually driven into the sediments by a dive team with the aid of a mallet. Sediment samples were recovered from each core at intervals of 0-0.5 m and 0.5-1.5 m (or shallower final depth) and homogenised in accordance with the recommended sampling methodology in the NAGD.

The chemical testing suite included:

- Heavy metals and metalloids (antimony, arsenic, cadmium, chromium (total), copper, lead, mercury, nickel, silver, and zinc);
- Total recoverable hydrocarbons (TRH);
- Polycyclic aromatic hydrocarbons (PAH);
- Organochlorine pesticides (OCP);
- Polychlorinated biphenyls (PCB);
- Tributyltin (TBT as Sn);
- Actual or Potential Acid Sulfate Soil (AASS/PASS) analysis [Suspension Peroxide Oxidation Combined Acidity and Sulfur (SPOCAS) suite]; and
- Total organic carbon (TOC).

Figure 7-2: Sediment sampling locations North Haven to Largs North (including SBA1)

Figure 7-3: Sediment sampling locations at West Beach Harbour Sand Trap (SBA3) and Rehandling Area (RA)

Figure 7-4: Sediment sampling locations at West Beach Sand Bar (SBA2)

7.5.1 Particle size

In accordance with the Wentworth scale and the EPA Dredge Guidelines (2020), sediment was typically classified as sand.

Table 7-1 Particle size distribution

Area	% Fines (<0.075mm)	% Sands (0.075 – 2.0 mm)	% Gravel (> 2.0 mm)
SBA1 - North Haven Sand Trap	2 – 8 %	87 – 99%	<1 %
SBA2 - West Beach Sand Bar	<0.1 – 1.6 %	95 – 100 %	<1 – 4%
SBA 3 - West Beach Harbour Sand Trap	1 – 2 %	97 – 100 %	<1 %
RA - Rehandling Area (West Beach)	<1 – 3 %	95 – 100 %	<1 %

7.5.2 Organic matter

Total organic carbon (TOC) results ranged from below the laboratory LOR (<0.1% e.g. S37_0.0-0.5 and S42_0.0-0.5) to a maximum of 5.6% (S39_0.0-0.5). Areas where higher TOC values were reported did not appear to correspond with the presence of seagrass or rhizome mats given the absence of these benthic observations throughout the areas subject to sampling. As such, the higher TOC values are considered likely to be related to the presence of a small amount of fine organic materials in some samples.

7.5.3 Chemical contaminants

All of the sediment analytical results for targeted inorganic and organic contaminants were reported below the NAGD Screening Levels and/or were reported below the laboratory limit of reporting (LOR), indicating the chemical suitability of the sediments for nearshore placement.

All sediment analytical results for targeted inorganic and organic contaminants were also below the WDF Standard (SA EPA, 2013) Waste Fill Guideline values. As a result, the sediments are classified as Waste Fill for the purposes of onshore placement.

It should be noted that, as all results for organic analytes and TBT (as Sn) were below the respective laboratory LORs, normalisation of the results relative to 1% TOC was not required. Furthermore, given that all chemical analytical results were below the NAGD Screening Levels, calculation of the 95% UCL value for specific contaminants was not required. As a consequence, in accordance with the NAGD, it has been determined that subsequent testing for elutriate, bioavailability and toxicity is not required.

Laboratory analytical testing also indicated the absence of AASS and PASS materials within the sediment samples recovered in each of the potential sand borrow areas. All results for net acidity were reported below the laboratory LOR and below all SA EPA (2007) criteria for acid sulfate soil material (for each sediment texture classification).

7.5.4 Physical contaminants

There were no observations of anthropogenic materials or physical contaminants in any of the sediments sampled throughout each of the potential sand borrow areas. Sediments generally comprised fine to coarse sand with some minor organic inclusions in some areas.

7.6 Benthic Habitat

The Adelaide metropolitan coastline is located within the Gulf St Vincent bioregion. The benthic environment largely consists of bare sand extending approximately 500m from the low water mark and patches of seagrass meadows of variable condition further offshore. The seagrass meadows along the Adelaide metropolitan coast mainly comprise of *Amphibolis* spp. and *Posidonia* spp. Pinna beds also occupy the benthic habitat adjacent to the northern section of the Project Area.

Seagrass loss in Australia has followed global patterns and since 1930, the seagrass meadows off the metropolitan Adelaide coastline have experienced up to 6,200 ha loss (Tanner *et al.* 2021).

In recent times, significant efforts have been made to arrest seagrass loss through reducing local and regional stressors (e.g. Adelaide Coastal Water Quality Study), and more recently through active restoration. This includes efforts such as the *New Life for Our Coastal Environment* project funded by the South Australian Government and led by SARDI and small-scale community-led seagrass restoration projects such as Seeds for Snapper funded through Oz Fish and Green Adelaide. These seagrass restoration sites are shown in Figure 7-5.

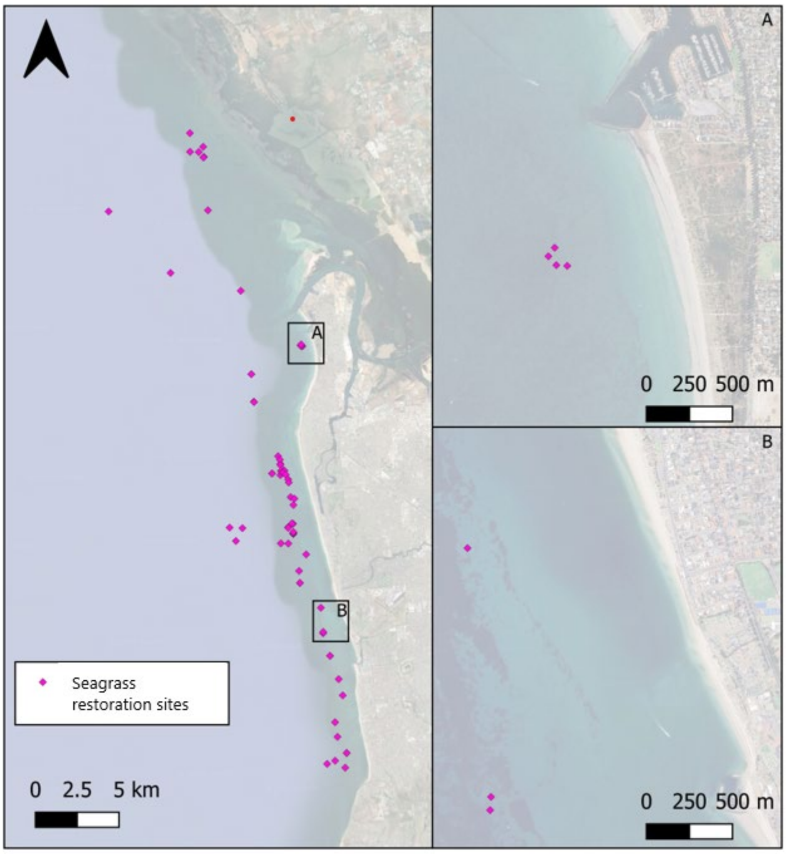


Figure 7-5: Seagrass Restoration Sites

To help inform the dredge and placement locations, the distribution and area coverage of seagrass meadow boundaries have been mapped using recent high-resolution aerial imagery from NearMaps (e.g., captured May 2024 and ensuring a resolution of at least 1m per pixel), aerial imagery provided by the University of Adelaide, and previously prepared spatial data for seagrass within the area. Ground-truthing of the preliminary seagrass meadow boundaries has been undertaken as part of the Seagrass Monitoring Plan (Appendix 2) and during field sediment sampling investigations.

Dredging locations avoid disturbing seagrass meadows. SBA1 is characterised as unconsolidated bare sand and is located adjacent to established seagrass meadows that occupy depths greater than 5 m depth. The seagrass meadows at this location mainly comprise of *Posidonia spp*. with sections of sparse *Amphibolis spp* that fringe the nearshore section of the meadow. *Pinna bicolor* beds have also been identified further offshore from SBA1.

SBA2 is characterised as unconsolidated bare sand and is located adjacent established seagrass meadows, comprising of *Amphibolis and Posidonia spp* at depths greater than 5 m. A reef system is located offshore from SBA2 within the seagrass meadow.

SBA3 is characterised as unconsolidated bare sand and is located the furthest distance away (>500m) from established seagrass meadows, situated adjacent West Beach Harbour.

As each SBA is located in close proximity to important seagrass habitat, the Water Quality Monitoring Plan (Appendix 1) aims to avoid harm to seagrass meadows by controlling turbidity levels (see Table 8-2 for trigger levels).

In addition, a Seagrass Monitoring Plan (Appendix 2) has also been developed. Baseline data will be collected pre-dredging and these areas subsequently monitored post-dredging and 12 months later, to measure any impacts on seagrass habitats located adjacent to SBA1, SBA2 and SBA3.

7.7 Marine Fauna

The Project Area is within a mapped distribution of threatened and migratory marine species, however there are few records of these species in close proximity. No SBAs are considered to provide significant habitat for marine fauna, however key species will likely traverse the Project Area. Control measures are listed in Table 8-2.

The Australian sea lion, Long-nosed fur seals and Indo-pacific bottlenose dolphins are considered frequent visitors and will likely be present in close proximity to the Project Area.

The Great White Shark frequents areas in and around *Pinniped* colonies (e.g. Fur Seal and Sea Lions at the Neptune Islands), areas of the Great Australian Bight, and regions with high prey densities. The Australian Sea Lion may visit the Project Area, however, more suitable habitat for this species can be found to the north of the Project Area. A haul-out site for this species exists at the Outer Harbour breakwater in Port River, approximately 2 km north of the Project Area. This aggregation is not considered to be large enough to attract resident Great White Sharks.

The Green Turtle rarely visits southern Australia and there is no known critical habitat or breeding grounds within the region. Similarly, the Leatherback Turtle is more commonly found in the northern half of Australia. There are no records of the Leatherback Turtle nesting in SA.

The Southern Right Whale is seasonally present along the Australian coast between late April and early November. There are no known current or historical aggregation areas within Gulf St Vincent and it is not part of the species' migration path. Visitation to Gulf St Vincent and the vicinity of the Project Area by an individual whale or whale pairs (i.e. mother/calf) is possible.

7.8 Marine Pests and Diseases

Pacific Oyster Mortality Syndrome is confined to Port River and not considered to be relevant for the trial.

There are other known pest species present in the vicinity of the Project Area. These include *Caulerpa cylindreacea* and *Caulerpa taxifolia*, two exotic species under the *Fisheries Management Act 2007*, which are known to be present in Port River. Neither *C. cylindreacea* nor *C.taxifolia* was recorded during benthic surveys undertaken to support the Trial development (initial benthic surveys, seagrass monitoring surveys, in-field sediment surveys).

Most of the dredging plant and equipment is locally based in Australia which reduces the risk of importing international exotic marine pests. All marine equipment utilised for the trial will follow the national best practice biofouling management guidelines as governed by the *Biosecurity Act 2015*.

7.9 Cultural Heritage

All shipwrecks older than 75 years are protected in South Australia. There are five recorded shipwrecks in the Project Area between North Haven and Largs Bay. These are:

- Amy – lost 1890 (Latitude -34.8195, Longitude138.4847)
- Little Orient – lost 1883 (Latitude -34.8153, Longitude 138.4875)
- Buck – lost 1920 (Latitude -34.8076, Longitude 138.4852)
- Young Foster – lost 1919 (Latitude -34.807, Longitude 138.4847)
- Lottie – lost 1932 (Latitude -34.8003, Longitude 138.486).

Shipwreck locations will be noted and avoided by the dredge operator.

7.10 Social and Recreational Values

The Adelaide metropolitan coastline offers significant recreational value to beach users and recreational fishing and boating communities. There are numerous local Surf Life Saving, sailing and yachting clubs that frequently use this coastline.

As the SBAs are in the nearshore marine environment, the presence of recreational fishers and boaters is likely during project activities. The comprehensive Engagement Plan support the communication of program details to affected stakeholders (Appendix 4).

The Project Area is located adjacent to metropolitan Adelaide, with sensitive receivers such as residential homes, education facilities and caravan parks nearby. The Noise Management Plan (Appendix 3a) will support the safe delivery of works and assist with minimising any noise nuisance. Management actions are provided in Table 8-2.

8 RISK ASSESSMENT AND MANAGEMENT

The identified risks associated with this Project are listed in Table 8-1 with responsibilities for mitigation measures to manage these risks:

Table 8-1; Risk Management Responsibilities

Risk type	Responsibilities
Water Quality	Contractor responsibility - considered in Water Quality Monitoring Plan (Appendix 1)
Seagrass	Contractor responsibility - considered in Seagrass Monitoring Plan (Appendix 2)
Noise	Contractor responsibility - considered in Noise Management Plans (Appendix 3)
Community	DEW responsibility - considered in Engagement Plan (Appendix 4)
Flora and Fauna	Contractor responsibility - considered low and in EPBC Self-Assessment (Appendix 5)
Beach Users	Contractor responsibility - considered temporary and low risk
Air Quality	Contractor responsibility - considered temporary and low risk
Odour	Contractor responsibility - considered temporary and low risk
Waste and Litter	Contractor responsibility - considered low and manageable risk
Hazardous materials	Contractor responsibility considered low and manageable risk
Biosecurity	Contractor responsibility - considered low and manageable risk
Cultural significance	Contractor responsibility - considered low and manageable risk
Placement of Dredged Materials	Contractor responsibility - considered low and manageable risk

8.1 Impact analysis and risk management

The key environmental risks associated with this dredge campaign relate to impacts to marine water quality and marine ecology. The potential nuisance caused to the community through noise impacts are also considered in this section.

Impacts to the marine environment could be a result of:

- Increased turbidity during dredging or placement operations.
- Interactions of wildlife with marine equipment.
- Result of accidents such as oil spills.
- Introduction of marine pests
- Direct removal of seagrass through mooring and anchoring.

This could lead to a:

- Loss of habitat (e.g. seagrass habitats).

- Impact on marine biodiversity (including to Matters of National Environmental Significance (MNES) protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) within and surrounding the Project Area).

Other impacts related to the dredging operations relate to social impacts such as:

- Nuisance noise from dredging negatively impacting amenity.
- Reduced visual amenity with presence of dredge and barge equipment.
- Reduced visual amenity from turbid water.
- Reduced recreational values such as swimming opportunities.
- Odour from placement of dredged sand onshore.

Impact analyses and risk management related to water quality, noise and MNES are outlined in Table 8-2.

Table 8-2: Impact analysis and risk management

Water Quality / Turbidity	
Applicability	Activities that could potentially result in elevated turbidity or plumes include: - Removal of sediment at the Sand Borrow Area (SBA). - Overflow of water when filling the barge that contains fine sediment, or loss during transit from the SBAs to the SPAs. - Placement activities using the Split Hopper Barge (SHB) or Cutter Suction Dredge (CSD) diffuser in the nearshore. - Resuspension of fine materials that have been placed during stormy weather. - Direct placement activities onto the beach.
Potential impacts	Potential impacts include: - Smothering of seagrass habitats and benthic communities by settling of suspended sediment. - Reduced light available for seagrass habitats if plumes persist. - Seagrass loss associated with smothering and reduced light. - Loss of visual amenity. - Loss of recreational values.
Desired outcomes	The main environmental outcome includes: - Dredging operations are undertaken in a manner that avoid or minimise impacts to the marine environment and to the community. The performance measures which demonstrate that this outcome has been achieved include: - Turbidity measurements at SBA and SPA are similar to background levels at control sites. - Community complaints are addressed and managed.
Risk analysis	Potential risks include: - Material to be dredged is classified as fine to coarse sand. - Seagrass meadows are located in close proximity to SBAs (minimum distance is approximately 100 m from SBA2). - Target volume of sand to be dredged across all SBAs and placed in the SPAs is 90,000m^3, with a maximum total volume of 150,000m^3. - Duration of dredging is approximately 8 weeks. Risk profile based on EPA risk category guidance is assessed as High.
Controls	The following operational controls will be implemented to minimise the risk of environmental impact: - A suitably qualified and experienced contractor will deliver the works in accordance with the approved DMP.

	- Environmental Monitoring Plans are developed and implemented to mitigate risks and detect impacts. - ALARM and HOLD triggers for water quality parameters exceeding baseline levels will be enforced.

Monitoring	The following parameters will be measured throughout the dredge campaign:
	- Turbidity will be monitored at 6 surface monitoring sites and benthic monitoring sites in control areas as well as in proximity to seagrass, sand borrow areas and sand placement areas. Turbidity is measured by optical scatter via a nephelometer producing readings in Nephelometric Turbidity Units (NTU). Turbidity at the surface monitoring sites will be measured using twin turbidity sensors for quality control purposes. Turbidity measures represent suspended sediments within the water column.
	- Electrical conductivity (EC), pH, dissolved oxygen (DO) and temperature will be monitored at three sites - one dredge plume monitoring site (D1), one placement site (P1) and one background site (B2). These parameters are anticipated to remain consistent spatially and temporally in the marine environment.
	- The above monitoring program will assist with identifying if turbidity is caused by the dredging campaign or other inputs such as stormwater runoff.
	<u>The following ALARM and HOLD triggers have been determined to assist with mitigating any long-term impacts of elevated turbidity:</u>
	The ALARM trigger signifies that operations should be immediately evaluated, impact assessed and operations modified if required.
	- **<u>ALARM LEVEL</u>** associated with boundary of zone of low-moderate impact:
	  o 4.8 NTU based on a 15 day rolling median
	  o 7.8 NTU based on a 6 day rolling median
	The HOLD trigger will result in a stop work order until turbidity levels return to background or approval to recommence is received from EPA.
	- **<u>HOLD LEVEL</u>** associated with boundary of zone of high impact:
	  o 7.8 NTU based on a 15 day rolling median
	  o 17.8 NTU based on a 6 day median rolling median
	<u>ALARM and HOLD values for dredging after 1 November are stricter:</u>
	- **<u>ALARM LEVEL</u>** associated with boundary of zone of low-moderate impact:
	  o 2.8 NTU (15-day median)
	  o 5.8 NTU (6-day median)
	- **<u>HOLD LEVEL</u>** associated with boundary of zone of high impact:
	  o 5.8 NTU (15-day median)
	  o 15.8 NTU (6-day median)
	In addition to live turbidity data from water quality monitoring buoys, satellite imagery will be captured two times per day during dredging to assist identifying plume extent.
	Seagrass habitat surveys will be repeated immediately post-dredge to assist with identifying any immediate impacts of the dredge campaign, and will be repeated 12 months post-campaign to identify potential long-term impacts of the activity. This also includes drone imagery over SBAs.

Management actions	Monitoring of turbidity levels via automatic Eagle.io will occur throughout the dredge campaign. In the event that ALARM triggers are exceeded, the dredge operator may modify activities including below and dependent on the situation and advice: - Slowing or pausing activities. - Relocating activities to another SBA. - Dredge only during incoming tides - Reducing overflow of SHB. In the event that HOLD triggers are exceeded: - Dredging or placement of sand will cease within 3 hours of exceedance - An assessment will be undertaken by EPA to determine whether background turbidity is a significant influence and if so, then dredging can recommence. - Dredging will recommence after clearance is provided by the EPA.

Reporting	Reporting will comprise the following: - 'Alarm' and 'Hold' trigger alerts will be reported immediately to the dredge contractor, DEW and EPA via automatic Eagle.io alerts. - Epic Environmental will follow up with DEW staff on any alerts to make sure they were received. - Weekly summary reports will be provided to EPA. - Daily Dredge logs including minute to minute activity notes. - A final water quality monitoring report will be provided to DEW and EPA following cessation of the dredging operations and monitoring period. This report will be provided 4 weeks post campaign and include raw data, summary of data, any exceedances (causes and if adaptive management required) and general discussion on water quality impacts with respect to the dredging and sand placement activities undertaken. - The final water quality monitoring report will also include analysis of benthic data compared to surface data to determine any differences, and advice on whether telemetered benthic data alone could be used in future dredge monitoring programs. - Seagrass habitat reports will be electronically provided to the EPA 4 weeks and 12 months post-dredge campaign. - Post-dredge surveys will be undertaken in accordance with the baseline survey methodology to allow for comparison. Negative change in seagrass health condition and extent will be interrogated further if required to examine if the change observed can be attributed to the dredging activity.

Noise	
Applicability	The Contractor may work 24 hours a day, 7 days a week. Noise management risk is an important consideration for North Haven and West Beach as residential areas. Noise travelling from the dredge location is expected to be masked somewhat by ambient wave noise. Activities that could potentially result in elevated noise includes: - Dredging activities in the SBAs – especially night-time operations. - Placement activities using the SHBs or CSD diffuser in the SPAs. - Placement activities using civil machinery on the beach.
Potential impacts	Residents who may be potentially impacted by noise have been identified through noise modelling (Appendix 3a). Potential impacts include: - Elevated noise levels are deemed a nuisance to sensitive receivers. - Noise impacts will be more prevalent during nighttime operations due to lower background noise levels.
Desired outcomes	The main noise outcome includes: - Dredging operations are undertaken in a manner that avoids or minimises noise impacts to sensitive receivers. The performance measures which demonstrate that this outcome has been achieved include: - Noise levels do not exceed the limits identified in the Noise Management Plan (NMP) and relevant guidelines. - Number of complaints received are regarded as minimal.
Risk analysis	Potential risks include: - Closest sensitive receiver is within 100m of dredging or civil works activity. - Noise reduction measures are not adequate to reduce immediate noise concerns. - Duration of dredging is planned for up to 8 weeks, potentially 24 hours 7 days a week. Risk profile based on EPA risk category guidance is assessed as High.
Controls	Communications and engagement: - Residents will be notified via letterbox flyer with details of the works and a contact number for any noise complaints or questions. - Should unplanned civil work be required, a rapid noise assessment will be undertaken to determine a conservative catchment area where additional sensitive receivers may be impacted, and staff will be mobilised to letterbox drop those areas. - In-person engagement may be undertaken as needed, to ensure people are aware of noise-generating work, mitigation measures and the likely duration. - All interactions including actions taken to address noise will be recorded in the central correspondence register and provided to the EPA as required. All reasonable and practicable measures are to be taken to minimise noise at sensitive receivers. On-site noise management strategies include: - Incorporating noise management items into safety/environment inductions and daily toolbox sessions. - Identifying noise-sensitive receivers to site staff during inductions/ orientations. - Instructing site supervisors to routinely check for unnecessary noise-generating activities and direct workers to manage the activity accordingly. - Instructing site supervisors to respond to any noise complaints by investigating the cause of the complaint and determine if alternative work methods can be implemented to remove or minimise noise.

	- Idling of plant or vehicles is minimised where possible and by enforcing equipment shut-downs when not in use. - Minimising on-site reversing of plant with reverse alarms by using a forward-in, forward-out pathway wherever possible. - Instructing workers to use radios to communicate and to avoid shouting, whistling and use of horns or alarms for communication. - Instructing plant operators to use the minimum power of equipment to complete the task, and throttle down to the minimum setting when not in use if it is not possible to shut plant down. - Placing petrol or diesel powered lighting towers away from residential locations. - Orienting directional noise sources such as exhausts or cooling fans on stationary plant to face away from residential locations. - Ensuring that plant is correctly maintained; noise reduction measures such as covers and mufflers are in place, rotating equipment is balanced, and cutting tools are sharp.
Monitoring	The following parameters will be measured throughout the dredge campaign: - Noise monitoring at SBAs and SPAs will be undertaken periodically during the dredging operations to measure noise levels for a sufficient period of time to capture representative noise data for the operations. - Measurements will be representative of worst case scenarios for each type of operation. - Noise data collected may be utilised to respond to noise complaints and inform if further measurements and management actions are required. - Monitoring locations will reflect the closest receivers to any dredging or civil works activity. - Full civil works may be required for emergency/safety and a communication plan will be developed to notify impacted receivers if full civil works are to be undertaken overnight.
Management actions	Where measured noise levels are less than the targets, works are considered 'Level 1' and 'basic noise mitigation' is required. Where 'Level 1' targets are exceeded, the works are deemed 'Level 2'. Level 2 works are required to implement 'advanced noise mitigation' strategies in line with the Department for Infrastructure and Transport's **(DIT)** *Guideline for the Management of Noise and Vibration: Construction and Maintenance Activities* (**DIT CM Guideline**). For any works occurring outside of standard operating hours, noise level targets based on the duration of works will be implemented (Appendix 3a).

Reporting	Reporting will comprise of the following:
	- Summary of the results obtained during the monitoring program.
	- Submission of a complaints register that was maintained throughout the trial which is to include:
	  • Contact details of complainant.
	  • Time and date of noise issue.
	  • Nature of noise issue and any noise sources/activities of concern.
	  • Actions taken to address the noise concerns.
	The report will be provided to the EPA 4 weeks post-dredge campaign.

Matters of National and Environmental Significance & Marine Fauna	
Applicability	Activities that could potentially result in negative impacts to marine mammals including MNES are: - Dredging activities in the SBAs. - Placement activities using the SHBs or CSD diffuser in the SPAs. - Placement activities using civil machinery on the beach. The key marine mammals and MNES that may be at risk from the activities include: - Australian sea lion - Long-nosed fur seals - Indo-pacific bottlenose dolphins - Southern Right Whale - Eastern Hooded Plover The above list will be the main species that will be monitored for during dredging operations.
Potential impacts	A EPBC self-assessment was completed for the trial. The report assessed whether any action associated with the trial is likely to have a significant impact on any Matters of National Environmental Significance (MNES) protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) within and surrounding the Project Area. Potential impacts from the Project include, but are not limited to: - Loss of habitat. - Underwater noise and vibration impacting physiology of marine fauna. - Introduction of diseases into the marine environment. - Physical disturbance. The assessment concluded that the trial is not likely to have a significant impact on listed threatened species. The project area is near high marine traffic areas, with vessel traffic accessing the nearby commercial port and recreational vessels navigating metropolitan waters and entering the North Haven and West Beach Harbours. A recent study that investigated the impacts of dredging activity on the long-term occurrence of Indo-Pacific bottlenose dolphins and long-nosed fur seals in the Port River estuary concluded that animals in this area are habituated to high noise levels and were not disturbed by dredging operations[1]. Likewise, although vessel strikes are reported for marine mammals, studies have shown that the risk of collision is low given that active dredgers are generally stationary and move at slow speeds. Collision risk can be actively managed by avoiding critical habitats, areas where calves or juveniles are present, and known migration routes[2]. Piling works are considered to pose a higher risk to marine mammals than dredging, with dredging often providing opportunistic feeding situations for highly mobile species. The underwater noise assessment completed for the trial was undertaken in accordance with the **DIT Underwater Piling and Dredging Noise Guidelines.** The assessment sets significant safety zones for specific species which have been considered by the project team and, based on discussions with the EPA, have been modified to reasonable and practicable distances based on the level of risk that the specific operations pose to marine mammals and MNES. 1. *Bossley, M.I., Steiner, A., Parra, G.J., Saltre, F., Peters, K.J. 2022. Dredging activity in a highly urbanised estuary did not affect long-term occurrence of Indo-Pacific bottlenose dolphins and long-nosed fur seals. Marine Pollution Bulletin. Vol 184: https://doi.org/10.1016/j.marpolbul.2022.114183.* 2. *Todd, V.L.G., Todd, I.B., Gardiner, J.C., Morrin, E.C.N., MacPherson, N.A., DiMarzio, N.A., Thomsen, F. 2015. A review of impacts of dredging activities on marine mammals. ICES Journal of Marine Science (2015), 72(2), 328–340. https://doi.org/10.1093/icesjms/fsu187*
Desired outcomes	The main environmental outcome includes: - Trial is undertaken in a manner that avoids or minimises impacts to marine fauna and MNES. The performance measures which demonstrate that this outcome has been achieved includes: - Negative interactions with marine mammals and MNES are minimised.

<table>
<tr><td>Risk analysis</td><td>
Potential risks include:

Underwater noise impacts to marine mammals and MNES.
Physical interactions with marine mammals and MNES.
Duration of dredging is up to 8 weeks.
Onshore works will mainly be conducted during daylight hours between 7:00 am and 7:00 pm. Nighttime onshore works will occur if deemed necessary.
Offshore activity will be 24/7.

Risk profile has been assessed as:
Likelihood:
Unlikely
Consequence:
Moderate
Risk rating:
Medium
<table>
<tr><th></th><th colspan="5">Consequence</th></tr>
<tr><th>Likelihood</th><th>Insignificant</th><th>Minor</th><th>Moderate</th><th>Major</th><th>Severe</th></tr>
<tr><td>Almost Certain</td><td>Medium</td><td>High</td><td>High</td><td>Extreme</td><td>Extreme</td></tr>
<tr><td>Likely</td><td>Medium</td><td>Medium</td><td>High</td><td>Extreme</td><td>Extreme</td></tr>
<tr><td>Possible</td><td>Medium</td><td>Medium</td><td>High</td><td>High</td><td>Extreme</td></tr>
<tr><td>Unlikely</td><td>Low</td><td>Medium</td><td>Medium</td><td>High</td><td>High</td></tr>
<tr><td>Rare</td><td>Low</td><td>Low</td><td>Medium</td><td>High</td><td>High</td></tr>
</table>
</td></tr>
<tr><td>Controls</td><td>
Management strategies for offshore activities include:

A suitably qualified and independent Marine Mammal Observer (MMO) will audit daylight operations at North Haven.
Crew members will be adequately trained to identify marine mammal species.
Standard operating procedures will be followed which include:

Marine mammal observation will take place 30 mins prior to works commencing. If no marine mammals are observed during this time, works can commence.
Marine mammal observations will continue throughout operations.
If a marine mammal is observed within 10 m of the equipment, operations will be modified until the individual is a safe distance away (>40 m).

Management strategies for onshore works include:

Pre-start surveys prior to works commencing to identify the presence of Hooded Plovers by a suitably trained staff member (DEW or Birdlife Australia staff/volunteer).
Bird spotters will be present during operations, where bird spotters are suitably trained DEW staff and/or Birdlife Australia staff/volunteers.

</td></tr>
<tr><td>Monitoring</td><td>
The following parameters will be measured throughout the dredge campaign:

Number of times marine mammals and MNES were sighted.
Description of species sighted.
Description of behaviour when sighted.
Number of times operations needed to be modified because of marine fauna presence.
Number of hours of modified operations or stand down time required until marine mammal was identified to be a suitable distance away.

</td></tr>
<tr><td>Management actions</td><td>
If required, the following management actions will be implemented:

Dredging or placement operations will be modified, including:

Slowing or pausing activities.
Relocating activities to another SBA until marine mammals are a safe distance away.

If Hooded Plovers are identified (breeding pair/chicks) adjacent to the SPAs:

Onshore placement works will cease until the chicks have successfully fledged.
If the birds remain in the area post-fledging, works will be modified to minimise disturbance e.g. areas where civil machinery is excluded.

</td></tr>
</table>

Reporting	Reporting will comprise the following: - Submission of marine mammal and MNES register that was maintained throughout the trial which is to include: • Type of fauna identified (species name). • Number of MNES identified in each interaction (number of individuals). • Description of interaction (behaviour identified). • Management action taken if required. • Details of who was notified of the interaction (date, time, contact name). The register will be provided to DEW and EPA 4 weeks post-dredge campaign.

Further discussion on impact analyses and risk management for risks identified in Table 8-1 is provided below.

8.2 Water Quality

Epic Environmental Pty Ltd (Epic) were engaged by the Department for Environment and Water (DEW) to develop and implement a marine Water Quality Monitoring Plan (WQMP). Monitoring will be undertaken continuously in real-time and will comprise a combination of surface and benthic water quality loggers:

- Near-surface (1m below surface) - monitoring buoys with twin turbidity sensors (and dissolved oxygen/salinity/temperature sensors at select locations) near the surface. Buoys fitted with telemetry for real-time data feed, automatic processing of data and comparison to trigger levels, with alerts sent to notify of exceedances.
- Near-bed (0.5 m above seabed) - benthic frames mounted with turbidity sensors. These sensors log internally with data downloaded during servicing trips and post-processed.

Water quality monitoring will be undertaken at six (6) monitoring sites as follows:

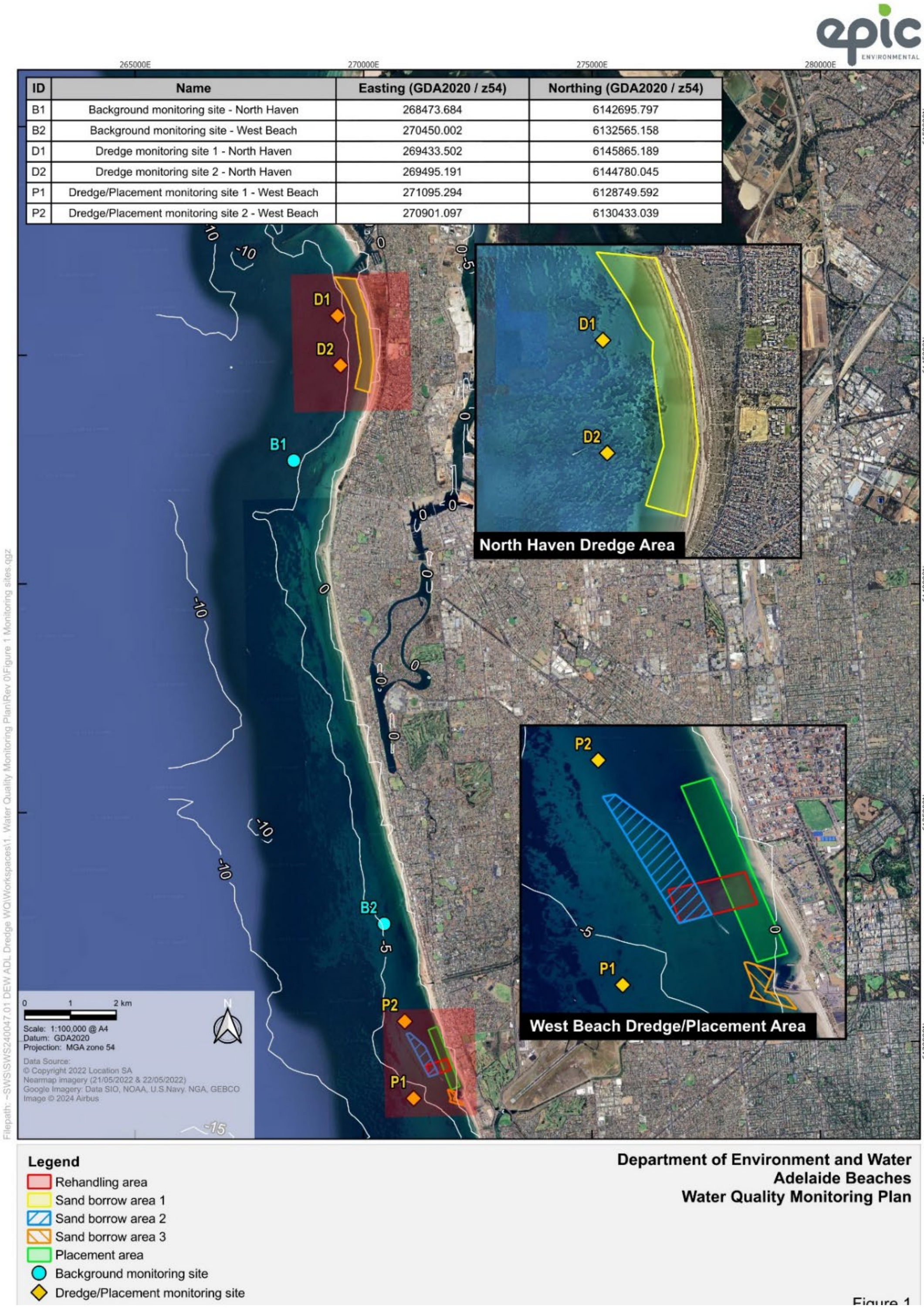
- Dredge area – two dredge plume monitoring sites (D1 and D2) located at North Haven
- Dredging/Placement area – two dredging and placement sites (P1 and P2) located at West Beach.
- Background – two 'background' sites (B1 will serve as background for the North Haven dredge area sites, while B2 will serve as background for the West Beach placement sites)

As specified in the Water Quality Management Plan (Appendix 1), the following parameters will be continuously measured (i.e. data logged every 15 minutes) throughout the monitoring program:

- Turbidity – will be monitored at each surface monitoring site and benthic monitoring site as measured by optical scatter via a nephelometer producing readings in Nephelometric Turbidity Units (NTU).
- Turbidity at the surface monitoring sites will be measured using twin turbidity sensors for quality control purposes. Turbidity provides a proxy for suspended sediments within the water column.
- Electrical conductivity (EC), pH, dissolved oxygen (DO) and temperature – these parameters are anticipated to remain consistent spatially and temporally in the marine environment, therefore will only be monitored at three sites - one dredge plume monitoring site (D1), one placement site (P1) and one background site (B2).

Fines in dredged and discharged sediment can increase turbidity of the water, reducing the ability of seagrasses photosynthesise. Dredging of the area may create a moderate plume in the immediate vicinity of the dredge and around the discharge diffuser. Plume formation at and near the diffuser/placement area will be monitored to ensure the plume does not encroach on any seagrass meadows or affect the amenity and safety of the swimming zone.

Water quality triggers are site specific meaning that if there are triggers occurring at North Haven this will not impact West Beach trigger alarms and vice versa. All triggers will be reviewed and management actions applied when necessary.



ID	Name	Easting (GDA2020 / z54)	Northing (GDA2020 / z54)
B1	Background monitoring site - North Haven	268473.684	6142695.797
B2	Background monitoring site - West Beach	270450.002	6132565.158
D1	Dredge monitoring site 1 - North Haven	269433.502	6145865.189
D2	Dredge monitoring site 2 - North Haven	269495.191	6144780.045
P1	Dredge/Placement monitoring site 1 - West Beach	271095.294	6128749.592
P2	Dredge/Placement monitoring site 2 - West Beach	270901.097	6130433.039

Figure 8-1 Water Quality Monitoring Sites

8.2.1 Split Hopper Barge Overflow

The SHB will be filled by pumping a slurry containing water and sand. As the sand settles in the hopper, water will eventually overflow and fines that have not settled in the hopper will re-enter the water resulting in risk of turbidity around the SHB location. Direct overflow may cause a plume around the SHB. Wave action will move and disperse the plume, likely towards the shoreline and north or south with the tide creating an elongated plume near the shoreline. Works will stop in line with the triggers outlined in the WQMP (see also Table 8-2).

There are few mitigation measures to manage turbidity from SHB overflow, other than stopping work. Mitigation measures to reduce the risk of overflow turbidity will be tested as part of the trial. These will include varying the filling process, pipeline layout, discharge design and fill heights to reduce potential turbid overflow and determine optimal operational measures.

8.2.2 Sediment Characteristics

As detailed in Section 7.6, characterisation and geotechnical testing of sediments within SBAs has been undertaken in 2024 and all reports have been provided to the EPA. Dredge material typically classified as ‘sand’.

8.3 Seagrass

Epic Environmental subcontracted Hydrobiology on behalf of DEW to assess the potential impacts on local seagrass meadows associated with the proposed dredging activities from the Dredge Trial.

Seagrass surveys will be conducted before, immediately after and 12 months post-dredging activities. A technical report will be prepared following the completion of the baseline survey, completion of the dredging activities, and 12-months post-dredging. The final report will include a comparison of seagrass meadow health and extent across the three surveys.

8.4 Noise

The Contractor may work 24 hours a day, 7 days a week. Residents who may be potentially impacted by noise have been identified through noise modelling. These residents will be notified via letterbox flyer, providing details of the project mobile phone that will be responded to 24 hours a day, 7 days a week for any noise or operational issues during the trial.

Should any unplanned civil work be required, a rapid noise assessment will be undertaken to determine a conservative catchment area where additional sensitive receivers may be impacted, and staff will be mobilised to letterbox drop those areas. In-person engagement may be undertaken as needed, to ensure people are aware of noise-generating work, mitigation measures and the likely duration. All interactions including actions taken to address noise will be recorded in the central correspondence register and provided to the EPA as required.

Noise management is an important consideration for North Haven and West Beach due to adjacent residential areas. Noise travelling from the dredge location is expected to be masked somewhat by ambient wave noise.

Baseline noise monitoring is being undertaken at both dredging and placement sites for several weekdays and a weekend to determine the existing noise environment. The results of this baseline (pre-trial) monitoring will be reported to DEW and the EPA.

During dredging and placement activities, additional noise monitoring will be undertaken at adjacent onshore locations at various stages of the trial representing the different operational scenarios and wherever possible, reflecting the worst-case scenario environmental conditions and noise outputs.

At completion of this trial, a final report summarising the results of noise monitoring will be prepared to inform potential future sand dredging activities.

All public complaints will be logged in a complaints register and reviewed by the Contractor and the EPA regularly. Works may be put on hold if required and as directed by the EPA.

8.4.1 Underwater Noise

In accord with the EPA Dredge Guideline, Section 4.3 Noise:

> "*Underwater noise may also impact marine megafauna such as whales and dolphins particularly when activities such as piling occurs. Dredge operators need to consider movements of megafauna to ensure the potential for noise impacts are minimised. For any dredging that occurs within the Port Adelaide River Estuary and Barker Inlet, proponents also need to consider the requirements for the Adelaide Dolphin Sanctuary. Marine mammal observers may be required to avoid impacts to marine megafauna."*
>
> "*Marine Mammal Observers are suggested for dredging activities classified as HIGH RISK: Operation within whale migration season or within Adelaide Dolphin Sanctuary*".

North Haven is in the vicinity of the Adelaide Dolphin Sanctuary. Dolphins calve during summer and calves are particularly inquisitive and therefore extra caution is required. Dolphins and Seals are known to proactively enter close proximity of a working dredge (<50m) and may take advantage of feeding opportunities.

The risk to marine mammals is considered low due to the nature of the dredging works (e.g. no piling) and, while their presence is expected, they are highly mobile and transient visitors and unlikely to be exposed to underwater noise for long enough to sustain temporary hearing damage (i.e. > 24 hours - refer Appendix 3b). However, due to the proximity of these works to the Adelaide Dolphin Sanctuary, a suitably qualified and independent Marine Mammal Observer (MMO) will be audit daylight operations at North Haven.

To further mitigate risk, all MCDP crew are trained in marine mammal observations and will submit logbooks to the EPA on request. Operators will visually monitor for the presence of marine mammals around the site (i.e. within 300m of the dredge) and look for any strange behaviour. If any Dolphins or Seals are spotted within dangerous proximity (i.e. <10m), operator is to cut power to the cutter head until they move away from the dredge cutter area. Any incidents/hazards must be reported through the internal reporting system and toolbox records.

8.5 Community

Community engagement shall be undertaken in accordance with the Engagement Plan (Appendix 4).

8.6 Flora and Fauna

Impacts to native flora or fauna is to be avoided at all times, however direct interactions or significant impact or disturbance is highly unlikely given the site is metropolitan and there is no proposed earthworks or traffic requirements required in or around the shoreline.

All Contractors representatives must ensure materials are stored in such a way as to not disturb or potentially disturb native fauna by unloading plant/materials in designated areas. Bunting will be erected if required, and dredging will cease if there are any safety concerns for either the flora or fauna.

Works must be carried out on existing paths and along existing pipe routes.

Any incidents/hazards must be reported through the internal reporting system and toolbox records. All Marine Fauna sightings will be logged by the dredge operator, including behaviour and actions into a Marine Fauna logbook/sheet. Records will be submitted to the Department for Environment and Water.

8.7 Beach Users

Engagement with local stakeholders and notification of works in advance of works commencing will support unnecessary disruption to all parties.

Impacts to beach users will be temporary. Beaches directly opposite the sand borrow and placement areas may be affected by changes in water quality. Additional WQM can be carried out by dredge operations to respond to beach user turbidity complaints. MCDP will check a radius around the complaint area and establish turbidity extent followed by changes over time.

Beach users typically use the beach at –1mCD or shallower, rarely swimming in deeper waters where the dredge will be operating. Dredging within SBA1 will be nearby the beach but set back at –2.5mCD. Distance from the beach and swimming activities will likely be 100m or more. The dredge will advance towards the beach but the measured distance from shore will change depending on tide.

Signage will be installed at commencement of dredging adjacent all SBAs to inform beach users of works and possible turbidity and drop-offs during and post-dredging activities, in particular in the intertidal areas. Deep sections are expected to slump and merge with existing sand within hours/days, particularly between weather events.

Dredge operators must pay constant attention to the proximity of public and swimmers approaching the dredge, will ask people to move away if within 100m and will cease operation if within 50m.

Beach placement works at SPA2 will include zoned off work areas using sand bunds and signage to direct the public to designated walking areas. Spotters will be used as necessary to direct beach pedestrian traffic.

8.8 Air Quality / Dust

Air quality and dust management are low risk for this dredging activity. Most of the sand will be discharged in water and therefore is not a dust or air-quality risk. A short (~ 2 - 4 weeks) trial of pumping sand and water mixture onshore will also occur in parallel with quarry sand placement operations.

8.9 Odour

Odour management is of moderate risk for this dredging activity. The activity area is located directly adjacent to residential areas and dredge sediments may comprise of some decomposing organic matter (seagrass). Given the placement site is along existing beaches with seagrass wrack naturally occurring, it is unlikely to generate a persistent or offensive odour.

All public complaints will be logged onto the complaints register and reviewed on an as needed basis by the project team and with the EPA/DEW.

8.10 Waste and Litter

Waste and litter are a risk to the environment. The project is split into three specific areas: Site compound, Dredge location(s), Placement areas and pipeline locations. Each area requires waste management with litter avoidance practices maintained. All waste oil, rags and other hydrocarbon impacted materials must be contained in watertight dry containers and disposed of appropriately.

8.10.1 Site compound

Housekeeping at the site compound must be maintained on a constant basis with the appropriate provision of waste and recycling bins, bunded waste oil storage and appropriate storage of parts and equipment.

8.10.2 Dredge location

Dredge barge and support vessels must be maintained on a constant basis with provision of a waste bin on each barge and regular inspection for litter and loose items such as rags and packaging. Any item that enters the water must be retrieved immediately using a support vessel, provided it's safe to do so.

8.10.3 Placement and pipeline outfall locations

Pipeline outfall locations must be inspected daily for leaks, kinks and other damage. Repair/replace dredge pipe immediately if it is safe to do so.

8.11 Hazardous Material storage/use

8.11.1 Fuel handling

On site fuel deliveries, handling and transport are an ongoing occurrence and risk for dredging activities. The dredge vessel(s) for this project will be fuelled using an anchor barge as a fuel transfer vessel with a 5000 L capacity. The anchor barge will be loaded with fuel via a land-based delivery vehicle.

Depending on the site layout and accessibility to trafficable areas with fuel tanker access, fuel delivery and filling of vessel tanks may present a spill risk to the environment. To ensure these risks are appropriately managed, the following measures are required as a minimum:

- Pre-start checks of plant and machinery
- General housekeeping, hazardous material storage and waste management
- Functional spill kits (including marine booms connected and ready)
- Fuelling procedures and checklists.

Operators are required to follow the necessary checks and steps for every fuelling event to ensure there are no preventable risks to the environment. Operators must not accept delivery of fuel if for any reason the condition of the equipment or fuelling area does not meet the requirements of the checklists and procedures.

8.11.2 Spills of Dangerous Goods or Hazardous Materials

Pollution from activities associated with the storage, maintenance and bunkering of machinery and equipment and the handling use and storage of Dangerous Goods or Hazardous Materials.

All contractor representatives using any Dangerous Goods or Hazardous Materials or carrying out any bunkering of plant, equipment or machinery must ensure storage and use of such materials is in accordance with EPA requirements for the immediate environment. All contractors and visitors involved in such activities must be aware of the location and correct use of spill management equipment. Consult with the project personnel for further advice.

8.11.3 Plant Maintenance

All plant must be maintained and undergo pre-start checks before operation as part of standard protocol to reduce the risk of plant malfunction and/or loss hazardous materials, leaks etc. All plant is registered in the company's asset management system whereby servicing and repairs are recorded and managed.

8.12 Biosecurity

As per best practice under PIRSA Guidelines, vessels and equipment associated with the marine activities pose risks of introducing new marine pests and diseases from biofouling. The vessels and equipment should be clean before arriving to a new location, to not introduce or spread any more aquatic pests (e.g. a vessel originating from the Port River which has exotic species that are not found at regional location) and cleaned before moving to new regions. MCDP will undertake the following:

- Biofouling management plans shall be developed and submitted to Biosecurity SA (PIRSA) for each of the vessels involved. The management plan shall consider inspection and cleaning prior to movement of the vessels to new regions using the following resources:
    - National Biofouling Management Guidelines for Non-Trading Vessels: http://www.marinepests.gov.au/marine_pests/publications/Documents/Biofouling_guidance__NTV.pdf
    - National Biofouling Management Guidelines for Commercial Vessels: http://www.marinepests.gov.au/marine_pests/publications/Documents/Biofouling_guidelines_commercial_vessels.pdf
    - IMO Guidelines: http://www.imo.org/en/OurWork/Environment/Biofouling/Documents/RESOLUTION%20MEPC.207%5b62%5d.pdf
- A record book shall be a mandatory requirement prior to the commencement of operations. The record book shall also include significant dates outlined in the management plan, such as hull inspections and cleaning.

All Biofouling management documents are maintained by Maritime Constructions and are subject to change depending on vessel availability.

8.13 Cultural Significance

The activity of dredging may uncover items of cultural significance. If an Aboriginal site or a site containing items that could be associated any cultural, archaeological or heritage significance is discovered or disturbed, work shall cease immediately, and DEW will be contacted for advice.

9 EPA DREDGING LICENCE #42842

EPA
South Australia

Licence No. 42842

ISSUED:
01 Feb 2024

EXPIRY:
31 Jan 2029

ACN:
162 287 916

MC DREDGING & PORT DEVELOPMENT PTY LTD

Environmental Authorisation under Part 6 of the *Environment Protection Act 1993*

South Australian Environment Protection Authority
GPO Box 2607
Adelaide SA 5001
Tel: 08 8204 2004

10 SITE COORDINATES

10.2 SBA1 Target

Vertex ID	Longitude	Latitude	Easting	Northing
1	138° 28' 44.4274" E	34° 47' 44.7533" S	269359.636	6146710.333
2	138° 28' 54.9266" E	34° 48' 00.5567" S	269638.738	6146230.072
3	138° 28' 58.9581" E	34° 48' 08.6807" S	269747.49	6145982.31
4	138° 29' 02.1647" E	34° 48' 12.7031" S	269832.099	6145860.411
5	138° 29' 11.9924" E	34° 48' 12.3139" S	270081.588	6145878.662
6	138° 29' 02.9818" E	34° 47' 46.5104" S	269832.629	6146668.029

10.3 SBA2 Target

Vertex ID	Longitude	Latitude	Easting	Northing
1	138° 29' 52.5857" E	34° 57' 03.9205" S	271522.65	6129523.468
2	138° 29' 45.9688" E	34° 56' 51.8934" S	271345.486	6129889.871
3	138° 29' 44.6971" E	34° 56' 50.9149" S	271312.465	6129919.215
4	138° 29' 42.8925" E	34° 56' 51.0455" S	271266.779	6129914.042
5	138° 29' 49.0047" E	34° 57' 04.8576" S	271432.519	6129492.315

10.4 SBA3

Vertex ID	Longitude	Latitude	Easting	Northing
1	138° 30' 05.5712" E	34° 57' 23.1423" S	271866.914	6128939.401
2	138° 30' 04.6355" E	34° 57' 23.1605" S	271843.19	6128938.247
3	138° 30' 07.0521" E	34° 57' 29.4211" S	271909.322	6128746.862
4	138° 30' 06.1420" E	34° 57' 31.5645" S	271887.882	6128680.238
5	138° 30' 17.3985" E	34° 57' 34.5275" S	272175.726	6128596.068
6	138° 30' 14.8166" E	34° 57' 31.4725" S	272107.877	6128688.572
7	138° 30' 09.6862" E	34° 57' 30.1173" S	271976.68	6128727.079
8	138° 30' 11.7980" E	34° 57' 25.1356" S	272026.419	6128881.926

10.5 SPA1

Vertex ID	Longitude	Latitude	Easting	Northing
1	138° 29' 49.2412" E	34° 56' 40.3497" S	271419.608	6130247.664
2	138° 29' 56.6641" E	34° 56' 38.1722" S	271606.271	6130319.475
3	138° 30' 15.1781" E	34° 57' 20.9568" S	272108.954	6129012.834
4	138° 30' 07.7543" E	34° 57' 23.1346" S	271922.291	6128941.023

10.6 SPA2

Vertex ID	Longitude	Latitude	Easting	Northing
1	138° 30' 16.2033" E	34° 57' 23.1573" S	272136.656	6128945.678
2	138° 30' 18.4406" E	34° 57' 23.3010" S	272193.527	6128942.666
3	138° 30' 19.0292" E	34° 57' 22.6657" S	272207.97	6128962.614
4	138° 30' 19.2376" E	34° 57' 21.8056" S	272212.594	6128989.249
5	138° 30' 19.1139" E	34° 57' 20.8878" S	272208.752	6129017.454
6	138° 30' 18.6808" E	34° 57' 19.2398" S	272196.496	6129067.962
7	138° 30' 11.9188" E	34° 57' 06.1528" S	272014.87	6129466.946
8	138° 30' 08.5506" E	34° 56' 59.5654" S	271924.343	6129667.798
9	138° 30' 06.8616" E	34° 56' 55.4161" S	271878.296	6129794.583
10	138° 30' 04.5357" E	34° 56' 48.8715" S	271814.241	6129994.776
11	138° 30' 01.6362" E	34° 56' 41.7055" S	271735.153	6130213.753
12	138° 29' 59.6945" E	34° 56' 37.2954" S	271682.486	6130348.415
13	138° 29' 56.6823" E	34° 56' 38.1710" S	271606.733	6130319.523

10.7 RA

Vertex ID	Longitude	Latitude	Easting	Northing
1	138° 29' 46.1670" E	34° 57' 05.6014" S	271361.097	6129467.594
2	138° 29' 49.2756" E	34° 57' 13.4394" S	271446.015	6129228.047
3	138° 30' 07.5665" E	34° 57' 08.6077" S	271906.34	6129388.541
4	138° 30' 04.3358" E	34° 57' 00.8503" S	271818.397	6129625.53

11 APPENDICES

Appendix 1 Water Quality Monitoring Plan

Appendix 2 Seagrass Monitoring Plan

Appendix 3 Noise Management Plan (a) and Underwater Noise Management Plan (b)

Appendix 4 Engagement Plan

Appendix 5 EPBC Act Self-Assessment

Water Quality Monitoring Plan

Department for Environment and Water Dredging Trial

SWS240047.01
20 September 2024

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1 INTRODUCTION

Epic Environmental Pty Ltd (Epic) were engaged by the Department for Environment and Water (DEW) to develop and implement a marine Water Quality Monitoring Plan (WQMP) for the Adelaide Beach Management Review Dredge Trial project.

The South Australian Government has committed to a dredging trial to determine its feasibility as a long-term solution for managing sand on Adelaide beaches. This will involve the restoration of West Beach with approximately 550,000 m^3 of sand over the next five years.

DEW is working closely with the Environment Protection Authority (EPA) to ensure potential impacts to sensitive environmental receivers are mitigated. As such, implementation of this WQMP is required to manage water quality during the dredging trial.

1.1 Objective

The objective of this WQMP is to provide a framework for water quality monitoring during the dredging trial, including development of the monitoring methodology, water quality trigger limits and delegation of roles and responsibilities.

1.2 Monitoring Overview

Monitoring will be undertaken at six locations and will comprise a combination of surface and benthic water quality loggers, as follows:

- **Near-surface** (1m below surface) - monitoring buoys with twin turbidity sensors (and dissolved oxygen/salinity/temperature sensors at select locations) near the surface. Buoys fitted with telemetry for real-time data feed, automatic processing of data and comparison to trigger levels, with alerts sent to notify of exceedances
- **Near-bed** (0.5 m above seabed) - benthic frames mounted with turbidity sensors. These sensors log internally with data downloaded during servicing trips and post-processed

At the end of the dredging trial, analysis of benthic data compared to surface data will be undertaken to determine differences in data, and assess whether telemetered benthic data could be used in future dredge monitoring programs. The results and recommendations for future programs will be provided in the final water quality monitoring report.

1.3 Program Timeframe

The monitoring program will comprise the following approximate schedule:

- Equipment deployment – late July 2024
- Pre-dredging – August/September 2024 (~6 weeks)
- Dredging trial – late September to end October/November 2024 (~7 weeks)
- Post dredging – November/December 2024 (~2 weeks)

2 WATER QUALITY MONITORING PLAN

This section outlines the WQMP that has been developed for the backpassing dredging trial along the Adelaide beaches.

2.1 Monitoring Sites

Water quality monitoring will be undertaken at six (6) monitoring sites as follows:

- **Dredge area** – two dredge plume monitoring sites (D1 and D2) located at North Haven
- **Dredge/placement area** – two dredge/material placement sites (P1 and P2) located at West Beach
- **Background** – two 'background' sites (B1 will serve as background for the North Haven dredge area sites, while B2 will serve as background for the West Beach sites)

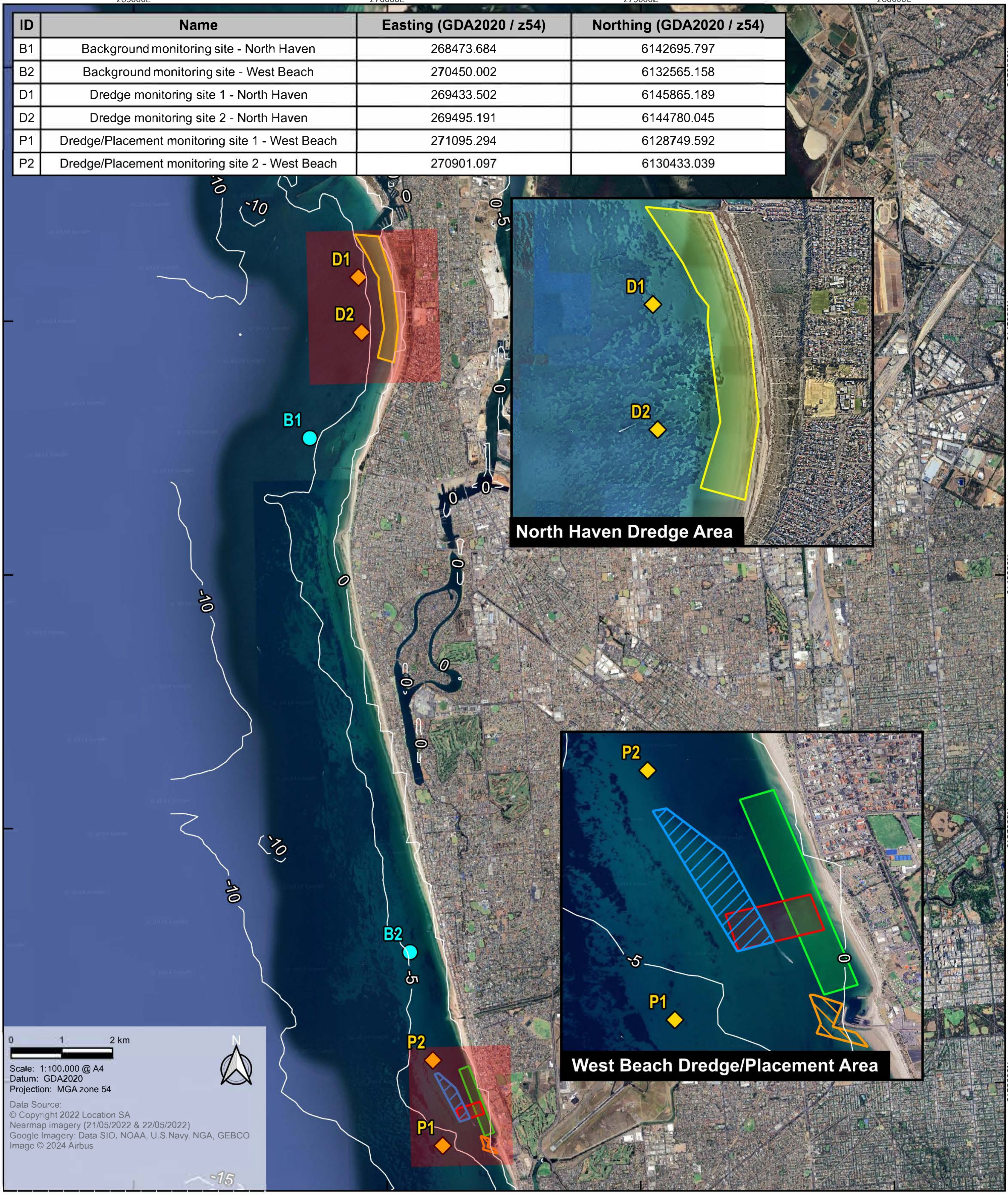
Surface and benthic water quality monitoring equipment will be deployed at the monitoring locations listed in **Table 1** and shown in **Figure 1**.

To supplement historical datasets, where possible the monitoring sites have been selected based on previous DEW harbour dredging monitoring sites (2021-2022) as indicated in **Table 1**. The sites are located in similar water depths near the 5 m Lowest Astronomical Tide (LAT) depth contour (**Figure 1**) to ensure data is comparable between sites.

Table 1. Monitoring Sites

Site	Description	Previous DEW Monitoring Site (2021/22)	Approximate Coordinates		Water depth (LAT)
			Latitude	Longitude	
D1	Dredge monitoring site 1 – North Haven	Near M1	-34.801550	138.480950	~5 m
D2	Dredge monitoring site 2 – North Haven	Near M1	-34.813172	138.479966	~5 m
B1	Background monitoring site – North Haven	B1	-34.831717	138.468233	~5 m
P1	Dredge/Placement monitoring site 1 – West Beach	N/A	-34.958466	138.492449	~5 m
P2	Dredge/Placement monitoring site 2 – West Beach	M2	-34.942741	138.491397	~5 m
B2	Background monitoring site – West Beach	B2	-34.923431	138.487048	~5 m

ID	Name	Easting (GDA2020 / z54)	Northing (GDA2020 / z54)
B1	Background monitoring site - North Haven	268473.684	6142695.797
B2	Background monitoring site - West Beach	270450.002	6132565.158
D1	Dredge monitoring site 1 - North Haven	269433.502	6145865.189
D2	Dredge monitoring site 2 - North Haven	269495.191	6144780.045
P1	Dredge/Placement monitoring site 1 - West Beach	271095.294	6128749.592
P2	Dredge/Placement monitoring site 2 - West Beach	270901.097	6130433.039



Filepath: ~SWS\SWS240047.01 DEW ADL Dredge WQ\Workspaces\1. Water Quality Monitoring Plan\Rev 0\Figure 1 Monitoring sites.qgz

Legend

- Rehandling area
- Sand borrow area 1
- Sand borrow area 2
- Sand borrow area 3
- Placement area
- Background monitoring site
- Dredge/Placement monitoring site

Department of Environment and Water
Adelaide Beaches
Water Quality Monitoring Plan

Figure 1
Monitoring sites

2.2 Parameters

The following parameters will be continuously measured (i.e. data logged every 15 minutes) throughout the monitoring program (refer to **Table 2**):

- Turbidity – will be monitored at each surface monitoring site and benthic monitoring site as measured by optical scatter via a nephelometer producing readings in Nephelometric Turbidity Units (NTU). Turbidity at the surface monitoring sites will be measured using twin turbidity sensors for quality control purposes. Turbidity provides a proxy for suspended sediments within the water column.
- Electrical conductivity (EC), pH, dissolved oxygen (DO) and temperature – these parameters are anticipated to remain consistent spatially and temporally in the marine environment, therefore will only be monitored at three sites - one dredge plume monitoring site (D1), one placement site (P1) and one background site (B2).

Table 2. Sites and Parameters

Area	Site	Type	Parameters	
			Surface	**Benthic**
Dredging	D1	Dredging	Twin turbidity, DO, pH, EC, temp	Turbidity
	D2	Dredging	Twin turbidity	Turbidity
	B1	Background	Twin turbidity	Turbidity
Dredging/Placement	P1	Dredging/Placement	Twin turbidity, DO, pH, EC, temp	Turbidity
	P2	Dredging/Placement	Twin turbidity	Turbidity
	B2	Background	Twin turbidity, DO, pH, EC, temp	Turbidity

2.3 Monitoring Equipment

2.3.1 Near-Surface Monitoring

To collect real-time water quality measurements from near-surface, water quality loggers will be mounted on purpose-built monitoring buoys. The buoys will be anchored to the seabed using a mooring system to maintain position. With the loggers installed in each monitoring buoy, the sensors will be located at a depth of approximately 1 m below the water surface.

The water quality logger (YSI EXO sonde) will be fitted with sensors designed for long-term deployments in the marine environment. The sensors will measure turbidity, with dissolved oxygen, pH, electrical conductivity and water temperature sensors installed at monitoring sites D1, P1 and B2. The water quality loggers will be capable of continuous logging of data, with a copper anti-fouling guard, copper tape and sensor wiping apparatus to prevent interference to sensors from marine growth. The loggers will be programmed to log data once every 15 minutes.

The monitoring buoys will be fitted with navigation lights set to flash in accordance with advice from the Harbour Master. Real-time data from each buoy will be made available via telemetry using in-built Campbell Scientific data loggers, 4G modems, batteries and solar panels.

Each buoy will be fitted with a secondary turbidity sensor for QA/QC purposes and redundancy (in case a turbidity sensor malfunctions or becomes fouled).

The monitoring equipment will be secured to the seabed using robust mooring lines and bruce anchors to minimise theft and movement of equipment. Each monitoring buoy will be installed with a GPS tracking device, with alerts if the buoy moves location and the equipment can be tracked on the web portal if moorings break or the buoy is stolen.

2.3.2 Benthic Monitoring

To collect near-bed benthic water quality data, benthic frames with water quality loggers (YSI EXO sondes) will be deployed. The water quality loggers will be fitted with turbidity sensors and be capable of continuous logging of data, with a copper anti-fouling guard, copper tape and sensor wiping apparatus to prevent interference to sensors from marine growth.

The benthic loggers will be programmed to log data once every 15 minutes with data downloaded during servicing trips.

2.3.3 Permits

For deployment of the equipment in the nearshore marine environment, a 'Notice to Mariners' will be prepared and submitted to the Department for Infrastructure and Transport (DIT). This will outline the type of equipment used, deployment locations and deployment period.

DIT has confirmed that a Licence Agreement for the water quality monitoring equipment is not required.

2.3.4 Calibration and Servicing

All monitoring equipment will be calibrated prior to deployment as per the manufacturer's specifications. Optical sensors (such as turbidity and DO) and EC sensors are fairly robust and the manufacturer recommends calibration at least once every 6-12 months during use, while pH sensors are recommended to be calibrated at least once every 2-4 months. To avoid disruption to the monitoring program, sensors will be calibrated prior to deployment and then calibration will be routinely checked throughout the monitoring program as follows:

- A calibrated, hand-held water quality meter will take measurements from surface to bottom at each site during servicing trips to confirm the ongoing accuracy of the sensor readings. If a sensor is not reading correctly, it will be replaced with a calibrated sensor (spare sensors will be available). Alternatively, data can be adjusted via the monitoring portal (Eagle.io) to account for any sensor drift based on monthly calibration checks
- Water quality grab samples (**Section 2.4**) will be collected adjacent to each buoy and analysed for turbidity as a secondary calibration check

To achieve the goals of the monitoring program and collect valid data, servicing of the water quality loggers will be undertaken approximately every 4-6 weeks (depending on weather conditions). The servicing trips will involve cleaning and calibration-check of all instrumentation, and any repairs or other maintenance required. Additional servicing trips may also be required if the monitoring data indicates equipment malfunction or interference.

2.3.5 Equipment Failure

In the event of failure of the monitoring equipment during dredging, the following will be undertaken:

- A servicing trip will be undertaken to rectify the issue
- If the issue cannot be rectified onsite, replacement equipment will be sourced as soon as possible. Note that a spare YSI EXO sonde and sensors will be available in Adelaide for immediate replacement if necessary
- If required, equipment from one of the background sites can be relocated temporarily to the dredging/placement site while additional replacement equipment is sourced

As mentioned previously, redundancy has been built into the monitoring design with duplicate sites at each area. If there are any issues with one of monitoring sites in an area during dredging, data from the other site in that area can be relied upon until the issue is rectified, allowing dredging to continue in the meantime.

2.4 Grab Samples

At each site, grab samples will be collected during deployment, servicing and retrieval trips. Samples will be collected from the top, middle and bottom of the water column at each site using a Van Dorn Sampler. Water samples will be collected into laboratory supplied sample containers and sent to a National Association of Testing Authorities (NATA) certified laboratory for the analysis of the following:

- Total suspended solids (TSS)
- Turbidity (NTU)

Analytical data from the grab samples will be used to determine TSS/NTU ratio at the dredging, sand placement and background locations.

2.5 Data Analysis

Real-time telemetered data will be collected from each of the surface sites and compared to the trigger values throughout the duration of the dredging trial. Data from the benthic sites will be logged internally and downloaded during servicing trips. Benthic data will be post processed at the end of the dredging trial.

Water quality data collected at surface monitoring buoys during dredging will be managed as follows:

- Data will be automatically downloaded on an hourly basis via a remote telemetry system. This raw data (not quality controlled) will be displayed on a monitoring portal (Eagle.io) developed for the project
- Raw data will undergo an automatic QC checking process, followed by a manual QC checking process (refer to **Section 2.6**) and any potentially erroneous data will be quarantined from the data set
- The QC-cleaned data will undergo automatic calculation of required metrics (e.g. 15-day and 6-day rolling medians) for comparison to trigger limits (**Section 2.5.1**). The calculated medians will be displayed on the monitoring portal as time series charts with trigger levels displayed. Alerts will be sent out to key project personnel if trigger limits are exceeded

The monitoring data will be presented in a dashboard style monitoring portal available to DEW and other project stakeholders (EPA).

2.5.1 Water Quality Trigger Limits

An adaptive management program using varying turbidity trigger levels will be implemented during the dredge trial. Trigger levels have been set based on EPA guidance, previous DEW monitoring data (2021/22) and the 2019 Outer Harbour Channel Widening (OHCW) project (BMT, 2019). The trigger levels take into account natural background turbidity and zones of impact thresholds for seagrass.

The 'Alarm' and 'Hold' trigger limits for the 2019 OHCW project used a baseline turbidity of 0.8 NTU (in deeper waters around 8 m LAT) with zone of impact threshold values added to this baseline value – 50th percentile for 15-day median and 80th percentile for 6-day median. The zone of impact thresholds are included in **Table 3** (BMT, 2019). This resulted in the following trigger levels for the 2019 OHCW project:

- Alarm (zone of low to moderate impact) - 2.8 NTU (15-day median) and 5.8 NTU (6-day median)
- Hold (zone of high impact) - 5.8 NTU (15-day median) and 15.8 NTU (6-day median)

Table 3. Zone of Impact Thresholds (BMT, 2019)

Impact Zone	Turbidity (NTU) thresholds above background[2]			
	20%ile	50%ile	80%ile	95%ile
Zone of High Impact	3	5	15	-
Zone of Low to Moderate Impact	1	2	5	-
Zone of Influence	-	0.5	2	5

To set appropriate trigger values for this project (with sites located in more turbid, shallower nearshore waters compared to the 2019 OHCW project), the DEW monitoring data (2021/22) was analysed. The DEW data was collected using sensors mounted on benthic frames approximately 0.5 m above the sea bed, and the data was collected over a 12-month period between November 2021 and December 2022. The analysis was undertaken on the cleaned data (i.e. outliers removed) with summary statistics presented in **Table 4**.

Table 4. Summary of DEW Data (2021/22)

Summary Statistic	DEW Monitoring Sites				Average
	M1	M2	B1	B2	
Minimum	0.2	0.2	0.1	0.3	0.2
20th percentile	1.3	1.8	1.1	2.0	1.6
Median (50th percentile)	2.5	3.0	2.2	3.3	2.8
80th percentile	4.5	5.1	3.5	5.2	4.6
Maximum	349.8	92.7	65.2	119.8	156.9

Based on the results of the analysis in **Table 4**, a <u>baseline turbidity value of 2.8 NTU</u> (average median value of all sites) is assumed at the nearshore monitoring sites. When the zone of impact threshold values (**Table 3**) are added to this baseline value, the revised trigger levels that will be applied to this project are as follows:

- **Alarm level** (associated with boundary of the zone of low to moderate impact):
  - 4.8 NTU based on a 15 day rolling median
  - 7.8 NTU based on a 6 day rolling median
- **Hold level** (associated with boundary of the zone of high impact):
  - 7.8 NTU based on a 15 day rolling median
  - 17.8 NTU based on a 6 day median rolling median

The 15-day and 6-day rolling median turbidity values will be compared to the 'Alarm' and 'Hold' criteria in Eagle.io and alerts sent out to key project personnel if they are exceeded. The response strategy to turbidity exceeding the trigger limits is described as follows and shown in **Figure 2**.

Level 1: Business as Usual

Turbidity levels remain below Alarm thresholds, dredging continues as planned with ongoing monitoring at all times.

Level 2: Alarm

Turbidity levels exceed either of the following thresholds requiring the implementation of management actions by the Dredge Contractor to reduce levels:

- 4.8 NTU based on a 15 day rolling median, or
- 7.8 NTU based on a 6 day rolling median.

Upon reaching the Alarm trigger level, the dredge contractor will assess the source of increased turbidity, slow dredging, and/or implement management measures to reduce turbidity levels to return readings below Level 1 (Business as Usual). Specific actions are detailed in the DMP.

<u>Note:</u> if the rolling median at either of the background sites (B1 or B2) also exceeds the trigger values (or is within 20%), then dredging can continue as per Level 1: Business as Usual.

Level 3: Hold

Turbidity levels exceed either of the following thresholds:

- 7.8 NTU based on a 15 day rolling median, or
- 17.8 NTU based on a 6 day median rolling median.

Upon reaching the Hold trigger level, the dredge contractor will cease dredging as soon as practicable but no longer than 3 hrs. An assessment will be undertaken by the EPA to determine whether background turbidity is a significant influence and if so, then dredging can recommence. Level 2 Alarm management measures are to be implemented for a period upon commencement until turbidity levels return below Level 2 (Alarm).

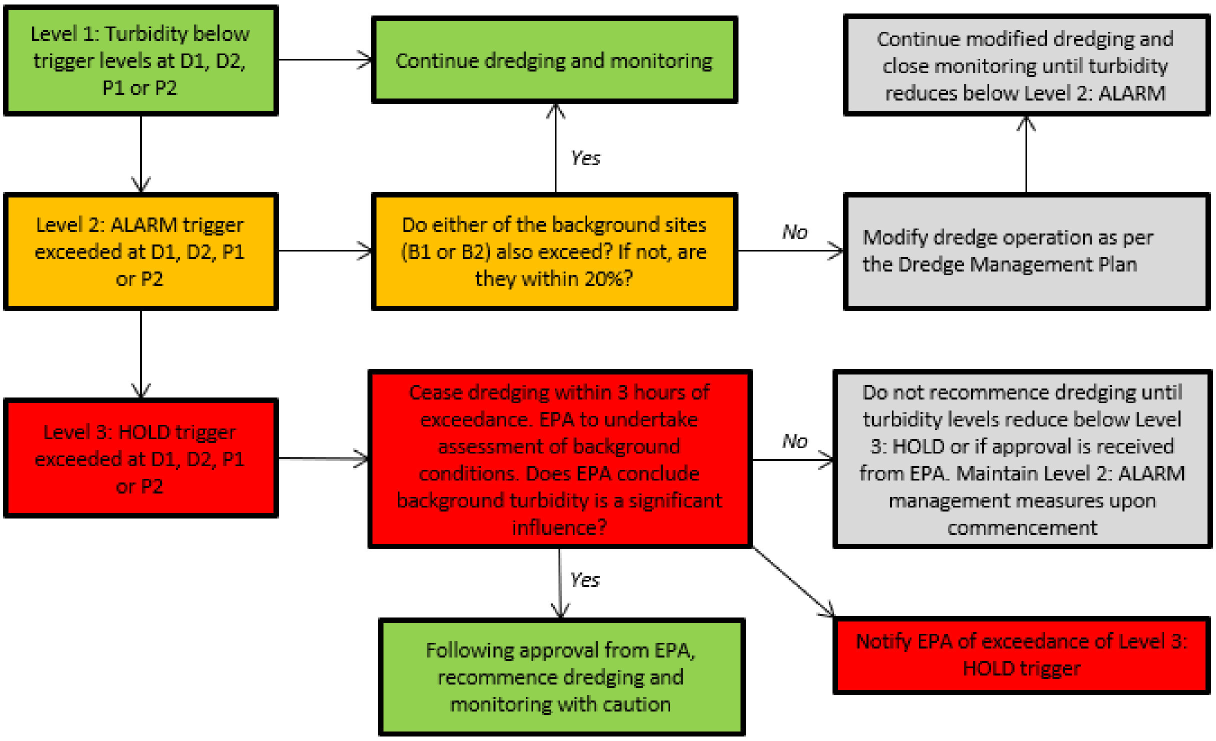


Figure 2. Turbidity Trigger Limit Response Strategy

2.5.1.1 Triggers during November

The above triggers are applicable for dredging up to 31 October. As per advice received from the EPA, dredging may pose a higher risk to seagrass if dredging continues into November. As such, lower (more stringent) triggers will be implemented if dredging is undertaken during November. These triggers include the following:

- **Alarm level**:
  - 2.8 NTU based on a 15 day rolling median
  - 5.8 NTU based on a 6 day rolling median
- **Hold level**:
  - 5.8 NTU based on a 15 day rolling median
  - 15.8 NTU based on a 6 day median rolling median

2.5.2 Assessment of Turbidity Data

Should the rolling median turbidity exceed the trigger limits, the rolling median turbidity (i.e. 6 day or 15 day) at the background monitoring sites (B1 or B2) is to be assessed to determine if ambient turbidity is elevated and is accounting for increased turbidity at D1, D2, P1 or P2.

If the rolling median turbidity exceeds the Alarm level trigger at D1, D2, P1 or P2 and neither of the background sites exceed the Alarm trigger, then Alarm level management measures will be implemented. The exception to this would be if either of the background sites are within 20% of the site that has exceeded, then dredging may continue, as this accounts for rolling median values either side of the trigger level (see worked examples below). Otherwise, if the rolling median turbidity exceeds the Alarm level trigger at D1, D2, P1 or P2 but the rolling median background data (B1 or B2) also exceeds, then dredging may continue, as this indicates higher background levels are occurring independent of the dredge activity (a natural weather event, for example).

If the rolling median turbidity exceeds the Hold level trigger at D1, D2, P1 or P2 and neither of the background sites exceed the Hold trigger, then dredging is to stop and not start until approval is received from the EPA to continue dredging. Level 2 Alarm management measures are to be implemented for a period upon commencement. The exception to this would be if either of the background sites are within 20% of the site that has exceeded, then dredging may continue after permission is granted from the EPA, as this accounts for rolling median values either side of the trigger level (see worked examples below).

2.5.2.1 Worked examples

The following provides some worked examples of the above assessment of turbidity data.

Worked Example 1

- 15-day rolling median at site P1 increases to 4.81 NTU (exceeds Alarm level)
- 15-day rolling median at site B1 and B2 is 4.90 NTU and 4.95 NTU respectively (exceeds Alarm level)
- P1 is lower than B1 and B2, therefore elevated turbidity is likely due to natural conditions and dredging can continue

Worked Example 2

- 15-day rolling median at site P1 increases to 4.81 NTU (exceeds Alarm level)
- 15-day rolling median at site B1 and B2 is 4.75 NTU and 4.65 NTU respectively (below Alarm level)
- However, P1 is only 1% higher than B1 and 3% higher than B2 (i.e. within 20%), therefore elevated turbidity is likely due to natural conditions and dredging can continue

Worked Example 3

- 15-day rolling median at site P1 increases to 4.81 NTU (exceeds Alarm level)
- 15-day rolling median at site B1 and B2 is 3.85 NTU and 3.90 NTU respectively (below Alarm level)
- P1 is 25% higher than B1 and 23% higher than B2, therefore elevated turbidity is likely due to dredging and Alarm level management measures are to be implemented

Worked Example 4

- 15-day rolling median at site P1 increases to 4.81 NTU (exceeds Alarm level)
- 15-day rolling median at site B1 and B2 is 3.85 NTU and 4.70 NTU respectively (below Alarm level)
- P1 is 25% higher than B1 but only 2% higher than B2, therefore elevated turbidity is likely due to natural conditions and dredging can continue

Worked Example 5

- 6-day rolling median at site D2 increases to 17.85 NTU (exceeds Hold level)
- 6-day rolling median at site B1 and B2 is 14.50 NTU and 13.90 NTU respectively (below Hold level)
- D2 is 23% higher than B1 and 28% higher than B2, therefore elevated turbidity is likely due to dredging and dredging is to stop until turbidity decreases below Hold level or if approval is received from EPA to continue dredging

Worked Example 6

- 6-day rolling median at site D2 increases to 17.85 NTU (exceeds Hold level)
- 6-day rolling median at site B1 and B2 is 17.90 NTU and 18.20 NTU respectively (exceeds Hold level)
- D2 is lower than B1 and B2, therefore elevated turbidity is likely due to natural conditions and dredging can continue after permission is granted from the EPA

2.5.3 TSS/NTU Ratio

The grab samples collected at each location during deployment, servicing and retrieval will be used to calculate TSS/NTU ratios for the dredging, placement and background locations. TSS and turbidity (NTU) will be analysed for samples collected from the surface, middle and bottom of the water column to capture a range of concurrent measurements. This will enable site-specific calculations of TSS/NTU ratios at each site.

This correlation typically requires at least 10 concurrent data points, therefore, 12 samples have been allowed for at each location.

2.6 Quality Assurance and Quality Control

The following will be undertaken to ensure data quality and to minimise any data loss from the real-time monitoring equipment:

- The real-time data on the Eagle.io monitoring portal will be maintained regularly to ensure good quality data is being recorded. If poor quality data becomes evident (potentially due to sensor fouling or malfunction), Epic will initiate actions to rectify (e.g. servicing trip)
- Sensors and equipment will be cleaned regularly (approximately once every 4-6 weeks, depending on weather conditions). All sensors will be calibrated prior to deployment as recommended by the manufacturer using standard solutions prepared from the National Institute of Standards and Technology (NIST) traceable reagents.
- Calibration checks will be undertaken during servicing trips to ensure accuracy and precision of sensor data is maintained. Minor sensor drift will be adjusted in the monitoring portal, while major sensor drift will be addressed by re-calibration of sensors
- When sensors are serviced in the field, their condition and appearance will be noted. This will identify if a sensor has been biofouled or has any other noticeable issues. This data will be used to assist in the post-processing assessment of the data
- A calibration log will be kept and made available upon request – the log will contain all calibration details and details of standards used during calibration

2.6.1 Data Quality Control Procedures

As real-time data is automatically downloaded by the web-based monitoring portal, any potential outliers and questionable data will be assigned a quality code which will then be examined further. Rules to flag potential outliers and questionable data will be as follows:

- If any individual measurement is >100% higher or lower than adjacent measurements (e.g. a brief spike in turbidity)
- If data is outside the bounds of typical readings, e.g. negative turbidity or turbidity higher than 1,000 NTU, pH values less than 4 or greater than 10
- The data will be automatically plotted on the web-based monitoring portal as a time series chart and visually scanned for outliers and evidence of failed sensors, including data which has been assigned a poor-quality code. Obvious failures will result in the data being quarantined from the dataset
- The use of twin turbidity sensors will assist investigations into the validity of potential outliers and questionable turbidity data. The two data sources will undergo automatic processing by the monitoring portal as follows:
  - Data from the two concurrent turbidity sensors will be downloaded and compared
  - If the difference in readings is within 20%, then the average turbidity value will be used
  - If the difference is greater than 20%, then the minimum turbidity value will be used (this assumes that biofouling would increase turbidity values)
- If turbidity readings are unusually high, data will then be examined with consideration to the meteorological conditions at the time (with data from the Bureau of Meteorology) to determine whether wind and wave conditions may have affected the measurements in question. If strong winds do not accompany spikes in turbidity, the data will be considered potentially erroneous and subjected to further scrutiny

3 DATA VALIDATION

Satellite imagery will be used to validate measured data. Site-specific algorithms will be used to convert satellite backscatter data into satellite-derived turbidity maps. Twice-daily MODIS images will be converted to turbidity maps and automatically uploaded to the Eagle.io monitoring portal. Satellite imagery will be used for the following:

- To complement measured monitoring data and detect dredge plumes in areas not captured by deployed instrumentation
- To validate sensor readings at monitoring buoys

4 ROLES AND RESPONSIBILITIES

The roles and responsibilities of the principal entities are detailed in **Table 5**.

Table 5. Roles and Responsibilities

Entity	Role
Dredge Contractor	• Undertake appropriate management actions to reduce turbidity when alerted of water quality triggers being reached • Assist DEW and Epic with reporting requirements • Assist DEW and Epic in investigating and responding to complaints received • Notify DEW and the EPA in the event of an environmental incident • Prepare and comply with a detailed Dredge Management Plan
Epic Environmental	• Install, operate and maintain water quality monitoring equipment • Collect water samples for laboratory analysis of TSS and turbidity at monitoring sites to determine TSS/NTU correlation • Provide regular satellite images of dredge plumes to all relevant parties • Set up and maintain water quality data management website portal, including data processing and sending trigger alert alarms to the appointed dredge contractor • Undertake regular equipment servicing trips (or more frequently, if required) • Prepare weekly summary reports and the post-dredging report for DEW and regulators
Department for Water and Environment	• Ensure the dredge contractor has appropriate environmental management systems and reporting protocols in place • Provide a complaints hotline and respond to any complaints received • Report any environmental incidences or non-conformances to the relevant agencies

5 REPORTING

Reporting will comprise the following:

- 'Alarm' and 'Hold' trigger alerts will be reported immediately to DEW and to EPA via automatic Eagle.io alerts. Epic will follow up on any alerts to make sure they were received
- Weekly summary reports will be provided to DEW
- A final water quality monitoring report will be provided to DEW and EPA following cessation of the dredging trial. This report will include raw data, summary of data, any exceedances (causes and if adaptive management required) and general discussion on water quality with respect to dredging and sand placement activities

The final water quality monitoring report will also include findings of an analysis of benthic data compared to surface data to determine differences in data, and recommendations on whether telemetered benthic data could be used in future dredge monitoring programs.

6 REFERENCES

BMT (2019). *Adelaide Outer Harbor Channel Widening Project: Environmental Monitoring Program*. Report prepared for Flinders Ports.

Wiltshire, K.H. (2023). *Analysis of near-shore turbidity data for the Adelaide metropolitan region: influence of harbour dredging and potential impacts on benthic habitats*. South Australian Research and Development institute (Aquatic and Livestock Sciences), Adelaide. SARDI Publication No. F2023/000317-1. SARDI Research Report Series No. 1195.

CONTACT US

www.epicenvironmental.com.au
https://www.linkedin.com/company/epic-environmental-pty-ltd/
1800 779 363
enquiries@epicenvironmental.com.au

ADELAIDE SEAGRASS MONITORING PLAN

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EPIC ENVIRONMENTAL

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STREET
1 / 22 Mayneview Street
Milton 4064
QUEENSLAND

REGISTERED
c/- de Blonk Smith and
Young Accountants
GPO 119, Brisbane 4001
QUEENSLAND

POSTAL
PO Box 2151
Toowong 4066
QUEENSLAND

CONTACT
+61 (0)7 3721 0100 P
info@hydrobiology.com

ABN 26 096 574 659

www.hydrobiology.com

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EXECUTIVE SUMMARY

West Beach, located near Adelaide, South Australia, has been impacted by severe and ongoing erosion for decades. The South Australian Department for Environment and Water (DEW) recently committed to a sand dredging trial that involves taking sand from the seabed and placing it at West Beach. Epic Environmental subcontracted Hydrobiology on behalf of DEW to assess the potential impacts on local seagrass meadows associated with the proposed dredging activities from the Dredging Trial.

As part of Hydrobiology's scope of works, this monitoring plan has been devised to establish an appropriate framework for monitoring the health, distribution, and density of seagrass meadows. The plan details the key components, including the study area, duration and frequency of monitoring, survey methodologies, biological indicators, data analysis, and reporting requirements of the seagrass monitoring plan to be established in relation to the dredging activities to be conducted by DEW.

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1. INTRODUCTION

1.1 BACKGROUND

West Beach, located near Adelaide, South Australia, has been impacted by severe and ongoing erosion for decades. Erosion at West Beach is due to a sand budget deficit, largely created by coastal development on dunes and coastal foreshore interrupting natural coastal processes and exacerbated by a lack of offshore sediment supply. To compensate for the sand budget deficit, the delivery of land-based quarry sand to West Beach commenced in August 2021 and continued intermittently while the independent review of Adelaide's beach management was undertaken. Following recommendations from an Independent Advisory Panel to the state government in late 2023, the South Australian Department for Environment and Water (DEW) have recently committed to a sand dredging trial to help preserve metropolitan beaches and combat coastal erosion along the Adelaide metropolitan coastline.

DEW is required to conduct the dredging in a manner that does not cause environmental harm or aims to minimise the extent of harm. The Environment Protection Authority (EPA) requires a buffer zone between equipment and seagrass to minimise any potential effects and requires that a seagrass monitoring plan is designed and implemented before and after the dredging trial.
Hydrobiology has been commissioned by Epic Environmental (hereafter Epic) to develop and implement a seagrass monitoring plan for the Dredging Trial.

1.2 SCOPE AND OBJECTIVES

Hydrobiology was subcontracted by Epic Environmental on behalf of DEW to assess the potential impacts on local seagrass meadows associated with the proposed dredging activities from the Dredging Trial. The specific scope of work included:

- The development of a seagrass monitoring plan that relies on an appropriate framework for monitoring the health, distribution, and density of seagrass meadows. The plan must outline the key components, including the study area, duration and frequency of monitoring, survey methodologies, biological indicators, data analysis, and reporting requirements.
- Once the monitoring plan has been approved, Hydrobiology is required to implement the monitoring plan and provide associated reporting. The survey is envisioned to involve ground-truthing seagrass meadows observable from recent aerial imagery downloaded from Nearmap. Each meadow's per cent cover and species composition will be mapped, and the total meadow extent and estimates of density (extrapolated from camera surveys and grab samples post-processed for biomass and species mix) will be provided.
- Aerial imagery is also being collected by the University of Adelaide as part of the project and where available, will be used to refine the mapped extent (refer to Appendix A).

2. REVIEW OF EXISTING INFORMATION

2.1 ECOLOGICAL FUNCTION OF SEAGRASS

Seagrass are monocotyledonous marine angiosperms found in most of the worldwide coastal environments and form one of the most productive coastal ecosystems in the world (Cingano et al., 2024; Mtwana Nordlund et al., 2016; Waycott et al., 2009). The meadows also provide several high-value ecosystems services such as improving water quality by oxygenating water and trapping sediments and pollutants, regulate nutrient cycles, providing food, habitat and shelter for marine species, carbon sequestration, and reducing coastal erosion by trapping and holding sediment and buffering wave energy(Fox et al., 2007; McRoy & Helfferich, 1977; Mtwana Nordlund et al., 2016; Waycott et al., 2009). Loss or degradation of seagrass beds can lead to a reduction or complete loss of the ecosystem services they provide, and results in a shift to different primary producers in the ecosystem that can only partially compensate for the loss of the seagrass meadows (Duarte et al., 2004), and a reduction in the net secondary productivity of other environments such as adjacent coral roofs and/or distant areas such as deep-sea bottoms which depend on energy subsidies from seagrass meadows (Waycott et al., 2009). Despite the numerous ecological services they provide and their natural value, seagrasses are among the most threatened ecosystems on Earth and a rapid decline has been observed globally with approximately 29% of known seagrass extant worldwide lost since 1979 (Cingano et al., 2024; Waycott et al., 2009). On a global scale, a number of natural and anthropogenic causes have been suggested for seagrass declines (Duarte et al., 2004).Theses are included but not limited to pathogens, climate extremes and climate change, eutrophication, mechanical loss, reduction in water clarity and direct human impacts (dredging, fishing and aquaculture, boating and anchoring, exotic species)(Cingano et al., 2024; Duarte et al., 2004; Dunic et al., 2021).

2.2 FACTORS AFFECTING PLANT GROWTH

As with terrestrial plants, the growth and distribution of seagrasses are controlled by the physical, mechanical and biological properties of the environment they inhabit (Greve & Binzer, 2004). Sufficient light, nutrients and inorganic carbon, a suitable substrate, moderate exposure, temperature and various biological affect the distribution of seagrass meadows (Duarte et al., 2004; Greve & Binzer, 2004; Hemminga & Duarte, 2000). The thresholds for seagrass species found in the Gulf St Vincent are summarised in Table 2-1.

- Light
  - Light is one of the key environmental resources imperative for the growth and survival of seagrasses (Erftemeijer, 2014; Hemminga & Duarte, 2000). The maximum depth of seagrass occurrence is largely driven by light availability which is driven by water transparency (which determines the depth-penetration of photosynthetically active radiation of sunlight). The amount of light to reach seagrass can be impacted by sediments (suspended and settled), the epiphyte cover on the seagrass itself and the natural water colour. Reduction in light due to turbidity has been identified as a major cause of the loss of seagrasses worldwide (Shepherd et al., 1989). Low light levels can have a range of lethal and sub lethal effects on seagrass and the level at which these effects are felt vary between taxa.
- Salinity
  - Tolerance to salinity is an essential requirement for seagrasses to inhabit the shallow coastal environments in which they occur (Erftemeijer, 2014; Hillman et al., 1989). Optimal salinity ranges vary between taxa, with shallow coastal species often exhibiting euryhaline tendencies while others are limited by their stenohaline tolerances. Generally, seagrasses are able to tolerate brief fluctuations in salinity outside of their normal range however their long-term tolerances are narrower (Hillman et al., 1989). In addition to tolerating high salinities, many shallow water species must also be able to tolerate low salinities from freshwater run-off.
- Temperature

  The temperature tolerance of seagrasses varies with geographical latitude and habitat. Species found within intertidal zones where exposure is possible have a broader thermal tolerance than species that remain submerged permanently and typically experience far narrower temperature variations (McMillan, 1984). Temperatures outside of their optimal range may not be fatal to seagrass species but may result in impaired productivity through reduction in metabolic rate or leaf mortality (Erftemeijer, 2014).
- Flow velocity
  - Forces generated by water motion originating from tides and wind can have a measurable effect on growth and distribution of seagrasses. For example, high wave energy may prevent establishment or forcefully remove seagrass from the bed, enhance the nutrient uptake in seagrasses by reducing the boundary layer around the leaves and assist in the pollination of seagrasses and in the dispersal of seagrass seeds and propagules. In contrast, a reduction in current flow or wave energy may cause a higher degree of sedimentation and reduced nutrient availability, and thus adversely affect seagrass growth. If increased current flow results in erosion of sediments, this may trigger the self-perpetuating destruction of the meadow. Conversely,

seagrass beds themselves reduce current velocity by extracting momentum from the moving water and in areas characterised by high currents seagrass species can persist but their ability to reduce the turbulence is virtually eliminated and they most likely to depend more on their root system for nutrient uptake (Erftemeijer, 2014; Fonseca & Kenworthy, 1987; Scoffin, 1970).

- Low tide exposure
  - The degree to which seagrasses can withstand low tide exposure differs between species. In the intertidal, seagrasses are periodically exposed to air where they experience stressful environmental conditions, such as desiccation, high light, nutrient limitation, high and low temperature, and osmotic stress (Davison & Pearson, 1996). In turbid waters, the optimum position of seagrasses in the intertidal zone is considered to be a compromise between desiccation and light conditions. The period during which a seagrass plant is exposed during low tide is essentially a function of the tidal amplitude and the depth at which the seagrass plant occurs, although wind stress may occasionally propel nearshore water levels up to higher levels than would be expected. Besides, intertidal seagrass plants are not always entirely exposed as a thin lens of water is often retained due to micro-variations in bottom-topography. The duration of the exposure period fluctuates over the tidal (spring-neap) cycle (Erftemeijer, 2014).
- Sediment composition
  - Where space is available, seagrass populations can only develop if the substrate is suitable. Most seagrass species are confined to sandy to muddy sediments, which are easily penetrated by seagrass roots, although some species can grow on rubble and over rock (Hemminga & Duarte, 2000). High mobility of fine sediments, in which currents and wave-induced bedload transport generate large sand ripples and sand waves, renders them unsuitable to support plant growth. These processes cause successive burial and erosion, which may cause seagrass mortality, depending on the size and frequency of these events relative to the life history and growth capacity of the species. Hence, highly mobile, but otherwise suitable, sandy sediments may be bare of seagrass cover (Erftemeijer, 2014; Hemminga & Duarte, 2000).
- Exposure to wave action
  - In their natural environment, seagrasses are exposed to wind-driven currents, tides, waves and wave-driven currents. While these hydrodynamic processes affect seagrasses, seagrasses also affect these hydrodynamic processes through the attenuation of currents and waves (Larkum et al., 2006; Mtwana Nordlund et al., 2016). Excessively weak currents and waves may lead to detrimentally high sediment organic contents or lead to limiting leaf diffusive boundary layer conditions. In contrast, in areas with high wave exposure and strong currents, seagrass may be damaged due to excessive sediment transport, which does not allow seeds to become established, or eroding/burying existing seagrass beds (Erftemeijer, 2014).
- Sedimentation and erosion
  - Excessive sedimentation and subsequent smothering has frequently been observed to lead to degradation of seagrass meadows. Seagrass species that develop vertical shoots (e.g. *Amphibolis*) may respond to fluctuations in sediment depth by modifying their vertical (i.e. plagiotropic) growth to relocate their leaf-producing meristems closer to the new sediment level, but there are limits to the level of sedimentation seagrasses can tolerate (Duarte et al., 2004; Erftemeijer, 2014; Marba & Duarte, 1994). Settlement of suspended material on leaf blades of seagrasses may interfere significantly with photosynthesis and appears especially significant in low wave energy environments where fine sediments are present and can settle out (Shepherd et al., 1989). The impact of sedimentation is often increased where epiphytes are abundant on seagrass leaves (for instance under nutrient enriched conditions) because epithelized leaf blades collect a greater amount of sediment.

2.3 SEAGRASS IN GULF ST VINCENT AND ADELAIDE METROPOLITAN COASTLINE

2.3.1 SUMMARY

Along the coasts of South Australia, 21 species of seagrass from nine genera are known to inhabit the sheltered bays from Port McDonell near the Victorian border to Fowlers Bay at the west end of South Australia's coastline (EPA, 2013; Fox et al., 2007; McDowell et al., 2009). The largest and most diverse meadows are known to occur in Spencers Gulf and the Gulf St Vincent, with the latter containing an estimated 5,000 km^2 of seagrass meadows comprised of thirteen seagrass species from seven genera (Fox et al., 2007; McDowell et al., 2009). Species known to exist and basic information regarding their biology is displayed in Table 2-1, and information relevant to each genus is expanded below. Within St Vincent Gulf, the dominant seagrass species are ribbon-weed or tape-weed (Posidonia spp.) and wire-weed (Amphibolis spp.), and in the shallower regions, dugong grass (Halophila spp.) and eelgrass (Zostera and Heterozostera spp.) (Fox et al., 2007; McDowell et al., 2009).

2.3.2 SEAGRASS TAXA PRESENT

Seagrass species found to exist along the metropolitan coastline of Adelaide in the Gulf St Vincent are detailed in Table 2-1. The seagrass known in the Gulf St Vincent belong to the following genera:

- Posidonia
  - *Posidonia* seagrass form large meadows and are the dominant seagrass taxa along the Adelaide metropolitan coast in terms of cover/abundance (Hemminga & Duarte, 2000; Westphalen et al., 2005). However, *Posidonia* (and Amphibolis) seagrass has seen the greatest seagrass loss along the Adelaide Coast according to Clarke and Kirkman (1989).
  - At least four species of *Posidonia* are present along Adelaide's coastline and the distributions of the species largely varies based on depth and habitat. *Posidonia australis* is largely found in sheltered and shallow subtidal areas. *P coriacea* is also found in uppermost sublittoral zones however extends into deep waters mostly in areas with strong wave action. *P. sinuosa* and *P.angustifolia* are difficult to distinguish but occur over different though partially overlapping ranges (EPA, 2013; Shepherd & Robertson, 1989; Westphalen et al., 2005).
  - *Posidonia* seagrasses are recognisable by their large size and strap like leaves that extend from a sheath at the base of the plant. The meadows formed by *Posidonia* have a substantial standing crop but only a moderate rate of production across three of the four cosmopolitan species (little is known about *P. coriacea* production) (Cambridge & Hocking, 1997). *P angustifolia* has a higher below ground component than *P. sinuosa* and *P. australis*, while *P. sinuosa* has the highest above ground biomass of the three with *P australis* occupying the midground (Cambridge & Hocking, 1997). The greater above ground biomass presumably allows for a higher growing capacity, while larger below ground biomass allows for increased carbon storage and tolerance to low light conditions (Cambridge & Hocking, 1997; Hemminga, 1998; Hemminga & Duarte, 2000)
- Amphibolis
  - The *Amphibolis* genus is endemic to the southern and western coasts of Australia and consists of only two species – *A. antarctica* and *A. griffithii* (Shepherd & Robertson, 1989; Westphalen et al., 2005). Both species are found along the Adelaide metropolitan coastline and, according to Clarke and Kirkman (1989) suffered the greatest losses along the Adelaide coast in conjunction with *Posidonia*. The loss is strongly believed to have been driven by eutrophication (opposed to low light conditions) however closure of sludge sites saw no recruitment of the genus (EPA, 2013; Westphalen et al., 2005). Natural recovery of the taxa is low and rehabilitation of the *Amphibolis* meadows have only been moderately successful (Bryars, 2008).

  - *Amphibolis* seagrasses form large stands across a broad depth range. Within the Gulf St Vincent, the two species are largely found in differing habitats. *A.griffithii* is primarily restricted to the southern parts of the gulf where it grows in lower light conditions and in areas with higher wave energy than *A. antarctica. A. antarctica* typically grows in more shallow intertidal areas, often alongside *Posidonia* meadows, and is more prevalent along the Adelaide metropolitan coastline (Robertson, 1984; Shepherd et al., 1989; Shepherd & Robertson, 1989; Westphalen et al., 2005).
  - Both *Amphibolis* seagrasses are highly productive in comparison to other seagrasses in Gulf St Vincent, with a bias towards above ground biomass that often is more than twice that seen in seagrass species from other genera (Westphalen et al., 2005). *A. antarctica* is the more productive of the two species, possibly because it is typically found within more shallow environments with greater light availability (Clarke & Kirkman, 1989)
- Heterozostera
  - Within the Gulf St Vincent, the *Heterozostera* genus is represented only by *H. tasmanica* which is widespread across the southern coasts of Australia (Shepherd & Robertson, 1989). The species is capable of inhabiting a wide range of depths but is typically a significant component of seagrass assemblages found in the intertidal zone to waters 8 m deep (Robertson, 1984).
  - *Heterozostera* grow relatively quickly, though they have comparably low biomass, indicative of its pioneer status. It can cope with smothering of its leafage but may react poorly to long periods in highly turbid areas (Westphalen et al., 2005).
- Zostera
  - The *Zostera* genus, and in particular *Zostera capricorni* along the Queensland coast, is particularly widespread (Bearlin et al., 1999; Short, 2003). However, the *Zostera capricorni* seagrass along the Adelaide metropolitan coastline is poorly studied, and little is known. The morphology of the Adelaide population is highly variable - morphological differences of populations along the Adelaide coastline has been noted and there is an estuarine form (previously thought to be a different species) that is thought to have different physiochemical requirements to open water forms (Robertson, 1984) (Westphalen et al., 2005).
- Halophila
  - Within South Australia, several species from the Halophila genus are known to occur including *Halophilia australis* and *Halophilia ovalis.* Along the Adelaide coast, the only species thought to be present is *Halophilia australis* (Robertson, 1984; Westphalen et al., 2005). The species occurs over a large depth range but is generally found as sporadic components of other meadows (Tanner, 2020; Tanner & Theil, 2019a; Westphalen et al., 2005).
- Lepilaena
  - *Lepilaena* have a broad range of salinity tolerances and are often found in estuaries and hypersaline environments such as coastal lakes and saltmarshes that are not classified as marine (Robertson, 1984; Shepherd & Robertson, 1989). For this reason, they are often not classified as seagrasses. However, it is worth noting that *Lepilaena marina* has been reported at Port Gawler in the Gulf St Vincent where it is often associated with *Z. capricorni* in the intertidal zones (Robertson, 1984).
- Ruppia
  - Similar to *Lepilaena*, *Ruppia* are often not considered true seagrass as they can inhabit non-marine environments. Both species present within the Gulf (*Ruppia megacarpa, R. tuberosa*) are widespread and co-occur within *Zostera* in intertidal mangroves throughout Barker Inlet and to the north (Robertson, 1984; Westphalen et al., 2005).

2.3.3 DISTRIBUTION AND THREATS

GULF ST VINCENT

Seagrass meadows and stands cover an estimated 5000 km2 of the Gulf St Vincent bioregion. Within the Gulf St Vincent bioregion, seagrass beds and stands are more prevalent along intertidal areas on the eastern side of the gulf however seagrass meadows and stands are present along most of the coastlines (Baker, 2015). Seagrass meadows and stand coverage within the Northern Gulf St Vincent as of 2014 is shown in Figure 2-1.

Seagrasses found within the Gulf St Vincent are monitored along the Adelaide metropolitan coastline, and in the Yankalilla Bay and Light River, northern Gulf St Vincent (Clinton bio-unit), Yorke Peninsula (Orontes bio-unit), and Kangaroo Island (Nepean bio-unit) areas. Since the 2008 South Australian State of the Environment Report (EPA 2008), more detailed information about the extent and cover of seagrass has been obtained for the majority of the state's shallow coastal waters. The summary of the bioregional assessment of seagrass in the Gulf St Vincent from the 2023 EPA assessment with information from additional reports for relevant sub-regions is detailed below:

- Adelaide metropolitan coastline
  - Seagrass beds along the metropolitan coastline have been characterised by the loss of more than 5000 hectares of both *Amphibolis spp*. and *Posidonia spp*. in the nearshore waters and in several locations adjacent to wastewater discharges, as indicated in the Adelaide Coastal Water Quality Improvement Plan (EPA, 2013). The remaining seagrasses are fragmented, leaving them vulnerable to further degradation. The numerous discharges of nutrients and sediment into the coastal waters, and the high residence time of discharges in the nearshore waters, due to lack of mixing with deeper waters, are likely to continue to cause further loss of seagrass along this section of coastline. Over the 2009-2021 period, seagrass cover has increased following historical losses (e.g. at and between Grange and Glenelg) (Gaylard et al., 2013), are most likely due to investment in improved coastal water quality through reduced nutrient loads (DEW, 2023)
- Yankalilla Bay and Light River
  - Levels of epiphyte cover observed in Yankalilla Bay are low. Seagrass off the Light River delta is in very good condition and not affected by discharges from the Light River (EPA, 2013). Seagrass cover has remained stable between 2009 and 2021 (DEW, 2023)
  - Tanner (2020) conducted a survey off the Light River and Port Adelaide in 2020 to replicate surveys conducted in 2011 and 2014, respectively to assess changes in seagrass meadows. They found that the Light River had seen a small increase in seagrass cover and habitat condition accompanied by a decrease in epiphyte load, while off Port Adelaide seagrass cover increased from 56-64% with increase cover in ephemeral *Halophila* and the long-lived *Posidonia*.
- Northern Gulf St Vincent (Clinton bio-unit)
  - Seagrass meadows dominate the shallow, low-energy environment at the top of Gulf St Vincent and are subjected to large tides and limited water exchange. Overall, the sites were dominated by dense seagrass habitats consisting mainly of *Posidonia spp*. and *Amphibolis spp*., and the region was considered to be in very good condition (EPA, 2013). Seagrass cover has remained stable between 2009 and 2021 (DEW, 2023)
- Yorke Peninsula (Orontes bio-unit)
  - The low–wave energy environment of western Gulf St Vincent sustains large seagrass meadows between Ardrossan and Troubridge Island (EPA, 2013). Large parts of the region were under significant stress because of nutrient enrichment, particularly near small coastal developments such as Black Point and Wool Bay (EPA, 2013; Gaylard et al., 2013), however seagrass cover has remained stable between 2009 and 2021 (DEW, 2023)

- Tanner and Theil (2019b) assessed changes in the seagrass condition and cover in Yankalilla and Encounter Bays along Yourke Peninsula, comparing data taken from 2020 to that recorded in 2009 from Yankalilla Bay and 2011-2014 from Encounter Bay They found that there was no significant changes in seagrass habitat condition in Yankalilla Bay and however there was a decline in seagrass condition in Encounter Bay (Tanner & Theil, 2019b).

- Kangaroo Island (Nepean bio-unit)
  - The northern coast of Kangaroo Island is dominated by seagrass-filled embayments punctuated by rocky headlands (DEW, 2023; EPA, 2013). Seagrass cover in the Kangaroo Island region has decline over the 2009 to 2021 period. On Kangaroo Island the declining trend and poor condition was previously report by the Environment Protection Authority. Seagrass decline was consistent among all of the EPA monitoring sites within Nepean Bay between survey periods. Epiphytic algae reduced in cover between surveys, however is still an indication of elevated nutrients in freshwater flowing into Nepean Bay. Several sources of elevated nutrients and sediment were identified (agricultural runoff, wastewater treatment and urban runoff) each with associated management actions (Bryars et al., 2003; EPA, 2013; Gaylard, 2005; Gaylard et al., 2013).

ADELAIDE METROPOLITAN AREA

Seagrass distribution and health within the Gulf St Vincent along the Adelaide metropolitan coastline has received significant attention in recent decades with an estimated 6,200 ha of seagrass thought to have been lost since the 1940s (Tanner & Theil, 2019a; Westphalen et al., 2005). The majority of this loss (5,200 ha) occurred between 1949-2002, with a net loss of another 1,800 ha recorded in 2007 and a net gain of approximately 800 ha occurring up to 2013 (Cameron, 2003; Hart, 2013; Tanner & Theil, 2019a). Most of the seagrass loss occurred within shallow waters (<7 m deep) and seagrass then retreated seaward. The subsequent 'flow on' effects have been observed along the metropolitan coastline, with examples including changed wave climates which contributed to a die-off in mangroves and led to significant shoreline erosion, requiring remediation works and/or sand replenishment (Mifsud, 2004; Seddon et al., 2003; Tanner, 2020).

The primary causes of seagrass decline in Adelaide are poorly understood, particularly as research to investigate the cause began long after declines began and because the decline has occurred through losses on the inner edges of seagrass meadows (i.e. meadows have receded seaward) (Westphalen et al., 2005). This contradicts the usual pattern seen elsewhere in Australia in the world from eutrophication where seagrass would be lost from deeper waters first (Westphalen et al., 2005). The initial study to document seagrass loss indicated that increased turbidity was the cause (EWS, 1975), however subsequent surveys indicated that seagrass loss in the Adelaide metropolitan region was strongly linked to eutrophication caused by discharges from wastewater treatment and industrial plants and stormwater drains which led to overgrowth of seagrass by epiphytic algae that thrives as a result of anthropogenic inputs and the impact on turbidity from stormwater runoff was minimal (Bryars, 2008; Erftemeijer, 2014; Fox et al., 2007; Tanner, 2020; Tanner & Theil, 2019a). Initial losses have led to further losses through erosion and fragmentation of remaining meadows (Westphalen et al., 2005).

Seagrass loss along the Adelaide metropolitan coast was first reported in 1968 near the Patawalonga outlet and the Glenelg wastewater treatment plant outfall (Shepherd et al., 1989; Westphalen et al., 2005). Numerous reports following explored the scale and potential cause of the seagrass loss from 1949-2002, however most of the reports estimated seagrass loss based on irregularly obtained aerial imagery that largely ranged from Outer Harbour to Marino but as far south as Aldinga (Butler et al., 1997; Cameron, 2003; Hart, 1997; Shepherd et al., 1989; Steffensen et al., 1989; Westphalen et al., 2005). The seagrass loss between 1949-2002 was concentrated at a 1-2 km strip parallel to the shore of Holdfast Bay, with smaller areas around Port of Adelaide sludge outfalls, at a dredge spoil-dumping ground off Outer Harbour and between St Kilda to Port Gawler (Westphalen et al., 2005). Westphalen (2005) constructed a map showing historical changes in seagrass across the range, which is shown in Figure 2-2. Similarly, Bryars (2008) conducted historical reconstructions of *Amphibolis* and *Posidonia* ranges from Port Gawler to Marino prior to losses of the species beginning in the1930s. They found that there was a significant decline of both species associated with wastewater treatment sludge outfalls or stormwater outlets however, the decline was greater for *Amphibolis* than *Posidonia*. The modelled declines can be seen in Figure 2-3. A more recent study conducted by Fernandes et al. (2022) used Landsat imagery to investigate changes in seagrass cover across 501 km^{2-} of the Adelaide metropolitan coast from 1988-2018. The graphical abstract of their findings is displayed in Figure 2-4 and shows the area that they studied which is a subset of the area examined by Bryars (2008) and Westphalen et al. (2005). Overall, their study found that seagrass persistence in the area had increased from 48 to 69% in the mapped area from 1989 to 2017, with a net regrowth of some 11,000 ha of seagrasses since the early 2000s predominantly following the closure of sludge outfalls. Their study also saw that seagrass expansion occurred primarily in deeper waters (>10 m) of the central coast and at the seaward edge of the distribution and that recovery continued until 2011 assisted by a window of opportunity created by a decade-long drought and further reductions in nitrogen loads from wastewater treatment plants and industry but localized seagrass losses however continued to be observed as a result of either permanent or transient increases in suspended solids loads (Fernandes et al., 2022).

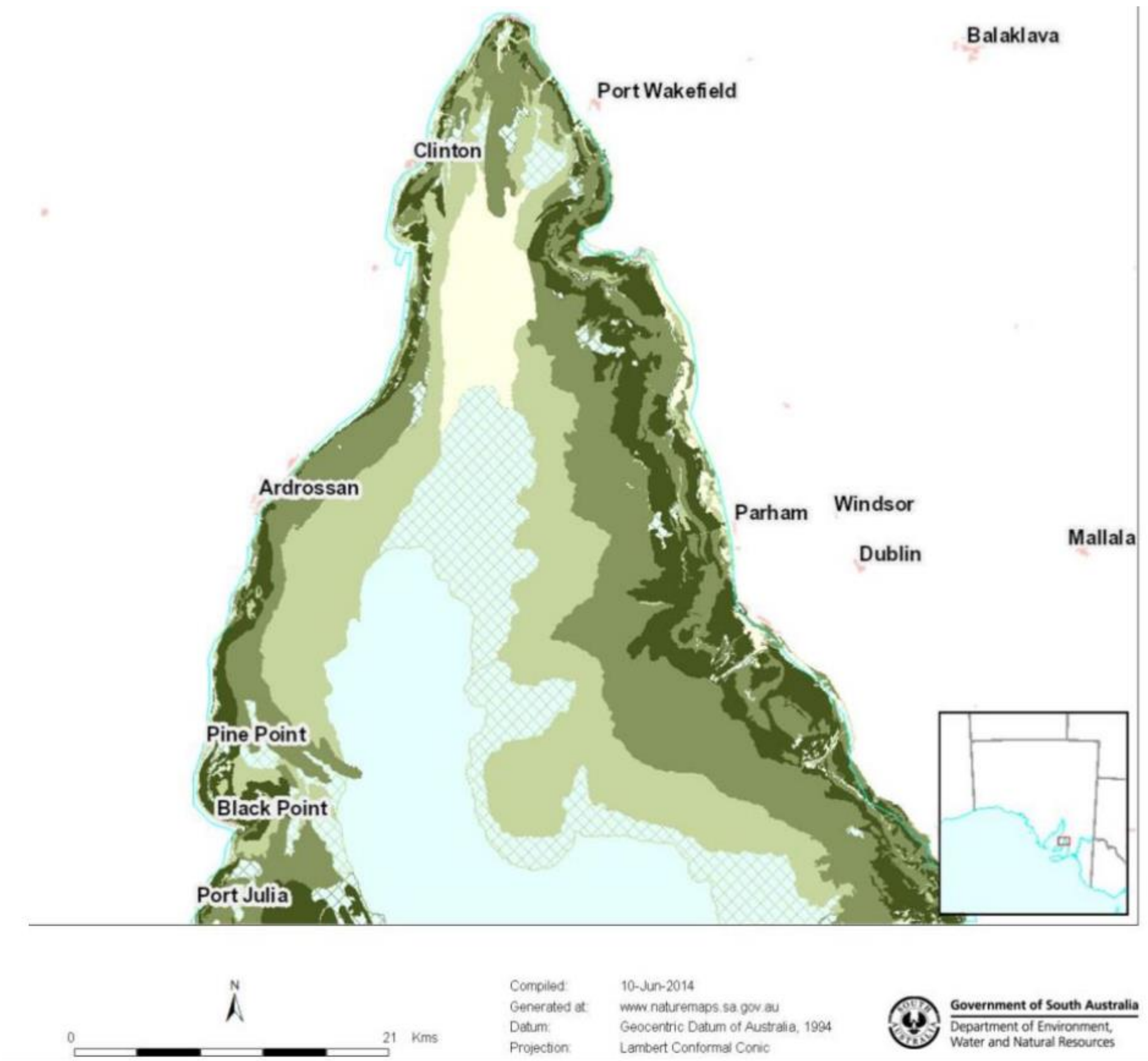

Figure 2-1 Seagrass coverage in the shallows of Northern Gulf St Vincent. Light, medium green and dark green shading indicate sparse, medium density and sense seagrass cover, respectively. Green hatch represents the same gradation in seagrass density according to colour but shows the location of seagrass patches as opposed to continuous stands. Sourced from Baker (2015).

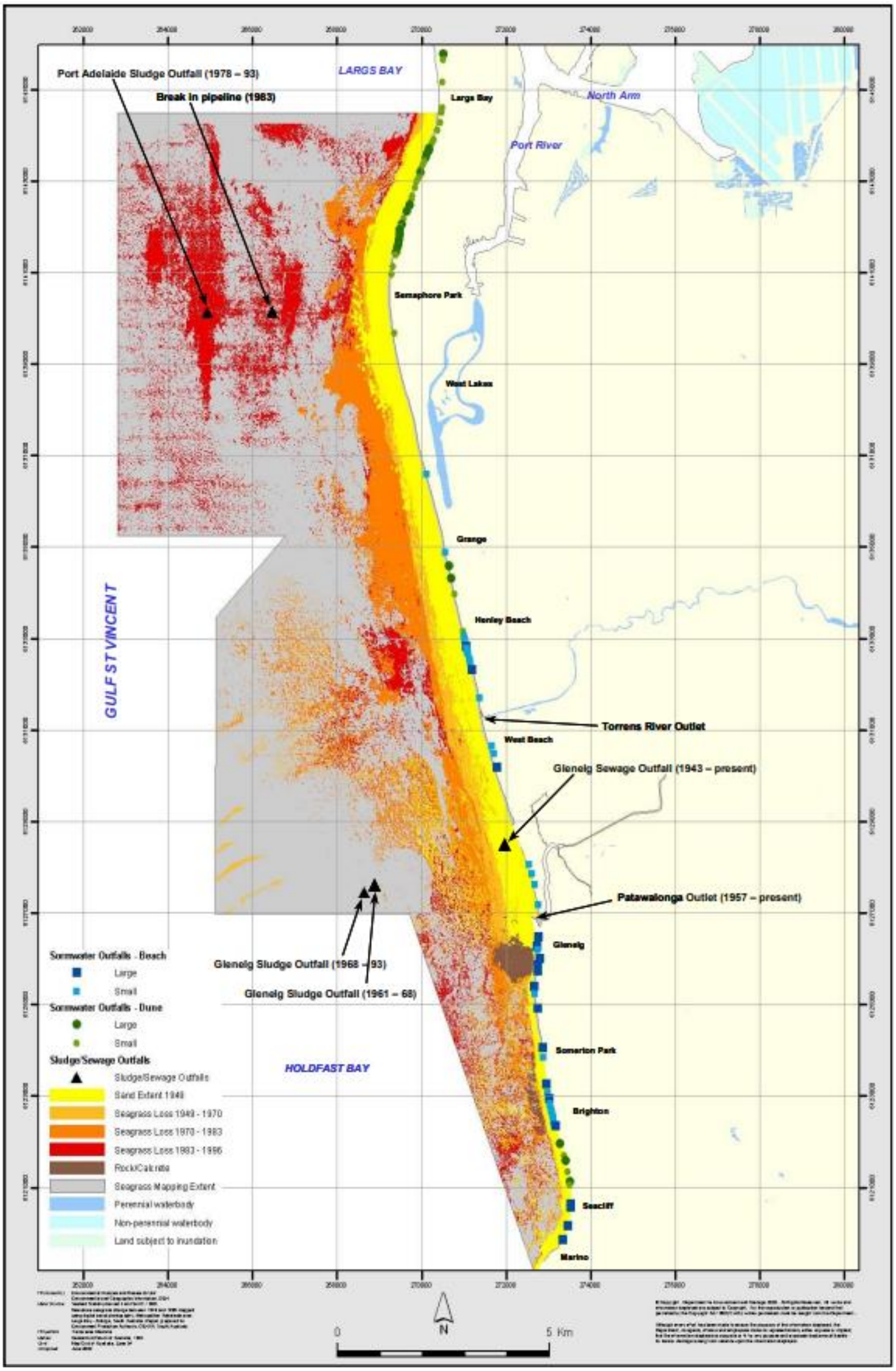

Figure 2-2 Map of the Adelaide metropolitan coast showing the accumulated loss of seagrasses from 1949 to 1996 between Largs Bay and Marino with the location of input sources identified. Sourced from Westphalen et al 2005 from Seddon (2002).

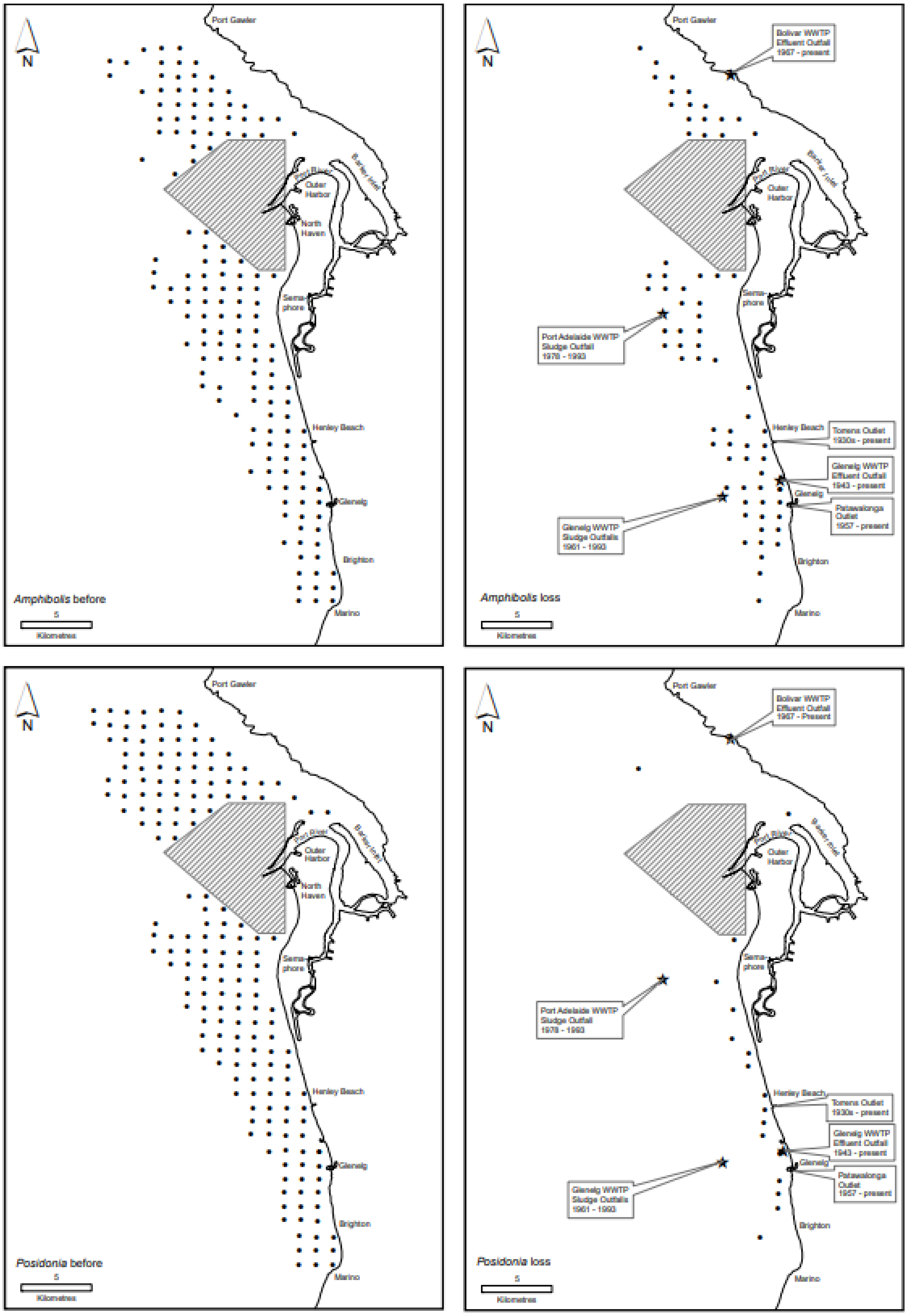

Figure 2-3 Historical distributions in the 1930s (before) and losses of *Amphibolis* and *Posidonia* since the 1930s in eastern Gulf St Vincent between Port Gawler and Marino, showing wastewater treatment plant (WWTP) outfalls and two of the major stormwater outlets in the area. Figure sourced from Bryars (2008).

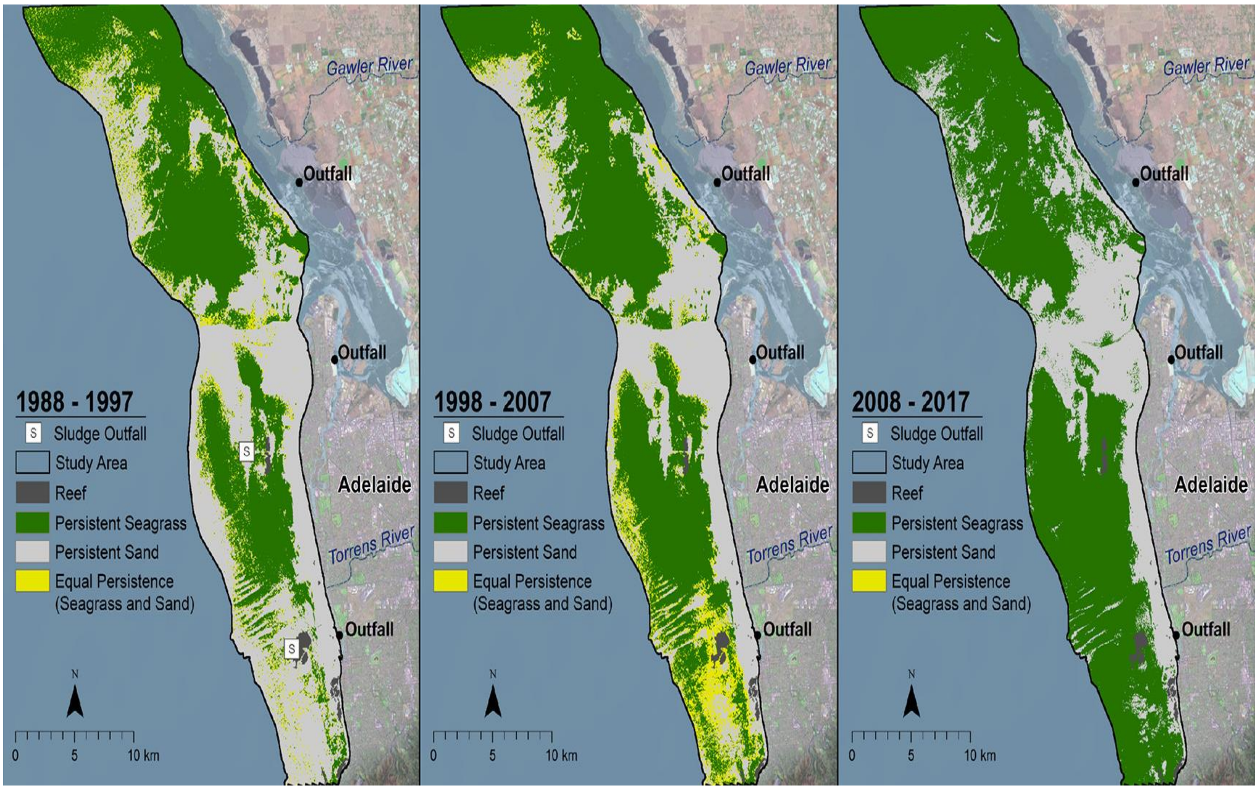

Figure 2-4 Large-scale seagrass change along Adelaide's metropolitan coastline over three decades. Sourced from Fernandes et al (2022)

Table 2-1 Seagrass species that are known to occur along the Adelaide metropolitan Coastline in the Gulf St Vincent, with notes on species biology and tolerances. Data sources from Erftemeijer (2014) and Westphalen et al (2005)

Species	Habitat	Sexes	Depth range (m)	Max length (cm)	Flowering and fruiting	Minimum light requirements (%SI)	Salinity (ppt)	Temp (°C)	Wave exposure	Low tide exposure (h/day)	Velocity (cm/sec)	Sediment
Posidonia sinuosa	Perennial - Rhizoids	Monoecious	0 - 15	120	Aug – Jan	4-24.7	<10	3-24, optimal 18-23	Grows at moderate wave exposure. Mean annual significant wave height approx. 1m.	0 (die if exposed)	NA	Fine to coarse sediments, Tolerates <10cm sedimentation (when 30% mortality recorded).
Posidonia australis	Perennial - Rhizoids	Monoecious	0 - 15	45	Oct – Dec	10	30-57	13-26, optimal 19-23	Able to withstand swell 1-1.5m	0 (die if exposed)	Withstands >25	Soft, sedimentary and sheltered environments. Reduced growth in more than 8 cm sedimentation.
Posidonia angustifolia	Perennial - Rhizoids	Monoecious	2 – 35	120	Nov – Feb	4-24.7	<10	14-20	NA	0 (die if exposed)	NA	Known to survive for at least four months following complete burial (60cm), only reduced growth
Posidonia coriacea	Perennial - Rhizoids	Monoecious	1 – 30	120	Dec	5-8	<50	14-20	Hydrodynamically active environment (high swell), more tolerant than other species in same genus	0 (die if exposed)	NA	NA, 4.5-8.5 erosion lead to loss of transplanted shoots
Amphibolis antarctica	Perennial - Lignified rhizoids	Dioecious	0 – 23	100	Flowers Sep – Feb Fruits Jul – Dec	5-24.7	35-57	10-26, optimal 23-26	Hydrodynamically active environment (high swell)	0 (die if exposed)	High flow	Occupies coarse sediments. Tolerates up to 10cm sedimentation.
Amphibolis griffithii	Perennial - Lignified rhizoids	Dioecious	0 – 40	100	Flowers Feb – Mar Fruits Sep – Feb	20	NA, assumed same as A. *antarctica*	13-23, optimal 23	Able to withstand swell 1-1.5m	0 (die if exposed)	Withstands >25	Sandy floors and sand covered rocks, gravel bottoms and compacted clay. Tolerates up to 10cm sedimentation
Heterozostera tasmanica	Perennial - Rhizoids	Monoecious	0 – 30+	85	Sep = Mar	0.7-24.7	15-38	5-40, optimal 30	Shallow, low wave areas	Can tolerate exposure at low tide	-	Optimal range 2.8-30.9% fines. Vulnerable to sedimentation coating leaves.
Zostera capricorni	Perennial - Rhizoids	Monoecious	Intertidal	60	Aug – Feb	16-36	10-40 (long term), 0-140 (short term)	10-33	NA	Able to tolerate 2-5 hour exposure.	<0.5 optimal, tolerates <0.5	Optimal range 0.5-72%, however remains sensitive to burial and sedimentation.

Species	Habitat	Sexes	Depth range (m)	Max length (cm)	Flowering and fruiting	Minimum light requirements (%SI)	Salinity (ppt)	Temp (°C)	Wave exposure	Low tide exposure (h/day)	Velocity (cm/sec)	Sediment
Halophila australis	Perennial - Stolons	Dioecious	0 – 23	7	Oct – Jan	NA (2.5-16 for Halophila species)	NA	14->30	Occurs in 2-3m waters, along side *Heterozostera* seagrass	NA	Mainly found in understory of Posidonia meadows	Occurs in finer silts and muds, associated with fine, soft sediments, coloniser of bare sand during dredging. Can not survive full burial.
Halophila ovalis	Perennial - Rhizoids	Dioecious	0 - 15	6	Aug-Apr	16	10-42	NA	2-3m wave height can dislodge seedlings	NA	NA	Occurs in finer silts and muds, associated with fine, soft sediments, coloniser of bare sand during dredging. Seen to tolerate up to 4cm burial
Lepilaena marina*	Annual – Rhizoids	Dioecious	Intertidal	10	Sep - Mar	NA						
Ruppia megacarpa*	Perennial - Rhizoids	Monoecious	0 - 2	25	Oct – Mar	NA						
Ruppia tuberos*	Annual or short-lived perennial – Rhizoids	Monoecious	0 - 1	10	Sep - Nov	NA						

*indicates taxa that are not considered true seagrasses and are typically found in hypersaline lakes and saltmarshes

3. METHODS

This SMP has been updated (12 September 2024) in response to queries from DEW and EPA. A snapshot of the data collected during the August surveys has been provided in Appendix B

3.1 SURVEY DESIGN

3.1.1 STUDY AREA

Seagrass communities adjacent to North Haven, West Beach and a control location at Tennyson along Adelaide's metropolitan coastline will be assessed. Figure 3-1 provides the approximate areas of Interest (AOIs) for each study area. However, it is understood the key survey area will be the fringing seagrass (100m-200m) and seagrass meadows, which are less than 5.0m CD water depth (e.g., yellow polygon) adjacent to both dredge areas (Figure 3-2).

3.1.2 DURATION AND FREQUENCY OF MONITORING

Surveys are to be conducted prior to, immediately after and one year post the initial survey. The initial seagrass surveys are expected to occur in the second week of August 2024, while the second survey depends on the completion of the dredging program, and the third survey is expected to occur over the same dates in August 2025 (or as close as possible) to limit seasonal impacts on seagrass meadows. Seagrass can be highly seasonal, with plants such as Posidonia, which is prevalent throughout the Gulf St Vincent, shedding their leaves annually in autumn and winter to reduce its energy demands during the cooler and shorter day length period (DES, 2018; Gaylardet al., 2020; McKenzie & Yoshida, 2023). Each survey is expected to be completed within a fortnight, which is within the two-week limit for replicate samples suggested by McKenzie et al. (2023).

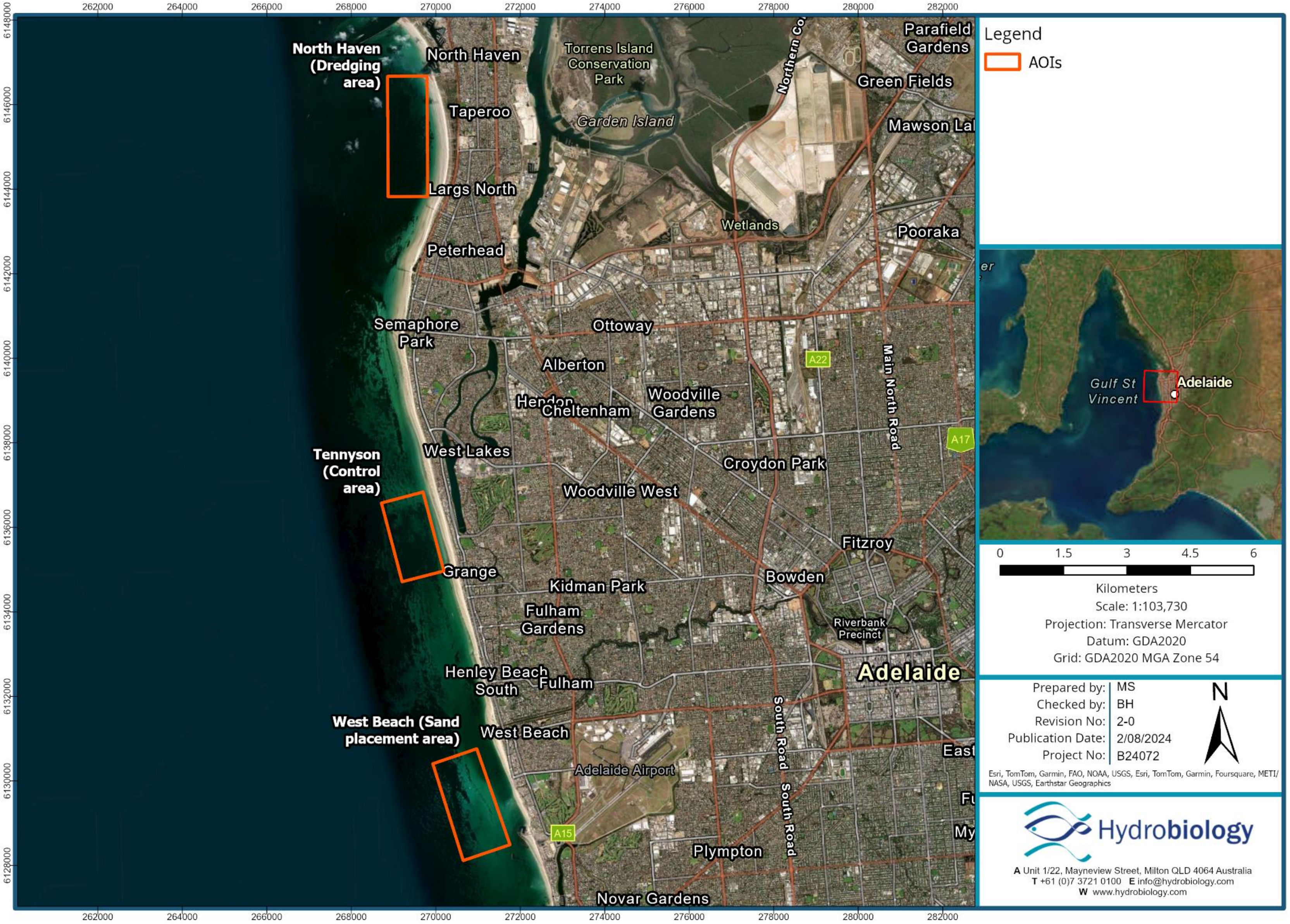

Figure 3-1 Location of AOIs

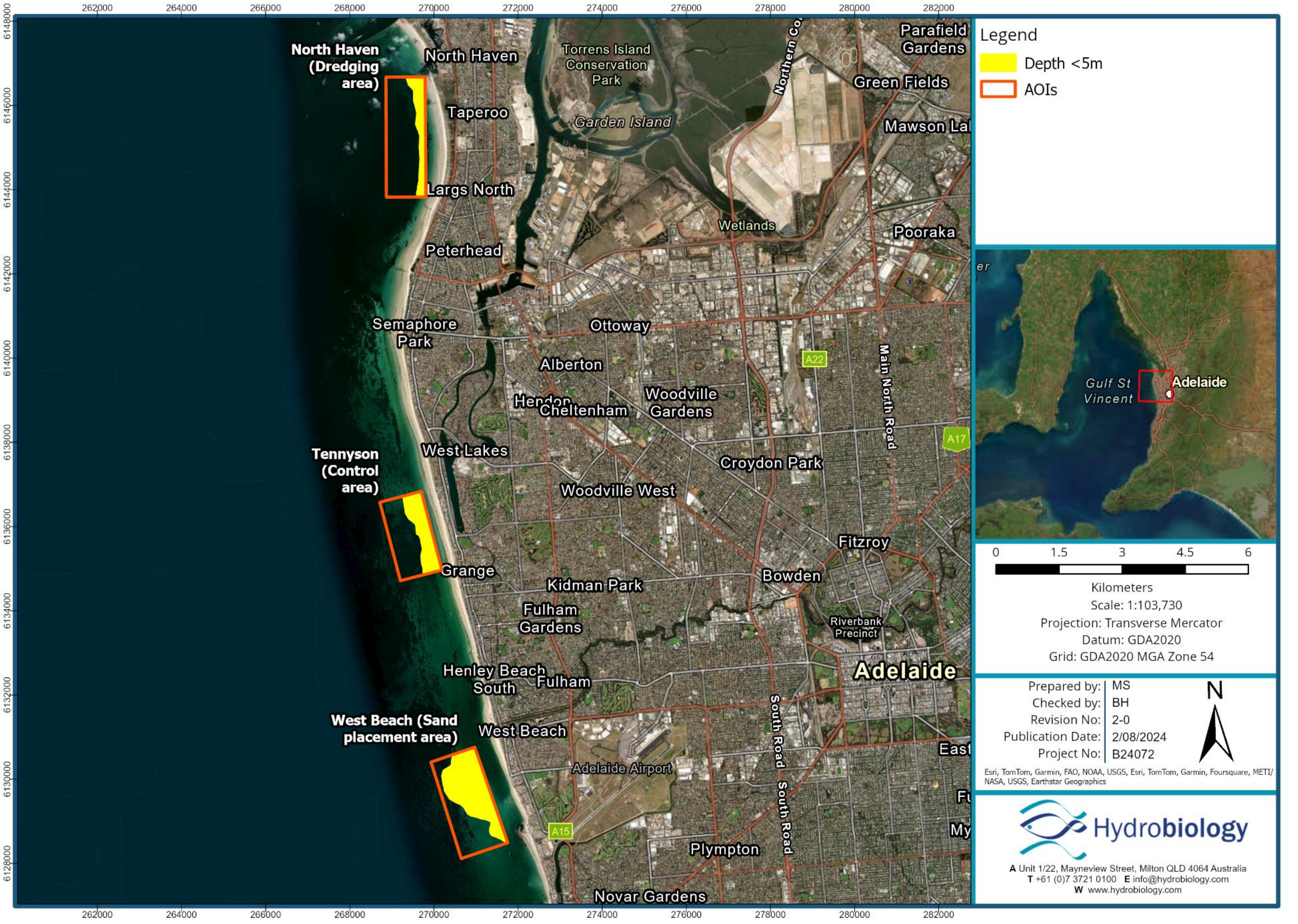

Figure 3-2 Focus areas within AOIs where depth <5m

3.2 MONITORING DESIGN

3.2.1 OVERVIEW

The following survey method will be adopted to establish the baseline presence and extent of subtidal marine seagrass within the AOIs, and the design has been developed in accordance with DES 2018, Irving (2009), and other relevant sources (Bremner et al., 2023; DES, 2018; McKenzie, 2003; McKenzie et al., 2015). The monitoring plan includes the following approaches:

- Seagrass mapping – seagrass distribution mapping of the AOIs (including the dredging footprint and the proposed beach nourishment area),
- Towed camera transect surveys – seagrass percentage cover and species cover
- Seagrass health – seagrass morphology survey.

3.2.2 SEAGRASS MAPPING

PRELIMINARY MAPPING

The distribution and area coverage of seagrass meadow boundaries will initially be mapped using recent high-resolution aerial imagery from Nearmap (e.g., captured May 2024 and ensuring a resolution of at least 1m per pixel), aerial imagery provided by the University of Adelaide (if available at the time) and previously prepared spatial data for seagrass within the area. Aerial imagery will be loaded into ArcGIS, and seagrass boundaries will be digitised, creating a separate polygon for each distinct seagrass meadow.

FIELD VALIDATION SURVEY

Ground-truthing of the preliminary seagrass meadow boundaries will involve a combination of towed camera transects through the AOIs and /or van Veen Grab. This includes transects previously mapped by Tanner (2020). The towed camera will be towed within 1m of the seabed and positioned so that imagery will be provided from directly under the vessel or within 2m of the stern of the survey vessel. Data will be collected from a series of transect lines (Table 2) that run perpendicular to the shore, with each line running towards the inshore region to the shallowest point the vessel can operate (generally 1m LAT) (refer to Figure 3-3 to Figure 3-5). These figures encompass seagrass coverage and genus distribution (e.g., Posidonia and Amphibolis) along the Adelaide metropolitan coastline, as determined by hyperspectral imagery from Clark et al. (2021). Realtime GPS location will be overlaid on the footage. In the field, seagrass species composition and percentage cover will be estimated visually, following the methods described by McKenzie (2003) and substrate type along each transect will be observed.

Within the North Haven AOI, two transects have been deliberately aligned with those of Tanner (2020) to enable potential future data mining (they were surveyed using comparable methods in 2014 and 2020).

Table 2 Proposed number of continuous towed camera transect lines per AOIs

Area of Interest	Number of Transect Lines	Number of Sampling locations
North Haven	15	153
Tennyson	10	101
West Beach	12	150

DATA ANALYSIS

The extent and composition of seagrass meadows will be mapped using GIS analysis techniques, incorporating field-validated data and high-resolution aerial imagery for each AOI. The dataset depicting the distribution and extent of seagrass and non-seagrass habitats will be created from interpolated point observations collected for each AOI. Each point was assigned a habitat type value (seagrass or non-seagrass), and seagrass habitats will be assigned a percentage cover (Low, Medium, High). Randomly selected images from the dataset will be selected and uploaded into Coral Point Count software for analysis of percentage cover and species composition. Polygon data will then be interpolated by distance, with spatially associated points forming distinct patches of habitat and density.

3.2.3 BROADSCALE TRANSECT SURVEY

A detailed analysis of seagrass communities will be conducted using continuous towed camera footage captured within each AOI. Details of the towed camera transects are described in Section 3.2.2 and the full extent of the data captured during the baseline survey is presented in Appendix B.

The imagery captured will provide quantitative data on seagrass percentage cover and support statistical assessments. At 100m intervals along each transect, images will be extracted and analysed for seagrass cover and species composition. A subset of these images from each point will be randomly selected and processed using Coral Point Count software.

In Coral Point Count, five random points will be overlaid on each image. For each point, the seagrass type (e.g., Posidonia) and percentage cover will be recorded. Statistical analysis will then be conducted using the PRIMER software package. A Permutational ANOVA (PERMANOVA) will be used to assess whether significant variation exists in seagrass meadows across AOIs, between different treatments, and over time.

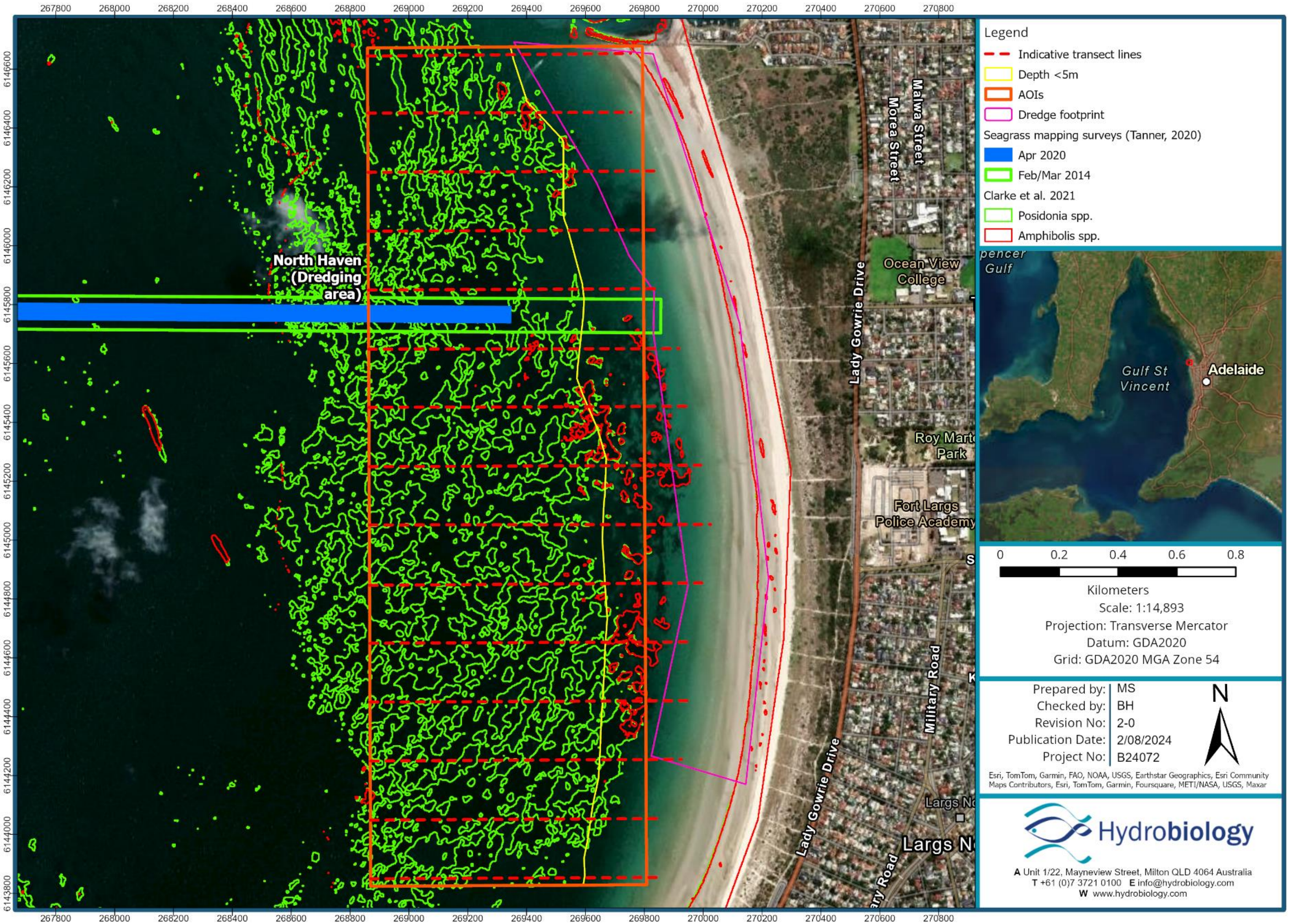

Figure 3-3 Seagrass points and transects used to map the distribution of seagrass at North Haven Dredge Area

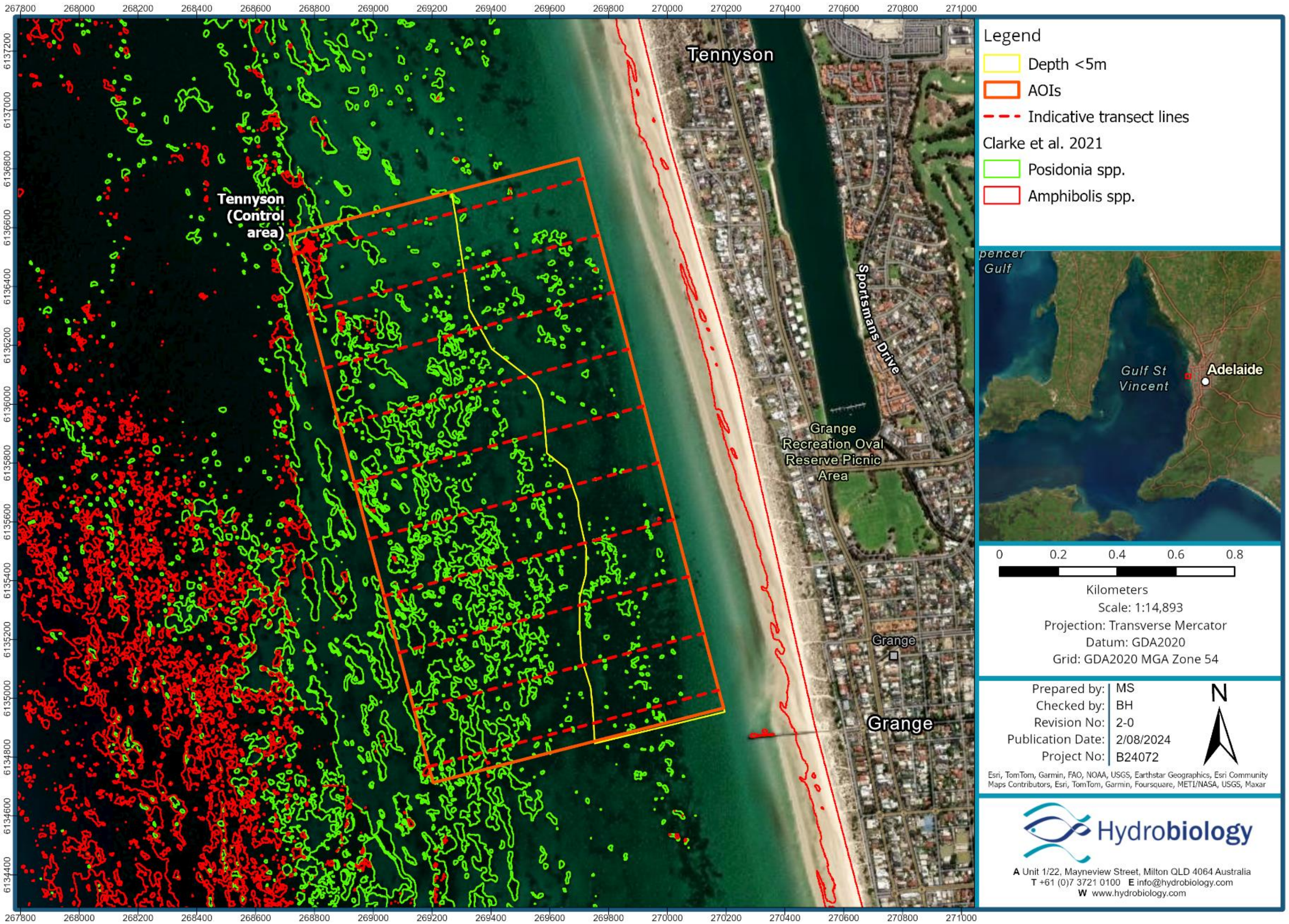

Figure 3-4 Seagrass points and transects used to map the distribution of seagrass at Tennyson – Control area

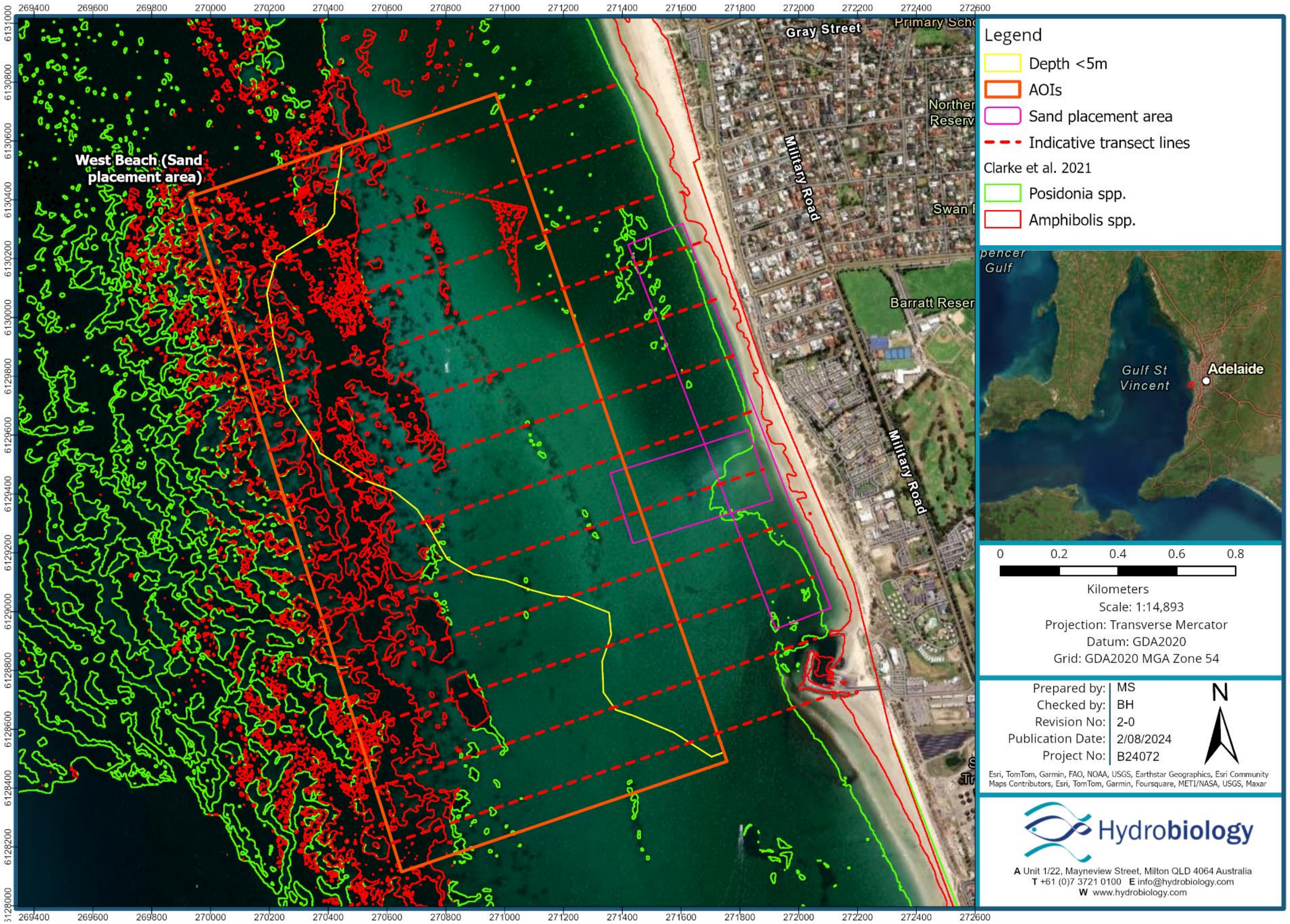

Figure 3-5 Seagrass points and transects used to map the distribution of seagrass at West Beach

3.2.4 DETAILED TRANSECTS

To determine seagrass condition, measures of seagrass cover and morphology data will be collected along a series of transects that will be established during the baseline monitoring survey. These transects will be randomly positioned across each AOI. Our approach is a modified version of Irving (2009) using a towed camera and harvesting seagrass samplings using a grab sampler rather than divers.

TOWED TRANSECTS

The following variables will be assessed within each transect.

- Area;
- Continuity;
- Proximity;
- Percentage cover;
- Species composition;
- Biomass;
- Shoot density;
- Leaf density;
- Leaf length; and;
- Biomass of epibiota.

The first five of the aforementioned points will be used for the calculation of an integrated habitat structure index H’ as per Irving (2009) Note that the first six parameters will be collected at a minimum, with the remaining parameters to be collected where possible. The following section below details how these values will be calculated, utilised, and analysed.

A total of five 1m x 50 m transects will be established in each AOI. Each transect will be assessed using a towed camera operated as low as feasibly possible to the seafloor (approximately 1.0m) and the camera pointed at 90° (i.e. pointing down at the seabed). In each 1 m^2 of the 50 m transects, the seagrass genus and the percentage covered by each genus will be assessed using imagery collected from the camera.

Furthermore, five seagrass samples along each transect will be collected using a 5L van Veen grab to collect seagrass samples. Grab samples are to be placed in a tray, all shoots are cut to their base (at sediment level), and leaves and epibiota remain attached. The above sediment growth is to be kept, and the remaining content of the grab sample is disposed of. All samples will be kept separate.

DATA PROCESSING

Following field sampling, seagrass samples are to be processed, and seagrass area, continuity, proximity, percentage cover and species composition data collected in the field will be used to calculate a habitat structure index value (H’).

Calculation of Habitat Structure Index

The calculation of the H’ value allows for the complexity of the five distinct habitat variables (seagrass area, continuity, proximity, percentage cover and species composition) while providing a simple, meaningful value that allows for direct comparison between sites. The calculated H’ value will be on a scale from 0-100 (0 and 100 indicating poor and excellent seagrass habitat structure, respectively). Calculation of H’ relies on the seagrass area, continuity, proximity, percentage cover and species composition data collected within the 50m transects. Each of these variables relies on the seagrass identity and percentage cover data collected from the transects, which will be calculated using the 1 m^2 quadrat imagery taken by the towed cameras.

To obtain seagrass identity and percent cover, an image from approximately every 1m will be imported into Coral Point Count software (or similar). Within the software, a digital photo-quadrat (1 x 1m) will be created, and percent cover calculations will be made for seagrass, sediment, and epiphytic cover based on a random overlay of points.

The habitat values, how they are calculated and how they are incorporated to calculate H' are designed by Irving (2009) and are described below.

- Area
  - Area (A) is the total amount of seagrass sampled within the transect
  - Calculated as A=(A*obs*/A*max*) * 100, where A*obs* is the observed total area of seagrass habitat sampled within the transect and A*max* is the maximum possible area of seagrass to sample (correlates to transect length)
- Continuity
  - Continuity (C) is the number of patches of seagrass in a transect
  - Calculates as C=[(C*max* - C*obs*) / (C*max* - C*min*)] * 100, where C*max* is the total number of 1m^2 quadrats with seagrass in them (regardless of abundance), C*obs* is the observed number of seagrass patches within a transect and C*min* is the minimum possible number of patches of seagrass (ie C*min* = 1)
- Proximity
  - Proximity (P) is the distance between patches of seagrass within the transect
  - Calculated as P= [(P*max*-P*obs*) / (P*max* – P*min*)] * 100, where P*max* is the minimum possible distance between a single patch of seagrass and another patch or the end of a transect (ie length of transect (m) – 1), P*obs* id the sum of the observed smallest ad largest distance between patches and P*min* is the minimum possible distance between two patches of seagrass or between a patch of seagrass and the end of the transect (ie P*min*=1 m)
- Percentage Cover
  - Percentage cover (K) is the averaged percentage cover of seagrass within the transect
  - Calculated as K= (K*obs*/K*max*) * 100, where K*obs* is the observed integrated cover value of the seagrass sampled within the transect and K*max* is the maximum possible cover value of the transect
- Species Identity
  - Species Identity (S) is the average value of species present in the transect
  - Calculated as S= (S*obs*/S*max*) * 100, where S*obs* is the observed integrated species value of the seagrass sampled within the transect and S*max* is the maximum possible species value of the transect
- Habitat Structure Index Value
  - Once the above values are known, the raw habitat structure index value (H) is calculated using the equation:

$$H = \sqrt{(A^2 + C^2 + P^2 + K^2 + S^2)}$$

  - H' is then calculated by apply a scaler value to H. The scaler value is calculated by diving 100 by the H value of a transect of a perfect structure (ie where each of the five variables is at the highest possible value). Therefore,

$$H' = H * (scaler\ value)$$

Processing of Seagrass Samples

Seagrass samples will be assessed in the laboratory. The variables to be sampled where possible are:

- Shoot density – the number of shoots in each sample
- Leaf density – the number of leaves in each sample
- Leaf length – the length of 5 representative leaves in each sample
- Epibiotic biomass – the dry weight of all epibiota present in each sample. Epibiota can be collected by scraping off epibiota off leaves carefully (to not reduce seagrass biomass) with a scalpel.
- Seagrass biomass – the dry weight of all seagrass in each sample after epibiota has been removed.

The dry weight value for the epibiota and seagrass samples can be found by oven-drying the leaves (70° for 48 hours).

DATA ANALYSIS

- Total areas of seagrass at each location will be presented in tables and maps for each survey period and overtime.
- Percent cover of total seagrass and seagrass species within each location will be presented in maps.
- The data collected for the habitat and biological variables listed 0 will be analysed using non-parametric, multi-dimensional scaling (nMDS), based on Bray-Curtis similarity matrices, which graphically presents the habitat complexity and biological indicators of each transect in a two-dimensional space. Permutational ANOVA (PERMANOVA) based on Bray-Curtis distance matrices will then be used to determine if there are a significant variation between the seagrass meadows between sites, treatments and over time
- Present calculate seagrass habitat structure index (H') values for each transect.

3.3 REPORTING

A technical report will be prepared following the completion of the dredging activities that provides the results from the pre- and post-surveys. A separate report will be provided for the 12-month post-dredge survey. Both reports will include an executive summary, introduction, scope, detailed methods, results, discussion and conclusion. The initial report will only report results immediately prior and following the dredging while the second report will include a summary of those results and a comparison of seagrass meadows health and range one year post the initial survey.

4. REFERENCES

Baker, J. L. (2015). Marine Assets of Yorke Peninsula. In *Volume 2 of report for Natural Resources - Northern and Yourke, South Australia*. Volume.

Bearlin, A. R., Burgman, M. A., & Regan, H. M. (1999). A stochastic model for seagrass (Zostera muelleri) in Port Phillip Bay, Victoria, Australia. *Ecological Modelling*, *118*(2–3), 131–148.

Bryars, S. (2008). Restoration of Coastal Seagrass Ecosystems: Amphibolis antarctica in Gulf St Vincent, South Australia. *Adelaide: South Australian Research and Development Institute*.

Bryars, S., Neverauskas, V., Brown, P., Gilliland, J., Gray, L., & Halliday, L. (2003). Degraded seagrass meadows and evidence of eutrophication in Western Cove, Kangaroo Island. *Primary Industries and Resources South Australia, Adelaide*.

Butler, A., Heinemann, D., Jernakoff, P., Kirkman, H., Loneragan, N., Parslow, J., Sherwood, C. R., Volkman, J. K., & Walker, S. (1997). *Adelaide Coastal Waters Study Scoping Report*.

Cambridge, M. L., & Hocking, P. J. (1997). Annual primary production and nutrient dynamics of the seagrasses Posidonia sinuosa and Posidonia australis in south-western Australia. *Aquatic Botany*, *59*(3–4), 277–295.

Cameron, J. (2003). Near-shore seagrass change between 1995/6 and 2002 mapped using digital aerial orthophotography, metropolitan Adelaide area. *North Haven-Sellicks Beach, South Australia*, *21*.

Cingano, P., Vuerich, M., Petruzzellis, F., Orzan, L., Trotta, G., Casolo, V., Asquini, E., Bacaro, G., & Boscutti, F. (2024). Seagrasses on the move: Tracing the multi-decadal species distribution trends in lagoon meadows using Landsat imagery. *Ecological Informatics*, 102685.

Clarke, K., Hennessy, A., McGrath, A., Daly, R., Gayland, S. Tuner, A., Cameron, J., Lewis, M. and Fernandes, M. (2021). Using hyperspectral imagery to investigate large-scale seagrass cover and genus distribution in a temperate coast. Sci Rep 11, 4182 (2021). https://doi.org/10.1038/s41598-021-83728-6

Clarke, S. M., & Kirkman, H. (1989). Seagrass dynamics. *Biology of Seagrasses*, *2*, 610–634.

Davison, I. R., & Pearson, G. A. (1996). Stress tolerance in intertidal seaweeds. *Journal of Phycology*, *32*(2), 197–211.

DES. (2018). *Monitoring and Sampling Manual: Environmental Protection (Water) Policy* (2nd ed.). Department of Environment and Science.

DEW. (2023). Technical information supporting the 2023 Seagrass: cover within sampling sites environmental trend and condition report card. *Department for Environment and Water Technical Note 2023/39*.

Duarte, C. M., Marbà, N., & Santos, R. (2004). What may cause loss of seagrasses. *European Seagrasses: An Introduction to Monitoring and Management*, *24*.

Dunic, J. C., Brown, C. J., Connolly, R. M., Turschwell, M. P., & Côté, I. M. (2021). Long-term declines and recovery of meadow area across the world's seagrass bioregions. *Global Change Biology*, *27*(17), 4096–4109.

EPA. (2013). State of the Environment Report, South Australia. *State of the Environment Report Prepared by the Environment Protection Authority*.

Erftemeijer, P. (2014). Seagrass Habitat Model. *Adelaide's Coastal Waters. Literature Review of Habitat Requirements of Seagrasses in Adelaide's Coastal Waters. Jacobs SKM, Perth, Western Australia*.

EWS. (1975). Gulf St Vincent water pollution studies 1972-1975. EWS 75/14. *Engineering and Water Supply Department, Adelaide, South Australia*.

Fernandes, M. B., Hennessy, A., Law, W. B., Daly, R., Gaylard, S., Lewis, M., & Clarke, K. (2022). Landsat historical records reveal large-scale dynamics and enduring recovery of seagrasses in an impacted seascape. *Science of The Total Environment*, *813*, 152646. https://doi.org/https://doi.org/10.1016/j.scitotenv.2021.152646

Fonseca, M. S., & Kenworthy, W. J. (1987). Effects of current on photosynthesis and distribution of seagrasses. *Aquatic Botany*, *27*(1), 59–78.

Fox, D. R., Batley, G. E., Blackburn, D., Bone, Y., Bryars, S., Cheshire, A., Collings, G., Ellis, D., Fairweather, P., Fallowfield, H., Harris, G., Henderson, B., Kämpf, J., Nayar, S., Pattiaratchi, C., Petrusevics, P., Townsend, M., Westphalen, G., & Wilkinson, J. (2007). Final Report, Summary of Study Findings. *The Adelaide Coastal Waters Study Prepared for South Australian Environment Protection Authority*, *1*.

Gaylard, S. (2005). Ambient water quality monitoring: Nepean Bay, Kangaroo Island. *Report 1: 1999–2004, Environment Protection Authority, Adelaide*.

Gaylard, S., Nelson, M., & Noble, N. (2013). The South Australian monitoring, reporting and evaluation program for aquatic ecosystems: rationale and methods for the assessment of nearshore marine waters,. *Environment Protection Authority, Adelaide*.

Gaylard, S., Nelson, M., & Noble, W. (2020). Outer Harbor channel widening dredging. Seagrass condition assessment. *Environmental Protection Authority (EPA)*.

Greve, T. M., & Binzer, T. (2004). Which factors regulate seagrass growth and distribution. *European Seagrasses: An Introduction to Monitoring and Management*, 19–23.

Hart, D. (1997). Near-shore seagrass change between 1949 and 1996 mapped using digital aerial orthophotography, metropolitan Adelaide area, Largs Bay-Aldinga, South Australia. *Report to Environmental Protection Authority, Department of Environment and Natural Resources (DENR) and SA Water, South Australia. DENR, Adelaide*.

Hart, D. (2013). Seagrass extent change 2007–13-Adelaide coastal waters. *Department of Environment, Water and Natural Resources, Adelaide*.

Hemminga, M. A. (1998). The root/rhizome system of seagrasses: an asset and a burden. *Journal of Sea Research*, *39*(3–4), 183–196.

Hemminga, M. A., & Duarte, C. M. (2000). *Seagrass ecology*. Cambridge University Press.

Hillman, K., Walker, D. I., Larkum, A. W. D., & McComb, A. J. (1989). Productivity and nutrient limitation. In *Biology of seagrasses: a treatise on the biology of seagrasses with special reference to the Australian region* (pp. 635–685). Elsevier Science Pub.

Larkum, A. W. D., Orth, R. J., Duarte, C. M., Koch, E. W., Ackerman, J. D., Verduin, J., & Keulen, M. van. (2006). Fluid dynamics in seagrass ecology—from molecules to ecosystems. *Seagrasses: Biology, Ecologyand Conservation*, 193–225.

Marba, N., & Duarte, C. M. (1994). Growth response of the seagrass Cymodocea nodosa to experimental burial and erosion. *Marine Ecology Progress Series. Oldendorf*, *107*(3), 307–311.

McDowell, L. M., Green, D., & Griffante, D. (2009). Adelaide Coastal Waters Information Sheet No. 1. *Fact Sheets on Adelaide Coastal Waters and the Findings of the Adelaide Coastal Waters Study (ACWS)*.

McKenzie, L. J., (2023). Draft guidelines for the rapid assessment of seagrass habitats in the western Pacific (QFS, NFC, Cairns)

McKenzie, L. J., & Yoshida, R. L. (2023). *Seagrass-Watch: Quick guide to monitoring Seagrass Resources*.

McMillan, C. (1984). The distribution of tropical seagrasses with relation to their tolerance of high temperatures. *Aquatic Botany*, *19*(3–4), 369–379.

McRoy, C. P., & Helfferich, C. (1977). Seagrass ecosystems. A scientific perspective. *Marine Science (USA). v. 4.*

Mifsud, J. (2004). *Section Bank, Outer Harbour, South Australia : baseline monitoring program to assess the potential impacts on seagrass and mangrove communities from the proposed sand dredging* (Joe Mifsurd (et al.), Ed.). Dept. for Environment and Heritage.

Mtwana Nordlund, L., Koch, E. W., Barbier, E. B., & Creed, J. C. (2016). Seagrass ecosystem services and their variability across genera and geographical regions. *Plos One*, *11*(10), e0163091.

Robertson, E. L. (1984). Seagrasses. *The Marine Benthic Flora of Southern Australia. Part I*.

Irving, A. D. (2009). Development of methods for the evaluation and monitoring of seagrass habitat structure. *Report Prepared by South Australian Research and Development Institute for the Coastal Management Branch of the Department for the Environment and Heritage SA and the Adelaide and Mount Lofty Natural Resources Management Board.*, *383*.

Scoffin, T. P. (1970). The trapping and binding of subtidal carbonate sediments by marine vegetation in Bimini Lagoon, Bahamas. *Journal of Sedimentary Research*, *40*(1).

Seddon, S., Miller, D., Fotheringham, D., Burgess, S., & McKechnie, J. (2003). Beachport seagrass loss and links with Drain M in the Wattle Range Catchment. *Prepared for the Coast Protection Board, Department for Environment and Heritage and the Environment Protection Authority. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. Publication No. RD03/0190*.

Shepherd, S. A., McComb, A. J., Bulthuis, D. A., Neverauskas, V. P., Steffensen, D. A., & West, R. (1989). *Decline of seagrasses* (A. W. D. Larkum, A. J. McComb, & S. A. Shepherd, Eds.). Elsevier.

Shepherd, S. A., & Robertson, E. L. (1989). Regional studies—seagrasses of South Australia, Western Victoria and Bass Strait. *Biology of Seagrasses: A Treatise on the Biology of Seagrasses with Special References to the Australian Region*, 211–229.

Short, F. T. (2003). *World atlas of seagrasses*. Univ of California Press.

Steffensen, D. A., Kirkegaard, I., & Johnson, J. (1989). *Position and background papers on man-made changes to Gulf St Vincent*.

Tanner, J. E. (2020). Seagrass Condition Monitoring: Light River and Port Adelaide 2020. *SARDI Research Report Series. Final Report Prepared for the Adelaide and Mount Lofty Ranges Natural Resources Managagment Board.*

Tanner, J. E., & Theil, M. J. (2019a). Adelaide Seagrass Rehabilitation Project: 2017 - 2019. *Final Report Prepared for the Adelaide and Moubt Lofty Ranges Natural Resources Management Board. South Australian Research and Development Institute (Aquatic Sciences), Adeliade. SARDI Research Report Series*, *125*, 1–77.

Tanner, J. E., & Theil, M. J. (2019b). Seagrass Condition Monitoring: Fleurieu Peninsula 2019. *Final Report Prepared for the Adelaide and Mount Lofty Rangers Natural Resources Management Board. South Australian Research and Development Institute (Aquatic Sciences), Adelaide.*, *1024*, 1–20.

Waycott, M., Duarte, C. M., Carruthers, T. J. B., Orth, R. J., Dennison, W. C., Olyarnik, S., Calladine, A., Fourqurean, J. W., Heck, K. L., Hughes, A. R., Kendrick, G. A., Kenworthy, W. J., Short, F. T., & Williams, S. L. (2009). Accelerating loss of seagrasses across the globe threatens coastal ecosystems. *Proceedings of the National Academy of Sciences*, *106*(30), 12377–12381. https://doi.org/10.1073/pnas.0905620106

Westphalen, G., Collings, G., Wear, R., Fernandes, M., Bryars, S., & Cheshire, A. (2005). ACWS Technical Report No. 2 prepared for the Adelaide Coastal Waters Study Steering Committee. *South Australian Research and Development Institute (Aquatic Sciences) Publication No. RD04/0073, Adelaide*.

APPENDIX A.

DRONE-BASED SEAGRASS MONITORING METHODOLOGY – UNIVERSITY OF ADELAIDE

Proposal: Drone-based seagrass monitoring for Adelaide Metropolitan Coast dredging trial

Prepared for: South Australian Department of Environment and Water

by the Uncrewed Research Aircraft Facility at
The University of Adelaide

make history.

Background

The South Australian Department of Environment and Water (DEW) have committed to a sand dredging trial along the Adelaide metropolitan coastline. Below entails the response from the Uncrewed Research Aircraft Facility (URAF) to the request from Swash PD, on behalf of DEW, to deliver a proposal for monitoring seagrass within key areas utilising an established protocol employing high-resolution drone imagery capture and analysis techniques.

The URAF at The University of Adelaide is one of Australia's leading University-based drone operation, research, and training facilities. The URAF performs, facilitates and supports a wide range of drone-related research, development, and training both domestically and internationally. The facility works alongside researchers, students, natural resource managers, industry partners, and government bodies to provide research and consultancy services, and customised training solutions.

The URAF team are deeply involved in advancing the uptake of drones in environmental monitoring using a blend of aircraft, sensors, and processing techniques, and hold unique expertise in employing novel approaches to extract meaningful information from data. The URAF have been working in partnership with SA Water since 2020 to establish a robust monitoring methodology for seagrass cover dynamics along the Adelaide metropolitan coastline, and continue this work to perform annual monitoring of key areas of change, enhancing their significant experience and expertise in the area of this proposal.

Approach

Methodology

The monitoring approach will follow an established method developed by the URAF in partnership with SA Water, which has been used consistently since 2022, to inform management practices. It utilises modern drone technology with high accuracy real-time kinematic (RTK) positioning systems to provide high-accuracy spatio-temporal monitoring of seagrass along the Adelaide Metropolitan Coast.

The data collection process will involve the acquisition of a set of several thousand RGB images at each of the three targeted monitoring sites which may be impacted by dredging works along the metropolitan coast. Drone imagery will be collected from a boat, with SA Water staff assisting with boat operations for data collection. For each monitoring site, the imagery will be processed through photogrammetry software to produce very-high-resolution orthorectified maps which are used to identify seagrass cover at a significantly finer-scale than alternative methods, such as satellite imagery. From these maps, a thresholding classification approach will be used to produce classified cover maps of each site, indicating areas of bare and seagrass cover respectively. A metric of drone classification success will be provided to comment on the overall accuracy in benthic cover estimates derived from the classified output.

The collection of data and production of orthorectified maps and relevant outputs will be fulfilled on three occasions: July 2024, pre-trial; November 2024, short-term post-trial; and November 2025, one-year post-trial. Following data collection in November 2024 and 2025, change detection analysis will be performed to produce maps which highlight changes in benthic cover between time points both visually and quantitatively.

RGB imagery is being utilised over multispectral or hyperspectral analysis based on the maturity of the technology, as well as previous success in identifying seagrass cover, and the reduced sensitivity of image quality with respect to environmental conditions such as lighting and sea-state.

An identified set of environmental conditions ideal for image capture associated with the established methodology have been outlined. Noting that the conditions typical for the scheduled first time point do not align with these optimal conditions, we will utilise the best conditions available within the timeframe to deliver the best quality data outputs possible within these restraints.

Site Details

We propose to image a 50-hectare plot at each of the three sites as a representative area of coverage to detect any potential changes to seagrass cover. 50 hectares is an optimal size for imaging within consistent environmental conditions to ensure that changes in lighting and weather over time do not confound mapping products. Additionally, as the July 2024 imaging will be conducted at a time of year conducive to sub-optimal environmental conditions for imaging, we recommend a minimum of one 50 ha plot is conducted at each site as a priority. There is then potential to expand imaging at the sand source site if optimal weather conditions permit within the timeframe (relevant additional costs included in quote as optional extras).

The location of each drone monitoring site has been determined based on key areas of interest provided by Swash PD. Considerations for specific plot placement include proximity to sand source and placement areas, as well as airspace regulations associated with the approach and departure paths of Adelaide Airport.

Sand source and placement areas:

The drone monitoring plot at North Haven has been positioned to the east of the identified area of interest based on consultation with Swash PD. It was noted that there is a need to monitor the eastern side, closer to the shore, in order to better understand the extent of existing seagrass (in this direction) to inform dredging plans. Visual interpretation of airborne imagery indicates that the eastern side contains less dense, more exposed meadows which may be more likely to be impacted by disturbance. As mentioned previously, if weather and time permit, there is opportunity to expand to monitoring at this site into additional areas as required.

The drone monitoring site at West Beach is predominantly restricted based on airspace. As this site is in close proximity to the approach and departure paths of Adelaide Airport, there are altitude restrictions in place, limiting the height at which imagery can be collected. Based on existing experience, a minimum flight altitude of 50 m is required to successfully orthorectify imagery captured over seagrass meadows in this area. The altitude restrictions largely exist in the northern and eastern parts of the identified area of interest and consequently drone flights are restricted to a 50 ha section in the south-west corner.

Control area: The Tennyson site has been selected as a suitable control site as it is not thought to be impacted by excavation or placement of sand. Additionally, a significant portion of the control area at Tennyson has been consistently imaged as part of existing monitoring projects with SA Water and therefore has associated historical data which provides base knowledge on seagrass cover dynamics in this area.

Deliverables

Pre-trial: July 2024

- High-resolution RGB drone imaging of 1x 50 ha plot at each of the 3x sites
- Brief initial report, including:
    - Summary of image capture, processing, and analysis methodology
    - High-resolution orthorectified maps of each plot
    - Classified benthic cover map of each plot and associated metrics

Post-trial: November 2024

- High-resolution RGB drone imaging of 1x 50 ha plot at each of the 3x sites
- Update and Change Assessment Report, including:
    - Updates to methodology (as relevant)
    - High-resolution orthorectified maps of each plot
    - Classified benthic cover map of each plot and associated metrics
    - Classified benthic cover map of each plot and associated metricsChange detection map highlighting cover change between two time points

One-year Post-trial: November 2025

- High-resolution RGB drone imaging of 1x 50 ha plot at each of the 3x sites
- Update and Change Assessment Report, including:
    - Updates to methodology (as relevant)
    - High-resolution orthorectified maps of each plot
    - Classified benthic cover map of each plot and associated metrics
    - Classified benthic cover map of each plot and associated metricsChange detection map highlighting cover change between three time points

Timeline

The collective team delivering this fieldwork are prepared to commence data capture as early as 3 July 2024. All preparations are being put in place in order to facilitate the completion of at least one initial 50 ha survey at each of the three sites by 31 July 2024 (weather permitting).

Fieldwork capture for the second and third time points are both achievable and able to be delivered upon.

Appendix 1: Site Maps

Figure 1. North Haven seagrass monitoring area of interest as indicated by Swash PD; subject to change after final trial design.

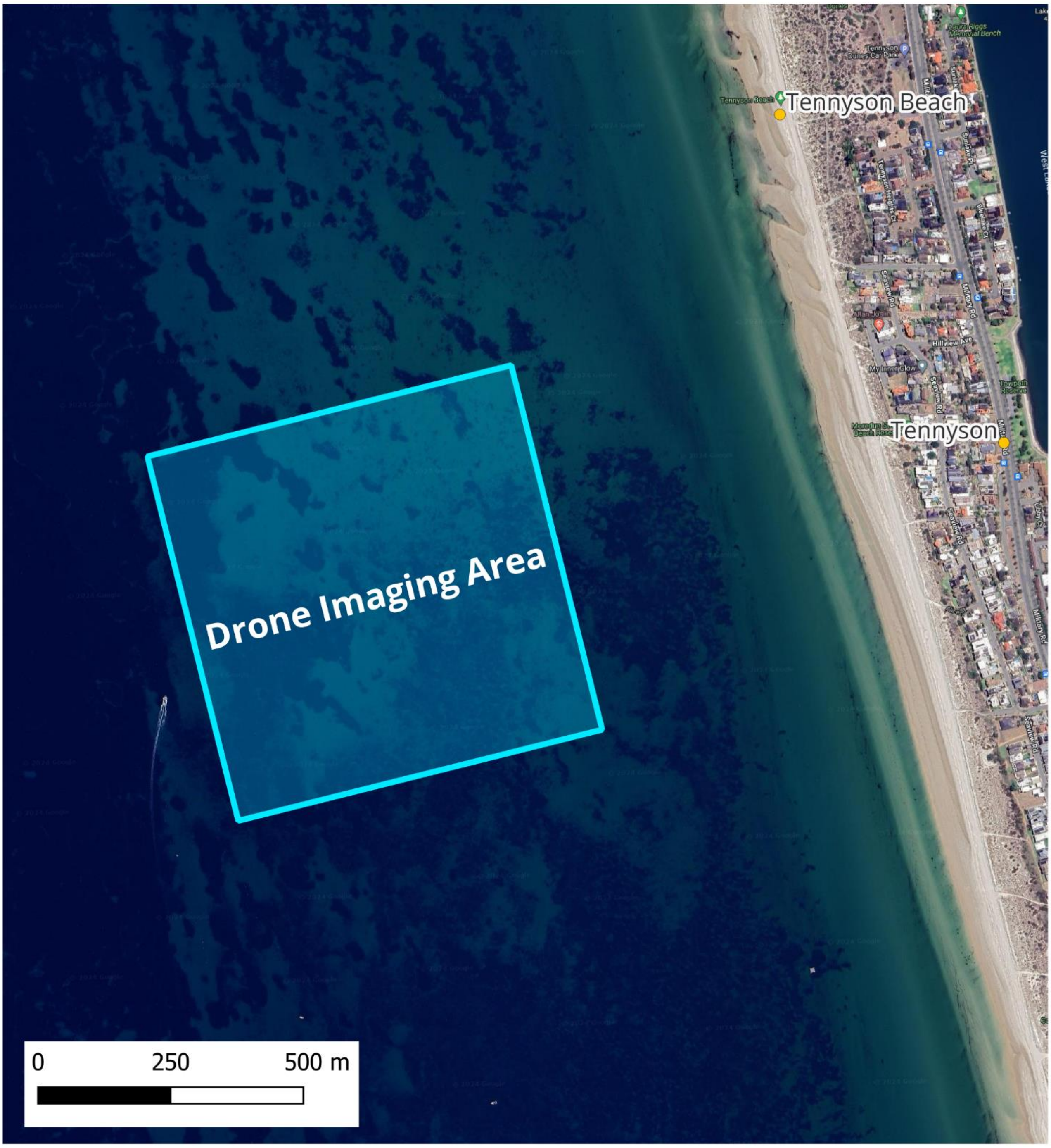

Figure 2. The proposed drone imaging area for the Tennyson control site.

Figure 3. West Beach seagrass monitoring area of interest as indicated by Swash PD; the irregular shape of the drone imaging area is due to altitude restrictions associated with proximity to Adelaide Airport; *subject to change after final trial design.

APPENDIX B. BASELINE DATASET

B.1 SEAGRASS MONITORING PROGRAM (SMP)

B.1.1 INTRODUCTION

The purpose of the SMP is to identify any large-scale changes in seagrass composition and extent within the AOIs associated with the proposed sand extraction activities. This section summarises the data collected during the baseline survey conducted over two survey events in August 2024. A post-dredging report monitoring will be prepared to outline the findings from the baseline and post-dredge surveys.

The proposed sand borrow areas are presented in Figure 4-7.

B.1.2 FIELD SURVEY METHODS AND SAMPLING SITES

The field survey methods followed those outlined in the SMP, and specific details are not repeated here. In summary, at each transect, the underwater tow camera system was deployed from the vessel to the seafloor. The camera was towed at a speed of less than 2kts, and the footage was monitored in real-time and digitally recorded on two cameras. Based on consultations with DEW and EPA, additional transect surveys were conducted at each AOI. In addition, bathymetry and side scan sonar data were collected opportunistically along each transect line. The number of transect lines achieved during the baseline survey is presented in Table 3 and are illustrated in Figure 4-4 to Figure 4-6.

In total, 43, 19, and 27 continuous transects, along with ten 50-meter transect lines, were completed at North Haven, Tennyson, and West Beach, respectively. Preliminary analysis of the footage indicated that the majority of seagrass mapped consisted of Posidonia beds (Figure 4-1), Posidonia/ Amphibolis beds, and Posidonia/ Zostera/ Halophila beds (Figure 4-2). Notably, the dominant Amphibolis beds previously mapped at North Haven and West Beach were absent.

Currently, data processing efforts will be as outlined in the SMP. However there is significant ability to upscale the analysis through further processing if a subsequent power analysis suggests this is necessary.

Seagrass samples were collected using a Van Veen grab alongside the 50-meter transects to identify species and gather data on biomass, epiphyte presence, leaf length, and shoot density (Figure 4-3).

Table 3 Summary of achieved data collected from each AOI

Area of Interest	Number of continuous lines proposed in SMP	Number of continuous transects collected	Distance of continuous transects (km)	Number of 50m transects in SMP	Number of 50m transects collected	Number of grab samples
North Haven	15	43	31	5	10	50
Tennyson	10	19	20	5	10	50
West Beach	12	27	24	5	10	50

Figure 4-1 Example screenshot of Posidonia bed from Transect 26 at West Beach

Figure 4-2 Example screenshot of Posidonia, Zostera and Halophila bed from Transect 7 at North Haven

Figure 4-3 Example of seagrass grab sample

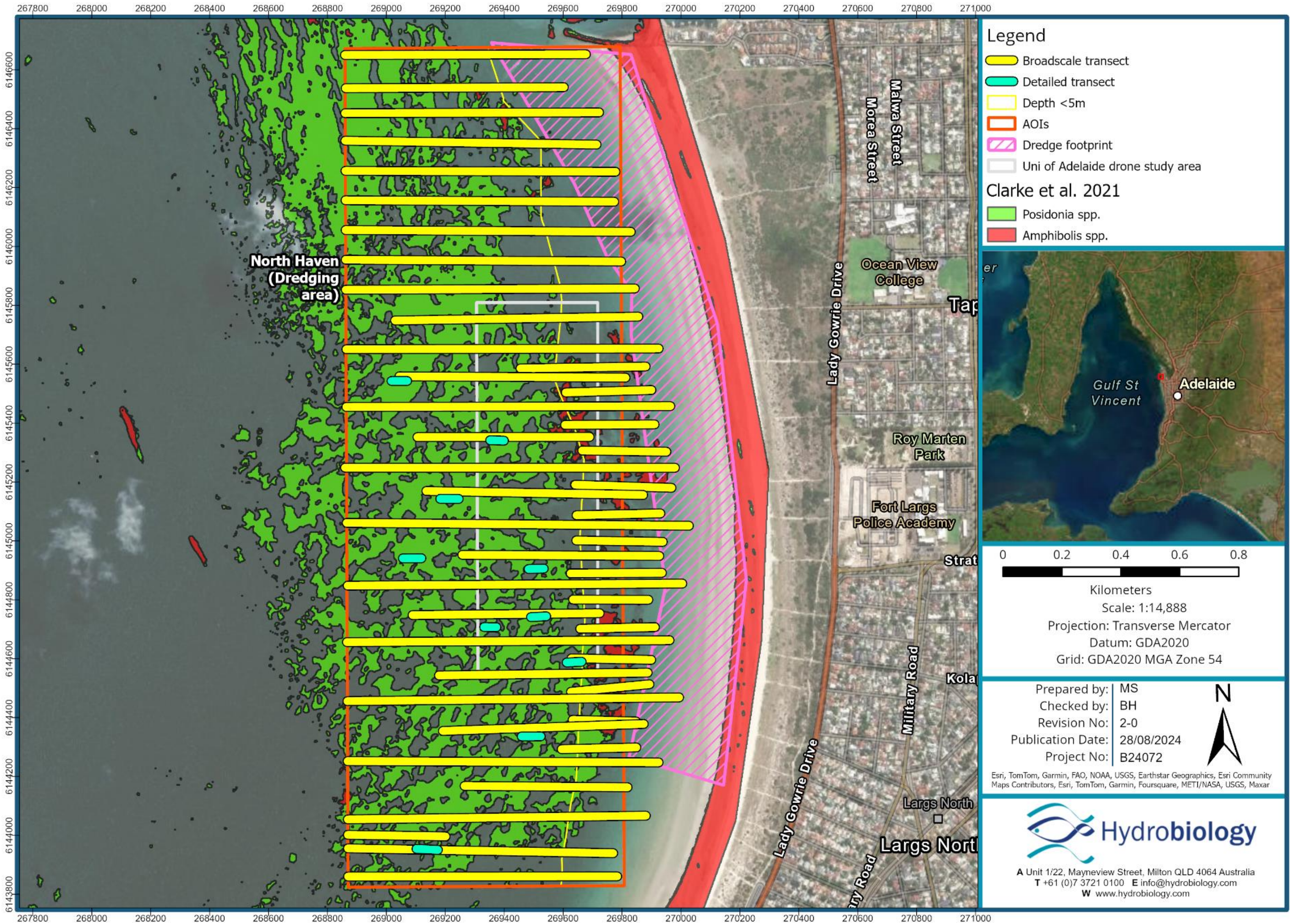

Figure 4-4 The extent and number of transects collected from North Haven

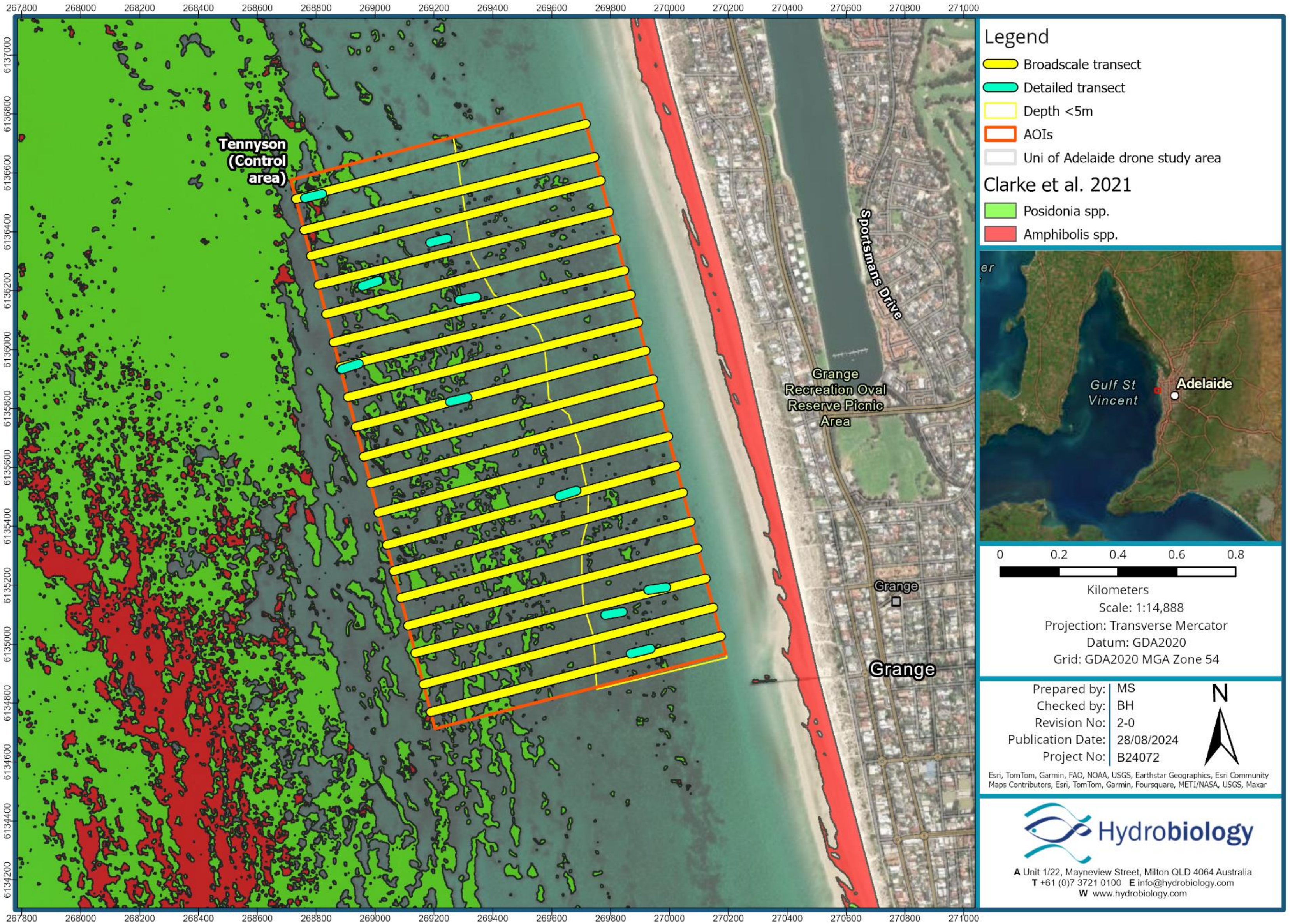

Figure 4-5 The extent and number of transects collected from Tennyson

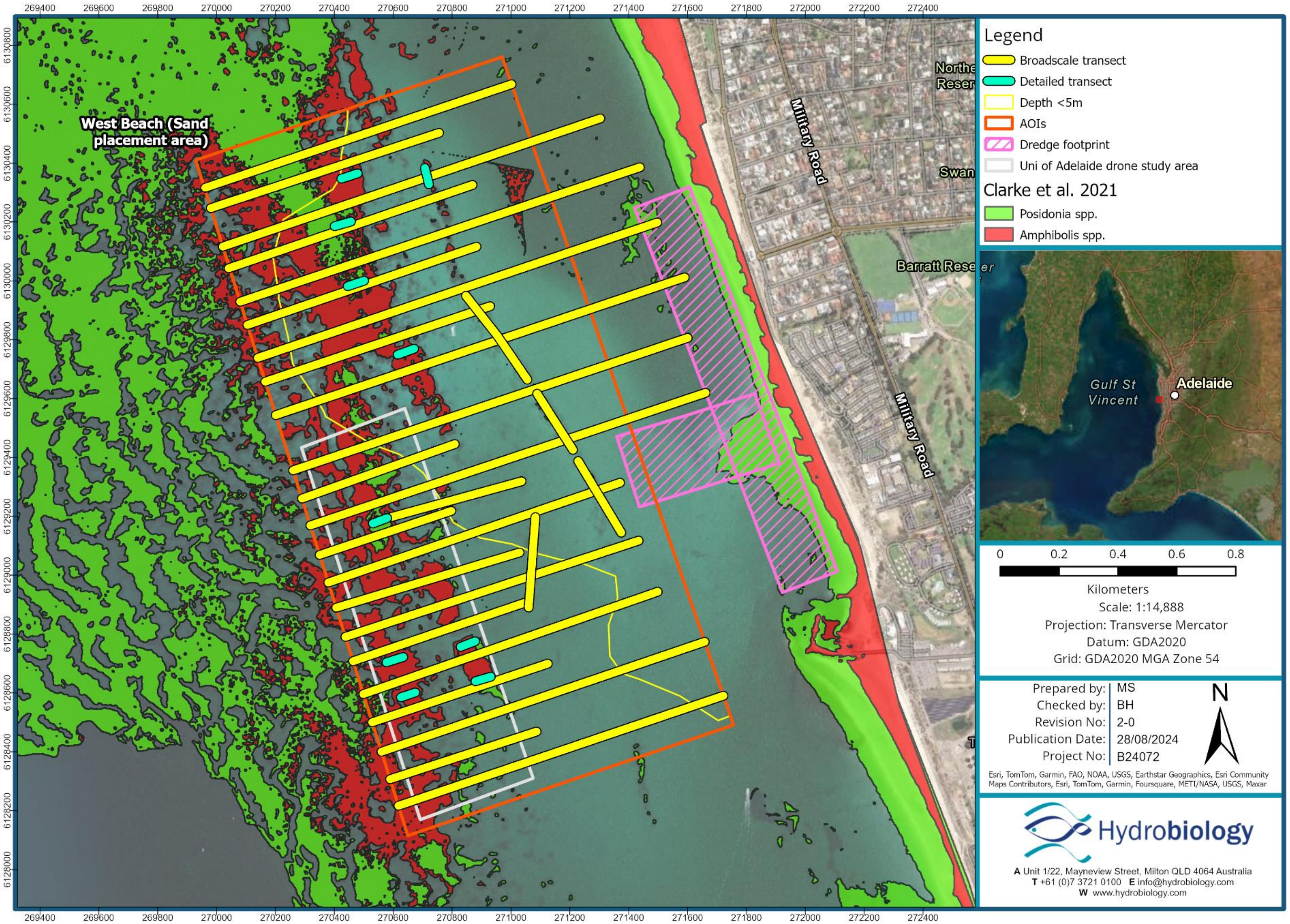

Figure 4-6 The extent and number of transects collected from West Beach

Figure 4-7 Raw vessel track file showing the transect lines in relation to the proposed Sand Borrow Area 2 and Sand Borrow Area 3

Hydrobiology

STREET
1 / 22 Mayneview Street
Milton 4064
QUEENSLAND

POSTAL
PO Box 2151
Toowong 4066
QUEENSLAND

CONTACT
+61 (0)7 3721 0100 P
info@hydrobiology.com

ABN 26 096 574 659

www.hydrobiology.com

Adelaide Beach Management Review

Implementation Project – Dredge Trial

Noise Management Plan

S8105.1C8

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Sonus Pty Ltd
17 Ruthven Ave
Adelaide SA 5000
Phone: +61 (8) 8231 2100
Email: info@sonus.com.au
www.sonus.com.au

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Date	: September 2024
Author	: Adam Cook, MAAS
Reviewer	: Simon Moore, MAAS

1 INTRODUCTION

A Noise Management Plan (**NMP**) has been prepared for the proposed Sand Dredging Trial at Adelaide metropolitan beaches (the **Project**). The Department for Environment and Water (**DEW**) is trialling dredging as a potential methodology for replenishment of coastal sands to combat tidal erosion. The erosion of beach sands has previously been managed through onshore excavation and transport of sand between metropolitan beaches. Dredging would collect sand from areas of accretion and deposit it to the shoreline at West Beach.

The assessment is based upon the following inputs:

- Advice from DEW regarding proposed dredge activities
- *Dredge Management Plan* by Maritime Constructions, report reference DP-0210-DMP.B3, dated 24 July 2024 (**Dredge Management Plan**).

2 PROPOSED ACTIVITIES

The proposed dredging activities considered in the NMP are based upon information provided by DEW and the Dredge Management Plan. These are summarised as follows:

- Dredging methodology:
  - Dredging offshore near North Haven and Largs Bay (the **Sand Borrow Area 1**) using a Cutter Suction Dredge (**CSD**).
  - Transport from Sand Borrow Area 1 to a nearshore deposition area at West Beach using Split Hopper Barges (**SHB**s)
  - Alternatively the SHBs can deposit into a sand re-handing area at West Beach with a second CSD to pump sand to nearshore or onshore areas via a pipeline where required.
  - The CSD may also operate at West Beach Sand Bar (**Sand Borrow Area 2**) or the West Beach Sand Trap (**Sand Borrow Area 3**) and pump sand to the onshore areas at West Beach.
  - Onshore sand placement may be assisted by civil equipment (dozer, dump trucks, loaders, excavators etc.).
- A typical operational cycle for the offshore CSD will be comprised of:
  - Continuous operation of the dredge in a Sand Borrow Area, filling one of two SHBs at a time
  - Sand will be pumped as a slurry from the dredge to the SHBs via a 400m pipeline at a rate of 100-200 m^3/hr, taking 4-8 hours to fill each SHB (760 m^3)
  - SHBs will be towed via tugboat to the deposition area or rehandling area at West Beach, anticipated to take 4-8 hours depending on weather conditions.
  - SHBs will deposit sand by manoeuvring to the deposition location and opening the split hull to discharge the load directly underneath the vessel.
  - The SHB will be towed back to the dredge for the next load.
- Dredging operating hours will be 24/7, unless there is adverse weather.

The indicative location of the dredging operation and transport route are shown in Figure 1.

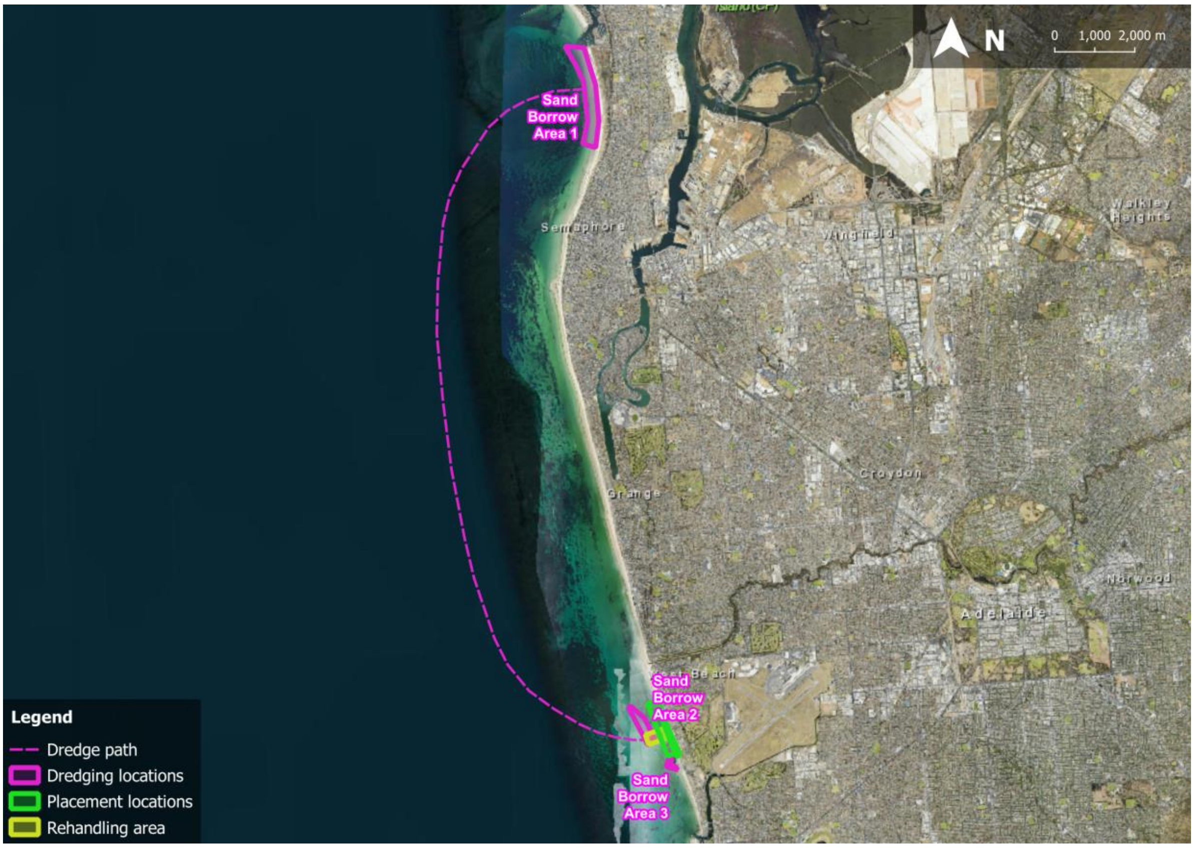

Figure 1: Dredging locations, transport route, rehandling area and deposition/placement locations

3 BASELINE NOISE MONITORING

Baseline noise monitoring was undertaken to determine the existing noise environment in the localities where noise-sensitive land uses are most likely to be affected by noise from the Project.

Unattended noise monitors were used for the noise monitoring, capturing ambient noise levels over a one week period.

A location in North Haven was selected as representative of the ambient level at noise-sensitive land uses near Sand Borrow Area 1. Figure 2 shows the location of the noise monitor in North Haven.

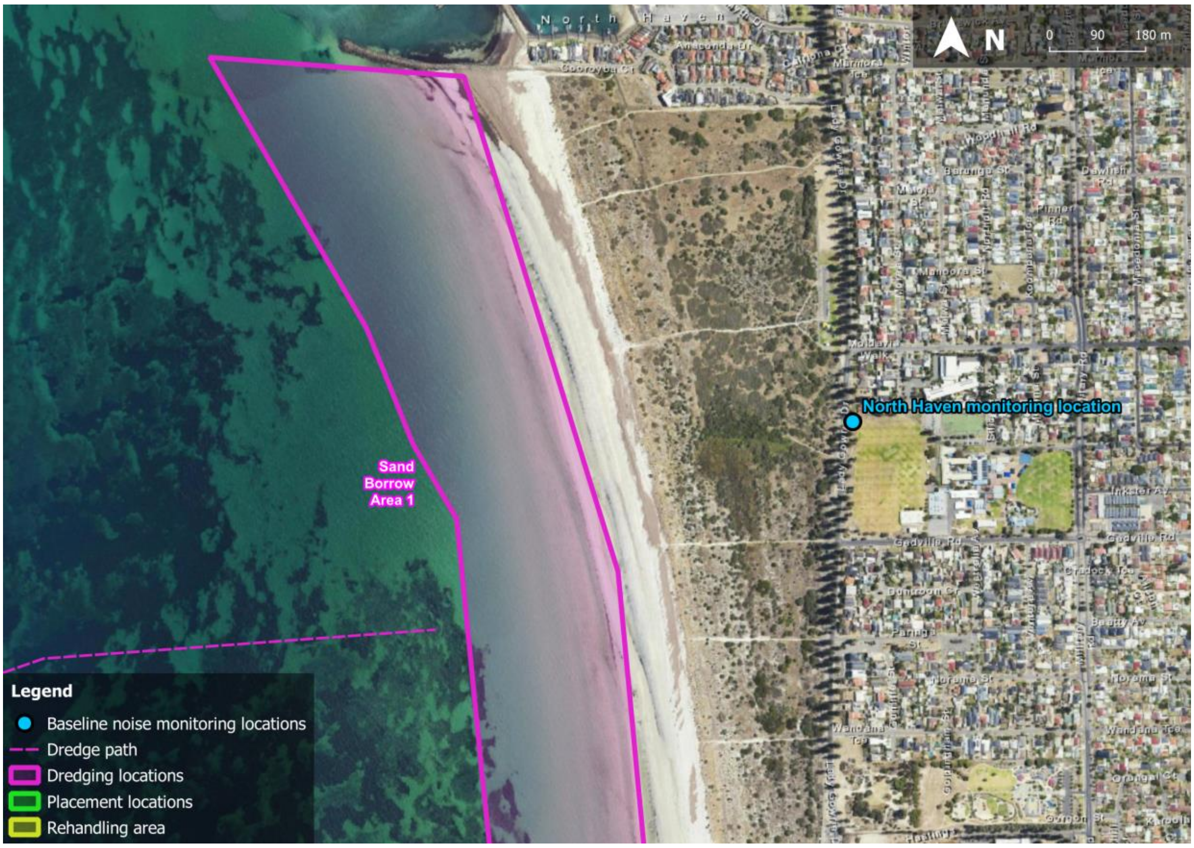

Figure 2: Noise monitoring location - North Haven

A location in West Beach was selected as representative of the ambient level at noise-sensitive land uses near the Rehandling Area and offshore/onshore sand Placement Locations. Figure 2 shows the location of the noise monitor in West Beach.

Figure 3: Noise monitoring location – West Beach

Results of the baseline line noise monitoring are provided in Appendix A. The results are summarised in Table 1.

Table 1: Baseline Noise Monitoring Results

Time of Day	North Haven				West Beach			
	Lowest Background Noise (L_{A90})	Average Background Noise (L_{A90})	Lowest Average Noise (L_{Aeq})	Mean Average Noise (L_{Aeq})	Lowest Background Noise (L_{A90})	Average Background Noise (L_{A90})	Lowest Average Noise (L_{Aeq})	Mean Average Noise (L_{Aeq})
Day(1)	35	51	61	68	37	44	41	53
Night(2)	33	39	38	58	35	41	39	46

Notes:

(1) Day period is 7am to 10pm, (2) Night period is 10pm to 7am

4 CRITERIA

4.1 Legislative context

Coastal dredging is regulated under the *Planning Development and Infrastructure Act 2016* (the **PDI Act**) and the *Environment Protection Act 1993* (the **EP Act**). The Planning and Design Code (the **Code**) is the principal Policy for assessment of activities administered under the PDI Act. The Code contains provisions which call for assessment of airborne noise emissions from certain types of activity.

4.2 Airborne noise

Under the *Assessment Provisions* for *Interfaces Between Land Uses* section of the Code, *Deemed to Satisfy / Designated Performance Feature 4.1* requires "noise that affects sensitive receivers to achieve the relevant Environment Protection (Industrial and Commercial Noise) Policy criteria" (the **Policy**). However, noise from vehicles, and noise from public infrastructure works are both specifically excluded from the *Environment Protection (Commercial and Industrial Noise) Policy 2023*.

Noise from dredging operations undertaken by DEW in State-controlled coastal waters could be considered as being within the scope of the Department for Infrastructure and Transport's **(DIT)** *Guideline for the Management of Noise and Vibration: Construction and Maintenance Activities* (**DIT CM Guideline**). While the DIT CM Guideline can be used for marine projects, it was originally developed for road construction projects and as such may not be well-suited to offshore activity. **It is therefore proposed to use the DIT CM Guideline for onshore activity only.**

4.2.1 Offshore Project activity

Reference is made to the recommendations of the *Guidelines for Community Noise 1999* (the **Guidelines**) published by the *World Health Organisation* (the **WHO**) with regard to annoyance during the day and sleep disturbance at night for offshore activity.

The Guidelines include:

> *"To protect the majority of people from being seriously annoyed during the daytime, the sound pressure level on balconies, terraces and outdoor living areas should not exceed 55 dB L_{Aeq} for a steady continuous noise. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound pressure level should not exceed 50 dB L_{Aeq}*
>
> *…*
>
> *At night, sound pressure levels at the outside facades of the living spaces should not exceed 45 dB L_{Aeq} and 60 dB L_{Amax}, so that people may sleep with bedroom windows open."*

For the assessment, relevant receivers are based on the definition provided by the Planning and Design Code, which includes existing residential dwellings, land zones primarily for residential purposes, childcare facilities, educational facilities, hospitals, supported accommodation (e.g. aged care facilities) and short-term accommodation such as hotels and caravan parks.

Based on the WHO guidelines, it is proposed that noise criteria for offshore activities are adopted based on equivalent noise levels (L_{eq}) at the facade of receiver buildings as follows:

- during day hours (7:00 am to 10:00 pm) no greater than $L_{eq,16h}$ 50 dB(A)
- during night hours (10:00 pm to 7:00 am) no greater than $L_{eq,8h}$ 45 dB(A) or L_{max} 60 dB(A)

It is noted that the night criterion provided by WHO guidelines is consistent with that applicable under the DIT CM Guideline, although considered over a longer measurement duration.

4.2.2 Onshore Project Activity

The DIT CM Guideline will be used for assessment of noise from onshore sand placement.

For these activities, the DIT CM Guidelines define Standard Construction Hours as:

- 7:00 am and 7:00 pm, Monday to Saturday
- 9:00 am and 7:00 pm on Sunday and Public Holidays.

During these hours, there are no objective noise criteria applicable to noise from infrastructure works, however all reasonable and practicable measures are to be taken to minimise noise at sensitive receivers.

For any works occurring outside of Standard Construction Hours, the DIT CM Guidelines provide noise level targets based upon the duration of the works outside of Standard Construction Hours. These are provided in Table 2.

Table 2: Noise level targets from DIT CM Guidelines

Day of the week	Time of day	Noise level targets					
		Up to two nights		Three to 14 nights		Greater than 14 nights	
		$L_{eq,\ 15min}$	L_{max}	$L_{eq,\ 15min}$	L_{max}	$L_{eq,\ 15min}$	L_{max}
Weekdays	6:00 am to 7:00 am	65	75	60	75	55	75
	7:00 am to 7:00 pm	All reasonable and practicable noise reduction measures are to be taken.					
	7:00 pm to 10:00 pm	75	90	70	85	65	80
	10:00 pm to 6:00 am	45	75	45	75	45	75
Saturday	Midnight to 7:00 am	45	75	45	75	45	75
	7:00 am to 7:00 pm	All reasonable and practicable noise reduction measures are to be taken.					
	7:00 pm to Midnight	45	75	45	75	45	75
Sunday & Public Holidays	Midnight to 9:00 am	45	75	45	75	45	75
	9:00 am to 7:00 pm	All reasonable and practicable noise reduction measures are to be taken.					
	7:00 pm to Midnight	45	75	45	75	45	75

Where predicted or measured noise levels are less than the targets the works are considered ‘Level 1’. Where the targets are exceeded, the works are deemed ‘Level 2’. Level 1 works are required to implement ‘basic noise mitigation’ whereas Level 2 works are required to implement ‘advanced noise mitigation’.

The DIT CM Guidelines also provide requirements for documentation, public notification, noise measurement and/or modelling, and stakeholder engagement activity to be implemented for works outside of Standard Construction Hours.

5 ASSESSMENT

5.1 Offshore Project activity

A list of offshore dredging plant was provided in the DMP. The relevant noise-generating items are summarised in Table 3.

Table 3: Construction phases and proposed equipment

Construction activity	Equipment	Location
Offshore dredging	• 55t Cutter Suction Dredge *Kingston* • 12t Anchor Barge *Kenny* • 2t Tender Vessel *Lloyd*	• Sand Borrow Areas
Placement	• 630t Split Hopper Barge *WH761* • 630t Split Hopper Barge *WH762* • 70t Primary Tug *Sea Pelican* • 360t Assistance Tug *Chapman*	• Hopper transport route between Dredging Area and West Beach deposition area or Rehandling Area
Rehandling	• 55t Cutter Suction Dredge • 2t Tender Vessel	• West Beach Rehandling Area

5.2 Onshore Project activity

A list of construction plant for onshore sand placement was provided in the DMP and are provided in Table 4.

Table 4: Construction phases and proposed equipment

Construction activity	Equipment
Onshore Sand Placement	• Bulldozer (CAT D5 or equivalent) • 30T Excavator • Front End Loader

Sound power levels for the above equipment were derived from the *Department for Environment, Food and Rural Affairs (United Kingdom), Update of noise database for prediction of noise on construction and open sites* which are summarised in Appendix B. It is understood that onshore sand placement will primarily take place on week days between 7am and 7pm, with work outside of these hours consisting of ad-hoc use of the excavator to maintain work areas if degradation occurs due to tidal movements.

5.3 Noise prediction methodology

Receiver noise levels from the construction activities have been determined using *SoundPLAN* noise modelling software (Version 9.0), and the CONCAWE noise propagation algorithm with Weather Category 6 acoustic propagation conditions.

Predictions consider the noise from all equipment operating simultaneously and evenly spread throughout the work area over the duration of the assessment period. As such, predicted levels are considered representative of worst-case construction noise emissions from the works.

5.4 Predicted Noise Levels

5.4.1 Offshore Project Activity

Noise levels have been predicted for each of the five options, with the highest predicted noise levels shown in Table 5 (note that the locations in Table 5 are listed from North to South).

Table 5: Highest Predicted Noise Levels from Offshore Activity

Location	Highest Predicted Noise Level [L_{eq} dB(A)]				
	Option 1	Option 2	Option 3	Option 4	Option 5
North Haven	48	48	48	< 20	< 20
Taparoo	44	44	44	< 20	< 20
Largs Bay	45	45	45	< 20	< 20
Semaphore	30	30	30	< 20	< 20
West Lakes Shore	21	22	22	< 20	< 20
Grange	< 20	21	21	< 20	< 20
Henley	21	27	27	22	22
West Beach	38	49	49	49	49
Glenelg North	24	34	34	40	40

Predicted noise from dredging activity at sensitive receptors will comply with the criterion from the WHO during the day, but exceed the WHO criterion of 45 dB(A) L_{eq} during the night at North Haven and West Beach. The predicted levels at Taparoo and Largs Bay are below the criteria (borderline compliant), therefore all reasonable and practicable noise reduction measures are to be taken in these areas.

5.4.2 Onshore Project Activity

Noise from onshore project activities at West Beach have been modelled within the onshore placement area, as shown in Figure 4.

Figure 4: Onshore Placement Area

The highest predicted noise level for daytime onshore works at a sensitive receiver was 68 dB(A), within the camping sites of BIG4 West Beach Parks. As these works are to be conducted during 7am to 7pm on weekdays, there are no explicit criteria, however all reasonable and practicable noise reduction measures are to be taken for these works.

For night time ad-hoc maintenance activity with the 30T excavator, the predicted noise level is 45 dB(A) at the closest receiver, which complies with the relevant Noise Level Target. From discussions with the contractor, it is understood that this activity will only be required as an ad-hoc response to tidal movements, rectifying erosion of site features such as sand berms or swales. The need for this work will be determined by staff monitoring onsite conditions over the night period.

Reasonable and practicable noise mitigation shall be applied to this activity during the night period, including the following night-works specific controls:

- Selecting the quietest possible size/make/model of construction plant (excavator) which can practically complete the task.
- Completing the task in the minimum duration possible while avoiding excessive noise emission.
- Minimising noisy processes such as tracking, bucket/tool impacts with hard surfaces, or erratic equipment movements.
- Where practical, orienting directional exhausts or other sources of noise to face away from sensitive receivers.
- Disabling audible warning devices (beepers, squawkers) or reducing the volume of these devices as far as possible while not affecting safe operation of the activity.
- Ensuring that construction plant is powered down as soon as the task is completed.

Exception to these procedures for night works are only to be made for urgent unplanned activities required to make the work area or public realm safe, repair of damaged essential services/infrastructure, or in an emergency.

6 RECOMMENDATIONS

Given the nature and timing of the proposed works and exceedance of the WHO Guideline and DIT Guideline noise targets, it is recommended that good-practice noise control strategies and stakeholder engagement practices are implemented during the works.

6.1 Noise control strategies

Recommended noise control strategies are comprised of Scheduling/Planning Considerations, Management Practices, and Work Practices.

6.1.1 Scheduling and planning of activities

When planning the works, the following should be considered to minimise noise impacts:

- Completing works over the minimum possible duration of nights.
- Undertaking any noise-generating activities which do not need to be at night during the day period.
- Scheduling works involving high noise emission or annoying character to shoulder-periods of night hours when nearby residential locations. Should periods are considered to be hours prior to 11:00 pm or after 6:00 am. Plant which produces high levels of noise or annoying character are listed in Section 6.1.3.
- Scheduling works to limit the consecutive nights where receivers are impacted. For example, alternating work areas within the Onshore Placement Area after several consecutive nights.
- Prohibit offsite movement of construction plant or site vehicles, particularly through residential streets.
- Construction plant selections to use the lowest noise generating equipment possible to complete the task. Equipment used should be fitted with broad-band reverse alarms (squawkers instead of beepers) which are set at the relevant level in accordance with ISO Standard 9533.

6.1.2 Noise management practices

On site noise management strategies include:

- Incorporating noise management items into safety/environment inductions and daily toolbox sessions.
- Identifying noise-sensitive receivers to site staff during site inductions/orientations.
- Instructing site supervisors to routinely check for unnecessary noise-generating activities and direct workers to cease the activity.
- Instructing site supervisors to respond to any noise complaints by investigating the cause of the complaint and determine if alternative work methods can be implemented to remove or minimise noise.

Off site noise management strategies include:

- Undertaking periodic noise monitoring at dredging and placement areas to confirm noise levels during the trial (outlined in Section 6.2).

6.1.3 Work practices

Noise-reducing work practices include:

- Minimising idling of plant or vehicles by enforcing equipment shut downs when not in use.
- Minimise on-site reversing of plant with reverse alarms by using a forward-in, forward-out pathway wherever possible.
- Instructing workers to use radios to communicate and to avoid shouting, whistling and use of horns or alarms for communication.
- Instructing plant operators to use the minimum power of equipment to complete the task, and throttle down to the minimum setting when not in use if it is not possible to shut plant down.
- Placing petrol or diesel powered lighting towers away from residential locations.
- Orienting directional noise sources such as exhausts or cooling fans on stationary plant to face away from residential locations.
- Ensuring that plant is correctly maintained; noise reduction measures such as covers and mufflers are in place, rotating equipment is balanced, and cutting tools are sharp.

6.2 Noise monitoring

Routine attended noise monitoring will be undertaken over the course of the Project, at locations representative of receivers closest to the work areas at West Beach and North Haven.

The proposed noise monitoring program includes the following (subject to suitable weather conditions):

- Attended noise measurements on the first day of dredging
- Attended noise measurements on the first use of the night-works excavator
- Attended noise measurements one week after commencement of dredging, once activity levels have normalised
- Attended noise measurements two weeks after commencement of dredging
- Attended noise measurements four weeks after commencement of dredging

- Attended noise measurements may also be conducted in response to a noise compliant (if a compliant is received), where monitoring is deemed to be an appropriate response to quantify the level of noise at the complainant location.

6.3 Stakeholder engagement practices

Noise-related content should be included in DEW's "Dredge trial – community and stakeholder engagement plan".

The following items are recommended for the Project:

- Designation of a Project Environmental Manager or Community Engagement Officer responsible for noise-related engagement activities and contactable by the community regarding noise issues.
- Provision of a complaints phone number which is monitored on a 24-hour basis while works occur.
- Maintenance of a complaints register including the following complaint details:
  - Time and date of contact.
  - Time and date of noise issue.
  - Nature of noise issue and any particular noise sources / activities of concern.
  - Actions taken to address the noise concerns.
  - Contact details of the complainant and if follow-up is required.
- Advance notification for all residents and businesses likely to be impacted by the works, with at least seven day's notice. This should include letter drops or doorknocking with the following information provided in writing:
  - Overview of the works and justification for works occurring at night.
  - Dates and times for the works, including anticipated completion date.
  - Contact name and number of the Project Manager/Community Engagement Officer or Site Supervisor for any questions before work commences or complaints during the work.
  - An outline of noise mitigation controls to be implemented.
  - If any extensions occur to timeframes or additional activities are required, follow-up information should be provided.
- Notification of local councils and authorities is recommended to ensure that any noise issues are appropriately managed and/or routed to the contractor if necessary.

A recommended footprint for notification of residential landholders is shown in Figure 5 and Figure 6.

Figure 5: Recommended Notification Area - North

Figure 6: Recommended Notification Area - South

7 CONCLUSION

A Noise Management Plan has been prepared for the proposed Dredging Trial at Adelaide metropolitan beaches. The plan considers the noise from dredging of sand offshore near North Haven and West Beach, transport of this sand by barge, and redistribution of the sand nearshore at West Beach.

Baseline noise monitoring has been conducted in the vicinity of the Sand Borrow Areas at both North Haven and West Beach. The monitoring showed low background noise levels, particularly at night, but relatively high average noise levels.

Predictions of noise levels have been made based upon the proposed activities. The predicted noise from offshore activity will comply with the day time criterion established through the WHO, however will exceed the night time WHO average noise criteria and noise targets of the relevant DIT Construction Noise Guidelines for receivers at North Haven and West Beach.

The DIT Guidelines do not establish noise targets for work conducted during the day on weekdays. As the onshore activities are to be conducted during this time, the noise emission levels are to be minimised as far as reasonably practicable.

Recommendations have been made, including noise control strategies and stakeholder engagement practices. Based on the implementation of these recommendations, it is considered that all reasonable and practicable noise reduction measures will have been taken.

APPENDIX A: BASELINE NOISE MONITORING RESULTS

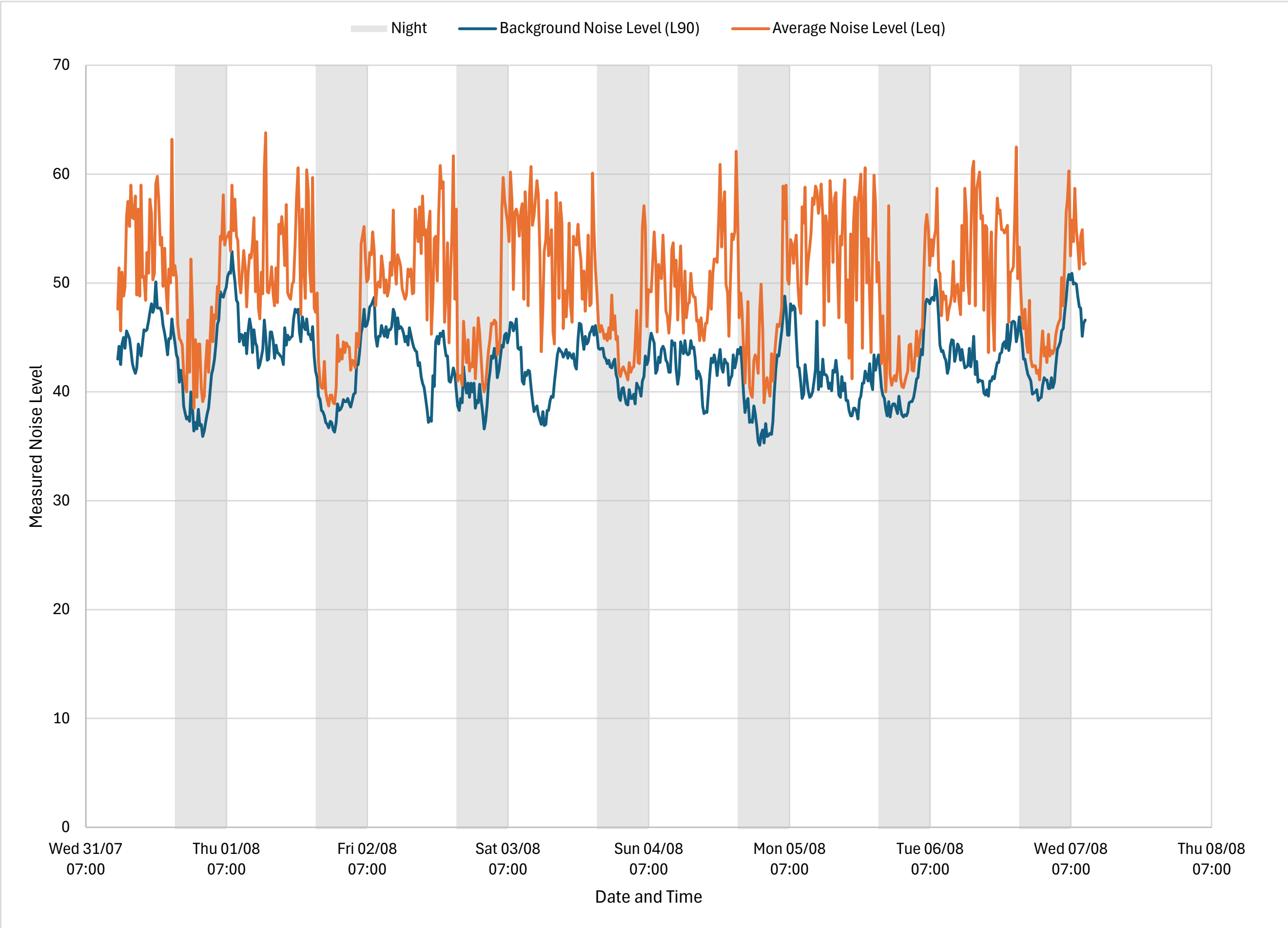

Figure 7: West Beach Monitoring Results

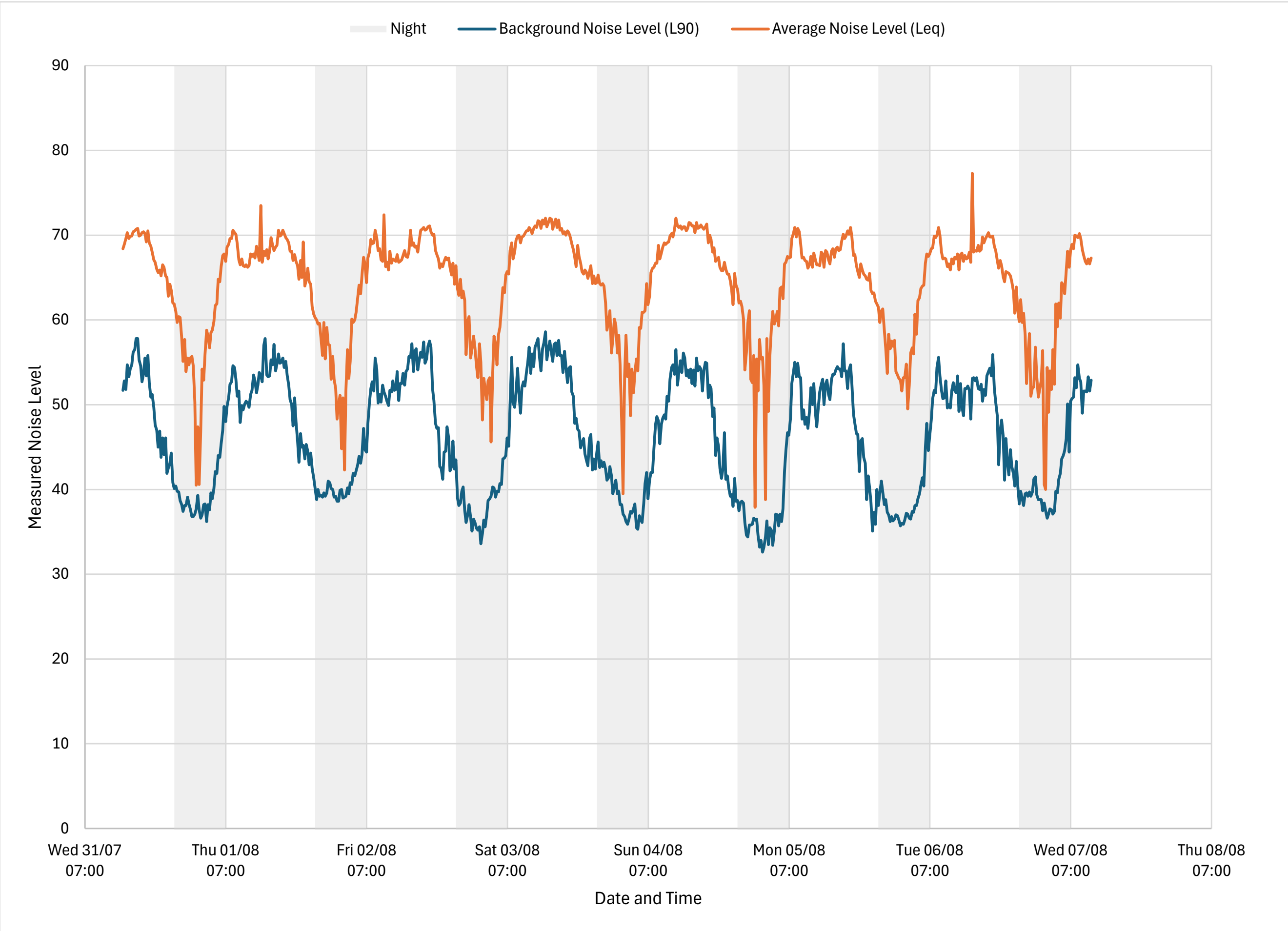

Figure 8: North Haven Monitoring Results

APPENDIX B: SOUND POWER LEVELS

Item	Sound Power Level [dB(A)]
Cutter Suction Dredge and tender vessels(1)	105 dB(A)
Barge and tug(2)	113 dB(A)
Front End Loader	103 dB(A)
Bulldozer	111 dB(A)
Excavator	114 dB(A)
30T Excavator (Night works)	107 dB(A)

Notes:

(1) Cumulative sound power for all items in work area

(2) Cumulative sound power for barge and tug

Adelaide Beach Management Review

Implementation – Dredge Trial

Underwater Noise Assessment

S8105.1C6

September 2024

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Sonus Pty Ltd
17 Ruthven Ave
Adelaide SA 5000
Phone: +61 (8) 8231 2100
Email: info@sonus.com.au
www.sonus.com.au

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	Underwater Noise Assessment
Client	: Department for Environment and Water
Document Reference	: S8105.1C6
Date	: September 2024
Author	: Adam Cook, MAAS
Reviewer	: Chris Turnbull, MAAS

1 INTRODUCTION

An Underwater Noise Assessment has been prepared for the proposed Sand Dredging Trial at Adelaide metropolitan beaches (the **Project**). The Department for Environment and Water (**DEW**) is trialling dredging as a potential methodology for replenishment of coastal sands to combat tidal erosion. The erosion of beach sands has previously been managed through onshore excavation and transport of sand between metropolitan beaches. Dredging would collect nearshore sand from North Haven and West Beach and deposit it to the shoreline at West Beach. Some dredging may also occur in a designated sand rehandling area nearby the West Beach boat ramp.

Underwater noise from the dredging operation has been assessed for marine fauna species present in coastal waters within the Gulf St Vincent.

The assessment is based upon the following inputs:

- Advice from DEW regarding proposed dredge activities
- *Dredge Management Plan* by Maritime Constructions, report reference DP-0210-DMP.B3, dated 24 July 2024 (**Dredge Management Plan**).

Reference is also made to the Project's Noise Management Plan (**NMP**) previously prepared by Sonus (refer Sonus report S8105.1C5).

sonus.

2 PROPOSED OFFSHORE ACTIVITIES

The proposed offshore activities considered in the assessment are summarised as follows:

- Dredging
    - Dredging offshore near North Haven (**Sand Borrow Area 1**) using a small (<1000kW) Cutter Suction Dredge (**CSD**) or a Backhoe Dredge (**BHD**)
    - A second small CSD operating in the designated sand rehandling area at West Beach, used to pump sand to nearshore or onshore areas via a pipeline.
    - The CSD may also operate at West Beach Sand Bar (**Sand Borrow Area 2**) or the West Beach Sand Trap (**Sand Borrow Area 3**) and pump sand to the onshore areas at West Beach.
- Transport from the dredge area to either a nearshore deposition area at West Beach or to the sand rehandling area, using Split Hopper Barges (**SHB**s) towed by tugboats.

These offshore activities are proposed to occur on a 24/7 basis throughout the Project, weather permitting.

The indicative location of the dredging operation and transport route are shown in Figure 1.

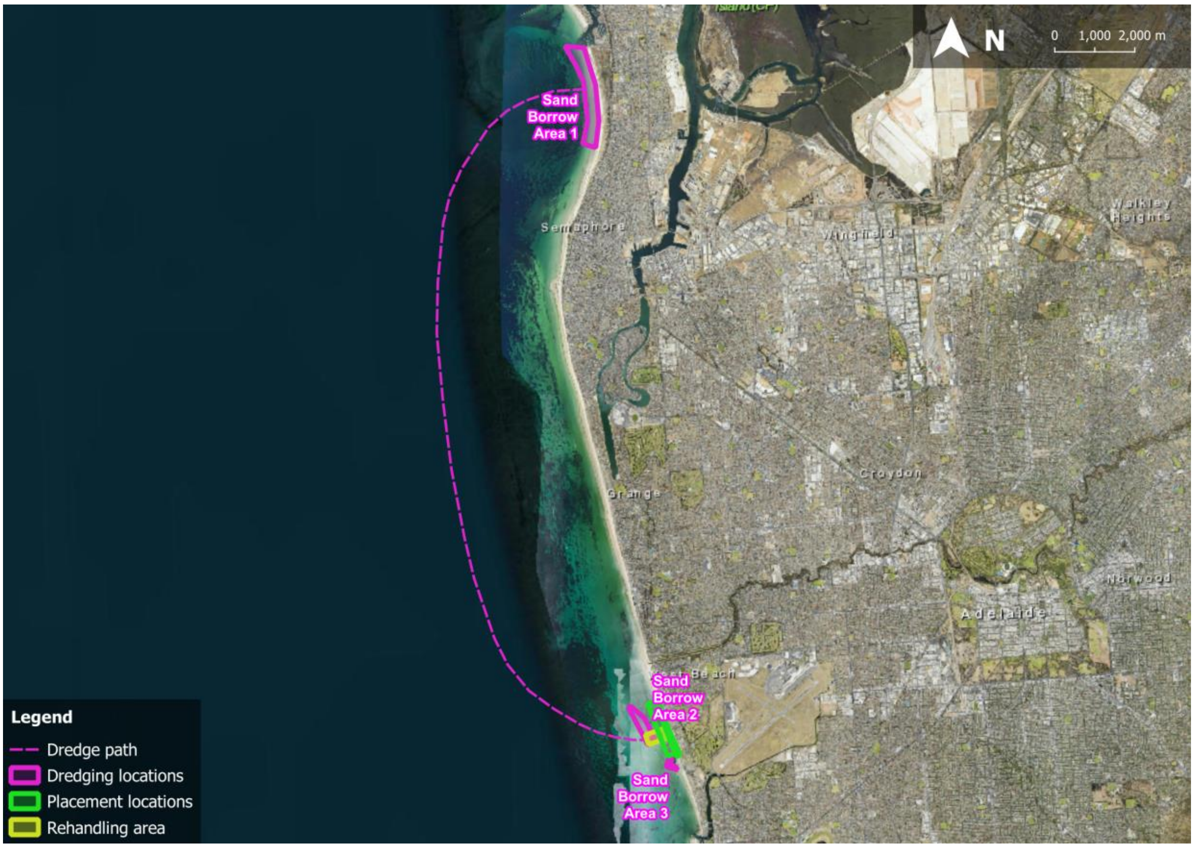


Figure 1: Site layout and sensitive receivers

3 CRITERIA

3.1 Legislative context

The underwater noise assessment is invoked under the *Environment Protection Act* (the **EP Act**) which mandates a general duty of care to the environment, alongside various other Federal and State legislation which protect either specific marine environments (such as Marine Parks or Commonwealth Marine areas) or specific marine fauna (such as species listed as a Matter of National Environmental Significance under the *Environment Protection and Biodiversity Conservation Act 1999 (Cth)*).

3.2 Underwater noise

Underwater noise from dredging in South Australian waters can be assessed under the *DIT Underwater Piling and Dredging Noise Guidelines* (the **DIT UW Guidelines**). The DIT UW Guidelines are applicable to marine infrastructure works undertaken by DIT but are also commonly applied for works undertaken by other government agencies or external contractors.

The DIT UW Guidelines provide assessment criteria for marine fauna, including species present in South Australian waters which are listed under the *Environment Protection and Biodiversity Act 1999 (Cth)* (the **EPBC Act**), are within a Marine Park, or otherwise protected by State or Federal Legislation.

Criteria provided by the DIT UW Guidelines for underwater noise are specific to species of concern and the type of noise generated. Fauna is classified into Functional Hearing Groups (**FHG**s) to account for the widely varying sensitivity to underwater noise across the range of various marine fauna physiologies. FHGs have been defined from international research which has identified species which are deemed to have similar sensitivity to underwater sound. Criteria for some FHGs use frequency weighting functions to specifically adjust noise levels to match a collective frequency sensitivity applicable to marine fauna in the group.

Criteria have been graded into four levels of severity by the DIT UW Guidelines. The levels of severity, in descending order, are:

- Organ Damage / Fatality
- Permanent Threshold Shift (**PTS**)
- Temporary Threshold Shift (**TTS**)
- Behavioural Response.

Organ Damage / Fatality criteria are indicative of a level of underwater noise which has been found to cause injury or death. PTS and TTS represent the thresholds of physiological damage to hearing caused by underwater noise. Behavioural Response represents the level of noise at which the behaviour of marine fauna is potentially adversely affected. Note that some Functional Hearing Groups do not have criteria assigned for each severity level.

For activities generating underwater noise which is not impulsive, such as dredging, criteria for physiological impacts are provided as cumulative sound exposure levels over a 24-hour period (**SEL_{24hr}**) or using SPL for behavioural impacts. Table 1 summarises criteria which are relevant for dredging.

Table 1: Marine mammal species and relevant criteria for dredging from DIT UW Guidelines

Type of fauna or functional hearing group	**Listed species known to occur in South Australian Waters**	**Applicable criteria**
Low-frequency cetaceans	Southern Right Whale Minke Whale Bryde's Whale Blue Whale Pygmy Right Whale Humpback Whale	**PTS:** SEL_{24hr} 199 dB(LF) **TTS:** SEL_{24hr} 179 dB(LF) **Behavioural Response:** SPL 120 dB RMS
High-frequency cetaceans	Bottlenose Dolphin Common Dolphin Dusky Dolphin Killer Whale Spotted Bottlenose Dolphin	**PTS:** SEL_{24hr} 198 dB(HF) **TTS:** SEL_{24hr} 179 dB(HF) **Behavioural Response:** SPL 120 dB RMS
Pinnipeds – Phocid carnivores	Leopard Seal	**PTS:** SEL_{24hr} 201 dB(PCW) **TTS:** SEL_{24hr} 181 dB(PCW) **Behavioural Response:** SPL 120 dB RMS
Pinnipeds – Other carnivores	Australian Sea Lion Australian Fur Seal New Zealand Fur Seal	**PTS:** SEL_{24hr} 219 dB(OCW) **TTS:** SEL_{24hr} 199 dB(OCW) **Behavioural Response:** SPL 120 dB RMS
Marine Turtles	Loggerhead Turtle Green Sea Turtle Leatherback Turtle Pacific Ridley Turtle	No specific criteria. Moderate risk of **TTS** within tens of metres from source. High risk of **Behavioural Response** within tens of metres of source.
Fish – Without swim bladder	Great White Shark Mackeral Shark	No specific criteria. Moderate risk of **TTS** within tens of metres from source. Moderate risk of **Behavioural Response** within hundreds of metres of source.
Fish – With swim bladder	Pipefish Seahorses Seadragons	**PTS:** SPL 170 dB for 48hr **TTS:** SPL 158 dB for 12hr High risk of **Behavioural Response** within tens of metres of source.

4 UNDERWATER NOISE ASSESSMENT

4.1 Existing environment

Underwater sounds are generated by a variety of natural sources (including wind, water turbulent-pressure fluctuations, breaking waves and marine life) and human sources (such as oceanic traffic). To contextualise the existing underwater noise environment, reference is made to curves developed by Wenz (1962)[1], which are shown in Figure 2 . The Wenz curves are based on measurement data and provide spectral levels of ambient underwater noise considering natural and anthropogenic sources, including surface wind, marine traffic, thermal noise, and precipitation.

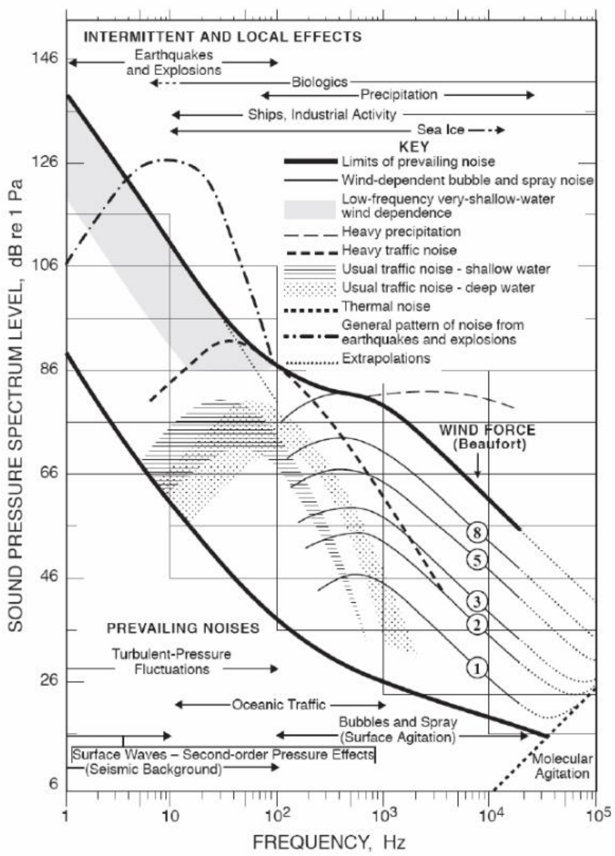


Figure 2: Ambient Noise Levels of Open Ocean Environments

Wind force (surface agitation) controls non-anthropological ambient noise limits in the spectral range of 1kHz – 100kHz in the absence of heavy precipitation. Thermal noise and oceanic traffic noise would typically control ambient noise in the spectral range of 10Hz to 1kHz.

[1] Wenz, G, 1962, Acoustic ambient noise in the ocean: Spectra and sources. Journal of the Acoustical Society of America, 34(12), pp1936-1956.

Noise from existing marine traffic is likely to be a significant source of underwater noise in the Project area, from vessel traffic accessing the nearby Port Adelaide commercial port, and recreational vessels navigating metropolitan waters and entering via the North Haven and West beach boat ramps. Figure 3 shows the density of annual marine traffic in the vicinity of the Project waters, with the Project's proposed activity areas overlaid.

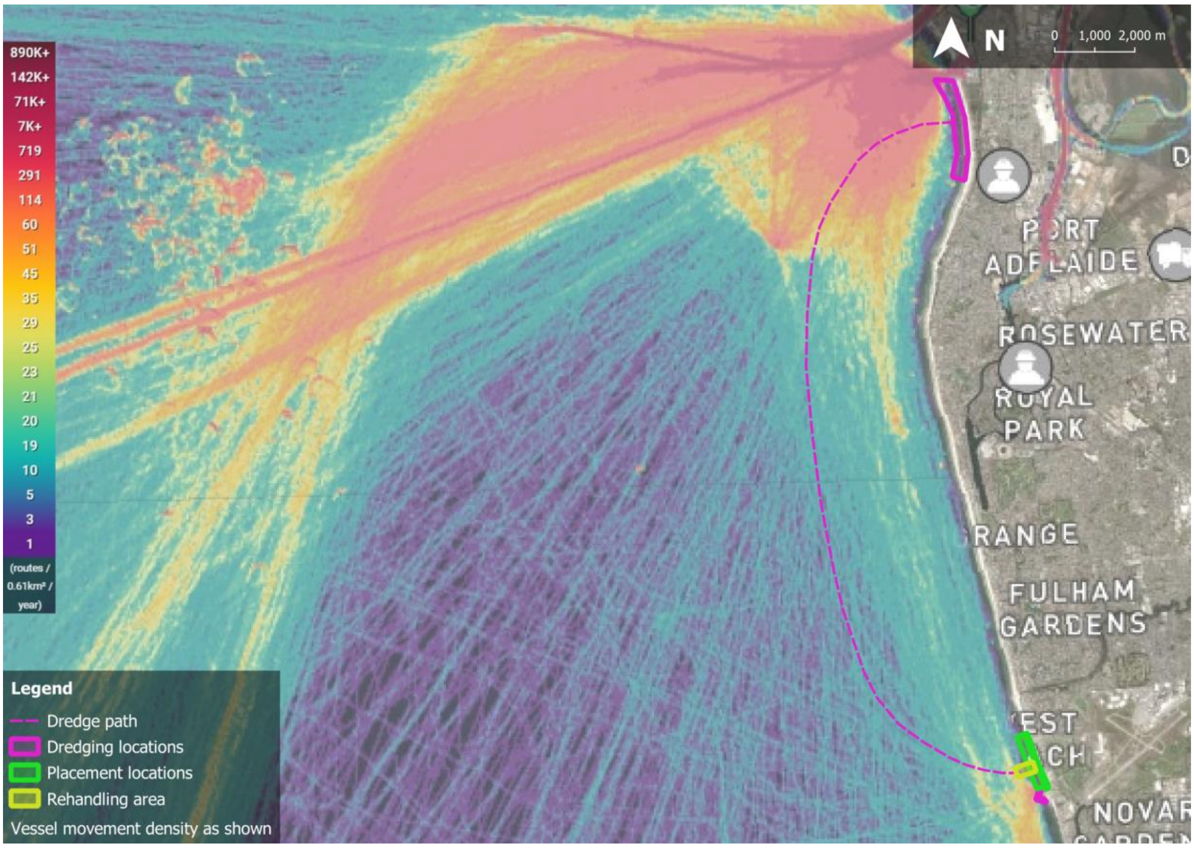


Figure 3: Dredging area existing marine traffic

4.2 Receivers

The Australian Government Department of Climate Change, Energy, the Environment and Water (**DCCEEW**) maintains a Species Profile and Threats Database. This database provides information on species listed under the EPBC Act, including information regarding the known distribution within Australian waters. DCCEEW also has a Protected Matters Search Tool (**PMST**) which can be used to search for presence of listed species at a location.

The DIT UW Guidelines suggest the use of the PMST to search for listed marine species which are 'threatened and/or migratory' and likely to be present in the marine region where the works are located. Marine fauna identified by the PMST for the Gulf St Vincent are provided in Table 2, grouped by the Functional Hearing Group which they are assigned by the DIT UW Guidelines. The status of EPBC Act Listing for each species has also been provided.

Table 2: Species of concern

Name	Scientific Name	EBPC Act Listing status	Prevalence
Low frequency cetaceans			
Eubalaena australis	Southern Right Whale	Endangered	Migratory Known breeding area
Balaenoptera edeni	Bryde's Whale	-	Migratory May be present
Balaenoptera acutorostrata	Minke Whale	-	May be present
Caperea marginata	Pygmy Right Whale	-	Migratory May be present
Megaptera novaeangliae	Humpback Whale	Vulnerable	Migratory Likely present
Balaenoptera musculus	Blue Whale	Endangered	Migratory May be present
High-frequency cetaceans			
Lagenorhynchus obscurus	Dusky Dolphin	-	Migratory May be present
Tursiops truncatus s. str.	Bottlenose Dolphin	-	May be present
Tursiops aduncus	Indian Ocean Bottlenose Dolphin	-	Likely present
Delphinus delphis	Common Dolphin, Short-beaked Common Dolphin	-	May be present
Grampus griseus	Risso's Dolphin, Grampus	-	May be present
Orcinus orca	Killer Whale, Orca	-	Migratory May be present

Name	Scientific Name	EBPC Act Listing status	Prevalence
Pinnipeds – Other Carnivores			
Arctocephalus pusillus	Australian Fur-seal, Australo-African Fur-seal	-	May be present
Arctocephalus forsteri	Long-nosed Fur-seal, New Zealand Fur-seal	-	May be present
Neophoca cinerea	Australian Sea lion	Endangered	Known
Turtles			
Caretta caretta	Loggerhead Turtle	Endangered	Migratory Known
Chelonia mydas	Green Turtle	Vulnerable	Migratory May be present
Dermochelys coriacea	Leatherback Turtle, Leathery Turtle	Endangered	Migratory Known
Fishes – Without swim bladder			
Carcharodon carcharias	White Shark, Great White Shark	Vulnerable	Known
Lamna nasus	Porbeagle, Mackerel Shark	-	Possible offshore
Galeorhinus galeus	School Shark Eastern School Shark, Snapper Shark, Tope, Soupfin Shark	Conservation dependent	Possible offshore
Fishes – With swim bladder			
Thunnus maccoyii	Southern Bluefin Tuna	Conservation dependent	Possible offshore
Seriolella brama	Blue Warehou	Conservation dependent	Possible offshore
Hippocampus abdominalis	Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse	-	May be present
Phyllopteryx taeniolatus	Common Seadragon, Weedy Seadragon	-	May be present
Urocampus carinirostris	Hairy Pipefish	-	May be present

Name	Scientific Name	EBPC Act Listing status	Prevalence
Hypselognathus rostratus	Knifesnout Pipefish, Knife-snouted Pipefish	-	May be present
Phycodurus eques	Leafy Seadragon	-	May be present
Vanacampus poecilolaemus	Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish	-	May be present
Vanacampus margaritifer	Mother-of-pearl Pipefish	-	May be present
Vanacampus phillipi	Port Phillip Pipefish	-	May be present
Pugnaso curtirostris	Pugnose Pipefish, Pug-nosed Pipefish	-	May be present
Notiocampus ruber	Red Pipefish	-	May be present
Solegnathus robustus	Robust Pipehorse, Robust Spiny Pipehorse	-	May be present
Maroubra perserrata	Sawtooth Pipefish	-	May be present
Hippocampus breviceps	Short-head Seahorse, Short-snouted Seahorse	-	May be present
Acentronura australe	Southern Pygmy Pipehorse	-	May be present
Filicampus tigris	Tiger Pipefish	-	May be present
Heraldia nocturna	Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish	-	May be present

In order to provide an assessment of noise for these and other species relevant to the Project locality, underwater noise predictions have been made for each FHG in the DIT UW Guidelines identified as including species which are present in South Australian waters.

4.3 Noise generating activities

The source of underwater noise considered in this assessment is dredging using either a CSD or BHD. Based on the Dredge Management Plan dredging will be undertaken for up to 24-hours per day (weather permitting).

Motorised vessels will be used to support dredging activities, including tender vessels for crew and tugboats towing the SHBs. Vessel propulsion noise is expected to be consistent in character with existing noise from the passage of shipping traffic. As noted in Section 4.1, there is significant commercial and recreational vessel traffic in the Project waters, particularly concentrated at the nearby Outer Harbor Port, the North Haven marina, and West Beach boat ramp. As such, the existing underwater acoustic environment is unlikely to be influenced by the addition of the relatively small number of vessel movements associated with the Project. As such, underwater noise levels from vessel movements between the dredging locations have not been predicted.

4.4 Modelling approach

Underwater noise predictions have been made using geometric spreading calculations. This is a range-independent approach which can provide high-level, conservative estimates of underwater sound propagation in relatively shallow coastal water environments.

Calculations were made using the *DIT Marine Fauna Noise Threshold Calculator* (**DIT Threshold Calculator**) which is a tool developed by DIT for use with the DIT UW Guidelines. Inputs to the DIT Threshold Calculator were:

- Dredge type: Small CSD (<1000kw), Backhoe dredge
- Dredging duration in 24 hours: 1440 minutes
- Mean Higher High Water depth: 0-15 m

4.5 Predicted threshold distances

Underwater noise modelling results are presented as threshold distances. These are the minimum separation distance between the source and fauna specimen (receiver) at which the relevant criterion is achieved.

- For criteria based on the SEL_{24hr} descriptor, the threshold distance is considered over a 24-hour period for an individual specimen. It represents the minimum separation distance from the activity that an animal of the relevant species would need to maintain for 24 hours to not be at risk of PTS/TTS.
- For behavioural response criteria, the threshold distance is the minimum distance from the source to any animal of the relevant species, for which the animal would receive a level of sound which could cause a change in behaviour.

4.5.1 Dredging - CSD

Threshold distances for dredging using a CSD are presented in Table 3.

Table 3: Threshold distances for marine mammals – CSD

Type of fauna or functional hearing group	Applicable criteria		Threshold distance
Low-frequency cetaceans	PTS	SEL_{24hr} 199 dB(LF)	4 m for 24 hours
	TTS	SEL_{24hr} 179 dB(LF)	70 m for 24 hours
High-frequency cetaceans	PTS	SEL_{24hr} 198 dB(HF)	1 m for 24 hours
	TTS	SEL_{24hr} 179 dB(HF)	4 m for 24 hours
Pinnipeds – Phocid carnivores	PTS	SEL_{24hr} 201 dB(PCW)	2 m for 24 hours
	TTS	SEL_{24hr} 181 dB(PCW)	40 m for 24 hours
Pinnipeds – Other carnivores	PTS	SEL_{24hr} 219 dB(OCW)	1 m for 24 hours
	TTS	SEL_{24hr} 199 dB(OCW)	3 m for 24 hours
Fish – With swim bladder	PTS	SPL 170 dB	2 m for 24 hours(1)
	TTS	SPL 158 dB	25 m for 24 hours(1)

Notes:

(1) The DIT UW Guidelines provide SPL criteria based on 48-hour exposure for PTS and 12 hour exposure for TTS. The DIT Threshold Calculator provides results labelled as a SEL_{24hr} for Fish (with swim bladder). As such, these results should be used with caution.

Plots of threshold distances relative to the dredging locations are provided in Appendix A.

4.5.2 Dredging - BHD

Threshold distances for dredging using a BHD are presented in Table 4.

Table 4: Threshold distances for marine mammals – BHD

Type of fauna or functional hearing group	Applicable criteria		Threshold distance
Low-frequency cetaceans	PTS	SEL_{24hr} 199 dB(LF)	50 m for 24 hours
	TTS	SEL_{24hr} 179 dB(LF)	1100 m for 24 hours
High-frequency cetaceans	PTS	SEL_{24hr} 198 dB(HF)	3 m for 24 hours
	TTS	SEL_{24hr} 179 dB(HF)	55 m for 24 hours
Pinnipeds – Phocid carnivores	PTS	SEL_{24hr} 201 dB(PCW)	30 m for 24 hours
	TTS	SEL_{24hr} 181 dB(PCW)	570 m for 24 hours
Pinnipeds – Other carnivores	PTS	SEL_{24hr} 219 dB(OCW)	2 m for 24 hours
	TTS	SEL_{24hr} 199 dB(OCW)	45 m for 24 hours
Fish – With swim bladder	PTS	SPL 170 dB	30 m for 24 hours(1)
	TTS	SPL 158 dB	370 m for 24 hours(1)

Notes:

(1) The DIT UW Guidelines provide SPL criteria based on 48-hour exposure for PTS and 12 hour exposure for TTS. The DIT Threshold Calculator provides the results labelled as a SEL_{24hr} for Fish (with swim bladder). As such, these results should be used with caution.

Plots of these threshold distances relative to the dredging locations are provided in Appendix A.

4.5.3 Turtle and fish species – high level guidance

For turtle species there are not specific criteria for PTS/TTS or behavioural response in the DIT UW Guidelines. Similarly, for fish species there are not specific behavioural response criteria. For these species and criteria, guidance is only provided in terms of 'level of risk' which are summarised in Table 5.

Table 5: Threshold distances for turtles and fishes

Type of fauna or functional hearing group	Threshold distance
Marine Turtles	Moderate risk of **TTS** within tens of metres from source. High risk of **Behavioural Response** within tens of metres of source.
Fish – Without swim bladder	Moderate risk of **TTS** within tens of metres from source. Moderate risk of **Behavioural Response** within hundreds of metres of source.
Fish – With swim bladder	High risk of **Behavioural Response** within tens of metres of source.

4.6 Management and mitigation of underwater noise impacts

4.6.1 Overview

The extent of management and mitigation strategies for underwater noise from dredging will be relative to the prevalence of species of sensitive marine fauna for the time of year during which dredging is undertaken. Guidance should be sought from a marine ecologist on the prevalence and movement patterns of these species relative to the relevant TTS threshold distances. During the construction period, if listed marine fauna are found to frequent waters of the Gulf St Vincent within the threshold distances identified in Table 3, reasonable and practicable mitigation measures are required to be implemented to minimise the risk of harm.

Advice from marine biologists should also identify the risk of harm to sensitive fauna from behavioural changes caused by noise. The DIT UW Guidelines do not specify threshold distances or mitigation requirements based on behavioural response criteria, but potential impacts of noise-induced behavioural change should be considered as part of a broader risk assessment of underwater noise.

The DIT UW Guidelines provide guidance on the following management and mitigation measures for underwater noise from dredging:

- Safety zones
- Potential Effects Zones
- Standard Operating Procedures
- Additional mitigation and management measures.

4.6.2 Management Measures – Safety Zones and Potential Effects Zones

The DIT UW Guidelines define two Safety Zones for marine mammals. These are:

- Shutdown Zones, where if a marine mammal is observed to enter, dredging activities must stop immediately.
- Observation Zones, where if a marine mammal is observed to enter, the dredging equipment operator must be placed on stand-by to shut down dredging, and marine fauna observers should continuously monitor the movement of the marine mammal.

The Shutdown Zone and Observation Zones for the Project have been determined in accordance with the DIT UW Guidelines, and are based upon the TTS threshold distance for Low Frequency Cetaceans. This is the largest safety zone applicable for the range of marine mammals considered in the assessment.

The Safety Zones determined for the Project are provided in Figure 4 based on the Low Frequency Cetacean FHG. The safety zone setback distances from dredging are also provided as tabulated results in Table 6 for CSDs and Table 7 for BHDs.

Table 6: Safety Zones - CSD

	Low Frequency Cetaceans (Safety Zones adopted for Project)	**Phocid Pinnipeds (Next-largest Safety Zones)**
Observation Zone – Dredging	320 m	290 m
Shut-down Zone – Dredging	70 m	40 m

Table 7: Safety Zones – BHD

	Low Frequency Cetaceans (Safety Zones adopted for Project)	**Phocid Pinnipeds (Next-largest Safety Zones)**
Observation Zone – Dredging	1350 m	820 m
Shut-down Zone – Dredging	1100 m	570 m

If it is determined that species from the Low Frequency Cetacean group would not occur in Gulf St Vincent waters during dredging (i.e. dredging is timed to occur outside of the migratory season for all species in the FHG) alternative Safety Zones would be applicable based on other FHGs with species which are likely to be present (such as the safety zones for Phocid Pinnipeds provided).

4.6.3 Management measures – Dredging Standard Operating Procedures

Standard Operational Procedures for Dredging are outlined within the DIT UW Guidelines. The DIT UW Guidelines provide the following requirements for offshore dredging activity.

- *Pre-start procedure:*
  - *The presence of marine fauna shall be visually monitored by a Marine Fauna Observer (**MFO**) (Level 2) for at least 30 minutes prior to the commencement of dredging.*
  - *The Shutdown Zone (and Observation Zone where visibility allows) shall be inspected by the MFO, ideally from a location greater than 6m above sea level.*
  - *Dredging may commence if marine fauna has not been sighted within, or is not likely to enter, the shutdown zone or observation zone during the pre-start procedure.*
- *Normal operating procedure:*

  - *The MFO shall maintain visual observations of the Safety Zones.*
  - *If there are long breaks in dredging activity, the Pre-start Procedure should be re-initiated.*
  - *If marine fauna is sighted within the Observation Zone, the dredge operator shall be placed on standby to stop dredging, and the marine fauna monitored continuously. Dredging may resume normal operation if the marine fauna is observed to leave the Observation Zone or is not sighted within the Observation Zone for a period of greater than 30 minutes after the previous sighting.*
- *Shut-down procedure:*
  - *If marine fauna is sighted within the shutdown zone, dredging shall be stopped immediately.*
  - *If marine fauna is sighted within the shutdown zone, observation shall continue in order to determine if the animal moves away from the dredging activity in a timely manner (up to 30 minutes).*

4.6.4 Management Measures – Additional mitigation and management

The DIT UW Guidelines state that the need for additional mitigation and management measures is to be based upon the Project's risk assessment for the impacts on EPBC Act Matters of National Environmental Significance. Where this assessment identifies the likelihood of impact occurrence as 'unlikely' or 'likely', or if there is uncertainty about the potentially serious or irreversible impacts, the additional mitigation and management measures must be considered.

The DIT UW Guidelines provide the following additional management measures to be considered:

- *increased safety zones*
- *use of a Level 1 Marine Fauna Observer*
- *validation of noise model using measurements*
- *restricting operations during poor visibility*
- *use of a Spotter Vessel.*

Adelaide Beaches Sand Backpassing Trial

Underwater Noise Assessment

CSD - Sand Borrow Area
Threshold distances - LFC

Figure: 4 Page: 1/3	Date: 21/08/2024 Refer report: S8105.1C4	Author: AC Reviewed: SM

0 70 140 210 280 m

GDA94 / MGA zone 54
1:10,000 at A3

Legend

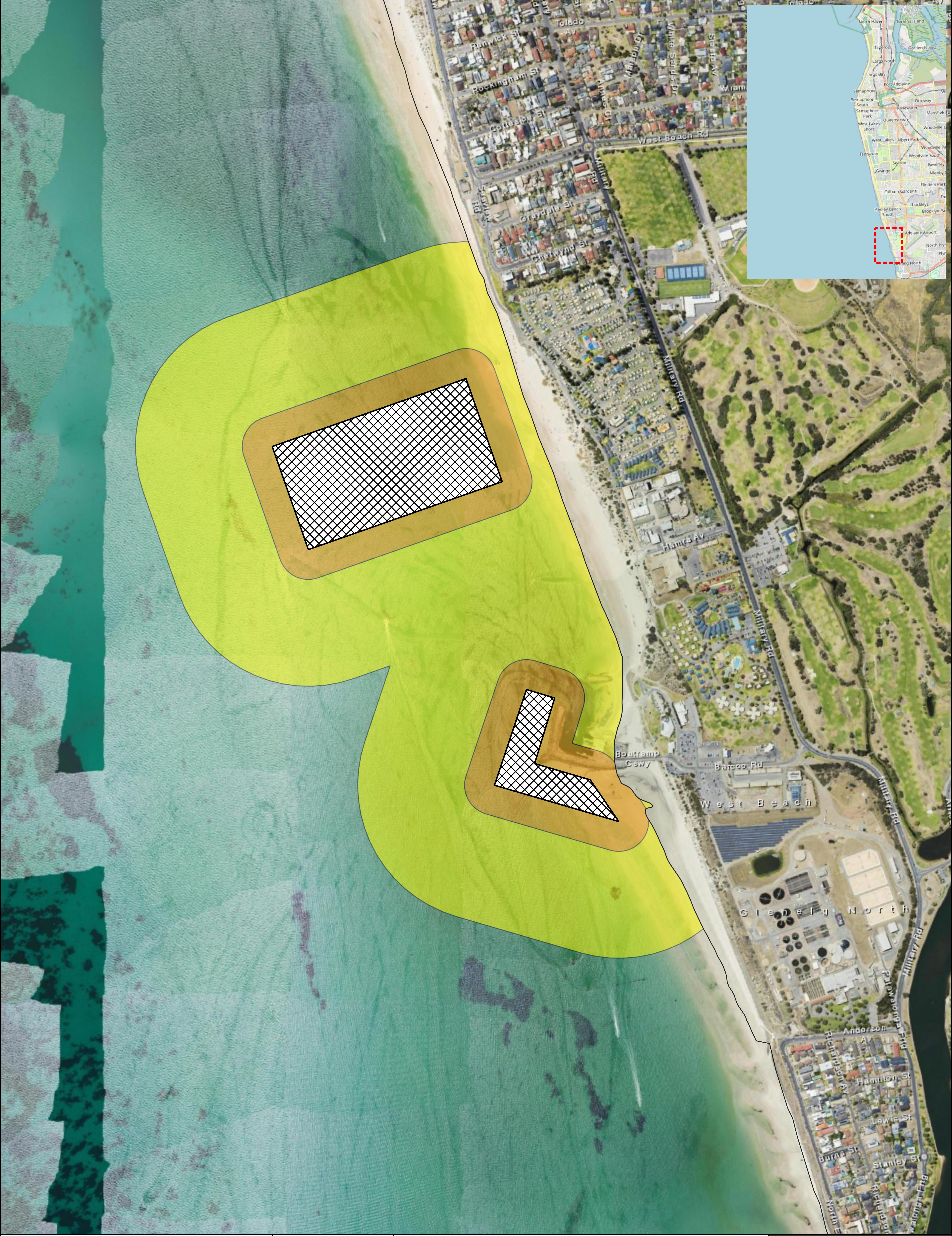
- Dredging area
- Coastline

Safety Zones

- Observation zone
- Shutdown zone

Imagery sources: Google Maps 2023

sonus.



Adelaide Beaches Sand Backpassing Trial

Underwater Noise Assessment

CSD - Sand Deposition Area
Threshold distances - LFC

Figure: 4 Page: 2/3	Date: 21/08/2024 Refer report: S8105.1C4	Author: AC Reviewed: SM

0 50 100 150 200 m

GDA94 / MGA zone 54
1:7,500 at A3

Legend

Dredging area
Coastline

Safety Zones

Observation zone
Shutdown zone

Imagery sources: Google Maps 2023

sonus.

Adelaide Beaches Sand Backpassing Trial

Underwater Noise Assessment

BHD - Sand Borrow Area
Threshold distances - LFC

Figure: 4 Page: 3/3	Date: 21/08/2024 Refer report: S8105.1C4	Author: AC Reviewed: SM

0 100 200 300 400 m

GDA94 / MGA zone 54
1:15,000 at A3

Legend

Dredging area
Coastline

Safety Zones

Observation zone
Shutdown zone

Imagery sources: Google Maps 2023

sonus.

4.6.5 Discussion

There is potential for underwater noise impacts to marine species with 'Endangered' Status under the EPBC act, if sensitive marine fauna is present within the relevant threshold distances identified in this assessment. This applies to 'Endangered' species such as the Southern Right Whale, Blue Whale, Australian Sea Lion, Loggerhead Turtle, and Leatherback Turtle, and 'Vulnerable' species such as the Humpback Whale, Green Turtle, and Great White Shark.

Investigation of the likelihood of impact occurrence to members of these species located within the threshold distances to the dredging operation should be undertaken as part of the Project's risk assessment. It will need to consider the likelihood of presence within the threshold distances for the 24-hour exposure duration which the criteria are based upon. An update of this risk assessment should be undertaken if there are any changes to the timing of works which coincides with increased prevalence of migratory species.

Outcomes of the risk assessment will inform the need for consideration of the additional management and mitigation measures which are provided in the DIT UW Guidelines.

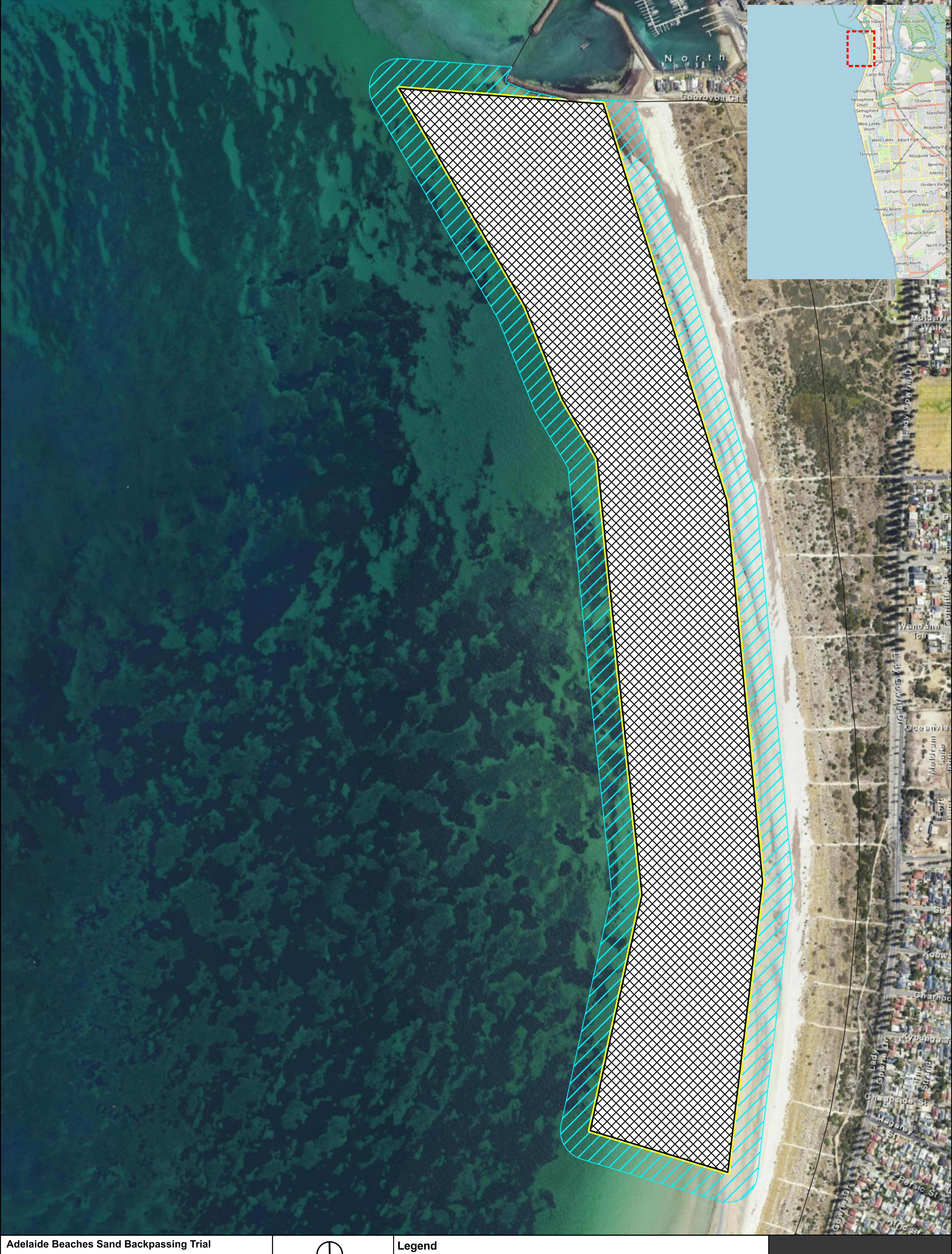
Other species noted in Table 2 with 'Migratory' and 'Possible' prevalence will also need to be risk-assessed considering the likelihood of prevalence during the dredging works and within the threshold distances identified in the assessment.

5 CONCLUSION

An assessment of underwater noise impacts from potential sand dredging activity in the Gulf St Vincent has been undertaken.

Underwater noise levels have been predicted and assessed against criteria determined in accordance with the *DIT Underwater Piling and Dredging Noise Guidelines*. Safety Zones and Potential Effects Zones have been determined from predicted underwater noise threshold distances, assuming potential prevalence of all relevant species during the dredging activity. The Standard Operating Procedures defined by the *DIT Underwater Piling and Dredging Noise Guidelines* are recommended to be implemented by the dredging contractor. The need for additional mitigation and management measures will need to be considered, based upon the Project's risk assessment of the potential impacts on EPBC Act Matters of National Environmental Significance.

APPENDIX A: THRESHOLD DISTANCE PLOTS



Adelaide Beaches Sand Backpassing Trial

Underwater Noise Assessment

CSD - Sand Borrow Area
Threshold distances - LFC

Figure: A1 Page: 1/2	Date: 20/08/2024 Refer report: S8105.1C4	Author: AC Reviewed: SM

0 50 100 150 200 m

GDA94 / MGA zone 54
1:7,500 at A3

Legend

Coastline
Dredge location

Threshold distances

PTS
TTS

Imagery sources: Google Maps 2023

sonus.

Adelaide Beaches Sand Backpassing Trial

Underwater Noise Assessment

CSD - Sand Deposition Area
Threshold distances - LFC

Figure: A1
Page: 2/2

Date: 20/08/2024
Refer report: S8105.1C4

Author: AC
Reviewed: SM

0 30 60 90 120 m

GDA94 / MGA zone 54
1:5,000 at A3

Legend

Coastline

Dredge location

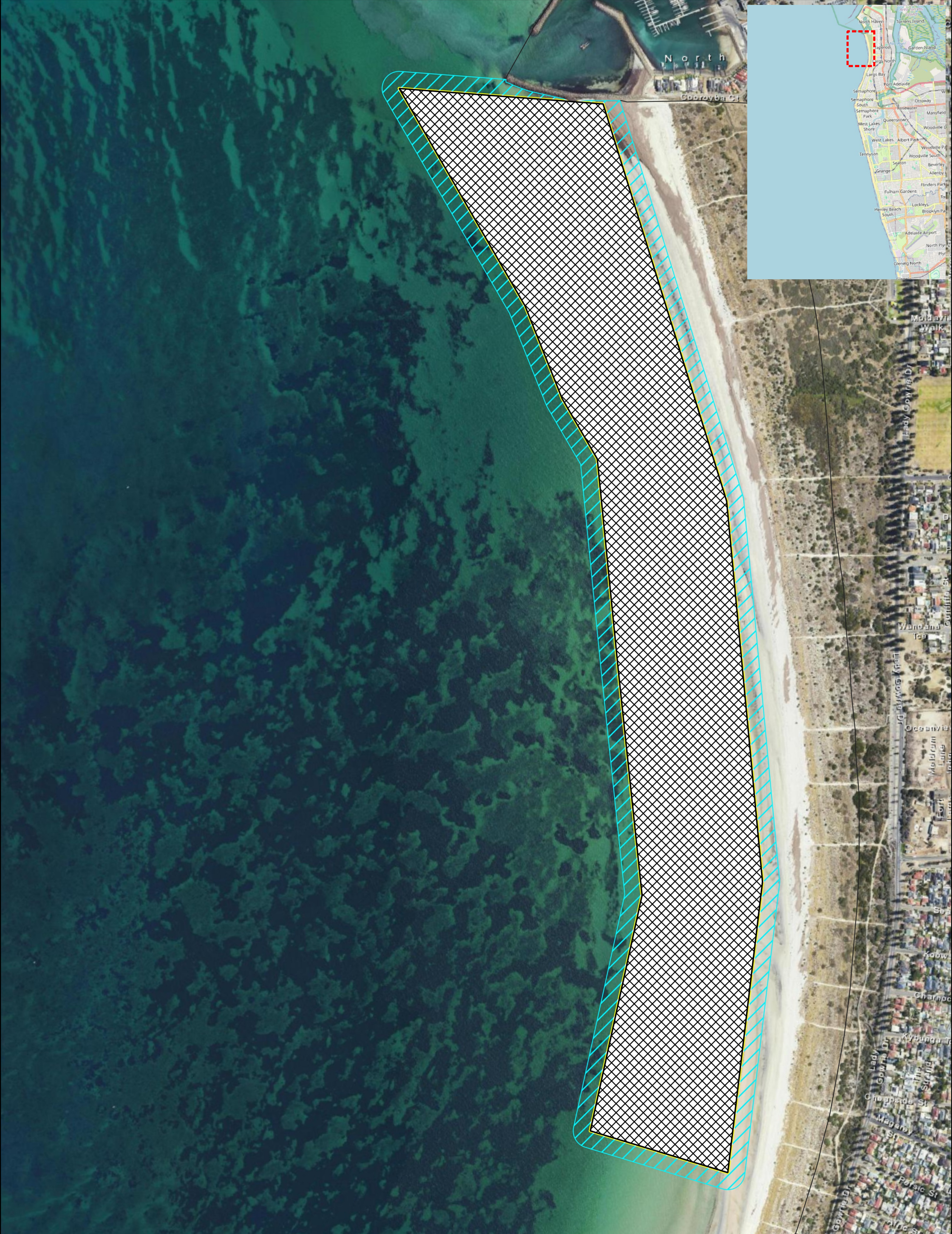
Threshold distances

PTS

TTS

Imagery sources: Google Maps 2023

sonus.



Adelaide Beaches Sand Backpassing Trial

Underwater Noise Assessment

CSD - Sand Borrow Area
Threshold distances - PP

Figure: A2
Page: 1/2

Date: 20/08/2024
Refer report: S8105.1C4

Author: AC
Reviewed: SM

0 50 100 150 200 m

GDA94 / MGA zone 54
1:7,500 at A3

Legend

Coastline

Dredge location

Threshold distances

PTS

TTS

Imagery sources: Google Maps 2023

sonus.

Adelaide Beaches Sand Backpassing Trial
Underwater Noise Assessment
CSD - Sand Deposition Area
Threshold distances - PP

Figure: A2 Page: 2/2	Date: 20/08/2024 Refer report: S8105.1C4	Author: AC Reviewed: SM

0 30 60 90 120 m
GDA94 / MGA zone 54
1:5,000 at A3

Legend
- Coastline
- Dredge location

Threshold distances
- PTS
- TTS

sonus.

Adelaide Beaches Sand Backpassing Trial

Underwater Noise Assessment

BHD - Sand Borrow Area
Threshold distances - LFC

Figure: A3 Page: 1/1	Date: 20/08/2024 Refer report: S8105.1C4	Author: AC Reviewed: SM

0 100 200 300 400 m

GDA94 / MGA zone 54
1:15,000 at A3

Legend

- Coastline
- Dredge location

Threshold distances

- PTS
- TTS

Imagery sources: Google Maps 2023

sonus.

Adelaide Beaches Sand Backpassing Trial

Underwater Noise Assessment

BHD - Sand Borrow Area
Threshold distances - PP

Figure: A4
Page: 1/1

Date: 20/08/2024
Refer report: S8105.1C4

Author: AC
Reviewed: SM

0 100 200 300 400 m

GDA94 / MGA zone 54
1:15,000 at A3

Legend

Coastline

Dredge location

Threshold distances

PTS

TTS

Imagery sources: Google Maps 2023

sonus.

APPENDIX B: UNDERWATER SOURCE LEVELS

Item	Level
CSD Dredge (<1,000 kW) – underwater noise	Source level: 157 dB re 1µPa (rms)(1)
BHD Dredge – underwater noise	Source level: 175 dB re 1µPa (rms) (1)

Notes:
(1) Source level provided in DIT UW Guidelines

Community and stakeholder engagement plan

Dredge trial

This *Dredge trial – community and stakeholder engagement plan* forms part of the Dredge Management Plan required by the Environment Protection Authority for any dredging activity undertaken in South Australia.

Focus of the engagement plan

- To demonstrate how the Department for Environment and Water (the department) will communicate and engage the public in relation to the dredge trial project, which is one of two strategies for restoration of West Beach erosion recommended by the Adelaide Beach Management Review Independent Panel.
- The focus of this engagement plan is to ensure that all people who are interested in the dredge trial are given an opportunity to be provided with further information, ask questions, and give feedback to the dredge project team.
- The engagement plan supports the implementation of the dredge trial, to raise public awareness and communicate planned dredging activities, and share information on possible impacts with potentially affected parties and how these risks are being managed.
- To outline how comprehensive community engagement will be implemented in acknowledgement that there is a high level of interest regarding dredging from community members with an interest in, and knowledge of, the marine environment.
- To supplement the broader media and communication objectives with targeted stakeholder engagement aimed at directing stakeholders to a central point of contact and source of updated information about the project, while ensuring content remains accurate in a rapidly changing program as new information and technical work is undertaken to inform the trial.
- To undertake early engagement to support strategic and purposeful liaison with the EPA, consultants, government agencies and key individual and community group stakeholders, to foster shared understanding of the project and evaluation criteria.

Key dates

May 2024: Government announces it will accept the panel recommendation to commence a dredge trial.
June 2024: Early engagement commenced with key community groups regarding beach access requirements. Environmental studies underway.
July 2024: Key coastal community groups join working group to enable a greater understanding of the details of the dredge trial and mass fill project. Water quality monitoring buoys deployed, and noise monitoring equipment installed to obtain existing background levels.
August 2024: Seeking EPA approval for the Dredge Management Plan. Preliminary communication to broader community to introduce the dredge trial project team.
Sept-Nov 2024: Proposed dredging trial using various methodologies subject to EPA approval. Communication to advise the community and stakeholders on the approved dredge trial design.
November 2024 onwards: Data gathered, analysed and compiled into expert reports. Results inform evaluation of the dredge trial incorporating social, environmental, economical and operational outcomes.

Community and stakeholder engagement plan

Dredge trial

Background and regulatory context

Adelaide's Beaches have been actively managed for nearly 50 years, to combat the perpetual northward sand drift that is caused by both natural and anthropological features of our coastline. In April 2022, the South Australian Government (Government) announced a comprehensive review of all available coastal sand management options. DEW established an Adelaide Beach Management Independent Advisory Panel (the panel), conducted two comprehensive state-wide public consultations, engaged state and national environmental and technical experts, and asked the panel to consider the comprehensive information and make a recommendation to Government.

During the consultation period on the shortlisted options, more than 348,000 people were reached via a social media campaign. Over 700 people provided feedback via the YourSAy survey and a further 39 individuals and groups provided written submissions. This included residents, fishers, boat users, jet skiers, swimmers, people using the beach and jetties, coastal residents, councils, and businesses. From an analysis of the feedback from the results of the YourSAy survey and direct community submissions, dredging from an offshore sand deposit received the strongest community support. There was however, evidence of detailed knowledge and a strong concern for the marine and seabed environment.

The panel recommended two key strategies be explored to preserve metropolitan beaches and combat coastal erosion:
1. Once-off restoration of West Beach with an external sand source; supplemented by
2. Long-term recycling of sand between the northern beaches and West Beach.

In order to achieve option 2, the panel recommended that the department conduct a sand dredging trial to determine whether this could be a feasible long-term sand recycling option. This *Dredge trial – community and stakeholder engagement plan* (the plan) relates to the dredge trial component of the panel's recommendations, and meets the requirements outlined by the Environment Protection Authority (EPA) stipulated in the Dredge Guidelines.

What will make this engagement successful?

- Community members are aware that there are environmental considerations to be managed as part of a dredge campaign.
- Community members are aware of the potential impacts of a dredge campaign, including noise, odour, turbid water, the presence of excavators and barges, and impact on seagrass.
- The outcome of further investigations such as water quality monitoring and sediment sampling will determine whether the dredge campaign will be able to successfully move the amount of sand required.
- People with an interest in the dredge program know how to find further information.
- To facilitate an understanding of the multitude of elements that comprise the dredge trial, and how it will be regulated by the EPA.

Community and stakeholder engagement plan

Dredge trial

International Association of Public Participation (IAP2) – proposed levels of engagement

Informative and inclusive practices will ensure stakeholder and community views are considered in the dredge trial evaluation. This plan follows the International Association of Public Participation (IAP2) principles to outline the level of engagement each stakeholder category should expect from the department and subsequent sections outline what levels will be used at what stages – pre-dredge, dredge, and post-dredge.

	Inform	Consult	Involve	Collaborate	Empower
IAP2 GOAL	Provide the public with balanced and objective information to assist them in understanding the problem, opportunities, and/or solutions.	To obtain public feedback on analysis and/or decisions, alternatives.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place the final decision making in the hands of the public.
IAP2 PROMISE	We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and aspirations, and provide feedback on how public input influenced the decision. We will seek your feedback on drafts and proposals.	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will look to you for advice and innovation in formulating solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.

The department is committed to undertake communication and engagement in line with the following Better Together principles:

- We are clear on the engagement objectives, with IAP2 levels selected according to the level of influence that are appropriate for a dredge trial and stipulated in the Environment Protection Authority (EPA) Dredge Guidelines.
- We have long-standing relationships with our communities and the local knowledge embedded within. A full list of community stakeholders is provided as Appendix A and is dynamic (see Upcoming communication phases).
- We respect our communities and acknowledge the diverse range of views and values, and the significant connection to the coastline and marine environment.
- The dredge trial project team will listen to the community, to fulfil our engagement objectives and be adaptive during the dredge trial.
- We will listen empathically and present community views transparently at the conclusion of the dredge trial.
- A variety of communication tools will be utilised to convey complex information in an easy-to-understand format (see Communication and engagement tools and techniques).

Community and stakeholder engagement plan

Dredge trial

Adelaide Beach Management Review Panel – 'Collaborate' level on the IAP2 spectrum

The Adelaide Beach Management Review Independent Panel (the panel) was established in response to concerns about the management and preservation of Adelaide's beaches. It was set up by the South Australian government to provide an independent assessment and recommendations for improving the management of these coastal areas.

The panel was formally established in September 2022. Its creation aimed to address issues related to beach erosion, environmental protection, and the balance between development and conservation along the Adelaide coastline. The independent nature of the panel was intended to ensure unbiased recommendations based on thorough research and stakeholder consultations. Panel members were selected for their diverse expertise, which covers scientific, engineering, environmental, and community aspects of beach management. Their collective knowledge is intended to provide a comprehensive review and set of recommendations for managing Adelaide's beaches effectively.

The dredge trial recommendation was based on an independent expert desktop review of 24 coastal management options, focusing on sand recycling methods including dredging, pipelines, and carting by truck. Community feedback on each of the options was considered alongside engineering solutions, which informed the panel's recommendation to trial sand dredging. The Government accepted the panel's recommendations and directed the Department to proceed with the dredge trial.

Panel Member	Areas of expertise
Mark Searle	Former Chief Executive Officer, City of Marion
Les Wanganeen	Kaurna representative
Sarah Smith	Kaurna representative
Professor Beverley Clarke	Flinders University, social science expert
Professor Emeritus Nicholas Harvey	University of Adelaide, coastal science expert
Professor Emeritus Michael Young	University of Adelaide, environmental science expert

First Nations consultation and engagement

The department acknowledges Aboriginal people as the First Peoples and Nations of the lands and waters we live and work upon and we pay our respects to their Elders past, present and emerging. We acknowledge and respect the deep spiritual connection and the relationship that Aboriginal and Torres Strait Islander people have to Country. We work in partnership with the First Peoples of South Australia and support their Nations to take a leading role in caring for their Country.

The department recognises the Adelaide coastline as the traditional lands of the Kaurna people. Kaurna representation on the panel was included to ensure it had consideration to First Nations cultural values, interests and potential concerns. Through this involvement the department recognises that evaluation of the dredge trial will need to further consider Kaurna perspectives upon completion, after reports are available and as part of the evaluation criteria. The department will take advice and seek guidance from the Kaurna Nation Cultural Heritage Association.

Community and stakeholder engagement plan

Dredge trial

Stakeholder analysis

Stakeholder mapping for the dredge trial is based on acknowledging the existing relationships that the department has with its communities and knowledgeable community members, responsible agencies and elected members. The approach for managing Adelaide's beaches is based on decades of research, monitoring and international best practice, with community input and historical knowledge intrinsically incorporated into departmental expertise.

Ongoing stakeholder identification will continue throughout the engagement process as new stakeholders with new information needs are identified. Any community member can self-identify as a stakeholder, and the department encourages everyone who has an interest in the dredge trial to contact us.

The below table outlines the main categories of stakeholders identified, the level of engagement that can be expected as part of this plan, and the engagement methods that the department will use to reach these stakeholders.

Stakeholder group	Options	Pre-dredge	Dredge trial	Post-dredge
Coastal community groups including coastal care groups and environmental interest groups	Consult	Involve	Inform	Consult
Coastal community members adjacent to beaches impacted by the dredge trial	Consult	Involve	Inform	Consult
Council executives and key staff	Consult	Involve	Inform	Consult
Department for Infrastructure and Transport	Involve	Involve	Inform	Consult
Department of Primary Industries and Regions SA	Involve	Involve	Inform	Consult
Environment Protection Authority*	Consult	Empower*	Empower*	Consult
First Nations communities	Involve	Inform	Inform	Consult
General public and other stakeholders, including people involved in previous consultations	Consult	Inform	Inform	Consult
Independent Panel	Empower	Inform	Collaborate	Consult
Local and state elected members				
Ocean users, including recreational fishers, boat users, swimmers, divers, sailing clubs, surf clubs etc.	Consult	Involve	Inform	Consult
South Australian Research and Development Institute, and university academics	Involve	Involve	Inform	Consult

**Dredging may not be undertaken without the EPA approval of a Dredge Management Plan and the EPA will enforce stop-work directions if water turbidity, which is sediment in the water that makes it cloudy, exceeds trigger values.*

At the conclusion of the post-dredge trial consultation period, the Department will provide an evaluation report on the outcomes of the trial that takes into consideration the environmental, operational, economical and social evidence that has been obtained.

Dredge trial

Communication and engagement tools and techniques

Extensive community consultation has been undertaken by the department across the various levels of the IAP2 spectrum. These are summarised at a high level in the table below and further detail is provided in the following sections.

	Inform	Consult	Involve	Collaborate	Empower
ENGAGEMENT TECHNIQUES	Direct phone number for the dredge trial project team Email distribution list for ongoing updates as information is available YourSAy page with project details and links to key documents Drone imagery to capture the excavation site, transportation and sand placement areas Fact sheets at key milestones FAQs uploaded to website May 2024 and reviewed weekly to address new requests for information Flyers at community information points Letterbox notifications to local communities impacted by work	Community group presentations Post-dredge trial community information session Post-dredge trial digital engagement via YourSAy	Early, direct, one-on-one engagement Regular meetings Location-based beach access workshops	Interagency consultation	Adelaide Beach Management Review Independent Panel

Community and stakeholder engagement plan

Dredge trial

Communication phases leading up to the dredge trial

- Apr-Jun 2023: Adelaide Beach Management Review community consultation values and longlist, resulting in the development of 24 options.
- Sep-Oct 2023: Adelaide Beach Management Review Options Shortlist community consultation and Independent Panel public hearings.
- Nov 2023: Independent Advisory Panel considered several feasible options that were shortlisted during the independent scientific review.
- May 2024: Government announces panel recommendation to trial sand dredging to supplement the once-off restoration from an external source.
- Jun 2024: Early engagement commenced with coastal community stakeholders near dredge excavation site, dredge sand placement site, community stakeholder groups and the EPA.
- July 2024: Early engagement feedback captured to inform the Dredge Management Plan.

Community and stakeholder engagement plan

Dredge trial

Upcoming communication phases

- Aug 2024: Information about the commencement of a dredge trial sent to electronic distribution list with the project team phone and email.
- Sep 2024: fact sheet detailing further work undertaken to get to trial, communicated via above channels and at community group meetings.
- Third communication subject to EPA approval: media, fact sheet regarding the dredge trial design, EPA regulation, YourSAy page, evaluation criteria.
- Ad hoc: dredge underway, any updates or changes, reminder how to contact the dredge project team and provide feedback distributed via the above channels, stop work notifications.
- Post dredge: advice about timeframes for the collation of data into reports and advice when made publicly available upon completion, communicated via above channels and notification for next steps.
- Invitation to an in-person community information session and digital engagement consultation post dredge. Kaurna consultation to provide information about elements of the dredge and seek feedback regarding cultural values (subject to completion of required reports to inform the consultation).

APPENDIX A: List of stakeholders at the time of Dredge Management Plan submission*

COMMUNITY STAKEHOLDER GROUPS – CENTRAL AND NORTHERN BEACHES AND SURROUNDS

Invitations sent to: Port Adelaide Residents Environment Protection Group, Taperoo Dunes Group, Semaphore Largs Dunes Group, Save Our Shores Semaphore Largs Bay, Tennyson Dunes Group, Friends of Tennyson and Grange, North Haven Dunes Group, Friends of St Vincent Gulf, Western Area Residents Association and the Port Environment Centre. Environment Protection Authority representatives were also invited and accepted.

If your organisation would like to be a part of this group, please get in contact with us.

COMMUNITY GROUPS AND RECREATIONAL CLUBS

Adelaide Coastal Communities Alliance
Adelaide Sailing Club
Angas Inlet Boat Club
Bird Life Australia
Blue Ice Charters
Brighton and Seacliff Yacht Club
Brighton SLSC
Brindabella Sailing
Coastal Ecology Group
Coastal solutions - connections to Dundon and City of Charles Sturt
Commercial fisheries
Conservation Council of South Australia
Cruising Yacht Club of SA
Experiencing Marine Sanctuaries
Flinders University
Friends of Grange Beach
Friends of Gulf St Vincent
Friends of Minda Dunes
Friends of North Haven Dunes Group
Garden Island Yacht Club
Grange Sailing Club Get Hooked Fishing Charters
Glenelg Fishing Charters
Glenelg SLSC
Grange Surf Life Saving Club
Henley and Grange Historical Society
Henley Beach Business Association
Henley Beach South Dune Care Group
Henley Coastal Voice
Henley Sailing Club
Henley SLSC
Heritage Restoration Dunes Group

COMMUNITY GROUPS AND RECREATIONAL CLUBS cont.

Holdfast Habitat Heroes (City of Holdfast Bay Program)
Kaurna Nation Cultural Heritage Association
Kaurna Yerta Aboriginal Corporation
Lot 101 Dune Care Group
North Haven Dunes Care Group
North Haven SLSC
OzFish
PIRSA, Fisheries & Aquaculture, Primary Industries & Biosecurity
Port Adelaide Resident's Environment Protection Group
Port Adelaide Sailing Club
RecFish
Royal South Australian Yacht Squadron
Sand Piper Dunes Care Group
Save our Shores
Save West Beach Sand
Seacliff SLSC
Sea Squadron at West Beach
Semaphore Mainstreet Association / traders
Semaphore SLSC
Semaphore to Largs Dune Care Group
Small Boat Club
Somerton SLSC
Somerton Yacht Club
South Australian Oyster Growers Association
South Australian Sea Rescue Squadron
St Kilda Boat Club
Surf Life Savings SA
Taperoo Dune Care Group
Temptation Sailing
Tennyson Dunes Group
University of Adelaide
University of South Australia
WACRA Western Adelaide Residents Association
West Beach Parks
West Beach SLSC
Western Business Leaders (City of Charles Sturt)
Whale and Dolphin Conservation Society
Wild Endangered Dunes Group (WEDGE)
Wildcatch Fisheries SA

Sand Dredging Trial

Department for Environment and Water

EPBC Act Self-Assessment

JBS&G | 67100 | 160,927

12 September 2024

We acknowledge the Traditional Custodians of Country throughout Australia and their connections to land, sea and community.

We pay respect to Elders past and present and in the spirit of reconciliation, we commit to working together for our shared future.

Caring for Country The Journey of JBS&G
Artist: Patrick Caruso, Eastern Arrernte

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Abbreviations

Term	Description
BDBSA	Biological Databases of South Australia
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEW	Department for Environment and Water
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
km	Kilometre
m	Metre
MMO	Marine mammal observers
MNES	Matters of National Environmental Significance
PMST	Protected Matters Search tool
SA	South Australia
SA EPA	South Australian Environmental Protection Authority
TEC	Threatened Ecological Community
The Code	Planning and Design Code
The Minister	The Australian Government Minister for the Environment

Executive Summary

Project Outline

The Department for Environment and Water (DEW) is proposing to undertake a sand dredging trial to determine if dredging can be a long-term solution to the natural erosion of Adelaide's southern and central beaches. The proposed works involves dredging sand from the littoral zone at Largs Bay and using a barge to deposit the sand at West Beach (hereafter referred to as the Project).

The purpose of this *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) self-assessment is to assess whether the Project is likely to require a referral under the EPBC Act. Under the EPBC Act an action will require approval from the Australian Government Minister for the Environment (the Minister) if the action has, will have, or is likely to have, a significant impact on a Matter of National Environmental Significance (MNES) (DEWHA, 2013a). This report describes the Project and assesses whether it has the potential for significant impact on an MNES.

Summary of Assessment Results

JBS&G has assessed the Project against nine MNES including:

- World heritage areas.
- National heritage places.
- Wetlands of international importance (listed under the Ramsar Convention).
- Listed threatened species and ecological communities.
- Listed migratory species (protected under international agreements).
- Commonwealth marine areas.
- Great Barrier Reef Marine Park.
- Nuclear actions (including uranium mines).
- Water resources (that relate to coal seam gas development and large coal mining development).

Of the nine MNES, two were considered relevant to the Project Area; listed threatened species and ecological communities, and listed migratory species.

Two Threatened Ecological Communities (TECs) were identified by the EPBC Act Protected Matters Search Tool (PMST) as potentially occurring within 5 km of the Project Area:

- Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands; and
- Derived Native Grasslands of South-eastern Australia (Endangered) and Subtropical and Temperate Coastal Saltmarsh (Vulnerable).

Both were assessed as unlikely to occur within the Project Area.

Ten EPBC Act listed threatened flora species were identified as potentially occurring within 5 km of the Project Area. All were assessed as unlikely to occur within the Project Area.

The EPBC Act PMST identified fifty-four EPBC Act listed threatened fauna species as potentially occurring within 5 kilometres (km) of the Project Area. Of these, one threatened terrestrial mammal, two threatened marine mammals, one threatened species of shark and two threatened species of turtle were also considered as possibly occurring within the Project Area as transient visitors only. Ten threatened bird species were assessed as possibly occurring (mostly as transient visitors) and one threatened bird species was assessed as likely to occur (*Calidris acuminata* Sharp-tailed sandpiper) within the project Area. None of these species were considered dependent on habitat within the Project Area. One threatened bird species was assessed as highly likely to occur (Eastern Hooded Plover *Thinornis cucullatus cucullatus*) within or close to the Project Area. It is proposed that an Eastern Hooded Plover Management Plan be developed that will detail management and mitigation measures to avoid impacts to this species. With the implementation of these management and mitigation measures, the Project is considered unlikely to have a significant impact on the Eastern Hooded Plover.

Sixty-four migratory bird species were identified by the desktop assessment as potentially occurring within 5 km of the Project Area. Approximately one quarter of these species were assessed as possibly occurring in the Project Area (mostly as transient visitors) and one species assessed as likely to occur within the Project Area (Sharp-tailed Sandpiper). It was considered that the Project Area would not provide important habitat for any of these migratory species.

Conclusion

JBS&G completed a self-assessment as per the Department of Climate Change, Energy, the Environment and Water (DCCEEW), 2013 *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance*. Commonwealth Department of the Environment Water Heritage and the Arts. This report presents the outcomes of this assessment. It was considered that the Project is unlikely to have a significant impact on any of the MNES identified.

Given this, a referral under the EPBC Act is not considered necessary. However, the decision whether to refer or not should consider a number of additional factors including political risk, community and social expectations.

1. Introduction

An Independent Adelaide Beach Management Review has recommended the South Australian Government investigate if dredging can be a long-term, sustainable solution to maintaining beach levels along Adelaide's metropolitan beaches by recycling sand that naturally drifts north along the coast.

Based on this recommendation, the Department for Environment and Water (DEW) is proposing to undertake a sand dredging trial along Adelaide's metropolitan coast, commencing in late Winter/early Spring 2024. The sand dredging trial involves dredging sand from the littoral zone at Largs Bay and depositing sand at West Beach (hereafter referred to as 'the Project'). The Project seeks to manage the ongoing erosion issues at West Beach, and maintain Adelaide's sandy beaches.

1.1 Study Area and Locality

The Project Area extends from North Haven to West Beach (Figure 1-1), an approximate 20 kilometre (km) stretch of Adelaide's coastline). Sand is proposed to be dredged from Largs Bay collection area and deposited at West Beach (Figure 1-1).

Within the Green Adelaide region, which was established under the *Landscape South Australia Act 2019*, the Project Area traverses the edge of the Local Government Areas of City of Port Adelaide Enfield, City of Charles Sturt and City of West Torrens. The Project is proposed on land zoned as Open Space by the Planning and Design Code (the Code) under the *Planning, Development and Infrastructure Act 2016.*

Several conservation parks and reserves occur approximately 4 to 10 km north of the northern most part of the Project Area (Figure 1-2). The Adelaide International Bird Sanctuary National Park - Winaityinaityi Pangkara, Torrens Island Conservation Park and Mutton Cove Conservation Reserve are located a minimum of 4 km northeast from the northern most part of the Project Area. The Barker Inlet – St Kilda Aquatic Reserve and the St Kilda – Chapman Creek Aquatic Reserve are located approximately 5 km northeast of the northern most part of the Project Area within the Port River estuary and associated mangroves.

1.2 Purpose and Scope of this Report

This report assesses whether any action associated with the Project is likely to have a significant impact on any Matters of National Environmental Significance (MNES) protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) within and surrounding the Project Area.

Under the EPBC Act, any action that will, or is likely to, result in a significant impact on MNES requires a referral to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) for a decision by the Australian Government Minister for the Environment (the Minister) on whether assessment and approval is required under the EBPC Act. The action is broadly defined as a project, an undertaking, an activity or a series of activities, or an alteration of any of these things. If it is deemed that significant impacts are likely, then the action will require further assessment and approval.

This self-assessment report considers the potential presence of MNES, the nature and extent of potential direct, indirect, and offsite impacts and any mitigation measures to assess whether or not the proposed action has the potential to have a significant impact on MNES and therefore, whether it requires referral to DCCEEW under the EPBC Act.

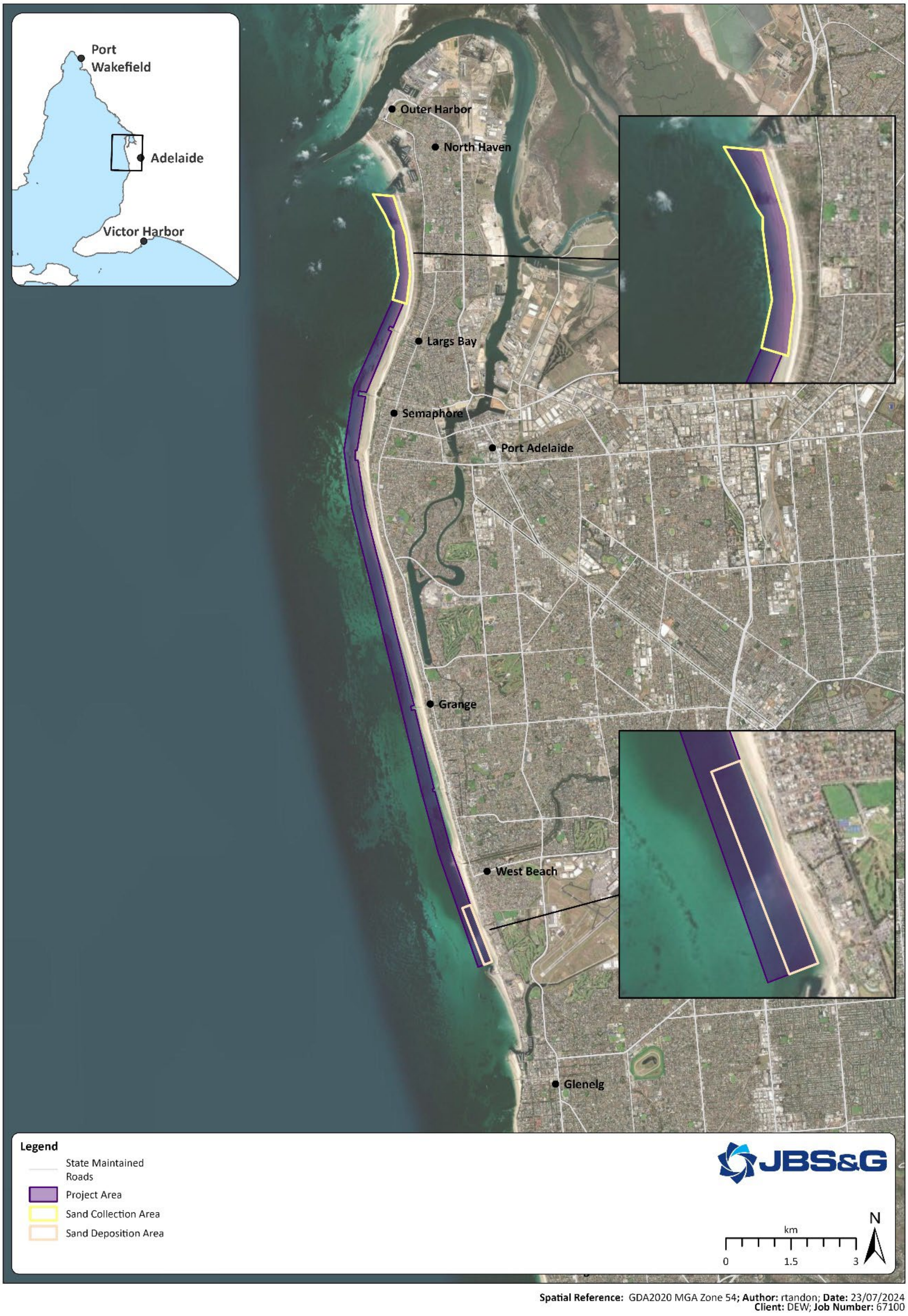
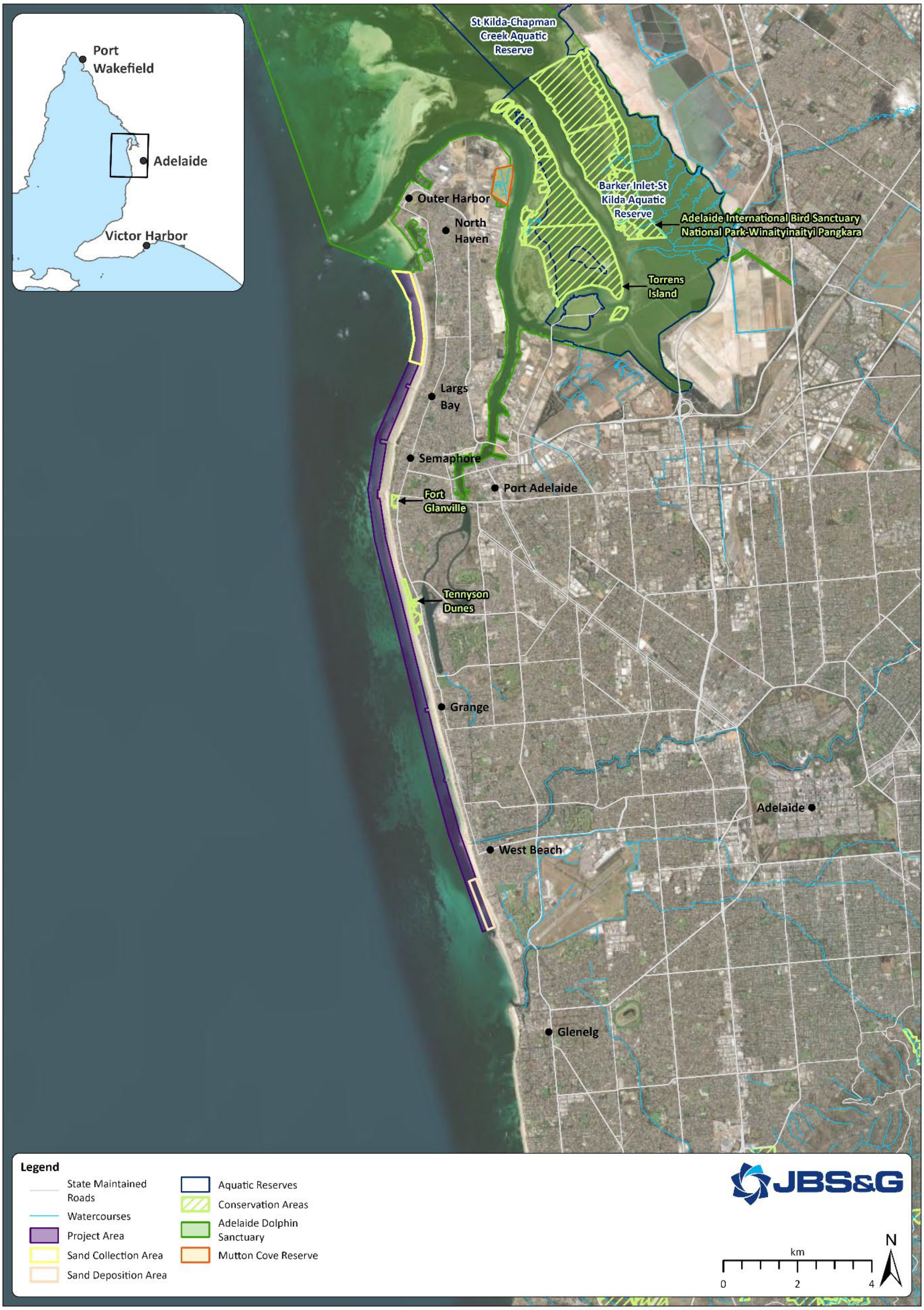


Figure 1-1: Location of the Project Area including the sand collection area at Largs Bay and sand placement area at West Beach



Spatial Reference: GDA2020 MGA Zone 54; Author: rtandon; Date: 24/07/2024
Client: DEW; Job Number: 67100

Figure 1-2: Conservation and aquatic reserves and sanctuaries north of the Project Area

2. Details of the Activity

2.1 Project Description

The Government of South Australia (SA) is proposing to trial sand dredging as a way to manage sand levels along Adelaide's metropolitan beaches. Sand naturally moves north along Adelaide metropolitan coast as a result of wind and wave activity. Significant erosion is an ongoing issue at West Beach. At the same time, significant accumulation of sand is occurring at Adelaide's northern beaches including Semaphore, Largs Bay and North Haven. The Project is a trial that will inform the state Government of the viability and success of dredging to manage the sand loss from West Beach.

The Project involves dredging sand from an area of significant sand accumulation and subsequent placement of dredged sand at West Beach. Several technical studies, including, but not limited to sediment characterisation, bathymetric surveys and a coastal process assessment, have been undertaken to understand the area most suitable for sand collection. An area at Largs Bay, situated in the littoral zone, has been identified as the most suitable area for sand collection (Figure 1-1). The littoral zone is defined herein, as the area between the high tide mark and extending seaward to where waves interact with the seabed.

Cutter suction dredging will be utilised for the Project as this is best suited for nearshore dredging environments due to its ability to minimise proximal sedimentation impacts. The cutter suction dredge would be located within approximately 200 metre (m) off the shoreline at Largs Bay. The dredged material will be transferred to a barge and transported seaward side, to West Beach.

The success of sand placement for widening the beach and or adding sediment to the beach is dependent on many factors, including geomorphology, metocean, and hydrodynamics. When depositing the material, different placement methods and locations may be tested during the trial. Options include nearshore placement, approximately 100 m from the shoreline, and beach placement. Beach placement may require short term beach closures.

Up to 90,000 m^3 of sand will be dredged from Largs Bay and placed at West Beach. The trial is proposed to commence in late August and operate continuously for six to eight weeks.

2.2 Potential Impacts

Potential impacts from the Project include, but are not limited to:

- Loss of habitat.
- Increased turbidity and sedimentation from dredging resulting in indirect impacts to nearby seagrass, via reduced light and or smothering.
- Underwater noise and vibration impacting physiology of marine biota.
- Introduction of diseases into the marine environment
- Localised increased turbidity resulting in reduced beach aesthetic amenity.
- Nuisance noise from dredging impacting amenity.
- Reduced visual amenity with presence of dredge and barge equipment.

It is noted that there is no seagrass within the area at Largs Bay where sand is proposed to be dredged (JBS&G, 2024). As such, no direct loss of seagrass habitat would occur through the Project. However, seagrass beds are present within close proximity to the area to be dredged.

2.3 Legislative Context

2.3.1 South Australia

Dredging is a prescribed activity of environmental significance listed in Schedule 1 of the South Australian *Environment Protection Act 1993*. Activities of prescribed environmental significance can only be undertaken with an environmental authorisation from the South Australian Environmental Protection Authority (SA EPA), predominantly in the form of a licence.

As part of SA EPA licence conditions, a Dredge Management Plan would be required to manage potential risks and impacts from dredging. Additional environmental monitoring would also be required as a condition of the SA EPA licence for the Project, including, but not limited to baseline and post dredging seagrass surveys, and water quality baseline and post dredging surveys. Ongoing consultation has been undertaken between DEW and SA EPA for the Project.

2.3.2 Commonwealth

The EPBC Act protects the following MNES:

- World heritage properties.
- National heritage places.
- Wetlands of international importance (listed under the Ramsar Convention).
- Listed threatened species and ecological communities.
- Migratory species protected under international agreements.
- Commonwealth marine areas.
- The Great Barrier Reef Marine Park.
- Nuclear actions (including uranium mines).
- A water resource, in relation to coal seam gas development and large coal mining development.

A person who proposes to take an action that will have, or is likely to have, a significant impact on a MNES must refer that action to the Minister for a decision on whether assessment and approval is required under the EPBC Act.

3. Methods

The self-assessment follows the process outlined in the MNES significant impact guidelines (DEWHA, 2013a).

The self-assessment uses the data obtained in a desktop review together with findings from an ecological assessment undertaken by EBS Ecology for the previously approved '*Securing the future of our coastline sand pumping system project*'[1] which was undertaken within the vicinity of the Project Area.

3.1 Sources of Information

A desktop assessment was undertaken which included using the following databases and search tools:

- EPBC Act Protected Matters Search Tool (PMST) (DCCEEW, 2024a) within a 5 km buffer zone of the Project Area (accessed 10 July 2024) (see Figure 3-1 and **Appendix A**).
- A search of the Biological Databases of South Australia (BDBSA) (DEW, 2024) for a 5 km radius around the Project Area (obtained 10 July 2024) (see Figure 3-1, **Appendix B**, and **Appendix C**).
- The species profile and threats database (DCCEEW, 2024b), approved conservation advice, recovery plans and other published information were used to obtain further information for individual species.

3.2 Field Survey

An on-ground ecological survey was undertaken by EBS Ecology (EBS Ecology, 2021) on 24 – 27 May 2021, and again on 18 October 2021 as part of the previously proposed sand pumping system project. The purpose of this assessment was to map the ecological values of the area including terrestrial vegetation and flora and fauna habitat across the proposed sand pumping system corridor. During this survey, vegetation was mapped a and species of conservation significance recorded if present within the area.

3.3 Threatened Flora and Fauna Likelihood of Occurrence

The likelihood of each threatened ecological community (TEC), listed threatened species (flora and fauna) and listed migratory species occurring within the Project Area, including a 5 km buffer, was assessed. A likelihood of occurrence rating assigned to each TEC and listed threatened and migratory species identified in the PMST and BDBSA search, according to the criteria listed in **Table 3-1**.

[1] The '*Securing the future of our coastline sand pumping system project*' proposed to construct and operate a sand pumping pipeline between West Beach and Semaphore to manage sand movement and erosion along Adelaide's metropolitan beaches. The sand pumping system project was approved, however amid local community concerns and with an incoming government, the project was halted and an Independent Advisory Panel appointed to oversee a process for the identification of a sustainable solution to manage Adelaide Beaches.

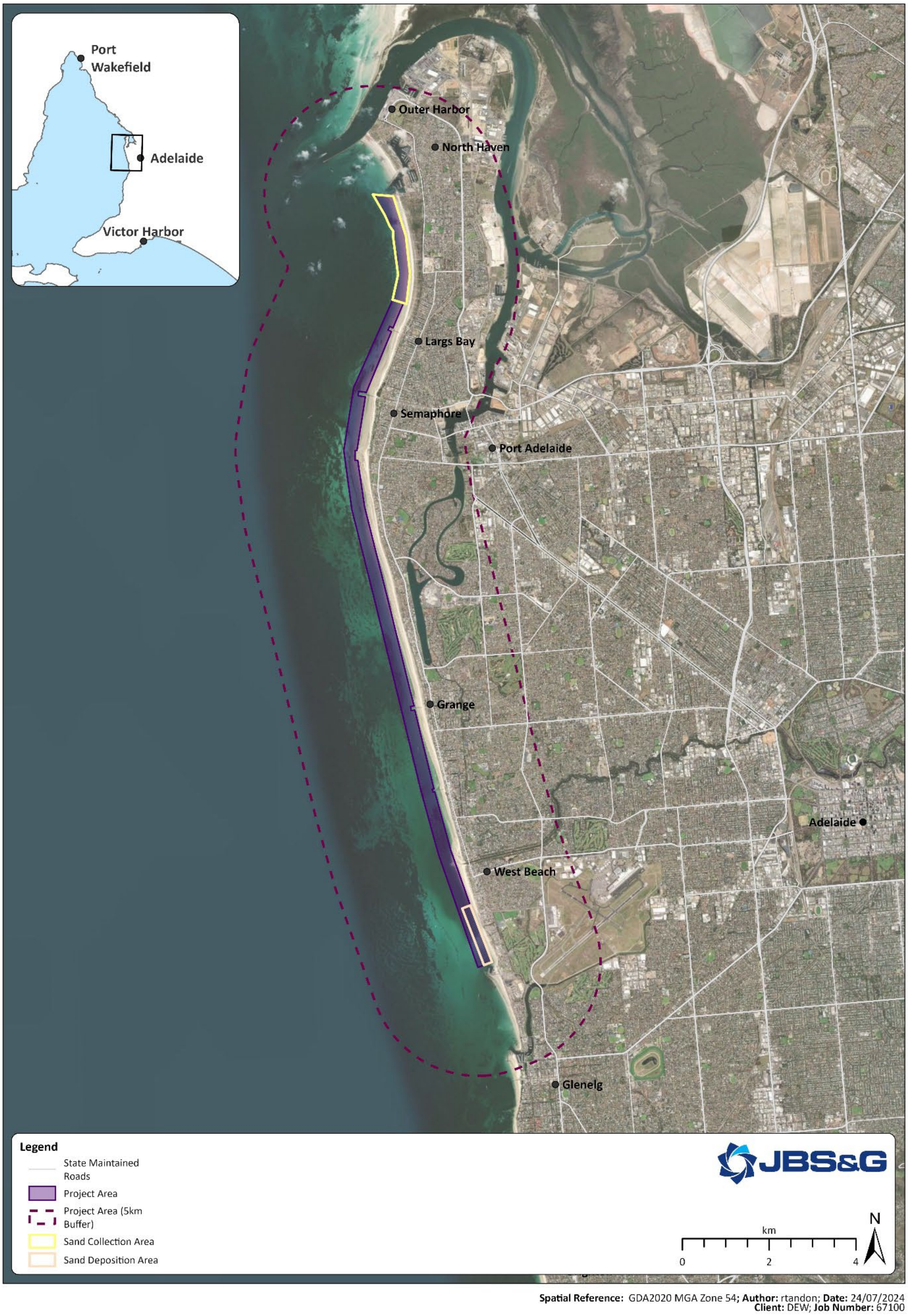


Figure 3-1: Project Area with a 5 km buffer zone

Table 3-1: Criteria for the liklihood of occurance of threatened species

Likelihood	Criteria
Highly likely/known	Recorded in the last 10 years, the species does not have highly specific niche requirements, the habitat is present and falls within the known range of species distribution or the species was recorded as part of the field surveys.
Likely	Recorded within the previous 20 years, the area falls within the known distribution of the species and the area provides habitat or feeding resources for the species.
Possible	Recorded within the previous 20 years, the area falls inside the known distribution of the species, but the area provides limited habitat or feeding resources for the species. Recorded within 20 – 40 years, survey effort is considered adequate, habitat and feeding resources is present, and species of similar habitat needs have been recorded in the area.
Unlikely	Recorded within the previous 20 years, but the area provides no habitat or feeding resources for the species, including perching, roosting or nesting opportunities, corridor for movement or shelter. Recorded within 20-40 years; however, suitable habitat does not occur, and species of similar habitat requirements have not been recorded in the area. No records despite adequate survey effort.

This assessment is detailed in **Table 4-2**, **Table 4-3**, and **Table 4-4**.

3.4 Significant Impact Criteria

3.4.1 Threatened species

For threatened flora and fauna, the Project has been assessed against the Commonwealth EPBC Act *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* (DEWHA, 2013a) significant impact criteria set out in **Table 3-2** below.

Table 3-2: Significant impact criteria for threatened species

Critically endangered and endangered species	Vulnerable species
An action is likely to have a significant impact if there is a real chance or possibility that it will:	
• Lead to a long-term decrease in the size of a population	• Lead to a long-term decrease in the size of an important population of a species
• Reduce the area of occupancy of the species	• Reduce the area of occupancy of an important population
• Fragment an existing population into two or more populations	• Fragment an existing important population into two or more populations
• Adversely affect habitat critical to the survival of a species	• Adversely affect habitat critical to the survival of a species
• Disrupt the breeding cycle of a population	• Disrupt the breeding cycle of an important population
• Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	• Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
• Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	• Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat
• Introduce disease that may cause the species to decline	• Introduce disease that may cause the species to decline
• Interfere with the recovery of the species	• Interfere substantially with the recovery of the species

3.4.2 Migratory species

Assessment of impact significance on migratory species has considered the significant impact criteria listed below (DEWHA, 2013b). An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

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

4. Self-Assessment of Impacts to MNES

The assessment of the likelihood of significant impacts from the Project on the nine MNES listed under the EPBC Act is summarised in **Table 4-1**, and further detail is provided in **Sections 4.1** to **4.3**.

Table 4-1: Summary of MNES relevant to the Project Area

Category	NES Matter	Details	Is the Project likely to have a significant impact?
World Heritage Properties	None	-	-
National Heritage Places	None	-	-
Wetlands of international significance (Ramsar wetlands)	None	-	-
Threatened species and ecological communities	Several threatened species and TECs predicted by the PMST and BDBSA searches within the search area.	See **Section 4.1** and **Section 4.2**.	No
Migratory species protected under international agreements	Several migratory species were predicted by the PMST and BDBSA searches within the search area.	See **Section 4.3**.	No
Commonwealth marine areas	None	-	-
Great Barrier Reef Marine Park	None	-	-
Nuclear actions (including uranium mining)	None	-	-
Water resource in relation to CSG or coal mining	None	-	-

4.1 Threatened Ecological Communities

The Subtropical and Temperate Coastal Saltmarsh TEC and the Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia TEC were predicted to occur within 5 km of the Project by the PMST. **Table 4-2** details these TECs, their likelihood of occurrence and the likelihood of significant impact from the Project.

Table 4-2: Likelihood of occurrence and assessment of impact significance for EPBC listed TEC in the Project Area

EPBC Act Conservation Status: V=Vulnerable, E=Endangered

Name	EPBC Status	Details	Likelihood of occurrence	Is Project likely to have a significant impact?
Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	E	This TEC is predicted by PMST to occur within 5 km of Project Area. This TEC is typically found in temperate woodlands and forests of the lower slopes and tablelands of southeastern Australia, and the semi-arid communities further inland (DCCEEW, 2010). The Project Area encompasses the littoral zone of Adelaide's coastline, which is not suitable habitat for the TEC. Aerial imagery confirms the TEC is not present within the Project Area. The Project will not impact this TEC.	Unlikely	No
Subtropical and Temperate Coastal Saltmarsh	V	This TEC is predicted by PMST to occur within 5 km of Project Area. This TEC is typically found in coastal areas under regular or intermittent tidal influence, most commonly within saltmarshes and estuaries (DCCEEW, n.d.). The closest predicted occurrence of this TEC is within the Mutton Cove Conservation Reserve and the Torrens Island Conservation Park, both approximately 3 km north from the Project Area. This TEC does not constitute a MNES. The significant impact guidelines (DEWHA, 2013b) state that listed ecological communities in the Vulnerable category are not MNES for the purposes of Part 3 of the EPBC Act (requirements for environmental approvals). While this TEC is not a MNES, the Project will not significantly impact this TEC.	Unlikely	N/A – see 'details' column for justification

4.2 Listed Threatened Fauna and Flora

The PMST predicted ten nationally threatened flora species and fifty-four[2] nationally threatened fauna species to occur or use habitat in the Project Area (see PMST results in **Appendix A**). Bird species comprised the majority of the fauna species. BDBSA records for listed threatened species within the search areas are further provided in **Appendix B** and **Appendix C**.

The likelihood of occurrence and assessment of impact significance for these species is summarised **Table 4-3**.

Within the Project Area, ten threatened bird species were assessed as possibly occurring (mostly as transient visitors), one threatened bird species was assessed as likely to occur (*Calidris acuminata* Sharp-tailed sandpiper). None of these species were considered dependent on habitat within the Project Area (**Table 4-3**).

One threatened bird species was assessed as highly likely to occur (Eastern Hooded Plover *Thinornis cucullatus cucullatus*). If present, the Eastern Hooded Plover may use the beach area between the low tide mark and foredune for foraging, and with nesting occurring near the foredune. Mitigation measures for minimising impacts to the Eastern Hooded Plover are detailed in Section 4.5.1.

One threatened terrestrial mammal, two threatened marine mammals, one threatened species of shark, and two threatened species of turtle were also considered as possibly occurring within the Project Area as transient visitors only.

The Project will not result in the loss of habitat that would significantly impact any threatened species through reduction in population size or area of occupancy, fragmentation of any population, disruption of breeding cycle, decline due to habitat impacts, introduction of invasive species or interference of the recovery of the species.

Consequently, the Project is **not likely** to have a significant impact on listed threatened species.

[2] Species that are listed as conservation dependent under the EPBC Act are not considered as MNES for the purposes of Part 3 of the EPBC Act and consequently have not been included in the assessment.

Table 4-3: Likelihood of occurrence and assessment of impact significance for EPBC listed threatened flora and fauna in the Project Area

EPBC Act Conservation Status: R=Rare, V=Vulnerable, E=Endangered, CE=Critically Endangered, Mi=Migratory

Scientific Name	Common Name	EPBC Status	Details	Likelihood of occurrence	Is the Project likely to have a significant impact?
Plants					
Caladenia tensa	Greencomb Spider-orchid, Rigid Spider-orchid	E	Occurs in *Callitris spp.* (cypress pine), *Eucalyptus leucoxylon* (Blue gum) woodland and *Melaleuca uncinata* (Broombush) mallee on Tertiary and Quaternary aeolian sandy loams in the Murray-Darling Depression bioregion (DCCEEW, 2016). There are no BDBSA records within 5 km of the Project Area. Unlikely to be present in the littoral zone of sandy beaches.	Unlikely	No
Caladenia conferta	Coast Spider-orchid	E	Typically found in mallee woodlands or broombush scrubs in terra-rosa soils over limestone, or on fertile red-brown soils amongst granite outcrops (DCCEEW, 2024b). There are no BDBSA records within 5 km of the Project Area. Unlikely to be present in the littoral zone of sandy beaches.	Unlikely	No
Euphrasia collina subsp. osbornii	Osborn's Eyebright	E	Typically grown in mallee scrubland, Osborn's Eyebright is also found in sclerophyll forests, sclerophyll woodland, heathy openings in wet sclerophyll forest, and in a swamp at Mt Compass (DCCEEW, 2024b). One historical record within 5 km of the Project Area (1943). As a short-lived, perennial herb (DCCEEW, 2024b), the species is unlikely to be present in the littoral zone of sandy beaches.	Unlikely	No
Prasophyllum pallidum	Pale Leek-orchid	V	Found within well-grassed open forests from the Flinders Ranges to the Northern and Southern Lofty regions of SA (DCCEEW, 2008a). There are no BDBSA records within 5 km of the Project Area. Unlikely to be present in the littoral zone of sandy beaches.	Unlikely	No
Prasophyllum validum	Sturdy Leek-orchid, Mount Remarkable Leek-orchid	V	Tends to grow in drier woodland habitats, generally with a low sparse understorey. In SA, occurs in *Eucalyptus cladocalyx* woodland with porcupine grass Triodia species understorey, on loamy soils (Duncan, 2010). There are no BDBSA records within 5 km of the Project Area. Unlikely to be present in the littoral zone of sandy beaches.	Unlikely	No

Scientific Name	Common Name	EPBC Status	Details	Likelihood of occurrence	Is the Project likely to have a significant impact?
Senecio macrocarpus	Large-fruit Fireweed, Large-fruit Groundsel	V	Previously widespread species occurring from the Yorke Peninsula in west of SA to Victoria. In SA, the species occurs most commonly in depressions in low lying closed sedgeland but may occur in sedgeland, herbland, low shrubland to low open woodland where competition from understorey plants is low. The soils range from clay to loamy sand. In SA, species occurs in the Messent Conservation Park, Gum Lagoon Conservation Park, and at Yalkiri Station (Sinclair, 2010). There are no BDBSA records within 5 km of the Project Area. Unlikely to be present in the littoral zone of sandy beaches.	Unlikely	No
Tecticornia flabelliformis	Bead Glasswort, Bead Samphire	V	Species is endemic to and widely distributed across southern Australia. It grows on margins of salt lakes and coastal salt marshes over gypsum deposits, and often associated with other *Tecticornia* species. It generally occurs on periodically, but not regularly, inundated depressions on clay (occasionally sandy) soils, often, but not always, in saline area (Carter, 2011). There are seven historical BDBSA records (all prior to the year 1991) of this species within 5 km of the Project Area in the Torrens Island Conservation Park which is 3 km east of northern end of the Project Area. There are no records within the Project Area. Unlikely to be present in the littoral zone of sandy beaches.	Unlikely	No
Thelymitra matthewsii	Spiral Sun-orchid	V	Typically found in open forests and woodlands in well-drained sand and clay loams. This post-disturbance coloniser is common in open areas around old quarries and gravel pits, on road verges, disused tracks, and animal trails (DCCEEW, 2024b). There are no BDBSA records within 5 km of the Project Area. Unlikely to be present in the littoral zone of sandy beaches.	Unlikely	No
Pterostylis arenicola	Sandhill Greenhood Orchid	V	Occurs within mallee and native pine woodlands on sloping or undulating sites with sand and sandy loam. It is common within areas with mild winters and warm to hot summers with winter dominant rainfall ranging from 320–470 mm (DCCEEW, 2008b). There are thirty-two BDBSA records of this species within the 5 km buffer of the Project Area, with the most recent being 2016. No records are within the Project Area. Unlikely to be present in the littoral zone of sandy beaches.	Unlikely	No

Scientific Name	Common Name	EPBC Status	Details	Likelihood of occurrence	Is the Project likely to have a significant impact?
Swainsona pyrophila	Yellow Swainson-pea	V	Species is a short-lived, fire adapted species and occurs from the northern Eyre Peninsula east to north-western Victoria and south-western and central-western New South Wales, generally within the 250–400 mm rainfall zone. Occurs in mallee scrub on well drained sands, sandy loams and heavier clay loams (Tonkinson & Robertson, 2010). There are no BDBSA records within 5 km of the Project Area. Unlikely to be present in the littoral zone of sandy beaches.	Unlikely	No
Terrestrial mammals and reptiles					
Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern)	E	Whilst this species can inhabit an array of habitats, including heathlands, shrublands, sedgelands, heathy open forests, and woodlands, they are typically found in areas of dense ground cover. Suitable habitat is any patches of native or exotic vegetation, within their distribution, which contains understorey vegetation structure with 50–80% average foliage density in the 0.2–1 m height range (DCCEEW, 2024b). The Project Area is outside of the mapped potential habitat of this species (DCCEEW, 2024b). There are no BDBSA records within 5 km of the Project Area. Species unlikely to be present in the littoral zone of sandy beaches.	Unlikely	No
Pteropus poliocephalus	Grey-headed Flying-fox	V	Occurs in the coastal belt from central Queensland, through New South Wales, Victoria, and into SA. Requires foraging resources and roosting sites. Species is a canopy-feeding frugivore and nectarivore, which utilises vegetation communities including rainforests, open forests, closed and open woodlands, Melaleuca swamps, and Banksia woodlands (DEW, 2021). There are 218 BDBSA records within the 5 km buffer of the Project Area, with the most recent record in 2020. No records are from within the Project Area. A roosting colony was first recorded at Botanic Park, approximately 10 km east of the Project Area, in 2010. The species forages over a wide area, with individuals capable of traveling 40 km between roost and feeding sites. The Project Area is within the mapped distribution for this species (DCCEEW, 2024b), however, the species is unlikely to use habitat of the littoral zone of sandy beaches.	Unlikely. Possible transient visitor outside Project area	No

Scientific Name	Common Name	EPBC Status	Details	Likelihood of occurrence	Is the Project likely to have a significant impact?
			May be a possible transient visitor in terrestrial vegetation adjacent but outside the Project area.		
Aprasia pseudopulchella	Flinders Ranges Worm-lizard	V	Distribution of this species ranges from the Flinders Ranges, SA, to the Mt Lofty Ranges. It inhabits open woodlands, native tussock grasslands, riparian habitats, and rocky isolates. Preferred habitat is stony soils or clay soils with a stony surface (DCCEEW, 2008c). There are no BDBSA records of this species within 5 km of the Project Area. The Project Area is within the mapped distribution for this species (DCCEEW, 2024b), however, it does not provide suitable habitat for this species. Species unlikely to be present in the littoral zone of sandy beaches.	Unlikely	No
Sharks, turtles, fish, and marine mammals					
Dermochelys coriacea	Leatherback Turtle, Leathery Turtle, Luth	E, Mi	This oceanic species is found in all the oceans of the world. They forage year-round in Australia, typically in areas where currents converge with steep bathymetric contours where food is more readily available. They generally venture close to shore during the nesting season, however, nesting has only been recorded in southern Queensland, Northern Territory, and New South Wales. There have been no records of nesting in Queensland since 1996 (DCCEEW, 2024b). There is one BDBSA record of this species within 5 km of the Project Area, recorded in 1996. The Project Area is within the mapped distribution for this species (DCCEEW, 2024b), however, it does not provide suitable foraging or nesting habitat for the species. Possible occurrence of the species as a transient visitor only.	Possible transient visitor	No
Caretta caretta	Loggerhead Turtle	E, Mi	This oceanic species has a worldwide tropical and subtropical distribution. It is found within the waters of coral and rocky reefs, seagrass beds and muddy bays throughout eastern, northern and western Australia. Nesting occurs in Queensland and Western Australia. Areas used for foraging are more widely distributed but occur in tidal and sub-tidal habitats. The species show fidelity to both their foraging and breeding areas (DCCEEW, 2024b). There are no BDBSA records of this species within 5 km of the Project Area. The closest historical record is more than 45 km away from the Project Area.	Unlikely	No

Scientific Name	Common Name	EPBC Status	Details	Likelihood of occurrence	Is the Project likely to have a significant impact?
			The Project Area is within the mapped distribution for this species (DCCEEW, 2024b), however, it does not provide suitable foraging or nesting habitat for the species. The species is unlikely to occur in the Project Area.		
Eubalaena australis	Southern Right Whale	E, Mi	Seasonally present along the Australian coast between late April and early November. While the entire SA coast is considered potential habitat, species tends to aggregate in predictable locations outside Spencer Gulf along the SA coast, with major calving grounds in the Great Australian Bight and smaller aggregations in Fowlers Bay and Encounter Bay (DSEWPC, 2012). There are no BDBSA records of this species within 5 km of the Project Area. No known current or historical aggregation areas occur within SA Gulfs including Gulf St Vincent. Possible occurrence of the species as a transient visitor only.	Possible transient visitor (by individual whales or whale pairs (i.e. mother/calf)) to Gulf St Vincent	No
Neophoca cinerea	Australian Sea Lion	E	Marine mammal. Prefers onshore habitats including exposed islands and reefs, rocky terrain, sandy beaches and vegetated fore dunes and swales (DCCEEW, 2024b). There are four BDBSA records (between 2005 and 2013) within 5 km of the Project Area. A haul-out site for the species exists at the Outer Harbor breakwater in Port River, 1.8 km north of the Project Area. The Project Area is within the mapped distribution of this species (DCCEEW, 2024b) and has the potential to provide habitat for the species. Possible occurrence of the species as a transient visitor only to the more suitable habitat found to the north of the Project Area.	Possible transient visitor	No
Carcharodon carcharias	White Shark, Great White Shark	V, Mi	Marine species. Widely but not evenly distributed in Australian waters with the majority of recorded movements occurring between the coast and the 100 m depth contour. Areas in SA where observations are more frequent include waters in and around some Fur Seal and Sea Lion colonies (e.g. the Neptune Islands), areas of the Great Australian Bight, and regions with high prey densities (e.g. pinniped colonies). Limited information is known on the species' breeding and life cycles (DSEWPC, 2013). There are no BDBSA records of this species within 5 km of the Project Area. The Project Area is within the mapped distribution of this species (DCCEEW, 2024b), however, there are no areas of known aggregation within the vicinity of the Project	Possible transient visitor	No

Scientific Name	Common Name	EPBC Status	Details	Likelihood of occurrence	Is the Project likely to have a significant impact?
			Area. The species is highly mobile and a possible transient visitor to the broader marine environment.		
Chelonia mydas	Green Turtle	V, Mi	Ocean-dwelling species spending most of their life at sea. Occurs in coral reefs rich in seaweeds, and coastal seagrass pastures in tropical and subtropical areas worldwide. Their key breeding and foraging habitat is in tropical Australia. Occasional visitor to SA, possibly associated with currents. No critical habitat or breeding grounds occur in southern Australia (DEE, 2017). There is one BDBSA record of this species within 5 km of the Project Area, recorded in 2013. The Project Area is within the mapped distribution of this species (DCCEEW, 2024b), however, the species rarely travels to southern Australia. Possible occurrence of the species as a transient visitor only, however, species rarely travels to southern Australia.	Possible transient visitor	No
Birds					
Acanthiza iredalei rosinae	Slender-billed Thornbill (Gulf St Vincent)	V	Mainly restricted to chenopod shrublands, particularly samphire dominated by shrubby glasswort (*Sclerostegia arbuscular*), on narrow coastal saline mudflats usually within 20 m of a tidal channel or saline lake. Mostly forages in dense, tall samphire, but occasionally from the surface of mud and among smaller samphires, and in grey mangrove (*Avicennia marina*) adjacent to samphire shrublands (DCCEEW, 2015a). There are no BDBSA records of this species within 5 km of the Project Area. The closest record of the species was in 2020, 7.5 km northeast of the Project Area (BirdLife Australia, 2024). The Project Area is outside of the mapped distribution for this species (DCCEEW, 2024b) and does not provide potential habitat for this species.	Unlikely	No
Aphelocephala leucopsis	Southern Whiteface	V	Species live in a wide range of open woodlands and shrublands, usually dominated by acacias or eucalypts, with understory of grasses and/or shrubs. Species favours habitat with low tree densities and an herbaceous understorey litter cover (DCCEEW, 2024b). There are no BDBSA records of this species within 5 km of the Project Area. The closest record of the species was in 2012, 10 km north of the Project Area (BirdLife Australia, 2024).	Unlikely	No

Scientific Name	Common Name	EPBC Status	Details	Likelihood of occurrence	Is the Project likely to have a significant impact?
			The Project Area is within the mapped distribution for this species (DCCEEW, 2024b), however, it does not provide suitable habitat for this species.		
Ardenna grisea	Sooty Shearwater	V, Mi	This species breeds in the southern hemisphere including in southern Australia and on islands off New South Wales and Tasmania. This species was found to be a moderately common migrant and visitor to SA, although no breeding islands are identified in this State. They forage in open ocean sub-tropical, sub-Antarctic and Antarctic waters. They breed on subtropical and sub-Antarctic islands, as well as on the mainland of New Zealand. They roost offshore or on the ground or sometimes in burrows (DCCEEW, 2024b). There are no BDBSA records of this species within 5 km of the Project Area. One historical record (from 1982) of the species was recorded approximately 50 km west of the Project Area (BirdLife Australia, 2024). The Project Area is within the mapped distribution for this species (DCCEEW, 2024b), however, it does not provide suitable foraging, nesting, or breeding habitat for this species.	Unlikely	No
Arenaria interpres	Ruddy Turnstone	V, Mi	During the non-breeding season, this species occurs in coastal regions around most of Australia. Preferred habitats are rocky shores or beaches with large deposits of rotting seaweed. This species does not breed in Australia (DCCEEW, 2024b). There are no BDBSA records of this species within 5 km of the Project Area. The closest record of the species was in 2015, 4 km north of the Project Area (BirdLife Australia, 2024). The Project Area is outside of the mapped distribution for this species, with no permanent preferred habitat. Possible occurrence only in the event of large quantities of seaweed deposited on the beach. Possible occurrence of the species as a transient visitor only if large deposits of seaweed is present.	Possible transient visitor	No
Botaurus poiciloptilus	Australasian Bittern	E	Preferred habitat comprises wetlands with tall dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water. Favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and reeds (e.g. *Phragmites*, *Cyperus*, *Eleocharis*, *Juncus*, *Typha*, *Baumea*, *Bolboschoenus*) or cutting grass (*Gahnia*) growing over a muddy or peaty substrate (DCCEEW, 2019a).	Unlikely	No

Scientific Name	Common Name	EPBC Status	Details	Likelihood of occurrence	Is the Project likely to have a significant impact?
			There are no BDBSA records of this species within 5 km of the Project Area. The closest record of the species was in 2008, 10 km east of the Project Area (BirdLife Australia, 2024). The Project Area is within the mapped distribution for this species (DCCEEW, 2024b), however, it does not provide preferred habitat for this species.		
Calidris acuminata	Sharp-tailed Sandpiper	V, Mi	This species has a widespread distribution and is found within all states of Australia. Suitable habitats comprise fresh and hypersaline environments including mudflats, wetlands, and sewage ponds, as well as rocky and sandy beaches. They prefer muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This species does not breed in Australia (DCCEEW, 2024b). Thirty-five BDBSA records, ranging from 1975-2020, were recorded within 5 km of Project Area. One record (from 2012) is within the Project Area (BirdLife Australia, 2024). The Project Area is within the mapped distribution for this species (DCCEEW, 2024b), however, the Project Area does not provide habitat critical to the survival of the species. Closest preferred habitat (intertidal seagrass, mudflats) occurs north of the Project Area, around Port River. With no loss of preferred habitat, the Project would not have a significant impact on the species through reduction in population size or area of occupancy, fragmentation of any population, disruption of breeding cycle, decline due to habitat impacts, introduction of invasive species or interference of the recovery of the species. Also see **Section 4**.	Likely	No
Calidris canutus	Red Knot, Knot	V, Mi	Species does not breed in Australia. In Australasia, it mainly inhabits intertidal mudflats, sandflats, and sandy beaches of sheltered coasts and sometimes on sandy ocean beaches or shallow pools on exposed rock platforms. Occasionally seen on terrestrial saline wetlands near the coast and on sewage ponds and saltworks. They typically forage in soft substrate near the edge of water on intertidal mudflats or sandflats exposed by low tide or at high tide at nearby lakes, sewage ponds, and floodwaters. They often roost on sandy beaches, spits and islets, mudflats, and in shallow saline ponds of saltworks (DCCEEW, 2024b).	Possible	No

Scientific Name	Common Name	EPBC Status	Details	Likelihood of occurrence	Is the Project likely to have a significant impact?
			There are no BDBSA records of this species within 5 km of the Project Area. The closest record of the species was in 2015, approximately 4 km north of the Project Area (BirdLife Australia, 2024). The Project Area is within the mapped distribution for this species (DCCEEW, 2024b), however, the Project Area would not provide preferred habitat for the species. The Project Area would not provide important habitat for this species. Closest preferred habitat (intertidal mudflats) occurs to the north of the Project Area, around Port River. With no loss of preferred habitat from the Project Area, the Project would not have a significant impact on the species through reduction in population size or area of occupancy, fragmentation of any population, disruption of breeding cycle, decline due to habitat impacts, introduction of invasive species or interference of the recovery of the species.		
Calidris ferruginea	Curlew Sandpiper	CE, Mi	In Australia, it mainly occurs on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. Occurs also in both fresh and brackish waters. Does not breed in Australia (DCCEEW, 2024b). There are no BDBSA records of this species within 5 km of the Project Area. The closest record of the species was in 2021, 1.6 km north of the Project Area (BirdLife Australia, 2024). The Project Area is within the mapped distribution for this species (DCCEEW, 2024b), however, it does not provide preferred habitat for the species. Possible occurrence of the species as a transient visitor only.	Possible transient visitor	No
Calidris tenuirostris	Great Knot	V, Mi	In Australia, this species prefers sheltered coastal habitats with large intertidal mudflats or sandflats including inlets, bays, harbours, estuaries, and lagoons. Occasionally found on exposed reefs or rock platforms, shorelines with mangrove vegetation, ponds in saltworks, at swamps near the coast, salt lakes and non-tidal lagoons. Typically, roosts in large groups in open areas, often at the water's edge or in shallow water close to feeding grounds (DCCEEW, 2024b). There are no BDBSA records of this species within 5 km of the Project Area. The closest record of the species was in 2011, approximately 4 km north of the Project Area (BirdLife Australia, 2024).	Unlikely	No

Scientific Name	Common Name	EPBC Status	Details	Likelihood of occurrence	Is the Project likely to have a significant impact?
			The Project Area is outside of the mapped distribution for this species (DCCEEW, 2024b) and does not provide preferred habitat for the species.		
Charadrius leschenaultii	Greater Sand Plover, Large Sand Plover	V, Mi	Mainly occurs on sheltered sandy, shelly or muddy beaches, large intertidal mudflats, sandbanks, salt-marshes, estuaries, coral reefs, rocky islands, rock platforms, tidal lagoons and dunes near the coast. The species does not breed in Australia. They typically feed from the surface of wet sand or mud on open intertidal flats of sheltered embayments, lagoons or estuaries. They roost on sand-spits and banks on beaches or in tidal lagoons, occasionally on rocky points, or in adjacent areas of saltmarsh or claypans. They typically roost further up the beach than other waders, sometimes well above high-tide mark (DCCEEW, 2024b). One BDBSA record from 1988 within 5 km of the Project Area. The most recent record is from 2009 and is approximately 4 km north of the Project Area (BirdLife Australia, 2024). The Project Area is within the mapped distribution for this species (DCCEEW, 2024b), however, the Project Area does not provide preferred habitat for the species.	Possible	No
Charadrius mongolus	Lesser Sand Plover, Mongolian Plover	E, Mi	Species is almost strictly coastal during the non-breeding season, preferring sandy beaches, mudflats of coastal bays and estuaries, sand-flats and dunes near the coast and occasionally frequenting mangrove mudflats in Australia. Mainly feeds on extensive, freshly exposed areas of intertidal sandflats and mudflats in estuaries or beaches, or in shallow ponds in saltworks. They commonly roost near foraging areas (DCCEEW, 2024b). There are no BDBSA records of this species within 5 km of the Project Area. The closest record of the species was in 2008, approximately 4 km north of the Project Area (BirdLife Australia, 2024). The Project Area is outside of the mapped distribution for this species (DCCEEW, 2024b) and does not provide preferred habitat for the species.	Unlikely	No
Falco hypoleucos	Grey Falcon	V	An elusive species endemic to mainland Australia, occurring in arid and semi- arid Australia, including the Murray Darling Basin and Eyre Basin, central and western Australia. The species frequents timbered low land plains, particularly acacia shrublands that are crossed by tree-lined water (DCCEEW, 2020).	Unlikely	No

Scientific Name	Common Name	EPBC Status	Details	Likelihood of occurrence	Is the Project likely to have a significant impact?
			There is one BDBSA record within 5 km of the of the Project Area from 2003. The most recent record is from 2008 and is approximately 20 km east of the Project Area (BirdLife Australia, 2024). The Project Area is within the mapped distribution for this species (DCCEEW, 2024b), however, it does not provide suitable habitat for the species.		
Gallinago hardwickii	Latham's Snipe, Japanese Snipe	V, Mi	In Australia, this species has a widespread on the eastern coasts from northern Queensland to SA. It does not breed in Australia. This species can be found in small wetlands such as urban water bodies, saltmarshes and creek edges. Preferred habitat includes areas with a dense cover of sedges, grasses, lignum, reeds and rushes. Foraging habitat comprises of soft mudflats and shallow water (DCCEEW, 2024b). There are six BDBSA records within 5 km of the of Project Area, ranging from 1976-2004. The most recent record is from 2013 and is approximately 3 km east of the Project Area (BirdLife Australia, 2024). The Project Area is within the mapped distribution for this species (DCCEEW, 2024b), however, it does not provide suitable habitat for the species.	Unlikely	No
Grantiella picta	Painted Honeyeater	V	Species endemic to mainland Australia. Sparsely distributed from south-eastern Australia to north-western Queensland and eastern Northern Territory. Highest number of records and concentrations occur from south of 26°S on inland slopes of the Great Dividing Range. Species shows seasonal north-south movements largely governed by fruiting of mistletoe with which its breeding is closely matched. The species prefers woodlands which contain a higher number of mature trees, as these host more mistletoes (DCCEEW, 2015b). There are no BDBSA records of this species within 5 km of the Project Area. The closest record of the species was in 2011, approximately 160 km northeast of the Project Area (BirdLife Australia, 2024). The Project Area is outside of the mapped distribution for this species (DCCEEW, 2024b) and does not provide suitable habitat.	Unlikely	No
Halobaena caerulea	Blue Petrel	V	Marine species breeding on subantarctic islands and foraging in Antarctic and subantarctic waters (DCCEEW, 2015c).	Unlikely	No

Scientific Name	Common Name	EPBC Status	Details	Likelihood of occurrence	Is the Project likely to have a significant impact?
			There are no BDBSA records within 5 km of the Project Area, and no Birdata (BirdLife Australia, 2024) records within 100 km. The Project Area is outside of the mapped distribution for this species (DCCEEW, 2024b) and does not provide suitable habitat.		
Hirundapus caudacutus	White-throated Needletail	V, Mi	Mostly aerial in Australia, from heights of less than 1 m up to more than 1,000 m above the ground. Although it occurs over most types of habitats, it is recorded most often above wooded areas, including open forest and rainforest, and may also fly below the canopy between trees or in clearings. Roosts in trees amongst dense foliage in the canopy or in hollows (DCCEEW, 2019b). There are three BDBSA records within the 5 km buffer of the of Project Area, ranging from 1994-2003. The closest Birdata (BirdLife Australia, 2024) record is from 1983 and is approximately 22 km southeast of the Project Area. The Project Area is within the mapped distribution for this species (DCCEEW, 2024b). While the species may fly over the Project Area, it does not provide the preferred vegetation for this species. Possible occurrence of the species as a transient overfly visitor only.	Possible as transient overfly visitor only	No
Limosa lapponica baueri	Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit	E	Occurs mainly in coastal habitats such as large intertidal sandflats, spits, and banks. Can be also found within mudflats, estuaries, coastal lagoons, and bays, often near beds of seagrass or saltmarshes. Has also been recorded in sandy ocean beach, rock platforms, coral reef flats, coastal sewage farms, saltworks and port. Does not breed in Australia (DCCEEW, 2024b). There are no BDBSA records within 5 km of the Project Area. The closest record is more than 30 km from the Project Area near the Adelaide International Bird Sanctuary – Winaityinaity Pangkara. The Project Area is outside of the mapped distribution for this species (DCCEEW, 2024b) and does not provide suitable habitat.	Unlikely	No
Limosa limosa	Black-tailed Godwit	E, Mi	Coastal species whose preferred habitat comprise sheltered bays, estuaries, and lagoons with large intertidal mudflats and/or sandflats. This species can also be found around muddy lakes and within wetlands with shallow waters (DCCEEW, 2024b).	Unlikely	No

Scientific Name	Common Name	EPBC Status	Details	Likelihood of occurrence	Is the Project likely to have a significant impact?
			There are no BDBSA records within 5 km of the Project Area. The closest record of the species was in 2021, 4.5 km north of the Project Area (BirdLife Australia, 2024). The Project Area is outside of the mapped distribution for this species (DCCEEW, 2024b) and does not provide suitable habitat.		
Melanodryas cucullata cucullata	South-eastern Hooded Robin, Hooded Robin (south-eastern)	E	Species prefer dry eucalypt and acacia woodlands and shrublands with an open understorey, some grassy areas, and a complex ground layer. In agricultural landscapes, the species prefer patches greater than 10 ha with deep soils (DCCEEW, 2024b). There are no BDBSA records within 5 km of the Project Area. The closest record is more than 20 km from the Project Area. The Project Area is outside of the mapped distribution for this species (DCCEEW, 2024b) and does not provide suitable habitat.	Unlikely	No
Neophema chrysogaster	Orange-bellied Parrot	CE	Breeds in south-west Tasmania in summer and migrates to coast of south-east mainland Australia for winter. Habitat varies throughout the year, including salt marshes, coastal dunes, pastures, shrub lands, estuaries, islands, beaches and moorlands generally within 10 km of the coast. Non-breeding birds usually found along coast of SA and Victoria with the species' current mainland distribution, covering approximately 1,000 km of coastline, from the mouth of the Murray River in SA, along the coast, to southeast Victoria (DELWP, 2016). There are no BDBSA records within 5 km of the Project Area. The closest record of the species was in 1999, approximately 27 km south of the Project Area (BirdLife Australia, 2024). The Project Area is outside of the mapped distribution for this species (DCCEEW, 2024b) with no suitable habitat.	Unlikely	No
Neophema chrysostoma	Blue-winged Parrot	V	Species breed in Tasmania, coastal south-eastern SA, and southern Victoria. They occur in a range of habitats from coastal, sub-coastal and inland areas, through to semi-arid zones. Species favours grasslands and grassy woodlands and are often found near wetlands near the coast and in semi-arid zones. The species may also use altered environments such as airfields, golf-courses, and paddocks (DCCEEW, 2024b).	Unlikely	No

Scientific Name	Common Name	EPBC Status	Details	Likelihood of occurrence	Is the Project likely to have a significant impact?
			There are no BDBSA records within 5 km of the Project Area. The closest record within the last 20 years was in 2020, 10 km south of the Project Area (BirdLife Australia, 2024). The Project Area is within the mapped distribution for this species (DCCEEW, 2024b), however, it does not provide suitable habitat for the species.		
Numenius madagascariensis	Eastern Curlew, Far Eastern Curlew	CE, Mi	Migratory species, breeding in Northern Hemisphere, and flying to the Southern Hemisphere in the southern spring and summer. During the non-breeding season in Australia, is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass (Zosteraceae). Occasionally occurs on ocean beaches (often near estuaries), and coral reefs and rock platforms (DCCEEW, 2024b). There is one historical BDBSA record (1968) within 5 km of the Project Area. The closest Birdata (BirdLife Australia, 2024) records are 4 km north of the Project Area near Point Grey, as recently as 2024. Whilst the Project Area is within the mapped distribution of the species (DCCEEW, 2024b), it does not provide preferred habitat. Possible occurrence of the species as a transient visitor only.	Possible transient visitor	No
Pachyptila turtur subantarctica	Fairy Prion (southern)	V	Oceanic species. Breeds on Macquarie Island and several subantarctic Islands outside of Australia. Spends most of its life (except nesting) in flight, fishing from ocean. Can be seen in coastal waters in winter to early spring, on continental shelf edge, and from shore during storms which blow them closer in shore (DCCEEW, 2015d). There are no BDBSA records of this species within 5 km of the Project Area. The closest record of the species was in 2009, 4 km north of the Project Area (BirdLife Australia, 2024). The Project Area is within the mapped distribution for this species (DCCEEW, 2024b), however, it does not provide suitable habitat for the species. Possible occurrence of the species as a transient visitor only.	Possible transient visitor	No
Pedionomus torquatus	Plains-wanderer	CE	Inhabits sparse grasslands with approximately 50% bare ground, with most vegetation less than 5 cm in height and some widely spaced plants up to 30 cm high. May	Unlikely	No

Scientific Name	Common Name	EPBC Status	Details	Likelihood of occurrence	Is the Project likely to have a significant impact?
			occasionally use lower-quality habitat including cereal stubble but cannot persist in an agricultural landscape (DCCEEW, 2015e). There are no BDBSA records of this species within 5 km of the Project Area. There are no Birdata (BirdLife Australia, 2024) records within 50 km of the Project Area. The Project Area is outside of the mapped distribution for this species (DCCEEW, 2024b) and does not provide suitable habitat.		
Pluvialis squatarola	Grey Plover	V, Mi	In Australia, preferred habitat for this species comprises on sandy areas, estuaries, or lagoons. This species can also be found on mangrove mudflats, and occasionally on anthropogenic wetlands such as saltworks and port. Has previously been observed on artificial islands created by dredge spoil. Does not breed in Australia (DCCEEW, 2024b). There are no BDBSA records of this species within 5 km of the Project Area. The closest records of this species are 4 km north, as recently as 2024 (BirdLife Australia, 2024). The Project Area is outside of the mapped distribution for this species (DCCEEW, 2024b) and does not provide suitable habitat for the species.	Unlikely	No
Rostratula australis	Australian Painted Snipe	E	Occurs in shallow freshwater (occasionally brackish) wetlands, both ephemeral and permanent, such as lakes, swamps, claypans, inundated or waterlogged grassland/saltmarsh, dams, rice crops, sewage farms and bore drains, generally with a good cover of grasses, rushes and reeds, low scrub, *Muehlenbeckia spp*. (lignum), open timber or samphire (DCCEEW, 2024b). There is one BDBSA record from 1979 within 5 km of the Project Area. The most recent record is from 2013, approximately 10 km east of the Project Area. The Project Area is within the mapped distribution for this species (DCCEEW, 2024b), however, it does not provide suitable habitat for the species.	Unlikely	No
Stagonopleura guttata	Diamond Firetail	V	Species occur in eucalypt, acacia or casuarina woodlands, open forests, and other lightly timbered habitats, including farmland and grassland with scattered trees. Preferred habitat has relatively low tree density, few large logs, and little litter cover but high grass cover (DCCEEW, 2024b). Birds roost in dense shrubs or in smaller nests built especially for roosting. There are no BDBSA records within 5 km of the Project Area. The closest record is from 1998, approximately 9 km northeast of the Project Area (BirdLife Australia, 2024).	Unlikely	No

Scientific Name	Common Name	EPBC Status	Details	Likelihood of occurrence	Is the Project likely to have a significant impact?
			The Project Area is within the mapped distribution for this species (DCCEEW, 2024b), however, it does not provide suitable habitat for the species.		
Sternula nereis nereis	Australian Fairy Tern	V	Species utilises a variety of habitats including offshore, estuarine or lacustrine (lake) islands, wetlands, beaches and spits. It nests and roosts on sheltered sandy beaches, spits and banks above the high tide line and below vegetation (DCCEEW, 2024b). There are no BDBSA records within 5 km of the Project Area. There are records 4 km north of the Project Area as this species is known to nest to on Bird Island (BirdLife Australia, 2024). The Project Area is within the mapped distribution for this species (DCCEEW, 2024b). The beaches above high tide line may provide roosting habitat for the species, however, more suitable habitat occurs on Bird Island, where they are known to nest. Possible occurrence of the species as a transient visitor only.	Possible transient visitor	No
Diomedea antipodensis	Antipodean Albatross	V, Mi	Oceanic species, spending most of their life (except nesting) in flight, fishing from the ocean (DSEWPC, 2011). Can be seen in coastal waters in winter to early spring, on continental shelf edge, and from shore during storms which blow them closer in shore. The Indian Yellow-nosed Albatross was recorded in 1994 and 2006 within 5 km of the Project Area. There are no BDBSA records of the other species in the vicinity of the Project Area. There are no Birdata (BirdLife Australia, 2024) records of any of these species within 50 km of the Project Area. There is no suitable habitat for these species within the Project Area.	Unlikely	No
Diomedea sanfordi	Northern Royal Albatross	E, Mi			
Diomedea epomophora	Southern Royal Albatross	V, Mi			
Diomedea exulans	Wandering Albatross	V, Mi			
Thalassarche carteri	Indian Yellow-nosed Albatross	V, Mi			
Thalassarche cauta	Shy Albatross	E, Mi			
Thalassarche impavida	Campbell Albatross, Campbell Black-browed Albatross	V, Mi			

Scientific Name	Common Name	EPBC Status	Details	Likelihood of occurrence	Is the Project likely to have a significant impact?
Thalassarche melanophris	Black-browed Albatross	V, Mi			
Phoebetria fusca	Sooty Albatross	V, Mi			
Thalassarche steadi	White-capped Albatross	V, Mi			
Macronectes giganteus	Southern Giant Petrel	E, Mi			
Macronectes halli	Northern Giant Petrel	V, Mi			
Pterodroma mollis	Soft-plumaged Petrel	V			
Thinornis cucullatus cucullatus	Eastern Hooded Plover	V	Inhabits ocean beaches, particularly wide beaches backed by dunes with large amounts of seaweed, creek mouths and inlet entrances. May also occur on near-coastal saline and freshwater lakes and lagoons, tidal bays and estuaries, on rock platforms, or on rocky or sandy reefs close to shore (DCCEEW, 2014). There are no BDBSA records within 5 km of the Project Area. Birdata (BirdLife Australia, 2024) does not provide records for the Eastern Hooded Plover. However, two individuals were observed at West Beach during the field survey in 2021 (EBS Ecology, 2021). The Project Area is within the mapped distribution for this species (DCCEEW, 2024b), with the sandy beach from the low tide mark up to the foredune area providing suitable habitat for the species. This species is further discussed in **Section 4.5.1**.	Highly Likely	No
Tringa nebularia	Common Greenshank	E, Mi	Shorebird with a widespread distribution in coastal regions. Occurs in estuaries and mudflats, mangrove, swamps and lagoons, and in billabongs, swamps, sewage farms, and flooded crops. Does not breed in Australia (DCCEEW, 2024b). There are sixty BDBSA records of this species within 5 km of the Project Area, ranging from 1975 – 2020; however, none of these records are from within the Project Area. There are no Birdata records (BirdLife Australia, 2024) within the Project area.	Possible transient visitor	No

Scientific Name	Common Name	EPBC Status	Details	Likelihood of occurrence	Is the Project likely to have a significant impact?
			The Project Area is within the mapped distribution for this species (DCCEEW, 2024b), however, it does not provide suitable habitat for this species. Possible occurrence of the species as a transient visitor only.		
Xenus cinereus	Terek Sandpiper	V, Mi	Shorebird found in sheltered coastal mudflats, including muddy sections of mangrove swamps. Can also be found in sandflats and estuaries, coral reefs, sandy beaches, sandbars or mudflats at mouths of rivers, coastal swamps, and saltpans. While they prefer wetlands, this species is occasionally found on sandy beaches, among seaweed and other debris and in rocky areas, using the supralittoral or upper littoral zone, where a film of water covers the sand. However, on exposed rock platforms, the species forages in the lower littoral zone. They do not breed in Australia (DCCEEW, 2024b). There are no BDBSA records within 5 km of the Project Area. The closest record is from 2009, approximately 4 km north of the Project Area (BirdLife Australia, 2024). The Project Area is outside of the mapped distribution for this species (DCCEEW, 2024b) and does not provide preferred habitat.	Possible transient visitor	No
Zoothera lunulata halmaturina	South Australian Bassian Thrush, Western Bassian Thrush	E	This species is found on Kangaroo Island, the adjacent mainland, Mt Lofty Ranges, and southern Flinders Ranges. It prefers damp eucalypt forest or woodland when on the mainland in SA. Suitable habitat is typically confined to creeklines or dune swale, with damp habitats being important in summer (DAWE, 2022). There are no BDBSA records within 5 km of the Project Area. The closest record is from 2020, 12 km south of the Project Area in Sturt Gorge Recreation Park (BirdLife Australia, 2024). The Project Area is outside of the mapped distribution for this species (DCCEEW, 2024b) and does not provide suitable habitat.	Unlikely	No

4.3 Migratory species

The PMST predicted up to sixty-four migratory species to occur or use habitat in the Project Area (refer PMST results in **Appendix A**). The majority of these were bird species. Records for migratory species within the search areas are further provided (refer BDBSA records in **Appendix B** and **Appendix C**).

The likelihood of occurrence and assessment of impact significance on these listed migratory species is summarised in **Table 4-4**. Note that some of these species are also listed threatened species and detail for these species is addressed above in **Table 4-3**.

Two turtle, one shark and one whale species were assessed as possibly occurring within the Project Area, but as transient visitors (assessed also in Section 4.2)

Fifteen of the migratory bird species were assessed as possibly occurring within the Project Area, however, mostly as transient individuals. One migratory species was assessed as likely to occur (Sharp-tailed sandpiper – assessed also in Section 4.2). However, it was considered that the Project would not provide important habitat for any of these migratory species.

Consequently, the Project is **not likely** to have a significant impact on migratory species.

4.4 Other listed species

A number of other marine fauna are listed as 'Marine' under the EPBC Act. For example, fishes from the family Syngnathidae are listed as 'Marine' under the EPBC Act and were all reported by the PMST as 'species or species habitats may occur within the area'. There are records of several sygnathid species within the wider marine area between Largs Bay and West Beach, with these species known to inhabit seagrass. As described in Section 2.2, no direct or indirect loss of seagrass is expected from the Project. Species that are listed as 'Marine' under the EPBC Act are not considered as MNES for the purposes of Part 3 of the EPBC Act and consequently have not been included further in the assessment.

Table 4-4: Likelihood of occurrence and assessment of impact significance for migratory species in the Project Area

EPBC Act Conservation Status: R=Rare, V=Vulnerable, E=Endangered, CE=Critically Endangered, Mi=Migratory

Scientific Name	Common Name	EPBC Status	Details	Likelihood of occurrence	Is the Project likely to have a significant impact?
Marine mammals, reptiles, and sharks					
Balaenoptera edeni	Bryde's Whale	Mi	For detail on the EPBC listed species, see **Table 4-3**. These species are marine and are mostly uncommon to the area in the vicinity of the Project Area. There are no BDBSA records of any of species within 5 km of the Project Area. The Project would not provide important habitat for any of these species.	Unlikely	No
Megaptera novaeangliae	Humpback Whale	Mi			
Lagenorhynchus obscurus	Dusky Dolphin	Mi			
Caperea marginata	Pygmy Right Whale	Mi			
Caretta caretta	Loggerhead Turtle	E, Mi			
Lamna nasus	Porbeagle, Mackerel Shark	Mi			
Dermochelys coriacea	Leatherback Turtle, Leathery Turtle, Luth	E, Mi	See detail on these EPBC listed species, see **Table 4-3**. These species are all highly mobile and are possible within proximity to the Project Area as transient visitors only.	Possible transient visitor	No
Carcharodon carcharias	White Shark, Great White Shark	V, Mi			
Eubalaena australis	Southern Right Whale	E, Mi			
Chelonia mydas	Green Turtle	V, Mi			
Marine birds					
Ardenna carneipes	Flesh-footed Shearwater	Mi	For detail on the EPBC listed species, see **Table 4-3**. Flesh-footed Shearwater is primarily an oceanic species. They spend most of their life (except nesting) in flight, fishing from the ocean. The closest record of this species is from 2016, approximately 36 km south of the Project Area (BirdLife Australia, 2024). The Project Area is within the mapped distribution of the Flesh-footed Shearwater (DCCEEW, 2024b). However, the Project Area	Unlikely	No
Ardenna grisea	Sooty Shearwater	V, Mi			
Diomedea antipodensis	Antipodean Albatross	V, Mi			
Diomedea epomophora	Southern Royal Albatross	V, Mi			
Diomedea exulans	Wandering Albatross	V, Mi			
Diomedea sanfordi	Northern Royal Albatross	E, Mi			

Scientific Name	Common Name	EPBC Status	Details	Likelihood of occurrence	Is the Project likely to have a significant impact?
Macronectes giganteus	Southern Giant Petrel	E, Mi	would not provide important habitat for the Flesh-footed Shearwater or any of these species.		
Macronectes halli	Northern Giant Petrel	V, Mi			
Phoebetria fusca	Sooty Albatross	V, Mi			
Thalassarche carteri	Indian Yellow-nosed Albatross	V, Mi			
Thalassarche cauta	Shy Albatross	E, Mi			
Thalassarche impavida	Campbell Albatross	V, Mi			
Thalassarche melanophris	Black-browed Albatross	V, Mi			
Thalassarche steadi	White-capped Albatross	V, Mi			
Thalasseus bergii	Greater Crested Tern	Mi	Widespread distribution in Australia around the coast and estuaries. Nesting habitat comprises flat open sites on offshore islands, low-lying coral reefs, sandy or rocky coastal islets, coastal spits, lagoon mudflats or islets in saltpans and sewage work (DEW, 2020). There are no BDBSA records of this species within 5 km of the Project Area. There are numerous Birdata (BirdLife Australia, 2024) records within the Project Area, as recently as 2023. The Project Area is outside the mapped distribution for this species (DCCEEW, 2024b), and the area to the north of the Project Area would provide more suitable habitat. The Project Area would not provide important habitat, nor would the Project disrupt the lifecycle of an ecologically significant proportion of the population.	Possible	No
Sternula albifrons	Little Tern	Mi	Widespread in Australia, they inhabit sheltered coastal environments, including lagoons, estuaries, river mouths and deltas, lakes, bays, harbours and inlets, especially those with exposed sandbanks or sand-spits, and also on exposed ocean beaches. They forage in shallow waters of estuaries, coastal lagoons, lakes, channels next to spits, often close to breeding	Possible	No

Scientific Name	Common Name	EPBC Status	Details	Likelihood of occurrence	Is the Project likely to have a significant impact?
			colonies, and along open coasts, especially around bars off the entrances to rivers and lagoons. No breeding sites are known close to the Project Area (DCCEEW, 2024b). There are no BDBSA records within 5 km of Project Area. The closest record from 2020, approximately 4 km north of the Project Area. While the Project Area is within the mapped distribution of this species (DCCEEW, 2024b), it does not provide preferred habitat. The Project Area would not provide important habitat, nor would the Project disrupt the lifecycle of an ecologically significant proportion of the population.		
Shorebirds (waders)					
Calidris acuminata	Sharp-tailed Sandpiper	V, Mi	See **Table 4-3**.	Likely	No
Arenaria interpres	Ruddy Turnstone	V, Mi	For EPBC listed species see **Table 4-3**. These migratory species do not breed in Australia. They primarily inhabit intertidal mudflats, sandflats, sandy beaches of sheltered coasts and saltmarsh. There are no BDBSA records within 5 km of the Project Area for these species. Birdata records (BirdLife Australia, 2024) within the Project Area within the last 20 years includes one Sanderling record in 2019, two Double-banded Plover records in 2016 and 2021, several Red Neck Stint records. The Project Area outside the mapped distribution for the majority of these species, and the Project Area does not provide important habitat.	Possible/ Possible transient visitor	No
Calidris alba	Sanderling	Mi			
Calidris canutus	Red Knot, Knot	V, Mi			
Calidris ferruginea	Curlew Sandpiper	CE, Mi			
Calidris ruficollis	Red-necked Stint	Mi			
Charadrius bicinctus	Double-banded Plover	Mi			
Charadrius leschenaultii	Greater Sand Plover, Large Sand Plover	V, Mi			
Numenius madagascariensis	Eastern Curlew, Far Eastern Curlew	CE, Mi			
Xenus cinereus	Terek Sandpiper	V, Mi			
Tringa nebularia	Common Greenshank	E, Mi			
Limicola falcinellus	Broad-billed Sandpiper	Mi	For detail on the EPBC listed species, see **Table 4-3**.	Unlikely	No

Scientific Name	Common Name	EPBC Status	Details	Likelihood of occurrence	Is the Project likely to have a significant impact?
Charadrius mongolus	Lesser Sand Plover, Mongolian Plover	E, Mi	These migratory species do not breed in Australia. They primarily inhabit intertidal mudflats, sandflats, sandy beaches of sheltered coasts and saltmarsh. They can sometimes be found in salt work and sewage farm ponds (DCCEEW, 2024b). There are no BDBSA records within 5 km of the Project Area for these species. Birdata records (BirdLife Australia, 2024) within the Project Area within the last 20 years includes one Sanderling record in 2019, two Double-banded Plover records in 2016 and 2021, several Red Neck Stint records. The Project Area is outside the mapped distribution for most of these species (DCCEEW, 2024b) and the Project Area does not provide important habitat.		
Calidris subminuta	Long-toed Stint	Mi			
Charadrius veredus	Oriental Plover, Oriental Dotterel	Mi			
Limosa limosa	Black-tailed Godwit	E, Mi			
Numenius minutus	Little Curlew, Little Whimbrel	Mi			
Phalaropus lobatus	Red-necked Phalarope	Mi			
Philomachus pugnax	Ruff (Reeve)	Mi			
Pluvialis squatarola	Grey Plover	V, Mi			
Tringa brevipes	Grey-tailed Tattler	Mi			
Tringa glareola	Wood Sandpiper	Mi			
Tringa stagnatilis	Marsh Sandpiper, Little Greenshank	Mi			
Calidris tenuirostris	Great Knot	V, Mi			
Actitis hypoleucos	Common Sandpiper	Mi			
Calidris melanotos	Pectoral Sandpiper	Mi			
Limosa lapponica	Bar-tailed Godwit	Mi			
Pluvialis fulva	Pacific Golden Plover	Mi			
Numenius phaeopus	Whimbrel	Mi			
Raptors					
Pandion haliaetus	Osprey	Mi	Considered moderately common in Australia occurring in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. Most abundant in northern Australia. This species requires extensive areas of open fresh, brackish or saline water for foraging (DEW, 2020).	Possible as overflying species	No

Scientific Name	Common Name	EPBC Status	Details	Likelihood of occurrence	Is the Project likely to have a significant impact?
			There are no BDBSA records within 5 km of the Project Area. The closest record is from 2015, approximately 2 km north of the Project Area (BirdLife Australia, 2024). The Project Area is within the mapped distribution of this species (DCCEEW, 2024b). This species may overfly the Project Area however the Project Area would not provide important habitat, nor would the Project disrupt the lifecyle of an ecologically significant proportion of the population.		
Wetland birds					
Gallinago hardwickii	Latham's Snipe, Japanese Snipe	V, Mi	For EPBC listed species see **Table 4-3**. Does not breed in Australia. Occurs in habitats with saline and brackish water, saltmarsh, mangrove creeks around bays and beaches (DCCEEW, 2024b). There are no BDBSA records of these species within 5 km of the Project Area. There are no Birdata records within 5 km of the Project Area (BirdLife Australia, 2024). The Project Area is outside the mapped distribution of this species (DCCEEW, 2024b), and would not provide important habitat.	Unlikely	No
Gallinago megala	Swinhoe's Snipe	Mi			
Gallinago stenura	Pin-tailed Snipe	Mi			
Terrestrial birds					
Apus pacificus	Fork-tailed Swift	Mi	For detail on the EPBC listed species, see **Table 4-3**. These migratory species do not breed in Australia (DCCEEW, 2024b). There are no BDBSA records within 5 km of the Project Area. There are two Birdata records for the Fork-tailed Swift within 5 km of the Project Area (2017 and 2019) (BirdLife Australia, 2024). The Fork-tailed Swift is almost exclusively ariel and forages aerially. It is mostly found over inland plains but sometimes above foothills or in coastal areas (DCCEEW, 2024b).	Possible as transient overfly visitor only	No
Hirundapus caudacutus	White-throated Needletail	V, Mi			

Scientific Name	Common Name	EPBC Status	Details	Likelihood of occurrence	Is the Project likely to have a significant impact?
			The Project Area is within the mapped distribution of each of these species, which all have a wide distribution across Australia (DCCEEW, 2024b). However, the Project Area would not provide important habitat for these species. The Project is unlikely to disrupt the lifecycle of an ecologically significant proportion of the population.		
Motacilla flava	Yellow Wagtail	Mi	For detail on the EPBC listed species, see **Table 4-3**. These migratory species do not breed in Australia (DCCEEW, 2024b). There are no BDBSA records within 5 km of the Project Area. The Project Area is within the mapped distribution of each of these species, which all have a wide distribution across Australia (DCCEEW, 2024b). However, the Project Area would not provide important habitat for these species. The Project is unlikely to disrupt the lifecycle of an ecologically significant proportion of the population.	Unlikely	No
Myiagra cyanoleuca	Satin Flycatcher	Mi			
Motacilla cinerea	Grey Wagtail	Mi			

4.5 Assessment of key species with potential to occur in the Project Area

As outlined in **Table 4-3** and **Table 4-4** above, significant impacts to listed threatened species are not expected to occur.

It is acknowledged that majority of the bird species listed in **Table 4-3** and **Table 4-4** that were assessed as possibly occurring within the Project Area are likely to be transient individuals. More suitable habitat for these species occurs north of the Project Area including Torrens Island, Point Grey and it's attached sandbank, Bird Island (all within Port Adelaide estuary), and Adelaide International Bird Sanctuary National Park – Winaityinaityi Pangkara, extending north of the Port Adelaide estuary. These areas comprise generally more sheltered areas of intertidal seagrass, mudflats and sandflats than the stretch of metropolitan beach between Semaphore and West Beach.

Similarly, Sharp-tailed sandpiper was assessed as likely to occur. However, the Project Area would not provide habitat critical to the survival of a species. Closest preferred habitat (intertidal seagrass, mudflats) occurs north of the Project Area. With no loss of suitable habitat, the Project would not have a significant impact on the species through reduction in population size or area of occupancy, fragmentation of any population, disruption of breeding cycle, decline due to habitat impacts, introduction of invasive species or interference of the recovery of the species.

The Eastern Hooded Plover has been recorded in the Project Area previously (EBS Ecology, 2021) and was assessed as having a high likelihood of occurrence within the Project Area. As such, additional information on the assessment of impact significance for the Eastern Hooded Plover is provided below in Section 4.5.1.

Several listed threatened marine fauna species were assessed as being possible transient visitors to the Project Area. Given the Project will predominantly occur with marine waters out to approximately 300 m from the shoreline, additional information, together with mitigation measures was provided for this group in Section 4.5.2.

4.5.1 Eastern Hooded Plover

The Eastern Hooded Plover inhabits ocean beaches, particularly wide beaches backed by dunes with large amounts of seaweed, creek mouths and inlet entrances (DCCEEW, 2014). They may also be found on near-coastal saline and freshwater lakes and lagoons, tidal bays and estuaries, on rock platforms, or on rocky or sandy reefs close to shore.

When not breeding, the species spends the majority of its time foraging along the beach between the tide line and the dunes, and the rest of time loafing (sitting or standing) or preening (EBS Ecology, 2021).

The Eastern Hooded Plover breeding season typically occurs between August and March. During the breeding season a breeding pair tend to be monogamous and typically occupy a home range of 1 km of coastline. The species nests above the high tide mark on flat beaches and in or near the foredune.

Potential Impacts to Eastern Hooded Plover

There would be no foredune or sandy beach habitat loss from the Project. In fact, the Projects' objective is to circumvent the ongoing erosion at West Beach by reintroducing suitable sand to widen the sandy beach area and support dune reinstatement. However, the activity of sand collection and placement has the potential to temporarily impact the species, if the species is present at either the collection or placement area.

As sand will be collected from the littoral zone at Largs Bay via dredge, direct impacts to Eastern Hooded Plover's, if the species is present, foraging area is considered low to negligible. Likewise, sand placement within the littoral zone at West Beach would not be expected to impact the Eastern Hooded Plover foraging area. Sand placement between the low and high tide mark at West Beach could, however, temporarily impact the Eastern Hooded Plover's foraging area, if the species is present. As this species nests above high tide mark, no nests will be disturbed by the Project.

Indirect impacts of noise generation from dredging and sand placement could also impact the species if the species is present at either location.

Mitigation measures

The sand dredging trial is designed to improve the sand quantity at West Beach. Project equipment will be primarily located in the ocean, thereby negating, if not, limiting impacts to the beach stretch itself. Further, compared to the currently employed method of sand carting along Adelaide's metropolitan coast, sand dredging is expected to impose less impacts to the local community, beach access and use.

It is proposed that an Eastern Hooded Plover Management Plan be developed that will detail management and mitigation measures to avoid impacts to this species as broadly described below:

- Educate staff on the risk to Eastern Hooded Plovers associated with the proposed Project.
- Undertake targeted survey of the works area for this species prior to the Project's commencement to clearly understand its use and distribution.
- If species present at the sand collection area during the Project, avoid collecting sand within the prescribed distance of the species, as defined in an Eastern Hooded Plover Management Plan.
- If the species is present at the sand placement area during the Project, avoid sand placement within the prescribed distance of the species, as defined an Eastern Hooded Plover Management Plan.
- Temporarily close areas to human access if Eastern Hooded Plovers are observed in the area so as to not disturb nests, breeding sites, or young. Fencing off the areas where the species is nesting and ensuring the public does not loiter in front of these areas will limit disturbance to this species. This measure is implemented along Adelaide's metropolitan beaches, regardless of the Project.
- Ensure dogs are leashed around known Eastern Hooded Plover nesting sites. This measure is implemented along Adelaide's metropolitan beaches, regardless of the Project.

Assessment

Areas of high conservation significance for the Eastern Hooded Plover include all breeding territories and non-breeding flocking sites (EBS Ecology, 2021). Important stretches of coast in SA include Kangaroo Island and the Yorke Peninsula (EBS Ecology, 2021). The Project will not impact these important areas of habitat.

The Project is unlikely to decrease the size of an important population. The area of occupancy of the species may be reduced in the short term by the Project, by a few months. However, the works are localised and will be temporary. Once completed, the Project will increase the area of sandy beach and dune habitat and hence, increase the area of occupancy available to the species. The Project will not fragment an existing important population into two or more populations. The Project will not adversely affect habitat critical to the survival of the species. As the species nests above the Project Area boundary, the Project will not disrupt the species breeding cycle.

It is further anticipated that direct and indirect impacts of the Project will not modify, destroy, remove and isolate or decrease the availability or quality of habitat to the extent that the species as a whole is likely to decline. The Project will not result in the introduction of invasive species within the Project Area. No diseases are cited as a threat to the Eastern Hooded Plover (DCCEEW, 2014), and equipment will predominantly be ocean based. While there is no National Recovery Plan for this species, the Project will not interfere substantially with the recovery of the species.

With the implementation of the proposed management and mitigation measures and in consideration of the above points, the Project is considered unlikely to have a significant impact on the Eastern Hooded Plover.

As a result, the Project is unlikely to have a significant impact on the Eastern Hooded Plover.

4.5.2 Marine Fauna

As outlined in **Table 4-3** and **Table 4-4** above, marine fauna may occur within the Project Area as transient visitors. While the Project Area is within the mapped distribution for these species, there are few records of the species within close proximity to Project Area. The Project Area does not provide preferable habitat for these species.

The Great White Shark frequents areas in and around some Fur Seal and Sea Lion colonies (e.g. the Neptune Islands), areas of the Great Australian Bight, and regions with high prey densities (e.g. pinniped colonies). There are no areas of known aggregation within the vicinity of the Project Area.

As the Green Turtle rarely visits southern Australia, there are no known critical habitat or breeding grounds in southern Australia. Similarly, the Leatherback Turtle is more commonly found in the northern half of Australia. There are no records of the Leatherback Turtle nesting in SA.

The Australian Sea Lion may visit the Project Area, however, more suitable habitat for this species can be found to the north of the Project Area. A haul-out site for this species exists at the Outer Harbor breakwater in Port River, approximately 2 km north of the Project Area.

The Southern Right Whale is seasonally present along the Australian coast between late April and early November. There are no known current or historical aggregation areas within Gulf St Vincent and it is not part of the species' migration path. Visitation to Gulf St Vincent and the vicinity of the Project Area by an individual whale or whale pairs (i.e. mother/calf) is considered possible.

Potential impacts to listed threatened marine fauna

Dredging activities have the potential to result in collision with marine fauna or result in behavioural changes.

In addition to risks of vessel collision with marine fauna, underwater noise generated from dredging has the potential to impact marine fauna, if present in the area.

Resonate (2020) states that for low frequency cetaceans such as Southern Right Whales and other baleen whales, prolonged exposure to dredging (>15 minutes) may cause permanent hearing damage at distances of 10 to 20 m from the noise source. Temporary hearing impact could occur for baleen whales within approximately 150 to 300 m of the dredging noise source but would depend on the direction of travel and their behavioural response to the given noise (Resonate, 2020).

The Project will temporarily increase the volume of Barge vessel movements along the coast from Largs Bay to West Beach. During barge vessel movements, there is the potential interaction of the barge with marine fauna.

Mitigation measures

Mitigation measures, as listed below, can be implemented to avoid and or minimise risks to marine fauna:

- Trained marine mammal observers (MMO) present on the dredge vessel and barge.
- A 'caution zone' of 150 m around the dredge vessel and barge, and a 'pause operations' if a marine fauna is within 50 m of the dredge vessel ('pause' means wait until the animal is out of the danger zone – not shut down all equipment).

Assessment

Applying the management measure of a 'caution zone' of 150 m around the dredge vessel as detailed above for avoiding risk of collision, will also minimise the impact of underwater noise from dredging on whales and other marine fauna. While it is considered rare for other baleen or beaked whale species to frequent the region of the Project, the measures listed below would ensure there is no significant impact to any cetacean species.

Marine fauna species are not considered to be significantly impacted by the Project, either by dredging or barging and unloading the material. It is noted that a previous large scale capital dredging campaign north of the Project in the Port River, and with spoil deposition within Gulf St Vincent, was referred under the EPBC Act in 2004 (2004/1339) and was determined as ‘not a controlled action’.

5. Conclusions

JBS&G completed a EPBC Act self-assessment based on findings from a desktop review, field-based ecological assessment, and our understanding of potential project impacts. It was JBS&G's determination that the Project is **unlikely** to have a significant impact on MNES. As such, referral of the Project under the EPBC Act is not required. However, the decision whether to refer or not should not only consider the information contained within this report but should also consider wider political and community expectations relating to the Project.

Key findings leading to this conclusion are summarised below for those MNES relevant to the Project.

Threatened Ecological Communities

- Two TECs were predicted by the EPBC Act PMST as likely to or may occur within 5 km of the Project Area: Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (Endangered) and Subtropical and Temperate Coastal Saltmarsh (Vulnerable). Both were assessed as unlikely to occur within the Project Area.
- The likelihood that the Project would have a significant impact on the TECs was determined to be **unlikely**.

Threatened and Migratory Species

- The database searches identified ten nationally listed (EPBC Act) threatened flora species as potentially occurring within 5 km of the Project Area. All were assessed as unlikely to occur within the Project Area.
- The database searches identified fifty-four nationally listed (EPBC Act) threatened fauna species as potentially occurring within 5 km of the Project Area. Of these, sixteen species were assessed as possibly occurring, mostly as transient individuals, one species was assessed as likely to occur, and one species was assessed as highly likely to occur.
- The database searches identified sixty-four migratory species that might occur or use habitat in the Project Area. Of these, approximately one quarter of these species were assessed as possibly occurring in the Project Area, mostly as transient visitors, and one species assessed as likely to occur within the Project Area.
- The likelihood that the Project would have a significant impact on threatened and migratory species was determined to be **unlikely**.

6. Limitations

Scope of services

This report ("the report") has been prepared by JBS&G in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and JBS&G. In some circumstances, a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

Reliance on data

In preparing the report, JBS&G has relied upon data and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise expressly stated in the report, JBS&G has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. JBS&G has also not attempted to determine whether any material matter has been omitted from the data. JBS&G will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to JBS&G. The making of any assumption does not imply that JBS&G has made any enquiry to verify the correctness of that assumption.

The report is based on conditions encountered and information received at the time of preparation of this report or the time that site investigations were carried out. JBS&G disclaims responsibility for any changes that may have occurred after this time. This report and any legal issues arising from it are governed by and construed in accordance with the law as at the date of this report.

Environmental conclusions

Within the limitations imposed by the scope of services, the preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted environmental consulting practices. No other warranty, whether express or implied, is made, including to any third parties, and no liability will be accepted for use or interpretation of this report by any third party.

The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

7. References

BirdLife Australia. (2024). *Birdata*. https://birdata.birdlife.org.au/explore#map=-27.2334388_134.0989190_5&visible_on_map=true

Carter, O. (2011). *National Recovery Plan for the Bead Glasswort Tecticornia flabelliformis*. https://www.dcceew.gov.au/sites/default/files/documents/tecticornia-flabelliformis.pdf

DAWE. (2022). *Conservation Advice for Zoothera lunulata halmaturina (western Bassian thrush)*. https://www.environment.gov.au/biodiversity/threatened/species/pubs/67121-conservation-advice-22042022.pdf

DCCEEW. (n.d.). *Conservation Advice for Subtropical and Temperate Coastal Saltmarsh*. Retrieved July 16, 2024, from http://www.environment.gov.au/biodiversity/threatened/communities/pubs/118-conservation-advice.pdf

DCCEEW. (2008a). *Approved Conservation Advice for Prasophyllum pallidum (Pale Leek-orchid)*. https://www.environment.gov.au/biodiversity/threatened/species/pubs/20351-conservation-advice.pdf

DCCEEW. (2008b). *Approved Conservation Advice for Pterostylis arenicola (Sandhill Greenhood Orchid)*. ttps://www.environment.gov.au/biodiversity/threatened/species/pubs/17919-conservation-advice.pdf

DCCEEW. (2008c). *Approved Conservation Advice for Aprasia pseudopulchella (Flinders Ranges Worm-lizard)*. https://www.environment.gov.au/biodiversity/threatened/species/pubs/1666-conservation-advice.pdf

DCCEEW. (2010). *Approved Conservation Advice for the Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-east Australia*. http://www.environment.gov.au/biodiversity/threatened/communities/pubs/86-conservation-advice.pdf

DCCEEW. (2014). *Conservation Advice Thinornis rubricollis rubricollis hooded plover (eastern)*. https://www.environment.gov.au/biodiversity/threatened/species/pubs/66726-conservation-advice.pdf

DCCEEW. (2015a). *Conservation Advice Acanthiza iredalei rosinae slender-billed thornbill (Gulf St Vincent)*. https://www.environment.gov.au/biodiversity/threatened/species/pubs/67080-conservation-advice.pdf

DCCEEW. (2015b). *Conservation Advice Grantiella picta painted honeyeater*. https://www.environment.gov.au/biodiversity/threatened/species/pubs/470-conservation-advice.pdf

DCCEEW. (2015c). *Conservation Advice Halobaena caerulea blue petrel*. https://www.environment.gov.au/biodiversity/threatened/species/pubs/1059-conservation-advice-01102015.pdf

DCCEEW. (2015d). *Conservation Advice Pachyptila tutur subantarctica fairy prion (southern)*. https://www.environment.gov.au/biodiversity/threatened/species/pubs/64445-conservation-advice-01102015.pdf

DCCEEW. (2015e). *Conservation Advice Pedionomus torquatus plains-wanderer*. https://www.environment.gov.au/biodiversity/threatened/species/pubs/906-conservation-advice.pdf

DCCEEW. (2016). *Conservation Advice Charadrius mongolus Lesser sand plover*. http://www.environment.gov.au/biodiversity/threatened/species/pubs/879-conservation-advice-05052016.pdf

DCCEEW. (2019a). *Conservation Advice Botaurus poiciloptilus Australasian Bittern*. https://www.environment.gov.au/biodiversity/threatened/species/pubs/1001-conservation-advice-18012019.pdf

DCCEEW. (2019b). *Conservation Advice Hirundapus caudacutus White-throated Needletail*. https://www.environment.gov.au/biodiversity/threatened/species/pubs/682-conservation-advice-04072019.pdf

DCCEEW. (2020). *Conservation Advice Falco hypoleucos Grey Falcon*. https://environment.gov.au/biodiversity/threatened/species/pubs/929-conservation-advice-09072020.pdf

DCCEEW. (2024a). *Protected Matters Search Tool*. https://pmst.awe.gov.au/#/map?lng=131.52832031250003&lat=-28.671310915880834&zoom=5&baseLayers=Imagery,ImageryLabels

DCCEEW. (2024b). *Species Profile and Threats Database*. https://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

DEE. (2017). *Recovery Plan for Marine Turtles in Australia*. https://www.agriculture.gov.au/sites/default/files/documents/recovery-plan-marine-turtles-2017.pdf

DELWP. (2016). *National Recovery Plan for the Orange-bellied Parrot, Neophema chrysogaster*. https://www.dcceew.gov.au/sites/default/files/documents/national-recovery-plan-orange-bellied-parrot.pdf

DEW. (2020). *Wildlife Conservation Plan for Seabirds*. https://www.dcceew.gov.au/sites/default/files/documents/wildlife-conservation-plan-for-seabirds.pdf

DEW. (2021). *National Recovery Plan for the Grey-headed Flying-fox*. https://www.dcceew.gov.au/sites/default/files/documents/recovery-plan-grey-headed-flying-fox.pdf

DEW. (2024). *NatureMaps*. http://spatialwebapps.environment.sa.gov.au/naturemaps/?locale=en-us&viewer=naturemaps

DEWHA. (2013a). *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance*. Commonwealth Department of the Environment Water Heritage and the Arts.

DEWHA. (2013b). *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance*. Commonwealth Department of the Environment Water Heritage and the Arts.

DSEWPC. (2011). *National recovery plan for threatened albatrosses and giant petrels 2011-2016*. https://www.dcceew.gov.au/sites/default/files/documents/albatrosses-and-giant-petrels-recovery-plan.pdf

DSEWPC. (2012). *Conservation Management Plan for the Southern Right Whale*. https://www.dcceew.gov.au/sites/default/files/documents/e-australis-2011-2021.pdf

DSEWPC. (2013). *Recovery Plan for the White Shark (Carcharodon carcharias)*. https://www.dcceew.gov.au/sites/default/files/documents/white-shark.pdf

Duncan, M. (2010). *National recovery plan for the sturdy leek orchid Prasophyllum validum*. Dept of Sustainability and Environment. https://www.dcceew.gov.au/sites/default/files/documents/prasophyllum-validum.pdf

EBS Ecology. (2021). *Securing the Future of Our Coastline Sand Pumping Project Hooded Plover EPBC Self Assessment*. http://www.ebsecology.com.au

Flinders Ports. (2019). *Outer Harbor Channel Widening Project - Monthly Report for June 2019*.

JBS&G. (2024). *Largs Bay Sediment Characterisation Program*.

Resonate. (2020). *Venice Energy Noise Impact Study*. *Revision 2*.

Sinclair, S. (2010). *National recovery plan for the large-fruit groundsel Senecio macrocarpus*. Dept of Sustainability and Environment. https://www.dcceew.gov.au/sites/default/files/documents/senecio-macrocarpus.pdf

Tonkinson, D., & Robertson, G. (2010). *National recovery plan for the yellow Swainson-pea Swainsona pyrophila*. Dept of Sustainability and Environment. https://www.dcceew.gov.au/sites/default/files/documents/swainsona-pyrophila.pdf

Appendix A EPBC Act Protected Matters Report

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: 10-Jul-2024

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:	2
Listed Threatened Species:	67
Listed Migratory Species:	64

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:	105
Commonwealth Heritage Places:	None
Listed Marine Species:	106
Whales and Other Cetaceans:	8
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:	8
Regional Forest Agreements:	None
Nationally Important Wetlands:	2
EPBC Act Referrals:	14
Key Ecological Features (Marine):	None
Biologically Important Areas:	3
Bioregional Assessments:	None
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	Buffer Status
Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Endangered	Community may occur within area	In buffer area only
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area	In buffer area only

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	Buffer Status
BIRD			
Acanthiza iredalei rosinae Slender-billed Thornbill (Gulf St Vincent) [67080]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Aphelocephala leucopsis Southern Whiteface [529]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Ardenna grisea Sooty Shearwater [82651]	Vulnerable	Species or species habitat may occur within area	In feature area
Arenaria interpres Ruddy Turnstone [872]	Vulnerable	Roosting known to occur within area	In buffer area only
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Roosting known to occur within area	In feature area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Calidris tenuirostris Great Knot [862]	Vulnerable	Roosting known to occur within area	In buffer area only
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area	In buffer area only
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area	In feature area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat may occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area	In feature area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Endangered	Species or species habitat may occur within area	In feature area
Limosa limosa Black-tailed Godwit [845]	Endangered	Roosting known to occur within area	In buffer area only
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In feature area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Melanodryas cucullata cucullata South-eastern Hooded Robin, Hooded Robin (south-eastern) [67093]	Endangered	Species or species habitat likely to occur within area	In feature area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area	In feature area
Neophema chrysostoma Blue-winged Parrot [726]	Vulnerable	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area	In feature area
Pedionomus torquatus Plains-wanderer [906]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Pluvialis squatarola Grey Plover [865]	Vulnerable	Roosting known to occur within area	In buffer area only
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In feature area
Stagonopleura guttata Diamond Firetail [59398]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat known to occur within area	In feature area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Thalassarche impavida			
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In feature area
Thalassarche melanophris			
Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche steadi			
White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
Thinornis cucullatus cucullatus			
Eastern Hooded Plover, Eastern Hooded Plover [90381]	Vulnerable	Species or species habitat known to occur within area	In feature area
Tringa nebularia			
Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area	In feature area
Xenus cinereus			
Terek Sandpiper [59300]	Vulnerable	Roosting known to occur within area	In buffer area only
Zoothera lunulata halmaturina			
South Australian Bassian Thrush, Western Bassian Thrush [67121]	Endangered	Species or species habitat may occur within area	In buffer area only
FISH			
Seriolella brama			
Blue Warehou [69374]	Conservation Dependent	Species or species habitat known to occur within area	In feature area
Thunnus maccoyii			
Southern Bluefin Tuna [69402]	Conservation Dependent	Species or species habitat known to occur within area	In feature area
MAMMAL			
Eubalaena australis			
Southern Right Whale [40]	Endangered	Breeding known to occur within area	In feature area
Isoodon obesulus obesulus			
Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern) [68050]	Endangered	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Neophoca cinerea			
Australian Sea-lion, Australian Sea Lion [22]	Endangered	Species or species habitat known to occur within area	In feature area
Pteropus poliocephalus			
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
PLANT			
Caladenia conferta			
Coast Spider-orchid [55000]	Endangered	Species or species habitat may occur within area	In buffer area only
Caladenia tensa			
Greencomb Spider-orchid, Rigid Spider-orchid [24390]	Endangered	Species or species habitat likely to occur within area	In feature area
Euphrasia collina subsp. osbornii			
Osborn's Eyebright [3684]	Endangered	Species or species habitat may occur within area	In buffer area only
Prasophyllum pallidum			
Pale Leek-orchid [20351]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Prasophyllum validum			
Sturdy Leek-orchid, Mount Remarkable Leek-orchid [10268]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Pterostylis arenicola			
Sandhill Greenhood Orchid [17919]	Vulnerable	Species or species habitat known to occur within area	In feature area
Senecio macrocarpus			
Large-fruit Fireweed, Large-fruit Groundsel [16333]	Vulnerable	Species or species habitat may occur within area	In feature area
Swainsona pyrophila			
Yellow Swainson-pea [56344]	Vulnerable	Species or species habitat may occur within area	In feature area
Tecticornia flabelliformis			
Bead Glasswort, Bead Samphire [82664]	Vulnerable	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Thelymitra matthewsii			
Spiral Sun-orchid [4168]	Vulnerable	Species or species habitat may occur within area	In buffer area only
REPTILE			
Aprasia pseudopulchella			
Flinders Ranges Worm-lizard [1666]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Caretta caretta			
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area	In feature area
Chelonia mydas			
Green Turtle [1765]	Vulnerable	Species or species habitat may occur within area	In feature area
Dermochelys coriacea			
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area	In feature area
SHARK			
Carcharodon carcharias			
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area	In feature area
Galeorhinus galeus			
School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark [68453]	Conservation Dependent	Species or species habitat may occur within area	In buffer area only

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Ardenna carneipes			
Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area	In feature area
Ardenna grisea			
Sooty Shearwater [82651]	Vulnerable	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area	In feature area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat may occur within area	In feature area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In feature area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Sternula albifrons Little Tern [82849]		Species or species habitat may occur within area	In feature area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Thalassarche impavida			
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In feature area
Thalassarche melanophris			
Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche steadi			
White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
Migratory Marine Species			
Balaenoptera edeni			
Bryde's Whale [35]		Species or species habitat may occur within area	In feature area
Caperea marginata			
Pygmy Right Whale [39]		Species or species habitat may occur within area	In feature area
Carcharodon carcharias			
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area	In feature area
Caretta caretta			
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area	In feature area
Chelonia mydas			
Green Turtle [1765]	Vulnerable	Species or species habitat may occur within area	In feature area
Dermochelys coriacea			
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area	In feature area
Eubalaena australis as Balaena glacialis australis			
Southern Right Whale [40]	Endangered	Breeding known to occur within area	In feature area
Lagenorhynchus obscurus			
Dusky Dolphin [43]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Lamna nasus			
Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area	In feature area
Megaptera novaeangliae			
Humpback Whale [38]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
Hirundapus caudacutus			
White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area
Motacilla cinerea			
Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
Motacilla flava			
Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
Myiagra cyanoleuca			
Satin Flycatcher [612]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Arenaria interpres			
Ruddy Turnstone [872]	Vulnerable	Roosting known to occur within area	In buffer area only
Calidris acuminata			
Sharp-tailed Sandpiper [874]	Vulnerable	Roosting known to occur within area	In feature area
Calidris alba			
Sanderling [875]		Roosting known to occur within area	In buffer area only
Calidris canutus			
Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area	In feature area
Calidris pugnax as Philomachus pugnax Ruff [91256]		Roosting known to occur within area	In buffer area only
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area	In buffer area only
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area	In buffer area only
Calidris tenuirostris Great Knot [862]	Vulnerable	Roosting known to occur within area	In buffer area only
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area	In buffer area only
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area	In buffer area only
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area	In buffer area only
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area	In feature area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area	In buffer area only
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area	In buffer area only
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area	In feature area
Limosa limosa Black-tailed Godwit [845]	Endangered	Roosting known to occur within area	In buffer area only
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area	In buffer area only
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area	In buffer area only
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area	In feature area
Phalaropus lobatus Red-necked Phalarope [838]		Roosting known to occur within area	In buffer area only
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area	In buffer area only
Pluvialis squatarola Grey Plover [865]	Vulnerable	Roosting known to occur within area	In buffer area only
Thalasseus bergii Greater Crested Tern [83000]		Breeding known to occur within area	In buffer area only
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area	In buffer area only
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area	In feature area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area	In buffer area only
Xenus cinereus Terek Sandpiper [59300]	Vulnerable	Roosting known to occur within area	In buffer area only

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	Buffer Status
Communications, Information Technology and the Arts - Australian Communications Authority		
Commonwealth Land - Australian Communications Authority [41593]	SA	In buffer area only
Communications, Information Technology and the Arts - Australian Sports Commission		
Commonwealth Land - Australian Sports Commission [40526]	SA	In feature area
Commonwealth Land - Australian Sports Commission [40527]	SA	In feature area
Defence		
Commonwealth Land - Defence Service Homes Corporation [40525]	SA	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [40529]	SA	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [40404]	SA	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [40451]	SA	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [40517]	SA	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [40453]	SA	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [40452]	SA	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [40397]	SA	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [40373]	SA	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [40374]	SA	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [40469]	SA	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - Defence Service Homes Corporation [40462]	SA	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [40468]	SA	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [40465]	SA	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [40367]	SA	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [40471]	SA	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [40470]	SA	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [40320]	SA	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [40321]	SA	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [40324]	SA	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [40322]	SA	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [40323]	SA	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [40530]	SA	In buffer area only
Defence - ALBERTON TRNG DEPOT [40313]	SA	In buffer area only
Defence - ALBERTON TRNG DEPOT [40312]	SA	In buffer area only
Defence - ALBERTON TRNG DEPOT [40315]	SA	In buffer area only
Defence - ALBERTON TRNG DEPOT [40314]	SA	In buffer area only
Defence - ALBERTON TRNG DEPOT [40317]	SA	In buffer area only
Defence - ALBERTON TRNG DEPOT [40316]	SA	In buffer area only
Defence - ALBERTON TRNG DEPOT [40318]	SA	In buffer area only
Defence - ALBERTON TRNG DEPOT [40319]	SA	In buffer area only
Defence - HMAS ENCOUNTER [40016]	SA	In buffer area only
Defence - PT ADELAIDE SHIPYARD & BOATSHED (TS ADELAIDE) [40233]	SA	In buffer area only
Defence - PT ADELAIDE SHIPYARD & BOATSHED (TS ADELAIDE) [40232]	SA	In buffer area only
Defence - PT ADELAIDE SHIPYARD & BOATSHED (TS ADELAIDE) [40231]	SA	In buffer area only
Defence - PT ADELAIDE SHIPYARD & BOATSHED (TS ADELAIDE) [40236]	SA	In buffer area only

Commonwealth Land Name	State	Buffer Status
Defence - PT ADELAIDE SHIPYARD & BOATSHED (TS ADELAIDE) [40235]	SA	In buffer area only
Defence - PT ADELAIDE SHIPYARD & BOATSHED (TS ADELAIDE) [40234]	SA	In buffer area only
Defence - WARRADALE BARRACKS [40092]	SA	In buffer area only
Defence - Defence Housing Authority		
Commonwealth Land - Defence Housing Authority [41423]	SA	In buffer area only
Commonwealth Land - Defence Housing Authority [41433]	SA	In buffer area only
Commonwealth Land - Defence Housing Authority [41454]	SA	In buffer area only
Commonwealth Land - Defence Housing Authority [41455]	SA	In buffer area only
Commonwealth Land - Defence Housing Authority [41559]	SA	In buffer area only
Commonwealth Land - Defence Housing Authority [41370]	SA	In feature area
Commonwealth Land - Defence Housing Authority [41371]	SA	In feature area
Commonwealth Land - Defence Housing Authority [41434]	SA	In buffer area only
Commonwealth Land - Defence Housing Authority [41435]	SA	In buffer area only
Commonwealth Land - Defence Housing Authority [41523]	SA	In buffer area only
Commonwealth Land - Defence Housing Authority [41522]	SA	In buffer area only
Education, Science and Training - CSIRO		
Commonwealth Land - Commonwealth Scientific & Industrial Research Organisation [40341]	SA	In buffer area only
Commonwealth Land - Commonwealth Scientific & Industrial Research Organisation [40340]	SA	In buffer area only
Commonwealth Land - Commonwealth Scientific & Industrial Research Organisation [40338]	SA	In buffer area only
Commonwealth Land - Commonwealth Scientific & Industrial Research Organisation [40339]	SA	In buffer area only
Commonwealth Land - Commonwealth Scientific & Industrial Research Organisation [41496]	SA	In buffer area only
Transport and Regional Services - Australian Maritime Safety Authority		
Commonwealth Land - Australian Maritime Safety Authority [40390]	SA	In buffer area only
Commonwealth Land - Australian Maritime Safety Authority [40389]	SA	In buffer area only
Commonwealth Land - Australian Maritime Safety Authority [40388]	SA	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - Australian Maritime Safety Authority [40387]	SA	In buffer area only
Transport and Regional Services - Australian National Railways Commission		
Commonwealth Land - Australian National Railways Commission [41587]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [41586]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [40521]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [40520]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [40493]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [40494]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [41588]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [41542]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [41540]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [41589]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [41318]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [41317]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [40376]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [41316]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [40375]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [41315]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [40449]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [41610]	SA	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - Australian National Railways Commission [41473]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [41474]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [41321]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [41324]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [41325]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [41320]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [41323]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [41322]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [41528]	SA	In buffer area only
Commonwealth Land - Australian National Railways Commission [41484]	SA	In buffer area only
Unknown		
Commonwealth Land - [40495]	SA	In buffer area only
Commonwealth Land - [41592]	SA	In buffer area only
Commonwealth Land - [40450]	SA	In feature area
Commonwealth Land - [40394]	SA	In buffer area only
Commonwealth Land - [40395]	SA	In buffer area only
Commonwealth Land - [40464]	SA	In buffer area only
Commonwealth Land - [40487]	SA	In buffer area only
Commonwealth Land - [41553]	SA	In buffer area only
Commonwealth Land - [40489]	SA	In buffer area only
Commonwealth Land - [40488]	SA	In buffer area only
Commonwealth Land - [40385]	SA	In buffer area only
Commonwealth Land - [40383]	SA	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - [40384]	SA	In buffer area only
Commonwealth Land - [40381]	SA	In buffer area only
Commonwealth Land - [40382]	SA	In buffer area only

Listed Marine Species

[Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Ardenna carneipes as Puffinus carneipes			
Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area	In feature area
Ardenna grisea as Puffinus griseus			
Sooty Shearwater [82651]	Vulnerable	Species or species habitat may occur within area	In feature area
Arenaria interpres			
Ruddy Turnstone [872]	Vulnerable	Roosting known to occur within area	In buffer area only
Bubulcus ibis as Ardea ibis			
Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata			
Sharp-tailed Sandpiper [874]	Vulnerable	Roosting known to occur within area	In feature area
Calidris alba			
Sanderling [875]		Roosting known to occur within area	In buffer area only
Calidris canutus			
Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area overfly marine area	In feature area
Calidris pugnax as Philomachus pugnax Ruff [91256]		Roosting known to occur within area overfly marine area	In buffer area only
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area overfly marine area	In buffer area only
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area overfly marine area	In buffer area only
Calidris tenuirostris Great Knot [862]	Vulnerable	Roosting known to occur within area overfly marine area	In buffer area only
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area	In feature area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area overfly marine area	In buffer area only
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area	In buffer area only
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area overfly marine area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area overfly marine area	In buffer area only
Chroicocephalus novaehollandiae as Larus novaehollandiae Silver Gull [82326]		Breeding known to occur within area	In buffer area only
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area	In feature area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat may occur within area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In feature area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area overfly marine area	In buffer area only
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area overfly marine area	In buffer area only
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area	In feature area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area overfly marine area	In buffer area only
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In feature area
Larus dominicanus Kelp Gull [809]		Breeding known to occur within area	In buffer area only
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area overfly marine area	In buffer area only
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area	In feature area
Limosa limosa Black-tailed Godwit [845]	Endangered	Roosting known to occur within area overfly marine area	In buffer area only
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In feature area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Motacilla flava			
Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
Myiagra cyanoleuca			
Satin Flycatcher [612]		Species or species habitat may occur within area overfly marine area	In feature area
Neophema chrysogaster			
Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Neophema chrysostoma			
Blue-winged Parrot [726]	Vulnerable	Species or species habitat likely to occur within area overfly marine area	In feature area
Numenius madagascariensis			
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Numenius minutus			
Little Curlew, Little Whimbrel [848]		Roosting known to occur within area overfly marine area	In buffer area only
Numenius phaeopus			
Whimbrel [849]		Roosting known to occur within area	In buffer area only
Pachyptila turtur			
Fairy Prion [1066]		Species or species habitat known to occur within area	In feature area
Pandion haliaetus			
Osprey [952]		Species or species habitat known to occur within area	In feature area
Phalacrocorax fuscescens			
Black-faced Cormorant [59660]		Breeding known to occur within area	In buffer area only
Phalaropus lobatus			
Red-necked Phalarope [838]		Roosting known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Phoebetria fusca			
Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Pluvialis fulva			
Pacific Golden Plover [25545]		Roosting known to occur within area	In buffer area only
Pluvialis squatarola			
Grey Plover [865]	Vulnerable	Roosting known to occur within area overfly marine area	In buffer area only
Pterodroma mollis			
Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Recurvirostra novaehollandiae			
Red-necked Avocet [871]		Roosting known to occur within area overfly marine area	In buffer area only
Rostratula australis as Rostratula benghalensis (sensu lato)			
Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
Stercorarius antarcticus as Catharacta skua			
Brown Skua [85039]		Species or species habitat may occur within area	In buffer area only
Sterna striata			
White-fronted Tern [799]		Foraging, feeding or related behaviour likely to occur within area	In feature area
Sternula albifrons as Sterna albifrons			
Little Tern [82849]		Species or species habitat may occur within area	In feature area
Thalassarche carteri			
Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Thalassarche cauta			
Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Thalassarche impavida			
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In feature area
Thalassarche melanophris			
Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche steadi			
White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
Thalasseus bergii as Sterna bergii			
Greater Crested Tern [83000]		Breeding known to occur within area	In buffer area only
Thinornis cucullatus as Thinornis rubricollis			
Hooded Plover, Hooded Dotterel [87735]		Species or species habitat known to occur within area overfly marine area	In feature area
Thinornis cucullatus cucullatus as Thinornis rubricollis rubricollis			
Eastern Hooded Plover, Eastern Hooded Plover [90381]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In feature area
Tringa brevipes as Heteroscelus brevipes			
Grey-tailed Tattler [851]		Roosting known to occur within area	In buffer area only
Tringa glareola			
Wood Sandpiper [829]		Roosting known to occur within area overfly marine area	In buffer area only
Tringa nebularia			
Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area overfly marine area	In feature area
Tringa stagnatilis			
Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area overfly marine area	In buffer area only
Xenus cinereus			
Terek Sandpiper [59300]	Vulnerable	Roosting known to occur within area overfly marine area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Fish			
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area	In feature area
Campichthys tryoni Tryon's Pipefish [66193]		Species or species habitat may occur within area	In feature area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area	In feature area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area	In feature area
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area	In feature area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area	In feature area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area	In feature area
Hypselognathus rostratus Knifesnout Pipefish, Knife-snouted Pipefish [66245]		Species or species habitat may occur within area	In feature area
Kaupus costatus Deepbody Pipefish, Deep-bodied Pipefish [66246]		Species or species habitat may occur within area	In feature area
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species habitat may occur within area	In feature area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area	In feature area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area	In feature area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area	In feature area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area	In feature area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area	In feature area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area	In feature area
Solegnathus robustus Robust Pipehorse, Robust Spiny Pipehorse [66274]		Species or species habitat may occur within area	In feature area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area	In feature area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area	In feature area
Stipecampus cristatus Ringback Pipefish, Ring-backed Pipefish [66278]		Species or species habitat may occur within area	In feature area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area	In feature area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area	In feature area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area	In feature area
Vanacampus vercoi Verco's Pipefish [66286]		Species or species habitat may occur within area	In feature area
Mammal			
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area	In feature area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area	In feature area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Endangered	Species or species habitat known to occur within area	In feature area
Reptile			
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area	In feature area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat may occur within area	In feature area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area	In feature area

Whales and Other Cetaceans [Resource Information]

Current Scientific Name	Status	Type of Presence	Buffer Status
Mammal			

Current Scientific Name	Status	Type of Presence	Buffer Status
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area	In feature area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area	In feature area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area	In feature area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area	In feature area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area	In feature area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat likely to occur within area	In feature area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area	In feature area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area	In feature area

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State	Buffer Status
Adelaide	Dolphin Sanctuary	SA	In feature area
Adelaide International Bird Sanctuary-Winaityinaityi Pangkara	National Park	SA	In buffer area only
Barker Inlet-St Kilda	Aquatic Reserve	SA	In buffer area only
Encounter	Marine Park	SA	In buffer area only
Fort Glanville	Conservation Park	SA	In feature area

Protected Area Name	Reserve Type	State	Buffer Status
St Kilda-Chapman Creek	Aquatic Reserve	SA	In buffer area only
Tennyson Dunes	Conservation Reserve	SA	In feature area
Torrens Island	Conservation Park	SA	In buffer area only

Nationally Important Wetlands

[Resource Information]

Wetland Name	State	Buffer Status
Barker Inlet & St Kilda	SA	In buffer area only
Port Gawler & Buckland Park Lake	SA	In buffer area only

EPBC Act Referrals

[Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Osborne North Car Park and Grade Separated Road	2023/09662		Completed	In buffer area only
Not controlled action				
AGL Energy Park	2010/5398	Not Controlled Action	Completed	In buffer area only
Construction of substation and 18km of underground cable	2009/4948	Not Controlled Action	Completed	In buffer area only
Dredging and Spoil Disposal at Outer Harbour of Port Adelaide	2004/1339	Not Controlled Action	Completed	In feature area
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed	In feature area
Osborne Maritime Precinct	2005/2065	Not Controlled Action	Completed	In feature area
Outer Harbour Wharf Redevelopment	2003/965	Not Controlled Action	Completed	In buffer area only
Torrens Island Battery	2021/8889	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
Ceres Wind Farm, SA	2012/6612	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval	In feature area

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action (particular manner)				
Port Adelaide Outer Harbor Channel Widening Project, SA	2017/8033	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
SEA Gas Project transmission pipeline	2001/513	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Referral decision				
Prescribed burning in Grey Box Grassy Woodlands	2011/6135	Referral Decision	Completed	In buffer area only

Biologically Important Areas [Resource Information]

Scientific Name	Behaviour	Presence	Buffer Status
Seabirds			
Phalacrocorax fuscescens Black-faced Cormorant [59660]	Foraging	Known to occur	In buffer area only
Sternula nereis Fairy Tern [82949]	Foraging	Known to occur	In feature area
Seals			
Neophoca cinerea Australian Sea Lion [22]	Foraging (male)	Known to occur	In feature area

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.

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

Department of Climate Change, Energy, the Environment and Water
GPO Box 3090
Canberra ACT 2601 Australia
+61 2 6274 1111

Appendix B BDBSA Search – Flora Records

Sighting Date	Reliability Description	Observer	Species	Common Name	National Rating	State Rating	Location
5/04/1990	0-5m	"FOTHERINGHAM D.G. Doug"	Tecticornia flabelliformis	Bead Samphire	VU	V	Torrens Island (CP)
20/03/1989	0-5m	"FOTHERINGHAM D.G. Doug"	Tecticornia flabelliformis	Bead Samphire	VU	V	Torrens Island (CP)
5/04/1990	0-5m	"FOTHERINGHAM D.G. Doug"	Tecticornia flabelliformis	Bead Samphire	VU	V	Torrens Island (CP)
20/03/1989	5-50m	"FOTHERINGHAM D.G. Doug"	Tecticornia flabelliformis	Bead Samphire	VU	V	Torrens Island (CP)
5/04/1990	0-5m	"FOTHERINGHAM D.G. Doug"	Tecticornia flabelliformis	Bead Samphire	VU	V	Torrens Island (CP)
20/03/1989	0-5m	"FOTHERINGHAM D.G. Doug"	Tecticornia flabelliformis	Bead Samphire	VU	V	Torrens Island (CP)
5/04/1990	5-50m	"FOTHERINGHAM D.G. Doug"	Tecticornia flabelliformis	Bead Samphire	VU	V	Torrens Island (CP)
3/10/1943	1-10km	H.M. Cooper	Euphrasia collina ssp. osbornii	Osborn's Eyebright	EN	E	0.5 km ESE of Taperoo (suburb centre)
29/08/2008	-	"OBST C.S. Chris""JURY T. Tim"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
24/09/2008	-	"QUARMBY J. Joe"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
28/08/1994	-	"SORENSEN B. Birgitte"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
1/08/2014	-	"QUARMBY J. Joe"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
1/08/2009	-	"QUARMBY J. Joe"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
17/12/1995	-	"MURFET D.E. Denzel""TAPLIN R.L. Rosemary"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
1/07/1993	-	"SORENSEN B. Birgitte"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
8/10/1991	-	"SORENSEN B. Birgitte"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
21/07/1991	-	"SORENSEN B. Birgitte""JUSAITIS M. Manfred"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
1/08/2013	-	"QUARMBY J. Joe"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
24/09/2008	-	"QUARMBY J. Joe"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
5/08/1991	-	"SORENSEN B. Birgitte"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
1/08/2012	-	"QUARMBY J. Joe"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
15/10/2004	-	"OBST C.S. Chris""POUND L.M. Leanne"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
8/09/1994	-	"SORENSEN B. Birgitte"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
12/02/1992	-	"SORENSEN B. Birgitte"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
6/09/2015	-	"DAVIES R.J-P. Richard""LAWRENCE R Robert""JURY T. Tim"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
24/09/2008	-	"QUARMBY J. Joe"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
5/10/1994	-	"SORENSEN B. Birgitte"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
29/08/2006	-	"OBST C.S. Chris""JURY T. Tim"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
27/10/2005	-	"OBST C.S. Chris""JURY T. Tim"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
15/09/2016	-	"DAVIES R.J-P. Richard""LAWRENCE R. Rosalie""JURY T. Tim"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
16/06/1994	-	"SORENSEN B. Birgitte"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
1/01/1980	-	"BATES R.J. Rob"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
20/11/1992	-	"SORENSEN B. Birgitte"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
1/08/2011	-	"QUARMBY J. Joe"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
23/09/1992	-	"SORENSEN B. Birgitte"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
15/06/1992	-	"SORENSEN B. Birgitte"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
1/08/2010	-	"QUARMBY J. Joe"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
26/07/1994	-	"SORENSEN B. Birgitte"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
14/10/1993	-	"SORENSEN B. Birgitte"	Pterostylis arenicola	Sandhill Greenhood	VU	V	
5/11/1991	-	"SORENSEN B. Birgitte"	Pterostylis arenicola	Sandhill Greenhood	VU	V	

Appendix C BDBSA Search – Fauna Records

Sighting Date	Reliability Description	Survey Name	Species	Common Name	Class Name	National Rating	State Rating	Number Observed
29/08/1979	1-10km	BIRDS SA/SAOA - JOURNALS AND NEWSLETTERS	Rostratula australis	Australian Painted-snipe	AVES	EN	E	1
24/11/2013	No entered	MLR THREATENED FAUNA REPORTINGS	Neophoca cinerea	Australian Sea Lion	MAMMALIA	EN	V	present but not counted
20/05/2005	501-1000m	MISC. OPPORTUNE RECORDS	Neophoca cinerea	Australian Sea Lion	MAMMALIA	EN	V	2
17/10/2013	No entered	MLR THREATENED FAUNA REPORTINGS	Neophoca cinerea	Australian Sea Lion	MAMMALIA	EN	V	1
1/03/2008	1-10km	SARDI- THREATENED MARINE SP POP. SURVEYS	Neophoca cinerea	Australian Sea Lion	MAMMALIA	EN	V	1
24/08/1991	501-1000m	BIRDS SA/SAOA - JOURNALS AND NEWSLETTERS	Halobaena caerulea	Blue Petrel	AVES	VU		1
2/04/2020	1-10km	PAE MIGRATORY BIRD MONITORING	Tringa nebularia	Common Greenshank	AVES	EN		2
22/12/2019	1-10km	PAE MIGRATORY BIRD MONITORING	Tringa nebularia	Common Greenshank	AVES	EN		1
19/03/2018	1-10km	PAE MIGRATORY BIRD MONITORING	Tringa nebularia	Common Greenshank	AVES	EN		1
30/11/2014	1-10km	PAE MIGRATORY BIRD MONITORING	Tringa nebularia	Common Greenshank	AVES	EN		1
24/03/2015	1-10km	PAE MIGRATORY BIRD MONITORING	Tringa nebularia	Common Greenshank	AVES	EN		1
12/01/2013	1-10km	PAE MIGRATORY BIRD MONITORING	Tringa nebularia	Common Greenshank	AVES	EN		1
7/03/2012	1-10km	PAE MIGRATORY BIRD MONITORING	Tringa nebularia	Common Greenshank	AVES	EN		1
28/03/2016	1-10km	PAE MIGRATORY BIRD MONITORING	Tringa nebularia	Common Greenshank	AVES	EN		2
24/10/2013	1-10km	PAE MIGRATORY BIRD MONITORING	Tringa nebularia	Common Greenshank	AVES	EN		1
30/10/2014	1-10km	PAE MIGRATORY BIRD MONITORING	Tringa nebularia	Common Greenshank	AVES	EN		1
23/09/2016	1-10km	PAE MIGRATORY BIRD MONITORING	Tringa nebularia	Common Greenshank	AVES	EN		1
19/02/2014	1-10km	PAE MIGRATORY BIRD MONITORING	Tringa nebularia	Common Greenshank	AVES	EN		1
25/01/2018	1-10km	PAE MIGRATORY BIRD MONITORING	Tringa nebularia	Common Greenshank	AVES	EN		1
28/01/2016	1-10km	PAE MIGRATORY BIRD MONITORING	Tringa nebularia	Common Greenshank	AVES	EN		2
13/11/2012	1-10km	PAE MIGRATORY BIRD MONITORING	Tringa nebularia	Common Greenshank	AVES	EN		1
15/03/2020	1-10km	PAE MIGRATORY BIRD MONITORING	Tringa nebularia	Common Greenshank	AVES	EN		1
27/11/2015	1-10km	PAE MIGRATORY BIRD MONITORING	Tringa nebularia	Common Greenshank	AVES	EN		1
25/01/2017	1-10km	PAE MIGRATORY BIRD MONITORING	Tringa nebularia	Common Greenshank	AVES	EN		1
5/05/2016	1-10km	PAE MIGRATORY BIRD MONITORING	Tringa nebularia	Common Greenshank	AVES	EN		2
12/01/1985	1-10km	SAOA 2ND BIRD ATLAS ADELAIDE REGION	Tringa nebularia	Common Greenshank	AVES	EN		present but not counted
10/11/2019	1-10km	PAE MIGRATORY BIRD MONITORING	Tringa nebularia	Common Greenshank	AVES	EN		1
22/03/2014	1-10km	PAE MIGRATORY BIRD MONITORING	Tringa nebularia	Common Greenshank	AVES	EN		1
25/07/2012	1-10km	PAE MIGRATORY BIRD MONITORING	Tringa nebularia	Common Greenshank	AVES	EN		20
11/01/2020	1-10km	PAE MIGRATORY BIRD MONITORING	Tringa nebularia	Common Greenshank	AVES	EN		1
28/03/2012	1-10km	PAE MIGRATORY BIRD MONITORING	Tringa nebularia	Common Greenshank	AVES	EN		1
30/10/2014	5-50m	SLENDER-BILLED THORNBILL NTH COAST SVY	Tringa nebularia	Common Greenshank	AVES	EN		1
16/11/2002	1-10km	BIRDS SA - PERSONAL BIRD RECORDS	Tringa nebularia	Common Greenshank	AVES	EN		1
1/01/1985	1-10km	SAOA 2ND BIRD ATLAS ADELAIDE REGION	Tringa nebularia	Common Greenshank	AVES	EN		present but not counted
16/03/2002	1-10km	BIRDS SA - PERSONAL BIRD RECORDS	Tringa nebularia	Common Greenshank	AVES	EN		1
1/11/2002	1-10km	BIRDS SA - PERSONAL BIRD RECORDS	Tringa nebularia	Common Greenshank	AVES	EN		1

Sighting Date	Reliability Description	Survey Name	Species	Common Name	Class Name	National Rating	State Rating	Number Observed
13/01/1985	1-10km	SAOA 2ND BIRD ATLAS ADELAIDE REGION	Tringa nebularia	Common Greenshank	AVES	EN		present but not counted
16/01/2003	1-10km	BIRDS SA - PERSONAL BIRD RECORDS	Tringa nebularia	Common Greenshank	AVES	EN		1
16/12/2002	1-10km	BIRDS SA - PERSONAL BIRD RECORDS	Tringa nebularia	Common Greenshank	AVES	EN		1
16/09/2002	1-10km	BIRDS SA - PERSONAL BIRD RECORDS	Tringa nebularia	Common Greenshank	AVES	EN		1
1/12/2002	1-10km	BIRDS SA - PERSONAL BIRD RECORDS	Tringa nebularia	Common Greenshank	AVES	EN		1
1/02/1985	1-10km	SAOA 2ND BIRD ATLAS ADELAIDE REGION	Tringa nebularia	Common Greenshank	AVES	EN		present but not counted
1/06/2003	1-10km	BIRDS SA - PERSONAL BIRD RECORDS	Tringa nebularia	Common Greenshank	AVES	EN		1
26/03/1994	1-10km	BIRD TRANSECTS - RIVER TORRENS	Tringa nebularia	Common Greenshank	AVES	EN		1
10/11/1979	1-10km	BIRD TRANSECTS - RIVER TORRENS	Tringa nebularia	Common Greenshank	AVES	EN		1
15/01/1977	1-10km	BIRD TRANSECTS - RIVER TORRENS	Tringa nebularia	Common Greenshank	AVES	EN		1
11/10/1976	1-10km	BIRD TRANSECTS - RIVER TORRENS	Tringa nebularia	Common Greenshank	AVES	EN		3
26/11/1977	1-10km	BIRD TRANSECTS - RIVER TORRENS	Tringa nebularia	Common Greenshank	AVES	EN		4
17/12/1977	1-10km	BIRD TRANSECTS - RIVER TORRENS	Tringa nebularia	Common Greenshank	AVES	EN		6
18/01/1976	1-10km	BIRD TRANSECTS - RIVER TORRENS	Tringa nebularia	Common Greenshank	AVES	EN		3
12/01/1992	1-10km	BIRD TRANSECTS - RIVER TORRENS	Tringa nebularia	Common Greenshank	AVES	EN		2
15/11/1975	1-10km	BIRD TRANSECTS - RIVER TORRENS	Tringa nebularia	Common Greenshank	AVES	EN		2
19/12/1975	1-10km	BIRD TRANSECTS - RIVER TORRENS	Tringa nebularia	Common Greenshank	AVES	EN		3
18/12/1976	1-10km	BIRD TRANSECTS - RIVER TORRENS	Tringa nebularia	Common Greenshank	AVES	EN		2
12/02/1977	1-10km	BIRD TRANSECTS - RIVER TORRENS	Tringa nebularia	Common Greenshank	AVES	EN		2
14/02/1976	1-10km	BIRD TRANSECTS - RIVER TORRENS	Tringa nebularia	Common Greenshank	AVES	EN		2
22/01/1995	1-10km	BIRD TRANSECTS - RIVER TORRENS	Tringa nebularia	Common Greenshank	AVES	EN		2
16/12/1978	1-10km	BIRD TRANSECTS - RIVER TORRENS	Tringa nebularia	Common Greenshank	AVES	EN		4
28/03/1982	1-10km	BIRD TRANSECTS - RIVER TORRENS	Tringa nebularia	Common Greenshank	AVES	EN		2
15/03/1986	1-10km	BIRD TRANSECTS - RIVER TORRENS	Tringa nebularia	Common Greenshank	AVES	EN		1
24/02/1979	1-10km	BIRD TRANSECTS - RIVER TORRENS	Tringa nebularia	Common Greenshank	AVES	EN		2
12/03/1978	1-10km	BIRD TRANSECTS - RIVER TORRENS	Tringa nebularia	Common Greenshank	AVES	EN		2
13/01/1991	1-10km	BIRD TRANSECTS - RIVER TORRENS	Tringa nebularia	Common Greenshank	AVES	EN		1
9/04/1977	1-10km	BIRD TRANSECTS - RIVER TORRENS	Tringa nebularia	Common Greenshank	AVES	EN		2
13/11/1997	1-10km	BIRD TRANSECTS - RIVER TORRENS	Tringa nebularia	Common Greenshank	AVES	EN		2
11/11/1978	1-10km	BIRD TRANSECTS - RIVER TORRENS	Tringa nebularia	Common Greenshank	AVES	EN		1
31/08/1985	1-10km	SAOA 2ND BIRD ATLAS ADELAIDE REGION	Sternula nereis nereis	Fairy Tern	AVES	VU	E	present but not counted
1/01/1985	1-10km	SAOA 2ND BIRD ATLAS ADELAIDE REGION	Sternula nereis nereis	Fairy Tern	AVES	VU	E	present but not counted
1/10/2007	1-10km	BIRDS SA - PERSONAL BIRD RECORDS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	10
16/10/2005	1-10km	BIRDS SA - PERSONAL BIRD RECORDS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	20
16/10/2007	1-10km	BIRDS SA - PERSONAL BIRD RECORDS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	4
1/07/2007	1-10km	BIRDS SA - PERSONAL BIRD RECORDS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	1
16/10/2003	1-10km	BIRDS SA - PERSONAL BIRD RECORDS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	1
16/06/2003	1-10km	BIRDS SA - PERSONAL BIRD RECORDS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	1

Sighting Date	Reliability Description	Survey Name	Species	Common Name	Class Name	National Rating	State Rating	Number Observed
1/06/2003	1-10km	BIRDS SA - PERSONAL BIRD RECORDS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	1
1/10/2006	1-10km	BIRDS SA - PERSONAL BIRD RECORDS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	3
1/10/2005	1-10km	BIRDS SA - PERSONAL BIRD RECORDS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	39
1/08/2007	1-10km	BIRDS SA - PERSONAL BIRD RECORDS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	1
1/11/2006	1-10km	BIRDS SA - PERSONAL BIRD RECORDS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	1
1/09/2006	1-10km	BIRDS SA - PERSONAL BIRD RECORDS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	1
16/10/2006	1-10km	BIRDS SA - PERSONAL BIRD RECORDS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	4
18/10/2003	1-10km	BIRD TRANSECTS - RIVER TORRENS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	12
15/10/2005	1-10km	BIRD TRANSECTS - RIVER TORRENS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	14
4/10/2004	1-10km	BIRD TRANSECTS - RIVER TORRENS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	10
18/10/2008	1-10km	BIRD TRANSECTS - RIVER TORRENS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	1
3/11/1985	1-10km	SAOA 2ND BIRD ATLAS ADELAIDE REGION	Sternula nereis nereis	Fairy Tern	AVES	VU	E	present but not counted
22/09/1979	1-10km	BIRD TRANSECTS - RIVER TORRENS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	1
8/11/1992	1-10km	BIRD TRANSECTS - RIVER TORRENS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	2
4/10/2004	1-10km	BIRD TRANSECTS - RIVER TORRENS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	10
18/10/2003	1-10km	BIRD TRANSECTS - RIVER TORRENS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	12
9/08/1998	1-10km	BIRD TRANSECTS - RIVER TORRENS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	3
23/08/1985	1-10km	SAOA 2ND BIRD ATLAS ADELAIDE REGION	Sternula nereis nereis	Fairy Tern	AVES	VU	E	present but not counted
15/10/2005	1-10km	BIRD TRANSECTS - RIVER TORRENS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	14
8/10/2000	1-10km	BIRD TRANSECTS - RIVER TORRENS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	47
23/08/1985	1-10km	BIRD TRANSECTS - RIVER TORRENS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	9
21/07/2012	1-10km	BIRD TRANSECTS - RIVER TORRENS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	2
21/10/2005	501-1000m	BIRDS SA/SAOA - JOURNALS AND NEWSLETTERS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	2
3/11/1985	1-10km	BIRD TRANSECTS - RIVER TORRENS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	4
25/09/1994	1-10km	BIRD TRANSECTS - RIVER TORRENS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	3
17/10/1999	1-10km	BIRD TRANSECTS - RIVER TORRENS	Sternula nereis nereis	Fairy Tern	AVES	VU	E	2
18/01/1968	501-1000m	BIRDS SA/SAOA - JOURNALS AND NEWSLETTERS	Numenius madagascariensis	Far Eastern Curlew	AVES	CR	E	16
19/09/2003	5-50m	SA MUSEUM APPROVED NON-SPECIMEN RECORDS	Chelonia mydas	Green Sea Turtle	REPTILIA	VU	V	1
1/06/2003	-	BIRDS SA - PERSONAL BIRD RECORDS	Falco hypoleucos	Grey Falcon	AVES	VU	R	1
25/12/2019	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
21/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
15/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
13/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
8/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
15/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
18/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
8/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1

Sighting Date	Reliability Description	Survey Name	Species	Common Name	Class Name	National Rating	State Rating	Number Observed
13/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
19/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
15/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
21/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
17/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
21/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
19/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
17/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
16/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
13/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
5/02/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
25/12/2019	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
5/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
18/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
26/12/2019	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
12/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
14/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
15/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
10/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
13/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
9/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
15/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
8/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
21/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
12/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
20/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
13/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
15/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
20/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
6/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
18/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
19/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
17/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
6/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
11/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
19/02/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
5/02/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
5/02/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
9/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
11/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
13/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
16/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1

Sighting Date	Reliability Description	Survey Name	Species	Common Name	Class Name	National Rating	State Rating	Number Observed
8/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
16/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
12/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
12/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
14/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
13/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
9/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
11/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
12/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
23/12/2019	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
18/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
12/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
13/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
14/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
16/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
21/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
17/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
19/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
19/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
17/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
19/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
20/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
11/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
7/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
5/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
19/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
12/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
19/02/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
5/02/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
18/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
7/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
11/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
24/12/2019	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
11/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
5/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
15/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
11/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
20/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
14/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
12/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
17/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
17/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1

Sighting Date	Reliability Description	Survey Name	Species	Common Name	Class Name	National Rating	State Rating	Number Observed
20/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
16/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
17/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
13/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
7/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
20/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
24/12/2019	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
5/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
11/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
5/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
18/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
15/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
5/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
14/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
8/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
12/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
5/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
16/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
20/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
19/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
20/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
19/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
16/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
20/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
6/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
5/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
24/12/2019	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
12/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
17/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
13/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
14/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
10/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
10/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
8/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
14/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
14/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
8/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
9/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
10/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
17/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
15/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
17/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1

Sighting Date	Reliability Description	Survey Name	Species	Common Name	Class Name	National Rating	State Rating	Number Observed
18/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
18/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
19/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
19/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
20/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
16/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
6/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
10/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
16/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
6/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
7/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
5/02/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
16/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
19/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
21/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
10/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
15/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
15/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
12/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
14/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
5/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
8/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
9/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
5/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
12/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
16/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
21/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
20/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
17/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
19/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
10/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
5/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
5/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
10/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
5/02/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
24/12/2019	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
10/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
14/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
17/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
6/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
11/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
18/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1

Sighting Date	Reliability Description	Survey Name	Species	Common Name	Class Name	National Rating	State Rating	Number Observed
15/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
18/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
16/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
12/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
8/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
9/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
13/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
12/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
15/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
18/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
12/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
16/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
19/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
21/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
21/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
19/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
17/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
17/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
18/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
20/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
15/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
7/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
7/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
25/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
5/02/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
30/10/2013	1-10km	MLR THREATENED FAUNA REPORTINGS	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
20/12/2019	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
20/12/2019	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
23/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
23/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
13/09/2013	501-1000m	MLR THREATENED FAUNA REPORTINGS	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
7/02/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
7/02/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
1/04/2014	5-50m	MLR THREATENED FAUNA REPORTINGS	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	3
7/02/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
7/02/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
10/02/2015	51-100m	MLR THREATENED FAUNA REPORTINGS	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
7/02/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
16/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
7/02/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
23/01/2020	0-5m	GHFF SATELLITE TRACKING RESEARCH PROJECT	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	1
22/02/2013	251-500m	MLR THREATENED FAUNA REPORTINGS	Pteropus poliocephalus	Grey-headed Flying-fox	MAMMALIA	VU	R	2

Sighting Date	Reliability Description	Survey Name	Species	Common Name	Class Name	National Rating	State Rating	Number Observed
16/06/1972	-	BIRDS SA/SAOA - JOURNALS AND NEWSLETTERS	Thinornis cucullatus cucullatus	Hooded Plover	AVES	VU	V	2
1/11/2006	-	MISC. OPPORTUNE RECORDS	Thinornis cucullatus cucullatus	Hooded Plover	AVES	VU	V	5
1/03/2007	-	MISC. OPPORTUNE RECORDS	Thinornis cucullatus cucullatus	Hooded Plover	AVES	VU	V	3
26/05/2007	-	MISC. OPPORTUNE RECORDS	Thinornis cucullatus cucullatus	Hooded Plover	AVES	VU	V	3
1/05/2007	-	MISC. OPPORTUNE RECORDS	Thinornis cucullatus cucullatus	Hooded Plover	AVES	VU	V	3
30/11/2022	-	SCIENTIFIC PERMIT DATA - APPROVED	Thinornis cucullatus cucullatus	Hooded Plover	AVES	VU	V	1
20/06/2009	-	MISC. OPPORTUNE RECORDS	Thinornis cucullatus cucullatus	Hooded Plover	AVES	VU	V	2
10/01/1994	501-1000m	BIRDS SA/SAOA - JOURNALS AND NEWSLETTERS	Thalassarche carteri	Indian Yellow-nosed Albatross	AVES	VU	E	1
16/09/2006	1-10km	BIRDS SA - PERSONAL BIRD RECORDS	Thalassarche carteri	Indian Yellow-nosed Albatross	AVES	VU	E	1
14/11/1994	501-1000m	BIRDS SA/SAOA - JOURNALS AND NEWSLETTERS	Gallinago hardwickii	Latham's Snipe	AVES	VU	R	1
1/06/2003	1-10km	BIRDS SA - PERSONAL BIRD RECORDS	Gallinago hardwickii	Latham's Snipe	AVES	VU	R	1
1/02/2004	1-10km	BIRDS SA - PERSONAL BIRD RECORDS	Gallinago hardwickii	Latham's Snipe	AVES	VU	R	1
13/11/1976	1-10km	BIRD TRANSECTS - RIVER TORRENS	Gallinago hardwickii	Latham's Snipe	AVES	VU	R	1
20/10/1994	501-1000m	BIRDS SA/SAOA - JOURNALS AND NEWSLETTERS	Gallinago hardwickii	Latham's Snipe	AVES	VU	R	1
12/02/1977	1-10km	BIRD TRANSECTS - RIVER TORRENS	Gallinago hardwickii	Latham's Snipe	AVES	VU	R	1
7/05/1996	5-50m	SA MUSEUM APPROVED NON-SPECIMEN RECORDS	Dermochelys coriacea	Leatherback Turtle	REPTILIA	EN	V	1
15/11/2017	1-10km	PAE MIGRATORY BIRD MONITORING	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		16
19/03/2018	1-10km	PAE MIGRATORY BIRD MONITORING	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		1
15/11/2013	1-10km	PAE MIGRATORY BIRD MONITORING	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		8
30/10/2014	5-50m	SLENDER-BILLED THORNBILL NTH COAST SVY	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		4
12/01/1985	1-10km	SAOA 2ND BIRD ATLAS ADELAIDE REGION	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		present but not counted
18/01/2019	1-10km	PAE MIGRATORY BIRD MONITORING	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		18
30/01/2015	1-10km	PAE MIGRATORY BIRD MONITORING	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		6
27/10/2015	1-10km	PAE MIGRATORY BIRD MONITORING	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		5
1/11/2020	501-1000m	THE STATUS OF THE SAMPHIRE THORNBILL	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		present but not counted
10/11/2019	1-10km	PAE MIGRATORY BIRD MONITORING	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		6
30/08/2014	1-10km	PAE MIGRATORY BIRD MONITORING	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		2
17/02/2018	1-10km	PAE MIGRATORY BIRD MONITORING	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		8

Sighting Date	Reliability Description	Survey Name	Species	Common Name	Class Name	National Rating	State Rating	Number Observed
1/11/1985	1-10km	SAOA 2ND BIRD ATLAS ADELAIDE REGION	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		present but not counted
16/12/2017	1-10km	PAE MIGRATORY BIRD MONITORING	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		12
27/11/2015	1-10km	PAE MIGRATORY BIRD MONITORING	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		6
31/10/2018	1-10km	PAE MIGRATORY BIRD MONITORING	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		28
25/01/2018	1-10km	PAE MIGRATORY BIRD MONITORING	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		9
28/01/2016	1-10km	PAE MIGRATORY BIRD MONITORING	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		12
4/02/2019	1-10km	PAE MIGRATORY BIRD MONITORING	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		1
27/09/2019	1-10km	PAE MIGRATORY BIRD MONITORING	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		10
8/12/2018	1-10km	PAE MIGRATORY BIRD MONITORING	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		14
1/02/1985	1-10km	SAOA 2ND BIRD ATLAS ADELAIDE REGION	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		present but not counted
25/10/1975	1-10km	BIRD TRANSECTS - RIVER TORRENS	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		12
13/11/1976	1-10km	BIRD TRANSECTS - RIVER TORRENS	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		32
11/09/1976	1-10km	BIRD TRANSECTS - RIVER TORRENS	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		8
17/12/1977	1-10km	BIRD TRANSECTS - RIVER TORRENS	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		30
15/11/1975	1-10km	BIRD TRANSECTS - RIVER TORRENS	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		72
26/11/1977	1-10km	BIRD TRANSECTS - RIVER TORRENS	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		18
10/10/1977	1-10km	BIRD TRANSECTS - RIVER TORRENS	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		11
27/09/1975	1-10km	BIRD TRANSECTS - RIVER TORRENS	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		13
24/09/1977	1-10km	BIRD TRANSECTS - RIVER TORRENS	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		5
11/11/1978	1-10km	BIRD TRANSECTS - RIVER TORRENS	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		1
10/11/1979	1-10km	BIRD TRANSECTS - RIVER TORRENS	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		3
19/12/1975	1-10km	BIRD TRANSECTS - RIVER TORRENS	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		16
22/09/1979	1-10km	BIRD TRANSECTS - RIVER TORRENS	Calidris acuminata	Sharp-tailed Sandpiper	AVES	VU		10
31/07/2012	No entered	MLR THREATENED FAUNA REPORTINGS	Arctocephalus tropicalis	Subantarctic Fur Seal	MAMMALIA	EN	E	1

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Rev No.	Author	Reviewer	Approved for Issue		
		Name	Name	Signature	Date
A	Lucy Harrison	Cameron Miller	Cameron Miller		17/07/2024
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C	Lucy Harrison/ Nicole Patten	David Lenel	David Lenel		26/7/2024
1	Nicole Patten	Cameron Miller	Cameron Miller		9/8/2024
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Adelaide

Kaurna Country | 100 Hutt St,
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T: 08 8431 7113

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Turrbal/Yuggera Country | Level 37, 123
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Parry Street Newcastle West, NSW 2302
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Perth

Whadjuk Nyoongar Country | Allendale Square,
Level 9, 77 St Georges Terrace, WA 6000
T: 08 9380 3100

Sydney

Gadigal Country | Level 1, 50
Margaret Street, Sydney, NSW 2000
T: 02 8245 0300

Wollongong

Dharawal Country | Suite 1A, 280 - 286
Keira Street, Wollongong, NSW 2500
T: 02 4225 2647