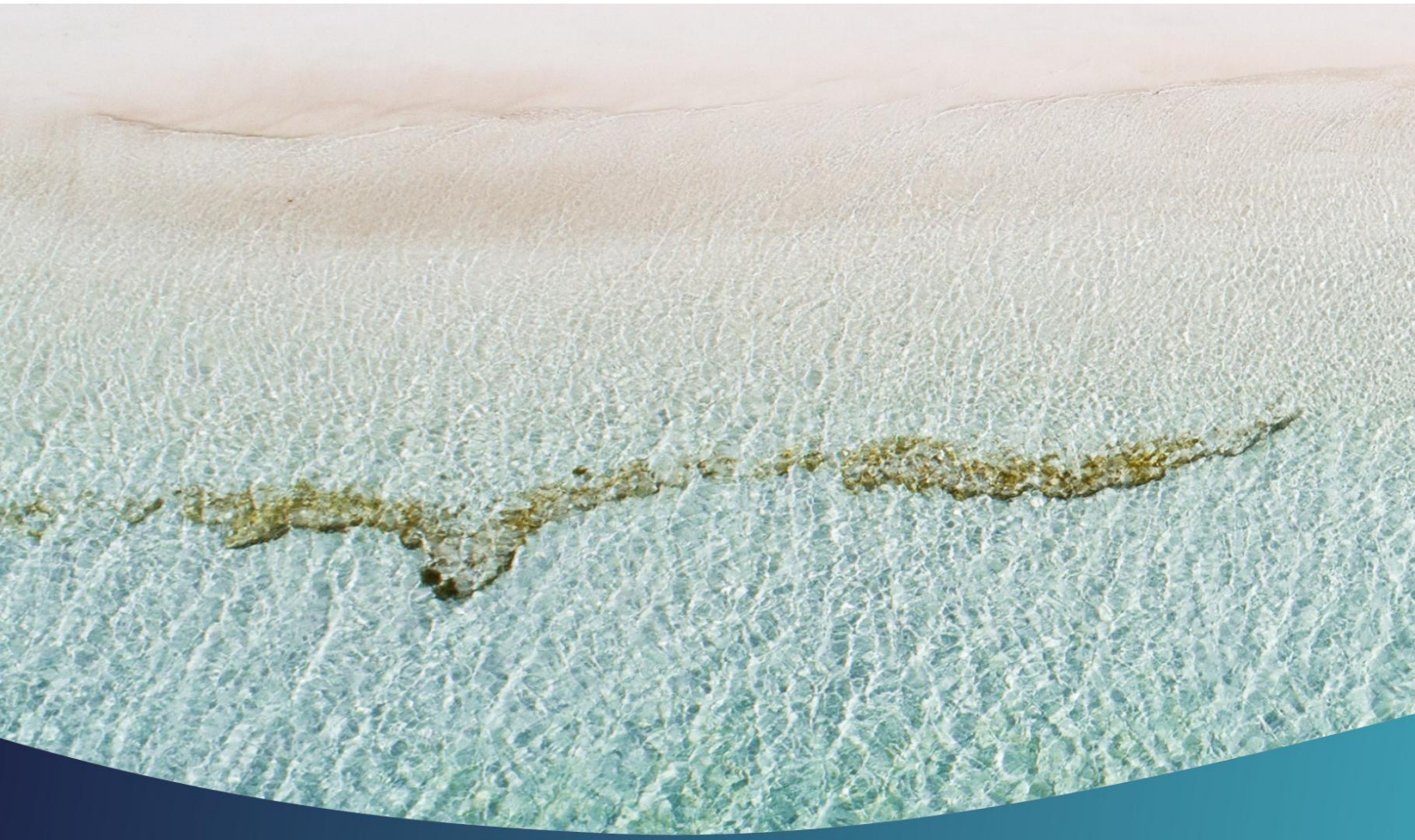
Dredging Environmental Monitoring and Management Plan

South Thomson Bay Barge Landing Development

ENVIRONMENT
An O2Marine company



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MARINE

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Acknowledgement Of Country

In the spirit of reconciliation O2 Marine Pty Ltd acknowledge that this project is proposed on the lands of the Whadjuk Noongar People. We pay our respects to Elders past, present and emerging and recognise their continuing connection to land, sea, culture and community.

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Version Register

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Transmission Register

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Acronym Table

Acronyms/Abbreviation	Description
ASS	Acid Sulfate Soil
BCH	Benthic Communities and Habitat
BTEX	benzene, toluene, ethyl-benzene and xylene
CD	Chart Datum
DBCA	Department of Biodiversity Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DO	Dissolved Oxygen
DoT	Department of Transport
DPIRD	Department of Primary Industries and Regional Development
DEMMP	Dredging Environment Management and Monitoring Plan
DWER	Department of Water and Environmental Regulation
EIL	Ecological Investigation levels
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPO	Environmental Protection Outcomes
ESL	Ecological Screening Levels
HIL-A	Health Investigation Levels for residential soil access
IMP	Introduced marine pests
Km	Kilometre
LAU	Local assessment unit
LCT	Landing Craft Tank
LoR	Limit of Reporting
m	Metre
MEQ	Marine Environmental Quality
MFO	Marine Fauna Observer
MNES	Matters of national environmental significance
MT	Management Targets
MWQMP	Marine water quality monitoring program
NAGD	National Assessment Guidelines for Dredging
NTU	Nephelometric Turbidity Units
The proposal	The South Thomson Barge Landing development
PAH	polycyclic aromatic hydrocarbons
PAR	Photosynthetically active radiation
PFAS	per- and poly-fluoroalkyl substances
POLREP	Pollution Report Form

Acronyms/Abbreviation	Description
RIA	Rottnest Island Authority
SSC	Suspended Sediment Concentration
SWASP	State Wide Array Surveillance Program
TMF	Tiered Management Framework
TRH	total recoverable hydrocarbons
TSS	Total Suspended Solids
WA	Western Australia
ZoHI	Zone of High Impact
ZoI	Zone of Influence
ZoMI	Zone of Moderate Impact

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1. Introduction

The Rottnest Island Authority (RIA) (the proponent) is intending to redevelop an area of South Thomson Bay to provide a barge landing for commercial marine and barge services. The South Thomson Barge Landing development (the Proposal) will consist of the construction of a laydown area and breakwater/groyne extension which involves dredging, construction of the laydown using the dredged material and piling for the jetty. A summary of the proposal is given in Table 1.

Table 1: Summary of the Proposal

Proposal title	South Thompson Barge Landing Development
Proponent name	Rottnest Island Authority
Short description	The Rottnest Island Authority is proposing to develop the South Thomson Barge Landing Development at the existing Army Groyne in South Thompson Bay. The proposal will be primarily used for barge operations, which will be relocated from the existing ferry terminal at central Thompson Bay to the proposed location at South Thompson Bay. This will separate barge operations from public passenger transfer activities and ease congestion at the ferry terminal.

Wadjemup (Rottnest Island) is located approximately 20 km west of the port of Fremantle in Western Australia (WA). It is an A-class reserve of ecological, cultural and social significance. It is a world-renowned tourist attraction with over 780,000 visitors annually. Most visitors travel by ferry, though many can travel by private vessel or even by small plane. There are limited short stay accommodation, and a very small resident population. The Proposal will be located at the existing Army Groyne less than 1 kilometre (km) south of the existing ferry terminal, where the cargo barges are berthed currently. The Rottnest Island Master Plan highlighted the need to improve functionality and efficiency of transporting bulk cargo to and from Wadjemup, reduce noise levels for residents and to improve safety and amenities for visitors. It is proposed that redeveloping the Army Grone will achieve this, by converting it into a barge landing, freight handling and associated storage area.

1.1. Proposal description

In order to redevelop the area, it is anticipated that the Proposal will require dredging and construction for the construction of a turning basin and jetty. The construction of the barge landing will be undertaken in two stages, Stage 1 involving the marine infrastructure and Stage 2 involving the onshore infrastructure and ferry berth.

Key activities involved in the Stage 1 works include:

- Mobilisation and setup: installation of site sheds and preparation of laydown areas. This includes mechanical clearing of vegetation and cut and fill/ leveling of adjacent dune.
- Dredging: An estimated 14,000 m^3 of sand and 2,107 m^3 of rock will be dredged using a backhoe dredge (BHD). Dredged material will be placed onto a flat top barge and then taken off by excavator to a Roll On Roll Off (RORO) facility at the existing Army Groyne until construction of the laydown area and wharf structure commences.

- Reclamation: A laydown area shall incorporate the reclaimed dredged fill material. Bunding will be constructed along the eastern and northern side of the reclamation zone to allow dredge spoil to settle and remain in place. The bunding is to prevent dredge spoil from being washed away into the marine environment by waves or during high tides.
- Construction: On completion of the reclamation works, construction and upgrade of the army groyne will take place, in addition to marine infrastructure which will include piling (barge landing ramp), underground services infrastructure (electrical, water, fuel) road works, storage shed, and finally a demobilisation process to ensure and debris on the seabed has been removed.

Key activities involved in the Stage 2 works include:

- Ferry berth: includes the installation of piles, precast concrete deck and surface, and the installation of the wharf with fenders, fender chains, mooring bollards, signage, lighting and other relevant marine infrastructure
- Small craft landing works: includes installation of piles, abutment, floating deck units and navigational aids
- Storage building installation: installation of storage building.

It is anticipated that the Proposal will be undertaken in 2026, during day light hours only and the marine construction to be undertaken with consideration to ecological windows to avoid the presence of marine fauna.

Dredging of the approach and footprint within the new breakwater structure will be undertaken to a declared depth of – 3.0 m Chart Datum (CD) and will include a turning basin with a nominal diameter of 80 m. This will result in a required dredging volume of approximately 16,000 m^3 when considering an overdredge requirement of 0.6 m.

A backhoe dredge is likely to be used for the dredging works and it is anticipated to be undertaken during the winter months.

The Proposal location with dredging and disposal footprint is shown in Figure 1.

1.2. Proposed dredging and disposal activity

1.2.1. Dredging volume

Capital dredging of up to 16,000 m^3 will be required to create the turning basin of approximately 80 m in diameter.

1.2.2. Dredging and disposal methods

It is anticipated that the sand section of the dredging area will be dredged using a BHD, though another method may be required for the rock sections. The methods are yet to be finalised, based on the dredge contractor specifications. A silt curtain will be used around the dredging to minimise the dredge plume.

Dredged material will be directly placed into a bunded area which will form the laydown area. The bund will be created with existing armour from the eastern side of the Army Groyne and moved periodically to the north to increase the reclamation area to allow for the dredge spoil to remain in place.

A geofabric textile weave will be placed within the bund walls to reduce the amount of fines being released back into the water. Based on studies of the particle size distribution of the material to be

dredged, there is a small proportion of fines in the material. Therefore, it is proposed that Texcel 1200R geofabric will be used which is expected to trap both sandy and fine sediments within the bund and still allowing water to return out of the bund.

1.2.3. Dredging schedule

Dredging and piling are likely to be undertaken in the winter months of 2026. Dredge plume modelling by Baird (2024) assumed that dredging may take up to 7.5 weeks to complete.

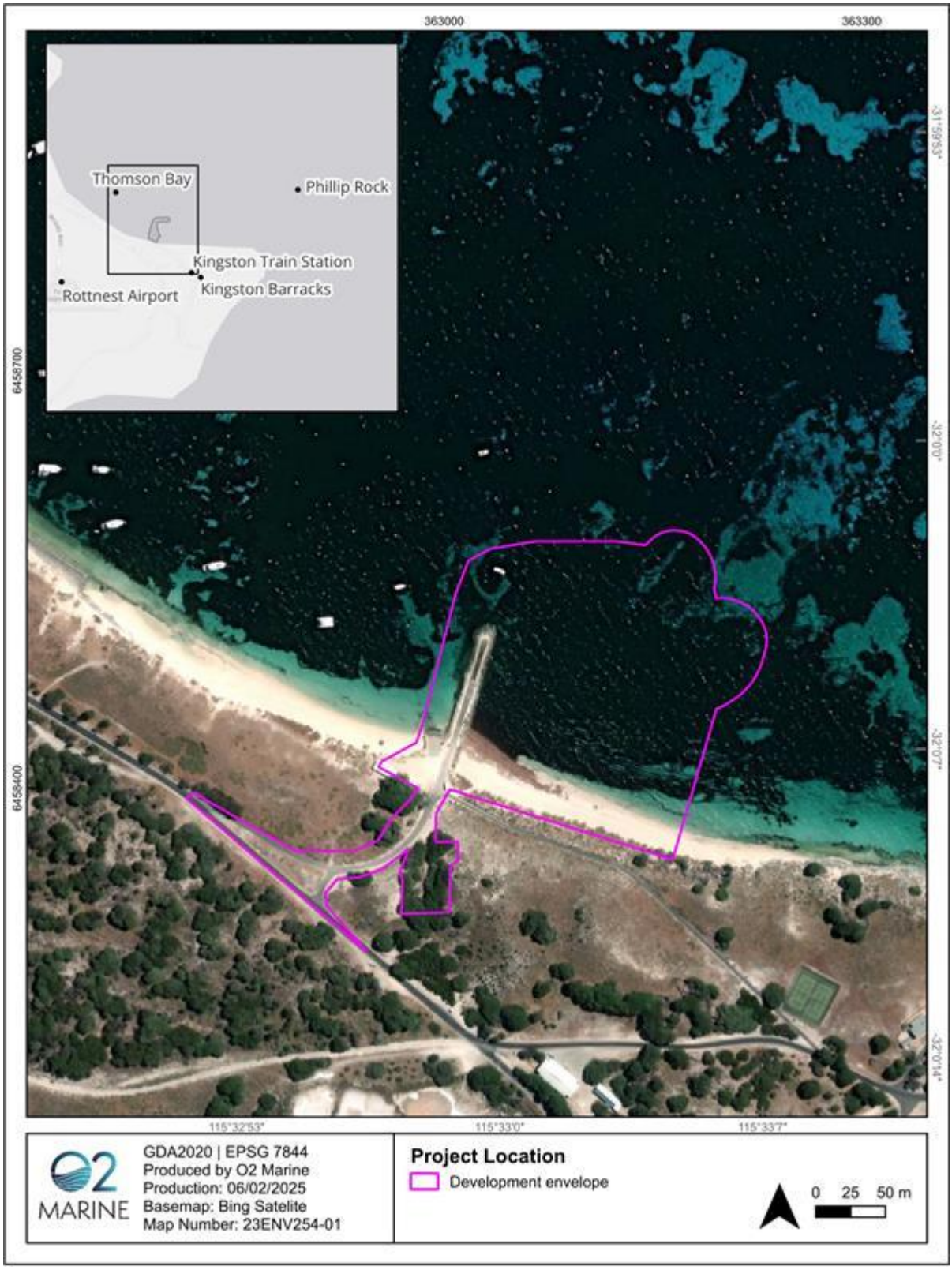

Figure 1: Proposal development envelope overview (Emerge 2024)

1.2.4. Zones of impact and influence

The zones of impact and influence associated with levels of dredging pressures on benthic communities and habitats (BCH) were determined by Baird (2024). The methods used were based on plume modelling undertaken with impact zone definitions and boundary thresholds from a previous Port Beach project by BMT (2021). These definitions were given in Baird (2024) and replicated here in Table 2. As dredging will be occuring in winter, the winter scenario was used for the calculations.

The calculated zones for this proposal are presented in Table 3 and Figure 2.

Table 2: Impact zones, definitions and boundary thresholds (BMT 2021 as presented in Baird 2024)

Impact zone	Definition	Boundary Threshold(s)
Zone of High Impact (ZoHI)	The area where impact on BCH are predicted to be irreversible. The term irreversible means 'lacking a capacity to return or recover to a state resembling that prior to being impacted within a timeframe of five years or less'. Areas within and immediately adjacent to proposed dredge and disposal sites are typically within the ZoHI.	• Boundary of the dredging and placement area • Where sedimentation/burial is >10 cm or 10,000 g/m^2
Zone of Moderate Impact (ZoMI)	The area within which predicted impacts on BCH are recoverable within a period of five years following completion of the dredging and placement activities. The ZoMI abuts and lies immediately outside of the ZoHI.	• The 95th percentile of the area where a total suspended solids (TSS) concentration of >10 mg/L was exceeded. • Where sedimentation burial is 5-10 cm or 5,000 – 10,000 g/m^2
Zone of Influence (ZoI)	The are within which changes in environmental quality associated with turbid plumes are predicted and anticipated during dredging and placement activities, but where these changes would not result in a measurable impact on BCH.	• The 100th percentile of the area where a TSS concentration of >2 mg/L above background was exceeded (representing the maximum predicted extent of visible plumes).

Table 3: Calculated zones of impact and influence for the Proposal

Impact zone	Resultant area definition	Resultant calculated area (km^2) (Baird 2024)
ZoHI	The ZoHI encompasses all the dredging area and construction area (which is also where disposal will occur) with a minimum distance of 25 m from the dredging footprint to be conservative	0.02
ZoMI	The ZoMI encompasses the area outisde the ZoHI to at least 150 m from the dedging area	0.07
ZoI	The ZoI encompasses the maximum predicted extent of visible plumes (though these would not result in a measurable impact on BCH)	0.17

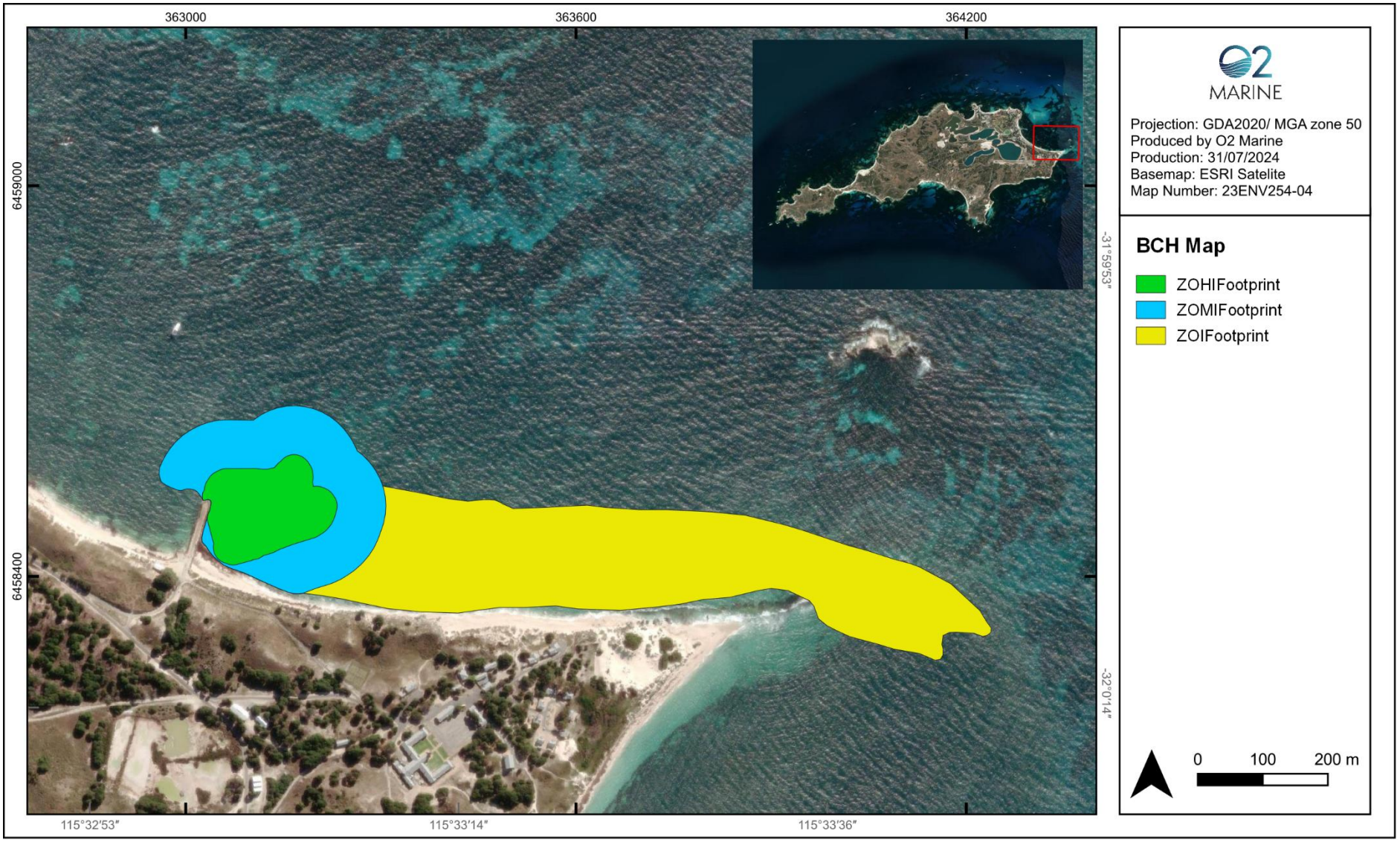

Figure 2: Zones of impact (Source: Baird (2024))

1.3. Definitions

For the purpose of this Dredging Environmental Monitoring and Management Plan (DEMMP) and the Construction Environmental Management Plan (CEMP; O2 Marine 2025) the following definitions apply to this Proposal:

- Construction: the overall construction including Stage 1 and Stage 2 works. This includes the marine and terrestrial components
- Marine construction: dredging piling, rock dumping and reclamation works within the marine environment

Dredging is defined as the removal of sediment within the marine environment as described in Section 1.2. Though this DEMMP is predominantly for dredging activities, including the environmental outcomes and management actions, the monitoring programs and tiered management framework will also apply to the marine construction activities in general. Further management actions for marine construction (including marine fauna requirements during piling and rock dumping) and construction in general are presented in the CEMP for the Proposal (O2 Marine 2025).

1.4. Purpose of this plan

The purpose of this DEMMP is to ensure that potential environmental impacts resulting from dredging and marine construction are effectively mitigated and to assign appropriate management targets and management actions.

This DEMMP has been prepared to be included in the environmental referral documents to the Western Australian Environmental Protection Authority (EPA) for the approval of the proposal. This DEMMP outlines the framework for the dredging activities including:

- Legislation and regulations that apply to the dredging program
- Overall management framework
- The areas where dredging is to occur
- Type of materials to be dredged
- Environmental values to be protected, the risks that dredging may pose, and the mechanisms to be implemented to mediate these risks (management strategies)
- Responsible parties
- Monitoring and reporting
- Consultation.

Note this DEMMP may need to be revised to meet conditions of any approvals issued for the Proposal.

1.5. Objectives

The specific objectives of this DEMMP are aligned with the environmental objectives presented within the EPA's statement of principles, environmental, factors, objectives and aims of EIA which are summarised below and explained in greater detail in Section 4 (EPA 2021):

- To protect benthic communities and habitat (BCH) so that biological diversity and ecological integrity are maintained

- To maintain the quality of water, sediment and biota so that environmental values are protected
- To protect marine fauna so that biological diversity and ecological integrity are maintained.

1.6. Legislation, regulations and guidelines

The potential environmental impacts of the proposal will be assessed at Commonwealth, State and Local Authority level with each Authority providing guidance on the level of assessment required. This DEMMP was developed with consideration of those approvals and with the following legislation and guidelines.

1.6.1. State

- *Environmental Protection Act 1986* (EP Act)
- *Biodiversity Conservation Act 2016* (BC Act)
- *Port Authorities Act 1999*
- Navigable Waters Regulations 1958
- Shipping and Pilotage (Port and Harbour) Regulations 1967
- *Western Australian Marine Act 1982*
- *Pollution of Waters by Oil and Noxious Substances Act 1987*
- *Marine and Harbours Act 1981*
- *Environmental Protection Act 1986*
- Environmental Protection Regulations 1987
- *Fisheries Resource Management Act 1994* (relevant to Introduced Marine Pests)
- Western Australia Environmental Protection Authority - Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans (EPA 2021a)
- Western Australia Environmental Protection Authority Technical Guidance - Assessment Guidelines of Marine Dredging Proposals (EPA 2021b)
- Western Australia Environmental Protection Authority Technical Guidance - Protecting the Quality of Western Australia's Marine Environment (EPA 2016a)
- Western Australia Environmental Protection Authority Technical Guidance – Protection of Benthic Communities and Habitats (EPA 2016b).

1.6.2. Commonwealth

- *Environment Protection and Biodiversity Conservation Act (1999)* (EPBC Act)
- *Environment Protection (Sea Dumping) Act 1981*
- *Protection of the Seas (Prevention of Pollution from Ships) Act 1983*
- *Biosecurity Act 2015*
- Biosecurity Regulations (2016)
- Australian Ballast Water Management Requirements Version 7 2017
- National Water Quality Management Strategy (Commonwealth of Australia 1992).

Even though offshore disposal of materials will not be occuring for this Proposal, the National Australian Guidelines for Dredging (NAGD) (Commonwealth of Australia 2009) has also been considered when preparing this document to ensure best practice.

1.7. Approvals background

Environment Protection and Biodiversity Conservation Act 1999

RIA referred the Proposal to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) in late 2024 within consideration to the relevant matters of national environmental significance (MNES) for this proposal including:

- Listed threatened species and communities (sections 18 and 218A)
- Listed migratory species (sections 20 and 20A)
- The world heritage values of a declared world heritage property (sections 12 and 15A)
- The heritage values of a national heritage place (sections 15B and 15C)
- Commonwealth land (section 26 and 27A).

On 16 January 2025 the DCCEEW decided the Referral was "not a controlled action" and therefore did not require further approval under the EPBC Act. The Proposal is currently being assessed by the EPA as described below.

Environmental Protection Act, 1986 Part IV

The Proposal was referred to the EPA for assessment on 23 August 2024 and decision on whether to assess the proposal was provided on 13 September by the EPA. It was determined that the Proposal would be assessed at the level of 'Referral Information with additional information' (required under s.40(2)(a) of the EP Act) with public review.

The environmental factors include:

- Benthic communities and habitat
- Coastal processes
- Marine environmental quality
- Marine fauna
- Flora and vegetation
- Terrestrial fauna
- Social surroundings
- Other factors.

In 2023 the RIA met with the WA EPA to discuss referral of the proposal. Following this meeting the RIA recommenced the proposal, and as such the following studies have been recently completed to progress environmental approvals:

- Terrestrial flora and fauna survey of the onshore area.
- Benthic habitat assessment of the marine development area and surrounds.
- Marine fauna desktop assessment of the marine development area and surrounds.
- MNES assessment.

- Dredge plume modelling.
- Coastal processes assessment.
- Baseline water quality monitoring.

Environmental Protection Act, 1986 Part V

A works approval and operating licence for the proposal may be required under the EP Act Part V. The following items will be assessed, and management provisions assigned:

- Noise emissions
- Air emissions
- Wastewater disposal
- Solid waste disposal.

1.8. Port governance

Rottnest Island Authority is the responsible authority over the marine jetties around the Island.

2. Existing Environment

2.1. General environment

The existing jetty at the proposal area at Wadjemup or Rottnest Island (the Island) was built from rock fill and compacted limestone base in 1972, which replaced an older jetty at the same location (RPS 2020). It is approximately 120 m long and approximately 1,700 m^2 and in 2018 the platform was removed and it was converted into a rock groyne due to its fragility and partial collapse (RPS 2020). It is within a relatively healthy environment, with little turbidity and abundant seagrasses and macroalgae.

The Rottnest Island Marine Reserve encapsulates all waters around the Island and is characterised by a unique blend of tropical and temperate species (RPS 2024a), and supports some of the most diverse marine gardens, ~20 species of coral and ~400 species (RIA n.d.). To protect this biodiversity there are five marine sanctuary zones in waters around Rottnest Island. The Proposal sits within the Rottnest Island Marine Reserve, however, it is not within or adjacent to any of the Island's five Sanctuary Zones.

2.1.1. Climate and oceanography

The Island is located within in the temperate region of the Indian Ocean approximately 18 km west of Perth in WA.

Sea water temperature generally ranges between 16.4℃ in September and 26.5℃ in March (Sea Temperature 2024). Air temperature ranges between a mean minimum of 12.4℃ in August and mean maximum of 27.2℃ in February (BoM 2024), coinciding with the six seasons. Mean annual rainfall is 558.4 mm, with a maximum average monthly rainfall of 111.5 mm in July. Annually, the 9am wind direction varies from northeasterly and easterly to southern winds, as shown in Figure 3. By 3pm there is less variation annually, with winds generally south to south-west, as shown in Figure 4.

Dredging is proposed to be undertaken in the winter months, which are between June and August.

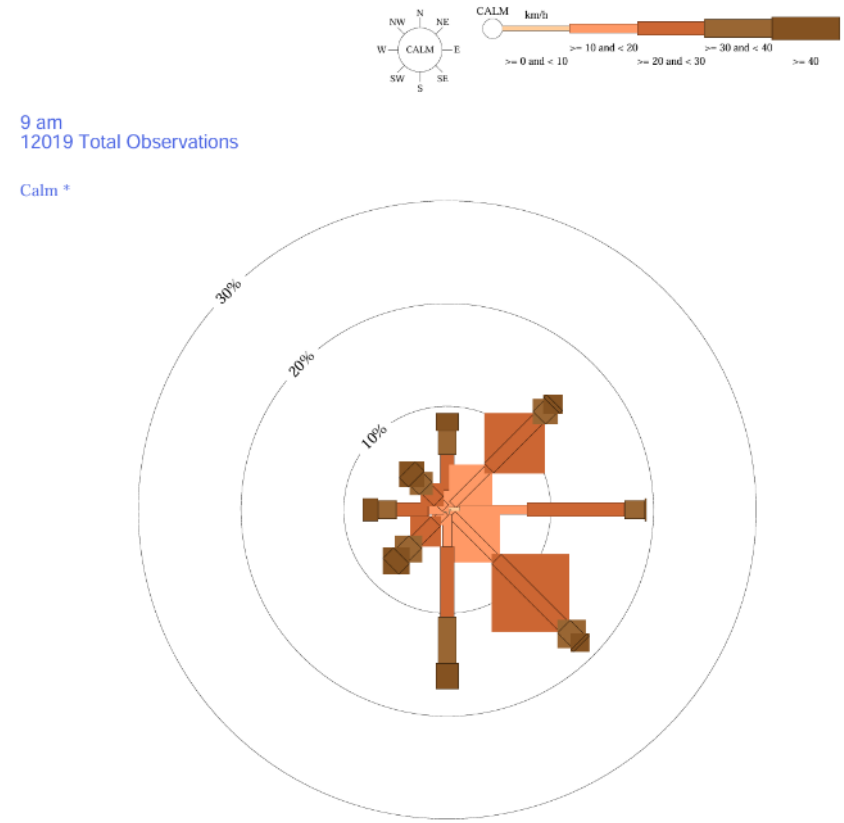

Figure 3: Wind direction and speeds measured at 9am over 12019 daily observations (BoM 2024)

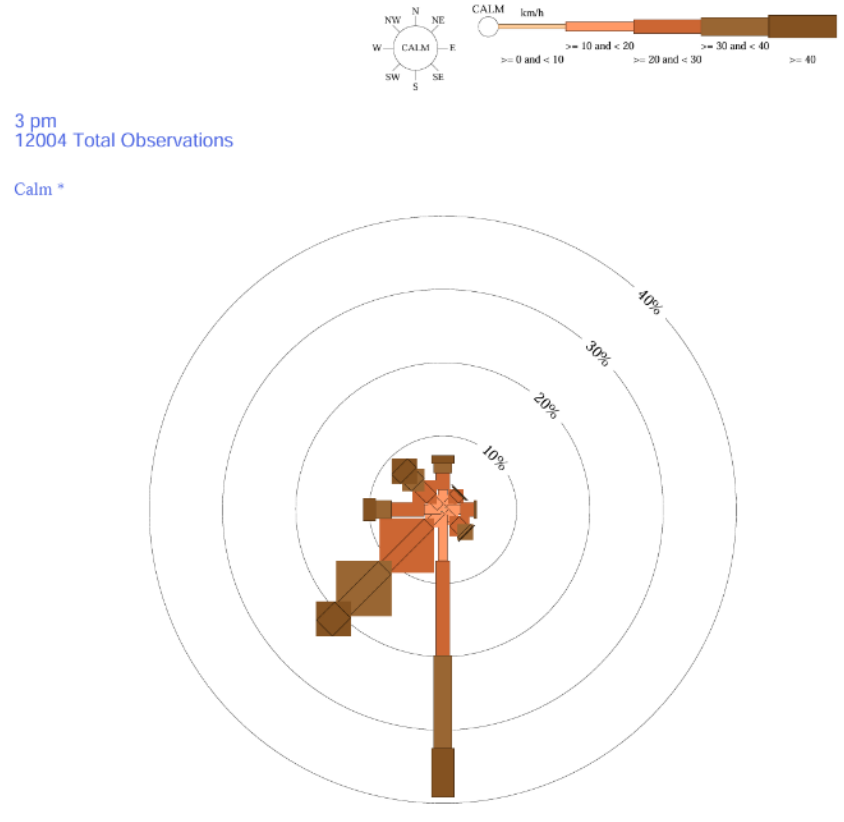

Figure 4: Wind direction and speeds measured at 3pm over 12004 daily observations (BoM 2024)

Currents measured around the Proposal site (Baird 2024) found a depth averaged peak current speed of 0.05 ms^{-1} to 0.1 ms^{-1} during neaps and 0.1 ms^{-1} to 0.15 ms^{-1} during spring tides. Current direction was relatively consistent across the tidal cycle at 80° - 100°, changing to come from northerly directions occasionally. Increasing wind speeds also seemed to strongly correlate with increasing current speeds (Baird 2024). Waves around the Island were found to be dominated by diffracted and refracted swell waves ranging from 0.4 m to 0.7 m with peak periods 12 to 18 seconds. Occasionally wind sea resulted in higher waves (0.8-0.9 m at peak wave periods of 5-10 s) arriving from the northwestern sector.

Within the proposal area, the bathymetry is relatively shallow, with up to 1.6 m at the end of the Army Groyne and decreasing to approximately 3.5 m CD depth 100 m offshore (DoT 2022). The rest of the Island is also relatively shallow, though to the west of Rottnest Island there a large drop in depth within 2 km, down to approximately -55 m at mean sea level.

2.1.2. Geology and geomorphology

The Island is the largest and northernmost island of the Garden Island Ridge, a rocky remnant Pleistocene ridge forming a chain of submarine reef platforms and emergent islands of approximately 12 km offshore of the Swan Coastal Plain. The Island sits within the middle shelf region of the narrow Rottnest shelf (Brooke 2010).

The Proposal site has been found to consist of white medium-grained sand, well-sorted, sub-angular quartz and shell debris (DMIRS 2020).

2.1.3. Water quality

Water quality sampling was undertaken between November and December 2023 at six locations in and around the Proposal site. Samples were analysed for turbidity (Nephelometric Turbidity Units (NTU) and total suspended solids (TSS)) in November, and in December the samples were analysed for NTU, TSS, hydrocarbons and metals. Hydrocarbons and phosphorus were all below the limit of reporting (LoR) in all samples. All metals sampled were also below the ANZG (2018) water quality guidelines except for one sample which had a high zinc concentration, however this would be considered to be an anomaly likely due to contamination from sunscreen or similar.

Turbidity at the site is very low, with profiles taken in December finding zero NTU at several sites within the proposal area. Turbidity of water samples was also measured in the laboratory in November and December 2023, which ranged between 0 and 0.66 NTU. Total suspended solids (TSS) was also found to be low, with <5.0 mg/L in all samples. This is not surprising due to the water clarity in the area during this time of year.

2.1.4. Sediment quality

Sediment sampling was undertaken in November 2019 (with some additional sampling in March 2020) at seven locations within the proposed dredge area (RPS 2020). Sediment samples were analysed for metals and metalloids, acid sulfate soil (ASS) parameters, pesticides, polycyclic aromatic hydrocarbons (PAHs), total recoverable hydrocarbons (TRHs) and benzene, toluene, ethyl-benzene and xylene (BTEX), nutrients and per- and poly-fluoroalkyl substances (PFASs).

Samples were taken from each 0.5 m horizon where possible, up to a depth of 1.2 m at each location. Some locations reached refusal due to hard sediment layers at approximately 1 m depth, and therefore

there were a total of 17 samples (with 14 additional samples taken in March 2020 to re-analyse for PFAS due to laboratory contamination).

Particle distribution was found to be predominantly sand between 0.06 and 2 mm, with the mean median particle size being 0.242 mm (242 µm). There was only a small proportion of sediment larger than 2 mm.

The toxicants were all analysed by a NATA accredited laboratory, and the results compared to the following guideline values:

- Ecological Investigation levels (EILs) and Ecological Screening Levels (ESLs) for areas of ecological significance and public open space (NEPM 2013)
- Health Investigation Levels for residential soil access (HIL-A) (NEPM 2013 and CRC CARE 2011)
- National Assessment Guidelines for Dredging (Commonwealth of Australia 2009) screening levels.

All metals, metalloids, pesticides, PAHs, TRHs, BTEX, nutrients and PFAS tested were below their respective guideline values. The site is also not considered to be an ASS risk (RPS 2020). One sample being classified as potential ASS as inorganic acidity was detected. However, there was a significant amount of acid neutralising capacity, so RPS (2020) recommended that no liming would be required if onshore disposal was conducted. Therefore, the material is considered suitable for reuse as fill for the construction of the jetty (or onshore disposal if required).

2.1.5. Benthic communities and habitat

In accordance with EPA (2016) a local assessment unit (LAU) should be established in order to calculate and assess the cumulative impacts of disturbance to BCH from projects. They are location specific, and would typically be approximately 50 km^2, though large or smaller areas would be considered by the EPA if well justified. An LAU around Rottnest Island has been nominated for this proposal based on the assessment area for a previous study of the BCH by Harvey (2009). The BCH within the LAU is given in Figure 5, and Harvey (2009) identified bare substrate, seagrass, macroalgae, coral and intertidal reef within the assessment area.

A benthic communities and habitat (BCH) assessment was undertaken by RPS in 2019, updated in 2023 for the proposal area and then updated again in early 2024 to include additional area where modelling predicted possible impacts (RPS 2024). Within South Thomson Bay, RPS (2023) conducted a finer scale survey within and around the proposal area as shown in Figure 6Figure 6. Seagrass and macroalgae species were identified and the habitats were classified by species dominance (a species was dominant if it was more than 50% covered by that species). The classification scheme is presented in RPS (2023) and the data was then used to determine BCH loss within the proposal area and the context of the survey area. These loss calculations are shown in Table 4. Within the wider LAU, historical BCH loss was also assessed to determine a cumulative loss. Overall, it was estimated that a 1.95% loss of seagrass had occurred over time due to human activities, and the proposal would lead to an additional 0.36% loss, resulting in a cumulative loss of 2.31% over the LAU (RPS 2025).

Table 4: Area of habitats within the development footprint (RPS 2025)

Area	Habitat (Ha)			
	Mixed seagrass	Macroalgae dominated	Sand/Sand with Wrack	Limestone reef/pavement
Field survey area (2019/2023 survey area)	108.10	10.80	42.43	1.79
Survey area (2024 plume extension survey area)	0.92	0	1.27	0.35
Total survey area	109.02	10.80	43.70	2.14
Development envelope	2.06	0	1.26	0

Figure 5: Broad scale benthic habitat within the Rottnest Island LAU (Harvey 2009)

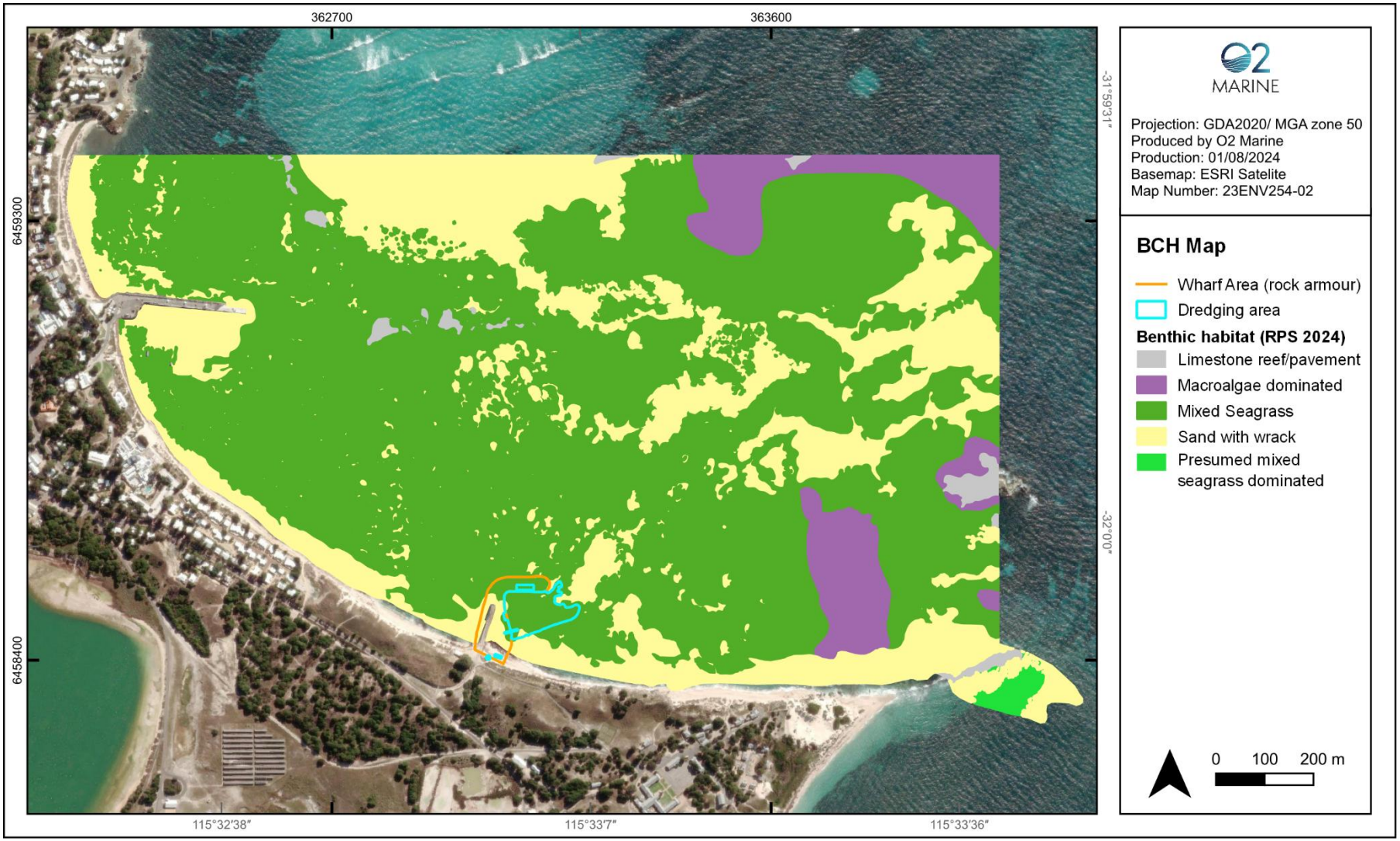

Figure 6: Benthic habitat within and around the proposal development envelope (data source: RPS 2024).

2.1.6. Marine fauna

A marine fauna desktop analysis was undertaken for the Proposal by RPS (2023). A list of species that may occur within the Proposal area was collated and included 41 threatened marine fauna species and 92 listed marine or migratory marine fauna species that may occur in Thomson Bay. Key species and their ecological windows for monitoring and management were not identified by RPS (2024a), though ecological windows for species that may occur we identified in the referral supporting document (RPS 2025; Table 5). Of the species that may occur within the Proposal area and that can be monitored during dredging activities include:

- Humpback whale (*Megaptera novaeangliae*)
- Killer whale (*Orcinus orca*)
- Pygmy blue whale (*Balaenoptera musculus brevicauda*)
- Minke whale (*Balaenoptera acutorostrata*)
- Australian sea lion (*Neophoca cinerea*)
- New Zealand fur seal (*Arctocephalus forsteri*)
- Indo-pacific bottlenose dolphin (*Tursiops aduncus*)
- Spinner dolphin (*Stenella longirostris*)
- Loggerhead turtle (*Caretta caretta*)
- Leatherback turtle (*Dermochelys coriacea*)
- Green turtle (*Chelonia mydas*).

These can often be viewed as umbrella species, so mitigation and management put into place to protect these species will also protect others that may occur within the Proposal area. Sharks, rays and fish species are occasionally visible if close enough to the surface and when weather conditions (e.g. wind, glare) and water clarity are favourable.

Table 5: Ecological windows for key marine fauna receptors as presented in RPS (2025)

Shading= peak period, light blue shading= mammals, yellow shading= fish, green shading= birds, teal shading= reptiles

Species	J	F	M	A	M	J	J	A	S	O	N	D	Reference (RPS 2024b)
Humpback whale (north migration)													DCCEEW (2024)
Humpback whale (south migration)													DCCEEW (2024)
Pygmy blue whale (north migration)													McCauley and Jenner (2010); McCauley and Duncan (2011); Double et al. (2012; 2014)
Pygmy blue whale (south migration)													McCauley and Jenner (2010); McCauley and Duncan (2011); Double et al. (2012; 2014)
Australian sea lion													
New Zealand fur seal													
White shark foraging BIA*													DCCEEW (2024)
Scalloped hammerhead migration													López et al. (2022)
Little penguin foraging													Higgins (2003); DAWE (2020); DCCEEW (2024)

Species	J	F	M	A	M	J	J	A	S	O	N	D	Reference (RPS 2024b)
Wedge-tailed shearwater foraging													Higgins (2003); DAWE (2020); DCCEEW (2024)
Caspian tern foraging													Higgins (2003); DAWE (2020); DCCEEW (2024)
Pacific gull foraging													Higgins (2003); DAWE (2020); DCCEEW (2024)
Bridled tern foraging													Higgins (2003); DAWE (2020); DCCEEW (2024)
Roseate tern foraging													Higgins (2003); DAWE (2020); DCCEEW (2024)
Fairy tern foraging													Higgins (2003); DAWE (2020); DCCEEW (2024)
Green turtle													
Leatherback turtle													
Loggerhead turtle													
* noting that the white shark BIA does not overlap with the Proposal.													

3. Roles and responsibilities

The roles and responsibilities for the implementation of the DEMMP are summarised in Table 6.

Table 6: Roles and responsibilities of key personnel

Position	Responsibility
RIA Project Manager	• Overall responsibility for implementation of this DEMMP • Overall responsibility for complying with relevant legislation, standards and guidelines • Ensures dredging activities are conducted in an environment safe for both site personnel and the public
RIA Environment Manager	• Complies with the requirements of this DEMMP • Provides advice on dredging and dredge material environmental issues • Oversee implementation of environmental controls, monitoring programs, inspections, audits and management actions in this DEMMP • Completes compliance reporting requirements • Responsible for the implementation of the environmental monitoring program and inspections • Prepares environmental monitoring reports • Provides advice with respect to environmental issues as required • Reports on environmental performance for the project to key stakeholders • Responsible for environmental compliance reporting • Responsible for reporting all environmental non-compliance incidents
Dredging and marine construction contractor	• Complies with the requirements of this DEMMP • Undertakes dredging and excavation works • Prepares and implements an environmental management plan in accordance with the requirements of this DEMMP • Implements the management actions of this DEMMP • Ensures adequate training of all staff within their area of responsibility • Ensures all equipment is adequately maintained and correctly operated • Responsible for reporting all environmental incidents to the Department of Transport (DoT) within 24 hours in accordance with DoT incident reporting procedures • Ensures dredging activities are conducted in an environment safe for both site personnel and the public
All persons involved in the project	• Comply with the requirements of this DEMMP • Comply with all legal requirements under the approval's documents and relevant Acts • Exercise a Duty of Care to the environment at all times • Report all environmental incidents

4. Environmental factors and objectives

The key environmental factors and objectives to be managed under this DEMMP have been derived from the Statement of environmental principles, factors, objectives and aims of EIA (EPA 2021), which outlines objectives aimed at protecting all environments (Themes) including Sea, Land, Water, Air and People. The Key Environmental Factors and EPA Objectives to be managed under this DEMMP are listed below:

- Benthic communities and habitats
- Marine environmental quality
- Marine fauna

The proposal specific Environmental Protection Outcomes (EPOs) and Management Targets (MTs) for each of these key marine environmental factors are outlined in Table 7.

Table 7: Potential environmental impacts from dredging and disposal and associated proposal specific Environmental Protection Outcomes and Management Targets

Environmental Factor	EPA Objective	Potential Environmental Impact Pathway	Environmental Protection Outcome (EPO)	Management Target (MT)	Risk Management Strategy
Marine Environmental Quality (MEQ)	To maintain the quality of water, sediment and biota so that environmental values are protected.	Disturbance of contaminants in sediments during dredging has the potential to deteriorate water quality and contaminate marine organisms.	Within two weeks following cessation of marine construction and dredging works, marine water quality will return to a High Level of Ecological Protection.	MEQ shall be maintained at a Moderate Level of Ecological Protection within the ZoHI and ZoMI (Figure 2) during dredging and marine construction and return to a High Level of Ecological Protection within 2 weeks following completion of dredging and marine construction.	Refer to Table 8, Table 11 and Table 12.
		Changes to the physico-chemical properties of the water column as a result of dredging.			

Environmental Factor	EPA Objective	Potential Environmental Impact Pathway	Environmental Protection Outcome (EPO)	Management Target (MT)	Risk Management Strategy
				MT allows for the increased turbidity which will occur in the vicinity of the dredging activities.	
		Hydrocarbon release into the marine environment from a vessel spill and or bunkering operations.	No reported hydrocarbon spills or release of waste into the marine environment from dredging and construction activities.	No hydrocarbon spills to the marine environment. No release of waste into the marine environment.	
Benthic Communities and Habitats	To protect BCH so that biological diversity and ecological integrity are maintained.	Direct impacts of BCH due to removal within the dredging and disposal footprint.	Irreversible impacts to benthic communities and habitats are limited to the wharf structure and ZoHI (Figure 2).	Dredging (and marine construction) operations do not occur outside the defined dredging footprint. Disposal operations do not occur outside the defined areas.	Refer to Table 9.
		Indirect impacts of BCH due to reduction in available light caused by increase in suspended sediments released into the water column during dredging.	No observable impacts to BCH outside of the ZoMI (Figure 2).	Observable impacts are limited to within the ZoHI and the temporary mooring area within the ZoMI (Figure 2).	
Marine Fauna	To protect marine fauna so that biological diversity	Injury or death of marine fauna as a result of dredge operations including hydrocarbon or waste	Irreversible impacts to marine fauna habitat are limited to the wharf structure and ZoHI.	No loss of marine fauna habitat outside of wharf structure and ZoHI.	Refer to Table 10, Table 11, Table 12 and Table 13.

Environmental Factor	EPA Objective	Potential Environmental Impact Pathway	Environmental Protection Outcome (EPO)	Management Target (MT)	Risk Management Strategy
	and ecological integrity are maintained.	spills or underwater noise impacts. Injury or death of marine fauna due to vessel movement (strike) or artificial light Introduced Marine Pests translocation from dredging vessels. Reduced biological functioning by clogging feeding mechanisms or respiratory structure from increased sediment released into the water column during dredging.	No reported introduction or establishment of IMS as a result of construction activities associated with the Proposal No reported impacts to marine fauna as a result of hydrocarbon spill or release of waste associated with construction activities including entanglement or ingestion of waste No reported behavioural changes which are known to be associated with distress or injury of marine fauna, health impacts (including temporary or permanent hearing loss), physical injury or mortality from underwater noise emissions from construction activities to significant marine fauna species No reported death or injury to marine fauna from vessel strike within the Rottnest Island Marine Reserve Boundary which is	No incidences of marine fauna injury or death as a result of dredge operations. No direct impacts to marine fauna from underwater noise from dredge operations. No incidences of marine fauna injury or death as a result of vessel strike. No introduction and/or spread of introduced marine species. No disruption to marine fauna from artificial lighting.	

Environmental Factor	EPA Objective	Potential Environmental Impact Pathway	Environmental Protection Outcome (EPO)	Management Target (MT)	Risk Management Strategy
			associated with the construction of the Proposal No changes in marine fauna behaviour attributable to the construction lighting requirements of the Proposal.		

5. Monitoring and Management

Identified environmental receptors most susceptible to dredging and disposal activities associated with the proposal include:

- Water quality
- Seagrass and macroalgae health
- Marine fauna.

In addition to the management actions that will be implemented during dredging to avoid adverse impacts on the surrounding environment, environmental monitoring of the marine environment will also be undertaken to verify the predicted impacts and to ensure that impacts do not exceed their predicted magnitude or trigger thresholds. The following monitoring will be undertaken for the proposal:

- Physical water quality monitoring using water quality profilers
- Monitoring of seagrass and macroalgae health
- Marine fauna observations.

The aim of environmental monitoring will be to identify any change in health of seagrass outside the ZoHI for the duration of dredging, disposal and reclamation activities. A summary of this monitoring and how they are related is presented in Figure 7, and further details of triggers and methods of monitoring are provided in Appendix B.

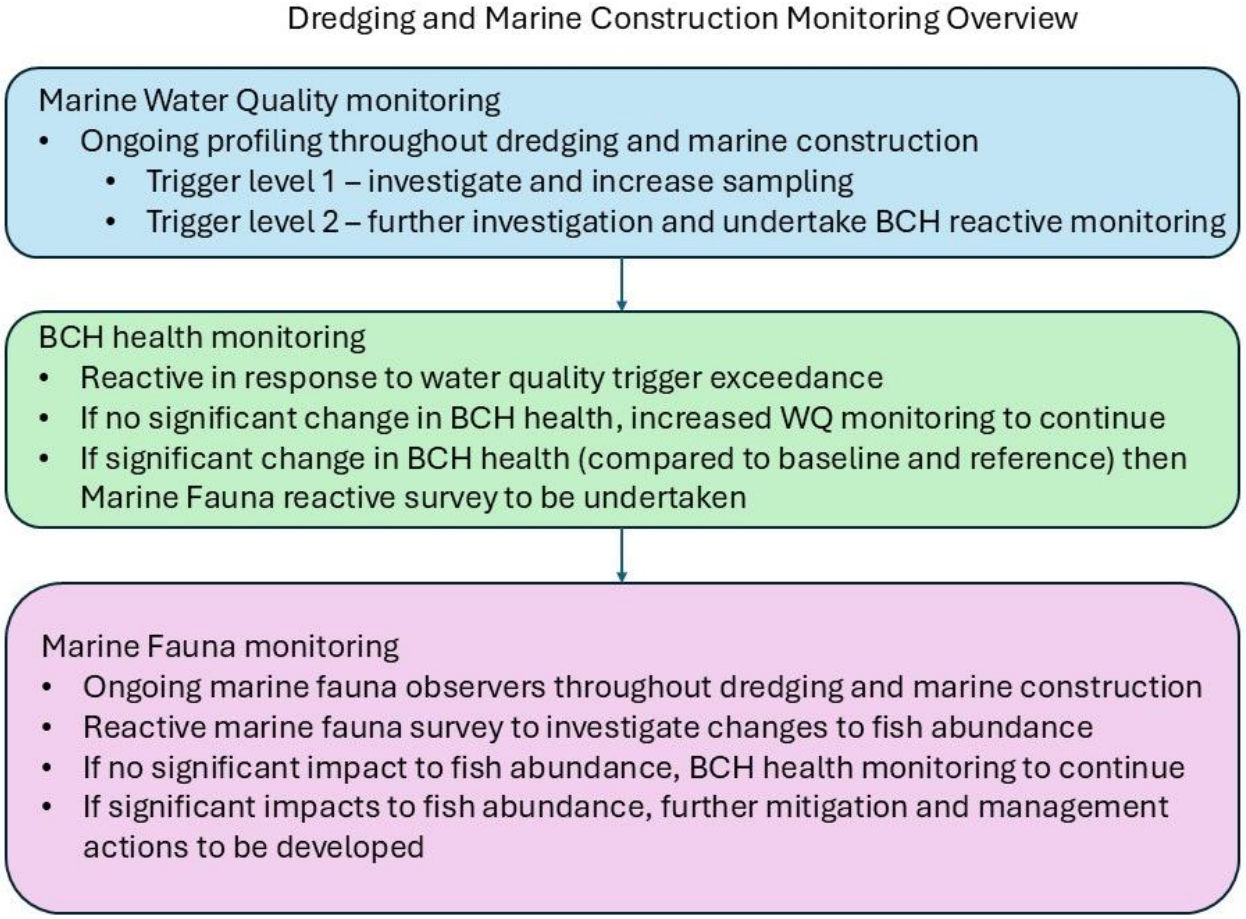

Figure 7: Monitoring program overview

The potential environmental impacts identified above in Table 7 have been assigned monitoring and management actions to measure compliance against the EPOs and MTs. Management measures for each environmental factor (EPA, 2018) are detailed below. Management actions have been separated into:

- Tier 1 (which specially address the three identified environmental factors, BCH, Marine environmental quality (MEQ) and marine fauna, including matters of national environmental significance (MNES))
- Tier 2 (which relate to the overall works and can be managed through standard operational procedures (including hydrocarbons, waste and introduced marine pests)).

5.1. Marine environmental quality

The (Tier 1) management actions proposed to minimise potential impacts on the environmental factor 'Marine Environmental Quality' are described in Table 8. For the management targets associated with hydrocarbon spills please refer to Section 5.4, and for waste management please refer to Section 5.5.

Table 8: Management actions to minimise impacts on MEQ

Marine environmental quality					
Activity	Dredging and disposal operations				
Potential Impacts	• Disturbance of contaminants in sediments during dredging has the potential to deteriorate water quality and contaminate marine organisms • Changes to the physico-chemical properties of the water column as a result of dredging • Hydrocarbon release into the marine environment from a vessel spill and or bunkering operations				
	Management Actions	Environmental Performance			
Management Targets	Actions	Responsibility	Reporting/Evidence	Timing	Contingency
MEQ shall be maintained at a Moderate Level of Ecological Protection (Figure 2) during dredging and marine construction and return to a High Level of Ecological	Implement the Marine Water Quality Monitoring Program (MWQMP) as defined in Appendix B.1 for suspended sediment	RIA	• Water quality monitoring in accordance with the MWQMP and final report following the cessation of dredging	• As described in Appendix B.1.3	• Implement Tiered Management Framework (TMF) as defined in Appendix B.1
	Inspections of all dredge equipment to check for leaks or damage	Contractor	• Vessel and Site Environment Safety and Health inspection checklist	• Daily throughout dredging	• Cease works if significant spillage or damage observed • Activate spill response actions (control drainage, clean up) as required • Undertake incident investigation and implement recommendations

Management Targets	Actions	Responsibility	Reporting/Evidence	Timing	Contingency
Protection within 2 weeks following completion of dredging and marine construction. MT allows for the increased turbidity which will occur in the vicinity of the dredging activities.	Use of silt curtains during dredging to minimise the potential impacts associated with increased turbidity	Contractor	• Maintain silt curtain to minimise leakage and report in pre-mobilisation checklist and equipment maintenance schedule /documentation	• Silt curtain to be inspected prior to commencement of dredging and daily thereafter	• If silt curtain is found to be damaged or leaking, dredge operations are paused and curtain repaired
	The placement of geofabric (such as Texcel 1200R) textile weave along the bund wall will ensure that the placement of dredge spoil during reclamation works will not impact or increase the dredge plume zones. All vessels will comply with commonwealth biosecurity requirements and complete DPIRDs 'Vessel check'. All vessels will have a ballast water management plan and ballast water exchanges will be in accordance with IMO requirements and the Commonwealth *Biosecurity Act 2015*	Contractor	• Water quality monitoring in accordance with the MWQMP and final report following the cessation of dredging • Maintain geofabric to minimise leakage and report in pre-mobilisation checklist and equipment maintenance schedule /documentation	• WQMP As described in Appendix B.1.3 • Geofabric to be inspected prior to commencement of disposal and daily thereafter	• Implement Tiered Management Framework (TMF) as defined in Appendix B.1 • If geofabric is found to be damaged or leaking, disposal operations will be paused until repaired

5.2. Benthic Communities and Habitats

The (Tier 1) management actions to minimise potential impacts on the environmental factor 'Benthic Communities and Habitat' are described in Table 9.

Table 9: Management actions to minimise impacts on BCH

Benthic Communities and Habitats					
Activity	Dredging and disposal operations				
Potential Impacts	• Direct loss of benthic communities and habitats due to dredging activities (and marine construction) • Indirect impacts of benthic communities and habitats due to reduction in available light caused by increase in suspended sediments released into the water column during dredging, increased sedimentation rates or burial				
	Management Actions	Environmental Performance			
Management Targets	Actions	Responsibility	Reporting/Evidence	Timing	Contingency
Dredging (and marine construction) operations do not occur outside the defined DE.	Employ high-resolution positioning system to control dredge operations	Contractor	• Validate positioning and vessel monitoring system • Dredge progress reports submitted throughout dredging works period	• Prior to and during dredge operations • Weekly throughout dredging	• Cessation of dredging and relocation of dredge • Service/replacement of positioning system
Disposal operations do not occur outside the defined areas	Flat top barge to be as close to RORO as possible for unloading Excavator to ensure construction methods and management plan is prepared prior to marine construction using dredged material Reclamation area to be bunded to minimise loss of sediment	Contractor	• Construction reports submitted throughout works period	• Throughout marine construction operations	• Cessation of disposal and relocation of dredge material dump position

Observable impacts are limited to within the ZoHI and the temporary mooring area within the ZoMI (Figure 2)	Implement the Marine Water Quality Monitoring Program (MWQMP) as defined in Appendix B.1	RIA	• Summary report at the completion of monitoring	• Commence at least one month prior to commencement of dredging • Continuous during dredging • Continue for one week after cessation of dredging and marine construction or until water quality has returned to pre-dredging baseline.	• Implement Tiered Management Framework (TMF) as defined in Appendix B.1. • Silt curtains to be employed to reduce plume as necessary
	Implement the Benthic Communities & Habitat Monitoring Program (BCHMP) as defined in Appendix B.2.	RIA	• Pre-disturbance Survey Report • Post-dredging Survey Report • Reactive Survey Report (As required) • Monitoring Close-out Report	• Pre-dredging surveys at least one month prior to commencement of dredging • Reactive surveys as required in accordance with MWQMP triggers. Refer to Appendix B.1. • Post-dredging survey within 2 months following completion of marine construction	• Implement Reactive BCH Monitoring Event as per Appendix B.2. • Continue post-construction surveys on an annual basis up to five years as required to identify evidence of BCH recovery within the authorised ZoMI as per Appendix B.2.
	Inspect and maintain dredge hopper and to minimise leakage	Contractor	• Pre-mobilisation equipment checklist • Equipment maintenance schedule/documentation	• Prior to commencement of dredging and daily during dredging	• Cease dredge operations and repair leakage

5.3. Marine Fauna

The (Tier 1) management actions proposed to minimise potential impacts on the environmental factor 'Marine Fauna' (including MNES) are described in Table 10. For the management targets associated with introduced marine pests please refer to Section 5.5.

Table 10: Management actions to minimise impacts on marine fauna

Environmental Factor	**Marine fauna**				
Activity	Dredging , disposal and general vessel operations				
Potential Impacts	• Injury, death or behavioural change of marine fauna as a result of dredge operations (loading and dumping, deployment of silt curtains) • Injury or death of marine fauna due to vessel movement (strike) • Direct impacts from underwater noise from dredging operations • Direct impacts from light pollution • Habitat disturbance or loss through reduction temporary localised increase in suspended sediment concentration (SSC).				
	Management Actions		Environmental Performance		
Management Targets	Actions	Responsibility	Reporting/Evidence	Timing	Contingency
No loss of marine fauna habitat outside of wharf structure and ZoHI	This will be achieved through meeting the MTs of MEQ and BCH	Contractor and RIA	• As per Section 5.1 and 5.2	• Throughout dredging and marine construction	• Tiered management framework in Appendix B • Reactive marine fauna monitoring in the event of BCH threshold exceedance in accordance with Appendix B.3
No incidences of marine fauna injury or death as a result	Implement marine fauna monitoring and management as outlined in Appendix B.3.	Contractor	• MFO daily records	• Daily	• Where marine fauna are observed within an Exclusion Zone then

Management Targets	Actions	Responsibility	Reporting/Evidence	Timing	Contingency
of dredge operations	Internal training of Marine Fauna Observer(s) (MFO), which provides clear direction on: • The dredging Management Zones (Observations Zones and Exclusion Zones) • Key marine fauna species that are known or likely to be present in the proposal area and how to identify species (i.e. whales, dolphins, seals and sea lions, and turtles) • The actions to be undertaken by the MFO in the event of marine fauna being sighted within the Management Zones. • The actions to be undertaken by the MFO in the event of an incident resulting in injury or death of a marine species. Inspection of the silt curtains during dredging to ensure marine fauna are not entrapped, tangled or injured. Use of silt curtains during dredging to minimise the potential impacts to marine fauna (including fish species) associated with increased turbidity.		• Final summary report • Refer to Appendix B.3 • Visual inspection of silt curtains for marine fauna • Maintain silt curtain to minimise leakage and report in pre-mobilisation checklist and equipment maintenance schedule /documentation	• Refer to Appendix B.3 • Visual inspection of silt curtains throughout dredging operations • Silt curtain to be inspected prior to commencement of dredging and daily thereafter	dredging will cease immediately. • If silt curtain is found to be damaged or leaking, or marine fauna are entangled, dredging operations are paused and silt curtain to be maintained and marine fauna to be released
No direct impacts to marine fauna from underwater noise from dredge operations	Implement marine fauna monitoring and management as outlined in Appendix B.3 Ensure all vessel equipment and machinery is in good condition and subject to regular maintenance When in transit, all proposal vessels will be operated in accordance with EPBC Regulations 2000- Part 8 Division 8.1 and the WA BC Act Minimise the duration of run-time for vessel engines, thrusters and dredging plant by avoiding stand-by or running mode to the degree practical and consistent with safe operations.	Contractor	• Refer to Appendix B.3	• Refer to Appendix B.3	• Where marine fauna are observed within an Exclusion Zone then dredging will cease immediately.

Management Targets	Actions	Responsibility	Reporting/Evidence	Timing	Contingency
No incidences of marine fauna injury or death as a result of vessel strike	Implement marine fauna monitoring and management as outlined in Appendix B.3 The maximum vessel speed within all areas of the proposal is 5 knots and all vessels are to adhere to standard set in the National Whale Watching Guidelines (DoEE 2017b).	Contractor	• Refer to Appendix B.3	• Daily • Refer to Appendix B.3	• Where marine fauna are observed within an Exclusion Zone then dredging will cease immediately.
No disruption to marine fauna from artificial lighting	All dredging and construction works to be undertaken during daylight hours only	Contractor	• Daily logs	• Throughout dredging and construction activities	• Pause dredging and construction if artificial lighting required

5.4. Hydrocarbon Management

The (Tier 2) management actions proposed to minimise potential impacts associated with hydrocarbon spill described in Table 11.

Table 11: Management actions to minimise the risk of hydrocarbon pollution

Activity	General Vessel Operations				
Potential Impacts	• Decrease in MEQ quality due to water and potential sediment contamination • Potential smothering of BCH and marine fauna				
	Management Actions	Environmental Performance			
Management Targets	Actions	Responsibility	Reporting/Evidence	Timing	Contingency
No hydrocarbon spills to the marine environment	Document vessel bunkering management, including appropriately licensed bunkering facilities	Contractor	• Vessel management procedures	• Prior to dredge entering Western Australian Waters from overseas or interstate.	• Dredge operations not to commence prior to development and Proponent approval of vessel bunkering management procedure
	Undertake vessel maintenance and bunkering in accordance with dredging contractors approved vessel management systems	Contractor	• Vessel management procedures	• For the duration of dredging	• Vessel bunkering management systems to be reviewed and refined (if required) in the event of an identified procedural breach or hydrocarbon spill
	Implement industry standard hydrocarbon management practices (chemical handling, storage, segregation and spill response)	Contractor	• Vessel management procedures • RIA is to be notified immediately in the event of a	• Prior to commencement of dredging	• Dredge operations not to commence prior to development and approval of vessel management procedures

Management Targets	Actions	Responsibility	Reporting/Evidence	Timing	Contingency
			hydrocarbon spill of any volume		• Investigate spill event and review management actions and responses
	Undertake an environmental inspection of all dredging vessels	Contractor	• Vessel management procedures	• Prior to the commencement of dredging	• Dredge operations not to commence prior to development and approval of vessel management procedures
	Implement prevention and response actions in accordance with the Spill Prevention and Response Plan (RIA 2025)	Contractor RIA	• RIA is to be notified immediately in the event of a hydrocarbon spill of any volume	• Throughout dredging	• In accordance with RIA (2025)

5.5. Waste Management

The (Tier 2) management actions proposed to minimise potential impacts that waste management may have on the environment are listed in Table 12.

Table 12: Management actions to manage waste

Activity	Incorrect or accidental disposal from a vessel				
Potential Impacts	• Impacts on the MEQ (both sediment and water) and marine fauna due to presence of foreign materials				
	Management Actions	Environmental Performance			
Management Targets	Actions	Responsibility	Reporting/Evidence	Timing	Contingency
No release of waste into the marine environment.	Manage waste in compliance with requirements for RIA and in accordance with MARPOL 73/78 Convention Annex IV (sewage) and Annex V (garbage). Dredging contractor to establish and implement a sewage and garbage disposal plan in accordance with RIA requirements and MARPOL 73/78	Contractor	• Plan – one week prior to dredging • Incident - Within 12 hours of a reportable incidence.	• Prior to commencement of dredging • Duration of dredging operations.	• RIA to approve Plan prior to commencement of dredging • Plan and procedures to be revised to prevent recurrence of incident • RIA to audit performance during dredging if/as required.
	Manage the correct onshore disposal and reporting systems Only a licenced Controlled Waste Carrier to be used for any controlled waste discharged ashore	Contractor	• Controlled waste tracking forms to be completed as soon as possible.	• Duration of dredging operations.	• RIA to audit performance during dredging if/as required.
	All forms of waste need to be stored in appropriately labelled drums or tanks and be correctly disposed of and not discharged to the environment	Contractor	• Approval certification and tracking forms to be completed as soon as possible	• Duration of dredging operations.	• Vessel management plan/procedures to be reviewed and endorsed by RIA prior to dredging

Management Targets	Actions	Responsibility	Reporting/Evidence	Timing	Contingency
			• Vessel waste management plan/procedures.		• RIA to audit performance during dredging if/as required.
	Reporting of any type of spillage within the marine environment directly to the RIA.	Contractor	• As soon as possible, within 24 hours.	• During the duration of dredging operations.	• Revise associated management plans or procedures to ensure no incident recurrence • RIA to audit performance during dredging if/as required
	Implement prevention and response actions in accordance with the Spill Prevention and Response Plan (RIA 2025)	Contractor RIA	• RIA is to be notified immediately in the event of a spill of any volume	• Duration of dredging operations.	• In accordance with RIA (2025)

5.6. Introduced Marine Pests

The (Tier 2) management actions proposed to minimise potential impacts that waste management may have on the environment are listed in Table 13.

Table 13: Management actions to minimise of introduced marine pests

Activity	Introduction of marine pests from vessels entering the area				
Potential Impacts	• Impacts on local marine fauna due to presence of introduced marine pests (IMPs)				
Management Targets	Management Actions	Environmental Performance			
	Actions	Responsibility	Reporting/Evidence	Timing	Contingency
No introduction or movement of IMPs	Use the WA Department of Primary Industries and Regional Development (DPIRD) 'Vessel Check' risk assessment (https://vesselcheck.fish.wa.gov.au) and submit to RIA (including supporting documentation) for all dredging and support vessels (i.e., Dredge vessel and Barges) that mobilise from interstate or international waters. Risk assessment must indicate that the vessel poses a low risk of IMP to the proposal area.	Contractor	• 'Vessel Check' risk assessment report (including supporting documentation) • If pest is identified record location, date and time, size, colour, water depth, environment (e.g. beach, sand etc), and take a photo.	• Prior to vessel(s) entering the proposal Area.	• Notify RIA and DPIRD of the introduction of IMPs within 12 hours (1800 815 507).
	All vessels will comply with Commonwealth biosecurity requirements and complete DPIRDs 'Vessel check'. All vessels will have a ballast water management plan and ballast water exchanges will be in accordance with IMO requirements and the Commonwealth *Biosecurity Act 2015*				

6. Reporting

A summary of the reporting requirements for the proposal are provided in Table 14. Reporting may be revised following further advice from DWER.

Table 14: Compliance reporting requirements

Report	Content	Timeframe	Responsibility	Recipient
Environmental Incidents or Environmental Risks Report	Report any environmental incident or environmental risk Detail the incident or risk, the measures taken, the success of those measures in addressing the incident or risk and any additional proposed to be taken Document any incidents involving the dumping activities that result in injury or death to any marine species. The date, time and nature of each incident and the species involved, if known, must be recorded.	Within 12 hours	Dredging Contractor	RIA / DoT – Reportable Oil Spill/ Pollution Report form (POLREP) Department of Biodiversity Conservation and Attractions (DBCA) – Reportable wildlife incident RIA / DPIRD – Reportable IMP detected.
Non-compliance Summary Report	Identify which EPO has not been achieved Detail the monitoring results that identified the EPO was not being achieved Describe the investigation being undertaken into the cause of the EPO not being achieved Identify any corrective or contingency management actions proposed to be implemented or being implemented	Within 7 days of determining that an EPO has not been achieved	RIA	Department of Water and Environmental Regulation (DWER)
Non-compliance Investigation Report	Identify which EPO has not been achieved Detail the findings of the investigations undertaken into the cause of the EPO not being achieved	Within 30 days of determining that any EPO has not been achieved	RIA	DWER

Report	Content	Timeframe	Responsibility	Recipient
Close-out Report	Report which evaluates the performance of monitoring and management in achieving the EPOs.	Within 12 months following completion of dredging	RIA	DWER

6.1. Additional Reporting

A summary of the additional reports that are expected to inform compliance reporting commitments (Table 14Table 14) are listed in Table 15.

If injured or deceased marine fauna are sighted or introduce marine pest is identified the reporting requirements for specific marine fauna incidents are listed below in Table 16. Injury to conservation significant fauna or listed species as a result of the Proposal operational activities, or general observations of injured wildlife not related to the Proposal, are to be reported immediately by the RIA or if identified by Barge Operators or other persons involved in the Proposal must be immediately reported to RIA.

Table 15: Additional reporting requirements required to demonstrate compliance

Topic	Content	Timeframe	Responsibility	Recipient
BCH Reporting	• Pre-dredging BCH survey report • Post-dredging BCH survey report • Reactive BCH survey report (as required).	• Pre-dredging survey report issued as soon as practical following the completion of the survey • Post-construction surveys issued within 6 months following completion of marine construction • Reactive survey reports as required to support potential non-compliance investigation.	RIA	DWER
Marine Water Quality Monitoring Program Reporting	• Marine Water Quality Monitoring Program Summary Report.	• Monitoring summary report to be issued with Close-out report.	RIA	DWER
Site and vessel inspection checklists / logs	• Vessel Environment, Safety & Health inspection – (e.g., equipment inspection, navigation equipment systems, speed, MFO personnel, bunkering log). • Dredge operation log – (e.g., operations times, types of operations, Global Positioning System (GPS) location, dredge volumes).	Daily during dredging	Contractor	RIA

Topic	Content	Timeframe	Responsibility	Recipient
	• Marine fauna observation Logs – (e.g., dredge operation time, name of observer, fauna species, distance/direction from vessel, management response).			
Pollution Incidents	Reactive pollution incident report as required. RIA to coordinate state reporting requirement to DoT Maritime Environmental Emergency Response (MEER) duty officer and online Pollution Report Form (POLREP)	Within 24 hours of incident	Contractor RIA	DoT / RIA
Complaints	RIA to be notified of any complaints received in relation to the dredging activities. Notification should detail the nature of the complaint and how it was resolved.	Within 7 days of any complaint received	Dredging Contractor	RIA

Table 16: Reporting requirements and contact details for injured marine fauna

Wildlife	Content	Timeframe	Responsibility	Recipient
Sick or injured wildlife; snake removal	• Location including GPS coordinate • Within or outside of work area • Time of observation • State/condition of individual/s • Affected species • Image (if possible).	Within 24 hours as being notified (as soon as possible)	Dredging contractor RIA	WILDCARE Helpline (24 hr) (08) 9474 9055
Fish deaths	• Location including GPS coordinate of fish kill • Estimated number of dead fish • Species affected	Within 24 hours as being notified (as soon as possible)	Dredging contractor RIA	Fish Watch (24 hr hotline) 1800 815 507

Wildlife	Content	Timeframe	Responsibility	Recipient
	• Photograph.			
Animal or plant deaths obviously caused by pollution	• Location including GPS coordinate • Within or outside of work area • Time of observation • Cause of pollution • Condition of species and estimated number	Within 24 hours as being notified (as soon as possible)	Dredging contractor RIA	DWER (24 hr Pollution Watch Hotline) 1300 784 784
Possible IMP	• Location (GPS coordinate, or nearest landmark) and water depth • Date and time of detection • Size and colour of IMP • Environment (i.e. beach, sand, rock pool, in weed, water, attached to structure) • Photo	Within 24 hours as being notified (as soon as possible)	Dredging contractor RIA	FishWatch on 1800 815 507 Email: aquatic.biosecurity@dprid.wa.gov.au Local DPIRD office

7. Ongoing stakeholder consultation

Stakeholders are important to any development within Western Australia, and RIA understands the stakeholders are extremely important in this process. Stakeholders will be notified of proposal developments through the proposal website https://www.ria.wa.gov.au/projects-and-developments/significant-projects/south-thomson-barge-landing.

8. Availability of the DEMMP

This DEMMP will be available on the EPA and RIA websites and can be provided to the public or stakeholders upon request.

9. Audit and review

RIA are committed to continual improvement and will conduct regular review of the content and implementation of this DEMMP. This includes undertaking audits of the dredge contractor and their operations as required throughout the proposal, to assess compliance against this DEMMP. The performance of the dredging operations against these requirements will be reported.

This DEMMP is a living document and will be reviewed in accordance with Table 17. Any significant changes must be documented in Appendix A. Changes to the document may also require approval from DWER, depending on the requirements of the Ministerial Statement.

Table 17: DEMMP Review Schedule

Timing	Rationale
Upon receipt of approval conditions	If DWER approval conditions are provided for the proposal this will necessitate a comprehensive review of this DEMMP to ensure all relevant commitments are covered within this Plan to ensure compliance.
Prior to commencement of action	To ensure that the contractor and RIA implement all commitments accordingly and that no operational details are non-compliant. To confirm the most suitable monitoring locations, trigger levels and monitoring methods area appropriate.
Any time operational activities significantly alter	Operational changes to the proposal may result in an altered risk profile. Therefore, the DEMMP will require a review to ensure that it remains fit-for-purpose for altered operational conditions. Any significant change in environmental risk may require the DEMMP to be resubmitted to DWER for endorsement (this may not be required if the proposal is Not Assessed or not considered a controlled action.
Following any significant incidents or non-compliance events	To ensure that the management actions and controls in place are adequate to ensure no re-occurrence of incidents or non-compliances.

During review of the DEMMP, consideration will be given, but not limited to:

- Overall effectiveness of the DEMMP
- Changes in schedule
- Changes to monitoring trigger values, where determined to be ineffective or inappropriate
- Any changes in methodology or equipment used.

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Appendix A. Plan Amendments

Document Change Register

Organisation	Date	Comment	Response

Appendix B. Monitoring programs

Appendix B.1. Marine water quality monitoring program

The environmental outcomes for MEQ for dredging activities and marine construction are as follows:

- Within two weeks following cessation of marine construction and dredging works, marine water quality will return to a High Level of Ecological Protection.
- No reported hydrocarbon spills or release of waste into the marine environment from dredging and construction activities.

B.1.1 Rationale

Dredge plume modelling undertaken by Baird (2024) calculated predicted increase in suspended sediment within the environment during dredging activities This was undertaken using suspended sediment concentration (SSC) and assumed the base case was 0 mg/L. Light was not modelled as the relationship between SSC and light (measured as Daily Light Integral) had not been derived, and therefore the interpretation of modelling results based on light impacts to seagrasses was not possible.

This marine water quality monitoring program (MWQMP) will be undertaken to ensure the turbidity at the zone boundaries as defined by Baird (2024) are meeting those management targets. As SSC is unable to be measured in situ, turbidity will be measured as Nephelometric Turbidity Units (NTU) using a turbidity profiler and compared to the SSC using a correlation coefficient calculated prior to the commencement of dredging.

As an additional line of evidence, turbidity (NTU) will also be measured using loggers taking measurements every 30 minutes throughout dredging activities at one impact site and one reference site. These will be downloaded at the end of the dredging campaign, or if the profiling measurements indicate that an exceedance of the trigger may be likely.

B.1.2 Monitoring locations

Turbidity (NTU) profiling will be measured at six impact sites and two reference sites. The impact sites will be located at the boundaries of the ZoHI/ZoMI, and ZoMI/ZoI and will be used to monitor EPOs and MTs associated with no negative change from baseline conditions. Impact sites will be positioned over identified seagrass/macroalgae receptors adjacent to the ZoMI boundary where practicable. No monitoring is proposed within the ZoHI as it assumed this area will have irreversible impacts to BCH. No monitoring is proposed further than the ZoMI/ZoI boundary as it is expected that no changes will be observed in BCH and WQ parameter requirements will be met at the ZoMI/ZoI boundary and extending out into the ZoI. A water quality logger measuring turbidity (NTU) will also be located within the ZoMI and one at the reference site, to be downloaded at the end of marine construction activities.

The proposed monitoring locations are presented in Table 14 and Figure 11, which have been based on the zones of impact and influence derived by Baird from the dredge plume modelling results (Figure 3).

During the establishment survey the benthic communities at each location will be reviewed in the field and the locations may be altered to be closer to seagrass.

Table 18: Proposed coordinates of water quality monitoring locations

	Name	Type	Easting (GDA2020 MGAz50)	Northing (GDA2020 MGAz50)
Impact Sites	ZoHI 1	ZoHI to ZoMI	363141	6458438
	ZoHI 2	ZoHI to ZoMI	363228	6458517
	ZoHI 3	ZoHI to ZoMI	363172	6458583
	ZoMI 1	ZoMI to ZoI	362975	6458595
	ZoMI 2	ZoMI to ZoI	363275	6458424
	ZoMI 3	ZoMI to ZoI	363302	6458533
	LI	Logger impact site	363268	6458509
Reference Sites	R1	Reference	364198	6458745
	R2	Reference (and logger reference)	362782	6458616

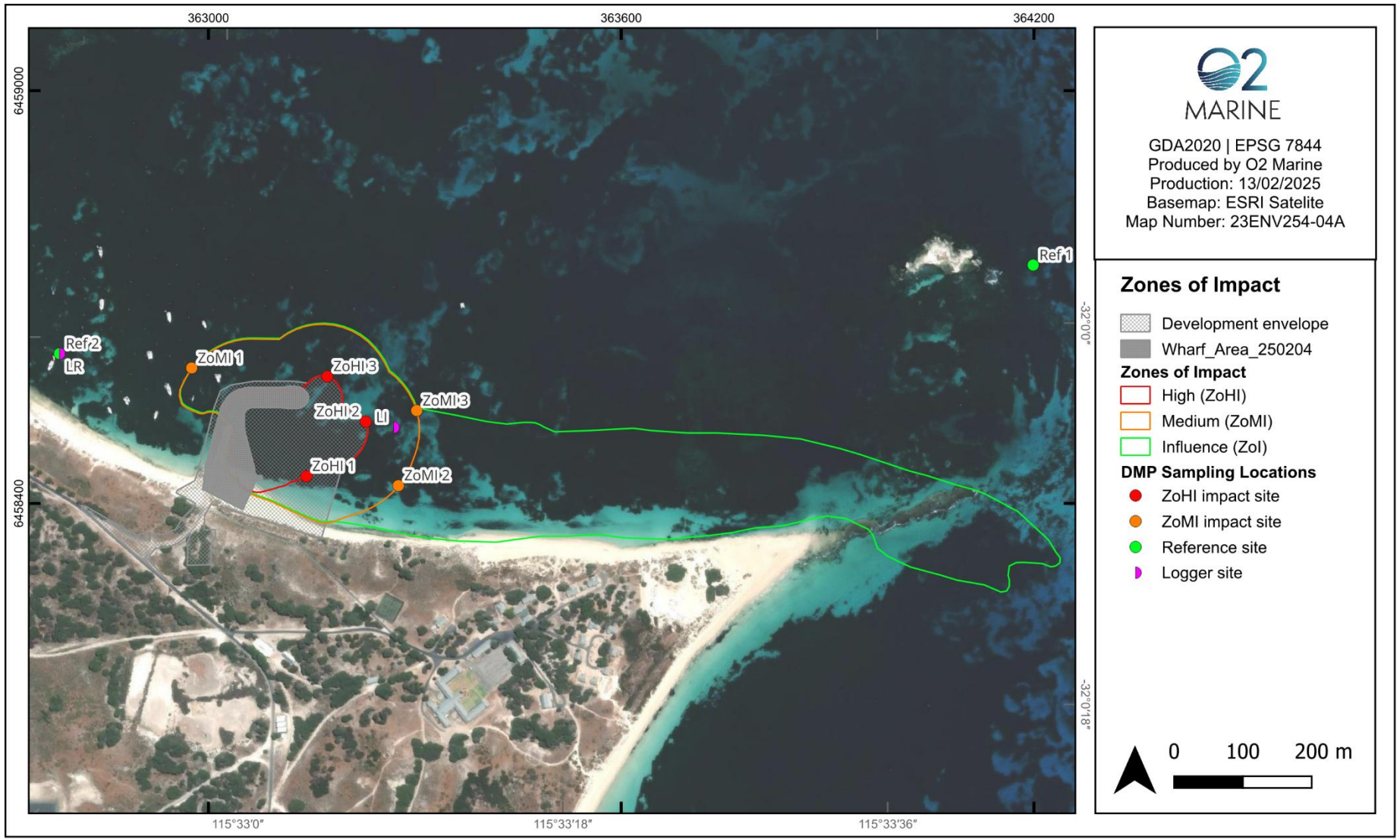

Figure 8: Proposed water quality monitoring locations

B.1.3 Frequency

Baseline

A TSS:NTU correlation sampling event will be undertaken one month prior to the commencement of dredging to validate the correlation coefficient used to set the trigger levels to be used during the dredging period. This will be undertaken at several sites within Thomson Bay, including around the existing ferry terminal to gain an understanding of a more turbid environment. The water quality loggers will also be deployed one month prior to the commencement of dredging, and will take measurements every 30 minutes and stored on the instruments.

Routine monitoring

Water quality profiling will be undertaken every 3 days during dredging activities. The following parameters will be measured:

- Turbidity (measured as NTU)
- Photosynthetic Active Radiation (PAR)
- Conductivity
- Temperature
- Dissolved Oxygen (DO)
- Depth.

This will be undertaken at impact and reference monitoring locations only.

If trigger levels are exceeded and management response actions are required, the logger information may be downloaded and analysed, and reactive BCH health monitoring will be implemented (triggers given in Section B.1.4).

Converting SSC to NTU will have some margin of error, and Fisher et al (2019) recommends frequent checking and reconfirming that the conversion factors are relevant throughout dredging activities. Therefore during dredging activities, one further TSS:NTU correlation sampling event will be undertaken to ensure the correlation coefficient remains accurate within the proposal environment. If NTU trigger values are updated then this will be reflected in the compliance monitoring report.

Post dredging

Water quality profiling will continue to be collected and analysed until water quality returns to pre-dredging levels, or at least two weeks following the cessation of marine construction (whichever is longer). The water quality loggers will also be demobilised two weeks following the cessation of marine construction.

B.1.4 Environmental protection outcomes, management targets and trigger levels

Seagrass was identified to be the most sensitive BCH receptor within the proposal area, and therefore EPOs, MTs and trigger levels have been developed for protection of seagrass during dredging and disposal. EPOs and MTs are presented in Table 7 of the DEMMP.

Zones of impact were identified by Baird (2023) based on the methods used by BMT in their analysis of the dredge plume and modelling and their impact on seagrasses using the thresholds defined by Statton et al (2017). This assessment determined nominal values of SSC that would have detrimental impacts on local BCH as follows:

- 2 mg/L, approximating a potentially visible plume
- 5 mg/L, approximating a value that may pose a low risk to seagrasses (ZoI will be expected to be between 2 mg/L and 10 mg/L above background)
- 10 mg/L, approximating a value that may pose a moderate risk to seagrasses (ZoMI will be expected to be between 10 mg/L and 20 mg/L above background)
- 20 mg/L, approximating a value that poses a high risk of impacts to seagrass health (ZoHI will be expected to be 20 mg/L or higher above background).

Given these values, 10 mg/L (95th percentile) was used to delineate the ZoMI, and 2 mg/L (100th percentile) was used to delineate ZoI. Therefore, it is predicted that at the boundary of the ZoHI/ZoMI, the SSC should be less than 20 mg/L, and at the ZoMI/ZoI boundary the SSC should be less than 10 mg/L. In order to ensure a high risk to seagrass health is not reached in the ZoMI and the moderate risk is not reached in the ZoI, the below trigger levels are proposed (Table 19).

Table 19: Proposed triggers and thresholds for the proposal

	Trigger 1	Trigger 2
ZoHI/ZoMI boundary	Turbidity >19 mg/L (to be converted to NTU following the TSS:NTU correlation calculation) above the medians of both reference sites. Duration Turbidity must exceed for any 2 week monitoring period to be considered a trigger exceedance.	Turbidity >20 mg/L (to be converted to NTU following the TSS:NTU correlation calculation) above the medians of both reference sites. Duration Turbidity must exceed for any 2 week monitoring period to be considered a trigger exceedance.
ZoMI/ZoI boundary	Turbidity >9 mg/L (to be converted to NTU following the TSS:NTU correlation calculation) above the medians of both reference sites. Duration Turbidity must exceed for any 2 week monitoring period to be considered a trigger exceedance.	Turbidity >10 mg/L (to be converted to NTU following the TSS:NTU correlation calculation) above the medians of both reference sites. Duration Turbidity must exceed for any 2 week monitoring period to be considered a trigger exceedance.

Management actions to be undertaken given an exceedance of a trigger:

- Trigger 1:
  - investigate if a Trigger 2 has been exceeded for any sites

- sample again at that monitoring site and associated reference site each day until turbidity has decreased.

- Trigger 2:
  - Investigate cause of exceedance using the following steps:
    - Assess metocean and weather conditions
    - Investigate if dredging/disposal has been occurring and if that's likely to be attributable to the exceedance.
  - Conduct further data collection and analysis:
    - Investigate results of the other parameters including PAR to determine if there is likely to be stress on the surrounding seagrass.
    - Investigate data collected on water quality loggers to gain more information on daily trends.
    - sample again at that monitoring site and associated reference site each day until turbidity has decreased.

If impacts to seagrasses are predicted due to the increased turbidity, the following actions should be considered and undertaken if relevant and possible as part of the Level 2 Management actions:

- Undertake a reactive BCH survey assessment (See Appendix B.2)
- Change the dredging activities e.g. pause dredging for 12 hours and consider changing dredging activities
- Change the disposal activities e.g. pause disposal until turbidity has decreased.

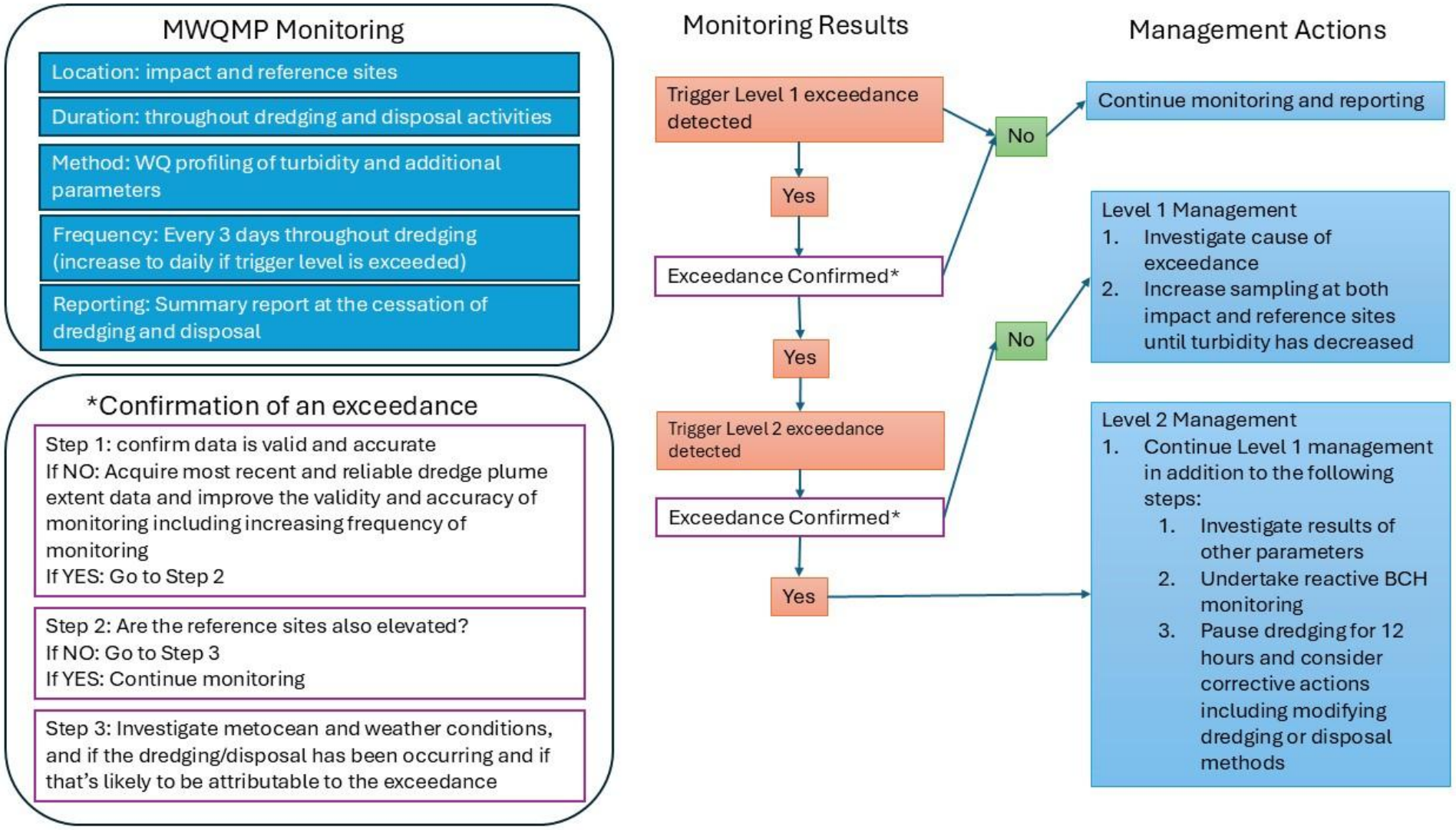

Figure 9: Tiered management framework for the Marine Water Quality Management Plan (MWQMP)

B.1.5 Data analysis

Any potential impact of dredging on water quality decline will be assessed and will include a consideration of the following factors:

- Correct instrument calibration, function, operation and maintenance
- Potential influence of shipping movements through the area
- Locations and status of dredging activities in relation to the site(s) at the time of the exceedance
- Metocean conditions at the time of the exceedance
- Assessment against background conditions (reference site)
- Spatial extent of water quality decline at the time of exceedance based on review of plume extent (i.e. multispectral imagery).

Baseline water quality will be analysed and the TSS:NTU correlation calculated as soon as possible following the completion of baseline monitoring. This will then be used to validate the interim trigger levels and compared to the compliance monitoring data.

This information will then be presented in the final water quality monitoring report.

B.1.6 Corrective actions

Turbidity and light data will be assessed against the established Trigger Levels (Table B1-2). If the Trigger Levels are exceeded (or indicate a progressive increase towards the Trigger Levels) then modifications to the dredging program are to be considered, and may include, but not necessarily be limited to:

- Temporary pause to dredging activities (e.g. if exceedance appears to be due to non-dredging vessel movements, tide and/or weather conditions)
- Relocate the dredge (e.g. to an area of coarser sediment)
- Reduce the dredge cut depth, rate of swing-speed and/or increase the dredge pump flow
- Reduce disposal of material if the plume is coming from the reclamation area.

Modifications to the dredge program are to continue until the trigger levels are no longer exceeded. If Trigger Level 2 is exceeded for two consecutive days ('continued exceedance') dredging will cease and Level 2 management actions shall be instigated. In this instance dredging will only recommence after Trigger Level 1 is no longer exceeded. In addition, detailed investigations on the likely causes of the exceedance and the recommended changes to dredge program is required within 7 days of this Trigger Level 2 exceedance.

B.1.7 Reporting

A compliance report will be prepared following the completion of the dredging and construction works and the associated water quality monitoring. Due to the short duration of the works, baseline information will be included in the compliance report.

Appendix B.2. Benthic communities & habitat monitoring program

B.2.1. Rationale

Seagrass communities are the most vulnerable (of those BCH present in the impact area) to the effects of increased turbidity (measured as NTU, TSS or SSC) and the associated decline in benthic light availability associated with dredging. Therefore, seagrass health will be lead indicator for monitoring of benthic community health. Seagrass and macroalgae will both be monitored with the water quality thresholds for the protection of seagrass during dredging activities.

Diver based transects will be used to collect data from each site, which will be analysed to determine percent cover, species dominance, and other health parameters (See B.2.4). 10 quadrats at three 50 m transects will be surveyed, with images of the 0.2 x 0.2 m quadrats taken. Additional qualitative observations will also be recorded such as evidence of dead rhizome mat, or presence of invasive marine species.

In addition to monitoring for the effects of increased suspended sediment and decreased light associated with dredging activities, temporary mooring of dredging and construction vessels may be necessary within the ZoMI of the DE. This area on the eastern side of the DE is conservatively large to allow for logistics of mooring the vessels, and the impacts will be temporary during dredging and construction only. Therefore, it is still anticipated that any loss of seagrass in this area will be recovered within 5 years and still meets the requirements of a ZoMI. This area will also be monitored to ensure this recovers within 5 years.

Therefore, the threshold for BCH (seagrass and macroalgae) for dredging and marine construction activities are as follows:

1. No significant change in BCH abundance and health associated with dredging/marine construction at the impact sites compared to the baseline
2. No significant change from the baseline associated with the temporary mooring within the ZoMI within 5 years.

B.2.2. Monitoring locations

Indicative monitoring locations will be selected in areas of at least moderate BCH cover and include:

- Three (3) locations along the ZoHI/ZoMI boundary to assess recoverable impacts
- Three (3) locations along the ZoMI/ZoI boundary to assess no change from baseline state.
- One (1) location within the temporary mooring area within the ZoMI to assess long term recovery.

A further two (2) reference monitoring locations are required to be determined as suitable control locations. These locations are proposed to be at the same/similar locations to the water quality sites so that water quality triggers are related to the BCH monitoring sites. No monitoring is proposed within the ZoHI as it assumed this area will have irreversible impacts, and no monitoring is proposed further than the ZoMI/ZoI boundary as it is expected that no changes will be from the boundary. The proposed coordinates and locations are given in Table 20 and Figure 10.

These monitoring locations will be confirmed during the establishment/baseline surveys after a review of the benthic communities. The locations of the temporary moorings will also impact the final monitoring locations within the ZoMI, and will focus on areas where BCH loss occurred due to the moorings.

Table 20: Proposed coordinates of BCH monitoring locations

	Name	Type	Easting (GDA2020 MGAz50)	Northing (GDA2020 MGAz50)
Impact Sites	ZoHI 1	ZoHI to ZoMI	363141	6458438
	ZoHI 2	ZoHI to ZoMI	363228	6458517
	ZoHI 3	ZoHI to ZoMI	363172	6458583
	ZoMI 1	ZoMI to ZoI	362975	6458595
	ZoMI 2	ZoMI to ZoI	363275	6458424
	ZoMI 3	ZoMI to ZoI	363302	6458533
	Mooring1	Within ZoMI	363143	6458417
Reference Sites	R1	Reference	364198	6458745
	R2	Reference	362782	6458616

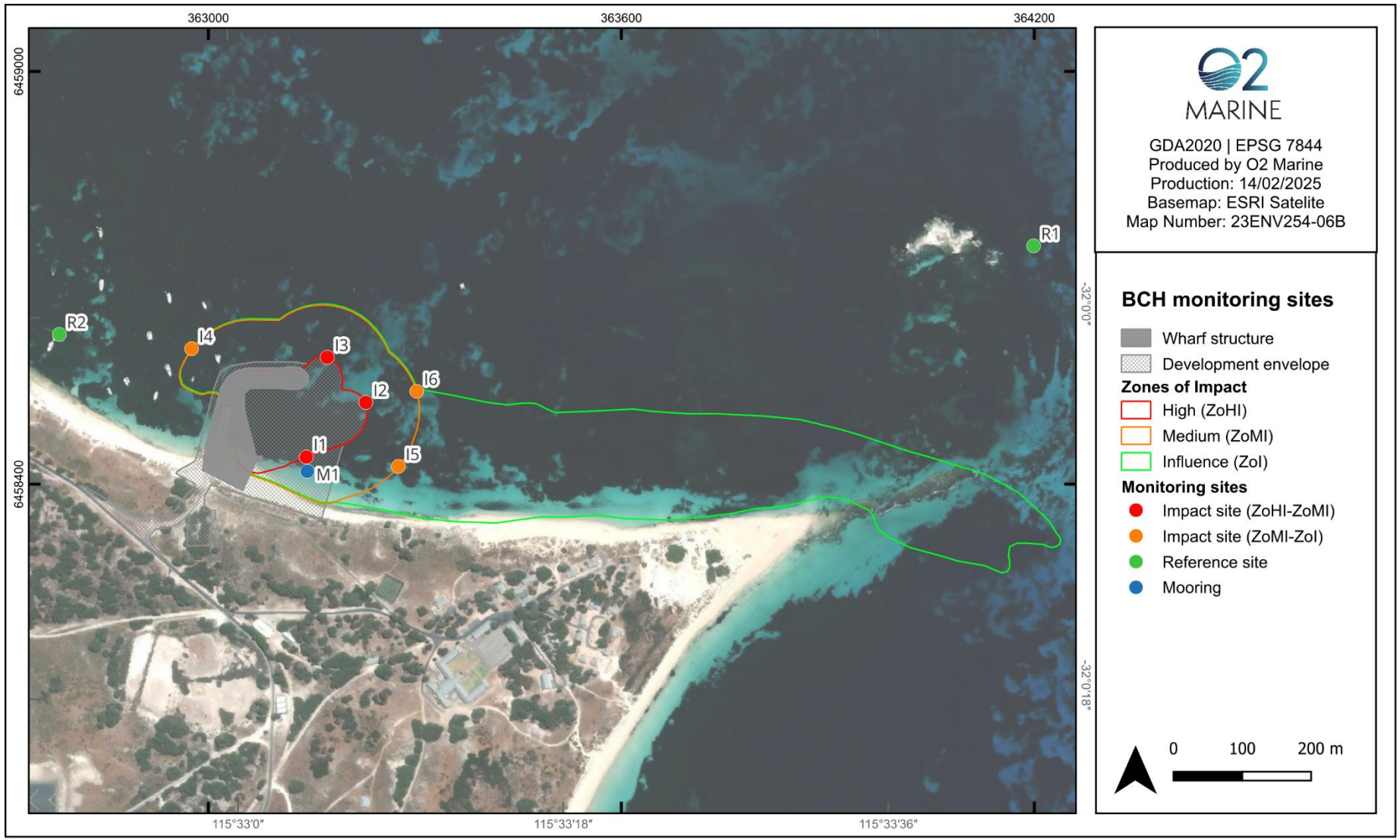

Figure 10: Proposed BCH monitoring locations

B.2.3. Frequency

Baseline surveys

BCH surveys to establish baseline conditions should be undertaken within one month prior to commencement of dredging.

Reactive surveys during dredging (as required)

During dredging, BCH surveys are only required in the event that a trigger level 2 exceedance has occurred management actions are required.

Post-Dredging Survey

If a reactive survey was required during the dredging activities, then post-dredging surveys will also be undertaken (i.e. it will not be required if the water quality triggers were not exceeded). One post-dredging survey will be undertaken within 2 months (preferably within the same season as the baseline) following completion of dredging and construction to evaluate status of EPOs within the ZoMI and the ZoI. Where dredging impacts were detected in areas outside of the ZoHI, then post-dredging BCH surveys will continue, on at least an annual basis, for up to 5 years, or until BCH that is impacted as a result of dredging is considered to have recovered to a pre-dredging (baseline) condition as demonstrated through monitoring.

For the monitoring site within the ZoMI associated with BCH loss due to temporary moorings, post-dredging/construction surveys will be undertaken on an annual basis, up to five years or until the area is considered completely recovered to a pre-dredging (baseline) condition.

B.2.4. Survey Methods

BCH monitoring for community health will involve implementation of a standard diver-based survey of before / after / control / impact (BACI) design. This includes using baseline information to compare to the reactive surveys, and impact sites compared to reference sites.

Rottnest Island currently has an annual seagrass monitoring program with 10 sites around the island. Methods of monitoring the additional sites for this Proposal have been based on the existing methods for the annual program. At each monitoring site, three x 20 m transects will be laid out with tape measures from the centre, and marked at 0^0, 120^0 and 240^0. Quadrats of 0.2 m by 0.2 m will then be placed on the right-hand side of the tape measures and within 1 m of the tape. Seven quadrats along each transect will be laid and three additional placed randomly adjacent to each transect. In total, there will be 10 quadrats per transect, giving 30 quadrats per site.

Divers will capture still images of each quadrat at the site using an underwater camera, approximately 1 m above the canopy. Data collected by the divers at each of the quadrats will include:

- Date
- Diver details
- Site Name
- Weather/water conditions
- Transect Bearing

- Quadrat Number
- Depth (m)
- Species
- No. Shoots/stems
- Max Leaf Height (mm)
- Avg Leaf Height (mm)
- Species dominance
- Estimate of visibility
- Any additional comments including presence of dead organisms.

B.2.5. Data Analysis

The percentage of benthic species cover that directly intercept the tape measure length of each 20 m transect using the line-intercept method will be calculated into a proportion of each benthic group (i.e., 20 m equals 100%). The benthic groups used will be calculated manually in excel to determine the relative abundance, mean, standard deviation, standard error and the Shannon-Weaver diversity Index of each benthic cover type at each site.

Multiple lines of evidence

In the event that management criteria are exceeded, a series of investigations and statistical analyses will be initiated in a structured decision-making framework to rigorously assess whether the detected change at an affected reef was due to dredging or simply the result of natural change.

The first step will be an assessment of the magnitude of change (effect size and its confidence interval) in cover between the impact and reference locations, from before dredging to the current survey period.

Multiple lines of evidence, based on causal indicators, are used to assess the impact hypothesis and may apply a variety of univariate or multivariate analysis. With lines of evidence there is a need to seek evidence not only to support the impact prediction, but evidence to rule out plausible alternative predictions, such as that the observed difference was due to natural processes including thermal bleaching from warm water temperatures, natural mortality, pollution, predation, cyclonic events, salinity change and anthropogenic causes for elevated turbidity (e.g. ship propeller disturbance). Potential natural and anthropogenic causes not related to the dredging activities will be monitored and noted during routine surveys as part of the MWQMP, and in some cases during the reactive monitoring program. A reactive monitoring program will be activated when there is a potential for a decline in BCH occurring.

A number of factors are relevant to the likelihood and level of severity of an impact occurring, including existing stress levels, age, size and health status of organisms, associated biota and adaptations to localised conditions. Differences in the physical characteristics between reference and impact locations and how this could affect the scale of effect observed should also be considered. The data will be compiled to provide a weight of evidence to determine if dredging activities were reasonably considered to cause or contribute to the impact.

Continuation of the post-dredging surveys on an annual basis (maximum of five years) may be required to identify evidence of BCH recovery within the authorised ZoMI. Where BCH has not shown evidence of recovery within the authorised ZoMI after 3 years, options for translocation, transplantation and/or restoration will be considered. In the event that water quality triggers are exceeded at the outer boundary of the authorised ZoMI, the pre- and post-dredging BCH surveys will consider a variety of health measures of BCH in the areas outside the authorised ZoMI and ZoHI, which can be used to provide evidence that this EPO has or has not been met.

B.2.6. Management actions

If the BCH thresholds are being exceeded, then further investigation into the management and mitigation methods will be undertaken. The dredging and/or marine construction works leading to the impacts should be paused until the water quality is improved. More frequent reactive BCH surveys may also be required to determine if BCH is recovering.

B.2.7. Reporting

Baseline report

A baseline report will be prepared following the completion of the baseline survey ready for comparison to reactive surveys if required. The results of the baseline surveys will be summarised and assessed with the intention to characterise natural background changes in the condition of BCH in the areas likely to be affected by capital dredging and in the reference locations.

The report is proposed to also include a summary of the weather and marine water quality conditions (i.e., benthic light availability), which will be recorded during the pre-dredge period. This information will be used to develop understanding of how the condition of BCH in the areas are likely to be affected by capital dredging and control locations are influenced by natural processes.

Reactive survey reports (as required)

In the event that level 3 management criteria are triggered, a reactive survey investigation may be warranted. The investigation will consider relevant field observations, comparison of reference sites, water quality and sediment deposition data collected, dredge operations and metocean conditions to delineate impacts detected from natural causes or other anthropogenic sources as part of a multiple lines of assessment approach. Each reactive survey report will include:

1. A summary of data collected during the survey
2. Comparison of BCH condition with baseline and against reference locations
3. Multiple lines of evidence assessment
4. Evaluation of whether EPOs have been achieved or not
5. Recommendations for additional investigations / management / monitoring if required.

Reactive survey reports should be reviewed together with any required compliance investigation reports for recommendations of the next steps for dredging operations.

Post-Dredging Report

The post-dredging report will be prepared following completion of each annual post-dredging survey. The Post-dredging report will include:

1. A summary of data collected during the survey
2. Comparison of BCH condition with baseline and against reference locations
3. Multiple lines of evidence assessment
4. Evaluation of whether EPOs were achieved or not
5. Evaluation of the effectiveness of the BHMP and WQMP
6. Recommendations for additional investigations / management / monitoring if required.

Appendix B.3. Marine Fauna Monitoring

B.3.1. Marine fauna Observations

The following protocols and procedures will be implemented by a Trained Marine Fauna Observer (MFO) which is defined in following sections.

Dredging Protocols and Procedures

The monitoring protocols and procedures will be informed by previous regulatory advice and dredging campaigns completed in similar environments. As part of this Proposal, piling will also be undertaken, and underwater noise modelling was completed to assess the magnitude of impacts associated with piling. The results are known to be similar for dredging and vibration piling, which both produce a continuous noise, and the zones here are sufficient for mitigating continuous noise, from both activities. Observation and Exclusion zones around the dredging and disposal activities to prevent injury, including collision with vessels and reducing entrainment and entrapment, are presented in Table B3-1. Note that the Observation and Exclusion zones for piling activities are different and are presented in the CEMP (O2 Marine 2025).

It is vital to ensure the protection of marine fauna for the duration of the Proposal. The frequency and location of the observer are paramount to ensure the safety of the marine fauna, with the continuity of the Proposal depending on their response to potential interactions with marine fauna. Fish and elasmobranch species are not surface breathers; therefore, they do not bask at the surface which makes observations an ineffective mitigation measure. However, larger elasmobranchs may be present (e.g. rays and sharks) and can occasionally be viewed from the surface if weather conditions and water clarity allows for it. As a precautionary approach, if rays or sharks are sighted within the turtle zones the procedures outlined below will be implemented.

Table B3-1: Dredging and disposal marine fauna management zones

Marine Fauna Group	Observation Zone (m)	Exclusion Zone Disposal (m)	Exclusion Zone Dredging (m)
Whales	500	300	300
Dolphins	300	150	150

Marine Fauna Group	Observation Zone (m)	Exclusion Zone Disposal (m)	Exclusion Zone Dredging (m)
Seals and sea lions	500	300	300
Turtles	500	300	300

To mitigate potential impacts of the proposed works on significant marine fauna the Contractor must implement the following management and monitoring protocols during dredging and disposal works:

Pre-start

Dredging activities must not commence until a suitably trained MFO has verified that no target marine fauna; whales, cetaceans, and marine reptiles have been observed within the Exclusion zone during the 30-minute pre-start period completed immediately prior to the commencement of dredging activities. If target marine fauna is observed within the Exclusion Zone, dredging operations shall be delayed until target marine fauna has been observed exiting the zone or has not been seen for 30-minutes.

Soft-start

Soft-start aims to gradually increase the level of dredging activity over a 30-minute period following pre-start, a shut-down or lengthy break, with the expectation that nearby animals respond to the soft-start via avoidance to the sound and have an early opportunity to move away before the equipment is in full operation, at a louder sound exposure level. For a BHD activating the bucket in a slow and controlled manner, increasing in energy/speed over a 30-minute period, prior to dredging, to passively disturb and deter resident marine fauna. During soft-start, the dedicated MFO will continuously monitor the management zones.

- Full energy dredging may only commence after the 30-minute period, if no marine fauna are sighted in the Exclusion Zone.
- If target marine fauna are observed in the Observation Zone, soft-start procedures will continue and the MFO will continue to monitor the marine fauna.
- If target marine fauna are observed in the Exclusion zone, soft-start procedures will cease until the observed target marine fauna leaves the Exclusion Zone or has not been seen for 30 minutes, on competition of the 30 minutes duration and no animal has been observed in the Exclusion Zone soft-start procedures will recommence.

If it is evident that the marine fauna are in distress then dredging operations shall cease until marine fauna have exited the management zones or have not been seen for 30 minutes. Once target marine fauna have exited the management zone, soft-start dredging may recommence.

Dredging and disposal

A suitably trained MFO must monitor the observation radius of 500 m (Observation Zone) around the dredging activities continuously during these works to identify if there are any target marine fauna in the management zones. If marine fauna sighted in Exclusion Zone shut-down procedures apply.

Shut-down procedures

The trained MFO must notify the Project manager/Dredging contractor if target marine fauna is sighted within the corresponding Observation and Exclusion Zone. The following will then be undertaken:

- If a suitably trained MFO observes target marine fauna within the nominated dredging or disposal Exclusion zones, then these activities must be suspended within two minutes of the sighting or as soon as safely possible.
- Dredging or disposal activities that have been suspended must not recommence until the sighted fauna have moved beyond the Exclusion Zone or not sighted for at least 30 minutes.
- Once able to resume, dredging it will recommence following soft-start procedures.

Low-visibility and nightworks

During periods of low visibility (where a distance out to 1 km cannot be clearly viewed), dredging activities may be undertaken, provided that during the preceding 24-hour period:

- There have not been 3 or more marine fauna shutdowns.
- A 2-hour period of good visibility has been maintained prior to onset of low visibility, and no marine fauna were sighted.
- If marine fauna is detected in the Exclusion Zone during poor, visibility, operations must cease until visibility improves to enable full visual monitoring of the management zones.

Vessel approach distances

A suitably trained MFO (see below) must maintain a watch for cetaceans (i.e., whales and dolphins) and marine turtles during transit of the barge and tug. If any of these organisms are sighted within 300 m the tug and barge maximum vessel speed must be limited to 5 knots (See Section below and Table B-1).

The distances have considered the Australian National Guidelines for Whale and Dolphin Watching (DoEE 2017) and the National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna (CoA 2017). During transit for the dredge and barge the trained MFOs will maintain watch to out for marine fauna.

The speed limit within the Proposal area is already below 6 knots and therefore consistent with vessel speed restriction for marine fauna of 6 knots. Caution zones cannot be entered into by a vessel if the animal is injured, stranded, entangled, or distressed or if a single calf or pod of calves are present. No more than three vessels are permitted to be in a caution zone at the same time. Should a travelling dolphin enter the no approach zone, including with an attempt to 'bow ride', the vessel shall either maintain its course and speed, or maintain its course and gradually slow down.

Table B- 2: Vessel approach distances (DoEE 2017)

Marine fauna group	Caution zone	No approach zone (metres)	Distress/disturbance
Adult whales	300	100 m to the side of the whale 300 m in front or to rear of the whale	Withdraw from caution zone at speed less than 6 knots
Whale calf* present	-	300 m	Withdraw from No approach zone at speed less than 6 knots

Marine fauna group	Caution zone	No approach zone (metres)	Distress/disturbance
Adult dolphins	150	50 m to the side of the dolphin 150 m in front or to rear of the dolphin with the exception of animals bow-riding	Withdraw from caution zone at speed less than 6 knots
Dolphin calf* present	-	150 m	Withdraw from No approach zone at speed less than 6 knots
Sea lion	300 m	100 m	Withdrawn from No approach zone at a speed less than 6 knots
**A calf is defined as half the length of the mother/nearest adult*			

Trained Marine Fauna Observer

Training and qualifications

Trained MFOs are crew members trained in marine fauna species observations and mitigation measures, consistent with the proposal environmental management plans. Trained MFOs will be on duty on proposal vessel during dredging. There will be always at least one Trained MFO on duty during dredging.

All vessel crews engaged for the marine construction and dredging for the Proposal will attend a minimum of one marine fauna induction to become familiar with the range of conservation significant marine fauna that could be present in the proposal area and the risks the dredging may present to this fauna. All commitments made by RIA to manage dredging activity with conservation significant marine fauna will be included in the induction. The content of the induction will be updated as required to ensure it remains current and reflects the marine fauna being observed in the proposal area and any vessel interactions with marine fauna that has occurred. This marine fauna induction can be combined with other crew inductions that may be required. Evidence of personnel and training certificates will be kept on record, which may be used in future audits. Information will include:

- MFO name and contact details
- Details of MFO training.

Frequency

Marine fauna observations shall be undertaken for the duration of dredging and disposal activities.

Location

Appropriate monitoring locations shall be selected by the MFO prior to the commencement of a dredging activities to ensure an unobstructed view of the exclusion zones describe above.

Records & Reporting

Field log

Trained MFOs will use pre-designed datasheets to record observer effort, fauna observations and mitigation measures. They will be based on those developed by the Australian Government to record marine fauna sightings made during seismic surveys. Datasheets will include:

- Location, date and start time of survey
- Name, qualifications and experience of MFOs involved in the survey
- Location, times and reasons when observations were hampered by poor sighting conditions
- Location and time of start-up delays, power downs, or stop work procedures as a result of marine fauna sightings
- Location, time and distance of any fauna sightings including species where possible.

Reportable incidents

All contractor employees shall immediately report all environmental incidents as a non-conformance (i.e. performance indicators are not met or management actions are not followed (See Section 2; Table 5)) to the site supervisor who will investigate the incident with both the RIA Project Manager and Contractor Project Manager.

Reportable incidences are injury to wildlife as a result of the proposal activities or general observations of injured wildlife not related to proposal activities to be reported to Subcon PM. The PM is to notify RIA, who will notify the DBCA.

It is a requirement that all incidents follow a contractor's Incident Management Procedure. The employee is to report the incident immediately to the site supervisor. In every case the site supervisor is to document the incident using RIA's Incident Management System.

Completion report

On completion of the program, a full report will be submitted which will allow compliance auditing. A log detailing marine fauna sightings and activities will also be maintained on all vessels.

All employees of RIA and Contractor shall immediately report all environmental incidents as a non-conformance (i.e., performance indicators are not met or management actions are not followed) to the Contractor site supervisor who will investigate the incident with both the Contractor Project Manager (PM) and RIA Project Manager.

Reportable incidences are injury to wildlife as a result of the proposal activities or general observations of injured wildlife not related to proposal activities to be reported to Contractor PM. The PM is to notify RIA who will notify the DBCA within 48 hours (See Table 16).

It is a requirement that all incidents follow the prepared incident Management Procedure by the Contractor. The employee is to report the incident immediately to the site supervisor. In every case the site supervisor is to document the incident using notify RIA Incident Management System.

B.3.2. Reactive Marine Fauna Monitoring

If significant changes in BCH are reported, it is likely this may also have impacts on marine fauna within and surrounding the Proposal area, and reactive marine fauna monitoring will be implemented. The reactive marine fauna monitoring will be developed consistent with RIA's Rottnest Island Marine Conservation Action Plan 2022-2032.

Monitoring will occur at the sites where significant changes to BCH have been recorded and the BCH reference site (see Figure 7 and Appendix B.2). The trends for the key ecological attributes, as identified in the Rottnest Island Marine Conservation Action Plan 2022-2032 will be monitored at these sites as

outlined in Table B3-1 and will be compared to the trends observed monitoring sites as described in RIAs Rottnest Island Marine Conservation Action Plan 2022-2032 to determine if this decreasing trend is attributable to the Proposal.

Table B3-3: Recreative marine fauna monitoring indicators and triggers

RIA conservation targets	Key ecological attribute	Indicator	Trigger
Seagrass community	Fish, sharks and rays diversity, abundance and size structure	Species diversity, abundance and size structure	Decreasing trend
	Fish recruitment	Species diversity and abundance	Decreasing trend
Subtidal reef community	Fish, sharks and rays diversity, abundance and size structure	Species diversity, abundance and size structure	Decreasing trend
	Fish recruitment	Species diversity and abundance	Decreasing trend
Water column	Mobile fish diversity and size structure, including sharks and rays	Species composition and size structure	Decreasing trend