



Kimberley Marine Offloading Facility

Environmental Review Document



PROPONENT: Kimberley Marine Support Base Pty Ltd
STATUS: Rev 1 **REPORT No.:** 200018
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Biodiversity, Conservation and Attractions (2018) Threatened and Priority Flora Database Search for Broome accessed on the 21 June 2019. Prepared by the Species and Communities program for Melanie Donda, O2 Marine for a Preliminary Environmental Impact Assessment of the Broome Boating Facility.

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Version Register

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Executive Summary

Kimberley Marine Support Base Pty Ltd (KMSB) are proposing to develop the Kimberley Marine Offloading Facility (the Proposal) at the Port of Broome, approximately 200 m south of the existing Broome Wharf. The proposed development will consist of a floating deep-water wharf and associated hardstand facilities suitable for container and general cargo stevedoring for coastal trading vessels, as well as berthing and mooring of Cruise Vessels and Roll on/Roll off ships. The KMSB will also provide general logistics and refuelling services to berthed vessels.

This Environmental Review Document provides supplementary information to support referral of the Proposal to the Environmental Protection Authority (EPA) in accordance Section 38 (Part IV) of the Environmental Protection Act 1986 (EP Act).

The Proposal is considered to pose a moderate risk to three of the EPA's environmental factors: Marine Environmental Quality, Marine Fauna and Terrestrial Fauna. The actual and potential impacts of the Proposal on each of these factors has been investigated and the significance of the impacts evaluated. A summary of the predicted outcomes for each key environmental factor is provided below.

Marine Environmental Quality

The proposal will result in the following predicted EPOs with respect to marine environmental quality:

- > Temporary and localised slight increase in turbidity immediately surrounding the piling operations;
- > No residual impact on marine environmental quality as a result of the Proposal activities; and
- > Maintenance of marine environmental quality in accordance with the Levels of Ecological Protection specified in the existing KPA OMMP.

Based on the above EPOs, and in consideration of the proposed monitoring and management strategies, the Proposal activities are not expected to pose a significant residual risks to maintaining the quality of water, sediment and biota and therefore the environmental values can be protected. In relation to the proposal, the Proponent considers that the EPA's objective for marine environmental quality has been met.

Marine Fauna

Implementation of the Proposal in accordance with the defined mitigation, management and monitoring actions will result within the following Environmental Protection Outcomes:

- > No impacts to important habitats (i.e. nesting, nursery, foraging or breeding areas), for any conservation significant marine fauna species;
- > No harm to any individual conservation significant fauna species;
- > No reduction in populations of species of local and regional importance;
- > No reduction in the biodiversity of marine fauna in the Development Envelope or surrounds;
- > No introduction and/or spread of invasive marine species or diseases; and

- > Temporary disturbance of marine fauna present in the vicinity of piling operations, possibly resulting in temporary behavioural changes to avoid the noise-affected area.

The combined impact of the Proposal activities and the consequent outcomes are not considered to pose any significant residual risks to the protection of marine fauna and therefore biological diversity and ecological integrity can be maintained. In respect of the proposed design and management of the Proposal, the Proponent considers that the EPA's objective for marine fauna has been met.

Terrestrial Fauna

Implementation of the Proposal in accordance with the defined mitigation, management and monitoring actions will result within the following Environmental Protection Outcomes:

- > Direct loss of 0.0028 ha of foraging habitat for Ruddy Turnstone;
- > Potential indirect impact to 3.25 ha of foraging habitat for Ruddy Turnstone as a result of LOS impairment from the new trestle jetty;
- > No reduction in the regional (i.e. Broome & Roebuck Bay) population of shorebirds is predicted;
- > No harm to any individual conservation significant terrestrial fauna species;
- > No reduction in the biodiversity of terrestrial fauna in the Development Envelope or surrounds;
- > No introduction and/or spread of invasive marine species or diseases; and
- > Temporary disturbance of migratory shorebirds present in the vicinity of construction activities, possibly resulting in temporary behavioural changes to avoid the noise-affected area.

The combined impact of the Proposal activities and the consequent outcomes are not considered to pose any significant residual risks to the protection of terrestrial fauna and therefore biological diversity and ecological integrity can be maintained. In respect of the proposed design and management of the Proposal, the Proponent considers that the EPA's objective for terrestrial fauna has been met.

Holistic Impact Assessment

Overall actual and potential impacts of the Proposal on the environment are considered not to represent a significant environmental risk on the basis that:

- > The EP Act principles and relevant EPA guidance documents have been considered in investigating and evaluating potential impacts of the Proposal on the EPA's environmental factors;
- > A comprehensive set of monitoring and management measures have been developed to further mitigate and avoid potential impacts of the Proposal on the EPA's environmental factors;
- > The proponent has committed to open and transparent reporting of environmental performance throughout the Proposal construction phase; and
- > Evaluation of impacts against all relevant environmental factors, including other environmental factors, determined that the EPA's objectives would be met.

Acronyms and Abbreviations

Acronyms/Abbreviation	Description
AHA	Aboriginal Heritage Act
AHD	Australian Height Datum
BBF	Broome Boating Facility
BC	Biodiversity Conservation
BCH	Benthic Communities & Habitat
BFA	Broome Future Alliance
BIA	Biologically Important Area
CAMBA	China-Australia Migratory Bird Agreement
CCTV	Closed Circuit Television
CD	Chart Datum
CEMP	Construction Environmental Management Plan
CHRMAP	Coastal Hazard Risk Management Adaption Plan
CMR	Commonwealth Marine Reserve
CMS	Case (Management System) number
COPC	Contaminants of potential concern
CP	Clearing Permit
CWL	Construction Works Lease
DAWE	Department of Agriculture, Water and Environment
DGV	Default Guideline Value
DMAs	Decision Making Authorities
DoT	Department of Transport
DPLH	Department of Planning Lands and Heritage
DWER	Department of Water and Environmental Regulation
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EP	Environmental Protection
EPA	Environmental Protection Authority
EPBC	Environmental Protection and Biodiversity Conservation

ERD	Environmental Review Document
EMS	Environmental Management System
EQMF	Environmental Quality Framework
EQO	Environmental Quality Objectives
EV	Environmental Values
FID	Flight Initiation Distance
ha	Hectares
HWA	Heritage of Western Australia
HWCA	Heritage Council Western Australia
HSE	Health, Safety & Environment
IA	International Agreement
IMEQMP	Integrated Marine Environmental Quality Management Plan
IMS	Invasive Marine Species
IUCN	International Union for Conservation of Nature
JAMBA	Japan-Australia Migratory Bird Agreement
JHA	Job Hazard Assessment
km	Kilometer
km ²	Square kilometer
KMOF	Kimberley Marine Offloading Facility
KMSB	Kimberley Marine Support Base Pty Ltd
KPA	Kimberley Ports Authority
KSN	Kimberley Science Mode
LEP	Levels of Ecological Protection
LNG	Liquid Natural Gas
LOS	Line of Sight
m	Meters
m ²	Square meter
mm	Millimeters
MA	Maritime Archaeology
MARPOL	Maritime Organization International Convention for the Prevention of Pollution from Ships

MBES	Multibeam Echo Sounder
MFO	Marine Fauna Observer
MNES	Matters of National Environmental Significance
NHP	National Heritage Place
NM	Nautical Miles
O2M	O2 Marine
OMMP	Ongoing Marine Monitoring Program
PBC	Prescribed Body Corporate
PEC	Priority Ecological Community
PLA	Ports Legislation Amendment Act
P2, P3 and P4	Priority 2, Priority 3 and Priority 4
ROKAMBA	Republic of Korean-Australia Migratory Bird Agreement
ROV	Remote Operated Vehicle
SBH	Safe Boat Harbour
SOP	Safe Operating Procedure
TEC	Threatened Ecological Community
TTS	Temporary Threshold Shift
TEMP	Tenancy Environmental Management Plan
UCH	Underwater Cultural Heritage
WA	Western Australia
WAMSI	West Australian Marine Science Institute
%	Percent

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1. Introduction

1.1. Document Purpose & Scope

This Environmental Review Document (ERD) presents an Environmental Review of a Proposal to develop the Kimberley Marine Offloading Facility (KMOF) in Broome, WA (the Proposal). The purpose of this ERD is to provide supplementary information to support referral of the Proposal to the Environmental Protection Authority (EPA) in accordance with Section 38 (Part IV) of the Environmental Protection Act 1986 (EP Act).

This document has been prepared in accordance with the structure and requirements of the EPA's 'Instructions and Template: Environmental Review Document'. The scope of the document includes:

- > A description of the Proposal (Section 2);
- > Summary of stakeholder engagement undertaken in support of the Proposal (Section 3);
- > An assessment of the potential environmental impacts of the Proposal in accordance with the EPA's Environmental principles, factors and associated objectives (Section 4);
- > An assessment of the potential environmental impacts of the Proposal on other environmental factors or matters against the environmental objective/s (Section 5);
- > Identification of any proposed offsets for the Proposal (Section 7); and
- > A holistic assessment of the impacts of the Proposal on the environment (Section 8).

1.2. Proponent

The Proponent for this Proposal is the Kimberley Marine Support Base Pty Ltd (KMSB). The Proponent details are provided in **Table 1**.

Table 1 Proponent Details

Entity Name:	Kimberley Marine Support Base Pty Ltd
Australian Business Number (ABN):	61 622 693 663
Address:	Suite 2, 105 Forrest Street, Cottesloe Western Australia 6011
Key Contact (Role):	Andrew Natta
Key Contact Email:	andrew@kmsb.com.au

1.3. Environmental Impact Assessment Process

1.3.1. Environmental Protection Act 1986 (EP Act) (Part IV)

A pre-referral meeting was held on the 18th December 2019 with the Department of Water and Environmental Regulation (DWER) to discuss the Proposal, the potential environmental impacts and the requirement for referral of the Proposal to the West Australian Environmental Protection Authority

in accordance with Part IV (Section 38) of the Environmental Protection Act 1986 (EP Act). Outcomes of the pre-referral meeting are summarised in **Table 6**.

Environmental Factors

The following three key environmental factors were identified for the Proposal construction and operational activities which could pose a moderate risk of compromising their respective Environmental Objectives:

- > Marine Environmental Quality;
- > Marine Fauna; and
- > Terrestrial Fauna.

Nine other environmental factors relevant to the Proposal were identified, however, due to the low risk of environmental impact, and in consideration of the mitigation measures proposed to manage potential impacts, these factors are not expected to be required for assessment by the EPA. The following environmental factors are deemed less significant, largely due to the existing environment/land use in which they occur. The other environmental factors are:

- > Benthic Communities and Habitat;
- > Coastal Processes;
- > Flora and Vegetation;
- > Landforms;
- > Terrestrial Environmental Quality;
- > Inland Water Environmental Quality;
- > Hydrological Processes;
- > Air Quality; and
- > Social Surroundings.

1.3.2. *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*

A pre-referral meeting was held on the 14th May 2020 with the Department of Agriculture, Water and Environment (DAWE) to discuss the Proposal, the potential impacts on Matters of National Environmental Significance (MNES) and the requirement for referral of the Proposal in accordance with the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Outcomes of the pre-referral meeting are summarised in **Table 6**.

Following this meeting, the Proponent determined that a referral of the Proposal is warranted and the Proposal was referred to DAWE concurrent with the Section 38 referral.

The potential for impacts upon MNES are considered and discussed briefly in **Section 2.3.2** and as they relate to the relevant environmental factors in **Section 4** and **Section 5**.

1.4. Other Approvals and Regulation

The Proposal is located on land under the jurisdiction of the Kimberley Ports Authority (KPA) and is zoned as 'Port' in the Broome Shire Town Planning Scheme No.6 (Shire of Broome, 2018). In addition,

the Development Envelope is positioned in an area that is identified in the KPA Port of Broome Masterplan as the 'Port Operational Terminal (Security Zone)' and is suitable for future Marine and Landside Development (GHD 2017).

The key legislation that applies to this ERD includes, but is not limited to:

- > *Aboriginal Heritage Act 1972* (AH Act);
- > *Biodiversity Conservation Act 2016* (BC Act);
- > *Environmental Protection Act 1986* (EP Act);
- > *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- > *Heritage of Western Australian Act 1990* (HWA Act);
- > *Underwater Cultural Heritage Act 2018* (UCH Act);
- > *Jetties Act 1926* (Jetties Act);
- > *Maritime Archaeology Act 1973* (MA Act); and
- > *Ports Legislation Amendment Act 2014* (PLA Act).

The key decision-making authorities (DMAs) and the other relevant approvals for the Proposal are identified in **Table 2**.

Table 2 Other approvals and regulation

Proposal Activities	Land tenure / Access	Type of Approval	Legislation Regulating the Activity	Responsible Agency	Timeframe
Floating wharf and trestle jetty development	'Seabed' Port of Broome Limits	Construction Works Lease (CWL)	PLA Act	Kimberley Ports Authority	Lease agreement executed on 08/10/2019
		Permission	AH Act	Nyamba Buru Yawuru	Permission obtained on 20/02/2020
		Jetty Licence	Jetties Act	Department of Transport	Application pending
Landside Terminal	Part of Lot 698 on DP 209491 Part of lot 621 on DP 70861	Lease Agreement	PLA Act	Kimberley Ports Authority	Lease agreement executed on 08/10/2019
		Permission	AH Act	Nyamba Buru Yawuru	Permission obtained on 20/02/2020
Clearing of Native Vegetation	Part of Lot 698 on DP 209491 Part of lot 621 on DP 70861	Native Vegetation Clearing Permit	EP Act	DWER	Clearing Permit CPS7256/1 was issued on 10/12/2016
Wharf Operations	'Waters' Port of Broome Limits	Lease Agreement	PLA Act	Kimberley Ports Authority	Lease agreement executed on 08/10/2019

1.4.1. Kimberley Port Authority Lease Arrangements

On the 8th of October 2019, KMSB signed a series of binding agreements with the Kimberley Ports Authority (KPA) to secure tenure and also set the context in which the KMOF will be managed and operated.

The Construction Works Lease (CWL) is the legal instrument that outlines KMSB's rights and obligations during the construction of the KMOF. This agreement notes the requirement of KMSB to secure all relevant approvals to the satisfaction of the KPA prior to construction commencing.

In addition to the statutory approvals, KMSB is also required to undertake a baseline environmental site assessment which will form the basis for ongoing monitoring and reporting to the KPA over the life of the agreement. The agreement specifies that the baseline assessment will need to consider:

- > The current state and condition of the Construction Area;
- > The existence, nature and level of and risk associated with any contamination or Pollution on, in or under the Construction Area;
- > The risk associated with any Contamination or pollution on, in or under the Construction Area, including the risk of that Contamination or pollution migrating from the Construction Area; and
- > Present the Baseline Environmental Report summarising all relevant findings to the level of detail considered satisfactory by the KPA no later than the Construction Commencement Date.

During the construction period KMSB will be governed by the Construction Environmental Management Plan (CEMP), which is also required to be submitted to the KPA for approval prior to construction commencing.

For the Operation of the Facility, KMSB is governed by a Terminal Lease and Licence in which the KPA have mandated KMSB to adhere to an Tenancy Environmental Management Plan (TEMP) which the KPA will approve to ensure consistency with the KPA (2019) EMP for the Port of Broome.

2. The Proposal

Kimberley Marine Support Base Pty Ltd (KMSB) is proposing to develop the Kimberley Marine Offloading Facility (KMOF) at the Port of Broome, Western Australia (**Figure 2**).

2.1. Background

O2 Marine (O2M) completed a Preliminary Environmental Impact Assessment in early 2019 as part of a pre-feasibility assessment. This document identified the anticipated environmental approvals and additional environmental technical investigations and management plans required to support the environmental approvals.

O2M and KMSB held a pre-referral meeting with the Department of Agriculture, Water and Environmental (DAWE) on the 18th December 2019 to discuss potential impacts, including Matters of National Environmental Significance, possible pre-liminary key environmental factors, stakeholder consultation, proposed management measures and potential assessment pathways for the proposal. .

A decision was made following the pre-referral discussion with DWER that both State (Environmental Protection Act 1986) and Commonwealth (Environmental Protection & Biodiversity Conservation Act 1999) environmental approval will be required for the proposal. KMSB made the decision to prepare a supplementary report for proposal referrals consistent with the requirements of an Environmental Review Document. The following further studies were then commissioned to provide a sufficient information with the referral:

- > Underwater Noise Modelling (Appendix C);
- > Shorebird Survey (Appendix D);
- > Benthic Infauna Survey (Appendix E); and
- > Flora and Fauna Habitat Survey (Appendix F).

Environmental Management Plans will also be prepared in accordance with Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans to support the referrals.

On 20th September 2019, the Minister for Transport, Hon Alannah MacTiernan, announced the State Government's approval of the lease agreements at the Port of Broome to enable the proposal to proceed to the next stage.

2.2. Proposal Description

2.2.1. Key Proposal Characteristics

The proposed KMOF involves construction and operation of a deep-water floating wharf, along with associated onshore hardstand and terminal facilities suitable for container and general cargo stevedoring for coastal trading vessels, as well as berthing and mooring for Cruise Vessels and Roll on/Roll off ships. The KMOF Project is comprised of five key components of infrastructure areas as depicted in **Figure 1**:

- > Landside terminal;
- > Access trestle;
- > Linkspan bridge;
- > Caisson pile restraint structure; and
- > Floating wharf.

The access trestle provides for heavy vehicle transport of cargo to and from the landside terminal. The linkspan bridge connects the fixed access trestle and floating wharf, providing vehicle access at all tides. The KMSB will also provide general logistics and refuelling services to berthed vessels.

Consistent with the requirements outlined within the EPA's '*Instructions on how to define the key characteristics of a proposal*', a summary of the Proposal is provided in **Table 3** and the key characteristics, including physical and operational elements are summarised in **Table 4** and presented in **Figure 1**.

Table 3 Summary of the Proposal

Proposal Title	Kimberley Marine Offloading Facility
Proponent Name	Kimberley Marine Support Base Pty Ltd
Short Description	Construction and operation of a common-user facility aligned to Kimberley Port Authority (KPA) with a floating deep-water wharf, onshore hard stand area, fueling facility and associated support services.

Table 4 Location and proposed extent of physical and operational elements

Element	Location	Proposed Extent
Physical Elements		
Hardstand area & associated infrastructure	Figure 1	Clearing of ~0.3 ha of native vegetation within the development envelope. Construction of access roads, stormwater drainage, fencing as required.
Access Trestle	Figure 1	Installation of ~36, 1500 mm steel piles along a 420 m long and 12 m wide trestle jetty.
Linkspan Bridge	Figure 1	Bridge platform of ~85 m length and ~12 m width and includes two dolphin structures each supported by 1800 mm steel piles.
Caisson Pile Restraint Structure	Figure 1	Installation of 1800 mm steel piles for a restraint system to support the floating pontoon.
Floating Wharf	Figure 1	Installation of 1 ha floating pontoon.
Operational Elements		
General wharf operations		Wharf operations include but are not limited vessel loading and unloading, refuelling and other ancillary support services.

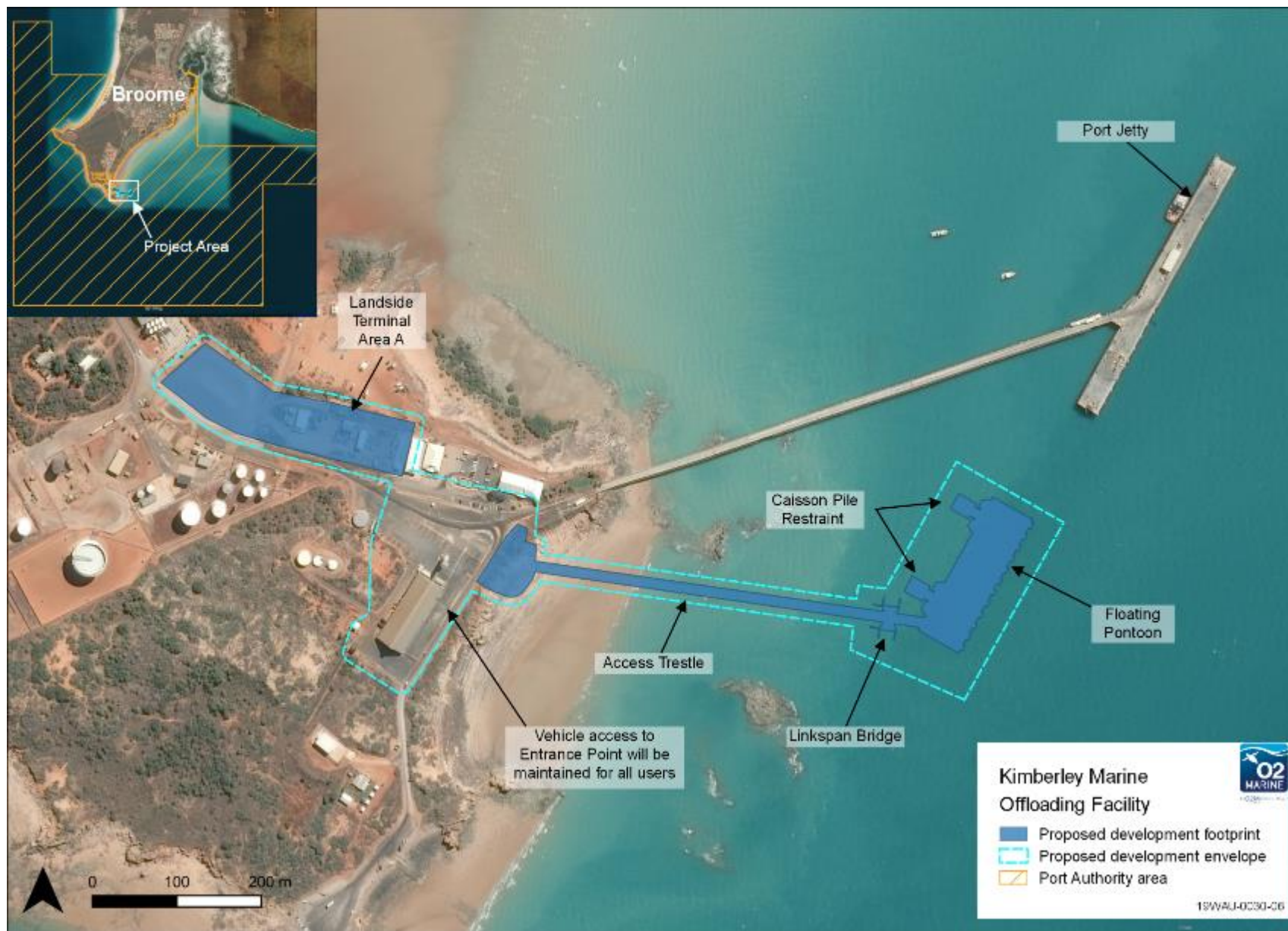


Figure 1 Proposed KMOF Infrastructure Layout and Associated Development Envelope

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KMSB Pty Ltd

Kimberley Marine Offloading Facility: Environmental Review Document

2.2.2. Justification

The Port of Broome has played a vital role in the past 126 years in the development of the North West and the Kimberley regional economy servicing the offshore oil and gas industry, cattle export, general cargo, fishing and charter boat industries, cruise ships, naval and custom boats. The proposed KMOF is planned to build on the capacity of the Port of Broome and strengthen the Kimberley region's economy by providing the infrastructure to support the growth of the Kimberley's existing industries and capitalise on Broome's proximity to Asia. It will also enable new industries to establish through direct import and export linkages, leading to new jobs and economic diversification.

2.2.3. Proposal Design Evolution

Before a lease agreement was resolved with the KPA for the location and design of the proposed facility, KMSB undertook a pre-feasibility assessment which considered multiple sites and design configurations to balance operational efficiency with the considerable cultural, environmental and engineering constraints which apply to development in the KMOF Project Area. Two primary site options were identified for investigation:

- > North-West of the current Port Jetty (in front of the existing slipway); and
- > South of the existing facility (in front of the sorghum shed or the current site).


Analysis was undertaken on the social, cultural, environmental and operational factors of each site during the pre-feasibility assessment with the current location chosen due to lower impacts across all areas of investigation. The primary advantage of the selected site was that it eliminated the need for capital dredging and spoil disposal during construction, with associated environmental impacts, and continued requirement for maintenance dredging during the life of the KMOF Project.

The initial design at the current location previously included a land-reclaimed hardstand area extending approximately 100 m northeast across the intertidal zone of Broome Jetty beach to meet the access trestle. In consultation with various stakeholders, KMSB made amendments to the design to reduce the width of the reclaimed hardstand area across the intertidal zone adjacent to the dune system and extend the access trestle, allowing the community to continue to access and utilise Broome Jetty beach.

Further detailed consultation with the Yawuru Prescribed Body Corporate (PBC) was undertaken to improve understanding of the cultural heritage values of the proposed development footprint. Nyamba Buru Yawuru engaged Spectrum Ecology to facilitate a heritage survey and ethnographic consultation regarding the mythological and ceremonial values within and surrounding the proposed KMOF development envelope. Based on the results of the analysis and Yawuru community input, the design was further modified, particularly the hardstand area, with land reclamation on the beach being limited to allowing the jetty to cross the dune system. This change ensured together with the elevated design and maximum spacing between pylons ensured that cultural and community access was not affected. The current design was approved by Yawuru PBC on 20th February 2020.

The current design is the result of ongoing engagement and consultation with key stakeholders to ensure environmental impacts for the KMOF Project are as low impact as practicable. A summary of the project design evolution, including key elements is provided in **Table 5**.

Table 5 KMOF Design Evolution

Concept Design	Key Design Elements & Changes
	<p><u>February 2018</u></p> <p>Key Design Elements:</p> <ul style="list-style-type: none"> > Causeway reclamation - 14,000 m² > Access trestle – 408 m > Linkspan bridge – 85 m > Floating wharf – 82 m x 120 m > Dredged approach channel and turning basin



November 2018

Key Design Elements:

- > Reclamation area for landside terminal – 16,000 m²
- > Access trestle – 350 m
- > Linkspan bridge – 85 m
- > Restraint structures x4.
- > Floating wharf – 82 m x 168 m
- > Berthing / mooring dolphins x3.

Changes from Previous Design:

- > Re-positioned to south of existing jetty
- > Dredging eliminated – Floating wharf now position next to naturally deep channel
- > Reclamation area for landside terminal added
- > Positioned in area of 'least concern' for dinosaur footprints



December 2019

Key Design Elements:

- > Reclamation for landside terminal - 13,000 m²
- > Access trestle – 325 m
- > Linkspan bridge – 85 m
- > Restraint structures x4
- > Floating wharf – 82 m x 168 m
- > Berthing / mooring dolphins x3

Changes from Previous Design:

- > Extent of reclamation for landside terminal reduced



May 2020 – Proposed Final Design

Key Design Elements:

- > Causeway – 2,000m²
- > Access trestle – 400m
- > Linkspan bridge – 85m
- > Restraint structures – 2 No.
- > Floating wharf – 55m x 180m

Changes from Previous Design:

- > Number and footprint of restraint structures reduced
- > Reclamation area for landside terminal eliminated
- > Berthing / mooring dolphins eliminated
- > Disturbance footprint reduced

2.2.4. Proposal Construction Elements

Scope of Construction Work

The scope and sequencing of the construction elements of the Proposal includes:

1. Establishment of temporary construction site facility
2. Construction of causeway and abutment
3. Mobilisation of jack-up barge, material barge, and other support vessels
4. Installation of steel tubular piles, jackets, and headstock substructures
5. Erection of access trestle modules superstructure
6. Installation of sheet piles
7. Construction of concrete capping beams
8. Installation of pile guide framework
9. Delivery and installation of floating wharf
10. Erection of linkspan modules
11. Levelling and surfacing of landside terminal area
12. Construction of KMOF offices within Landside terminal area.

Preliminary Construction Schedule

Under the current proposed schedule, construction activities are planned to commence in Quarter 1, 2021 once all required internal and external approvals are granted. Construction is proposed to occur 24 hours per day, 7 days per week for approximately eight months.

Construction Site Facility

The area which is intended for use for site facilities and lay-down is located at the proposed Landside Terminal on Port Drive, pending confirmation from the KPA. The Lay-Down area will be used for laydown of equipment and materials such as piles and trestle modules. A basic site office with relevant amenities will be set-up. This site office will contain all the requirements under the contract as well as the superintendent's office (if required). No clearing of native vegetation is required for use of, or access to this location.

Landside Terminal

KMSB will be utilising previously developed land within the Port of Broome to facilitate its landside terminal. All assets on the land in which the KPA maintenance yard is located will be removed and the site sealed to facilitate a just in time laydown area. This design and methodology for delivery will adhere to the KPA's development standards which included the management of stormwater.

The landside terminal will be levelled using imported clean fill and compacted to create suitable hard stand areas. Appropriate drainage and stormwater management will be installed within the landside terminal area to ensure that all runoff from the hardstand areas is directed through appropriate stormwater drainage network. KMOF offices and storage sheds will also be erected within the landside terminal area.

Causeway

The approach causeway is required to accommodate heavy vehicle maneuvers exiting the roundabout and to provide a stopping area before crossing the trestle. The area will be built up using imported sand fill. Rock protection will be placed on side slopes to protect against erosion. The abutment will then be constructed from the shore.

Access Trestle & Linkspan Bridge

Observing applicable environmental controls, steel tubular piled foundations will be driven in pairs to depth using pile top drilling and hydraulic hammer techniques. Depending on the construction methodology, piling will be either be conducted from a jack-up barge or from a canti-traveller.

Prefabricated steel headstocks and jacket frames will be craned onto the piles and grouted into position. Steel trestle modules will be erected into position with the concrete deck panels installed afterwards. With a canti-traveller approach, modules will be fed from shore and erected behind the advancing front. Otherwise modules will be delivered and erected into position from a crane barge.

The linkspan pontoon and first span will be craned into position. The second span can only be installed once the floating wharf is in place.

Restraint Structures

Sheet piles will be driven into the seabed from a jack-up barge. Once the box has been formed, imported fill will be placed inside. Tie rods and other internal components will be installed internally before the box is filled to the top. Concrete capping beams will be constructed on top of the caisson comprising precast and in-situ concrete elements which will be delivered by barge.

Piling is the most significant construction activity generating underwater noise. Approximately 46 piles are proposed to be used for the jetty and wharf construction. Minimal dressing of tubular piles is required due to adoption of jackets. The activity of cutting and grinding piles has therefore not been included. Piling activities can be divided as follows:

- > Jetty and Restraint Structure piles will be tubular piles which will be driven in using a combination of hydraulic impact hammer and drilling. The tubular piles will be driven in one at a time.
- > Raking piles will also be tubular piles which will be drilled to include rock anchors.
- > Caissons will be formed using sheet piles which will be inserted using a vibro-hammer.

Of the 46 piles, approximately 36 piles occur within the intertidal and shallow water zone (i.e. < 5 m), 8 piles are in less than 10 m of water and the remaining 2 piles are in 10 to 22 m water depth.

Floating Wharf

The steel floating wharf will be constructed offsite and towed into position once the restraint structures are complete. The vessel will be temporarily moored in position while the pile guide is assembled around the jacket. The vessel will be ballasted to achieve the operating configuration. Services will be finally installed and connected to shore.

2.2.5. Proposal Operational Elements

Development of the KMOF will enable the Port of Broome to receive up to approximately 2500 additional vessels per annum. KMSB have executed an agreement with the KPA that aligns all operational practices at the facility to the existing standards at the Port, with the design of the facility catering for the following vessel classes:

- > Anchor Handling;
- > Barge;
- > Bulk Cargo;
- > Cruiseline / Passenger;
- > Diving;
- > Heavy Load;
- > Offshore Supply;
- > Roll-on / Roll-off;
- > Research/Survey; and
- > Tug.

The commercial operation and industry use of the KMOF including the floating platform, waterway access arrangements, priority allocation, arrival/approval processes and facility user charges are managed by the KPA-appointed harbour master.

2.2.6. Exclusions

The scope of the Proposal that is subject to assessment under Part IV of the EP Act excludes:

- > Vessel operations within the Port of Broome waters;
- > Any future changes to the KPA road network within the Port of Broome to maintain public access to Entrance Point. Note - Public access will not be impeded by the proposed KMOF; and
- > Any development associated with the adjacent Department of Transport's proposed Broome Boating Facility (Refer Section 2.3.1).

2.3. Local and Regional Context

The Proposal Development Envelope is situated near to the town of Broome, in West Roebuck Bay between the Port of Broome and Entrance Point, in the Kimberley Region of Western Australia (**Figure 2**). The site is located approximately 200 m south of the existing Port of Broome wharf and approximately 500 m north of the Department of Transport's proposed Broome Boating Facility.

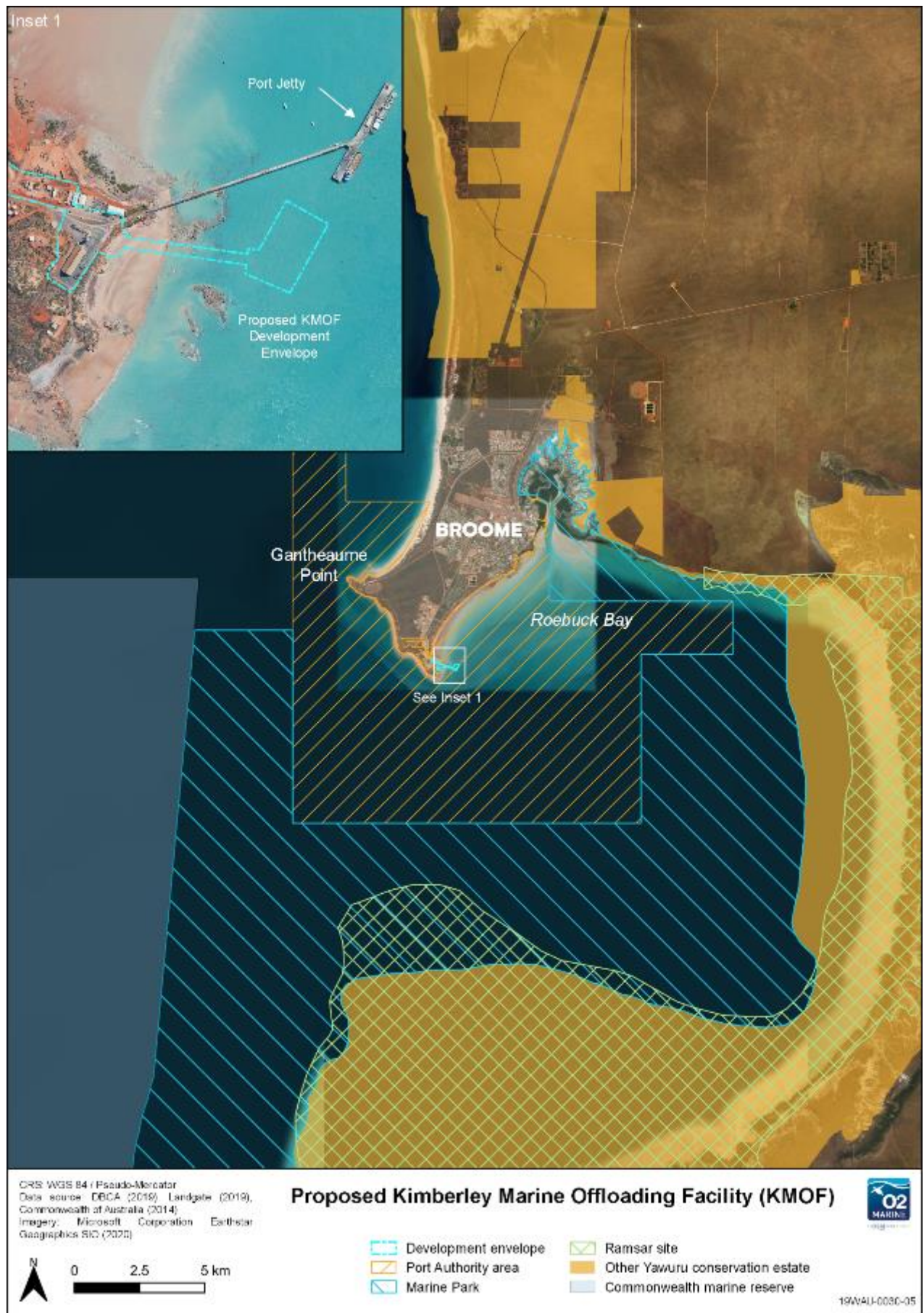


Figure 2 Proposed KMOF Development Envelope – Local & Regional Context

2.3.1. Other Regional Developments

Several recent developments are proposed or have recently been completed within the vicinity of the Proposal area. These include:

- > **Broome Boating Facility** (Proposed – Not Yet Referred) – Small recreational boat harbour and boat ramp proposed to be developed by the Western Australian Department of Transport at Entrance Point, approximately 500m south of the proposed KMOF;
- > **Broome Channel Optimisation Project** (Completed)– Dredging project to improve safe navigation in the Port of Broome waters (EPA CMS 17328). Located within 100m of the proposed KMOF; and
- > **Broome Town Beach Groyne Upgrade and Jetty Project** (Proposed) – Public jetty structure proposed to be constructed within Roebuck Bay adjacent to the main townsite. Located approximately 3km north of the proposed KMOF (EPA CMS 17622).

The above recent developments have been considered in the context of potential cumulative impacts for the proposed KMOF and are discussed as appropriate in Sections 4 and 5.

2.3.2. Environmental Assets

Other than protected or conservation significant species which may occur in the Proposal Area, the following key features of conservation significance were identified within or adjacent to the Proposal area:

Commonwealth Features of Conservation Significance

- > **West Kimberley National Place (NHP)** - The Proposal area is located within 5 km of the West Kimberley NHP. This area is recognised as one of Australia's very special places, primarily due to presence of dinosaur footprints which are typically associated with the areas of exposed Broome Sandstone (CoA, 2011; Salisbury & Romilio, 2018). Impacts to this area are not predicted, however, they are discussed further in **Section 5, Table 15**;
- > **Roebuck Bay RAMSAR Wetland** - The Project area is located approximately 10 km west of the Roebuck Bay RAMSAR Wetland. The Roebuck Bay RAMSAR Wetland is a tropical marine embayment with extensive, biologically diverse intertidal mudflats. The Wetland is recognised as a site of international importance for at least 20 species of migratory shorebirds with total numbers of waders using the site each year estimated at over 300,000. This makes the Roebuck Bay RAMSAR Wetland one of the most important sites for shorebird conservation in the World. Given the distance to from the Proposal area, impacts to this RAMSAR Wetland are not predicted. However, impacts to migratory shorebirds are assessed and discussed in **Section 4.5**;
- > **Roebuck Commonwealth Marine Reserve (CMR)** - The nearest CMR to the Proposal area is the Roebuck CMR, which is located approximately 5 NM west of the Proposal area. Given the distance to from the Proposal area, impacts to this CMR are not predicted;
- > **Threatened Ecological Community** – Flora surveys of the Proposal area identified that the '*Monsoon vine thickets on the coastal sand dunes of the Dampier Peninsula*' TEC occurs adjacent to the Proposed Development Envelope. However, care has been taken to avoid any impacts to this TEC (Refer to **Section 5, Table 15**); and

- > **Underwater Cultural Heritage** - Eleven (11) shipwrecks were identified and additional wrecks identified on the WA museum shipwreck database but the exact location of many of these shipwreck sites is unknown. KMSB commissioned a UCH survey to ensure that the proposal does not impact on any UCH, with the results to be provided to the WA Museum.

State Features of Conservation Significance

- > **Yawuru Nagulagun / Roebuck Bay Marine Park** - The Development envelope lies entirely within KPA Port Limits. However, the Port of Broome is surrounded on all sides by the Yawuru Nagulagun / Roebuck Bay Marine Park which is jointly managed by the Department of Biodiversity, Conservation and Attractions (DBCA) and Nyamba Buru Yawuru Ltd.
- > **Aboriginal Heritage** - Two registered Aboriginal Heritage Sites are recorded in the Aboriginal Heritage Inquiry System (AHIS) as being in the vicinity of the Project area. To better understand and mitigate impacts to Aboriginal heritage, KMSB commissioned a multicriteria analysis of the key cultural and environmental sensitivities of the proposal. The outcomes of this study were then used as a guide to refine the proposal to ensure minimal impact on cultural heritage values. Permission for the proposal was granted by Nyamba Buru Yawuru on 20th February 2020.
- > **Other Heritage** - A search of the Heritage Council database indicates the Port jetty is heritage listed, due to its significant association with shipping, imports and exports and more frequently tourism (Heritage Council 2018). It is unlikely that the heritage values of the Port Jetty would be disturbed in any way as a result of the Project.

There are 34 Shipwrecks identified on the WA Museum Shipwrecks database that are located off the coast of Broome, however only 11 were identified in a search of the online database NationalMap that were nearby to the Project area. Shipwrecks in State Waters are protected under the MA Act.

During World War II a Japanese aerial attack destroyed a number of flying boats moored in Roebuck Bay and many of these vessels and any associated artefacts (i.e. aircrafts, aircraft parts and unexploded ordnances) have not been located (BMT 2018). World War II wrecks are protected under the HWA Act and sovereignty law, as these artefacts remain the property of different nations' military forces.

3. Stakeholder Engagement

3.1. Key Stakeholders

KMSB has been working with key proposal stakeholders to advance the Proposal since 2018.

Given the proximity of the KMSB Project to the town of Broome, and the location of the Project to Matters of National Environmental Significance which the key environmental factors fall under, there are a substantial number of relevant stakeholders. KMSB has undertaken targeted consultation with the following stakeholders:

- > Broome Chamber of Commerce & Industry;
- > Broome Future Alliance;
- > Broome Community;
- > Broome Bird Observatory;
- > Department of Agriculture, Water and the Environment (DAWE);
- > Department of Biodiversity, Conservation and Attractions (DBCA);
- > Department of Primary Industries and Regional Development;
- > Department of Planning Lands and Heritage (DPLH);
- > Department of Transport;
- > Department of Water and Environmental Regulation (DWER);
- > Kimberley Development Commission
- > Kimberley Environs;
- > Kimberley Ports Authority;
- > Kimberley Marine Tourism Association;
- > Pearl Producers Association;
- > Paspaley Pearls Company;
- > Regional Development Australia - Kimberley
- > Roebuck Bay Working Group;
- > Shire of Broome;
- > Nyamba Buru Yawuru Ltd; and
- > WA Museum.

3.2. Stakeholder Consultation

Engagement with key stakeholders involved a combination of face to face meetings, online ‘virtual meetings’, exchange of emails and provision of a comprehensive stakeholder memorandum which included an overview of the Proposal and summary of the potential environmental impacts and proposed management and mitigation. The outcomes of stakeholder consultation that relate to assessment of the Proposal in accordance with Part IV of the EP Act are summarised in **Table 6**. Other unrelated comments that were raised by key stakeholders are being addressed by the Proponent directly with those stakeholders. Copies of Stakeholder feedback forms are included in **Appendix A**.

Key stakeholders were also provided with the opportunity to comment on the ERD (Rev0) on matters relating to assessment of the Proposal in accordance with Part IV of the EP Act through the seven-day public comment period between 9-15 July 2020. The key comments which raise concerns of matters not sufficiently addressed within the ERD are summarised in **Table 6**.

Table 6 Stakeholder Consultation Outcomes

Stakeholder	Date	Consultation	Issues/topics raised	Proponent Response / Outcome
Broome Future Alliance	14/5/2020	Stakeholder Feedback Form	<p>BFA supports the development of the KMOF and continues to liaise with the KPA Board and local Management team, as well as the KMSB management team, on the design, requisite approvals and construction phases of the project, and further opportunities to leverage this facility to attract new businesses, jobs, skills and families into our community .</p> <p>The BFA board is more than satisfied that the KMSB management team, together with the KPA, have undertaken a very effective and professional pathway to bring this project to this stage and is also confident that, together, they will institute effective strategies and management processes to protect the environmental area surrounds as identified in the environmental impact and mitigation study.</p>	KMSB is participating in ongoing consultation with BFA to support information dissemination
			<p>BFA consider the construction phase as being the critical period for diligence and note that is recognised in the EIS findings.</p> <p>BFA also note, that whilst potential impacts may arise through the operation of this facility, these are no more than currently faced by the existing Port of Broome facility and which are being professionally managed by the KPA management team.</p>	In addition to the proposed management strategies, KMSB is also operating under lease agreements with KPA during both construction and operational phases of the facility. The agreements include provision for KMSB to meet KPA environmental monitoring and management commitments. Thus, ensuring that KPA's existing high standards of environmental management are maintained.
Department of Transport	6/5/2020	Stakeholder Feedback Form	<p>KMOF Development Envelope: DoT notes that the proposal's hardstand area will be designed to ensure vehicle access to Entrance Point is maintained for all users. DoT is supportive of maintaining access along Kabbarli Road, but notes that a new access road is currently under investigation that transects the western edge of the proposed hardstand area. The objective of placing a road reserve in this area is to direct public traffic away from areas utilised for Port activities, while minimising the disturbance to the Monsoon Vine Thicket community (Threatened Ecological Community). DoT suggests that KMSB undertake further consultation with the Shire of Broome during the delineation of the proposal's development envelope.</p>	The proposed realignment of the recreational vehicle access to entrance Point is being considered by the Shire of Broome as a possible future project. KMSB is ensuring that the existing road access is maintained to alleviate the need for further works, but is maintaining contact with the Shire of Broome to support a low impact outcome.

			Consider potential cumulative impacts arising from this proposal and together with DoT's proposed Broome Boating Facility.	Potential cumulative impacts of this Proposal and other adjacent projects/proposals are discussed in relation to the factors marine environmental quality (Section 4.2), marine fauna (Section 4.4) and migratory shorebirds (Section 4.5).
			The Shire of Broome and DoT engaged the University of Queensland to undertake a Paleontological Heritage Survey (Salisbury et al, 2018) of the Reddell Point-Entrance Point area in 2018, including the area delineated by KMOF's development envelope. According to the Report, the KMOF's development envelope is located within 'Zone F', which is known to support isolated sauropod tracks and partial trackways on detached rock platforms occurring just below the astronomical high tide mark along the upper shoreline. Although this section of the study area is considered an area of least concern.	KMSB has taken care to site the development in within the area identified by Salisbury et al. (2018) as least concern (Refer Figure 18). In addition, KMSB has taken care to avoid damage to areas of broome sandstone which is the geological feature that has the potential to support the dinosaur footprints. The potential impacts to dinosaur footprints are discussed further in Section 5, Table 15.
			Broome Sandstone: Noting the Paleontological Heritage Issues discussed previously, it may be worth presenting the potential impacts to Broome Sandstone in the context of the EPA Factor - Landforms. Broome Sandstone in the development envelope has a high likelihood of being considered a significant landform based on the scientific and social importance of the landform for supporting dinosaurian footprints and trackways. This is likely to be the views of the community groups who are anticipated to comment on the proposal during the referral process. DoT has identified this as a key risk that requires consideration during the impact assessment and referral for the BBF. Presenting the impacts on a local scale (i.e. presented in a Local Assessment Unit as per EPA Guidelines), as well as assessing the impacts on a regional scale (including cumulative impact considerations), may assist in presenting a logical case as to why the impacts can be considered not significant enough to warrant formal assessment by the EPA.	As stated above, KMSB is avoiding disturbance to areas of Broome sandstone, therefore potential impacts to the factor landforms are not considered to be significant. Nevertheless, the potential impacts on this factor are evaluated in Section 5, Table 15.
			Natural Heritage: Alternatively (refer comment above), the same approach outlined in Landforms can be considered in the context of the EPA Factor - Social Surrounding (Natural Heritage) in accordance with the EPA's Guidelines (Social Surroundings). The impact assessment approach and management objectives could focus on avoiding and minimising impacts to Dinosaurian footprints	KMSB considers that the dinosaur footprints are bet dealt with in the context of the factor 'Landforms'. As stated above, KMSB has gone to significant lengths to avoid areas of Broome sandstone that could potentially support dinosaur footprints. As this landform has been avoided through

			and trackways in the development envelope, as opposed to the geological landforms that support them (i.e. Broome Sandstone). This approach may require targeted survey work to investigate the occurrences of individual trackways and footprints in the development envelope, which may present an opportunity for coordinated survey work to be undertaken with DoT to inform the impacts associated with the BBF proposal.	project design, the proposed KMOF cannot have any impact on dinosaur footprints. Further discussion regarding potential impacts on dinosaur footprints is provided in Section 5, Table 15.
			Benthic Communities and Habitat Cumulative Loss Assessment: DoT recommends considering the impacts associated with the BBF when presenting the KMOF's ecological impact assessment for BCH. DoT identifies an opportunity to work with the proponent to coordinate the identification of an appropriate Local Assessment Unit addressing both proposals, to inform the cumulative loss assessment, required in accordance with EPA Guidelines.	Potential cumulative impacts of this Proposal and other adjacent projects/proposals are discussed in relation to benthic communities & habitat (BCH) in Table 15. BCH in the development envelope consists of sand and rocky reef. However, the reef area is devoid of benthic primary producers due to the significant scouring that occurs in this area associated with strong tidal currents and high suspended sediment concentrations in the water column. As there are no primary producers, the potential impacts on BCH from the KMOF are limited to direct impacts to areas of sand for each pile. Given this very small disturbance area, this impact is considered to be negligible and assessment of cumulative impacts is not warranted.
			Coastal Processes: DoT recommends that the referral to the EPA discusses the potential cumulative impacts to coastal processes and provides justification as to why the BBF does not factor into the impact predictions for the proposal. DoT notes that the same consultant is undertaking the coastal process modelling for both proposals.	The proposed KMOF has undergone significant design iterations to move the land-backed portion of the facility off the beach and to space the jetty piles at 24 metre spacings. These design elements mean that the potential for any changes to coastal processes arising from the proposed KMOF are effectively mitigated. As such consideration of cumulative impacts from the proposed KMOF on coastal processes are not required.
DAWE	14/5/2020	Pre-referral Meeting	DAWE is supportive of the limited disturbance footprint of the Proposal, in particular the efforts made by the Proponent to avoid dredging and to minimise disturbance to the beach.	KMSB has taken care to avoid and minimise any environmental and cultural impacts that may arise from the Proposal. The process for site selection and final design is described in Section 2.2.3.
			Consider potential impacts to migratory shorebirds and requirement for ongoing management / monitoring. Potential impact to migratory shorebirds warrants referral to DAWE.	Potential impacts on migratory shorebird species are discussed in Section 4.5 and Appendix D.

			<p>If direct removal of Monsoon Vine Thicket TEC cannot be avoided, consider the impact in the context of the EPBC Act significance criteria.</p> <p>The proponent should consider removal of this patch in the context of reconnection with other larger tracts to contribute to the overall regeneration of the area. Being surrounded by development, this vegetation is unlikely to ever reconnect with the larger tracts and is therefore not likely to be considered a significant impact.</p>	<p>Monsoon Vine Thicket TEC is no longer proposed to be impacted as result of this Proposal. Refer to maps of the Development Envelope and native vegetation shown in Figure 16.</p>
			<p>Consider construction impacts of underwater noise (piling) on conservation significant marine fauna and provide clear concise strategies to manage/mitigate impacts. Management should include use of exclusion zones, observation zones and marine fauna observers.</p>	<p>Potential impacts on conservation significant marine fauna species are discussed in Section 4.4.5.</p> <p>Piling operations are proposed to be managed in accordance with industry best-practice, including soft start procedures and use of marine fauna observers for maintenance of observation and exclusions zones for conservation significant marine fauna species. Proposed piling management measures are described in Section 4.4.6.</p>
			<p>Describe the governance for the proposed facility during both construction and operations (i.e. how will KPA manage the Proponent's operations as a lessee). Describe environmental management provisions included within landholder lease arrangements.</p>	<p>A summary of the governance for the Proposal is provided in Section 2.2.</p>
			<p>Consider potential impacts to dinosaur footprints and demonstrate avoidance through siting and limited disturbance footprint. DAWE consider that although the boundary of the West Kimberly National Heritage Place (NHP) does not extend into the Proposal area, the Proponent should consider the potential for indirect impacts which may occur to the values of the West Kimberley NHP based on a reasonable buffer.</p>	<p>Proponent has taken care to ensure development is located in an area identified in Salisbury (2018) as least concern for dinosaur footprints (Figure 18). Furthermore, the Proposal avoids construction on areas of Broome Sandstone, which is the landform that has retained dinosaur footprints in other areas of the Broome Peninsular.</p> <p>Potential impacts on dinosaur footprints are discussed further in Section 5, Table 15.</p>
			<p>Consider potential impacts on conservation significant marine fauna associated with increased shipping in the region. Discuss in the context of a new berth within the Port of Broome and subject to existing operational management provisions by the Kimberley Port</p>	<p>Potential impacts on conservation significant marine fauna species including the risk associated with increased vessel traffic leading to increased incidences of vessel strike are discussed in Section 4.4.5.</p>

			Authority to limit impacts on marine fauna such as speed limits and reporting of vessel strike.	
DWER	18/12/2019	Pre-referral Meeting	Include rationale for proposal design and location in referral document.	Rationale for the final Proposal design and location is provided in Sections 2.2.2 and 2.2.3.
			Describe how Proposal design has avoided requirement for dredging and/or construction on the beach.	A summary of the various options considered for the Proposal is provided in Section 2.2.3.
			Describe the governance for the proposed facility (i.e. how will KPA manage the Proponent's operations as a lessee).	A summary of the governance for the Proposal is provided in Section 2.2.
			Consider construction impacts of underwater noise (piling) on conservation significant marine fauna and provide clear concise strategies to manage/mitigate impacts.	Potential impacts on conservation significant marine fauna species are discussed in Section 4.4. Piling operations are proposed to be managed in accordance with industry best-practice procedures including soft start procedures and use of marine fauna observers and maintenance of observation and exclusions zones for conservation significant marine fauna species. Proposed piling management strategies are described in Section 4.4.6.
			Consider how marine biosecurity will be managed through operation of the proposed facility.	Marine biosecurity will be managed by KPA. Key elements of KPA's existing marine biosecurity measures are outlined in Section 4.4.6.
			Consider potential impacts on conservation significant marine fauna associated with increased shipping in the region.	Potential impacts on conservation significant marine fauna species are discussed in Section 4.4.
			Consider Key Environmental Windows in timing of construction activities (i.e. Humpback Whale Migration: July – September)	Key Environmental Windows are discussed for Marine fauna in Section 4.4.3 and migratory shorebirds in Section 4.5.3.
			Consider how Proponent will manage potential impacts to Marine Environmental Quality through ongoing operations.	Potential impacts to marine environmental quality are discussed in Section 4.2.
			Consider use of information obtained through the WAMSI Kimberley Science Node (KSN) to inform the assessment.	WAMSI KSN data was used to inform the likelihood of occurrence assessment for marine fauna which is presented in Appendix B.

			Consultation with key stakeholders (including local community and environmental groups) is recommended prior to referral.	Outcomes of consultation with key stakeholders is presented in this Table and stakeholder feedback forms are included in Appendix A.
			Consider potential cumulative impacts arising from this proposal and others in the immediate vicinity i.e. Channel Optimisation Project and Proposed Broome Town Jetty.	Potential cumulative impacts of this Proposal and other adjacent projects/proposals are discussed in relation to the factors benthic communities & habitat (Table 15), marine environmental quality (Section 4.2), marine fauna (Section 4.4) and migratory shorebirds (Section 4.5).
			Confirm status of any other statutory and/or landholder approval requirements for the Proposal.	A summary of all other statutory and landholder approvals is provided in Section 1.4.
Kimberley Ports Authority (KPA)	(2017/2019) Various	Meetings	KPA requires KMSB to obtain appropriate approvals for the project.	KMSB is referring the project to both State and Commonwealth environmental agencies. Other relevant approvals are noted in Table 2.
			Clearing in the development area can be undertaken in accordance with KPAs existing clearing permit CPS7256/1.	Noted, KMSB has kept all vegetation clearing to be within the existing clearing permit area.
			KPA requires review and approval of the Construction Environmental Management Plan (CEMP) prior to commencement of construction.	Noted. KMSB will submit CEMP to KPA for Review at least 3 months prior to commencement of construction.
			KPA requires review and approval of a Tenancy Environmental Management Plan (TEMP) prior to commencement of operations.	Noted. KMSB will submit TEMP to KPA for Review at least 3 months prior to commencement of construction.
			KPA requires completion of a baseline environmental (Contamination) site assessment prior to prior to commencement of construction.	Baseline environmental site assessment is scheduled to occur in August 2020.
			KPA requires KMSB to align monitoring with existing monitoring programs including the KPA Ongoing Marine Monitoring Program (OMMP) and Biannual Groundwater Monitoring Program.	KMSB has committed to alignment of monitoring programs with existing KPA programs. These commitments are included with regard to marine environmental quality in Section 4.3.6.
KPA Community Consultative Committee	29/4/2020	Virtual Meeting	The community consultative committee was supportive of the project and its approach to environmental management, particularly as management is aligned with existing KPA plans and procedures.	KMSB is bound through lease arrangements to implement a CEMP throughout the construction period and operate in accordance with a TEMP during the operational phase of the project. Both plans are required to be approved by KPA prior to commencement.

			Proponent should avoid the reef platform (rock outcrops) on either side of the access trestle.	KMSB has taken care in the siting of the facility to avoid the rocky outcrops.
			Consider the presence of dinosaur footprints in the project area and review the report prepared by Salisbury a& Romilio (2018) (Supplied)	KMSB has taken care to site the development within the area identified by Salisbury et al. (2018) as least concern (Refer Figure 18).
Nyamba Buru Yawuru	2017 – 2020 (Various Dates)	Presentations to PBC board through heritage clearance process	The Yawuru law bosses made several clarifications in relation to social, cultural and environmental impacts. The law bosses main area of environmental concern related to piling through the exposed rocky outcrops present on either side of the access trestle as well as development of the laydown area on the beach.	As outlined in section 2.2.3 this feedback supported the project's evolution.
Paspaley Pearling Company Pty Ltd	15/5/2020	Stakeholder Feedback Form	Introduced Marine Pests are a minor concern. However, it is understood this is managed in the context of the existing operational Port.	As stated, risks associated with Introduced Marine Pests will be managed in accordance with the KPA's existing marine pest monitoring and management procedures.
			Potential for product spills from new mineral export through the facility e.g. zinc or lead. However, it is understood that this would be managed in the context of the existing operational Port.	KMSB is not proposing to have uncovered mineral export through the proposed KMOF, therefore potential for product spill to the marine environment is very low. However, to ensure that the marine environment is not contaminated through KMSB's operations, KMSB will undertake annual sediment and water quality sampling. Further details regarding potential risks to marine environmental quality and proposed monitoring and management is provided in Section 4.2.
WA Museum	7/5/2020	Stakeholder Feedback Form	<p>This KMSB area has not previously been surveyed for historic shipwrecks or underwater cultural heritage (UCH). The WA Museum recommends that a survey of the development footprint by a qualified and experienced maritime archaeologist be undertaken to ensure that any terrestrial maritime and underwater cultural heritage (UCH) that could be potentially impacted by the development may be located, and to allow any mitigation measures to be taken.</p> <p>The surveys should at a minimum include a side scan sonar and/or Lidar and/or Multibeam Echo Sounder (MBES), and magnetometer survey at sufficient resolution to enable assessment of the potential for exposed or buried UCH, followed up by diver-based or ROV</p>	KMSB engaged a suitably qualified maritime archaeologist to undertake a UCH survey using side scan sonar and magnetometer. Results have subsequently been provided to the WA Museum for review.

			<p>surveys to identify any targets/ anomalies, with a report provided to the WA Museum.</p> <p>Commonwealth legislation has recently changed. As of 1st July 2019 all historic shipwrecks over 75 years old in Australian waters are now automatically protected by the Commonwealth Underwater Cultural Heritage Act 2018:</p> <p>Any historic shipwreck material located within the offshore component (below Lowest Astronomical Tide) of the development footprint would be automatically protected by the Commonwealth UCH Act. The Commonwealth UCH Act defines an historic shipwreck as over 75 years old.</p> <p>Any historic shipwreck material above the L.A.T. mark, including the inter-tidal zone and on land would be automatically protected by the State Maritime Archaeology Act 1973. The Maritime Archaeology Act defines an historic shipwreck as pre-1900.</p>	<p>A database search and targeted surveys have been completed to identify potential shipwrecks within the proposed disturbance area. Based on the survey results it does not appear that the proposals poses any risk to UCH. Results have subsequently been provided to the WA Museum for review.</p>
Shire of Broome	7/5/2020	Stakeholder Feedback Form	<p>Note. The site is a Port Reserve and waterbodies under the Shire of Broome Local Planning Scheme No 6.</p>	Noted and updated in Section 1.4.
			<p>Coastal Processes – The stakeholder summary documents provides background on the marine component of the development but does not comment on the land-based component of the development. Baird prepared a Coastal Hazard Risk Management Adaption Plan (CHRMAP) for the Shire of Broome, which shows the land based component of the project within the coastal processes setback allowance. The CHRMAP recommends that KPA perform erodibility study to determine the geotechnical properties of the foreshore area. Was this considered as part of the environmental studies performed?</p>	Coastal processes has subsequently been assessed with an additional technical memorandum include as Appendix G .
			<p>In relation to landforms and associated dinosaur footprints, the recent work performed by Dr Steve Salisbury for the 2018 Broome Safe Boat Harbour Site Assessment Process (September 2018) should be referenced.</p>	KMSB has taken care to site the development within the area identified by Salisbury et al. (2018) as least concern (Refer Figure 18).
Anonymous	9-15/7/2020	7 Day Public Consultation	<p>Several comments were received surrounding the proposals potential impacts on coastal processes. It was noted that the impacts of the structure would be unknown and therefore further assessment is required.</p>	The final design of the proposal's infrastructure was selected based upon a review of investigations and consultation outcomes during assessment period. To avoid impacts upon

				<p>coastal processes the following design principles are considered in the final design:</p> <ul style="list-style-type: none"> • eliminated requirements for capital dredging and spoil disposal during construction; • Removal of the reclaimed land and rock armour landing previously included within earlier designs in favour of extending the trestle jetty through to above the intertidal zone; • Designing the trestle jetty at an elevated design height with maximum spacing between pylons through the intertidal zone; • Avoidance of the development using historical design methods such as large groynes, rock armour reclaims and other fixed features known to alter coastal processes. <p>Whilst the coastal processes outlined in Section 5 assess the infrastructure as meeting the EPAs objective the number of public comments received raised sufficient concern to undertake a subsequent assessment presented in Appendix G.</p>
			Several comments were received highlighting the increased risks from oil spills due to increased vessel traffic on the Roebuck Bay RAMSAR and Marine Park environs.	Increased information has been included within the assessment for Marine Environmental Quality (Section 4.3).
DBCA	9-15/7/2020	7 Day Public Consultation	<p>During internal assessment the local DBCA Office were invited to comment. The following were noted during this review:</p> <ul style="list-style-type: none"> • It appears that the proposed development footprint intersects a portion of DBCA's mapped occurrence of the 'species-rich faunal community of the intertidal mudflats of Roebuck Bay' threatened ecological community (TEC) (ranked vulnerable). • While the proposed disturbance to the TEC appears to be relatively minor, DBCA would like to ensure that the proponent is aware of the potential requirement for an authorisation to modify an occurrence of a threatened ecological community under section 45 of the Biodiversity Conservation Act 2016, prior to ground-disturbing activities. Should the proposal be approved, consultation 	<p>The proponent acknowledges the comments regarding intersection with the TEC and that further consultation with DBCA's Species and Communities Program is recommended. KMSB will assist with this process to ensure no impacts to this section of the identified TEC will be significantly impacted by the Proposal.</p> <p>KMSB also acknowledge the potential requirement to obtain DBCA authorisation to modify an occurrence of a threatened ecological community under section 45 of the Biodiversity Conservation Act 2016, prior to ground-disturbing activities.</p> <p>Additional information for assessment purposes has also been supplied within Section 4.4 to assist with recommendations during the consultation period.</p>

			with DBCA's Species and Communities Program is recommended prior to the commencement of any construction activities.	
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3.3. Ongoing Stakeholder Consultation

The Proponent has committed to further ongoing consultation with all key stakeholders as the project progresses. One of the primary mechanisms for undertaking this consultation is through KMSB membership on the KPA Port of Broome Community Consultative Committee which includes community members and representatives from:

- > Broome Chamber of Commerce;
- > Broome Community Representatives;
- > Dinosaur Coast Management Group;
- > Kimberley Development Commission;
- > Kimberley Ports Authority;
- > Roebuck Bay Working Group; and
- > Shire of Broome.

KMSB also undertakes ongoing consultation and engagement with the traditional owners of the land represented by the Yawuru Prescribed Body Corporate.

4. Environmental Principles and Factors

4.1. Principles

A summary of how the EP Act principles have been considered in relation to the Proposal is presented in Table 7.

Table 7 EP Act Principles

Principle	Consideration
<p>1. The precautionary principle</p> <p><i>Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.</i></p> <p><i>In application of this precautionary principle, decisions should be guided by:</i></p> <ul style="list-style-type: none"> a) <i>Careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and</i> b) <i>An assessment of the risk-weighted consequences of various options.</i> 	<p>A Pre-referral meeting with DWER was undertaken to identify and consider all environmental risks of the Proposal. This enabled the Project Team (including KMSB) to identify key risks, information gaps, monitoring and management requirements and to consider any appropriate alternatives to those aspects of the Proposal that posed the most significant environmental risks. Key change made to the project design to preserve the environment include:</p> <ul style="list-style-type: none"> > Dredging requirement removed from the Proposal; > Project siting avoided areas of mangrove and seagrass BCH; > Project siting avoided important heritage areas; > Project changes significantly reduced footprint of the proposal on the beach; and > Adjusted landside terminal configuration to avoid impacts to the Monsoon Vine Thickets TEC.
<p>2. The principle of intergenerational equity</p> <p><i>The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.</i></p>	<p>The Proposal will enable new industries to establish, leading to new jobs and economic diversification which will enhance the value of the area for future generations.</p> <p>The Proponent considers that the Proposal is unlikely to result in any significant environmental impacts that would pose a threat to the health, diversity and productivity of the environment.</p>
<p>3. The principle of the conservation of biological diversity and ecological integrity</p> <p><i>Conservation of biological diversity and ecological integrity should be a fundamental consideration.</i></p>	<p>The potential impacts of the Proposal activities on the conservation of biological diversity and ecological integrity has been considered and discussed in relation to the following environmental factors:</p> <ul style="list-style-type: none"> > Marine Fauna (Section 4.2); > Marine Environmental Quality (section 4.3); and > Terrestrial Fauna (Section 4.4).
<p>4. Principles relating to improved valuation, pricing and incentive mechanisms</p> <ul style="list-style-type: none"> i. <i>Environmental factors should be included in the valuation of assets and services.</i> ii. <i>The polluter pays principles – those who generate pollution and waste should bear the cost of containment, avoidance and abatement.</i> 	<p>Environmental factors were considered in the Proposal design. The Proposal is not expected to generate any significant pollution or waste.</p> <p>Where possible, KMSB will:</p> <ul style="list-style-type: none"> > Employ appropriately trained local personnel and source local goods and services;

<p>iii. <i>The users of goods and services should pay prices based on the full life-cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste.</i></p> <p>> <i>Environmental goals, having been established, should be pursued in the most cost-effective way, by establishing incentive structure, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solution and responses to environmental problems.</i></p>	<p>> Ensure leading best practice standards during construction to minimise emissions and discharges as far as reasonably possible;</p> <p>> Where possible, source goods and services that have the least environmental impact.</p>
<p>5. The principle of waste minimisation</p> <p><i>All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.</i></p>	<p>Waste generated from the Proposal will be minimised through the implementation of the hierarchy of waste controls: reduce, re-use, recycle, recover and dispose.</p>

4.2. Preliminary Key Environmental Factors

The preliminary key environmental factors for the Proposal were determined by KMSB through a preliminary environmental impact assessment process and discussed with EPA Services during the Pre-referral meeting. The preliminary key environmental factors are:

- > Marine Environmental Quality;
- > Marine Fauna; and
- > Terrestrial Fauna.

These factors are addressed individually in **Sections 4.3 to Section 4.5**. Other relevant environmental factors are addressed in **Section 5**.

4.3. Marine Environmental Quality

4.3.1. EPA Objective

The EPA's objective for the factor 'Marine Environmental Quality' is:

'To maintain the quality of water, sediment and biota so that environmental values are protected.'

4.3.2. Policy & Guidance

- > EPA (2016a). *Environmental Factor Guideline: Marine Environmental Quality*, EPA, Western Australia; and
- > EPA (2016b). *Technical Guidance: Protecting the Quality of Western Australia's Marine Environment*, EPA, Western Australia. EPA, Western Australia.

4.3.3. Receiving Environment

Studies of marine environmental quality that are relevant to the Proposal are identified in **Table 8**.

Table 8 Receiving Environment Studies – Marine Environmental Quality

Author (Date)	Study
O2 Marine (2020a)	Port of Broome Ongoing Marine Monitoring Program Annual Report 2019
Oceanica (2012)	Baseline Water Quality Results: Wet and Dry Season
Ecological Australia (2016)	Port of Broome Marine Environmental Site Assessment

Environmental Quality Plan

An Environmental Quality Management Framework (EQMF) has not yet been formerly established for the Port of Broome or the wider Roebuck Bay marine waters. However, KPA has been implementing an Ongoing Marine Monitoring Program (OMMP) for the Port of Broome to monitor and manage potential impacts to marine environmental quality which may arise as a result of Port operations. Consistent with the EPA's Technical Guidance for *Protecting the Quality of Western Australia's Marine Environment* (EPA 2016b), the KPA OMMP includes a draft EQMF, which defines the Environmental Values (EVs), Environmental Quality Objectives (EQOs) and spatial Levels of Ecological Protection (LEPs) that are appropriate to the Port of Broome and adjacent Marine Park waters. These are defined in **Table 9** and presented in **Figure 3**. In addition, KPA are currently in consultation with Nyamba Buru Yawuru and the DBCA with a view to expanding the KPA OMMP to be part of an Integrated Marine Environmental Quality Management Plan (IMEQMP) for the marine waters within the Port of Broome and the adjacent Yawuru Nagulagun / Roebuck Bay Marine Park.

Table 9 Proposed Environmental Values and Environmental Quality Objectives applicable to the Port of Broome and surrounding waters (O2 Marine 2020a)

Environmental Values	Environmental Quality Objectives
Ecosystem Health	EQO1: Maintenance of ecosystem integrity. EQO1 can be split into four sub-objectives, being: Maximum, High, Moderate and Low Levels of Ecological Protection (LEPs). However, the following sub-objectives are applicable to the Proposal Area (Figure 3): <ul style="list-style-type: none"> > Maximum LEP: Assigned to the Yawuru Nagulagun / Roebuck Bay Marine Park area; > High LEP: Assigned to the marine waters within the Port of Broome jurisdiction; and > Moderate LEP: Assigned to a 250m buffer of the operational berths located at the existing Port of Broome Jetty.
Fishing & Aquaculture	EQO2: Seafood (caught) is of a quality safe for human consumption. EQO3: Water quality is suitable for aquaculture purposes.
Recreation & Aesthetics	EQO4: Water quality is safe for primary contact recreation (e.g. swimming and diving). EQO5: Water quality is safe for secondary contact recreation (e.g. fishing and boating). EQO6: Aesthetic values of the marine environment are protected.
Cultural & Spiritual	EQO7: Cultural and spiritual values of the marine environment are protected.
Industrial Water Supply	EQO8: Water quality is suitable for industrial supply purposes.

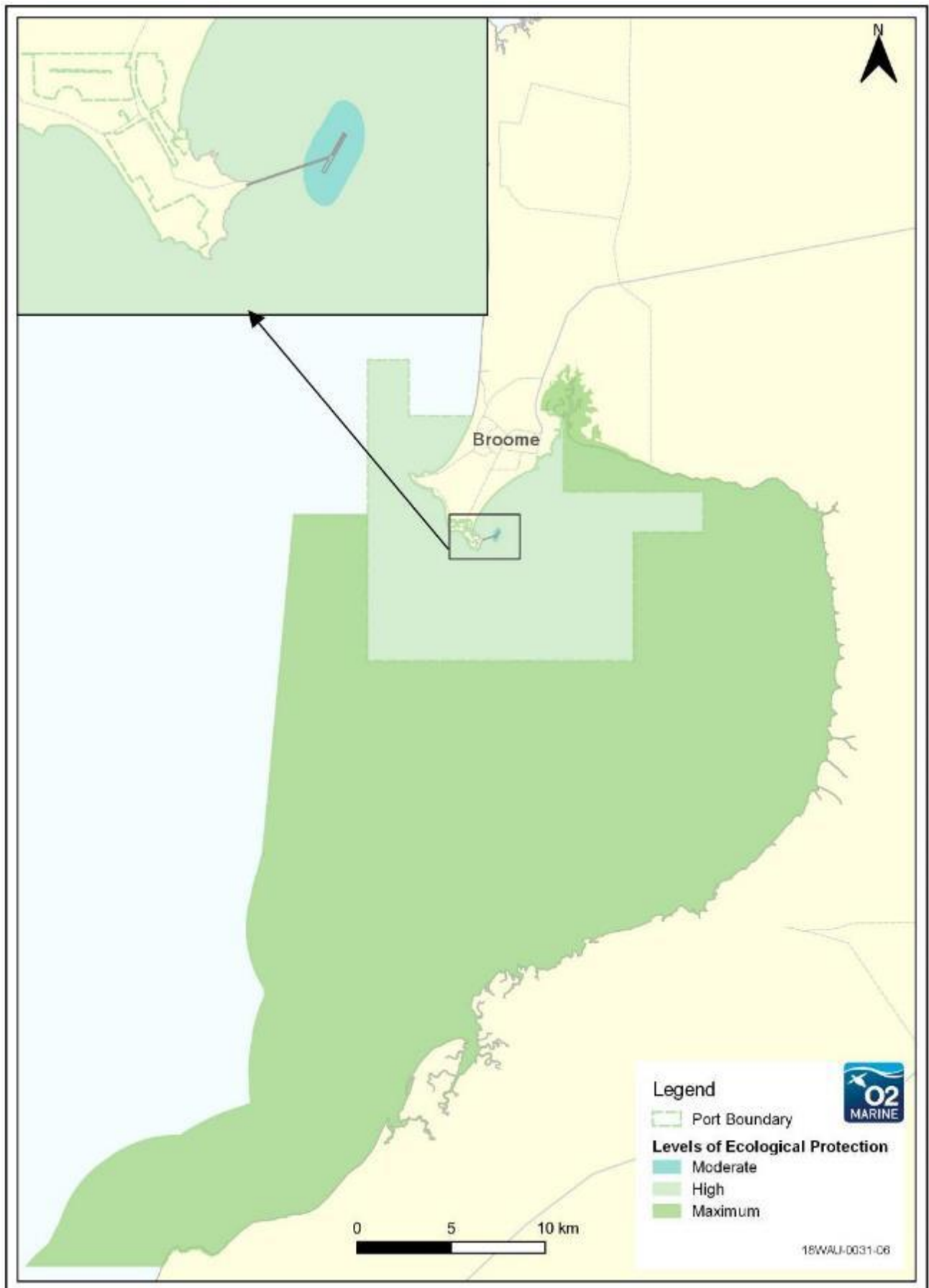


Figure 3 Proposed Levels of Ecological Protection for the Port of Broome and surrounding waters

Marine Water Quality

Baseline marine water and sediment quality for the project area is well understood from historic sampling implemented by the KPA. Due to limited disturbance and a high degree of natural tidal flushing, the water quality in Roebuck Bay is generally considered to be of a high quality, although can be highly variable between seasons.

Biannual water quality monitoring at the Port of Broome from 2018 to 2020 has found that the marine waters are consistently achieving a high level of ecological protection, with contaminant (i.e. metals and hydrocarbons) concentrations in marine waters found to be below the relevant ANZG 2018 default guideline values (DGV) (O2 Marine 2020a).

Biannual monitoring has also shown that the physico-chemical conditions in the marine waters surrounding the Port of Broome are most strongly influenced by season (wet versus dry) and tidal conditions (spring versus neap). Specifically, the marine waters are typically fresher, warmer and nutrient enriched during the wet season compared with the dry season (Rose *et al.*, 1990 and Department of Fisheries, 2005; Oceanica, 2012; O2 Marine 2020a). Spring tides are generally associated with lower water clarity and higher concentrations of nutrients and chlorophyll-a than neap tides and this tidal variability is most pronounced during the wet season (Rose *et al.*, 1990 and Department of Fisheries, 2005; Oceanica, 2012; O2 Marine 2020a).

Arguably the most notable risk to water quality in Roebuck Bay occurs towards the end of the wet season, when high nutrient concentrations coincide with high temperatures and improving water clarity, thus resulting in an increased potential for blooms of the potentially toxic cyanobacteria, *Lyngbya majuscula* (McKenzie *et al.* 2017; Oceanica 2012). These blooms have occurred in the shallow waters around Broome since 2005 (Deeley, 2009) and can be toxic to a range of marine fauna. Large blooms also have the potential to smother seagrass meadows and coral, causing impacts to fauna species that depend on these habitats (Ecological, 2016).

Marine Sediment Quality

Recent marine sediment investigations in the immediate vicinity of the proposed KMOF have found that the sediments are comprised of coarse to medium-grained, grey-brown marine sand (Oceanica 2017; Ecological 2016; Worley Parsons 2013), with contaminants of potential concern (COPC) (i.e. metals, benzene/toluene/ethylbenzene/xylene, organic pesticides, organotins, PAH, and TPH) found to be below the National Assessment Guideline for Dredging (NAGD 2009) screening levels (and the ANZG 2018 DGVs) (Ecological 2016).

4.3.4. Potential Impacts

Construction Phase Impacts

During the construction phase of the Proposal, the following activities and resulting impacts have the potential to adversely affect marine environmental quality in the vicinity of the proposed KMOF development:

1. Temporary and localised minor increase in suspended sediments immediately surrounding the piling works; and
2. Hydrocarbon release into the marine environment from a vessel spill and/or bunkering operations during construction.

Operational Phase Impacts

The following post-construction or operational phase impacts have the potential to adversely impact on marine environmental quality within the Proposal Area:

3. Fuel spill during vessel bunkering on floating wharf resulting in hydrocarbon release to the marine environment;
4. Vessel collision may result in hydrocarbon release into the marine environment;
5. Bulk handling and loading/unloading of materials which may pollute the marine environment; and
6. Contaminated runoff entering the marine environment via stormwater.

4.3.5. Impact Assessment

Construction Phase Impacts

Piling Operations: Temporary, Localised Turbidity Increases (1)

Piling operations will occur for up to one hour, twice per day for 2-3 months. These operations are expected to result in a temporary, localised increase in turbidity within 5-20 m from the piling location. However, the marine waters in the project area are naturally turbid, particularly during spring tide conditions. Given the strong tidal currents in the proposed piling locations it is expected that any excess turbidity generated above ambient background conditions would be quickly dissipated. Furthermore, it is noted that the BCH in this area is adapted to highly turbid conditions and the rocky reef systems do not support benthic primary producers which may be susceptible to elevated turbidity. As such this impact is predicted to be very minor and temporary and is unlikely to represent a significant impact to marine environmental quality.

Targeting periods of low tide to conduct piling works is also recommended to mitigate underwater noise impacts to marine fauna. However, this strategy will also effectively mitigate against the affects elevated turbidity, which would not be generated if piling at low tide (i.e. in air).

Vessel Operations: Accidental Hydrocarbon Spill (2)

There is potential for a hydrocarbon release into the marine environment from a vessel spill and or vessel bunkering operations during construction works. However, this risk is inherent in all marine construction operations and can be effectively managed through application of standard operating procedures, which are briefly outlined in **Section 4.3.6**.

Operational Phase Impacts

Vessel Bunkering: Potential Hydrocarbon Spill (3)

There is potential for a hydrocarbon release into the marine environment during vessel bunkering operations. However, as above this risk is inherent in all marine refuelling operations and can be effectively managed through application of standard vessel bunkering procedures, which are briefly outlined in **Section 4.3.6**. In addition, vessel bunkering is an activity only permitted by KPA endorsed professional operators which operate in accordance with strict procedures.

In addition to the risks posed during refuelling, diesel spills onto the floating deck pose a secondary risk of being washed into the marine environment either through stormwater or via large waves breaking

over the deck during storms. To mitigate this risk, the proponent has also proposed a stormwater capture and filtration system to be installed on the floating deck to remove hydrocarbons from stormwater prior to releasing stormwater to the marine environment. Whilst this system will be effective under normal rain conditions, breaking waves over the deck in cyclonic conditions does still have the potential to collect any hydrocarbon residue on the floating deck and transport it to the marine environment. Therefore, standard refuelling and hydrocarbon spill clean-up procedures will be employed to ensure that the risk of residual hydrocarbon on the deck is minimised.

Vessel Operations: Potential Hydrocarbon Spill (4)

Increased vessel traffic within the Port of Broome and surrounding waters, increases the risk of vessel collision and associated accidental hydrocarbon spill. Although hydrocarbon spills are possible, the risk of significant hydrocarbon spill is considered very low but is inherent in all operational port facilities. Standard operational management practices regulated by the Port of Broome are considered adequate to effectively mitigate the risk. All vessel movements are controlled by the Harbourmasters Office and subject to significant planning requirements which consider all vessel traffic, tides and all shipping movements are subject to KPA Pilotage requirements.

Furthermore, KPA have committed to updating their Oil Spill Contingency Plan and Tactical Response Plans to counter the additional, albeit low risk, that the additional facility poses. In response to the additional level of risk KPA are also in the Process of procuring improved oil response equipment. KMSB will continue to work alongside KPA to ensure all levels of risk posed from increased vessel movements are adequately covered to reduce the unlikely occurrence of a vessel collision. KMSB will also work with KPA to ensure an adequate level of first response oil spill equipment is procured and maintained.

Further details regarding how these standard operating practices have been adopted is provided in **Section 4.3.6.**

Bulk Material Loading / Unloading (5)

A variety of goods and materials are likely to be loaded and unloaded through the KMOF. Materials which may pose a risk to the marine environment include but are not limited to items such as fertiliser, chemicals, hydrocarbons, minerals, etc. A spill of any of these materials to the floating wharf deck or marine environment could, conceivably occur during transport and loading/unloading to/from vessels docked at the wharf. To reduce the likelihood of this risk, the proponent is proposing to only conduct loading/unloading of dangerous or environmentally hazardous materials via sealed containerised transport.

Contaminated Runoff (6)

Activities undertaken at the landside terminal such as abrasive / high pressure blasting and cleaning of various equipment and machinery have the potential to generate waste residue (e.g. anti-foul paint residue) that may be affect to marine environmental quality if untreated runoff from the landside terminal is able to reach the marine environment. However, these activities are currently undertaken in other areas of the Port and this risk is considered low in the context of the proposed mitigation, which includes designated, bunded cleaning areas and stormwater filtration systems.

4.3.6. Mitigation

Mitigation measures proposed to minimise potential impacts on the environmental factor 'Marine Environmental Quality' are described in **Table 10** and presented in accordance with the EPA's mitigation hierarchy (Avoid, Minimise, Rehabilitate¹).

¹ Rehabilitation measures are excluded from Table 10 as these are not expected to be required to mitigate impacts to marine environmental quality.

Table 10 Mitigation measures to minimise impacts on Marine Environmental Quality

Potential Impact	Avoidance	Minimisation	Residual Impact
Construction Phase Impacts Construction phase impacts will be managed through development and implementation of a Construction Environmental Management Plan (CEMP), which is required to be reviewed and approved by KPA prior to commencement of construction works (Refer Section 1.4.1). The following mitigation measures will be included in the CEMP to mitigate impacts on marine environmental quality during construction.			
Localised Turbidity Increases from Piling (1)	<ul style="list-style-type: none"> > Minimum number of piles to be used in construction of the KMOF. > Wherever possible, piling will be target during low tide periods, as per underwater noise mitigation (Refer Table 12). 	<ul style="list-style-type: none"> > Undertake piling as efficiently as possible to minimise the duration of the disturbance. 	No residual impacts are predicted.
Hydrocarbon Spills (2)	<ul style="list-style-type: none"> > Ensure all construction vessels are compliant with the International Maritime Organisation International Convention for the Prevention of Pollution from Ships (MARPOL). > Inspect and maintain all construction vessels and equipment on a daily basis. > Implement existing KPA refuelling procedures (KPA 2019) and use only KPA endorsed bunkering professionals. > Store all fuels, oils and lubricants on site to ensure that they do not pose a threat to the environment or the safety of staff and the public. > Maintain vessel speeds below 8 knots whilst within the construction zone, to limit the potential for vessel collisions. > Maintain an appropriate exclusion zone around the construction site to minimise the risk of non-project related vessels entering the area. 	<ul style="list-style-type: none"> > Supply and maintain adequate hydrocarbon spill kits on site and within immediate access during refuelling. > Implement procedures aligned to KPA requirements to maintain clean and tidy work areas, including the safe storage of all hydrocarbons and chemicals. > Implement Ongoing Marine Monitoring Program in accordance with existing KPA procedures 	No residual impacts are predicted.

Potential Impact	Avoidance	Minimisation	Residual Impact
	<ul style="list-style-type: none"> > Erect signage at nearby public facilities (e.g. boat ramp) to educate the public about the project and the ongoing construction activities. 		
<p>Operational Phase Impacts</p> <p>Operational phase impacts will be managed through development and implementation of an Tenancy Environmental Management Plan (TEMP), which is required to be reviewed and approved by KPA prior to commencement of KMOF operations (Refer Section 1.4.1). In addition, any vessels transiting through the Port of Broome to the KMOF will be managed by the KPA in accordance with their existing policies and procedures. The following key management actions will be included in the TEMP to mitigate impacts on marine environmental quality during operations.</p>			
Hydrocarbon Spills (Vessel Bunkering) (3)	<ul style="list-style-type: none"> > Inspect and maintain all KMOF refuelling equipment on a daily basis or at least prior to each and every use. > Implement existing KPA refuelling procedures (KPA 2019) and use only KPA endorsed bunkering professionals. > Vessel Bunkering induction is required for persons involved in bunkering activities. > Store all fuels, oils and lubricants on site to ensure that they do not pose a threat to the environment or the safety of staff and the public. > Erect signage at nearby public facilities (e.g. boat ramp) to educate the public about the project and the ongoing construction activities. > Implement KPA Ongoing Marine Monitoring Program (OMMP), including baseline sampling prior to commencement of operations (Refer Below). 	<ul style="list-style-type: none"> > Install and maintain an appropriate stormwater retention system on floating wharf for removal of oil in water prior to release of stormwater to the marine environment. > Supply and maintain adequate hydrocarbon spill kits on site and within immediate access during refuelling. > Implement procedures to maintain clean and tidy work areas, including the safe storage of all hydrocarbons and chemicals. > KPA are committed to updating and reviewing the Oil Spill Response and Tactical Response Plans to accommodate the increased levels of risk posed by additional vessel movements. > KPA are committed to procurement of additional oil spill response equipment to reduce the impact of any oil spills into the marine environment. 	No residual impacts are predicted.

Potential Impact	Avoidance	Minimisation	Residual Impact
		<ul style="list-style-type: none"> > KPA will continue to train staff in first response and attend DoT led oil spill response exercises and training as required. > KMSB are committed to working alongside KPA to ensure oil spill response capabilities are met. 	
Hydrocarbon Spills (Vessel Operations) (4)	<ul style="list-style-type: none"> > All vessel movements are subject to the Harbourmaster's approval to ensure they are all planned, no incompatible operations co-occur, and that weather and tidal movements are factored into all vessel operations. > All vessel movements subject to KPA procedures, including qualified and experienced vessel operators, > All shipping movements are subject to KPAs scheduling and Pilotage requirements to ensure the highest level of planning, which includes all vessel movements, weather and tides. > Follow all reasonable directions given by the harbour master to ensure vessel collisions are avoided. > Ensure all construction vessels are compliant with the International Maritime Organisation International Convention for the Prevention of Pollution from Ships (MARPOL). > Maintain an exclusion zone around the construction site to minimise the risk of non-project related vessels entering the area. > Contribute to implementation of KPA Ongoing Marine Monitoring Program (OMMP) (Refer Below) 	<ul style="list-style-type: none"> > KPA are committed to updating and reviewing the Oil Spill Response and Tactical Response Plans to accommodate the increased levels of risk posed by additional vessel movements. > KPA are committed to procurement of additional oil spill response equipment to reduce the impact of any oil spills into the marine environment. > KPA will continue to train staff in first response and attend DoT led oil spill response exercises and training as required. > KMSB are committed to working alongside KPA to ensure oil spill response capabilities are met. 	No residual impacts are predicted.

Potential Impact	Avoidance	Minimisation	Residual Impact
Product spills from hazardous material loading and unloading (5)	<ul style="list-style-type: none"> > All potentially hazardous materials (e.g. chemicals, minerals, fertilizer, pesticides, etc.) will be transported in sealed containers. > Follow all reasonable directions given by the harbour master to ensure safe loading and unloading of vessels. > A KPA HSE and Security Induction is required for any personnel working on the facility. > Apply the KPA Environmental Management System (EMS)S including Standard operating procedures (SOPs), Job Hazard Analysis (JHAs) and Permit to Work System > Implementation of an audits and inspection program. > Implementation of a maintenance program. > Use of the KPA Port and Terminal Handbook. > Use of the KPA Contractors Handbook. > Contribute to implementation of KPA OMMP (Refer Below). 	<ul style="list-style-type: none"> > CCTV system monitoring loading and unloading activities. 	No residual impacts are predicted.
Contaminated runoff entering the marine environment (6)	<ul style="list-style-type: none"> > Design stormwater site drainage to ensure any potentially contaminated runoff (i.e. from hardstand or washdown areas) is directed to stormwater retention basins for capture and treatment prior to release. > All washdown and/or sand blasting areas will be appropriately bunded. > All potentially hazardous materials (e.g. chemicals, minerals, fertilizer, pesticides, etc.) will be stored in 	N/A	No residual impacts are predicted.

Potential Impact	Avoidance	Minimisation	Residual Impact
	<p>sealed containers whilst onsite at the landside terminal.</p> <ul style="list-style-type: none"> > Implement an audit and inspection program for site drainage and bunded areas. > Contribute to implementation of KPA biannual groundwater monitoring program. 		

KPA Ongoing Marine Monitoring Program

As part of lease arrangements with KPA, the Proponent is required to undertake baseline groundwater, soil and marine sediment investigations to confirm baseline levels of contamination (if any) prior to commencement of construction. This sampling will then be undertaken on an ongoing basis in accordance with the existing KPA OMMP. Monitoring for the KMOF will be consistent with the existing OMMP and will include:

- > Biannual marine water sampling and analysis for hydrocarbons and heavy metals;
- > Biannual water column profiling of physicochemical parameters;
- > Three-yearly sediment sampling and analysis for hydrocarbons and heavy metals;
- > Annual benthic communities and habitat survey;
- > Marine Pest State-Wide Array Surveillance Program (SWASP); and
- > Biannual groundwater sampling and analysis for hydrocarbons and heavy metals.

KPA Oil Spill Response Plan

KPA are the nominated first-response agency for Tier 1 oil spills which occur in the Kimberley region. Therefore, KPA are required to develop and continuously review the Marine Oil and Pollution Tactical Response Plan, which includes several underlying sector specific tactical response or first response plans. Due to the increased vessel movements associated with the KMOF, KPA's Harbourmaster has committed to updating the suite of KPA Oil Spill Response Plans. Additionally, KPA have committed to procuring additional first-response oil spill equipment which is commensurate with the level of risk posed by KPA and KMSB operations.

As with all Western Australian state oil spills any Tier 2 or 3 oil spills will be dealt with by either the DoT or Australian Maritime Safety Authority strike forces, assisted by KPA's first response personnel. KPA are also committed to ensuring that first responders are suitably trained to reduce any impact through application of the tactical response plans in the event of a marine oil spill.

KMSB are committed to working alongside KPA to ensure that all Oil Spill Response Plans and first response equipment are commensurate with the risk posed by KPA and KMSB vessel operations.

4.3.7. Predicted Outcome

The proposal will result in the following predicted EPOs with respect to marine environmental quality:

- > Temporary and localised slight increase in turbidity immediately surrounding the piling operations;
- > No residual impact on marine environmental quality as a result of the Proposal activities;
- > Maintenance of marine environmental quality in accordance with the Levels of Ecological Protection specified in the existing KPA OMMP.

Based on the above EPOs, and in consideration of the proposed monitoring and management strategies, the Proposal activities are not expected to pose a significant residual risks to maintaining the quality of water, sediment and biota and therefore the environmental values can be protected. In

relation to the proposal, the Proponent considers that the EPA's objective for marine environmental quality has been met.

4.4. Marine Fauna

4.4.1. EPA Objective

The EPA's objective for the environmental factor 'Marine Fauna' is to:

'To protect marine fauna so that biological diversity and ecological integrity are maintained.'

4.4.2. Policy & Guidance

The following EPA policies and guidance have been considered in evaluating potential impacts on this factor:

- > EPA (2016c). Environmental Factor Guideline: Marine Fauna, EPA, Western Australia.
- > Commonwealth of Australia (CoA) (2015). Sawfish and River Sharks Multispecies Recovery Plan. Department of the Environment.
- > Commonwealth of Australia (CoA) (2017). Recovery Plan for Marine Turtles in Australia. Department of the Environment and Energy.
- > Environmental Protection Authority (EPA) (2010). Environmental Assessment Guideline 5, Protecting Marine Turtles from Light Impacts.
- > Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2012). Marine Bioregional Plan for the North-west Marine Region.

4.4.3. Receiving Environment

The Broome region provides habitat for a range of marine fauna species including conservation significant marine fauna species such as whales, dolphins, dugongs, turtles, sea snakes, crocodiles, sawfish and bony fish species. The marine fauna species that are found within the Broome region are found in other regions of the Western Australia, and some species are distributed nationally within Australian waters and globally.

Extensive marine fauna and other environmental monitoring has been conducted across Broome, extending to adjacent regions, by the Western Australian Government and regional monitoring programs (**Table 11**). The surveys have used a range of methods to describe the extent, distribution and habitat preferences of marine fauna present across the Broome Region. These studies have used a range of database searches, as well as field methods, including:

- > Nocturnal spotlight surveys (Turtles);
- > Targeted search transects;
- > Boat-based surveys; and
- > Aerial surveys.

Studies of marine fauna that are relevant to the Proposal are identified in **Table 11**.

The field surveys provide sufficient data for the assessment of the fauna of the study area for the requirements of this ERD.

The marine waters within and adjacent to the Project area support a variety of fauna, several of which are listed as being of conservation significance and protected under the Commonwealth EPBC Act and/or State BC Act.

Table 11 Marine fauna studies undertaken in the vicinity of the Project Area.

Author (Date)	Study Title	Description
Brown <i>et al</i> (2014a)	Abundance of coastal dolphins in Roebuck Bay, Western Australia	Abundance of snubfin dolphins within 100km ² area of Roebuck Bay, Western Australia. Data collected via a survey vessel over a five-week period from 04 October to 05 November 2013. Opportunistic sightings of Dugongs were also recorded during the survey.
RPS (2009a)	Nearshore Regional Survey Dugong Report	Baseline dugong survey to support EIA for the Woodside LNG development. Data collected via aerial survey on the abundance and distribution of dugongs in inshore waters of the west coast of the Dampier Peninsula (1,000km ²) during two periods, in mid-July and mid-September 2009.
Bayliss and Hutton (2017) (WAMSI)	Integrating indigenous knowledge and survey techniques to develop a baseline for dugong (<i>Dugong dugon</i>) management in the Kimberley	Capture and Tagging (Satellite tracking) of dugongs and integration of various surveys to determine the abundance and distribution of dugongs.
RPS (2009b)	Humpback Whale Survey Report	Marine Megafauna baseline survey to support EIA for the Woodside LNG development. Aerial and vessel-based surveys were undertaken during the period July to mid-October 2009 with a focus on the James Price Point but extending along the Kimberley coast. Data were collected on the distribution and abundance of humpback whales.
Jenner <i>et al.</i> (2010)	Satellite tracking of south-bound female humpback whales in the Kimberley region of Western Australia	Satellite tags used on > 20 humpback whales to determine the distribution and behaviour of nursing humpback whales in the Kimberley Region of Western Australia. The study took place between the 25 th August and the 6 th September 2009.
RPS (2012)	Dolphin Review	Aerial and vessel-based surveys collected baseline data on the distribution and abundance of marine mammals along the west coast of the Dampier Peninsula. The report presents a review of Dolphin populations of the West Kimberley in Western Australia. Data reviewed between 2009- 2011.
RPS (2010)	Ecology of Marine Turtles of the Dampier Peninsula and the	Baseline survey to collect data on the distribution and relative abundance of marine turtles along the

	Lacepede Island Group 2009-2010	Dampier Peninsula, including the Lacepede Island Group and specifically within and adjacent to the James Price Point area. The surveys included aerial (nearshore, regional, and offshore), vessel surveys, beach studies (track counts, nearshore surveys, and sand temperature analysis) and satellite tracking.
O'Dea and Winderlich (2019)	Community Flatback turtle monitoring report at Eco Beach 2018.	Night and day beach surveys, collecting data on the abundance of turtles, in particular Flatback turtles known to nest at the beaches between Cape Villaret and Jacks Creek. Data collected on nesting activity and number of nests during the summer nesting period.
Talis (2020)	Underwater Noise Assessment: Kimberley Marine Offloading Facility	Study to predict and assess underwater noise levels and associated marine fauna impacts as a result of piling activities undertaken for the KMOF Project.
Whiting <i>et al</i> (2018) (WAMSI)	Marine Turtles in the Kimberley: key biological indices required to understand and manage nesting turtles along the Kimberley coast	Aerial Surveys in the winter (8 consecutive days) and summer (8 consecutive days) 2014 and ground truthing surveys used to map the distribution and relative density of marine turtles from the Northern Territory border to Eighty Mile beach on both mainland and island beaches.
Thums <i>et al</i> (2018) (WAMSI)	Humpback whale use of the Kimberley: understanding and monitoring spatial distribution	Compilation of historical tracking, aerial and vessel based survey data from the Kimberley region. Surveys between June and October from years 1993 to 2014 to determine the distribution, abundance, movements, and habitat use in the Kimberley Region.
Brown <i>et al</i> (2016) (WAMSI)	Relative abundance, population genetic structure and passive acoustic monitoring of Australian snubfin and humpback dolphins in regions within the Kimberley	Boat based visual surveys and photo identification used to identify the presence of snubfin and humpback dolphins at survey sites. In addition Passive acoustic monitoring was conducted at three sites within the Kimberley during 2014 and 2015 using prior information of dolphin visual survey data. Sites for the PAM survey including Roebuck Bay, Cone Bay and Cygnet Bay.
Halford and Barrow (2017) (WAMSI)	Saltwater crocodiles (<i>Crocodylus porosus</i>) in the northwest Kimberley	Spotlight survey at the Prince Regent and Roe-Hunter River Systems to collect data on abundance, distribution, and size structure of populations. In addition, genetic sampling methodology was used to understand the genetic structure of the populations.

Database searches (below) have been conducted to determine what species are likely to occur in the area and their likelihood of occurrence.

Conservation Significant Communities

Database searches identified the possible occurrence of the Threatened Ecological Community (TEC) 44 'Species rich faunal community of the Roebuck Bay Mudflats'. DBCA fact sheet (accessed 6/8/2020) for the TEC describes the ecosystem as 'occurs on the intertidal mudflats of Roebuck Bay' 'containing large intertidal flats composed predominantly of carbonate sediments' and 'with an estimated 300 to 500 species of macrobenthic fauna as well as a high diversity and abundance of migratory shorebirds'.

Investigations undertaken as part of this assessment have identified several characteristics of the Entrance Point intertidal area that are not commensurate with the description of TEC 44. These include:

- > Sites south of the port, including Entrance Point comprise predominately of sandy beaches with coarse sand and gravel on a relatively steep bank and characterised by low fauna composition and low diversity, richness and feeding guild abundance (Ecological 2016).
- > Surveys undertaken by OTS (2020) identified significantly higher migratory shorebird species richness and abundance at Roebuck Bay study sites compared to sites at Entrance Point.
- > Surveys by O2M (2020b) identified infauna community composition as statistically heterogenous among the limited sites samples within Roebuck Bay and Entrance Point, however Species Richness and Abundance were detected highest within Roebuck Bay.
- > Surveys by O2M (2020b) identified significant differences in sediment particle size distributions between Entrance Point and Roebuck Bay sites, with Entrance Point typically characterised by medium sand (>77%), low proportions of fine sands (<11%) and very low proportion of silts and clays (<3%). Alternative Roebuck Bay sites were typically characterised by Fine Sands (range=54%-83%) with higher proportions of silts and clays (range=4%-26%) and lower proportions of medium sands (range=9%-30%).
- > The intertidal mudflats of Roebuck bay are typically flat and can extend up to 13km from the high water mark, whilst Entrance Point comprises a much steeper beach profile with a much shorter intertidal flat (~ 100s meters).
- > Coastal processes at Entrance Point are typically subjected to much stronger nearshore currents and are more exposed to wind driven waves associated with prevailing south-easterly winds or sporadic cyclone driven wind waves. These coastal process drivers are able to constantly shift sands and expose underlying bed rock at entrance point, whereas the Roebuck Bay environment is much less exposed to these processes

The description of the environmental characteristics of the TEC are better represented within by the Dampier Creek to Eighty Mile Beach system, where sediments of a smaller particle size, flatter beach profiles and wider intertidal flats occur, and coastal processes are not dominated by strong nearshore currents and wave action. Dampier Peninsula would therefore represent a point within the coastline system where aspect, coastal processes and exposure, coarser sediments, narrower tidal flats and steeper beach profiles interspersed with rocky outcrops and small headlands occur. This system is then represented further north where Riddell Beach and Gantheaume Point make way for expansive sandy Cable Beach.

Indirect impacts from the proposal to the adjacent Roebuck Bay intertidal are not predicted.

Conservation Significant Species

Database searches identified a total of 15 listed threatened species and a further 57 species listed as marine under the EPBC Act that have the potential to occur within the Study Area. However, a likelihood of occurrence assessment was undertaken for each species and only 22 species were regarded as either known (based on historic records) or highly likely to occur given the presence of suitable habitat within Darwin Harbour. These include:

Nine (9) reptile species including:

- > Three (3) turtles: Green Turtle, Loggerhead and Flatback Turtle;
- > One (1) Crocodile: Salt-water Crocodile; and
- > Five (5) Sea snakes: Olive Seasnake, Stoke's Seasnake, Olive-headed Seasnake, North-western Mangrove Seasnake and Black-ringed Seasnake.

Seven (7) mammal species:

- > Dugong;
- > Five (5) Dolphins: Irrawaddy Dolphin, Australian Snubfin Dolphin, Indo-Pacific Humpback Dolphin, Indian Ocean Bottlenose Dolphin and the Spotted Bottlenose Dolphin; and
- > Humpback Whale

Three (3) elasmobranch species:

- > Dwarf Sawfish, Green Sawfish and Largetooth Sawfish

Three (3) Fish:

- > Tidepool Pipefish, Tiger Pipefish and the Flat-face Seahorse.

A complete list of the conservation species that may occur (based on database searches), those that have been recorded, and the likelihood of occurrence for those that have not, is included in **Appendix B**.

The following sections discuss, in more detail the species of conservation significance that have a high likelihood of occurrence within the Project area. This excludes species that are listed as 'Least Concern' under the BC Act, or 'Marine/Migratory' under the EPBC. In particular, this section will discuss species vulnerabilities, whereas further details on lifecycle, distribution, significance and habitat requirements are provided in **Appendix B**.

Marine Turtles

Marine turtles have a complex lifecycle that spans a large geographic range over multiple habitats and many decades. All marine turtles are migratory during some life phases and several turtles utilise Australian waters for either foraging or nesting, or both. Migratory pathways for marine turtles nesting in Western Australia region include the coastal waters of Broome. Turtles spend their lives in the sea however females require terrestrial habitat for nesting such as on sandy island and mainland beaches.

Database searches identified three (3) marine turtle species that are known or have a high likelihood of occurring within 10km of the Project Area:

- > Green turtle (*Chelonia mydas*) – Vulnerable/Marine/Migratory (EPBC), Endangered (IUCN) and Vulnerable (BC);
- > Flatback turtle (*Natator depressus*) – Vulnerable/Marine/Migratory (EPBC), Vulnerable (BC) and Data Deficient (IUCN); and
- > Loggerhead Turtle (*Caretta carretta*) – Endangered/Marine/Migratory (EPBC), Endangered (BC) and Vulnerable (IUCN).

Of these species the Green and Flatback turtles are known to nest on beaches north and south of the Project Area on both the mainland and offshore islands, these beaches are regarded as significant nesting beaches. Flatback turtles are known to nest at Cable beach during the wet season (October to February) which is approximately 10 km north from the Project Area. Nesting is also known to occur south at Eighty Mile Beach and Eco Beach > 100 km from the Project Area. There are no known biologically Important areas (BIAs) within the development envelope for any of the turtle species, however biologically important areas such as foraging and nesting for Flatback, Green and Loggerhead Turtles do exist in the Kimberley region. Tracking data for nesting Green and Flatback Turtles recorded in the region show that majority of turtles travel north-east along the Kimberley coast post nesting to foraging grounds (RPS, 2010). Data also indicated turtles forage in waters between 10m – 70m deep.

Due to the known foraging and nesting activity of marine turtles in the Kimberley region, the potential for them to occur within the Project Area is possible in any given season.

The life history traits of marine turtles make them vulnerable to a wide range of anthropogenic threats. These traits include late maturation, high natural mortality of hatchlings and small juveniles, strong fidelity to breeding areas, migrating over long distances, and use of both terrestrial and marine environments to complete their life cycle (CoA, 2017).

Crocodile

The Saltwater Crocodile (*Crocodylus porosus*) is listed as Migratory Marine under the EPBC Act, and Least Concern by the IUCN.

The Saltwater crocodile has been sighted as well as captured within Broome, however there are no records of the species within the Project Area. The species is found in both freshwater and saltwater environments. Saltwater crocodiles could potentially occur within the Project Area as they are known to occur in tidal areas. The species is fairly adaptable and in the case of potential impacts they would likely shift their range (DSEWPac, 2012). The greatest vulnerability associated with crocodiles is egg mortality due to increase in sea temperatures, however suitable nesting habitat has not been identified for this species within the Project Area.

There is no Recovery Plan for the Saltwater Crocodile listed under the EPBC Act.

Sea Snakes

Seasnakes show diversity across various habitat types and are found in coral reefs, lagoons, bays and estuaries, including coral reefs, deep inter-reef areas, rocky substrates, and muddy substrates. Mixed

benthic habitats exist within the Project Area, including coral reef habitat and mudflat habitat. Sea snakes are known to dive to depths around 100m.

The following five (5) sea snake species are known or have a high likelihood of occurring within 10 km of the Project area:

- > Olive Seasnake (*Aipysurus laevis*) – Marine (EPBC), Least Concern (IUCN);
- > Stoke's Seasnake (*Astrotia stokesii*) – Marine (EPBC), Least Concern (IUCN);
- > Olive-headed Seasnake (*Disteira major*) – Marine (EPBC);
- > North-western Mangrove Seasnake (*Ephalophis greyi*) - Marine (EPBC); and
- > Black-ringed Seasnake (*Hydrelaps darwiniensis*) - Marine (EPBC), Least Concern (IUCN).

However, rare sightings of sea snakes within the Project Area indicate the area is not a significant habitat for either species and therefore the Project activities would have little impact on the species population, although individual impacts may be possible. The slow growth rate, low fecundity, restricted diet of gobies and eels in the region, makes sea snakes more susceptible to changes in trophic structures. Sea snakes are vulnerable to indirect impacts such as broadscale habitat destruction and disruption of the trophic structure.

Sawfish

The following three (3) sawfish species are known or have a high likelihood of occurring within 10 km of the Project area:

- > Dwarf Sawfish (*Pristis clavata*) – Vulnerable (EPBC), P1 (BC), Endangered (IUCN);
- > Largetooth/Freshwater Sawfish (*Pristis pristis*) – Vulnerable/Migratory (EPBC), P3 (BC), Critically Endangered (IUCN); and
- > Green Sawfish (*Pristis zijsron*) – Vulnerable/Migratory (EPBC), Vulnerable (BC), Critically Endangered (IUCN)

There are no records of sightings of the Dwarf Sawfish, Green Sawfish or Freshwater Sawfish within the Project Area, however nearby in Roebuck Bay, north of the Project Area each of the species presence is known. Pupping and nursing is known to occur in Roebuck Bay for the Freshwater and Green Sawfish. The Project Area is not likely to provide suitable habitat for these species as a nursery given it lacks their preferred habitat such as mangroves and creeks which offer juveniles protection. They are more likely to reside in the Roebuck Bay Area given it is lined with mangroves and small creeks run into it.

Sawfish inhabit coastal/inshore and freshwater/estuarine habitats for a large proportion of their life history. Freshwater environments are important nursery habitats for freshwater sawfish. This reliance on a physically restricted environment contributes to their susceptibility by limiting their ability to evade the pressure. Repeated use of small areas of habitat means these species are susceptible to localised depletion. Research suggests populations are in decline globally.

Biologically, elasmobranchs are characterised by their 'limited' life history (late age maturity, slow growth rate, low fecundity, longevity, low rate of natural mortality), which results in restricted productivity. Sawfish are top level predators that occupy a high trophic level. They are viviparous, giving birth to well-developed live young. The female residency at place of birth and the decline in females

and would not be replenished by other females in the region (as females remain residents to their place of birth). This combination of life history traits makes them susceptible to developments and slow to recover. However, most aspects of the reproductive biology of sawfish species are unknown and the sawfish of northern Australia are generally poorly understood. Reproductive periodicity is unknown for all species.

Dolphins

The following five (5) dolphin species are known or have a high likelihood of occurring within 10 km of the Project area:

- > Irrawaddy Dolphin (*Orcaella brevirostris*) – Migratory/ Cetacean (EPBC), P4 (BC), Vulnerable (IUCN)
- > Australian Snubfin Dolphin (*Orcaella heinsohni*) – Migratory (EPBC), P4 (BC), Vulnerable (IUCN)
- > Indo-Pacific Humpback Dolphin (*Sousa chinensis*) – Migratory/ Cetacean (EPBC), P4 (BC), Near Threatened (IUCN)
- > Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin (*Tursiops aduncus*) – Cetacean (EPBC), Data Deficient (IUCN)
- > Spotted Bottlenose Dolphin (*Tursiops aduncus*) (Arafura/ Timor Sea Populations) – Migratory/ Cetacean (EPBC).

The Australian Snubfin is a recently identified species, having previously been combined with the Irrawaddy Dolphin. Therefore, for the purposes of this document the Irrawaddy Dolphin will fall under the Australian Snubfin.

The species' vulnerability to pressures is intensified due to their life history characteristics (they are long-lived, females take many years to reach sexual maturity, (e.g. around nine years for the Australian Snubfin Dolphin); and they have a low rate of reproduction (one calf every 2-3 years)). Evidence suggests the dolphin species distributions are severely fragmented, at least in some parts of their range. The species exhibit site fidelity and long-term associations between individuals. The populations of dolphins in the region may be genetically distinct from populations elsewhere, and population numbers low.

The Australian Snubfin occur mostly in shallow waters up to 10 km from the coast and 20 km from the nearest river mouth and forages in a variety of habitats, ranging from mangrove communities to seagrass beds, sandy bottom communities and open coastal areas with rocky shores and coral reefs. With the exception of mangroves and seagrass beds all of these habitats occur in the Project Area, and all habitats occur within the Broome region (Study Area). However, the Australian Snubfin is more likely to occur in waters closer to the shallow shores of north eastern Roebuck Bay, where previous surveys have identified populations occurring commonly foraging and feeding over the shallow mudflats, which provide a greater extent of available food than that of the small portion of mudflat in the Project Area (**Figure 4**).

The Indo-Pacific Humpback Dolphin occur mostly in shallow waters up to 10 km from the coast and 20 km from the nearest river mouth and forages in a variety of habitats, ranging from mangrove communities to seagrass beds, sandy bottom communities and open coastal areas with rocky shores

and coral reefs. With the exception of mangroves and seagrass beds all of these habitats occur widely in Project Area, however all habitats occur within the Broome region (Study Area).

The Indian Ocean Bottlenose Dolphin tend to occur in deeper, more open coastal waters, primarily in continental shelf waters (up to 200 m deep), although still including coastal areas and around oceanic islands, often in depths of less than 10m. In the Kimberley it occurs in low numbers and is widely dispersed. Given its affinity to shallow coastal waters, this species has the potential to occur within the Project Area in any season.

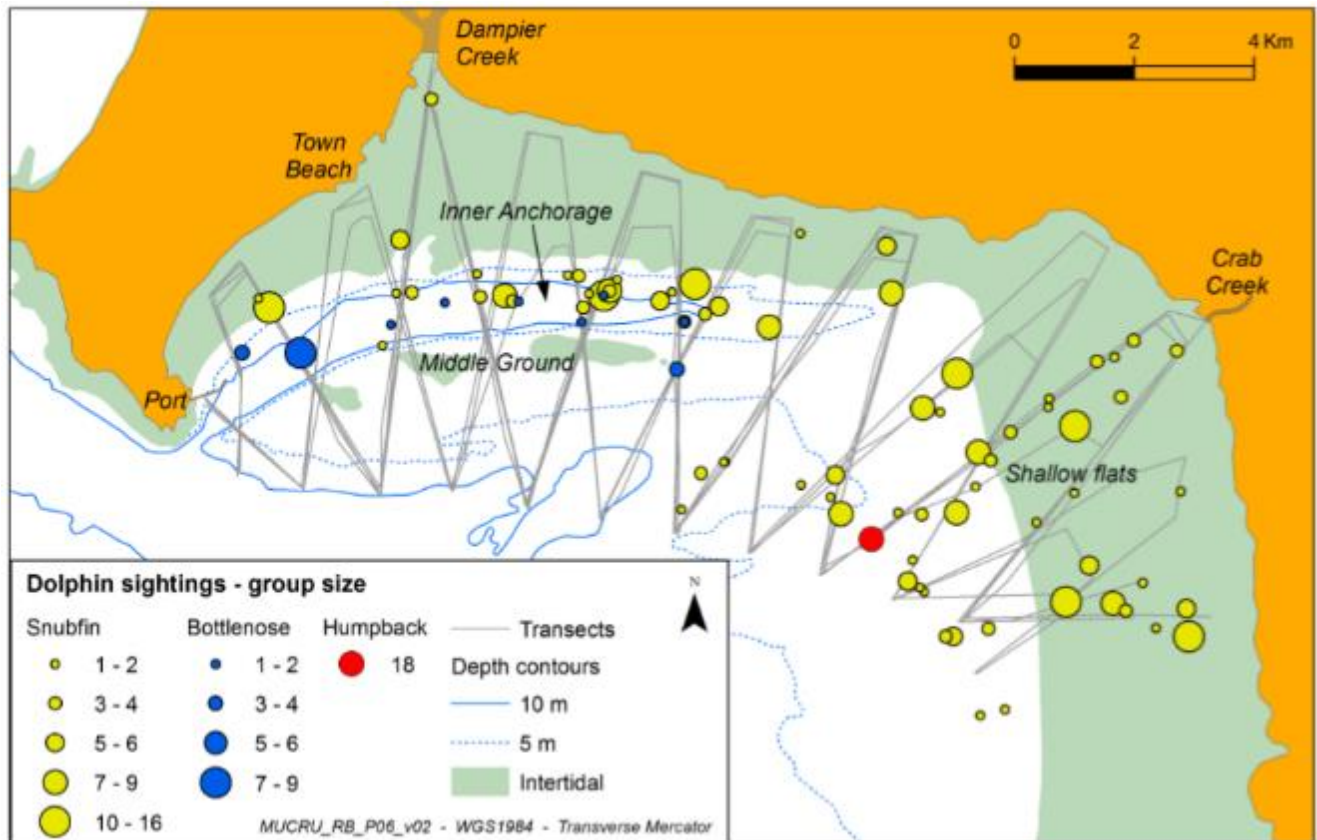


Figure 4 Dolphin sightings by group size along transects (grey lines) between 4th October and 5th November 2013 within Roebuck Bay Area (Brown *et al*, 2014).

Dugong

Dugong (*Dugong dugon*) are listed as Migratory Marine under the EPBC Act, as Other Protected Fauna under the BC Act and as Vulnerable by the IUCN.

Dugongs have not been recorded in the Project Area. They have been recorded further north of the Project Area, within Roebuck Bay, feeding on seagrass beds, and often within the intertidal zone close to the township of Broome (**Figure 5**). Dugongs are a highly mobile species and their distribution and abundance is generally associated with seagrass and algal habitats given it is their preferred food. Therefore, dugongs are usually found in shallow protected bays, mangrove areas and the lee side of large islands where seagrass grows. Given that seagrass habitat does not occur in the Project Area and occurs within sparse quantities within Roebuck Bay they are more likely to be found within Roebuck Bay rather than the Project Area, and would only expect to be sighted within the Project Area whilst transiting in and out of the bay.

Specific vulnerabilities to populations of dugongs include long gestation (12-14 months), single offspring, long intervals between births (more than 2.5 years), prolonged periods until sexual maturity (6-17 years), and high temporal stable adult survival. Adult survival is the most important determinant of population growth. The maximum rate of population increase under optimum conditions when natural mortality is low is approximately 5 per cent per year. The maximum sustainable mortality rate of adult females killed by human activities is approximately 1 or 2 per cent and lower when food supplies are low. Pressures that cause dugong mortality are therefore of potential concern if such pressures occur over wide geographic area, even if the magnitude of the pressures is uncertain.

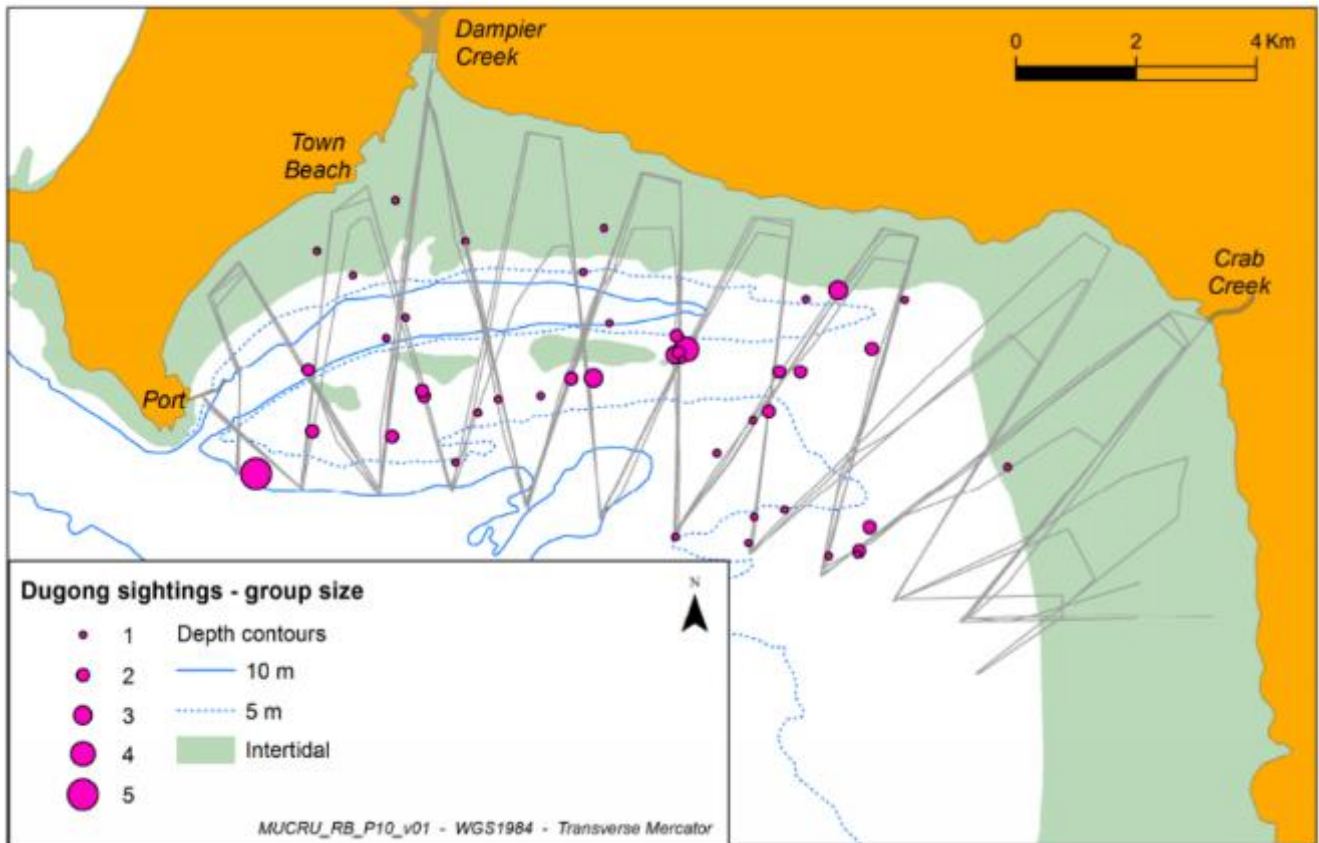


Figure 5 Opportunistic dugong sighting by group size along transects (grey lines) between 4th October and 5th November 2013 (Brown *et al*, 2014).

Whale

The Humpback whale (*Megaptera novaeanglie*) is listed as Migratory Marine under the EPBC Act, as Conservation Dependant under the BC Act, and as least concern by the IUCN.

Humpback Whales have not been recorded in the Project Area, however they have been sighted within 10 km of the Project Area to the south in deeper waters >20m, and further north west off Gantheaume Point, and are known to move through the region during their annual migration. Within the Kimberley and Broome region Humpback whales are commonly sighted in waters >10m, however they have been sighted in waters less than 10m in the region, although less common. They generally travel along the 20m depth contour and greatest densities are found between the 10-50m depth contours. The distance at which they are found from shore varies and is dependent on their migration path north and south (**Figure 6**). Mother and calve humpback whales are found closer to the shore at an average of 40km on their southern migration during August - October to reduce possible attacks from sharks, killer

whales and threat from male humpback whales in deeper waters. It is also suggested that cow and calf pods use inshore waters and sheltered bays for resting. On their northward migration (April – August) humpback whales predominately occur further offshore (~70km). Biologically important areas such as nursing, foraging, and feeding have not been identified for humpback whales within the Project Area. Given the shallow waters of the Project Area it is unlikely Humpback Whales would occur here.

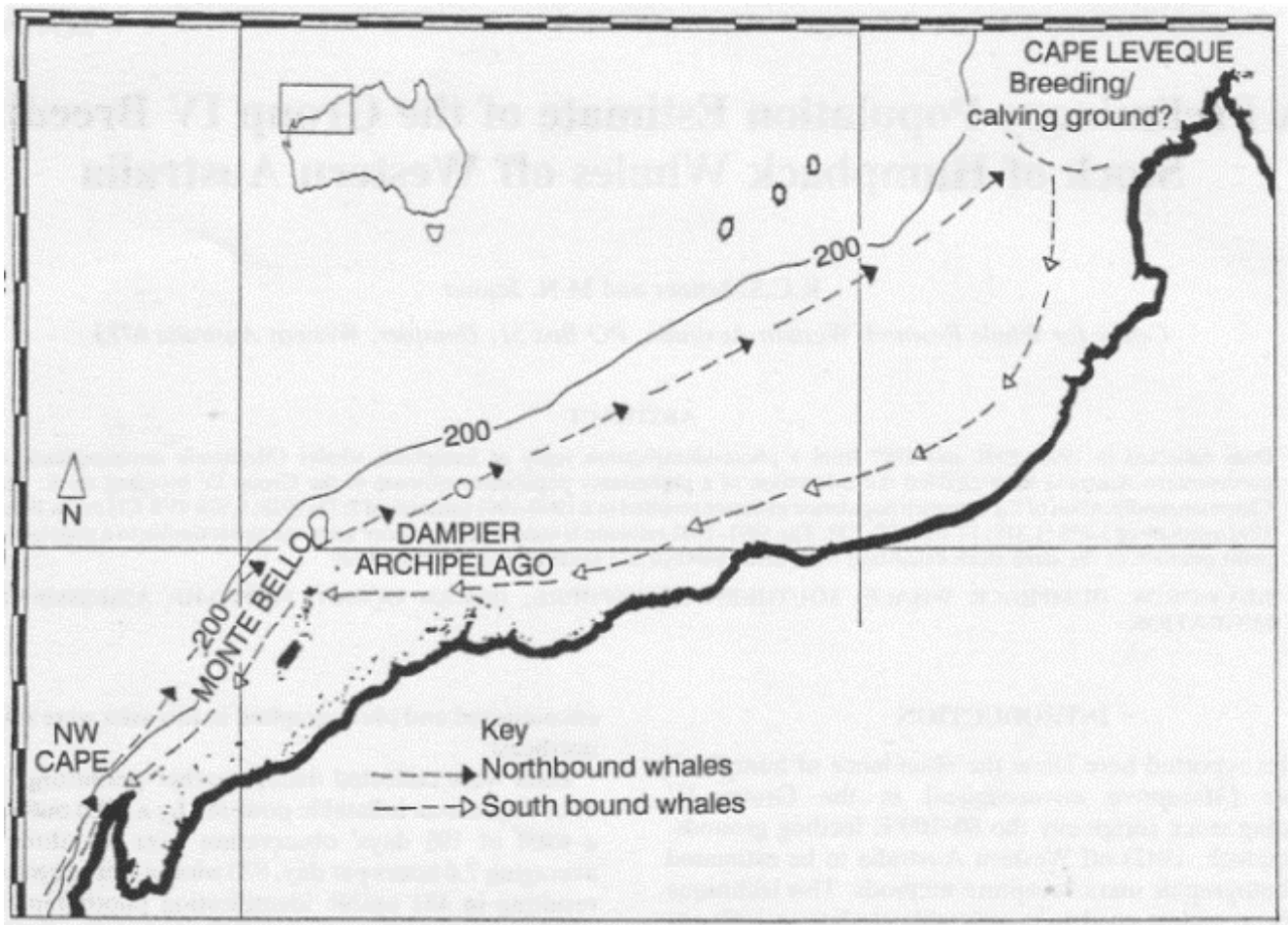


Figure 6 Northern and Southern migratory route of the Group IV humpback whales (Jenner and Jenner, 1994).

Bony Fish

The following three (3) syngnathid (Pipefish and Seahorse) species are known or have a high likelihood of occurring within 10 km of the Project area:

- > Tiger Pipefish (*Filicampus tigris*) – Marine (EPBC), Least Concern (IUCN);
- > Flat-face Seahorse (*Hippocampus planifrons*)– Marine (EPBC), Least Concern (IUCN); and
- > Tidepool Pipefish (*Micrognathus micronotopterus*) – Marine (EPBC), Least Concern (IUCN)

All three species have not been recorded in the Project Area and biologically important areas such as breeding, foraging, resting or migration have not yet been identified for seahorse and pipefish species in the region. Their likelihood to occur within the Project Area is based on their preferred habitat and the existence of this habitat within the Project Area. Habitat characteristics that determine species occurrence include depth and substrate. The Flat-faced seahorse is typically found at depths between 10 – 100 m, in areas where seagrass, kelp beds, algae, coral reef, mangroves, gravel, sandy bottoms

around shallow reefs and muddy bottoms in deeper waters. The Tidepool pipefish are associated with shallow waters of inshore reefs and tidepools, but also found in sparse seagrasses and algae rubble; generally at depths between 1 and 5m and individuals have been found at 10m. Tiger pipefish inhabits shallow seagrass beds and sponge, mud, sand, rock, and rubble areas in depths of 2 – 30m. Given habitat exists in the Project Area for each of these species it is likely either species could occur here.

Many syngnathids, particularly seahorses, are susceptible to habitat degradation as a result of their biology (CoA, 2012). Syngnathids are characterised by relatively low population densities (which means that lost partners are not quickly replaced); Natural rates of adult mortality may be low (short lived); low adult mobility and small home range sizes (may restrict the recolonization of depleted areas or colonization of new areas, although juveniles may be the primary disperses); dependency at birth and offspring dependence on the survival of the males; monogamous breeding (a ‘widowed’ partner may stop reproducing until another mate is found); small brood sizes (production of few young per breeding cycle limits the potential reproductive rate, however they have advanced development of the young when they leave the pouch); and strong association with preferred habitats (specific habitat requirements) (Lourie et al, 2004). Habitat protection is one of the most important factors in protecting seahorses (CoA, 2012).

In contrast, a number of pipefish species that live in coastal waters have high population densities and live in unstable habitats subject to damage from storms and dramatic changes in temperature or salinity. These species can quickly colonise patches of suitable habitat.

4.4.4. Potential Impacts

Construction Phase Impacts

During the construction phase of the Proposal, the following activities and resulting impacts have the potential to adversely affect marine fauna in the vicinity of the proposed KMOF development:

1. Underwater noise emissions from piling operations causing temporary or permanent injury to marine fauna;
2. Increased risk of marine fauna vessel strike from construction vessels;
3. Inappropriate lighting on construction vessels affecting marine fauna behaviour;
4. Hydrocarbon spill during construction causing marine fauna injury or fatality and/or impact on critical habitat; and
5. Introduction of marine pest species from construction vessels resulting in decline in local marine fauna populations.

Operational Phase Impacts

The following post-construction or operational phase impacts have the potential to adversely impact on marine fauna in the vicinity of the proposed KMOF development:

6. Hydrocarbon spill during construction causing marine fauna injury or fatality and/or impact on critical habitat;
7. Increased vessel movements resulting in greater risk of vessel strike on marine fauna;

8. Introduction of marine pest species from trading vessels resulting in decline in local marine fauna populations; and
9. Inappropriate lighting on the KMOF has the potential to affect marine fauna behaviour.

4.4.5. Impact Assessment

Construction Phase Impacts

Underwater noise emissions from piling (1)

Noise generated by piling activities has the potential to disturb marine fauna, causing temporary or even long-term avoidance of an area that may be important for feeding, reproduction or sheltering. Underwater noise may interfere with communication systems of fish and marine mammals, masking important biological cues or causing behavioural disturbance. Intense underwater noise in close proximity to marine fauna may cause temporary or permanent hearing damage or death. These impacts may affect critical behaviours and functions, such as feeding, migration, breeding and response to predators, all of which may ultimately affect an individual animal's survival.

To evaluate the underwater noise impacts on conservation significant marine fauna, KMSB commissioned a study by Talis (2020), which is provided in Appendix C. The study focused on those conservation significant species that were considered to have the highest likelihood of occurrence in the vicinity of the proposal area, including whales, dugong, dolphins, turtles and sawfish.

The Talis (2020) study simulated underwater noise from piling sources along the length of the trestle jetty for two depth scenarios, including:

- > Shallow water piling in water depths <5 m; and
- > Deep water piling in water depths >5 m depth.

During shallow water piling Talis (2020) found that there was an initial rapid attenuation of the piling noise until it reached the deeper water of the channel, where the noise attenuates slower and the spatial extent is restrained to limit the trajectory range of the noise generated by shallow piling activities (**Figure 7A**). Conversely, during deep water piling, the initial attenuation is not as rapid as in shallow water, because the higher sea levels and the spatial extent to which the trajectory of the noise is restrained is different to that of the shallow piling activities (**Figure 7B**). The noise emissions for deep-water piling follow the 20 m contour North East into Roebuck Bay. It is noted that for both deep and shallow water piles, the land mass to the north west of the Project area shields piling noise, preventing any noise propagating toward the north west direction (Talis 2020).

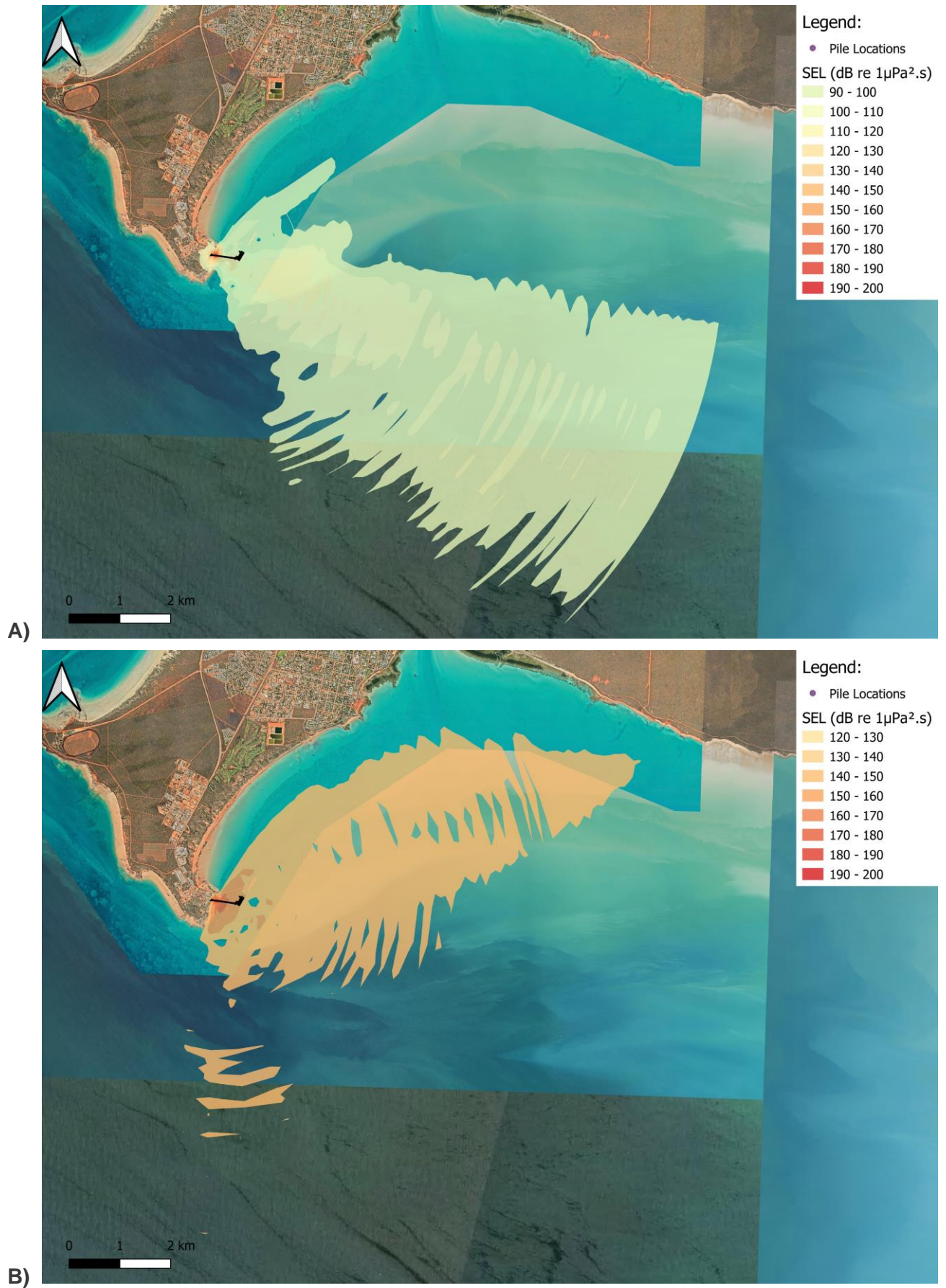


Figure 7 A) Shallow water piling trajectory; B) Deep water piling trajectory (Talis 2020)

Talis (2020) then assessed the noise modelling results in the context of Temporary Threshold Shift (TTS) and behavioural disturbance levels (i.e. management ranges) for each of the target marine fauna species. These results are presented in Figure 8 (Turtles & Sawfish), Figure 9 (Whales & Dugong) and Figure 10 (Dolphins).

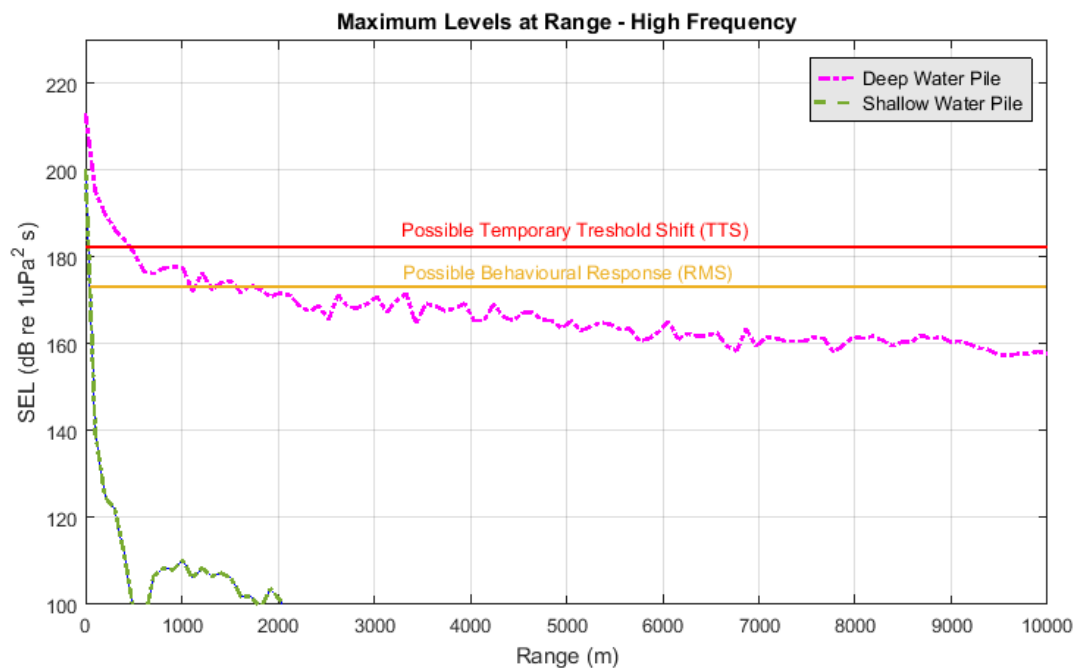


Figure 8 Maximum noise level with range for Turtles and Sawfish – Piling – SEL for a single strike

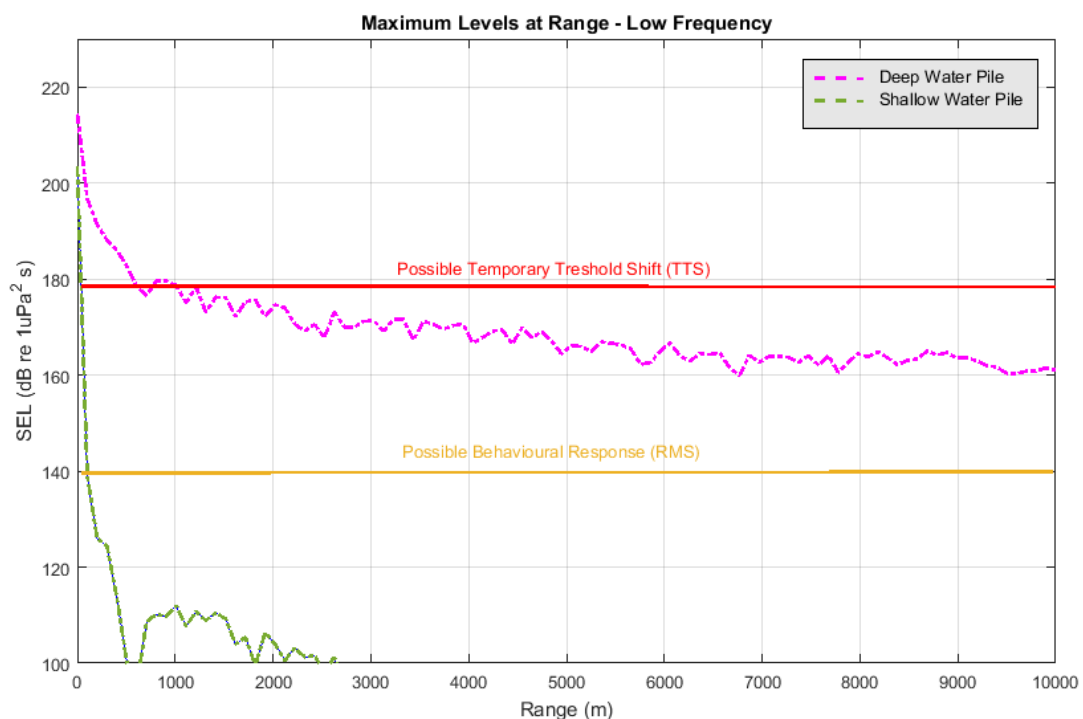


Figure 9 Maximum noise level with range for Whales and Dugongs – Piling – SEL for a single strike

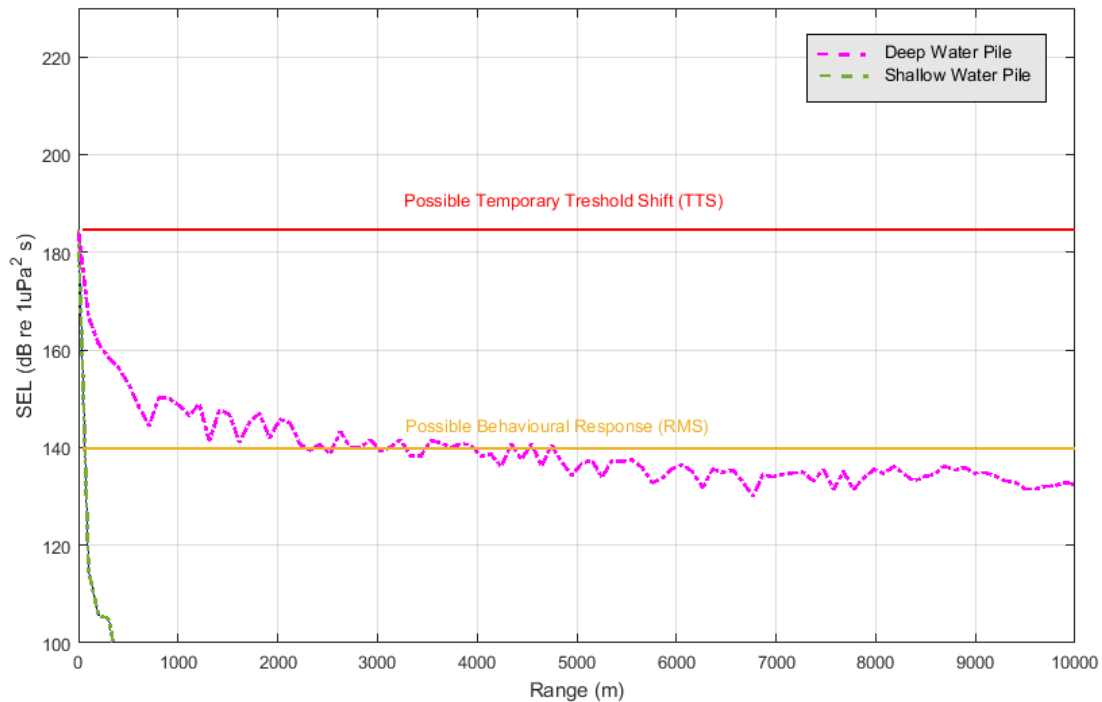


Figure 10 Maximum noise level with range for Dolphin – Piling – SEL for a single strike

The following conclusions are made by Talis (2020) regarding these management ranges and the potential impact on the target species:

- > Shallow water piling exceedances of TTS and behavioural disturbance levels only occur in proximity of the pile for Whales, Dugongs Dolphins and Sawfish. It is therefore possible to manage using Marine Mammal Observers (MMO's).
- > Deep-water piling exceedances of TTS levels occur up to ranges of 500 m for turtles and sawfish and up to 1 km for Whales and Dugongs. It is therefore possible to manage using Marine Mammal Observers (MMO's).
- > Deep-water piling behavioural exceedances range from 1.7 to greater than 10 km. These extended ranges are difficult to manage using MMO's, in particular the >10 km range for Whales. As a result, the following management or mitigation options should be considered:
 - There are only 10 deep water piles (assuming all other piling can be undertaken when water depths are < 5m). If each pile takes 1 hour to drive-in, this equates to a total 10 hours of disturbance, or maximum of 1 to 2 hours a day depending on whether 1 or 2 deep-water piles are driven in.
 - Blue and Bryde's whales are expected to occur outside Roebuck Bay in deeper water and will therefore not be affected by the piling.
 - Humpback whales occur in the vicinity of the Project area during their annual migration between July and September each year. Scheduling deep-water piling outside this time period will therefore mitigate the impacts.
 - Dugong feeding grounds are expected to occur in shallow water, which will result in far lower received noise levels. If dugongs are found outside of the shallow water areas their ranges from the piling should be monitored in a similar way to whales.

Increased risk of vessel strike due to construction vessel traffic (2)

The Marine fauna known to occur in the Project area may be impacted by vessel strike during the construction phase, with the potential impact resulting in injury or fatality. However, due to the mobility of dolphins minimal risk would be expected of the species being injured. Dugongs, whales and turtles would also be able to hear vessel noise and have plenty of time to respond. Important foraging habitats for dolphins, dugongs and turtles are not found within the development envelope, and therefore, it is less likely these species will be in the direct path of construction vessel movement. Vessel speeds can be effectively managed to afford greater protection of individual animals from a broad range of sensitive marine fauna to the potential impacts from vessel strikes.

DSWEPaC (2012) classifies vessel strike as a “Potential Concern” for humpback whales, dugongs and turtles. Vessel speeds can be managed to afford greater protection of individual animals from a broad range of sensitive marine fauna to the potential impacts from vessel strikes. Laist, (2001) found significant increase in the risk of vessel collision between marine megafauna and vessels at speeds above 10 knots and more severe and lethal injuries were found to be caused by vessels travelling at speeds above 14 knots. The likelihood of a vessel strike during construction from proposed vessel movements is considered low due to the small scale (i.e. spatial movements) of the operation and piling plant (i.e. slow-moving and small support vessels). The risk is further reduced by limited vessel speeds in the construction zone to no more than 8 knots.

The consequence of vessel strike on marine fauna may result in injury or mortality, although potential impacts from proposal activities are unlikely to result in significant declines in the local or regional populations of species and their distribution, or reductions in the diversity of species.

Inappropriate lighting has the potential to affect marine fauna behaviour (3)

Artificial lighting has the potential to disrupt the behaviour of light sensitive marine fauna, such as marine turtles. Turtles have been classified as “Concern” in relation to the vulnerability of these animals to artificial lighting (DSWERaC, 2012).

For marine turtle and seabird species, light pollution along, or adjacent to, nesting beaches or rookeries may cause alterations to critical nocturnal behaviours, particularly the selection of nesting sites and the passage of emerging turtle hatchlings from the beach to the sea. During construction there may be small temporary increases in light levels in and around the works areas. However, significant or prolonged night works are not required for the Proposal. Pile set up (or emergency piling to stabilise a positioned but unstable pile) may occur between 7 – 10 pm, in which case temporary lighting will be required.

Given that the nearest turtle nesting beaches are >10 km from the proposal area at Cable Beach, no impacts are predicted on any significant turtle habitats.

Hydrocarbon spill causing marine fauna injury or fatalities and/or impact on critical habitat (4)

In the event of a Hydrocarbon spill, there is a risk of marine fauna being exposed to surface oil or ingesting small quantities. Birds, dolphins, sea snakes, sharks and rays and finfish have been classified as “Potential Concern” for their vulnerability to chemical spills (DSWEPaC 2012). The primary substance of concern is diesel and small amounts of lubricating oil and grease for maintenance of vessel equipment which may be accidentally spilled during regular vessel activities (i.e. accidental

discharge, collision, deck drain and refuelling). KMSB has developed a CEMP, which includes appropriate mitigation measures to avoid and minimise the risk of a spill occurring during the construction phase of the proposal and these are described with respect to marine environmental quality in **Table 10**.

Overall, the risk of an hydrocarbon spill during construction is considered low and with the appropriate planning and mitigation measures in place in the event of a spill, the threat to marine fauna is considered very low.

Introduced marine pest incursion from construction vessels (5)

Marine pests can be introduced through ballast water exchange or via biofouling. Dredgers and supply vessels are among the vessels considered high-risk for the introduction of species. There is a low risk of marine pests becoming established and affecting the biodiversity values and/or ecological integrity of the local environment when appropriate mitigation measures are adopted.

Mitigation measures consistent with the National System for the Prevention and Management of Marine Pest Incursions, the Australian Ballast Water Management Requirements, the National biofouling management guidelines for commercial vessels reduce the risk that Proposal activities will result in the introduction of marine pests in port and inshore environments. Management measures to mitigate the risk of invasive marine species are outlined in **Table 12** and included in the KMSB CEMP. Provided that these mitigation measures are implemented, the risk of marine pest incursion during construction is considered to be negligible.

Operational Phase Impacts

Hydrocarbon spill causing marine fauna injury or fatalities and/or impact on critical habitat (6)

Risks of impact to marine fauna from hydrocarbon spill are also present during the operation phase of the project, particularly associated with spills during refuelling and/or vessel collision. However, these risks can be effectively mitigated through industry standard controls which are described with respect to marine environmental quality in **Table 10**. Through implementation of these controls the residual risk to marine fauna is considered to be very low.

Increased vessel movements resulting in greater risk of vessel strike on marine fauna (7)

As with the construction phase, the risk of vessel strike on marine fauna during the operation of the KMOF is considered unlikely due to speed restrictions of less than 8 knots for the approach channel and Port of Broome and the limited number of vessels using the facility (i.e. ~2 vessel movements per day).

The consequence of vessel strike on marine fauna may result in injury or mortality, however, potential impacts from proposal activities are unlikely to result in significant declines in the local or regional populations of species and their distribution, or reductions in the diversity of species.

Introduced marine pest incursion from trading vessels (8)

As with the construction phase, marine pests can be introduced during operations through ballast water exchange or via biofouling. Trading vessels are among the vessels considered high-risk for the introduction of species. However, where appropriate mitigation measures are adopted, the risk of

marine pests becoming established and affecting the biodiversity values and/or ecological integrity of the local environment is low.

Mitigation measures consistent with the National System for the Prevention and Management of Marine Pest Incursions, the Australian Ballast Water Management Requirements, the National biofouling management guidelines for commercial vessels reduce the risk that Proposal activities will result in the introduction of marine pests in port and inshore environments. Management measures to mitigate the risk of invasive marine species are outlined in **Table 12** and included in the KMSB TEMP. In addition, KPA participates in the SWASP monitoring program. Provided that these mitigation measures are implemented, the risk of marine pest incursion during operations is considered to be negligible.

Inappropriate lighting has the potential to affect marine fauna behaviour (9)

As stated above, artificial lighting has the potential to disrupt the behaviour of light sensitive marine fauna, such as marine turtles. However, the MOF is located in area that is already an operational port with 24-hour lighting. The proposal is also located more than 10 km from the nearest turtle nesting beaches (i.e. Cable Beach), therefore, given turtles are at most risk from artificial light sources this risk is considered to be negligible. Nevertheless, KMSB will install wild-life friendly lighting on the trestle jetty and floating platform.

4.4.6. Mitigation

Management proposed to minimise potential impacts on the environmental factor 'Marine Fauna' are described in **Table 12** and presented in accordance with the EPA's mitigation hierarchy (Avoid, Minimise, Rehabilitate²).

² Rehabilitation measures are excluded from Table 12 as these are not expected to be required to mitigate impacts to marine fauna.

Table 12 Mitigation measures to minimise impacts on Marine Fauna

Potential Impact	Avoidance	Minimisation	Residual Impact
Construction Phase Impacts Construction phase impacts will be managed through development and implementation of a CEMP, which is required to be reviewed and approved by KPA prior to commencement of construction works (Refer Section 1.4.1). The following mitigation measures will be included in the CEMP to mitigate impacts on marine fauna during construction.			
Underwater noise emissions from piling	<ul style="list-style-type: none"> > Piling will be undertaken in shallow (i.e. < 5 m depth) waters whenever possible. > Deep-water (i.e. > 5 m depth) piling will not occur between July and September when Humpback Whales are migrating throughout the Kimberley region. > Piling will be limited to daylight hours only, when marine fauna observations can occur. 	<ul style="list-style-type: none"> > Implement underwater noise management procedure as described below and presented Figure 11, which broadly includes: <ul style="list-style-type: none"> o Trained marine fauna observers to be used prior to and throughout piling operations. o Maintenance of visual observation and exclusions zones. o Soft-start procedures. 	<ul style="list-style-type: none"> > Temporary disturbance of marine fauna present in the vicinity of piling operations, possibly resulting in temporary behavioural changes to avoid noise-affected areas. > No injury to marine fauna as a result of piling operations.
Hydrocarbon spill	Mitigation as defined for the factor marine environmental quality (Refer Table 10)		> No residual impact is predicted.
Vessel strike on marine fauna		> All vessels will travel between 5-8 knots in the Proposal area.	> No vessel strikes on marine fauna are predicted.
Artificial lighting affecting turtle behaviour	> Piling works will not be undertaken at night time, thereby reducing lighting requirements during construction.	> Where required, lighting will be temporary in nature.	> No residual impact is predicted.
Operational Phase Impacts Operational phase impacts will be managed through development and implementation of an TEMP, which is required to be reviewed and approved by KPA prior to commencement of KMOF operations (Refer Section 1.4.1). In addition, any vessels transiting through the Port of Broome to the KMOF will be managed by the KPA in accordance with their existing policies and procedures. The following key management actions will be included in the TEMP to mitigate impacts on marine fauna during operations.			
Hydrocarbon spill	Mitigation as defined for the factor marine environmental quality (Refer Table 10)		> No residual impact is predicted.

Potential Impact	Avoidance	Minimisation	Residual Impact
Vessel strike on marine fauna	> Maximum vessel speed within all operational areas of the KMOF is five knots;	> All incidents of marine fauna vessel strike that occur within the operational areas of the KMOF are required to be reported to the harbour master.	> No vessel strikes on marine fauna are predicted.
Artificial lighting affecting turtle behaviour	N/A	> Where possible, wild-life friendly lighting (i.e. with amber LED and narrow spectral distribution will be used.	> No residual impact is predicted.
Introduced Marine Pests / Biosecurity	N/A	> Implementation of KPA existing procedures which include: <ul style="list-style-type: none"> ○ Requirement for all vessels to comply with Commonwealth Department of Agriculture and Water Resources – Biosecurity Requirements. ○ Requirement for all vessels visiting the Port of Broome from international or interstate waters are required to complete the WA Department of Primary Industries and Regional Development ‘Vessel Check’ risk assessment (https://vesselcheck.fish.wa.gov.au). ○ Implementation of the Marine Pest State-Wide Array Surveillance Program (SWASP) at the Port of Broome. 	> No residual impact is predicted.

Underwater Noise Management Procedure

Underwater noise generated from piling works and vessel operations during construction will be managed by KMSB in accordance with the following underwater noise management procedure described below and presented in **Figure 11**. Target marine fauna for underwater noise management includes whales, dugong, dolphins and turtles.

To mitigate and manage noise impacts generated from piling works on the target marine fauna, noise impacts from piling will be managed according to the depth of water which piling will be conducted i.e. shallow water (<5 m) and deep water (>5 m). Within each depth corresponding management zones will be applied. A suitable trained marine fauna observer will conduct visual observations for both shallow and deep-water zones. A marine fauna observer will conduct visual observations on the piling platform during shallow water piling. During deep water piling a marine fauna observer will conduct visual observations from a roaming vessel.

Management Zones

The marine fauna observer will perform visual observations within a 500m Observation zone (distance from piling works) for all target marine fauna during shallow water piling. Within the observation zone is a 100 m exclusion zone for all target marine fauna (**Figure 12**).

During Deep water piling the marine fauna observer will perform visual observations within a 2 km observation zone for all target marine fauna. Due to the extent of this zone, roaming vessel observations will be conducted. Within the observation zone is a 1 km exclusion zone which applies to whales and dugongs, and a 500 m exclusion zone which applies to turtles (**Figure 13**).

Management Procedure

1. Commence Marine Fauna Visual Observation Prior to Commencement of Piling

Prior to piling works each day the marine fauna observer will commence visual observations for 30 minutes within the management zones (i.e. if shallow water piling, only management zones corresponding to this depth zone).

- > If target marine fauna are observed within the management zone, piling operations shall delay until target marine fauna have exited the management zones or have not been seen for 20 minutes.
- > If target marine fauna are not observed within the management zone, piling operations may commence with soft-start procedures.
- > Daily records of all target marine fauna observations within 500 m of piling operations;
 - Record observed cetaceans in a format consistent with the National Cetacean Sighting and Stranding's Database;
 - Other target marine fauna observations within 500 m of piling operations;
 - Fauna behaviors, in particular any behaviors that could be attributed to piling activities;
 - Management responses in relation to dead and injured wildlife, including suspension of piling activities; and
 - Observation effort in relation to piling activities.

2. Soft-Start Piling

Soft-start procedures involve gradually increasing the piling impact energy over a 30-minute period. The soft-start procedure may alert marine mammals to the presence of the piling activity and enable animals to move away to distances where injury is unlikely. The marine fauna observer will continually monitor the management zones during soft-start procedure.

Observation Zones

- > Where target marine fauna are observed within the observation zone then following procedure shall be applied:
 - If it is evident that the marine fauna are in distress then piling operations shall cease until marine fauna have exited the management zones or have not been seen for 20 minutes. Once target marine fauna have exited the management zone, soft start piling may recommence.
 - If target marine fauna are not showing signs of distress, soft start procedures will continue and the marine fauna observer will continue to monitor the marine fauna.
- > Where target marine fauna are not observed within the management zones for the duration of the soft-start procedure then normal piling operations may commence.

Exclusion Zones

- > Where target marine fauna are observed within the exclusion zone then soft-start piling operations shall cease until target marine fauna have exited the management zones or have not been seen for 20 minutes. Once target marine fauna have exited the management zone, soft start piling may recommence.
- > Where target marine fauna are not observed within the management zones for the duration of the soft-start procedure then normal piling operations may commence.

3. Normal Piling

Where target marine fauna are not observed in management zones during soft start procedures then normal piling can commence. Normal piling involves commencement of full impact piling. The marine fauna observer will continually monitor the management zones during normal piling.

Observation Zones

- > Where target marine fauna are observed within the observation zone then following procedure shall be applied:
 - If it is evident that the marine fauna are in distress then piling operations shall cease until marine fauna have exited the management zones or have not been seen for 20 minutes. Once marine fauna have exited the management zone, soft-start piling may recommence.
 - If target marine fauna are not showing signs of distress, piling operations will continue and the marine fauna observer will continue to monitor the marine fauna.

Exclusion Zones

- > Where target marine fauna are observed within the exclusion zone then piling operations shall cease until target marine fauna have exited the management zones or have not been seen for 20 minutes. Once target marine fauna have exited the management zone, soft-start piling may recommence.
- > Where target marine fauna are not observed within the management zones then normal piling operations may continue.

4. Low-Visibility Conditions

During periods of low visibility (i.e. where a distance of 500 m cannot be clearly viewed), then piling operations may commence with soft-start procedures provided that during the preceding 24-hour period:

- > There have not been three or more circumstances where marine fauna have been observed which resulted in ceasing of piling operations;
- > A 2-hour period of continual observations was undertaken in good visibility within the 24-hour period prior to proposed piling and no marine fauna sighted; and
- > Piling should occur during daylight hours unless in the case of a safety/emergency; at such times it will not extend beyond 10pm.

5. Additional Considerations

- > Piling should be undertaken in shallow (i.e. < 5 m depth) waters whenever possible;
- > Deep-water (i.e. > 5 m depth) piling should not occur between July and September when Humpback Whales are migrating throughout the Kimberley region;
- > Piling should only be undertaken during daily hours when marine fauna observations can occur; and
- > The management procedure must be repeated from the beginning for all piles.

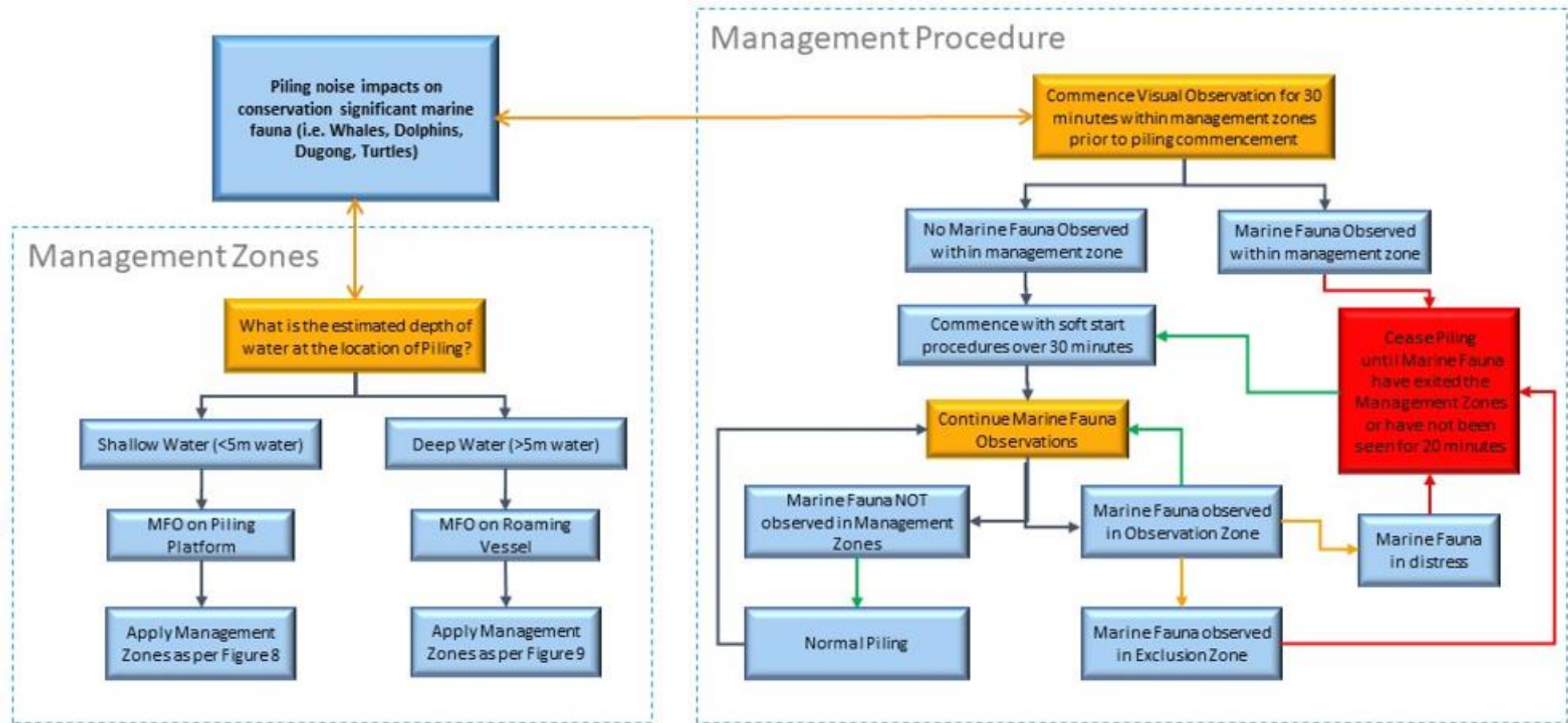


Figure 11 Underwater Noise Management Process

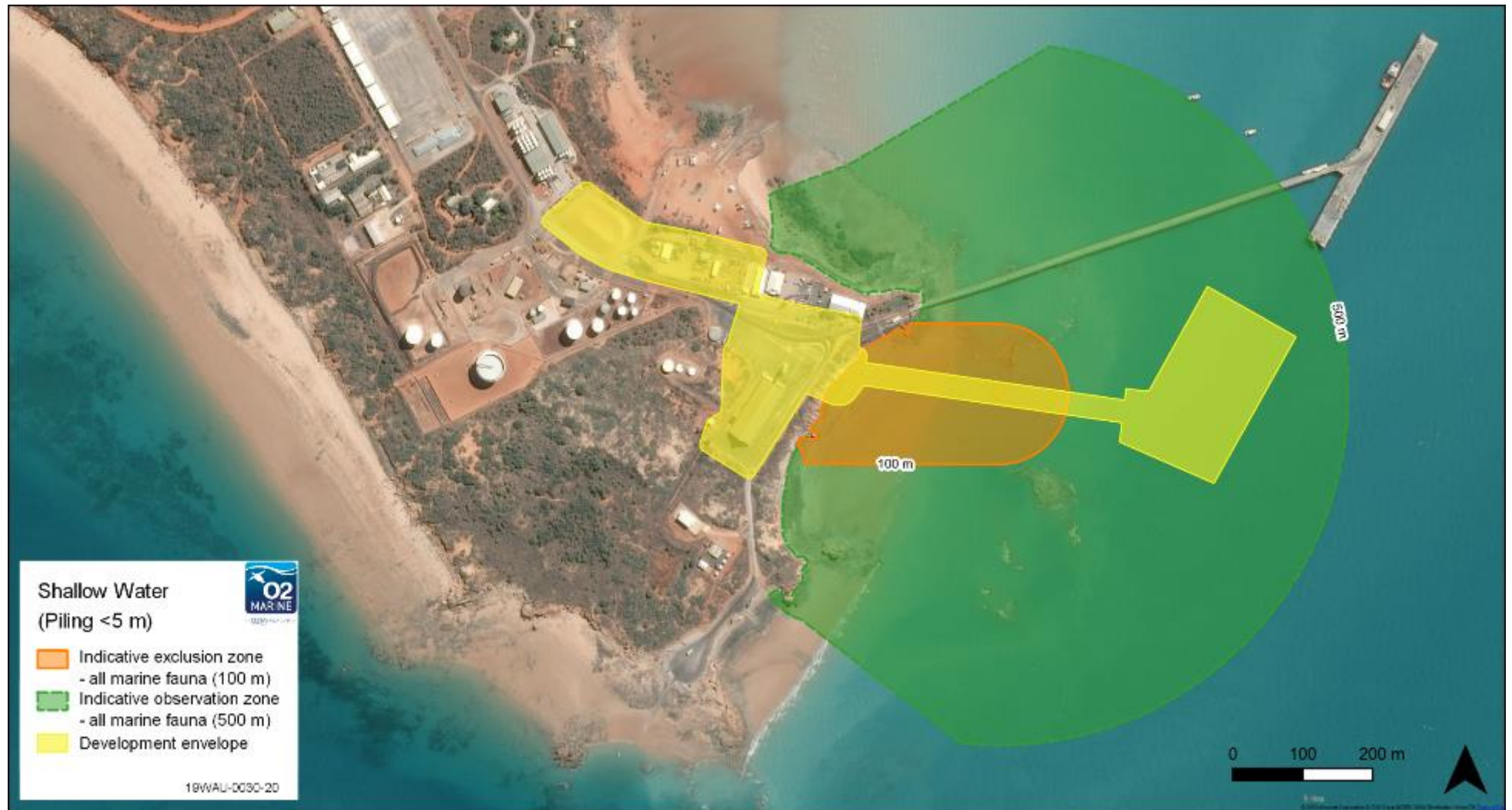


Figure 12 Shallow water piling management zones



Figure 13 Deep water piling management zones

4.4.7. Predicted Outcome

Implementation of the Proposal in accordance with the defined mitigation, management and monitoring actions will result within the following Environmental Protection Outcomes:

- > No impacts to important habitats (i.e. nesting, nursery, foraging or breeding areas), for any conservation significant marine fauna species;
- > No harm to any individual conservation significant fauna species;
- > No reduction in populations of species of local and regional importance;
- > No reduction in the biodiversity of marine fauna in the Development Envelope or surrounds;
- > No introduction and/or spread of invasive marine species or diseases; and
- > Temporary disturbance of marine fauna present in the vicinity of piling operations, possibly resulting in temporary behavioural changes to avoid the noise-affected area.

The combined impact of the Proposal activities and the consequent outcomes are not considered to pose any significant residual risks to the protection of marine fauna and therefore biological diversity and ecological integrity can be maintained. In respect of the proposed design and management of the Proposal, the Proponent considers that the EPA's objective for marine fauna has been met.

4.5. Terrestrial Fauna

4.5.1. EPA Objective

The EPA's objective for the environmental factor 'Terrestrial Fauna' is to:

'To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.'

4.5.2. Policy and Guidance

The following EPA policies and guidance have been considered in evaluating potential impacts on this factor:

- > EPA (2016d). Environmental Factor Guideline: Terrestrial Fauna, EPA, Western Australia; and
- > Commonwealth of Australia (2017). EPBC ACT Policy Statement 3.21 - Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species.

4.5.3. Receiving Environment

Studies of terrestrial fauna that are relevant to the Proposal are identified in **Table 13**.

Table 13 Receiving Environment Studies – Terrestrial Fauna

Author (Date)	Study
APM (2020)	Biological Survey: Kimberley Marine Offloading Facility
Ornithological Technical Services (2020)	Kimberley Marine Offloading Facility: Migratory Shorebird Survey
O2 Marine (2020b)	Kimberley Marine Offloading Facility: Benthic Infauna Survey
Rogers & Hassell (2017) (WAMSI)	Evaluating the impacts of local and international pressures on migratory shorebirds in Roebuck Bay and Eighty Mile Beach

Proposed disturbance of terrestrial fauna habitat within the landside component of the Development Envelope is limited. Therefore, whilst other conservation significant fauna species are briefly discussed, this chapter is primarily focussed on assessing potential impacts to migratory shorebirds.

Shorebirds

The Roebuck Bay RAMSAR Wetland, located 10 km west of the proposed KMOF, is recognised as a site of international importance for at least 20 species of migratory shorebirds with total numbers of waders using the site each year estimated at over 300,000 (OTS 2020).

The EPBC Protected Matters Search Tool (PMST) database identified a total of 37 migratory shorebird species which are protected under the EPBC Act that have the potential to occur in the vicinity of the Proposal. These species are known breed in the northern hemisphere and migrate to Australia along the East Asian-Australasian flyway during the northern hemisphere winter. Australia's coastal and freshwater wetlands provide vital habitat for these birds during their non-breeding season, where they must increase their body weight by up to 70% to build sufficient energy reserves to travel the long distance back to their breeding grounds. They rest during high tide at suitable roosting sites, such as an ocean beach or in salt marshes and mangroves bordering the coastal wetlands. Despite legislative protection and international bilateral conservation agreements, many of these shorebirds have suffered massive population declines in the last 30 years (OTS 2020).

A comprehensive survey of migratory shorebirds within and adjacent to the proposed Development Envelope was undertaken by Ornithological Technical Services (OTS) between December 2019 and February 2020. The aim of this survey was to complete a detailed assessment in accordance with EPBC Act Policy Statement 3.21 to evaluate the significance of the habitat and potential impacts on migratory birds from the proposed development. The complete survey results are presented in **Appendix C** and summarised briefly below.

Over four surveys between December 2019 to February 2020, OTS (2020) confirmed a maximum shorebird abundance observed of 105 individuals, including the presence of seven (7) migratory shorebird species and five (5) species listed in CAMBA, JAMBA and RoKAMBA within the proposed Development Envelope. Of these species, only Ruddy Turnstone (*Arenaria interpres*) was detected in nationally significant numbers (i.e. At least 0.1% of the species' flyway population), and only during three (3) of the 29 targeted surveys of the proposed Development Envelope. Comparatively, surveys

of a single site in the nearby Roebuck Bay RAMSAR Wetland, identified maximum abundance of 8,951 individuals, 17 migratory shorebird species, 13 species present in nationally significant numbers.

The OTS (2020) survey results demonstrate that nationally significant numbers of Ruddy Turnstone are, on occasion, recorded within the footprint of the proposed KMOF. However, the results also show that the area is not used on a continual basis by nationally significant numbers of this species (i.e. Only used 10% of the time), thus demonstrating a low site fidelity to the proposed development area (OTS 2020). No other migratory shorebird species were present in conservation significant numbers, nor were the overall diversity or shorebird abundance at the site of national significance (OTS 2020). Despite qualifying as an area of national significance (due to numbers of Ruddy Turnstone), when the proposed KMOF Development Envelope is considered in the context of the adjoining and surrounding control count areas, it was found to have a considerably lower conservation status.

A supplementary benthic infauna study in February 2020 by O2 Marine examined the shorebird prey resources available at each of the OTS shorebird survey locations. The study aimed to identify if any relationships existed between the species richness and abundance and spatial population results of the migratory birds with benthic infauna at sites adjacent to the project site along with reference sites located within Roebuck Bay.

Whilst the OTS (2020) survey identified significantly higher migratory shorebird species richness and abundance at Roebuck Bay study sites, results from the infauna survey identified the individual site with highest species richness and diversity occurred in Roebuck Bay. However, statistical analysis determined that the benthic infauna community composition was considered to be heterogenous across the study area including both Roebuck Bay and the Broome Peninsula (Development area).

Whilst comparative surveys have identified that increases in infauna richness and abundance being supportive of increases in migratory shorebirds, the result from this the O2 Marine (2020) survey were not conclusive in regard. Rather, it is considered that the following are more likely explanations as to the shorebird numbers surveyed within Roebuck compared to the Development area:

- > The total biomass of benthic infauna present in Roebuck Bay is far in exceedance of the Broome Peninsula (Development area) due to the significantly greater spatial extent of tidal flats available for infauna to habituate, therefore providing a greater foraging opportunities for migratory shorebirds;
- > Roebuck Bay experiences significantly lower levels of anthropogenic interaction due to there being no infrastructure, limited visitor numbers and vessel traffic when compared to the Broome Peninsula (Development area); and
- > The preferred foraging habitat at Roebuck Bay provides shorebirds with 360-degree line-of-site (LOS) over vast distances which are typically required to facilitate foraging efficiency. Comparatively, the currently existing anthropogenic infrastructure (Port Jetty) and natural geomorphology of the rocky headlands, outcrops and the high, steep coastal sand dunes surrounding the Broome Peninsula (Development area) significantly reduce the LOS, thus likely to deter foraging shorebirds from this system.

Other Conservation Significant Fauna

A comprehensive review of the terrestrial fauna habitat and conservation significant fauna likelihood of occurrence within the Development Envelope is provided in the KMOF Biological Survey Report (APM 2020) (**Appendix F**). Results of desktop searches and site investigation is summarised briefly below.

Database searches presented in APM (2020), identified 82 conservation significant terrestrial species (excluding shorebirds) that may occur in the area. Within the DBCA conservation significant fauna database there were three (3) records within the Development Envelope, all for *Sula leucogaster* (Brown Booby) listed under International Agreements (IA) under State and Federal legislation and as a Marine (M) bird under Federal legislation.

APM (2020) also determined that the Development Envelope contains suitable foraging habitat for seven (7) bird species with a High likelihood of occurrence and suitable foraging habitat for four (4) bird species with a Moderate likelihood of occurrence. No suitable habitat occurs for nesting or breeding for conservation significant birds within the Study Area.

No database records of conservation significant reptiles occur within the Study Area (APM 2020). However, the Dampierland Burrowing Snake (P2) and Dampierland Plains Slider (P2) are known to occur in the region and potentially suitable habitat exists in the dunes of the Study Area (APM 2020).

There are no terrestrial mammal records in the DBCA conservation significant fauna database for the Proposed Development Envelope. Records from the Broome area are shown in **Appendix F**. Of the conservation significant mammals known from the area, suitable habitat is present only for the Bilby (APM 2020).

4.5.4. Potential Impacts

Construction Phase Impacts

During the construction phase of the Proposal, the following activities and resulting impacts have the potential to adversely affect terrestrial fauna (particularly migratory shorebirds) in the vicinity of the proposed KMOF development:

1. Construction activities have the potential to cause:
 - a. Disturbance to migratory shorebirds within and adjacent to the proposed disturbance footprint on the beach;
 - b. Injury or disturbance to other conservation significant terrestrial fauna.

Operational Phase Impacts

The following post-construction or operational phase impacts have the potential to adversely impact on terrestrial fauna (particularly migratory shorebirds) in the vicinity of the proposed KMOF development:

2. Direct loss of habitat as a result of the proposed KMOF development for:
 - a. Migratory shorebirds; and
 - b. Other conservation significant terrestrial fauna.

3. Presence of the KMOF facility resulting in habitat degradation for migratory shorebirds arising through:
 - a. Line of sight impairment.
 - b. Habitat fragmentation;
 - c. Shading; and
 - d. Introduction of Invasive Marine Species that may affect prey availability.
4. Operation of the KMOF facility resulting in disturbance of migratory shorebirds;
5. Vessel spill or collision may result in hydrocarbon release into the marine environment, resulting in:
 - a. Loss of shorebird prey availability within the affected area; and
 - b. Death or injury to migratory shorebirds.

4.5.5. Impact Assessment

Impacts to shorebirds are discussed below primarily in the context of the Ruddy Turnstone which is the only species present in the development area at nationally significant levels.

Construction Phase Impacts

Disturbance of Migratory Shorebirds (1a)

Site staff, vehicles and plant involved in construction activities have the potential to cause disturbance to migratory shorebirds. However, these activities will be restricted to the proposed development footprint, leaving the majority of the available habitat surrounding the area entirely unaffected (OTS 2020).

Loud, unpredictable noises and strong vibrations (e.g. from installing the access trestle support piles) will disturb shorebirds, potentially at a longer distance than visual disturbances such as moving vehicles (OTS 2020). However, noise associated with piling will generally only occur for approximately one hour, twice per day for 2-3 months. To mitigate this impact, piling works will aim (where possible) to avoid summer periods when migratory shorebirds will be most active at the development beach i.e. December to February.

Bright artificial light can disturb shorebirds at night particularly if the light source is moving and/or flashing/flickering. Some research suggests that shorebirds can benefit from artificial illumination at foraging areas by allowing them to use visual foraging strategies and increase their foraging efficiency (Dwyer *et al.* 2013; Santos *et al.* 2010). Given the area is an operational Port and is already well lit, it is unlikely that any further lighting would impact on shorebirds. However, in order to mitigate any potential affects, construction lights will be directed away from shorebird feeding and roosting areas wherever possible, and no flickering lights will be used (except where required for navigational purposes).

Injury to / Disturbance of Other Conservation Significant Fauna (1b)

Clearing of a small area Dunes vegetation for the proposal has the potential to disturb conservation significant fauna which may reside there. However, given the small area and degraded condition of the

Dunes vegetation within the Development Envelope, it is very unlikely to provide suitable habitat for the Bilby, although may support very small populations of the Dampierland Burrowing Snake (P2) and/or Dampierland Plains Slider (P2) (APM 2020). Therefore, to avoid disturbance of these conservation significant species, a pre-clearance fauna survey will be undertaken prior to any vegetation clearing. The small amount of area to be cleared is very small and in poor condition in comparison to the adjoining vegetation which is larger and of higher quality.

Operational Phase Impacts

Direct Habitat Loss – Shorebirds (2a)

Direct loss of habitat used by migratory shorebirds will be confined to a very small area where the support structures (piles) of the jetty access trestle are proposed to be installed. The access trestle is expected to be supported by approximately 36 piles with a diameter of 1500 mm each along its length of 420 meters. More than half of this length will be above habitat that is submerged permanently and lies within the neritic zone and as such is not available for shorebirds to utilise. An estimated 16 support piles will be installed within the extent of the beach habitat available to shorebirds when the tide is at its lowest point. This calculation results in a 0.0028 ha area of feeding habitat lost. The remaining intertidal habitat comprises of intertidal rocky reef and rock outcrops which are used by shorebirds and are of particular value to Ruddy Turnstone (OTS 2020), but the development will not lead to direct loss of any of this habitat.

Direct Habitat Loss – Other Conservation Significant Terrestrial Fauna (2b)

Only a very small area of highly degraded Dunes vegetation is proposed to be cleared for the proposal. Whilst this area is not considered suitable habitat for the Bilby, the Dampierland Burrowing Snake (P2) and/or Dampierland Plains Slider (P2) may occupy this area (APM 2020) and have the potential to be displaced. However, the disturbance area is surrounded by good condition, undisturbed Dune habitat that could support any displaced individuals.

Shorebird Habitat Degradation – Line of Sight Impairment (3a)

The physical structure of the proposed jetty has a relatively small footprint in terms of habitat loss as already discussed, however the height and length of the proposed structure may cause it to impair line-of-sight (LOS) for shorebirds using the study area. Migratory shorebirds rely on vision for predator detection, thus prefer open habitat where LOS is unimpaired. Migratory shorebirds are less likely to use foraging habitat located next to a large structure/feature that restricts LOS, as this makes them more vulnerable to predation. When visibility is impaired, Ruddy Turnstones spend more time scanning for predators and their foraging efficiency is likely to be reduced (Metcalf 1984).

The existing Port of Broome jetty is 13.4 m above the water line at lowest astronomical tide (Kimberley Ports Authority 2020) and already probably affects shorebirds in the same way as the proposed KMOF, which provides a useful indicator of the potential impact of the proposed KMOF. In this regard, very few Ruddy Turnstones (or other shorebird species) were observed foraging in suitable habitat within 100 meters of the existing jetty (OTS 2020), but it is unclear whether LOS is the main or only factor influencing this apparent avoidance. OTS (2020) observed Ruddy Turnstones roosting within 100 m of the existing jetty on three occasions, however the majority of Ruddy Turnstones (including the largest flocks) to the north of the existing Jetty were seen foraging and roosting further than 100 m from the existing jetty. OTS (2020) considers that currently, LOS impairment has possibly contributed to an

avoidance zone of roughly 100 meters around the existing jetty. However, there are currently no published LOS avoidance thresholds for Ruddy Turnstones, therefore the potential for the new KMOF structure to negatively impact on Ruddy Turnstones cannot be confirmed.

Nevertheless, in a worst-case scenario, if we assume that LOS impairment will apply for approximately 100 m surrounding the new structure, then the areas between the existing and proposed jetties would be the most heavily impacted by LOS impairment, as the distance between the two jetties will be less than 200 meters and LOS will be impaired on two sides. The area within 100 meters south of the proposed jetty could become less suitable due to LOS impairment, but still available for foraging Ruddy Turnstones and other migratory shorebirds (**Figure 14**). Assuming this 100-meter avoidance is an accurate estimator of Ruddy Turnstone occurrence, the area of degraded shorebird habitat will be approximately 4.38 ha (63% of the total shorebird habitat on the development beach), however part of this is already degraded by the existing jetty. The area of newly degraded shorebird habitat will be approximately 3.25 ha (47.5% of the total shorebird habitat on the development beach). This leaves 37% of the total shorebird habitat on the development beach unaffected by LOS impairment (**Figure 14**). Approximately 45.5% of the unaffected shorebird habitat area is intertidal Rocky Reef and rock outcrops, habitats preferred for feeding and roosting by Ruddy Turnstones.

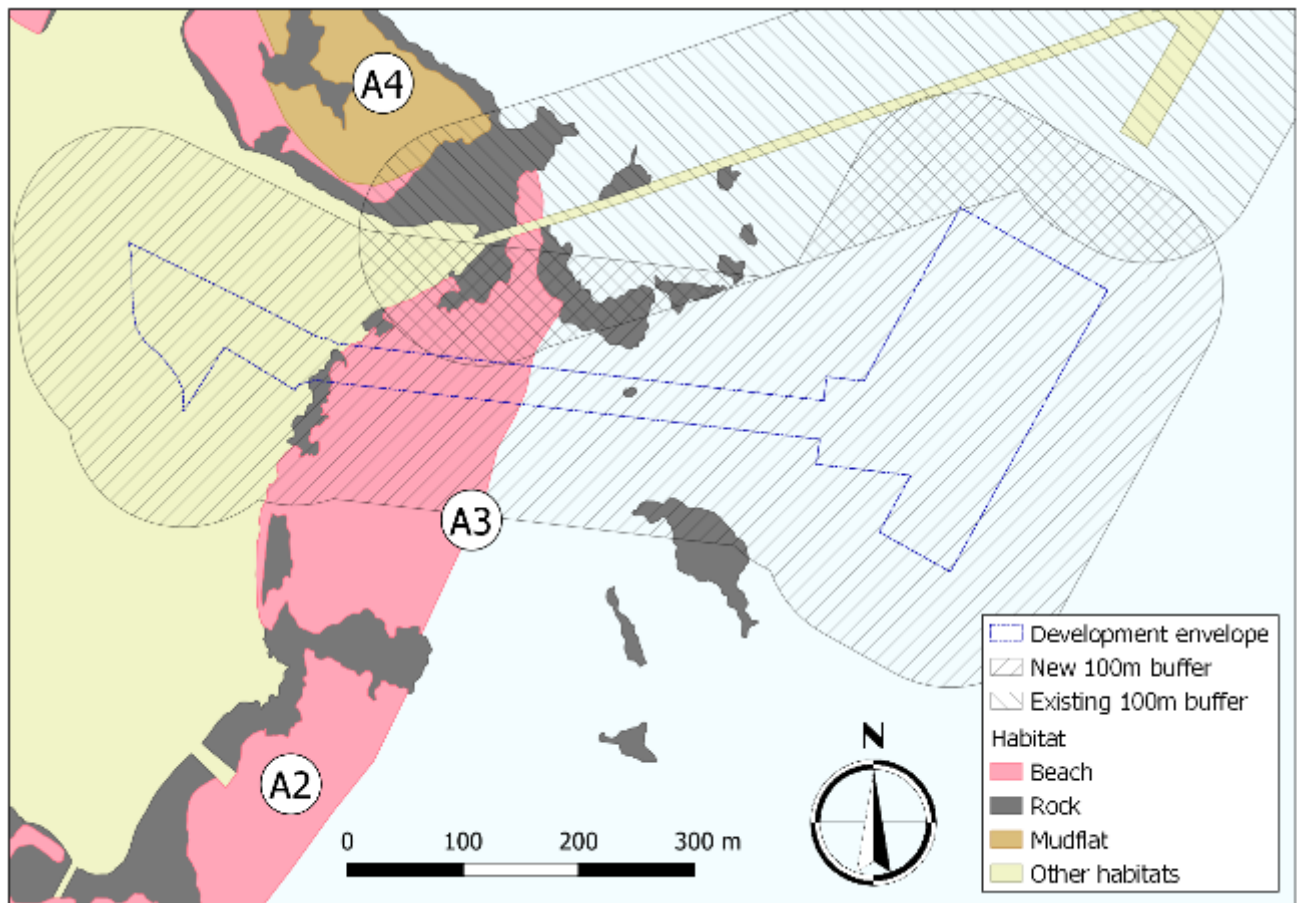


Figure 14 Shorebird habitats at low tide, showing the development envelope and potential 100-metre LOS impairment zones around the existing and proposed jetties (OTS 2020).

Shorebird Habitat Degradation - Fragmentation (3b)

Although the habitat will not be physically fragmented by the proposed development, LOS impairment may cause the area underneath and near the new jetty to become degraded – this can be viewed as effective habitat fragmentation. If LOS impairment does lead to reduced habitat quality and avoidance of structures, the beach in the development area will be split into two effective habitat fragments separated by the new jetty. Habitat fragmentation has the potential to result in a reduction in the number of shorebirds using the site for foraging.

Flight initiation distance (FID) is the distance at which shorebirds take flight in response to a disturbance (e.g. dogs), and this plays a more important role as the area of effective habitat decreases (due to fragmentation or other forms of habitat degradation) (OTS 2020). In small habitat fragments, species with a large FID (low tolerance to disturbances) may not feel comfortable returning to the area if disturbed (OTS 2020). Species with a small FID are less affected by habitat fragmentation, as their higher tolerance to disturbances will allow them to return to a different part of the habitat fragment if disturbed (OTS 2020). The remaining patch of unaffected habitat on the development beach (excluding the proposed jetty and 100-meter buffer zone) is approximately 150 x 100 meters, and published research estimates the average FID for Ruddy Turnstone at 13.8 meters (Weston *et al.* 2012). The habitat fragment is still much larger than the FID for Ruddy Turnstone, therefore habitat fragmentation is considered unlikely to result in a significant reduction to the number of Ruddy Turnstones supported at the development beach (OTS 2020).

Shorebird Habitat Degradation – Shading (3c)

Theoretically, the proposed structure will provide shade across a portion of the beach which previously was unshaded. This reduced light has the potential to reduce the primary productivity of the Benthic Communities and Habitats (BCH) underneath the jetty, causing a reduction in foraging suitability for migratory shorebirds. This impact will probably be restricted to a small very area directly underneath the jetty (0.207 ha, which is 4.4 % of the shorebird beach habitat on the development beach). In addition, this habitat may already be impacted due to LOS impairment as described above.

Shorebird Habitat Degradation – Introduction of Invasive Marine Species (3d)

Invasive marine species may be introduced or translocated in ballast water or on the hulls of vessels. Some invasive species have the potential to negatively impact migratory shorebirds by modifying the habitat and/or the productivity of benthic communities on which shorebirds feed. Invasive weeds such as *Spartina* species are known to modify intertidal habitat and make it less suitable for foraging shorebirds (Commonwealth of Australia 2017). However, whilst invasive marine species have the potential to impact on Shorebirds this risk is already present and effectively mitigated through the existing Port of Broome operational introduced marine pest and biosecurity management and monitoring programs. The Proposed KMOF will operate under this existing management framework. Therefore, the risk of marine pest introduction and subsequent impact on migratory shorebirds is considered to be low.

Operations Causing Disturbance of Migratory Shorebirds (4)

Actions that cause disturbance to shorebirds include visual disturbance from human activities (e.g. vehicles, walking dogs, lights, etc.), loud noises and/or vibrations (e.g. demolition activities), and presence of other animals (e.g. feral predators). These actions may lead to significant impacts if they

take place within an area of important habitat. Roosting and foraging birds are particularly sensitive to discrete, unpredictable disturbances such as sudden loud noises.

Movement of vehicles and personnel along the access trestle are unlikely to impact shorebirds as they will be elevated away from the shorebird habitat. Vessels approaching from the water and docking at the jetty are likely disturb shorebirds if they approach too close to their feeding habitat, although this is unlikely as most operations are expected to take place at the eastern end of the jetty at the floating pontoon.

As with the construction phase, sudden loud noises will still lead to disturbance of shorebirds especially if irregular and unexpected. Nocturnal lighting from the usual operation of the jetty may impact migratory shorebirds (Poot *et al.* 2008).

There is also a large body evidence showing large aggregations of shorebirds in noisy, brightly lit industrial port environments in the North West, including at the Port of Port Hedland, Port of Dampier, Cape Preston, Cape Lambert, etc (Bennelongia 2011). The fact that these large aggregations occur so close to large industrial Ports demonstrates tolerance of at least some shorebird species to industrial port environments.

Given all of the above impacts are already present at the development beach, operations at the new KMOF facility are unlikely result in any new disturbances, which species using the beach would not already be unaccustomed to.

Hydrocarbon Spill (5a, 5b)

Discharges and spills of oils and toxic material has the potential cause direct mortality to shorebirds and/or the prey resources. The Port of Broome is already an operational Port and, as such, the risk of hydrocarbon spills or other unplanned discharges that may potentially affect shorebirds is already present. Therefore, the risk will continue to be minimised through adherence to best practice and maintaining a rapid response capability to protect migratory shorebirds and other wildlife from any effects of unplanned discharges and spills.

4.5.6. Mitigation

Management proposed to minimise potential impacts on the environmental factor 'Terrestrial Fauna' are described in **Table 14**. and presented in accordance with the EPA's mitigation hierarchy (Avoid, Minimise, Rehabilitate³). Given the potential impacts on terrestrial fauna, other than migratory shorebirds are negligible, the proposed mitigation presented in **Table 14** is primarily focussed on mitigating potential impacts to migratory shorebirds.

³ Rehabilitation measures are excluded from Table 14 as these are not expected to be required to mitigate impacts to marine fauna.

Table 14 Management actions to minimise impacts on Terrestrial Fauna

Potential Impact	Avoidance	Minimisation	Residual Impact
Construction Phase Impacts Construction phase impacts will be managed through development and implementation of a CEMP, which is required to be reviewed and approved by KPA prior to commencement of construction works (Refer Section 1.4.1). The following mitigation measures will be included in the CEMP to mitigate impacts on terrestrial fauna during construction.			
Disturbance of migratory shorebirds (General Noise, Light) (1a)	<ul style="list-style-type: none"> > The timing of the construction phase to coincide with the breeding season of Ruddy Turnstone when the vast majority of Ruddy Turnstones that use the development area will be on their Arctic breeding grounds. Specifically, any ground-disturbing works (excluding piling⁴) on the beach/dune area be targeted between May to August. > Pest management is required to prevent encouraging feral predators, i.e. cats, foxes, etc into the construction area. > Induction / education of construction crews regarding the shorebirds species that may occur and the activities that may cause disturbance. 	<ul style="list-style-type: none"> > Soft-start piling procedures will be utilised to warn birds from the area prior to commencement of full energy impact piling. > Piling operations will be limited to twice per day to avoid sustained periods of loud noise. > Wildlife-friendly lighting shall be used wherever possible. > Visual disturbance from personnel and vehicles can be kept to a minimum by ensuring that all construction activities are kept within the construction footprint of the project, and by erecting barriers around the work site to hide activities from the view of nearby shorebirds. 	<ul style="list-style-type: none"> > Temporary disturbance of shorebirds present in the vicinity of piling operations, possibly resulting in temporary behavioural changes to avoid noise-affected areas. However, sufficient areas of extensive higher value habitat occur immediately adjacent to the area.
Injury to / Disturbance of Other Conservation Significant Fauna (1b)	<ul style="list-style-type: none"> > Induction / education of construction crews regarding the shorebirds species that may occur and the activities that may cause disturbance. 	<ul style="list-style-type: none"> > Soft-start piling procedures will be utilised to warn birds from the area prior to commencement of full energy impact piling. 	<ul style="list-style-type: none"> > No injury to shorebirds.

⁴ Piling is required to not occur between July to September for Humpback Whales, which are at greater risk than Shorebirds from piling operations.

Potential Impact	Avoidance	Minimisation	Residual Impact
Operational Phase Impacts Operational phase impacts will be managed through development and implementation of an TEMP, which is required to be reviewed and approved by KPA prior to commencement of KMOF operations (Refer Section 1.4.1). The following key management actions will be included in the TEMP to mitigate impacts on terrestrial fauna during operations.			
Direct Habitat Loss – Shorebirds (2a)	> Development is positioned in an area that supports much lower numbers of migratory shorebirds than adjacent areas	N/A	> Construction of the facility has the potential to result in direct loss 0.0028 ha area of feeding habitat lost. > This loss is considered to be negligible in the context of the adjacent higher value, undisturbed feeding habitat in nearby Roebuck Bay.
Direct Habitat Loss – Other Conservation Significant Terrestrial Fauna (2b)	N/A	Clearing will be limited to areas approved under the existing KPA clearing permit.	> Extent of clearing is very small (i.e. <04 ha) area of degraded dune habitat. This impact is therefore considered to be negligible in the context of the good quality habitat adjacent areas. > Impact is already approved through the existing KPA clearing permit.
Shorebird Habitat Degradation – Line of Sight Impairment, Fragmentation & Shading (3a, b & c)	N/A	> Undertake annual monitoring of shorebirds (3 years post-development) in the immediate vicinity of the KMOF to determine the effect (if any) that LOS impairment (due to jetty-type	> Potential degradation of up to 3.25 ha of foraging habitat. However, very little is known about the affect of LOS impairment on Ruddy

Potential Impact	Avoidance	Minimisation	Residual Impact
		structures) has on Ruddy Turnstone abundance and foraging behaviour.	<p>Turnstone and given that this species was also observed within the potential 'degraded' habitat surrounding the existing jetty it is difficult to know if this maximum extent of degradation is accurate, when it could in fact be much smaller.</p> <ul style="list-style-type: none"> > This impact is therefore considered to be negligible in the context of the adjacent higher value, undisturbed feeding habitat in nearby Roebuck Bay. > Despite the limited potential impact, KMSB is committed to understanding this impact to better inform future projects.
Shorebird Habitat Degradation – Introduction of Invasive Marine Species (3d)	Mitigation as defined for the factor marine fauna in Table 12.		No residual impacts to shorebirds are predicted as a result of IMP incursion.
Operations Causing Disturbance of Migratory Shorebirds (4)	> Where possible, wild-life friendly lighting (i.e. with amber LED and narrow spectral distribution will be used.	N/A	No residual impacts to shorebirds are predicted as a result of KMOF operations.
Hydrocarbon Spill (5a, 5b)	Mitigation as defined for the factor marine environmental quality in Table 10.		No residual impacts predicted.

4.5.7. Predicted Outcome

Implementation of the Proposal in accordance with the defined mitigation, management and monitoring actions will result within the following Environmental Protection Outcomes:

- > Direct loss of 0.0028 ha of foraging habitat for Ruddy Turnstone;
- > Potential indirect impact to 3.25 ha of foraging habitat for Ruddy Turnstone as a result of LOS impairment from the new trestle jetty;
- > No reduction in the regional (i.e. Broome & Roebuck Bay) population of shorebirds is predicted;
- > No harm to any individual conservation significant terrestrial fauna species;
- > No reduction in the biodiversity of terrestrial fauna in the Development Envelope or surrounds;
- > No introduction and/or spread of invasive marine species or diseases; and
- > Temporary disturbance of migratory shorebirds present in the vicinity of construction activities, possibly resulting in temporary behavioural changes to avoid the noise-affected area.

The combined impact of the Proposal activities and the consequent outcomes are not considered to pose any significant residual risks to the protection of terrestrial fauna and therefore biological diversity and ecological integrity can be maintained. In respect of the proposed design and management of the Proposal, the Proponent considers that the EPA's objective for terrestrial fauna has been met.

5. Other Environmental Factors

In addition, to those key environmental factors identified in Section 4, nine other relevant environmental factors were also identified. However, due to the low risk of environmental impact on these factors, and in consideration of the mitigation measures that the Proponent proposes to implement to manage any impacts, these factors are not expected to be required for assessment by the EPA. These other environmental factors are presented in **Table 15** and included:

- > Benthic Communities and Habitat;
- > Coastal Processes;
- > Flora and Vegetation;
- > Landforms;
- > Terrestrial Environmental Quality;
- > Inland Water Environmental Quality;
- > Hydrological Processes;
- > Air Quality; and
- > Social Surroundings.

During the DBCA internal review process and public consultation period comments were received which identified the requirements to assess the following the two factors which were previously omitted from the ERD:

- > Coastal Processes; and
- > Flora and Vegetation.

The Factor 'Coastal Processes' has been formerly assessed with an additional Technical Memorandum included as Appendix G.

The Factor 'Flora and Vegetation' was not deemed to warrant formal assessment as whilst the database identified the possibility of two TECs (one relating to Marine Fauna – See Section 4.5) and two PECs which may occur within the development envelope. These include:

- > TEC 67 – Monsoon Vine Thickets of the Dampier Peninsula
- > PEC – Kimberley Community #11 – Priority 1: *Corymbia paractia* dominated community on dunes; and
- > PEC – Kimberley Community #12 – Priority 1 – Relict dune system dominated by extensive stands of *Sersalisia sericea*.

Further information on this TEC and the two PECs are provided within **Table 15**.

Table 15 Other Environmental Factors and Potential Impacts of the Proposed KMOF

Environmental Factor	Receiving Environment	Project Activities	Management, Monitoring & Mitigation	Impacts
Benthic Communities & Habitats (BCH)	<p>BCH in the Broome area has been mapped in a number of recent studies, including Worley Parsons (2013), Ecological (2016), BMT (2018) & O2 Marine (2019).</p> <p><u>Intertidal BCH</u></p> <p>Intertidal bare s& comprises ~10% of the BCH characterised by sandy beach south of Broome Port Jetty & sand/mudflats to the west. Mangroves occur west of the Broome Port Jetty forming ~1.2% of BCH. The sandy beach within the development envelope is characterised by low fauna diversity, richness & feeding guild abundance compared to the mudflats, which provide a valuable food source for marine organisms & resident & migratory birds. Intertidal rock reef comprises 5% of BCH along the shoreline & as small outcrops. The intertidal rock is covered in gastropods & barnacles with small cover of turf algae.</p> <p><u>Subtidal BCH</u></p> <p>Subtidal BCH in the vicinity of the Project area is predominantly bare sandy sediment (71%) with patches of mostly bare subtidal rocky reef & sparse algae/coral/hydroid cover (12.2%). The studies indicate fine-scale variability due to dynamic changes in the distribution & depth of the mobile sand veneer, which causes intermittent covering & exposure of the underlying rocky substrate, likely impeding development of substantial biological communities. Similarly, sparse epifaunal filter feeder species on bare sandy substrate is likely limited by the highly dynamic sediment transport regime.</p>	<ul style="list-style-type: none"> > Direct removal or disturbance of benthic habitat from piling. > Accidental fuel or other hazardous material spills during refuelling or loading/offloading with toxic effects on BCH. > Introduction / translocation of Invasive Marine Species (IMS) in ballast water or on vessel hulls. 	<ul style="list-style-type: none"> > Construction Environmental Management Plan (CEMP) > Tenancy Environmental Management Plan (TEMP) 	<p>Meets EPA Objective</p> <p>Project infrastructure avoids & minimises impacts to mudflats, intertidal rock, seagrass & mangrove BCH.</p> <p>Direct disturbance & permanent shading of approximately 1.3 ha of mapped subtidal rocky reef BCH of low biological value & well represented in the vicinity of the Project Area from under the wharf & floating pontoon structures.</p> <p>It is also noted that shading will not affect any benthic primary producers so the affect of this impact is negligible.</p> <p>Other potential impacts to BCH as a result of IMS translocation or accidental fuel spills are considered to be low risk & can be effectively managed.</p> <p>Vertical piles for the Project will form suitable intertidal & subtidal habitat suited to colonisation of sessile marine organisms.</p>

	Seagrass patches occur to the north of the Broome Port Jetty in small patches comprising ~0.5% of BCH in the area.			
Coastal Processes	<p>Metoccean conditions around the KMOF Project area were investigated by Baird (2019). Marine sediment within the vicinity of the Project Area from the shoreline to +5 m CD is generally composed of coarse sand (0.25 mm). Further offshore gravel-size sediment (2.00 mm) are mostly found.</p> <ul style="list-style-type: none"> > Dry Season: Sediment transport is most active during the dry season under the influence of the easterly & south easterly winds which mobilise sediment across shallow waters of Roebuck Bay. Fine sediment is transported southward past Broome Jetty Beach under the influence of strong tidal flow & enhanced by wind waves generated by south easterly winds which remove sediment from the upper beach. > Wet Season: The prevailing westerly wind regime during the wet season blows offshore & results in relatively sheltered conditions. Broome Jetty Beach may be replenished with sediments from the western coast of the Broome Peninsula which are transported around Entrance Point 	<ul style="list-style-type: none"> > Altered coastal processes from jetty/pontoon piles due to wharf construction 	<ul style="list-style-type: none"> > Project design which minimises restriction to water flow & prevents sediment trapping 	<p>Meets EPA Objective</p> <p>KMSB has minimised the infrastructure footprint on the beach to the extent that it no longer poses a risk to coastal processes.</p>
Flora & Vegetation	<p>A detailed study of the native vegetation was undertaken by APM (2020) and is provided in Appendix F.</p> <p>The study area falls within the Dampier Botanical District, which is broadly characterised by Pindan formation on sandplains (Beard, 1979). Vegetation of the bioregion can be classified as Pindan or Pindan Woodland, with both vegetation types dominated by Acacia species (GHD, 2009). Other habitat types present in the Port of Broome area include: Coastal sand dunes, Open woodland, Open woodland of mixed species, & monsoon vine thicket on lower slopes behind dunes & secondary dunes (Bamford & Turpin, 2008).</p> <p>A database search identified that two TECs (the monsoon vine thicket & Roebuck Bay Mudflats) & two PECs</p>	<ul style="list-style-type: none"> > Clearing of native vegetation for construction of hardstand area & access roads. > Disturbance / removal of conservation significant flora species. 	<ul style="list-style-type: none"> > Avoidance of areas of flora and vegetation wherever possible thought the use of previously cleared industrial land for the landside development area > No clearing or disturbance to the TEC (monsoon vine thicket) through this area being completely avoided during construction and routine operations > Minimisation of infrastructure footprint through the use of 	<p>Meets EPA Objective</p> <p>Although the TEC Monsoon Vine Thicket was observed adjacent to the development envelope and with an overlap of ~105m², detailed surveys have enabled the KMSB development footprint (i.e. actual infrastructure) to entirely avoid all impacts to these sensitive vegetation communities .</p>

<p>(<i>Corymbia paractia</i> and <i>Sersalisia sericea</i>) are known to occur within the Port of Broome & are considered features of conservation significance. Detailed flora surveys were undertaken across the development envelope & reconnaissance survey in adjacent areas by APM (2020). Vegetation was generally found to be in good to very good condition. One conservation significant flora species (Priority 3 <i>Acacia monticola</i> x <i>Tumida</i> var <i>kulparn</i>) was identified from the border of the Study Area but not within the Development Envelope.</p> <p>Surveys by APM (2020) confirmed presence of the Monsoon Vine Thicket TEC in very good condition as occurring within the vegetation immediately to the northwest of the Development Envelope. A small, degraded patch of this TEC is present within the Development Envelope (~105m²), however the actual development footprint (i.e. the actual infrastructure) will be completely avoiding this TEC thus no impacts (Figure 16 and Figure 17).</p> <p>A section of <i>Corymbia paractia</i> woodland was identified and mapped occurring approximately 100-150m from the development envelope (Figure 16). As the proposal development will occur within previously disturbed land, no additional impacts (direct or indirect) are predicted to this PEC.</p> <p>No <i>Sersalisia sericea</i> PEC was identified in the surveys either adjacent or within the Proposal development envelope.</p> <p>No conservation significant flora was recorded in the development envelope, however one species of conservation significant flora (Priority 3 <i>Acacia monticola</i> x <i>Tumida</i> var <i>kulparn</i>) was identified near the boundary of the development envelope (Figure 16 and Figure 17). There are no predicted indirect impacts upon these species. KPA currently hold a Land Clearing Permit (CPS7256/1) to undertake vegetation clearing for the purposes of road maintenance, carpark extension and the construction of a powerline, water pipeline, slipway and truck turnaround area. This permit allows for clearing of up to 2.4 Ha of native vegetation within the defined clearing area (Figure</p>		<p>trestle jetty which has minimal disturbance footprint.</p> <ul style="list-style-type: none"> > CEMP > All clearing of native vegetation will be in accordance with approved DBCA clearing permits > TEC (monsoon vine thicket) avoidance to be included within CEMP and ongoing environmental management plans. This will include (as a minimum) signage, staff awareness and identifying the mapped exclusion zone to ensure complete avoidance. > Rehabilitation of VA1 in the immediate project footprint (i.e. adjacent to trestle jetty piles). 	
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	<p>19) Any clearing of vegetation required for the proposed development will be in accordance with this permit, including weed management and drainage conditions.</p> <p>Further clearing of the dunal complex VA1 (APM 2020) will be required where the trestle jetty intersect landside infrastructure, typically where piles are placed. VA1 in this area is considered of poor condition having frequent disturbances including erosion and a high density of the weed <i>Cenchrus biflorus</i></p>			
Landforms	<p>No significant landforms occur within the development footprint. However, the Proposal area is located within 5 km of the West Kimberley NHP, an area which is recognised as one of Australia's very special places, primarily due to presence of dinosaur footprints which are typically associated with the areas of exposed Broome Sandstone (CoA, 2011; Salisbury & Romilio, 2018).</p> <p>Although one dinosaur footprint is known to occur in the immediate vicinity of the proposed KMOF, extensive surveys of the area by renowned Dinosaur Expert Dr Steven Salisbury, have identified the Development Area as one of two locations on Entrance Point that could support future developments without impacting on dinosaur footprints. Figure 18 shows the KMOF occurs within an area identified by Salisbury & Romilio (2018) as 'Area of Least Concern in Respect of dinosaur tracks'.</p>	<ul style="list-style-type: none"> > Disturbance of dinosaur footprints associated with areas of Broome sandstone. 	<ul style="list-style-type: none"> > Project design has been modified to minimise impacts to areas of Broome sandstone which potentially support dinosaur footprints. 	<p>Meets EPA Objective</p> <p>The development is proposed in an area which supports Dinosaur Footprints,. However, the area has previously been identified as 'Area of Least Concern in Respect of dinosaur tracks'. In addition, the Dinosaur footprints are only associated with areas of Broome Sandstone, which KMSB has taken great care in the siting of the proposed KMOF to avoid impacting areas of Broome sandstone.</p> <p>No impacts to dinosaur tracks or any other special landforms in the nearby West Kimberley NHP are predicted as a result of the proposed development.</p>
Terrestrial Environmental Quality	<p>The onshore hardstand of the development envelope lies within two registered contaminated sites: 57974 & 25591. <u>Contaminated Site: 57974 (DWER 2020a)</u></p> <p>The nature & extent of contamination is described as hydrocarbons (such as from diesel or oil), organochlorine pesticides & asbestos-containing materials present in fill material, contained beneath a capping layer of compacted</p>	<ul style="list-style-type: none"> > Disturbance of an existing contaminated site. > Accidental fuel spill to land resulting in hydrocarbon contamination of soil. 	<ul style="list-style-type: none"> > KPA are responsible for any remediation action required for commercial / industrial use of the site > KMSB will undertake baseline site investigation required in 	<p>Meets EPA Objective</p> <p>The proposed disturbance areas are located within the areas of the Lot that have been remediated.</p> <p>Management Plans will be developed in collaboration with</p>

	<p>gravel cover. This occurred due to historical uncontrolled filling with demolition rubble.</p> <p>The land use of the site is restricted to commercial/industrial use. The land has been classified as Remediated for restricted use & the site is managed in accordance with "Slipway Asbestos Management Plan, Port of Broome (Cardno, 8 September 2016)".</p> <p><u>Contaminated Site: 25591 (DWER 2020b)</u></p> <p>The nature & extent of contamination is described as hydrocarbons (such as from diesel & petrol) are present in soils & groundwater beneath the drum platform in the eastern portion of the site. The land use of the site is restricted to commercial/ industrial use.</p> <p>The land has been classified as contaminated with remediation required.</p>		<p>accordance with KPA lease agreement.</p> <ul style="list-style-type: none"> > CEMP > TEMP 	<p>KPA and in accordance with their Pollution Control guidelines to mitigate further risk of contamination from project activities.</p>
Hydrological Processes	<p>There are no wetlands or watercourses within the development envelope & surface water flows are limited to natural stormwater runoff through the sand dunes to the beach. Surface water runoff in the Broome area is only generated after periods of heavy rainfall (typically associated with cyclone events). Surface & groundwater flow seaward & are considered to strongly influence the ecological character of Roebuck Bay through changes in salinity & transport of dissolved & particulate nutrients & carbon. Groundwater levels in the area are at approximately +2 to 3 m AHD & vary seasonally with highest levels in April & lowest in November/December.</p>	<ul style="list-style-type: none"> > Changes to stormwater flow paths. > Construction of hardstand area and access roads. 	<ul style="list-style-type: none"> > KMSB Project Drainage Plan > Design to consider flow where drainage of roads etc will not direct contaminants into the water system where there is reduced flushing or fine sediments, as accumulation of toxins can occur > CEMP > TEMP 	<p>Meets EPA Objective</p> <p>Surface water flow will be redirected as a result of hardstand areas of the project. However, the areas being developed are already part of the existing KPA drainage network.</p>
Inland Waters Environmental Quality	<p>Most of the historical & current data exceeds the ANZG (2018) Standard trigger criteria</p> <p>KPA undertakes Groundwater Monitoring following the industry recognised protocol specified within Groundwater Sampling & Analysis – A field Guide (Sundaram et.al, 2009).</p>	<ul style="list-style-type: none"> > Accidental fuel spill to land resulting in hydrocarbon contamination of groundwater. > Construction of hardstand area & access roads. > General facility operations (vessel & vehicle maintenance, abrasive blasting, etc) 	<ul style="list-style-type: none"> > KPA are responsible for any remediation action required for commercial / industrial use of the site > CEMP > TEMP 	<p>Meets EPA Objective</p> <p>Baseline sampling of groundwater is required to determine condition of the system prior to KMSB developing the land. If required KPA will be responsible for</p>

	<p>As the Project Area is located within a light industrial area, sources of hydrocarbons are known to be present in the groundwater.</p> <p>Remediation of groundwater contamination is required, including the assessment of remedial options & development of a remediation action plan in accordance with actions required for Contaminated Site: 225591 (DWER 2020b).</p>		<ul style="list-style-type: none"> > Continuation of groundwater monitoring in accordance with KPA commitments for the site 	<p>remediation prior to development.</p> <p>Management Plans will be developed in collaboration with KPA in accordance with their Pollution Control guidelines to mitigate further risk of contamination from project activities</p>
Air Quality	<p>Pindan Soil in the area consisting of fine grains that are easily windborne.</p> <p>Kimberley Ports Development Guidelines (KPA 2015) requires the following minimum actions for managing air quality on Port Lands:</p> <ul style="list-style-type: none"> > Effective dust suppression shall be implemented > Main roads shall be at least gravel sealed. > Transfer of powder shall only be allowed via leak proof pipe and vessel system Burning of waste is not permitted on sites. 	<ul style="list-style-type: none"> > Dust generation from construction of hardstand area & access roads. 	<ul style="list-style-type: none"> > CEMP (including Dust Management procedures) > Watering of the site prior to digging & moving earth to consolidate particle movement. > Avoidance of earth moving during wet season. 	<p>Meets EPA Objective</p> <p>Windborne soils are not expected to be localised and temporary during construction only.</p> <p>Air quality will be managed in accordance with KPA Environmental Guidelines</p>
Social Surroundings	<p><u>Noise</u></p> <p>The nearest source of noise emissions to the Project area are generated from users of the Port & visitors to the Port. All noise emissions generated during construction & operations as detailed in the KPA handbook must be managed in accordance with the <i>Environment Protection (Noise) Regulations 1997</i>. Construction Works must be conducted in accordance with Section 6 of Australian Standard 2436:2010 "Guide to Noise Control on Construction, Maintenance & Demolition Sites".</p> <p><u>Cultural Heritage</u></p> <p>European: The Port of Broome (HCWA: 04855) is listed on the State Heritage Register due to significant association with Shipping, & imports & exports, & more recently tourism (Heritage Council, 2019).</p>	<ul style="list-style-type: none"> > Noise generated during construction of wharf, hardstand area & access roads. > Disturbance of a shipwreck or WWII artefact. > Disturbance of an aboriginal heritage site. > Disturbance of public amenity (i.e. mixed-use wharf zone). > Increased vessel traffic & maritime safety. > Disturbance of local commercial (e.g. adjacent pearl aquaculture leases) & recreational fishing. 	<ul style="list-style-type: none"> > CEMP > Consultation with the WA Museum > Consultation undertaken with Yawuru PBC for Project design > Multibeam survey of the Project area prior to construction. 	<p>Meets EPA Objective</p> <p>Noise generated during construction will be temporary and limited to daylight hours. Noise during operations is considered equivalent to existing port facilities.</p> <p>No impacts on the Port of Broome heritage jetty are predicted.</p> <p>No known WWII artefacts or shipwrecks of significance in the Project Area. Sidescan sonar and magnetometer survey has been undertaken to</p>

	<p>During World War II Japanese aerial attack destroyed a number of flying boats moored in Roebuck Bay. Many of these vessels & associated artefacts (i.e. aircrafts, aircraft parts & unexploded ordnances) have not been located (BMT 2018). World War II wrecks are protected under the HWA Act.</p> <p>Aboriginal: KPA manage aboriginal heritage in accordance with the KPA Aboriginal Heritage Plan & the Aboriginal Heritage Act 1972 (AHA). Three registered aboriginal heritage sites exist within the Project Area, belonging to the Yawuru people.</p> <p><u>Shipwrecks</u></p> <p>There are 20 shipwreck sites in the vicinity of the Project area (DoEE 2018) protected under the Commonwealth HS Act. There are 11 Shipwrecks on the WA Museum Shipwrecks database with NationalMap showing they occur nearby to the Project area. Shipwrecks in State Waters are protected under the MA Act. The exact location of many of these shipwreck sites is unknown (BMT 2018).</p> <p><u>Vessel Traffic</u></p> <p>Port waters are utilised already by both commercial & recreational vessels.</p>			<p>confirm, with results provided to the WA Museum</p> <p>Aboriginal heritage approval was granted by the Yawuru PBC</p> <p>Vessel traffic will only increase in the area immediately around the Port where majority of recreational activities do not occur.</p>
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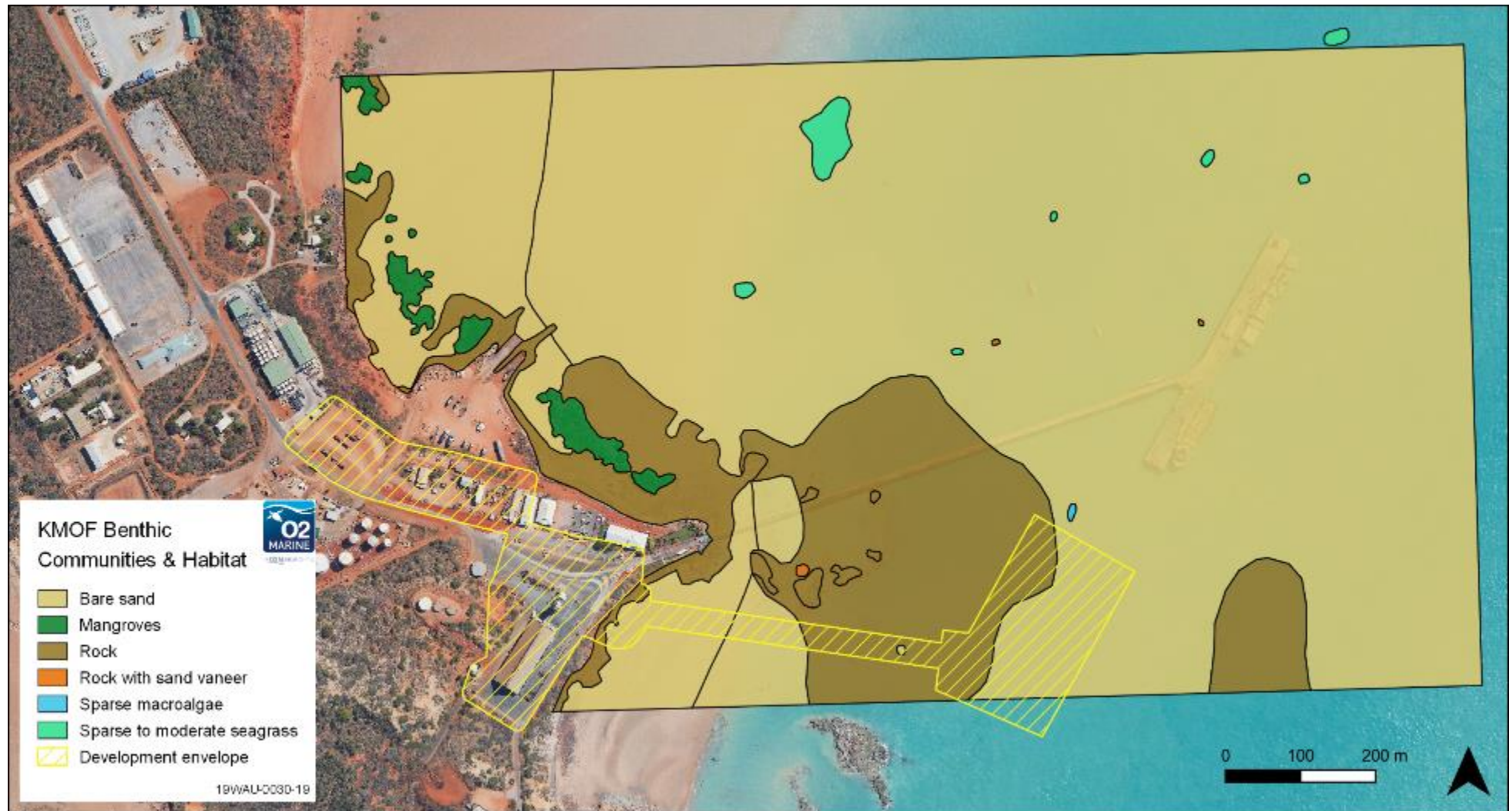


Figure 15 Benthic Communities and Habitat in the vicinity of the Development Envelope



Figure 16 Threatened and Priority flora species in the vicinity of the Development Envelope

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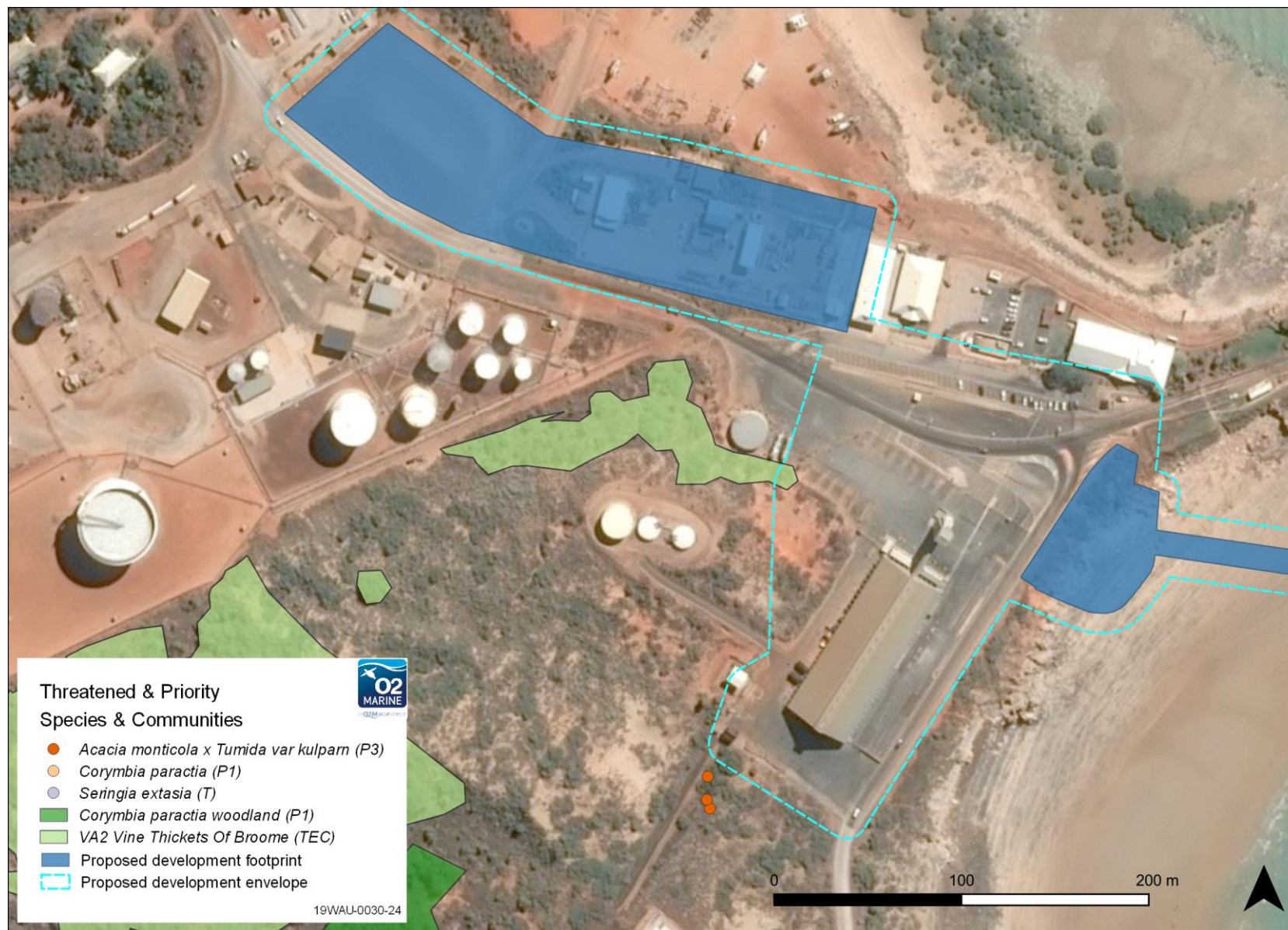


Figure 17 Threatened and Priority flora species in the vicinity of the Development Envelope displaying clearly the small overlap of the TEC VA2

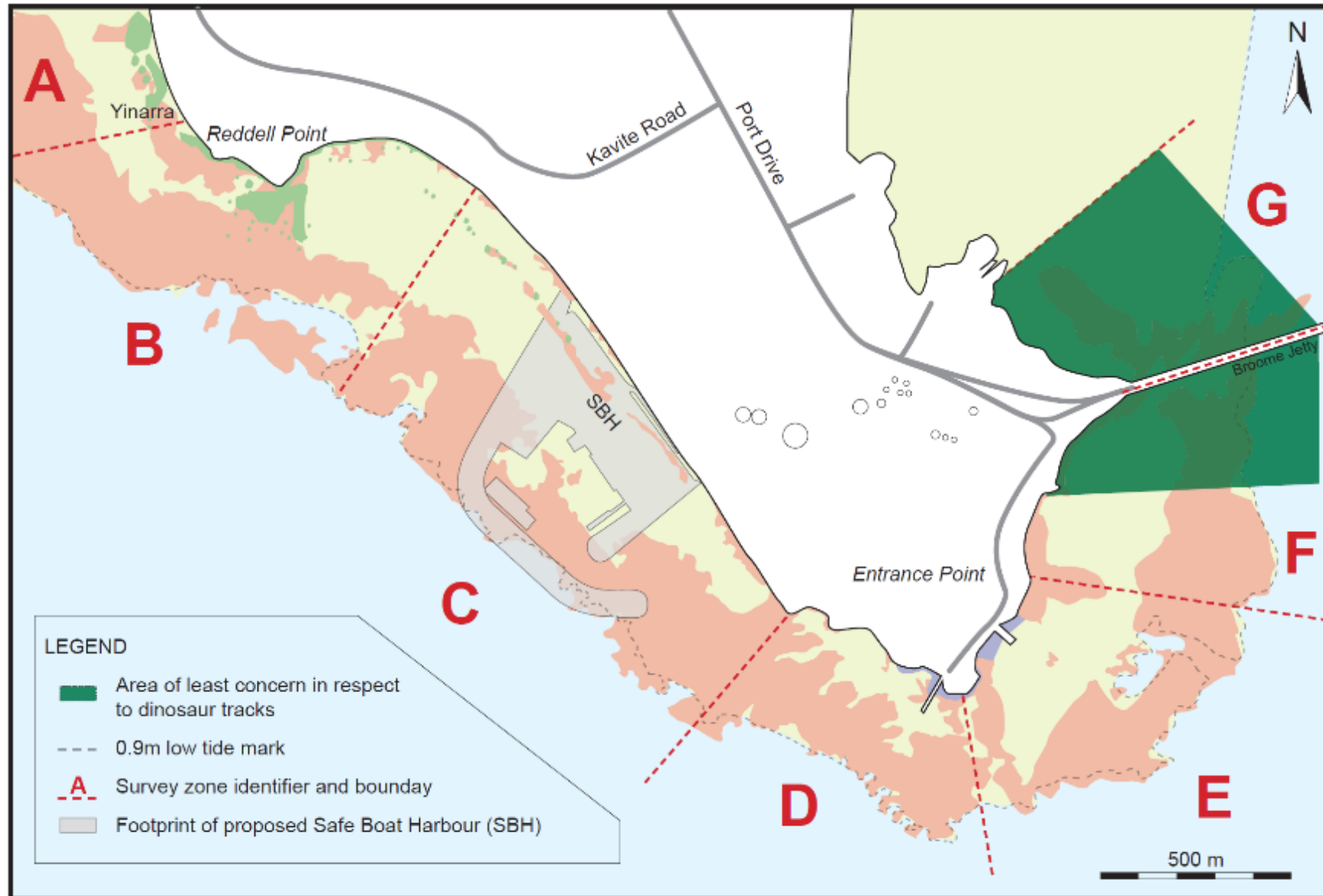


Figure 18 Suitable development areas on Entrance Point to avoid impacts to dinosaur footprints (Source: Salisbury & Romilio 2018)

Plan CPS 7256/1

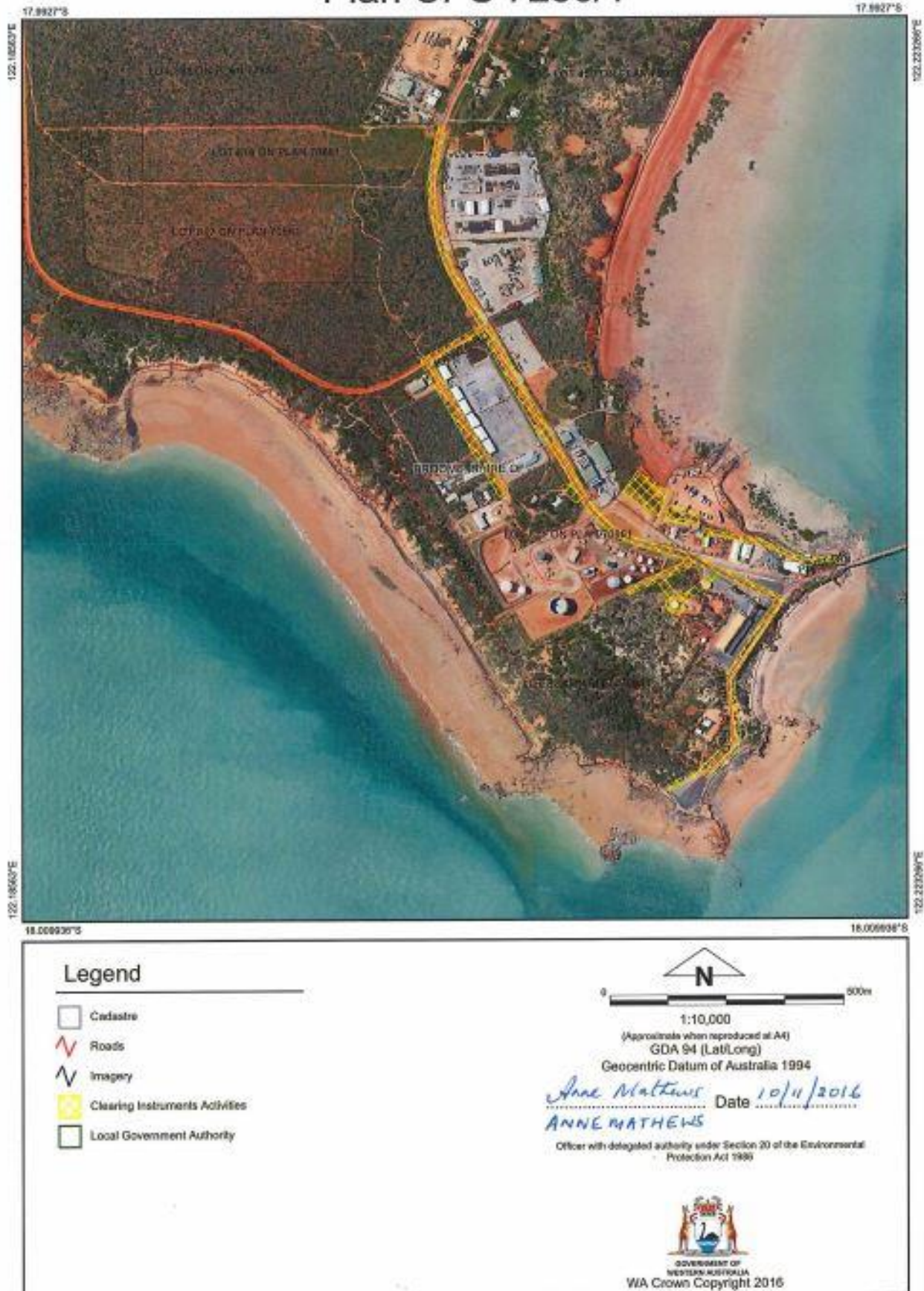


Figure 19 Area currently applicable to Clearing Permit CPS 7256/1

6. Offsets

There were no significant residual impacts of the Proposal identified in this Environmental Review Document and therefore no offsets are proposed.

However, as the potential indirect impacts to Ruddy Turnstone through LOS impairment are poorly understood, KMSB is committed to undertaking a 3-year study to determine the effect (if any) that LOS impairment (due to jetty-type structures) has on Ruddy Turnstone abundance and foraging behaviour. The aim of this study will be to better inform impact assessment for future wharf/port development projects in important shorebird habitat areas.

7. Holistic Impact Assessment

Overall actual and potential impacts of the Proposal on the environment are not considered to represent a significant environmental risk on the basis that:

- > The EP Act principles and relevant EPA guidance documents have been considered in investigating and evaluating potential impacts of the Proposal on the EPA's environmental factors;
- > A comprehensive set of monitoring and management measures have been developed to further mitigate potential impacts of the Proposal on the EPA's environmental factors;
- > The proponent has committed to open and transparent reporting of environmental performance throughout the Proposal construction phase;
- > Evaluation of impacts against all relevant environmental factors, including other environmental factors determined that the EPA's objectives were considered to be met. Specifically, for the key environmental factors the following outcomes were predicted:
 - o Marine Environmental Quality - the combined impact of the Proposal activities and the consequent EPOs are not expected to pose any significant residual risks to maintaining the quality of water, sediment and biota and therefore the environmental values are protected;
 - o Marine Fauna - the combined impact of the Proposal activities and the consequent EPOs are not considered to pose any significant residual risks to the protection of marine fauna or the identified Roebuck Bay Mudflats TEC and therefore biological diversity and ecological integrity can be maintained;
 - o Terrestrial Fauna - the combined impact of the Proposal activities and the consequent outcomes are not considered to pose any significant residual risks to the protection of terrestrial fauna and therefore biological diversity and ecological integrity can be maintained. In respect of the proposed design and management of the Proposal, the Proponent considers that the EPA's objective for terrestrial fauna has been met; and
 - o Coastal Processes - the combined impact of the Proposal activities and infrastructure are not considered to pose any significant residual risks to the protection of geophysical processes thus ensuring that the environmental values of the coast are protected;
- > Evaluation of impacts against MNES determined that predicted impacts were not significant, particularly where impacts could be effectively mitigated or managed. Specifically, for the Commonwealth MNES the following outcomes were predicted:
 - o Migratory Shorebirds – The KMOF will result in direct loss of 0.0028 ha and potential indirect loss of 3.25 ha of foraging habitat for the Ruddy Turnstone. Despite being present in the development area in nationally significant numbers (i.e. At least 0.1% of the species' flyway population), this species was present in only 10% of the surveys, thus indicating that the species showed obvious preference to the extensive adjacent habitat within Roebuck Bay which offer greater foraging and roosting opportunities. Therefore, although a very small portion of this species habitat will be impacted the impact is not considered to be significant in the context of the Roebuck Bay region; and
 - o Marine Fauna Species – Piling operations have the potential to result in temporary behavioural response in whales, dugong, dolphins, turtle and sawfish during piling operations, which may cause them to avoid the affected area. However, through avoiding key environmental windows (i.e. humpback whale migration) and application of

stringent underwater noise management procedures all potential residual impacts on these species can be avoided. The operational phase of the project is not predicted to have any impact on conservation significant marine fauna species.

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Appendix A Stakeholder Feedback Forms

Appendix B Marine Fauna Desktop Assessment

Appendix C Underwater Noise Assessment

Appendix D Shorebird Survey

Appendix E Benthic Infauna Survey

Appendix F Biological Survey Report

Appendix G Technical Memorandum - Coastal Processes

